SIEMENS

SIMATIC

Engineering Tools
S7-PLCSIM V16 online help

Programming and Operating Manual

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Legal information

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⚠ 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.

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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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Security information

1

Siemens provides products and solutions with industrial security 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 security 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 security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

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 customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (https://www.siemens.com/industrialsecurity).

S7-PLCSIM overview

2

2.1 Introduction to S7-PLCSIM

S7-PLCSIM supports debugging and validating a single PLC program without requiring actual hardware. S7-PLCSIM allows you to use all STEP 7 debugging tools, including the watch table, program status, online & diagnostics functions, and other tools.

S7-PLCSIM also provides tools that are unique to S7-PLCSIM, including a SIM table, sequence editor, events editor, and scan control.

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

1. Configure your PLC and any associated modules in STEP 7
2. Program your application logic
3. Download the hardware configuration and program to S7-PLCSIM in either Compact view or Project view

2.2 What's new in S7-PLCSIM V16?

S7-PLCSIM V16 introduces the following new or updated functionality:

Feature	Topic
Support for the latest hardware and firmware	Hardware and firmware support (Page 11)
Event simulation	Event simulation overview (Page 96)
Scan control	Scan control overview (Page 102)
SIM table enhancements: Reordering columns, browse function	SIM table editor description (Page 59) Browsing to a STEP 7 table to create a SIM table (Page 66)

2.3 A note about input values

Input values from the S7-PLCSIM SIM table editor and sequence editor in Project view are equivalent to the inputs on a physical CPU. These are the values that are copied to the process image at the start of each scan cycle.

In STEP 7, you cannot modify input values. S7-PLCSIM allows you to assign inputs in SIM tables and sequence tables. This feature allows you to simulate program behavior with different input values.

2.4 Installation setup, requirements, repair, and removal

Installing TIA Portal does not install S7-PLCSIM. Installing S7-PLCSIM V16 also installs S7-PLCSIM V5.4.8 for simulation of S7-300 and S7-400 CPUs.

You can install multiple versions of S7-PLCSIM on the same computer without interference.

Supported operating systems

S7-PLCSIM V16 supports the same set of operating systems as TIA Portal V16. Refer to the TIA Portal online help readme for a definitive list of supported operating systems.

If you have already installed TIA Portal V16 successfully, you can install S7-PLCSIM V16.

Hibernation mode and power saving settings

Hibernation mode or sleep mode can disrupt communication connections between STEP 7 and S7-PLCSIM. Potentially, you could lose unsaved work.

To prevent such problems, apply these Windows operating system settings:

- Disable hibernation mode.
- Set the power saving options to never put the computer to sleep. This setting ensures that a timer does not automatically trigger hibernation.
- Do not trigger hibernation when using S7-PLCSIM.

Hardware requirements

S7-PLCSIM V16 has the same hardware and software requirements as TIA Portal V16.

For acceptable performance, use a programming device with a quad core processor that is equal to, or better than, an Intel® Core™ i5-6440EQ 3.40 GHz.

Refer to the Installation section of the TIA Portal V16 online help for specific details.

Repairing and uninstalling S7-PLCSIM

S7-PLCSIM appears in the installed programs section of Microsoft Windows. Click the "S7-PLCSIM V16" entry to uninstall or to modify (repair) the installation.

You can repair or uninstall S7-PLCSIM V16 without affecting other installed versions of S7-PLCSIM or any other installed SIMATIC software.

2.5 Supported hardware

2.5.1 Hardware and firmware support

Your STEP 7 license determines which CPUs you can simulate with S7-PLCSIM.

STEP 7 Basic and S7-PLCSIM

With a STEP 7 Basic license, you can simulate the following CPU families in S7-PLCSIM:

- S7-1200 with firmware version 4.0 through version 4.4
- S7-1200F with firmware version 4.1 through version 4.4

If your project contains CPUs with older firmware versions, the "Start simulation" button in the TIA Portal is not selectable and you cannot start a simulation.

You can start and run two S7-1200 or S7-1200F simulations at the same time with any combination from these two CPU families.

STEP 7 Basic does not support the following CPU families:

- S7-1500 and S7-1500F
- ET 200SP and ET 200SPF

STEP 7 Professional and S7-PLCSIM

With a STEP 7 Professional license, you can simulate any of the following CPU families:

- S7-1200 with firmware version 4.0 through version 4.4
- S7-1200F with firmware version 4.1 through version 4.4
- S7-1500 and S7-1500F with any firmware version up to version 2.8
- ET 200SP and ET 200SPF with any firmware version up to version 2.8

You can start and run two simulations at the same time with any combination of these CPUs.

2.5.2 Hardware with upgraded firmware

S7-PLCSIM cannot simulate CPUs with a newer firmware version than the highest supported version at the time of the S7-PLCSIM release (Page 11).

If you change the firmware version of your hardware and then attempt to download to an existing S7-PLCSIM project, STEP 7 displays a message. The message states that you must delete and replace the existing device configuration in S7-PLCSIM to load the hardware configuration.

You can only download the hardware configuration from STEP 7 if S7-PLCSIM is compatible with the firmware version of the hardware. For example, if you have installed or updated a device's firmware in STEP 7 using a hardware support package (HSP), you might not be able to download to S7-PLCSIM.

2.5.3 Other S7-PLCSIM products

Siemens provides other S7-PLCSIM products in addition to S7-PLCSIM V16.

S7-PLCSIM V5.4.8

S7-PLCSIM V5.4.8 supports simulation for the following SIMATIC CPU families:

- S7-300
- S7-300F
- S7-400
- S7-400F

S7-PLCSIM V16 and S7-PLCSIM V5.4.8 are separate software applications. You can install and run both of them on the same machine at the same time. You can simulate communication using this combination of applications.

S7-PLCSIM Advanced

S7-PLCSIM Advanced is a product that provides advanced simulation capabilities. You can install S7-PLCSIM and S7-PLCSIM Advanced on the same machine if the S7-PLCSIM version is V15 or higher and the S7-PLCSIM Advanced version is V2.0 or higher. You cannot run both S7-PLCSIM and S7-PLCSIM Advanced at the same time.

2.6 S7-PLCSIM documentation

2.6.1 Online help system

A comprehensive online help system describes the features and procedures you need to work more effectively with S7-PLCSIM and STEP 7. The online help system opens in a separate window from the S7-PLCSIM user interface so that you can continue to work while you obtain the information you need.

You can launch the online help in the following ways:

- Select the Help > Show help menu command.
- Click the F1 key anywhere in the application.

The online help system includes help for both S7-PLCSIM and the TIA Portal under the "Content" tab:

- The S7-PLCSIM help is designated as "S7-PLCSIM V16 online help".
- The TIA Portal help is designated as "Information System".

Note

TIA Portal Information System

The TIA Portal Information System that is included with S7-PLCSIM is a subset of the complete TIA Portal Information System. The chapters and topics are those most relevant to S7-PLCSIM. For the complete TIA Portal Information System, access the help from the TIA Portal Help menu.

Intended audience

The help documentation is intended for personnel with knowledge and experience in the following technologies:

- Industrial automation and automation engineering
- PLC programming
- SIMATIC PLCs
- STEP 7

Searching the online help

When you search for information, results might show matching topics from both the S7-PLCSIM help and the TIA Portal help.

As an example, search on the term "display format" in the "Search for:" box on the left-hand side of the information system. The results of the search will contain both S7-PLCSIM and TIA Portal topics.

If you want to view only the S7-PLCSIM help search results, sort on the "Position" column header and the S7-PLCSIM help search results are grouped together. In this way you can be sure you are seeing all of the S7-PLCSIM search results. This makes it easier for you to determine which S7-PLCSIM help topic will address your display format question in the way that is most useful to you.

Online help available in electronic format

The online help is also available in PDF and HTML5 format from the Siemens Industry Online Support (https://support.industry.siemens.com/cs/us/en/view/109761511) Web site. In addition to the S7-PLCSIM online help you can find additional information at this Web site:

- News about the latest information on your products
- Documentation for your products
- Forums for worldwide knowledge exchange between users and experts
- Your local contact for Siemens Industry products and services
- Information about on-site services, repairs, spare parts, and much more

2.6.2 Readme file

The S7-PLCSIM readme file provides additional information about S7-PLCSIM.

S7-PLCSIM readme file

The readme file is available at the time you install S7-PLCSIM.

You can access the readme file during installation by clicking the "Read product information" button.

You can access the readme file after installation from the Help folder in your installation location.

S7-PLCSIM installs one readme file for each language:

Language	File name
Chinese (simplified)	ReadMePE2MzhCN.chm
English	ReadMePE2MenUS.chm
French	ReadMePE2MfrFR.chm
German	ReadMePE2MdeDE.chm
Italian	ReadMePE2MitIT.chm
Spanish (modern)	ReadMePE2MesES.chm

Updates to the readme are posted online

The readme file is updated as needed. Updates are posted online in each language in PDF format.

If you encounter unexpected behavior in S7-PLCSIM, consult the online version of the readme file to see if there is a topic that addresses your issue. Visit the Siemens Industry Online Support website (https://support.industry.siemens.com/cs/?lc=en-US) and search for "S7-PLCSIM V16 readme".

S7-PLCSIM concepts

3

3.1 Two views: Compact view and Project view

With S7-PLCSIM, you can choose between two different user interfaces: Compact view and Project view. The view you select will depend on how you want to use S7-PLCSIM in conjunction with TIA Portal.

Compact view

Compact view (Page 31) consists of one small window with a limited number of controls and functionality.

This view will be useful to you if you want to debug your program in STEP 7 rather than in the S7-PLCSIM Project view.

S7-PLCSIM launches in Compact view by default. If you want to make Project view the default view, you can make this change in the Project view main menu under Options > Settings.

Project view

Project view (Page 33) contains the full functionality of S7-PLCSIM. Project view has the same look and feel as the user interface of the TIA Portal.

Project view consists of several components:

- Main menu and main toolbar
- Options and settings (accessed from the main menu)
- Project tree
- Device view
- SIM table editor
- Sequence editor
- Events editor
- Online tools, including the operator panel and scan control settings

Project view is useful to you if you prefer to debug your program using the full functionality of S7-PLCSIM.

Switching between Compact view and Project view

Regardless of which view you selected as the default, you can easily switch between Compact view and Project view by clicking the switch views  button.

3.2 Starting and ending a simulation

Both Compact view (Page 31) and Project view (Page 33) have a power button for starting and ending a simulation.

Starting and ending simulations are separate tasks from creating or opening S7-PLCSIM projects (Page 49).

Starting a simulation

To start a new simulation, select your desired CPU family from the drop-down list (Page 28) and then click the power button to launch the simulation. The power button is green when your simulation is running.

Ending a simulation

You can end an active simulation by clicking the power button again.

You can end a simulation regardless of whether there is an open S7-PLCSIM project. If there is an open project and you are in Project view, the project tree shows this state.

In Compact view, the power button is gray and the CPU family selector is selectable when you have ended a simulation.

Ending a simulation can be useful in the following cases:

- Simulating a power cycle (Page 27)
- Changing the CPU family (Page 28)

Power cycling the CPU

When you end a simulation, S7-PLCSIM saves your configuration. When you click the power button again, the new simulation starts with the same configuration it had when you ended it. This has the effect of power cycling the simulated CPU.

Changing the CPU family

You must end the active simulation to change the CPU family you are simulating (Page 28).

3.3 Simulation states

S7-PLCSIM recognizes the following types of PLC simulation:

- Unconfigured PLC (powered on, but no downloaded STEP 7 project)
- Configured PLC (powered on, with a downloaded STEP 7 project)
- No simulation (powered off)

Unconfigured PLC

The simulated PLC is unconfigured if you have started a simulation for a PLC from STEP 7 but have not yet performed a project download from STEP 7. The simulated CPU is powered on.

In this state, S7-PLCSIM displays the PLC name as "Unconfigured PLC".

Configured PLC simulation

S7-PLCSIM simulates a configured PLC after you have downloaded a specific PLC from STEP 7. In this case, S7-PLCSIM displays the PLC name and CPU type, for example, "PLC_1 [CPU 1215 DC/DC/DC]". The simulated CPU is powered on.

No simulation

S7-PLCSIM is in the "no simulation" state when the simulated PLC is powered off. The power button is gray, or disabled, in this state.

If you are in the "no simulation" state, you can still create an S7-PLCSIM project and set up your SIM tables and sequences in Project view. If you start S7-PLCSIM from the Windows desktop or Start menu (Page 24), it has no simulation.

3.4 Supported STEP 7 programs for simulation

S7-PLCSIM accepts the download of any valid program for a supported, configured CPU. With some exceptions, the downloaded program should go to RUN mode without changes.

In the following cases, consider these changes to your STEP 7 program before downloading the program to S7-PLCSIM:

- **Fail-safe programs**. S7-PLCSIM supports fail-safe program simulation. You might, however, need to increase the F-cycle time because scan times for the simulation will be longer.
- **Motion control programs**. To successfully simulate motion control programs, you might need to increase the motion cycle time because scan times for the simulation will be longer.

Your STEP 7 configuration might support newer hardware than S7-PLCSIM recognizes. If you have installed devices with an HSP (hardware support package), those devices might not appear in S7-PLCSIM's Device configuration.

3.5 Differences between a simulated PLC and a physical PLC

3.5.1 Differences common to all supported PLCs

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

I/O device support

S7-PLCSIM does not support specialized I/O device functionality. It provides only process image and direct access simulation of I/O registers.

You can observe this specialized functionality with, for example, analog output range monitoring. On a physical device, if the STEP 7 program writes an out-of-range value to an analog output register, the analog module returns a diagnostic error. This does not occur in S7-PLCSIM.

PC-based controllers

S7-PLCSIM V16 does not support simulation of a PC-based controller.

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 is not the same as if PLC firmware performed those actions.

If your program is highly dependent on 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.

Flashing LEDs

STEP 7 and other tools can only flash LEDs on physical PLCs. You cannot flash the LEDs in either view of S7-PLCSIM from STEP 7 or any other tool.

Features that require an SD memory card

S7-PLCSIM does not simulate CPU functionality that requires an SD memory card.

Recipes

S7-PLCSIM does not support recipes.

Web server

S7-PLCSIM does not support Web server functionality.

PROFIBUS

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

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.

Timing dependencies

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

3.5.2 S7-1200: Technology module and technology object support

S7-PLCSIM does not simulate the following technology modules and technology objects:

- Counting
- PID
- Motion control

3.5.3 S7-1500: Technology module and technology object support

Technology module support

S7-PLCSIM supports the following technology modules for the S7-1500 and S7-1500F:

- Counting and measurement
- PID
- Time-based I/O
- Motion control

Technology object support

S7-PLCSIM supports the following technology objects for the S7-1500 and S7-1500F:

- Counting and measurement
- PID
- Motion control

3.5.4 ET200SP: Technology module and technology object support

Technology module support

S7-PLCSIM supports the following technology modules for the ET 200SP and ET 200SPF:

- Counting and measurement
- PID
- Time-based I/O
- Motion control

Technology object support

S7-PLCSIM supports the following technology objects for the ET 200SP and ET 200SPF:

- Counting and measurement
- PID
- Motion control

Startup options

4

4.1 Overview of startup options

There are several options for starting S7-PLCSIM:

- Startup from the TIA Portal
- Startup from the Windows desktop icon or start menu
- Startup from an existing S7-PLCSIM project

Note that you can start multiple instances of S7-PLCSIM and run two concurrent simulations (Page 109).

After you start S7-PLCSIM, you can change your default start view (Page 43).

Enabling simulation support

You must enable simulation support for any program you intend to download to S7-PLCSIM. If you start the simulation from the TIA Portal, STEP 7 prompts you to enable simulation support. If you start simulation by opening S7-PLCSIM or opening a saved simulation project, you must enable simulation support from STEP 7.

To enable simulation support in STEP 7, follow these steps:

1. Open the project properties.
2. Select the Protection tab.
3. Select the check box to support simulation.
4. Compile the project.

4.2 Starting a simulation from TIA Portal

After you have installed S7-PLCSIM, the "Start simulation" command is available in STEP 7 for the following devices:

- S7-1200
- S7-1500
- ET 200SP

If you have know-how protected blocks in your program, you must remove the know-how protection. If not, you can start simulation with no prerequisites.

Enabling simulation for know-how protected blocks

To be able to simulate blocks with know-how protection, follow these steps in STEP 7:

1. Remove the know-how protection from the protected blocks. You must enter the password to remove the know-how protection.
2. Enable simulation support (Page 23) for the STEP 7 project.
3. Compile the project.

Starting a simulation when S7-PLCSIM is not running

To start S7-PLCSIM from STEP 7, select your CPU in the project tree and choose one of the following methods:

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

STEP 7 loads the project to S7-PLCSIM. By default, S7-PLCSIM launches in Compact view with no open project.

Downloading from STEP 7 to a running instance of S7-PLCSIM

If you want to use to an open instance of S7-PLCSIM, download the project from STEP 7 to the PLCSIM PG/PC interface.

4.3 Starting from a desktop icon or start menu

You can start S7-PLCSIM from the desktop icon or from the Windows start menu. When you start from the desktop icon or start menu, S7-PLCSIM launches without an open project.

4.4 Starting from an existing S7-PLCSIM project

You can use previously saved S7-PLCSIM projects for simulation. The S7-PLCSIM project contains the SIM tables and sequences that you previously created and saved. Your project also contains the hardware and software configuration you downloaded to the simulation. The configuration is automatically restored to the simulation when you open the S7-PLCSIM project.

There are two ways you can open an existing S7-PLCSIM project:

- Double-clicking a project file on your programming device
- Open a project from the S7-PLCSIM main menu or main toolbar in Project view

When you open a saved project, S7-PLCSIM opens all editors that were open when you saved your project.

Opening a project from a saved file

You can open an existing project by double-clicking a *.sim16 project file. In this case, S7-PLCSIM launches in Project view, regardless of the application setting for "Start view":

- The Project view opens and contains the SIM tables, event tables, and sequences for the project.
- If you previously downloaded a STEP 7 project to S7-PLCSIM, S7-PLCSIM goes online with the running simulation.

Opening a project from S7-PLCSIM

You can open a project in Project view by:

- Navigating to Main menu > Project > Open project
- Clicking the "Open project" button on the main toolbar

Note

You cannot open a project while you are in Compact view. You must switch to Project view to open a project.

4.4.1 Opening a project from a previous version

You can open an S7-PLCSIM V15.1 project with S7-PLCSIM V16. When you select the project, S7-PLCSIM notifies you that the project must be converted to an S7-PLCSIM V16 project (.sim16). Upgrading the project creates a new project folder for the upgraded project. Once the upgrade is complete, S7-PLCSIM opens the upgraded .sim16 project. The .sim16 project is no longer compatible with S7-PLCSIM V15.1.

