SIEMENS

SIMATIC

Engineering Tools
S7-PLCSIM online help

Operating Manual

Introduction 1

S7-PLCSIM overview 2

Working with simulated PLC instances 3

Working with SIM views 4

Simulating motion control 5

Error conditions and limitations 6

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Table of contents

1 Introduction 6

1.1 S7-PLCSIM documentation guide 6

1.2 SIMATIC Technical Documentation 7

1.3 Tool support 9

1.4 Cybersecurity information 10

2 S7-PLCSIM overview 11

2.1 Workspaces and starting S7-PLCSIM 12

2.2 Creating, opening, and saving S7-PLCSIM workspaces 13

2.3 S7-PLCSIM Essentials view 15

2.4 Configuring the settings for S7-PLCSIM 15

2.5 Using and customizing keyboard shortcuts 15

2.6 Differences between a simulated PLC and a physical PLC 17

2.6.1 Overview of differences 17

2.6.2 Differences common to all supported PLCs 17

2.6.3 S7-1200: Technology support 19

2.6.4 S7-1200 G2, S7-1500, ET 200SP, and ET 200pro: Technology support 19

3 Working with simulated PLC instances 20

3.1 Starting a simulated PLC instance 20

3.2 Downloading a PLC from STEP 7 to a simulated PLC instance 23

3.3 Viewing the exact quantity structure allocations for S7-PLCSIM Advanced instances 24

3.4 Virtual time scaling 24

3.5 Communication modes 25

3.6 Resetting a simulated PLC instance 26

3.7 Performing a memory reset (MRES) 27

3.8 Removing a simulated PLC instance 27

4 Working with SIM views 28

4.1 Introduction to SIM views 28

4.2 SIM tables 29

4.2.1 Creating, editing, and deleting SIM tables 29

4.2.2 Importing SIM table files 31

4.2.3 Monitoring and modifying values in a SIM table 31

4.3 Event simulation 32

4.3.1 Configuring events ... 32
4.3.2 Configuring LADDR ... 33
4.3.3 Simulating a pull or plug of modules event ... 33
4.3.4 Simulating a rack or station failure event ... 34
4.3.5 Simulating a hardware interrupt event ... 34
4.3.6 Simulating a diagnostic error interrupt event ... 35
4.3.7 Triggering events ... 36
4.4 Sequences ... 36
4.4.1 Adding and configuring a sequence ... 36
4.4.2 Importing sequence files ... 37
4.4.3 Adding and working with sequence steps ... 37
4.4.4 Working with actions in a sequence step ... 38
4.4.5 Running the sequence ... 40

5 Simulating motion control ... 41
5.1 Motion control overview ... 41
5.2 Simulations and homing mode ... 41
5.3 Isochronous mode not possible error ... 41
5.4 Motion OB overruns ... 42
5.5 Simulation deactivates MC-PreServo and MC-PostServo ... 42
5.6 Technology objects not loaded ... 42
5.7 Upgraded projects containing MC-Servo (OB91) and MC-Interpolator (OB92) blocks ... 42
5.8 Maximum of 5,120 motion control resources ... 43
5.9 High Speed Counter ... 43
5.10 Wait after going to RUN mode to access motion control technology objects ... 43
5.11 High-Speed Counter functionality for S7-1500C (compact) PLCs ... 43
5.12 TO_PositioningAxis ... 44
5.13 TO_ExternalEncoder ... 44

6 Error conditions and limitations ... 45
6.1 Simulating instances with IP address from DHCP server ... 45
6.2 Simulated PLC will not RUN with local I/O send clock ... 45
6.3 Synchronization of IRT systems ... 45
6.4 Using a proxy server with S7-PLCSIM ... 45
6.5 Cannot locate S7-PLCSIM Advanced Instances ... 45
6.6 S7-1200 Fail-Safe simulation ... 46
6.7 Value status defaults ... 46
6.8 Processor requirements for S7-PLCSIM ... 46
6.9 High feature module support ... 47

6.10 HMI type-safe array element display ... 47
6.11 Saving S7-1500 retentive data block (DB) values ... 47
6.12 Yellow coloring for fail-safe I/O ... 47
6.13 Scan cycle overflow ... 47
6.14 Incompatible diagnostic status for simulated S7-1500 PLCs with firmware version 1.8 ... 48
6.15 Simulating HMI connections ... 48
6.16 HMI Accessible tags ... 48
6.17 Compile error after attempting to download to S7-PLCSIM ... 48
6.18 Simulating communication with an HMI and multiple PLCs ... 49
6.19 Simulating fail-safe programs ... 49
6.20 Use STEP 7 safety system library V1.3 or later for Fail-Safe I/O ... 49
6.21 Working with global libraries ... 50
6.22 Incorrect RET_VAL parameter values for S7-1500 EN_AIRT and DIS_AIRT instructions that are called from multiple OBs ... 50
6.23 HMI password protection levels and simulation ... 50
6.24 STEP 7 online & diagnostics functions ... 50
6.25 Simulation during standby mode ... 50
6.26 Working with automatically synchronized network drives ... 51
6.27 Decimal place character ... 51
6.28 Modbus V5.2 not supported ... 51
6.29 Error returned by High_Speed_Counter instruction ... 51
6.30 Restrictions for instructions ... 52
6.31 Simulating the Drive controller ... 52

Index ... 53

Introduction

1

1.1 S7-PLCSIM documentation guide

S7-PLCSIM and the TIA Portal provide a variety of documentation and other resources for finding the technical information that you require.

- The S7-PLCSIM Online help provides specific information about simulating and testing your PLC programs without the need for physical hardware.
- The S7-PLCSIM Online help is available in multiple languages and is accessible in the following ways:
  - From the ? icon in the top right of the user interface
  - From the S7-PLCSIM Online help (https://support.industry.siemens.com/cs/us/en/view/109972225) page at Siemens Industry Online Support (https://support.industry.siemens.com/).
- The TIA Portal Information System provides access to the conceptual information and specific instructions that describe the operation and functionality of the programming package and basic operation of SIMATIC CPUs.

You can also follow or join product discussions on the Service & Support technical forum (https://support.industry.siemens.com/tf/ww/en/?Language=en&siteid=csius&treeLang=en&groupid=4000002&extranet=standard&viewreg=WW&nodeid0=34612486). These forums allow you to interact with various product experts, for example, the forum for TIA Portal (https://support.industry.siemens.com/tf/ww/en/threads/243?title=step-7-tia-portal&skip=0&take=10&orderBy=LastPostDate+desc).

Contact your Siemens distributor or sales office for assistance in answering any technical questions, for training, or for ordering products. Because sales representatives are technically trained and have knowledge about your operations, process and industry, as well as about the Siemens products that you are using, they can provide efficient answers to problems you might encounter.

Readme updates

When needed, changes and supplements to Online help documents are available in a Readme document. These updates take precedence over the system manual. You can find the latest Readme updates on S7-PLCSIM Readme (https://support.industry.siemens.com/cs/ww/en/view/109972226)

1.2 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.

The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:



Industry Online Support International (https://support.industry.siemens.com/cs/ww/en/view/109742705)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:



Quick introduction to the technical documentation of automation products per video (https://support.industry.siemens.com/cs/us/en/view/109780491)



YouTube video: Siemens Automation Products - Technical Documentation at a Glance (https://youtu.be/TwLSxxRQQsA)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
   - Industry Online Support International: (https://support.industry.siemens.com)

     The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
   - ID link:

     Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

With "mySupport" you can get the most out of your Industry Online Support.

Registration	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
Support requests	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
Documentation	In the Documentation area you can build your personal library.
Favorites	You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries.
Recently viewed articles	The most recently viewed pages in mySupport are available under "Recently viewed articles".
CAx data	The CAx data area gives you access to the latest product data for your CAx or CAe system. You configure your own download package with a few clicks: • Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files • Manuals, characteristics, operating manuals, certificates • Product master data

You can find "mySupport" on the Internet. (https://support.industry.siemens.com/My/ww/en)

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You can find the application examples on the Internet.
(https://support.industry.siemens.com/cs/ww/en/ps/ae)

1.3 Tool support

Tools

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools , the TIA Selection Tool assembles the already known configurators for automation technology into a single tool.

With the TIA Selection Tool , you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet.
(https://support.industry.siemens.com/cs/us/en/view/109767888)

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and the optimal use of resources

You can find SINETPLAN on the Internet
(https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html).

1.4 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/cert.

S7-PLCSIM overview

2

S7-PLCSIM supports the debugging and validation of PLC programs without requiring actual hardware. With simulated PLC instances in S7-PLCSIM, you can use STEP 7 debugging tools, including the watch table, program status, online & diagnostics functions, and other tools. S7-PLCSIM also operates in conjunction with S7-PLCSIM Advanced. You can also download from STEP 7 to simulated PLC instances that you started from the S7-PLCSIM Advanced control panel or from the S7-PLCSIM Advanced API.

S7-PLCSIM provides the following tools for simulated PLCs:

- Support for the latest firmware of the following product families:
  - S7-1500
  - S7-1200
  - S7-1200 G2
  - ET 200SP
  - ET 200pro
  - S7-1500R/H
  - Software Controller
- Multiple simulated PLC instances (Page 20)
- Simulation (SIM) tables (Page 29) for monitoring and modifying simulated PLC inputs, outputs, and data
- Simulation of interrupts to trigger supported event OBs (Page 32)
- Sequences (Page 36) to simulate an external process interacting with your program
- Virtual time scaling (Page 24) for S7-PLCSIM Advanced instances
- The ability to connect to physical communication networks (Page 25) for S7-PLCSIM Advanced instances

S7-PLCSIM operates in conjunction with STEP 7 in the TIA Portal. You use STEP 7 to perform the following tasks:

1. Configure a PLC and any associated modules
2. Program your application logic
3. Start a simulation or download a PLC configuration and program to S7-PLCSIM

When S7-PLCSIM has a configured simulated PLC instance, you can use the online tools in STEP 7 to observe simulated program behavior. Observe the requirements for user authentication based on the communication mode (Page 25).

