

A man in a light blue shirt is seen from the side, holding a tablet. He is in a factory environment with various industrial equipment in the background. Overlaid on the image are several digital graphics: a Siemens logo in the top right, a '24/7' circular icon, a 'NEWS' section with a person icon, a 'Home' button, and a large 'Industry Online Support' text. There are also icons for a folder, a network of people, and a gear. The background is a blurred factory floor with overhead lights and a clock on the wall.

SIEMENS

SIMATIC Target: Calling Simulink® Models

STEP 7, S7-1500 Software Controller, SIMATIC ODK 1500S

<https://support.industry.siemens.com/cs/ww/en/view/109482830>

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1 Introduction

1.1 Overview

Requirements

The MATLAB and Simulink software from MathWorks are frequently used in automation and controls engineering to simulate processes and create algorithms. The requirement is to run the model, the algorithm or the function in few steps on an ODK-capable CPU (SIMATIC S7-1500 Software Controller or CPU 1518 MFP). Alternatively, the software controller can also be simulated from S7-PLCSIM Advanced V6.0 or later, enabling the complete Target workflow to be tested in a simulated environment.

- Using the MATLAB Coder and Simulink Coder add-on packages, the Simulink models are compiled in C/C++ code.
- This code can be added to the CPU via the Open Development Kit (ODK) interface.
- Within the CPU's C++ environment, the code can be called from the S7 program and executed.

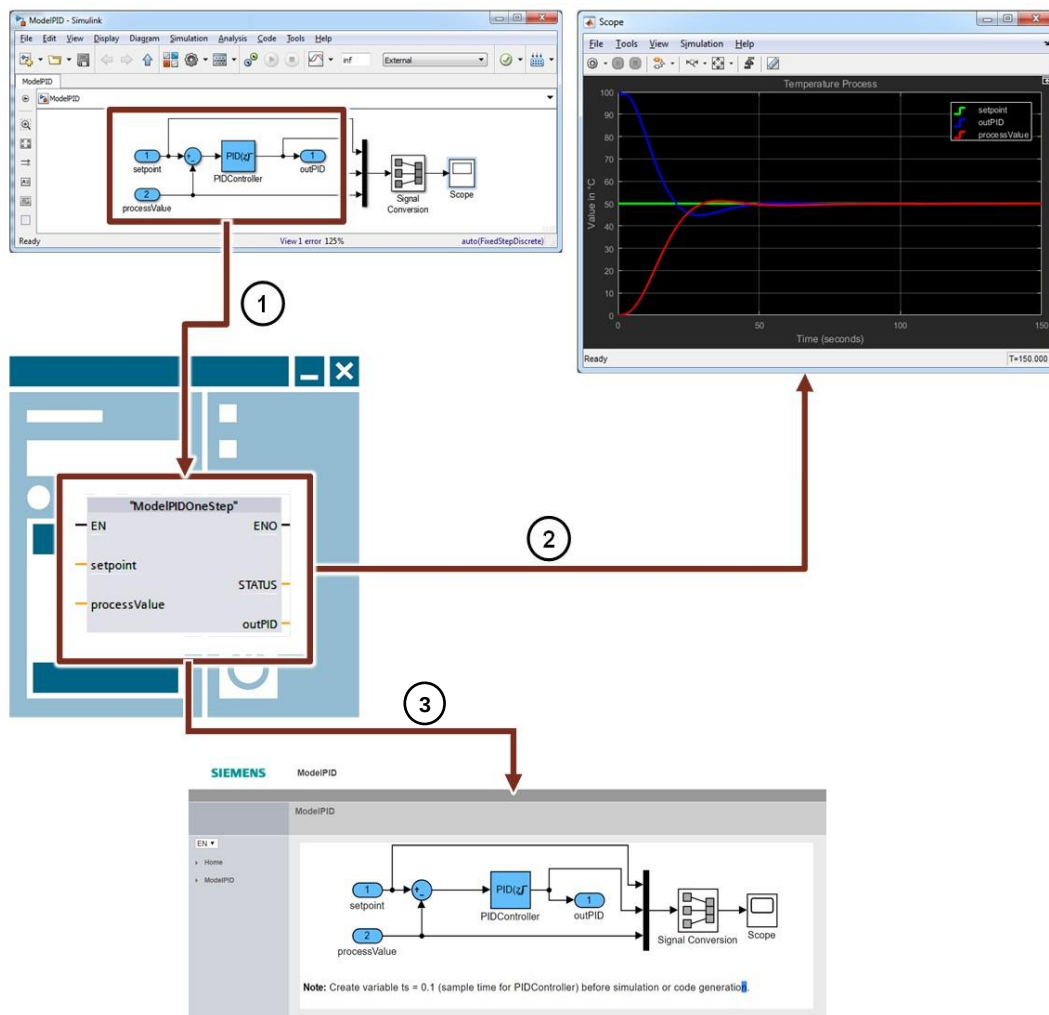


Figure 1-1: Running the Simulink model on an S7-1500 Software Controller

General task description

1. You can code the Simulink model with the SIMATIC Target add-on and run it on the SIMATIC S7-1500 Software Controller.
2. You can monitor the model with the Simulink External Mode and alter parameters during operation.
3. You can also interact with the Simulink model via a user-defined website on the S7-1500 web server.

Automation task

This application example will show you how to put a Simulink model into operation on the SIMATIC S7-1500 Software Controller. The automation task is to regulate temperature with a simulated control path (temperature process).

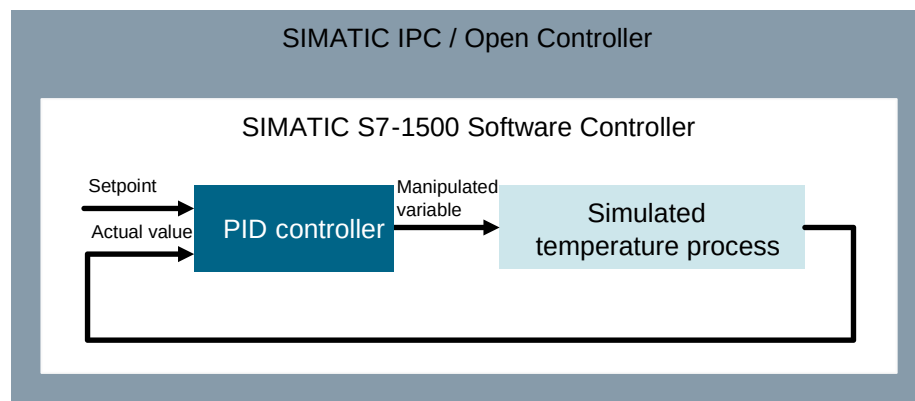


Figure 1-2: Temperature control automation task

For the application example, the PID controller is created with Simulink and ported to the S7-1500 Software Controller. The temperature process is simulated in the S7 program with the function block "LSim_PT3" from the "LSim" library.

Note

The "LSim" library can be found in the following article:
<https://support.industry.siemens.com/cs/ww/en/view/79047707>

Note

The application example has been deliberately kept simple in order to keep the use of SIMATIC Target in focus. The entire workflow can also be simulated with a PLCSIM Advanced instance without additional hardware.

Instructional content of this application example

The application example offers you the following instructional content:

- Simulate an example process with Simulink and create closed-loop controllers.
- Learn how SIMATIC Target works.
- Code Simulink model and port it to a SIMATIC S7-1500 Software Controller.
- Learn how External Mode with Simulink works.
- Generate a user-defined website with the Simulink model and make it run on the S7-1500 web server.

1.2 Principle of operation

1.2.1 Coding with SIMATIC Target

The Figure below shows the sequence, from model creation in Simulink all the way to commissioning on an S7-1500 Software Controller. Table 1-1 explains the steps in detail.

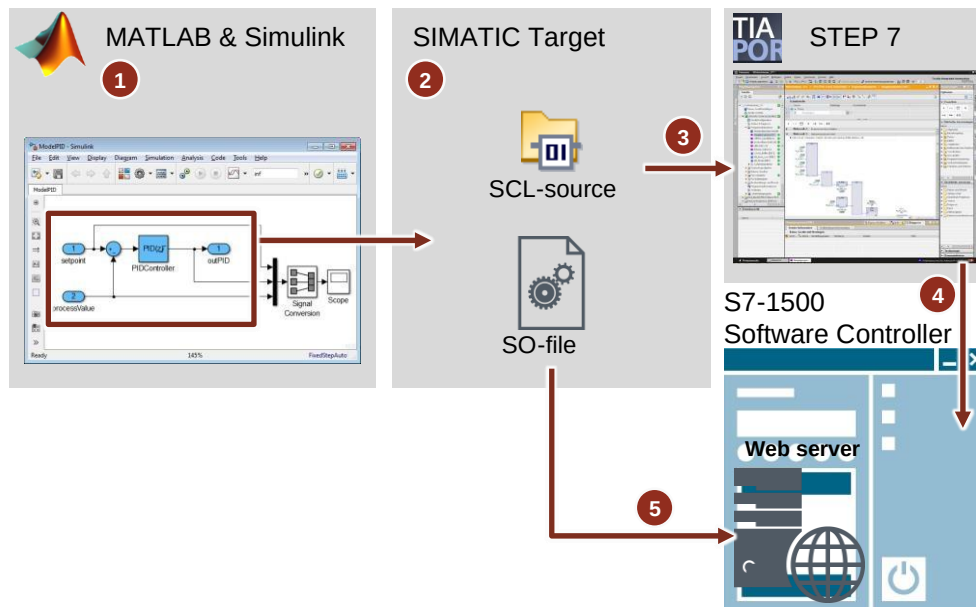


Figure 1-3: Coding with SIMATIC Target

Table 1-1: Individual steps

Step	Action	Note
1.	Create model in Simulink.	The PID controller is created here.
2.	Compile the model with SIMATIC Target.	SCL blocks (sources) and SO file (Shared Object file / real time function) are created.
3.	Add SCL source to STEP 7 (TIA Portal).	Integrate SCL components (sources) in S7 program via Openness or by selecting "External source files" in the project tree.
4.	Integrate user-defined website with Simulink model. Download S7 program to the S7-1500 Software Controller.	Add generated "website" folder to the CPU web server settings and "generate blocks".
5.	Download SO file to CPU load memory.	Automated upload of the SO file or via the CPU's web server by selecting "File browser".

The original interfaces of the model are applied during code generation with SIMATIC Target. The SCL block has the same interfaces as the Simulink model.

The block contains additional parameters (EN, ENO and STATUS). The block is called via EN and ENO. The STATUS output gives diagnostic information.

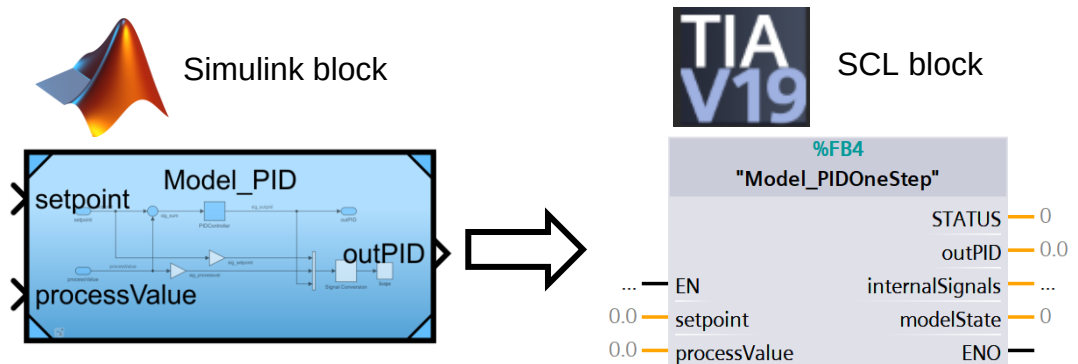


Figure 1-4: Simulink block and SCL block

1.2.2 Sequence of the overall solution

This application example describes a temperature control setup with the following structure:

- A SIMATIC ET 200SP Open Controller CPU 1515 PC2 (F/T/TF) serves as the execution system.
- The SO file is initialized in the Startup OB. The SO file is loaded into the memory.
- The temperature process is simulated in the S7 program with the function block "LSIM_PT3".
- The PID controller created in Simulink is trans-coded to an SO file with SIMATIC Target. The S7 program calls the SO file.
- The entire temperature control (PID controller and simulated process) is called in the cyclic OB with an interrupt time of 0.1 seconds.

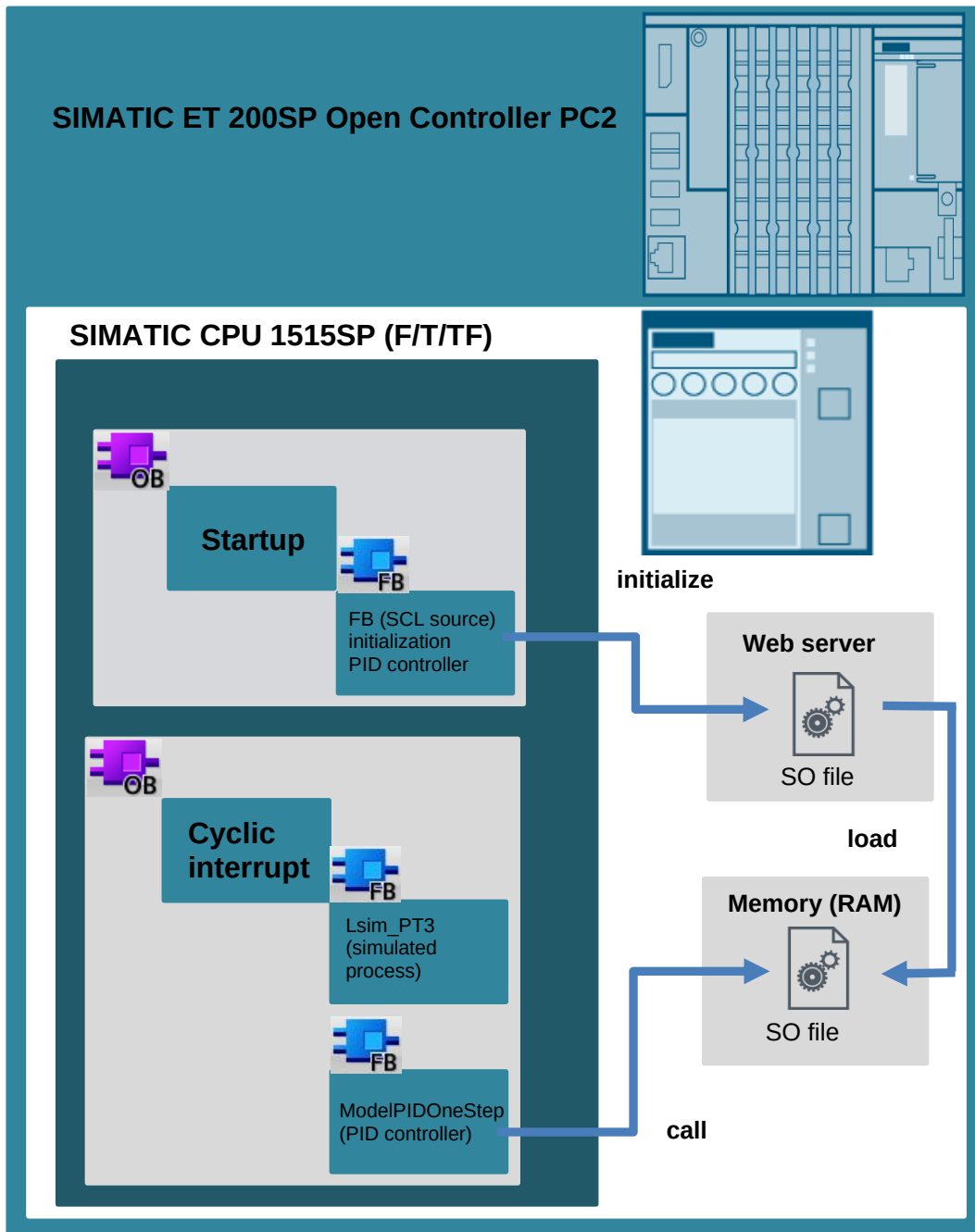


Figure 1-5: Overview of the complete solution

1.2.3 Simulink External Mode

Using Simulink's External Mode, you can observe the model on the CPU while it runs and change parameters online.

In order to use External Mode, you must enable and configure the "External Mode" interface in the code generation settings before generating the code.

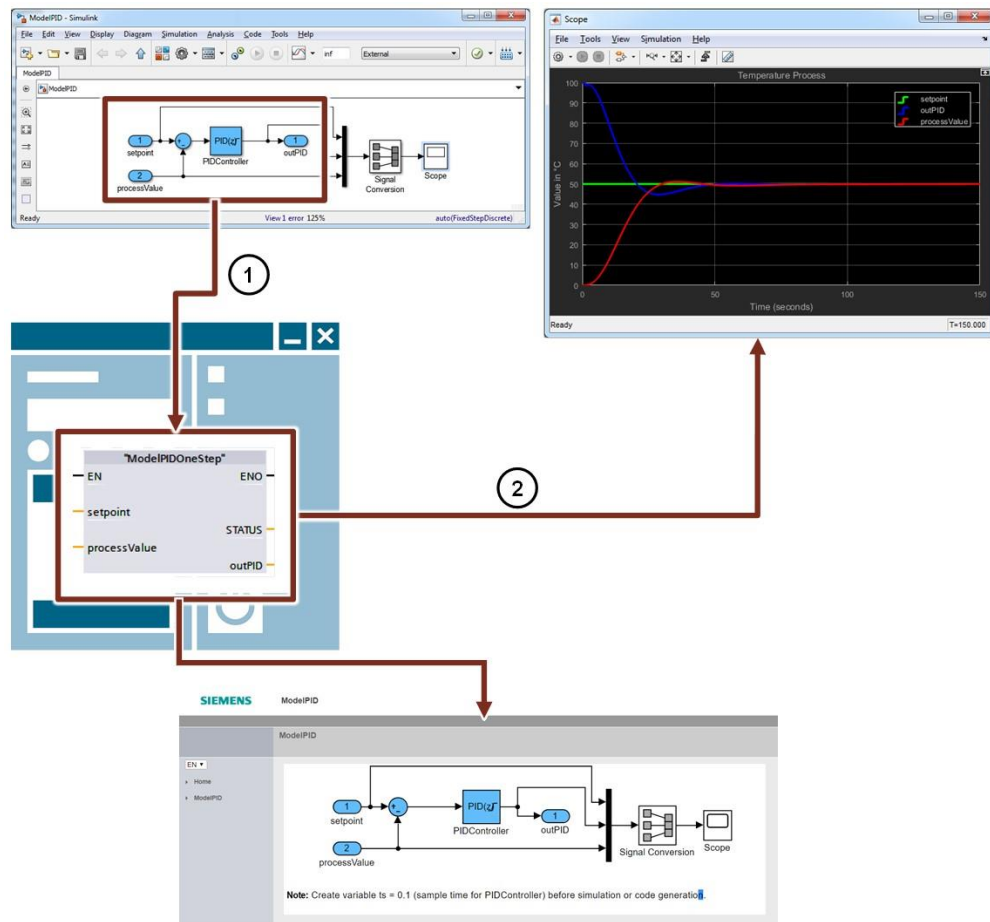


Figure 1-6: Flow for the Simulink model on an S7-1500 Software Controller

1. Monitor parameters

Using the Scope block in Simulink, you can display signals graphically. In this case it is the following three signals:

- "setpoint" (nominal value) in yellow
- "processValue" (process value) in red
- "outPID" (manipulated variable) in blue

2. Modify parameters

In Simulink, there are blocks (here, "PIDController") that have internal parameters such as P, I, and D. You can open the block screen and alter the parameter values during operation. The parameter change affects the simulation and you will observe an altered result.

1.2.4 User-defined website with Simulink model

With the option "Generate model diagrams for PLC Web Server" in Simulink, the option has been available since Target V3.0 to generate a user-defined website from the Simulink model.

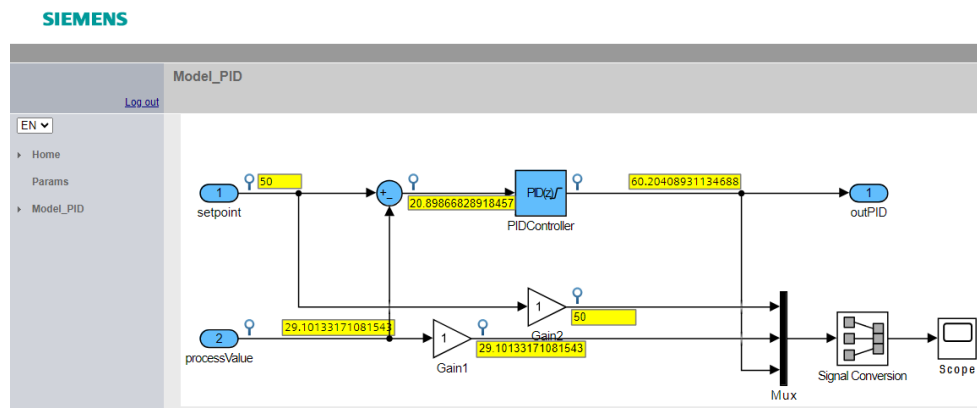


Figure 1-7: User-defined website on the S7 web server

With the user-defined website, the Simulink model is visible even without Matlab. A web browser thus gives one the option of using the Scope to monitor internal signals and manipulate model parameters. If the model is constructed of multiple layers, lower model levels can also be viewed.

Note

With Target V2.0 it is also possible to generate a user-defined website, although an additional [software tool](#) will be needed to do this.

1.2.5 Manipulating model parameters with STEP 7

If you wish to adjust the parameters to the process during operation, you can access the internal parameters in the Simulink model.

Optionally, you can create a global data block with the parameters required for the Simulink model. You can manipulate the model parameters in the S7 program with the global data block.

Note If you wish to manipulate the model's parameters with STEP 7, you must enable "Parameter access with STEP 7" before generating the code (see chapter 2.8 Modifying model parameters).