Versions older than V15.1

You cannot open S7-PLCSIM projects from versions older than S7-PLCSIM V15.1. To open these projects with S7-PLCSIM V16, follow this procedure:

1. Open the project with S7-PLCSIM V15.1.
2. Save the project as an S7-PLCSIM V15.1 project.
3. Open the .sim15_1 project with S7-PLCSIM V16.

4.4.2 Using an existing S7-PLCSIM project for simulation and debugging

Once you have opened the S7-PLCSIM project, the simulation is active and ready for debugging in either S7-PLCSIM or STEP 7.

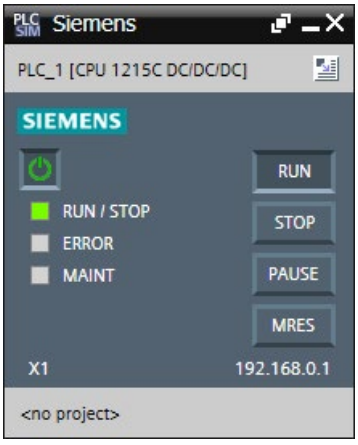
If you do not have the STEP 7 project that you previously used to create the simulation, you can still use STEP 7 for debugging. Open a new STEP 7 project in the TIA Portal and upload the running simulation. You can then go online in STEP 7 with the running simulation.

Modifying an active simulation

5

5.1 Simulating a power cycle

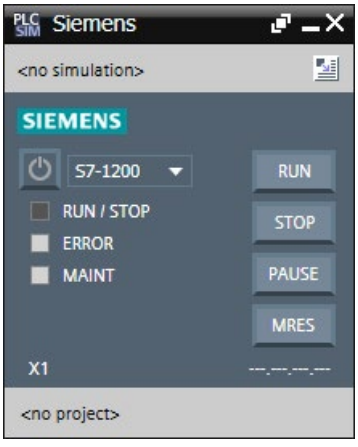
The following Compact view shows a running, configured S7-1200 CPU simulation.



Notice the following:

- The power button is green.
- The configured CPU name is displayed.
- The communications (IP) address is shown.
- The LEDs are active.
- The RUN, STOP, and MRES buttons are enabled.

Clicking the power button to turn off the simulation results in the following appearance:



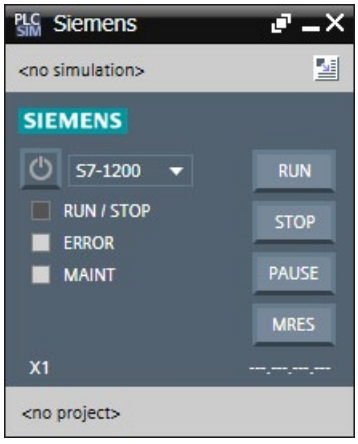
Note what has, and has not, changed in the user interface:

- The power button is gray.
- The configured CPU name is still displayed.
- The communications (IP) address is removed.
- The LEDs are disabled.
- The RUN, STOP, and MRES buttons are disabled.
- The CPU family selection is visible.

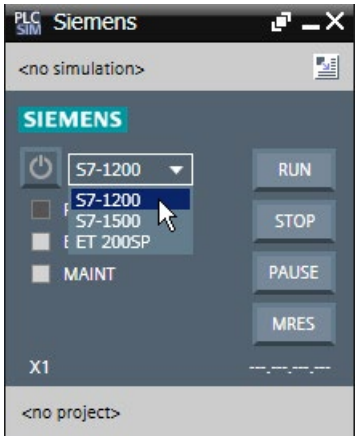
The virtual PLC configuration is retained when you stop the simulation. If you click the power button again, the new simulation starts with the same configuration. This has the effect of power cycling the previous simulation.

5.2 Changing the CPU family

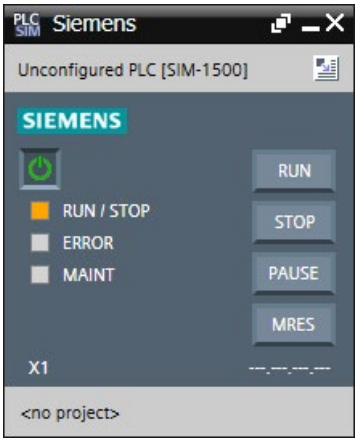
You can also change the CPU family for the simulation. Here, the simulation is in Compact view in the powered off state:



The drop-down list for the CPU family is visible. Clicking the down arrow displays the list of supported CPU families:



If you change CPU families and then click the power button, S7-PLCSIM starts a new, unconfigured simulation of the family you selected. S7-PLCSIM discards the configuration from the previous simulation. If you click S7-1500, for example, the Compact view appears as follows:



In an unconfigured simulation, note the following:

- S7-PLCSIM displays an Unconfigured PLC name of the CPU family you selected.
- No communications (IP) address is shown.
- The RUN, STOP, PAUSE, and MRES buttons are disabled.
- You must download a STEP 7 project to simulate a new CPU.

Appearance in Project view

Project view shows an open S7-PLCSIM project if you have created or opened a project. You can use the operator panel (Page 40) in Project view to change the simulation family. Starting a new simulation causes the Project tree to update to show the new, unconfigured simulation.

5.3 Resetting memory (MRES)

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

Resetting memory

To reset the memory on a powered-on simulated CPU, click the MRES button.

S7-PLCSIM performs the following actions during a memory reset:

- Power cycles the simulated PLC.
- Breaks the online connection between STEP 7 and S7-PLCSIM, if STEP 7 was online with S7-PLCSIM.

Result: M memory and Data Block values return to their start values. The simulated PLC is powered on.

You can perform a memory reset at any time regardless of the scan mode (RUN, STOP, HOLD, PAUSED, ERROR).

You can reset memory from either the Compact view or the operator panel (Page 40) in the Project view.

Working in Compact view

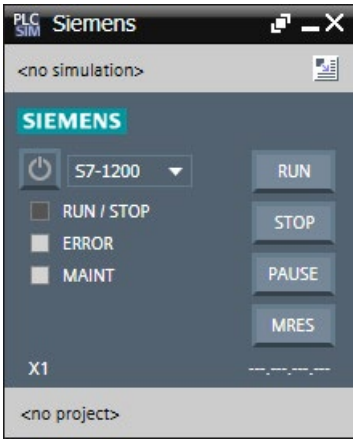
6

Compact view is the default view for S7-PLCSIM and uses less screen space than the Project view (Page 33).

If you prefer to launch in Project view, you can change the default view from the Project view main menu under Options > Settings.

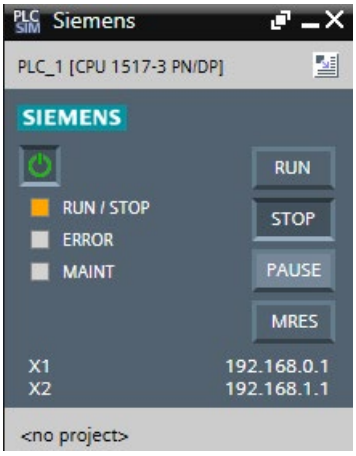
You cannot perform project actions or run sequences in Compact view. You must switch to Project view to use these functions.

When you launch S7-PLCSIM in Compact view, S7-PLCSIM opens with no project and no simulation:



Description of the Compact view user interface

When configured and connected to a CPU, Compact View has the following appearance:



Compact view has the following sections:

Section	Description
Title bar	The title bar displays the S7-PLCSIM logo and three control buttons: • "Keep on top" button - Causes Compact view to display on top of all other windows • Minimize button - Standard Windows functionality • Close button - Standard Windows functionality
CPU name	This section of Compact view shows the name and type of the virtual PLC. Different text is displayed based on the state of the application: • "<no simulation>": S7-PLCSIM has no open simulation • "Unconfigured": S7-PLCSIM has an unconfigured simulation. You have not yet downloaded a project from STEP 7 to S7-PLCSIM • CPU name and CPU type: S7-PLCSIM has a configured simulation. The CPU name and CPU type correspond to the STEP 7 project's device configuration. Example: "PLC_1 [CPU 1517-3 PN/DP]" The CPU name section also contains the "Switch to Project view" button.
CPU control panel	The control panel includes the power button and these LEDs: • RUN / STOP • ERROR • MAINT Compact view also provides buttons for these functions: • RUN • STOP • PAUSE • MRES These controls are only operational when S7-PLCSIM has an active, configured simulation. This section also displays the IP address for each interface of a simulated CPU. The Compact View control panel functions are the same as the operator panel (Page 40) in the Project View.
Project name	The project name section of Compact view displays the name of the S7-PLCSIM project, if a project exists. You do not need an S7-PLCSIM project to run a simulation. When you do not have an open S7-PLCSIM project, this section displays "<no project>". When you have created or opened an S7-PLCSIM project, you see the name of your project.

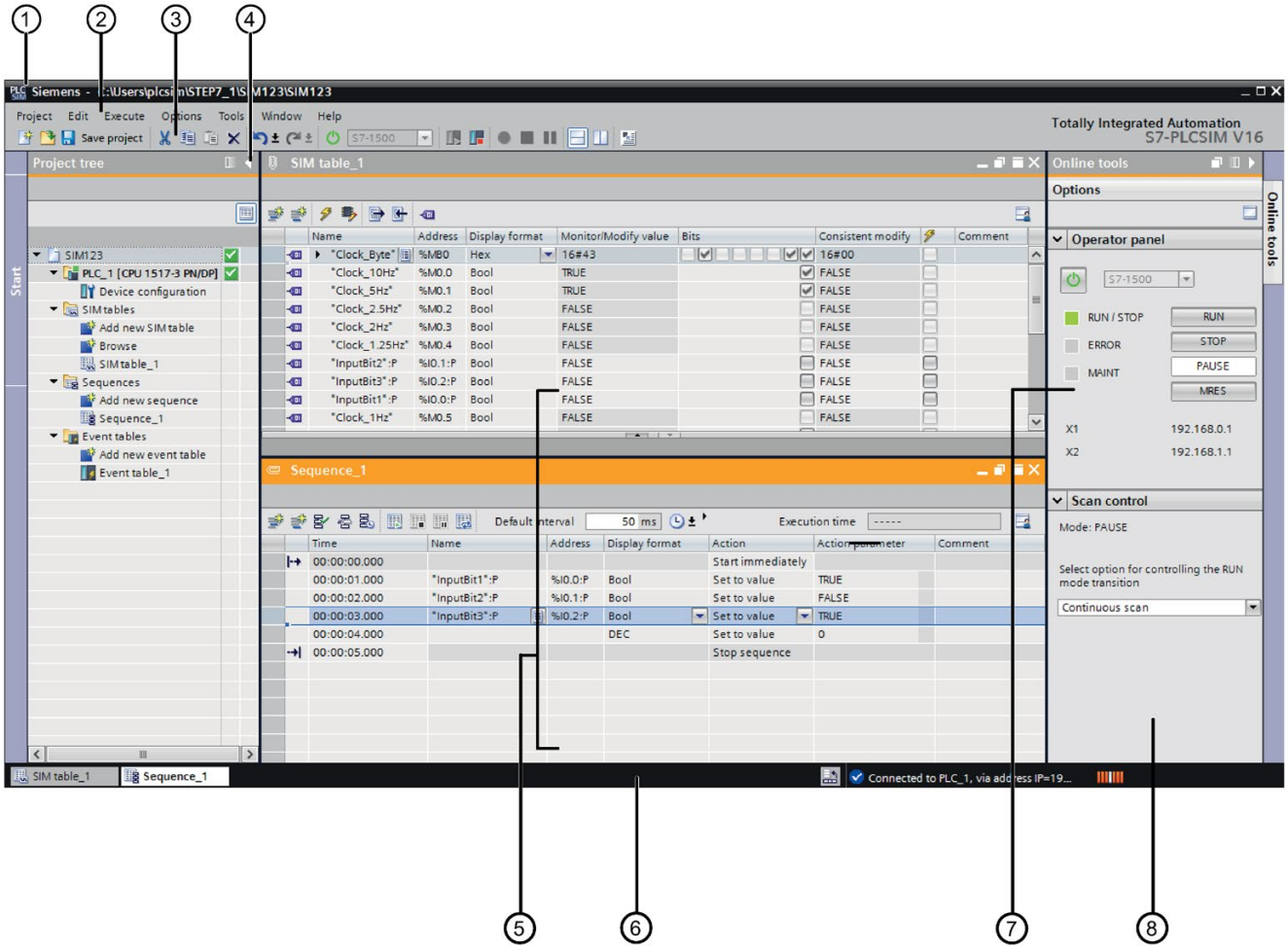
Working in Project view

7

7.1 Project view user interface

7.1.1 Project view user interface overview

Project view provides the full functionality of S7-PLCSIM:



①	Title bar	Displays the project path and project name, and buttons to switch to Compact view, minimize the application, maximize the application, and close S7-PLCSIM.
②	Menu bar	Displays menus for project commands, edit commands, execute commands, options settings, tool commands, window commands, and help commands.
③	Toolbar	Provides buttons for project commands, edit commands, execute commands, switching to Compact view, window commands, and recording tool commands.

④	Project tree	Displays the project name and the simulated PLC type, and allows you to edit the Device configuration, SIM tables, sequences, and event tables.
⑤	Editor windows	Provides editors for Device configuration, SIM tables, sequences, and event tables. You can display two editors at the same time either horizontally or vertically.
⑥	Editor bar and status bar with progress display	Displays shortcuts to open editors and the status of the simulated PLC.
⑦	Operator panel	Displays the operator panel for the simulated CPU with operating mode and scan control buttons
⑧	Scan control	Provides configuration settings for scan control

Switching to Compact view from Project view

You can switch from Project view to Compact view by clicking the "Switch to Compact view" button on the main toolbar.

7.1.2 The S7-PLCSIM menu bar

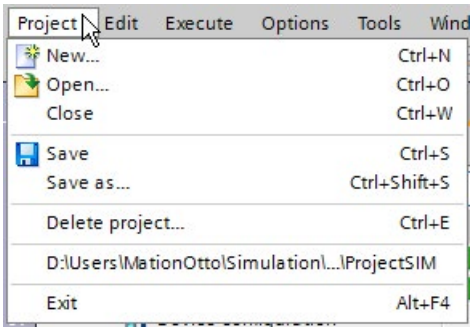
The S7-PLCSIM main menu provides the following functions:

Menu	Description
Project (Page 35)	Contains commands for creating new projects; opening existing projects; closing, deleting, and saving projects; and exiting S7-PLCSIM. There is also a list of your most recent projects.
Edit (Page 36)	Contains editing commands for the selected object.
Execute (Page 37)	Switches the simulated PLC to RUN mode or to STOP mode.
Options (Page 37)	Opens the settings dialog so you can adjust the application settings.
Tools (Page 37)	Contains recording commands
Window (Page 38)	Allows you to customize the workspace.
Help (Page 39)	Opens the help system, provides a link to the Siemens Industry Online Support website, and shows details of the installed software.

For most menu commands, S7-PLCSIM provides a toolbar button (Page 39) for the function.

7.1.2.1 Project menu commands

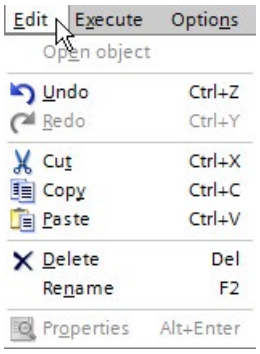
The Project commands are as follows:



Menu text	Description
New	Creates a new project (Page 49) and a new simulated PLC. If the current project contains unsaved changes, you are asked to save the project.
Open	Allows you to navigate to the project you want to open. If your current project contains unsaved changes, you are asked to save the project.
Close	Closes the current simulation project. If the current project contains unsaved changes, you are asked to save the project.
Save	Saves the simulation project using the current path and file name. You cannot save a project during a download from STEP 7.
Save as	Allows you to save your project with a new name and/or a new path. "Save as" is disabled during a download from STEP 7.
Delete project	Allows you to select a project for deletion.
<List of recent projects>	Allows you to open a project that you have recently saved. If your current project contains unsaved changes, you are asked to save the project before opening your selected project.
Exit	Closes the simulated PLC and the S7-PLCSIM application. If the current project contains unsaved changes, you are asked to save the project.

7.1.2.2 Edit menu commands

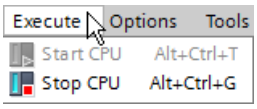
The Edit functions are as follows:



Menu text	Description
Open object	This menu item is enabled when an object that can be opened has application focus. This is true when the focus is on the Project tree and one of the following elements is selected: • The simulated PLC • A SIM table • A sequence
Undo	Undo the last action
Redo	Redo the action that was undone
Cut	Standard clipboard Cut functionality. Cut is enabled or disabled based on your current selection.
Copy	Standard clipboard Copy functionality. Copy is enabled or disabled based on your current selection.
Paste	Standard clipboard Paste functionality. Paste is enabled or disabled based on your current selection.
Delete	Standard Delete functionality. Delete is enabled or disabled based on your current selection.
Rename	Allows you to rename the selected object. Rename is enabled when you select one of the following Project tree elements: • A SIM table • A sequence
Properties	Not available

7.1.2.3 Execute menu commands

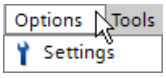
The Execute functions are as follows:



Menu text	Description
Start CPU	Transitions the simulated PLC to RUN mode. You can click the Start CPU button when the simulated PLC is in STOP mode.
Stop CPU	Transitions the simulated PLC to STOP mode. You can click the Stop CPU button when the simulated PLC is in RUN mode.

7.1.2.4 Options menu commands

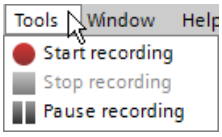
The Options command is as follows:



Menu text	Description
Settings (Page 42)	Allows you to make changes to the appearance and behavior of S7-PLCSIM.

7.1.2.5 Tools menu commands

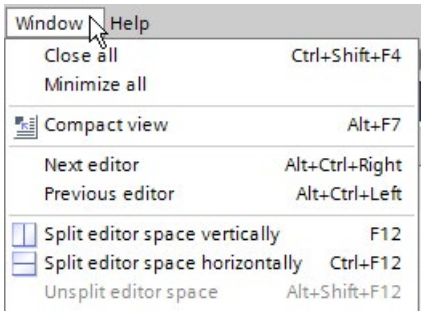
The Tools menu commands Record, Stop, and Pause (Page 79) enable you to record and save a series of actions in the SIM table editor or in the Addresses section of Device configuration and then play them back by using a sequence:



Menu text	Description
Start recording	Starts recording actions in the SIM table editor or the Addresses section of Device configuration.
Stop recording	Stops recording actions in the SIM table editor or the Addresses section of Device configuration and then creates a new sequence from the recording in the Project tree.
Pause recording	Pauses a recording.

7.1.2.6 Window menu commands

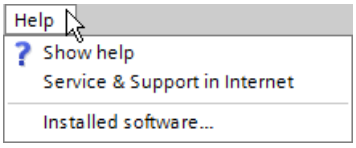
The Window functions allow you to customize the workspace to fit your needs and to switch the application to Compact view.



