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SITRANS and SIPART Device Library for SIMIT SP

SIMIT SP V9.1

https://support.industry.siemens.com/cs/ww/en/view/109757452

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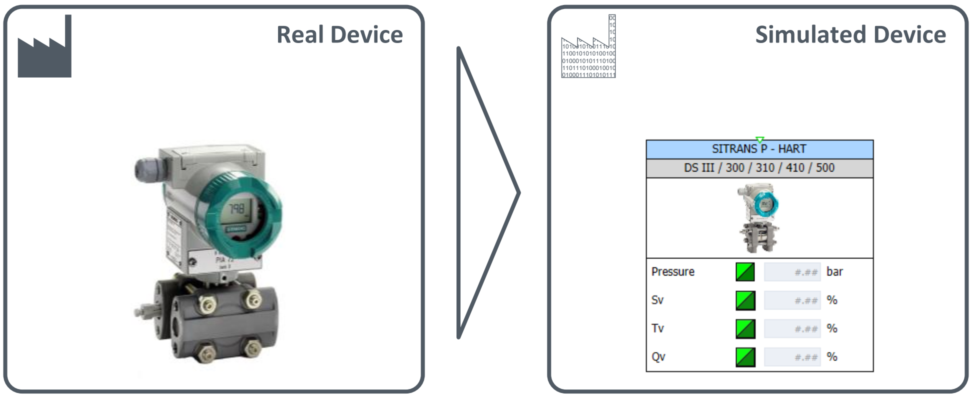
1 Introduction

1.1 Overview

SIMIT Simulation Platform contains several standard components, such as drives and valves, for simulating devices and measuring points. This standard functionality is not sufficient for the simulation for every device installed in the system since the behavior of field devices can have a decisive influence on the behavior of the overall system. Modern field devices offer a multitude of functions and parameters that are only very inconvenient to simulate or cannot to be simulated with the standard SIMIT tools.

Specific device models have the requirement to exchange measured or controlled values and status signals with the PCS 7 driver blocks. The dynamic device behavior is simulated in SIMIT.

This application example provides you with a library of device-specific simulation blocks from SITRANS and the SIPART device family. The simulation blocks simulate the behavior of the corresponding actuators and sensors in their most important properties, making them ideal for virtual commissioning of process plants.



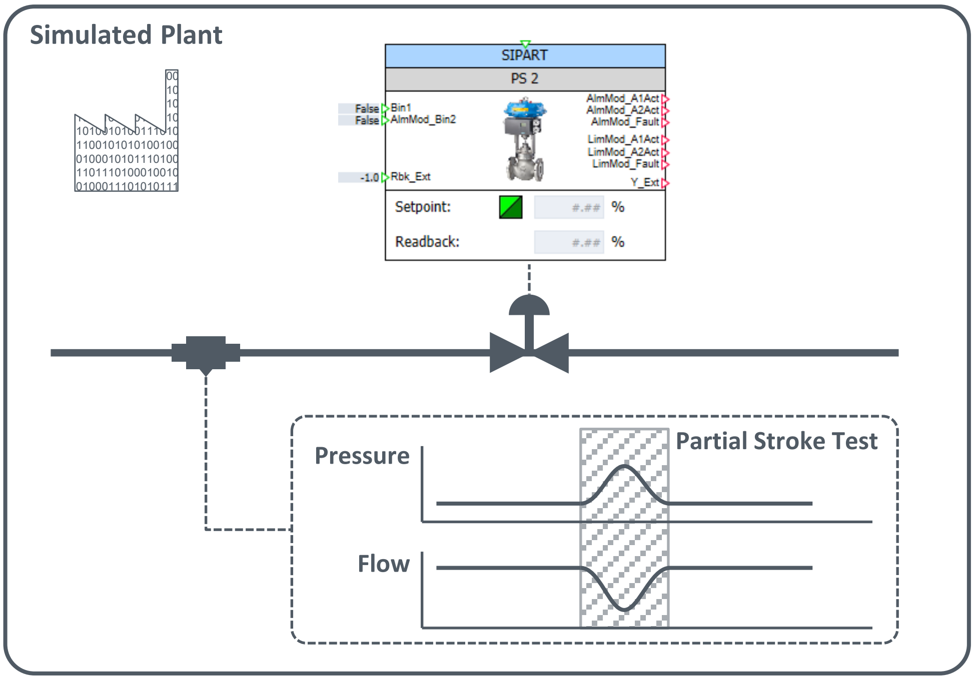
The use of the blocks yields the following advantages:

- Simulation of product-specific functions based on detailed device models
- Increasing the accuracy and thus the benefit of the system model
- Allows the determination of the optimal parameters of the field devices
- Virtual commissioning of the devices in the context of plant simulation
- Training of personnel in operator training systems (OTS) that realistically map the process behavior of the plant

1.2 Mode of operation

The detailed device models of the SIMIT device library reproduce the behavior and characteristics of the most important functions of the real field devices. By creating the plant simulation with these components, it is possible for you to test the special properties and their effects on the plant process during virtual commissioning.

The following figure shows a schematic representation of the effect of the partial stroke test of a control valve on the pressure and flow in a pipeline.



1.3 Components used

The application example was created using the following software component:

Component	Number	Article number	Note
SIMIT SP V9.1	1	6DL5260-...68-....	Demo project / library

This application example consists of the following components:

Component	File name	Note
Documentation	109757452_Device_Library_Doc_de.pdf	This document
Library	109757452_Device_Library_V10_zip	SIMIT library
Demo project	109757452_Demo_Device_Models_V10.zip	SIMIT project archive

2 Device library

The SIMIT device library contains generic device models and detailed device models. The generic models contain basic functions of the actuators and sensors. These are not type specific and can be used for most field devices. The detailed device models have been developed specifically for the simulation of certain devices. These can only be used together with the generic models.

Note

No guarantee can be given for the functionality and completeness of the simulation models offered in this application example.

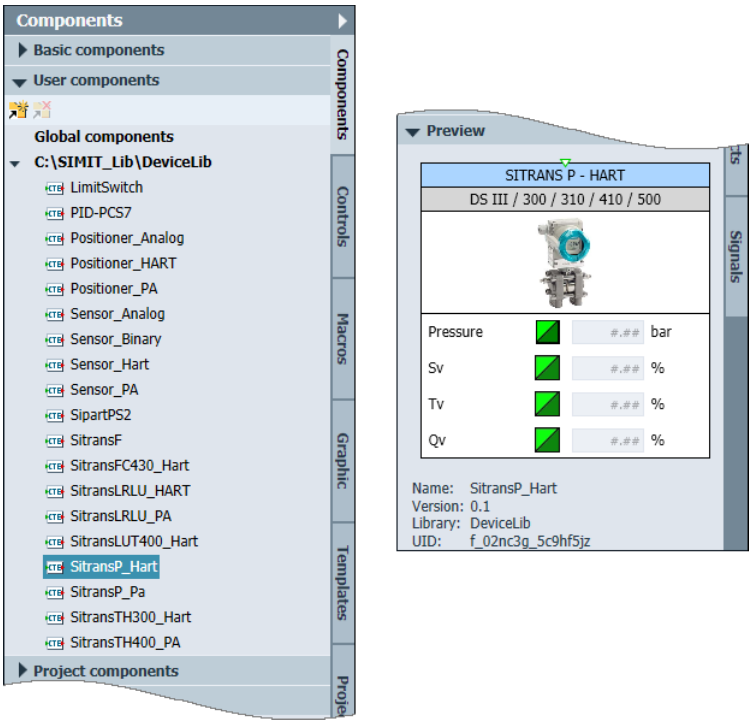
2.1 Installation

First, download the library from the download page of this sample application:
https://support.industry.siemens.com/cs/ww/en/view/109757452

To install, proceed as follows:

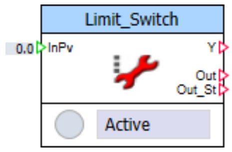
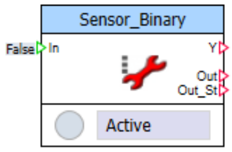
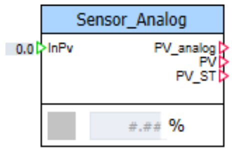
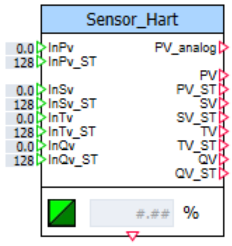
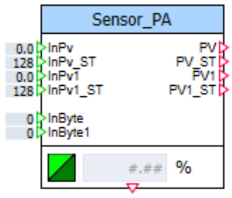
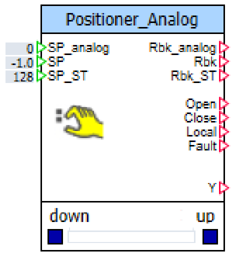
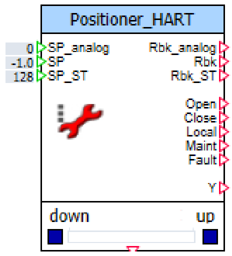
1. Extract the ZIP file into any directory on the SIMIT configuration computer.
2. Open a new or existing SIMIT project.
3. Open the "Components" task card and expand the "User components" area.
4. Click on the "Open library" button and navigate to the storage location of the SIMIT device library.

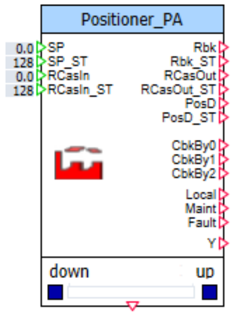
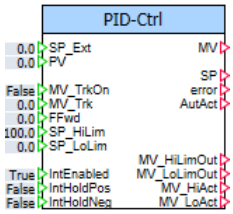
After the library has been loaded, you can use it just like the standard SIMIT libraries.



2.2 Generic device model

You can find the following generic device models in the library:

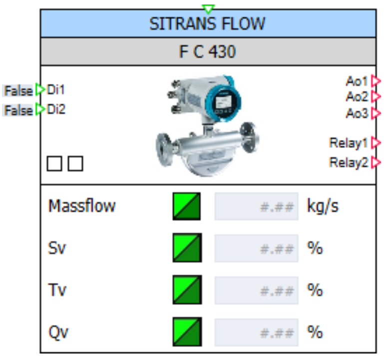
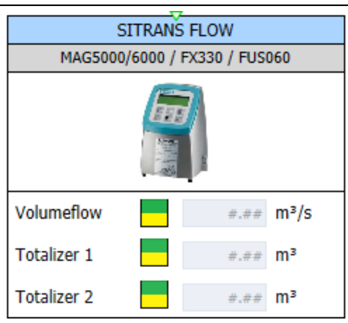
Name	Description	Symbol
Limit _Switch	Limit value monitoring of process variables.	
Sensor_Binary	Simulation of binary limit switches.	
Sensor_Analog	Simulation of analog field devices. (unipolar or bipolar input signal)	
Sensor_HART	Simulation of analog field devices with HART communication The block can be extended with a detailed device model. (unipolar input signal)	
Sensor_PA	Simulation of analog field devices with PROFIBUS PA communication. The block can be extended with a detailed device model. (unipolar input signal)	
Positioner_Analog	Simulation of analog control valves (0..100 %)	
Positioner_HART	Simulation of analog control valves with HART communication. The block can be extended with a detailed device model.	

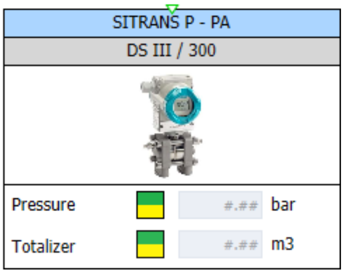
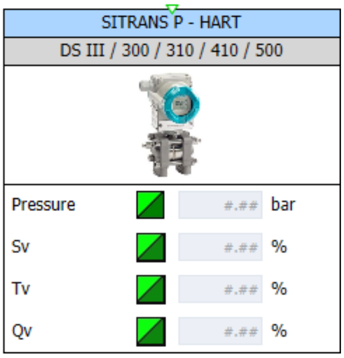
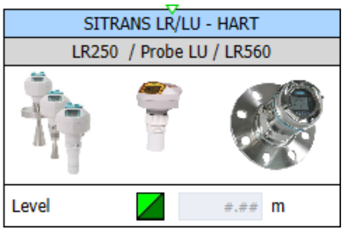
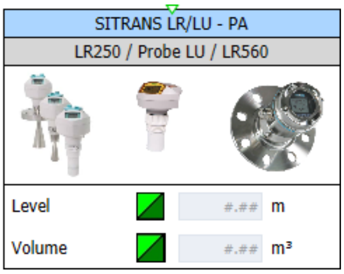
Name	Description	Symbol
Positioner_PA	Simulation of analog control valves with PROFIBUS PA communication. The block can be extended with a detailed device model.	
PID-Ctrl	With the PID controller, the simulation model can be tested right from the development stage, even if no PCS 7 project is available yet (model in the loop).	

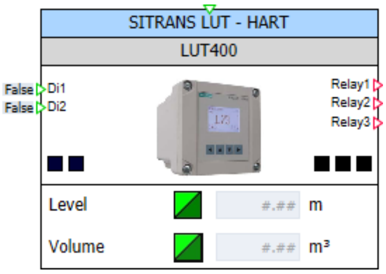
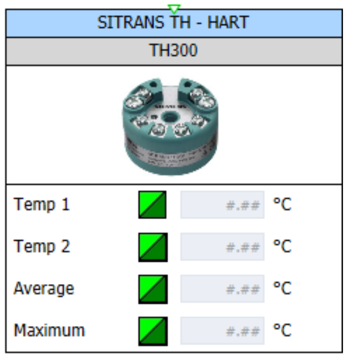
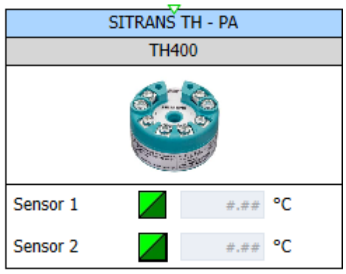
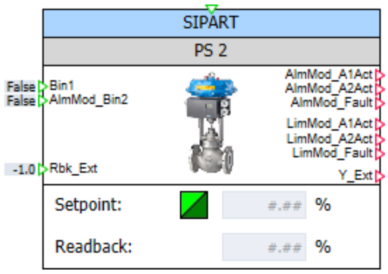
2.3 Detailed device models

The detailed device models extend the generic models in order to perform special functions and cannot be used as a stand-alone. The generic and detailed models are linked together via a special interface.

You can find the following detailed device models in the library:

Name	Description	Symbol
SitransFC430	Simulation of the SITRANS FC430 flowmeter with HART or PA communication. Related generic models: "Sensor_HART" or "Sensor_PA"	
SitransF	Simulation of a SITRANS FLOW transmitter with PROFIBUS PA communication. The following devices can be simulated: • SITRANS F M MAG 5000/6000 • SITRANS FX330 • SITRANS FUS060 Related generic model: "Sensor_PA"	

Name	Description	Symbol
SitransP_PA	Simulation of a SITRANS P transmitter with PROFINET PA communication. The following devices can be simulated: • SITRANS P DS III (PA) • SITRANS P300 (PA) Related generic model: "Sensor_PA"	
SitransP_Hart	Simulation of a SITRANS P transmitter with HART communication. The following devices can be simulated: • SITRANS P DS III (Hart) • SITRANS P300/P310 (Hart) • SITRANS P410 • SITRANS P500 Related generic model: "Sensor_HART"	
SitransRLU _Hart	Simulation of a SITRANS LR/LU transmitter with HART communication. The following devices can be simulated: • SITRANS LR250 (HART) • SITRANS LR560 (HART) • SITRANS Probe LU (HART) Related generic model: "Sensor_HART"	
SitransRLU _PA	Simulation of the SITRANS LR/LU transmitter with PROFINET PA communication. The following devices can be simulated: • SITRANS LR250 (PA) • SITRANS LR560 (PA) • SITRANS Probe LU (PA) Related generic model: "Sensor_PA"	

Name	Description	Symbol
SitransLUT400 _Hart	Simulation of the SITRANS LUT transmitter with HART communication. Related generic model: "Sensor_HART"	
SitransTH300 _Hart	Simulation of the SITRANS TH300 transmitter with HART communication. Related generic model: "Sensor_HART"	
SitransTH400 _PA	Simulation of the SITRANS TH400 transmitter with PROFINET PA communication. Related generic model: "Sensor_PA"	
SipartPS2	Simulation of the SIPART PS 2 Positioner with HART or PA communication. Related generic models: "Sensor_HART" or "Sensor_PA"	

3 Application

This chapter uses three examples to show you how to configure the library objects and how to use the simulation.

These three components are described in detail below:

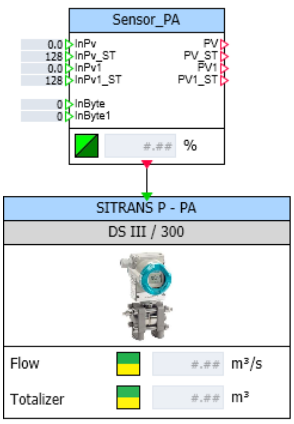
- SitransP_PA with Sensor_PA
- SipartPS2 with Positioner_HART
- SitransLRLU_PA with Sensor_PA

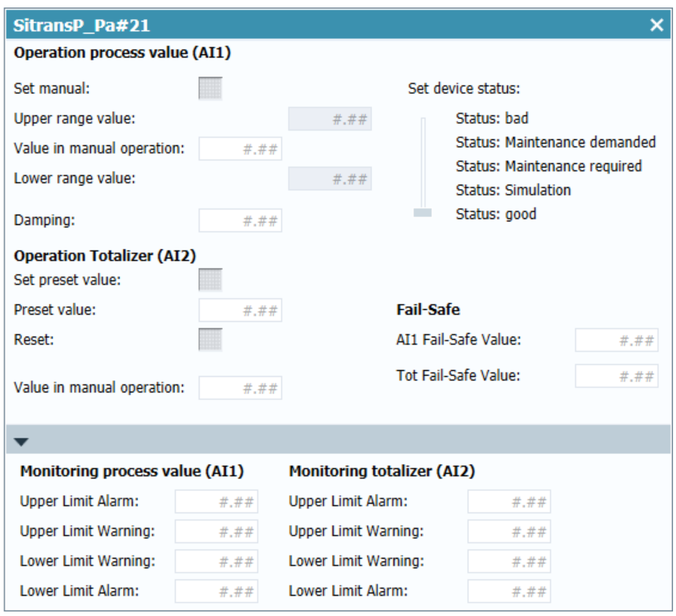
3.1 SITRANS P

With this simulation block, transmitters of the SITRANS P series can be simulated.