The Figure below shows the internal parameters of the "PIDController" block from Simulink and the corresponding tags in STEP 7.

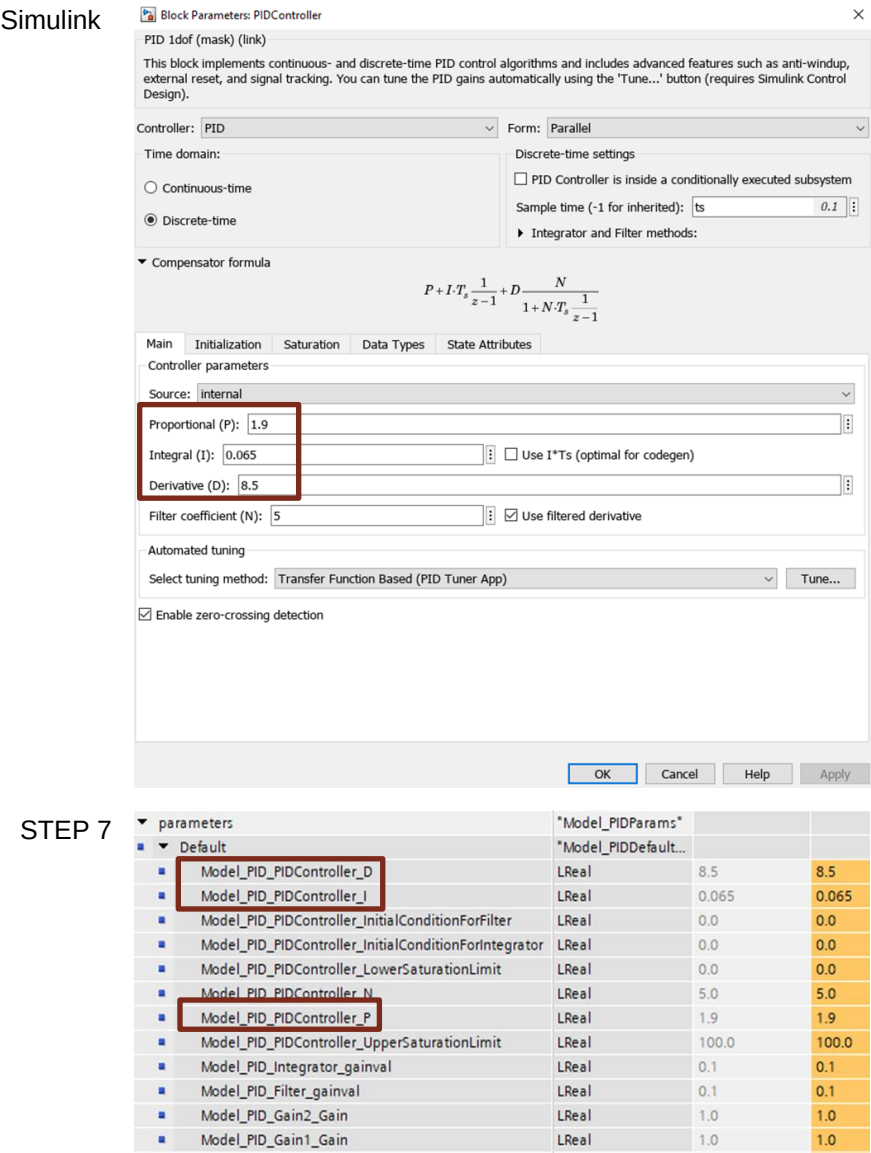


Figure 1-8: Model parameters in Simulink and STEP 7

1.3 Components used

The application example has been created with the following software components:

Table 1-2: Software components

Component	Item number / Notes / Link
(R2023b) MATLAB V23.2 MATLAB Coder V23.2 Simulink V23.2 Simulink Coder V23.2	MathWorks online documentation: http://mathworks.com/help/http://mathworks.com/help/
STEP 7 V19 Professional	6ES7822-1AE23-0YA5 Trial download: https://support.industry.siemens.com/cs/ww/en/view/109820994 Manual: https://support.industry.siemens.com/cs/ww/en/view/109826862
SIMATIC S7-1500 ODK 1500S V2.5 SP4	6ES7806-2CD03-0YA0 trial download: https://support.industry.siemens.com/cs/ww/en/view/109774241 Manual: https://support.industry.siemens.com/cs/ww/en/view/109778204
SIMATIC Target for Simulink V6.0 SP1	6ES7823-1BE05-0YA5 https://support.industry.siemens.com/cs/ww/en/view/109807110 Manual: https://support.industry.siemens.com/cs/ww/en/view/109801419

The application example was created with the following hardware components:

Table 1-3: Hardware component

Component	Quantity	Item number	Note
SIMATIC ET 200SP Open Controller CPU 1515SP V30.1 8GB (Win10, 64-bit)	1	6ES7 677-2DB40-0AA0	T, F & TF can also be used
			Manual, SIMATIC S7-1500 CPU 150xS https://support.industry.siemens.com/cs/de/en/view/109825803
			Manual: SIMATIC ET 200SP Open Controller CPU 1515SP PC https://support.industry.siemens.com/cs/ww/en/view/109758551

Documentation and sample project

The following table contains all the files and projects used in this application example.

Table 1-4: Example files and projects

Component	Note
109482830_SIMATIC_Target_DOC_V13_en.pdf	This document
109482830_SIMATIC_Target_CODE_V13.zip	This compressed file contains the example project: • Simulink model • Coded Target files • S7 program (LAD and SCL variant)

2 Engineering

2.1 Model simulation with Simulink

This chapter describes how to create the simulated model with Simulink. Alternatively, open the Simulink model from the example project named "Model_ProcessPID.slx".

2.1.1 Temperature process

This application example simulates a temperature process. As a reaction to a step from 0 °C to 50 °C, the process aperiodically approaches the value of 50 °C (see Figure 2-1).

The Figure below shows the step response of the process as a function of time (s). The Y axis corresponds to temperature (°C).

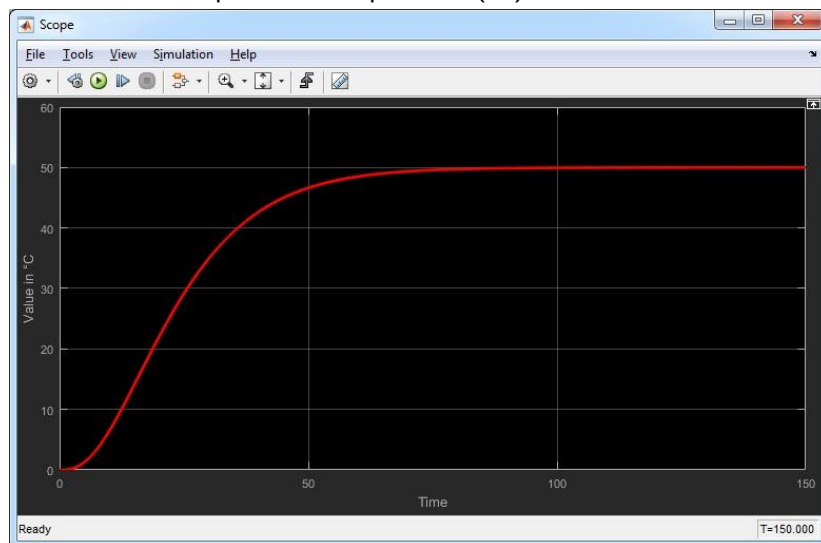


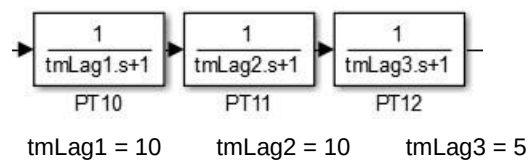
Figure 2-1: Step response of the temperature process

A continuous PT3 control path with the following formula is available as a mathematical model:

$$G(s) = \frac{1}{10s + 1} \cdot \frac{1}{10s + 1} \cdot \frac{1}{5s + 1}$$

In Simulink, the process is simulated in the form of three PT1 functions linked in series.

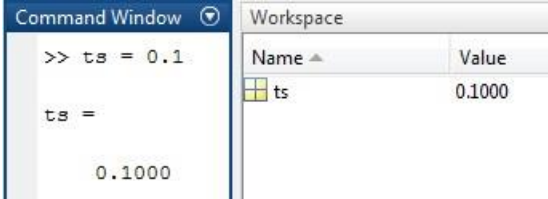
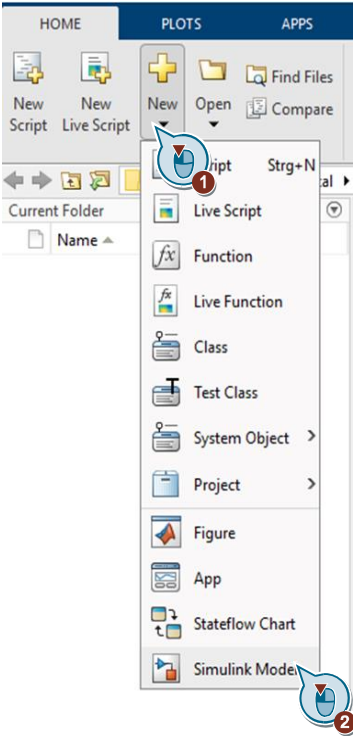
Figure 2-2: Simulink model: temperature process

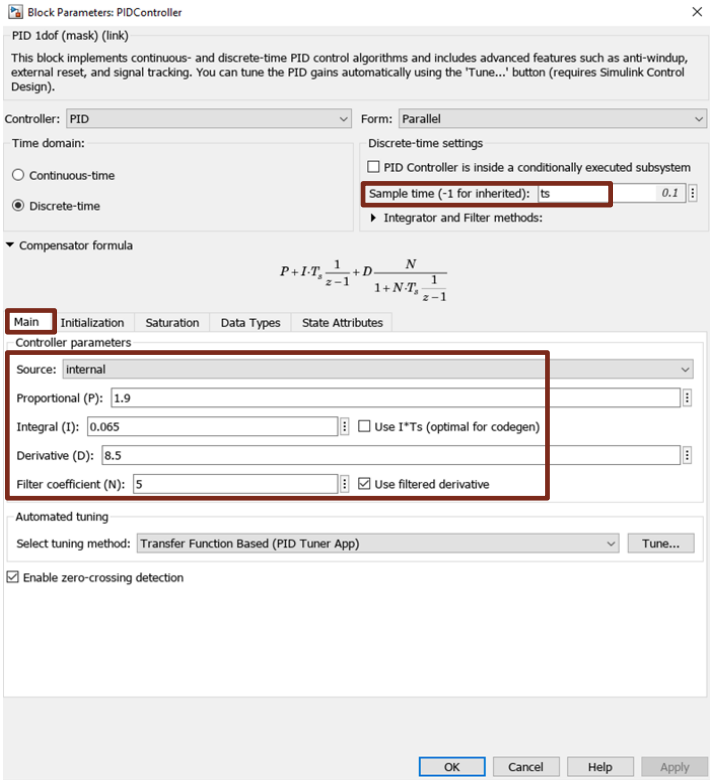


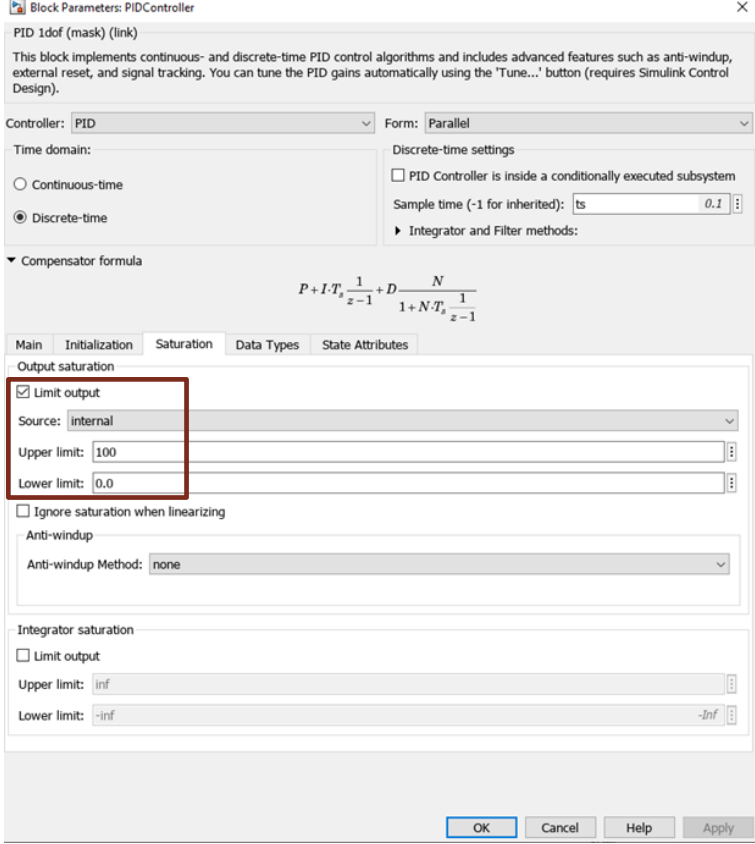
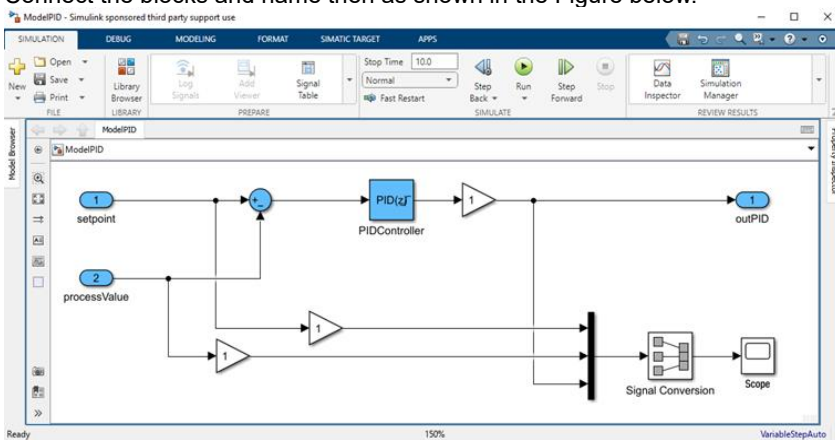
2.1.2 PID controller

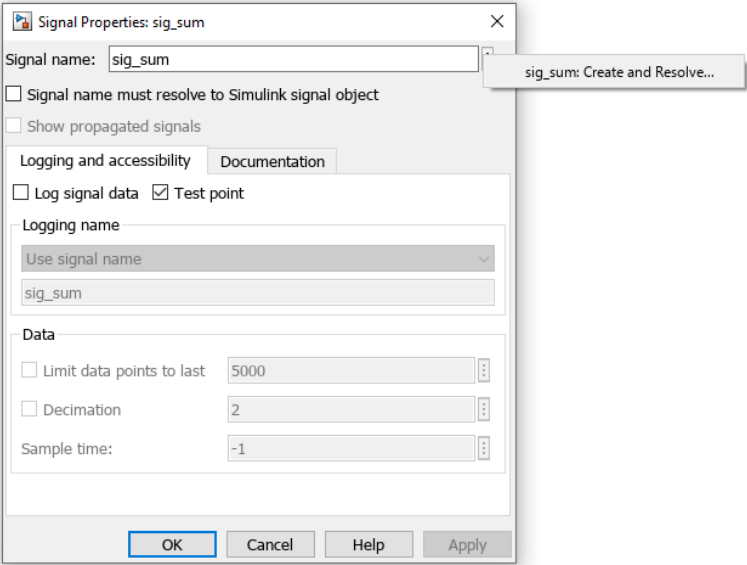
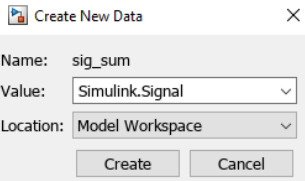
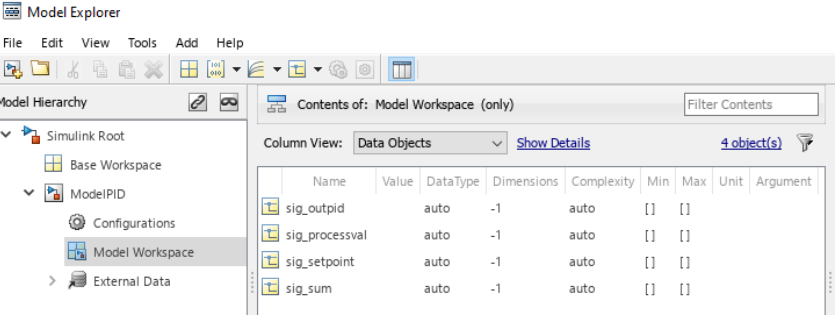
Create model with PID controller in Simulink

Table 2-1: Creating the Simulink model

Step	Instruction
1.	Open "MATLAB".
2.	Create a tag for the cycle time in the "Workspace": Enter "ts = 0.1" for 100 ms in the "Command Window" and confirm with "Enter". 
3.	Create a new model ("Blank Model") with Simulink and save it under the name "Model_PID". 
4.	Open the "Simulink Library Browser" in the toolbar. 

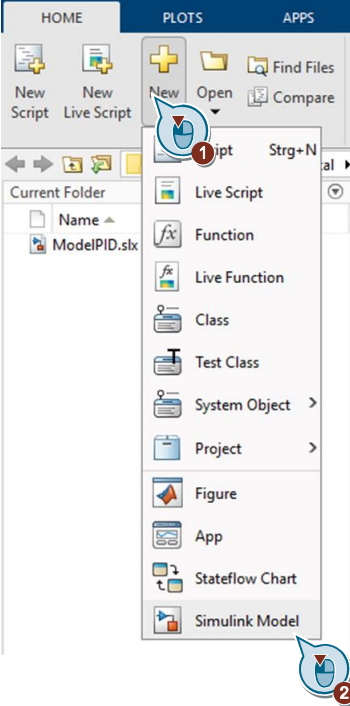
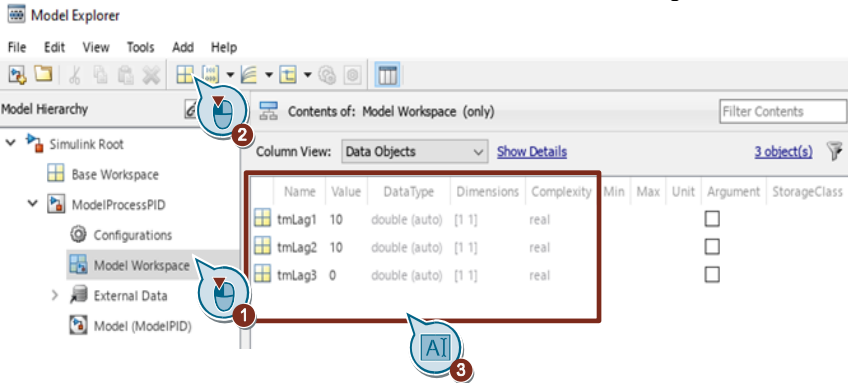
Step	Instruction
5.	Add the following blocks from the Simulink Library to the subsystem: - Input In1: "Simulink > Sources > In1" - Input In2: "Simulink > Sources > In2" - Output Out1: "Sink > Sources > Out1" - Addition block: "Simulink > Math Operations > Sum" - PID controller: "Simulink > Discrete > Discrete PID Controller" - Signal Conversion: "Simulink > Signal Attributes > Signal Conversion" - Scope: "Simulink > Sinks > Scope" - Mux: "Simulink > Signal Routing > Mux" 2 x Gain block: "Simulink > Commonly Used Blocks > Gain"
6.	Double-click on the block parameters for "Sum" and change the value of the parameter "List of signs" to " +- ".
7.	Then close the parameter screen.
8.	Open the block parameters of "Discrete PID controller" and apply the value in the following figure.  Note For "Sample time", the tag "ts" (0.1 for 100 ms) is entered. The controller and the process are later called in the CPU in the OB "CyclicInterrupt" (100 ms cycle). The PID values have been determined empirically for this application example. This parameterization achieves good master control behavior with minimal oversteer.

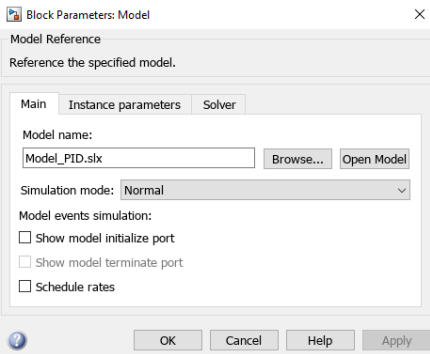
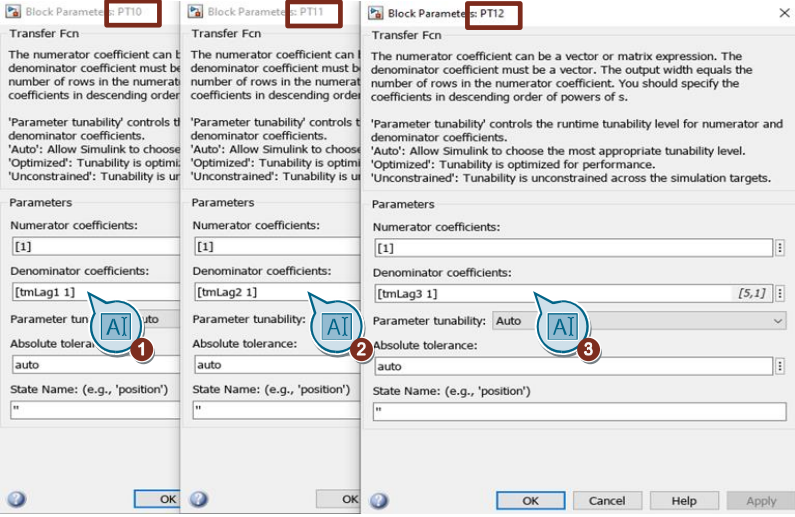
Step	Instruction
9.	In the tab "PID Advanced", set limits of 0.0 to 100.0 for the PID output. 
10.	Close the parameter screen.
11.	Double-click on the "Mux" block and change the value of the parameter "number of inputs" to 3. Close the parameter screen.
12.	Connect the blocks and name then as shown in the Figure below. 

