

SIMIT
Automated import using the stirred tank reactor example

SIMIT V11.0

https://support.industry.siemens.com/cs/ww/en/view/109817350

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1 Introduction

1.1 Overview

SIMIT Simulation Platform (referred to herein as "SIMIT") is employed for plant simulation on a Windows computer. SIMIT is especially suited for implementing a digital twin for virtual commissioning, or for training simulations.

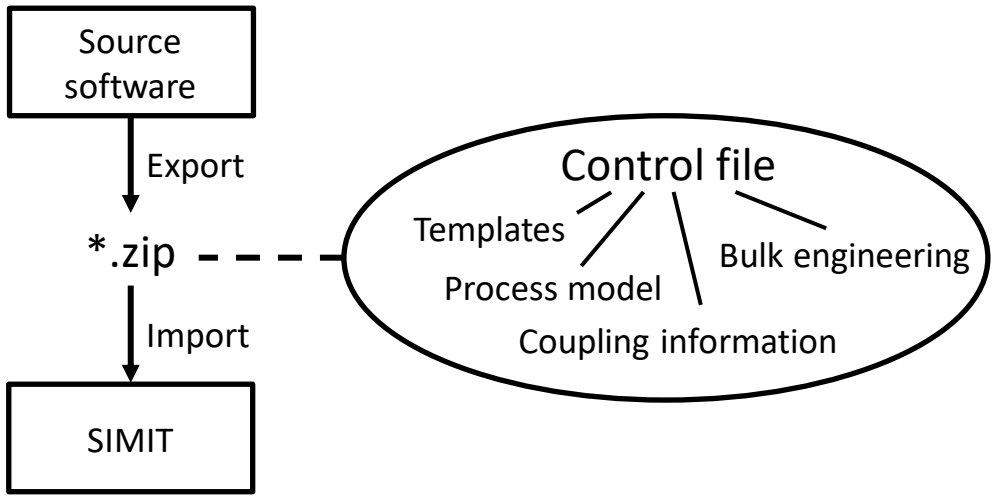
The simulation model is created with a combination of manual and automatic engineering. Automatic generation of simulation components is faster and less prone to errors. It also offers the ability to reuse model data from other software.

Creation of simulations in SIMIT is characterized by an ever-increasing degree of automation. It has been possible, for example, to automatically generate the emulated CPU in SIMIT ("Virtual Controller" or "VC") on the basis of a PCS 7 project. The simulation model, too, could be created in parts with the aid of templates, which has been enormously helpful in the case of repeating structures.

SIMIT offers multiple methods of automatic model creation. This application example concentrates on the so-called "Automated import" feature. As early as SIMIT V10.3, the program enabled model creation on am XML basis, and with it, export and import of simulation data from a different software program such as COMOS, Process Automation Accelerator (PAA) or TIA Portal. In this version, however, was unable to create any "Controls", which are essential for creating operator screens in SIMIT. Fully automated creation of coupling was not possible, either.

SIMIT V11 changes that. Now it is possible to generate a SIMIT project almost entirely with a single import process. Here, it is possible to create a fully configured coupling, an arbitrary number of charts in the desired folder hierarchy, and individual components along with their positions, interconnections, and process screens, in one step. This represents a considerable addition to the interface on the SIMIT side.

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1.2 The stirred tank reactor

The "stirred tank reactor" application example will serve to illustrate the present application example. You can find more information in the following article:
https://support.industry.siemens.com/cs/ww/en/view/93148023

As part of this application example, you will import the SIMIT project – used in the "stirred tank reactor" application example – with the help of the Automated import.

1.3 Aim of the application example

This application example presents the following features of SIMIT V11:

- Automatic creation of an operator screen with various "Controls" components
- Generation of a fully configured and simulation-ready Virtual Controller coupling
- Generation of a SIMIT "from scratch" through the use of external interfaces

This application example addresses the "Automated import" interface on the SIMIT side only. Operation of COMOS, PAA or TIA Portal is not part of this document.

To simulate the "stirred tank reactor" application example, you will import an import file in ZIP format; it generates all essential project components automatically. The focus here lies on the structure of the ZIP file and the files within. In this way you can better familiarize yourself with the Automated import feature.

Testing the simulation solution is not part of this application example. You can obtain information on testing with WinCC in the "stirred tank reactor" application example: https://support.industry.siemens.com/cs/ww/en/view/93148023

1.4 Target group

This application example is intended for all users of the SIMIT "Automated import" feature who wish to become more familiar with the interface on the SIMIT side. It is also suitable for developers who work on an interface solution for third-party software.

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1.5 Components used

The following hardware and software components were used to create this application example:

Component	Quantity	Note
SIMATIC SIMIT Simulation Platform V11.0	1	Engineering license required

The components listed here can be obtained from the Siemens Industry Mall.

