SIEMENS

SIMATIC

STEP 7 (TIA Portal) options Target 1500S™ for Simulink® V4.0 Update 2

Programming Manual

12/2020
A5E38915112-AG

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 personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Note the following:

> ⚠ **WARNING**
>
> Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. 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.

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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

Introduction

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1.1 Guide for this manual

Purpose of the documentation

This documentation provides important information about installing and setting up SIMATIC Target 1500S for Simulink and generating an ODK object.

Basic knowledge required

The following knowledge is required in order to understand the documentation:

- General knowledge of automation technology
- Knowledge of the SIMATIC industrial automation system
- Knowledge of working with STEP 7
- Use of Microsoft Windows operating systems
- Proficiency with Mathworks MATLAB and Simulink

Validity of the documentation

This documentation is valid for the product SIMATIC Target 1500S for Simulink.

Notes

Please also observe notes labeled as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product or on the part of the documentation to which particular attention should be paid.

Definitions and naming conventions

The following terms are used in this documentation:

- Target 1500S: This term refers to the product SIMATIC Target 1500S for Simulink.
- ODK: This term refers to the product Open Development Kit 1500S in the compatible version.
- SO: Shared Object. Output object after an ODK build.
- SCL: Structure Control Language. Programming language in STEP 7.
- STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal V15.1 or higher)".
- MATLAB: Mathworks MATLAB

  MATLAB and Simulink are registered trademarks of The MathWorks, Inc.
- TIA Portal Openness: TIA Portal automation interface

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.
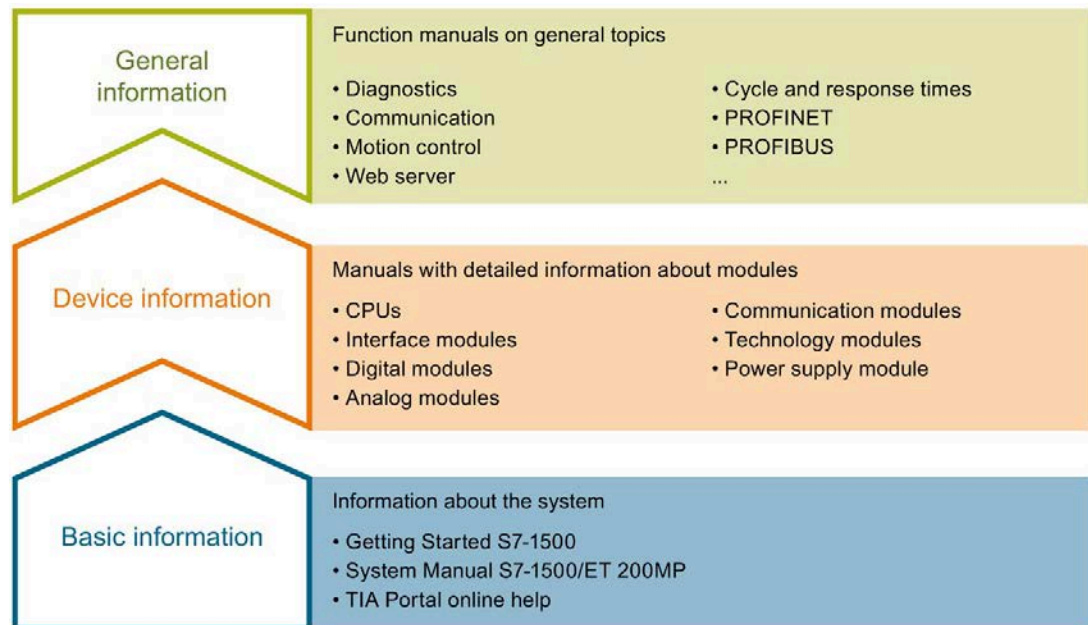
Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

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General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC S7-1500 and ET 200MP systems, e.g. diagnostics, communication, motion control, Web server, OPC UA.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742691).

Changes and supplements to the manuals are documented in a Product Information.

You can download the product information free of charge from the Internet (https://support.industry.siemens.com/cs/us/en/view/68052815).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (https://support.industry.siemens.com/cs/ww/en/view/86140384).

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet (https://support.industry.siemens.com/cs/ww/en/view/86630375).

"mySupport"

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You must register once to use the full functionality of "mySupport".

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 will find the application examples on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2054).

The Manual Collection includes the complete documentation for distributed I/O system SIMATIC ET 200SP assembled in a single file.

You can find the Manual Collection on the Internet (http://support.automation.siemens.com/WW/view/en/84133942).

Security information

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

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For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

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You can find current information on the following topics quickly and easily here:

- **Product support**

  All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

  Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

  Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**

  For answers and solutions concerning automation technology.

- **mySupport**

  Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (http://www.siemens.com/automation/service&support).

Industry Mall

<div style="text-align: right; font-size: 2em; font-weight: bold;">4</div>

The Industry Mall is the catalog and order system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

You can find catalogs for all automation and drive products on the Internet (https://mall.industry.siemens.com) and in the Information and Download Center.

Product overview

<div style="text-align: right; font-size: 3em; font-weight: bold;">5</div>

5.1 Overview of functions

Basics

Mathworks MATLAB is software for the primary solution of mathematical problems and their visualization.

Simulink is an add-on for MATLAB for graphical modeling of systems and their simulation.

Target 1500S

Target 1500S is an add-on for Simulink that generates an executable object from a Simulink model for an ODK-enabled controller. It enables you to run a Simulink model on a controller. In an automated process, Target 1500S integrates the generated program logic and the executable object. Target 1500S automatically generates all the required blocks and files for this. An SCL and SO file is created from the generated C/C++ code. The SCL file is imported as external source to STEP 7 and contains the generated function blocks. The SO file contains the C/C++ implementation and is available to the CPU after transfer to the Web server.

5.2 Basic procedure

Overview of the individual steps

To run a Simulink model on a controller, follow these steps:

1. Create a model in Simulink.

2. Configure the properties of the model in Simulink.

3. Under "Code Generation", select Target 1500S as System Target File.

4. Adapt the parameters for Simulink and Target 1500S.

    - Select a TIA Portal project in which to integrate the generated code.

    - Select the options for integration in the CPU user program.

    - Select the settings for External Mode, access to Model Dynamics, and Web visualization.

    - Set up automatic SO file transfer and loading to the CPU.

5. Start the build in Simulink.

    The SO and SCL files are generated and stored in the "outputs" output directory. Depending on your selected settings, these files are either automatically integrated into the TIA Portal project and loaded into the CPU, or you have to perform the integration into the TIA Portal project and loading into the CPU manually (see also Loading and running the ODK application (Page 47)).

Installing

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6.1   System requirements

Requirements

Your PC must meet the following system requirements in order to use the Target 1500S:

Category	Requirement
Operating system	Microsoft Windows 10, 64-bit
Processor and memory	PC system: • 100 MB of free space on the hard disk C:\ • At least systems with Intel Core i5 processor • 1.2 GHz or higher • At least 4 GB RAM
Operator interface	Monitor, keyboard and mouse.
SIMATIC Software	• SIMATIC ODK 1500S V2.0 or higher • Optional: SIMATIC STEP 7 Professional (TIA Portal) V15.1 or higher with TIA Portal Openness • Optional: SIMATIC CPU 15xx that supports ODK 1500S V2.0 or higher • Optional: S7-PLCSIM Advanced V3.0 or higher

Additional software	• MATLAB 2020b (64-bit) in the following configuration:
	  – MATLAB 9.9
	  – MATLAB Coder 5.1
	  – Simulink 10.2
	  – Simulink Coder 9.4
	• Java Runtime Environment (32-bit)

6.2   Installing Target 1500S

To install Target 1500S, select the installation folder. Follow the instructions of the setup program.

If the setup program does not start automatically, manually start the "Start.exe" file by double clicking it.

Note

Use of antivirus software

To avoid problems during the installation, disable the antivirus software for the period of the installation or exclude the directory "C:\Program Files\Common Files\Siemens\Automation\Siemens Installer Assistant" and the directory in which Start.exe is located, for the antivirus software.

Order of the installed Target 1500S versions

When you install multiple versions, make sure that the older version is installed before the newer one. If problems occur, uninstall all versions and install these again in this order.

Requirements

- You have installed a compatible ODK 1500S version and a 32-bit Java Runtime Environment .

- You need administrator rights for this action.

- MATLAB and Simulink are installed in the required configuration.

- Close all MATLAB instances.

Procedure

You can also run the installation automatically with the batch file "SilentInstall_Target_1500S.bat".

To install Target 1500S manually, follow these steps:

1. Launch the "Start.exe" file manually with a double-click.

2. Select the language for performing the installation.

3. Confirm with "Next".

   The "Configuration" view opens.

4. Click "Next" to confirm the list of components that are to be installed.

   The check mark for Automation License Manager (ALM) cannot be removed.

   Note

   Target 1500S is already installed

   If Target 1500S is already installed, you can select between "Repair (Page 20)" and "Uninstall (Page 19)" here.

   ---

5. Confirm with "Next".

6. Agree to the license conditions and safety information.

7. Confirm with "Next".

   The "Overview" with the installation settings opens.

8. Start the installation with "Install"

   The following directory is created:

   ProgramFiles(x86)%\Siemens\Automation\Target1500S*<current version>*

9. Choose whether you want to carry out the licensing (Page 17) during the installation or at a later time.

Result

The installation is complete. All product languages were installed by default during the installation process. During the installation, Target 1500S was integrated in Simulink and the product help was created in the Windows Start menu.

Note

You can install ODK after Target. Close MATLAB and other applications and then restart it after the installation.

6.3 Licensing Target 1500S

The software requires a product-specific license key that you install with the Automation License Manager. Each SIMATIC software product for automation that is subject to license (e.g., STEP 7) has its own license key. You must install the license key for each product.

Working with the Automation License Manager

The Automation License Manager is a product of Siemens AG and is used for managing license keys. The Automation License Manager is supplied on the installation data medium of this product by default and is transferred automatically during the installation process.

Software products that require license keys for operation register the requirement for license keys automatically in the Automation License Manager. If the Automation License Manager finds a valid license key for this software, the software can be used according to the conditions of use associated with this license key.

Certificate of license

A Certificate of License is included in the scope of delivery. It contains your unique license number. The license certificate serves as proof that you have a valid license key. Store this certificate in a safe place.

Note

Obtaining a replacement license key

You must have a valid certificate of license to get a replacement license key.

Recovering the license key in case of defective mass storage

If an error has occurred on the mass storage or USB flash drive containing your license key file, you can restore the license using the license certificate. You can find additional information in a FAQ (https://support.industry.siemens.com/cs/ww/en/view/772175).

Validity of license keys for older versions of Target 1500S

With a valid license key for Target 1500S™ for Simulink® V4.0, you can also operate older versions of Target 1500S without restrictions.

License key

The download of Target 1500S allows you to access ordered license keys.

For access, you need:

- A personalized login that you can use to call all license keys assigned to you.

- An anonymous login that you can use to fetch an individual license key, and the corresponding license certificate. This document contains all data required for the anonymous download.

Additional information on the license key and the download is available in the Automation License Manager manual (https://support.industry.siemens.com/cs/ww/en/view/102770153).

Transferring the license key

The license key can be transferred during the installation or afterwards.

If the USB flash drive with the relevant license key is inserted in the USB port of the PC at the start of installation, the license key will be transferred automatically during the installation. If the USB flash drive is not inserted at the start of installation, you have three options for installing the license key subsequently:

- To transfer the license key **manually** from a network computer or other storage medium, select the "Manual license transfer" button.

- Insert the USB flash drive with license key, and select the "Retry license transfer" button. The Automation License Manager opens in order to transfer the license key.

- If you do not want to install a license key, select the "Skip license transfer" button.

Working without valid license key

For legal reasons, a valid license key is required for this product.

If no valid license key is present on your PC, you cannot generate any projects and the system indicates the non-licensed mode with a message. You have the one-time option of activating a trial license. However, this license is valid for a limited period only and expires after 21 days. Therefore, the system prompts you to activate your Trial License during the first build. The runtime of the license starts with the activation. When the trial license has expired, an error message appears during the build process.

Manually transferring the license key subsequently

A message is displayed if you start the Target 1500S without transferred license key. If the Automation License Manager is not yet installed on your computer, you must install it beforehand.

To **manually** transfer the license key for Target 1500S subsequently, follow these steps:

1. Start the installation of Target 1500S with administrator rights.

2. In the "License Transfer" section, select the "Manual license transfer" button.

   A dialog box for synchronization of the license opens.

3. Select the destination and the source of the license key.

4. To transfer the license key, click the "Synchronize" button.

   The license key is transferred.

6.4   Uninstalling Target 1500S

Requirement

- You need administrator rights for this action.
- You have already installed Target 1500S .
- Close all MATLAB instances.

Procedure

You can also run the uninstallation automatically with the batch file "SilentUnInstall_Target_1500S.bat".

To uninstall Target 1500S manually, follow these steps:

1. Launch the "Start.exe" file manually with a double-click.

2. Select the language for performing the installation.

3. Confirm with "Next".

   The "Configuration" view opens.

4. Select the "Uninstall" option.

5. Confirm with "Next".

Result

- Target 1500S is removed from the MATLAB environment.
- The entries in the Start menu are deleted.
- Target-specific folders are deleted.

   Previously generated output of Target 1500S is not deleted.

6.5   Repairing Target 1500S

Requirement

- You require administrator rights for this procedure.
- You have already installed Target 1500S .
- Close all MATLAB instances.

Procedure

1. Launch the "Start.exe" file manually with a double-click.
2. Select the language for performing the installation.
3. Confirm with "Next".

   The "Configuration" view opens.
4. Select the "Repair" option.
5. Confirm with "Next".

Result

Target 1500S is re-installed.

Example of a workflow

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7.1 Creating a Simulink model

Procedure

1. In MATLAB, select the storage path for the model under "Current Folder".

   Alternatively, you can also set the storage path in the Simulink preferences under "File generation control".

2. Create the model in Simulink.

   You can also use an existing model or one provided by Simulink.

