

SIMATIC

Engineering Tools S7-PLCSIM online help

Operating Manual

Introduction

1

Industrial cybersecurity

2

S7-PLCSIM security best practices

3

S7-PLCSIM overview

4

Working with simulated PLC instances

5

Working with SIM views

6

Simulating motion control

7

Error conditions and limitations

8

Legal information

Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the application described in the catalog and the associated usage information. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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.

Table of contents

1	Introduction.....	7
1.1	S7-PLCSIM documentation guide.....	7
1.2	SIMATIC Technical Documentation.....	8
1.3	Tool support.....	10
2	Industrial cybersecurity.....	11
2.1	Introduction.....	11
2.1.1	Cybersecurity information.....	11
2.2	Basic information on industrial cybersecurity.....	12
2.2.1	Definition of industrial cybersecurity.....	12
2.2.2	Objectives of industrial cybersecurity.....	12
2.3	Operational application environment and security assumptions.....	12
2.3.1	Intended use.....	12
2.3.2	Requirements for the operational application environment and security assumptions.....	13
2.4	Secure operation.....	14
2.4.1	Security update notification.....	14
2.4.2	Hardening measures.....	15
2.4.3	Access control.....	15
2.4.4	Notifications about security vulnerabilities (Siemens Security Advisories).....	15
2.4.5	Data backup.....	16
2.4.6	Secure uninstallation.....	16
3	S7-PLCSIM security best practices.....	17
3.1	Verifying file integrity and authenticity.....	17
3.2	Managing workspace locations and anti-virus usage.....	18
4	S7-PLCSIM overview.....	20
4.1	Workspaces and starting S7-PLCSIM.....	21
4.2	Creating, opening, and saving S7-PLCSIM workspaces.....	22
4.3	Understanding the S7-PLCSIM Activity Log functionality.....	24
4.4	Configuring application settings for S7-PLCSIM.....	24
4.5	Using and customizing keyboard shortcuts.....	25
4.6	Using the S7-PLCSIM Essentials view.....	26
4.7	Differences between a simulated PLC and a physical PLC.....	27
4.7.1	Overview of differences.....	27
4.7.2	Differences common to all supported PLCs.....	27
4.7.3	S7-1200: Technology support.....	29

4.7.4	S7-1200 G2, S7-1500, ET 200SP, and ET 200pro: Technology support.....	29
5	Working with simulated PLC instances.....	30
5.1	Downloading a PLC from STEP 7 to a simulated PLC instance.....	30
5.2	Creating a simulated PLC instance from S7-PLCSIM.....	31
5.3	Setting the simulated PLC instance properties.....	32
5.4	Setting Global Properties.....	33
5.5	Communication modes.....	34
5.6	Viewing the exact quantity structure allocations for S7-PLCSIM Advanced instances.....	35
5.7	Virtual time scaling.....	36
5.8	Resetting a simulated PLC instance.....	37
5.9	Performing a memory reset (MRES).....	37
5.10	Removing a simulated PLC instance.....	37
6	Working with SIM views.....	38
6.1	Introduction to SIM views.....	38
6.2	SIM tables.....	39
6.2.1	Creating, editing, and deleting SIM tables.....	39
6.2.2	Importing SIM table files.....	41
6.2.3	Monitoring and modifying values in a SIM table.....	41
6.3	Sequences.....	42
6.3.1	Adding and configuring a sequence.....	43
6.3.2	Importing sequence files.....	43
6.3.3	Adding sequence table action rows.....	43
6.3.4	Defining action row parameters.....	44
6.3.5	Running the sequence.....	46
6.4	Event simulation.....	47
6.4.1	Configuring events.....	47
6.4.2	Configuring LADDR.....	48
6.4.3	Simulating a pull or plug of modules event.....	48
6.4.4	Simulating a rack or station failure event.....	48
6.4.5	Simulating a hardware interrupt event.....	49
6.4.6	Simulating a diagnostic error interrupt event.....	49
6.4.7	Triggering events.....	51
7	Simulating motion control.....	52
7.1	Motion control overview.....	52
7.2	Simulations and homing mode.....	52
7.3	Isochronous mode not possible error.....	52
7.4	Motion OB overruns.....	53
7.5	Simulation deactivates MC-PreServo and MC-PostServo.....	53

7.6	Technology objects not loaded.....	53
7.7	Upgraded projects containing MC-Servo (OB91) and MC-Interpolator (OB92) blocks.....	53
7.8	Maximum of 5,120 motion control resources.....	54
7.9	High Speed Counter.....	54
7.10	Wait after going to RUN mode to access motion control technology objects.....	54
7.11	High-Speed Counter functionality for S7-1500C (compact) PLCs.....	54
7.12	TO_PositioningAxis.....	55
7.13	TO_ExternalEncoder.....	55
8	Error conditions and limitations.....	56
8.1	Factory reset password behavior in STEP 7.....	56
8.2	Configuring read/write tag access for S7-PLCSIM based on PLC version.....	56
8.3	Instance will not power on after opening a saved workspace.....	56
8.4	Long downloads or timeouts when downloading STEP 7 projects with large arrays.....	57
8.5	Simulating instances with IP address from DHCP server.....	57
8.6	Simulated PLC will not RUN with local I/O send clock.....	57
8.7	Synchronization of IRT systems.....	57
8.8	Using a proxy server with S7-PLCSIM.....	57
8.9	Cannot locate S7-PLCSIM Advanced Instances.....	57
8.10	S7-1200 Fail-Safe simulation.....	58
8.11	Value status defaults.....	58
8.12	Processor requirements for S7-PLCSIM.....	58
8.13	High feature module support.....	59
8.14	HMI type-safe array element display.....	59
8.15	Saving S7-1500 retentive data block (DB) values.....	59
8.16	Yellow coloring for fail-safe I/O.....	59
8.17	Scan cycle overflow.....	59
8.18	Incompatible diagnostic status for simulated S7-1500 PLCs with firmware version 1.8.....	60
8.19	Simulating HMI connections.....	60
8.20	HMI Accessible tags.....	60
8.21	Compile error after attempting to download to S7-PLCSIM.....	60
8.22	Simulating communication with an HMI and multiple PLCs.....	61
8.23	Simulating fail-safe programs.....	61
8.24	Use STEP 7 safety system library V1.3 or later for Fail-Safe I/O.....	61
8.25	Working with global libraries.....	62
8.26	Incorrect RET_VAL parameter values for S7-1500 EN_AIRT and DIS_AIRT instructions that are called from multiple OBs	62
8.27	HMI password protection levels and simulation.....	62

8.28	STEP 7 online & diagnostics functions.....	62
8.29	Simulation during standby mode.....	62
8.30	Working with automatically synchronized network drives.....	63
8.31	Decimal place character.....	63
8.32	Modbus V5.2 not supported.....	63
8.33	Error returned by High_Speed_Counter instruction.....	63
8.34	Restrictions for instructions.....	64
8.35	Simulating the Drive controller.....	64
8.36	Downloading to a simulated PLC instance with "Protection of confidential PLC configuration data" selected in STEP 7	65
8.37	Restrictions with NTP (Time synchronization).....	65
Index.....		66

Introduction

1.1 S7-PLCSIM documentation guide

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

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

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

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

Readme updates

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

1.2 SIMATIC Technical Documentation

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

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

Overview of the SIMATIC Technical Documentation

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



Industry Online Support International

(<https://support.industry.siemens.com/cs/ww/en/view/109742705>)

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



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



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

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

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

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

mySupport

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

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

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

Application examples

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

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

1.3 Tool support

Tools

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

TIA Selection Tool

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

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

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

You can find the TIA Selection Tool on the Internet.