This application example consists of the following components:

Component	File name
This document	"AUT_IMP_SIMIT_V11_0_DOC_en.pdf"
ZIP import file	"Import.zip"

2 Automated import

2.1 Overview

The SIMIT "Automated import" feature lets you efficiently create models using external data sources. In this application example, you will import a ZIP file. This folder is prepared as part of this application example. It contains the following:

- "Simulation.xml" file with chart data: This file creates the process model.
- "Procedure.cfg" file: This file serves as the "instructions" for importing the coupling; reference to the subfolder.
- Subfolder "Folder" containing the following:
  - "StirredTankReactor_MP.xml": This file contains the most important coupling information (e.g. for a VC coupling).
  - "DBs.awl": This file contains all data block information.

The individual components are presented below. The import process in SIMIT is also described.

Target configuration

At the end of the import process, described in this chapter, you will have access to a SIMIT project for the "stirred tank reactor" application example.

2.2 Simulation model

The simulation model is described in an XML file that is generated in external software (e.g. COMOS). Use of an XML editor is recommended if you want to edit the file. Refer to the SIMIT V11 manual, chapter 4.3.2 for a refresher on the syntax of the XML file.
https://support.industry.siemens.com/cs/ww/en/view/109812085/156722437131

There you will find a list of all options available to you when configuring controls and components. This application example only addresses a subset of them.

The simulation model for this application example is described in the file "Simulation.xml". It is contained in the ZIP file, making it part of the download on the article page.

This chapter explains the structure of the "Simulation.xml" file.

A valid XML file begins with the element "GENERIC". The version number "8.0" should be specified as an attribute in this element:

```
<?xml version="1.0" encoding="ISO-8859-1" standalone="true"?>
<!DOCTYPE GENERIC>
<GENERIC VERSION="8.0">
    <!-- Instantiate device visualization -->
  + <FOLDER NAME="temp">
    <!-- Chart "Reactor Overview" -->
  + <DIAGRAM NAME="Reactor Overview neu" WIDTH="1000" HEIGHT="650">
    <!-- Chart "Physical Parameter" -->
  + <DIAGRAM NAME="Physical Parameter neu" WIDTH="1400" HEIGHT="600">
    <!-- Folder "Devices" -->
  + <FOLDER NAME="Devices">
  + <FOLDER NAME="Process">
</GENERIC>
```

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Under it, the top level of the project hierarchy contains the two charts "Reactor Overview" and "Physical Parameter". They are described by the "DIAGRAM" element. Then come the folders "Devices" for the devices and "Process" for the process model (each element of type "FOLDER"). The "temp" folder is described further on.

Even before SIMIT V11, SIMIT offered the capability to create charts with the Automated import feature, as well as to interconnect components and instantiate templates. New in SIMIT V11 is the addition of components from the "Controls" task card.

- "Display"
  - "Binary display"
  - "Analog display"
  - "Digital display"
  - "Bar graph display"
- "Input"
  - "Pushbutton"
  - "Pushbutton with image"
  - "Switch"
  - "Switch with image"
  - "Step switch"
  - "Step switch with image"
  - "Digital input"
  - "Slider"
- "Others"
  - "Action"

Controls are used to implement control elements and display objects in a SIMIT chart.

Note Graphical objects from the "Graphics" task card are not supported by Automated import.

The structure of the XML description of controls, components and macros is the same. Below, various examples are presented to illustrate the syntax.

The description of a control or a component/macro begins with the element "CTRL" or "COMP" (also for macros). The "UID" attribute uniquely identifies the object. The UIDs of components and macros can be found in the Preview area once you have highlighted the object in the SIMIT library. You can find the UIDs of controls in the SIMIT V11 manual in chapter 4.3.2: https://support.industry.siemens.com/cs/ww/en/view/109812085/156722437131

The "NAME" attribute defines the name of the object in the chart.

