SIEMENS

Teamcenter 10.1 Systems Engineering and Requirements Management

MATLAB/Simulink Interface User's Manual

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Manual History

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Contents

Preface

This manual is a users reference for the Systems Architect/Requirements Management interface with MATLAB/Simulink. Architect/Requirements belongs to the Siemens PLM Software portfolio of digital product lifecycle management software and services.

Audience

This manual is for project team members who use Architect/Requirements and MATLAB/Simulink to illustrate system elements with building blocks and to model their behavior. This manual provides both conceptual information and step-by-step instructions for specific tasks.

This manual assumes that you are familiar with your project and your product development process, that you understand general computer terminology and the Microsoft Windows operating system, and that you have experience with MATLAB/Simulink.

- An Architect/Requirements **Architect** license is required for the procedures in this manual. If you have questions about your license, consult your Architect/Requirements project administrator.
- Simulink's Verification and Validation Toolbox is required for linking model blocks to requirements. However, you can create and attach models without this software.

Organization

This manual contains the following chapters:

Chapter 1	*Overview of the Simulink Interface* presents an overview of Architect/Requirements and MatLAB/Simulink, discussing the basic concepts of its purpose and application.
Chapter 2	*Working With Models* contains instructions for creating new model objects, attaching existing Simulink models to building blocks, and editing and viewing a model.
Chapter 3	*Linking Model Blocks to Requirements* contains instructions for creating trace links to model blocks, navigating to linked objects in Architect/Requirements, viewing linked requirement content, and deleting trace links.

Browser and Dialog Window Examples

The examples of browsers and dialog windows in this manual may appear different from those you see on your screen:

- The examples reflect Systems Architect/Requirements Management as initially installed at your site. Your enterprise may customize the browsers and dialog windows such that they appear different from those in the examples.
- The examples reflect individual Systems Architect/Requirements Management modules. If you install additional modules, your dialog windows and browsers reflect the additional modules.
- The examples reflect Systems Architect/Requirements Management installed on a Windows platform.

Names and Values

This manual represents system names, file names, and values in fonts that help you interpret the name or value. For example:

Change or add the parameter to the **init*sid*.ora** file.

The conventions are:

Bold	Bold font represents unvarying text or numbers within a name or value. Capitalization is as it appears.
Italic	Italic font represents text or numbers that vary within a name or value. The characters in italic text describe the entry. Letters are shown in lowercase, but the varying text may include uppercase letters. In **init*sid*.ora**, *sid* identifies a varying portion of the name (a unique system ID). For example, the name of the file might be: **initBlue5.ora**
text-text	A hyphen separates two words that describe a single entry.

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Chapter 1: Overview of the Simulink Interface

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This chapter presents an overview of the Architect/Requirements interface with Simulink, discussing the basic concepts of its purpose and application.

The Architect/Requirements interface with Simulink brings together requirements management features and Simulink's mathematical visualization and evaluation capabilities. The interface allows you to simulate the behavior of Architect/Requirements building blocks in Simulink models. When models are stored as model objects in the Architect/Requirements database, individual model blocks can be linked to defining requirements for traceability.

You must have an Architect/Requirements **Architect** license to use the Simulink interface. If you have questions about your license, consult your Architect/Requirements project administrator.

For more information about constructing system views with building blocks, see the *Systems Architect/Requirements Management User's Manual*.

Model Objects in Architect/Requirements

Each model object in the Architect/Requirements database is owned by a parent building block. There are two ways to store a model object:

- Create a new model object in Architect/Requirements.

  You then construct the block diagram in the Simulink Model Editor.

- Attach an existing Simulink model to a selected building block.

  You can edit the block diagram in the Simulink Model Editor.

A building block is created in the database for each block that you add to a model. For more information, see chapter 2, *Working With Models*.

Traceability for Model Blocks

To trace a model block upstream to its defining conditions, you can create a trace link from a requirement in Architect/Requirements to the model block in the Simulink Model Editor. The model must exist as an object in the Architect/Requirements database.

Simulink's Verification and Validation Toolbox is required for linking model blocks to requirements. However, you can create and attach models without this software.

For more information, see chapter 3, *Linking Model Blocks to Requirements*.