(<https://support.industry.siemens.com/cs/us/en/view/109767888>)

SINETPLAN

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

The advantages at a glance

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

You can find SINETPLAN on the Internet

(<https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html>).

Industrial cybersecurity

2.1 Introduction

Due to the digitalization and increasing networking of machines and industrial plants, the risk of cyber attacks is also growing. Appropriate protective measures are therefore mandatory, particularly in the case of critical infrastructure facilities.

Refer to the relevant system manual of the devices used for general information and measures regarding industrial cybersecurity.

2.1.1 Cybersecurity information

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

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

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

For additional information on industrial cybersecurity measures that may be implemented, please visit

<https://www.siemens.com/cybersecurity-industry>.

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

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

<https://new.siemens.com/cert>.

2.2 Basic information on industrial cybersecurity

2.2.1 Definition of industrial cybersecurity

Industrial cybersecurity is generally understood to mean all measures to protect against the following threats:

- Loss of confidentiality due to unauthorized access to data
- Loss of integrity due to manipulation of data
- Loss of availability (for example, due to the destruction of data or denial of service (DoS))

2.2.2 Objectives of industrial cybersecurity

The objectives of industrial cybersecurity are:

- Ensuring trouble-free operation of industrial plants and production processes
- Preventing threats to people and production from cybersecurity attacks
- Protection of industrial plants against espionage and manipulation
- Protection of industrial automation systems and components against unauthorized access and data loss
- Provision of a practical and cost-effective concept for securing existing plants and devices that do not have their own security functions
- Use of existing, open, and proven industrial cybersecurity standards
- Compliance with legal requirements

An optimized and adapted security concept applies to automation and drive technology. The security measures must not impede or endanger production.

2.3 Operational application environment and security assumptions

2.3.1 Intended use

SIMATIC products are intended for use in industry. If you plan to use the product in a different environment, check the conditions required for such use.

The product may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety information. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products.

2.3.2 Requirements for the operational application environment and security assumptions

Siemens recommends the following security measures:

- Threat and Risk Assessments (as part of security management)
- Network security concepts
 - Network segmentation
 - Asset and network management
 - Network protection
 - Remote access
- Access control concepts (utilizing access control systems)
 - Physical protection
 - Physical corporate security
 - Physical product security

Threat and Risk Assessment

Vulnerabilities and risks are identified, and countermeasures are proposed to ensure the security of the system, networks, and data.

Network security concepts

You can find information on network security in the whitepaper "Industrial Network Security Architecture", available at the Download Center

(<https://www.siemens.com/us/en/company/topic-areas/cybersecurity/industrial-security/downloads.html>) on the Industrial Cybersecurity

(<https://www.siemens.com/us/en/company/topic-areas/cybersecurity/industrial-security.html>) website.

Access control concepts

Physical protection

In addition to closing off and/or monitoring entire production facilities, it may be necessary to physically secure cabinets or even individual components such as circuit breakers.

Physical corporate security

You can ensure physical corporate security by the following measures, among others:

- Closed off and monitored company premises
- Access control, locks/card readers, and/or security personnel
- Accompaniment of non-employees by company personnel
- Employees are trained on and embrace security processes within the company

Physical production security

You can ensure the physical production security by, among others, the following measures:

- Separate access control for critical areas, such as production zones.
- Installation of critical components in lockable cabinets/control rooms with monitoring and alarm capabilities. The cabinets/control rooms must be secured with a cylinder lock. Do not use simple locks, such as universal, triangular/square, or double-bit locks.
- Radio field planning to limit WLAN coverage areas, preventing them from extending beyond defined zones (e.g. factory floor).
- Guidelines that prohibit the use of external data storage media (such as USB flash drives) and IT devices (such as laptops) classified as unsafe on systems.

2.4 Secure operation

This section describes measures that Siemens recommends to protect against manipulation and unauthorized access.

Guidelines

Observe the following guidelines for secure operation:

- Use only the original version as provided on the Internet and follow the Installation notes.
- Check regularly whether there are new versions available for download and use the latest version.

Dependencies on other software components

Verify that your computer meets the System requirements.

2.4.1 Security update notification

Read the special information on maintaining the operational safety of your plant in the Introduction ([Page 11](#)) section.

Set up notification of security updates

To receive notifications about security updates, proceed as follows:

1. Register with mySiePortal (<https://sieportal.siemens.com/en-ww/mysieportal>).
2. Enter the keyword "Security" in the search engine.
3. Choose the "Search in Knowledge base" option.
4. Enter the name or article number of the product in the product search.
5. Select the "Other types" option from the filter menu for "Type," and then choose "Download" and "Product note".

6. For the document you want to be informed about, select "Add to my favorites" using the 3 dots on the right.

For example, if you want to receive notifications about all firmware versions of the S7-1500 CPUs, select the entry "Firmware update S7-1500 CPUs incl. Displays and ET 200 CPUs (ET 200SP, ET 200pro)".

7. In the following dialog, enter a name for the favorite, select the storage location and select the "Notify me" option. Then click the "+ Add to my favorites" button.

Result: You will be notified by email each time the document is changed.

Under "mySiePortal" > "Lists & notifications" > "My notifications", you can display your notifications and delete them if necessary.

2.4.2 Hardening measures

System hardening, also simply referred to as hardening, is the secure configuration of products or systems. The aim is to close security gaps and take various measures to reduce the attack surfaces for cyberattacks.

Measures for system hardening include, for example:

- Secure configuration in which only necessary software components and services are installed or activated for proper operation.
- Access control, by which a restrictive user and rights management system is implemented.

2.4.3 Access control

In addition to physical protection, also establish logical safeguards to control access to your system:

- Use a restrictive user and rights management system, for example, for accessing the CPUs and TIA Portal.
- Refer to the information about password management in the section Users and roles (https://docs.tia.siemens.cloud/access?ft.originId=../100365717643/100365717643_enUS.htm&ft.clusterId./100365717643/100365717643.htm) and in the STEP 7 online help (TIA Portal).

2.4.4 Notifications about security vulnerabilities (Siemens Security Advisories)

A vulnerability is a security vulnerability in information security. A vulnerability can pose a threat as it provides intruders with the opportunity to access system resources and manipulate or steal data. Many vulnerabilities allow availability to be impaired.

