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Testing and simulation of HMI projects in conjunction with a SIMATIC PLC and PLCSIM

WinCC (TIA Portal) / V14 SP1 / PLCSIM / PLCSIM Advanced

<https://support.industry.siemens.com/cs/ww/en/view/109748099>

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1 Introduction

1.1 Overview

There are already various possibilities for testing the HMI configuration during the configuration phase. However, the requirements for this can be very extensive. Depending on the scope of the task, for example, several HMI operator panels and SIMATIC PLCs may be required.

How to test the HMI configuration including the PLC program without or with incomplete hardware is described in this application example.

The application example shows:

- What options exist for testing and simulating the HMI configuration including the associated SIMATIC PLCs.
 - HMI configuration simulation.
 - PLCSIM V14.
 - PLCSIM Advanced
- What the requirements are.
 - Installed software.
 - Required licenses.
- Which settings need to be made.
 - In the HMI configuration.
 - On the configuration PC.
 - On the HMI device.

Example scenarios

In Section 2 the example scenarios presented here are discussed in detail.

- Example 1, "Simulation HMI operator panel":
 - A SIMATIC PLC is available.
 - The HMI operator panel is not available and must be simulated.
- Example 2, "Simulation HMI operator panel and SIMATIC PLC":
 - There is no SIMATIC PLC and no HMI operator panel available.
 - Both devices must be simulated.
- Example 3, "Simulation SIMATIC PLC":
 - The HMI device is available.
 - The SIMATIC PLC is not available and must be simulated.
- Example 4, "Simulation of SIMATIC PLCs and HMI operator panels":
 - The configuration consists of several SIMATIC PLCs and HMI operator panels.
 - Individual HMI operator panels and SIMATIC PLCs are available. The missing devices must be simulated.

1.2 Mode of operation

Siemens provides various software tools for the simulation of SIMATIC HMI operator panels and SIMATIC PLCs.

- PLCSIM V14
- PLCSIM Advanced
- HMI Runtime-Simulation

Detailed information on the above-mentioned software tools is provided in Section 3 "[Useful information](#)".

Which simulation tool is best to use when is discussed in Section 2 using different example scenarios

1.3 Components Used

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

Table 1-1

Component	Number	Article number	Note
WinCC Comfort V14 SP1	1	6AV2101-0AA04-0AA5	Or successor version
STEP 7 Professional V14 SP1	1	6ES7822-1AA04-0YA5	Or successor version
PLCSIM V14	1	Integrated in STEP 7 Basic / Professional	
PLCSIM Advanced V1.0 SP1	1	6ES7823-1FA00-0YA5	Or successor version
HMI Runtime Simulation	1	Integrated in WinCC Basic / Comfort / Advanced.	
SIMATIC TP1200 Comfort Panel	2	6AV2124-0MC01-0AX0	Or equivalent HMI operator panel
SIMATIC CPU 1516-3 PN/DP	2	6ES7516-3AN01-0AB0	Or equivalent CPU

This application example consists of the following components:

Table 1-2

Component	File name	Note
Documentation	109748099_DOKU_V1.0.pdf	

2 Engineering

2.1 Simulation HMI operator panel

In this example, the SIMATIC PLC is available in hardware. The HMI operator panel is not available and must be simulated.

Specification

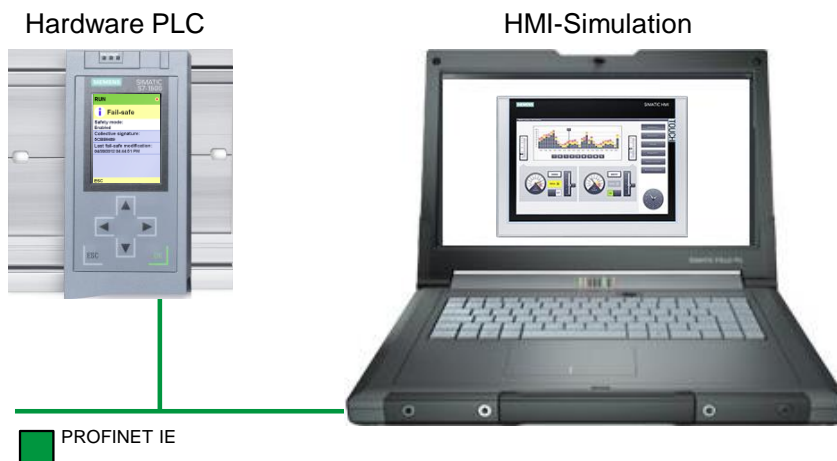
The following is required:

- A configuration consisting of an HMI project and a STEP 7 project.