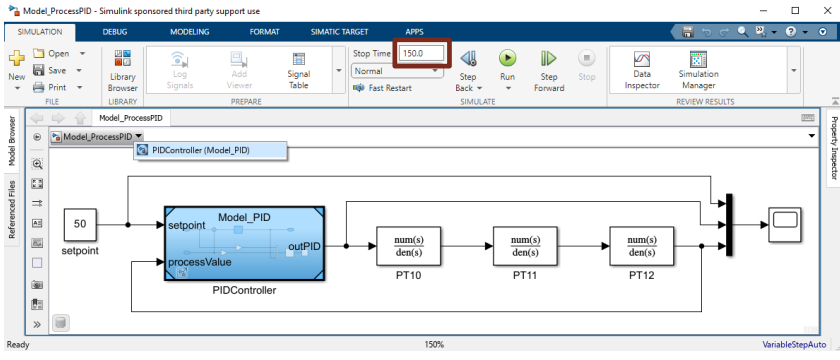
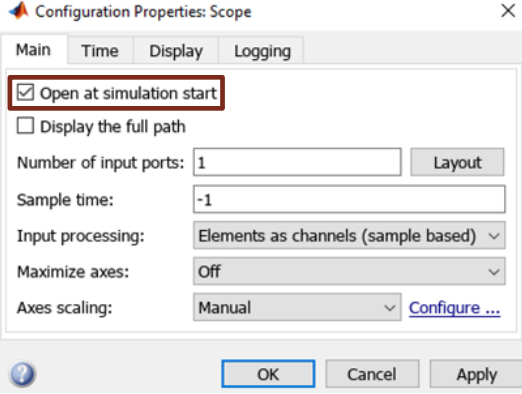
Step	Instruction
13.	Name the internal signals as in the Figure: • Right-click on Connection > Properties > Signal Name • After assigning the signal name, click on "<signal name>: Create and Resolve..."  • Then select the following parameters:  • Enable the "Test Point" option • The created signals can be viewed in the Model Explorer (shortcut: "Ctrl+H") in the "Model Workspace" section.  Note The Scope block is added in order to demonstrate the functionality of External Mode. The Gain blocks are used in order to later visualize the internal signals (sig_setpoint, sig_processval) on the web server (see Target manual).
14.	Save and close the model.

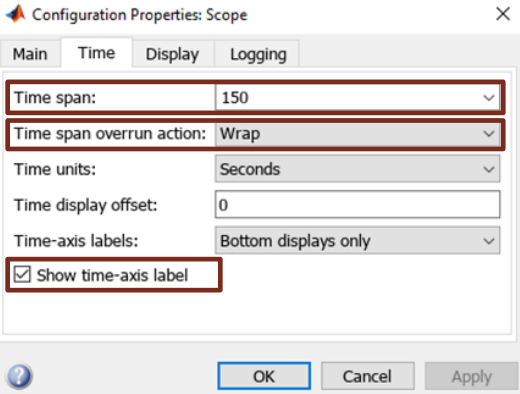
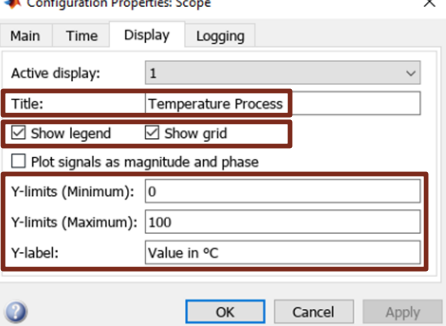
2.1.3 Complete control loop (PID controller and temperature process)

Table 2-2: Creating a complete control loop

Step	Instruction
1.	Create a new model ("Blank Model") with Simulink and save it under the name "Model_ProcessPID". 
2.	Open the "Model Explorer" in the toolbar or with the shortcut "Ctrl + H". 
3.	Create three variables with "Add MATLAB Variable", as in the figure below. 
4.	Close the "Model Explorer".

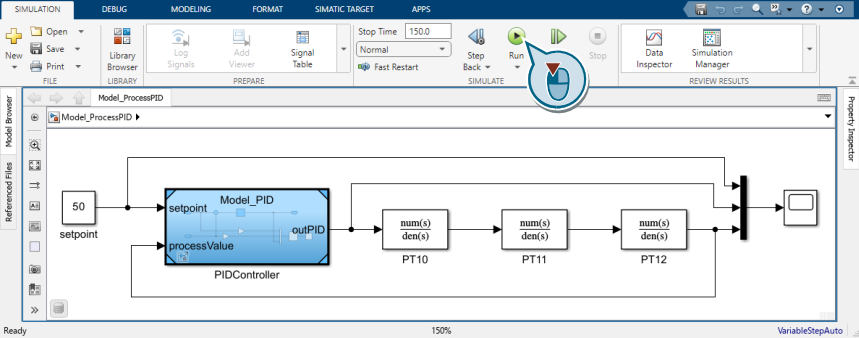
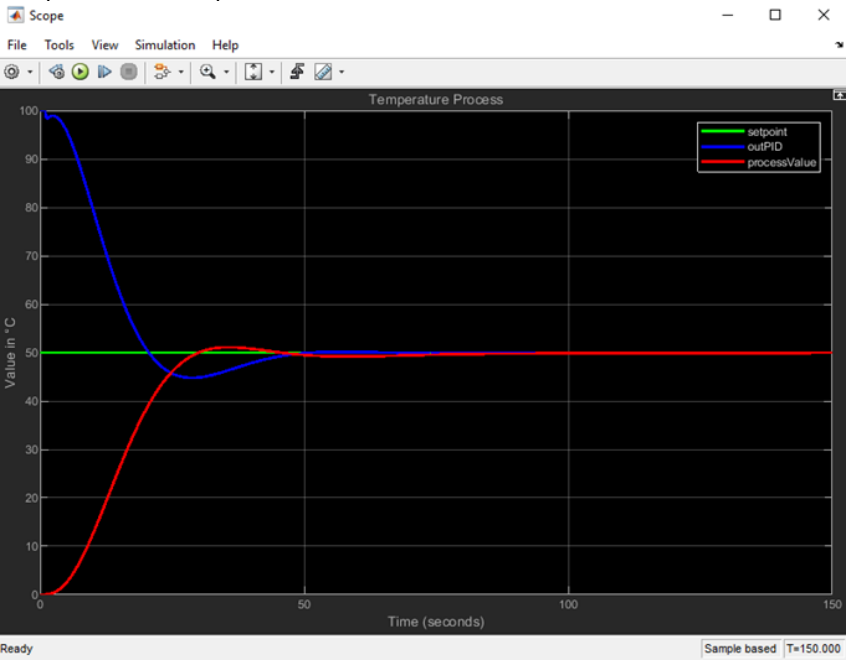
Step	Instruction
5.	Open the "Simulink Library Browser" in the toolbar. 
6.	Add a "Model" from the category "Simulink > Ports & Subsystems" to the model. Name it "Model_PID". The model you just created will be referenced by Simulink using the model name. 
7.	Add three blocks of the following type from the Simulink Library to the Simulink model: "Simulink > Continuous > Transfer Fcn"
8.	Open the "Transfer Fcn" blocks one after the other.
9.	Parameterize three "Transfer Fcn" blocks as shown in the following Figure. 
10.	Close the parameter screens.
11.	Add the following blocks: "Simulink > Sources > Constant" for the setpoint "Simulink > Sinks > Scope" for visualizing the control loop "Simulink > Signal Routing > Mux" to merge the signals

Step	Instruction
12.	Double-click on the "Mux" block and change the value of the parameter "number of inputs" to 3. Close the parameter screen.
13.	Double-click the block "Constant" and change the value "Constant Value" to 50. Close the parameter screen.
14.	Connect the complete control loop and name the blocks as shown in the following Figure. Select 150 for the "Simulation stop time". 
15.	Double-click the "Scope" block. Navigate in the menu bar to "View > Configuration Properties ..." and make the following settings.
16.	Open the scope automatically when the simulation starts. 

Step	Instruction
17.	- Time interval that appears on the Y axis, "Time span" "Wrap" mode - X axis scaling to time "Show time-axis label" 
18.	- Graph title - Show legend and grid - Y-axis scaling for "Temperature value" 
19.	Close the model.

2.1.4 Simulation of the complete control loop

Table 2-3: Simulation of the complete control loop

Step	Instruction
1.	Open the Simulink model from the example project named "Model_ProcessPID.slx".
2.	Start the simulation with the "Run" button in the toolbar of the Simulink model. 
3.	The simulation starts. You will obtain the temperature progression in time for the complete control loop as a result. 

2.2 Hardware configuration

2.2.1 Overview

The S7-1500 Software Controller is pre-installed on the ET 200SP Open Controller by default. The following Figure shows you the hardware setup of the application.

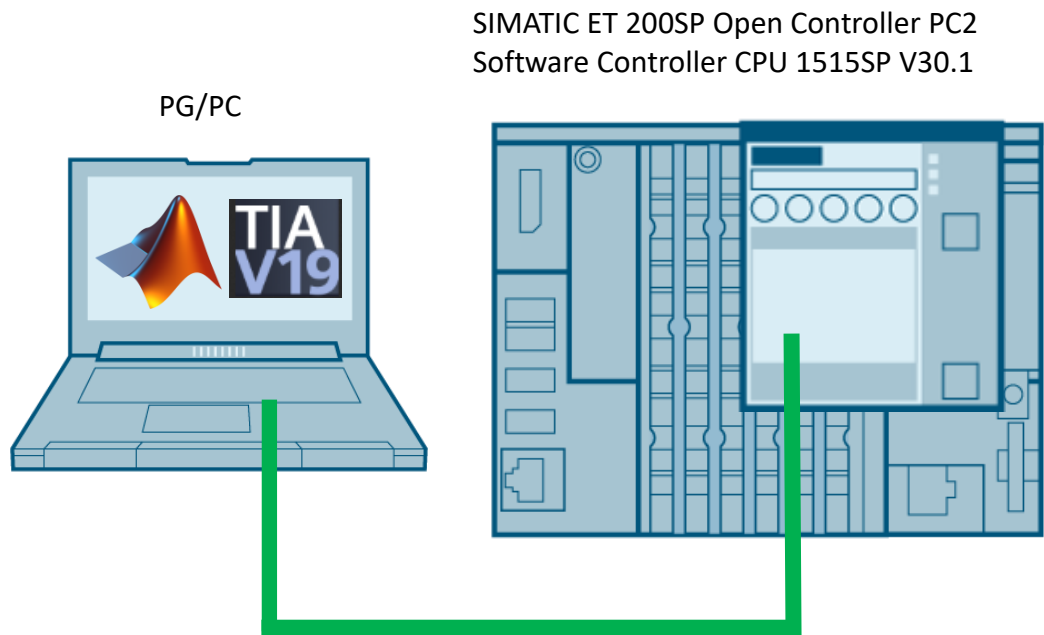


Figure 2-3: Hardware and network setup

You must connect the programming device (PG/PC) and the execution system (SIMATIC ET 200SP Open Controller) with each other using an Ethernet cable.

Make the following settings:

- ET 200SP Open Controller:
 - CPU PROFINET X1 interface (IP: 192.168.2.1)

The subnet mask for all interfaces is 255.255.255.0.

Note

For External Mode, the correct hardware identifier must be parameterized in the SIMATIC Target options and in the S7 program (call FB "ModelPIDCallExtMode"). Every interface has its own hardware identifier:

Interface	Hardware identifier
CPU PROFINET X1 interface	64

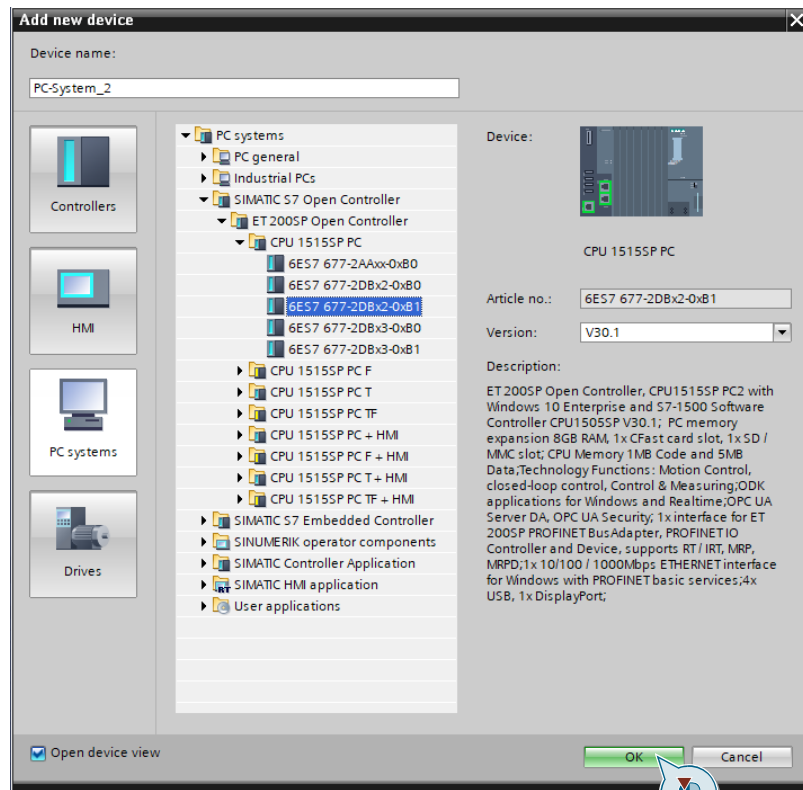
You can read the hardware identifier in TIA Portal in any CPU under "PLC tags > Display all tags > System constants".

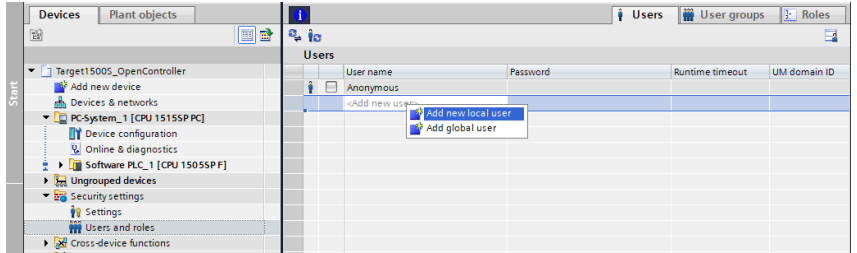
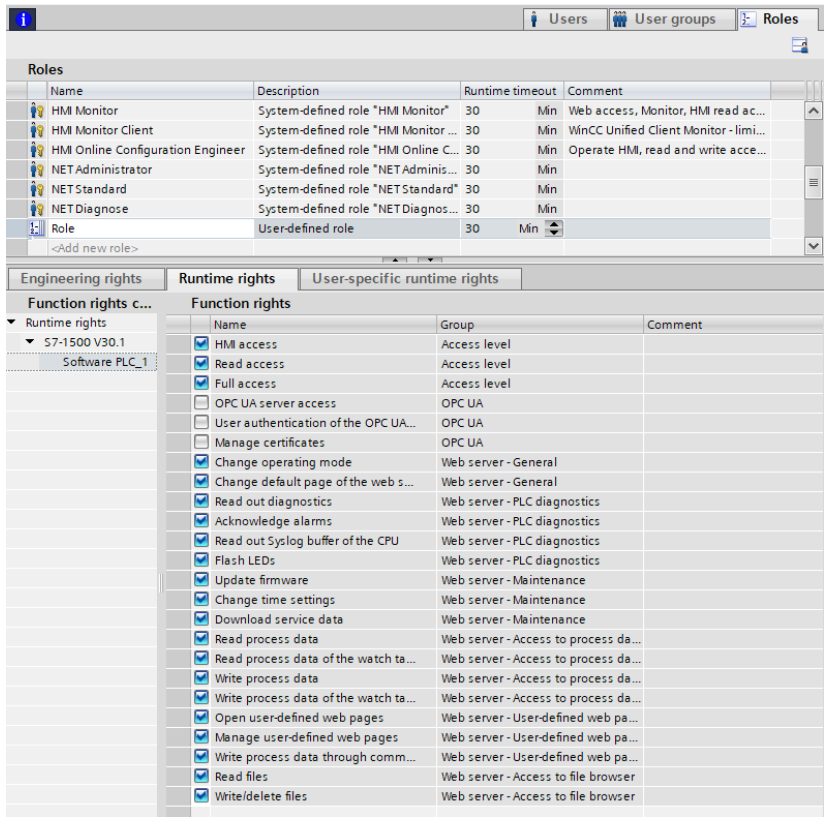
2.2.2 Hardware configuration with STEP 7

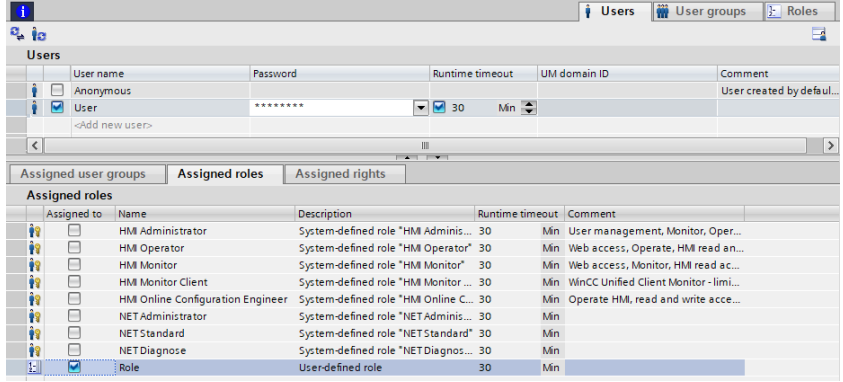
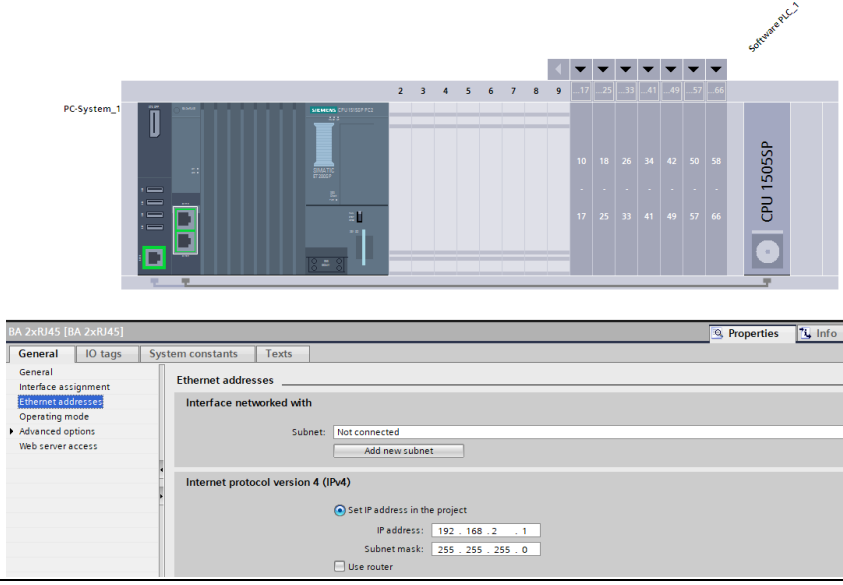
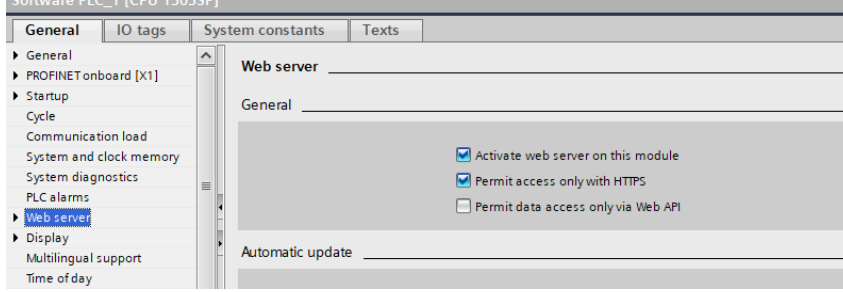
The following steps describe how the hardware is configured on the basis of the SIMATIC ET 200SP Open Controller. Alternatively, you can also open the example project.

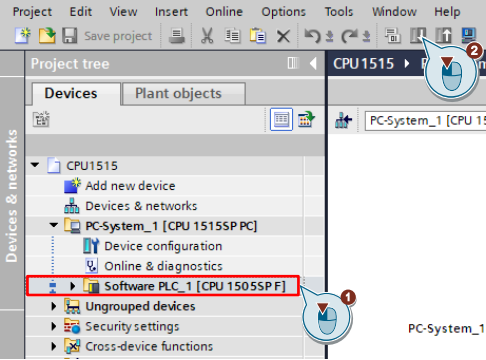
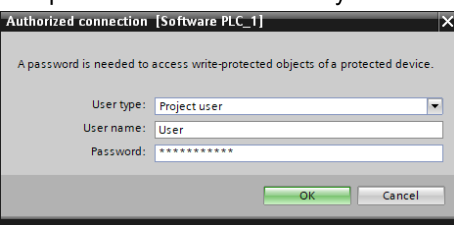
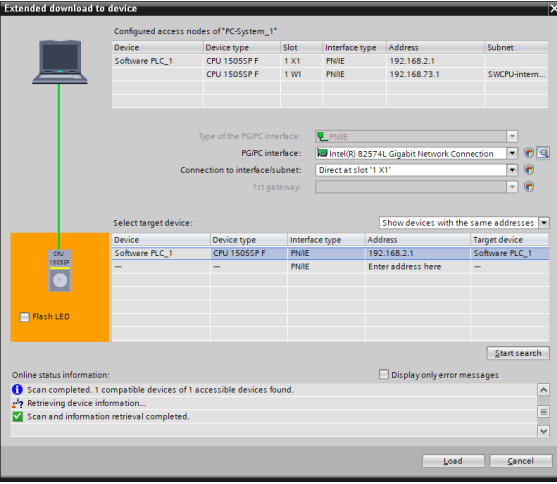
Table 2-4: Hardware configuration with STEP 7

Step	Instruction
1.	Open TIA Portal and create a new project.
2.	- Click on "Add new device" in the project tree. - Click on "PC systems" - In the dialog, select an ET 200SP Open Controller. The version "V30.1" for the software controller is version 30.1. - Bear in mind that with firmware of version V2.5 or later, the ODK 1500S V2.5 must be installed.