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```
<!-- Analog display -->
<CTRL NAME="PIC_Pressure_analog_display" UID="a_0ep6g9_1r48zhf8">
    <POS Y="130" X="555"/>
    <PROP NAME="LocalDataType" VALUE="analog"/>
    <PROP NAME="Minimum" VALUE="0"/>
    <PROP NAME="Maximum" VALUE="10"/>
    <PROP NAME="StartAngle" VALUE="225"/>
    <PROP NAME="EndAngle" VALUE="315"/>
    <PROP NAME="Delta" VALUE="2"/>
    <PROP NAME="DecimalPlaces" VALUE="0"/>
    <PROP NAME="Unit" VALUE="bar"/>
    <PROP NAME="FontSize" VALUE="10"/>
    <PROP NAME="Foreground" VALUE="#FFFFFF"/>
    <PROP NAME="Background" VALUE="#0054A8"/>
    <TRANSFORM SCALEY="1" SCALEX="1"/>
  - <PORT NAME="X">
        <CONNECTION NAME="Y" SOURCE="PIC_Pressure" TYPE="IMPLICIT"/>
    </PORT>
</CTRL>
```

Position

You can describe the position of a component with the "POS" element. Here, the attributes "X" and "Y" represent the coordinates in the chart.

Property

The property of a component is described with the element "PROP". Select the property with the "NAME" attribute and set the value with the "VALUE" attribute.

Scaling

Describe the size and dimension of a component with the "TRANSFORM" element. The attributes "SCALEX" and "SCALEY" refer to the scaling factor in the X and Y direction. It is not possible to specify the absolute size of the component.

A bar chart in SIMIT is oriented horizontally by default and scaled accordingly. A vertical bar chart (property "LocalOrientation" = "vertical") must therefore be modified manually:

```
<!-- Bar display -->
<CTRL NAME="Level_out_bar_display" UID="a_0ep6g9_1jxihn32 ">
    <POS Y="375" X="335"/>
    <PROP NAME="LocalDataType" VALUE="analog"/>
    <PROP NAME="StartValue" VALUE="0"/>
    <PROP NAME="EndValue" VALUE="100"/>
    <PROP NAME="LocalOrientation" VALUE="vertical"/>
    <PROP NAME="ShowTicBar" VALUE="true"/>
    <PROP NAME="ShowDisplay" VALUE="true"/>
    <TRANSFORM SCALEY="4" SCALEX="0.375"/>
  - <PORT NAME="X">
        <CONNECTION NAME="Y" SOURCE="Level_Out_Percent" TYPE="IMPLICIT"/>
    </PORT>
</CTRL>
```

Connection

Component inputs can only be connected with an output of another component. Outputs of components, by comparison, can have connections to the inputs of multiple other components. Therefore, components are always connected starting with the input.

To connect a component, first specify the name of the input in question. It is designated with "PORT". Indicate the name for the "NAME" attribute. Then you will define the source of the connection with the element "CONNECTION". The "NAME" attribute denotes the name of the

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connection; "SOURCE" designates the name of the source component, and "TYPE" the type of connection.

You can interconnect controls and other components either explicitly with connection lines ("LINE") or implicitly ("IMPLICIT"). Lines in an operator screen are distracting. For this reason, the controls in the "Reactor Overview" chart are interconnected implicitly.