7.2 Description of Simulink parameters

Some configuration parameters are preset when you select Target 1500S as the System Target File . To do so, select the system target file for Target_1500S (*.tlc) of the required version in the "Configuration Parameters".

Note

Change/migrate the System Target File

If you change parameters in the "Configuration Parameters" and then want to change the System Target File, you need to first confirm the changes with the "Apply" button.

When you migrate from an older Target 1500S version to a newer version, the Target 1500S parameters that are identical in the versions are applied. Parameters that are not present in the older version are set to the default value by the system.
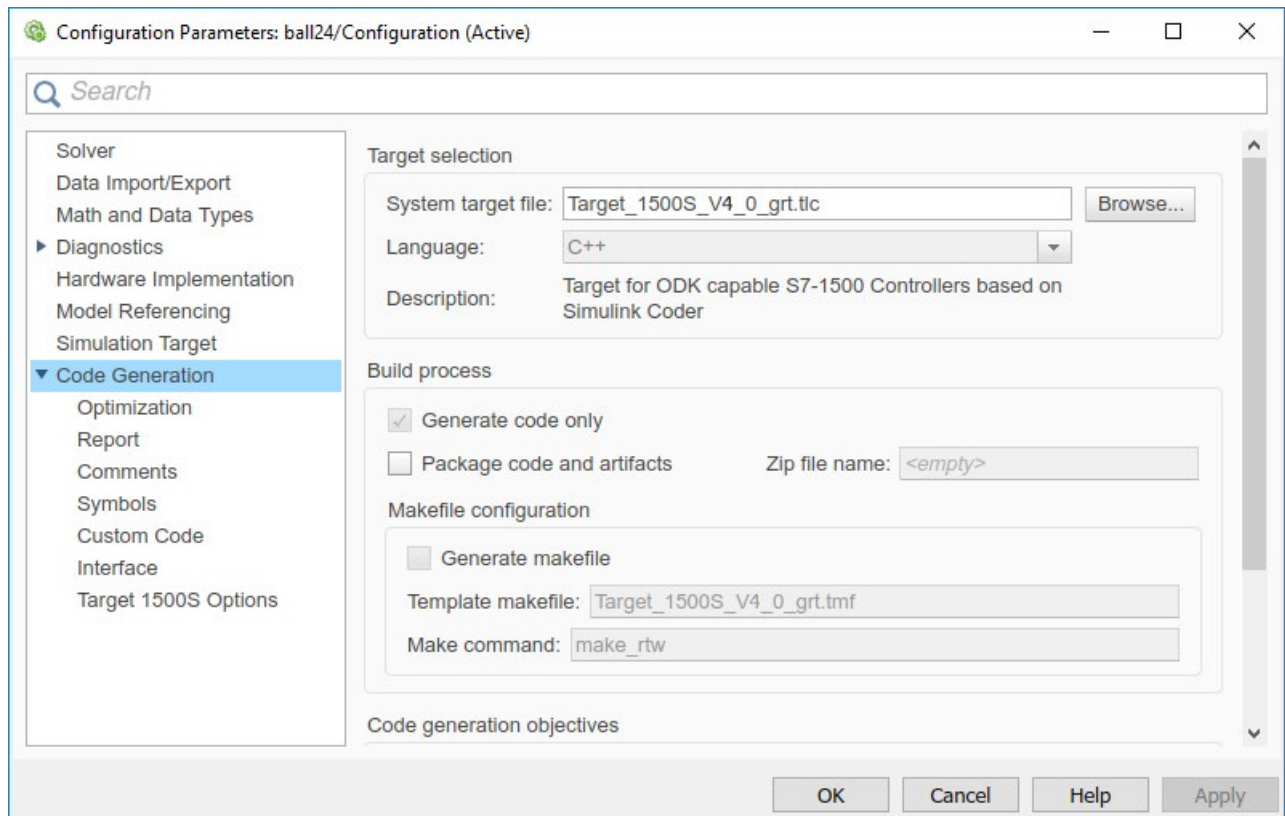
Figure 7-1   Configuration parameters using the System Target File for Target 1500S as an example

The default parameters are listed below. To successfully create an ODK object, you are not allowed to change some parameters. These parameters are marked in this product help with "(fixed)". Use the default values whenever possible.

You can also set special Target 1500S options here.

Note

Default parameters

The system assigns default parameters, and these may overwrite existing entries.

Requirement

You have selected Target 1500S as the System Target File .

Relevant parameters

Solver

A dynamic system is modeled as a mathematical calculation in Simulink. This calculation is performed at certain time intervals to simulate the execution of the system. The size of this time interval is referred to as the "Step-Size". The method for calculating the states of a model is referred to here as solving the model.

- Solver options

  Determine the solver selection

  - Type (fixed): Fixed Step

  - Solver: auto (Automatic solver selection)

- Tasking and sample time options

  - Periodic sample time constraint: Unconstrained

  - Tasking mode for periodic sample times: Treat each discrete rate as a separate task (disabled)

Data Import/Export

- Time (disabled)

- States (disabled)

- Output (disabled)

- Final States (disabled)

- Format ("Array" option activated)

- Limit data points to last (activated and "1000" value set)

- Decimation ("1" value set)

Hardware Implementation

- Device vendor (fixed): Intel

- Device type(fixed): x86-32 (Windows32)

Code Generation General

- Language (fixed): C++

- Makefile configuration (fixed): "Generate makefile" option disabled

- Generate code only (fixed): "Generate code only" option enabled

- Advanced parameters

  - Verbose Build

    This option is disabled by default. Only relevant information is displayed in the Diagnostic Viewer during the build process.

    Enable this option to get more detailed information during the build process.

Code Generation > Optimization

- Code generation

  You can select between "Tunable" and "Inlined" under "Default parameter behavior".

  Select "Tunable" if you want to allow parameter access from STEP 7. You can also change the parameter values during runtime.

  Select "Inlined" so that the values of the parameters are fixed and cannot be changed during runtime. The execution of the code is then faster.

Code Generation > Identifiers

- Maximum identifier length

  The default value is 256.

  You can enter a higher value, but be aware of the ODK limits.

Code Generation > Interface

- Code interface packaging (fixed): Nonreusable function
- Classic call interface (fixed): "Classic call interface" option disabled
- Single output/update function (fixed): "Single output/update function" option enabled
- MAT-file logging (fixed): "MAT-file logging" option disabled
- Data exchange interface

  Select "External mode (Page 54)" to use this. The settings are thereby made automatically.

  You can find the description of the individual parameters under "Setting communication parameters for external mode (Page 55)".

Code Generation > Target 1500S Options
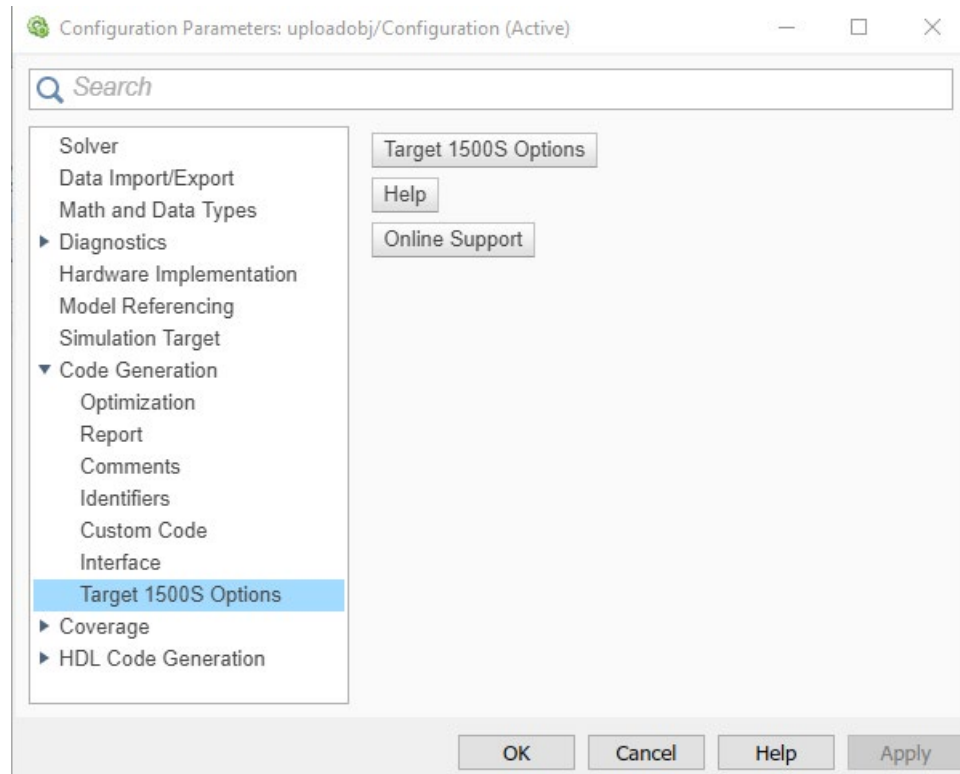
Figure 7-2   Target 1500S options

Target 1500S Options

When you click on this button, a new dialog opens with the Target 1500S options in individual tabs. The options are described in more detail in the following sections:

- Description of the TIA Portal integration options (Page 26)

- Description of the external mode options (Page 30)

- Description of the Accessibility options (Page 33)

- Description of the Post-build Options (Page 36)

- Description of the ODK options (Page 38)

Help

Click this button to open the online help for Target 1500S.

Online Support

To open the Support website, click this button.

7.3 Target 1500S configuration parameters

7.3.1 Description of the TIA Portal integration options

Requirement

- You have installed one of the following TIA Portal versions with STEP 7 Professional and the Openness plugin:
    - TIA Portal V15.1
    - TIA Portal V16
- You have selected Target 1500S as the System Target File.
- You are included in the Computer Management in the user group "Siemens TIA Openness" with your registered user and have restarted the operating system.

Parameters that can be set

Figure 7-3   TIA Portal Integration options

TIA Portal project

Define the path to the STEP 7 project into which the generated SCL file is imported.

For example: D:\tiaprojects\project\project.ap15

Device

From this list, select the name of the CPU in the STEP 7 project into which the generated SCL file is to be imported.

PROFINET interface

Select the PROFINET interface of the selected CPU from this list.

The selected PROFINET interface is used for:

- External mode
- Import of the SO file

IP address

Displays the IP address of the PROFINET interface.

Port

Shows the used port number of the IP address.

Note

When you do not fill the input fields for integration into a TIA Portal project with values or configure the IP address and the port number using the command line, the "Port:" input field is not visible.

Import the generated SCL file to STEP 7 (TIA Portal)

Automatic import of the generated SCL file into the TIA Portal project once the build is complete.

Software unit

Select the software of the selected CPU from this list.

Organization block

From this list, select the organization block of the selected CPU into which the generated "OneStep" FB is to be imported. To create a new cyclic interrupt OB, click "Create a new OB".

Instance DB

From this list, select the instance DB for the generated "OneStep" FB. To create a new instance DB, click "Create a new DB".

Cyclic time (µs)

For cyclic interrupt OBs, enter the cycle time of the selected organizational block. To set the value recommended by the model, click "Set to recommended value". The recommended value is the "Fixed-step size (fundamental sample time)" setting of the model.

Compile the CPU after import

Compiles the CPU after the file import.

Automatically save the TIA Portal project after build process

Saves the TIA Portal project once the build is completed.

7.3.2   Description of the external mode options

Requirement

You have selected Target 1500S as the System Target File.

Parameters that can be set

Figure 7-4   External mode options

Enable external mode

Enable this option to permit external mode communication for the model.

Verbosity level

Enable the "Verbose Mode (1)" option to get more detailed information during External mode communication in the "Diagnostic Viewer".

Port number

Enter the CPU-side port number for the TCP/IP connection during External mode communication.

Standard: 17725

Wait for start

The simulation starts automatically as soon as the "OneStep" function is executed. When you enable the "On (1)" option, the execution of the Simulink model does not start automatically. In this case, you need to start the simulation in the Simulink window after the connection is established using the "▶" button.

Hardware interface ID

Here, you can manually change the numeric value of the hardware ID of the corresponding communication interface. The value must correspond to the value assigned under "Hardware identifier" for a communication interface in the TIA Portal. If the values do not match, the connection between Simulink and the controller cannot be established via External Mode.