2.1 Workspaces and starting S7-PLCSIM

S7-PLCSIM workspaces

An S7-PLCSIM workspace can contain multiple simulated PLC instances (Page 20) and simulation views (Page 28) (SIM views) that include SIM tables, events, and sequences. You can work in a workspace without saving or you can create, save, and reopen workspaces (Page 13).

Starting S7-PLCSIM

You can start S7-PLCSIM by any of the following means:

- S7-PLCSIM desktop icon
- S7-PLCSIM in the Start menu
- "Start simulation" command from STEP 7 for supported devices

Starting S7-PLCSIM from a desktop icon or the Start menu

When you start S7-PLCSIM from the Start menu or desktop icon, S7-PLCSIM starts in an unsaved workspace.

Starting S7-PLCSIM from STEP 7

To start simulating a PLC in your STEP 7 project, select your PLC in the project tree and choose one of the following methods:

- Click the "Start simulation" button on the main toolbar. 
- Right-click the PLC in the project tree and select "Start simulation" from the shortcut menu.

From the STEP 7 dialogs, you might need to perform some or all of these tasks:

- Select the PLCSIM PG/PC interface if you have not previously selected it.
- Answer prompts to enable simulation support if necessary.
- Answer the prompt about trusting the device.
- Click "Start search" to find a PLCSIM instance for the download.
- Click Load and Finish to complete the download

If S7-PLCSIM is not running, starting a simulation starts S7-PLCSIM with a new workspace containing the simulated PLC instance. The workspace name corresponds to the STEP 7 project name. Note that if you start a simulation from STEP 7 with the same project name as a current workspace, that named workspace will open and will not create a new PLC instance.

If S7-PLCSIM is already running, starting a simulation adds a new simulated PLC instance to the current workspace.

If the simulated PLC instance name in the workspace is the same as a running instance from another application such as S7-PLCSIM Advanced, S7-PLCSIM prompts you for handling of the instance name conflict. You can choose to remove the instance from the other workspace

and start the simulation. If you do not want S7-PLCSIM to remove the other running instance, cancel the operation and resolve the instance name conflict manually.

NOTE

If you start simulation from STEP 7 more than once for a PLC, you start multiple simulation instances for that PLC.

2.2 Creating, opening, and saving S7-PLCSIM workspaces

You can perform the following workspace tasks by selecting the Workspace icon on the top toolbar of S7-PLCSIM. Use the dropdown menu to select from the following:

- New - Create a workspace.
- Open - Open a previously created workspace.
- Save - Save your workspace.
- Save as - Save your workspace with a new name and/or in a new location.
- Show in File Explorer - Show the location of your current workspace in a File Explorer window.
- Recent workspaces - Choose and open one of up to three recently saved workspaces.

NOTE

You cannot convert projects from S7-PLCSIM V17 or earlier to workspaces. Project formats from earlier versions and workspace files are not compatible.

Working in the "Unsaved workspace"

When you open S7-PLCSIM, you can begin working in an unsaved workspace. The "Unsaved Workspace" allows to you add new simulation instances (Page 20) and SIM views (Page 28). You can save and name the workspace or close without saving.

Opening a new "Unsaved workspace"

To open a new "Unsaved workspace", click the workspace icon and select "New". You are prompted to save your current work, or continue without saving, before S7-PLCSIM creates the new workspace.

NOTE

"New" is only an option in the workspace dropdown menu if you have added at least one instance in an unsaved workspace, or if you are working in a saved workspace.

Opening a saved workspace

To open any saved workspace, follow these steps:

1. Select the Workspace icon
2. Choose "Open"
3. Select your project from the explorer window.

NOTE

You can also use the pre-defined shortcut "Ctrl+O" anywhere within the S7-PLCSIM main application to open a saved workspace.

To open a recent workspace, select the Workspace icon and choose your project from the list under "Recent workspaces". Note that this menu will show only up to the three most recent workspaces saved.

S7-PLCSIM opens the workspace and displays the project name beside the Workspace icon. You can then use the icons to switch to the Instances window or the SIM view window(s).

If a simulated PLC instance name in the workspace is the same as a running instance from another application such as S7-PLCSIM Advanced, S7-PLCSIM prompts you to handle the instance name conflict. You can choose to remove the instance from the other workspace and continue to open the workspace. If you do not want S7-PLCSIM to remove the other running instance, cancel the open operation and resolve the instance name conflict manually.

Saving a workspace

Click the Workspace icon and choose "Save" from the dropdown menu to save your current workspace.

NOTE

You can also use the pre-defined shortcut "Ctrl+S" anywhere within the S7-PLCSIM main application to save your current work.

Deleting a workspace

You can only delete a workspace from Windows File Explorer. Click the Workspace icon and select "Show in file explorer" to open Windows File Explorer. Delete the folder that corresponds to the workspace you want to delete.

2.3 S7-PLCSIM Essentials view

S7-PLCSIM offers an "Essentials view" that allows you to perform the following quick functions in a smaller window on your screen:

- Add/Delete simulated PLC instances
- Power on PLC instances
- Place PLC instances into RUN or STOP mode
- Configure the network
- Set virtual time scaling (Advanced instances only)
- Perform Scan control operations

To access the "Essentials view", launch S7-PLCSIM and click the icon in the top right of the home page.

For full functionality, view and use S7-PLCSIM from the main application view.

2.4 Configuring the settings for S7-PLCSIM

To adjust the settings for S7-PLCSIM, click the settings icon on the bottom left side of S7-PLCSIM. Settings contains the following three tabs:

1. General - allows you to do the following:
   - Set the default language
   - Set the appearance of all S7-PLCSIM screens to either dark or light mode
   - Choose the Home workspace location - S7-PLCSIM automatically stores workspaces that you save in this location
   - View the Keyboard shortcuts (Page 15) menu
   - Reset general settings to default
2. Instance - allows you to set your default instance type as either Standard or Advanced.
3. About - contains the following information:
   - Installed Components
   - Copyright

2.5 Using and customizing keyboard shortcuts

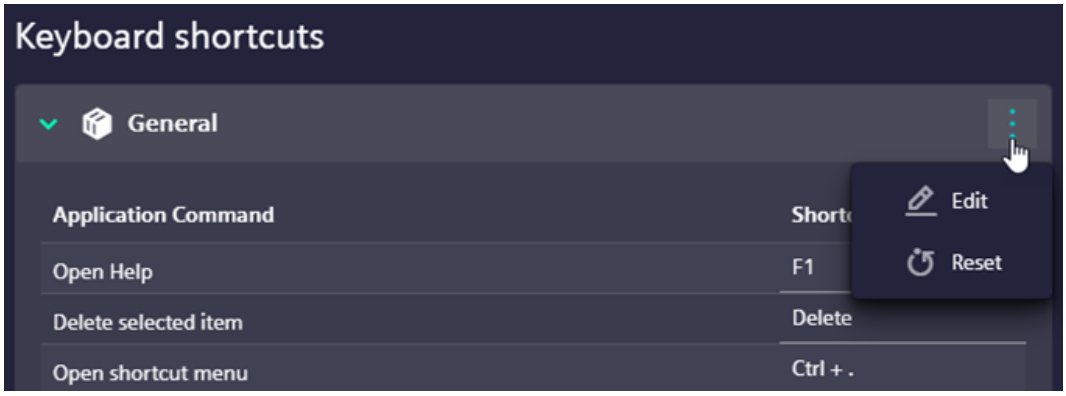
Access the S7-PLCSIM "Keyboard shortcuts" in the Settings by clicking the Keyboard shortcuts button.

Keyboard shortcuts are divided into the following main categories and displayed in a dropdown menu under each category:

- General
- Navigation
- Instance
- Simulation

You can edit the keyboard shortcuts in each category following these steps:

1. Click the vertical ellipsis menu on the top right of the shortcut category.



2. Select "Edit".
3. Click to place your cursor in the shortcut field that you want to change.
4. Add the new shortcut by entering a key combination (ctrl/shift/alt + a keystroke) or using a command key.
5. Click "Save".

NOTE

Do not duplicate a custom shortcut in S7-PLCSIM that you already use with any application running on the same machine.

Reset keyboard shortcut

Select "Reset" from the vertical ellipsis menu on the top right of the shortcut category to reset all shortcuts within that category to the default setting.

To reset all shortcuts for S7-PLCSIM to the default, repeat this process in each category.

Conflict detected for a custom shortcut

To avoid conflicts, do not to create custom shortcuts that are already assigned. If you attempt to assign a conflicting shortcut, S7-PLCSIM displays a warning symbol in the edited field. If you hover over the warning symbol icon, a tooltip above the field identifies which shortcut is conflicting. To clear the error, choose another key combination or command key for your shortcut and click "Save".

2.6 Differences between a simulated PLC and a physical PLC

2.6.1 Overview of differences

A simulated PLC can behave differently than a physical PLC.

Many CPU System Functions (SFCs) and System Function Blocks (SFBs) have limited behavior for simulation. Programs that rely on this functionality behave differently during simulation. Program dependencies on PLC clock times or specific hardware timing, for example, will behave differently in a Windows simulated PLC.

Also, programs that are highly dependent on timing might be difficult to debug with a simulation due to differences in timing between a software-based simulation and physical hardware.

2.6.2 Differences common to all supported PLCs

S7-PLCSIM differs from physical PLCs in the following areas.

Diagnostics

S7-PLCSIM does not support all of the error messages written to the diagnostic buffer. For example, S7-PLCSIM does not simulate messages about bad batteries in the CPU, or EPROM errors. However, S7-PLCSIM simulates most program errors.

Time-based performance

Because S7-PLCSIM is software running on a programming device under the Windows operating system, the scan cycle time and the exact time of actions in S7-PLCSIM are not the same as if PLC firmware performed those actions.

If your program is highly dependent upon the time that actions execute, do not evaluate your program based only on the time results of your S7-PLCSIM simulation.

Access and copy protection

S7-PLCSIM does not simulate access protection or copy protection.