Siemens ProductCERT

If Siemens identifies or fixes Security Vulnerabilities in the products, this will be published in the Security Advisories.

You can find the documents for SIMATIC on the following website of the Siemens Aktiengesellschaft: Siemens ProductCERT and Siemens CERT (<https://new.siemens.com/global/en/products/services/cert.html?s=SIMATIC#SecurityPublications>)

"Search Security Advisories" is the default entry in the "SIMATIC" search field. You can also enter other product names or other terms in the search field and search for them.

On this page, you will also find all the required information on how to deal with vulnerabilities:

- Contact persons for matters related to vulnerabilities
- Options for automated notifications regarding vulnerabilities
- Notifications are also possible in CSAF format
- Option to subscribe to RSS feeds and newsletters
- List of all current vulnerabilities and detailed information such as:
 - Description
 - Classification according to Common Vulnerability Scoring System (CVSS)
 - Measures
 - Availability
 - Etc.

Set up Security feeds (<https://www.siemens.com/cert>) to receive notifications about security-related topics.

If you suspect or have discovered a vulnerability in a Siemens product, please let us know immediately. To do this, press the "Contact" button on the CERT Services page (<https://www.siemens.com/cert>) and follow the instructions.

2.4.5 Data backup

Secure your configuration and parameter settings so that you can quickly restore this data if needed.

2.4.6 Secure uninstallation

Use the Windows control panel to uninstall the product and follow the dialog prompts.

S7-PLCSIM security best practices

3.1 Verifying file integrity and authenticity

To protect against security (Page 14) threats, always verify the integrity and authenticity of files you download or receive from Siemens.

Verify file integrity

Ensure that any the file you have downloaded or received has not been altered. Follow these steps to verify the checksum using Windows Powershell:

1. Use the "(get-filehash -algorithm sha256 'filename' | Format-List)" command in Windows PowerShell to calculate a SHA256 hash for your downloaded file.
2. Compare the SHA256 hash your computer generated with the checksum provided by Siemens.

Verify file authenticity

Confirm that the file genuinely originated from Siemens Aktiengesellschaft. Check the file authenticity by following these steps:

1. Right-click the file
2. Select "Properties"
3. Click the "Digital Signatures" tab
4. Select the signature and click "Details"
5. Verify the certificate issued by Siemens AG:
 - Signer: Siemens AG
 - Certificate Status: Valid
 - Certificate Chain: Leads to a trusted root certificate
 - Expiration: Check that the certificate has not expired

Failed file verification

If the file fails verification of either integrity or authenticity, do not run the software. Siemens recommends you take the following actions:

- Re-download the software from an official Siemens source.
- Contact Siemens support.
- Check for security advisories on Siemens ProductCERT (<https://new.siemens.com/global/en/products/services/cert.html?s=SIMATIC#SecurityPublications>).

3.2 Managing workspace locations and anti-virus usage

Siemens recommends implementing hardening measures for S7-PLCSIM's workspace locations and maintaining active anti-virus protection.

Workspace locations

Adhere to the following storage location recommendations for S7-PLCSIM workspaces saved on your computer:

- Preferred location: %USERPROFILE%\Documents\PLCSIM
- Locations to avoid:
 - Temporary folders (%TEMP%)
 - Root of system drives (C:)
 - USB drives or removable media for permanent storage
 - Shared folders without proper permissions

Optimizing S7-PLCSIM Workspace Storage Security

To store saved S7-PLCSIM workspaces securely, follow these recommendations:

- Create a dedicated folder for S7-PLCSIM workspaces.
- Set appropriate Windows file permissions.
- Configure S7-PLCSIM to always use your desired secure workspace location in "Settings > Home workspace location".
- Ensure regular backups of workspace data.

Anti-virus configuration

Use a supported anti-virus security program

(https://docs.tia.siemens.cloud/access?ft:originId=/.10867694603/98908383499_enUS.htm&ft:clusterId/.10867694603/98908383499.htm) that is compatible with S7-PLCSIM.

For optimal performance, configure your anti-virus program to exclude the following:

- Folders
 - PLCSIM installation directory: C:\Program Files\Siemens\Automation\PLCSIM_Vxx
 - User data directory: %APPDATA%\Siemens\Automation\PLCSIM Vxx
 - Workspace storage locations
- Processes
 - S7PLCSIMVxx
 - Siemens.Simatic.PlcSim.VplcHost.exe
 - Siemens.Simatic.PlcSim.VplcHost64.exe
 - Related Siemens processes
 - Siemens.Simatic.Simulation.Runtime.Instance.exe

- Siemens.Simatic.Simulation.Runtime.Instance.x64.exe
- Siemens.Simatic.Simulation.Runtime.Manager.exe
- SIMATIC S7-PLCSIM
- S7DOS Online DLL 32->64 Server

NOTE

Without proper exclusions, anti-virus scanning might cause any or all of the following:

- Slower workspace loading time
 - Delayed simulation responses
 - Increased system resource usage
-

System hardening measures

To ensure S7-PLCSIM operates resiliently against potential attacks and errors, implement the following system hardening measures:

- Keep both Windows and S7-PLCSIM updated with the latest security patches and updates.
- Install and activate only the essential software components and services required for proper operation.
- Establish a restrictive user and rights management system to control access to your system and software.

Data protection

Protect your project data by implementing the following data protection measures:

- Enable Windows BitLocker encryption for all drives containing sensitive project data.
- Enable "Protection of confidential PLC configuration data" in your STEP 7 project.
- Implement and maintain regular backup procedures for all critical data and projects.
- Use secure network connections, such as VPNs and encrypted shares, when accessing shared resources.
- Adhere to organizational policies and guidelines for data handling.

S7-PLCSIM overview

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

S7-PLCSIM provides the following tools for simulated PLCs:

- Support for the latest firmware of the following product families:
 - S7-1500
 - S7-1200
 - S7-1200 G2
 - ET 200SP
 - ET 200pro
 - S7-1500R/H
 - Software Controller
- Multiple simulated PLC instances [\(Page 31\)](#)
- Simulation (SIM) tables [\(Page 39\)](#) for monitoring and modifying simulated PLC inputs, outputs, and data
- Simulation of interrupts to trigger supported event OBs [\(Page 47\)](#)
- Sequences [\(Page 42\)](#) to simulate an external process interacting with your program
- Virtual time scaling [\(Page 36\)](#) for S7-PLCSIM Advanced instances
- The ability to connect to physical communication networks [\(Page 34\)](#) for S7-PLCSIM Advanced instances

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

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

When S7-PLCSIM has a configured simulated PLC instance, you can use the online tools in STEP 7 to observe simulated program behavior. Observe the requirements for user authentication based on the communication mode [\(Page 34\)](#).

NOTE

Be aware of the known error conditions and limitations [\(Page 56\)](#) between STEP 7 and S7-PLCSIM.

4.1 Workspaces and starting S7-PLCSIM

S7-PLCSIM workspaces

An S7-PLCSIM workspace can contain multiple simulated PLC instances (Page 31) and simulation views (Page 38) (SIM views) that include SIM tables, events, and sequences. You can work in a workspace without saving or you can create, save, and reopen workspaces (Page 22).

