

A man in a light blue shirt is seen from the side, holding a tablet. He is in a factory or industrial setting with various machines and equipment in the background. Overlaid on the image are several digital graphics: a '24/7' icon with a circular arrow, a 'NEWS' icon with a person silhouette, a 'Home' icon, and a 'Simulink® Web Visualization Converter' title. There are also binary code (0s and 1s) and a network diagram with three nodes and connecting lines. The Siemens logo and tagline are in the top right corner.

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# Simulink® Web Visualization Converter

ODK1500S / Target1500S / SWV Converter

<https://support.industry.siemens.com/cs/ww/en/view/109761034>

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# 1 Introduction

## 1.1 Overview

### Requirement

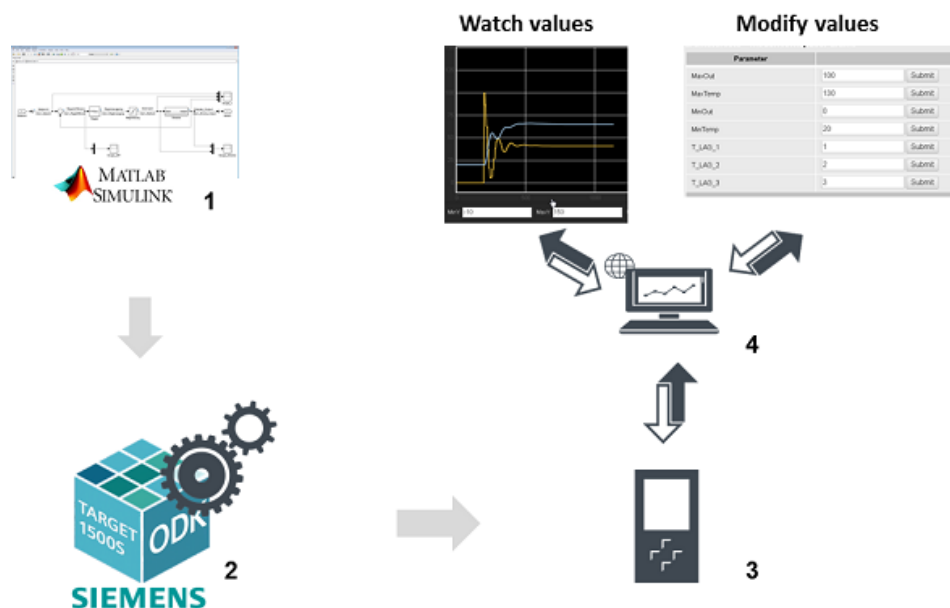
Development with MATLAB/Simulink® and the Target1500S requires interaction with the developed model or insight into internal process variables. In addition to "External Mode", the Simulink® Web Visualization Converter (SWV Converter) offers an additional option to interact with the developed model.

With the SWV Converter you can display Simulink® models on the SIMATIC S7 web server. The converter lets you convert a created model into a web page. This means users can examine the behavior of the model with the help of the S7 web server, for example, they can have actual values displayed in a diagram or manipulate parameters.

### Note

As of Target1500S V3.0, the SWV Converter function has already been integrated.

Figure 1-1: Overview



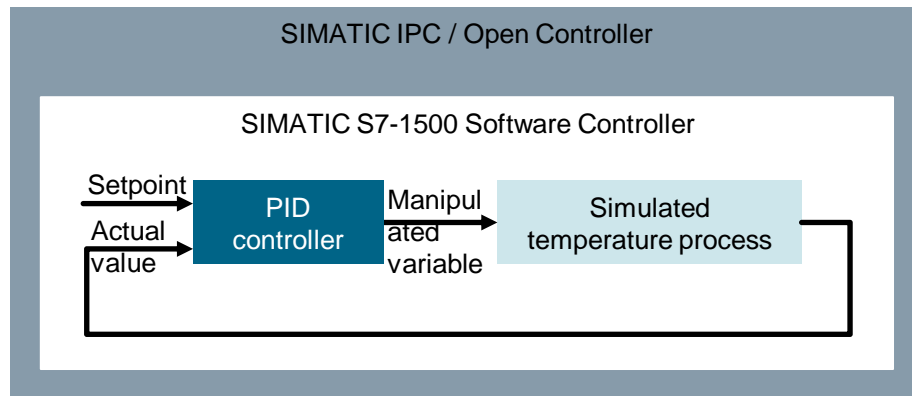
You encode the Simulink model (1) with the SIMATIC Target 1500S (2) add-on. Then you download it to a controller (3) with ODK capability, such as the SIMATIC S7-1500 Software Controller or SIMATIC S7-1518 ODK/MFP. Afterwards, you convert the model into a user-defined web page for the SIMATIC S7 web server (4) with the help of the SWV Converter and download it to the controller. You can now interact with your model via a web browser. Web-based visualization lets you

- monitor timelines of internal tags with the help of web traces.
- read or write model parameters by means of parameter lists.



### Automation task

In this application example we are using a hardware-in-the-loop simulation to show you how the visualization of a Simulink® model can be used. The project shown here is used for the simulation of temperature controlled systems. A PT3 controlled system is controlled in the S7 program with the help of a controller modelled in MATLAB/Simulink. The process is simulated on a SIMATIC Industrial PC with the SIMATIC S7-1500 Software Controller.



### Required knowledge

- Basics of code generation with the SIMATIC Target 1500S for Simulink®
- Basics of configuration and programming with STEP 7 (TIA Portal)

## 1.2 Principle of operation

The SWV Converter is an additional tool for the SIMATIC Target1500S. It analyzes the transferred Simulink model and extracts information, such as tags used, the model structure, etc.

A user-defined web page and additional blocks are created in the process to supply the visualization with values from the controller.