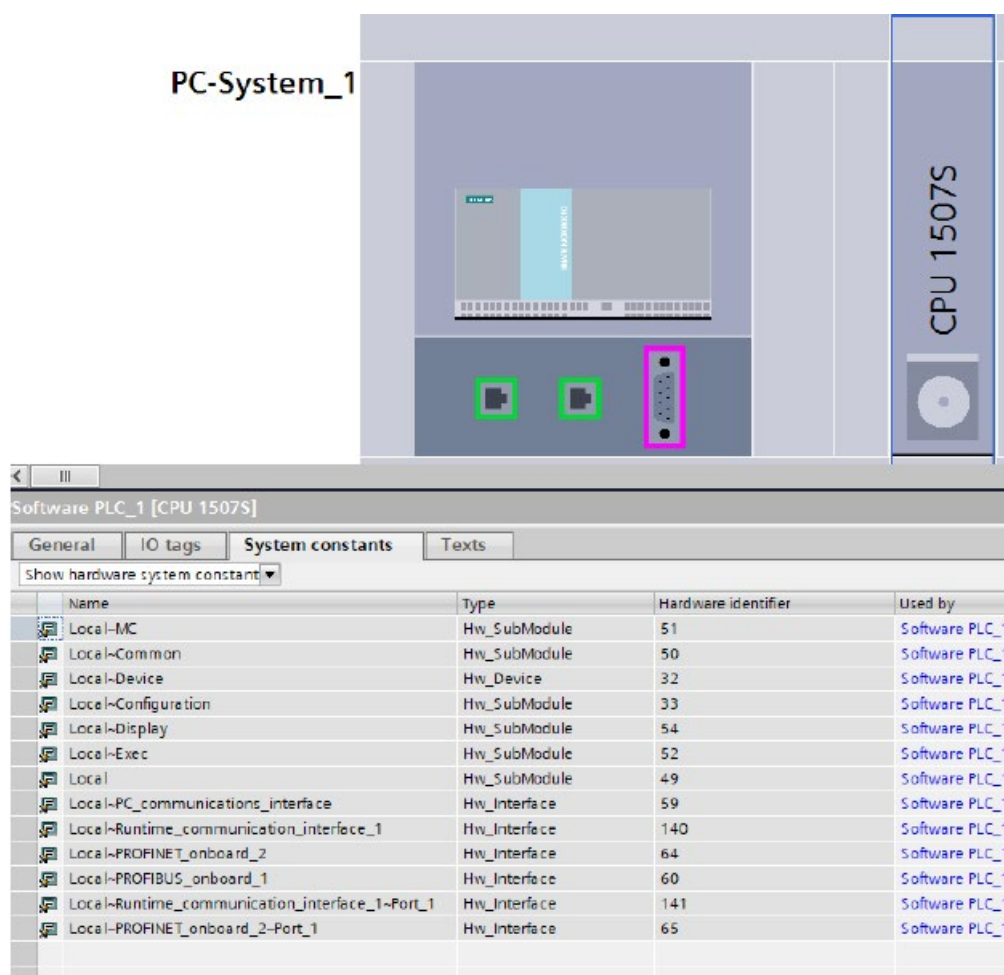|	Name	Type	Hardware identifier	Used by
	Local~MC	Hw_SubModule	51	Software PLC_1
	Local~Common	Hw_SubModule	50	Software PLC_1
	Local~Device	Hw_Device	32	Software PLC_1
	Local~Configuration	Hw_SubModule	33	Software PLC_1
	Local~Display	Hw_SubModule	54	Software PLC_1
	Local~Exec	Hw_SubModule	52	Software PLC_1
	Local	Hw_SubModule	49	Software PLC_1
	Local~PC_communications_interface	Hw_Interface	59	Software PLC_1
	Local~Runtime_communication_interface_1	Hw_Interface	140	Software PLC_1
	Local~PROFINET_onboard_2	Hw_Interface	64	Software PLC_1
	Local~PROFIBUS_onboard_1	Hw_Interface	60	Software PLC_1
	Local~Runtime_communication_interface_1~Port_1	Hw_Interface	141	Software PLC_1
	Local~PROFINET_onboard_2~Port_1	Hw_Interface	65	Software PLC_1

Figure 7-5   Example of a Hardware identifier setting

Connection ID

Enter a value between 1 and 4095 for the Open User Communication in STEP 7 for the communication of the External Mode.

The value must be unique for the STEP 7 user program.
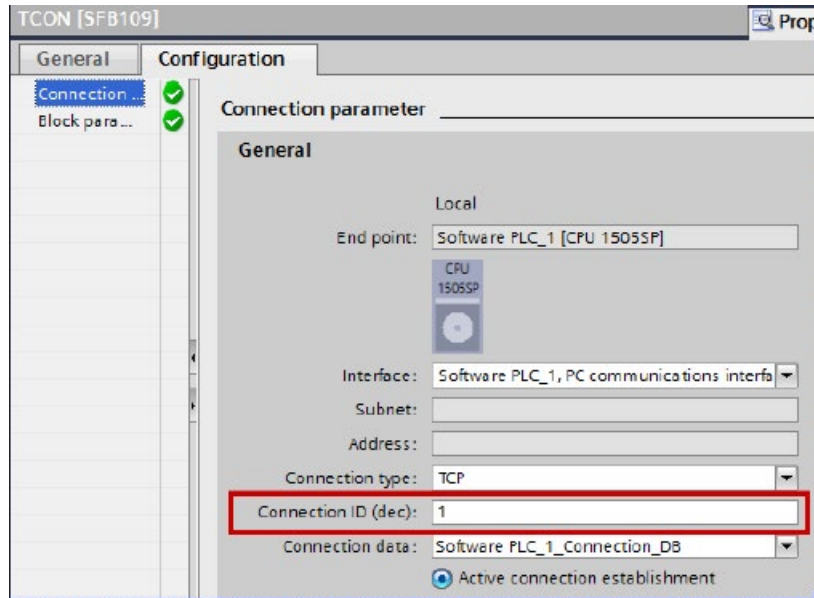
Figure 7-6   Example of the setting of the connection ID in STEP 7

Thread-safety of communication

Select the thread safety of the connection from this list. If the communication is thread-safe, you can call the "CallExtMode" FB and the "OneStep" FB in different OBs.

Organization block

From this list, select the OB of the selected CPU into which the generated "CallExtMode" FB is imported. To create a new OB, click "Create a new OB".

Instance DB

From this list, select the instance DB for the generated "CallExtMode" FB. To create a new instance DB, click "Create a new DB".

7.3.3   Description of the Accessibility options

Requirement

You have selected Target 1500S as the System Target File.

Parameters that can be set

Figure 7-7   Accessibility options

Enable parameter access with STEP 7

Select this option to generate a special code for accessing the model parameters from the STEP 7 program.

Note

Enable / disable Parameter access with STEP 7.

If you enable "Parameter access with STEP 7" under "Optimization" in the "Code generation" area, select the setting "Tunable" from the "Default parameter behavior" selection.

If you disable "Parameter access with STEP 7" under "Optimization" in the "Code generation" area, select the setting "Inlined" from the "Default parameter behavior" selection.

- Organization block

  From this list, select the OB of the selected CPU into which the generated "ReadWriteParameters" FB is imported. To create a new OB, click "Create a new OB".

- Instance DB

  From this list, select the instance DB for the generated "ReadWriteParameters" FB. To create a new instance DB, click "Create a new DB".

Enable STEP 7 access to internal model signals

Enable this option to obtain defined measurement points (internal signals) in the Simulink model as output(s) of the "OneStep" FB.

You can find additional information in the section "Access to internal signals (Page 64)".

From the "Internal signal selection" list, select the type of internal signals for the access from STEP 7.

- All measurement points including test points

  All measurement points are used as internal signals.

- All measurement points excluding test points

  All measurement points, excluding test points, are used as internal signals.

- Only test points

  Only measurement points defined as test point are used as internal signals.

Enable STEP 7 access to Stateflow states

Allows STEP 7 access to Stateflow states defined in Simulink models.

Generate model diagrams for PLC Web server

To display the Simulink model in the Web server, enable this option.

You can find additional information in the section "Display model on the Web server (Page 66)".

- Application name

  Enter the name of the Web server application. If you do not enter a name, the model name is automatically assigned for the application.

- Organization block

  From this list, select the OB of the selected CPU into which the generated "WebReadWrite" FB is imported. To create a new OB, click "Create a new OB".

- Instance DB

  To create a new instance DB with the fixed name "gDB_SWV_Interface", select "Create a new DB" from the list.

7.3.4 Description of the Post-build Options

If you have selected Target 1500S as System Target File, you can set a number of configuration parameters specific to Target 1500S. These parameters are listed below.

Parameters that can be set

Figure 7-8   Post-build Options

Transfer the generated SO file to CPU

To automatically import the generated SO files into the CPU after the build, enable this option.

- User

  If a login is required, select a user for Web server access to the CPU from this list.

- Password

  If a login is required, enter the password for Web server access to the CPU.

  Note

  Note that neither the password nor the user name is saved for security reasons.

Download TIA Portal project to device

To automatically download the STEP 7 project to the CPU after the build, enable this option.

- Type of the PG/PC interface

  Select a PG/PC interface from this list. Only PN/IE is available.

- PG/PC interface

  Select a PG/PC interface from this list, depending on the selected interface type.

- Connection to interface/subnet

  Select a subnet from this list, depending on the selected interface.

- After the download, start the CPU.

Note

Automatic download to fail-safe CPUs

Note that automatic download of a STEP 7 project to a fail-safe CPU is not possible.

7.3.5 Description of the ODK options

In the "ODK options" tab, you can set the following configuration parameters.

Requirement

You have selected Target 1500S as the System Target File.

Parameters that can be set
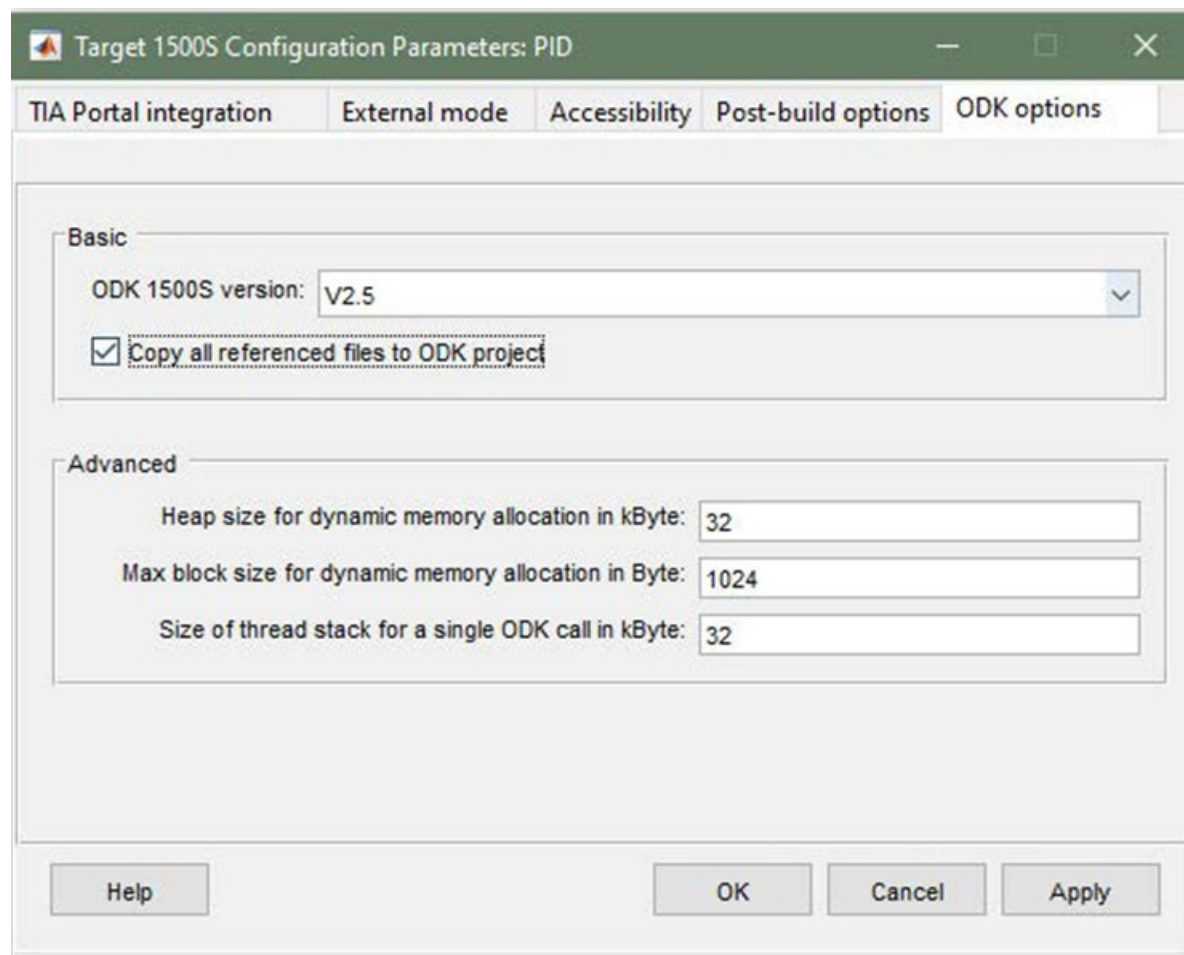
Figure 7-9   ODK options

ODK 1500S version

Choose an installed ODK version from this list. All versions that are compatible with the installed Target version are shown. Restarting MATLAB updates the list, if you have subsequently installed ODK.

Copy all referenced files to ODK project

To copy all MATLAB source files and other code into the ODK project, enable this option. The ODK project can then still be compiled on a PC without a MATLAB installation.

The referenced files are copied to the "references" folder under "<Model name>_Target_1500S_<Current version>_grt_Output".

Heap size for dynamic memory allocation in kByte

Specify the memory for dynamic memory allocation in the ODK object numerically. You need a greater memory allocation in the following cases:

- When you append additional source files to create an ODK project.

- When you are using "malloc".

- When you use new operations in your own functions.

    The value must be between 4 and [<available CPU memory>].

You can find additional information in the ODK documentation (https://support.industry.siemens.com/cs/ww/en/ps/13914/man).

Max block size for dynamic memory allocation in Byte

Specify the memory for dynamic memory allocation in the ODK object numerically. You need a greater memory allocation in the following cases:

- When you append additional source files to create an ODK project.

- When you are using "malloc".

- When you use new operations in your own functions.

    The value must be between 8 and [<Heap size>].

You can find additional information in the ODK documentation (https://support.industry.siemens.com/cs/ww/en/ps/13914/man).

Size of thread stack for a single ODK call in kByte

Numerically specify the memory for the thread stack of a call in the ODK application.

The value must be between 1 and 1024.

You can find additional information in the ODK documentation (https://support.industry.siemens.com/cs/ww/en/ps/13914/man).

7.4 Command line access to options

As an alternative to setting the Target 1500S parameters via the user interface, you can also access the parameters from the MATLAB command line window. To do this, use the command set_param as:

```
>> set_param ('<SimulinkModel>','ParameterName>','<NewValue');
```

Note

However, to maintain consistency, we recommend that you set the parameters via the user interface.

Callable options

The following tables show all callable options together with their parameter names in the program line, possible parameter values and mutual dependencies.