Starting S7-PLCSIM

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

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

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

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

Starting S7-PLCSIM from STEP 7

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

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

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

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

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

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

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

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

NOTE

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

4.2 Creating, opening, and saving S7-PLCSIM workspaces

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

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

NOTE

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

Working in the "Unsaved workspace"

When you open S7-PLCSIM, you can begin working in an unsaved workspace. The "Unsaved Workspace" allows to you add new simulation instances [\(Page 30\)](#) and SIM views [\(Page 38\)](#). You can save and name the workspace or close without saving.

Opening a new "Unsaved workspace"

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

NOTE

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

Opening a saved workspace

To open any saved workspace, follow these steps:

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

NOTE

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

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

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

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

Saving a workspace

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

NOTE

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

Deleting a workspace

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

4.3 Understanding the S7-PLCSIM Activity Log functionality

The "Activity Log" provides a chronological record of significant events and status changes that occur as you use S7-PLCSIM.

S7-PLCSIM begins recording data to the "Activity Log" as soon as you open the application, and automatically logs application events during your session. Closing S7-PLCSIM completes the saved log file for your session.

NOTE

All activity log files are stored on your local machine to ensure your data privacy. Siemens does not automatically collect or access this information.

To access the saved activity log files, follow these steps:

1. Open the AppData Roaming folder:
 - Press Windows Key + R to open the "Run" dialog.
 - Type %AppData% and press Enter.
2. Navigate to the log directory by following this path from the AppData Roaming folder: "Siemens > Automation > PLCSIM VXX (your current version) > Logs"
3. Within the "Logs" folder, open your preferred language folder. The files are organized by date.

NOTE

S7-PLCSIM enables "Activity Log data sanitization" by default. This feature redacts the user data that it saves to the activity log files. You can disable this setting under "Settings > Security > Activity Log data sanitization".

4.4 Configuring application settings for S7-PLCSIM

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

1. General - allows you to do the following:
 - Language: Set the default language
 - Appearance: Set the appearance of all S7-PLCSIM screens to either dark or light mode
 - Startup view: Select your preferred startup view of S7-PLCSIM: Last used, Workspace, or Essentials
 - Home workspace location: Choose the Home workspace location - S7-PLCSIM automatically stores workspaces that you save in this location
 - Security: Toggle "Activity Log data sanitization" on and off.
 - View the Keyboard shortcuts [\(Page 25\)](#) menu
 - Reset general settings to default

2. Instance - allows you to set your default instance type as either Standard or Advanced or reset the instance settings to default.
3. About - contains the following information:
 - Installed Components
 - Copyright

4.5 Using and customizing keyboard shortcuts

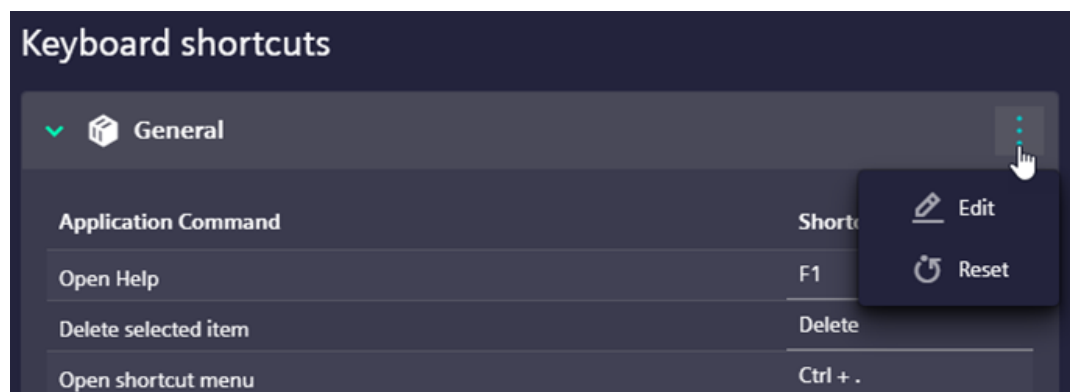
Access the S7-PLCSIM "Keyboard shortcuts" in the Settings  by clicking the **Keyboard shortcuts** button.

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

- General
- Navigation
- Instance
- Simulation

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

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



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

NOTE

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

Reset keyboard shortcut

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

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

Conflict detected for a custom shortcut

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

4.6 Using the S7-PLCSIM Essentials view

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

- Add or delete simulated PLC instances
- Power on/off PLC instances
- Place PLC instances into RUN or STOP mode
- Configure instance properties
- Set Global Properties

You can use the following tabs, located at the bottom of the Essentials view viewlet, to fully configure your simulated PLC instance:

- Instance Properties (Page 32): Allows you to set the following parameters for your simulated PLC instances:
 - License type
 - Scan control (set number of scans and scan duration for simulated PLC instances with the Standard license type only)
 - Virtual Time Scaling (available for simulated PLC instances with the Advanced license type only)
 - X1 Interface
 - Map to adapter (TCP/IP Multiple Adapter communication mode only)
 - Cycle time
- Global Properties (Page 33): Incorporates S7-PLCSIM Advanced control panel functionality and allows you to configure the following settings for your simulated PLC instances:
 - Select the Communication mode
 - Enable or disable Runtime Port Manager and manually define the port number
 - Enable or disable Strict Motion Timing
- Help: View the Online Help for S7-PLCSIM, S7-PLCSIM Advanced, and S7-PLCSIM Advanced API

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

4.7 Differences between a simulated PLC and a physical PLC

4.7.1 Overview of differences

A simulated PLC can behave differently than a physical PLC.

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

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

4.7.2 Differences common to all supported PLCs

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

Diagnostics

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

Time-based performance

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

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

Access and copy protection

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

Know-how protection

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

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

Flashing LEDs

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

Features that require a memory card

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

Web server

S7-PLCSIM supports the Web server only when the instance is an Advanced instance and the communication mode [\(Page 34\)](#) is a TCP/IP mode.

PROFIBUS

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

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

F-CPU simulation

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

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

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

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

Instruction support

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

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

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

4.7.3 S7-1200: Technology support

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

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

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

Technology support

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

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

S7-1500R/H simulation differences

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

Working with simulated PLC instances

You can start a simulated PLC instance in one of the following ways:

- Download an instance from STEP 7
- Start an instance in the S7-PLCSIM application main view
- Start an instance in the S7-PLCSIM essentials view
- Start an Advanced instance from the S7-PLCSIM Advanced UI or API to view in S7-PLCSIM

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

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

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

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

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

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

- Select the PLCSIM PG/PC interface if you have not previously selected it. Select PLCSIM if you are using the Softbus communication mode ([Page 34](#)) and Siemens PLCSIM Virtual Ethernet Adapter if you are using one of the TCP/IP communication modes.
- Answer prompts to enable simulation support if necessary.
- Answer the prompt about trusting the device.
- Click "Start search" to find an S7-PLCSIM instance for the download.
- Click Load and Finish to complete the download.