```
<!-- Bar display -->
<CTRL NAME="Level_out_bar_display" UID="a_0ep6g9_1jxihn32 ">
    <POS Y="375" X="335"/>
    <PROP NAME="LocalDataType" VALUE="analog"/>
    <PROP NAME="StartValue" VALUE="0"/>
    <PROP NAME="EndValue" VALUE="100"/>
    <PROP NAME="LocalOrientation" VALUE="vertical"/>
    <PROP NAME="ShowTicBar" VALUE="true"/>
    <PROP NAME="ShowDisplay" VALUE="true"/>
    <TRANSFORM SCALEY="4" SCALEX="0.375"/>
  - <PORT NAME="X">
        <CONNECTION NAME="Y" SOURCE="Level_Out_Percent" TYPE="IMPLICIT"/>
    </PORT>
</CTRL>
```

The "Physical Parameter" chart contains only input fields and one switch. For practical reasons, these controls are connected with connectors. This is not realized with "CONNECTION" elements, but rather with the position of the components. The position of the components and connectors are chosen such that the connections lie on top of one another. This establishes the connection between component and connector.

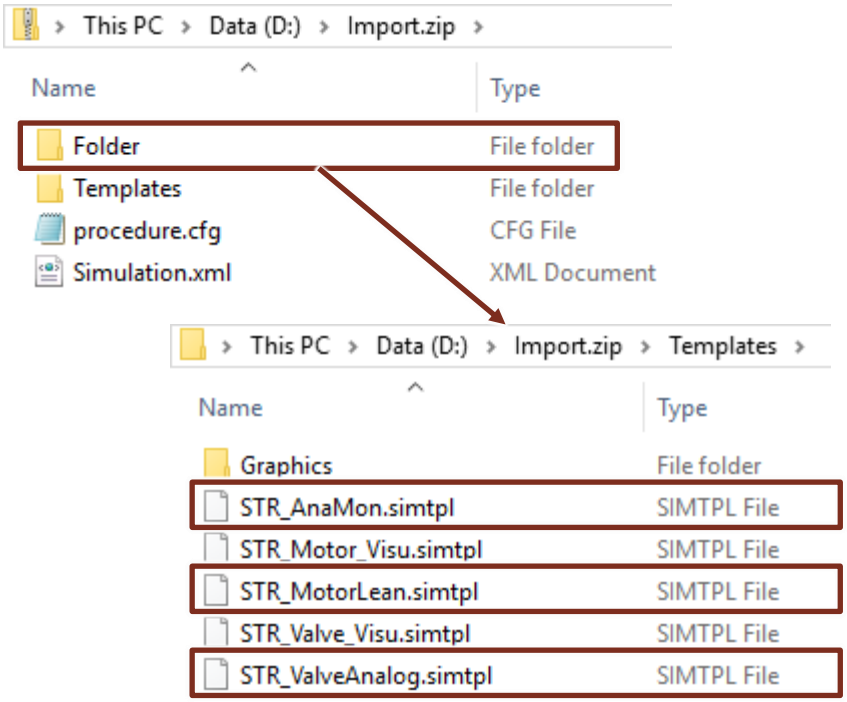
Mass data processing

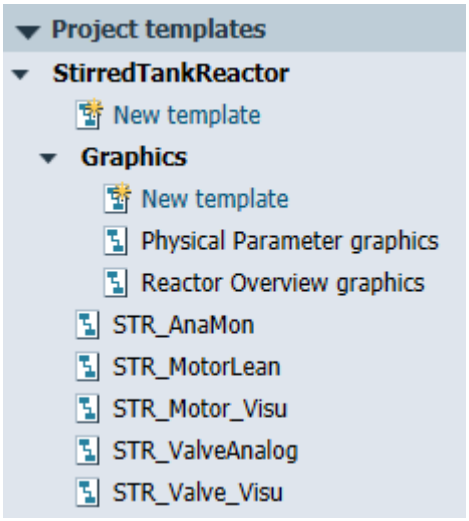
SIMIT offers various ways of efficiently creating repeating structures. Mass data engineering relies on templates in which placeholders are defined. These can be component designations or signal names. These placeholders are replaced with values during instantiation. An XML import as part of the Automated import offers one way to utilize this template-instance method.

This application example uses mass data engineering in the device logic. Valves, for example, have differing names, parameters and signal names, but the structure of the charts is similar.

The "Templates" task card contains the templates "STR_AnaMon.simtpl", "STR_MotorLean.simtpl" and "STR_ValveAnalog.simtpl". They are part of the ZIP folder (subfolder "Templates") and are automatically copied to the Project Templates during automatic generation of the SIMIT project.

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Note

The templates "STR_Motor_Visu.simtpl" and "STR_Valve_Visu.simtpl" are relevant for chapter 2.3.3, "DBs.awl".

Instantiate templates with the "TEMPLATE" element. A "DIAGRAM" element is not needed in this case. The "SUBST" element describes how the placeholders are replaced. Under the "NAME" attribute, you will specify the name of the placeholder, and under the attribute "VALUE", the value with which the placeholder will be substituted.

```
<!-- STR_MotorLean -->
<TEMPLATE NAME="STR_MotorLean" INSTANCE="NS_StirringMotor">
    <SUBST NAME="COUPLING" VALUE="VC01"/>
    <SUBST NAME="ChartName" VALUE="NS_StirringMotor"/>
    <SUBST NAME="FBR_SymbolName" VALUE="NS_StirringMotor_FBR"/>
    <SUBST NAME="MMON-TDYN_Value" VALUE="10"/>
    <SUBST NAME="OUTR_SymbolName" VALUE="NS_StirringMotor_CTR"/>
</TEMPLATE>
```

You can also instantiate multiple templates in one chart. Use the "BUILDUP" element to do this. The "ALIGNMENT" attribute is crucial to this. It specifies whether the instances should be placed next to each other ("HOR") or under each other ("VER") in the chart. The attribute "INSTANCE" contains the name of the chart that will be created:

```
<BUILDUP WIDTH="200" ALIGNMENT="VER" INSTANCE="Devices">
    <!-- Valves -->
  - <TEMPLATE NAME="STR_Valve_Visu">
        <SUBST NAME="COMP" VALUE="YC_Quantity"/>
        <SUBST NAME="SIGNAL" VALUE="LO"/>
    </TEMPLATE>
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
  + <TEMPLATE NAME="STR_Valve_Visu">
    <!-- Motors -->
  - <TEMPLATE NAME="STR_Motor_Visu">
        <SUBST NAME="COMP" VALUE="NS_StirringMotor"/>
        <SUBST NAME="SIGNAL" VALUE="FB_Speed"/>
    </TEMPLATE>
  + <TEMPLATE NAME="STR_Motor_Visu">
</BUILDUP>
```

Macros

The XML file treats macros like controls or components. Macros are given a UID upon creation. Like with components, you will specify it as the "UID" attribute in the XML file.