Table 7- 1   TIA Portal integration

Option	Command line parameters	Possible parameter values	Requirements and dependencies
TIA Portal project	`TiaPortalProject`	A valid file path string and file extension	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group
Device	`CpuName`	Device name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • A TIA Portal project has been specified
PROFINET interface	`PNInterface`	Interface name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Device' was selected
IP address	`IPAddress`	A valid IPv4 string	Manual setting: • No requirements Automatic extraction: • TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • PROFINET interface selected
Port	`IPAddressPort`	A positive number as string	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • PROFINET interface was assigned to the selected PC station

Option	Command line parameters	Possible parameter values	Requirements and dependencies
Import the generated SCL file to STEP 7 (TIA Portal)	`ImportScl`	'on', 'off'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group
Software unit	`SoftwareUnit`	'Non Unit program' or unit name in the TIA Portal	• TIA Portal Openness is installed (V16 or later) • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected
Organization block	`CyclicOB`	OB name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected
Instance DB	`CyclicDB`	DB name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected
Cyclic time (µs)	`CyclicOBTime`	A value between 100 and 60000000 as a string	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected • 'Organization block' is selected as cyclic interrupt OB
Compile the CPU after import	`CompileCpuAfterIm-port`	'on', 'off'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected
Automatically save the TIA Portal project after build process	`SaveTiaPortalProj`	'on', 'off'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected

Table 7- 2   External mode options

Option	Command line parameters	Possible parameter values	Requirements and dependencies
Enable external mode	`ExtMode`	'on', 'off'	'Enable external mode' is selected
Verbosity level	`ExtMode_VerbosityLevel`	'on', 'off' or '1', '0'	
Port number	`ExtMode_PortNumber`	A positive number as string	
Wait for start	`ExtMode_WaitForStart`	'on', 'off' or '1', '0'	
Hardware interface ID	`InterfaceID`	A positive number as string	
Connection ID	`ConnectionID`	A value between 1 and 4095 as a string	
Thread-safety of communication	`AllowExtModeInDifferentOB`	'on', 'off'	
Organization block	`ExtModeOB`	OB name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected • 'Enable external mode' is selected
Instance DB	`ExtModeDB`	DB name in the TIA Portal	

Table 7- 3   Accessibility options

Option	Command line parameters	Possible parameter values	Requirements and dependencies
Enable parameter access with STEP 7	`Control_Parameters`	'on', 'off'	
Organization block	`ParamAccessOB`	OB name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected • 'Enable parameter access with STEP 7' is selected
Instance DB	`ParamAccessDB`	DB name in the TIA Portal	
Enable STEP 7 access to internal model signals	`GenerateCodeForInternalSignals`	'on', 'off'	

Option	Command line pa-rameters	Possible parameter values	Requirements and dependencies
Internal sig-nal selection	`InternalSig-nalSelection`	• 'All measurement points including test points' • 'All measurement points excluding test points' • 'Only test points'	
Enable STEP 7 access to Stateflow states	`StateflowAccess`	'on', 'off'	Stateflow toolbox installed and valid license available
Generate model dia-grams for PLC Web server	`Generate-CodeForWebPage`	'on', 'off'	
Application name	`Generate-CodeFor-WebPage_AppName`		
Organization block	`WebAccessOB`	OB name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Import the generated SCL file to STEP 7' is selected • 'Generate model diagrams for PLC Web server' is selected
Instance DB	`WebAccessDB`	DB name in the TIA Portal	

Table 7- 4   Post-build options

Option	Command line pa-rameters	Possible parameter values	Requirements and dependencies
Transfer the generated SO file to the CPU	`UploadObject`	'on', 'off'	
User	For security reasons, no tag is accessible via the command line	Web server user name in the TIA Portal	Manual setting: • 'Transfer the generated SO file to the CPU' is select-ed Automatic extraction: • TIA Portal Openness is installed (V16 or later) • Windows user was added to the 'Siemens TIA Openness' group • 'Transfer the generated SO file to the CPU' is select-ed
Password	For security reasons, no tag is accessible via the command line	Web server user password	'Transfer the generated SO file to the CPU' is selected

Option	Command line parameters	Possible parameter values	Requirements and dependencies
Download TIA Portal project to device	`DownloadTiaProjToDevice`	'on', 'off'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group
Type of the PG/PC interface	`PgPcInterfaceType`	'PN/IE'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Download TIA Portal project to device' is selected
PG/PC interface	`PgPcInterface`	Interface name in the TIA Portal	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Download TIA Portal project to device' is selected • 'Device' is selected
Connection to interface/subnet	`PgPcInterfaceConnection`	Connection name in the TIA Portal (e.g.: '1 X1', '2 X3')	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Download TIA Portal project to device' is selected • 'PG/PC interface' is selected
Start CPU after download	`StartCpuAfterDownload`	'on', 'off'	• TIA Portal Openness is installed • Windows user was added to the 'Siemens TIA Openness' group • 'Download TIA Portal project to device' is selected

Table 7- 5   ODK options

Option	Command line pa-rameters	Possible parameter values	Requirements and dependencies
ODK 1500S version	`ODK_Versiontype`	'V2.0', 'V2.5'	A compatible ODK 1500S version
Copy all ref-erenced files to ODK pro-ject	`PortableProject`	'on', 'off'	
Heap size for dynamic memory allocation in kByte	`HeapSize`	[4...<available CPU memory>]k	
Max block size for dy-namic memory allocation in kByte	`MaxBlockSize`	[8...<HeapSize>]	
Size of thread stack for a single ODK call in kByte	`SyncCallStack-Size`	[1...1024]k	

7.5   Running Simulink build

Procedure

1. Start the build process in Simulink via the menu "Code > C/C++ Code > Build Model".

   The system creates a new ODK Eclipse project in the following folder:

   C:\ProgramData\Siemens\Automation\ODK1500S\<ODK version>\workspace

2. If the ODK workspace is already being used by another Eclipse application, the dialog "ODK 1500S default workspace is locked" opens.

   Close the Eclipse application and confirm the dialog with "OK".

3. If there is already an ODK project of the same name in the ODK workspace, the "Existing ODK 1500S Project" dialog opens.

   Click "Yes" to replace the existing project in the ODK workspace.

   Click "No" to cancel the build process.

Note

Rebuild model with a different Target version

If you rebuild a model with the same ODK version but a different version of the Target 1500S, the existing ODK project is overwritten.

Results

- The Diagnostic Viewer (Page 47) displays information about the build process.

- A folder containing all generated files was created. The folder name is: <Model name>_Target_1500S_V<Current version>_grt_Output.

- The relevant files are stored in the "outputs" subfolder.

- Depending on the selected target settings, the generated code is loaded into the TIA Portal project, compiled and transferred to the CPU.

You can find more information on the generated files in the appendix (Page 51).

Integration of files in program/data blocks

If you configured integration in program/data blocks before running the build, the program blocks are arranged in the TIA Portal project for the corresponding CPU:

- Add instance DB calls to the selected program blocks (at the end of each program block)

- Overwrite existing DB calls in program blocks

- Remove instance DB calls whose functionality cannot be called for the new build

---

Note

If there is an instance DB call to a previous build in a function block (FB), that call cannot be modified during automatic integration into the STEP 7 project and can cause a compilation error in the affected CPU. In such a case, remove or edit the call manually before you run the build.

Note

Automatic program block operations are currently only supported for SCL.

Compatible devices

The generated SO file can be executed in the following environments:

- S7-1500 Software Controller

- ET 200SP Open Controller

- CPU 1518 MFP/ODK

- S7-PLCSIM Advanced (as of V3.0)

7.6 The Diagnostic Viewer

The Diagnostic Viewer displays information about the build process.

Layout
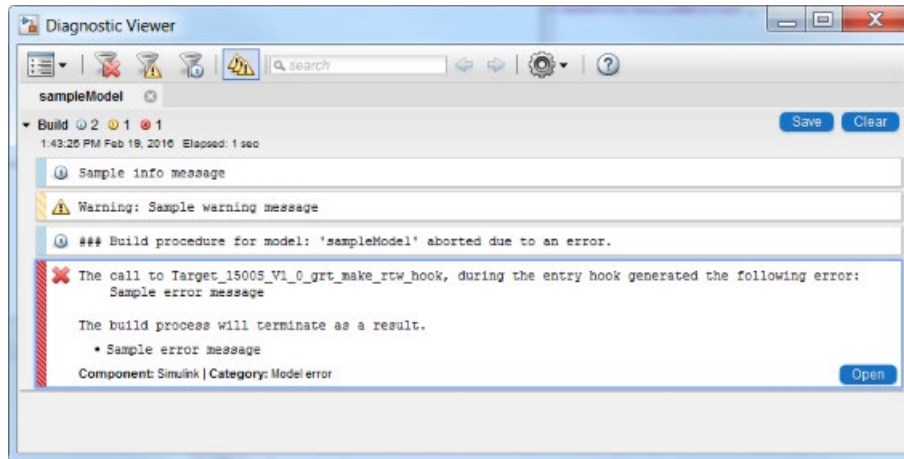
Symbol	Designation	Meaning
	Information	This alarm provides information about the progress of the build process.
	Warning	This alarm does not abort the build process. You are made aware of special considerations and possible problems.
	Error	This alarm indicates an error that results in termination of the build process.

You can find the possible information, warning and error messages under Alarms (Page 78).

7.7 Loading and running the ODK application

The procedure for loading and executing an ODK application is described in the next steps. More information about the individual steps is provided in the manual of the Open Development Kit 1500S (https://support.industry.siemens.com/cs/ww/en/ps/13914/man).

Note

If the ODK application is not loaded automatically during the build, you can load the ODK application into the CPU manually.

Procedure

1. Open the Web server of the ODK-enabled S7-1500 CPU.

2. Upload the SO file to the ODK 1500S folder via "Filebrowser".

   Steps 1 and 2 describe manual steps. Only perform these steps manually if automatic execution is disabled or not possible.
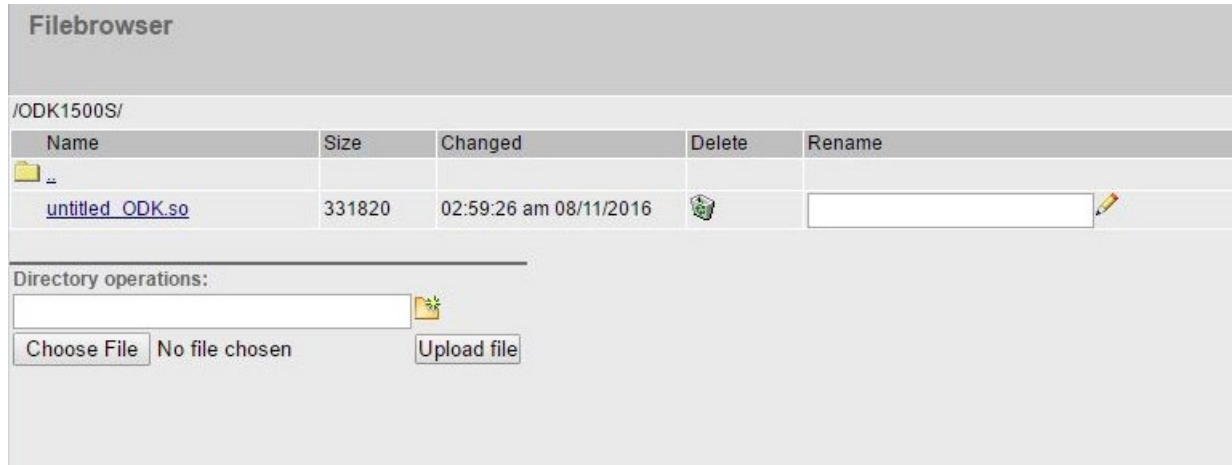
The SO file is transferred to the load memory.

3. Insert the SCL file in the project tree in STEP 7 as an external source.

4. Generate the program blocks from the external source in STEP 7 by right-clicking on the SCL file > "Generate blocks from source".

   Depending on the parameters set, the following function blocks are created:

   – <Simulink model>_Load

   – <Simulink model>_Unload

   – <Simulink model>CallExtMode

   – <Simulink model>OneStep

   – <Simulink model>ReadWriteParameters

   – <Simulink model>WebReadWrite

   Steps 3 and 4 describe manual steps. Only perform these steps manually if automatic execution is disabled or not possible.

5. Load the application from the load memory to the work memory of the CPU with the instruction "<Simulink model>_ Load".

Note

Loading and unloading blocks

Note that the "Load/Unload blocks" function is not automatically integrated into the TIA Portal project within the block options.

---

6. Run the application with the instruction "<Simulink model>OneStep".

Note

Run a modified SO file

A modified SO file is not executed until the old SO file is unloaded with the <Simulink model>_Unload function and the new SO file is loaded with the <Simulink model>_Load function to the work memory.

If previously loaded SO files are not unloaded, they remain in the work memory and reduce it. This can mean that no more SO files can be loaded because the available work memory is no longer sufficient. To empty the work memory, shut down your system and restart it.

Procedure:

1. Unload previously loaded SO files.
2. During the build, perform an automatic import of the new SCL file into the CPU of the TIA Portal project or manually import the new SCL file after the build.
3. During the build, perform an automatic transfer of the new SO file to the TIA Portal project CPU or manually transfer the new SO file after the build.
4. Load the new changed SO file.

Using an example project **8**

An example project is ready for you on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109482830) to help getting started with the Target 1500S.

An application example for virtual commissioning with SIMATIC and Simulink is available on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109749187) under application case 3.

Files generated by coders

A

To create ODK-enabled data, the Target 1500S TLC is used based on the Simulink Coder. The generated files and their main functions are explained below.

Files created by Simulink Coder

- <Simulink model>.cpp

  This file has three main functions:

  - void <Simulink model>_step(void)

    This function is called by the OneStep FB and is casted to the Simulink model.

  - void <Simulink model>_initialize(void)

    This function is called by the <Simulink model>_Load FB.

  - void <Simulink model>_terminate(void)

    This function is called by the <Simulink model>_UnLoad FB.

- <Simulink model>.h

Files created by the Target 1500S TLC

- <Simulink model>_ODK.odk

  This file is used as input for the ODK code generator.

- <Simulink model>_ODK.cpp

  This file contains the execution of OnLoad, OnUnload and OneStep functions.

- <Simulink model>_ODK.scl.additional

  This file is only generated when external mode (Page 54) is activated.