Know-how protection

You must enable simulation of know-how protected blocks to simulate them in S7-PLCSIM. To enable know-how protection for a block, follow these steps:

1. Right-click the project in STEP 7.
2. Select Properties.
3. From the Protection tab, select the check box "Support simulation during block compilation".

Flashing LEDs

STEP 7 and other tools can only flash LEDs on physical PLCs. You cannot flash the LEDs on a simulated PLC from STEP 7 or any other tool.

Features that require a memory card

S7-PLCSIM does not simulate CPU functionality that requires a memory card, such as data logging and recipes.

Web server

S7-PLCSIM supports the Web server only when the instance is an Advanced instance and the communication mode (Page 25) is a TCP/IP mode.

PROFIBUS

If your STEP 7 project contains PROFIBUS elements, S7-PLCSIM will not simulate the PROFIBUS elements, but simulates the remainder of your project.

You do not need to remove the PROFIBUS elements from your project before starting your simulation. Just be aware that S7-PLCSIM ignores the PROFIBUS elements.

F-CPU simulation

To simulate an F-CPU, you must adjust the F-parameter F-monitoring time in your STEP 7 project before you download to S7-PLCSIM. This is due to the difference in timing between a software-based simulation and physical hardware.

To adjust the F-monitoring time, follow these steps:

1. In the STEP 7 Project tree, right-click your F-CPU and select "Properties".
2. In the Properties dialog, navigate to "Fail-Safe > F-parameter > Default F-monitoring time for central F-I/O".
3. Adjust the F-monitoring time from the default of 150 ms to a higher value.
4. Click OK.

You might need to repeat this procedure until you find an F-monitoring value that allows your F-CPU simulation to run without errors.

Instruction support

S7-PLCSIM supports most instructions for the simulated S7-1200 and S7-1200F in the same way as for a physical PLC.

You can download all programs that successfully compile to the virtual PLC. However, some instructions call SFCs (system functions) or SFBs (system function blocks) that are only partially supported, and your simulation might not function as you expect.

For programs with partially supported instructions, S7-PLCSIM validates input parameters and returns outputs that are valid, but not necessarily what a real PLC with physical I/O would return. For example, S7-PLCSIM does not support the SIMATIC SD memory card, so program instructions that save data on a memory card do not actually save data when a simulation executes.

2.6.3 S7-1200: Technology support

S7-PLCSIM does not simulate the following technology features for the S7-1200:

- Counting, measurement, and position detection
- PID Control
- Motion control

2.6.4 S7-1200 G2, S7-1500, ET 200SP, and ET 200pro: Technology support

Technology support

S7-PLCSIM supports the following technology features for the S7-1200 G2, S7-1500, S7-1500F, Software Controller, ET 200SP, and ET 200pro:

- Counting, measurement, and position detection
- PID Control
- Time-based IO
- Motion control

S7-1500R/H simulation differences

You can simulate an S7-1500R/H in RUN-Solo mode only. You can run only one instance of S7-PLCSIM for an S7-1500R/H.

Working with simulated PLC instances 3

3.1 Starting a simulated PLC instance

If you started simulation from STEP 7 (Page 12), you already have PLC instances for each PLC simulation that you started.

Creating a new instance in the main view

To create new simulated PLC instances within either a saved or unsaved workspace, make sure that you are working in the "Instances" window.

To add a new simulation instance to your workspace, select your device from the Library on the right side of S7-PLCSIM, and click the + icon. S7-PLCSIM creates a new instance that is powered off.

You can power on a maximum of two simulated PLC standard instances. Click the power button of the instance to power it on. The simulated PLC is unconfigured until you download a STEP 7 project (Page 23) to it.

NOTE

System performance degrades with each added instance.

Creating a new instance in the Essentials view

You can add new simulated PLC instances when working from the Essentials view. The toggle on the top left of the Essentials view reflects your default instance type. You can use the toggle to change license type before you add a new instance.

To add a new instance, use the dropdown menu to select your PLC and then click the "+" icon to add the instance to your Essentials view screen.

NOTE

When using the Essentials view to create new simulated PLC instances, take note of the following behaviors:

- If you add new simulated PLC instances from the Essentials view, those instances show in your current workspace when you switch back to the main application view.
- If you open an existing workspace in the main application view before launching the Essentials view, PLC instances in that workspace show in the Essentials view window.

Setting the properties for a PLC instance

Double-click an instance to set the following parameters from the Properties tab :

- License type
- Scan control (set number of scans and scan duration for Standard instances only)
- Virtual Time Scaling (Page 24) (available for simulated PLC instances with the Advanced license type only)
- X1 Interface
- Map to adapter (TCP/IP Multiple Adapter communication mode only)
- Cycle time

The following table describes the parameters in the Properties tab:

Parameter	Description
License type	Select a Standard or Advanced license from the dropdown menu. You can configure the following as a Standard instance or an Advanced instance: • S7-1500 • ET 200SP • ET 200pro • S7-1500R/H • Software Controller S7-1200 G2 and S7-1200 are only supported as Standard instances and cannot be configured as Advanced instances.
Scan control[1]	S7-PLCSIM provides the following functionality for both Standard and Advanced instances. With an instance powered on and configured in STEP 7, you can use the buttons to do the following: • The "Pause" button pauses a running scan. If the simulated PLC instance is in STOP mode, clicking the pause button puts the instance into RUN mode and then pauses the scan. • The "Scan" button resumes a paused scan. For Standard instances, clicking the scan button runs the scan for a specified interval. For Advanced instances, clicking the scan button runs a single scan. • The 'Play' button places the instance back into RUN and cancels any scan in progress. For Standard instances, you can set the scan count and duration. To set these values, make sure the simulated PLC instance is configured in STEP 7 and set to RUN in S7-PLCSIM, then follow these steps: 1. Pause the scan. 2. Click the radio button to the left of the value you want to set. 3. Use your keypad to set the values. Note that the scan count must be between 0 and 9999 and the time format must be in mm:ss.ms.

[1] You can also use Scan control functions and set the scan count and duration for Standard instances from the Essentials view.

[2] For "TCP/IP Single Adapter" communication mode, use the Communication Mode to map to a network adapter.

Parameter	Description
Virtual Time Scaling	With the instance powered on, from the dropdown menu, select one of the following: • 0.01 • 0.1 • 0.5 • No Scaling • 2 • 10 • 100 • Custom If "Custom", the value must be between 0.01 and 100.
X1 interface	The IP address displays a default IP address or the IP address of the downloaded PLC from the STEP 7 project. If using an advanced instance, you can set the IP address, Subnet mask, and Default gateway in S7-PLCSIM. To change the Subnet mask or Default gateway, you must also change the IP address simultaneously. Note: If using the "TCP/IP Multiple Adapter" communication mode, map to an adapter before setting the interface.
Map to adapter[2]	For "TCP/IP Multiple Adapter" communication mode, use the dropdown menu in the Properties tab for each instance to map a network interface to an adapter (Page 25). If the CPU type supports multiple interfaces, they will be available after a download to the CPU.
Cycle time	Select the radio buttons to do the following: • Use downloaded maximum cycle time • Disable scan cycle monitoring • Specify maximum cycle time in milliseconds Enter the max cycle time in the box provided. The downloaded maximum cycle time refers to the cycle monitoring time in the device configuration in STEP 7 for the PLC. Note that the Windows operating system clock is not a real-time system clock. Windows cannot duplicate the precise behavior of a CPU's clock.

[1] You can also use Scan control functions and set the scan count and duration for Standard instances from the Essentials view.

[2] For "TCP/IP Single Adapter" communication mode, use the Communication Mode to map to a network adapter.

Features of simulated PLC instances

For each simulated PLC instance in the current workspace, you can use SIM views (Page 28) to interact with your simulated PLC and process values. SIM views provide the following features:

- SIM tables (Page 29) enable you to monitor and modify I/O points, memory values, and PLC tags.
- Event simulation (Page 32) enables you to simulate events and test your program's event interrupt OB code.
- Sequences (Page 36) enable you to simulate an external process interacting with your program.

These features provide a means for you to test your program without physical I/O and to simulate events dependent on hardware. Your simulated instances are visible in the instances

window of S7-PLCSIM. From the instances window, you can also set the communication mode (Page 25).

NOTE

If you start a simulated PLC instance from the S7-PLCSIM Advanced Control Panel or the API, S7-PLCSIM loads that instance as an "External" PLC.

3.2 Downloading a PLC from STEP 7 to a simulated PLC instance

If S7-PLCSIM is running, you can download a PLC from STEP 7 to a powered on simulated PLC instance in S7-PLCSIM. The instance can be a standard instance in your workspace or an S7-PLCSIM Advanced instance in other workspaces.

Select the PLC in your STEP 7 project and download the device to S7-PLCSIM using one of the following methods:

- Right-click the PLC and select "Download to device" from the context menu.
- Click the "Download to device" button from the STEP 7 toolbar.
- Select "Download to device" from the Online menu.

Download both the hardware configuration and software initially. After the initial download, STEP 7 downloads the changes on subsequent downloads.

From the STEP 7 dialogs, you might need to perform some or all of these tasks:

- Select the PLCSIM PG/PC interface if you have not previously selected it. Select PLCSIM if you are using the Softbus communication mode (Page 25) and Siemens PLCSIM Virtual Ethernet Adapter if you are using one of the TCP/IP communication modes.
- Answer prompts to enable simulation support if necessary.
- Answer the prompt about trusting the device.
- Click "Start search" to find an S7-PLCSIM instance for the download.
- Click Load and Finish to complete the download.

If you get download errors about blocks that cannot be simulated, follow these steps to enable simulation support:

1. Right-click the project in STEP 7 and select Properties.
2. From the Protection tab, select "Support simulation during block compilation.".

On the first download, STEP 7 downloads to the unconfigured, simulated PLC instance at the default IP address that was powered on first.

On future downloads, STEP 7 will load to the powered on S7-PLCSIM instance with the IP address of the PLC in STEP 7. If no instance exists with that IP address, STEP 7 will download to another powered on unconfigured instance.