Overview picture

Fig. 2-1

Simulation eines HMI-Bediengeräts



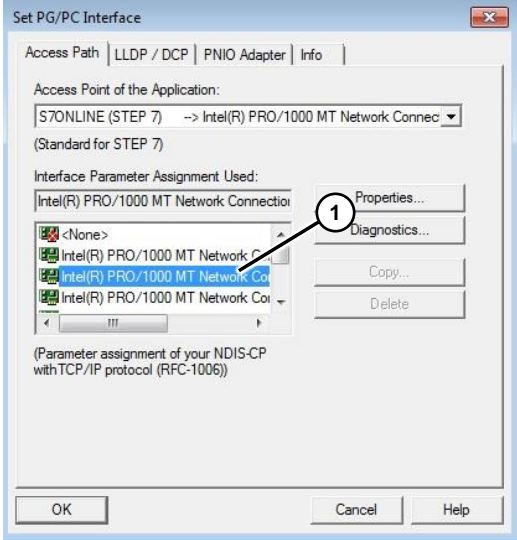
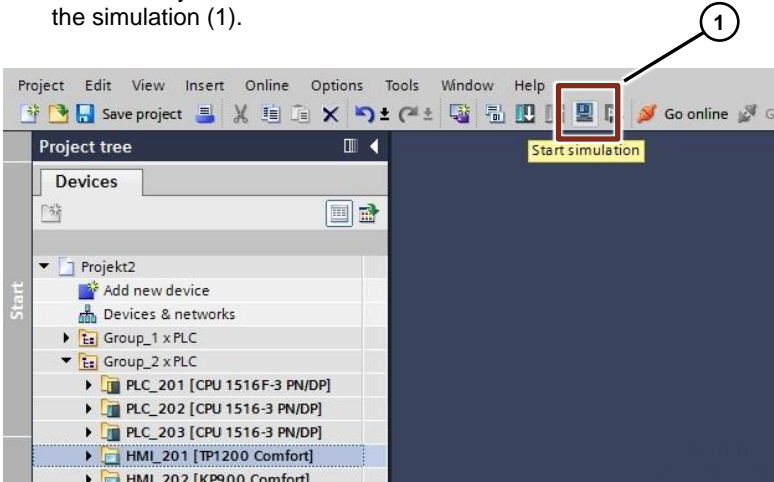
Software Used

The simulation software, which is completely integrated into the TIA portal, is used for this application.

Depending on the installed WinCC version, "Basic Panels, Comfort Panels or PC Runtime Systems" can be simulated. A license is not required for this.

Configuration

Table 2-1

No.	Description
1.	<p>General</p> <ul style="list-style-type: none"> • Network the SIMATIC PLC with the configuration PC. • Make sure that all devices are in the same IP band ("CPU / Configuration PC"). • Open your WinCC (TIA Portal) configuration • Check the settings in the PG/PC interface (Start> Control Panel> Set PG/PC interface). Under "Interface parameters used:" select your "network card". In this case "Intel.....TCPIP" (1). 
2.	<p>SIMATIC PLC</p> <ul style="list-style-type: none"> • Select the PLC configuration in the project navigation. • Transfer the control program to the PLC.
3.	<p>HMI configuration</p> <ul style="list-style-type: none"> • Select the HMI configuration in the project navigation. • Select the symbol in the toolbar to start the simulation (1). 

No.	Description
4.	After starting the simulation software, you can operate the HMI operator panel on the configuration PC. To operate the HMI device, use a mouse.

Notes

- You can only start the simulation of an "HMI operator panel" on a PC.
- If the software WinCC (TIA Portal) including the integrated simulation software is installed on several PCs, then you can simulate other HMI operator panels from these PC stations and exchange data with the SIMATIC PLC.

2.2 Simulation HMI operator panel and SIMATIC PLC

In this example, the SIMATIC PLC and the HMI operator panel are not available in hardware and must be simulated.

Specification

The following is required:

- A configuration consisting of an HMI project and a STEP 7 project.
- PLCSIM is installed on the configuration PC.