Step	Instruction
3.	- First, create a new local user under "Security settings" and assign a password.  - Then switch to the "Roles" menu item and create a new role. Under "Runtime rights", select the parameters "... read files" and "write/delete files". - Check all checkboxes under "Access level" to grant full access.  Note To upload the SO file to the web server or delete it, the "read files" and "write/delete files" parameters must be enabled. Any further parameters are optional.

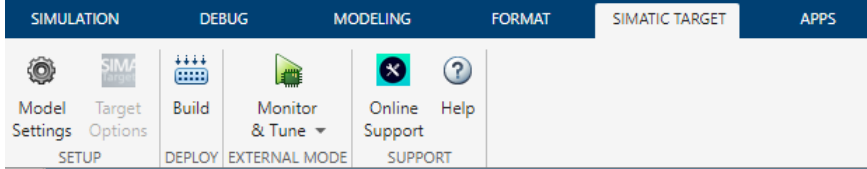
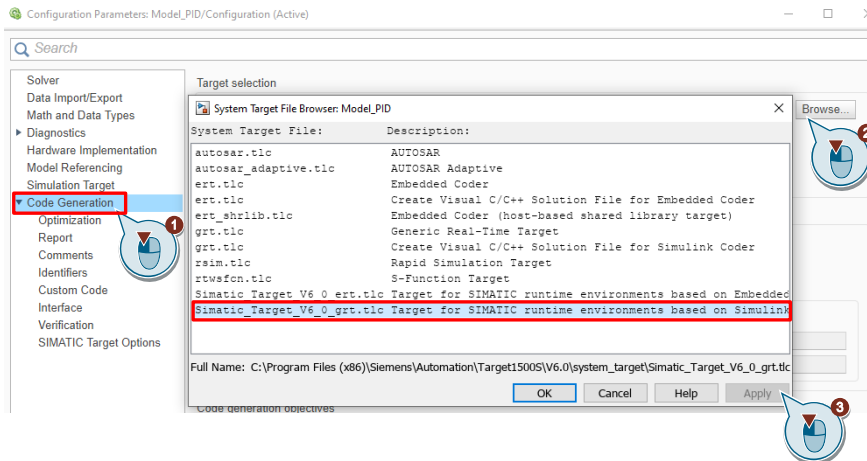
Step	Instruction
4.	Assign the newly created role to the user you created previously. 
	The X1 interface of the Open Controller is reserved by the Software Controller. Assign any IP address. 
	- Click on the "CPU 1505SP F" and enable "Activate web server on this module". - Acknowledge the security dialog. 

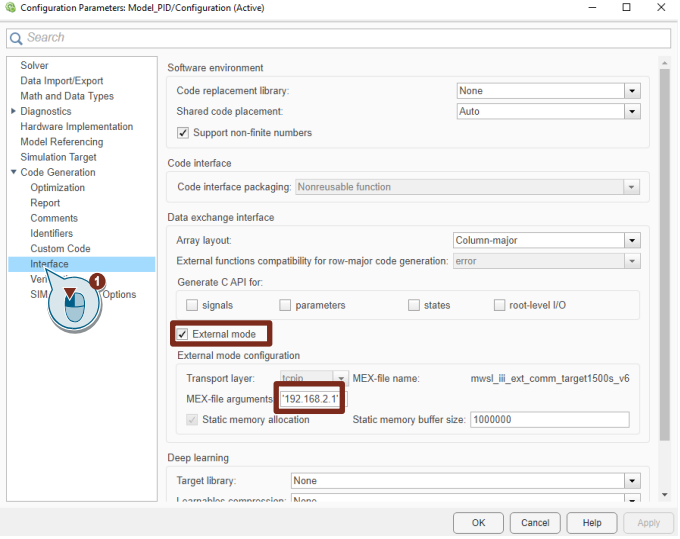
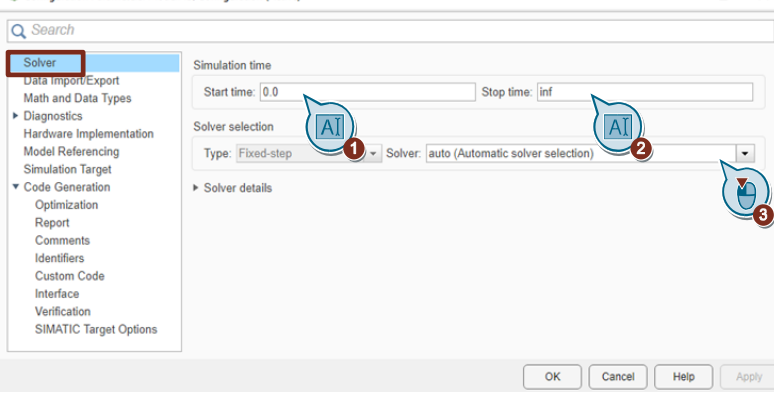
Step	Instruction
6.	Download the hardware configuration to the ET 200SP Open Controller. - Select the Software Controller "Software PLC_1" in the project tree. - Click the "Download to Device" button.  In the "Legitimated Connection" dialog box, enter the username and password of the local user you created earlier. 
7.	- Select "PN/IE". - Select the Ethernet interface of your PG/PC. - Select "Direct at Slot '1 X1'". - Click "Start search". - Click "Load".  Note Alternatively, you can simulate the project with an S7-PLCSIM Advanced instance.
8.	Confirm all subsequent dialogs until the download is complete, and save the project.

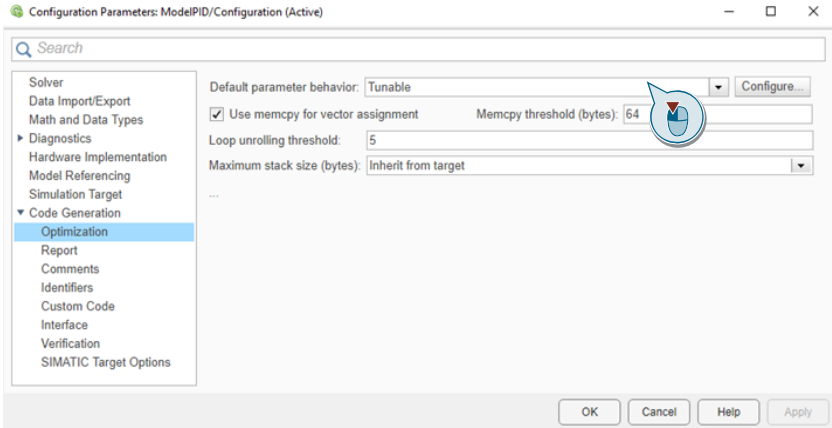
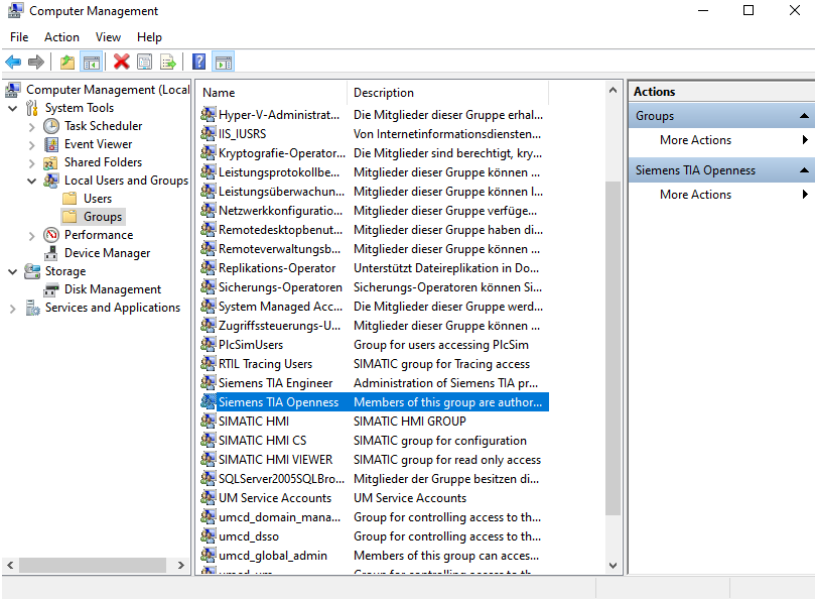
2.3 Code generation with SIMATIC

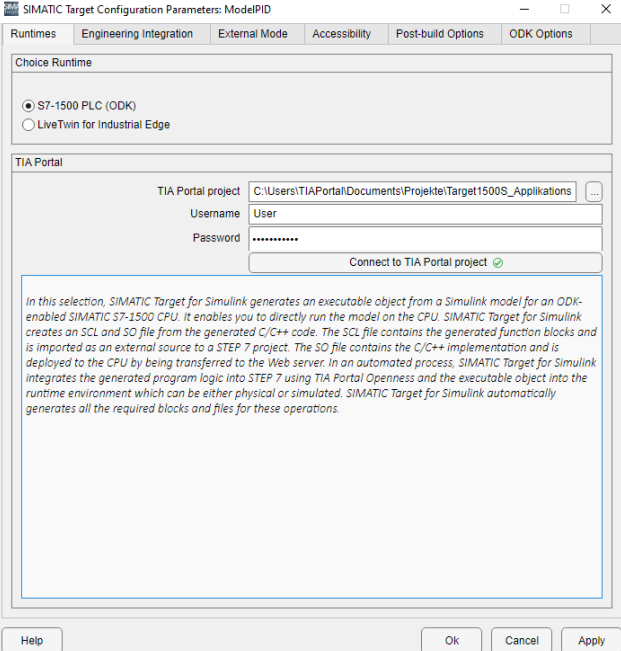
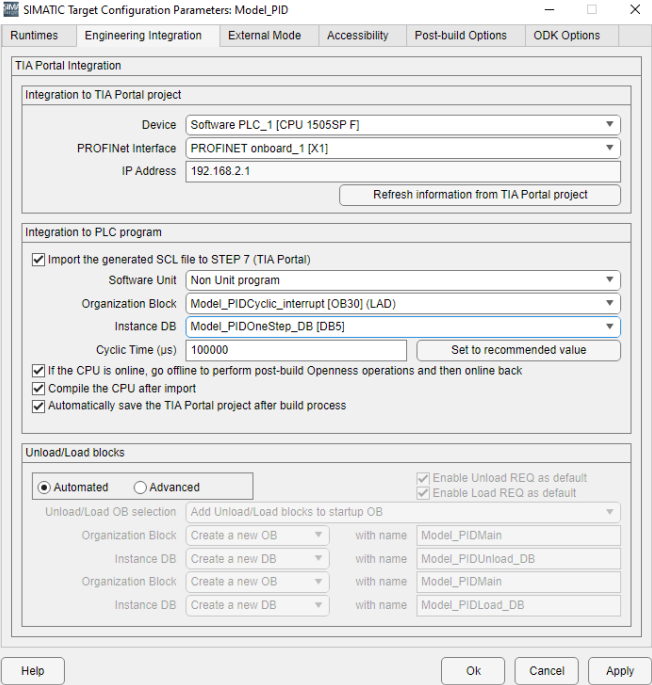
2.3.1 Settings for code generation

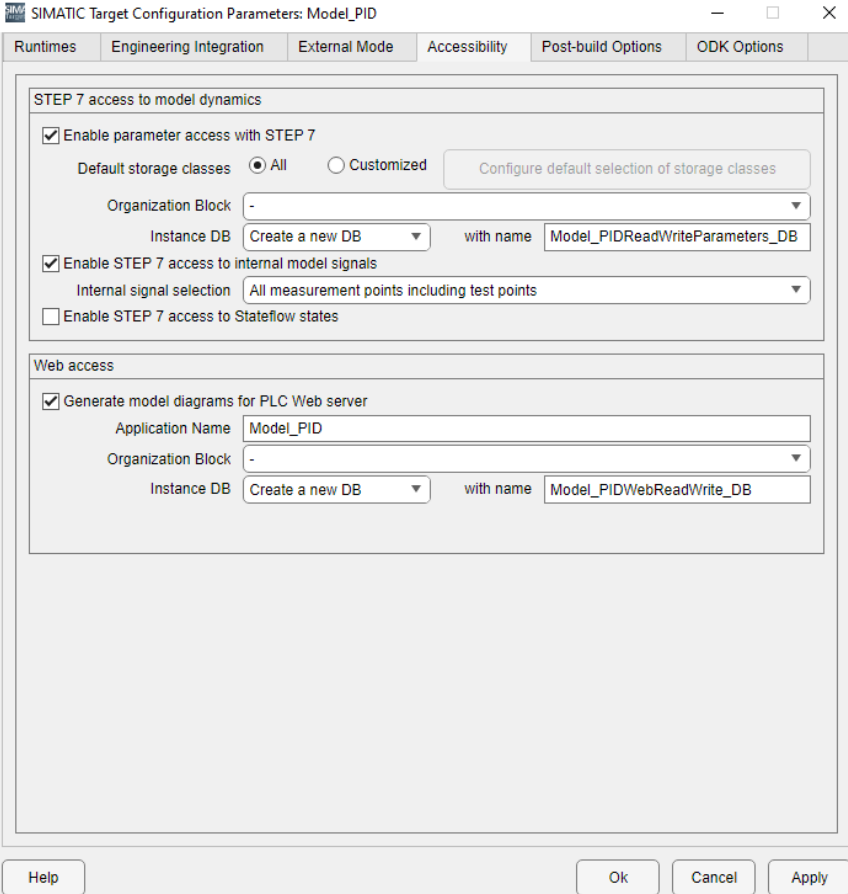
Table 2-5: Settings for code generation

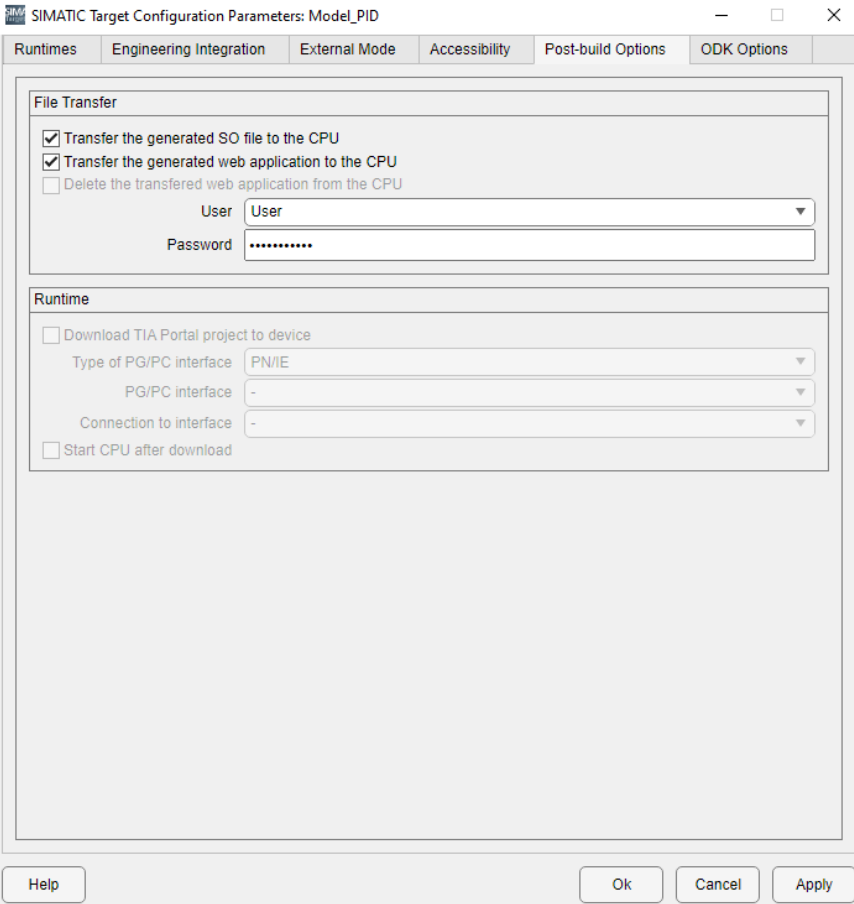
Step	Instruction
1.	Open the "Model_PID" model.
2.	In the menu bar, click on "SIMATIC Target > Model Settings" 
3.	Navigate to "Code Generation". - Click the "Browse" button to open the target selection window. - Select "Simatic_Target_V6_0_grt.tlc" - Confirm the setting with "Apply" or "OK". 

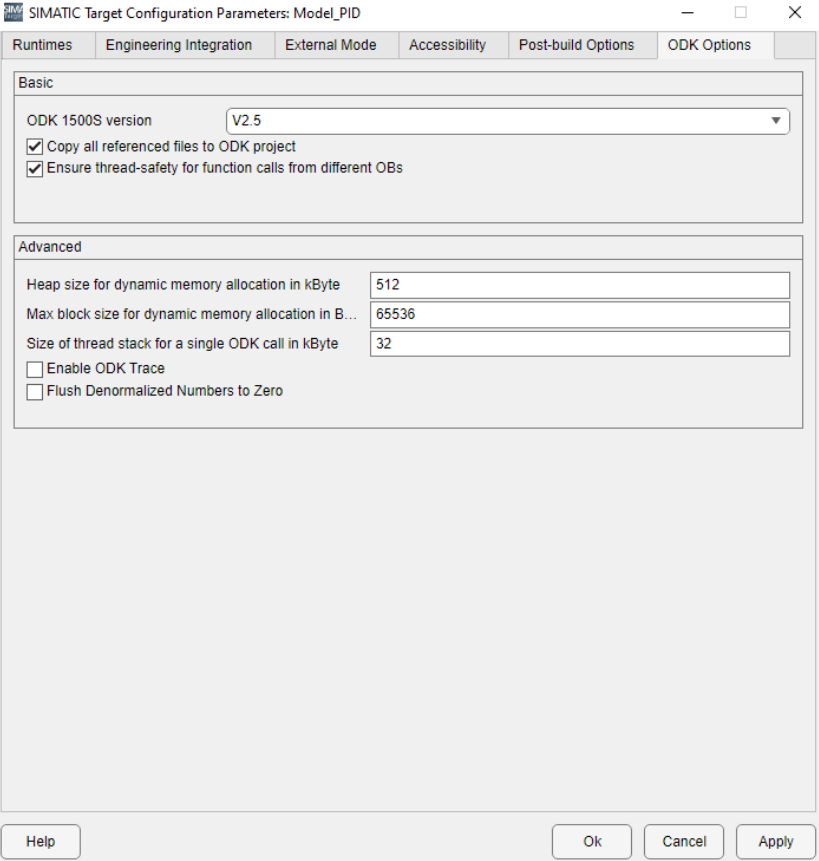
Step	Instruction
4.	Navigate to "Interface". - Under "Interface", select the setting "External Mode". This setting enables External Mode. - For "MEX file arguments", enter the IP address of the execution system (here, the X1 interface). Enter '192.168.2.1' for the application example.  Note Note that the IP address must be specified with the apostrophe, '192.168.2.1'.
5.	Navigate to "Solver". - Leave "Start time" at "0". - Change "Stop time" to "inf". This ensures that the External Mode will be used without a definite end. - Leave "Solver" on the default "auto (Automatic solver selection)". 

Step	Instruction
6.	Navigate to "Code Generation > Optimization". Set the parameter "Default parameter behavior" to "Tunable". After code generation, this setting gives you access with STEP 7 (TIA Portal) to all internal parameters of the model. 
7.	Navigate to "SIMATIC Target Options" - In order for the SIMATIC Target Options to run properly, the current Windows account must be added as a Siemens TIA Openness user. - On your PC, open "Computer Management" and navigate to "Siemens TIA Openness". Next, add your current Windows account as a user of this group. 

Step	Instruction
8.	In the "Runtimes" section of Target Options, add the TIA Portal project. Enter the username and password that was previously assigned in the TIA Portal under "Security Settings".  <i>In this selection, SIMATIC Target for Simulink generates an executable object from a Simulink model for an ODK-enabled SIMATIC S7-1500 CPU. It enables you to directly run the model on the CPU. SIMATIC Target for Simulink creates an SCL and SO file from the generated C/C++ code. The SCL file contains the generated function blocks and is imported as an external source to a STEP 7 project. The SO file contains the C/C++ implementation and is deployed to the CPU by being transferred to the Web server. In an automated process, SIMATIC Target for Simulink integrates the generated program logic into STEP 7 using TIA Portal Openness and the executable object into the runtime environment which can be either physical or simulated. SIMATIC Target for Simulink automatically generates all the required blocks and files for these operations.</i>
9.	In the "Engineering Integration" section, select the parameters as follows: Optionally, select automatic import of the SCL source into the TIA Portal project. Alternatively, the generated SCL source can also be integrated into TIA Portal via "External source files".  Note: Be aware that the message "SCL file import finished successfully" will appear later in the Diagnostic viewer (see Table 2-6 Step 4). The Windows user should be entered in the Openness user group.

Step	Instruction
10.	In the "Accessibility" section, select the following parameters: 1. Check the box for "Enable parameter access with STEP 7". This setting enables parameter access to the model parameters via the S7 program. 2. Check the box for "Enable STEP 7 access to internal model signals". This enables access to internal model signals via TIA Portal. 3. Also check the box by "Generate model diagrams for PLC Web Server". This setting causes files to be generated for the user-defined website. 