The simulation block contains the following functions:

- Selection of the measuring mode (pressure, flow, level and volume)
- Smoothing the measured value
- Quantity acquisition (totalizator)
- Limit alarms for the process value and the totalizer
- Substitute value in manual mode
- Simulation of the device status in manual mode
- Failsafe behavior in case of a device error





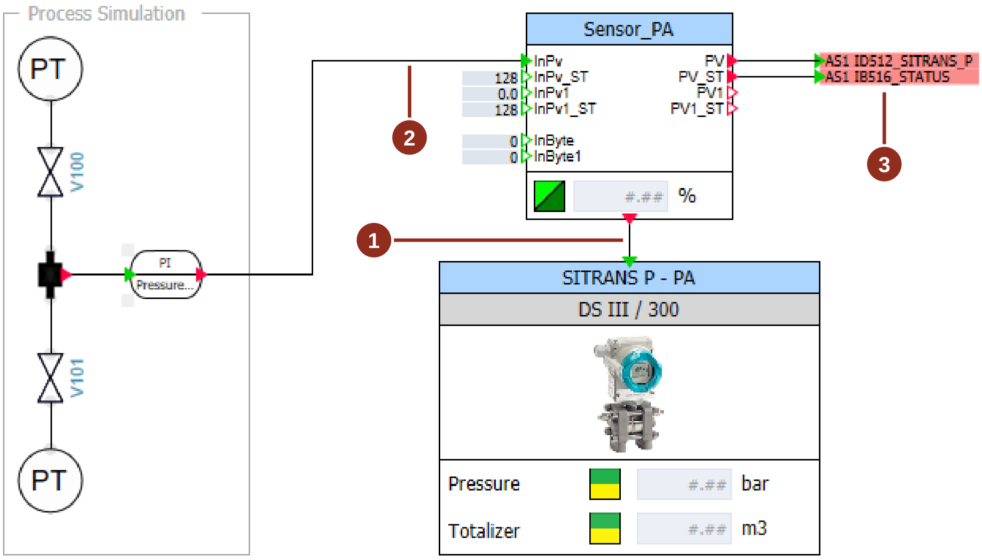
3.1.1 Configuration

1. Drag and drop the following blocks from the device library into the SIMIT diagram:
   - Sensor_PA
   - SitransP_PA

Note

There is an output at the "Sensor_PA" block and at the "SITRANS P - PA" block there is an input of the complex connection type "L2DetailledModel2". Both blocks exchange signals and process values with each other via this interface. The connection type contains all relevant input and output variables. The data exchange works in both directions.

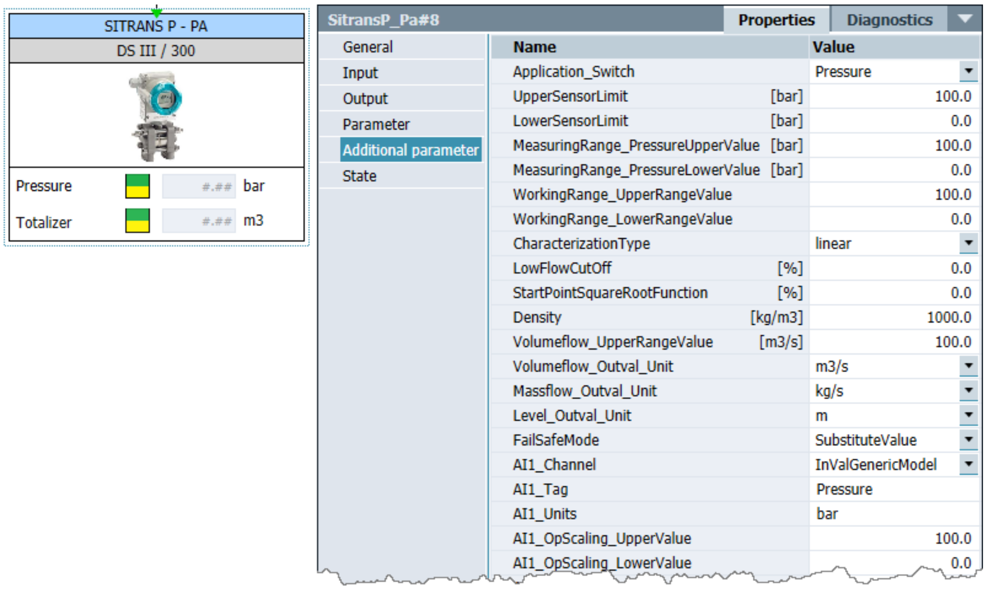
2. Connect the connections "L2DetailledModel" and "L2SensorProfibus" (1).
3. Connect the simulated process value to the input "InPv" (2).
4. Connect the outputs "PV" and "PV_ST" with the corresponding input signals of the configured coupling (3). The output "PV" is supplied with the parameterized value "AI1_Channel".
5. The process value input "InPv1" can only be used without the detailed simulation model. As soon as the detailed model is used, the parameterized associated value "AI2_Channel" is output at output "PV1".



3.1.2 Parameter assignment

The real SITRANS P transmitter can be used for different types of measurement. The simulation model has a large number of parameters that are parameterized according to the real device. Proceed as follows:

1. Select the "SITRANS P - PA" block.
2. In the Properties window, select the folder "Additional parameter".



The following case studies show how to parameterize the block for the following purposes:

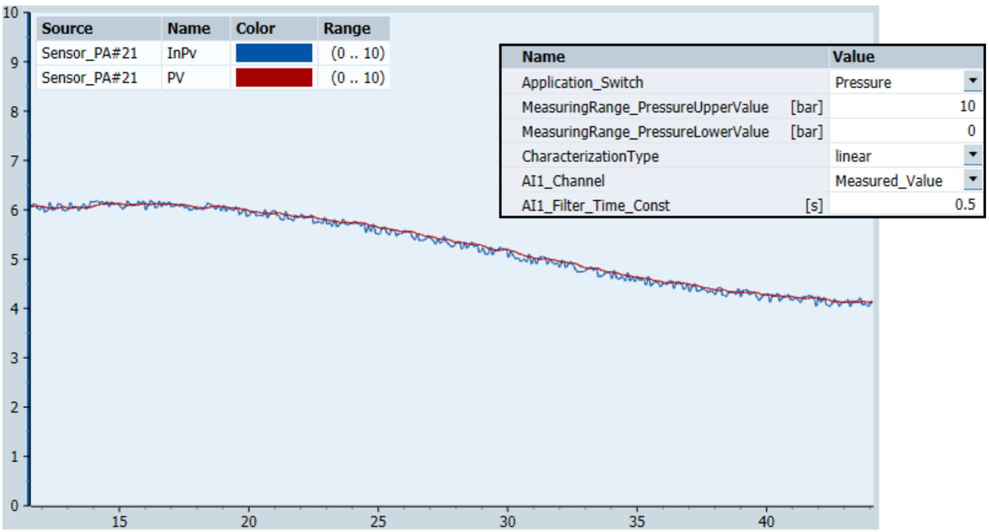
- Pressure measurement
- Level measurement
- Volume measurement
- Flow measurement

Parameter assignment for measurement of a pressure

The value at the input "InPv" is a pressure in the unit [bar]. The totalizator cannot be used. Parameterize the values at the "STRANS P PA" block according to the following table:

Parameter	Value
Application_Switch	"Pressure"
MeasuringRange_PressureUpperValue [bar] MeasuringRange_PressureLowerValue [bar]	Maximum pressure Minimum pressure
CharacterizationType **Note:** In the case of an inverse characteristic, the values at the measuring range must be reversed. (..UpperValue <..LowerValue)	"linear"
AI1_Channel **Note:** With the "InValGenericModel" setting, the process value is output unchanged.	"Measured_Value"
AI1_Filter_Time_Const [s] **Note:** Time constant for the filter for smoothing the measured value.	"0" = no smoothing Max "100" = largest smoothing
AI1_Tag [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"Pressure"
AI1_Units [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"bar"

The following figure shows the comparison of the recorded process signal "InPv" and the output measured value "PV":

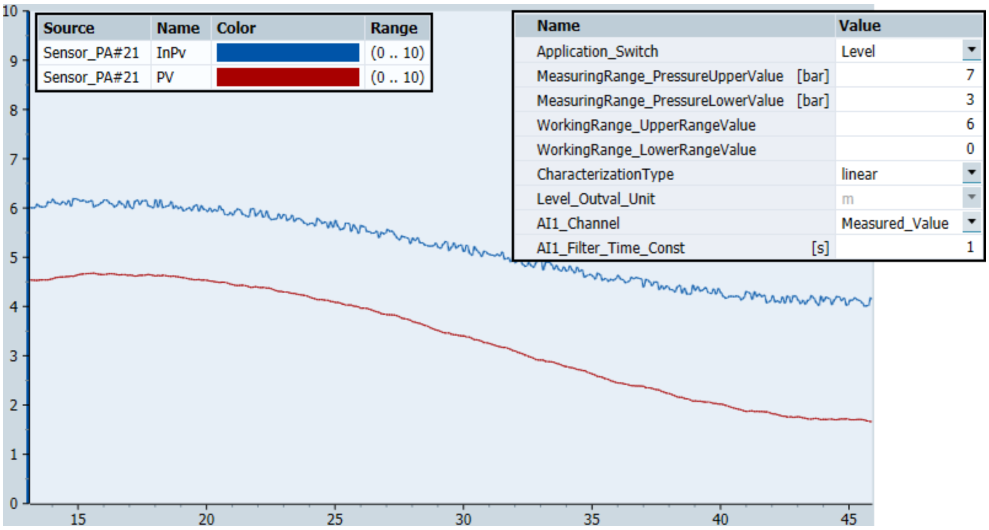


Parameter assignment for measurement of a level

The value at the input "InPv" is a pressure in the unit [bar]. The totalizator cannot be used. Parameterize the values according to the following table:

Parameter	Value
Application_Switch	"Level"
MeasuringRange_PressureUpperValue [bar] MeasuringRange_PressureLowerValue [bar]	Maximum pressure Minimum pressure
WorkingRange_UpperRangeLevel WorkingRange_UpperRangeLevel **Note:** The measuring range is scaled to the working area. MeasuringRange_[Upper] ≙ WorkingRange_[Upper] MeasuringRange_[Lower] ≙ WorkingRange_[Lower]	Maximum fill level Minimum fill level
CharacterizationType **Note:** In the case of an inverse characteristic, the values at the measuring range must be reversed. (..UpperValue <..LowerValue)	"linear"
AI1_Channel **Note:** With the "InValGenericModel" setting, the process value is output unchanged as pressure.	"Measured_Value"
AI1_Filter_Time_Const [s] **Note:** Time constant for the filter for smoothing the measured value.	"0" = no smoothing Max "100" = largest smoothing
Level_Outval_Unit [m] / [%] **Note:** Selection of the unit of the measured value in [m] or [%].	Unit of level
AI1_Tag [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"Level"
AI1_Units [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"m"

The following figure shows the comparison of the recorded process signal "InPv" and the output measured value "PV". The process value [3..7 bar] is scaled linearly to the measured value [0..6 m]:



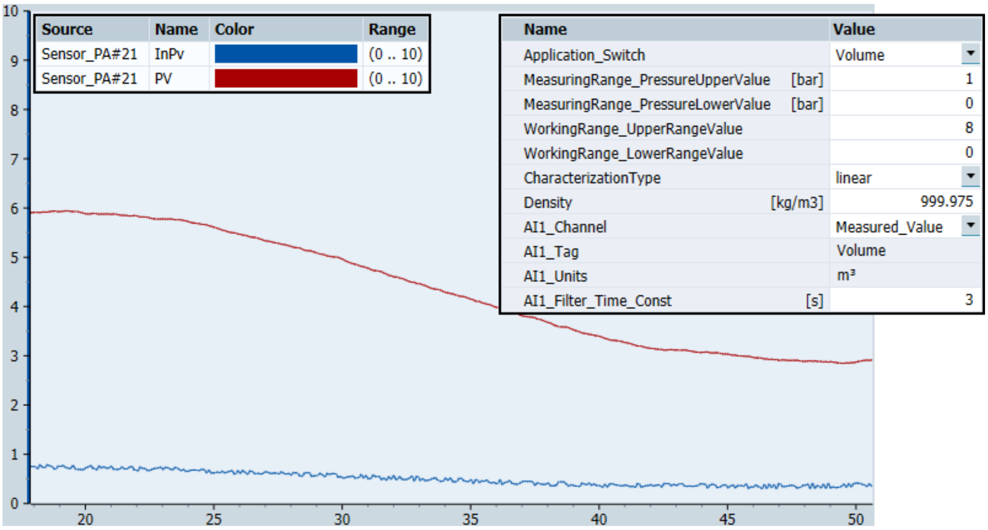
Parameter assignment for measurement of a volume

The value at the input "InPv" is a pressure in the unit [bar]. The totalizator cannot be used. Parameterize the values according to the following table:

Parameter	Value
Application_Switch	"Volume"
MeasuringRange_PressureUpperValue [bar] MeasuringRange_PressureLowerValue [bar]	Maximum pressure Minimum pressure
WorkingRange_UpperRangeLevel WorkingRange_UpperRangeLevel **Note:** The measuring range is scaled to the working area. MeasuringRange_[Upper] ≙ WorkingRange_[Upper] MeasuringRange_[Lower] ≙ WorkingRange_[Lower]	Maximum volumes Minimum volumes
CharacterizationType **Note:** In the case of an inverse characteristic, the values at the measuring range must be reversed. (..UpperValue <..LowerValue)	"linear"
Density [kg/m³]	Density of the medium
AI1_Channel **Notes:** With the "Secondary_Value_3" setting, the process value is output as a mass depending on the configured density. With the "InValGenericModel" setting, the process value is output unchanged as pressure.	"Measured_Value" ≙ Volumes "Secondary_Value_3" ≙ Mass
AI1_Filter_Time_Const **Note:** Time constant for the filter for smoothing the measured value.	"0" = no smoothing Max "100" = largest smoothing

Parameter	Value
AI1_Tag [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"Volume"
AI1_Units [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"m³"

The following figure shows the comparison of the recorded process signal "InPv" and the output measured value "PV". The process value [0..1 bar] is scaled linearly to the measured value [0..8 m³]:



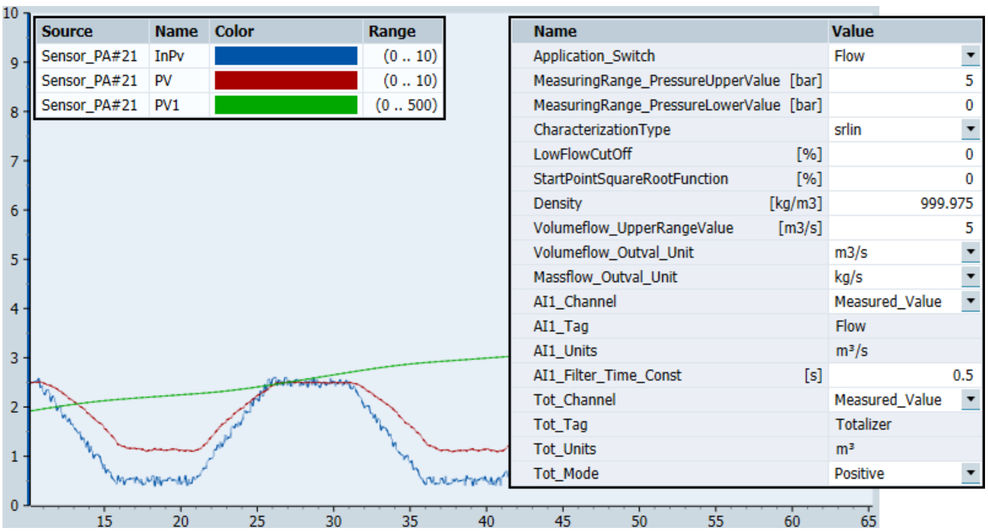
Parameter assignment for measurement of a flow

The value at the input "InPv" is the **differential pressure** in the unit [bar]. The totalizer measures the amount of fluid flowing through. Parameterize the values according to the following table:

Parameter	Value
Application_Switch	"Flow"
MeasuringRange_PressureUpperValue [bar] MeasuringRange_PressureLowerValue [bar]	Maximum pressure Minimum pressure
CharacterizationType	"srllin"
LowFlowCutOff [%] **Note:** Cut-off point of the low flow cut-off. "0" = no suppression.	Limit value
StartPointSquareRootFunction [%] Note: Starting point of the characteristic. If the parameter "CharacterizationType" = "sroff", this value has the same effect as "LowFlowCutOff".	Limit value
Density [kg/m³]	Density of the medium
Volumeflow_UpperRangeValue [m³/s]	Maximum flow rate