```
<COMP NAME="Rate_of_temperature_change#2" UID="g_4dorja14ff6_00927y544xphw">
    <POS Y="285" X="960"/>
  - <PORT NAME="Heat_Flow">
        <CONNECTION NAME="Y" SOURCE="Sum_of_Heat_Flow_Reac" TYPE="LINE"/>
    </PORT>
  - <PORT NAME="Mass">
        <CONNECTION NAME="Y" SOURCE="Selection#1" TYPE="LINE"/>
    </PORT>
  - <PORT NAME="specific_Heat_Capacity">
        <CONNECTION NAME="Y" SOURCE="Cp_Reactor" TYPE="LINE"/>
    </PORT>
</COMP>
```

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Note

Like controls or components, macros can always be placed in a chart and interconnected. Unlike components, however, it is not possible to automatically import macros from a folder during automatic project creation.

The aim of this application example is project generation "from scratch". Macros cannot be used here directly. Macros in templates are exempt from this limitation.

While macros from the reference article are used in the finished simulation of the stirred tank reactor, the corresponding logic has been taken apart in the present application example.

SIMIT components used

You can successfully place and interconnect controls, components and macros using the XML import only if the objects referenced therein are also present in one of the project libraries ("Basic", "User", "Project"). Identification is done with the UID.

The UID is assigned to a component and is not the same across all SIMIT versions. Therefore, when importing with the XML file supplied with this application example, please note the following:

- Use the SIMIT V11 components.
- Alternative: Replace the UIDs in the included XML import file with the UIDs of the components of your SIMIT version.

Below you will find a list of the SIMIT components used in the XML import file in this application example, along with their UIDs:

SIMIT component name	Hierarchy	UID
Connector	CONNECTORS	f_000hsn_21b4dv0t
ADD	STANDARD/AnalogBasic	f_000hsn_4ho68i0d
DIV	STANDARD/AnalogBasic	f_000hsn_4ho69lu6
MUL	STANDARD/AnalogBasic	f_000hsn_4ho69yg4
SUB	STANDARD/AnalogBasic	f_000hsn_4ho6adxb
AFormula	STANDARD/AnalogExtended	f_000hsn_4hpl9whk
Compare	STANDARD/AnalogExtended	f_000hsn_4hp4qlpg
INT	STANDARD/AnalogExtended	f_000hsn_50e9lwq1
Multiplexer	STANDARD/AnalogExtended	f_000hsn_4danx8me
PTn	STANDARD/AnalogExtended	h_4dvxpyqfq8k_0097ug8ddns0h
Selection	STANDARD/AnalogExtended	f_000hsn_4daoh3w9
AND	STANDARD/BinaryBasic	f_000hsn_4hp4ubfw
NOTc	STANDARD/BinaryBasic	f_000hsn_33dc8gm3
OR	STANDARD/BinaryBasic	f_000hsn_4hp4w7g7
Bit2Byte	STANDARD/Conv	f_000hsn_4hp528ax
Compare_I	STANDARD/IntegerExtended	f_000hsn_4hp57lci
SQRT	STANDARD/Math	f_000hsn_4hp5g7jt