Step	Instruction
11.	In the "Post-build Options" section, select the following parameters and enter your username and password. In order to further simplify the workflow, there is also the option of automatically downloading the shared object file (.SO) to the CPU. Select the "Transfer the generated SO file to CPU" option.  Note Be aware that the message "SO file transfer finished successfully" will later appear in the Diagnostic viewer (see Table 2-6 Step 4).

Step	Instruction
12.	Optionally, check the box for "Copy all referenced files to ODK project" in the "ODK Options" section. This setting makes the SIMATIC Target create an ODK project which you can edit with Eclipse and compile even without Simulink.  Note The parameters "Heap size for dynamic memory allocation in kByte" and "Max block size for dynamic memory allocation in Byte" only need to be adjusted if there are problems with the code generation. For more information, see the Target manual at https://support.industry.siemens.com/cs/ww/en/view/109801419 and the SIMATIC S7-1500 ODK 1500S manual at https://support.industry.siemens.com/cs/ww/en/view/109783714.

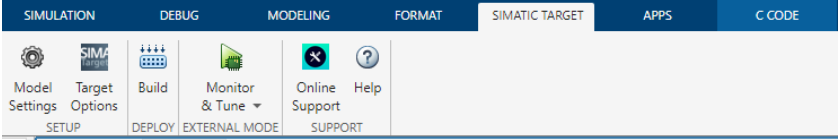
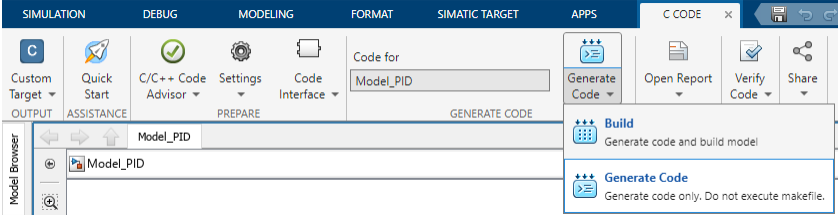
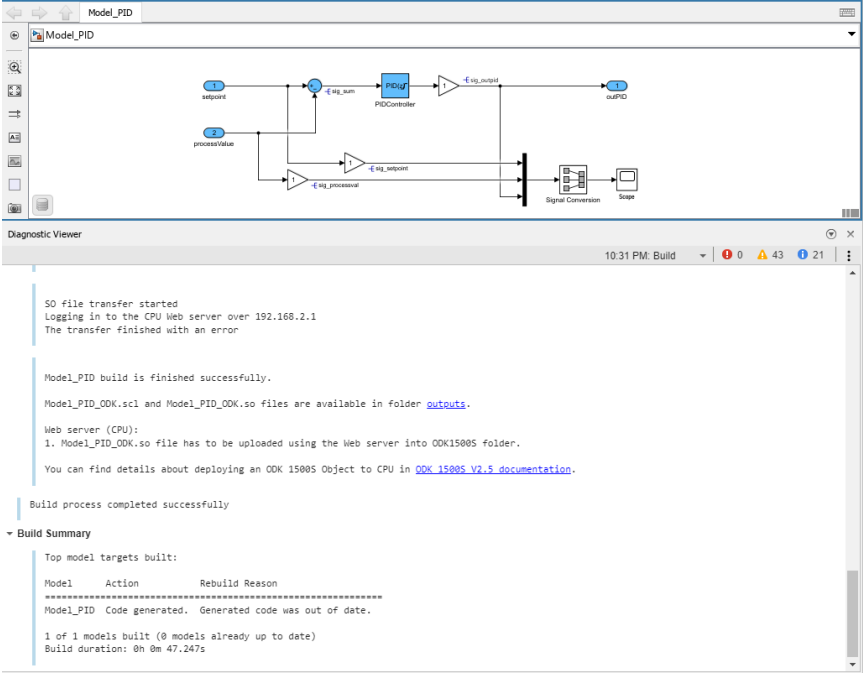
Note

In this application example, the TIA Portal project is available both in the SCL programming language and in LAD, but the logic in each case is identical. Due to the graphical overview, the documentation deals with the LAD project. In the LAD variant, the generated function blocks must be called manually in the organization blocks.

With the SCL programming language, the function blocks (generated via Target Options) can be automatically called in the organization blocks. After that, only the tags have to be interconnected.

2.3.2 Coding with SIMATIC Target

Table 2-6: Code generation with the Target

Step	Instruction
1.	Create the model by selecting the "Build" command under the "SIMATIC Target" menu item. You can also use the shortcut "Ctrl+B" for this.  Alternatively, you can also use the "Generate Code" command under "C Code". 
2.	• Simulink cannot be operated while the code is generating. • SIMATIC Target compiles the block "PIDController", with its input and output tags, in C/C++ code. • This source code is then used to generate the SO file and SCL source with the ODK compiler of the SIMATIC ODK 1500S. • Once the code generation is done, you can click the "View diagnostics" link in the status bar of the Simulink window.
4.	• The "Diagnostic Viewer" opens. • Click the "outputs" link. You will be taken directly to the save directory of the SO file and SCL source. 

Step	Instruction																																				
5.	The Windows Explorer directory of the Simulink model, "...\\Model_PID_Simatic_Target_V6_0_grt_Output\\outputs" contains the generated files. <table><thead><tr><th>Name</th><th>Date modified</th><th>Type</th><th>Size</th></tr></thead><tbody><tr><td> Model_PID_ODK.scl</td><td>3/1/2024 12:04 PM</td><td>SCL File</td><td>41 KB</td></tr><tr><td> Model_PID_ODK.so</td><td>3/1/2024 12:04 PM</td><td>SO File</td><td>387 KB</td></tr><tr><td> Model_PID_SC_TagTable.xml</td><td>3/1/2024 12:03 PM</td><td>Microsoft Edge H...</td><td>1 KB</td></tr></tbody></table>	Name	Date modified	Type	Size	 Model_PID_ODK.scl	3/1/2024 12:04 PM	SCL File	41 KB	 Model_PID_ODK.so	3/1/2024 12:04 PM	SO File	387 KB	 Model_PID_SC_TagTable.xml	3/1/2024 12:03 PM	Microsoft Edge H...	1 KB																				
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 Model_PID_ODK.so	3/1/2024 12:04 PM	SO File	387 KB																																		
 Model_PID_SC_TagTable.xml	3/1/2024 12:03 PM	Microsoft Edge H...	1 KB																																		
6.	And the Simulink model folder under "...\\Model_PID_Simatic_Target_V6_0_grt_Output\\website" contains the generated user-defined website. <table><thead><tr><th>Name</th><th>Date modified</th><th>Type</th><th>Size</th></tr></thead><tbody><tr><td> css</td><td>2/7/2024 3:08 PM</td><td>File folder</td><td></td></tr><tr><td> img</td><td>2/7/2024 3:08 PM</td><td>File folder</td><td></td></tr><tr><td> js</td><td>2/7/2024 3:08 PM</td><td>File folder</td><td></td></tr><tr><td> param</td><td>3/1/2024 12:04 PM</td><td>File folder</td><td></td></tr><tr><td> svg</td><td>3/1/2024 12:03 PM</td><td>File folder</td><td></td></tr><tr><td> home.html</td><td>1/31/2023 7:33 AM</td><td>Microsoft Edge H...</td><td>8 KB</td></tr><tr><td> login.html</td><td>1/31/2023 7:33 AM</td><td>Microsoft Edge H...</td><td>1 KB</td></tr><tr><td> WebAppConfig.json</td><td>3/1/2024 12:04 PM</td><td>JSON-Quelldatei</td><td>1 KB</td></tr></tbody></table>	Name	Date modified	Type	Size	 css	2/7/2024 3:08 PM	File folder		 img	2/7/2024 3:08 PM	File folder		 js	2/7/2024 3:08 PM	File folder		 param	3/1/2024 12:04 PM	File folder		 svg	3/1/2024 12:03 PM	File folder		 home.html	1/31/2023 7:33 AM	Microsoft Edge H...	8 KB	 login.html	1/31/2023 7:33 AM	Microsoft Edge H...	1 KB	 WebAppConfig.json	3/1/2024 12:04 PM	JSON-Quelldatei	1 KB
Name	Date modified	Type	Size																																		
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 img	2/7/2024 3:08 PM	File folder																																			
 js	2/7/2024 3:08 PM	File folder																																			
 param	3/1/2024 12:04 PM	File folder																																			
 svg	3/1/2024 12:03 PM	File folder																																			
 home.html	1/31/2023 7:33 AM	Microsoft Edge H...	8 KB																																		
 login.html	1/31/2023 7:33 AM	Microsoft Edge H...	1 KB																																		
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2.4 Creating the program and downloading it to the CPU

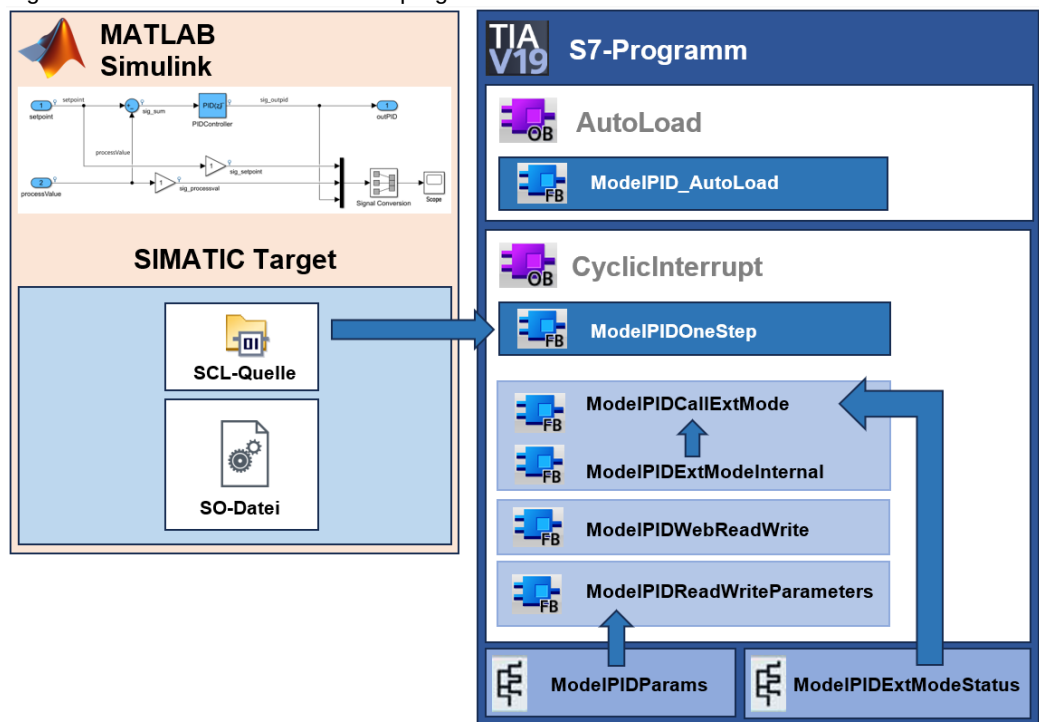
2.4.1 Overview

The following Figure shows all function blocks and PLC data types which are generated by the SCL source that SIMATIC Target creates. Some blocks are optional, depending on the code generation settings.

- External Mode
- Parameter access with STEP 7

The OBs (Startup and CyclicInterrupt) are created manually. Calling the FBs is recommended, as illustrated in the Figure below.

Figure 2-4: Simulink model in the S7 program



* optional blocks (depending on parameter in SIMATIC Target)

2.4.2 Description of the generated function blocks

The following table describes all blocks that are generated from the SCL source.

Table 2-7: Block explanation

Generated block / PLC data type	Functional description
FB ModelPID_Autoload	Block enables automatic unload/load block operations by updating the SO file.
FB ModelPID_Unload	Block clears the SO file from the CPU's memory.
FB ModelPID_Load	Block loads the SO file from the web server into the CPU's memory.
FB ModelPIDOneStep	Block calls up the SO file. The interfaces correspond to the original Simulink model.
FB ModelPIDCallExtMode (optional)	Block is called to use the Simulink External Mode.
PLC data type ModelPIDExtModeStatus (optional)	PLC data type of the "STATUS" output of FB ModelPIDCallExtMode
FB ModelPIDExtModeInternal (optional)	Block contains internal functions for using External Mode. This block is called in FB ModelPIDCallExtMode; it cannot be called any other way in the S7 program.
FB ModelPIDReadWriteParameters (optional)	Block is called to read or write manipulable model parameters.
FB ModelPIDWebReadWrite (optional)	Block is used to initialize the user-defined website including data exchange (model parameters and internal signals).
PLC data type ModelPIDParams (optional)	PLC data type of the in/out parameter "inOutParams" of FB "ModelPIDReadWriteParameters" or FB "ModelPIDWebReadWrite"
PLC data type ModelPIDInternalModelSignals	PLC data type contains a listing of all internal signals/testpoints.

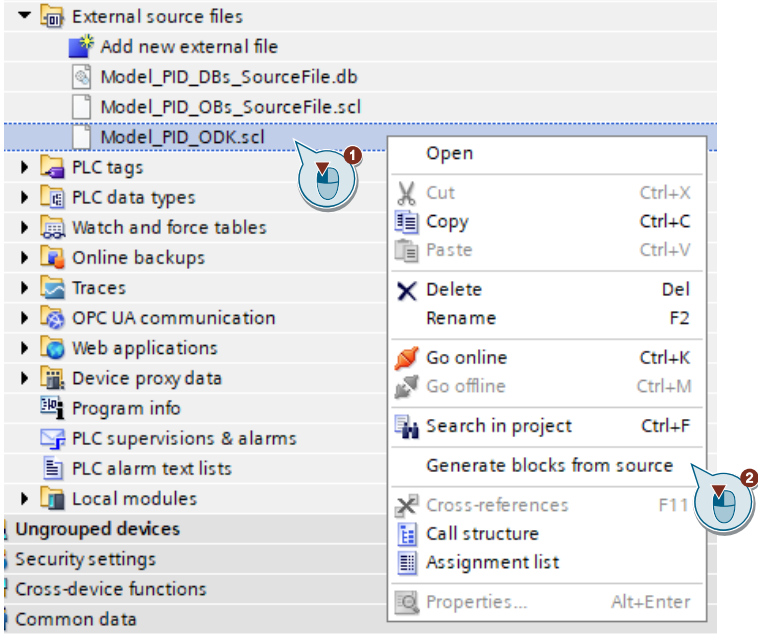
2.4.3 Integrating Simulink model into the S7 program

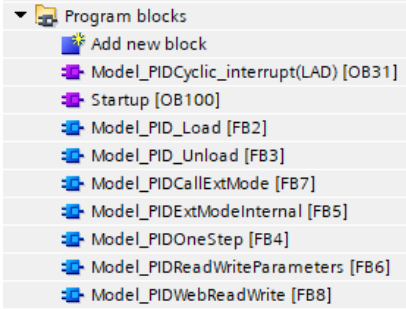
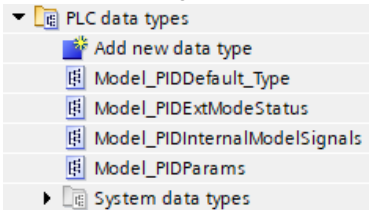
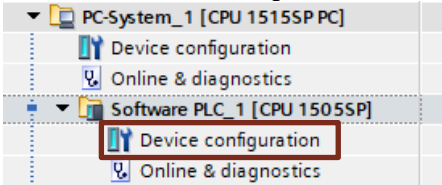
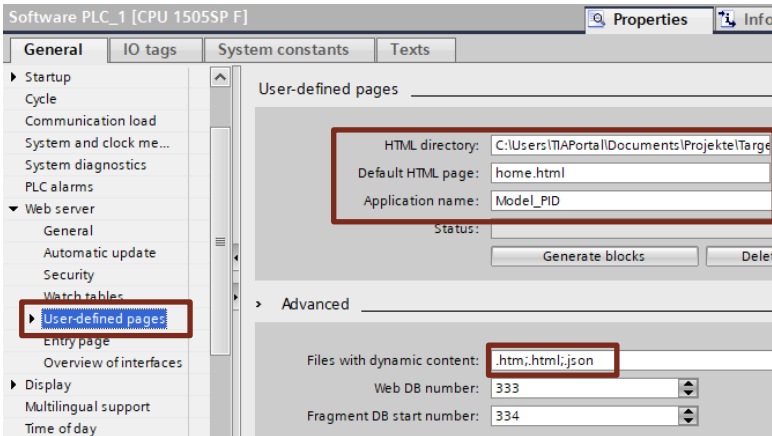
Import SCL source

Note

If you have followed Table 2-5, Step 8, then go directly to Step 6.

Table 2-8: Import SCL source

Step	Instruction
1.	Use TIA Portal to open the already created S7 program, with hardware configuration.
2.	In the project tree, navigate to "External source files".
3.	Click "Add new external file".
4.	Select the generated SCL source "ModelPID_ODK.scl" and import the file into the S7 program.
5.	- Right-click the file "ModelPID_ODK.scl". - Click "Generate blocks from source" and confirm the dialog.  TIA Portal will use the SCL source to generate the blocks created by Target.

Step	Instruction
6.	You will find the generated blocks under "Program blocks". 
7.	You will find the generated PLC data types under "PLC data types". 
8.	You can now make settings for the web visualization under "User-defined pages".  - Under "HTML directory", enter the path of the website folder you generated. - Enter "home.html" under "Default HTML page". - You can enter any name you wish under "Application name".  Note Only enter the web server settings manually if you are not using the web server API.

Create OBs and global DB

Table 2-9: Creating OBs and global DB

Step	Instruction																																																												
1.	Add the following organization blocks to your S7 program: • OB: "Startup" • OB: "CyclicInterrupt" (with a cyclic interrupt time of 100 ms) • DB: "GlobalParameters" Note The cycle of the "CyclicInterrupt" OB must match the cycle of the "PIDController" in the Simulink model (here, 0.1 or 100 ms).																																																												
2.	Open the DB "GlobalParameter". Add the following tags and structures: • setpoint [LReal] • process [LReal] • outPID [LReal] • statusOneStep [Word] • statusExternalMode [ModelPIDExtModeStatus] • paramAccess [Bool] • writeActive [Bool] • parameters [ModelPIDParams] • statusParameters [Word] • internalSignals [ModelPIDInternalModelSignals] • statusUnload [Word] • statusLoad [Word] <table><tr><th colspan="4">GlobalParameters</th></tr><tr><th></th><th>Name</th><th>Data type</th><th>Start value</th></tr><tr><td>1</td><td>Static</td><td></td><td></td></tr><tr><td>2</td><td>setpoint</td><td>LReal</td><td>0.0</td></tr><tr><td>3</td><td>process</td><td>LReal</td><td>0.0</td></tr><tr><td>4</td><td>outPID</td><td>LReal</td><td>0.0</td></tr><tr><td>5</td><td>statusOneStep</td><td>Word</td><td>16#0</td></tr><tr><td>6</td><td>paramAccess</td><td>Bool</td><td>true</td></tr><tr><td>7</td><td>writeActive</td><td>Bool</td><td>false</td></tr><tr><td>8</td><td>parameters</td><td>"Model_PIDParams"</td><td></td></tr><tr><td>9</td><td>statusParameters</td><td>Word</td><td>16#0</td></tr><tr><td>10</td><td>internalSignals</td><td>"Model_PIDInternalModelSignals"</td><td></td></tr><tr><td>11</td><td>statusUnload</td><td>Word</td><td>16#0</td></tr><tr><td>12</td><td>statusLoad</td><td>Word</td><td>16#0</td></tr><tr><td>13</td><td>statusExternalMode</td><td>"Model_PIDExtModeStatus"</td><td></td></tr></table>	GlobalParameters					Name	Data type	Start value	1	Static			2	setpoint	LReal	0.0	3	process	LReal	0.0	4	outPID	LReal	0.0	5	statusOneStep	Word	16#0	6	paramAccess	Bool	true	7	writeActive	Bool	false	8	parameters	"Model_PIDParams"		9	statusParameters	Word	16#0	10	internalSignals	"Model_PIDInternalModelSignals"		11	statusUnload	Word	16#0	12	statusLoad	Word	16#0	13	statusExternalMode	"Model_PIDExtModeStatus"	
GlobalParameters																																																													
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3	process	LReal	0.0																																																										
4	outPID	LReal	0.0																																																										
5	statusOneStep	Word	16#0																																																										
6	paramAccess	Bool	true																																																										
7	writeActive	Bool	false																																																										
8	parameters	"Model_PIDParams"																																																											
9	statusParameters	Word	16#0																																																										
10	internalSignals	"Model_PIDInternalModelSignals"																																																											
11	statusUnload	Word	16#0																																																										
12	statusLoad	Word	16#0																																																										
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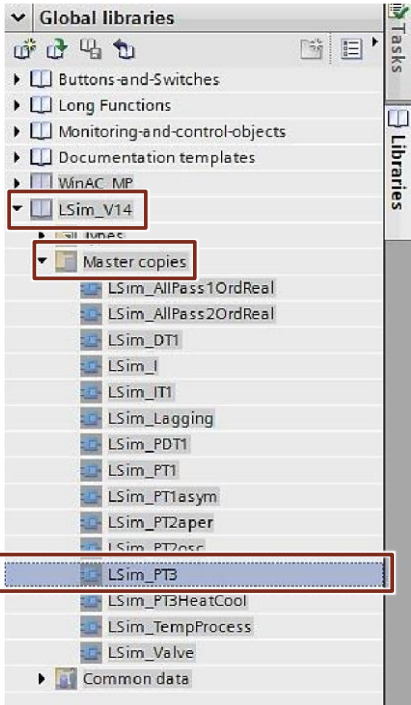
OB "Startup"