3.3 Viewing the exact quantity structure allocations for S7-PLCSIM Advanced instances

STEP 7 allows you to use the specific allocations for quantity structures and memory usage for S7-PLCSIM Advanced PLC instances.

To use this feature with the "download to device (Page 23)" method in STEP 7, you must do the following:

1. Download your STEP 7 project to an Advanced PLC instance.
2. Power cycle the instance after the download.

To use this feature with the "Start Simulation (Page 12)" method in STEP 7, you must configure the settings for S7-PLCSIM to use the "Advanced" default instance type before starting the simulation. You do not need to power cycle the instance.

In STEP 7, you can view the maximum quantity structure in the project tree under "Program information" for all the CPUs. You can view the maximum quantity structure of the simulated CPU under "Online & Diagnostics".

3.4 Virtual time scaling

Virtual time scaling is available for simulated PLC instances with the Advanced license type in the Properties tab of the instance. Virtual time scaling is not available for Standard simulated PLC instances or S7-PLCSIM Advanced instances in "other" workspaces.

A simulated PLC instance uses two types of internal clocks for the simulation: A virtual clock and a real clock. The virtual clock is always the basis for the user program. It is used by components that are relevant for running the STEP 7 user program, such as cyclic OBs, cycle time monitoring, minimum cycle time, virtual system time and time calculations. Also, the time between two cycle control points is measured in virtual time.

The virtual time can be accelerated or slowed for test purposes.

The real clock always runs unchanged. It is used by components that are not subject to control processes, for example, communication with STEP 7.

Interruption of the process

Since S7-PLCSIM runs in a Windows environment, Windows might temporarily suspend the process corresponding to the simulated PLC instance. In such a case, both the virtual and the real clock stop in the simulated PLC instance. They only continue to run when Windows resumes processing.

Virtual system time

When you start S7-PLCSIM, the virtual system time of the simulated PLC instance starts with the system time of Windows.

The virtual system time is based on the virtual clock. If you use a scaling factor, the system time runs correspondingly faster or slower.

Scaling factor

Using a scaling factor, you can speed up or slow down the virtual clock of the simulated PLC instance for testing and debugging. Speeding up the virtual clock could be useful, for example, in testing time of day interrupt behavior. Slowing down the virtual clock can be useful, for example, when testing motion OBs without error conditions.

To set the scaling factor, select a virtual scaling factor from the dropdown list, or select Custom to enter a custom value. S7-PLCSIM displays the scaling factor next to the dropdown selector.

- The default is 1. The course of the virtual time corresponds to the course of real time.
- **Fast forward:** A scaling factor greater than 1 accelerates the virtual clock.

  Example: Scaling factor 2.0 → The virtual time is running twice as fast.
- **Slow motion**: A scaling factor less than 1 decelerates the virtual clock.

  Example: Scaling factor 0.5 → The progress of the virtual time slows down to 50%.

3.5 Communication modes

You can choose one of the following communication modes:

- S7-PLCSIM Softbus (internal only): This mode allows for local simulated communication.
- TCP/IP single adapter: This mode allows for local communication to a physical communication network over a single network adapter. Only S7-PLCSIM Advanced simulation instances can use this mode.
- TCP/IP multiple adapter: This mode allows for local and distributed communication to a physical communication network. For each simulated PLC instance, you can map the adapter to a network interface. Only S7-PLCSIM Advanced simulation instances can use this mode.

NOTE

If you are using TCP/IP Single or Multiple adapter, standard instances cannot be powered on.

The mode you select applies to all simulated PLC instances. All existing instances must be powered off to change the communication mode from S7-PLCSIM Softbus to a TCP/IP mode. If you set the mode to TCP/IP mode, you can only power on S7-PLCSIM Advanced instances.

NOTE

Going online from STEP 7

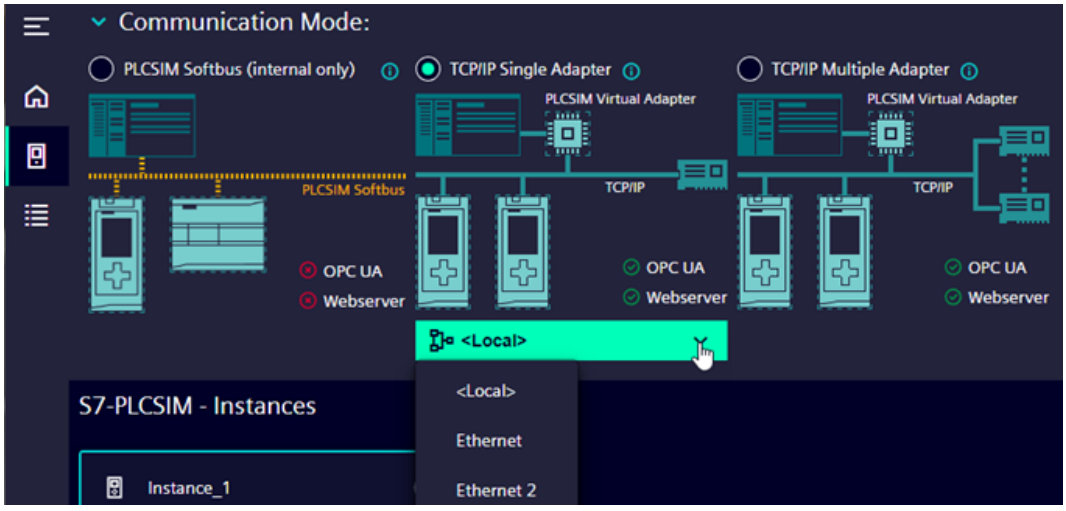
Observe the following requirements for user authentication based on the communication mode:

- In Softbus mode, you can go online from STEP 7 with a local project user, but not a central user (global user).
- For Advanced instances in TCP/IP mode, you can go online from STEP 7 with a central user (global user), but only from programming devices that can access the UMC server on which you configured the central users.

Mapping to a network adapter (single)

If you are using the "TCP/IP Single Adapter" communication mode, map a single network interface to the network adapter by doing the following:

1. Use the radio button to select "TCP/IP Single Adapter" from the "Communication Mode" bar located at the top in the S7-PLCSIM instances tab .
2. Click the arrow to the left of "Communication Mode" to show the communication mode dropdown.
3. Use the dropdown menu below "TCP/IP Single Adapter" to map a network interface to the adapter.



Mapping to network adapters (multiple)

If you are using the "TCP/IP Multiple Adapter" communication mode, use the dropdown menu in the Properties tab (Page 20) for each instance to map a network interface to an adapter. Note that the instance must be powered off.

3.6 Resetting a simulated PLC instance

To reset your simulated PLC instance back to an unconfigured state in S7-PLCSIM, follow these steps:

1. Select the instance you want to reset and make sure it is powered off.
2. Click the Properties tab icon in the Instances window.
3. Select the reset instance icon .

The simulated instance automatically resets.

3.7 Performing a memory reset (MRES)

A memory reset (MRES) clears all working memory areas and copies load memory to working memory.

To perform an MRES on a configured and powered on PLC instance, follow these steps:

1. Click the Properties tab icon in the Instances window.
2. Select the MRES button.
3. Click "Yes" on the Memory Reset pop-up dialog.

The simulated instance automatically performs the memory reset.

3.8 Removing a simulated PLC instance

You can remove instances from S7-PLCSIM that are powered off. Select the instance you want to remove, and then do one of the following:

- Press the delete key.
- Select the Properties tab icon on the right side of S7-PLCSIM, then click the trash can icon .

Working with SIM views

4

4.1 Introduction to SIM views

For each simulated PLC instance, you can use SIM views to interact with your simulated PLC and process values. SIM views provide the following features:

- SIM tables (Page 29) enable you to monitor and modify I/O points, memory values, and PLC tags.
- Event simulation (Page 32) enables you to simulate events and test your program's event interrupt OB code.
- Sequences (Page 36) enable you to simulate an external process interacting with your program.

A workspace can contain up to eight SIM views. In each SIM view, you can have up to 16 simulation items, including multiple SIM tables, event instances, and sequences. Each SIM table, event, or sequence binds to the newest viable simulated PLC instance. In the Properties tab for each simulated item, you can change the binding of an existing SIM table, event, or sequence to another simulated PLC instance.

Adding SIM views

Click the  icon to open the default SIM view window. To create additional SIM views, click the add new SIM view icon below the last SIM view tab.

You can select a unique reference icon to represent each SIM view on the left side of S7-PLCSIM. To select or change the SIM view icon follow these steps:

1. On the left side of S7-PLCSIM, click the SIM view icon that you want to change.
2. Click the Properties tab icon .
3. Use the scroll bar under "Reference icon" and click to select your new SIM view icon.

The properties tab also shows the contents of each SIM view.

4.2 SIM tables

4.2.1 Creating, editing, and deleting SIM tables

A SIM table can contain tags, I/O addresses, and memory addresses that you want to monitor and modify for a specific simulated PLC. SIM tables are similar to STEP 7 watch tables.

Adding SIM tables to a SIM view

Within each view, you can add up to 16 SIM tables. Select the Library tab icon on the right side of S7-PLCSIM and click "+" next to "SIM Table" to create a table. Select the Properties tab icon on the right side of S7-PLCSIM to configure the following settings:

- Instance binding

  The binding establishes that this table can monitor and modify tags and addresses for the simulated PLC instance that you selected.

- Views
  Here you select the columns you want for this SIM table:
  - Name
  - Address
  - Display Format
  - Monitor/Modify State
  - Consistent Modify
  - Comment

- Tag loading

  You can select and load any or all tags from the simulated PLC that correspond to these areas:
  - Input
  - Output
  - Memory

  When you click the "Load Selected Tags" button, S7-PLCSIM loads these tags into your current SIM table.

Adding tags and addresses directly to a SIM table

A SIM view has a Tags tab to assist with entering tags into a SIM table. To enter PLC tags or Data block tags into a SIM table, follow these steps:

1. Select the SIM table in the SIM view.
2. Select the Tags tab icon on the right side of S7-PLCSIM.
3. Select the instance name that corresponds to the PLC binding for the SIM table.