Parameter	Value
Volumeflow_Outval_Unit	Unit of volume flow
Massflow_Outval_Unit	Unit of mass flow
AI1_Channel **Notes:** With the "Secondary_Value_3" setting, the process value is output as mass flow depending on the configured density. With the "InValGenericModel" setting, the process value is output unchanged as pressure.	"Measured_Value" ≙ Volume flow "Secondary_Value_3" ≙ Mass flow
AI1_Filter_Time_Const **Note:** Time constant for the filter for smoothing the measured value.	"0" = no smoothing Max "100" = largest smoothing
AI1_Tag [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"Flow"
AI1_Units [STRING] **Note:** The character string is only used to display the symbol in SIMIT.	"m³/s"
Tot_Channel	"Measured_Value"
Tot_Tag **Note:** The character string is only used to display the symbol in SIMIT.	"Totalizer"
Tot_Units **Note:** The character string is only used to display the symbol in SIMIT.	"m³"
Tot_Mode	"Positive"

The following figure shows the comparison of the recorded process signal "InPv" and the output measured value "PV". The process value [0..5 bar] is scaled linearly to the measured value [0..5 m³/s]. "PV1" returns the value of the totalizer:



3.1.3 Parameter overview

All parameters are described in the table below:

Parameter / value	Description
Application_Switch • [Pressure] • [Level] • [Flow] • [Volume]	Type of application of the transmitter. **Note:** The totalizer can only be activated at flow and differential pressure.
UpperSensorLimit LowerSensorLimit [ANALOG]	Measuring range of sensor
MeasuringRange_PressureUpperValue MeasuringRange_PressureLowerValue [ANALOG]	Working range of sensor (used measuring range)
WorkingRange_UpperRangeValue WorkingRange_LowerRangeValue [ANALOG]	Scaling of the measured value depending on the parameter "Application_Switch" • Pressure: none • Level: [bar] → [m] or [%] • Volume: [bar] → [m^3] • Flow: [bar] → [kg/s] (srlin/linear)
CharacterizationType • [linear] • [srlin] • [sroff]	Characteristic curve • srlin: Linear to the entry point and after that square root extracting. • sroff: 0 up to the point of application and after that square root extracting (low flow cut-off) **Notes:** For "App._Switch = Flow", only "srlin" or "sroff" may be parameterized. With "App._Switch = Pressure, Level, Volume", only "linear" may be parameterized. For linearly falling characteristics, the range limits "MeasuringRange_PressureUpperValue" and "MeasuringRange_PressureLowerValue" must be interchanged.
LowFlowCutOff [ANALOG]	Low flow cut-off for flow in [%] of the measuring range
StartPointSquareRootFunction [ANALOG]	Starting point of the characteristic curve in [%] of the measuring range **Note:** With "sroff" it works like the low flow cut-off suppression.
Density [ANALOG]	Density of the medium in kg/m^3 **Note:** The density is used to calculate the mass and volume flow.
Volumeflow_UpperRangeValue [ANALOG]	Upper limit of the working range in [m^3/s] **Notes:** At maximum inlet pressure "MeasuringRange_UpperRangeValue" the volume flow corresponds to the value "Volumeflow_UpperRangeValue" The differential pressure must not be zero.

Parameter / value	Description
Volumeflow_Outval_Unit • [m³/s] • [l/s] • [m³/min] • [l/min] • [m³/h] • [l/h] • [m³/d] • [l/d]	The output value of "Measured_Value" and the range limits are scaled based on this unit.
Massflow_Outval_Unit • [kg/s] • [kg/h] • [kg/min] • [kg/d]	The output value of "SecondaryValue_3" and the range limits are scaled based on this unit
Level_Outval_Unit [m] / [%] • [m] • [%]	Output unit of the level
FailSafeMode • [SubstituteValue] • [LastValidValue] • [UseBadValue]	Behavior in case of failure. The device status is set to "bad". **Note:** The Totalizer does not have its own "FailSafeMode". In the event of an error, the counter is stopped or set to the substitute value.
AI1_Channel • [InValGenericModel] • [MeasuredValue] • [Secondary_Value_1] • [Secondary_Value_3]	Selection of the measured value for the first channel.
AI1_Tag [STRING]	Measured value type – Default. "Pressure" **Note:** The character string is displayed at the symbol.
AI1_Units [STRING]	Measured value unit – Default: "bar" **Note:** The character string is displayed at the symbol.
AI1_OpScaling_UpperValue AI1_OpScaling_LowerValue [ANALOG]	Measured value operating limits **Note:** The limits must also be parameterized on the PCS7 driver block.
AI1_UpperAlarm_Enable AI1_UpperWarning_Enable AI1_LowerWarning_Enable AI1_LowerAlarm_Enable [BOOL]	Activation of limit value monitoring
AI1_UpperLimitAlarm AI1_UpperLimitWarning AI1_LowerLimitWarning AI1_LowerLimitAlarm [ANALOG]	Limits for warnings and alarms
AI1_LimitHysteresis [ANALOG]	Hysteresis for limit monitoring
AI1_FailSafeValue [ANALOG]	Parameterizable substitute value in case of error
AI1_Filter_Time_Const [ANALOG]	Time constant for the filter for smoothing the measured value in [s]. **Note:** Maximum value is 100 s. With "zero", the smoothing is inactive and the value is output unchanged.

Parameter / value	Description
Tot_Channel • [notUsed] • [Measured_Value] • [Secondary_Value_3]	Selection of the input size for the totalizer **Note:** The totalizer can only be activated with "Application_Switch = Flow".
Tot_Tag [STRING]	Designation of the measured value, default = "Totalizer"
Tot_Units [STRING]	Unit of the measured value, default = "m³"
Tot_Preset_Value [ANALOG]	Starting value for the totalizer
Tot_UpperAlarm_Enable Tot_UpperWarning_Enable Tot_LowerWarning_Enable Tot_LowerAlarm_Enable [BOOL]	Activation of limit value monitoring
Tot_UpperLimitAlarm Tot_UpperLimitWarning Tot_LowerLimitWarning Tot_LowerLimitAlarm [ANALOG]	Alarm limit values
Tot_LimitHysteresis [ANALOG]	Hysteresis for limit monitoring
Tot_FailSafeValue [ANALOG]	Parameterizable substitute value in case of error

3.1.4 Operation

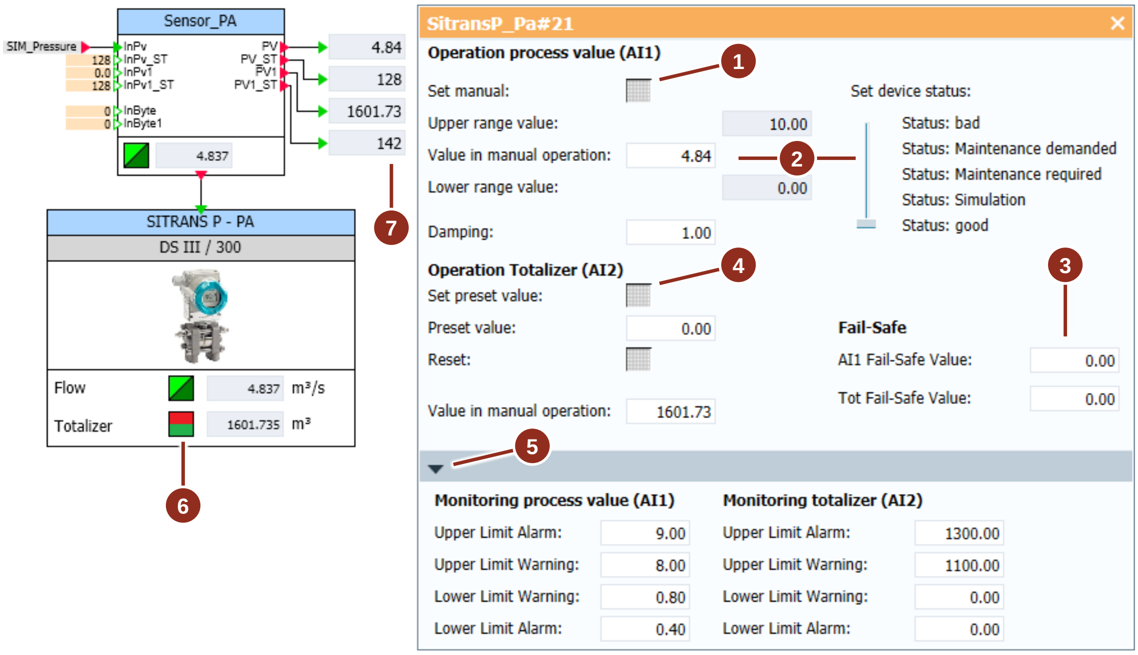
As soon as a detailed device model is connected to the "Sensor_PA" block, the operating function of the generic block is deactivated. The operation then takes place exclusively on the "SITRANS P - PA" block. However, this is not visible to the user. Changes to the generic model are overwritten by the detailed model.

Double-click on the "SITRANS P - PA" block to open the operating window. The operating window displays the current measured values and limit values.

If you press the "Set manual" switch (1), you can enter a replacement value "Value in manual operation" for the measured value and specify the device status "Set device status" (2). The "Fail-Safe" values for the error case (3) become active when you set the device status to "bad" in manual mode.

If the totalizer is used, you can specify a value and activate this value with the "Set preset value" switch (4). The "Reset" switch sets the value back to "0".

The operating window can be expanded by a mouse click on the triangle symbol (5). There you can view and change the parameterized limit values. Limit overruns are displayed on the block icon (6) and the status of the process value (7) is set accordingly.

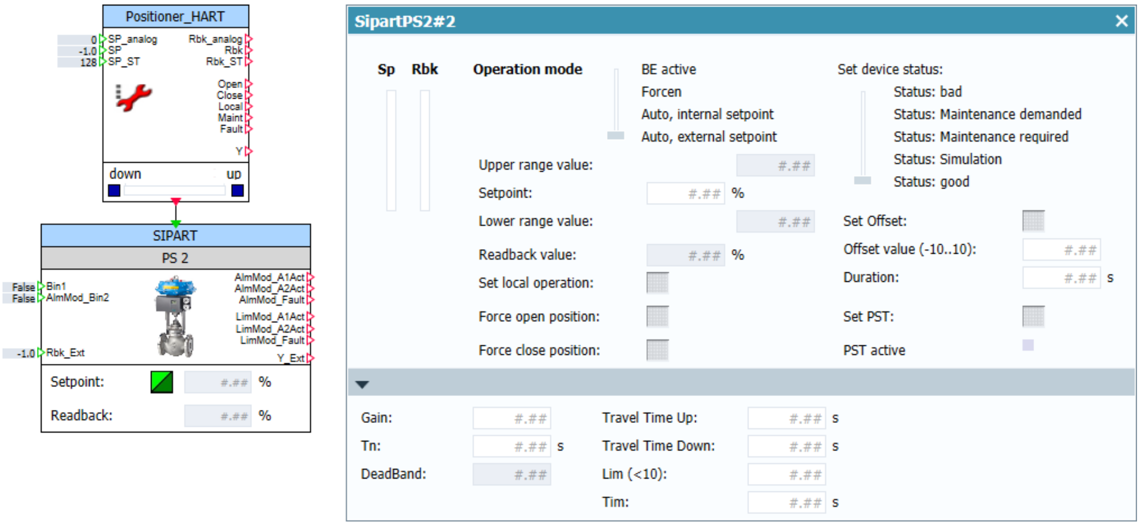


3.2 SIPART PS2

The SIPART PS2 positioner can be simulated with this simulation block. The detailed simulation model can be used with the "Positioner_HART" and "Positioner_PA" generic models.

The simulation block contains the following functions:

- Manual/local operation of the valve
- Simulation of the device status
- Simulation of a partial stroke test
- Simulation of the control loop
- Simulation of a tight-closing function
- Failsafe behavior in case of device failure or bad condition
- Simulation of a blockage.
- "Control in the field" function with the help of binary inputs



The example uses the HART variant.

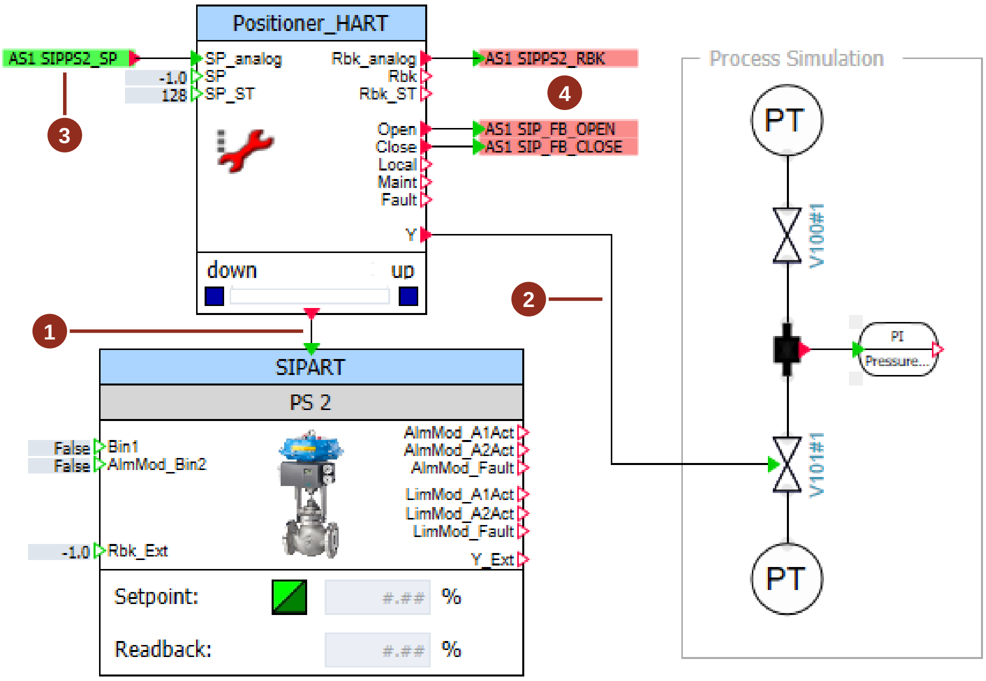
3.2.1 Configuration

1. Drag and drop the following blocks from the device library into the SIMIT diagram:
   - Positioner_HART
   - SipartPS2

Note

> There is an output at the "Positioner_HART" block and at the "SipartPS2" block there is an input of the complex connection type "L2DetailledModel2". Both blocks exchange signals and process values with each other via this interface. The connection type contains all relevant input and output variables. The data exchange works in both directions.

2. Connect the two connections "L2DetailledModel" (1).
3. Connect the setting position "Y" (2) with the process simulation.
4. Connect the input "SP_analog" (3) to the output signal of the coupling.
5. Connect the outputs "Rbk_analog", "Open" and "Close" (4) with the corresponding input signals of the coupling.



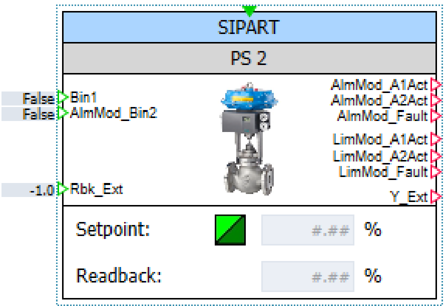
Note

> The connections "SP_analog" and "Rbk_analog" process the 4 ... 20 mA raw value. Here, the signals do not need to be normalized. Alternatively, you can also specify the setpoint as a floating-point number at the "SP" input.

3.2.2 Parameter assignment

The parameters of the simulation model largely correspond to those of the device in SIMATIC PDM.

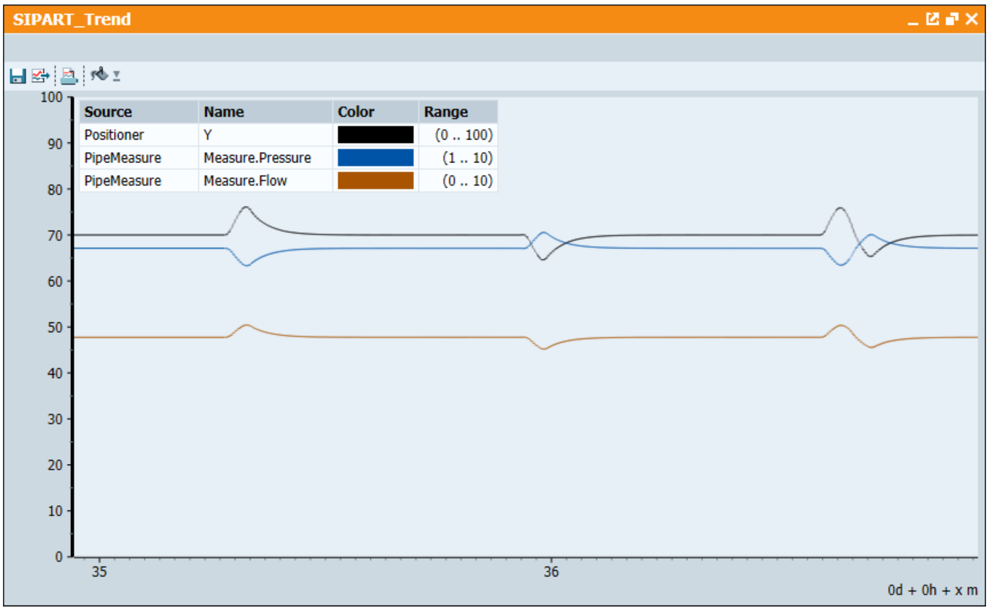
Select the block of the detailed device model "SIPART PS 2" and change in the properties to the category "Additional parameter".