Target 1500S TLC generated a comment with the following information in the files:

- Name and version of the Simulink model.
- Name and date of creation of file.
- Target 1500S version and the System Target File used.
- ODK 1500S version
- Versions of the MATLAB configuration

Referenced models

<div style="text-align: right">

B

</div>

Since Version V1.0 Update 1, Target 1500S has been supporting the code generation of referenced models for controllers with ODK capability. With referenced models, a parent model contains one or more referenced models. A referenced model itself can refer to further referenced models.

Special considerations for code generation with referenced models

Target 1500S detects referenced models and processes the models from the referenced models to the parent model during the build. The system creates an ODK Eclipse project at the end of the build.

You can configure the parameters for the parent model and the referenced models differently under "Configuration Parameters (Page 21)". In the following table, you can see the response to the respective parameters.

Parameter	Response to referencing	
	Only the settings of the parent model are taken into consideration	**The settings are individually evaluated**
ODK 1500S version	✔	
Copy all referenced files to ODK project	✔	
Parameter access with STEP 7		✔
Enable STEP 7 access to internal model signals		✔
Enable STEP 7 access to Stateflow states		✔
Generate model diagrams for PLC Web server	✔	
Enable external mode	✔	
Settings for "Integration to TIA Portal project"	✔	
Import the generated SCL file to CPU(s)	✔	
Compile the CPU after import	✔	
Automatically save the TIA Portal project after build process	✔	
Transfer the generated SO file to the CPU	✔	
Download TIA Portal project to device	✔	
Start CPU after download	✔	

External mode

If the external mode (Page 54) is enabled in the parent model, it can also be used for the referenced models contained therein.

For code generation, the "Interface" settings of the referenced models are ignored and the settings of the parent model are used.

If you select a setting other than "External mode" or "None" for the referenced model under "Interface", an error message appears during the compiling.

External mode

<div style="text-align: right; font-size: 3em;">C</div>

C.1　The external mode

The external mode of Simulink enables you to monitor the model during runtime and change the parameters of the model online.

For Simulink to be able to communicate with the model on the controller via external mode, external mode must be activated before starting the build process. In this case, the code is supplemented by communication code for the data exchange between Simulink and the controller. The communication is realized on the basis of TCP/IP.

> **⚠ DANGER**
>
> **Changes to the model only in the test environment**
>
> Use the external mode for test purposes only.
>
> Changing the tag values while the plant is operating may result in severe damage to property and personal injury in the event of malfunctions or program errors. Make sure that dangerous states cannot occur before you use the "Modify" function.
>
> When using the external mode, note that no CPU password is required to control tags.

Activating external mode

To activate external mode, select the value "External mode" under "Code Generation > Interface > Data exchange interface" in the Simulink parameters (Page 21). Alternatively, activate the "Enable external mode" option in the user interface of the Target 1500S configuration parameters.

C.2   Setting communication parameters for external mode

- External mode options on the Target 1500 user interface
  - IP address:

    IP address of the ODK-enabled controller which is to run the application.

    Uses the IP address of the "IP Address" option of the "TIA Portal integration" tab of the Target 1500S user interface.

  - Verbosity level (optional):

    Set the value "1" in order to obtain detailed information about the external mode in the "Diagnostic Viewer (Page 47)".

  - Port number (optional):

    The port number of the server for the TCP/IP connection (ODK-enabled controller).

    Default: 17725

  - Wait for start (optional):

    If you set the value to "0", the simulation starts automatically when the "OneStep" function is executed.

    If you set the value to "1", the execution of the Simulink model does not start automatically. In this case, you need to start the simulation in the Simulink window after the connection is established using the " ▶ " button.

- Other external mode options in the Simulink configuration
  - Static memory buffer size

    This memory is required for communication of the external mode.

    Increasing "Static memory buffer size", however, simultaneously reduces the available memory for loading the ODK object. Adhere to the ODK limits. If necessary, you can enter a higher value or change your model.

You can find a description of the other options of the "External mode" tab in section "Description of the external mode options (Page 30)".

Note

Change the parameters of the external mode

If you change the parameters of the external mode, you need to rebuild the Simulink model. Then update the STEP 7 user program and the SO file on the CPU (see "Loading and running the ODK application (Page 47)").

C.3 The function block CallExtMode

Structure of the function block (FB)

If the block call is not generated automatically, you can also insert the block manually as described below.

```
                      #myModelCallExt
                       Mode_Instance
                   "myModelCallExtMode"
                EN                        ENO
#enableExtMode — EnableExtMode
            64 — HW-Identifier         STATUS — #myModelExtMod
         17725 — LocalPort                      eStatus
             1 — OUC-Identifier
```
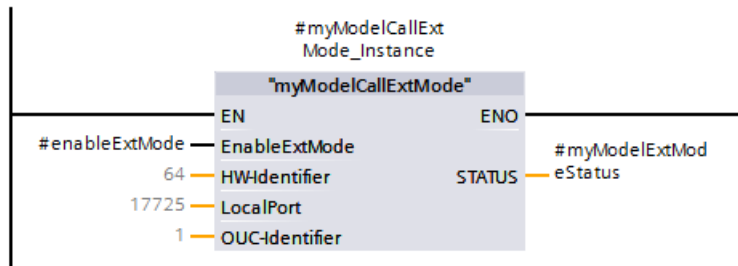
The "<Simulink model>CallExtMode" FB has the following input parameters:

- EnableExtMode (Bool)

    To establish an external mode connection, set this parameter to "true" using a tag.

- HW-Identifier (UInt)

    You specify the value of the hardware interface ID for the communication interface in the Target 1500S options.

    The default value is "64".

- LocalPort (UInt)

    The port number value is set in the Target 1500S options.

    Change the value to establish the external mode connection using a different CPU port.

- OUC-Identifier

    The value for the Connection ID is set in the Target 1500S options.

    The Connection ID is required for Open User communication and the value must be unique for the STEP 7 user program.

The "<Simulink model>CallExtMode" FB has the following output parameters:

- STATUS

  The status parameter has the type <Simulink model>ExtModeStatus_UDT (User Definied Datatype) and contains the following parameters:

  - Status_TCON (Word)

  - Status_TDISCON (Word)

  - Status_TRCV (Word)

  - Status_TSEND (Word)

  - Status_ODK (Int)

  - Status_ExtMode (Word)

  You can find the status descriptions for "TCON", "TDISCON", "TRCV", "TSEND" in the STEP 7 help.

  You can find the status descriptions for ODK in the manual (https://support.industry.siemens.com/cs/ww/en/ps/13914/man).

Note

Special features of the option "Thread-safety of communication"

If the option is set to "Not thread-safe", call the "CallExtMode" FB in the same block (OB, FB) as "OneStep". Otherwise, the model calculation is not performed synchronously with the data connection.

If the option is set to "Thread-safe", you can call the FB "CallExtMode" in a different "OneStep" block.

Note the following when option is "Thread-safe":

- The block which contains the FB "OneStep" must have a higher priority than the block with the FB "CallExtMode".
- The possible available memory for running ODK applications is reduced.
- Call the FB "CallExtMode" in a program cycle OB.
- If the cycle interruption time of the OB in which the FB "OneStep" is called is too short, interruptions may occur in the graphs (scope) during simulation of the model in Simulink.

Functionality of the block

The FB has the following tasks:

- Communication between Simulink and controller.

- Data transfer between Simulink and controller.

Return value for Status_ExtMode	Description
0x0000	Return value after successful execution or initial state.
0x0001	Not enough memory for the external mode.
	The allocated memory may be too small for a complex Simulink model.
	Increase the value in the interface options under "Static memory buffer size". To apply the value, generate the ODK object again.
	"Static memory Buffer size", however, reduces the space available for the application at the same time.

C.4 Establishing an external mode connection

Procedure

1. Call the FB "<SimulinkModel>CallExtMode" and enable access (EnableExtMode).

Note

Run the OneStep FB before the external mode connection is made.

Simulation steps are executed as soon as the OneStep FB of a cyclic OB is called. If the external mode connection is not yet established, these steps are lost.

To prevent this, set the "Wait for start" option to "On" (1) in the "External mode" dialog of the Target 1500S.

2. Select "External" as the simulation mode.

3. As the simulation stop time, select the value "inf" for endless simulation or an appropriate value for your model.

Note

Checking the solver settings

Check whether the setting "fixed-step-size (fundamental sample time)" under "Solver > Solver details" is set appropriately for your model.

You can find more information about parameters in the MATLAB and Simulink documentation.

---

4. To establish the external mode connection, click on the connect symbol " ".

Result

You can monitor the model during runtime of the controller and change parameters of the model online.

Note

When the simulation is completed or canceled, the CPU must be switched from "STOP" to "RUN" in order to start a new connection with subsequent simulation. Data from the previous simulation is overwritten.

Parameter access from STEP 7 D

D.1　Introduction

Certain parameters can be read and changed at runtime after you enable parameter access in the STEP 7 user program. These parameters can be user parameters used in the model or parameters integrated in the blocks of the model.

It is also possible to read and change the model parameters via External Mode in order to test and adapt your model at runtime.

D.2　Enabling parameter access

Parameter types

For a parameter used in a Simulink model, there are two different contexts for optimizing the parameters.

Block parameters

Block parameters are integrated parameters of a Simulink block in the model. To allow access to these parameters, select "Tunable" under "Default parameter behavior" in "Code Generation > Optimization".

Workspace parameters

You define the workspace parameters in a MATLAB workspace.

Procedure

1. Enable the "Parameter access with STEP 7" in the Target 1500S options.

2. In order to generate the UDT "<Simulink model>Params" and FB "<Simulink model>ReadWriteParameters" in the SCL file, select "Tunable" under "Default parameter behavior" in "Code Generation > Optimization".

   You can also configure parameters other than "Tunable". You can add the parameters defined in the MATLAB workspace in the "Model Parameter configuration" area.

   To do this, select a supported storage class.

Storage class	Support
Model default	Yes
ExportedGlobal	Yes
ImportedExtern	Yes
ImportedExternPointer	No

3. Compile the model, transfer the corresponding files to STEP 7 as before and load the STEP 7 project into the CPU.

D.3 The ReadWriteParameters function block

In order to read and change parameters, you need the UDT "<Simulink model>Params" and the FB "<Simulink model>ReadWriteParameters".

Structure of the function block (FB)
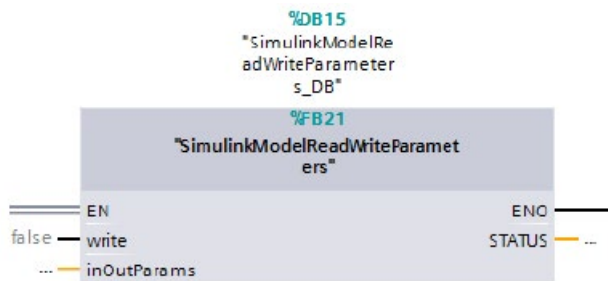
The "<Simulink model>ReadWriteParameters" FB has the following input parameters:

- write (Bool)

  To write the parameters from the S7 program to the Simulink model, set this value to "true". The values passed with the "inOutParams" parameter are processed by the Simulink model.

  To read the parameters from the Simulink model, set this value to "false". The current values of the Simulink model parameters are written to a tag interconnected to "inOutParams".

The "<Simulink model>ReadWriteParameters" FB has the following parameters:

- inOutParams

  The inOutParams has the type <Simulink model>Params UDT and is used for reading or writing parameters in the Simulink model.

The "<Simulink model>ReadWriteParameters" FB has the following output parameters:

- STATUS

  This return value is automatically generated by ODK.

  The return value is "0" when the execution is successful.

  You can find information on the other error codes in the ODK manual (https://support.industry.siemens.com/cs/ww/en/ps/13914/man)

The UDT parameter values are initialized with their default values as defined in MATLAB/Simulink.

D.4 Establishing parameter access

Procedure

If automatic block call is not possible, proceed as follows:

1. Generate blocks from the SCL file in STEP 7.

2. Use the blocks generated in STEP 7.

   – To set the values in the same cycle, call the "ReadWriteParameters" FB before "OneStep".

   – To set the values in the following cycle, call the "ReadWriteParameters" FB after "OneStep".

Note

Thread-safety requirement of the "ReadWriteParameters" FB

You cannot change the model parameters dynamically using the "OneStep" model function block.

To change the parameters dynamically, use the "ReadWriteParameters" FB in STEP 7.

Note

The "ReadWriteParameters" FB is thread-safe, i.e. you can call the "ReadWriteParameters" FB and the "OneStep" FB in different OBs.

The UDT parameter values are initialized with their default values set in MATLAB/Simulink.

Note

Changed model parameters in the S7 program are kept in the work memory. If the associated ODK object is re-initialized, the parameters are reset to their default values.