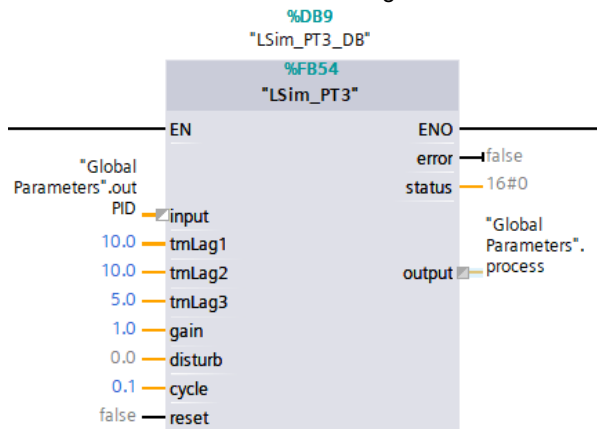
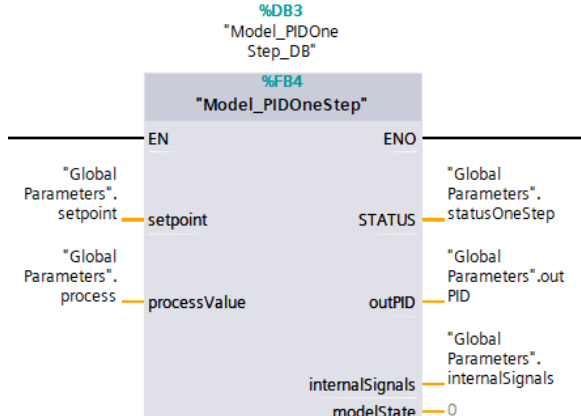
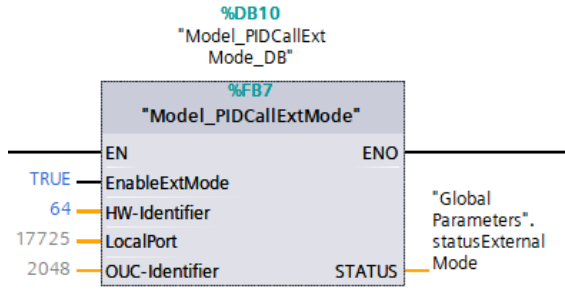
Table 2-10: OB "Startup"

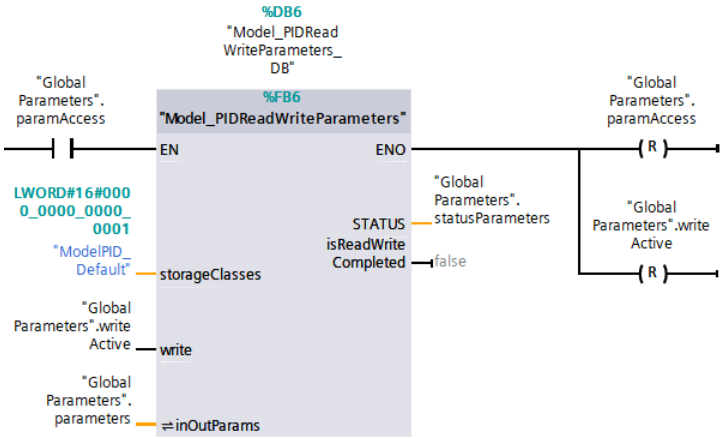
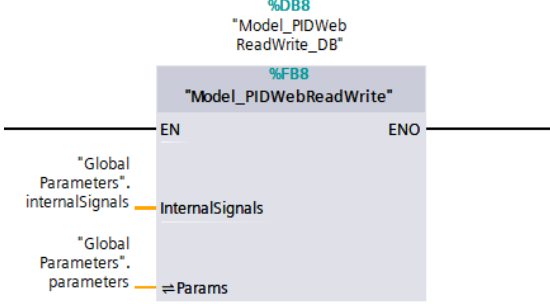
Step	Instruction
1.	Open the OB "<Project_name>Main_AutoLoad".
2.	The startup organization block was created automatically; it enables an automated update of the SO file of the model after each build. Steps 3 to 4 are only necessary if "Advanced" has been selected instead of "Automated" in the "Unload/Load blocks" section of the Target Options. If you select "Advanced", the "Unload/Load FBs" must be created manually in a Startup OB.
3. (optional)	- Call the FB "ModelPID_Unload" in Network 1. - Interconnect the "REQ" input with "TRUE". %DB12 "Model_PID_Unload_DB" %FB3 "Model_PID_Unload" EN ——— ENO ——— TRUE — REQ ——— DONE — false BUSY — false ERROR — false STATUS — "Global Parameters".statusUnload Interconnect the "STATUS" output with "GlobalParameters.statusUnload".
4. (optional)	- Call the FB "ModelPID_Load" in Network 2. - Interconnect the "REQ" input with "TRUE". %DB13 "Model_PID_Load_DB" %FB2 "Model_PID_Load" EN ——— ENO ——— TRUE — REQ ——— DONE — false BUSY — false ERROR — false STATUS — "Global Parameters".statusLoad Interconnect the "STATUS" output with "GlobalParameters.statusLoad".
5.	Close the OB.

OB "CyclicInterrupt"

Table 2-11: OB "CyclicInterrupt"

Step	Instruction
1.	- Open the "Libraries" task card. - Click on the "Open global library" button. - Select the extracted LSim library and open it. (Accept the upgrade if you are using a TIA Portal version that is more recent than the library provided.) - In the "LSIM_V1x" library under "Master copies", you will find the PT3 block "LSim_PT3".  Note You can find the "LSim" library in the following article: https://support.industry.siemens.com/cs/ww/en/view/79047707
2.	Open the OB "CyclicInterrupt".

Step	Instruction
3.	- Drag the FB "LSim_PT3" from the integrated library and into your project. - Call the block "LSim_PT3" in Network 1. - Interconnect the FB with the tags as illustrated in the figure below.  The block represents the temperature process from the Simulink model. Note The "cycle" parameter must match the cycle of the OB "CyclicInterrupt" and "PIDController" in the Simulink model (here, 0.1 or 100 ms).
4.	- Call the FB "ModelPIDOneStep" in Network 2. - Interconnect the FB with the tags as illustrated in the figure below. 
5.	- Call the FB "ModelPIDCallExtMode" in Network 3. - Interconnect the "EnableExtMode" input with "TRUE". - Interconnect the input "HW-Identifier" with 59. 

Step	Instruction
6.	- Call the block "ModelPIDReadWriteParameters" in Network 4. - Interconnect the tags as shown in the following Figure. - Reset the tags "GlobalParameters".paramAccess and "GlobalParameter".writeActive after the block is called. 
7.	- Call the block "ModelPIDWebReadWrite" in Network 5. - Interconnect the tags as shown in the following Figure. - You can find DB333 in the Device view under "System blocks" -> "Web server".  Note: Interconnecting DB333 is only necessary if the web server API is not used.
8.	Before you load the S7 program, load the SO file into the web server of the SIMATIC S7-1500 Software Controller (see following chapter), or use the automatic .SO file upload as described in Table 2-5 Step 9.

2.5 Manually loading the SO file to the web server

Requirement

- You have loaded the hardware configuration with web server enabled to the SIMATIC S7-1500 Software Controller (see chapter 2.2 Hardware configuration).

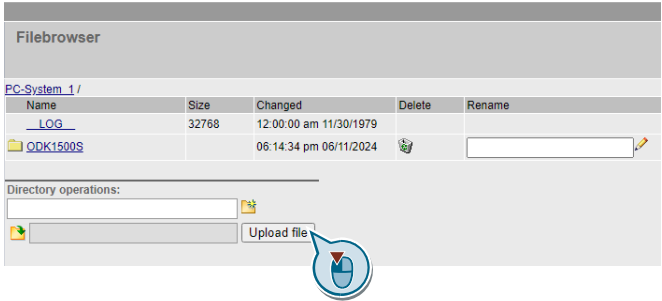
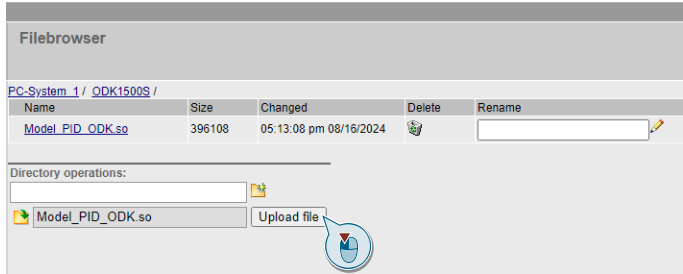
Note

The steps in this chapter are only necessary if the automatic .SO file upload was not carried out (see Table 2-5 Step 9). The output "SO file transfer finished successfully" should appear in the Diagnostic Viewer (see Table 2-6 Step 4).

Upload SO file to web server

Table 2-12: Web server

Step	Instruction
1.	Open a browser of your choice (Internet Explorer, Firefox, etc.).
2.	Open the website https://192.168.2.1/ The homepage of the CPU web server will open.
3.	Click on "Proceed 192.168.2.1 (insecure)".  Your connection is not private Attackers might be trying to steal your information from 192.168.2.1 (for example, passwords, messages, or credit cards). Learn more NET::ERR_CERT_AUTHORITY_INVALID  Turn on enhanced protection to get Chrome's highest level of security Hide advancedBack to safety This server could not prove that it is 192.168.2.1; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection. Proceed to 192.168.2.1 (unsafe)
4.	Navigate to "File browser".

Step	Instruction
5.	Click the folder "ODK1500S". PC-System_1/Software PLC_1 
6.	Click the "Browse" button.
7.	Navigate to the file "ModelPID_ODK.so" that was created by Target. The file is located in the "outputs" folder of the generated Target code.
8.	Select the file and click "Open".
9.	Click the "Upload file" button. PC-System_1/Software PLC_1 
10.	Close the browser.

Note

Once you have uploaded the SO file to the web server, you must restart the CPU (STOP->RUN).

The SO file will only be loaded to the CPU's memory once the block "Model_PIDLoad" is called in the OB "Startup".

2.6 Commissioning with STEP 7

Requirement

- You have loaded the hardware configuration with web server enabled to the SIMATIC S7-1500 Software Controller (see chapter 2.2 Hardware configuration).
- You have fully programmed the S7 program (see chapter 2.4 Creating the program and downloading it to the CPU).
- You have loaded the SO file to the CPU's web server (see chapter 2.5 Manually loading the SO file to the web server).

S7 program download

Table 2-13: S7 program download

Step	Instruction
1.	Open TIA Portal.
2.	Open your project or the example project.
3.	Select "Software PLC_1" and click the "Download to device" button.
4.	Confirm the dialog with "Load".
5.	Confirm the dialog with "Finish".
6.	Check the box for "Start all".
7.	Confirm the dialog with "Finish".

Commissioning with watch table

Table 2-14 Commissioning with watch table

Step	Instruction																																																																																																																																																																																				
1.	Open the "Watch and force tables" folder.																																																																																																																																																																																				
2.	Create the watch table "WatchTableModelPID" as illustrated below. <table><thead><tr><th></th><th>Name</th><th>Display format</th><th>Monitor val...</th><th>Modify value</th><th></th></tr></thead><tbody><tr><td colspan="6">// Process Parameters</td></tr><tr><td>2</td><td>"GlobalParameters".setpoint</td><td>Floating-point number</td><td>50.0</td><td>☒</td><td></td></tr><tr><td>3</td><td>"GlobalParameters".process</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>4</td><td>"GlobalParameters".outPID</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>5</td><td>"GlobalParameters".statusOneStep</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td colspan="6">// External Mode parameters</td></tr><tr><td>7</td><td>"GlobalParameters".statusExternalMode.Status_TCON</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td>8</td><td>"GlobalParameters".statusExternalMode.Status_TDICON</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td>9</td><td>"GlobalParameters".statusExternalMode.Status_TRCV</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td>10</td><td>"GlobalParameters".statusExternalMode.Status_TSEND</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td>11</td><td>"GlobalParameters".statusExternalMode.Status_ODK</td><td>DEC+-</td><td></td><td>☐</td><td></td></tr><tr><td>12</td><td>"GlobalParameters".statusExternalMode.Status_ExtMode</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td colspan="6">// Model parameters</td></tr><tr><td>14</td><td>"GlobalParameters".paramAccess</td><td>Bool</td><td>TRUE</td><td>☒</td><td></td></tr><tr><td>15</td><td>"GlobalParameters".writeActive</td><td>Bool</td><td>TRUE</td><td>☒</td><td></td></tr><tr><td>16</td><td>"GlobalParameters".statusParameters</td><td>Hex</td><td></td><td>☐</td><td></td></tr><tr><td>17</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_D</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>18</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_I</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>19</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_InitialConditionForFilter</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>20</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_InitialConditionForIntegrator</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>21</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_LowerSaturationLimit</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>22</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_N</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>23</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_P</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>24</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_UpperSaturationLimit</td><td>Floating-point number</td><td>100.0</td><td>☒</td><td></td></tr><tr><td>25</td><td>"GlobalParameters".parameters.Default.Model_PID_Integrator_gainval</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>26</td><td>"GlobalParameters".parameters.Default.Model_PID_Filter_gainval</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>27</td><td>"GlobalParameters".parameters.Default.Model_PID_Gain1_Gain</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>28</td><td>"GlobalParameters".parameters.Default.Model_PID_Gain2_Gain</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr><tr><td>29</td><td>"GlobalParameters".parameters.Default.Model_PID_Gain3_Gain</td><td>Floating-point number</td><td></td><td>☐</td><td></td></tr></tbody></table>		Name	Display format	Monitor val...	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3.	Click the "Monitor" button.																																																																																																																																																																																				
4.	1. For the "setpoint", enter the value 50.0 in the "Modify value" column. 2. Click the "Modify all selected values once and now" button. <table><thead><tr><th></th><th>Name</th><th>Display format</th><th>Monitor val...</th><th>Modify value</th><th></th><th>Comment</th></tr></thead><tbody><tr><td colspan="7">// Process Parameters</td></tr><tr><td>2</td><td>"GlobalParameters".setpoint</td><td>Floating-point nu...</td><td>50.0</td><td>50.0</td><td>☒</td><td></td></tr><tr><td>3</td><td>"GlobalParameters".process</td><td>Floating-point number</td><td>50.684051...</td><td></td><td>☐</td><td></td></tr><tr><td>4</td><td>"GlobalParameters".outPID</td><td>Floating-point number</td><td>48.160650...</td><td></td><td>☐</td><td></td></tr><tr><td>5</td><td>"GlobalParameters".statusOneStep</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td colspan="7">// External Mode parameters</td></tr><tr><td>7</td><td>"GlobalParameters".statusExternalMode.Status_TCON</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td>8</td><td>"GlobalParameters".statusExternalMode.Status_TDICON</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td>9</td><td>"GlobalParameters".statusExternalMode.Status_TRCV</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td>10</td><td>"GlobalParameters".statusExternalMode.Status_TSEND</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td>11</td><td>"GlobalParameters".statusExternalMode.Status_ODK</td><td>DEC+-</td><td>0</td><td></td><td>☐</td><td></td></tr><tr><td>12</td><td>"GlobalParameters".statusExternalMode.Status_ExtMode</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td colspan="7">// Model parameters</td></tr><tr><td>14</td><td>"GlobalParameters".paramAccess</td><td>Bool</td><td>FALSE</td><td>TRUE</td><td>☒</td><td></td></tr><tr><td>15</td><td>"GlobalParameters".writeActive</td><td>Bool</td><td>FALSE</td><td>TRUE</td><td>☒</td><td></td></tr><tr><td>16</td><td>"GlobalParameters".statusParameters</td><td>Hex</td><td>16#0000</td><td></td><td>☐</td><td></td></tr><tr><td>17</td><td>"GlobalParameters".parameters.Default.Model_PID_PIDController_D</td><td>Floating-point number</td><td>8.5</td><td></td><td>☐</td><td></td></tr></tbody></table>		Name	Display format	Monitor val...	Modify value		Comment	// Process Parameters							2	"GlobalParameters".setpoint	Floating-point nu...	50.0	50.0	☒		3	"GlobalParameters".process	Floating-point number	50.684051...		☐		4	"GlobalParameters".outPID	Floating-point number	48.160650...		☐		5	"GlobalParameters".statusOneStep	Hex	16#0000		☐		// External Mode parameters							7	"GlobalParameters".statusExternalMode.Status_TCON	Hex	16#0000		☐		8	"GlobalParameters".statusExternalMode.Status_TDICON	Hex	16#0000		☐		9	"GlobalParameters".statusExternalMode.Status_TRCV	Hex	16#0000		☐		10	"GlobalParameters".statusExternalMode.Status_TSEND	Hex	16#0000		☐		11	"GlobalParameters".statusExternalMode.Status_ODK	DEC+-	0		☐		12	"GlobalParameters".statusExternalMode.Status_ExtMode	Hex	16#0000		☐		// Model parameters							14	"GlobalParameters".paramAccess	Bool	FALSE	TRUE	☒		15	"GlobalParameters".writeActive	Bool	FALSE	TRUE	☒		16	"GlobalParameters".statusParameters	Hex	16#0000		☐		17	"GlobalParameters".parameters.Default.Model_PID_PIDController_D	Floating-point number	8.5		☐																																																							
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By specifying the setpoint value, the block "Model_PIDOneStep" steers the process to the programmed value with the SO file.																																																																																																																																																																																					

2.7 External Mode

Simulink External Mode gives you the ability to monitor the model while the CPU is running, and to alter parameters of the model online.

Note

Please observe the information in the Target manual when you use External Mode.

<https://support.industry.siemens.com/cs/ww/en/view/109801419>

Because External Mode and the web visualization should not be used together, an open contact has been configured in the example project upstream of the call FB "ModelPIDCallExtMode".

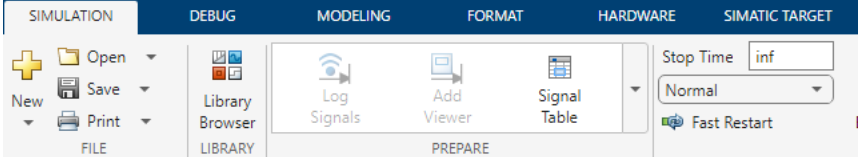
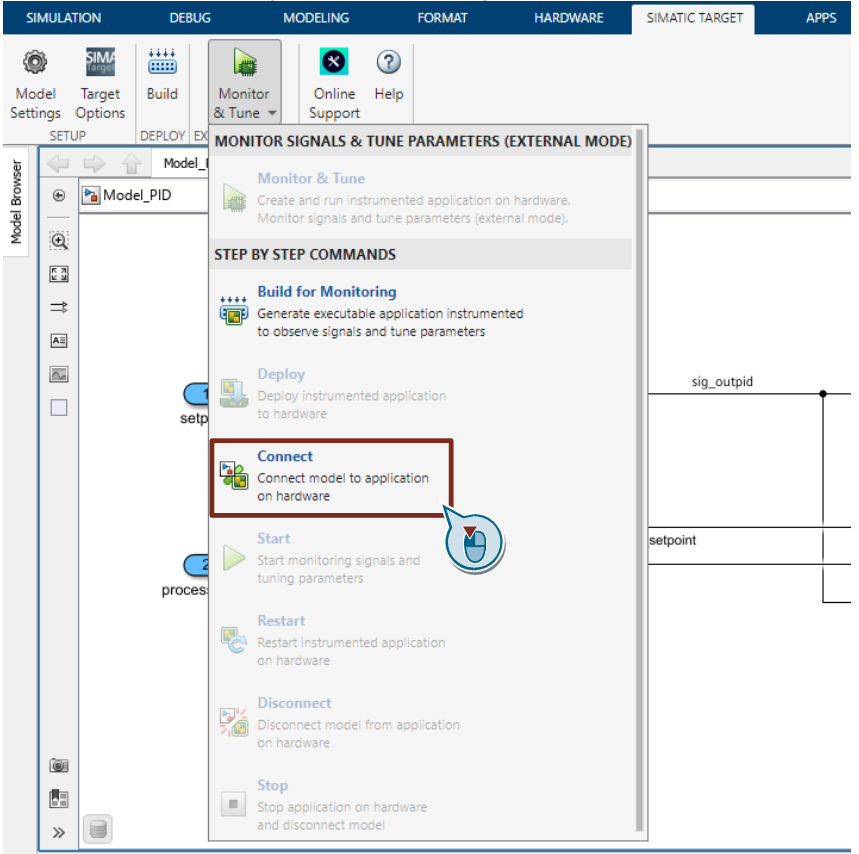
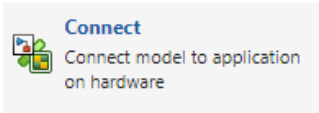
Requirement

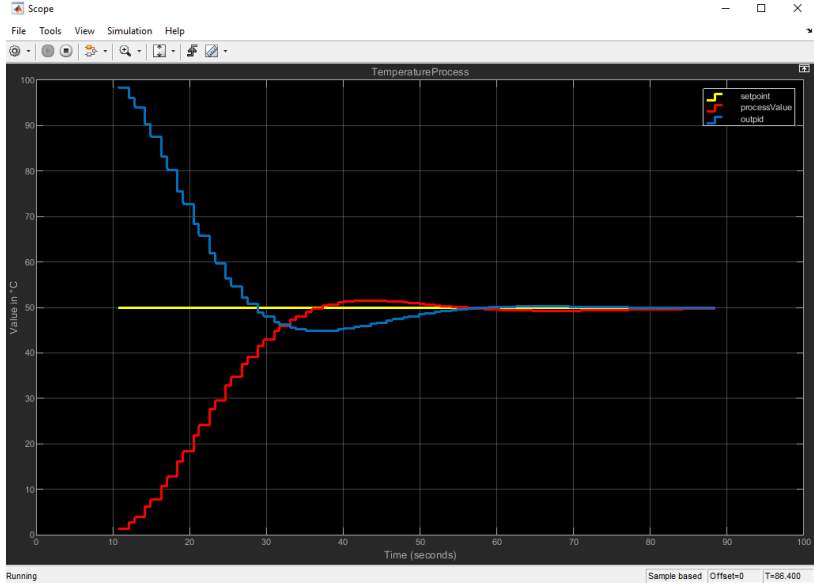
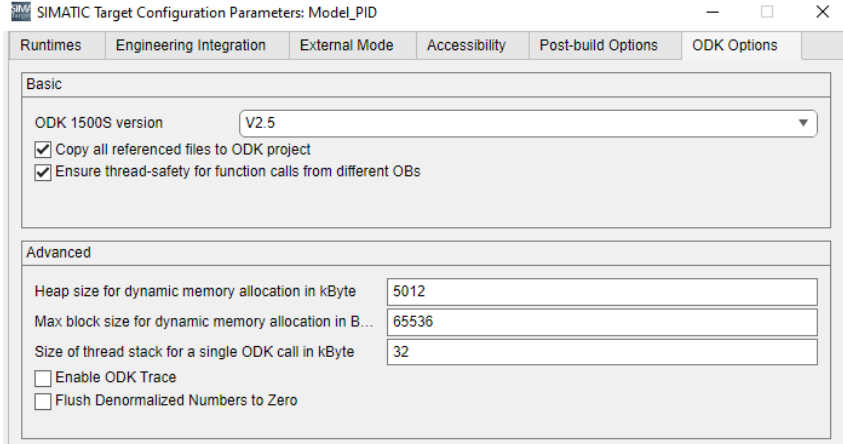
- You have configured External Mode before generating (see chapter 2.3.1 Settings for code generation).
- You have interconnected the input "EnableExtMode" with "TRUE" when calling the FB "ModelPIDCallExtMode".
- You have loaded the SO file to the CPU's web server (see chapter 2.5 Manually loading the SO file to the web server).
- You have loaded the S7 program into the CPU (see chapter 2.6 Commissioning with STEP 7).
- You have put the CPU in "RUN" mode.
- You have connected your PG/PC (MATLAB & Simulink) with the CPU via Ethernet (in this application example: Open Controller – X1 interface).
- You have allowed access via port 17725 under "incoming rules" in the "Windows Firewall" settings of the Open Controller.