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

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

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

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

NOTE

When you perform a factory reset from STEP 7 while running a simulated instance in S7-PLCSIM, be aware of the Factory reset password behavior in STEP 7 [\(Page 56\)](#).

5.2 Creating a simulated PLC instance from S7-PLCSIM

If you started simulation from STEP 7 [\(Page 21\)](#), you already have PLC instances for each PLC simulation that you started.

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

Creating a new instance in the main view

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

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

You can power on a maximum of two simulated PLC standard instances. Click the power button of the instance to power it on. The simulated PLC is unconfigured until you download a STEP 7 project [\(Page 30\)](#) to it.

NOTE

System performance degrades with each added instance.

Creating a new instance in the Essentials view

You can add new simulated PLC instances when working from the Essentials view [\(Page 26\)](#).

To add a new instance to your Essentials view screen, do the following:

1. Click the "+" icon from the home screen to access the list of PLCs.
2. Click the "+" icon next to the PLC you want to simulate.

NOTE

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

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

5.3 Setting the simulated PLC instance properties

Setting the properties for a simulated PLC instance

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

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

The following table describes the parameters in the Properties tab:

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

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

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

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

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

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

5.4 Setting Global Properties

The "Global Properties" tab is designed to incorporate the functionality and centralized control found in the S7-PLCSIM Advanced control panel. Click the Global Properties tab  icon to configure the following options:

- Select the "Communication Mode [\(Page 34\)](#)".
- Enable or Disable the "Runtime Manager Port" and manually define the port number.

NOTE

You must set the port number you want to use before enabling the Runtime Manager Port. Once the Runtime Manager Port is enabled, the port number input field is disabled.

- Enable or Disable "Strict Motion Timing".

5.5 Communication modes

You can choose one of the following communication modes from the Global Properties tab:

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

NOTE

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

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

NOTE

Going online from STEP 7

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

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

Mapping to a network adapter (single)

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

1. Use the radio button to select "TCP/IP Single Adapter" from the "Communication Mode" list in the "Global Properties" tab.
2. Use the dropdown menu below "TCP/IP Single Adapter" to map a network interface to the adapter.

Mapping to network adapters (multiple)

If you are using the "TCP/IP Multiple Adapter" communication mode, use the dropdown menu in the Properties tab [\(Page 31\)](#)  for each instance to map a network interface to an adapter.

NOTE

The instance must be powered off.

Network ports and protocols

The following table outlines the specific ports, their associated protocols, and their primary functions within S7-PLCSIM

Port	Protocol	Default state	Purpose
8101 ¹	HTTP / TCP + SignalR	Closed	Blazor Server web interface
8100 ¹	Socket.IO / TCP	Closed	Electron communication
Dynamic	gRPC / HTTP/2	Closed	vPLC API communication

¹ Default ports might adjust based on system availability.

By default, the ports in S7-PLCSIM operate under the following conditions:

- Closed: Ports do not listen until S7-PLCSIM starts.
- Localhost Only: All network interfaces bind exclusively to localhost (127.0.0.1).
- Dynamic Allocation: All ports adjust based on system availability.

NOTE

For S7-PLCSIM Advanced TCP/IP Single Adapter and TCP/IP Multiple Adapter mode, refer to the S7-PLCSIM Advanced Function Manual.

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

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

To use this feature with the "download to device (Page 30)" method in STEP 7, you must do the following:

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

To use this feature with the "Start Simulation (Page 21)" method in STEP 7, you must configure the settings for S7-PLCSIM to use the "Advanced" default instance type before starting the simulation. You do not need to power cycle the instance.

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

5.7 Virtual time scaling

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

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

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

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

Interruption of the process

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

Virtual system time

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

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

Scaling factor

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

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

- The default is 1. The course of the virtual time corresponds to the course of real time.
- **Fast forward:** A scaling factor greater than 1 accelerates the virtual clock.
Example: Scaling factor 2.0 → The virtual time is running twice as fast.
- **Slow motion:** A scaling factor less than 1 decelerates the virtual clock.
Example: Scaling factor 0.5 → The progress of the virtual time slows down to 50%.

5.8 Resetting a simulated PLC instance

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

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

The simulated instance automatically resets.

5.9 Performing a memory reset (MRES)

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

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

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

The simulated instance automatically performs the memory reset.

5.10 Removing a simulated PLC instance

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

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

Working with SIM views

6.1 Introduction to SIM views

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

- SIM Table [\(Page 39\)](#) - monitor and modify I/O points, memory values, and PLC tags.
- Sequence [\(Page 42\)](#) - simulate an external process interacting with your program.
- Simulate the following Events:
 - Diagnostic interrupt
 - Hardware interrupt
 - Pull or Plug event
 - Rack or station error

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

Adding SIM views

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

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

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

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

See also

[Event simulation \(Page 47\)](#)

6.2 SIM tables

6.2.1 Creating, editing, and deleting SIM tables

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

Adding SIM tables to a SIM view

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

- Instance binding
The binding establishes that this table can monitor and modify tags and addresses for the simulated PLC instance that you selected.
- Views
Here you select the columns you want for this SIM table:
 - Name
 - Address
 - Display Format
 - Monitor/Modify State
 - Consistent Modify
 - Comment
- Tag loading
You can select and load any or all tags from the simulated PLC that correspond to these areas:
 - Input
 - Output
 - Memory

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

Adding tags and addresses directly to a SIM table

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

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

4. Select Area tags that you want to see:

- Input
- Output
- Memory
- DB

S7-PLCSIM displays the PLC tags and DB tags for your instance and area selection.

5. Click any tag to add it to the selected SIM table. If a tag name is truncated, hover over it to see the full name.

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

Adding rows to a SIM table

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

Deleting rows from a SIM table

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

Editing SIM table rows

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

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

NOTE

Adding or deleting tags to a SIM table stops monitoring [\(Page 41\)](#) if the SIM table is monitoring. Editing actions such as deleting or moving rows also stops monitoring.

Deleting a SIM table

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

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

6.2.2 Importing SIM table files

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

- S7-PLCSIM V17
- TIA Portal V17 and later

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

1. Open or create a new SIM view [\(Page 38\)](#).
2. Select the Library tab icon , then click the import icon  to the right of "SIM Table".
3. If you have only one instance in your workspace, select the import file from your File Explorer window and click "Open".
If you have more than one instance in your workspace, you are prompted to select the instance for PLC binding. Once selected, click "OK", then select the import file from your File Explorer window and click "Open".

6.2.3 Monitoring and modifying values in a SIM table

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

Stopping monitoring of a SIM table

To stop monitoring a SIM table, click the  button

Starting monitoring of a SIM table

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

NOTE

Binding of a SIM table to a simulated PLC instance

Each SIM table is bound to a specific simulated PLC instance. You established this binding when you created the SIM table [\(Page 39\)](#). You might have stopped, started, or deleted simulated PLC instances since you created the SIM table. If the PLC name from the STEP 7 project appears in red in your SIM table, the table is not bound to a simulated PLC instance. Note that both former and past simulated PLC instances can exist for the same PLC name in STEP 7. Correct the binding in the SIM table properties to restore the binding of the table to the correct simulated PLC instance.