Name		Value
Function_of_Binary_Input_1		Off
Function_of_Binary_Input_2		Off
Response_Threshold_of_Ala...	[%]	90.0
Response_Threshold_of_Ala...	[%]	10.0
LimMod_act		False
LimMod_A1	[%]	100.0
LimMod_A2	[%]	0.0
Gain		0.5
Tn	[s]	0.0
Travel_Time_Up	[s]	10.0
Travel_Time_Down	[s]	10.0
Setpoint_Direction_Rise		True
Setpoint_End_Value	[%]	100.0
Setpoint_Initial_Value	[%]	0.0
Setpoint_TSUP	[s]	5.0
Setpoint_TSDO	[s]	5.0
Safety_Position_Mechanical		Fail_Safe_Close
Response_Threshold_for_Fault_...		10.0
Monitoring_Time_for_Fault_M...	[s]	100.0
PST_Enable		True
PST_Step_Height	[%]	10.0
PST_Step_Direction		up
PST_Tim		10.0
Tight_Closing_YCLS		NoActive
Tight_Closing_YCUP	[%]	100.0
Tight_Closing_YCDO	[%]	0.0

Partial stroke test

The following figure shows the effect of the partial stroke test on the process. The PST with the change quantity of 10% is always executed with the settings at the parameter "PST_Step_Direction" with "up", "down" and "up_down".



3.2.3 Parameter overview

Parameter / value	Description
Function_of_Binary_Input_1 [%] Function_of_Binary_Input_2 [%] • [Off] • [Open] • [On] • [Close] • [Stop] • [PST]	Parameterizable function of the inputs "Bin_1" and "AlmModBin_2".
Response_Threshold_of_Alarm_1 [%] Response_Threshold_of_Alarm_2 [%]	Upper limit for the alarm signal "AlmMod_A1Act" Lower limit for the alarm signal "AlmMod_A2Act"
LimMod_act	Activate limit value module
LimMod_A1 [%] LimMod_A2 [%]	Upper limit of the limit value module Lower limit of the limit value module
Gain	Regulator gain
Tn [s]	Integral time of the controller
Travel_Time_Up [s] Travel_Time_Down [s]	Positioning speed of the valve 0-100% Positioning speed of the valve 100-0% **Note:** These values cannot be configured in PDM "Actuating_Time" but are a measured characteristic of the valve.
LowFlowCutOff [ANALOG]	Low flow cut-off for flow in [%] of the measuring range
Setpoint_Direction_Rise [BOOL]	Control value inversion [TRUE]=Normal; [FALSE]=Inverted

Parameter / value	Description
Setpoint_End_Value [%] Setpoint_Initial_Value [%]	Upper limit of the setpoint value Lower limit of the setpoint value
Setpoint_TSUP [s] Setpoint_TSDO [s]	Time constant for setpoint ramp on Time constant for setpoint ramp off
Safety_Position_Mechanical • [Fail_Safe_Open] • [Fail_Safe_Close] • [Fail_Freeze]	Safety position in the case of failure
Response_Threshold_for_Fault_Message [%]	Permissible control deviation Threshold of the fault message "Control deviation (TIM)", the alarm signal "AlmMod_Fault" is set
Monitoring_Time_for_Fault_Message [s]	Monitoring time in which the nominal state of the positioner must be within the control deviation
PST_Enable [BOOL]	Activate partial stroke test
PST_Step_Height [%]	PST setting range
PST_Step_Direction • [Up] • [Down] • [Up_Down]	PST setting direction
PST_Tim [s]	Monitoring duration transient response for PST **Note:** The PST is executed if the control difference has been within the deadband for the duration of a monitoring period (PST_TIM). The jump is then executed and withdrawn after the monitoring period has elapsed. The PST is performed for the current operating point; the parameters STPOS and STTOL are therefore not used.
Tight_Closing_YCLS • [Up] • [NoActive] • [Down] • [Up_Down]	Setting direction for the sealing
Tight_Closing_YCUP [%]	If the value is exceeded, the valve is moved to the "Open" position.
Tight_Closing_YCDO [%]	If the value is fallen below, the valve is moved to the "Close" position.

3.2.4 Operation

As soon as the detailed device model "SIPART PS 2" is connected to one of the blocks "Positioner_PA" or "Positioner_HART", the operating function of the generic block is deactivated. The operation then takes place exclusively on the detailed model.

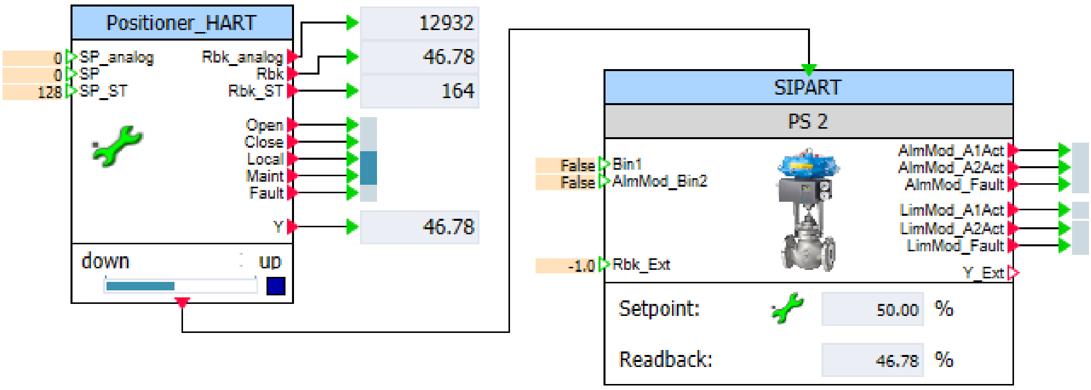
Double-click on the "SIPART PS 2" block to open the operating window. You can perform the following functions:

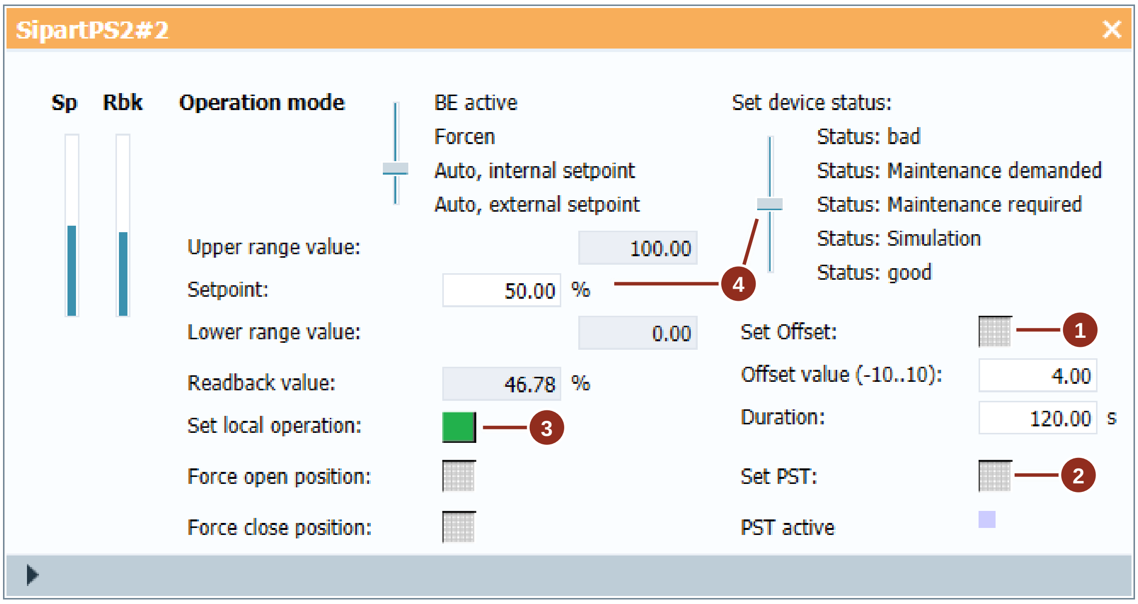
(1) Offset with deviation quantity and duration

(2) Partial stroke test

(3) Local operation

(4) Change of process value and device status in manual mode.





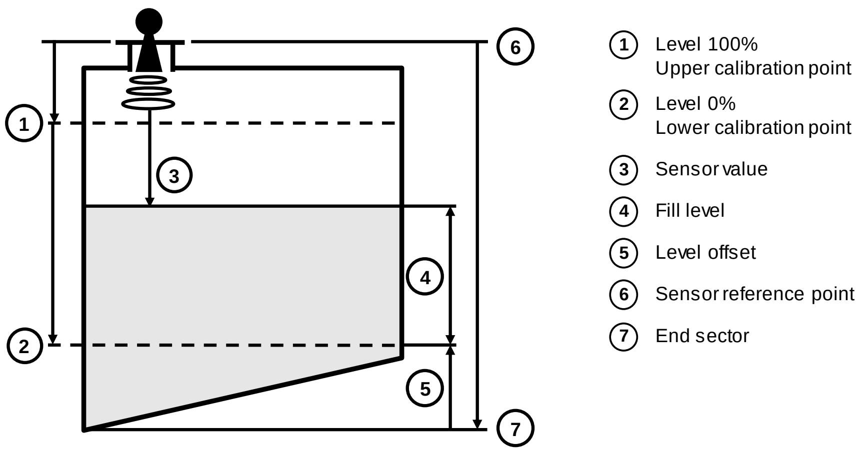
3.3 SITRANS LR/LU - PA

With this simulation block, the transmitters SITRANS LR250, SITRANS LR560 and STRANS Probe LU can be simulated.

The simulation block contains the following functions:

- Configurable measurement of level, distance, space and volume
- Reaction rate and damping
- Simulation of the device status
- Monitoring of alarm limits
- Behavior in the event of a device failure or a radar failure
- Manual operation and simulation of process values

The transmitters for detecting a level work according to the following scheme:



For further information, refer to the manual for the respective device.

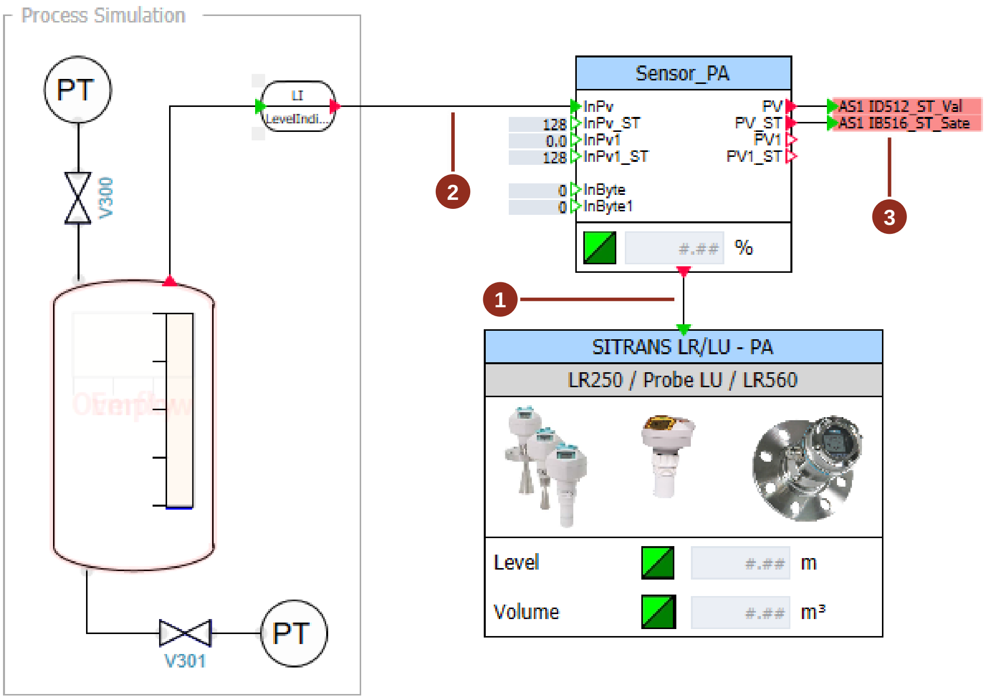
3.3.1 Configuration

1. Drag and drop the following blocks from the device library into the SIMIT diagram:
   - Sensor_PA
   - SitransLRLU_PA

Note

There is an output on the "Sensor_PA" block and an input of the complex connection type "L2DetailledModel2" on the "SITRANS LR/LU - PA" block. Both blocks exchange signals and process values with each other via this interface. The connection type contains all relevant input and output variables. The data exchange works in both directions.

2. Connect the connections "L2DetailledModel" and "L2SensorProfibus" (1).
3. Connect the simulated process value to the input "InPv" (2).
4. Connect the outputs "PV" and "PV_ST" with the corresponding input signals of the configured coupling (3). The output "PV" is supplied with the parameterized value "AI1_Channel".
5. The process value input "InPv1" can only be used without the detailed simulation model. As soon as the detailed model is used, the parameterized associated value "AI2_Channel" is output at output "PV1".



3.3.2 Parameter assignment

The following case studies show the effects of the "Response rate" parameter on the process value.

In this example, the level of a container is measured. The simulated container has the following parameters:

- Maximum height: 5 m
- Maximum volume: 20 m³

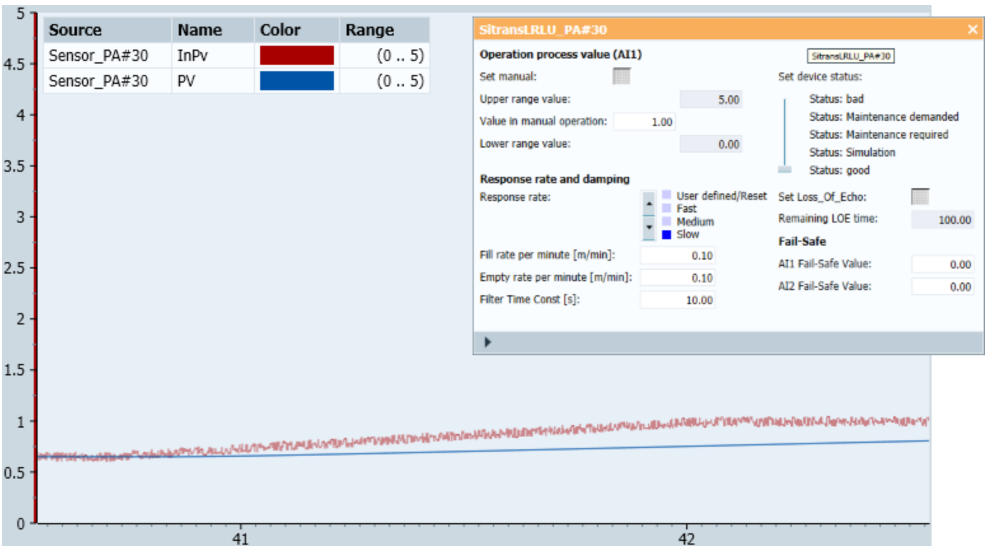
The inlet and outlet are each regulated by a valve.

Change limit "Slow"

The maximum change in the level was limited via the parameter "Response rate = slow" to 0.1 m/min.

Result:

The response rate of the meter is too low. The process value deviates from the measured value.

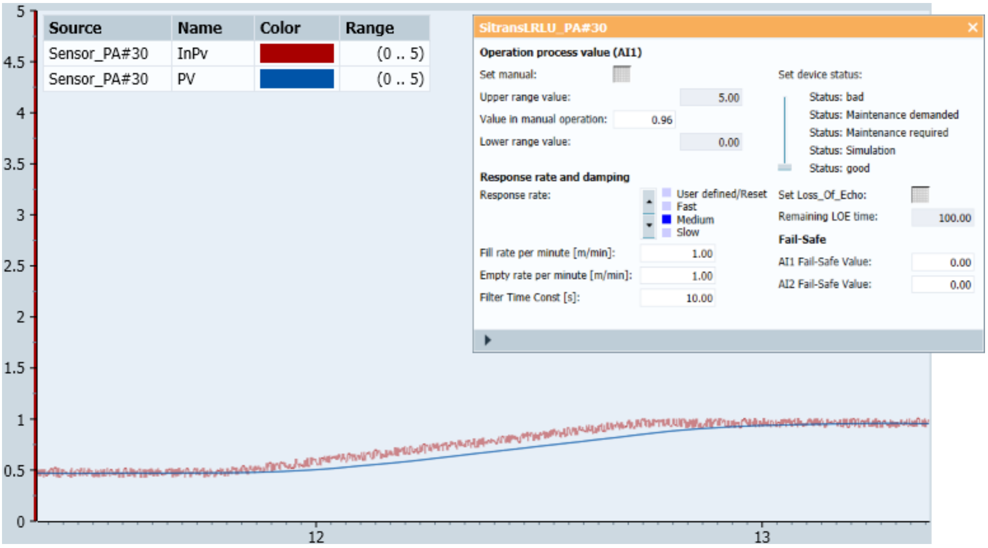


Change limit "Medium"

The maximum change in the level was limited via the parameter "Response rate = medium" to 1.0 m/min.

Result:

The response rate of the meter is somewhat too low. The process value deviates slightly from the measured value.

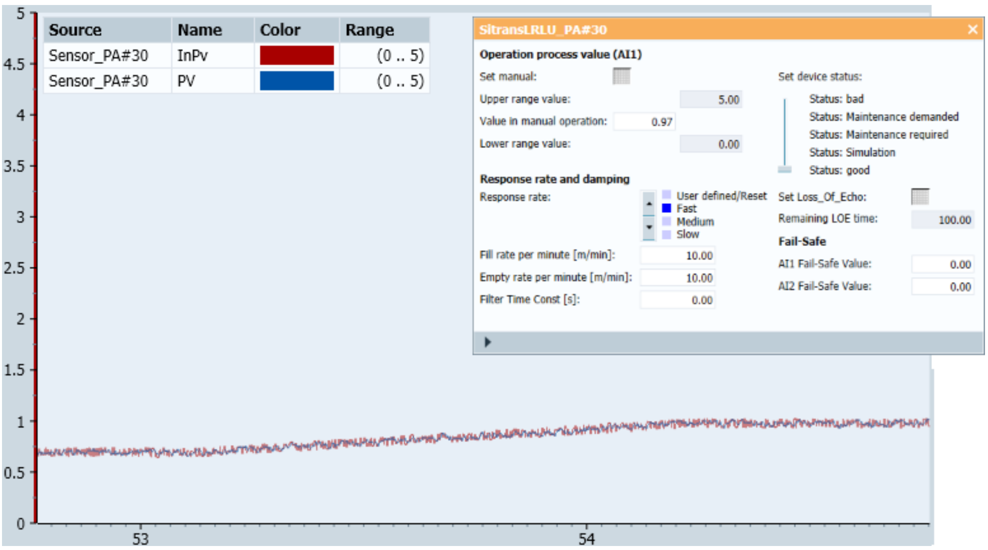


Change limit "Fast"

The maximum change in the level was limited via the parameter "Response rate = fast" to 10.0 m/min.