4. Select Area tags that you want to see:
   - Input
   - Output
   - Memory
   - DB

   S7-PLCSIM displays the PLC tags and DB tags for your instance and area selection.
5. Click any tag to add it to the selected SIM table. If a tag name is truncated, hover over it to see the full name.

You can also enter memory or I/O addresses as well as tag names into a SIM table row.
If you have nested tag structures in STEP 7, you can only add tags up to the first level.

Adding rows to a SIM table

Click the + sign at the bottom of a SIM table to add rows. S7-PLCSIM adds a row below the row that you have currently selected. If you have not selected a row or if you have selected multiple rows, S7-PLCSIM adds the new row at the bottom.

Deleting rows from a SIM table

You can select rows and click the trash can symbol at the bottom of a SIM table to delete the rows that you selected.

Editing SIM table rows

You can edit tag names, display formats, and comments for any row.

You can move rows up or down using the arrow keys at the button of the SIM table.

NOTE

Adding or deleting tags to a SIM table stops monitoring (Page 31) if the SIM table is monitoring. Editing actions such as deleting or moving rows also stops monitoring.

Deleting a SIM table

You can delete a SIM table from the SIM view. Select the SIM table you want to delete, and then do one of the following:

- Press the delete key.
- Select the Properties tab icon on the right side of S7-PLCSIM , then click the trash can icon .

4.2.2 Importing SIM table files

S7-PLCSIM supports importing SIM tables that were exported from the following:

- S7-PLCSIM V17
- TIA Portal V17 and later

To import an exported SIM table file, follow these steps:

1. Open or create a new SIM view (Page 28).
2. Select the Library tab icon , then click the import icon to the right of "SIM Table".
3. If you have only one instance in your workspace, select the import file from your File Explorer window and click "Open".
   If you have more than one instance in your workspace, you are prompted to select the instance for PLC binding. Once selected, click "OK", then select the import file from your File Explorer window and click "Open".

4.2.3 Monitoring and modifying values in a SIM table

You can continually monitor values and modify one or more values for up to three SIM tables simultaneously. Note that some actions, such as downloading a new PLC configuration, modifying SIM table entries, or leaving the SIM view can cause the SIM table to stop monitoring values.

Stopping monitoring of a SIM table

To stop monitoring a SIM table, click the button

Starting monitoring of a SIM table

To start monitoring a SIM table, click the button. If you have stopped monitoring a SIM table or have powered off a simulated PLC instance, use this button to resume monitoring.

NOTE

Binding of a SIM table to a simulated PLC instance

Each SIM table is bound to a specific simulated PLC instance. You established this binding when you created the SIM table (Page 29). You might have stopped, started, or deleted simulated PLC instances since you created the SIM table. If the PLC name from the STEP 7 project appears in red in your SIM table, the table is not bound to a simulated PLC instance. Note that both former and past simulated PLC instances can exist for the same PLC name in STEP 7. Correct the binding in the SIM table properties to restore the binding of the table to the correct simulated PLC instance.

Modifying values in a SIM table

To modify a single value in a SIM table, enter a value in the "Monitor/Modify State" cell that you want to modify. When you press Enter, S7-PLCSIM modifies the value for the current scan cycle.

To modify values for multiple tags or addresses, follow these steps:

1. Display the "Consistent Modify " column for your SIM table.
2. Select the "Consistent Modify" check box beside each value that you want to modify. Enter a modify value for each of the cells that you selected.
3. Click the button to modify all selected values immediately.

If you are monitoring the SIM table, the SIM table continues to update values while you are modifying values.

You can hover over any name in the Name column to see the full name.

SIM table behavior when you download a project from STEP 7

When you download a program from STEP 7, S7-PLCSIM displays in red any tags or addresses in your SIM table that are not in the project that you downloaded or that correspond to unsupported data types. For unsupported data types, you can use a watch table in STEP 7 for monitoring and modifying.

Forced addresses

Forced values from STEP 7 supersede S7-PLCSIM operations. Be aware that forced values might alter the behavior of your simulation.

4.3 Event simulation

S7-PLCSIM enables you to create events for simulating the following events:

- Hardware interrupt (OB 4x)
- Diagnostic error interrupt (OB 82)
- Pull or plug of module (OB 83)
- Rack or station failure (OB 86)

S7-PLCSIM responds to event triggers in the same way a physical CPU would respond. When an event trigger occurs, the STEP 7 program executes the OBs that correspond to the events. STEP 7 updates the diagnostic status of the CPU, and the new status is visible in both S7-PLCSIM and in STEP 7.

4.3.1 Configuring events

To create a new event, follow these steps:

1. Open or create a new SIM view (Page 28).
2. From the Library tab icon on the right side of S7-PLCSIM, click "+" next to "Event" to create an event instance.

3. From the Properties tab icon , you can configure these settings:
   - Event name
   - PLC Binding - Instance name of the simulated PLC instance for this event
   - Event category - Which of the four event categories (Page 32)
   - Event configuration: Module logical address (LADDR) - logical address of the module from the module's device configuration, which is the LADDR parameter (Page 33) for the event interrupt OB
   - IO State - For diagnostic Interrupt events (Page 35)

4.3.2 Configuring LADDR

Every event type that S7-PLCSIM supports requires a module logical address (LADDR) parameter. Configuring LADDR is the same for all event types.

Configuring the LADDR parameter

The LADDR parameter is a 16-bit unsigned decimal integer.

In the configuration of your event, select or enter the module logical address (LADDR) for your device. The integer corresponds to the device's Hardware Identifier in STEP 7. In STEP 7, you can find the Hardware Identifier in the System Constants of the Properties in the Device Configuration.

When you rename racks, stations, or modules in TIA Portal and then download, you see updated device names in the LADDR parameter.

4.3.3 Simulating a pull or plug of modules event

Add a pull or plug of modules event (OB 83) and configure the common event parameters. (Page 32)

Cause

Configure the Cause parameter in the event properties as one of the following:

- IO module removed
- IO submodule removed
- IO submodule plugged in
- Wrong IO submodule plugged in
- IO submodule plugged in with error

4.3.4 Simulating a rack or station failure event

Add a rack or station failure (OB 86) event and configure the common event parameters. (Page 32)

Cause

Configure the Cause from one of the following drop-down menu selections:

- Rack or station error resolved
- Rack or station error occurred

4.3.5 Simulating a hardware interrupt event

Add a hardware interrupt event (OB 4x) and configure the common event parameters. (Page 32)

Channel

Channel corresponds to the IChannel parameter in STEP 7 for the module that triggers the hardware interrupt. From the event instance in the SIM view, click the Channel to select one of the options in the dropdown menu for Event Type:

- For S7-1500 PLC Instances:
  - Rising edge
  - Falling edge
  - Limit 1 Underrun
  - Limit 1 Overrun
  - Limit 2 Underrun
  - Limit 2 Overrun
- For S7-1200 PLC Instances:
  - Rising edge
  - Falling edge
  - HSC CV=RV1
  - HSC direction changed
  - HSC reset
  - HSC CV=RV2

4.3.6 Simulating a diagnostic error interrupt event

Add a diagnostic error interrupt event (OB 82) and configure the common event parameters. (Page 32)

IO State

To configure the IO State parameter, select one or more of the following from the IO State section in the Properties tab:

- Good
- Maintenance required
- Maintenance demanded
- Error

If you select "Good" for the IO State, then you are simulating the event with no errors. If you do not select "Good", you can select any, or all, of the other IO states.

Channel

The Channel corresponds to the Channel parameter in STEP 7 for the module that triggers the diagnostic error hardware interrupt. For each event instance in S7-PLCSIM you can add up to four channels. If you need more channels, configure additional diagnostic error interrupt events for the additional channels.

To add a channel, click the + sign in the event instance. Click the channel to configure its properties:

- Channel number: channel number from 0 to 63
- Error Type:
  - Unknown error
  - Short-circuit
  - Undervoltage
  - Overvoltage
  - Overload
  - Overtemperature
  - Wire break
  - High limit violated
  - Low limit violated
  - Error
- Severity:
  - Failure
  - Maintenance required
  - Maintenance demanded
- Direction: Incoming or Outgoing

Deleting channels

You can delete channels from an event. Select the channel you want to delete and do one of the following:

- Press the delete key.
- Select the Properties tab and click the trash can icon .

4.3.7 Triggering events

To trigger an event, click the trigger event button for the event instance. When you trigger an event, the STEP 7 program calls the OB associated with the event for the event type (IO state).

4.4 Sequences

The purpose of a sequence is to simulate an external process interacting with your program. The sequence can be used to simulate the behavior of external devices on the running program. This allows you to observe the effect of your program logic and to make any adjustments that might be necessary. When you save your project, you save the sequences. You can replay them multiple times to assist in debugging your program.

NOTE

S7-PLCSIM does not support sequences for Advanced instances.

Multiple sequences

You can have multiple sequences in a single project, but you can only run one sequence per CPU instance at a time. When a sequence is running, the "Start sequence" button is not active for any other sequence attached to that CPU instance. You might want to create multiple sequences to see the effect of various adjustments to your program logic rather than modifying a single sequence many times.

4.4.1 Adding and configuring a sequence

To create a new sequence, follow these steps:

1. From the left side S7-PLCSIM, select an existing SIM view or create a new SIM view.
2. From the Library tab icon on the right side of S7-PLCSIM, click "+" next to "Sequence" to create a sequence instance.

3. From the Properties tab icon , you can choose the instance name of the simulated PLC instance for this sequence under PLC Binding and configure the following under Sequence Control:
   - Choose whether to set the sequence to stop automatically when it finishes the last step or continue to repeat until it is stopped manually.
   - Set the default step time interval that will be applied to each subsequent step after the first step. Time interval is shown in hh.mm.ss.ms format and must be set to 00:00:00.500 milliseconds or greater.