Overview picture

Fig. 2-2

Simulation des HMI-Bediengeräts und der SIMATIC Steuerung

PLCSIM und HMI Runtime-Simulation




Software Used

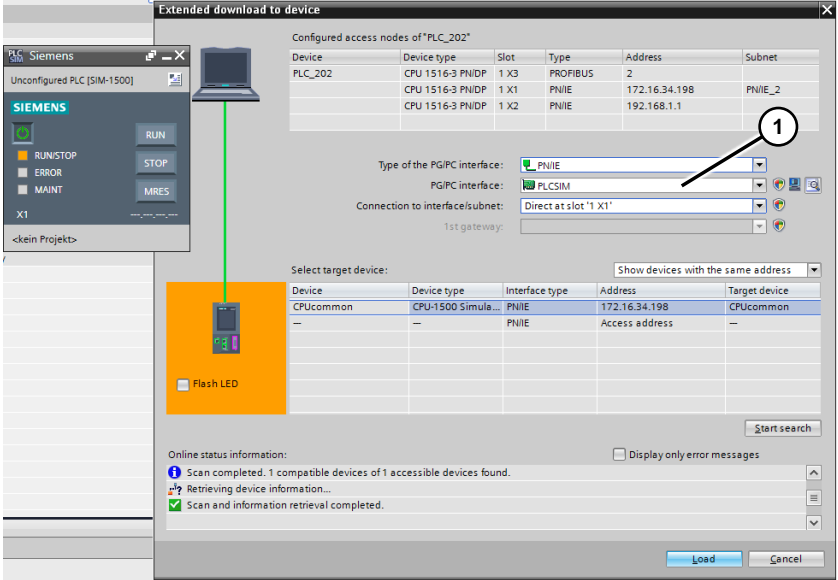
The simulation software, which is completely integrated into the TIA portal, is used for this application.

Depending on the installed WinCC version, "Basic Panels, Comfort Panels or PC Runtime Systems" can be simulated. A license is not required for this.

Configuration

Table 2-2

No.	Description
1.	<p>General</p> <p>There are no special settings to make, such as</p> <ul style="list-style-type: none"> • networking the SIMATIC PLC with the configuration PC. • Controlling settings in the PG/PC interface, etc.
2.	<p>SIMATIC PLC</p> <ul style="list-style-type: none"> • Select the project folder of the PLC configuration in the project tree. • In the toolbar, select the icon to start the simulation. It is the same symbol used to start the HMI simulation (see Fig. 2-1). • After activating the button to start the simulation, you receive the message "By starting the simulation all other online interfaces will be deactivated". This means that the system switches the PG/PC interface to "PLCSIM.TCPIP". Due to the changeover of the PG/PC interface, no connection to external devices can be established. Confirm the message with "OK". <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">Recreate the cross-reference information (0626... ✕</p> <div style="display: flex; align-items: center;">  <div> <p>Starting simulation will disable all other online interfaces.</p> <p><input type="checkbox"/> Do not show this message again.</p> </div> </div> <div style="text-align: right; margin-top: 10px;"> OK Cancel </div> </div> <ul style="list-style-type: none"> • The "PLCSIM software" is started. • Wait until the graphic interface of a PLC is displayed. After a short wait, the "PLCSIM software" is started and the STEP 7 configuration can be loaded. • Start the program download. To do this, select the "Download to device" icon in the toolbar. • The window with the transfer settings opens.

No.	Description
3.	<p>Transfer settings</p> <p>Carry out the necessary transfer settings. Make sure that "PLCSIM" is selected under the parameter "PG/PC interface" (1)</p> <p>Click the "Load" button to load the configuration. The control program is transferred to the PLCSIM.</p> 
4.	<p>HMI configuration</p> <ul style="list-style-type: none"> • Select the HMI configuration in the project navigation. • Select the symbol in the toolbar to start the simulation (see Fig. 2-1). • After starting the simulation software, you can operate the HMI operator panel on the configuration PC. <p>To operate the HMI device, use a mouse.</p>

Note You can only start the simulation of an "HMI operator panel" and a "SIMATIC PLC" on a PC.

2.3 Simulation SIMATIC PLC

In this example, the HMI operator panel is available in the hardware. The SIMATIC PLC must be simulated.

Specification

The following is required:

- A configuration consisting of an HMI project and a STEP 7 project.
- PLCSIM is installed on the configuration PC.