Result:

The response rate of the meter is too high. The process value maps the measurement noise of the sensor.

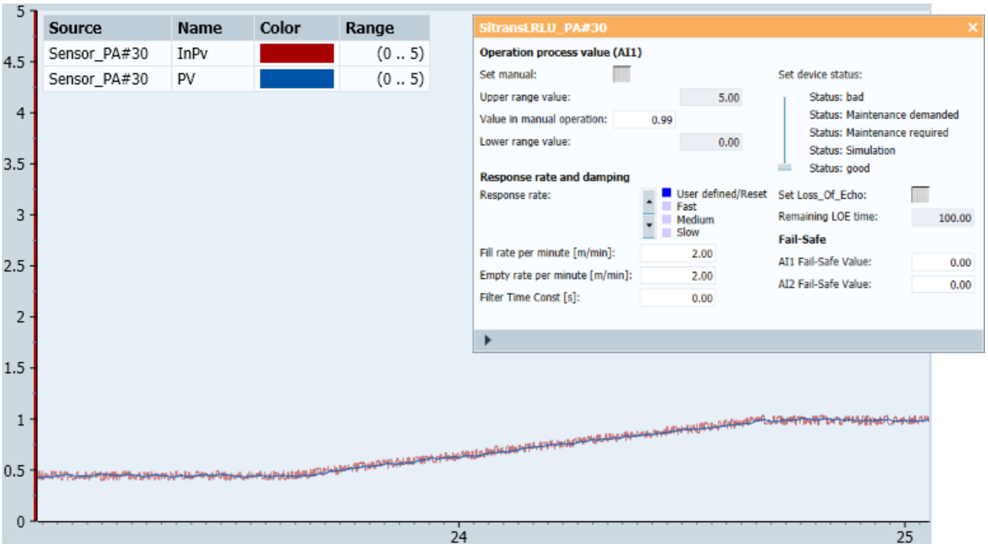


Change limit "User defined"

The maximum change in the level limited set via the parameter "Response rate = User defined" to 2.0 m/min.

Result:

The response rate of the meter is correct. The process value does not deviate from the measured value, and the measurement noise is not transmitted to the process value.



3.3.3 Parameter overview

Parameter / value	Description
High_Calibration_Point [m] Low_Calibration_Point [m]	Upper and lower calibration point
Response_Rate • [fast] • [medium] • [slow] • [user defined]	Change limitation of the process value of channel 1 (AI1) **Note:** Slow ≙ 0.1 m/min filling and emptying rate Medium ≙ 1.0 m/min filling and emptying rate Fast ≙ 10.0 m/min filling and emptying rate User Defined ≙ value of "Fill_Rate" and "Empty_Rate"
Empty_Rate [m/min] Fill_Rate [m/min]	Maximum emptying or filling rate **Note:** Only with "Response_Rate" = "user defined"
Filter_Time_Const [s]	Time constant for the filter for smoothing the measured value. **Note:** 0s = no smoothing; 100s = maximum smoothing The filter time constant only affects the primary variable
Max_Volume [m³]	Volume at maximum filling level
LevelUnit • [m] • [%]	Selection of the level output unit

Parameter / value	Description
FailSafeMode • [SubstituteValue] • [LastValidValue] • [UseBadValue]	Behavior in case of failure. The device status is set to "bad". **Note:** The "FailSafeMode" affects both channels "AI1" and "AI2".
LOE_Timer [s]	Delay in the signaling of a device failure (Loss of echo) **Note:** If the error "Loss of echo" occurs; For the period of "LOE_Timer", the status is set to "Maintenance demanded" and the last valid value is output. After the counter has elapsed, the status "bad" is output and the setting of "FailSafeMode" becomes effective.
AI1_Channel • [InValGenericModel] • [Level] • [Distance] • [Volume]	Selection of the measured value of channel 1
AI1_Tag [STRING]	Name of the measured value displayed on the model symbol
AI1_Units [STRING]	Unit of the measured value displayed on the model symbol
AI1_OpScaling_UpperValue AI1_OpScaling_LowerValue [ANALOG]	Measured value operating limits
AI1_UpperAlarm_Enable AI1_UpperWarning_Enable AI1_LowerWarning_Enable AI1_LowerAlarm_Enable [BOOL]	Activation of limit value monitoring
AI1_UpperLimitAlarm AI1_UpperLimitWarning AI1_LowerLimitWarning AI1_LowerLimitAlarm [ANALOG]	Alarm limit values **Note:** Upper = monitoring for overshoot Lower = monitoring for undershoot
AI1_LimitHysteresis	Hysteresis for limit monitoring
AI1_FailSafeValue	Substitute value in case of error
AI2_Channel • [InValGenericModel] • [Level] • [Distance] • [Volume]	Selection of the measured value of channel 2
AI2_Tag [STRING]	Name of the measured value displayed on the model symbol
AI2_Units [STRING]	Unit of the measured value displayed on the model symbol
AI2_OpScaling_UpperValue AI2_OpScaling_LowerValue [ANALOG]	Measured value operating limits

Parameter / value	Description
AI2_UpperAlarm_Enable AI2_UpperWarning_Enable AI2_LowerWarning_Enable AI2_LowerAlarm_Enable [BOOL]	Activation of limit value monitoring
AI2_UpperLimitAlarm AI2_UpperLimitWarning AI2_LowerLimitWarning AI2_LowerLimitAlarm [ANALOG]	Alarm limit values **Note:** Upper = monitoring for overshoot Lower = monitoring for undershoot
AI2_LimitHsyteresis	Hysteresis for limit monitoring
AI2_FailSafeValue	Substitute value in case of error

3.3.4 Operation

As soon as the detailed device model "SITRANS LR/ LU - PA" is connected to the "Sensor_PA" block, the operating function of the generic block is deactivated. The operation then takes place exclusively on the detailed model.

Double-click on the "SITRANS LR/LU - PA" block to open the operating window. You can perform the following functions:

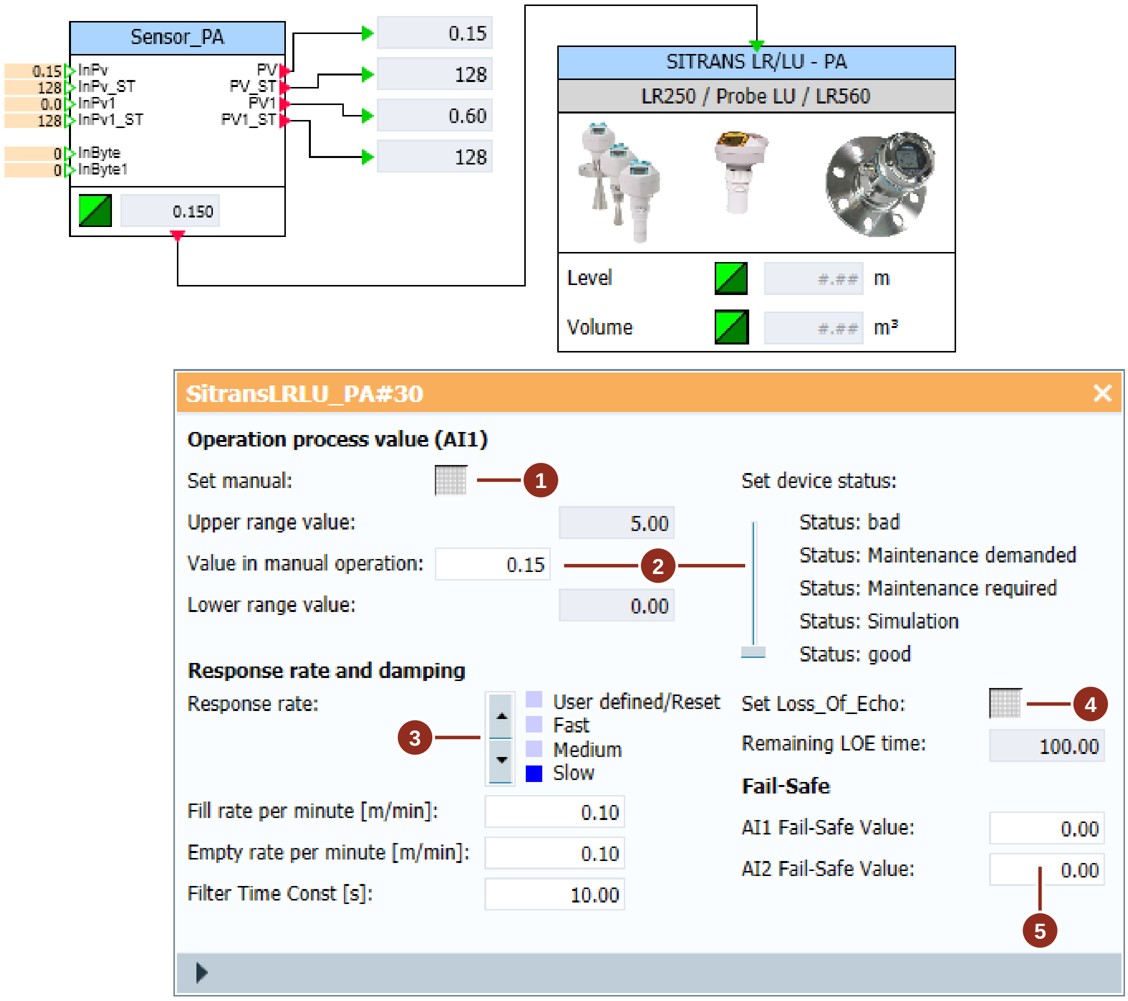
(1) Manual operation

(2) Change of the sensor response rate

(3) Error simulation "Loss of echo"

(4) Specification of substitute values in case of error (status: "Bad")

(5) Change of process value and device status in manual mode.



4 Demo project

From the article page of this sample application, you can download a demo project that will allow you to test the library.

It contains the following components:

- Diagrams for an overview of all device models
- Diagrams describing the detailed device models
- Simulation of several measuring points in one process
- Trend indicators for analyzing device behavior on the process

The demo project and the individual diagrams are structured as follows:

(1) Diagrams with the device models

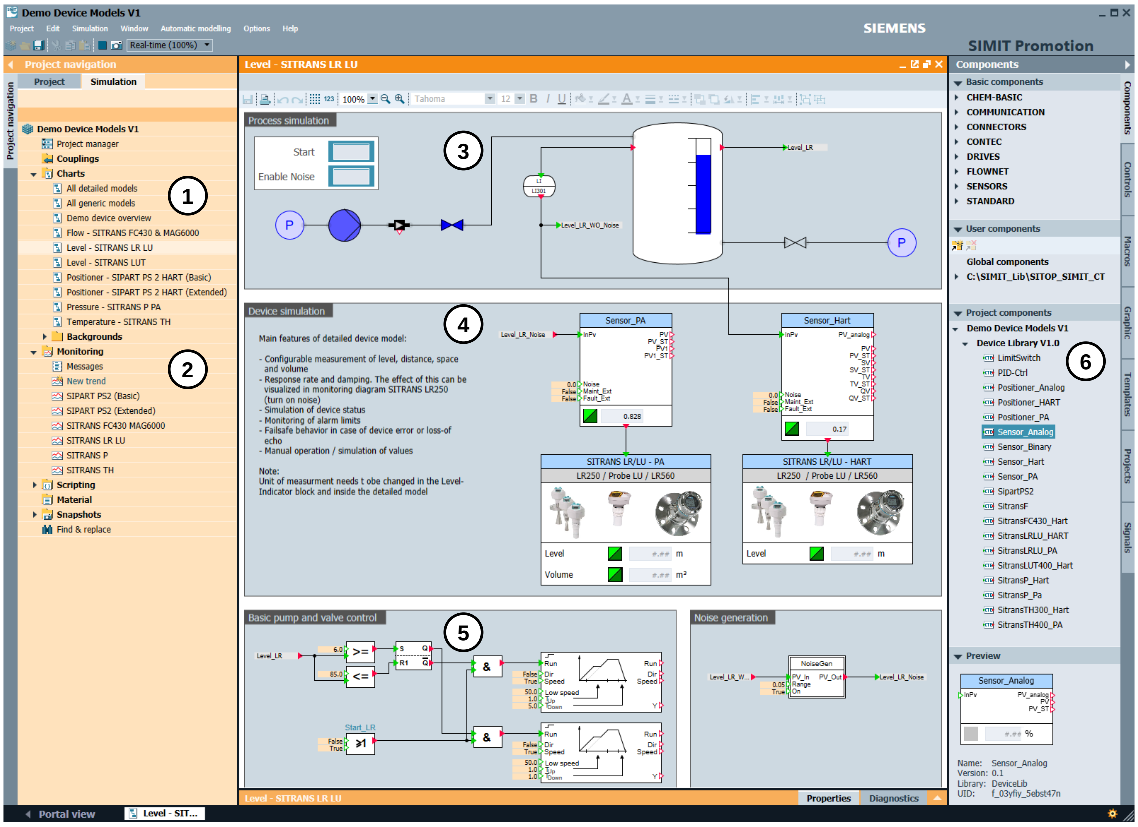
(2) Trend displays for visualization of process values

(3) Simple process simulation that supplies the measuring points with values

(4) Device models including description

(5) Additional simulation behavior

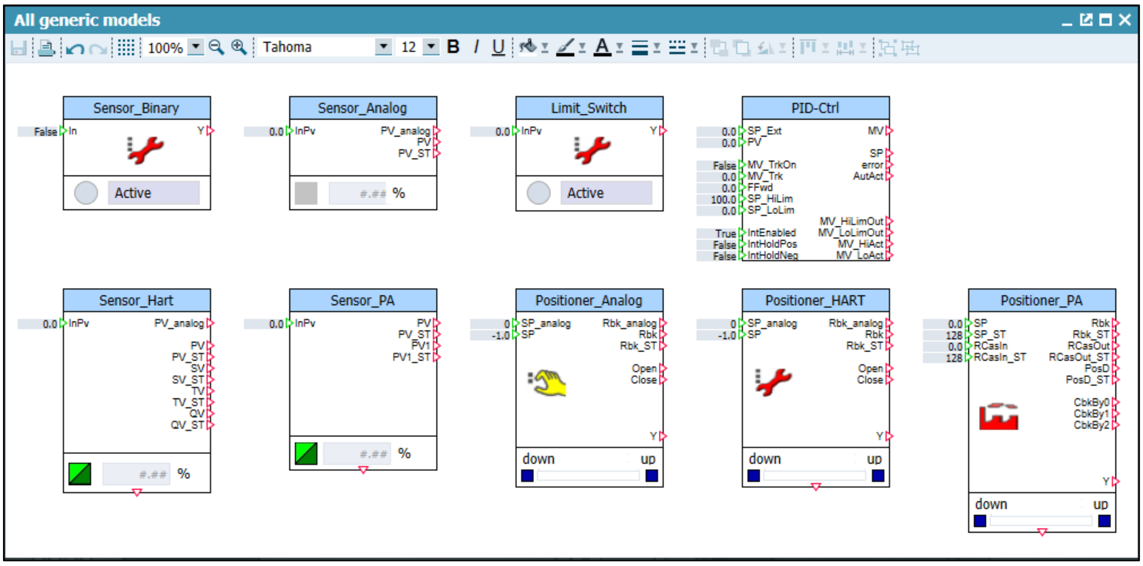
(6) Integrated project library



4.1 Overview of the device models

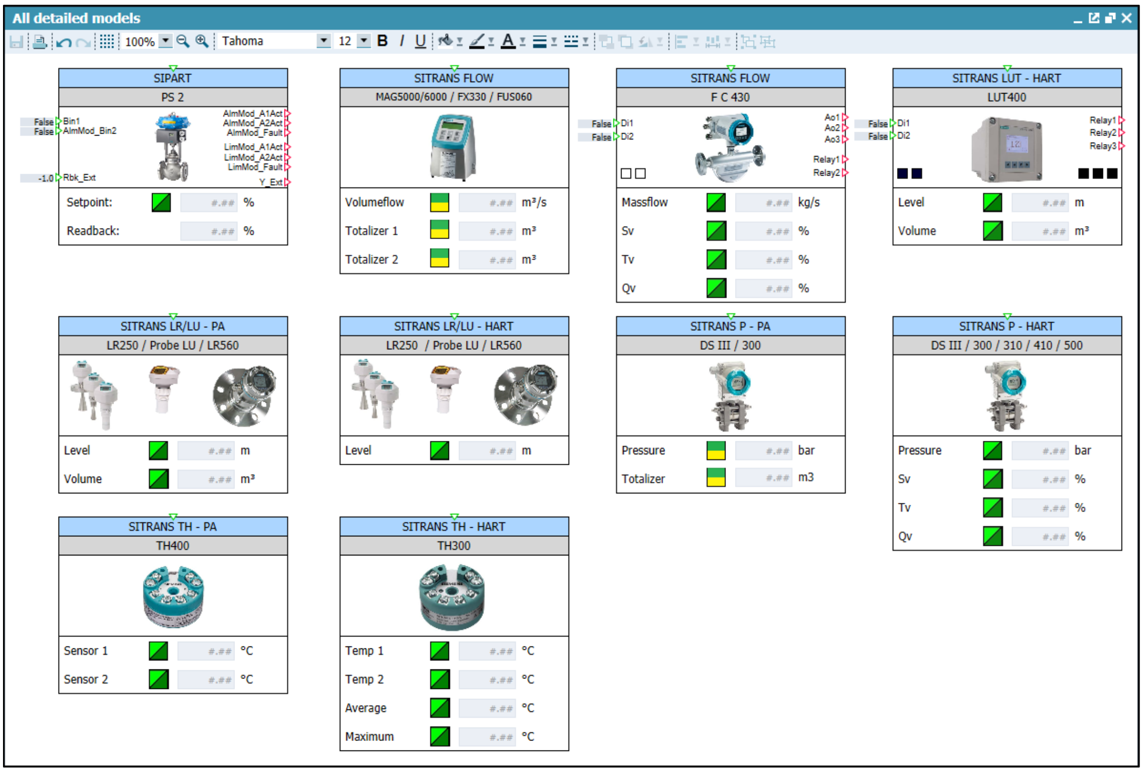
Generic device model

In the diagram "All generic models" you will find an overview of the generic device models:



Detailed device models

In the diagram "All detailed Models" you will find an overview of the detailed device models.