4.4.2 Importing sequence files

S7-PLCSIM supports exported sequence files from S7-PLCSIM V17:

- S7-PLCSIM V17
- TIA Portal V17 and later

To import an exported sequence file, follow these steps:

1. Open or create a new SIM view (Page 28).
2. Select the Library tab icon , then click the import icon to the right of "Sequence".
3. If you have only one instance in your workspace, select the import file from your File Explorer window and click "Open".
   If you have more than one instance in your workspace, you are prompted to select the instance for PLC binding. Once selected, click "OK", then select the import file from your File Explorer window and click "Open".

4.4.3 Adding and working with sequence steps

To create a new step in a sequence, click the "+" below the sequence. After you have created a step in the sequence, you can add more steps by clicking the "+" that follows each step. If you need to add a step between two existing steps, click the "+" that appears when you hover over the connector between the steps.



Setting time intervals

Click the time interval in the top right corner of the sequence step or select the step and click the Properties tab to configure a time interval other than the default. The first step in the sequence can begin instantly (00:00:00:000). Each subsequent step will be set at a default of 500 milliseconds, represented as "00:00:00:500". You can set the interval as low as 5 milliseconds, represented as "00.00.00.005".

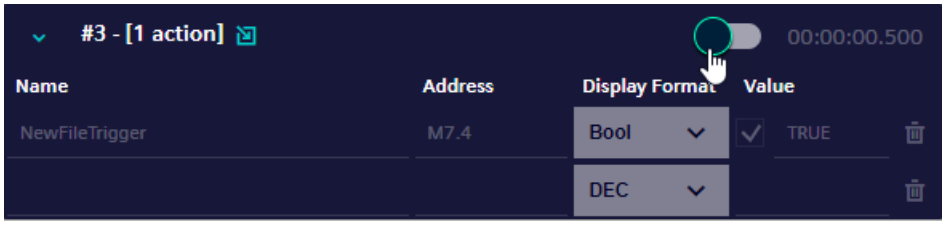
The time displayed in the top right corner of each step is the time interval between when the previous step ends, and that step begins.

Collapsing/hiding a step

Use the arrow beside the step name to collapse or re-display a step in your sequence.

Enabling/disabling step functionality

Use the toggle to enable or disable a step. When the sequence runs, disabled steps are skipped, as are their time intervals.



4.4.4 Working with actions in a sequence step

Each step in a sequence represents a set of actions that are executed at the specified time interval. Sequence steps execute in order from top to bottom.

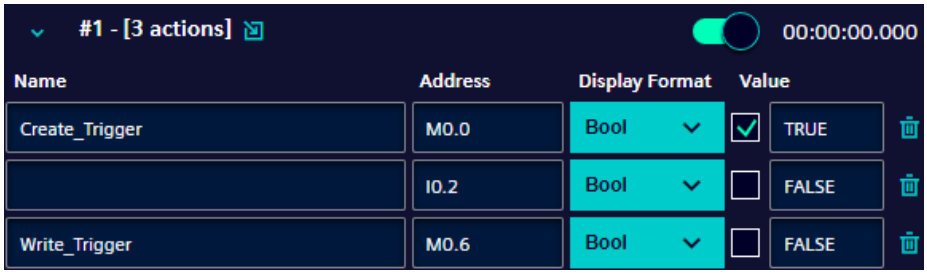
Adding tags and addresses

Enter tag names and input addresses manually or use the Tags tab to assist with entering tag names into an action. To enter PLC or Data block tags, follow these steps:

1. Select the action row in your sequence step in the SIM view.
2. Select the Tags tab icon on the right side of S7-PLCSIM.
3. Select the instance name that corresponds to the PLC binding for the sequence.
4. Select Area tags that you want to see:
   - Input
   - Output
   - Memory
   - DB

   S7-PLCSIM displays the PLC tags and DB tags for your instance and area selection.
5. Click any tag name to add it to the "Name" row in your selected action. If a tag name is truncated, hover over it to see the full name.

Note that you can enter inputs by either tag name or input address. For outputs, memory, or data block values, you must enter associated tag names.



"Display Format" and "Values"

The "Display Format" is set to DEC by default. You can select the display format from the drop-down menu.

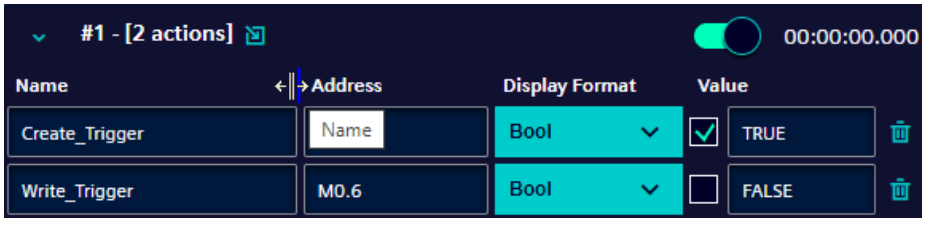
Enter the values before running the sequence (Page 40).

Deleting an action

To delete an action entry, click the trash can icon .

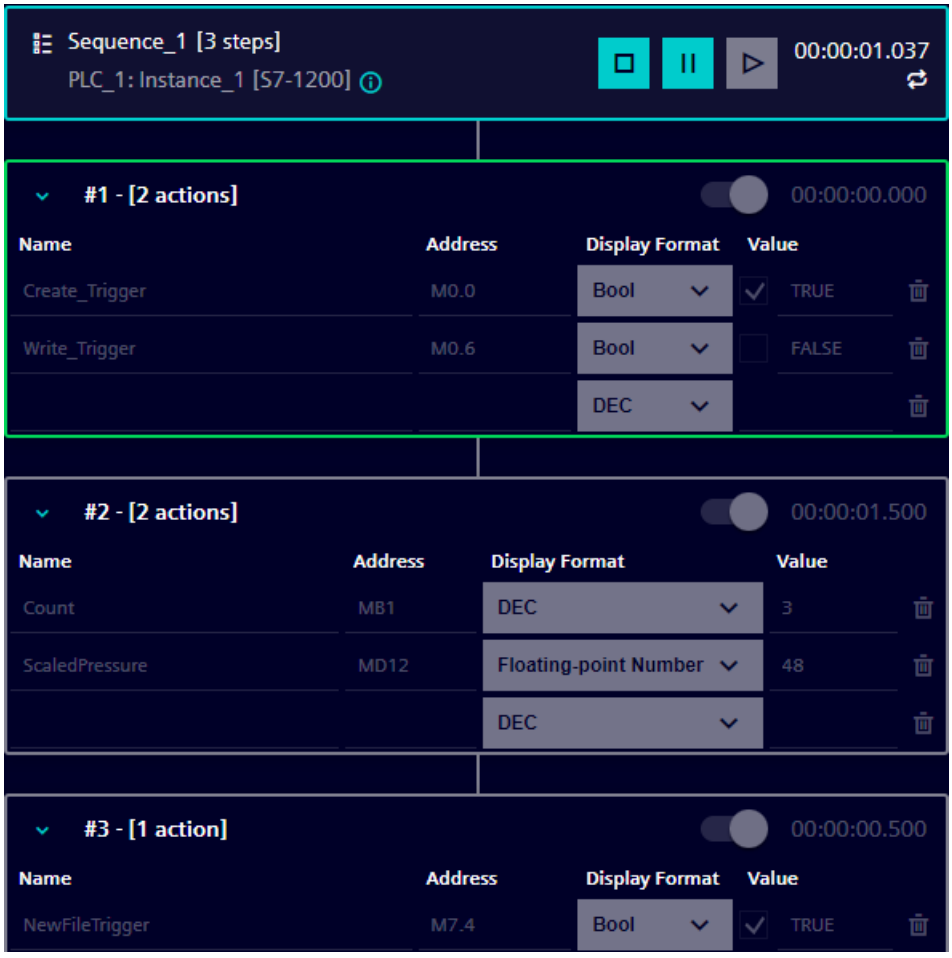
Adjusting column width

To adjust the width of the Name, Address, Display Format, and Value columns in an action, hover over the column divider and drag.



4.4.5 Running the sequence

Click the play button from the sequence to run the sequence. As the sequence runs, each step highlights with a green border and the total time interval counts up.



You can run one sequence per powered on instance.

Note: If a powered on instance is in STOP mode or has been paused from scan control, clicking play on the sequence will set the instance to RUN and run the sequence.

Running the sequence on a loop

To run the sequence on a continuous loop, click the Properties tab and select "Repeat sequence until manual stop" under Sequence Control.

Modifying a sequence

You can only modify a sequence when it is stopped.

Simulating motion control 5

5.1 Motion control overview

S7-PLCSIM supports downloading STEP 7 projects that contain motion control elements.

NOTE
S7-1200 motion control projects
S7-PLCSIM supports motion control for S7-1200 CPUs in a limited capacity.

Technology modules and simulation

S7-PLCSIM simulates a real CPU, but not configured, connected technology modules or other I/O devices.

It is possible to download a project with technology modules for operation of motion control. However, the built-in logic of the technology modules is not part of the simulation. Therefore, S7-PLCSIM cannot simulate the associated motion control instructions.

Motion control simulation limitations

In general, your simulation results might be limited if any of the following are true:

- Your project uses very short cycle times
- Your project has a hardware configuration with a large number of devices
- Your project uses a large number of technology objects

The behavior of your simulation also depends on the type of technology object(s) you use.

5.2 Simulations and homing mode

With a real CPU, homing is set directly, and the state reference is set correspondingly. The hardware inputs are not evaluated in simulation.

5.3 Isochronous mode not possible error

When simulating motion control, you might receive an error message that isochronous mode is not possible.

Example scenario

The TO OutputCam is configured with TM Timer DIDQ in a distributed ET 200SP high feature interface module.

Observation

When TO is activated with MC-OutputCamEnable, Alarm Number 113 displays a message that isochronous mode is not possible.

Cause

The configured output for the cam or cam track technology object or the input for the technology object measuring input cannot be used in isochronous mode.

Solution

To avoid the error, make these configuration changes in the STEP 7 project:

- Configure the I/O in the device configuration as isochronous I/O.
- Make sure that the organization block MC_Servo [OB91] is called synchronously with the bus system.