The visualization offers users the following functions:

- Identical model display as in Simulink®
- Observation and representation of internal signals (test points)
- Chronological display of internal tags (scopes) as web traces
- Model navigation through submodels of random depth (interactive)
- Parameter list for reading/writing block parameters
- Parameter list for reading/writing all parameters
- Parameter list for reading/writing the workspace tags
- Parameter list for reading/writing the model workspace tags
- Automatic generation

## 1.3 Components used

This application example was created with these hardware and software components:

Table 1-1

Component	Quantity	Article number	Note
SIMATIC ET 200SP Open Controller CPU1515SP PC	1	6ES7 677-2xB42-0xx0	Must support ODK V2.5
<b>Alternative:</b> SIMATIC S7-1518 ODK/MFP	1	6ES7518-4AX00-1AC0	V2.5
Microsoft Windows 7 Enterprise Version 6.1 (Build 7601: Service Pack 1)	1		
MATLAB Version 9.3 (R2017b)	1		
Simulink® Version 9.0 (R2017b)	1		
Control System Toolbox Version 10.3 (R2017b)	1		
Embedded Coder Version 6.13 (R2017b)	1		
Simulink® Coder Version 8.13 (R2017b)	1		
SIMATIC Target 1500S for Simulink® Version 2.0.0.0	1	6ES7823-1BE01-0YA5	
Google Chrome Browser Version 67.0.3396.99	1		
Microsoft .NET Frame Work 4.6.1	1		
Siemens TIA Portal V15 Upd.3	1		
SIMATIC ODK 1500S V2.5	1	6ES7806-2CD03-0YA0	

This application example consists of the following components:

Table 1-2

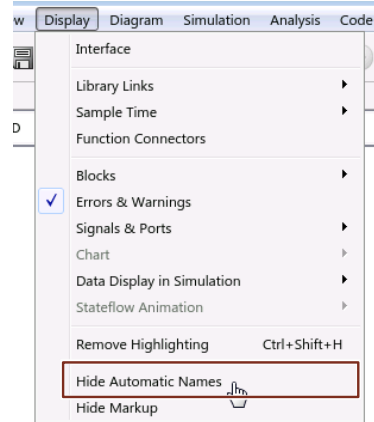
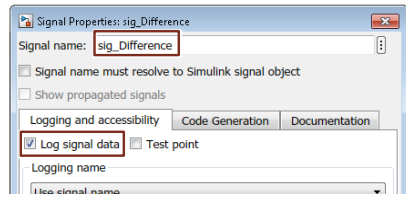
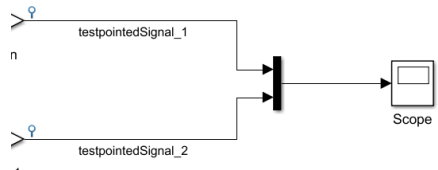
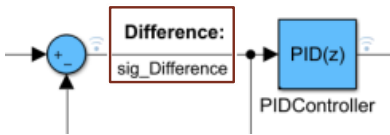
Component	File name	Note
Application	109761034_SimulinkWebVisualisationConverter_CODE	Zip file contains executable application
TIA Portal project	109761034_SimulinkWebVisualisationConverter_PROJ	V15
Documentation	109761034_SimulinkWebVisualisationConverter_DOC	This document
Simulink® model	ModelPID	Can be located in the AdditionalFiles folder after a "Retrieve..."

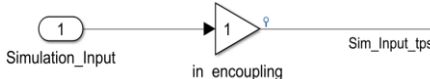
## 2 Engineering

### 2.1 Requirements

Specific requirements apply when using the SWV Converter to ensure an error-free process:

Table 2-1

No.	Requirement	Explanation
1.	Use of the "auto" data type in Simulink® tags.	Only ODK_Double parameters may be used in the ODK1500S project. The Target 1500S creates ODK_Double tags by default.
2.	Block names must not be hidden.  Disable the option "Hide Automatic Names".	 The screenshot shows the 'Display' menu in Simulink. The 'Hide Automatic Names' option is checked, and a red box highlights it with a mouse cursor pointing to it.
3.	Internal signals must be logged and given unique names.	 The screenshot shows the 'Signal Properties' dialog for a signal named 'sig_Difference'. The 'Log signal data' checkbox is checked, and a red box highlights it.
4.	Use Simulink® scopes only in combination with an MUX block and with signals declared as test point.	 The diagram shows two input signals, 'testpointedSignal_1' and 'testpointedSignal_2', connected to a MUX block. The output of the MUX block is connected to a Scope block. <p>This figure shows you how to create scopes for the web visualization.</p>
5.	Test points must have unique names.	 The diagram shows a difference block (labeled 'Difference: sig_Difference') connected to a PID(z) block. A red box highlights the difference block. <p>A declared test point (internal signal) must be uniquely labeled throughout the entire model.</p>
6.	Remove unused model workspace/workspace tags.	You should remove unused tags as they may result in display problems.

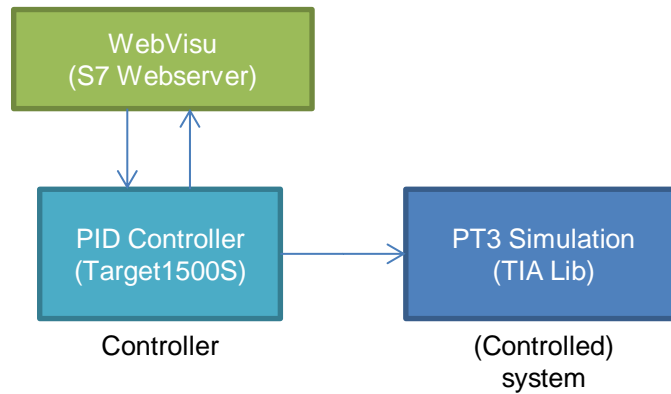
No.	Requirement	Explanation
7.	Use only MATLAB tags in the model workspace.	-
8.	Inputs/outputs must be decoupled during observation.	 <p>The diagram shows a signal path starting from a block labeled 'Simulation_Input' (containing the number 1). This signal goes into a gain block (triangle with '1' inside). The gain block has an input labeled 'in_encoupling' and an output labeled 'Sim_Input_tps'.</p>
9.	Do not use special characters and spaces in names.	
10.	Do not use referenced models.	