Chapter 2: Working With Models

Chapter 2: Working With Models

This chapter contains instructions for creating new model objects, attaching existing Simulink models to building blocks, and editing and viewing a model.

Models help to visualize concepts or components of a system. A model illustrates a system decomposition by building blocks and connections that represent system elements and their behavior.

Creating a New Model Object

Create a new model object in Architect/Requirements before constructing the block diagram through the MATLAB/Simulink interface. You can create any number of model objects for a given building block.

You must have an **Architect** license to create a model. If you have questions about your license, consult your Architect/Requirements project administrator.

1. Select the owning building block for the model, and then pull down the **File** menu and choose the **Matlab→Create Model** options.

   The **Attachments** tab displays the new model with a default name in an open text field.

2. Enter a meaningful name, and then press the enter key.

   Architect/Requirements launches MATLAB, which displays the Simulink Library Browser and an empty Simulink Model Editor window.

   You can leave the model open to add blocks and lines from the Library Browser. Or, you can close the model and construct the block diagram later. For more information, see *Editing a Model*, later in this chapter.

Procedure Notes

Step 1: You can also right-click the building block and choose the **Matlab→Create Model** options from the popup menu.

Attaching an Existing Simulink Model to a Building Block

Simulink models that are stored outside the Architect/Requirements database can be attached to building blocks in Architect/Requirements. For example, you may have models on your local desktop or on a shared drive. You can reuse these existing models to save time in working with complex systems.

- You must have an **Architect** license to attach a model.

  If you have questions about your license, consult your Architect/Requirements project administrator.

- Blocks and lines in the model do not automatically create building blocks and connections in Architect/Requirements.

  After attaching the model, you can edit the model to add building blocks and connections to the database. For more information, see *Editing a Model*, later in this chapter.

1. Select the owning building block for the model, and then pull down the **File** menu and choose the **Matlab→Attach MATLAB Model** options.

   Architect/Requirements displays the Open dialog window, which lists existing folders and files in the current drive or folder.

2. Select the model in the list, or enter the model name in the **File name** field.

   If the model to attach is not in the list, you can use the **Look in** field to change the drive or folder.

3. Click **Open**, or press the enter key.

   A progress indicator and an information message show that the attachment is in progress. When the process is complete, a confirmation message is displayed.

   The model is attached to the selected building block and is added to the **Attachments** tab.

Procedure Notes

Step 1: You can also right-click the building block and choose the **Matlab→Attach MATLAB Model** options from the popup menu.

Editing a Model

Edit a model to construct the block diagram for a new model or to modify an existing model. Edits are synchronized with the Architect/Requirements database when you save the model in Simulink.

You must have an **Architect** license to edit a model. If you have questions about your license, consult your Architect/Requirements project administrator.

1. Do one of the following:
   - If the model is already open, go to step 4-2.
   - To open the model, select it in the **Attachments** tab, and then pull down the **File** menu and choose **Open**.

     You can also right-click the model and choose **Open** from the popup menu. Or, double-click the model.

     The model opens in the Simulink Model Editor and the Simulink Library Browser is displayed. Blocks and lines in the model are updated with any changes to the corresponding building blocks and connections in Architect/Requirements.

     

     If you have **Read** privilege in a security profile that is applied to the model object by another user, a warning message is displayed when you open the model. Changes that you make to model blocks are applied only to the corresponding building blocks in Architect/Requirements. You cannot change the model blocks themselves.

2. In the Model Editor, do any or all of the following:
   - Add blocks and lines from the Simulink Library Browser.

     Corresponding building blocks and connections are created in Architect/Requirements when you save the model.

     

     - If you add a Simulink block that has no matching subtype in Architect/Requirements, the new building block receives the **Building Block** subtype. If you have questions about subtypes, consult your Architect/Requirements project administrator.
     - New building blocks become direct children of the model owner.
     - Connections are created without ports.

You can also add existing building blocks from Architect/Requirements:

a. Select a building block, and then pull down the **File** menu and choose the **Matlab→Copy To Matlab** options.

   You can also right-click the building block and choose the **Matlab→Copy To Matlab** options from the popup menu.

b. In the Model Editor, add a new block from the Library Browser.

c. Right-click the new block in the model and choose the **Teamcenter→Associate To Block** options from the popup menu.