Menu text	Description
Close all	Closes all open editor windows.
Minimize all	Minimizes all open editor windows. The editors are still active and are available by using the icons in the editor frame.
Compact view	Transitions the application to Compact view. The main S7-PLCSIM view becomes invisible.
Next editor	Used to switch between open editor windows. The ordering of the open editors is the order in which they were opened. "Next editor" is disabled if only one editor is open.
Previous editor	Used to switch between open editor windows. The ordering of the open editors is the order in which they were opened. "Previous editor" is disabled if only one editor is open.
Split editor space vertically	Creates a vertically split work space so that you can view two editor windows concurrently.
Split editor space horizontally	Creates a horizontally split work space so that you can view two editor windows concurrently.
Unsplit editor space	Returns a vertically or horizontally split work space to a single editor window.

7.1.2.7 Help menu commands

The Help functions are as follows:



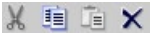
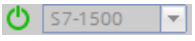
Menu text	Description
Show help	Opens the help system.
Service & Support in Internet	Provides a link to the Siemens Industry Online Support website.
Installed software	Displays information about your installed Siemens software, including version numbers for S7-PLCSIM and the TIA Portal.

7.1.3 S7-PLCSIM toolbar

The S7-PLCSIM toolbar provides the same functionality as the main menu, and also provides power on/power off and CPU family selection functionality:



The toolbar contains the following button groups:

Button group	Function
	Project commands (Page 35)
	Edit commands (Page 36)
	Power on or off the simulated CPU. When powered off, change the CPU family. Both functions are also available on the Operator Panel (Page 40) and in Compact view (Page 31).
	Operating mode (Execute menu) (Page 37)
	Undo and redo actions (Page 36)
	Recording commands (Tools menu) (Page 37) Contains recording commands
	Window display and Compact view selection (Page 38) Allows you to customize the workspace.

7.1.4 The Operator panel

The CPU operator panel contains the following:

- A button for powering on and powering off the CPU
- A CPU family drop-down list
- Status LEDs that enable you to see the operating mode and state of the CPU: RUN/STOP, ERROR, or MAINT
- Buttons that enable you to change the CPU operating mode to RUN or STOP
- A PAUSE button to pause a scan that is running.
- An MRES button for resetting memory (Page 30)
- The CPU IP address or addresses

Button functions

You can use the power button to power off the CPU at any time regardless of the scan mode (RUN, STOP, HOLD, PAUSE, or ERROR).

Use the RUN button to place the CPU in RUN when the scan is in STOP or PAUSE mode.

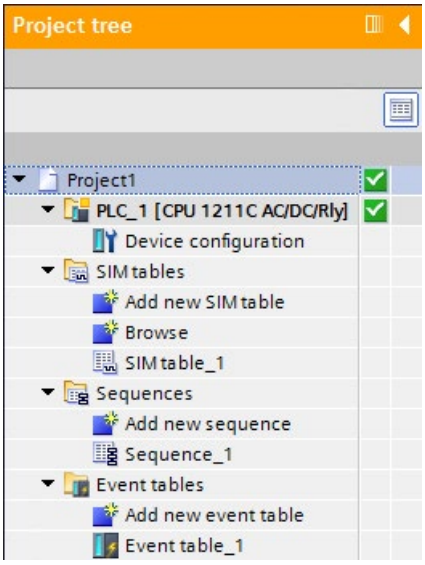
Use the STOP button to place the CPU in STOP when the scan in RUN, PAUSE, or HOLD mode.

Use the PAUSE button to pause a scan in RUN mode.

You can perform a memory reset of the CPU at any time regardless of the scan mode (RUN, STOP, HOLD, PAUSE, or ERROR).

7.1.5 Project tree description

The S7-PLCSIM project tree is similar in design and operation to the project tree in STEP 7. The top level folder in the tree represents the project and shows the name of the project.



The project contains the following sections:

- The downloaded PLC and its Device configuration (Page 52)
- SIM tables (Page 59)
- Sequences (Page 71)
- Event tables (Page 96)

PLC

The PLC is the name of the simulated PLC as configured in STEP 7 along with its CPU type, for example, "PLC_1 [CPU 1211C AC/DC/Rly]". S7-PLCSIM displays "Unconfigured PLC" until you download from STEP 7.

The PLC node also includes the Device configuration as downloaded from STEP 7.

SIM tables folder

A project can contain multiple SIM tables. This folder groups the project's SIM tables and provides functions for working with SIM tables.

- **Add new SIM table:** Click this node to add a SIM table to your project. S7-PLCSIM creates a SIM table with a unique name and displays the new, empty SIM table in the SIM table editor.
- Browse: The browse function (Page 66) allows you to create a SIM table from a STEP 7 watch table, force table, or PLC tag table.
- **SIM table_1:** By default, a new project contains a single SIM table named "SIM table_1".

Sequences folder

This folder contains the project's sequences. A project can contain multiple sequences.

- **Add new sequence:** Click this node to add a sequence to your project. S7-PLCSIM assigns the sequence a unique default name and displays the new, empty sequence in the sequence editor.
- **Sequence_1:** By default, a new project will contain a single sequence named "Sequence_1".

Event tables folder

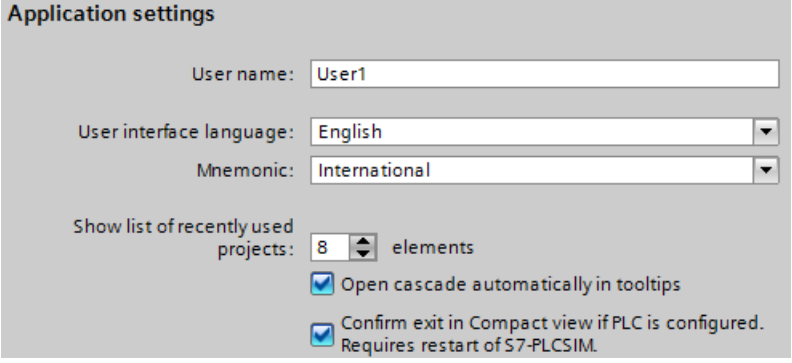
This folder contains the project's event tables. A project can contain multiple event tables.

- **Add new event table:** Click this node to add an event table to your project. S7-PLCSIM assigns the event table a unique name and displays the new, empty event table in the event table editor.
- **Event table_1:** By default, a new project contains a single event table named "Event table_1".

7.1.6 S7-PLCSIM settings

7.1.6.1 Application settings

You can access the following application settings from the Options > Settings menu command:

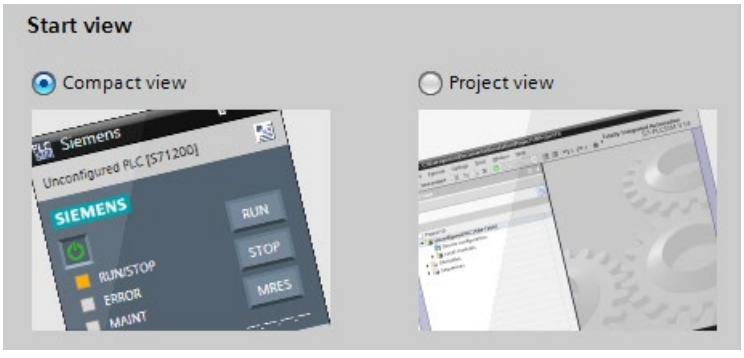


The application settings contain the following information:

Setting	Description
User name	User name that you can define and assign to the project. S7-PLCSIM creates new projects with this user name until you change it.
User interface language	Language for the S7-PLCSIM user interface
Mnemonic	Specifies the mnemonics for programming: "German" uses the German mnemonics, for example, "E1.0". "International" uses international mnemonics, for example, "I1.0".
Show list of recently used projects	Number of entries in the list of recently used projects in the "Project" menu
Open cascade automatically in tooltips	After a brief time, the tooltips expand to display a cascade containing additional help. If you deselect this option, you must expand the tooltips to see the cascade.
Confirm exit in Compact view if PLC is configured. Requires restart of S7-PLCSIM.	Selected: If you exit S7-PLCSIM from Compact view and you have a configured PLC, you must confirm your choice to exit S7-PLCSIM. For this configuration setting to take effect, you must restart S7-PLCSIM. Not selected: You can exit from Compact view at any time without confirming.

7.1.6.2 Start view

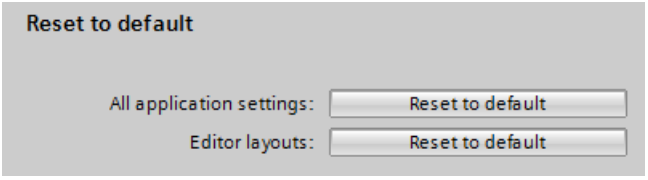
From the Options > Settings menu command, you can choose which view to launch when you start S7-PLCSIM:



Compact view is the default setting.

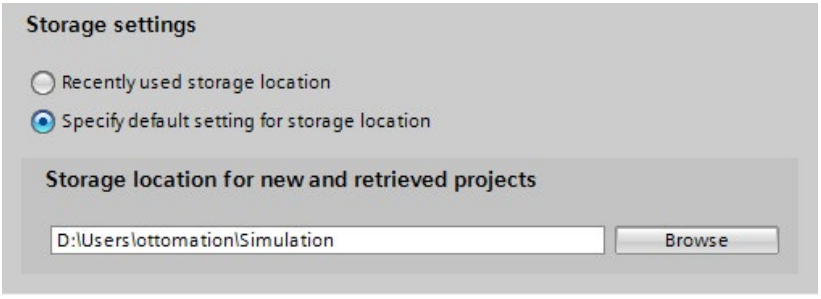
7.1.6.3 Reset to default

From the Options > Settings menu command, you can reset S7-PLCSIM settings to defaults:



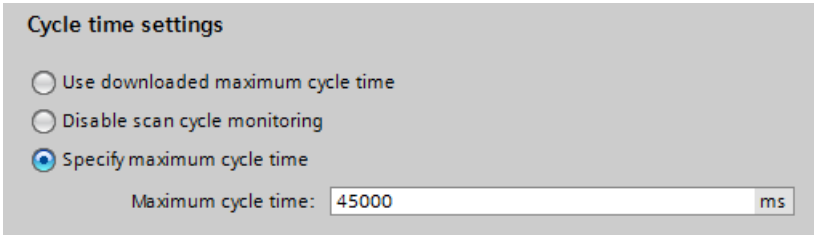
7.1.6.4 Storage settings

You can access the following project storage settings from the Options > Settings menu command:



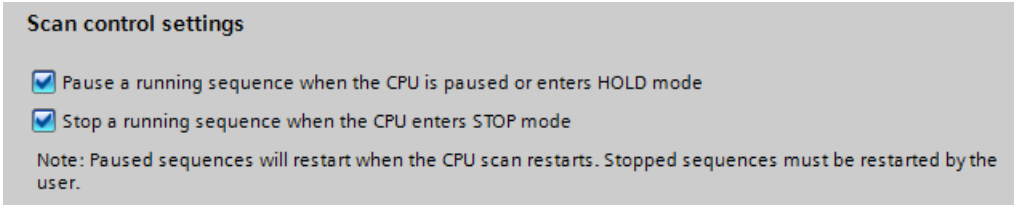
7.1.6.5 Cycle time settings

From the Options > Settings menu command, you can adjust cycle times for your specific programming device. If you have a slower or older programming device, you might want to disable cycle time monitoring or adjust the maximum cycle time. The simulated PLC uses your configured cycle time settings.



7.1.6.6 Scan control settings

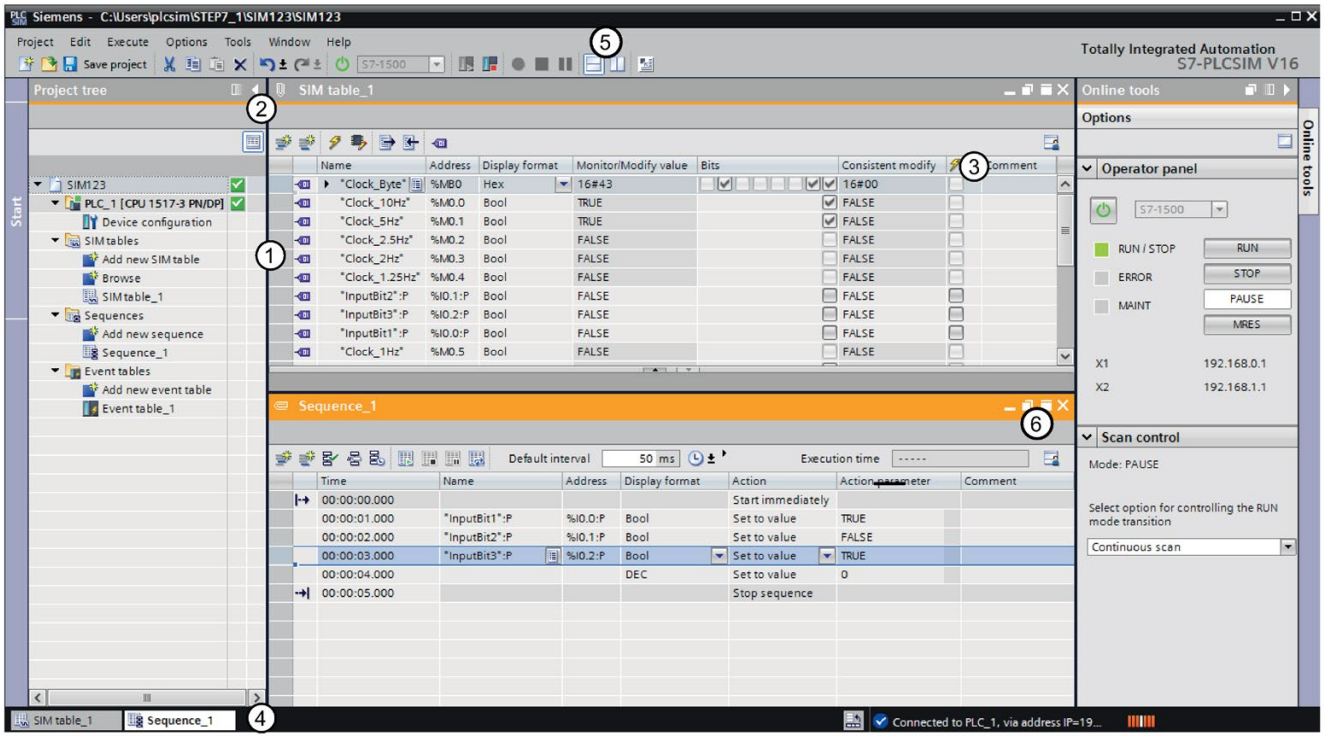
You can access the following scan control settings from the Options > Settings menu command:



These settings are enabled by default. You can set both settings, either one of the settings, or neither setting.

7.1.7 Managing the workspace

You can customize the S7-PLCSIM workspace to conform to your preferred work style just as you can with many other Windows applications:



① You can drag the right bar of the Project tree to make it wider and show more information.

② You can collapse the Project tree by clicking "Collapse" or "Collapse automatically" from the top right corner of the Project Tree frame.

③ You can resize columns in SIM tables, sequences, and event tables by selecting the line between columns and moving it left or right.

④ You switch between open windows by either double-clicking them in the Project tree or by selecting them in the status bar.

⑤ You can split the workspace vertically or horizontally to show two work areas at the same time.

⑥ You can float windows.

You can further customize your workspace by selecting Options > Setting" from the main menu.

If you split the screen vertically or horizontally, each pane contains either a "pin" icon or an "unpin" icon. Click the "pin" icon to keep one of the panes constant as you view objects in the other pane. For example, if you have several sequences, you can pin one of them to keep it visible while you cycle through other sequences in the unpinned pane. Clicking Ctrl+F6 in an unpinned pane allows you to cycle between sequences (or any other work area you want to view).

If you reposition or resize your editor windows, you can save the new layout by clicking the "Save window settings" button in the upper right corner of each editor.

7.1.8 Keyboard shortcuts

The following table lists the keyboard shortcuts that you can use in S7-PLCSIM:

Shortcut	Behavior
ALT	Activate or inactivate menu bar mode
ALT+CTRL+LEFT	Previous open editor
ALT+CTRL+RIGHT	Next open editor
ALT+F4	Close the application
ALT+F7	Toggle between Compact view and Project view
CTRL+1	Opens or closes the project tree
CTRL+A	Select all
CTRL+C	Copy
CTRL+DOWN	Jump down
CTRL+END	Go to the very end
CTRL+F12	Split the editor horizontally
CTRL+F4	Closes the active editor
CTRL+F6	Next open editor
CTRL+HOME	Go to the beginning
CTRL+INSERT	Copy
CTRL+NUM-	Zoom out
CRL+NUM+	Zoom in
CTRL+O	Open existing project
CTRL+RETURN	Multiline text box: Insert line break without confirmation Grid editor: Insert row above current
CTRL+S	Save
CTRL+SHIFT+F4	Close all editors
CTRL+SHIFT+F6	Previous open editor
CTRL+SHIFT+K	Screen keyboard
CTRL+SHIFT+RIGHT	Increase selection to the right (depends on context)
CTRL+SHIFT+S	Save as
CTRL+SPACE BAR+lasso with the mouse	Zoom to selected area - Device configuration
CTRL+UP	Jump up
CTRL+V	Paste
CTRL+W	Close project
CTRL+X	Cut
DELETE	Delete
DOWN	Move down
END	Go to the end
ESC	Stop/ cancel the current task or search, close dialog or drop down
F1	Starts the application's help system from most user interface areas
F12	Split the editor vertically
F2	Rename

Shortcut	Behavior
F4	Open drop-down
F6	Switches between frames of the S7-PLCSIM workspace
HOME	Go to the beginning
LEFT	Move left
PAGE DOWN	Go one page down
PAGE UP	Go one page up
RIGHT	Move right
SHIFT+DELETE	Cut
SHIFT+DOWN	Increase selection
SHIFT+F10	Open shortcut menu
SHIFT+HOME	Increase selection
SHIFT+INSERT	Paste
SHIFT+LEFT	Increase selection
SHIFT+PAGE DOWN	Increase selection
SHIFT+PAGE UP	Increase selection
SHIFT+RETURN	Multiline text box: Insert line break without confirmation
SHIFT+RIGHT	Increase selection
SHIFT+TAB	Jump backward
SHIFT+UP	Increase selection
UP	Move up

Microsoft Windows shortcut keys can also be useful.

7.2 Managing projects

S7-PLCSIM stores all project data in a unique project folder. Within the folder, S7-PLCSIM saves a project file with the extension .sim16:

Creating a project

To create a new project, go to "Project > New" from the main menu or main toolbar in Project view, or from the toolbar in Compact view.

By default, a new project contains one SIM table named "SIM table_1" and one sequence named "Sequence_1". You can rename these tables.

Naming a project

S7-PLCSIM automatically creates a unique, generic name for your project, such as "Project23.sim16". You can rename a project as long as the new name is unique.