Modifying values in a SIM table

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

6.3 Sequences

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

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

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

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

SIM table behavior when you download a project from STEP 7

When you download a program from STEP 7, S7-PLCSIM displays a yellow warning icon in the relevant field for any tags or addresses in your SIM table that are not in the project that you downloaded or that correspond to unsupported data types. A tooltip shows the specific error. For unsupported data types, you can use a watch table in STEP 7 for monitoring and modifying.

Forced addresses

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

6.3 Sequences

A sequence allows you to simulate the behavior of external devices on your running program. You can observe the effect of your program logic and to make any adjustments that might be necessary. When you save your project, you save the sequences. You can replay them multiple times to assist in debugging your program.

NOTE

S7-PLCSIM does not support sequences for Advanced instances.

Multiple sequences

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

6.3.1 Adding and configuring a sequence

To create a new sequence, follow these steps:

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

To configure your sequence properties, select the Properties tab icon  on the right side of S7-PLCSIM. From this tab, you can do the following:

- Create, edit, or delete sequence name.
- Select the simulated PLC instance for your sequence using the "Instance Binding" dropdown menu.
- Set the default time interval for each subsequent action row after the top (Start or Wait for condition) row. The interval must be set to 5 milliseconds or greater.
- Select the time interval format from the dropdown menu. Format options are as follows:
 - hh.mm.ss.ms
 - Milliseconds
 - Seconds
 - Minutes

6.3.2 Importing sequence files

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

To import an exported sequence file, follow these steps:

1. Open or create a new SIM view [\(Page 38\)](#).
2. Select the Library tab icon , then click the import icon  to the right of "Sequence".
3. If you have only one instance in your workspace, select the import file from your File Explorer window and click "Open".
If you have more than one instance in your workspace, you are prompted to select the instance for PLC binding. Once selected, click "OK", then select the import file from your File Explorer window and click "Open".

6.3.3 Adding sequence table action rows

Each new sequence table displays the following rows, in order, by default:

1. Top row: "Start" or "Wait for condition" action
2. Sequence action row
3. Bottom row: "Stop" action

There are several ways to add additional sequence action rows between the start and stop actions. You can do any of the following:

- Click the "+" at the bottom left of the sequence table viewlet to add a blank row just above the "Stop" row.

6.3 Sequences

- Select the checkbox at the beginning of the row directly above the new action row's intended position, then click the "+" at the bottom left of the sequence table viewlet to add a blank row between two existing action rows.
- Use the Tags tab to add an autopopulated row [\(Page 44\)](#).

Deleting sequence table action rows

To delete an action row in the sequence table, select the checkbox in front of the row or rows you want to delete, then click the trash can icon on the bottom left of the sequence table viewlet.

Rearranging action rows in a sequence table

To rearrange the action rows in a sequences table, you can do either of the following:

- Drag and drop individual action rows.
- Select the checkbox in front of the action row you want to move, then use the up and down arrows on the bottom left of the sequence table viewlet to adjust the position.

NOTE

You can only move one action row at a time.

6.3.4 Defining action row parameters

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

Setting the action row time interval

The "Start" row in the sequence table begins instantly (00:00:00:000).

Subsequent action rows default to a 500 millisecond time interval unless you have configured a time interval in the SIM view Properties tab [\(Page 43\)](#) that differs from the default. Each action row displays the time at which that action begins.

You can manually adjust the start time for each action row as low as five milliseconds, represented as "00.00.00.005" from the sequence table Properties tab.

Adding tag names and addresses from the Tags tab

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

1. Select the Tags tab icon  on the right side of S7-PLCSIM.
2. Select the instance name that corresponds to the PLC binding for the sequence.

3. Select Area tags that you want to see:

- Input
- Output
- Memory
- DB

S7-PLCSIM displays the PLC tags and DB tags for your instance and area selection.

4. In your sequence table, select the checkbox in front of the row directly above the new action row's intended position. Alternatively, if you do not select a checkbox, S7-PLCSIM will add the new action row at the end of the sequence table just above the "Stop" row.
5. Click any tag name to create your new action row. If a tag name is truncated, hover over it to see the full name.

Selecting the "Display Format"

The "Display Format" is set to "DEC" by default for each action row. If you prefer a different display format, select from the drop-down menu options in the "Display Format" column for each row.

Selecting the "Action" and providing the "Action Parameter"

The top row's "Action" dropdown menu provides an option to either "Start" or "Wait for condition".

Each subsequent action row provides the following "Action" options in the dropdown menu:

- Wait for condition
- Set to value (default)
- Control frequency
 - Start frequency
 - Stop frequency
 - Stop all frequencies

The bottom row only allows for the "Stop" action.

In the field provided, you can manually enter the "Action Parameter" that corresponds to the action selected for each row.

NOTE

The "Start frequency" action parameter input must be between 1Hz and 100Hz and expressed in whole numbers only.

Enter the "Action" and "Action Parameter" before running the sequence ([Page 46](#)).

6.3.5 Running the sequence

You can run one sequence per powered on instance by clicking the play button located in the bottom right corner of the sequence table viewlet .

As the sequence runs, the timer in the top right corner of the sequence table viewlet counts up.

S7-PLCSIM adds an icon at the beginning of the each action row as the sequence runs. Indicator icons are as follows:

Indicator Icon	Meaning
	Action complete
	Action is waiting for condition
	Action is next to execute in the sequence
	Action skipped based on manually set execution time for first sequence iteration

NOTE

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

Modifying a sequence

You can only modify a sequence when it is stopped.

Disabling an action row in the sequence

If you want to disable one or more action rows in the sequence, follow these steps:

1. Select the checkbox at the beginning of the row you want to disable.
2. Click the eyeball icon in the bottom left of the sequence table viewlet to dim the disabled row.

NOTE

If you deselect the checkbox in front of a step while the step is disabled, the step remains disabled in the sequence table. To remedy this, re-select the checkbox, click the eyeball icon to brighten the step, then deselect the checkbox.

Running the sequence on a loop

To run the sequence on a continuous loop, click the repeat button  in the top right of the sequence table viewlet. The default number of iterations is infinity. To set a finite number of iterations, enter the number in the "Iterations" field.

Manually setting the execution time for the first sequence iteration

You can manually set the execution time for the first sequence iteration. Click anywhere in the time field (00.00.00.000) in the top right corner of the sequence table viewlet to edit the execution time. S7-PLCSIM skips action rows that are set to begin before the manually set execution time.

NOTE

Manually setting the execution time only applies for the first sequence iteration. Subsequent sequence iterations will execute at the time selected for the first enabled action row in the sequence table.