   When you save the model, the new model block receives the exact properties of the Architect/Requirements building block. Also, any updates to the model block are applied to the building block.

- Change existing blocks and lines, using Simulink functions.

  Changes are applied in Architect/Requirements when you save the model.

- Copy a block within the model and create a corresponding building block in Architect/Requirements:

  o Select the block, and then right-click the canvas in the Model Editor and choose **Paste and Create** from the popup menu.

  The copy appears with a unique name in the upper left corner of the canvas.

  The building block is created in Architect/Requirements when you save the model.

To create a new item in Simulink, you must avoid using the mouse to drop the element on the canvas in the Model Editor. Such an item does not carry a unique identifier that allows it to be associated with an Architect/Requirements building block.

To use an existing block within a model to create a new instance:

a. Right-click the selected block in the model and choose **Copy**.

b. Right-click the canvas in the Model Editor and choose **Paste and Create** from the popup menu.

   The copied block is pasted as a new block in the model. Its name, which you can edit, is a combination of the original name and an automatically-generated number. The **Tag** property value of this block is empty.

   When you save this newly created block, it is created as a building block in Architect/Requirements.

- Delete existing blocks and lines, using Simulink functions.

  The corresponding building blocks and connections remain in Architect/Requirements.

- Delete building blocks and connections from Architect/Requirements while keeping blocks and lines in the model:
  - Right-click the block or line in the model and choose the **Teamcenter→Delete in TcSE** options from the popup menu.

    The corresponding building block or connection is deleted from Architect/Requirements when you save the model.

For information about using the Simulink Model Editor and Library Browser, see the Simulink Help.

3. To apply the edits in Architect/Requirements, save the model in the Model Editor.

You can also save the model in a location outside the database, for example, on your local desktop. However, trace links cannot be created between that model and objects in Architect/Requirements.

The MATLAB interface with Architect/Requirements uses the **Tag** property of the MATLAB model block to uniquely identify the blocks in Architect/Requirements. When blocks from the Simulink library are added in the model, they have a preset **Tag** property value. In this scenario, on saving the model, the MATLAB interface modifies the **Tag** property value with the data as per the Architect/Requirements format.

Hence, you must be careful about the usage of the **Tag** property with the MATLAB interface.

Viewing a Model

From the **Attachments** tab, you can open a model for viewing in read-only mode. To open a model for editing, see *Editing a Model*, earlier in this chapter.

You must have an **Architect** license to view a model. If you have questions about your license, consult your Architect/Requirements project administrator.

- Select the model, and then pull down the **File** menu and choose **Open Read-Only**. Or, right-click the model and choose **Open Read-Only** from the popup menu.

  The read-only model opens in the Simulink Model Editor.

  Objects in the model are updated with any changes to the corresponding objects in Architect/Requirements.

Unsupported Functionalities

The following functionalities are not supported by the MATLAB interface with Architect/Requirements:

- MATLAB's subsystem

  Blocks in the subsystems can be created and associated with a Architect/Requirements building block. However, the subsequent actions on those objects may fail to synchronize correctly with Architect/Requirements.

  For example, errors similar to **Error using ==> get_param Invalid Simulink object name: Subsystem** are encountered when you try to delete a trace link between a requirement and a block inside a subsystem from MATLAB/Simulink.

- MATLAB's branched connections between blocks

  A model that has MATLAB's branched connections between blocks is not allowed to be saved in Architect/Requirements by the MATLAB interface.

  For example, the error message **Model has Branch connection and Teamcenter does not support branch connection. Change the model accordingly and try saving it** is encountered.

Chapter 3: Linking Model Blocks to Requirements

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This chapter contains instructions for creating trace links to model blocks, navigating to linked objects in Architect/Requirements, viewing linked requirement content, and deleting trace links.

- An Architect/Requirements **Architect** license is required for all procedures in this chapter. If you have questions about your license, consult your Architect/Requirements project administrator.
- The Simulink Verification and Validation Toolbox must be installed on your computer.

Creating a Trace Link to a Model Block

By creating a trace link from a defining requirement in Architect/Requirements to a block in a Simulink model, you can trace the model block upstream to the conditions that define its design constraints. A model block can have trace links from multiple defining requirements.

The model must exist as an object in Architect/Requirements. You cannot link to blocks in models that reside outside the database, for example, on your local desktop.