Overview picture

Fig 2-3

Simulation einer SIMATIC Steuerung



Software Used

For this application, you **cannot** use the simulation software completely integrated in the TIA portal.

If the simulation software is activated on the PC, all online interfaces are disabled, so that no communication to the "outside" is possible. See the example "[Simulation HMI operator panel and SIMATIC PLC](#)" Section 2.2 for this.

To implement the task, you need "S7-PLCSIM Advanced".

Further information on the subject of the "S7-PLCSIM Advanced" can be found in Section 3 "[Useful information](#)".

2.4 Simulation of SIMATIC PLCs and HMI operator panels

In this example, the configuration consists of several SIMATIC PLCs and HMI operator panels. Individual HMI operator panels and SIMATIC PLCs are available as hardware. The missing SIMATIC PLCs and HMI operator panels must be simulated.

Specification

The following is required:

- A configuration consisting of several HMI projects and STEP 7 projects.
- S7-PLCSIM Advanced V1.0 (or higher) is installed on the configuration PC. Comment: Apart from the "S7-PLCSIM Advanced V1.0" software, **no** other PLCSIM software may be installed.
- The firmware version of the SIMATIC PLC to be simulated must be V2.0.

Note

From WinCC V15, PLCSIM and PLCSIM Advanced can be installed together on one computer. Furthermore, as of this version, a higher firmware version > V2.0 can be used for the SIMATIC PLCs to be simulated.

Overview picture

Fig. 2-4



Software Used

For this application you need "S7-PLCSIM Advanced V1.0".

With "S7-PLCSIM Advanced V1.0" you have the opportunity to simulate simple and complex automation tasks.

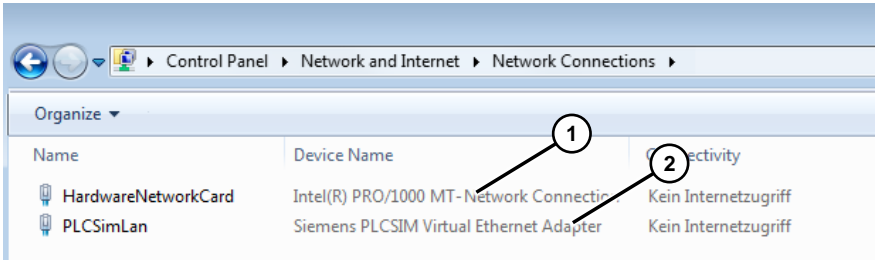
A test license, limited to 21 days, is available for testing PLCSIM Advanced V14 SP1.


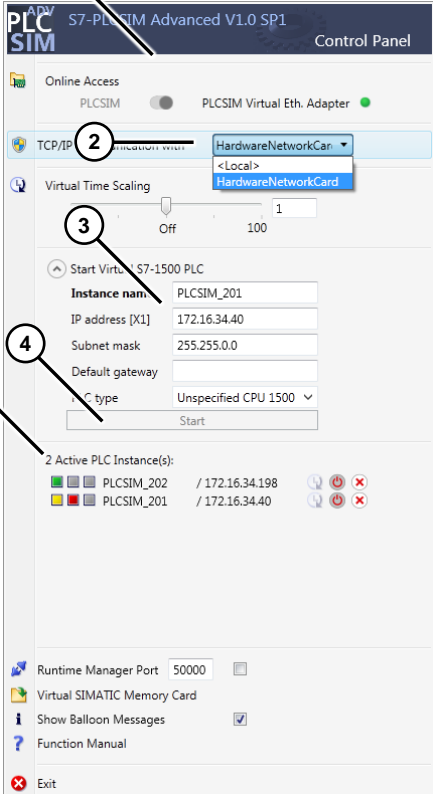
Special features:

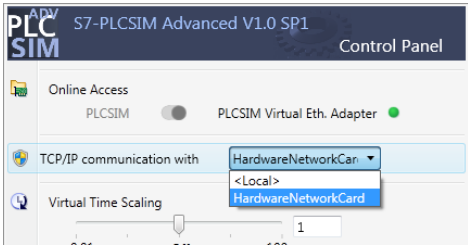
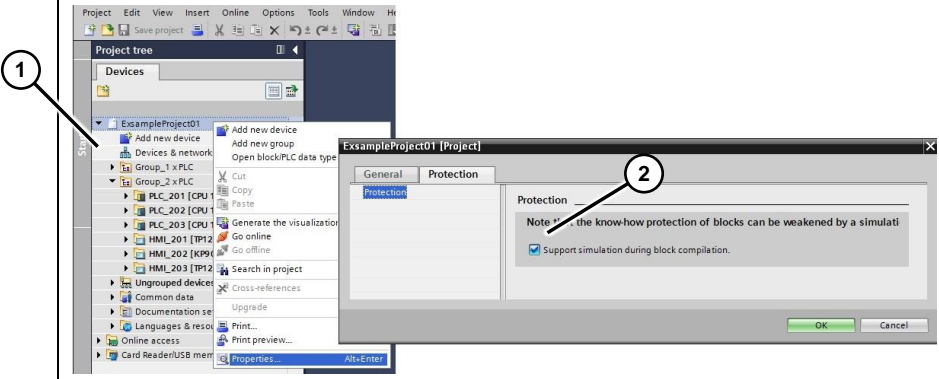
- Up to 16 SIMATIC 1500 PLCs can be simulated on one PC. You can communicate to the outside via the Ethernet interface.
- In addition to the simulation of the SIMATIC PLC, you can also simulate **one** HMI operator panel via the PC.
- To simulate several HMI operator panels, use several PC stations with "WinCC TIA Portal Simulation" installed.
- Communication / data exchange between simulated and existing hardware.

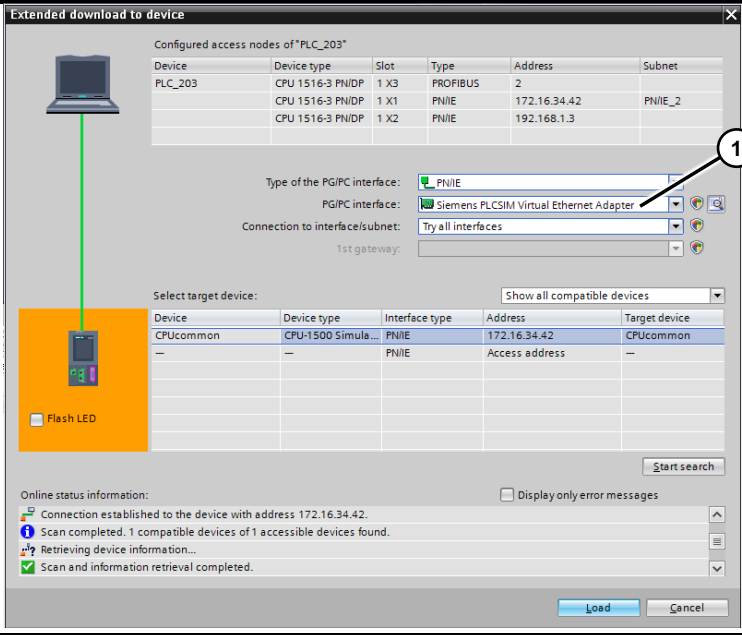
Configuration

Table 2-3

No.	Description
1.	<p>General</p> <ul style="list-style-type: none"> • Connect all participants together including the PC on which the S7-PLSIM Advanced V1.0 is installed. • Make sure that all devices are in the same IP band ("CPU / Configuration PC").
2.	<p>Network adapter settings</p> <ul style="list-style-type: none"> • Open the network settings. "Start> Control Panel> Network and Sharing Center> Change Adapter Settings". • By default, two Ethernet adapters are displayed. Depending on which adapter you use when configuring the S7-PLCSIM Advanced V1.0 station, different communication options are available. <ul style="list-style-type: none"> - (1) The existing hardware network card. - (2) The PLCSIM adapter interface installed with the installation of S7-PLCSIM Advanced V1.0 <p>Note: When configuring PLCSIM Advanced, this adapter is called "<Local>".</p> • Provide an IP address for both adapters. 