## 2.2 Project planning

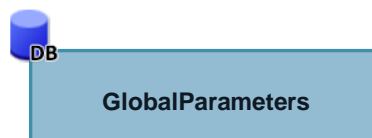
The overview shows that the PID Controller interacts with the S7 Webserver. The program structure of the application example is shown below.

Figure 2-1: Overview



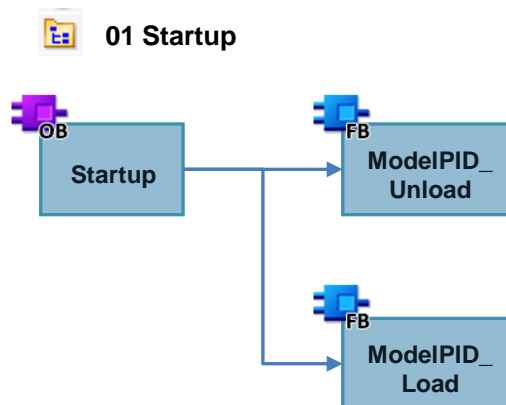
The "GlobalParameters" data block contains the system variables used to validate the simulation result.

Figure 2-2: GlobalParameters



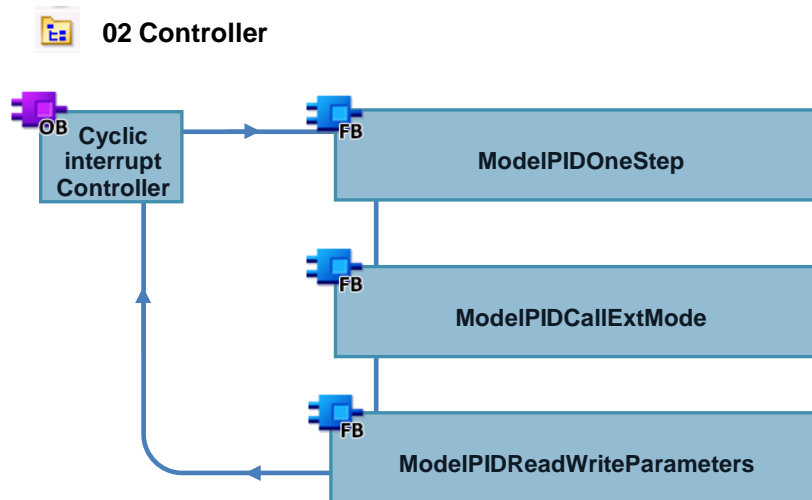
In group "01 Startup", the controller created in MATLAB/Simulink® is loaded to the system during the start. To do this, you must store the corresponding SO file on the web server beforehand (see [Target1500S](#) manual).

Figure 2-3: Group "01 Startup"



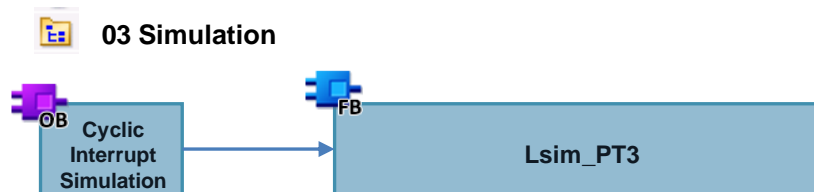
In group "02 Controller", the controller is called, the ExternalMode connection to MATLAB is implemented, and the model parameters are read from the ODK1500S Runtime.

Figure 2-4: Group "02 Controller"



The group "03 Simulation" provides the simulation of the controlled system.

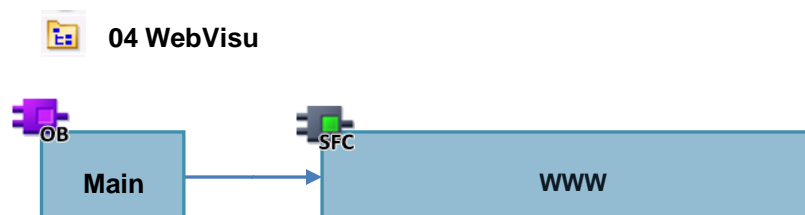
Figure 2-5: Group "03 Simulation"



The web visualization is implemented in the group "04 WebVisu". To do this, the web server must be activated on the CPU according to the instruction, and the WWW system block must be called. The interface to the visualization is the ModelPIDWebVisuInterface data block that is automatically generated by the converter.

The data block contains the current time stamp for communication with the web browser and enables the parameter changes via the web page.

Figure 2-6: Group "04 Web Visu"



## 2.3 Configuration

You can find information on using the SIMATIC Target1500S and the SIMATIC web server (user-defined web pages) in the existing manuals/application examples.

### Note

User-defined web pages:

<https://support.industry.siemens.com/cs/ww/en/view/68011496>

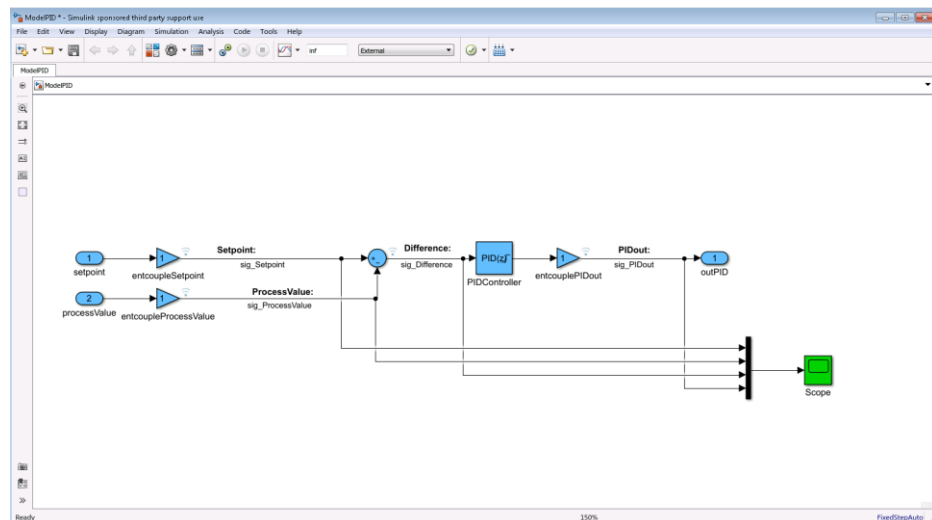
SIMATIC Target1500S:

<https://support.industry.siemens.com/cs/ww/en/view/109741754>

Calling Simulink® Models

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

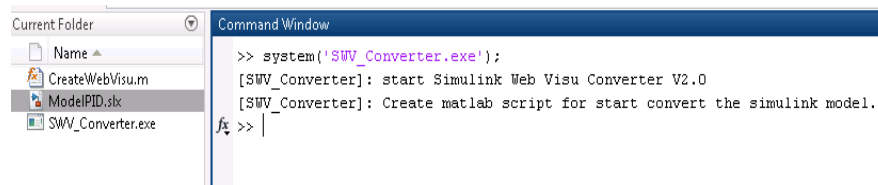
1. Create your model in Simulink® as described in the manual taking into account the [Requirements](#). Check whether the model can be compiled. Note that the names of the Simulink® blocks are displayed.



2. Execute the converter with the following command.

```
system('SWV_Konverter.exe');
```

Afterwards, the folder contains the CreateWebVisu.m script.



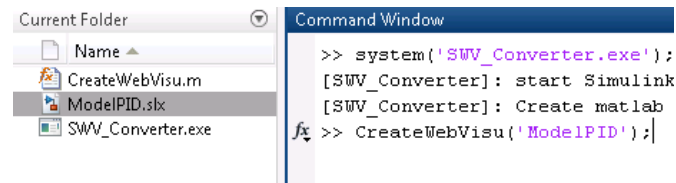
3. In the next step, execute the CreateWebVisu script.

```
CreateWebVisu('ModelPID');
```

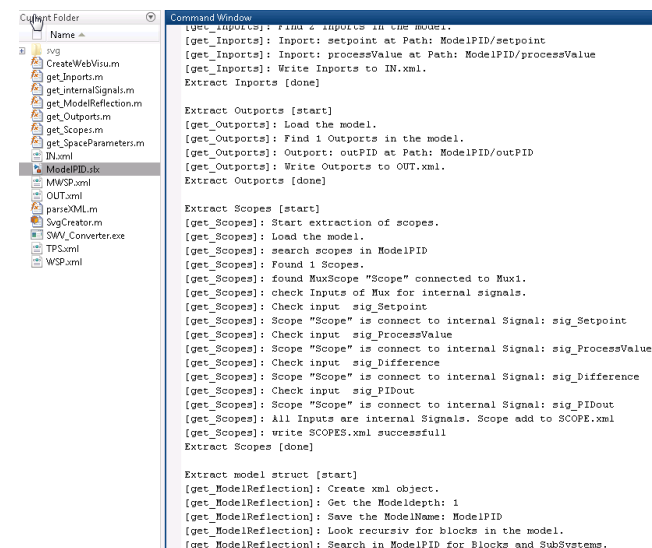
The generator now starts analyzing your model and creates the web visualization. To do so, the model is created with the Target1500S.

**Note:**

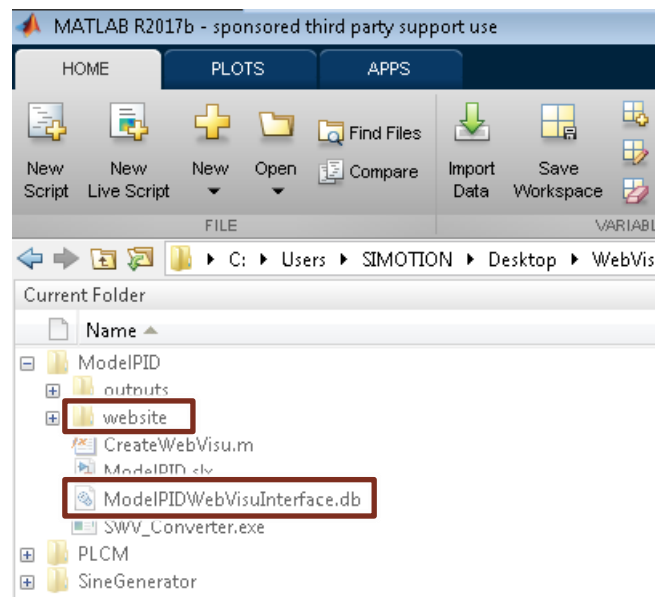
If you determine a malfunction of the web visualization, check the generated log entries. Here you will find the first clues regarding potential errors.



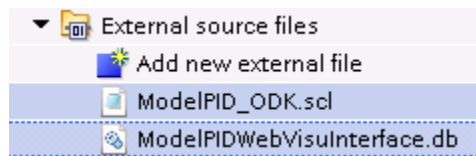
4. Some temporary files are created during the generation. Wait until the `converter` is completely finished. The model is recreated during the generation. The temporary files are removed again afterwards.