Access to internal signals

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You can define measurement points in the Simulink model by giving names to the lines of a model. Measurement points are referred to as "internal signals" in the context of Target 1500S.
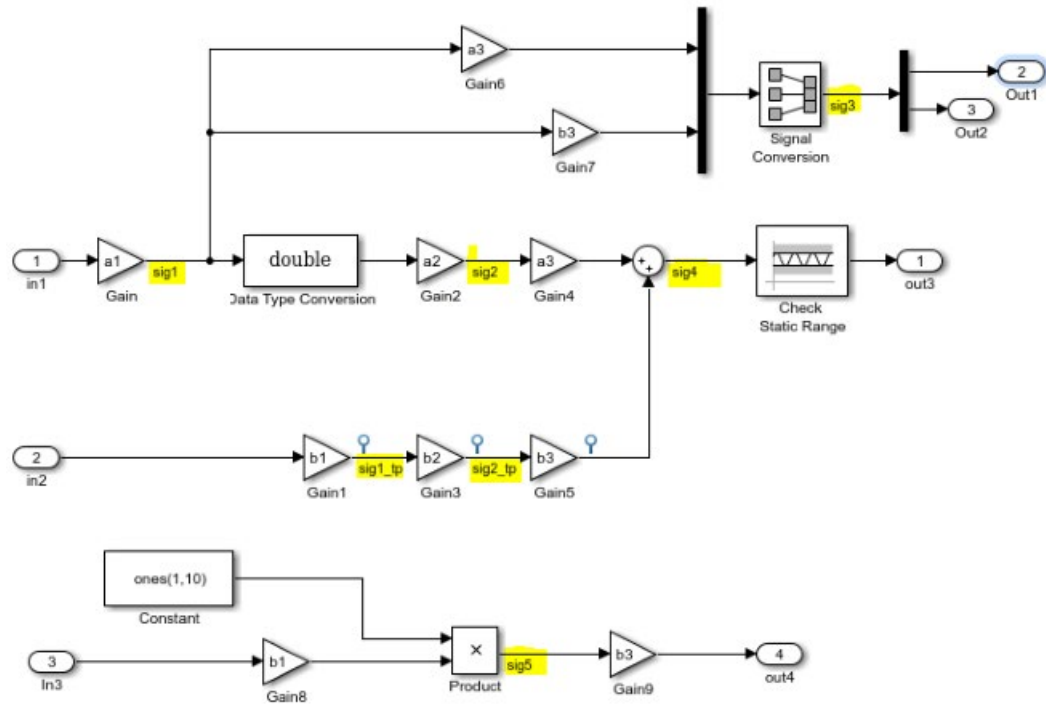
Figure E-1   Example model with internal signals

If you enable the "Enable STEP 7 access to internal model signals" option in the Target 1500S options, these internal signals are defined as output of the "OneStep" FB during the generation of the code.

Special features for the FB "OneStep"

Target 1500S defines the internal signals during the generation of the code in an ODK_STRUCT with the name "InternalModelSignals". The FB "OneStep" needs a new output parameter "OUT" with the name "internalSignals" for this purpose.

Properties of the signal
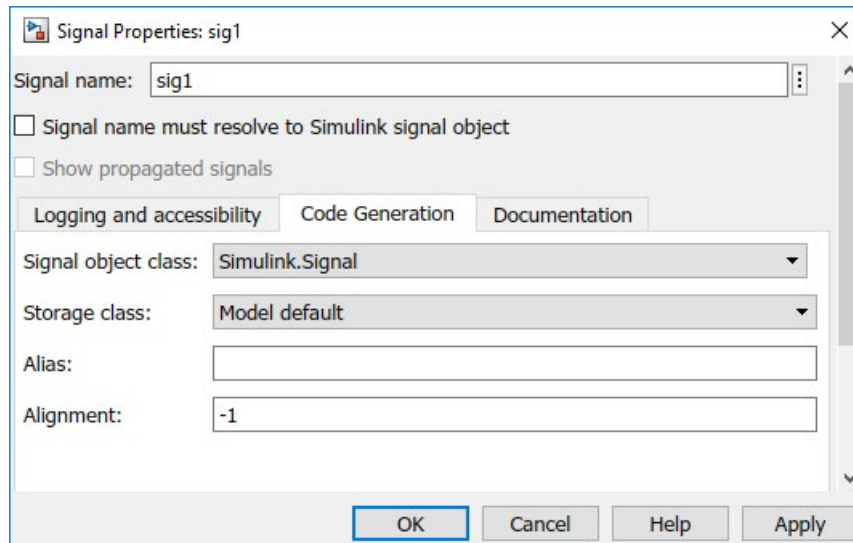
Figure E-2   Dialog box Signal Properties

1. Under "Signal name:", enter the name of the signal.

2. Select a supported storage class for the signal under "Storage class:".

Storage class	Support
Auto	Yes, if it is casted to a supported storage class.
Model default	Yes
ExportedGlobal	Yes
ImportedExtern	Yes
ImportedExternPointer	No
Custom storage class	No

Display model on the Web server

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F.1 Notes on protection

Configuration of the Web server

A user with the name "Everybody" is created by default in the user list of the Web server. The user stands for any user who uses the Web server without a user name. By default, the user has minimal access rights, such as read access to the intro and start page. Because the user "Everybody" does not have a password assigned in STEP 7, pay close attention to the access rights you assign to this user. Individual authorizations, such as the option to change the operating mode, may represent a security risk.

To assign safety-related authorizations, configure a new user and always assign a password in STEP 7. Assign secure passwords to users during configuration. An example of a secure password is one which is only used for a single application, is more than 8 characters long, and consists of lower-case and upper-case letters as well as special characters and numbers (?!+%$1234...).

Whenever possible, select the option "Permit access only with HTTPS" as soon as you have assigned a password to at least one user.

Reference

You will find more information on the configuration of the Web server in the Web Server (http://support.automation.siemens.com/WW/view/en/59193560) function manual.

F.2　The WebReadWrite function block

Since version V3.0, Target 1500S supports a Web interface to display and control a Simulink model using all values on the CPU's Web server.

Structure of the function block (FB)
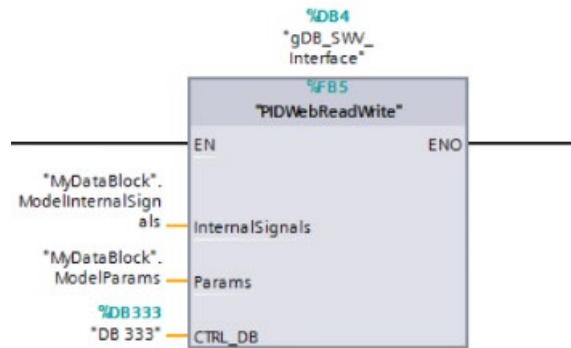
Figure F-1　WebReadWrite

The "<Simulink model>WebReadWrite" FB has the following input parameter:

- InternalSignals

  The parameter is available when you enable the Access to internal signals (Page 64).

- Params

  The parameter is available when you enable the Parameter access (Page 60).

- CTRL_DB

  Specify the start number of the first data block of the generated Web server blocks. The value corresponds to the Web DB number in the STEP 7 settings.

Calling the FB

Call "WebReadWrite" in the same OB as "OneStep" and "ReadWriteParameters". The name of the instance DB for calling the "WebReadWrite" FB in the STEP 7 user program must be "gDB_SWV_Interface".

F.3 Adding files to a STEP 7 project

Generating files for Web access

To create all required files for access via the Web server, enable the "Generate model diagrams for PLC Web server" option.

The files are generated during the build in the folder "website" under "<Model_name>_Target_1500S_<current version>_grt_Output".

Adding files automatically to a STEP 7 project

To create all required files for access via the Web server, enable the "Generate model diagrams for PLC Web server" option.

All required settings for "user pages" are performed automatically in the TIA Portal project:

- Set the HTML directory as the "website" folder generated during the build
- Set the default HTML pages as "home.html" in the folder
- Set the application name as specified by the user
- Add ".json" to the list of files with dynamic content
- Generation of blocks for Web access

Note

The automatic steps described are only possible as of TIA Portal V16.

Adding files manually to a STEP 7 project

To create the required data blocks for the Web server from the generated Web content, proceed as follows:

1. Open your project in STEP 7.

2. In the properties of the CPU in the "General" tab, select the "User-defined pages" property in the "Web server" group.
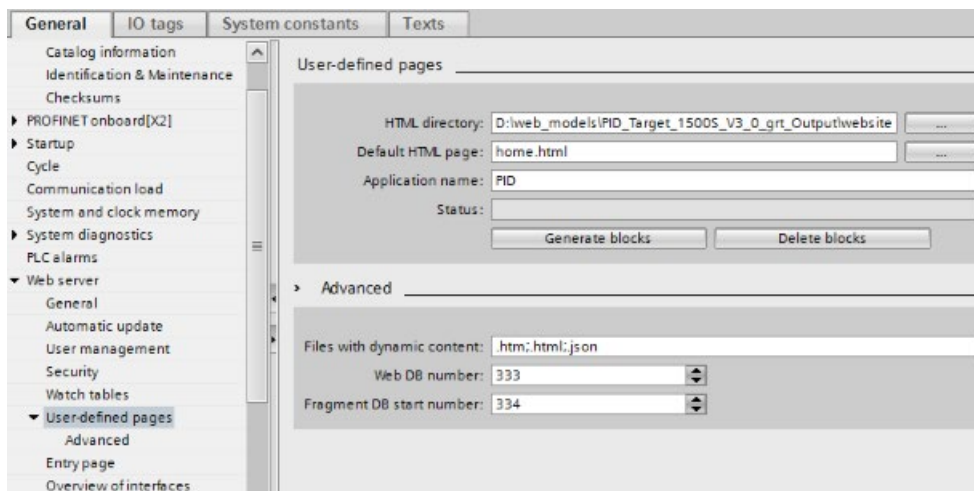
3. Make the following settings under "User-defined pages":

   – HTML directory: Enter the path of the "website" folder.

   – Default HTML page: Specify the created file "home.html".

   – Application name: Enter the name of the application.

4. In addition to ".htm" and ".html" enter the type ".json" under "Advanced" in the "Files with dynamic content" input field.

5. Create the data blocks for the Web server by clicking on "Generate blocks".

Result

The data blocks for the Web server are generated, starting with the value defined under "Web DB number".

F.4 Using the Web server

Requirement

- You have installed one of the following browsers:
  - Google Chrome
  - Microsoft Edge
  - Microsoft Internet Explorer 11
  - Mozilla Firefox 31 or later
- You have loaded the STEP 7 project.
- The model runs on the CPU.

Procedure

Follow these steps to access the model from the Web server:

1. Enter the IP address of the CPU in the Web browser.
2. Select the user interface language.

   Log on to the system if needed. The user requires authorization to open user pages.
3. Select "User-defined pages".
4. To display the model, click "Start page of the application <application name>:".

   A new page with the diagram of the model opens.

Properties of the Web page

The following properties are available to you on the page:

- To get to the main diagram, click "Home".
- To gain Web access to the parameters (Page 71), click on the respective ("Params", "WorkspaceParams" or "ModelWorkspaceParams") parameter in the menu.
- Referenced models, subsystems, visualizable Stateflow blocks (e.g. charts and state transition tables) can be opened via the menu or by clicking on the block in the diagram.
- Clicking on a "Scope" block opens a pop-up window that graphically displays the current values of internal signals.
- You can run "OpenFcn" callbacks defined in Simulink via the diagram.
- Commented out model parts are grayed-out.
- In "RUN" mode of the CPU, internal signals are displayed dynamically at the corresponding connection in the diagram.

F.5 Web access to parameters

You can read and write the parameters on the Web server.

Requirement

- You have enabled parameter access.
- The parameter is used in the model.

Parameter categories

There are three parameter categories in Simulink that you can select in the Web server.

- Model parameters

  Parameters of the blocks in a model.

- Base workspace parameters

  These parameters are defined in the basic workspace of MATLAB and can be used on every level of the model hierarchy.

- Model workspace parameters

  These parameters are defined in the context of a model and only apply to the respective model.

To open a list with the parameters, click on the respective parameter category in the menu.

You can change the value of the parameter using the input field. To send the new value, click "Submit" for the relevant parameter. To update all parameters in the list, click "Reload".

Click "Exit" to close the list with the parameters.

F.6 Display signals on the Web server

You can display and monitor the internal signals of your model in a graph. Only internal signals that are connected to a "Scope" block are displayed.

Requirements

- You have enabled access to internal signals.
- You have assigned names for the signals.

Procedure

1. To open the graph, click the "Scope" block in the model.

   A window with the graph opens. The individual signals are shown in different colors.
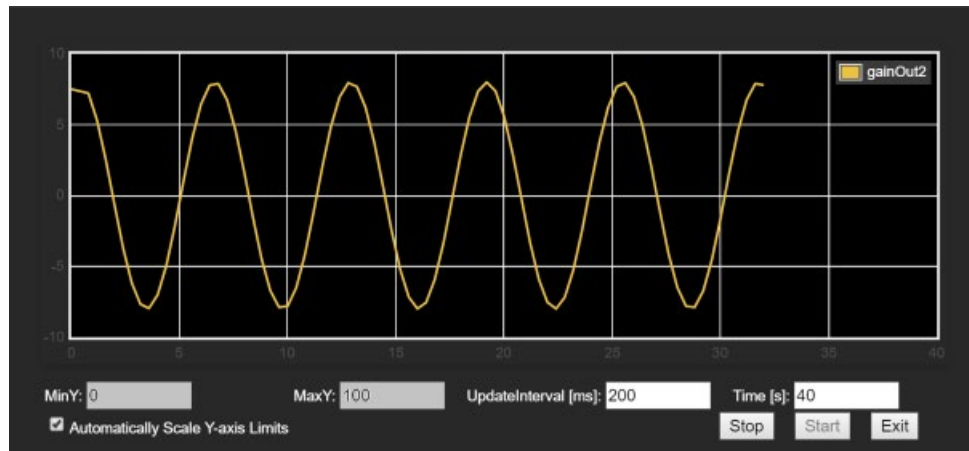
   - MinY; MaxY:

     Specify the range of the Y axis.

   - Automatically Scale Y-axis Limits

     To dynamically scale the area of the Y-axis, enable this option. The input fields "MinY" and "MaxY" are blocked when the option is enabled.

   - UpdateInterval [ms]:

     Enter in milliseconds the interval at which the values are read from the CPU.

   - Time [s]:

     Specify the size of the X axis.

2. To start the recording, click "Start". To stop the recording, click "Stop".
3. To close the window with the graph, click "Exit".

F.7 Show active Stateflow states on the Web server

Mathworks offers the licensed "Stateflow" toolbox for modeling and simulation of decision-making logic via flowcharts. Target 1500S supports the use of Stateflow. In Simulink, you can visualize the active states in the charts and transition tables of states. This feature is also available in the Web server of the CPU.

You can use the Web server of the CPU to check the current state without Simulink.

To handle complex logical decision-making algorithms, Stateflow provides three main blocks:

- TruthTables

- Charts

- State Transition Tables

Parameters for accessing states

To display the active Stateflow states on the Web server, you need enabled Target 1500S parameters in the Accessibility options (Page 33).

Enable STEP 7 access to Stateflow states

To have access to the active Stateflow states in the created project, enable the "Enable STEP 7 access to Stateflow states" parameter.