5.4 Motion OB overruns

For a Standard instance, an overload occurs when events that originate from the same source occur faster than they can be processed. S7-PLCSIM does not process motion OB overruns.

5.5 Simulation deactivates MC-PreServo and MC-PostServo

S7-PLCSIM does not simulate the operations of the motion OBs MC-PreServo and MC-PostServo for Standard simulated PLC instances.

5.6 Technology objects not loaded

If your motion project contains too many technology objects, your motion program might not download to a Standard instance.

5.7 Upgraded projects containing MC-Servo (OB91) and MC-Interpolator (OB92) blocks

You cannot load a motion control project that contains the blocks MC-Servo (OB91) and MC-Interpolator (OB92) to a Standard instance.

To enable simulation, delete these blocks and then recompile your project. When you recompile, the properties of blocks OB91 and OB92 reset to the default values. You can then load your motion control project to your Standard instance.

5.8 Maximum of 5,120 motion control resources

There are motion control resources on each CPU that can be distributed to the technology objects. S7-PLCSIM Standard instances support a maximum of 5,120 motion control resources.

Exceeding the quantity structure

When you load a project into a CPU, STEP 7 checks whether the quantity structure for a configured CPU is correct. An alert message displays if the quantity structure is exceeded.

A project that uses more than 5,120 motion control resources can be downloaded to a simulated PLC instance. There is no message indicating that the quantity structure has been exceeded.

After your program accesses the technology objects, you can observe the following indications if the quantity structure has been exceeded:

- An error message at the block
- A value of zero for the object

5.9 High Speed Counter

S7-PLCSIM does not support simulation for the High_Speed_Counter technology object for S7-1500 compact CPUs.

5.10 Wait after going to RUN mode to access motion control technology objects

The simulated PLC processes motion control commands more slowly than a physical PLC. Because of this difference in processing time, you might encounter an "error" or "busy" state if you attempt to access motion control objects too quickly after going to RUN mode. This is because the objects might not have finished processing completely.

To avoid this situation, wait to access motion control objects after you put the PLC in RUN mode.

5.11 High-Speed Counter functionality for S7-1500C (compact) PLCs

S7-PLCSIM supports simulation for the S7-1500 compact controllers (S7-15xxC).

However, it is not possible to simulate the onboard high-speed counters (HSC) or pulse generators (PTO/PWM). Programs that rely on this functionality might not behave realistically during simulation.

5.12 TO_PositioningAxis

With the TO_PositioningAxis technology object, the simulated drive provides feedback regarding position functions to S7-PLCSIM.

Axis position feedback

The setpoint (position) is integrated with a certain time delay (PT1 element). The result of this calculation is fed back to the TO_PositioningAxis object as the actual position of the axis.

Homing axis

If you have selected the homing mode "Use zero mark via PROFIdrive telegram" in STEP 7, S7-PLCSIM responds immediately to every active (Mode 2, 3, 8) or passive (Mode 4, 5) homing command (MC_Home) with the actual position being set as the home position.

Simulation restrictions

- S7-PLCSIM does not simulate an analog positioning axis.
- With Dynamic Servo Control (DSC) telegram 5, you might need to adjust the STEP 7 settings under "Control loop: Precontrol and velocity gain (Kv factor)" and/or under "Positioning monitoring > Following error" to obtain meaningful simulation behavior. Adjust these settings incrementally until your simulation responds as expected.

5.13 TO_ExternalEncoder

With the TO_ExternalEncoder technology object, the simulated external encoder provides static/fixed position feedback, which is set by homing commands, to S7-PLCSIM.

Homing

Active homing is not possible with the TO_ExternalEncoder object.

If you have selected the passive homing mode "Use zero mark via PROFIdrive telegram" in STEP 7, S7-PLCSIM responds immediately to every passive (Mode 4, 5) homing command (MC_Home) with the actual position being set as the home position.

Error conditions and limitations 6

6.1 Simulating instances with IP address from DHCP server

S7-PLCSIM does not support simulation of Standard PLC instances with "IP address from DHCP server" selected in the Device configuration. For Advanced instances, refer to the S7-PLCSIM Advanced Function Manual.

6.2 Simulated PLC will not RUN with local I/O send clock

If you configure an isochronous OB in your STEP 7 project to run with the send clock of the central I/O system, you cannot set the simulated PLC instance to RUN. Synchronization with the central I/O bus-system is not supported. To mitigate this issue, follow these steps:

1. Access the properties of the OB in your STEP 7 project.
2. Under the "General" tab, select "Cycle time".
3. Click the radio button to change the Cycle time to "cyclic".

You can now set the simulated PLC instance to RUN.

6.3 Synchronization of IRT systems

Synchronization of IRT IO-Systems is not supported.

6.4 Using a proxy server with S7-PLCSIM

If you are using a proxy server with S7-PLCSIM, you must disable the proxy server for local addresses. If you do not disable the proxy server for local addresses, S7-PLCSIM might launch incorrectly.

6.5 Cannot locate S7-PLCSIM Advanced Instances

If you are unable to locate your S7-PLCSIM Advanced instances, follow these steps:

1. From your Windows OS, open the Network and Sharing Center.
2. Click the network that corresponds to the "Siemens PLCSIM Virtual Ethernet Adapter".

3. Select Properties.
4. If any of the following services appear in "This connection uses the following items", ensure the checkboxes for these services are deselected for the "Siemens PLCSIM Virtual Ethernet Adapter":
   - Fortinet VPN service
   - Juniper Network Service
   - Reliable Multicast Protocol

6.6 S7-1200 Fail-Safe simulation

To use S7-PLCSIM to simulate an S7-1200 Fail-Safe CPU, you must use a safety system version that is compatible with the CPU firmware version:

S7-1200 Fail-safe CPU firmware version	System Safety version
V4.2 or below	V2.1 or below
V4.3 or above	Any version

To modify the system safety version, follow these steps in STEP 7:

1. Open the Safety Administration dialog for the CPU.
2. Click "Settings" and select an appropriate system safety version from the drop-down list.

6.7 Value status defaults

The default value status differs between Fail-safe I/O devices and non-Fail-safe (standard) I/O devices as follows:

- Fail-safe I/O device value status defaults to "1", ON, or TRUE
- Standard I/O device value status defaults to "0", OFF, or FALSE

You can modify the reported value status by using SIM tables and sequences.

6.8 Processor requirements for S7-PLCSIM

Because you run S7-PLCSIM and TIA Portal together, your programming device requires a more powerful processor than if you were running either application alone. For acceptable performance, your programming device needs a quad core processor that is equal to, or better than, an Intel® Core™ i5-6440EQ processor, up to 3.40 GHz.

6.9 High feature module support

For physical CPUs, high feature (HF) modules can provide advanced functions for additional requirements.

S7-PLCSIM does not support simulation of any of these advanced functions. For example, high feature power modules do not provide additional retentive memory for simulations.

6.10 HMI type-safe array element display

HMI tags for type-safe array elements might display as "####". This display can be avoided in one of the following ways:

- Do not use arrays in HMI tags. Use single elements only.
- Adjust the maximum acquisition time of the HMI tag to a higher value (such as 10 seconds) to allow the tag to display correctly.

6.11 Saving S7-1500 retentive data block (DB) values

Retentive data block values for an S7-1500 PLC might not be saved unless you power off the PLC before you save the workspace.

S7-1200 projects do not experience this behavior.

6.12 Yellow coloring for fail-safe I/O

S7-PLCSIM does not display I/O addresses for fail-safe devices with yellow coloring or indicate F-CPUs with yellow coloring.

6.13 Scan cycle overflow

The S7-PLCSIM cyclic event queue can overflow when your simulation contains cyclic interrupts. Due to the speed of S7-PLCSIM in relation to the speed of actual hardware, your simulation might not be able to process cyclic OBs within the cycle time you specified.

If the main scan cycle overflows, follow these steps:

1. Select the properties for the simulated PLC instance.
2. From the "Cycle time" options, take one of the following actions:
   - Select "Disable scan cycle monitoring".
   - Select "Specify maximum cycle time" and then increase the value in the "Max Cycle Time" box.

If a cyclic interrupt OB overflows, increase the cyclic time for the OB in STEP 7 and download the PLC from STEP 7.

6.14 Incompatible diagnostic status for simulated S7-1500 PLCs with firmware version 1.8

When you simulate an S7-1500 PLC with firmware version 1.8, S7-PLCSIM might display the diagnostic status "Incompatible". You can ignore this status message because your simulation will function normally.

6.15 Simulating HMI connections

When you simulate HMI connections, the simulated HMI firmware version must be 14.0.0.0 or higher.

6.16 HMI Accessible tags

STEP 7 sets tags to "Accessible from HMI" by default. In the following example, a user has removed HMI accessibility for the tags "Static_3" and "Static_4":

Data_block_1

	Name	Data type	Start value	Retain	Accessible from HMI/OPC UA
1	Static			☐	☐
2	Static_1	Bool	false	☐	☑
3	Static_2	Bool	false	☐	☑
4	Static_3	Bool	false	☐	☐
5	Static_4	Bool	false	☐	☐
6	Static_5	Bool	false	☐	☑
7	Static_6	Bool	false	☐	☑

After you download from STEP 7 to S7-PLCSIM, the tags "Static_3" and "Static_4" are not available in S7-PLCSIM. To work with these tags in S7-PLCSIM, you must select HMI accessibility for the tags in STEP 7 and download the changes to S7-PLCSIM.

6.17 Compile error after attempting to download to S7-PLCSIM

When you attempt to download a STEP 7 program to S7-PLCSIM, you might receive an error that the user program was not compiled and that you should compile the program again.

You might encounter this scenario under one of these conditions:

- When you simulate a program that was uploaded from a physical PLC
- When you simulate a program that was copied and pasted into your project

This error is related to automatically generated program blocks such as MC-Servo and MC-Interpolator OBs in motion control programs.

To resolve the error, delete the automatically generated blocks and then compile the program again by using the command "Compile > Software (rebuild all blocks)". This command will correctly recreate and compile the blocks for use in S7-PLCSIM. However, before deleting the blocks, check the settings in your OBs.