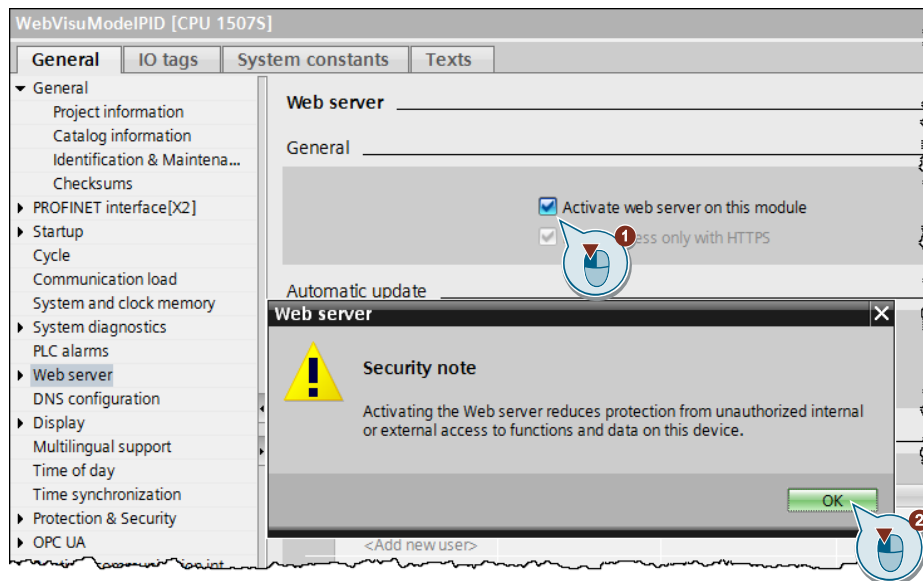
5. In addition to the familiar output files of the Target1500S, the "website" folder is created in the current MATLAB folder as well as the WebVisuInterface data block. In addition to the external SCL file, the data block is also imported as external source into the TIA Portal.



- Now start TIA Portal and create your project. Start by importing the SCL source created by the Target1500S followed by the data block mentioned above.

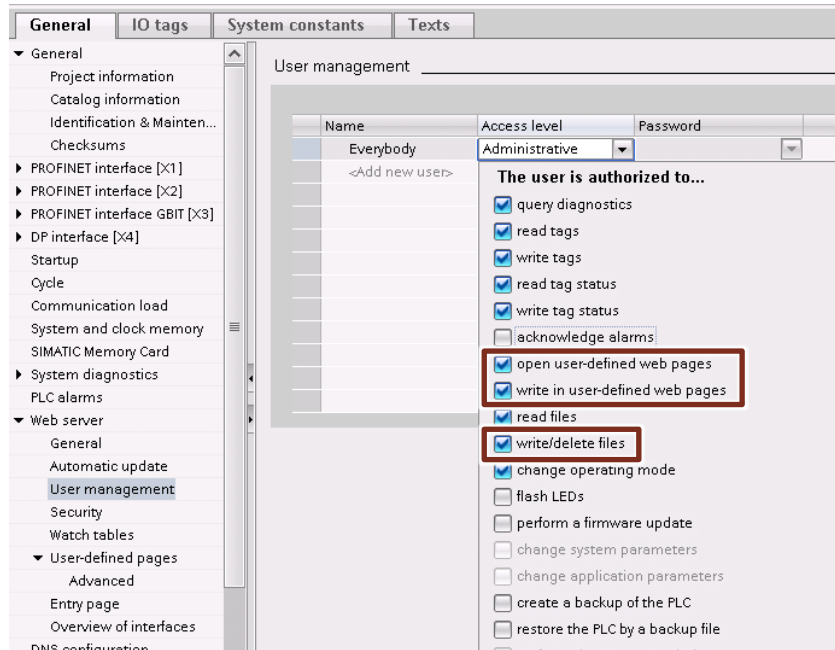


- Activate the web server of the CPU. To do so, check "Activate web server on this module" in the CPU properties under "Web server > General". Then confirm the security note with "OK".

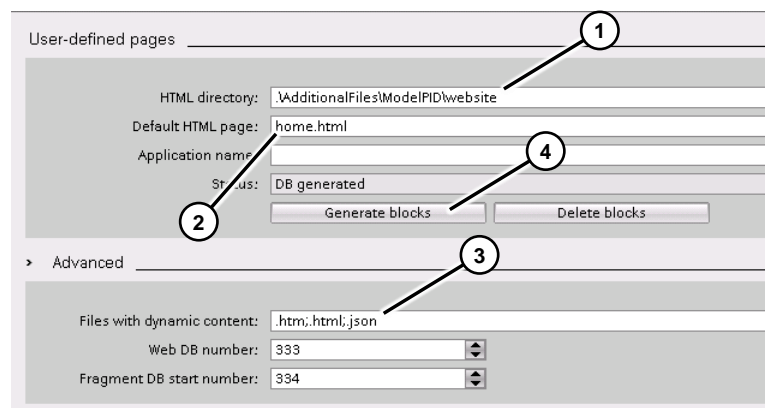




8. Assign the rights on the web server so that the user is authorized to...:  
...open user-defined web pages  
...write in user-defined web pages  
...write/delete files



9. In the settings of the user-defined web pages you now enter the path to the "website" folder created by the SWV Converter (1). We recommend using the "Additional Files" folder in the project folder, because the files are forwarded when you archive the project. Set the default page to "home.html" (2). For dynamic content, you add the data type 'json' (3). Now you can generate blocks (4).