During the build process, Target 1500S creates an ODK_STRUCT named "StateflowChartStates" that contains string tags. These string tags contain the names of the active states. They are divided into two classes of string tags with different naming conventions:

- Chart state variables

  Representation of the active states at the top level of a chart. The name of the tag consists of the name of the chart and an ID, e.g. "myChart_2".

- Parent state variables

  Representation of the active child states of a parent state. The name of the tag consists of the name of the chart, the name of the parent state and an ID, for example "myChart_myParentState_3".

ODK_STRUCT "StateflowChartStates" is an output type in the "chartStates" tag in the FB "<Simulink model>OneStep".

Generate model diagrams for PLC Web server

To display the Stateflow blocks and activities on the Web server, enable the "Generate model diagrams for PLC Web server".

You can navigate in the Web server over the Stateflow blocks and state changes are displayed.

Restrictions of the Stateflow toolbox

The visualization is identical to a normal simulation in Simulink. However, there are some restrictions in the Stateflow blocks and activities.

Supported Stateflow blocks

Stateflow block type or use case	Can be displayed and navigated on the Web server
Charts	Yes
Simulink functions in charts	Yes
Simulink states in charts	Yes
Graphic functions in charts	Yes
Hierarchies of parent and child states in charts	Yes
Grouping of states in charts	Yes (as ungrouped states)
MATLAB functions in charts	No
TruthTables in charts	No
Subcharts in subcharts	No
Preview of subcharts and subcharts	Yes
Atomic subcharts in charts	Yes
Boxes	Yes
Transition tables of states	Yes (as underlying Stateflow chart)
TruthTables	No

Supported Stateflow activities

Type of Stateflow activity	Can be displayed on the Web server
Active states in charts	Yes
Active Simulink states in charts	Yes
Active subcharts in charts	Yes
Active Simulink states / states in subcharts	No
Active atomic subcharts in charts	Yes
Active Simulink states / States in atomic subcharts	Yes
Active paths in graphic functions	No
Active transitions in charts	No
Active states in previews of charts	No
Active states in previews of subcharts	Yes
Parallel execution of states	No
Active states in 'moore' charts	No

Additional restrictions

Using state names in programs:

For a Simulink model with stateflow® charts in which state names are used in the program as an argument in another state, runtime access to states is not possible and build operations can fail. An example of this is the use of the in operator in a stateflow® chart with parallel state decomposition to verify that a state is active within a certain time step during chart execution. Additional information is available under:

https://www.mathworks.com/help/stateflow/ug/checking-state-activity.html (https://www.mathworks.com/help/stateflow/ug/checking-state-activity.html)

Using data types

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G.1 Bus objects

You can define bus objects in the Simulink model. These objects can contain simple data types or other bus objects.

Converting bus objects

Bus objects are compiled with the Simulink build in PLC data types for the S7 program.

The following figure shows bus objects in Simulink on the right and the generated PLC data types in STEP 7 on the left.
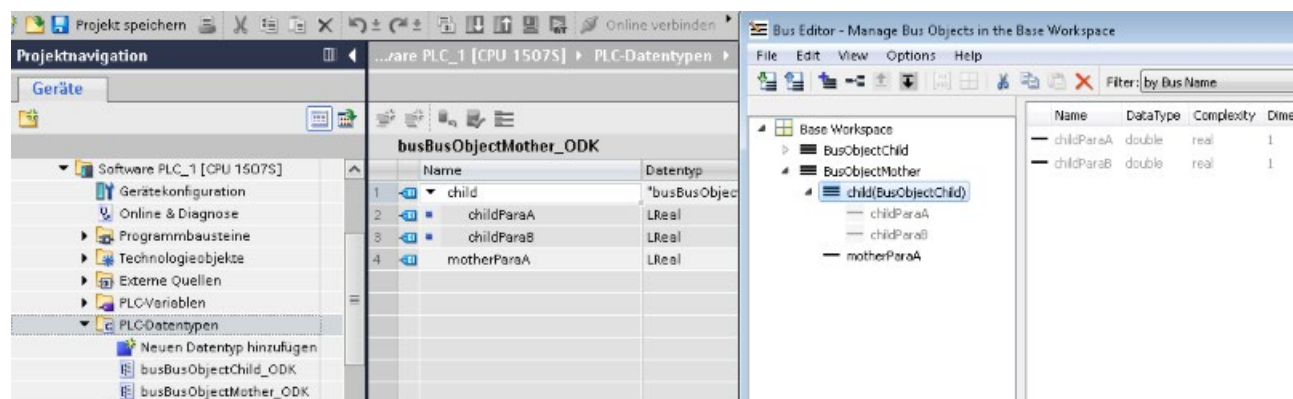
A bus object can be used as a data type for a signal of the Simulink model.

Reference

You can find more information about using PLC data types in the STEP 7 help system.

G.2 Supported basic data types

The following table represents the supported basic data types in Simulink and their assignment in ODK, STEP 7 and C/C++:

Simulink	ODK	C++	STEP 7	Description
double	ODK_DOUBLE	double	LREAL	64-bit Floating Point, IEEE 754
single	ODK_FLOAT	float	REAL	32-bit Floating Point, IEEE 754
int8	ODK_INT8	char	SINT	8-bit signed integer
uint8	ODK_UINT8	unsigned char	USINT	8-bit unsigned integer
int16	ODK_INT16	short	INT	16-bit signed integer
uint16	ODK_UINT16	unsigned short	UINT	16-bit unsigned integer
int32	ODK_INT32	int	DINT	32-bit signed integer
uint32	ODK_UINT32	unsigned int	UDINT	32-bit unsigned integer
int64	ODK_INT64	long long	LINT	64-bit signed integer
uint64	ODK_UINT64	unsigned long long	ULINT	64-bit unsigned integer
boolean	ODK_BOOL	bool	BOOL	1 bit bitstring

G.3 Complex data types

The following table represents the complex data types for STEP 7 access:

Contents	Complex types			
	Arrays	Bus objects	Enumeration types	Complex numbers
Inputs/Outputs	✓	✓	✓	✓
Parameters	✓	✓	✓	✓
Internal signals	✓	✓	✓	✓

✓: Supported

X: Not supported

The following table represents the complex data types for Web server access:

Contents	Complex types			
	Arrays	Bus objects	Enumeration types	Complex numbers
Parameters	✓	✓	X	✓
Internal signals	X	X	X	X
Scoping	X	X	X	X

✓: Supported

X: Not supported

Alarms

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H.1 Alarms during the build process

Meaning of the alarms

- Information messages (Page 78)

  This alarm provides information about the progress of the build process.

- Warnings (Page 81)

  This alarm does not abort the build process. You are made aware of special considerations and possible problems.

- Error messages (Page 84)

  This alarm indicates an error that results in termination of the build process.

H.2 Information messages

Info no.	Alarm	Meaning
1	"Build of <SimulinkModel> with Target 1500S <Version> is started"	The build process starts
2	"Generating Target 1500S specific files:"	Target 1500S is creating files.
3	"<Filename> is generated"	Target 1500S has created files.
4	"Generating Simulink Model sources"	The Simulink Coder is generating source files.
5	"Creating ODK 1500S project <SimulinkModel>_ODK under <OutputPath>"	Target 1500S is creating an ODK project.
6	"ODK 1500S Project <SimulinkModel>_ODK is created successfully"	The ODK project has been successfully created.
7	"Building ODK 1500S project <SimulinkModel>_ODK"	An ODK project is being built. If you have selected the "Verbose" option in the Options menu of the code generator, the Diagnostic Viewer displays each output.
8	"<SimulinkModel>_ODK project build is finished successfully"	The ODK project build was completed successfully.

Info no.	Alarm	Meaning
9...12	"<SimulinkModel> build is finished successfully. <SimulinkModel>_ODK.scl and <SimulinkModel>_ODK.so files are available in folder "outputs". TIA Portal: 1. Navigate to the CPU / 'External Source' area and import the <SimulinkModel>_ODK.scl file. 2. Select the imported file and generate blocks out of this source (right-click or Toll menu) 3. Integrate the blocks into your CPU program in order to load and execute it. Web server (CPU): 1. <SimulinkModel>_ODK.so file has to be uploaded using the Web server into ODK1500S folder. You can find details about deploying an ODK 1500S Object to CPU in ODK 1500S documentation (https://support.industry.siemens.com/cs/ww/en/view/109752683)." For Web access to the runtime model, the file 'home.html' is available in folder "website" TIA Portal: 1. Navigate to Web server > User-defined pages in CPU properties 2. Select the path to the 'website' folder as HTML directory 3. Set the default HTML page as 'home.html' 4. Define an application name 5. Make sure that '.htm', '.html' and '.json' are defined in files with dynamic content 6. Generate blocks 7. Integrate the generated FB for Web access into your CPU program and name its DB as 'gDB_SWV_Interface'	The Simulink build was completed successfully. The files "<Simulink model>_ODK.scl" and "<Simulink model>_ODK.so" are available in the "outputs" folder. TIA Portal: This message is only output when the option "Import the generated SCL file to STEP 7 (TIA Portal)" is disabled or the process was unsuccessful. 1. Navigate to the CPU in the "External sources" area and import the file "<SimulinkModel>_ODK.scl". 2. Mark the imported files and generate blocks from the source with a right-click. 3. Integrate the blocks into your program to download and execute it. Web server of the controller: This message is only displayed if the "Generated model diagrams for PLC Web server" option is enabled and the process was successful. 1. Download the file "<SimulinkModel>_ODK.so" over the Web server to the ODK 1500S folder. If you have disabled the option "Import the SCL file generated by the build to a CPU" or if the execution was unsuccessful, you can update the sources manually via the TIA Portal. Proceed as follows for this: You can find additional information in the ODK manual (https://support.industry.siemens.com/cs/ww/en/view/109752683).
13	"Removing <SimulinkModel>_ODK from ODK 1500S default workspace"	You have confirmed the "Existing ODK Project" dialog with "Yes". The existing project is overwritten.
14	"<SimulinkModel>_ODK is removed from ODK 1500S default workspace"	You have confirmed the "Existing ODK Project" dialog with "Yes". The existing project was overwritten.
15	"Terminating all running Eclipse instances"	The running Eclipse instances are being terminated.
16	"All running Eclipse instances are terminated successfully. Proceeding with build"	The running Eclipse instances are terminated.
17	"Generating Simulink Model sources"	The Simulink Coder is generating source files.
18	"Creating the static library project <ProjectName> under <ProjectPath>"	The process requires another static library besides the ODK project.
19	"Building the static library project <ProjectName>"	The static library is being built.
20	"Importing the static library project <ProjectName>"	The static library is being imported.
21	"The project <ProjectName> is imported successfully."	The project was imported successfully.
101	"SCL file import started"	The SCL file import starts.

Info no.	Alarm	Meaning
102	"Checking for compatible TIA Portal and Openness installations"	The compatibility of STEP 7 and Openness plugin is being checked.
103	"Opening / attaching to the TIA Portal project <TiaPortalProjectName>"	The STEP 7 instance used is being attached to the STEP 7 project.
104	"CPU <CpuName>: Searching for it in the TIA Portal project"	Searching for CPU(s) in the STEP 7 project.
105	"CPU <CpuName>: <SimulinkModel>_ODK.scl is being imported"	The SCL file is being imported.
106	"CPU <CpuName>: Blocks are being generated out of the imported SCL source"	Blocks are being generated from the SCL file.
107	"CPU <CpuName>: CPU is being compiled"	You have selected the option "Compile the CPU after import". The CPU is being compiled.
108	"The TIA Portal project is being saved"	The STEP 7 project is being saved.
109	"SCL file import finished successfully"	The SCL file import was finished successfully.
110	"In order to manually import the SCL file: 1. In TIA Portal project tree, double click on '<CPUName> > External source files > Add new external file' 2. Select the SCL file in folder "outputs". 3. Right click on the added file '<ModelName>_ODK.scl' and select 'Generate blocks from source'	To import the SCL file manually, follow these steps: 1. In the project view in STEP 7, double-click "<CPUName> > External source files > Add new external file". 2. Select the SCL file in the "outputs" folder. 3. In the shortcut menu of the added "<ModelName>_ODK.scl" file, select the command "Create blocks from the source".
111	"In order to manually complete the SCL import process: 1. In TIA Portal project tree, right click on the added file '<ModelName>_ODK.scl' under '<CpuName> > External source files' and select 'Generate blocks from source'	To complete the SCL import manually, follow these steps: 1. In the project view in STEP 7, navigate to "<CPU name> > External source files". 2. In the shortcut menu of the added "<ModelName>_ODK.scl" file, select the command "Create blocks from the source".
121	"TIA Portal project download is started"	The download of the STEP 7 project begins.
122	"TIA Portal project download finished successfully"	The download of the STEP 7 project was successfully completed.
123	"Configuration of the user defined page is started""	The configuration of the customized page begins.
124	"Configuration of the user defined page is finished successfully""	The configuration of the customized page was successfully completed.
125	"Program block operations started"	The calculation of the program block begins.
126	"Program block operations finished successfully"	The calculation of the program block has been successfully completed.
201	"Generation of Web content for <ModelName> is started"	Process for generation of the Web content for the model starts.
202	"Checking preconditions for generation of Web content"	The requirements for generating the Web content are being checked.
203	"Clearing existing content"	Any existing content is being deleted.
204	"Getting internal signal info"	The information of the internal signals is being obtained.
205	"Getting workspace parameter info"	The information of the "Base workspace parameters" is being obtained.
206	"Getting model workspace parameter info"	The information of the "Model workspace parameters" is being obtained.