Be aware that this error is not limited to motion control. Any program that contains automatically generated blocks might experience the issue. After you remove the

automatically generated blocks, your program should compile and download to S7-PLCSIM without further error.

6.18 Simulating communication with an HMI and multiple PLCs

If you want to simulate multiple PLCs with an HMI, you might encounter unexpected connection behavior due to the way S7-PLCSIM simulates communication.

You can prevent the problem by starting all PLC simulations before launching your HMI.

NOTE

If you have started your HMI before starting all PLC simulations and then notice unexpected behavior, close and restart the HMI while the PLC simulations remain active.

6.19 Simulating fail-safe programs

Because of differences in cycle times between the simulated PLC and a physical PLC, your fail-safe program might go to STOP unexpectedly.

To correct the situation, increase the F parameter value in STEP 7 by following these steps:

1. From the Device configuration for the F-CPU, go to "Fail-safe > F parameters" and set the "Default F monitoring time for central F I/O" to its maximum allowable time (65535 ms).
2. Download from STEP 7 and then run your simulation again.

6.20 Use STEP 7 safety system library V1.3 or later for Fail-Safe I/O

To successfully simulate and debug a project that contains Fail-Safe I/O, your STEP 7 project must use safety system library V1.3 or later. If your project uses an older version of this system library, your Fail-Safe I/O simulation will not function correctly.

6.21 Working with global libraries

If your STEP 7 project uses a library, you must compile both hardware and software before performing a download to S7-PLCSIM. If you perform only a partial compile, your download will fail.

6.22 Incorrect RET_VAL parameter values for S7-1500 EN_AIRT and DIS_AIRT instructions that are called from multiple OBs

The extended interrupt instructions EN_AIRT and DIS_AIRT function correctly for S7-1500 projects if they are called from the same OB.

These instructions do not function correctly if they are called from more than one OB. If they are called from more than one OB, the RET_VAL parameter value might not be correct.

6.23 HMI password protection levels and simulation

You cannot configure a PLC protection password in your HMI and then download to S7-PLCSIM.

If you attempt to run a simulation with protection levels set, the HMI receives an error and is unable to connect to S7-PLCSIM. S7-PLCSIM does not check protection levels, and therefore indicates that no password is set.

If you have already set protection levels for your PLC, you must remove them before running a simulation. After you are finished with your simulation, you can restore your protection levels.

6.24 STEP 7 online & diagnostics functions

Some online & diagnostics functions do not serve a useful purpose for simulation. Using them might cause unexpected behavior in S7-PLCSIM. These include:

- Assign IP address
- Format memory card
- Assign name
- Update firmware

6.25 Simulation during standby mode

Simulation might stop when your computer or programming device enters "standby" or "sleep" mode. If this happens, communication between STEP 7 and S7-PLCSIM is suspended.

When your programming device becomes active again, it might be necessary to reestablish communication, or in some cases, to restart S7-PLCSIM.

To prevent this situation, disable standby mode for your programming device.

6.26 Working with automatically synchronized network drives

If you store a STEP 7 project that is automatically synchronized on a network drive or in a cloud directory (with Dropbox, Syncplicity or Google Drive, for example), this can lead to data loss if the synchronization takes place only partially or asynchronously. Therefore, storing and editing projects directly on synchronized network drives or cloud directories is not recommended.

If you must use synchronization, make sure that it is implemented in such a way that the current (local) project data replaces the project data on the network drive or in the cloud directory.

Always close your projects before synchronization, and then make sure that all project directory files are synchronized together and completely.

6.27 Decimal place character

Do not enter commas, for example, "1,23", to indicate decimal places.

Use the international format with a period as the decimal place, for example, "1.23".

6.28 Modbus V5.2 not supported

S7-PLCSIM does not support Modbus V5.2, but does support other versions of Modbus.

6.29 Error returned by High_Speed_Counter instruction

If you use S7-PLCSIM to simulate a high-speed counter in a TM Count module, the High_Speed_Counter instruction returns the error 16#80C7.

The High_Speed_Counter instruction expects that the module has set a status ready (STS_READY) bit. Because S7-PLCSIM does not simulate module behavior, the instruction returns an error.

The STS_READY bit is in the input area of the module at offset 13.4. If the input area of your TM Count module begins at %I32, for example, then the STS_READY bit is at %I45.4.

You can set the STS_READY bit to avoid the error condition that the High_Speed_Counter instruction returns.

Setting STS_READY from a SIM table

Consider an example using an S7-1500 with a TM Count 1x24V module where the TM Count 1x24V begins at %I.0. Note that you can find this address in the device configuration for your technology module.

To set the STS_READY bit for the module to TRUE, enter the corresponding I address for offset 13.4 in your SIM table. Set the modify value to TRUE.

6.30 Restrictions for instructions

S7-PLCSIM simulates instructions for CPUs as close to reality as possible, but some instructions are not supported.

Unsupported instructions are treated as non-operational. The value of unsupported instructions is always "OK". S7-PLCSIM does not support the following instructions:

- DT_TOPOL
- PORT_CFG
- InitIOSystemSync
- StartIOSystemSync
- GetIOSystemSync
- GetPNWorkingClock

T_CONFIG instruction

The instruction T_CONFIG works for Advanced instances only via TCP/IP, but not via Softbus.

6.31 Simulating the Drive controller

S7-PLCSIM simulates only the standard CPU functionality of the SIMATIC Drive Controller.

S7-PLCSIM does not simulate the following:

- Technology functions of the onboard I/O
- SINAMICS Integrated
- PROFINET IO
- PROFIBUS DP

You can only simulate the integrated inputs/outputs of the X122, X132, and X142 interfaces as binary inputs/outputs.

Index

A

Access protection, 17

Adding sequence steps, 37

Automatically-synchronized network drives, 51

Avoiding STOP mode in Fail-Safe simulations, 49

C

Cause parameter
  pull or plug of modules event, 33
  rack or station failure event, 34

Channel parameter (Hardware interrupt), 34

Communication disruption due to standby mode, 50

Communication modes, 25

Compile error when downloading, 48

Configuring LADDR, 33

Contact information, 6

Copy protection, 17

Counting, measurement and position detection, 19

Cycle time, 21

D

Data logging, 18

Decimal place character, 51

Diagnostic error interrupt event, 35

Diagnostic errors, 17

Documentation, 6

Downloading to a PLC from STEP 7, 23

E

Essentials view
  overview, 15
  creating a new instance, 20
  scan control, 21-22

ET 200SP and ET 200pro technology support, 19

Event configuration, 32

Event simulation, 32
  configuring LADDR, 33
  pull or plug of modules, 33
  rack or station failure, 34
  hardware interrupt, 34
  diagnostic error interrupt, 35
  triggering events, 36

F

Fail-safe yellow coloring, 47

F-monitoring time, 18

Forced address, 32

G

Global libraries, 50

H

Hardware interrupt event, 34

HMI Accessible tags, 48

HMI connections, 48

HMI password protection levels, 50

I

Import SIM sequence files, 37
Import SIM table files, 31
Incompatible status display, 48
Incorrect parameter values, 50
Information resources, 6
Instruction simulation support, 18
Interrupt events
  simulating, 32
  configuring, 32
  LADDR parameter, 33
Introduction, 11

K

Keyboard shortcuts, 15, 15
Know-how protection, 17

L

LADDR, 33
LEDs, 18
License type, 21

M

Manuals, 6
Mapping to a network adapter, 26
Map to adapter, 21
MC-Interpolator, 42
MC-Servo, 42
Memory card, 18
Memory reset (MRES), 27
Memory usage, 24
Motion control, 19
  S7-1500 and ET 200SP, 19
  limitations, 41
  technology objects, 41
  homing mode, 41
  isochronous mode error, 41
  alarm 113, 42
  errors from technology objects, 42
  loading project with MC-Servo and MC-Interpolator , 42
  maximum resources, 43
  quantity structure, 43
  TO_PositioningAxis, 44
  TO_ExternalEncoder, 44
MRES, 27

N

Network drives, 51
Network interfaces as adapters, 26

O

Online & diagnostics functions, 50

P

PID Control technology, 19
PLCs, simulated vs. real, 17
Pull or plug of modules event, 33

Q

Quantity structures, 24

R

Rack or station failure event, 34
Recipes, 18
Removing instances, 27
Reset, 26
Reset a simulated PLC, 26
Running the sequence, 40

S

S7-1200
  Fail-Safe, 18
  technology support, 19
S7-1200 G2 technology support, 19
S7-1500 technology support, 19
Scan control, 21
Scan cycle overflow, 47
Sequence actions
  adding tags and addresses, 38
  deleting an action, 39
Sequences
  overview, 36
  multiple, 36
  adding and configuring, 36
  importing files, 37
  steps, 37
  setting time intervals, 38
  actions, 38
  running the sequence, 40
Sequence steps
  adding, 37
  configuring, 38
Service and support, 6
Setting properties for a PLC instance, 21
Settings, 15
SIM tables
  creating and editing, 29
  importing files, 31
  monitoring and modifying values, 31
Simulating
  pull or plug of modules, 33
  rack or station failure, 34
  diagnostic error interrupt, 35
  motion control in run mode, 43
  HMI connections, 48
  communication with an HMI and multiple PLCs, 49
SIM views, 28
Single adapter and multi adapter modes, 25
Sleep mode, 50
Softbus, 25
Standby mode, 50
Starting a simulation
  from desktop icon or Start menu, 12
  from STEP 7, 12
  from the S7-PLCSIM library, 20
Starting S7-PLCSIM, 12
STEP 7 online & diagnostics functions, 50
Support, 6

T

TCP/IP, 25
Technology
  S7-1200, 19
  S7-1200 G2, S7-1500, ET 200SP, ET 200pro, 19
  modules, 41
Time-based IO, 19
Time scaling, 24
Triggering events, 36

U

Using the STEP 7 safety system library, 49

V

Virtual time scaling, 24

W

Web server, 18
Workspaces, 12

X

X1 interface, 21

Y

Yellow coloring for Fail-safe, 47