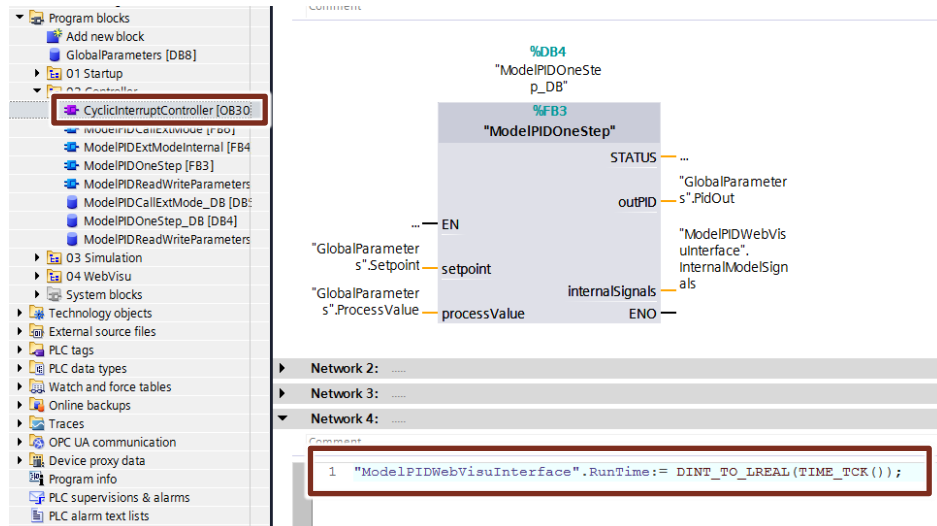


10. Insert the following assignment to a cyclic OB, such as OB30, to get the corresponding time stamp of the CPU:

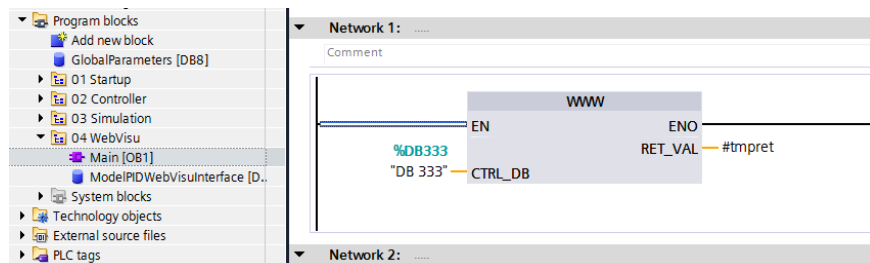
```
"ModelPIDWebVisuInterface".RunTime:= DINT_TO_LREAL (TIME_TCK());
```

**Note:**

The time stamp is required but can also be assigned in a different cyclic OB.



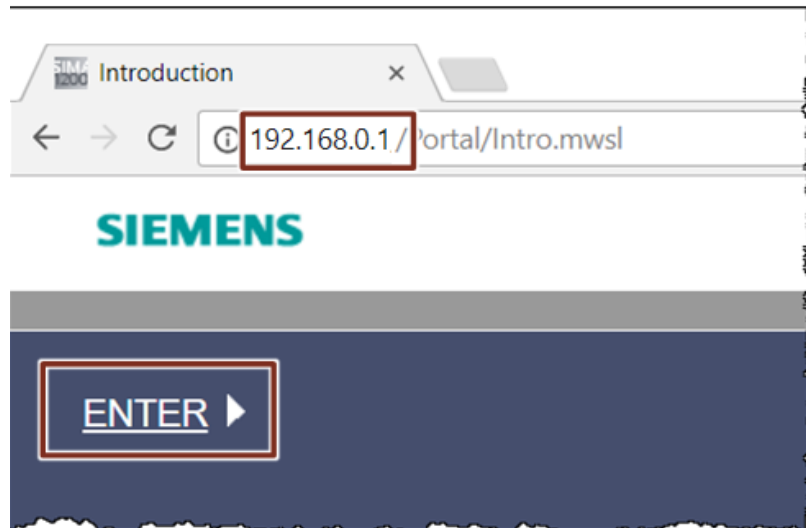
11. Call the WWW system block in OB1.



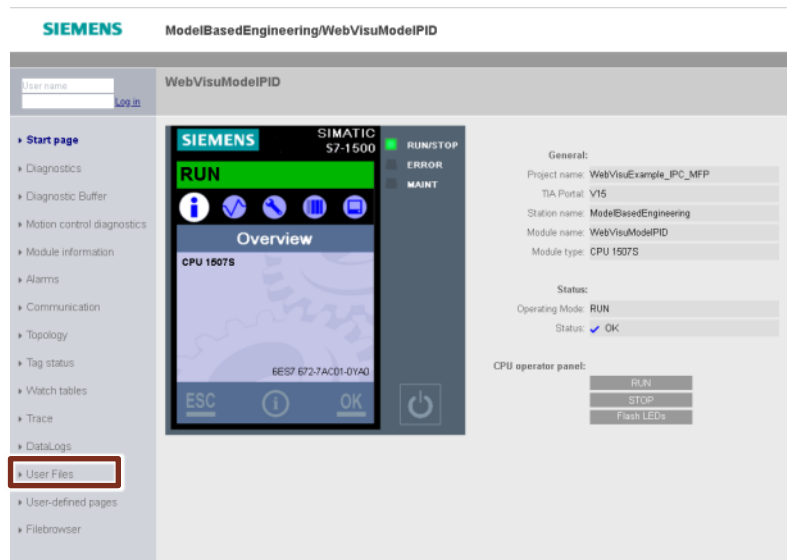
12. Download the project to the controller.

## 2.4 Operation

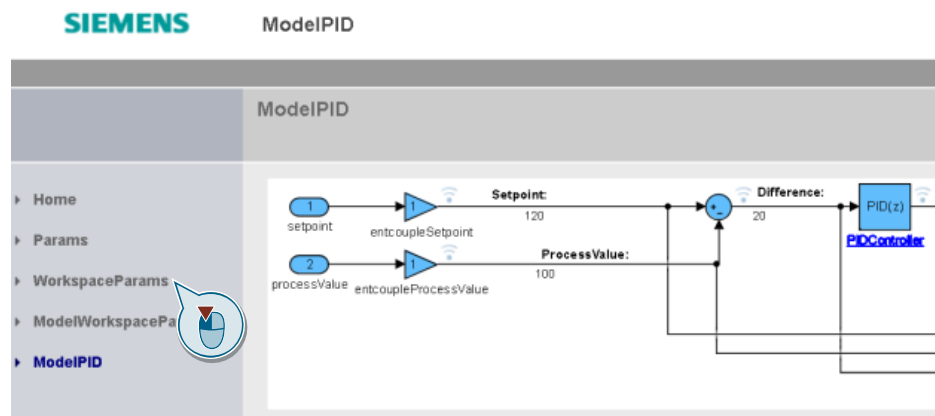
1. Open the browser of your programming device and enter the IP address of your CPU in the address bar. Then click on "ENTER".