1. Select the requirement, and then pull down the **File** menu and choose the **Matlab→Copy To Matlab** options.

   The requirement LOID is placed in the Clipboard.

2. With the model open in the Simulink Model Editor, right-click the target block and choose the **Teamcenter→Paste from Teamcenter** options from the popup menu.

3. Save the model in the Model Editor.

   In the Architect/Requirements **Links** tab, the trace link is created in the **Relations** subtab. In the **Trace** subtab, the building block associated with the model block is added in the **Complying Trace** column.

When you right-click the model block and choose **Requirements** from the popup menu, a submenu lists each defining requirement for the block. Each time the model is opened, the model block's list is synchronized with the current trace link set for the corresponding building block.

Linked requirements are added to and removed from the list according to changes in Architect/Requirements since the model was last opened:

- If trace links were added to the building block, those requirements are added to the list.
- If trace links were deleted from the building block, those requirements are removed from the list.
- If the corresponding building block was copied to a different Architect/Requirements project:
  - A linked requirement remains in the list if the requirement was included in the selection with the copied building block.
  - A linked requirement is removed from the list if the requirement was not copied with the building block.

Procedure Notes

Step 1: You can also right-click the requirement and choose the **Matlab→Copy To Matlab** options from the popup menu.

Navigating to Linked Objects in Architect/Requirements

You can navigate from a selected model block to the corresponding building block in Architect/Requirements. Also, you can navigate to defining requirements that are linked to the model block.

You cannot navigate to an Architect/Requirements building block from a model that resides outside the database, for example, on your local desktop. You must open the model object in Architect/Requirements.

- For the corresponding building block, right-click the model block and choose the **Teamcenter→Go To TcSE** options from the popup menu.

  The building block is highlighted in the Architect/Requirements main window.

- For a defining requirement:

  1. Right-click the model block and choose the **Teamcenter→Go To Teamcenter** options from the popup menu.

     A submenu is displayed, listing the ROIN and name of each requirement that is linked to the model block.

  2. Select the requirement name from the submenu.

     The requirement is highlighted in the Architect/Requirements main window.

- If the requirement is deleted from Architect/Requirements, an error message is displayed.

  Microsoft Office Word opens the temporary file that was created the last time the requirement was opened before its deletion.

- If the Architect/Requirements client is not running, Microsoft Internet Explorer displays the Systems Engineering and Requirements Management login page.

  Enter your Architect/Requirements user name and password, and then click **Login**. The requirement opens in Word for editing.

Viewing Linked Requirement Content

To view the content of a defining requirement for a model block, you can open the requirement in Microsoft Office Word directly from the model.

1. Right-click the model block and choose **Requirements** from the popup menu.

   A submenu lists the name of each requirement that is linked to the model block.

2. Select the requirement name from the submenu.

   The requirement opens in a read-only Word file, which is stored on your computer as a temporary file.

The first time you open the requirement, the temporary file contains the latest content from the Architect/Requirements database. If you close and reopen the requirement while the model is open, you reopen the same temporary file.

This file does not reflect content changes that may be made in the database while the model is open. To generate a new temporary file with the latest database content, close the model, reopen it, and repeat this procedure.

If the temporary file is deleted from your computer, a new file is generated with the latest content from the database.

Deleting a Trace Link

Defining requirements for a model block are listed on a submenu when you right-click the block and choose **Requirements** from the popup menu. Each listed requirement has a trace link to the Architect/Requirements building block that corresponds to the model block.

You can delete a trace link directly from the model block, for example, if the requirement's content is changed and is no longer valid for the design. Architect/Requirements automatically removes the trace link from the requirement and building block.

1. Right-click the model block and choose the **Requirements→Edit/Add Links** options from the popup menu.

   Simulink displays the Requirements dialog window. On the **Requirements** tab, the list pane shows the name of each linked requirement.

2. Select the name of the requirement that has the trace link, and then click the **Delete** button.

   The requirement name is deleted from the list pane.

3. Click **OK** to close the dialog window.

   The requirement is deleted from the list of linked requirements for the block.

4. Save the model in the Simulink Model Editor.

   In Architect/Requirements, the trace link is removed from the **Relations** subtab of the **Links** tab and is placed in your Recycle Bin.

Index

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