CAUTION

Exercise caution around changes to macros or components!

After every save operation in the macro editor or component type editor, macros and components receive a new UID. The UIDs in the XML file must be current. Keep your database up to date!

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CAUTION

UIDs can also differ between SIMIT versions!

The UIDs in the XML file must be current. Keep your database up to date!

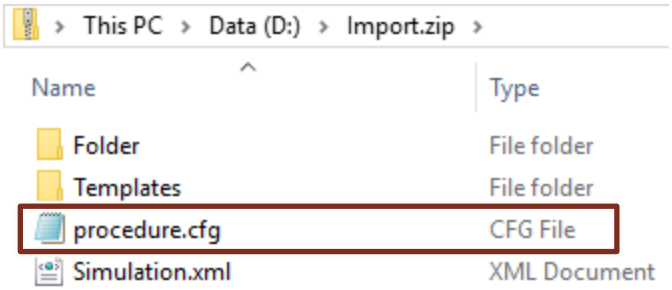
Note

As of its version 2, the TIA Portal add-in "Simulation Model Generator" is able to assign the UIDs from different SIMIT versions to the right components:
https://support.industry.siemens.com/cs/ww/en/view/109780391

2.3 Coupling

2.3.1 "Procedure.cfg"

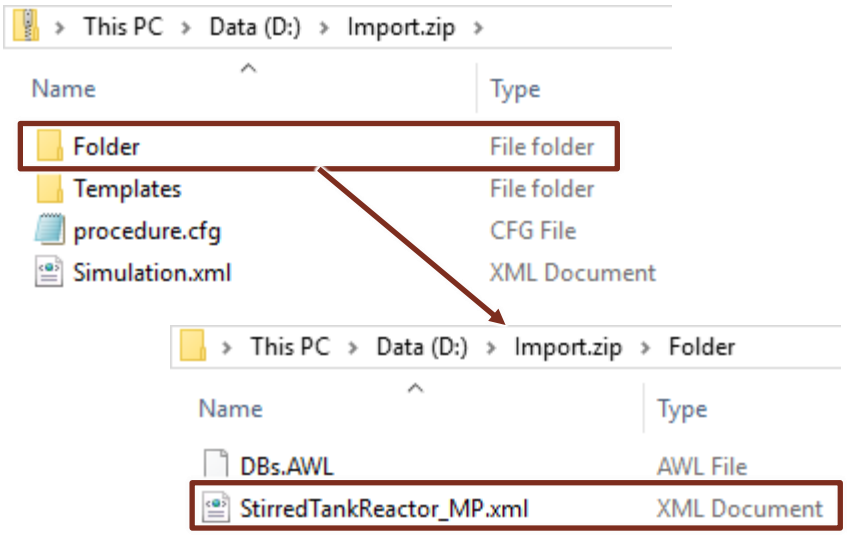
The "Procedure.cfg" control file coordinates the import process. It should be saved to the top level in the ZIP folder.



2.3.2 "StirredTankReactor_MP.xml"

The configuration file "StirredTankReactor_MP.xml" contains the most important information about the CPU being emulated. The name of the file does not matter.

The "HWCNExport" tool can be used to export this file from PCS 7. It is included along with SIMIT. More information about the tool can be found in the manual for SIMIT V11, in chapter 2.4:
https://support.industry.siemens.com/cs/ww/en/view/109812085/146372490123

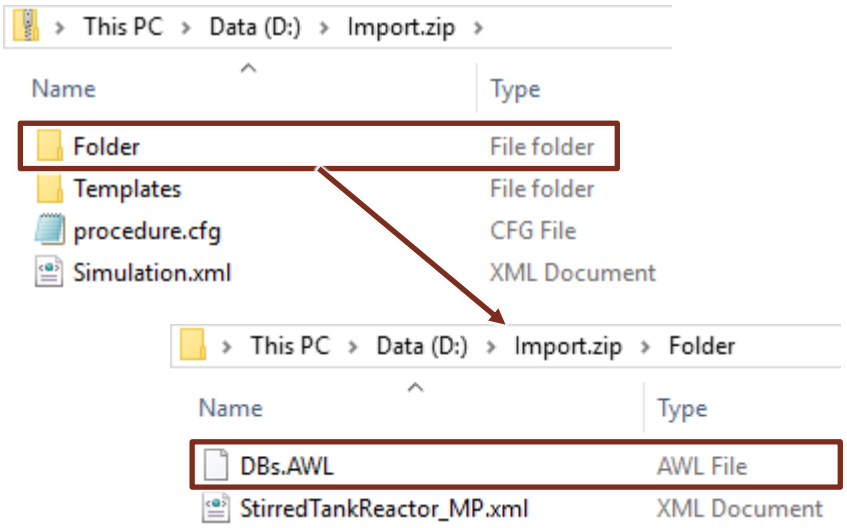


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2.3.3 "DBs.awl"

The configuration file "DBs.awl" contains information about the data blocks of the CPU being emulated. It can be generated in PCS 7.

Specify the name of the AWL file in the control file "Procedure.cfg".



2.4 Import process

The preparations described above shorten the process of project creation. The necessary input data can be prepared with external software. You can create a complete and ready-to-run SIMIT project from these data in a few steps.

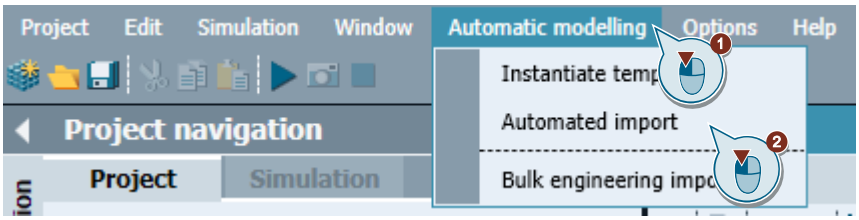
Below, we present two ways that you can create the SIMIT project from the Automated import feature:

- Manually create the project and then import the ZIP file.
- Create the project with the help of call parameters.

Manual project creation

Carry out the following steps:

1. Create an empty SIMIT project.
2. Click on "Automated modelling > Automated import" in the menu bar.



3. In the dialog, select the ZIP folder that you wish to open, then click "Open".

The import starts and the SIMIT project is automatically generated.

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Project creation with call parameters