Storing a project

When you create a new project, S7-PLCSIM automatically suggests a storage location for the project. You can view your project's current storage location by right-clicking the project name in the project tree and selecting "Properties".

To change the default project storage location, follow these steps:

1. Select the "Options > Settings" menu command.
2. Select the check box for "Default storage location" in the "Storage settings" area.
3. Type the storage path, or browse to it and select it.
4. Click the "OK" button when you are finished.

Opening a project

Select "Project > Open" to open an existing project. You can select a project from the list of recent projects, or browse to the project you want to open. You can also open a project from a previous version (Page 25).

Saving a project

To save your project with its current name and storage location, use the "Project > Save" or "Project > Save as" menu command. You can accept the default name and location, or change either or both before you save.

Opening a saved project

Your saved project opens with the same configuration it had when it was saved, including the hardware configuration and STEP 7 program, SIM tables, sequences, and workspace layout.

Deleting a project

To delete a project, select "Project > Delete project" and then select the project you want to delete.

You can also use Windows Explorer to browse to your project's storage location and delete it from there.

7.3 Using undo and redo in Project view

S7-PLCSIM supports undo and redo for many editing actions. You can access the undo and redo commands from the following methods:

Undo	Redo
Toolbar button 	Toolbar button 
Edit > Undo menu command	Edit > Redo menu command
Ctrl+Z	Ctrl_Y

Clearing the undo/redo queue

The following actions clear the undo/redo queue:

- Saving an S7-PLCSIM project
- Closing an S7-PLCSIM project
- Downloading a STEP 7 program

Each project opens with an empty undo queue. The undo options remain disabled until you perform an undoable action.

Each instance of S7-PLCSIM has its own undo/redo queue. When two instances of S7-PLCSIM are open, the two instances are independent, so actions you take in one instance do not affect the other instances.

When S7-PLCSIM is in Project view without an open project, there are no undoable actions.

As you make edits that can be undone, those edits are added to the undo queue. The redo option is only available if your last action was an undo.

If you select to undo multiple actions, each of those actions is then listed in the redo queue. However, as soon as you make a new edit (a new undoable action), S7-PLCSIM empties the redo queue and then disables the redo option.

Interaction between undo and redo

As you make edits that can be undone, those edits are added to the undo queue.

The "redo" option only becomes available when you undo an action. If you select to undo multiple actions, each of those actions is then listed in the redo queue.

As soon as you make a new edit that is undoable, S7-PLCSIM empties the redo queue and then disables the redo option.

Redo is only available if your last action was an undo.

7.4 Visual feedback regarding online and offline states

The S7-PLCSIM Project view provides visual feedback of online status when there is an active connection to the simulated PLC. Two changes occur in Project view when S7-PLCSIM is online:

- Parts of the user interface are colored orange
- An animation appears in the lower right corner of the application:

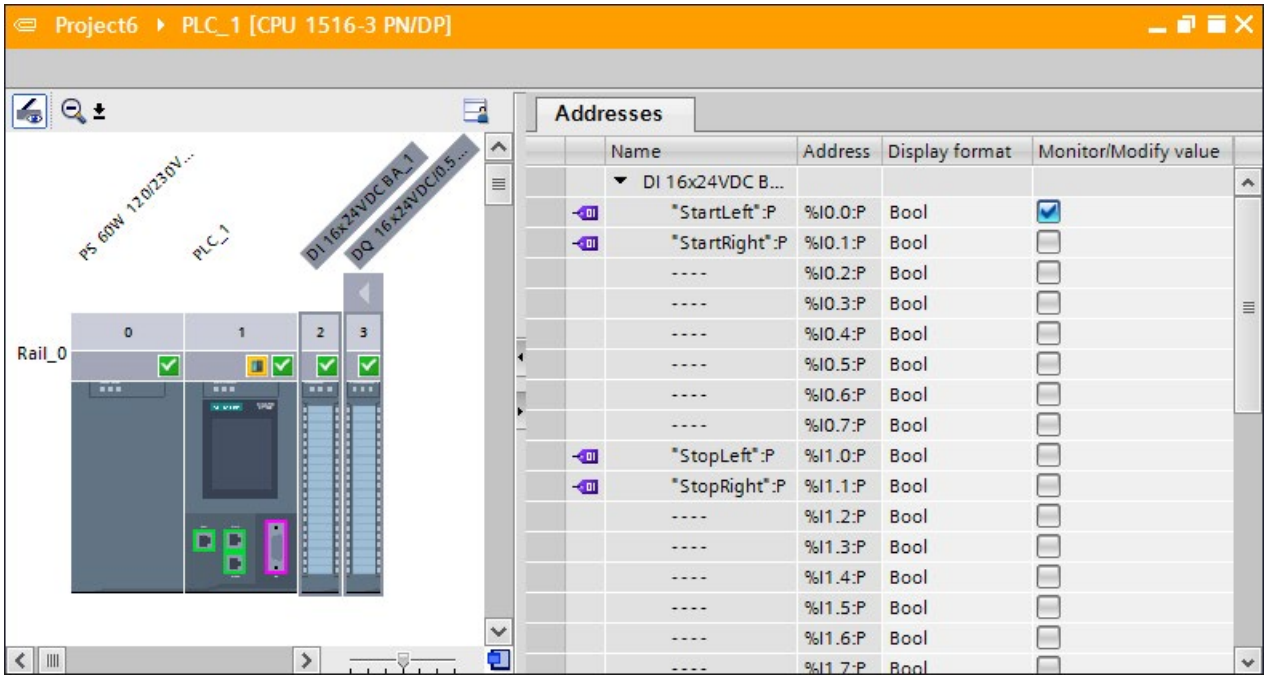


7.5 Working in Device configuration view

7.5.1 Device configuration user interface

The Device configuration contains two sections:

1. A Device view (Page 53) that displays the hardware that you downloaded from STEP 7. The Device configuration is for display purposes only. You cannot alter the Device configuration in S7-PLCSIM.
2. An Addresses section (Page 54) that displays all of the possible addresses for your input and output devices, as well as a subset of the SIM table that allows you to monitor and modify values without switching to the full SIM table editor.



Device configuration

Modules that are functioning properly display a green checkmark. Modules with faults display a fault icon. The CPU displays a RUN or STOP icon depending on the operating mode, which is the same as STEP 7.

Controls

The toolbar in the configured hardware section is similar to the controls in the STEP 7 Device configuration:

- Button to toggle module names
- Button to select zoom in, zoom selection, and zoom out
- Drop-down list box to indicate zoom percentage

Addresses

When you select a device in the hardware section, the Addresses section displays entries for each I/O channel of the device.

The Addresses section includes columns that are a subset of the SIM table:

- Name
- Address
- Display format
- Monitor/Modify value

7.5.2 Device view

When you download a hardware configuration from STEP 7, S7-PLCSIM updates the Device configuration display (Page 52). The device names are the same as in the STEP 7 Device configuration section.

S7-PLCSIM recognizes supported S7-1200, S7-1500, or ET 200SP hardware configurations. You might not be able to simulate devices that S7-PLCSIM does not recognize. S7-PLCSIM omits unrecognized devices from the Device configuration view.

Unrecognized hardware

Your STEP 7 installation might support newer hardware that Device configuration does not recognize. If you have installed devices with an HSP (hardware support package), those devices might not appear in Device configuration.

Local and remote modules

The device view displays both local (central) and remote (decentralized) modules that you download from the STEP 7 to S7-PLCSIM.

If S7-PLCSIM is not able to display the hardware configuration for a device, you can manually enter addresses for that device in the Addresses section (Page 54) of Device configuration or in the SIM table.

Device view features

S7-PLCSIM displays icons to indicate the online status of a device in the same manner as the STEP 7 Device configuration in online mode.

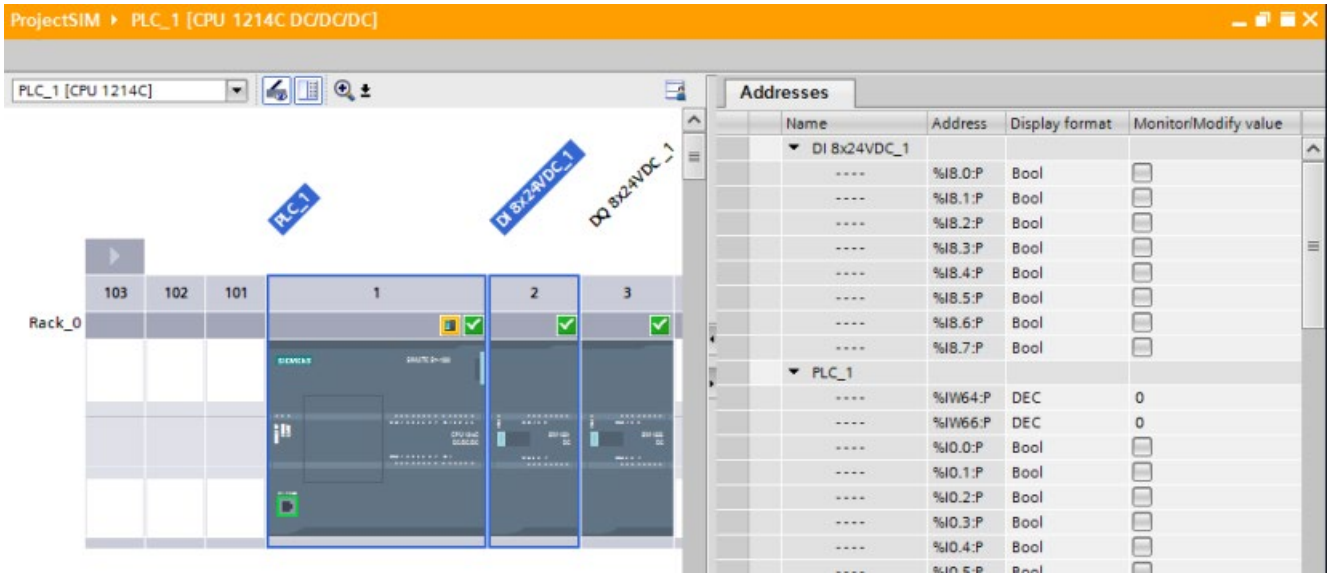
S7-PLCSIM displays I/O tag names if the STEP 7 project includes tag names for I/O.

The Device configuration toolbar contains controls for zooming in and out when you view your hardware configuration. These controls function in the same way as in the STEP 7 Device configuration.

7.5.3 Addresses section of Device configuration view

Device configuration contains a pull-out section that displays an entry for each I/O channel for a device you have selected in the hardware configuration section. This Addresses section functions as a subset of the SIM table editor, and allows you to view and set values for I/O channels.

You can select and work with the I/O channels for one, or multiple, devices in the hardware configuration section:



You cannot undo or redo actions in the Addresses section.

7.5.4 Device configuration view before and after a STEP 7 download

If you have created or opened an S7-PLCSIM project but have not yet performed a download from STEP 7, Device configuration view displays a generic PLC.

The generic PLC label is "PLC Powered Off" if the PLC is powered off and "Unconfigured PLC" if the PLC is powered on.

After you configure your simulation by downloading from STEP 7, or when you open a project that contains a configured CPU, the Device configuration appears as follows:

- The hardware configuration section of Device configuration view displays the name and model of the downloaded PLC.
- The addresses section displays the onboard addresses for the downloaded PLC.

7.6 Features common to editors

7.6.1 Overview of common features

S7-PLCSIM has the following grid-based editor views with several common editing features:

- SIM tables (Page 59)
- Sequences (Page 71)
- Event tables (Page 96)

7.6.2 Common editing actions

S7-PLCSIM editors support standard clipboard actions (cut/copy/paste) for the following:

- Text within a cell
- Cell contents
- Single rows (entire row selections)
- Multiple rows (where rows are contiguous or not)

You can select clipboard actions in the following ways:

- Using standard Windows shortcut keys:
  - Ctrl+C for copy
  - Ctrl+X for cut
  - Ctrl+V for paste
- Shortcut menu provided in each editor; accessible by right-clicking in the editor
- The "Edit" menu on the main toolbar

Pasting tags or addresses from STEP 7

You can copy tags and addresses from STEP 7 and paste them into S7-PLCSIM sequences and SIM tables. You can copy from any of these STEP 7 locations:

- PLC tag table
- Watch table
- Force table

If you have added or edited tag names in STEP 7 after your last download, download the STEP 7 project to S7-PLCSIM to resolve the new or changed tag names.

You can paste a structured tag (Struct) from STEP 7 to S7-PLCSIM. When you copy and paste a structured tag, add a period to the end of the tag name to display an Intellisense menu of the Struct components. You can then select the specific component to add to the sequence or SIM table.

Cutting and pasting between separate instances of S7-PLCSIM

If you cut rows from one instance of an S7-PLCSIM sequence or SIM table and paste into another S7-PLCSIM instance, S7-PLCSIM does not remove the rows from the source instance.

Selecting multiple rows for clipboard actions

S7-PLCSIM supports selecting multiple rows for clipboard actions, generally in the same way that Windows does.

You can select multiple rows in the following ways:

- Left-click on the selection column for a row, then drag the mouse downward or upward to select multiple contiguous rows.
- Click the selection column for a row, then press and hold the Shift key and click another row (above or below the original) to select all the rows between the two clicks.
- To select multiple noncontiguous rows, click the selection column for a row, then press and hold the "Ctrl" key while selecting other rows. All the clicked rows then become part of the selection.

Renaming cell contents

You can rename the contents of many cells. When renaming is possible, you can rename the contents using one of these methods:

- Select rename from the shortcut menu.
- Clicking twice on a cell to get an edit field
- Click F2 on a cell.

7.6.3 Adding and deleting entries in the editors

The S7-PLCSIM editors provide an empty row in which to add new entries to a SIM table, Sequence, or Event table. S7-PLCSIM supports adding or inserting empty rows at any valid location in the editor.

- Selecting "Add row" or "Add event" causes a new, empty row to be added immediately below the row with current editing focus.
- Selecting "Insert row" or "Insert event" causes a new, empty row to be added immediately above the row with current editing focus.
- If you have selected multiple rows and these rows have focus, adding causes the new row to be added below the first selected row and inserting causes the new row to be added above the first selected row. Note that both of these options might not always be available in the sequence editor, due to the special nature of the first and last rows in that editor.

The S7-PLCSIM editors also support deleting one or more rows or events. Once you have selected the rows or events, you can delete the selection using the shortcut menu, Edit menu, or toolbar button.

7.6.4 Applying tags for addresses

Each time you download from STEP 7, S7-PLCSIM updates tag information that has changed in STEP 7 since the last download.

S7-PLCSIM resolves additions, changes, and deletions in the following areas:

- Tag names
- Memory and I/O assignments for tags

7.6.5 Auto-completion for tags

When you download a STEP 7 project to S7-PLCSIM, the tags in the downloaded project are available for SIM tables and sequences.

S7-PLCSIM supports auto-completion for entering tag names. As you type characters, auto-complete provides a list of tag names in the downloaded STEP 7 project that correspond to your text.

7.6.6 Common row indicators

Several row indicator icons are common to both the SIM table and sequence editors:

- Errors
- Forced addresses
- Fail-Safe modules and the tags associated with them

Error indicator

Whenever invalid data exists in an editor; it is marked as an error.

Cells containing invalid data are colored pink, and the row containing invalid data is marked with an error icon.

Force indicator

A "force icon" displays for forced addresses that you download from STEP 7. It is the same icon as the one used in STEP 7. The icon displays for both fully- and partially-forced addresses. The icon displays in the following locations:

- SIM table rows that contain a fully- or partially-forced address downloaded from STEP 7.
- Sequence steps that contain a fully- or partially-forced address downloaded from STEP 7. However, if you disable the sequence step, the force icon does not display.
- Device configuration addresses that contain a fully- or partially-forced address downloaded from STEP 7.

Fail-Safe indicator

In S7-PLCSIM, Fail-Safe I/O addresses are displayed with the same yellow Fail-Safe coloring as in the TIA Portal.

This is true wherever Fail-Safe addresses are used:

- SIM table editor
- Sequence editor
- Addresses section of Device configuration view

7.7 Working with SIM tables

7.7.1 SIM tables and the SIM table editor

The S7-PLCSIM SIM table editor enables you to modify simulated inputs and read simulated outputs. It is similar to a STEP 7 watch table, but the focus is on modifying peripheral inputs and reading peripheral outputs.

A simulation project can contain one or multiple SIM tables. You can configure multiple SIM tables concurrently for the same simulated PLC.

Tag name and address display

As soon as you download a program from STEP 7, any open SIM table automatically begins monitoring specified tags and addresses.

Forced addresses

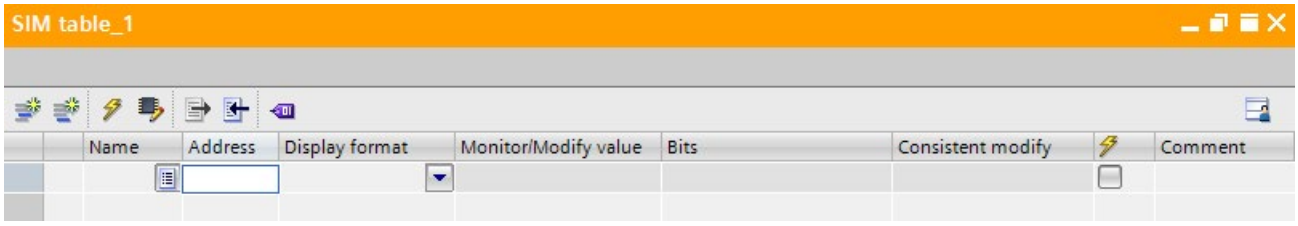
Forced values supersede typical S7-PLCSIM operations. Be aware that forced values might alter the behavior of your simulation.

7.7.2 SIM table editor description

The SIM table editor consists of two sections divided by a horizontal split view. The upper section contains the SIM table grid and the lower section contains the control view.

The SIM table grid

The SIM table grid is similar in design to a STEP 7 watch table:



A simulation project can contain multiple SIM tables, but each SIM table must have a unique name. You can rename a SIM table.

SIM table toolbar

The icons on the toolbar perform the following actions:

Icon	Function	Description
	Insert row	Inserts a new, empty row immediately above the current cursor position.
	Add row	Inserts a new, empty row immediately below the current cursor position.
	Modify all selected values	Writes values in the "Consistent modify" column for rows that have the check box selected to write those values in consistent, or batch, mode.
	Enable/disable modification of non-inputs	By default, you can only write updates to inputs. When you click this button, you can also write updates to outputs, memory areas, and data block addresses. This button is only used to indicate an editing option - it is not an online action.
	Export to Excel (Page 64)	Exports the contents of a SIM table in Microsoft Excel .xlsx file format.
	Import from Excel (Page 64)	Imports the contents of a Microsoft Excel .xlsx file into a SIM table.
	Load project tags (Page 63)	Loads all tags currently downloaded from your STEP 7 project into the open SIM table. This button is disabled if there are no currently downloaded tags.
	Save window settings	Saves any changes you have made to the appearance of the SIM table editor, such as column widths. The saved settings also apply to new SIM tables that you create.