6.4 Event simulation

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

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

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

6.4.1 Configuring events

To create a new event, follow these steps:

1. Open or create a new SIM view [\(Page 38\)](#).
2. From the Library tab icon  on the right side of S7-PLCSIM, click "+" next to "Event" to create an event instance.
3. From the Properties tab icon , you can configure these settings:
 - Event name
 - PLC Binding - Instance name of the simulated PLC instance for this event
 - Event category - Which of the four event categories [\(Page 47\)](#)
 - Event configuration: Module logical address (LADDR) - logical address of the module from the module's device configuration, which is the LADDR parameter [\(Page 48\)](#) for the event interrupt OB
 - IO State - For diagnostic Interrupt events [\(Page 49\)](#)

6.4.2 Configuring LADDR

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

Configuring the LADDR parameter

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

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

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

6.4.3 Simulating a pull or plug of modules event

Add a pull or plug of modules event (OB 83) and configure the common event parameters.
(Page 47)

Cause

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

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

6.4.4 Simulating a rack or station failure event

Add a rack or station failure (OB 86) event and configure the common event parameters.
(Page 47)

Cause

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

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

6.4.5 Simulating a hardware interrupt event

Add a hardware interrupt event (OB 4x) and configure the common event parameters. [\(Page 47\)](#)

Channel

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

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

6.4.6 Simulating a diagnostic error interrupt event

Add a diagnostic error interrupt event (OB 82) and configure the common event parameters. [\(Page 47\)](#)

IO State

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

- Good
- Maintenance required
- Maintenance demanded
- Error

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

Channel

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

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

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

Deleting channels

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

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

6.4.7 Triggering events

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

Simulating motion control

7.1 Motion control overview

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

NOTE**S7-1200 motion control projects**

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

Technology modules and simulation

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

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

Motion control simulation limitations

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

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

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

7.2 Simulations and homing mode

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

7.3 Isochronous mode not possible error

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

Example scenario

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

Observation

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

Cause

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

Solution

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

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

7.4 Motion OB overruns

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

7.5 Simulation deactivates MC-PreServo and MC-PostServo

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

7.6 Technology objects not loaded

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

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

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

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

7.8 Maximum of 5,120 motion control resources

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

Exceeding the quantity structure

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

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

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

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

7.9 High Speed Counter

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

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

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

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

7.11 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.

7.12 TO_PositioningAxis

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

Axis position feedback

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

Homing axis

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

Simulation restrictions

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

7.13 TO_ExternalEncoder

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

Homing

Active homing is not possible with the TO_ExternalEncoder object.

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

Error conditions and limitations

8.1 Factory reset password behavior in STEP 7

When you perform a factory reset from STEP 7 while running a simulated instance in S7-PLCSIM, the reset process clears the stored password for protection of confidential PLC configuration data from the simulated instance. This happens regardless of whether you select the "Delete password for protection of confidential PLC configuration data" checkbox in Online access > Properties > Functions > Firmware update > Reset to factory.

When downloading your STEP 7 project to the simulated instance after the factory reset, enter your original password for protection of confidential PLC configuration data to restore the connection.

8.2 Configuring read/write tag access for S7-PLCSIM based on PLC version

S7-PLCSIM allows you to read and write PLC tags. Based on your PLC version, configure Full (read and write) or Read only access as described in the table below:

PLC Version	Actions in STEP 7
- S7-1500 V3.0 and earlier - S7-1200 V4.6 and earlier	Under "Access control", select either "Full access (no protection)" or "Read access".
- S7-1500 V3.1 and later - S7-1200 V4.7	Option A: Disable access control Option B: With access control enabled, use "Security settings" > "Users and Roles" to assign Full access (or Read access only) to the enabled Anonymous user. For more information on assigning Users and Roles, see "Managing users and roles", in the TIA Portal Information System.

8.3 Instance will not power on after opening a saved workspace

In the following scenario, your simulated instance might not power on correctly when you try to reopen it from a previously saved workspace:

- You downloaded your STEP 7 project to an instance
- You set the instance to RUN mode
- The instance performed frequent file write operations to the virtual SD card
- You saved the workspace while the simulated instance was in RUN mode

To avoid this issue and prevent potential data loss, power off or set the S7-PLCSIM instance to STOP before saving the workspace.

8.4 Long downloads or timeouts when downloading STEP 7 projects with large arrays

For arrays in the STEP 7 project that are visible in HMI engineering, each array element is a tag. A single entry could have tens of thousands of tags. You might experience long download times or timeouts when downloading a project with large arrays to S7-PLCSIM.

8.5 Simulating instances with IP address from DHCP server

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

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

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

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

You can now set the simulated PLC instance to RUN.

8.7 Synchronization of IRT systems

Synchronization of IRT IO-Systems is not supported.

8.8 Using a proxy server with S7-PLCSIM

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

8.9 Cannot locate S7-PLCSIM Advanced Instances

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

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

8.12 Processor requirements for S7-PLCSIM

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

8.10 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.

8.11 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.

8.12 Processor requirements for S7-PLCSIM

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

8.13 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.

8.14 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.

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

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

S7-1200 projects do not experience this behavior.

8.16 Yellow coloring for fail-safe I/O

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

8.17 Scan cycle overflow

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

If the main scan cycle overflows, follow these steps:

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

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

8.18 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.

8.19 Simulating HMI connections

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

8.20 HMI Accessible tags

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

Data_block_1					
	Name	Data type	Start value	Retain	Accessible from HMI/OPC UA
1	Static			☐	☐
2	Static_1	Bool	false	☐	☒
3	Static_2	Bool	false	☐	☒
4	Static_3	Bool	false	☐	☐
5	Static_4	Bool	false	☐	☐
6	Static_5	Bool	false	☐	☒
7	Static_6	Bool	false	☐	☒

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

8.21 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.

8.22 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.

8.23 Simulating fail-safe programs

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

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

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

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

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

8.25 Working with global libraries

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

8.26 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.

8.27 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.

8.28 STEP 7 online & diagnostics functions

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

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

8.29 Simulation during standby mode

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

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

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

8.30 Working with automatically synchronized network drives

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

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

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

8.31 Decimal place character

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

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

8.32 Modbus V5.2 not supported

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

8.33 Error returned by High_Speed_Counter instruction

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

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

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

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

Setting STS_READY from a SIM table

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

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

8.34 Restrictions for instructions

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

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

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

T_CONFIG instruction

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

8.35 Simulating the Drive controller

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

S7-PLCSIM does not simulate the following:

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

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

8.36 Downloading to a simulated PLC instance with "Protection of confidential PLC configuration data" selected in STEP 7

To use "Protection of confidential PLC configuration data" in a TIA Portal V20 project with your simulated PLC instance, select the check box and set the password for it in the STEP 7 project. Download "Hardware and software" to the simulated PLC instance.

NOTE

Problems from downloading

If you select "Protection of confidential PLC configuration data" and set a password in the STEP 7 project, then download only "Hardware configuration" to a simulated PLC instance, this causes a password error on the instance.

If you receive an error message when you power cycle the simulated PLC instance in S7-PLCSIM, S7-PLCSIM might freeze requiring you to "End task" in the task manager.