4.2 SITRANS flowmeters

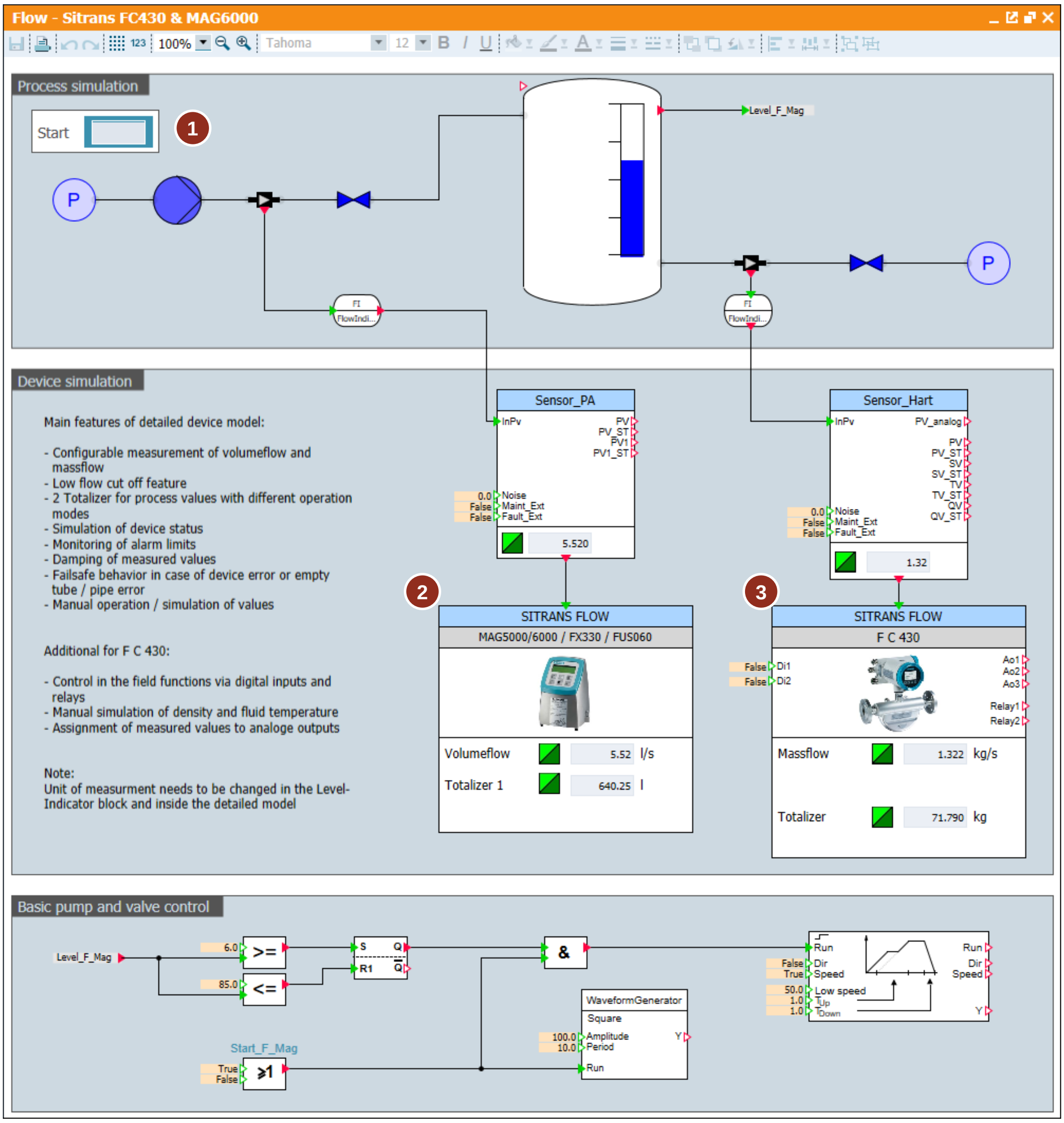
The simulation models for the SITRANS FC430 and the SITRANS MAG6000 are configured in the diagram "Flow - SITRANS FC430 & MAG6000".

Simulation

The process simulation is activated using the "Start" button (1). When the level falls below 6 %, the tank is filled to the level of 85 %. The emptying takes place periodically and independently of the level.

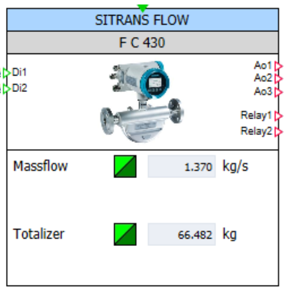
The measuring point for the simulation model of the "MAG6000" (2) is configured at the inlet. The volume flow is recorded in "l/s". The totalizer calculates the amount delivered to the tank in "l".

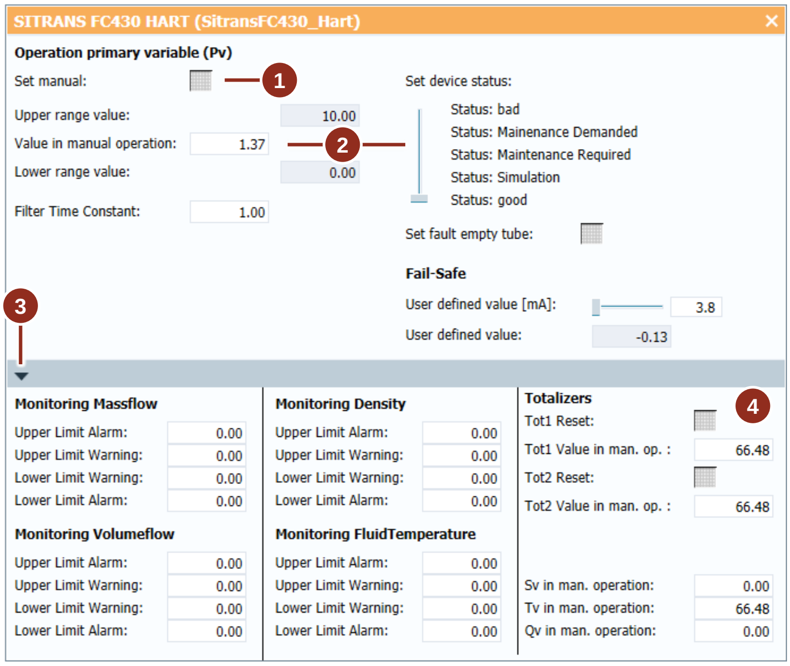
The measuring point for the simulation model of the "FC430" (3) is configured at the outlet. The mass flow rate is recorded in "kg/s". The totalizer calculates the amount delivered to the tank in "kg".



Operation

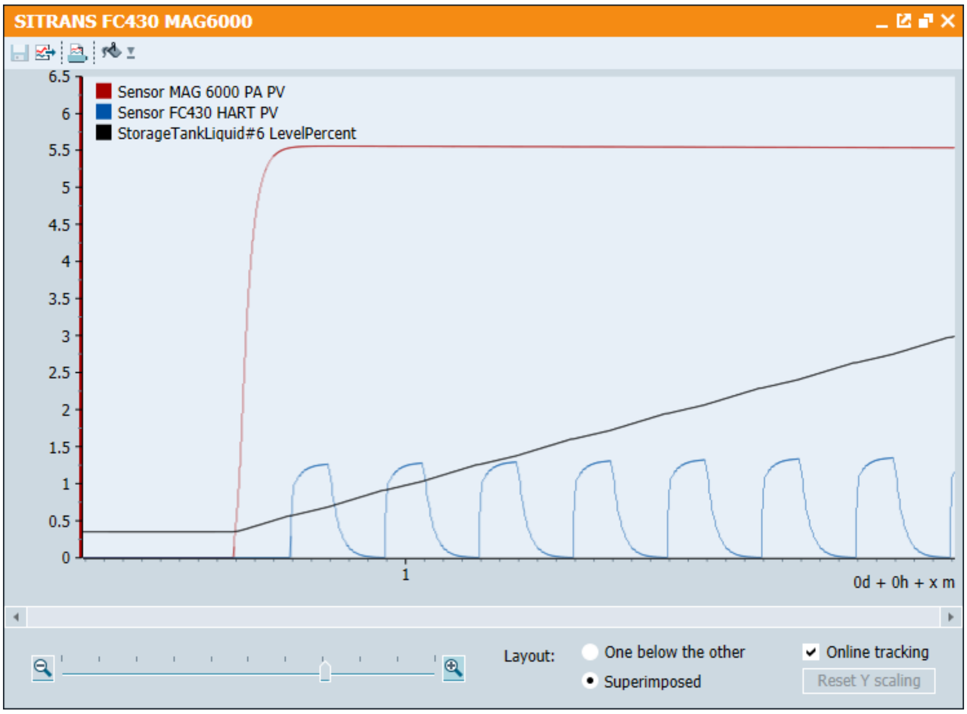
Double-click to open the operating window of the simulation model. If you activate the manual mode (1), you can determine the process value and the device status (2) yourself. After expanding the operating window (3), you can set limits or reset the totalizer (4).





Monitoring

In the trend display "SITRANS FC430 MAG6000" you can observe the process values of the inlet, the outlet and the level.



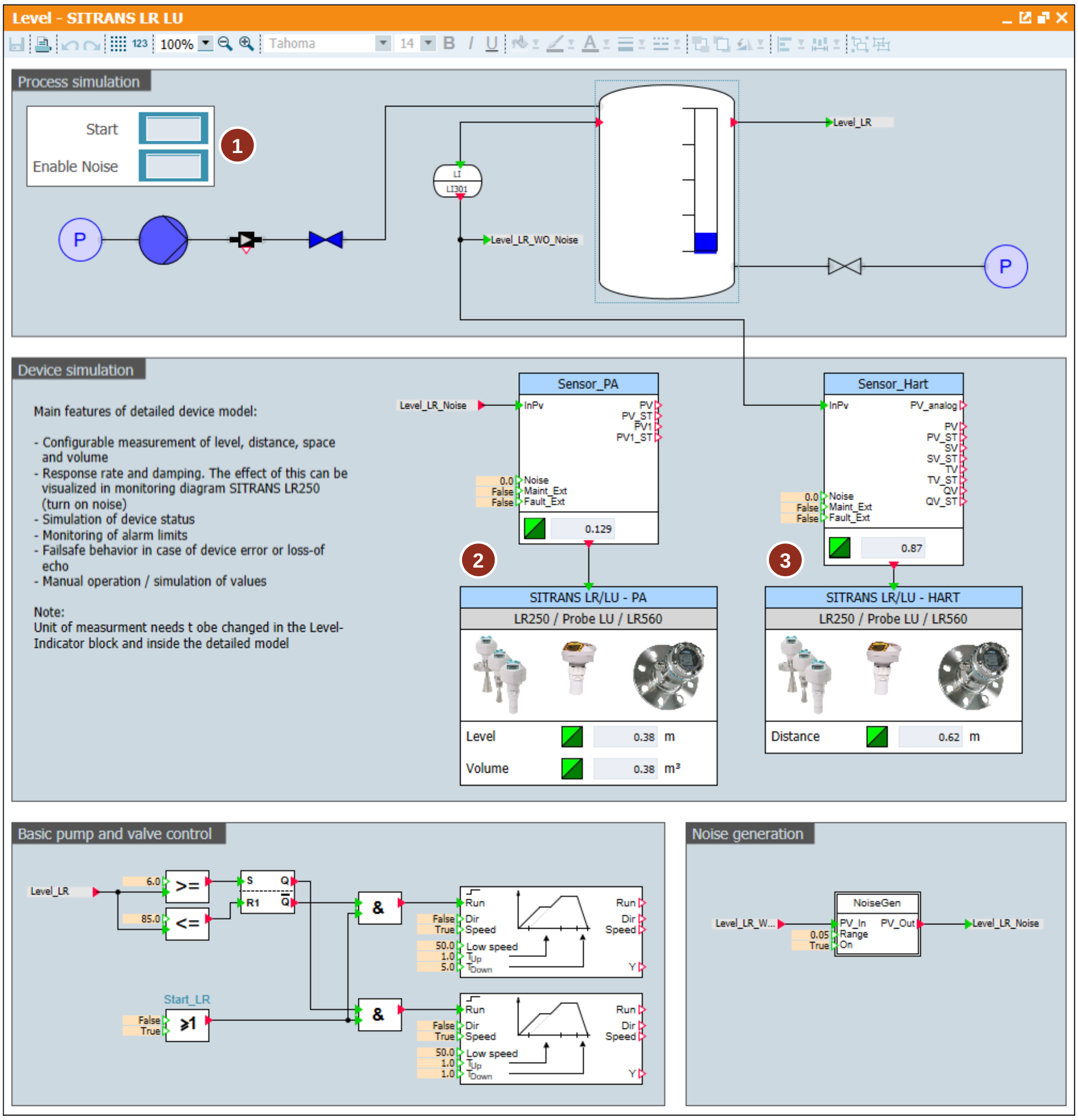
4.3 SITRANS LR250 level meter

The simulation models for the SITRANS LR250 PA and the SITRANS LR250 HART are configured in the "Level - SITRANS LR LU" diagram.

Simulation

The process simulation is activated with the "Start" button. In addition, a measurement noise can be switched on for the SITRANS LR250 PA with the "Enable Noise" button (1). The tank is filled to the level of 85 % when the filling level falls below 6 % and then emptied again to the level of 6 %.

The LR250 PA sensor (2) measures the level, and the LR250 HART sensor (3) measures the distance from the surface in the tank.



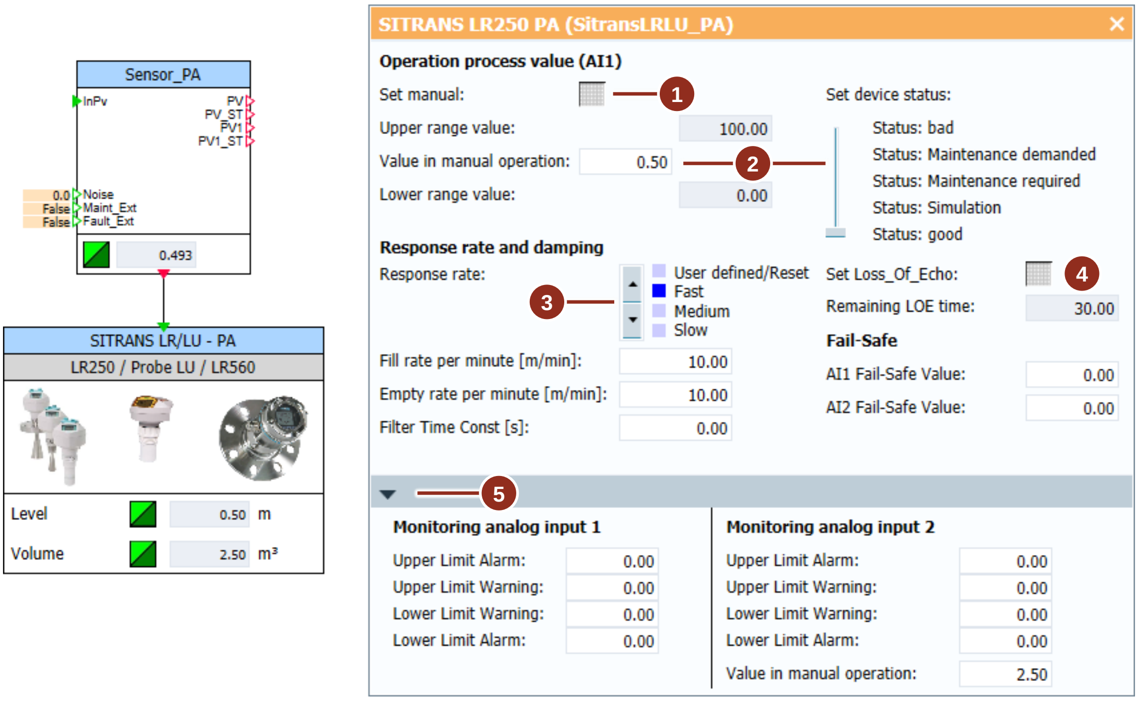
Operation

Double-click to open the operating window of the simulation model. If you activate the manual mode (1), you can determine the process value and the device status (2) yourself.

In the "Response rate and damping" section, you can set the response speed of the sensor or the attenuation of the measured value (3).

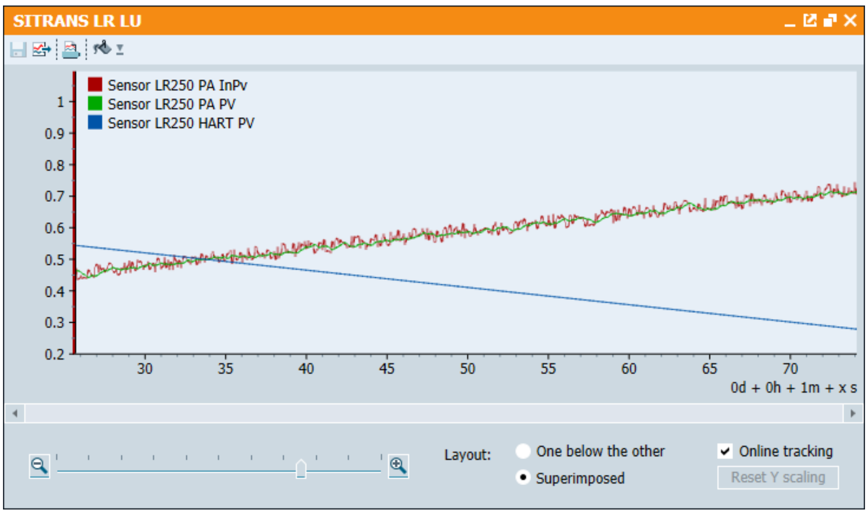
With "Loss of echo" (4) you can simulate a device error.