2.7.1 Monitoring

Table 2-15: Monitoring with External Mode

Step	Instruction
1.	Open MATLAB.
2.	Open the model "ModelPID.slx".

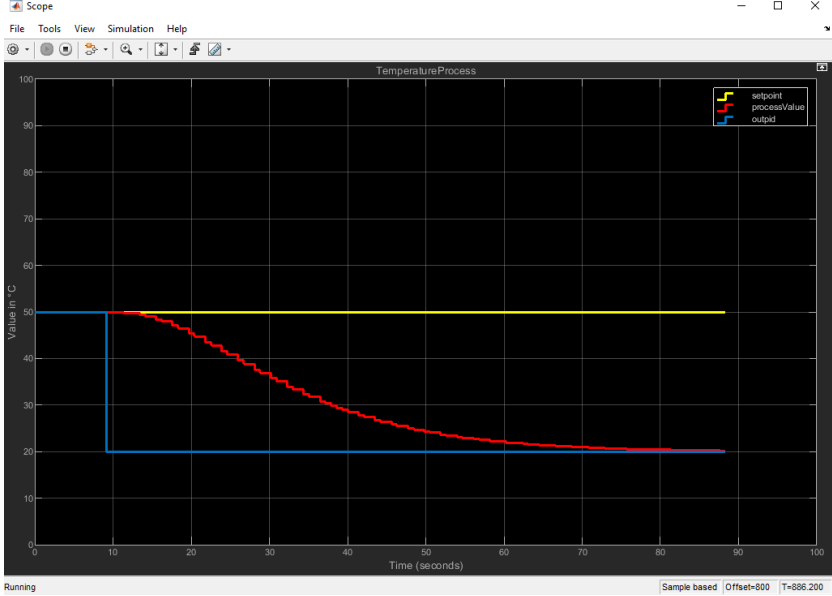
Step	Instruction
3.	Set the following values: 1. "Simulation stop time": Value "Inf".  Model_PID - Simulink sponsored third party support use  2. Under "SIMATIC Target", open the settings for External Mode.  The screenshot shows the SIMATIC Target interface with the 'Monitor & Tune' window open. The window title is 'MONITOR SIGNALS & TUNE PARAMETERS (EXTERNAL MODE)'. It contains a 'Monitor & Tune' section with a description: 'Create and run instrumented application on hardware. Monitor signals and tune parameters (external mode)'. Below this is a 'STEP BY STEP COMMANDS' section with several buttons: 'Build for Monitoring', 'Deploy', 'Connect', 'Start', 'Restart', 'Disconnect', and 'Stop'. The 'Connect' button is highlighted with a red box and a blue callout arrow. The background shows a Simulink model with signals like 'sig_outpid', 'setpoint', and 'process'.
4.	Click "Connect".  The close-up shows the 'Connect' button with the text 'Connect model to application on hardware'.

Step	Instruction
5.	To open the "Scope" window, double-click the "Scope" icon in the Simulink model. You can modify the setpoint value "setpoint" with the watch table "WatchTableModelPID" in STEP 7 and observe the progress in the "Scope" window. If you change the setpoint value from 0.0 to 50.0, you will obtain the following signal behavior. 
6.	Click "Disconnect" to terminate the connection.
	Note: In the "ODK Options" section of the SIMATIC Target settings, modify the values for "Heap size for dynamic memory allocation in kByte" and "Max block size for dynamic memory allocation in Byte" if External Mode is hindered by insufficient memory. 

2.7.2 Changing model parameters

Table 2-16: Modifying model parameters with External Mode

Step	Instruction
1.	Open MATLAB.
2.	Open the model "Model_PID.slx".
3.	Connect to External Mode with the CPU.
4.	Double-click the block "PIDController" to open the parameters.
5.	1. Navigate to "PID Advanced" and change "Upper saturation limit" to 20 (as an example). 

Step	Instruction
6.	The Scope will show that "outPID" is limited to 20. The process value "process Value" aperiodically approaches the value. 
7.	Reset the "Upper saturation limit" to 100 and confirm with "Apply". The system will return to the value of 50.
8.	Using this procedure, you can change any value in the model that you wish.

Note

If you change parameter values via External Mode, these changes are only valid until the CPU is restarted. After the restart, the original values will apply.

If you wish to permanently change the values, regenerate the blocks with Target. Load the SO file to the web server again. Restart the CPU.

If you not only adjust parameters but also change the model and change the interfaces of the block (here, "PIDController"), you will have to re-integrate the SCL source into the S7 program.

2.8 Changing model parameters

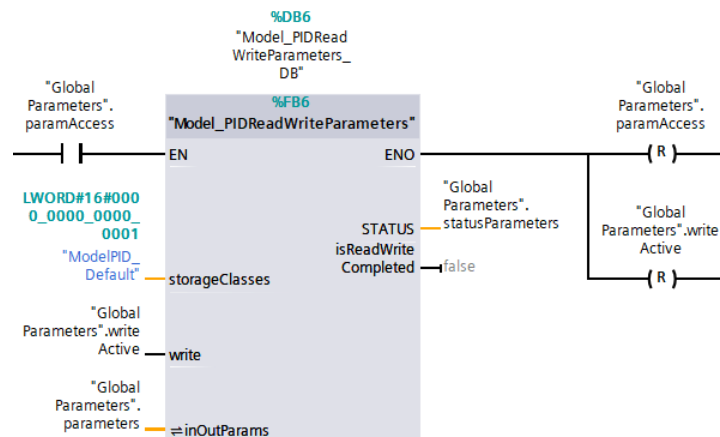
Requirement

- You have enabled parameter access with STEP 7 before generating (see chapter 2.3.1 Settings for code generation).
- You have loaded the SO file to the CPU's web server (see chapter 2.5 Manually loading the SO file to the web server).
- You have loaded the S7 program into the CPU (see chapter 2.6 Commissioning with STEP 7).
- You have put the CPU in "RUN" mode.
- You have connected your PG/PC (MATLAB & Simulink) with the hardware via Ethernet (in this application example: OpenController – Windows interface).

2.8.1 Block for changing the model parameters

- The model parameters can be changed during operation via the block "ModePIDReadWriteParameters".
- The parameters are passed with the in/out parameter "inOutParams".
- At each call, the block reads or writes the model parameters depending on the "write" input.
- The block is called in the OB "CyclicInterrupt".
- The block is called with the "paramAccess" tag from the DB GlobalParameter".
- Every time after the block is called, the tags "paramAccess" and "writeActivate" in the DB "GlobalParameter" are reset.

Figure 2-5: Block "ModePIDReadWriteParameters"



Input parameters

Table 2-17: Input parameters

Parameters	Data type	Description
write	BOOL	Set this value to TRUE to write the parameters from the S7 program to the Simulink model. The values passed at the parameter "inOutParams" are written to the Simulink model. In order to read the parameters from the Simulink model, set this value to FALSE. The current values of the Simulink model parameters are written to the tag that is interconnected at "inOutParams".

Parameters	Data type	Description
inOutParams	PLC data type ModelPIDParams	Using the in/out parameter "inOutParams", you can pass the parameters of the Simulink model for reading or writing.

Output parameters

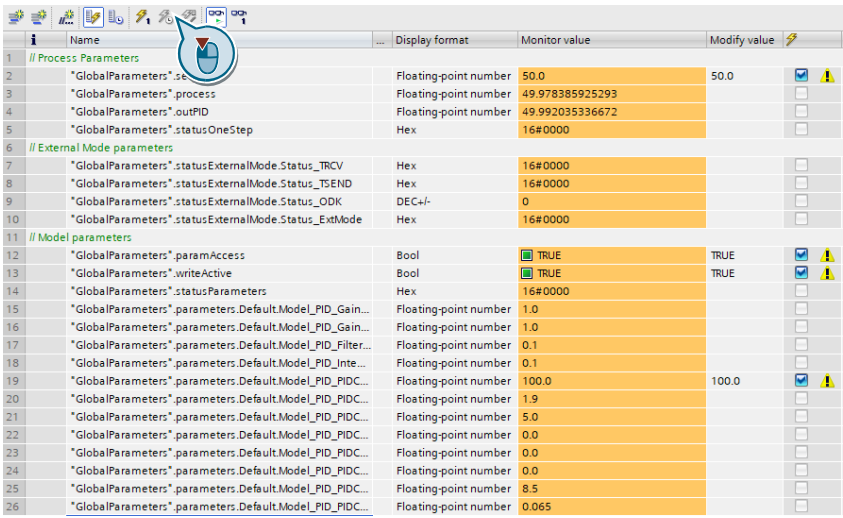
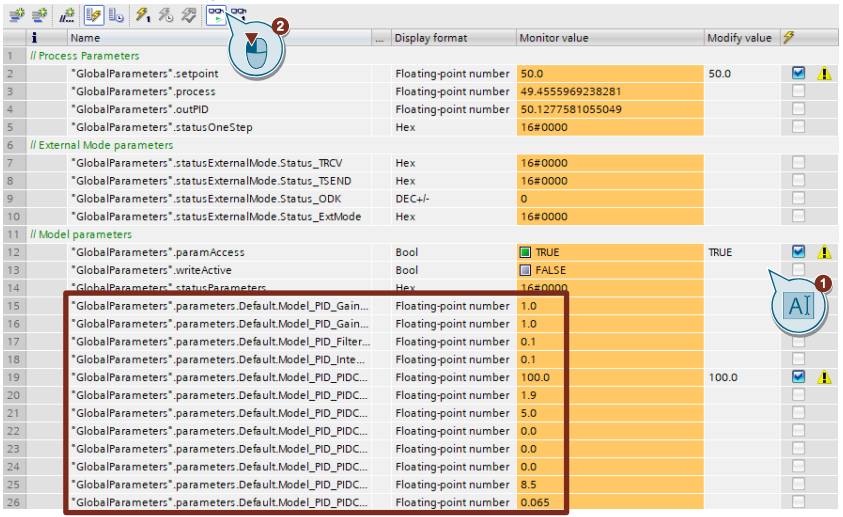
Table 2-18: Output parameters

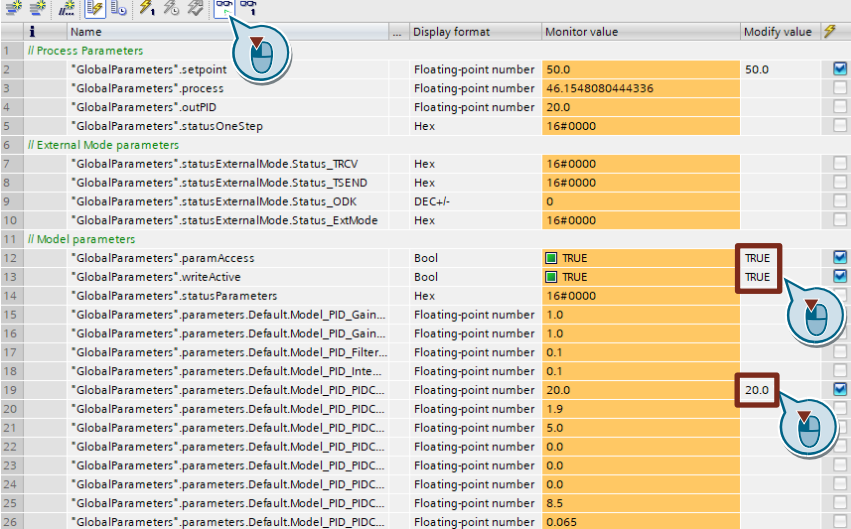
Parameters	Data type	Description
STATUS	WORD	This returned value is automatically generated by the ODK. The returned value is 0 if execution is successful.

2.8.2 Modifying model parameters with watch table in STEP 7

Table 2-19: Modifying model parameters with watch table in STEP 7

Step	Instruction
1.	Open the "Watch and force tables" folder.
2.	Open "WatchTableModelPID".

Step	Instruction																																																																																																												
3.	Click the "Monitor" button.  <table><thead><tr><th>Name</th><th>Display format</th><th>Monitor value</th><th>Modify value</th></tr></thead><tbody><tr><td colspan="4">// Process Parameters</td></tr><tr><td>"GlobalParameters".setpoint</td><td>Floating-point number</td><td>50.0</td><td>50.0</td></tr><tr><td>"GlobalParameters".process</td><td>Floating-point number</td><td>49.978385925293</td><td></td></tr><tr><td>"GlobalParameters".outPID</td><td>Floating-point number</td><td>49.992035336672</td><td></td></tr><tr><td>"GlobalParameters".statusOneStep</td><td>Hex</td><td>16#0000</td><td></td></tr><tr><td colspan="4">// External Mode parameters</td></tr><tr><td>"GlobalParameters".statusExternalMode.Status_TRCV</td><td>Hex</td><td>16#0000</td><td></td></tr><tr><td>"GlobalParameters".statusExternalMode.Status_TSEND</td><td>Hex</td><td>16#0000</td><td></td></tr><tr><td>"GlobalParameters".statusExternalMode.Status_ODK</td><td>DEC+/-</td><td>0</td><td></td></tr><tr><td>"GlobalParameters".statusExternalMode.Status_ExtMode</td><td>Hex</td><td>16#0000</td><td></td></tr><tr><td colspan="4">// Model parameters</td></tr><tr><td>"GlobalParameters".paramAccess</td><td>Bool</td><td>TRUE</td><td>TRUE</td></tr><tr><td>"GlobalParameters".writeActive</td><td>Bool</td><td>TRUE</td><td>TRUE</td></tr><tr><td>"GlobalParameters".statusParameters</td><td>Hex</td><td>16#0000</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_Gain...</td><td>Floating-point number</td><td>1.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_Gain...</td><td>Floating-point number</td><td>1.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_Filter...</td><td>Floating-point number</td><td>0.1</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_Inte...</td><td>Floating-point number</td><td>0.1</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>100.0</td><td>100.0</td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>1.9</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>5.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>0.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>0.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>0.0</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>8.5</td><td></td></tr><tr><td>"GlobalParameters".parameters.Default.Model_PID_PIDC...</td><td>Floating-point number</td><td>0.065</td><td></td></tr></tbody></table>	Name	Display format	Monitor value	Modify value	// Process Parameters				"GlobalParameters".setpoint	Floating-point number	50.0	50.0	"GlobalParameters".process	Floating-point number	49.978385925293		"GlobalParameters".outPID	Floating-point number	49.992035336672		"GlobalParameters".statusOneStep	Hex	16#0000		// External Mode parameters				"GlobalParameters".statusExternalMode.Status_TRCV	Hex	16#0000		"GlobalParameters".statusExternalMode.Status_TSEND	Hex	16#0000		"GlobalParameters".statusExternalMode.Status_ODK	DEC+/-	0		"GlobalParameters".statusExternalMode.Status_ExtMode	Hex	16#0000		// Model parameters				"GlobalParameters".paramAccess	Bool	TRUE	TRUE	"GlobalParameters".writeActive	Bool	TRUE	TRUE	"GlobalParameters".statusParameters	Hex	16#0000		"GlobalParameters".parameters.Default.Model_PID_Gain...	Floating-point number	1.0		"GlobalParameters".parameters.Default.Model_PID_Gain...	Floating-point number	1.0		"GlobalParameters".parameters.Default.Model_PID_Filter...	Floating-point number	0.1		"GlobalParameters".parameters.Default.Model_PID_Inte...	Floating-point number	0.1		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	100.0	100.0	"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	1.9		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	5.0		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	0.0		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	0.0		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	0.0		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	8.5		"GlobalParameters".parameters.Default.Model_PID_PIDC...	Floating-point number	0.065	
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Step	Instruction
5.	Add the following values in the "Modify value" column: "GlobalParameters".paramAccess = TRUE "GlobalParameters".writeActive = TRUE "GlobalParameters".parameters.ModelPID_PIDController_UpperSaturationLimit = 20.0 - Click on "Modify all selected values once and now."  The value of the parameter "GlobalParameters".outPID will be reduced to the value 20.0.
6.	To restore the original state, change the value of the parameter "GlobalParameters".parameters.ModelPID_PIDController_UpperSaturationLimit back to 100.0. Click on "Modify all selected values once and now."

Note

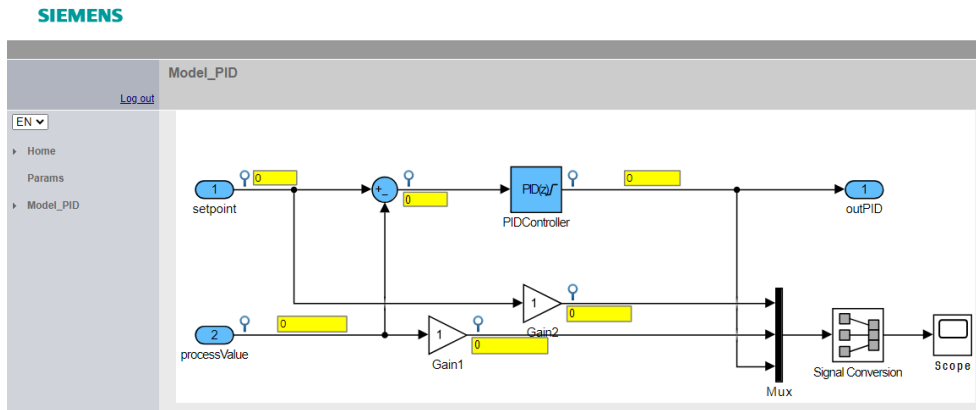
If you use the watch table to modify parameter values, these changes are only valid until the CPU restarts. After the restart, the original values will apply.

If you want to change the values permanently from the S7 program, you must make a snapshot of the GlobalParameters data block and set it to define the start values (see chapter after next).

2.8.3 Modifying model parameters via web visualization

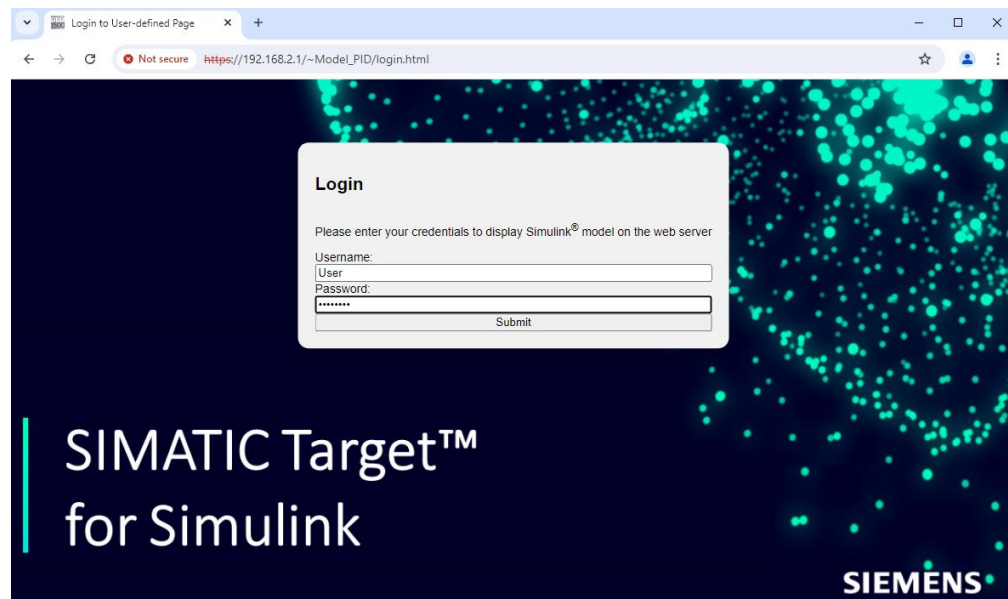
The visualization of the model can be accessed on the PLC web server under "User-defined websites":

Figure 2-6: User-defined website on the S7 web server



Open the user site. Enter your username and password to open the user site.

Figure 2-7: Website login



Using the tag table "WatchTableModelPID" in TIA Portal, a setpoint value can now be set, so as to detect changes to internal signals. With this web interface you can also make changes to model parameters in the "Params" tab.