SIM table grid columns

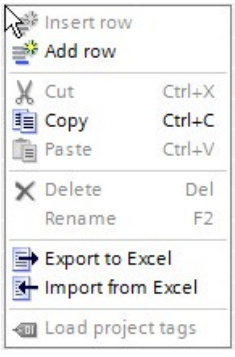
The following table describes the SIM table columns:

Column	Description	
Indicator (no column header)	This column shows information about your SIM table entry.	
		A purple tag icon appears in this column when a valid tag name is entered, or when you enter an address for a valid tag name from your downloaded STEP 7 program. If you have a Fail-Safe tag, the purple tag displays on a yellow background just as it does in the TIA Portal.
		A red "X" appears if there is an error with your entry. An error message will display.
		A force indicator displays if the address is forced in any way. For example, a partially forced address displays the same force icon in the SIM table as a fully forced address.
Name	Displays the tag name.	
Address	Displays the tag address.	
Display format	Different display formats are available and depend on the type of entry. Some examples include Bool, Hex, and signed decimal (DEC +/-).	
Monitor/Modify value	Displays the entry's current value.	
Bits	A series of check boxes (one box per bit) will display in the field if the address is a bit or byte address. From left to right, the bit order is: 7, 6, 5, 4, 3, 2, 1, 0.	
Consistent modify	This value is written to the PLC when you click the "Modify all selected values" button.	
	Select the check box in this column if you want the values in the row to be modified when you click the "Modify all selected values" button on the toolbar.	
Comment	You can add a comment here to provide documentation for the SIM table entry.	

You can reorder columns in the SIM table editor. Drag a column header to its new position to reorder.

SIM table view shortcut menu

Right-click inside the SIM table grid to display the following context menu:



The context menu commands provide editing functions and SIM table functions.

For commands corresponding to buttons on the toolbar, the behavior of these context menu commands is the same as for the buttons.

The Delete command allows you to delete a SIM table row or a value in an editable field.

The Rename command allows you to rename editable values in SIM table fields.

Control view

The SIM table control view contains two controls that you can use to easily adjust values:

- A slider for adjusting analog values
- A push button for adjusting Boolean values

Note that you can also adjust these values in the table grid.

The slider and push button controls are described in detail in the topic "Working with analog and Boolean values in Control view (Page 68)".

Undo and redo button behavior

You can undo and redo many actions in the SIM table. However, the following actions do not have undo and redo support:

- Edit text for "Monitor/modify value"
- Clicking the "bits" checkboxes in table view
- Modify all selected values (toolbar button)
- Export to Excel (toolbar button)
- Enable/disable modification of non-inputs (toolbar button)

Note that additional actions, such as downloading a program from STEP 7, might erase the contents of the undo/redo queue.

7.7.3 Creating and populating a SIM table

7.7.3.1 Overview of creating and populating a SIM table

You have the following options for adding or inserting rows in a SIM table, or for creating an entire SIM table:

- Loading the tags (Page 63) from the STEP 7 project
- Copy and paste all, or a portion of, a STEP 7 tag table, watch table, or force table
- Drag and drop a module from the hardware configuration section of the S7-PLCSIM Device configuration view
- Import (Page 64) all or a portion of, a STEP 7 tag table, watch table, or force table
- Use auto fill (Page 65) to create additional rows based on a selected tag or address
- Browse (Page 66) and select a STEP 7 tag table, watch table, or force table
- Entering tag names manually

7.7.3.2 SIM table: load project tags from STEP 7

You can use the "Load project tags" button on the SIM table editor toolbar to load your STEP 7 tags into an open SIM table.

Clicking this button loads all of the tags from your most current STEP 7 download.

If the most recent download had no tags, the progress indicator from the "Load project tags" disappears very quickly. S7-PLCSIM loads no tags.

7.7.3.3 Monitoring and modifying values in table view

The "Monitor/Modify value" column displays the current value in the format you selected in the "Display format" column. You can modify values in the SIM table either individually, using this column, or in a consistent (batch) mode using the "Consistent modify" column.

Some SIM table values might only update if the virtual PLC is in RUN mode.

The SIM table continues to monitor and update even as you enter new values.

Bit and byte value display

If the address is a bit address, one check box appears in the "Bits" column.

If the address is a byte address, eight check boxes (one check box per bit) appear in the "Bits" column. The order of the bits, from left to right, is: 7, 6, 5, 4, 3, 2, 1, 0.

The following image shows the representation of bits and bytes in a SIM table:

Name	Address	Display format	Monitor/Modify value	Bits	Consistent modify
"InputBit3":P	%I0.2:P	Bool	FALSE		FALSE
"Clock_Byte"	%MB0	Hex	16#00		16#00

Expanding byte addresses

When you enter a byte address, a triangle icon appears beside the name of the entry. The triangle icon indicates that you can expand the entry.

When you click the triangle icon, the byte address expands to show separate entries for each bit in the byte. The names and addresses for these "expanded" entries are read-only.

Modifying non-input addresses

By default, you can only write values to inputs. The SIM table editor toolbar button allows you to also write values to outputs, memory, timer, counter, and data block addresses.

Modifying individual values

Use the "Monitor/modify value" and "Bits" fields to enter a value that writes immediately to the simulated PLC.

To modify a value individually and immediately, simply enter the new value in the "Monitor/ modify value" field.

You can use the individual check boxes in the "Bits" field to immediately change the values of individual bits in a byte address. There is one check box per bit. An empty check box indicates a 0, or FALSE, value. A selected check box indicates a 1, or TRUE, value.

Modifying values in a consistent (batch) mode

You can update multiple values concurrently by entering the new values in the "Consistent modify" fields.

Select the check boxes for the fields you want to modify in the column headed by the "lightning bolt" icon:



A yellow triangle indicates that a value will be applied when you click the "Modify all selected values" button on the toolbar. The button writes data for all the checked entries containing a modified value. If you do not have an active connection to the simulated PLC and click this button, a warning message appears.

7.7.3.4 SIM table: Import and export using Microsoft Excel

The S7-PLCSIM export button allows you to export an existing SIM table in .xlsx format that can then be imported into another SIM table within the same project, or imported into a SIM table in a different project.

The import button allows you to create or expand a SIM table by importing contents from an .xlsx file. The .xlsx file can contain the following contents:

- A different SIM table
- A STEP 7 tag table, watch table, or force table

Exporting a table from STEP 7 to a Microsoft Excel file

To export STEP 7 tables to Microsoft Excel, follow these steps:

1. Select tags in a STEP 7 tag table, watch table, or force table. Note that the entire table is exported no matter how many tags you select.
2. Right-click and select "Export" from the shortcut menu.
3. Select a location and name for the exported Excel file.
4. Click "Open".

Result: The entire table is exported with the name and location you entered.

Importing a table from a Microsoft Excel file into a SIM table

To import a Microsoft Excel file into a SIM table, follow these steps:

1. Open a SIM table.
2. Select the "Import" button from the SIM table toolbar, or select "Import from Excel" from the SIM table shortcut menu.
3. Locate the Excel file you want to import. Note that the import file must be closed for the import to work correctly.
4. Click "Open".

Result: The .xlsx file contents appear in your SIM table.

Note

Imported files with empty address fields

If your .xlsx file contains one or more empty address fields, a warning message displays that the import was only partially successful. An error icon displays in the status indicator column for a row that contains an empty address field.

7.7.3.5 Using auto fill in the SIM table

You can populate your SIM table by using auto fill. SIM table auto fill works in the same way as in a STEP 7 watch table.

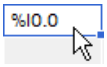
You must have at least one row already entered for auto fill to use as a basis for incrementing addresses.

After a download, you can also use auto fill with the "Name" field.

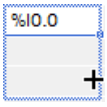
Auto fill procedure

Use the following procedure to auto fill rows in a SIM table:

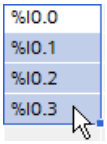
1. Enter an address in the SIM table "Address" field. A small blue square appears on the bottom right corner of the field.



2. Hover over the blue square. A plus sign ("fill handle") appears. Click and hold the mouse button while you drag straight down to fill the number of addresses you want to add.



3. S7-PLCSIM adds addresses in sequential order according to the selected tag. For example, beginning with "I0.0" as the selected address and auto filling three rows adds I0.1, I0.2, and I0.3.



4. If entries already exist in the cells you select to auto fill, S7-PLCSIM prompts you to either "Overwrite existing elements" or "Insert elements".

7.7.3.6 Browsing to a STEP 7 table to create a SIM table

S7-PLCSIM can create SIM tables from PLC tag tables, watch tables, and force tables in STEP 7 projects. STEP 7 with the TIA Portal Openness option must be running on your programming device for S7-PLCSIM to find these tables. If you have multiple instances of STEP 7 running, S7-PLCSIM can access the tables from all running STEP 7 instances.

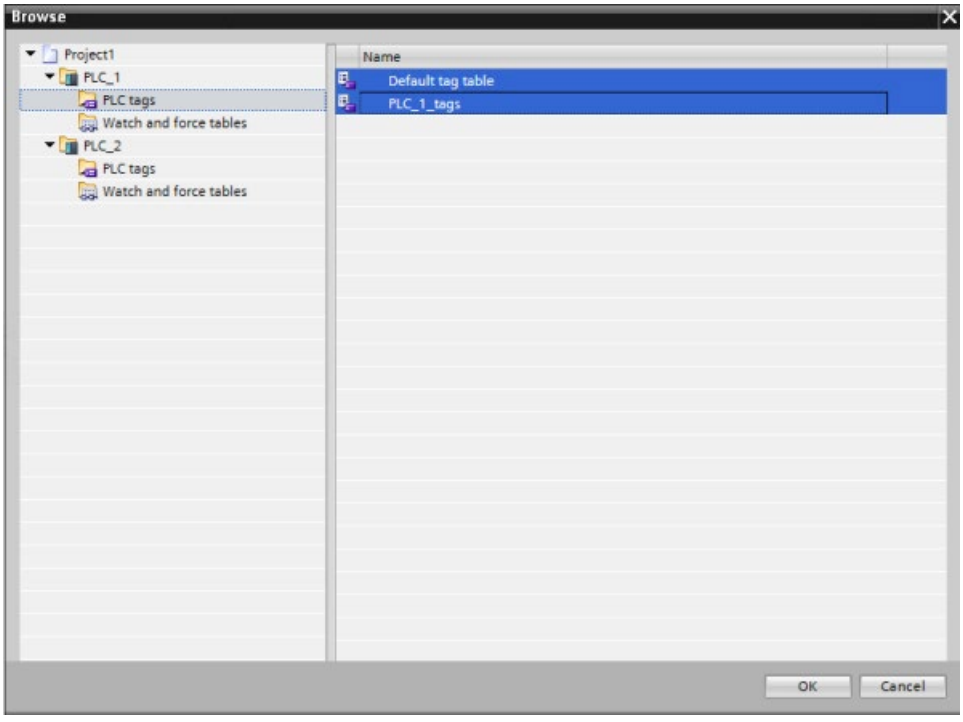
To create a SIM table from a STEP 7 table (PLC tag table, watch table, or force table), follow these steps:

1. In the S7-PLCSIM project tree, click Browse in the SIM tables folder to open the Browse dialog.

   S7-PLCSIM displays a Browse dialog with all STEP 7 projects, PLCs, and tables from the running STEP 7 instances.

2. From the Browse dialog, navigate to the folder for a PLC, PLC tags, or Watch and force tables for any PLC in any project.

3. From the list of tables, select one or more to load to an S7-PLCSIM SIM table.



4. Click OK.

   S7-PLCSIM creates a new SIM table for each selection that contains all tags in the table. The default name for each SIM table is the table name in STEP 7.

7.7.3.7 Creating a new sequence from recorded SIM table editor actions

You can record actions you take in the SIM table editor to create a sequence, and then play back those actions by running the new sequence.

Procedure to create a new sequence from the SIM table editor

Follow these steps to create a new sequence from the SIM table editor:

1. Create a SIM table.
2. Perform a download from STEP 7.
3. Click the "Start recording" button on the main toolbar, or select "Start recording" from the Tools menu.
4. Enter actions in the SIM table section, such as adding and deleting entries, and changing values individually or in consistent (batch) mode.
5. If you want to pause while you are recording your actions, click the "Pause recording" button on the main toolbar, or select "Pause recording" from the Tools menu.
6. To resume recording, click or select "Pause recording" again. When you are finished recording your actions, click the "Stop recording" button on the main toolbar, or select "Stop recording" from the Tools menu.

Result: S7-PLCSIM creates a new sequence from your recorded actions. The sequence appears in the Sequences folder with a default name.

7.7.4 Working with values in control view

7.7.4.1 Overview of control view

When you work with your STEP 7 program, you might want to simulate a gradual ramp up or ramp down of an analog value, or simulate a momentary value change for a Boolean value. S7-PLCSIM provides an easy way to adjust these values with two controls.

SIM table editor: Table view and Control view

The SIM table editor is horizontally divided into two views:

- Table view is the upper part of the editor and contains the SIM table grid and toolbar
- Control view is the lower part of the editor and contains a slider for adjusting numeric values and a push button for adjusting Boolean values

You can manage the SIM editor workspace by resizing the Table view or the Control view, or by collapsing the Control view.

Displaying Control view

To display the Control view, you must select exactly one Table view row. If you select multiple rows, the Control view will be empty.

Control view also remains empty if you select a Table view row with non-numeric data types, such as Char and Time_of_Day.

Changing values in Control view

When you switch focus from one Table view row to another, Control view displays information related to your newly-selected row. When you select and edit a row, the information in Control view updates to reflect your edits.

Control view displays context sensitive controls based on the values in your Table view row selection:

- If there is a numeric value in your selected Table view row, then Control view displays the slider control (Page 69).
- If there is a Boolean value in your selected Table view row, then Control view displays the push button control (Page 70).

7.7.4.2 Slider for numeric values in SIM table control view

The SIM editor displays the slider control when you select a row that contains a numeric value. The value can be a BYTE, WORD, DWORD, or QWORD.

The slider control is not displayed if a selected row does not contain a numeric value.

Updating values

When you are not directly controlling the slider by clicking and dragging the handle, the slider updates periodically to display the actual values in your simulation.

When you control the slider by clicking and dragging the handle, S7-PLCSIM writes the corresponding value to the simulation approximately every 200 ms. If you are recording a sequence, the values are recorded in the sequence.

Note

Be aware that a sequence has a minimum allowable delay between steps, and the sequence editor will not accept a value below that minimum.

You can operate the slider handle only by using a mouse. The slider does not support keyboard input.

Controlling the valid value range

Process values often have a limited range of validity. You can set a minimum and maximum value for the slider to reflect the valid range of values for each Table view row.

- The slider handle is in the leftmost position at the configured minimum of the valid value range.
- The slider handle is in the rightmost position at the configured maximum of the valid value range.

The slider displays the minimum and maximum values with the same data width and format as shown in the selected Table view row. For example, a Table view row containing a DWORD value displayed in HEX format will display in the same manner in the slider control. HEX format is treated as unsigned.

The slider accepts negative settings for signed values.

When the process value exceeds your configured limits, the slider control moves as much as it can - to the minimum or maximum end of the range - since it cannot indicate the actual value.

Slider range defaults

Minimum and maximum values for "integer-like" data types default to the minimum and maximum values for the given data width and format.

For example, if you have a memory address such as MW10 and choose HEX or Octal as the display format, S7-PLCSIM does not know if the address contains a signed or unsigned value. That address will therefore be treated as containing an unsigned value.

For signed integers, the minimum value will be negative.

Floating point values will default to a range minimum of 0.0 and a range maximum of 1.0.

Slider range persistence

Minimum and maximum values are persisted with the corresponding table row. When you save your project, each row's minimum and maximum values are saved.

When you cut or copy and then paste a row, the minimum and maximum values are pasted.

Minimum and maximum values are included when importing and exporting SIM table contents.

7.7.4.3 Push button for Boolean values in SIM table control view

The SIM editor displays the push button control in Control view when you select a row containing a Boolean value.

Push button use and behavior

The push button control operates much like a physical momentary push button. When you click and hold the button, the associated process value is modified. When you release the button, the process value is restored to its default state.

Like a physical push button, the button is write only. The visual state of the button does not change to match the actual process value.

Note

If you use another method to change the value at the same time, such as by running a sequence, the button might behave in an unexpected manner.

7.7.5 SIM table error conditions

The SIM table editor recognizes several error conditions. When an entry error occurs, the cell containing the error turns pink, the ✖ icon appears in the indicator column, and S7-PLCSIM does not gather data for that entry. S7-PLCSIM does continue to monitor all valid entries.

S7-PLCSIM recognizes the following error conditions at the time of entry:

- Address is invalid (for example, syntactically incorrect)
- Address is out of range; that is, the address is too large for the physical memory of the hardware
- The Monitor/Modify value is out of range for the data type

Empty address field in imported file

If an imported Microsoft Excel .xlsx file contains one or more empty address fields, a warning message informs you that the import was only partially successful. Error icons in the status indicator column indicate rows with empty address fields.

7.8 Working in the Sequence editor

7.8.1 Sequences and the Sequence editor

The purpose of a sequence is to simulate an external process interacting with your program. An external process interacts with the PLC through inputs. Any time you enter an input address (%I) in the sequence editor, S7-PLCSIM converts the address to a peripheral input address (%I:P) to more accurately simulate a physical input signal.

Sequence editor and addresses

You can manipulate any of the following address areas within a sequence:

- Peripheral Inputs (%I:P)
- Outputs (%Q)
- Memory (%M)
- Data block (%DB)
- Timer (%T)
- Counter (%C)

With the sequence editor, you can define a set of timed value changes on inputs, outputs, and memory addresses. 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.

A project can contain multiple sequences, but you can run only one sequence at a time. 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.

When you save your project, you save the sequences. You can replay them multiple times to assist in debugging your program.

When a sequence is no longer useful, you can delete it from your project.

Forced addresses

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

Sequences and breakpoint functionality

When the program in the CPU reaches a breakpoint, S7-PLCSIM takes the following actions:

- Enters the HOLD state
- Either pauses or continues running sequences based on your selections in Settings (Page 45)

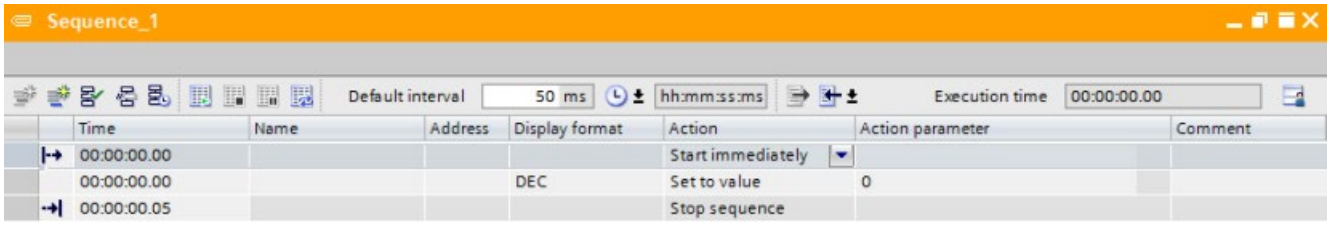
When the CPU continues past a breakpoint, S7-PLCSIM restores the scan control options (Page 102) in the task card.