After expanding the operating window (5), you can set limits.



Monitoring

In the trend display "SITRANS LR LU" you can observe the process values of the inlet, the outlet and the level.



4.4 SITRANS LUT400 level meter

The simulation models for the SITRANS LUT400 are configured in the "Level - SITRANS LUT" diagram.

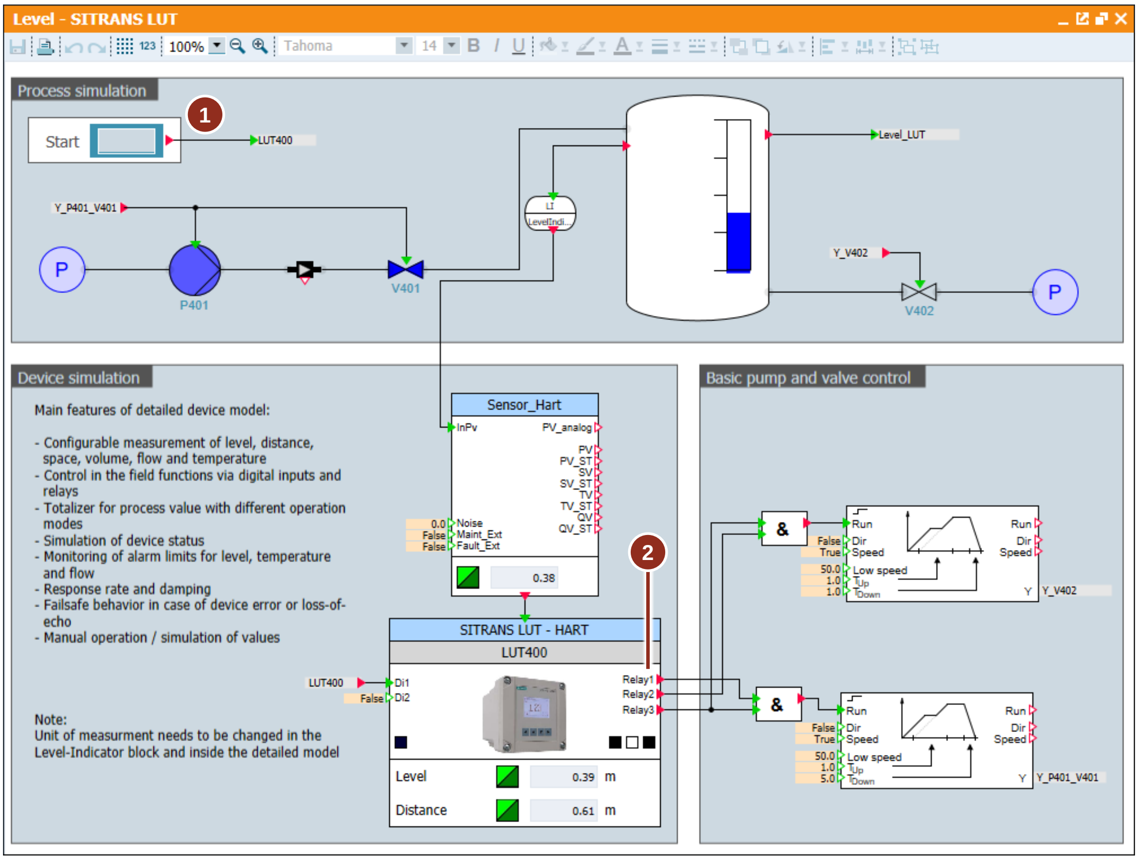
Simulation

The process simulation is activated using the "Start" button (1). In this example, the level of the container is controlled by the meter itself.

The output signals "Relay_1", "Relay_2" and "Relay_3" (2) can be assigned different functions.

The following functions were parameterized in the example:

- "AssignRelay_LoLevel" = "Relay_1"
  The "LoLevel" signal is set when the level falls below the 0.1 m level and is reset when it exceeds 0.85 m.
- "AssignRelay_HiLevel" = "Relay_2"
  The "HiLevel" signal is set when the filling level height of 0.85 m is exceeded and reset when it falls below 0.1 m.
- "AssignRelay_D1" = "Relay_3"
  The input signal "DI1" is transferred directly to the output "Relay_3".



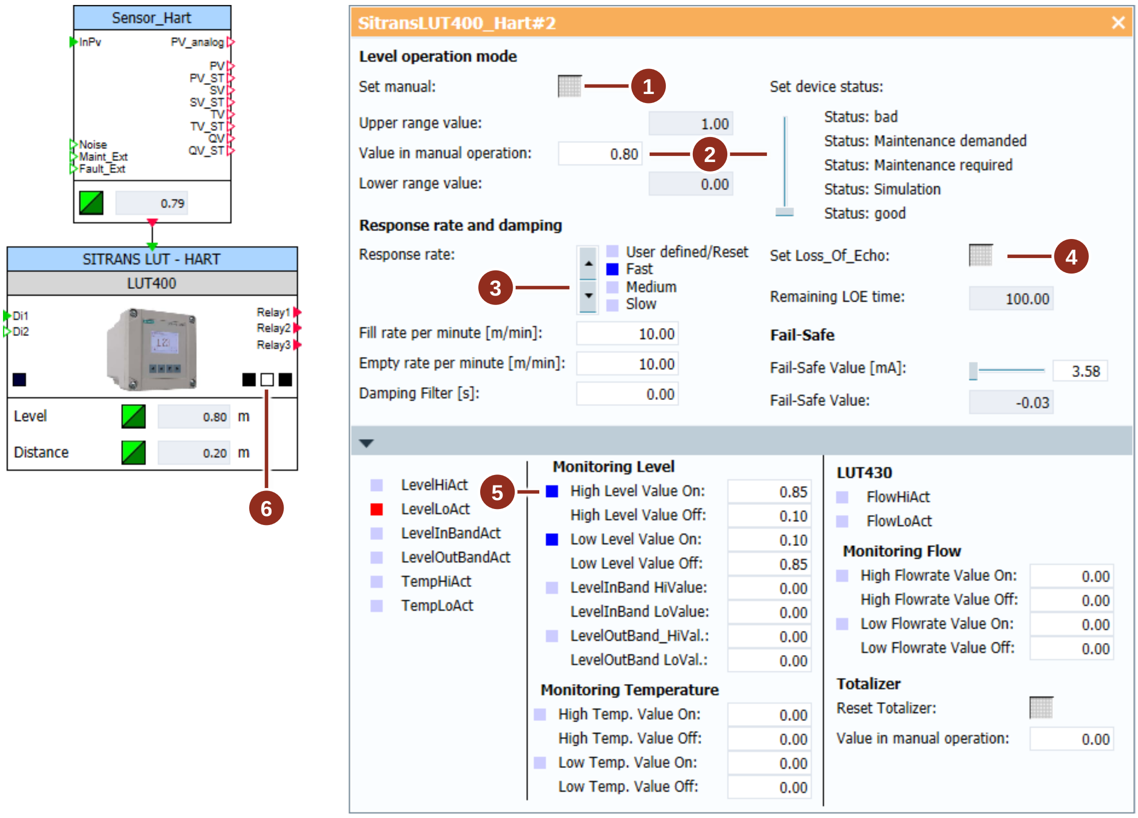
Operation

Double-click on the symbol to open the operating window of the simulation model. If you activate the manual mode (1), you can determine the process value and the device status (2) yourself.

In the "Response rate and damping" section, you can set the response speed of the sensor or the attenuation of the measured value (3).

With "Loss of echo" (4) you can simulate a device error. After the LOE time has elapsed, the block reports the status "bad".

After expanding the operating window, you can monitor signals and set limits. The symbol (5) indicates the active monitoring parameters. The symbol displays the signal states of the "Relay" outputs (6).



Monitoring

In the trend display "SITRANS LUT" you can observe the measured value and the signal states of "Relay_1" and "Relay_2".

4.5 SITRANS P pressure transmitter

The SITRANS P can be used to measure absolute pressure, relative pressure, differential pressure, flow and level. In the diagram "Pressure - SITRANS P PA", the simulation model of SITRANS P is configured in three different variants.

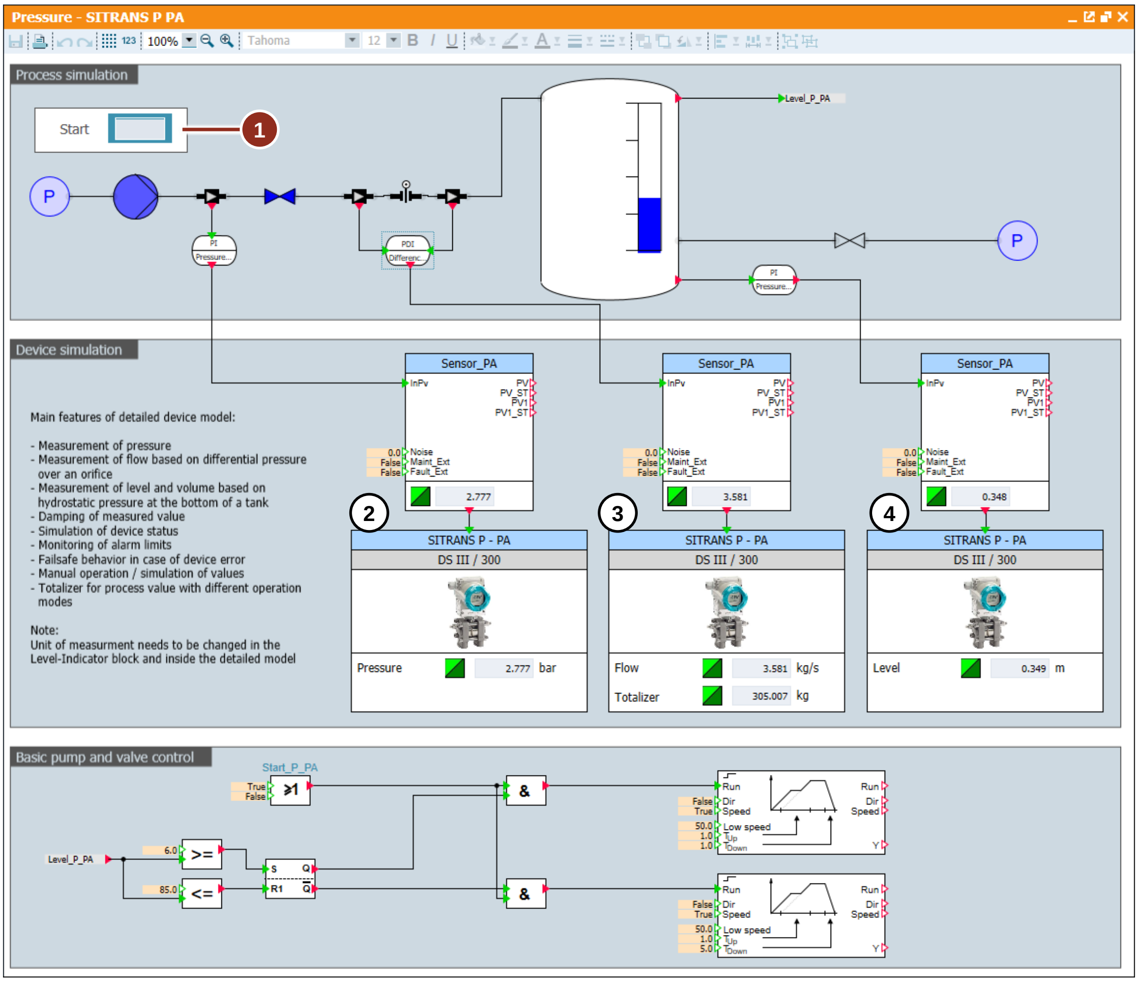
Simulation

The process simulation is activated using the "Start" button (1). When it falls below the level of 6%, the tank is filled to the level of 85% and then emptied again to the level of 6%. The models are parameterized as follows:

(2) Pressure measurement

(3) Flow measurement

(4) Level measurement

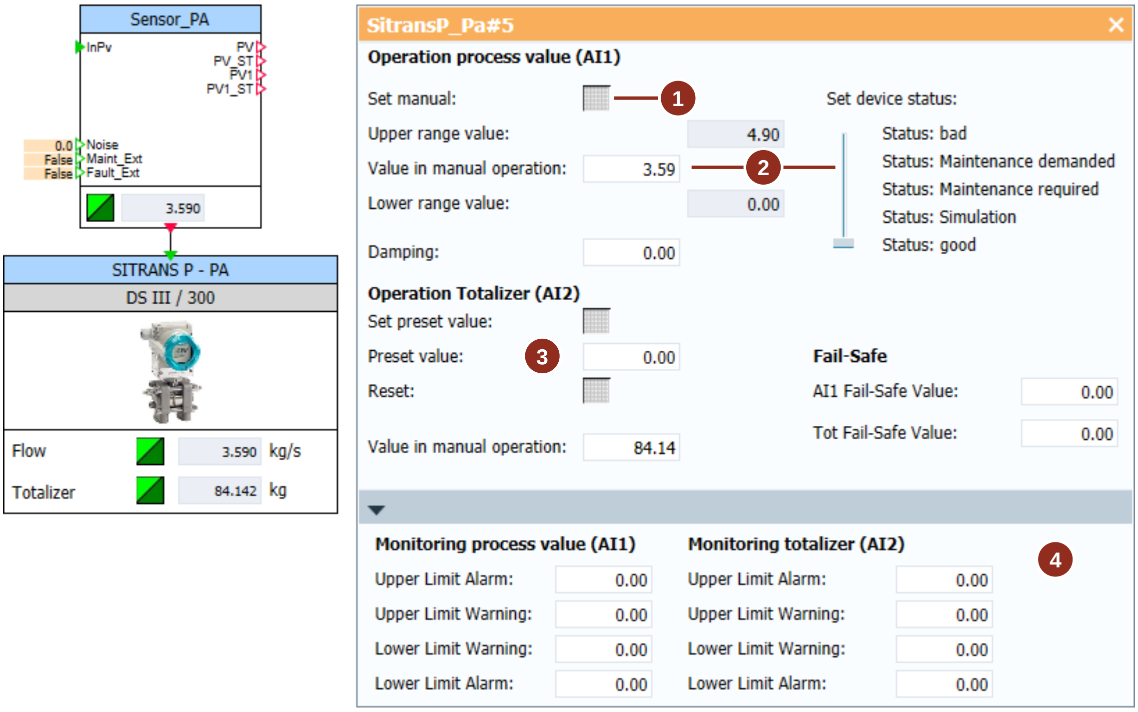


Operation

Double-click to open the operating window of the simulation model. If you activate the mode for manual operation (1), you can specify the setpoint independently of the input and determine the device status (2) yourself.

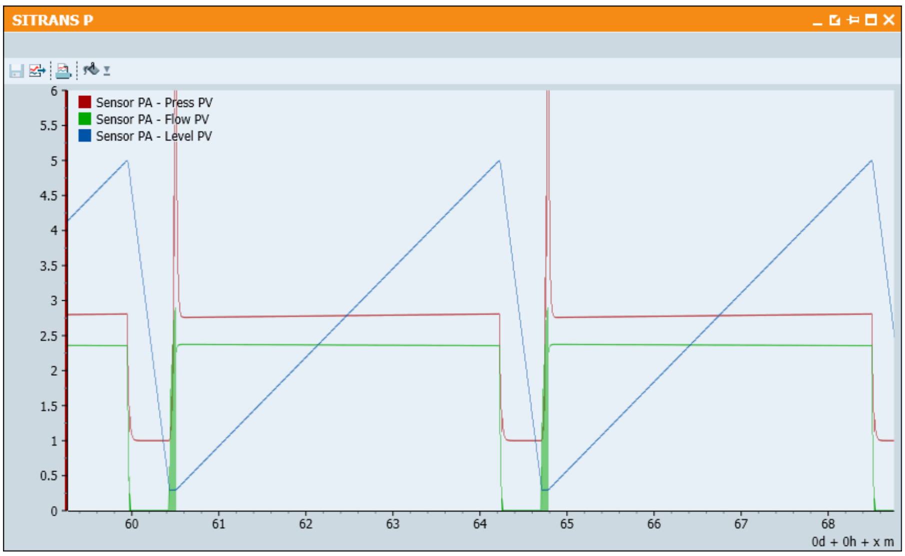
In the case of flow measurement, the integrator can be parameterized and a value can be set or reset (3) on the operating window.

In the extended area of the operating window, you can view or change any parameterized alarm limits (4).



Monitoring

The measurement results are displayed in the trend display "SITRANS P".