Figure 2-8: Editing model parameters

Parameter List - Params Storage class: All

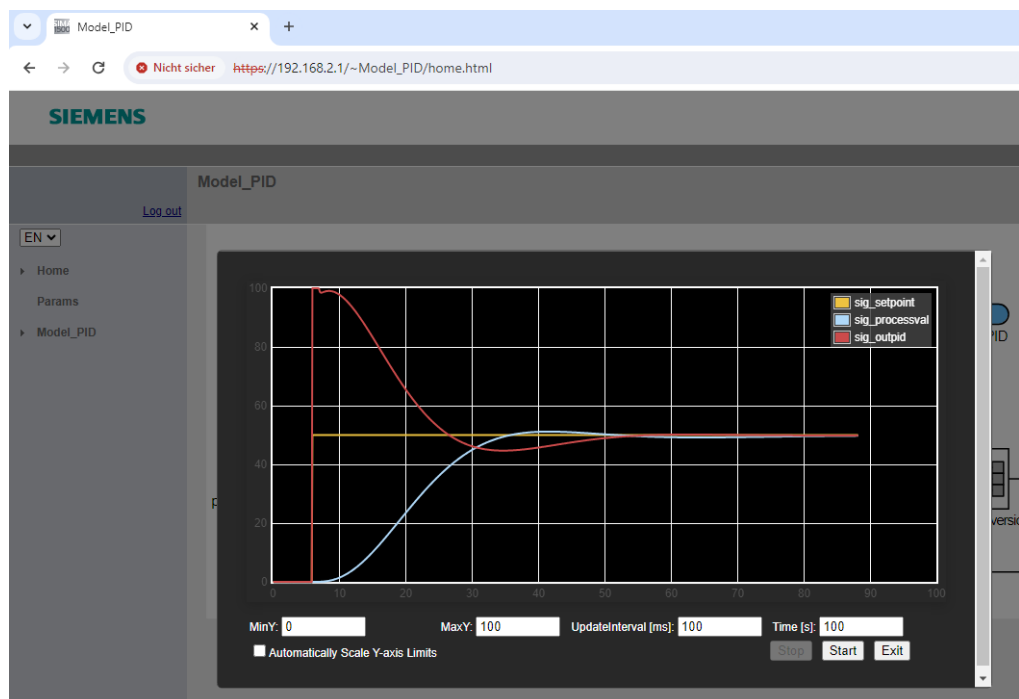
Parameter	Value	
Model_PID_PIDController_D	8.5	Submit
Model_PID_PIDController_I	0.065	Submit
Model_PID_PIDController_InitialConditionForFilter	0.0	Submit
Model_PID_PIDController_InitialConditionForIntegrator	0.0	Submit
Model_PID_PIDController_LowerSaturationLimit	0.0	Submit
Model_PID_PIDController_N	5.0	Submit
Model_PID_PIDController_P	1.9	Submit
Model_PID_PIDController_UpperSaturationLimit	100.0	Submit
Model_PID_Integrator_gainval	0.1	Submit
Model_PID_Filter_gainval	0.1	Submit
Model_PID_Gain2_Gain	1.0	Submit
Model_PID_Gain1_Gain	1.0	Submit

Exit Reload

The changes are applied immediately when you click "Submit".

You can also use the integrated Scope to monitor process values. To do this, first click on the Scope and then click "Start". The time axis can be scaled under "Time".

Figure 2-9: Scope

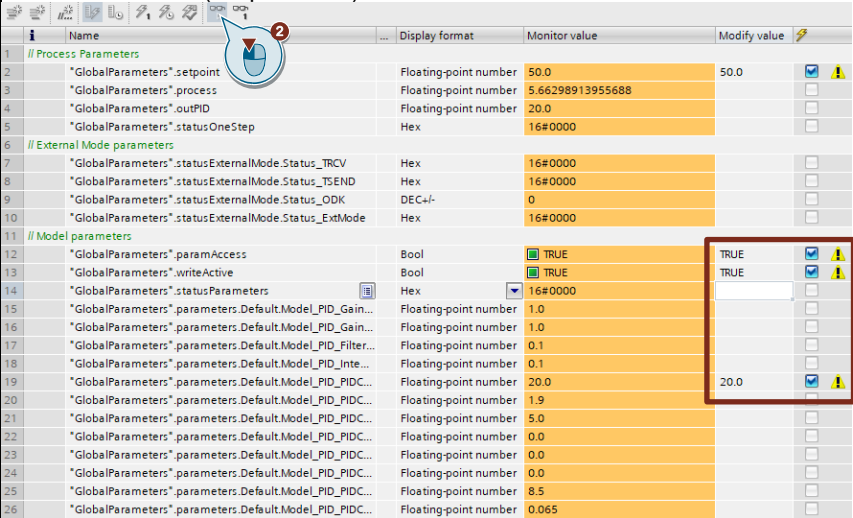
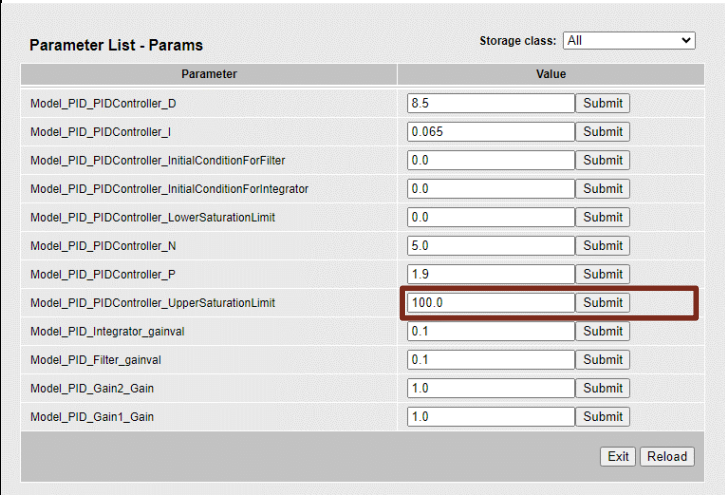


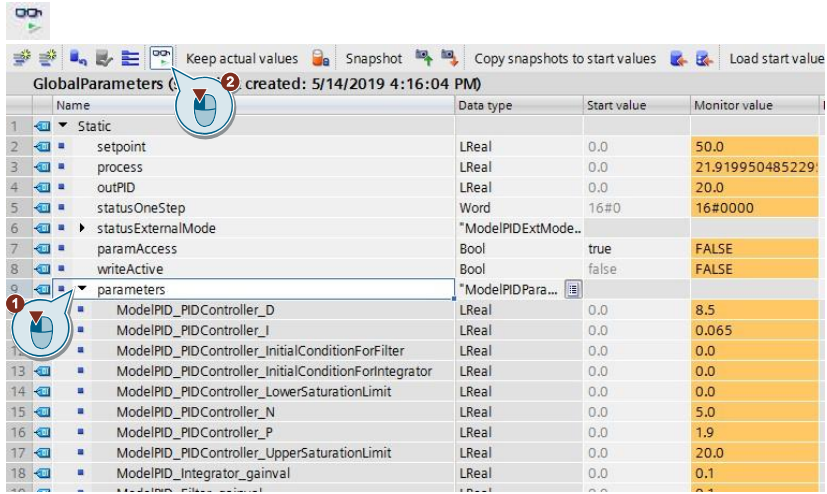
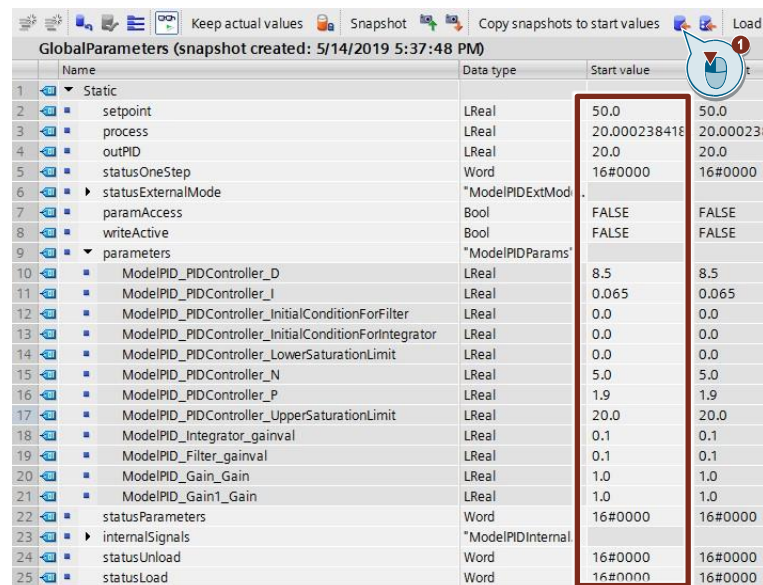
2.8.4 Permanently changing model parameters

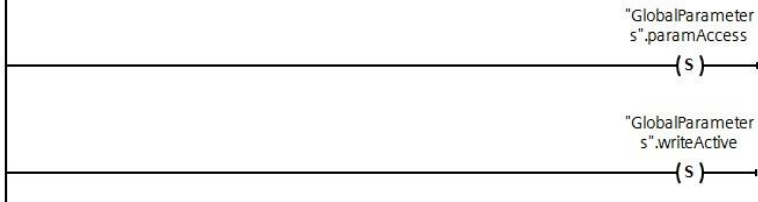
In order to permanently retain the model parameters (even after the CPU restarts), you must first adjust the parameters as in one of the chapters above. Then take a snapshot of the data block "GlobalParameters" and apply the values from the snapshot as start values. As a final step, the tags "GlobalParameters".paramAccess and "GlobalParameters".writeActive must be set in the "Startup" OB.

Define new model parameters

Table 2-20: Defining new model parameters as start values

Step	Instruction
1.	Use the watch table to adjust your model parameters (chapter 2.8.2), or via the web visualization (chapter 2.8.3).  Or 
2.	Navigate to "Program blocks" and open the DB "GlobalParameters".

Step	Instruction																																																																																																								
3.	Expand the "parameters" tag. Click the "Monitor all" button.  GlobalParameters (created: 5/14/2019 4:16:04 PM) <table><thead><tr><th>Name</th><th>Data type</th><th>Start value</th><th>Monitor value</th></tr></thead><tbody><tr><td>Static</td><td></td><td></td><td></td></tr><tr><td>setpoint</td><td>LReal</td><td>0.0</td><td>50.0</td></tr><tr><td>process</td><td>LReal</td><td>0.0</td><td>21.919950485229</td></tr><tr><td>outPID</td><td>LReal</td><td>0.0</td><td>20.0</td></tr><tr><td>statusOneStep</td><td>Word</td><td>16#0</td><td>16#0000</td></tr><tr><td>statusExternalMode</td><td>*ModelPIDExtMode...</td><td></td><td></td></tr><tr><td>paramAccess</td><td>Bool</td><td>true</td><td>FALSE</td></tr><tr><td>writeActive</td><td>Bool</td><td>false</td><td>FALSE</td></tr><tr><td>parameters</td><td>*ModelPIDPara...</td><td></td><td></td></tr><tr><td>ModelPID_PIDController_D</td><td>LReal</td><td>0.0</td><td>8.5</td></tr><tr><td>ModelPID_PIDController_I</td><td>LReal</td><td>0.0</td><td>0.065</td></tr><tr><td>ModelPID_PIDController_InitialConditionForFilter</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_InitialConditionForIntegrator</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_LowerSaturationLimit</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_N</td><td>LReal</td><td>0.0</td><td>5.0</td></tr><tr><td>ModelPID_PIDController_P</td><td>LReal</td><td>0.0</td><td>1.9</td></tr><tr><td>ModelPID_PIDController_UpperSaturationLimit</td><td>LReal</td><td>0.0</td><td>20.0</td></tr><tr><td>ModelPID_Integrator_gainval</td><td>LReal</td><td>0.0</td><td>0.1</td></tr></tbody></table>	Name	Data type	Start value	Monitor value	Static				setpoint	LReal	0.0	50.0	process	LReal	0.0	21.919950485229	outPID	LReal	0.0	20.0	statusOneStep	Word	16#0	16#0000	statusExternalMode	*ModelPIDExtMode...			paramAccess	Bool	true	FALSE	writeActive	Bool	false	FALSE	parameters	*ModelPIDPara...			ModelPID_PIDController_D	LReal	0.0	8.5	ModelPID_PIDController_I	LReal	0.0	0.065	ModelPID_PIDController_InitialConditionForFilter	LReal	0.0	0.0	ModelPID_PIDController_InitialConditionForIntegrator	LReal	0.0	0.0	ModelPID_PIDController_LowerSaturationLimit	LReal	0.0	0.0	ModelPID_PIDController_N	LReal	0.0	5.0	ModelPID_PIDController_P	LReal	0.0	1.9	ModelPID_PIDController_UpperSaturationLimit	LReal	0.0	20.0	ModelPID_Integrator_gainval	LReal	0.0	0.1																												
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4.	Click "Snapshot of the actual values". 																																																																																																								
5.	Click the "All values" button and confirm the dialog to copy the current values to the start values.  GlobalParameters (snapshot created: 5/14/2019 5:37:48 PM) <table><thead><tr><th>Name</th><th>Data type</th><th>Start value</th><th>Monitor value</th></tr></thead><tbody><tr><td>Static</td><td></td><td></td><td></td></tr><tr><td>setpoint</td><td>LReal</td><td>50.0</td><td>50.0</td></tr><tr><td>process</td><td>LReal</td><td>20.000238418</td><td>20.000238</td></tr><tr><td>outPID</td><td>LReal</td><td>20.0</td><td>20.0</td></tr><tr><td>statusOneStep</td><td>Word</td><td>16#0000</td><td>16#0000</td></tr><tr><td>statusExternalMode</td><td>*ModelPIDExtMod...</td><td></td><td></td></tr><tr><td>paramAccess</td><td>Bool</td><td>FALSE</td><td>FALSE</td></tr><tr><td>writeActive</td><td>Bool</td><td>FALSE</td><td>FALSE</td></tr><tr><td>parameters</td><td>*ModelPIDParams</td><td></td><td></td></tr><tr><td>ModelPID_PIDController_D</td><td>LReal</td><td>8.5</td><td>8.5</td></tr><tr><td>ModelPID_PIDController_I</td><td>LReal</td><td>0.065</td><td>0.065</td></tr><tr><td>ModelPID_PIDController_InitialConditionForFilter</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_InitialConditionForIntegrator</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_LowerSaturationLimit</td><td>LReal</td><td>0.0</td><td>0.0</td></tr><tr><td>ModelPID_PIDController_N</td><td>LReal</td><td>5.0</td><td>5.0</td></tr><tr><td>ModelPID_PIDController_P</td><td>LReal</td><td>1.9</td><td>1.9</td></tr><tr><td>ModelPID_PIDController_UpperSaturationLimit</td><td>LReal</td><td>20.0</td><td>20.0</td></tr><tr><td>ModelPID_Integrator_gainval</td><td>LReal</td><td>0.1</td><td>0.1</td></tr><tr><td>ModelPID_Filter_gainval</td><td>LReal</td><td>0.1</td><td>0.1</td></tr><tr><td>ModelPID_Gain_Gain</td><td>LReal</td><td>1.0</td><td>1.0</td></tr><tr><td>ModelPID_Gain1_Gain</td><td>LReal</td><td>1.0</td><td>1.0</td></tr><tr><td>statusParameters</td><td>Word</td><td>16#0000</td><td>16#0000</td></tr><tr><td>internalSignals</td><td>*ModelPIDInternal</td><td></td><td></td></tr><tr><td>statusUnload</td><td>Word</td><td>16#0000</td><td>16#0000</td></tr><tr><td>statusLoad</td><td>Word</td><td>16#0000</td><td>16#0000</td></tr></tbody></table>	Name	Data type	Start value	Monitor value	Static				setpoint	LReal	50.0	50.0	process	LReal	20.000238418	20.000238	outPID	LReal	20.0	20.0	statusOneStep	Word	16#0000	16#0000	statusExternalMode	*ModelPIDExtMod...			paramAccess	Bool	FALSE	FALSE	writeActive	Bool	FALSE	FALSE	parameters	*ModelPIDParams			ModelPID_PIDController_D	LReal	8.5	8.5	ModelPID_PIDController_I	LReal	0.065	0.065	ModelPID_PIDController_InitialConditionForFilter	LReal	0.0	0.0	ModelPID_PIDController_InitialConditionForIntegrator	LReal	0.0	0.0	ModelPID_PIDController_LowerSaturationLimit	LReal	0.0	0.0	ModelPID_PIDController_N	LReal	5.0	5.0	ModelPID_PIDController_P	LReal	1.9	1.9	ModelPID_PIDController_UpperSaturationLimit	LReal	20.0	20.0	ModelPID_Integrator_gainval	LReal	0.1	0.1	ModelPID_Filter_gainval	LReal	0.1	0.1	ModelPID_Gain_Gain	LReal	1.0	1.0	ModelPID_Gain1_Gain	LReal	1.0	1.0	statusParameters	Word	16#0000	16#0000	internalSignals	*ModelPIDInternal			statusUnload	Word	16#0000	16#0000	statusLoad	Word	16#0000	16#0000
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6.	Open the OB "Startup".																																																																																																								

Step	Instruction
7.	In Network 3, set the parameters "GlobalParameters".paramAccess and "GlobalParameters".writeActive. 
8.	Select the "Program blocks" folder and click "Download to Device". 
9.	Restart the CPU (STOP -> RUN).

Result:

- The block "ModelPIDReadWriteParameters" will be called once each time the CPU is restarted.
 - The tags "GlobalParameters".paramAccess and "GlobalParameters".writeActive will be set in the "Startup" OB.
 - After the FB "ModelPIDReadWriteParameters" is called in the "CyclicInterrupt" OB, the tags will be reset.
- All model parameters will be set with the saved values from the tag "GlobalParameters".parameters at each restart.

3 Useful information

SIEMENS STEP 7 (TIA Portal)

STEP 7 is the development environment for programming and commissioning SIMATIC programmable logic controllers.

<https://www.siemens.com/global/en/products/automation/industry-software/automation-software/tia-portal/software/step7-tia-portal.html>

SIMATIC S7-1500 Software Controller

The SIMATIC S7-1500 Software Controller is a CPU for PC-based automation solutions on SIMATIC IPCs.

<https://www.siemens.com/global/en/products/automation/systems/industrial/plc/simatic-software-controller.html>

SIMATIC S7-1500 ODK 1500S

The SIMATIC 1500S Open Development Kit (ODK) add-on makes it possible to extend the CPU functionality with user-specific C/C++ programs either as Windows or realtime functions.

<https://sieportal.siemens.com/su/bj3pj>

SIMATIC Target

With SIMATIC Target, Simulink models can be coded and run on SIMATIC CPUs (SIMATIC S7-1500 Software Controller and S7-1518 ODK).

<https://sieportal.siemens.com/su/bj3pq>

MathWorks

MATLAB and Simulink are registered trademarks of MathWorks, Inc.

MATLAB

Program for solving mathematical operations and graphically representing the results. A proprietary programming language is used to program in MATLAB.

<http://mathworks.com/products/matlab/index.html><http://mathworks.com/products/matlab/index.html>

MATLAB Coder

Add-on for MATLAB for creating "C/C++" code from the proprietary MATLAB programming language. MATLAB Coder requires the MATLAB base package to be installed.

<https://www.mathworks.com/products/matlab-coder.html>

Simulink

MATLAB add-on for graphical programming and simulation of models. Simulink offers a comprehensive library with functions, for example for designing controls engineering applications. Simulink requires the MATLAB base package to be installed. <http://mathworks.com/products/simulink/index.html>

Simulink Coder

Simulink add-on for creating "C/C++" code from Simulink models. Simulink Coder requires that MATLAB, MATLAB Coder and Simulink be installed.

<http://mathworks.com/products/simulink-coder/index.html>

Embedded Coder

Add-on for Simulink to create readable, compact, and fast C/C++ code for embedded processors.

<https://mathworks.com/products/embedded-coder.html>

4 Appendix

4.1 Service and support

SiePortal

The integrated platform for product selection, purchasing and support - and connection of Industry Mall and Online support. The SiePortal home page replaces the previous home pages of the Industry Mall and the Online Support Portal (SIOS) and combines them.

- **Products & Services**
In Products & Services, you can find all our offerings as previously available in Mall Catalog.
- **Support**
In Support, you can find all information helpful for resolving technical issues with our products.
- **mySieportal**
mySiePortal collects all your personal data and processes, from your account to current orders, service requests and more. You can only see the full range of functions here after you have logged in.

You can access SiePortal via this address:

sieportal.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.

Please send queries to Technical Support via Web form:

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

SITRAIN - Digital Industry Academy

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

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

siemens.com/sitrain

Industry Online Support app

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



4.2 Links and literature

Table 4-1: Links

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the article page of the application example https://support.industry.siemens.com/cs/ww/en/view/109482830
\3\	Manual: STEP 7 V14 Professional https://support.industry.siemens.com/cs/ww/en/view/109742272
\4\	Manual: SIMATIC S7-1500 ODK 1500S https://support.industry.siemens.com/cs/ww/en/view/109783714
\5\	Target manual https://support.industry.siemens.com/cs/ww/en/view/109801419
\6\	Manual, SIMATIC S7-1500 CPU 150xS https://support.industry.siemens.com/cs/ww/en/view/109249299
\7\	Manual: SIMATIC ET 200SP Open Controller CPU 1515SP PC https://support.industry.siemens.com/cs/ww/en/view/109248384
\8\	Application example: Closed-Loop Control of Simulated Controlled Systems in the S7-1500 https://support.industry.siemens.com/cs/ww/en/view/79047707
\9\	MathWorks online documentation: http://mathworks.com/help

4.3 Change documentation

Table 4-2: Change documentation

Version	Date	Change
V1.0	12/2016	First edition
V1.1	07/2019	Update, TIA Portal V15.1
V1.2	11/2020	Update for SIMATIC Target V3.0, TIA Portal V16
V1.3	09/2024	Update for SIMATIC Target V6.0 SP1, TIA Portal V19