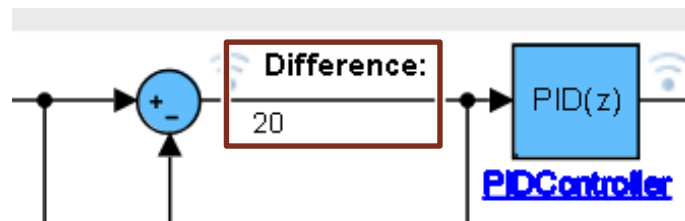
2. Call the user-defined web page under "User-defined pages".



3. When calling the page, the first level of your model opens. From here you can navigate to the parameter lists or block parameters.



4. The internal signals declared as test points are supplied with current values directly in the model.



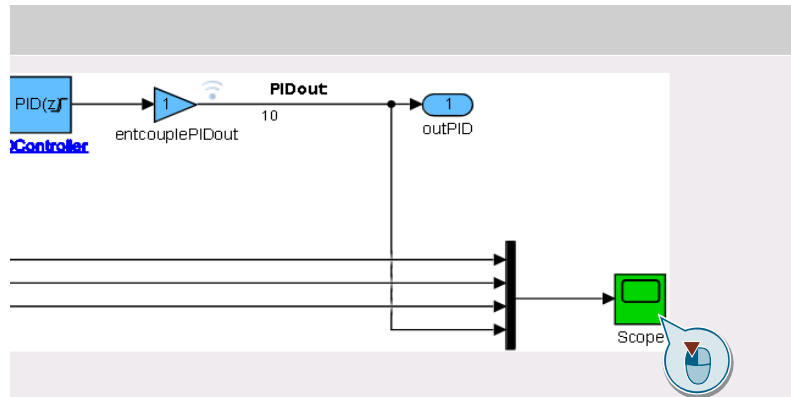
5. When selecting the parameter lists, you can change the corresponding values in the parameter view.

Parameter List - Params

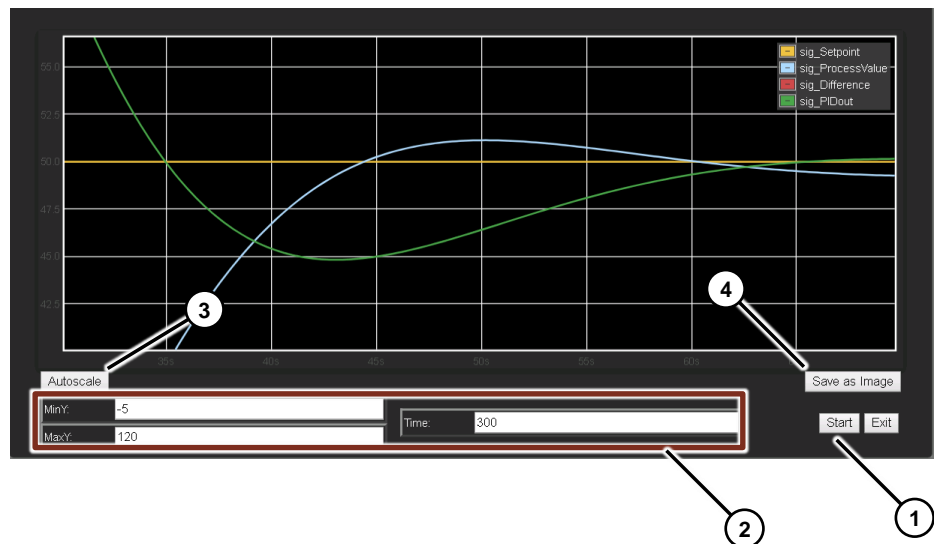
Parameter	Value	
ModelPID_PIDController_D	0,8	Submit
ModelPID_PIDController_I	0,065	Submit
ModelPID_PIDController_N	5	Submit
ModelPID_PIDController_P	1,9	Submit
ModelPID_entcoupleSetpoint_Gain	1	Submit
ModelPID_entcoupleProcessValue_Gain	1	Submit
ModelPID_Integrator_gainval	0,1	Submit
ModelPID_Integrator_IC	0	Submit
ModelPID_Filter_gainval	0,1	Submit
ModelPID_Filter_IC	0	Submit
ModelPID_Saturation_UpperSat	100	Submit
ModelPID_Saturation_LowerSat	0	Submit

Exit Reload

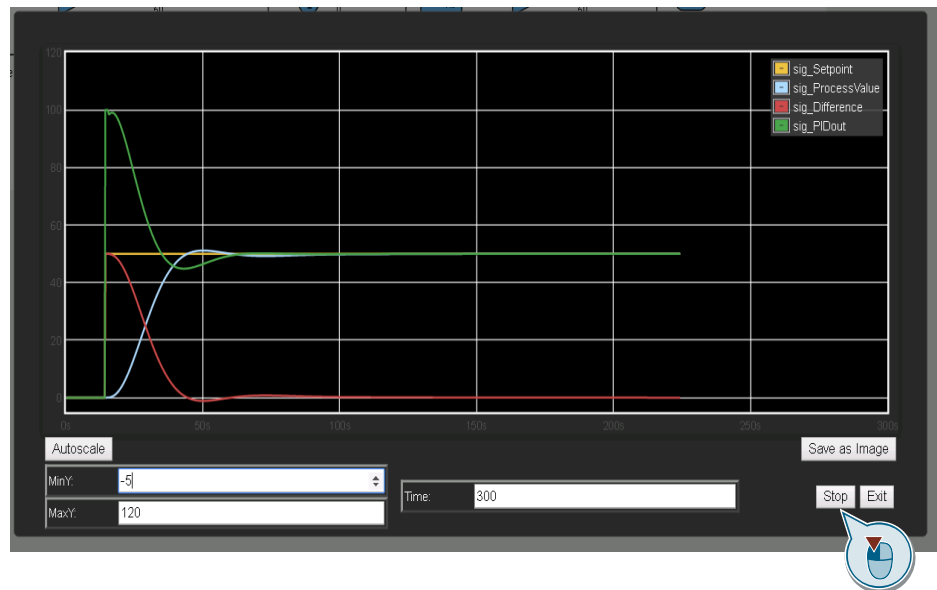
6. To use the scope, click the Simulink Scope icon.