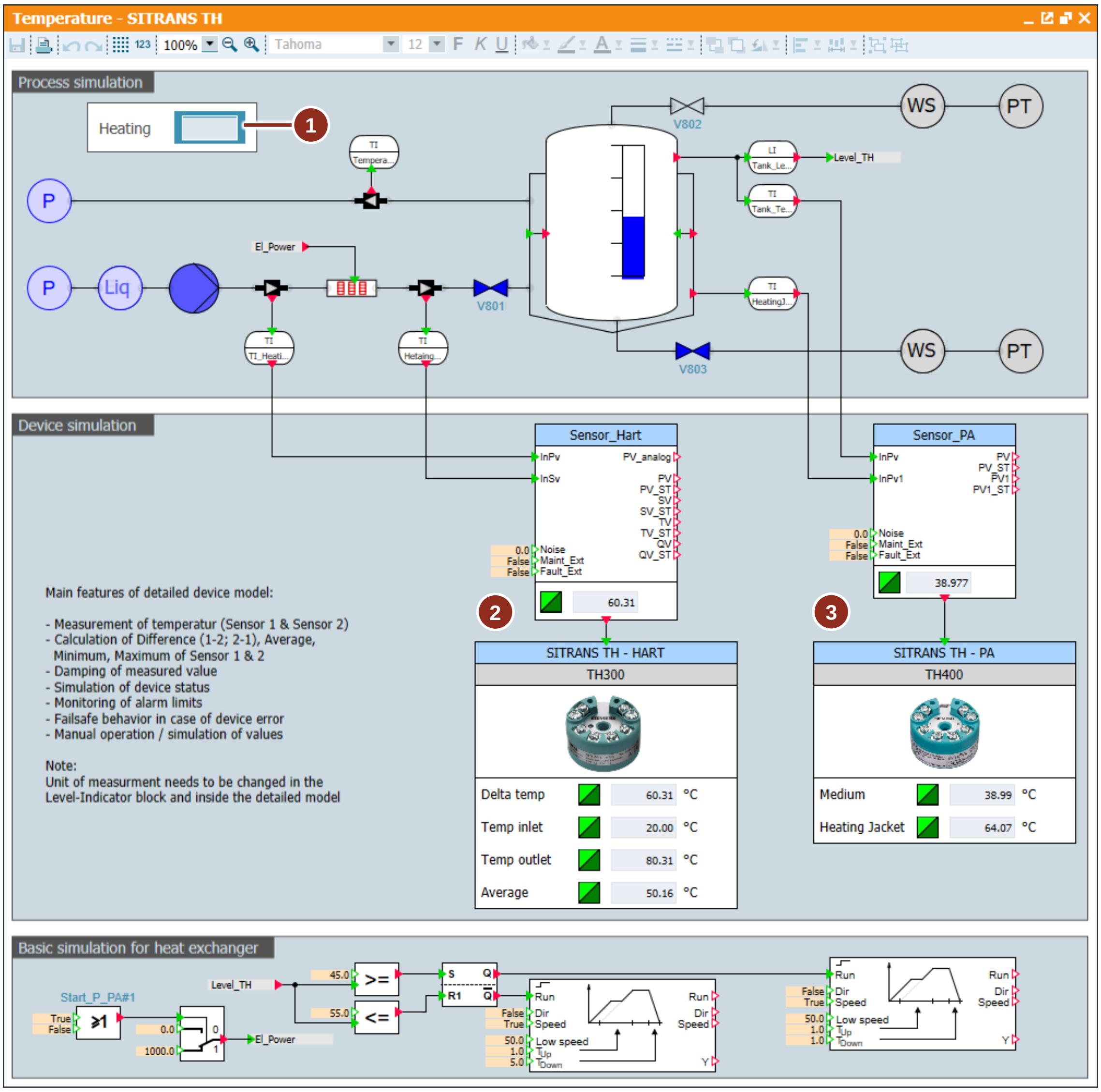


4.6 Temperature transmitter SITRANS TH

In the "Temperature - SITRANS TH" diagram, the simulation models of SITRANS TH are configured in the HART variant and in the PA variant.

Simulation

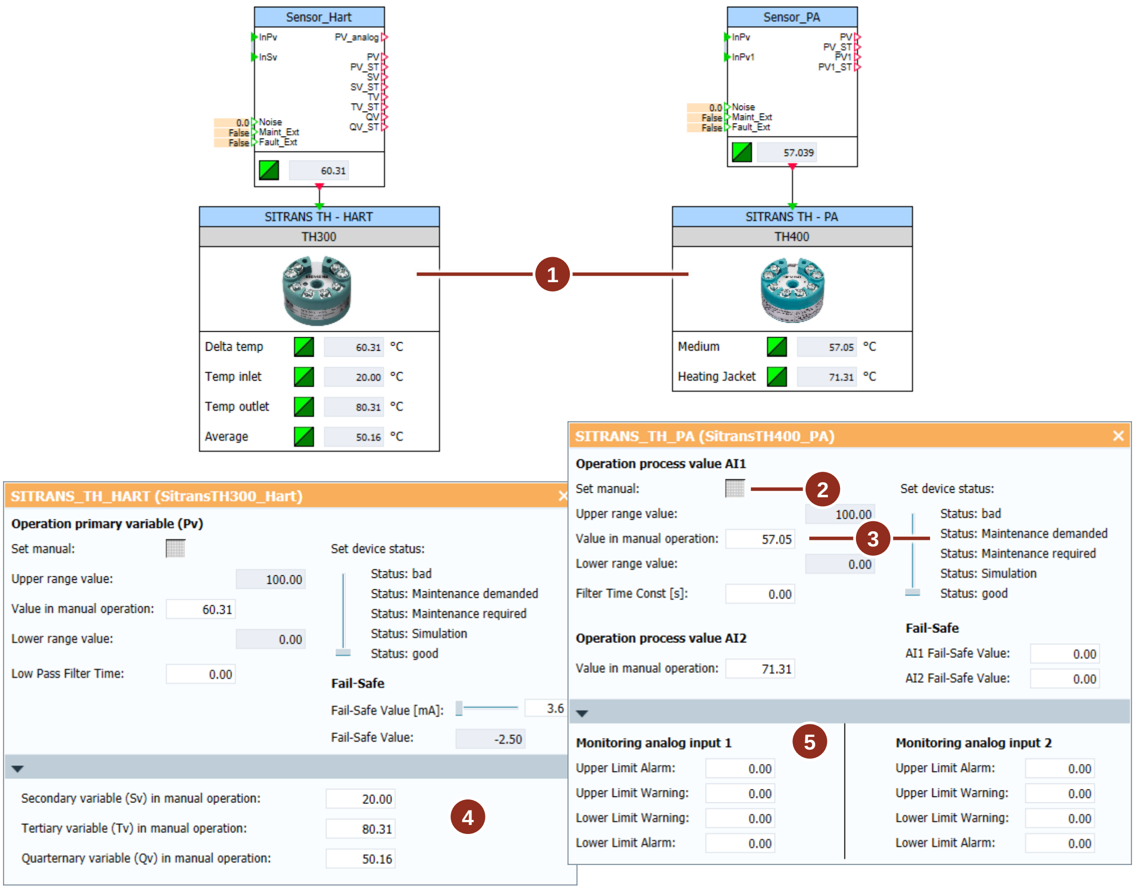
In the simulation, the level of the tank is kept between 45 % and 55 %. The "Heating" button (1) heats the medium of the heating jacket. The heating medium is permanently conveyed through the heat exchanger. The SITRANS TH300 HART (2) records the temperatures before and after the electric heat exchanger and the SITRANS TH400 PA (3) records the temperatures of the heating jacket and the medium in the tank.



Operation

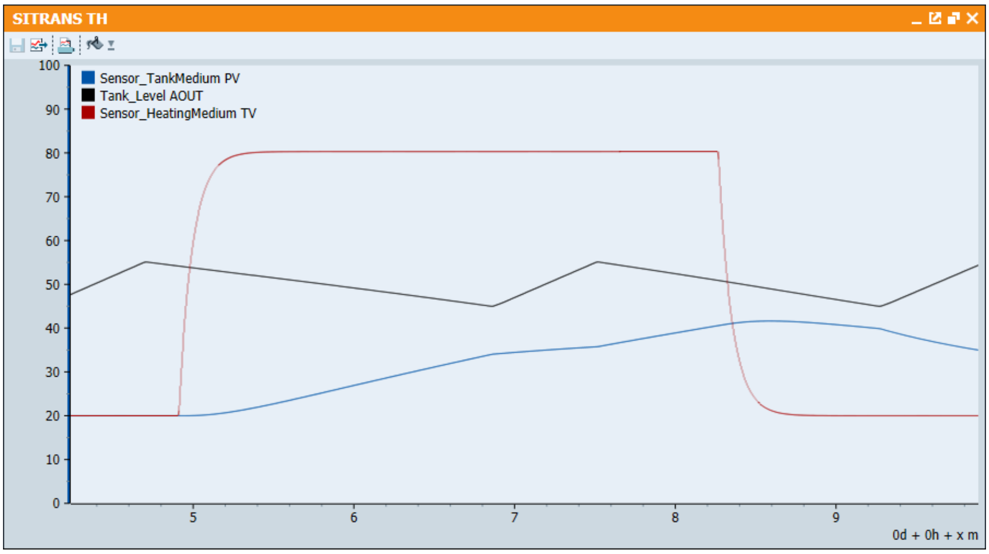
Open the operating window by double-clicking on the symbol (1) of one of the simulation models. By activating the button "Set manual" (2) you can manually enter the temperature values on the control panel or change the simulated status of the devices (3).

In the extended area of the operating window of the TH300 you can set the additional values (4) in manual mode. In the extended area of the operating window of the TH400, you can display and change any configured alarm limits (5).



Monitoring

The "SITRANS TH" trend display shows the temperature profile of the medium in relation to the heating temperature and the level.



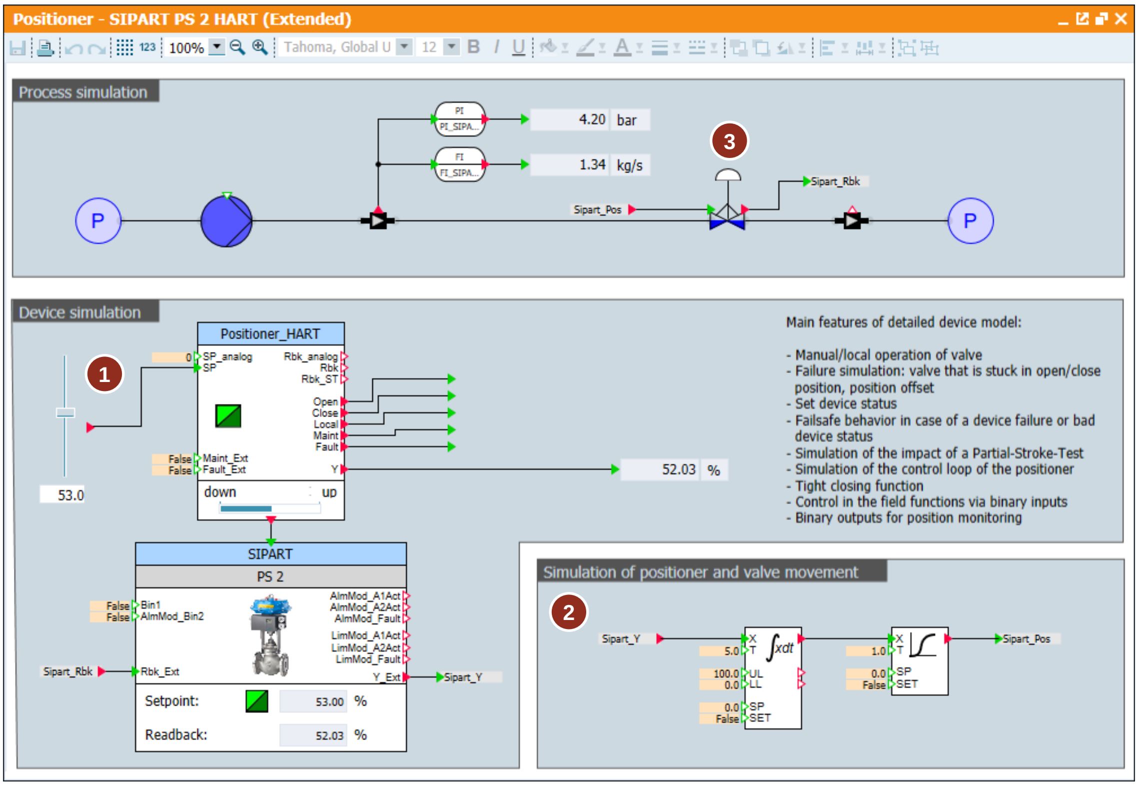
4.7 SIPART PS2 positioner

The simulation model for the positioner is configured in two different variants.

In the "Positioner - SIPART PS 2 HART (Basic)" diagram, the behavior is simulated directly by the model. In the "Positioner - SIPART PS 2 HART (Extended)" diagram, the behavior is defined by an extended simulation.

Simulation

The setpoint of the valve can be adjusted by means of the slide (1). In the "Extended" variant shown in the figure, the valve behavior is calculated using an additional simulation (2). For this, the connections "Rbk_Ext" and "Y_Ext" are connected to the simulation. In the "Basic" variant, the positioner is connected directly to the valve (3) of the process simulation.

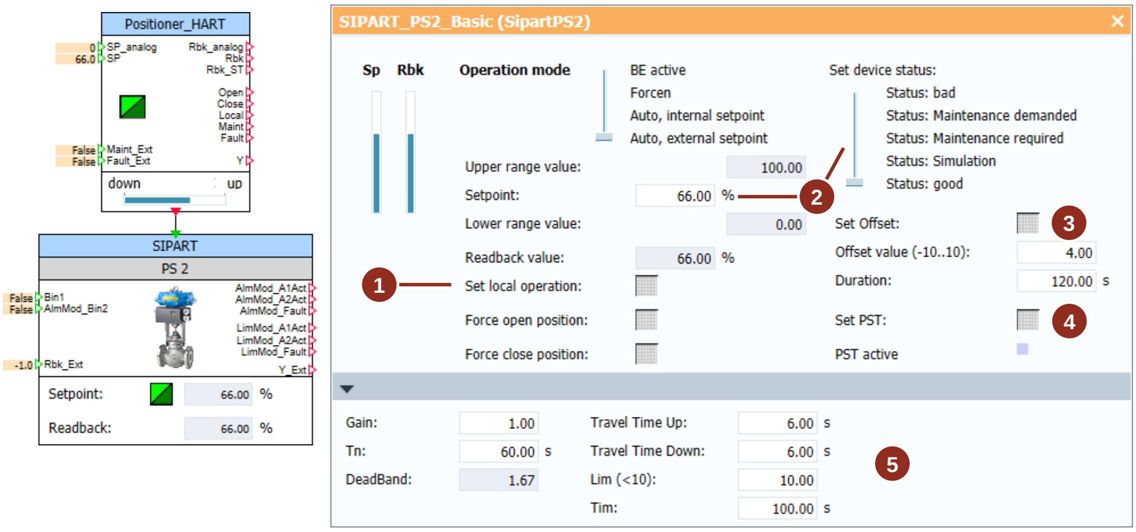


Operation

Double-click to open the operating window of the simulation model. If you activate the mode for local operation (1), you can specify the setpoint independently of the input and specify the device status (2) yourself.

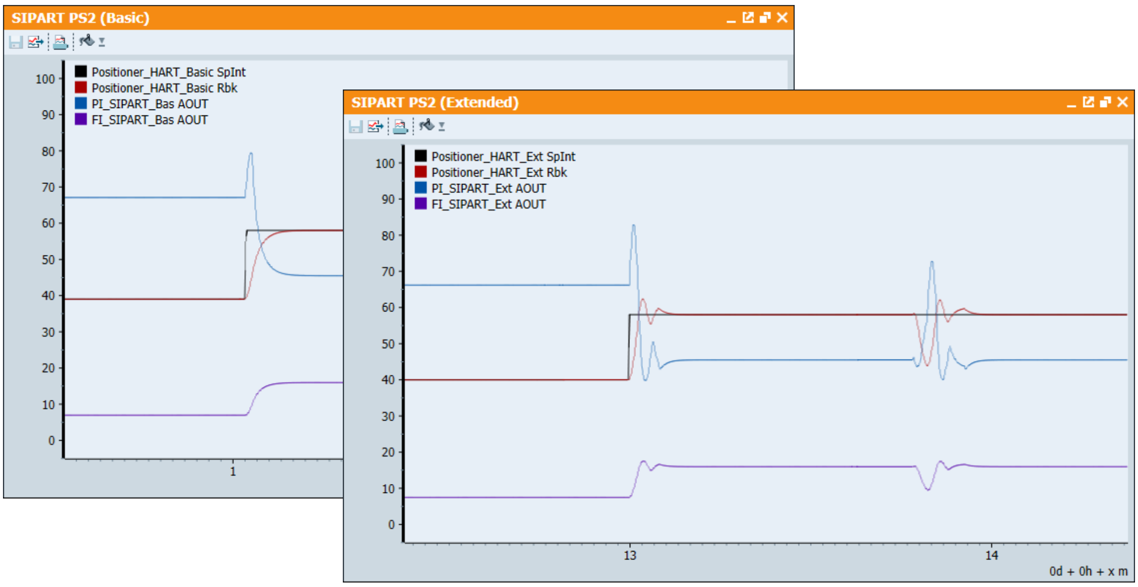
For the positioner, you can set a negative or positive offset (3) to the setpoint. Use the "Set PST" button (4) to perform a partial stroke test.

In the extended area of the operating window, you can change the general parameters of the valve.



Monitoring

In the trend displays "SIPART PS2 (Basic)" and "SIPART PS2 (Extended)", you can track the influence of setpoint changes or a partial stroke test on the process.



5 Appendix

5.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks at:
https://support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. You send queries to Technical Support via Web form:
www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

With our globally available training courses for our products and solutions, we help you achieve 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:
www.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:
https://support.industry.siemens.com/cs/ww/en/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 Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067

5.2 Links and Literature

Table 5-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109757452
\3\	SIMATIC SIMIT Simulation Platform – Overview https://support.industry.siemens.com/cs/ww/en/view/109746429
\4\	SIEMENS Process Instrumentation https://www.siemens.com/global/en/home/products/automation/process-instrumentation.html

5.3 Change documentation

Table 5-2

Version	Date	Modification
V1.0	05/2018	First Version