If you know that you have downloaded only "hardware configuration" and you have not received an error message, follow these steps to avoid a crash:

1. Power off simulated PLC instance.
2. Click the reset  icon to reset your simulate PLC instance to a clean state.
3. Power on the instance.

You can now download "Hardware and software" to the simulated PLC instance.

8.37 Restrictions with NTP (Time synchronization)

You cannot download to a simulated PLC instance if time synchronization via NTP is enabled in the CPU's device configuration. If it is enabled, disable it to download to the simulated PLC instance.

Index

A

Access protection, [27](#)
Activity Log data sanitization, [24](#)
Activity logs, [24](#)
Automatically-synchronized network drives, [63](#)
Avoiding STOP mode in Fail-Safe simulations, [61](#)

C

Cause parameter
 pull or plug of modules event, [48](#)
 rack or station failure event, [48](#)
Channel parameter (Hardware interrupt), [49](#)
Communication disruption due to standby mode, [62](#)
Communication modes, [34](#)
Compile error when downloading, [60](#)
Configuring LADDR, [48](#)
Contact information, [7](#)
Copy protection, [27](#)
Counting, measurement and position detection, [29](#)
Cycle time, [32](#)

D

Data logging, [28](#)
Decimal place character, [63](#)
Diagnostic error interrupt event, [49](#)
Diagnostic errors, [27](#)
Documentation, [7](#)
Downloading to a PLC from STEP 7, [30](#)

E

Essentials view, [26](#)
 creating a new instance, [31](#)
 scan control, [32-33](#)
ET 200SP and ET 200pro technology support, [29](#)
Event configuration, [47](#)
Event simulation, [47](#)
 configuring LADDR, [48](#)
 pull or plug of modules, [48](#)
 rack or station failure, [48](#)
 hardware interrupt, [49](#)
 diagnostic error interrupt, [49](#)
 triggering events, [51](#)

F

Fail-safe yellow coloring, [59](#)
F-monitoring time, [28](#)
Forced address, [42](#)

G

Global libraries, [62](#)
Global Properties, [33](#)

H

Hardware interrupt event, [49](#)
HMI Accessible tags, [60](#)
HMI connections, [60](#)
HMI password protection levels, [62](#)

I

Importing SIM sequence files, [43](#)
Import SIM table files, [41](#)
Incompatible status display, [60](#)
Incorrect parameter values, [62](#)
Information resources, [7](#)
Instruction simulation support, [29](#)
Interrupt events
 simulating, [47](#)
 configuring, [47](#)
 LADDR parameter, [48](#)
Introduction, [20](#)

K

Keyboard shortcuts, [24](#), [25](#)
Know-how protection, [28](#)

L

LADDR, [48](#)
LEDs, [28](#)
License type, [32](#)

M

Manuals, [7](#)
Mapping to a network adapter, [34](#)
Map to adapter, [32](#)
MC-Interpolator, [53](#)
MC-Servo, [53](#)
Memory card, [28](#)
Memory reset (MRES), [37](#)
Memory usage, [35](#)

Motion control, [29](#)
 S7-1500 and ET 200SP, [29](#)
 limitations, [52](#)
 technology objects, [52](#)
 homing mode, [52](#)
 isochronous mode error, [52](#)
 alarm 113, [53](#)
 errors from technology objects, [53](#)
 loading project with MC-Servo and MC-Interpolator, [53](#)
 maximum resources, [54](#)
 quantity structure, [54](#)
 TO_PositioningAxis, [55](#)
 TO_ExternalEncoder, [55](#)
MRES, [37](#)

N

Network drives, [63](#)
Network interfaces as adapters, [34](#)

O

Online & diagnostics functions, [62](#)

P

PID Control technology, [29](#)
PLCs, simulated vs. real, [27](#)
Pull or plug of modules event, [48](#)

Q

Quantity structures, [35](#)

R

Rack or station failure event, [48](#)
Recipes, [28](#)
Removing instances, [37](#)
Reset, [37](#)
Reset a simulated PLC, [37](#)
Runtime Manager Port, [33](#)

S

- S7-1200
 - Fail-Safe, [28](#)
 - technology support, [29](#)
 - S7-1200 G2 technology support, [29](#)
 - S7-1500 technology support, [29](#)
 - S7-PLCSIM Help, [26](#)
 - Scan control, [32](#)
 - Scan cycle overflow, [59](#)
 - Security
 - file integrity, [17](#)
 - file authenticity, [17](#)
 - workspace location, [18](#)
 - anti-virus usage, [18](#)
 - system hardening measures, [19](#)
 - data protection, [19](#)
 - Sequences
 - overview, [42](#)
 - multiple, [42](#)
 - adding a sequence table, [43](#)
 - importing files, [43](#)
 - indicator icons, [46](#)
 - modify, [46](#)
 - loop, [46](#)
 - execution time, [47](#)
 - Sequence table action rows
 - deleting, [44](#)
 - rearranging, [44](#)
 - defining parameters, [44](#)
 - setting the time interval, [44](#)
 - adding tags and addresses, [44](#)
 - selecting display format, [45](#)
 - selecting the action, [45](#)
 - providing the action parameter, [45](#)
 - disabling, [46](#)
 - skipping, [46](#)
 - Sequence tables
 - configuring properties, [43](#)
 - action rows, [43](#)
 - Service and support, [7](#)
 - Setting properties for a PLC instance, [32](#)
 - Settings, [24](#)
 - SIM tables
 - creating and editing, [39](#)
 - importing files, [41](#)
 - monitoring and modifying values, [41](#)
 - Simulating
 - pull or plug of modules, [48](#)
 - rack or station failure, [48](#)
 - diagnostic error interrupt, [49](#)
 - motion control in run mode, [54](#)
 - HMI connections, [60](#)
 - communication with an HMI and multiple PLCs, [61](#)
 - SIM views, [38](#)
 - Single adapter and multi adapter modes, [34](#)
 - Sleep mode, [62](#)
 - Softbus, [34](#)
 - Standby mode, [62](#)
 - Starting a simulation
 - from desktop icon or Start menu, [21](#)
 - from STEP 7, [21](#)
 - from the S7-PLCSIM library, [31](#)
 - Starting S7-PLCSIM, [21](#)
 - STEP 7 online & diagnostics functions, [62](#)
 - Strict Motion Timing, [33](#)
 - Support, [7](#)
- ## T
- TCP/IP, [34](#)
 - Technology
 - S7-1200, [29](#)
 - S7-1200 G2, S7-1500, ET 200SP, ET 200pro, [29](#)
 - modules, [52](#)
 - Time-based IO, [29](#)
 - Time scaling, [36](#)
 - Triggering events, [51](#)
- ## U
- Using the STEP 7 safety system library, [61](#)
- ## V
- Virtual time scaling, [36](#)
- ## W
- Web server, [28](#)

Workspaces, [21](#)

X

X1 interface, [32](#)

Y

Yellow coloring for Fail-safe, [59](#)