Info no.	Alarm	Meaning
207	"Getting external input info"	The port information of the inputs is being obtained.
208	"Getting external output info"	The port information of the outputs is being obtained.
209	"Getting scope info"	The graph (scope) information is being obtained.
210	"Getting model hierarchy"	The model hierarchy is being obtained.
211	"Creating SVG files for model view"	The SVG files are being created.
212	"Generating JSON files for parameters"	The JSON file for the parameters is being created.
213	"Generating JSON files for model"	The JSON file for the model is being created.
214	"Generating JSON files for internal signals"	The JSON file for the internal signals is being created.
215	"Generating JSON files for scopes"	The JSON file for the graphs (scopes) is being created.
216	"Generating files for Web application"	The files for the Web application are being created.
217	"Generation of Web content for <ModelName> completed successfully"	Process for generation of the Web content for the model was completed successfully.
301	"SO file transfer started"	The SO file import starts.
302	"Logging in to the CPU Web server over <IP-Address>"	Logging in to the CPU Web server.
303	"Deleting a possibly existing file on the server"	If a file already exists, it is deleted.
304	"Uploading the SO file to ODK1500S folder on <IP-Address>"	The SO file is being uploaded to the ODK 1500S folder.
305	"SO file transfer finished successfully"	The SO file import was finished successfully.
306	"SO file transfer finished with an error"	The process for import of the SO file was completed with an error.

H.3   Warnings

Warning no.	Alarm	Meaning
1	"Using 'External Mode' can cause serious damage to property or injury to persons if there are functional disturbances or program errors. Make sure that no dangerous situations can arise before you conduct a test with the 'External Mode' function."	If "External Mode" is enabled in the settings under "Code Generation", this alarm appears at the end of the build process.
2	"'Default parameter behavior' shall be set to 'Tunable' for STEP 7 access also tunable block parameters of the model. Otherwise STEP 7 access only to global tunable parameters will be possible."	You have activated the "Parameter access with STEP 7" option and selected "Inlined" under "Default parameter behavior". Set the selection to "Tunable".

Warning no.	Alarm	Meaning
3	"The syntax of the current MEX-file arguments is not correct. It might happen, that the External Mode cannot be established. The correct syntax: '<IPAddress>' <VerbosityLevel> <PortNumber> <WaitForStart> • IPAdress and PortNumber is related with your PLC. • Set VerbosityLevel to 1 for getting detailed information in diagnostic viewer. • If WaitForStart is set to 1, the application will wait for the Simulink start command Please check the SIMATIC Target 1500S documentation for further information."	The structure of the "MEX-file arguments" is incorrect. External mode may not run properly. The correct structure is: '<IPAddress>' <VerbosityLevel> <PortNumber> <WaitForStart> • The IP address and port number depends on your controller. • Set the VerbosityLevel to 1 to get detailed information in the Diagnostic Viewer. • If WaitforStart is set to 1, the application waits for the start command from Simulink.
4	Establishing external mode communication will not be possible since 'UpdateModelReferenceTargets' is set to 'Always' for the model <SimulinkModel>. Please change it to another option in order to be able to use external mode.	Communication for the external mode cannot be set up because the "UpdateModelReferenceTargets" setting for the <SimulinkModel> is set to "Always". Change this to another setting to use external mode.
5	Since multiple number of instances of <ChildModel> is allowed to be referenced, STEP 7 access to some internal signals of this model may not be possible because 'Model default' or 'Auto' storage class definition has been detected. For <ChildModel>, set 'Total number of instances allowed per top model' to 'One' or set storage class for internal signals to 'ExportedGlobal' or 'ImportedExtern' in order to access all internal signals.	Since multiple instances of the referenced model can be referenced, access from STEP 7 to some internal signals of this model may not be possible because the storage class "Model default" or "Auto" was selected. To access all internal signals, set "Total number of instances allowed per top model" to "One" for the referenced model or set the storage class for internal signals to "ExportedGlobal" or "ImportedExtern".
701	"The required dll for <OperationName> import does not exist in the bin folder. Please repair or uninstall/install Target 1500S setup."	The required DLL for the output operation does not exist in the directory "<TARGET_ROOT_DIR>\bin\tools". Repair or uninstall/install the Target 1500S.
703	"Empty or invalid field: <OptionName>"	You have installed no compatible Openness plugin. You can find the compatible Openness plugin at "Description of the TIA Portal integration options (Page 26)".
704	"The required functionality is not supported by the TIA Openness version."	An error has occurred while loading the Openness.dll.
705	"An error occurred during TIA Openness operation: <OperationName>"	An error occurred during the TIA Openness operation <OperationName>.
750	"Download provider is NULL"	The download provider is set to ZERO.
751	"Download configuration does not seem to be correct"	The configured download options do not correspond to the selectable options in the TIA Portal.
752	"PCStation download has just failed"	Error downloading the HW Config (PC station download)
753	"CPU download has just failed"	Error downloading to the CPU.
799	"Unknown error"	An unknown error occurred during a TIA Portal Openness operation.
801	"Error while extracting internal signal info"	Error while extracting the information of the internal signals.
802	"Error while extracting workspace parameter info"	Error while extracting the information of the "Base workspace parameters".
803	"Error while extracting model workspace parameter info"	Error while extracting the information of the "Model workspace parameters".

Warning no.	Alarm	Meaning
804	"Error while extracting external input info"	Error while obtaining the port information of the inputs.
805	"Error while extracting external output info"	Error while obtaining the port information of the outputs.
806	"Error while extracting scope info"	Error while obtaining the graph (scope) information.
807	"Error while extracting model hierarchy"	Error referencing the model hierarchy.
808	"Error while creating SVG file <SvgFileName>"	Error while creating the SVG file.
809	"Error while modifying SVG file <SvgFileName>"	Error while modifying the SVG file.
810	"Error while extracting field <FieldName> from model data structure."	A data field required for creating the SVG file could not be read.
811	"Error while generating JSON files for parameters"	Error while creating the JSON file for the parameters.
812	"Error while generating JSON files for model"	Error while creating the JSON file for the model.
813	"Error while generating JSON files for internal signals"	Error while creating the JSON file for the internal signals.
814	"Error while generating JSON files for scopes"	Error while creating the JSON file for the graph (scope).
815	"The file <FileName> could not be opened"	Unable to open a temporary file.
899	"Unknown error"	An unknown error occurred during Web file generation.
901	"Error while renaming the file or directory - Memory Card is write-protected"	Error while renaming the file or the directory. The memory card is write-protected.
902	"Error while renaming the file or directory - name already exists"	Error while renaming the file or the directory. The name has already been assigned.
903	"Error while renaming the file or directory - Memory Card is full"	Error while renaming the file or the directory. The memory card is full.
904	"Error while creating the directory"	Error while creating the directory.
905	"Error while creating the directory - Memory Card is write-protected"	Error while creating the directory. The memory card is write-protected.
906	"Error while creating the directory - name already exists"	Error while creating the directory. The name has already been assigned.
907	"Error while creating the directory - Memory Card is full"	Error while creating the directory. The memory card is full.
908	"Error while uploading the file"	Error while uploading the file.
909	"Error while uploading the file - name already exists"	Error while uploading the file. The memory card is write-protected.
910	"Error while uploading the file - Memory Card is write-protected"	Error while uploading the file. The name has already been assigned.
951	"IP address is empty. Please provide IP address of the CPU to transfer the SO file"	No IP address assigned. Enter the IP address of the CPU.
952	"IP address is not in correct format"	Enter the IP address in the correct format.
953	"Connection Error"	The host is not reachable.
954	"Invalid login information"	Login has failed.
955	"Error while uploading the file - file too big"	Error while uploading the SO file. The SO file must not be larger than 2147483648 bytes.
956	"Allowed characters are a-z A-Z 0-9 ._- (){}[]$!=~ (space)"	An invalid character was used for the name of the SO file.
957	"The file could not be found"	The SO file was not found.
958	"IO Exception"	An error occurred while reading the content for opening the SO file.

Warning no.	Alarm	Meaning
959	"Unauthorized Access"	An authorization error occurred while accessing the SO file.
960	"File write protected"	File is read-only
961	"An error occurred while uploading the so file: <Error-String>"	Error uploading the SO file
999	"Unknown error"	Unknown error
1000	Building model with Target 1500S trial mode: <RemainingDaysInTrialPeriod> day(s) left	The model was created with the Target 1500S test version.

H.4 Error messages

Error no.	Alarm	Meaning
1	Depending on the error, the corresponding error message is displayed.	Appears in case of Simulink Coder errors.
10	"Eclipse workspace is locked. Please close any Eclipse instance(s) that might have locked ODK 1500S default workspace."	Close all affected Eclipse instances with a standard ODK Workspace, which is also used by Target 1500S.
600	"ODK 1500S Code Generator gives the following error for <SimulinkModel>_ODK project: <Error text of the ODK Code Generator> Please refer to ODK 1500S documentation (https://support.industry.siemens.com/cs/ww/en/view/109752683) or contact customer support!"	If the code generator of ODK detects an error during the build process, this alarm appears. You can find additional information in the ODK manual (https://support.industry.siemens.com/cs/ww/en/view/109752683) or by contacting Customer Support.
30	**For MATLAB versions older than R2016b:** "Only 'SingleTasking' is allowed as tasking mode for Target 1500S <Version>. Please choose 'SingleTasking' in the solver options menu in order to proceed with build." **For MATLAB version R2016b or higher:** "Only 'SingleTasking' is allowed as tasking mode for Target 1500S <Version>. Please uncheck the option 'Treat each discrete rate as a separate task' under the solver options in order to proceed with build."	Disable the option "Treat each discrete rate as a separate task" in the properties of the code generator under "Solver".
31	"'ImportedExternPointer' is not allowed as Storage Class for tunable parameters for Target 1500S <Version>. Please change Storage Class of <ParameterName> to other than 'ImportedExternPointer' in order to proceed with build."	Select a different memory class than "ImportedExternPointer".
20	"No compatible ODK 1500S version is installed. Please first install a compatible version and restart MATLAB in order to proceed with build. A list of compatible ODK 1500S versions can be found in the Target 1500S documentation."	No compatible ODK version available. Install a compatible ODK 1500S version (Page 14) and restart MATLAB.

Error no.	Alarm	Meaning
22	"The selected ODK 1500S version doesn't work proper-ly. The reason could be installation of the selected ODK 1500S version failed due to some reason. ODK 1500S <OdkVersion> documentation describes, how to check the functionality of the ODK 1500S installation."	The selected ODK version is not working properly. The reason can be the installation of the selected ODK version failed. You can find information on checking the functionality in the ODK manual (https://support.industry.siemens.com/cs/ww/en/view/109752683).
519	"Size of input and output parameters of <Simulink-Model> reaches to the limits of ODK 1500S. Please reconsider your model and try to reduce the size of your parameters in order to proceed with build."	The maximum ODK data volume is exceeded. Check the model and reduce the parameter size.
520	"A parameter which exceeds limits of ODK 1500S maximum array size is defined in <SimulinkModel>. Please reconsider your model and try to reduce the size of array which exceeds ODK 1500S limits in order to proceed with build."	The maximum array size is exceeded. Check the model and reduce the array size.
515	"<SimulinkModel> causes to exceed limits of ODK 1500S naming rules for generated functions or structs. Please perform one of the following actions in order to proceed with build: 1- Set 'Maximum identifier length' in symbols options to a smaller value. 2- Set <SimulinkModel> to a shorter name."	Prefix and function name are too long. Reduce the value of "maximum identifier length" in the properties of the code generator under "Symbols" or shorten the name of the Simulink model.
516	"<Variable> name exceeds the limits of ODK 1500S maximum variable name size. Please perform one of the following actions in order to proceed with build: 1- Set 'Maximum identifier length' in symbols option to a smaller value. 2- Set <Variable> to a shorter name."	The tag name is too long. Decrease the value of "maximum identifier length" in the properties of the code generator under "Symbols" or shorten the name of the tag.
32	"Because of the length of <SimulinkModel> name and path of your model, some generated files reach to the path limits of Windows. Please perform one of the following actions in order to proceed with build: 1- Set your <SimulinkModel> name to a shorter string. 2- Move your <SimulinkModel> to a shorter path."	The maximum Windows path length has been exceed-ed. Shorten the name of the Simulink model or move your Simulink model to a shorter path.
11	"A project with same name as <SimulinkModel>_ODK exists in ODK 1500S default workspace. In order to proceed, either change the name of the existing pro-ject or remove/rename it from workspace manually."	The ODK workspace already contains an ODK project with the same name. Change the name of the Simulink model or de-lete/rename the existing project manually.
12	"An error occurred during removing <SimulinkMod-el>_ODK project from default workspace of ODK 1500S. Please either change name of your <SimulinkModel> or remove/rename the project from workspace manu-ally"	Removal of the ODK project from the workspace was unsuccessful. Change the name of the Simulink model or de-lete/rename the project manually from the workspace.

Error no.	Alarm	Meaning
40	"Build of <SimulinkModel>_ODK is failed due to the following error(s): <Error text coming from gcc compiler with the complete line and multiple errors> Please enable 'Verbose' mode in Code Generation Options to see the stack trace and contact customer support!"	Generation of the ODK project was unsuccessful due to a compiler error. Enable "Verbose" mode in the properties of the code generator to see the stack trace and contact Customer Support.
33	"'Device vendor' can be only selected as 'Intel' and 'Device type' can be only selected as 'x86-32 (Windows32)' in hardware implementation options. Please select the proper values in order to proceed with build."	Select "x86-32 (Windows32)" in the properties under "Device type".
34	"The maximum data size for external mode is 64k. The current used data (<sizeOfData>) exceeds this limit. Please reconsider your model and try to reduce the size of the parameters."	The maximum data size for external mode is 64k. The data currently used exceeds this limit. Revise your model and reduce the size of the parameters.
23	"An incompatible version of Java Runtime Environment (JRE) could be installed. Please prove, if the installed Java Runtime Environment (JRE) and its architecture (x86, x64) is compatible with the selected ODK 1500S Version. ODK 1500S <ODK Version> documentation describes, how to check the functionality of the ODK 1500S installation."	No compatible JRE is installed on the PC. You can find information on checking the functionality in the ODK manual (https://support.industry.siemens.com/cs/ww/en/view/109752683).
14	"An error occurred while creating the shared object file"	The SO file could not be created.
1000	License key missing	The Target 1500S license was not transferred and the test version has expired.
1001	Retrieving license key not possible	ALM is not installed, cannot be reached or unknown error occurred during the license check.

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