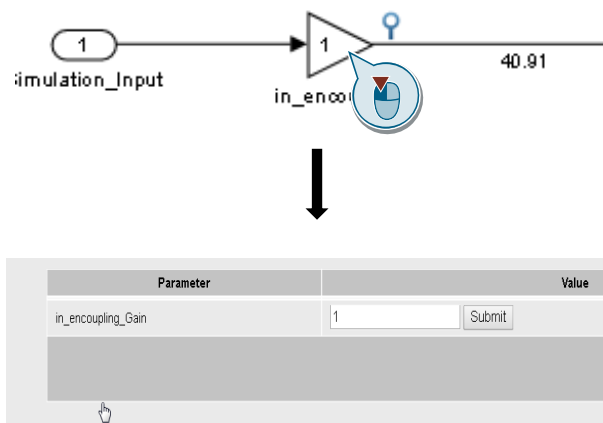
7. Click on the Start button (1) to start the scope. You can configure the scaling manually (2) or adjust it automatically with the Autoscale button. Click on "Save as Image" (4) to save an image of the latest measurement.



8. Click on "Stop" to stop the recording. You can now zoom in and out of the measurement.



9. When a BlockElement is linked to a parameter, you can change it individually by clicking on it.



## 2.5 Notes on the "ModelPID" project

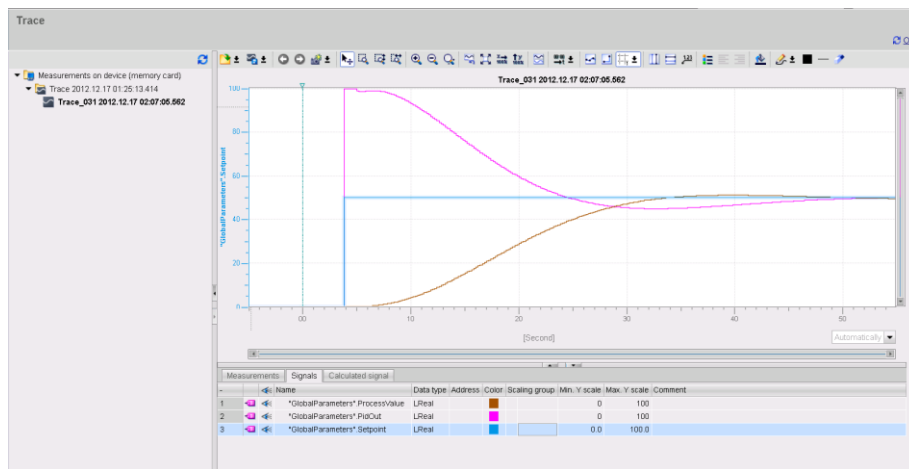
In the ModelPID application example, you can find a watch table on the web server in addition to the functions of the SWV Converter. Here you can specify the setpoints, enable the web visualization or start a measurement with SIMATIC Trace. The measurement records the same values as in the configured scope over a time period of one minute.



1. In the "Watch tables" menu item you will find the process variables of the example and you can start recording with SIMATIC Trace.

Watch tables					
Control ▾					
Name	Address	Format	Value	Modify value	
"GlobalParameters".Setpoint		Floating-point number ▾	50.0	<input type="text"/>	Apply
"GlobalParameters".PidOut		Floating-point number ▾	50.0002435076841	<input type="text"/>	Apply
"GlobalParameters".ProcessValue		Floating-point number ▾	49.9998512268066	<input type="text"/>	Apply
"GlobalParameters".StartTrace		Bool ▾	FALSE	<input type="text"/>	Apply
"ModelPIDWebVisulInterface".WriteParameters		Bool ▾	FALSE	<input type="text"/>	Apply

2. When you have recorded a process, you can examine the recording of the model data on the web server.



3. If you want to activate the parameter change of the web visualization, you must set the WriteParameters parameter in the watch table to 'True'.

"GlobalParameters".StartTrace	Bool ▾	FALSE
"ModelPIDWebVisulInterface".WriteParameters	Bool ▾	TRUE

## 3 Appendix

### 3.1 Service and Support

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<https://support.industry.siemens.com/cs/sc>

#### Industry Online Support app

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

<https://support.industry.siemens.com/cs/ww/en/sc/2067>

## 3.2 Links and Literature

Table 3-1

No.	Topic
\1\	Siemens Industry Online Support <a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a>
\2\	Link to the article page of the application example <a href="https://support.industry.siemens.com/cs/ww/en/view/109761034">https://support.industry.siemens.com/cs/ww/en/view/109761034</a>
\3\	Target1500S <a href="https://support.industry.siemens.com/cs/ww/en/view/109741754">https://support.industry.siemens.com/cs/ww/en/view/109741754</a>
	PID_Compact <a href="https://support.industry.siemens.com/cs/ww/en/view/79047707">https://support.industry.siemens.com/cs/ww/en/view/79047707</a>
	User-defined web pages <a href="https://support.industry.siemens.com/cs/ww/en/view/68011496">https://support.industry.siemens.com/cs/ww/en/view/68011496</a>
	Calling Simulink® Models <a href="https://support.industry.siemens.com/cs/ww/en/view/109482830">https://support.industry.siemens.com/cs/ww/en/view/109482830</a>

## 3.3 Version history

Table 3-2

Version	Date	Change
V1.0	01/2019	First version