Multiple sequences

You can have multiple sequences in a single project, but you can only run one sequence at a time. When a sequence is running, the "Start sequence" button is not active for any other sequence.

7.8.2 Sequence editor description

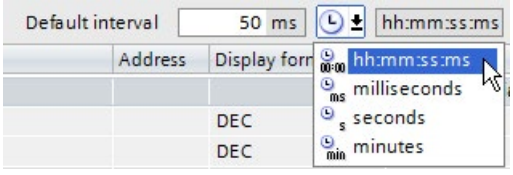
S7-PLCSIM displays the sequence editor when you add a new sequence or edit a sequence:

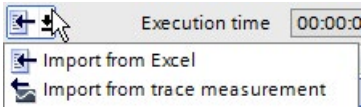
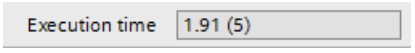


A simulation project can contain one or multiple sequences. Each sequence must have a unique name.

Sequence editor toolbar

The Sequence editor toolbar includes the following functions:

Button	Function
 Insert step	Inserts a new empty step immediately above the currently selected step.
 Add step	Inserts a new empty step immediately below the currently selected step.
 Enable step	Enables a previously disabled step.
 Disable step	Disables a step so it will be skipped when you run the sequence.
 Step time adjustment	Adjusts the time of the selected steps by a specified time increment.
 Start sequence	Plays the sequence from the beginning. The button is only available when the following conditions are true: • There are no other sequences currently running. • There are no errors in the sequence. You can also click this button to resume a paused sequence.
 Stop sequence	Immediately stops a running sequence.
 Pause sequence	Pauses the sequence at the step that will execute next. You must click the "Start sequence" button to resume your paused sequence.
 Repeat sequence	Loops your sequence until you manually stop the sequence.
 Default interval and time format settings	Allows you to enter a time in milliseconds to increment the time in the "Time" column for newly added rows. The valid range is 0 - 3600000 ms. Use the time format settings to change the time format.
 Export to Excel	Exports sequence to Excel format.

Button	Function
 Import from Excel Import from trace measurement	Allows you to select to import either an Excel spreadsheet or a trace measurement file.
 Execution time	Displays the total execution time for a running sequence, as well as the number of repetitions for a repeating sequence.
 Save window settings	Saves any changes you have made to the appearance of the sequence editor, such as column widths and split windows. The saved settings also apply to new sequences that you create.

Sequence editor columns

Column	Description	
Indicator (no column title)	This column displays icons to indicate the following information:	
		The first step in the sequence
		The last step in the sequence
		The step that is executing during playback
		An error in the sequence
Time	Displays the time in hours:minutes:seconds.fractional seconds (00:00:00.00). The maximum time allowed is 23:59:59.95.	
Name	Displays the tag name.	
Address	Displays the memory address affected by the step.	
Display format	Different display formats are available and depend on the data type of the tag. For example, some of the available display formats include Bool, Hex, and floating-point number.	
Action	For the first step in the sequence, the only option is "Start sequence". For the last step in the sequence, you can: • Stop the sequence • Repeat the sequence For action steps, you can select: • Set to value • Set to frequency (for input bit memory only)	
Action parameter	Action parameters based on the Action column: • For "Set to value", you can enter a numerical value that is compatible with the entry's data type. • For "Set to frequency", you can enter a frequency in Hertz.	
Comment	You can add a comment here to provide documentation for the step.	

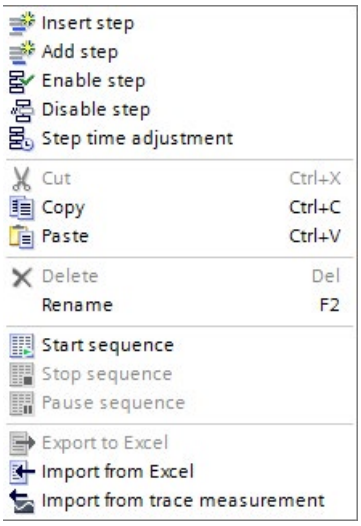
Sequence editor rows (steps)

Each row in the Sequence editor represents a step in the sequence. The icons in the indicator column indicate the first and last step, which step is executing during playback, and whether a step has an error:

Step and related icon	Description
Start step	This is a fixed row that does not accept entries. It contains a time of "00:00:00.00". There are two options in the Action column: Start immediately Trigger condition
Editable steps	Steps with times between the first step and the last step in the sequence.
Stop step	The last step in a sequence. The Action column contains the text "Stop sequence" or "Repeat sequence".
Currently executing step	Indicates the step that will execute next. If you set the same execution time for more than one entry, all of the steps will show the green arrow.
Error indicator	Indicates that the step contains an error. A message displays information about the error.

Sequence editor context menu

Right-click anywhere in a step to display the following context menu:



The context menu commands provide common editing functions and Sequence editor functions.

For commands corresponding to buttons on the toolbar, the behavior of these context menu commands is the same as for the buttons.

The Delete command allows you to delete a sequence step or a value in an editable field.

The Rename command allows you to rename editable values in Sequence editor fields.

7.8.3 Breakpoint functionality

S7-PLCSIM V16 supports breakpoints for S7-1500 and ET 200SP CPUs.

When your STEP 7 program triggers a breakpoint, the simulated CPU enters the HOLD operating mode and your simulation stops executing.

Breakpoint behavior in a sequence

If you have a sequence running when a breakpoint triggers, S7-PLCSIM operates as follows:

- The sequence pauses while the CPU is in HOLD mode.
- The Play, Pause, and Stop commands are disabled.

The paused sequence resumes when the CPU exits HOLD mode.

Visual feedback during HOLD mode

The PLCSIM user interface provides visual feedback to show that the CPU is in HOLD mode.

- The simulated PLC LEDs flash in the same pattern as a physical CPU.
- In Project view, if you have created a project in S7-PLCSIM, an icon appears next to the PLC in the project tree just as it does in the TIA Portal project tree.

7.8.4 Undo and Redo in the Sequence editor

The Sequence editor supports undo and redo for many actions you perform. However, some actions cannot be undone or redone.

Examples of actions that do not have undo and redo support include:

- Export to Excel (toolbar button)
- Play sequence (from toolbar button or shortcut menu)
- Stop sequence (from toolbar button or shortcut menu)
- Pause sequence (from toolbar button or shortcut menu)
- Sorting columns
- Selecting or deselecting "Repeat sequence" (from toolbar button)
- Edit execution time

Note that additional actions might also erase the contents of the undo/redo queue.

Undo and Redo during sequence playback

Undo and redo are disabled when a sequence is playing or paused. This is true even when the playing sequence does not have the editing focus or when the playing sequence is not visible.

When the playing sequence ends or you explicitly stop it, undo and redo again become enabled. Any editing actions you perform during sequence playback will be visible in the undo queue.

7.8.5 Creating and populating a sequence

In addition to creating sequences and entering and editing steps, S7-PLCSIM provides additional methods for performing tasks in the Sequence editor:

- Use auto fill to create additional steps based on a selected address or tag name (Page 79).
- Create a new sequence from recorded SIM table editor actions (Page 79).
- Copy and paste all, or a portion of, a STEP 7 tag table, watch table, or force table.
- Import all, or a portion of, a STEP 7 tag table, watch table, or force table using Microsoft Excel (Page 81).
- Import a trace measurement file from STEP 7 to create a sequence (Page 82).

7.8.5.1 Sequence: Using auto fill

Using auto fill with a sequence works in a different way than it works in a SIM table. In a sequence, it is more useful to use auto fill to copy the contents of the auto filled cell than to increment that cell. You can then apply different start times to the same address to see the effect on your program.

Before download, you can use the Address field as the starting field for auto fill. After download, you can use either the Name or Address field for auto fill.

Auto fill behavior and the last sequence step

If you have defined a time for the last step in the sequence and auto fill would result in exceeding that time because of the Default interval, S7-PLCSIM automatically adjusts the time for the last step when you perform the auto fill.

Auto fill and the Default interval time

Before auto filling starts, the time in the Default interval is read. The Default interval value is 50 ms, and you cannot have a Default value less than 50 ms. The auto fill process uses this time to increment the time in the auto filled steps. Each auto filled step will have the same address as the field you selected as the basis for auto fill.

7.8.5.2 Recording a sequence from SIM table or device configuration actions

You can create a sequence by recording actions (Page 67) you take in a SIM table (Page 59) or in the device configuration (Page 52). You can use this recording to generate a sequence based on the timing of your recorded actions.

Recordable actions from a SIM table or device configuration

When you record actions, S7-PLCSIM creates a sequence step for every action that changes a value at an address. For example, when you make a change to a value in the "Monitor/Modify value” column, S7-PLCSIM records a new sequence step. The sequence step time is the relative time of when you performed the action from the time you started recording.

If you make multiple changes to a value over time, each of those changes becomes a step in the created sequence.

S7-PLCSIM creates sequence steps for actions such as clicking bit checkboxes to change values in the "Bits" column, or by using the "Consistent modify" column to change a single value or multiple values.

You can also make recordable actions in the "Addresses" section of Device configuration. You can make modifications to values corresponding to module addresses. When recording is active, S7-PLCSIM records any actions you take in the Addresses section of Device configuration in the same way as if you performed those actions in the SIM table.

S7-PLCSIM rounds the times for sequence actions to the nearest 10 ms, in conformance with minimum sequence step time resolution specifications.

Recording actions

When you open a SIM table or device configuration, S7-PLCSIM enables the following buttons in the Tools menu and on the toolbar buttons:


"Start recording" button


"Stop recording" button


"Pause recording" button

When you click the "Start recording" button, S7-PLCSIM begins to record specific actions and creates a sequence from those actions. The Pause and Stop buttons are then active.

Pausing the recording

When you click the "Pause recording" button, S7-PLCSIM pauses the recording clock and stops recording actions. Any actions you take while the sequence is paused are not included in your recording. When you click the "Pause recording" button again, S7-PLCSIM continues recording.

Ending the recording session

When you click the "Stop recording" button, S7-PLCSIM generates a new sequence and adds it to your project. You can see this new sequence in the project tree. You can rename the sequence. This new sequence is populated with all the actions you recorded from the SIM table.

When you have recorded all the actions you want for your sequence, end the recording session by clicking the "Stop recording" button on the SIM table toolbar. S7-PLCSIM creates a new sequence from your recording, which contains a step for each action that results from a value change for an address. S7-PLCSIM assigns a time for each step that is relative to the time the action was recorded. Sequences that are generated from a recording always have a first step with the action set to "Start immediately".

Editing and playing back a recorded sequence

When you open a sequence that S7-PLCSIM created from actions that you recorded in the SIM table editor, you see that the times for the sequence steps match the times for the actions you entered in the SIM table editor.

You can use the sequence the way it is, or edit the times in the "Time" column for individual steps.

To play back a recorded sequence, simply click the "Start sequence" button.

7.8.5.3 Sequence: Import and export using Microsoft Excel

You can use Microsoft Excel .xlsx files to export from and import to a sequence by using the export and import buttons  just as you would for a SIM table, but there are differences from the way export and import work between a SIM table and a sequence.

Editing an exported file

If you edit fields, including values, in an exported sequence file in Microsoft Excel, and then import that file into S7-PLCSIM, the results might be different than you expect.

You can address this issue in one of two ways:

- To prevent the issue, you can edit the exported Excel file by changing the format of the time and other numerical field(s) to be text fields, and then edit the Excel file.
- You can import the file and then edit the incorrect values in the sequence editor.

Considerations for using import and export with a sequence

You can import an .xlsx file into an empty sequence or into a sequence that already contains steps. Make sure that the imported file is not currently open in Excel or the import will fail.

The import operation does not overwrite the first or last step in a sequence because these steps are reserved.

You can export a sequence to import into another project.

If your .xlsx file contains one or more rows with empty address fields, the rows are imported into the sequence as empty steps.

Importing into an existing sequence

If the sequence already contains entries, S7-PLCSIM adds the imported rows at the bottom of the existing entries and before the last step.

If you have defined a time for the last step in the sequence and the import results in exceeding that time, S7-PLCSIM automatically adjusts the stop time to accommodate the imported steps.

Importing watch table entries containing structured tags

When you import a watch table that contains structured tags, the cells containing the structured tags turn red in S7-PLCSIM. Click the cell, add a period to the end of the tag name, and a drop-down list displays all of the tag's subnodes. Select the subnode tags to use in the sequence.

7.8.5.4 Sequence: Import a STEP 7 trace to create a sequence

S7-PLCSIM can create sequences based on trace measurement files that were exported from STEP 7. Supported formats are:

- .ttrec
- .ttrecs
- .csv

Importing the trace file

To import a trace measurement file, follow these steps:

1. Select "Import sequence from trace measurement" from the shortcut menu using one of the following methods:
   - Right-clicking the Sequences folder in the project tree
   - Clicking the Import button dropdown arrow from the sequence toolbar
   - Right-clicking within the sequence grid
2. Navigate to and select a trace measurement file.

Trace measurement addresses

A trace can record measurements for many addresses. You might not want to include all trace addresses in your sequence. For example, the trace measurement might include recordings for output addresses (%Q memory). These addresses are not valid for an S7-PLCSIM sequence.

S7-PLCSIM displays a trace measurement dialog for your selected trace file:

- S7-PLCSIM imports all addresses from the trace measurement.
- S7-PLCSIM displays tag names for addresses with available tag information. The tag names come from current configuration downloaded to S7-PLCSIM. They do not come from the imported trace measurement. For addresses with no available tag name, S7-PLCSIM displays "----".
- By default, S7-PLCSIM selects all addresses except output addresses. Output addresses appear in the list but are not selected for import.

After you have selected the addresses to include and click "OK", S7-PLCSIM generates a sequence from the trace measurement.

Note

Trace measurement files contains tag information. If tag assignments change in the STEP 7 project, you must download the project with the changes to S7-PLCSIM.

Details about sequence generation

The sequence is generated according to the following rules:

- S7-PLCSIM creates an "initialization step" for each included address. This step corresponds to the time of the first sample in the trace file. The address in the sequence is the address in the first sample in the trace file. Each initialization steps includes a comment that says: "Initial step". If you do not want to use initialization, you can edit, disable or delete the steps.
- S7-PLCSIM creates a sequence step for each change of value at one of the included addresses.

  Note

  Trace measurements are taken at each sample time. No sequence step is generated if the value of the address has not changed since the last sample time.

- The sample time for a trace can be much faster than the minimum increment time between sequence steps. S7-PLCSIM adds a sequence step for each sample in the trace file. If the time difference between two samples in the trace file violates the minimum sequence step increment time, the sequence step displays an error. You must correct all sequence step time errors before you can use the sequence.
- The trace supports triggering the recording based on a tag value. When you select this, the trace also supports recording values before triggering. This means the measurements during this pre-trigger time have negative time values. The S7-PLCSIM sequence does not support negative times for steps. When a measurement has negative times, the time values are adjusted so that the first measurement time has a value of zero in the sequence. Subsequent step times are converted to positive values.

After you create a sequence from an imported trace measurement file, you can edit it. There is no further connection to the original TIA Portal trace.

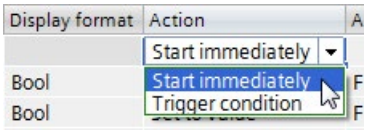
7.8.6 Methods for starting a sequence

7.8.6.1 Sequence start action

The first row of the sequence defines the start condition for the sequence. The start condition is one of two actions:

- "Start immediately". When you select this option, the first step of the sequence (the second row in the sequence editor) will immediately become active, and the execution time for the sequence will begin to count.
- "Trigger condition". For this option, you must define a trigger condition that will be evaluated to determine when the sequence executes. When you have defined a trigger for the sequence, and then select to play the sequence, the first step in the sequence will only become active when the trigger condition is satisfied.

Select the start condition by clicking the "Action" column in the first row:



The default start action for a new sequence is "Start immediately".

Start immediately

When you select this option, the first step of the sequence (the second row in the sequence editor) becomes active, and the execution time for the sequence begins to count.

"Start immediately" is the default start action. When you select this start action, you do not need to edit any other fields. The "Time" field displays 00:00:00.00 (or the equivalent time, based on your selected time format). It is not editable. The "Action parameter" is not applicable for the "Start immediately" action.

Trigger condition

When you select this option, you must define a trigger condition (Page 85) that S7-PLCSIM evaluates to determine when your sequence begins to execute. When you define a trigger condition and then play the sequence, the first sequence step executes only when the trigger condition occurs.

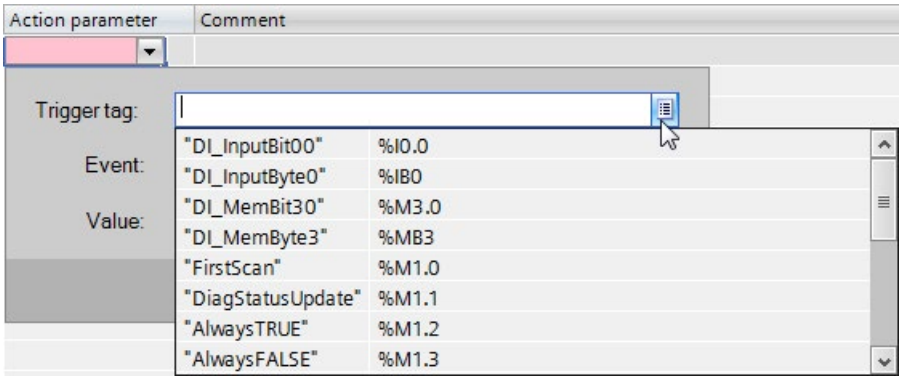
For a trigger condition, you must define the start condition under the "Action parameter" column. The trigger is a specific condition for a single tag (or address), like the trigger condition for a STEP 7 trace.

7.8.6.2 Starting a sequence with a trigger condition

Sequences that begin with a trigger condition (Page 84) require an action parameter. To configure the action parameter, click the Action parameter dropdown to configure the following information:

- Tag or address to be used for the trigger
- Event that will be monitored
- Trigger value for the tag (if required)

To input the tag or address, click the "Trigger tag" control to see a list of all available tags:



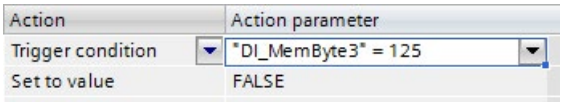
Select a tag from the list, or enter a tag name in the field.