Project creation with call parameters only works if the following requirements are met:

- .NET framework V4.6 or higher is installed.
- SIMIT is not started.
- The target folder for the project contains no additional subfolders.

Carry out the following steps:

1. Open the command line window.
2. Navigate to the folder containing "SIMIT.exe":
   ```
   cd C:\Program Files (x86)\Siemens\Automation\SIMIT\SIMIT SF\bin\
   ```
3. Run the command to create the SIMIT project. Follow the syntax below:
   ```
   SIMIT.exe /o|c:<projectname>.simit [/i:<importfile>.zip]
   [/l:<licensetype>]
   ```

   Example:
   ```
   SIMIT.exe /c:D:\Import_folder\StirredTankReactor.simit /i:D:\Import.zip
   ```

The folder "Import_folder" is created automatically. SIMIT starts, creates a project in "Import_folder" with the name "StirredTankReactor", and imports the data from the file "Import.zip".

Note

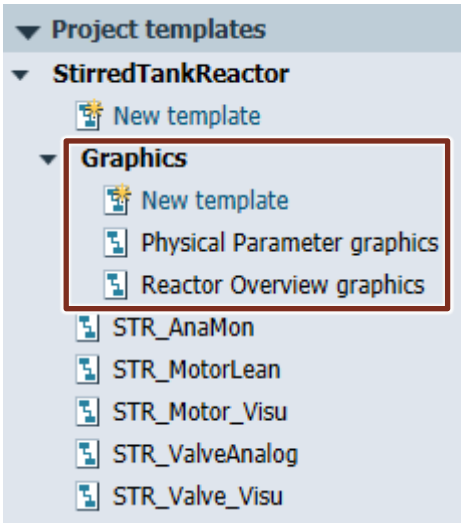
More information on starting SIMIT with call parameters can be found in the SIMIT V11 manual in chapter 1.4:
https://support.industry.siemens.com/cs/ww/en/view/109812085/154370078219

Operator screens

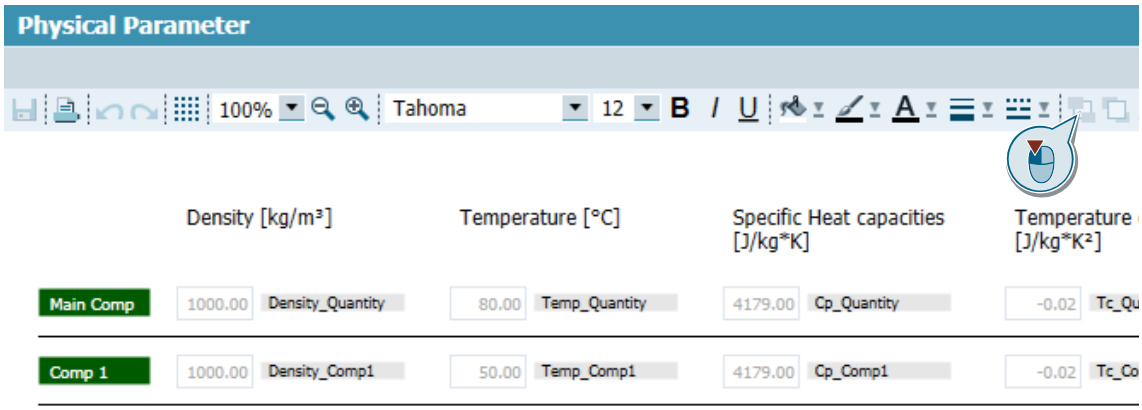
Graphic objects can be helpful for the charts "Reactor Overview" and "Physical Parameter", which serve as operator screens: They can increase clarity. SIMIT also offers animation options for graphic objects. However, in SIMIT V11, graphic objects and animations cannot be created straightaway with the Automated import feature. You can nevertheless add them manually. Alternatively, it is possible to insert animated graphic objects into templates, and then import the templates.

For this application example there are prepared templates that contains supplemental graphic objects for the two operator screens and other charts. The objects inside are already correctly positioned, so you can add the entire contents of the graphic templates via copy/paste in the corresponding logic chart. You can find the prepared templates in the "Templates" task card under "Project templates > Graphics".

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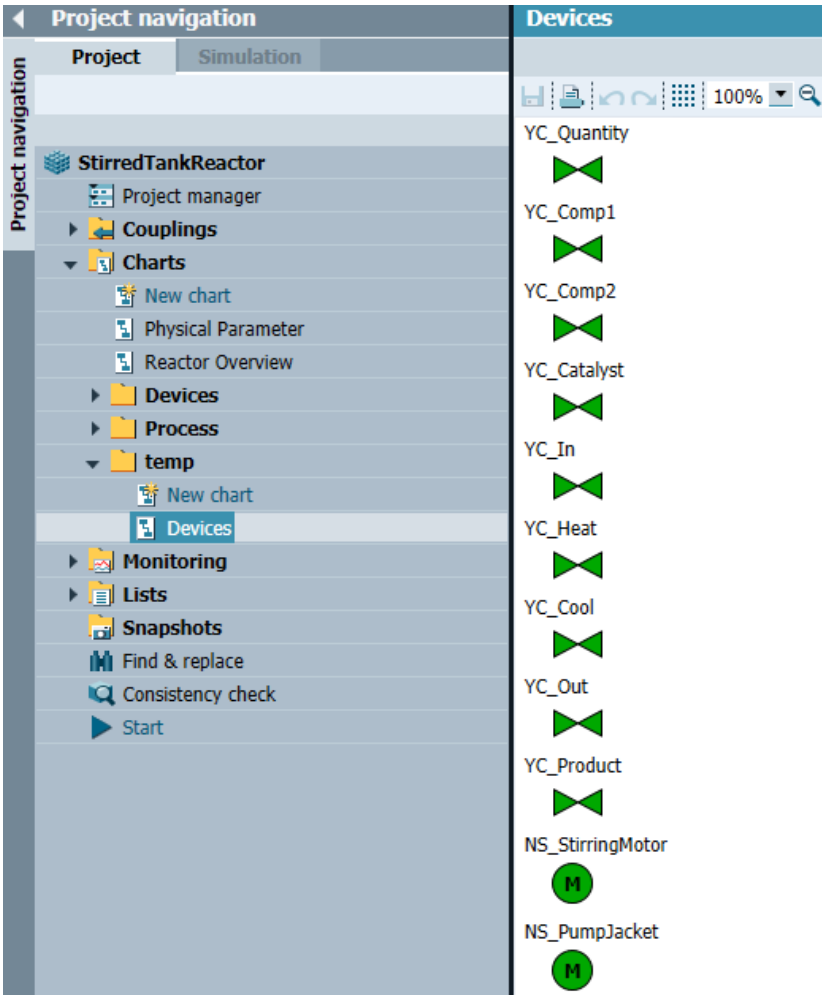


Push the graphic objects to the background once inserted.



In addition to these prepared charts, the "Simulation.xml" file also defines fully-animated device "icons". You created these during the automatic import. They are based on the templates "STR_Motor_Visu.simtpl" and "STR_Valve_Visu.simtpl". During automatic project creation, they are placed in the "temp" folder in the top level of the project hierarchy in the "Devices" chart. They are linked with the appropriate signals.