No.	Description
3.	<p>Open S7-PLCSIM Advanced</p> <ul style="list-style-type: none"> Start PLCSIM Advanced "Start > All Programs > Siemens Automation > S7-PLCSIM Advanced V1.0." Open PLCSIM Advanced Control Panel <ul style="list-style-type: none"> Open the notification panel (1) from the task bar. Right-click on the "PLCSIM icon" (2). The "Control Panel" of "S7-PLCSIM Advanced V1.0" is opened. 
4.	<p>Configure S7-PLCSIM Advanced</p>  <div style="border: 1px solid black; padding: 5px;"> <p>(1) Set the switch to "PLCSIM Virtual Eth. Adapter".</p> <p>(2) Using the drop-down list, select the adapter via which the communication takes place.</p> <p>(3) Enter any name for the SIMATIC PLC to be simulated and enter the configured IP and subnet mask.</p> <p>(4) Click on the "Start" button. After a short delay, a new instance is created.</p> <p>(5) View of two instances.</p> <p>Note: For each SIMATIC 1500 PLC to be simulated, you must create an "instance". Repeat steps 2-4 to create additional instances.</p> </div>

No.	Description
5.	<p>Information on TCP / IP communication (S7-PLCSIM Advanced)</p>  <ul style="list-style-type: none"> • <Local> => Siemens PLCSIM Virtual Ethernet Adapter <ul style="list-style-type: none"> - If you use "<Local>" then you cannot communicate "outside" using the simulated CPU. • Name of the network adapter => Existing hardware network card <ul style="list-style-type: none"> - You can communicate both "outside" and "internally" with the simulated CPU. You can thus communicate with an externally available HMI operator panel and an "internally" simulated HMI operator panel. • "TCP/IP communication with" <ul style="list-style-type: none"> - The selected configuration under "TCP/IP communication with" always refers to all instances.
6.	<p>Adapt / check project properties</p> <ul style="list-style-type: none"> • In the project navigation, right-click on the project name and open the "Properties ...". (1) • Open the "Protection" tab. • Select the check box. "Support simulatability when compiling blocks" (2). 
7.	<p>Transfer control program</p> <ul style="list-style-type: none"> • Select the project folder of the PLC configuration to be simulated in the project navigation. • Transfer the control program to the PLC. To do this, select the "Download to device" icon in the toolbar. The window with the transfer settings opens. • PG/PC interface (1) Select "SIEMENS PLCSIM Virtual Ethernet Adapter" via the drop-down list. • Click "Start search". • Select the station found and load the configuration into the PLC (S7-PLCSIM Advanced).

No.	Description
	
8.	<p>Transfer HMI configuration</p> <ul style="list-style-type: none"> The HMI operator panel is available in hardware. <ul style="list-style-type: none"> In the usual way, transfer the HMI configuration to the HMI operator panel. HMI operator panel. <p>Note: In order to be able to communicate with the external panel with S7-PLCSIM Advanced, the physically existing network adapter must be selected in the configuration of the PLCSIM Advanced Station under "TCP / IP communication" (not <Local>).</p> HMI operator panel not available in hardware. <ul style="list-style-type: none"> Select the HMI configuration that is to be simulated. Click the "Start simulation" icon in the toolbar.

3 Useful information

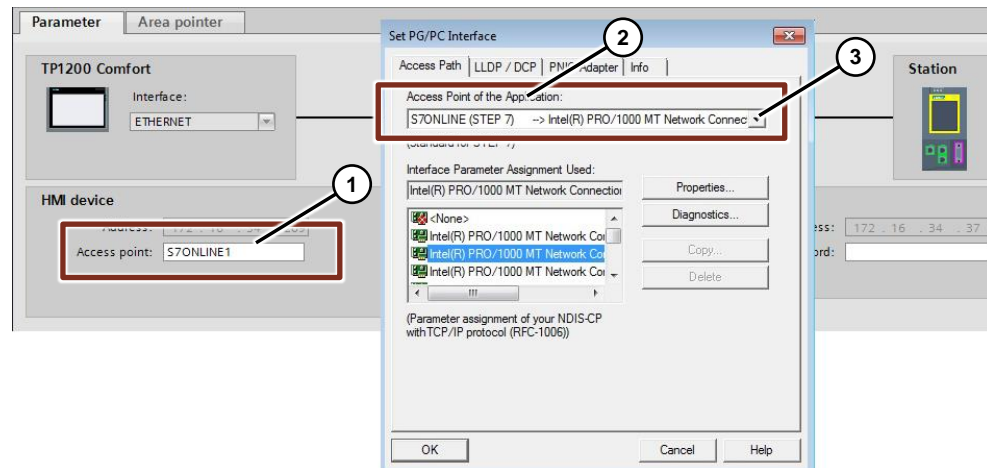
3.1 Troubleshooting

No connection is established

In the HMI configuration, check the name of the set access point under the menu "Connections> Parameters> HMI device".