You can also enter an address into the "Trigger tag" field. If the address has an associated tag, S7-PLCSIM displays the tag name for the address you enter. If the address does not have an associated tag, S7-PLCSIM displays the address.

Selecting the tag or address also determines what events are available. For example, you can test an input bit (Boolean) for the event "= TRUE". For value comparisions, you enter a specific value.

To cancel your edits, click the button.

To accept and apply your changes, click the button. The sequence then shows your Action parameter for the trigger condition:



7.8.6.3 Repeating a sequence

The last step in a sequence is the "Stop sequence" step. For sequences that don't repeat, the sequence stops executing at the time indicated in this step. Any active "Set to frequency" actions stop, and the sequence returns to a stopped, editable state. You can, however, configure your sequence to repeat in a loop.

Repeating a sequence from the toolbar button

To cause a sequence to repeat in a loop, click the "repeat sequence" toolbar button . When a sequence is repeating, the button appears pressed.

A repeating sequence has the following functionality:

- When the running sequence reaches the "Stop sequence" step, any active "Set to frequency" actions end.
- The first step of the sequence becomes active, and the sequence once again proceeds through the steps.
- The time that displays in the "Execution time" field is the time for the current iteration of the sequence, rather than the total cumulative time since the sequence first began executing. The current iteration for the repeating sequence (1…n) appears in parentheses next to the execution time.

You can stop a repeating sequence in the following ways:

- Click the stop button. The sequence stops immediately. Clicking the stop button does not affect the state of the "repeat sequence" button.
- De-select the "repeat sequence" button. This causes the sequence to stop when the time for the "stop sequence" step is reached.

Note

S7-PLCSIM does not save sequence repeat settings in the S7-PLCSIM project.

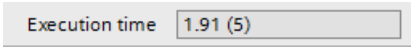
Repeating a sequence with a trigger condition

When a repeating sequence starts with a trigger condition, S7-PLCSIM evaluates the starting condition each time the sequence repeats. The sequence continues to repeat if the trigger condition is true. If the trigger condition is not true, the sequence pauses until the trigger condition becomes true.

7.8.6.4 Visual feedback while running a sequence

Visual feedback in Project view while playing a sequence

S7-PLCSIM provides the following visual feedback while a sequence is actively running:

	In the project tree, a "running" icon displays next to the sequence that is currently running. If the sequence is paused, a "pause" icon appears in place of the "running" icon. In this way, you can select the correct sequence that you want to stop.
Sequence playing: 	The "sequence playing" icon appears in the lower right side of the Sequence editor window while the sequence is running.
	The "step execution" icon moves from step to step in the sequence, indicating which step is executing. If you defined multiple steps to begin at the same time, all of the steps display the green arrow.
	The execution time is displayed in the Sequence editor toolbar.

Visual feedback after stopping a sequence

You can tell when a sequence has stopped running from the following visual indicators:

- There is no "running" icon next to the sequence name in the Project tree.
- The "sequence playing" icon no longer appears in the lower right corner of the Sequence editor window.
- The "step execution" icon stops on the last step executed.
- The execution time stops and displays the total sequence run time. If the sequence is a repeat sequence, the number of repetitions displays in parentheses.

7.8.7 Sequence actions and action parameters

Each entry, or step, in a sequence represents an action to take on the specified address at the time specified in the "Time" column. The type of action that can be specified depends on the data type of the address.

You can specify an address by tag name in the "Name" field or by address in the "Address" field. A sequence entry's address determines its data type and available actions.

Sequence example using bit address

The following example describes how the address for the step determines available options for a bit address:

- Enter an input bit address either by address or by tag name.
- S7-PLCSIM populates the remaining fields in the sequence row with default values.
- The "Set to value" action is the default action. You have two possible options for the action parameter: FALSE or TRUE.
- If you want the "Set to frequency" action rather than the "Set to value" action, select it using the drop-down list and enter a frequency in Hertz in the "Action parameters" field. The input will pulse at that frequency when you run the sequence.

Sequence action: "Set to value"

"Set to value" is a discrete action. S7-PLCSIM writes the value once to the peripheral input. Because there is no physical I/O to overwrite this action, the input retains its value until another action changes it.

Sequence action: "Set to frequency"

The "Set to frequency" action is only available for input bit memory.

When the action is "Set to frequency", you must specify a frequency value in Hz. S7-PLCSIM pulses the bit at the configured frequency until the sequence stops. If you have selected "Repeat sequence" for the last step, S7-PLCSIM continues to pulse the input bit until you stop the sequence.

7.8.8 Time-related Sequence information

7.8.8.1 Sequence time entry

Your sequence entries sort and run based on the contents of the "Time" field. The time displays in the format: Hours:minutes:seconds.fractional seconds (00:00:00.00).

If you select the "Time" field and simply enter a number (such as "12", for example), S7-PLCSIM interprets and displays the number as 12 seconds (00:00:12.00). To get hours, minutes, and fractional seconds, you must explicitly enter the time using the proper format.

The maximum time allowed for an entry is 23:59:59.95 (S7-PLCSIM rounds sequence time entries to the nearest 50 milliseconds).

The following table shows examples for time values in your sequence:

Value entered	Resulting time value
12	00:00:12.00
12.2	00:00:12.20
.02	00:00:00.02
2:2	00:02:02.00
12:12.12	00:12:12.12
Empty	00:00:00.00
Any illegal entry, such as text "abcd"	The cell turns pink, an error icon displays, and the text that caused the error displays.

Order of sequence steps

You do not need to add steps to the sequence in the order they should be executed. You can enter the steps in any order, and they run based on the times you enter in the "Time" column.

You can sort your steps by time before running the sequence by selecting the "Time" column header.

Sequence time entry rules

You can define multiple entries with the same time as long as they are not for the same address. An error occurs if you define multiple actions for the same address with the same time.

Note

Multiple steps with the same time

If you define multiple actions with the same time for different addresses, no error displays, but there is no way to know which action will execute first until you play the sequence. This could result in different ending values for your addresses.

You can sort on the Address column to see the actions based on which input addresses are affected.

Sequence end times for Stop and Repeat sequences

The time for the last step of your sequence must be equal to or greater than the time for the last step of your sequence plus 50 ms for both Stop and Repeat sequences.

Sequence time entry examples

If you want an input point to pulse at a certain frequency for five seconds and then want the input cleared, you could use one of the following two sequence examples to accomplish this.

Example: Ending a set to frequency action after five seconds

For the first step, choose "Set to frequency" as the action and enter the frequency in Hertz in the "Action Parameters" field.

For the second step, enter a time of 00:00:05.00 in the "Time" field, choose "Set to value" as the action, and enter the value "0" in the "Action Parameter" field.

The pulse generation stops after five seconds.

Example: Ending a sequence after five seconds

You can also enter 00:00:05.00 in the Time field for the last step in the Sequence. This also stops the pulse generation after five seconds if you have selected "Stop sequence" in the last step.

7.8.8.2 Sequence step timing

You can specify sequence step timing in two ways:

- Actions occur at the same time
- Steps execute sequentially

You can create multiple steps to set the values for several addresses at the same time. This is valid. If you create multiple steps to set the value for the same address at the same time, this is an error condition. S7-PLCSIM indicates the error condition by changing the color of the error fields to red.

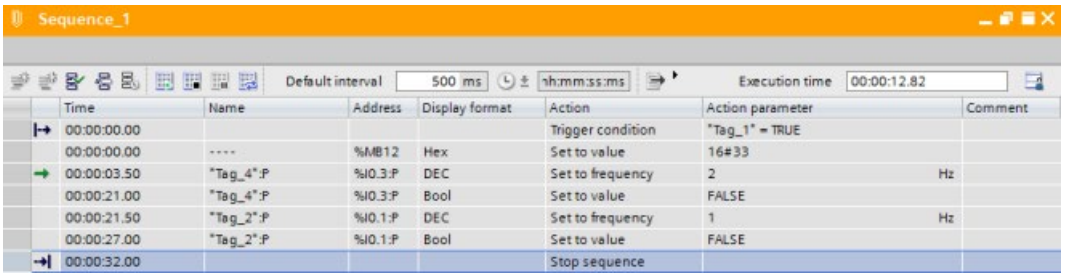
If the sequence steps contain different times, S7-PLCSIM enforces a minimum time of 5 ms between steps. If you enter a time that is less than 5 ms after the time in the previous step, S7-PLCSIM rounds up the difference to 5ms. The stop sequence time must be at least 5 ms after the last step.

7.8.8.3 Edit execution time

When you pause a sequence, you can edit the execution time. Editing the current execution time allows you to restart the sequence at a different location. You can either rewind to a prior step or skip ahead to a later step.

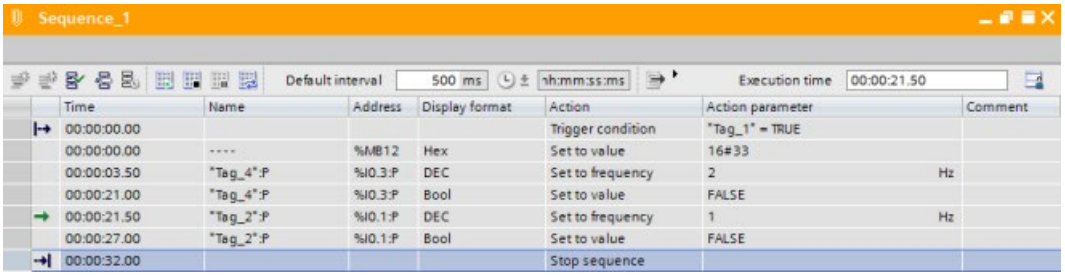
Example: Editing execution time to skip ahead

Consider the following sequence that you have paused at 12.82 seconds:



No steps execute while the sequence is paused.

Now, assume you edit the execution time to be 21.5 seconds and then click "Start sequence”:



Sequence operation starts at the step corresponding to the new execution time. In this example, the sequence skips the step defined at time 21.0 seconds and begins operation at the step defined for time 21.50 seconds.

If you edit the execution time so that it is between two steps, clicking Start sequence causes the sequence timer to start and the next step becomes active when its time is reached.

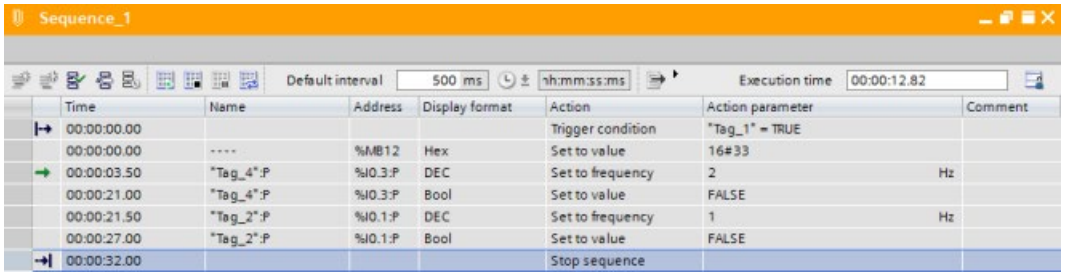
Note that the step that was active when you paused your sequence is a "set to frequency” action. Since this step was active when you paused the sequence and then moved the execution time forward, this step is still active when the sequence is started again.

Here is exactly what happened in the above example:

- When the sequence was paused, the active step was running a "set to frequency” action for %I0.3.
- While the sequence was paused, the execution time was edited to skip the next step in the sequence. This step would have stopped the "set to frequency” action.
- By skipping this step, the set to frequency action for %I0.3 is allowed to remain active.

Example: Editing execution time to skip back

You can also edit the execution time to replay a portion of the sequence. Here is our original example of a sequence paused at 12.82 seconds:



Now, assume you edit the execution time to be 0.00

The step that was active when you paused the sequence at 12.82 seconds (set to frequency for %I0.3) is no longer active. S7-PLCSIM resets the active step to the step at 00.00 seconds.

Setting the execution time to 0.00 restarts the sequence. In the example above, the sequence starts on a trigger condition. S7-PLCSM evaluates the trigger condition and proceeds if the trigger condition is true.

Additional information

You cannot set the execution time past the time of the last step.

When you save your project, S7-PLCSIM does not save the current execution time in the project.

7.8.9 Inserting, adding, and deleting sequence steps

When you open a new sequence, it contains three rows, or steps:

- A first step containing the "first step" icon in the indicator column, "00:00.00:00" in the "Time" column, and "Start immediately" in the "Action" column. You cannot edit this step.
- An empty step with "00:00.00.00" in the "Time" column.
- A final step containing the "last step" icon in the indicator column, "00:00.00:05" in the "Time" column, and "Stop sequence" (the default value) in the "Action" column.

You can create the first step in a new sequence by editing the empty row.

Inserting a step

When you insert a step, the new step appears above your currently selected step.

You can insert a step in one of the following ways:

- Click the "Insert step" button on the Sequence editor toolbar
- Right-click anywhere in a step and select "Insert step" from the shortcut menu

Adding a step

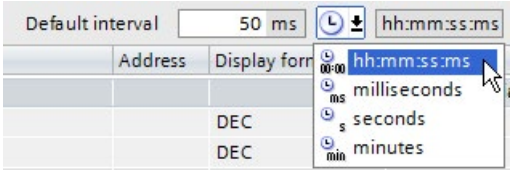
When you add a step, the new step appears below your currently selected step. The time for the added step will equal the time for the currently selected step plus the default interval time.

You can add a step in one of the following ways:

- Click the "Add step" button on the Sequence editor toolbar
- Right-click anywhere in a step and select "Add step" from the shortcut menu

Using the default interval

If you want to change the default time for an added step, enter a different value in the "Default interval" text box on the Sequence editor toolbar. The time for the new step will be the time for the selected step plus the default interval time value.



For example, if the time for the current step is "00:00:05.00" and you enter "2000" for the default step interval, your added step will have the time "00:00:07.00".

When you add a new step, the default interval time is added to the time of the selected step and all subsequent added steps.

Note

Effect of the default interval on inserted steps

The default step interval is only used for added steps. If you insert a step, the time for the inserted step is the time for the currently selected step minus the default interval time value.

The valid range for the default interval is 50 to 5000 ms. Your entry is rounded to the nearest 10 ms. For example, if you enter "1445" the default interval rounds to "1450".

Deleting a step

To delete a step, select the step you want to delete and perform one of the following actions:

- Click the "Delete" key on your keyboard
- Click the "Delete" toolbar button
- Right-click and select "Delete" from the shortcut menu

7.8.10 Enable and disable sequence steps

You can temporarily disable one or more steps in a sequence. Disabled steps are ignored when you play a sequence. This functionality provides you with flexible way to debug your sequence. You can re-enable the disabled step(s) with a single click so that the steps are included the next time you play the sequence.

To disable a step, follow these steps:

1. Select the step by either selecting the entire row, or clicking a cell in the row
2. Click the "Disable step" button on the Sequence editor toolbar.

To disable multiple steps, select the steps and and click the "Disable step" button.

To re-enable a step, select the step and click the "Enable step" button.

Tips regarding disabling and enabling steps

You can disable a step even if it contains an error. In this case the error icon for the row will be replaced by the disabled icon. This allows you to play the sequence and ignore the error.

You can edit a disabled step.

You cannot disable either the "Start sequence" step or the "Stop sequence" step.

The enabled or disabled state of a step is preserved when you copy and paste it and when you export and import a sequence.

7.8.11 Step time adjustment

When editing and debugging a sequence, you might find that you need to insert a step in the middle of a sequence. As a part of this operation, you might want to delay all the following steps by some amount of time.

To accomplish this, follow this example:

- After testing your sequence, you determine that you need a new step between the existing steps at 02.00 seconds and 02.50 seconds. First use the "Insert step" button to create an empty step at the correct position, then edit the step.
- You want to add a 0.50 second delay to all of the following steps in the sequence. You can do this by manually editing the time for each step, or you can select the steps, right-click and select "Step time adjustment".

- This action allows you to add a positive or negative time to all the selected steps. Selecting this context menu option will display a small dialog box where you can enter an amount of time to add to each step.
  - Adding a positive time increases the "Time" value for each of the steps by that amount.
  - Adding a negative time decreases the "Time" value for each of the steps by that amount. If the decrease would cause any times to become negative, then these step(s) are set to a time of 00.00.

The step time adjustment action does not apply to the start step of the sequence. This step always begins at time zero. If the start step is included with a multiple row selection, there is no change to the start step.

The step time adjustment action does apply to the "stop sequence step". You can edit the time for this step either individually or together with other steps.

The minimum delay (either positive or negative) is 10 ms.

"Step time adjustment" is an action you can undo.

A dialog box with a text entry field is used to indicate the delay time.

7.8.12 Sequence error conditions

When an error condition exists for a sequence entry, the cell containing the error turns pink and an icon appears in the indicator column. You can hover over the erroneous entry to display an associated error message.

You cannot play a sequence as long as error conditions exist in the sequence.

The possible errors for a sequence are as follows:

Error	Description
Undefined tag name	Tag name entered has no match in the download from STEP 7
Invalid address	Address is syntactically incorrect
Invalid time	Time is syntactically incorrect
Invalid Action parameter	Action parameter is syntactically incorrect, or is out of range for the address
Action parameter out of range for "Set to frequency" value	The valid range is 1 to 100 Hz
Duplicate steps	Two steps are attempting to act on the same address at the same time
Steps too close together	S7-PLCSIM enforces a minimum 5 ms time difference between any two steps
Not online	STEP 7 is not online when attempting to run a sequence
Import only partially successful	One or more missing addresses in a Microsoft Excel file

Note that the Sequence editor does not perform a range check on addresses.