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If you would like to have a visual animation of the valves and motors, drag the icons to their correct positions in the "Reactor Overview" chart so that they cover their gray counterpart. For precise positioning, hold down the ALT key and use the arrow keys. You can delete the "temp" folder afterwards.

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3 Results and test

At the end of these brief steps, you will obtain a simulation-ready SIMIT project. However, you cannot yet start the simulation: The distribution editor cannot find the IP address configured for the VC.

If you start the simulation and wish to test the project along with a WinCC visualization, then you must carry out some preparations on the host computer on the PCS 7/WinCC side. For this, follow the steps in the stirred tank reactor application example (documentation in the "Downloads" section, chapter 2.1, "Preparations"):
https://support.industry.siemens.com/cs/ww/en/view/93148023

Important: For a smooth simulation, the Virtual Controller configured in SIMIT must match the CPU configured in PCS 7! This application example and the "stirred tank reactor" application example are not developed in concert, however. There may be some differences as a result. Therefore, always import the current version of the CPU data. Do this by modifying the ZIP folder being imported before generating the SIMIT project. Update the following two files in the process:

- "StirredTankReactor_MP.xml": Export the HWConfig from SIMATIC Manager with the "HWCNExporter" tool.
- "DBs.awl": Export the data block data from PCS 7.

This does not affect the preparations for PCS 7 and the OS in the "stirred tank reactor" application example. For the preparations in SIMIT, start at Step 5.

The other chapters of the "stirred tank reactor" application example, such as chapter 2.2, "Operation", can now be used.

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4 Appendix

4.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

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4.2 Industry Mall



The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

4.3 Links and literature

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109817350
\3\	Simulation Model Generator, TIA Portal add-in https://support.industry.siemens.com/cs/ww/en/view/109780391
\4\	Simulation of a PCS 7 stirred tank reactor with SIMIT Simulation Platform https://support.industry.siemens.com/cs/ww/en/view/93148023

4.4 Change documentation

Version	Date	Modifications
V1.0	03/2023	First version

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