The name must match the name selected in the PG/PC interface under "Access point of the application".

Fig. 3-1



Example:

- In the HMI configuration, "S7ONLINE1" is defined as the access point.
- In the PG/PC interface, "S7ONLINE" is defined as the access point.

In this case, add a new access point named "S7ONLINE1".

- To do this, open the "drop-down list" (3).
- In the opened list, select the function "<Add/Delete>".
- The "Add / delete access points" window then opens. Under "New access point", enter the name "S7ONLINE1" and confirm your entry with the "Add" button. Then close the window.
- In the standard view, select the newly added "access point" and assign the "Interface parameterization".
- Click "OK" to confirm your entries.

3.2 Simulation of devices

The TIA portal allows you to run and test the project's hardware and software in a simulated environment. The simulation is executed directly on the PG/PC. No additional hardware is required for this.

The simulation software provides a graphical user interface for monitoring and changing the configuration. It differs depending on the currently selected device.

Integration into the TIA Portal

The simulation software is fully integrated with the TIA Portal but is only supported by certain devices. Therefore, the button for calling the simulation software can only be operated if the selected device supports the simulation.

The simulation software for some devices requires its own virtual interface to communicate with the simulated devices. The virtual interface can be found in the project navigation under the entry "Online accesses" next to the physical interfaces of the PG/PC.

3.3 S7-PLCSIM

S7-PLCSIM is used to test and validate a single PLC program without the need for the actual hardware. With S7-PLCSIM you can use all STEP 7 test tools, including the monitoring table, the program status and the online and diagnostic functions. S7-PLCSIM also offers tools that are only available in S7-PLCSIM, for instance, a SIM table and a sequence editor.

Detailed information on "S7-PLCSIM", such as

- system requirement
- supported SIMATIC PLCs
- etc.

can be found in the online help and the features guide.

- S7-PLCSIM V14 online help [\7](#)
- S7-PLCSIM V14 SP1 online Readme [\8](#)

3.4 PLCSIM Advanced

With S7-PLCSIM Advanced, you can simulate your CPU programs on a virtual PLC. You do not require real PLCs for this. You can configure your CPU in STEP 7 V14, program your application logic, and then load the hardware configuration and program into the virtual PLC. From there, you can run your program logic, observe the effects of simulated inputs and outputs, and customize your programs.

In addition to communication via Softbus, S7-PLCSIM Advanced offers a **fully-fledged** Ethernet connection and can thus also communicate in a distributed manner.

A test license, limited to 21 days, is available for testing S7-PLCSIM Advanced V14 SP1.

As soon as you start an instance in the Control Panel, the Automation License Manager (ALM) searches the network for a valid license. If no license is available for S7-PLCSIM Advanced V1.0 SP1, the ALM offers the test license for activation.

Detailed information on "PLCSIM Advanced", such as

- system requirement
- supported SIMATIC PLCs
- etc.

can be found in the online help and the features guide.

More information.

- Delivery release SIMATIC S7-PLCSIM Advanced V1.0 SP1 & TRIAL Download [\3\](#).
- SIMATIC S7-PLCSIM Advanced [\4\](#).
- Readme SIMATIC S7-PLCSIM Advanced V1.0 SP1 [\5\](#)

4 Appendix

4.1 Service and Support

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4.2 Links and Literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page for the application example https://support.industry.siemens.com/cs/ww/en/view/109748099
\3\	Delivery Release SIMATIC S7-PLCSIM Advanced V1.0 SP1 and TRIAL download https://support.industry.siemens.com/cs/ww/en/view/109745647
\4\	SIMATIC S7-PLCSIM Advanced https://support.industry.siemens.com/cs/ww/en/view/109739153
\5\	Readme SIMATIC S7-PLCSIM Advanced V1.0 SP1 https://support.industry.siemens.com/cs/ww/en/view/109739154
\6\	SIMATIC S7-PLCSIM Advanced: Co-simulation via API https://support.industry.siemens.com/cs/ww/en/view/109739660
\7\	S7-PLCSIM V14 Online help https://support.industry.siemens.com/cs/ww/en/view/109741755
\8\	S7-PLCSIM V14 SP1 Online Readme https://support.industry.siemens.com/cs/ww/en/view/109746745

4.3 Change documentation

Table 4-2

Version	Date	Modification
V1.0	01/2018	First version