Event simulation

8

8.1 Event simulation overview

S7-PLCSIM enables you to create event tables 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)

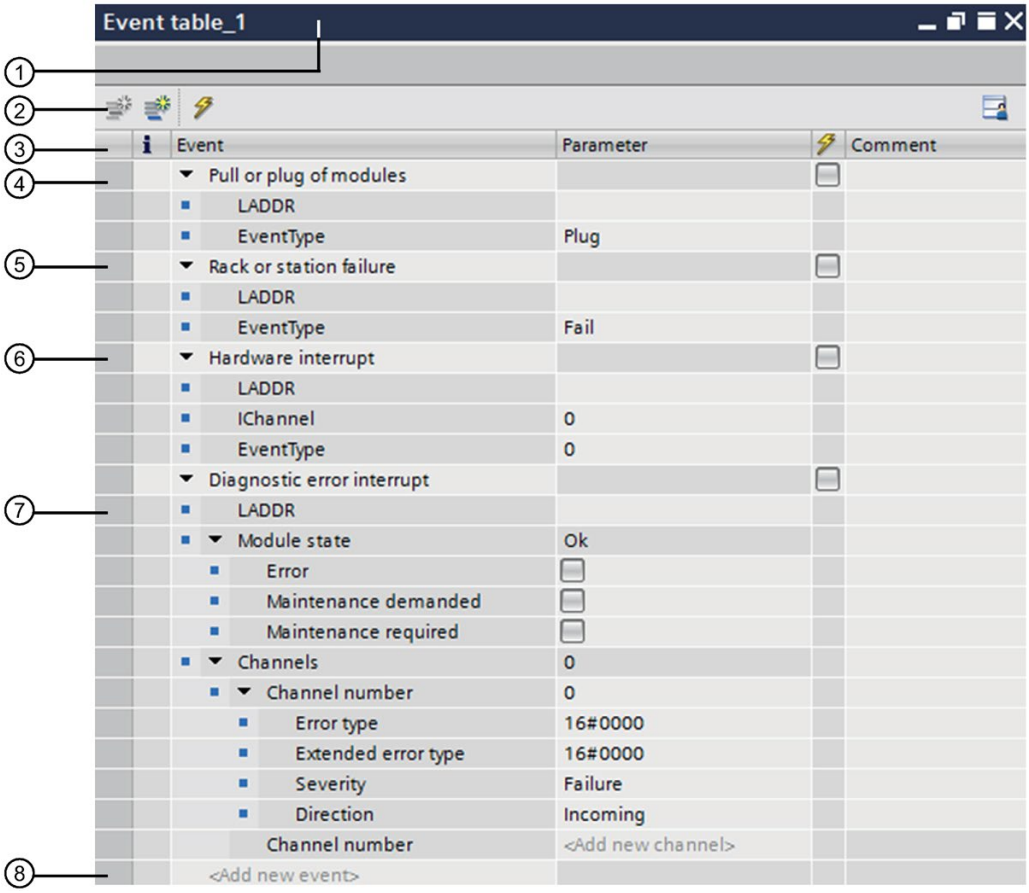
S7-PLCSIM responds to event triggers in the same way a physical CPU would respond. When an event trigger occurs, the STEP 7 program executes the OBs that correspond to the event. STEP 7 updates the diagnostic status of the CPU, and the new status is visible in both S7-PLCSIM and in the TIA Portal.

You can access the event table folder from the project tree in Project view.

Note

You cannot access event tables from Compact view.

Create or open an event table to open the event table editor. The event table editor hosts a toolbar and grid for configuring and triggering events. An example event table containing four events appears below:



① Event table title bar with the Event table name and icons to Minimize, Float, Maximize, and Close the table

② Event table toolbar with icons to Insert event, Add event, Trigger selected event, and Save window settings

③ Event table columns for Status, Event, Parameter, Trigger, and Comment

④ Pull or plug of modules event with LADDR and EventType parameters as sub-rows of the event

⑤ Rack or station failure event with LADDR and EventType parameters as sub-rows of the event

⑥ Hardware interrupt event with LADDR, IChannel, and EventType parameters as sub-rows of the event

⑦ Diagnostic error interrupt event with LADDR, Module state, and Channels parameters as sub-rows of the event. Each of these parameters has additional configurations as sub-rows of the parameter.

⑧ <Add new event> row

8.2 Configuring events

8.2.1 Configuring events

You can add a new unconfigured event using one of the following methods:

- Click the <Add new event> cell and select an event type
- Add or insert a row using the buttons on the toolbar

You can also change an event you have already configured to another event type.

8.2.2 Configuring LADDR

Every event type supported in S7-PLCSIM requires a 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.

You can select your device from the drop-down list or enter the LADDR parameter, where the integer corresponds to the device's Hardware Identifier in TIA Portal.

When you perform a download from TIA Portal, S7-PLCSIM displays the name of the downloaded module if it exists.

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

8.2.3 Simulating a pull or plug of modules event

Add an event (Page 98) for the pull or plug of modules event (OB 83) event and configure the LADDR parameter (Page 98) and Event type parameter.

To configure the Event type parameter, select one of the following from the drop-down menu:

- Pull
- Plug
- Plug (wrong module)

When you trigger a pull or plug of modules event, the STEP 7 program calls the OBs associated with the event and updates the status of your simulated device.

8.2.4 Simulating a rack or station failure event

Add an event (Page 98) for the rack or station failure (OB 86) event and configure the LADDR parameter (Page 98) and Event type parameter.

To configure the EventType parameter, select one of the following from the drop-down menu:

- Fail
- Return

When you trigger a rack or station failure event, the STEP 7 program calls the OBs associated with the event.

8.2.5 Simulating a hardware interrupt event

Add an event (Page 98) for a hardware interrupt event (OB 4x) event. Configure the LADDR parameter (Page 98) and the IChannel and EventType parameters.

You configure the IChannel parameter as an unsigned 8-bit decimal integer. The range is 0 to 255.

You configure the EventType parameter as an unsigned 8-bit integer. The range is 0 to 255. EventType is the identifier for the event type that triggers the interrupt, for example, a positive edge event. Refer to the documentation for each module for that module's EventType identifier values.

When you trigger a hardware interrupt event, the STEP 7 program calls the OBs associated with the event.

8.2.6 Simulating a diagnostic interrupt event

Add an event (Page 98) for a diagnostic error interrupt event (OB 82) event. Configure the LADDR parameter (Page 98), Module state, and zero or more Channel parameters.

Configuring module state

To configure the Module state parameter, select one or more of the following from the drop-down menu:

- Error
- Maintenance demanded
- Maintenance required

Configuring channels and channel numbers

To add new channel numbers to the Channel parameter, use one of these options:

- Type a channel number in the <Add new channel> field
- Select a channel row and select "Add channel" from the shortcut menu or click the Add button on the Event table toolbar. Adding a channel adds the new channel below the currently-selected row.
- Select a channel row and select "Insert channel" from the shortcut menu or click the Insert button on the Event table toolbar. Inserting a channel adds the new channel above the currently-selected row.

You are limited to a maximum of 16 channels per Diagnostic error interrupt event. You can see all channel numbers as a read-only comma-separated text string in the Channels row.

You are limited to a maximum of 16 channels per Diagnostic error interrupt event.

The channel number is a 16-bit unsigned integer. The default channel number is 0 and the default display format is decimal. You can enter values in either decimal or hexadecimal format (16#xxxx).

A special case for channel number values is the value 16#8000, which is used to signify a diagnostic report for the module itself according to the PROFINET specification.

Parameters for Channel number include the following:

Error type is a 16-bit WORD displayed in hexadecimal format.

Extended error type is a 16-bit WORD displayed in hexadecimal format.

Severity contains a drop-down list. You can select one of the following:

- Failure
- Maintenance demanded
- Maintenance required

Direction contains a drop-down list. You can select one of the following:

- Incoming
- Outgoing

When you trigger a Diagnostic interrupt event, the STEP 7 program calls the OBs associated with the event and updates the status of your simulated device.

Deleting channels and channel numbers

You can delete channels and channel numbers by selecting the row and pressing the delete key, or right-clicking and selecting Delete from the shortcut menu.

8.3 Triggering events

Triggering a single event

To trigger a single event, right-click the event row and select "Trigger event" from the shortcut menu.

Triggering multiple events

To trigger events in a table, follow these steps:

1. Select the check box in the trigger column for each event you want to trigger. For events in the table that you do not want to trigger, make sure the trigger check box is not selected for those events.
2. Click the trigger button (lightning bolt icon) on the events toolbar.

Event triggering errors

When you attempt to trigger an event that contains syntax errors, such as text in a numeric field, S7-PLCSIM does not perform any action for that event.

If you attempt to trigger an event with invalid parameters, S7-PLCSIM indicates this error with a red X icon in the status column. An error message explains the error.

Scan control

9

9.1 Scan control overview

S7-PLCSIM enables you to control the scan cycle of your simulated CPU. A scan is defined as one complete loop through all program cycle OBs. At startup, the simulated CPU also executes startup OBs if they are present.

You can access scan control features in two ways:

- In Project view from the Online tools task card
- In Compact view

You can use scan control with or without an open project. The requirements for scan control are the following:

- You have downloaded a STEP 7 project.
- The simulated CPU is powered on.

9.2 Controlling scans in Project view

9.2.1 The scan control user interface in Online tools

The scan control section contains the following items:

- Displayed operating mode of the CPU
- A drop-down list that enables you to control a scan using one of the following methods:
  - Continuous scan

    The simulated CPU scans continuously.
  - Pause after running startup OBs

    The simulated CPU executes the startup OBs and then pauses.
  - Specify scan duration

    For this option, you can select a number of scans (Page 103) or units of time (Page 103). When you click the Go button, the simulated CPU runs for the number of scans or for the specified time. The scan then pauses.

9.2.2 Running a scan for a specified time period

To run a scan for a specified period of time, follow these steps:

1. Be sure the simulated CPU is powered on.
2. If the CPU is in RUN mode, set it to STOP or PAUSE.
3. From the scan control option for controlling the RUN mode transition, select "Specify scan duration"
4. For the scan duration drop-down list, select milliseconds, seconds, or minutes for the time base.
5. Enter a time duration from 1 to 9999.
6. Click the “Go” button, which has the following effect:

- The scan runs for the duration you specified.
- The simulated CPU then pauses.

You can interrupt a running scan by clicking either the STOP or PAUSE button. Clicking either button stops the scan. If you want to resume the scan, click the RUN button. Stopping or pausing occurs at the end of a complete scan. S7-PLCSIM runs at least one full scan even if you specify only 1 ms for the scan time.

The status bar at the bottom of the Project view provides feedback on scan control.

9.2.3 Running a specified number of scans

To run a specified number of scans, including a single scan, follow these steps:

1. Be sure the simulated CPU is powered on.
2. If the CPU is in RUN mode, set it to STOP or PAUSE.
3. From the scan control option for controlling the RUN mode transition, select "Specify scan duration"
4. From the scan duration drop-down list and text box, select a number of scans to run. You can run from 1 to 9999 scans.
5. Click the “Go” button, which has the following effect:

- The simulated CPU runs the number of scans that you specified.
- The simulated CPU then pauses.

You can interrupt a running scan by clicking either the STOP or PAUSE button. Clicking either button stops the scan. Stopping or pausing occurs at the end of a complete scan.

For a large number of scans, a scan counter shows the number of completed scans. The scan counter stops at the number of scans you have chosen to execute.

The status bar at the bottom of the Project view provides feedback on scan control.

9.3 Controlling scans in Compact view

The following scan controls are available in Compact view:

- Click the PAUSE button to pause program execution at the end of the currently running scan.
- Click the STOP button to transition to STOP mode.
- Click the RUN button to restart scanning.

9.4 Scan control settings for sequences

From the "Options > Settings" menu command, you can select options for sequence behavior under "Scan control":

- Pause a running sequence when the CPU scan is paused or enters HOLD mode
- Stop a running sequence when the CPU enters STOP mode

Paused sequences restart when the CPU scan restarts. You must restart stopped sequences manually.

Breakpoints and scan control

When the simulated CPU reaches a breakpoint, the scan enters HOLD mode.

When the simulated CPU is in HOLD mode, scan control features are not available.

Simulating motion control 10

10.1 Motion control overview

S7-PLCSIM supports downloading STEP 7 projects that contain motion control elements for S7-1500 and ET 200SP CPUs.

Note

S7-1200 motion control projects

S7-PLCSIM does not support motion control for S7-1200 CPUs.

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.

10.2 Restrictions with motion control

10.2.1 Simulations and homing mode

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

10.2.2 Technology objects not loaded

If your motion project contains a large number of technology objects, your motion program might not download to S7-PLCSIM.

10.2.3 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 supports 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 virtual controller. However, 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

10.2.4 Wait briefly 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 the situation, wait briefly to access motion control objects after you put the PLC in RUN mode.

For further details about motion control, see the help section "Differences common to all supported PLCs" > "Simulating motion control".

10.2.5 Motion OB overruns

An overload occurs when events which originate from the same source occur faster than they can be processed. S7-PLCSIM does not process motion OB overruns.

10.2.6 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 S7-PLCSIM.

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 will then be able to load your motion control project to S7-PLCSIM.

10.2.7 Simulation deactivates MC-PreServo and MC-PostServo

S7-PLCSIM does not simulate the operations of the motion OBs MC-PreServo and MC-PostServo.

10.2.8 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.

10.2.9 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.

10.2.10 High Speed Counter

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

10.2.11 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.

10.2.12 Isochronous mode not possible error

Under some motion control scenarios, 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.

Solution

- 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. 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.

Simulating communication 11

S7-PLCSIM supports communication between simulation instances. An instance can be an S7-PLCSIM simulation, a WinCC runtime simulation, or an S7-PLCSIM V5.4.8 simulation.

You can run two S7-PLCSIM simulations, up to eight instances of S7-PLCSIM V5.4.8, and an even larger number of WinCC runtime simulations, and they can communicate with each other.

For simulation instances to communicate with each other, observe these requirements:

- The simulation instances must run on the same programming device.
- The CPUs in the separate simulation instances must have unique IP addresses.

You can run multiple instances of S7-PLCSIM, but only two can have active simulations.

Supported connections

S7-PLCSIM supports TCP/IP and PROFINET connections.

If you want to simulate communication using a TCP connection, you must use a TCON instruction to set up and establish the communication connection. S7-PLCSIM does not recognize a TCP connection that is established in the TIA Portal "Devices & networks" section.

IP addresses and communication

You cannot run multiple simulations if the simulated PLCs have the same IP address. Each simulated PLC must have a unique IP address.

T-Block instructions and data buffering

S7-PLCSIM implements T-Block instructions without data buffering on the receiving CPU.

The simulated sending CPU's TSEND instruction does not complete until the program on the simulated receiving CPU executes the TRCV instruction.

T-block instructions and 1024 byte limitation

The maximum number of data bytes that can be received at a time is 1024.

Error conditions and limitations 12

Specific actions or events might result in errors or unexpected behavior in S7-PLCSIM or in STEP 7. A description of each known issue and any workarounds follow.

12.1 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.

12.2 Devices added using a GSD or HSP

The S7-PLCSIM device view does not fully support devices added with GSD (General Station Description) files or HSPs (Hardware Support Packages). This limitation is only a visibility issue. Your devices are still available and S7-PLCSIM functionality is not affected.

When a PLC has configured connections to such devices, S7-PLCSIM attempts to display the devices. The presence of GSD or HSP devices might also prevent the display of non-GSD/HSP devices.

You should use the TIA Portal device view when:

- S7-PLCSIM cannot display the devices
- You want to see an overview of all your devices

12.3 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.

12.4 SIM table recording might generate invalid sequences

It is possible to modify process values without tags in the SIM table. However, sequences require tags for most process values.

To avoid possible errors when you use the SIM table "record sequence" function, define tags for the relevant addresses, or avoid such operations when you record a sequence.

12.5 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.

12.6 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.

12.7 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 project.

S7-1200 projects do not experience this behavior.

12.8 Yellow coloring for fail-safe I/O

S7-PLCSIM might not display I/O addresses for fail-safe devices with yellow coloring. Be aware that this might happen when you simulate fail-safe applications.

12.9 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. S7-PLCSIM provides visual notification of an overflow by means of diagnostic buffer messages and a red error icon in the project tree.

If the main scan cycle overflows, follow these steps:

1. Select the Options > Settings menu command.
2. Select the "Cycle time monitoring" settings.
3. You can then take one of the following actions:
   - Select "Disable scan cycle monitoring".
   - Select "Specify maximum cycle time" and then increase the value in the "Maximum cycle time" box.

If a cyclic interrupt OB overflows, increase the cyclic time for the OB in STEP 7.

After taking any of these actions, you must download from STEP 7 for the change to take effect.

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

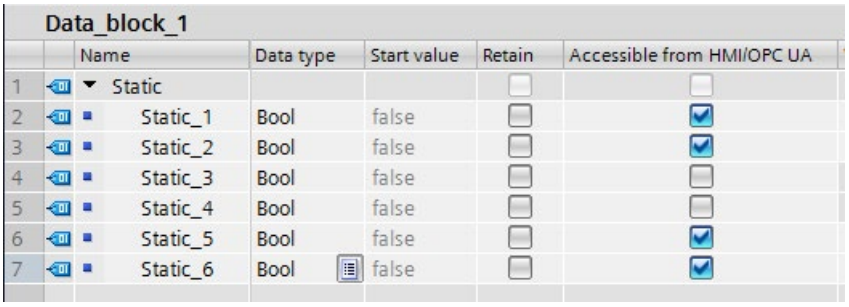
When you simulate an S7-1500 PLC with firmware version 1.8, S7-PLCSIM might display the diagnostic status "Incompatible". You can ignore this status message because your simulation will function normally.

12.11 Simulating HMI connections

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

12.12 HMI Accessible tags

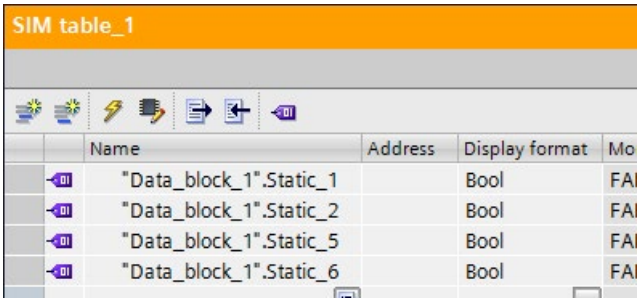
STEP 7 sets tags to "Accessible from HMI" by default. In the following example, a user has removed HMI accessibility for the tags "Static_3" and "Static_4":



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:



SIM table_1

Name	Address	Display format	Mo
"Data_block_1".Static_1		Bool	FA
"Data_block_1".Static_2		Bool	FA
"Data_block_1".Static_5		Bool	FA
"Data_block_1".Static_6		Bool	FA

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.

12.13 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.

12.14 "Cut" performs a "Copy" between S7-PLCSIM instances

When you perform a cut and paste operation between two open instances of S7-PLCSIM, the data from the source instance is copied instead of being cut.

Description of behavior

Start two instances of S7-PLCSIM and create a simulation project in both instances.

Enter addresses into a SIM table or sequence in one of the instances.

Cut one, or several, of the rows from one instance and paste them into a SIM table or sequence in the other instance.

Observe that the cut items from the source instance are copied instead of being cut or removed. The cut items appear in the target instance as expected but remain in the source instance.

Solution

To work around this behavior, delete the cut rows from the source instance after you have pasted them into the target instance.

12.15 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.

12.16 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. In the inspector window, go to "General > Fail Safe > F parameter" 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.

12.17 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 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.

12.18 Working with global libraries

If your 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.

12.19 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.

12.20 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.

12.21 STEP 7 online & diagnostics functions

STEP 7 online & diagnostics functions

Certain 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
- Firmware update

12.22 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 computer or programming device becomes active again, it might be necessary to reestablish communication, or in some cases, to reopen your simulation project.

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

12.23 Working with automatically synchronized network drives

If you store a 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.

12.24 Project menu delay

You might experience delays, and possibly a crash, when you are opening the project menu if a project in the most recently used projects list is located on a network drive that is not connected.

To correct the problem, reconnect the network drive, or move your projects folder to a connected drive.

12.25 Mnemonics selection

Entering values with commas as decimal places (for example, "1,23") might lead to an error with some Windows language settings.

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

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