SIEMENS

Connection of TCP/UDP Partners to SIMIT

TIA Portal V16 / SIMIT V10.2 / TCP/ UDP

Siemens Industry Online Support

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1 Introduction

1.1 Overview

In today's world, simulation is the state of the art for verifying, testing, commissioning, and maintaining automation software. Therefore, the simulation software must offer maximum flexibility in terms of connection to different simulation partners.

The SIMIT SP simulation software offers a variety of dedicated and standardized options for connecting to simulation partners (e.g., via the integrated standard interfaces OPC DA/UA and SHM). An overview of all couplings that SIMIT SP makes available to you is shown in the following table.

Table 1-1

Category	Coupling	Description
Emulated Controller	S7-PLCSIM	S7-PLCSIM for S7-Classic S7-300 or S7-400 family
	S7-PLCSIM Advanced	TIA Portal, S7-1500 family
	Virtual Controller	SIMATIC Controller type S7-300 or S7-400 (including R and H functionalities)
Hardware Controller	SIMIT Unit	Hardware-in-the-loop setups based on PROFINET or PROFIBUS
Default	OPC UA	Client and Server
	OPC DA	Client and Server
	SHM	Shared memory, use of common system memory for data exchange
Co-simulation	Mechatronic Concept Designer	Direct coupling to NX-MCD, including synchronization mechanism
	gProms	Coupling for gPROMS software based on OPC UA

This application example shows you how SIMT SP can also communicate with simulation partners via the common communication protocols TCP and UDP.

Figure 1-1

1.2 Principle of Operation

SIMIT SP offers a variety of coupling options for exchanging data with controllers or co-simulation partners. If the couplings already existing are not sufficient, it is possible to create further couplings with the help of a programming interface described by SIMIT SP and to integrate them into SIMIT SP.

The SIMIT SP couplings TCP Client, TCP Server and UDP are based on this mechanism, it is called external coupling.

This application example helps you to integrate the developed external couplings into SIMIT SP and to use them in your simulation environment.

1.3 Components Used

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

Table 1-2

Components	Quantity	Article number	Notes
TIA Portal V16	1	6ES7822-1AA06-0YA5	-
S7-PLCSIM Advanced V3.0	1	6ES7823-1FA02-0YA5	-
SIMIT SP V10.2	1	6DL8913-0AK00-0AB5	-
TCP_Client coupling V1.0	1	-	-
TCP_Server coupling V1.0	1	-	-
UDP coupling V1.0	1	-	-

The listed components can be obtained from the [Siemens Industry Mall](#), for example.

This application example consists of the following components:

Table 1-3

Components	File name	Notes
Documentation	109805252_SIMIT_TCP_UDP_Coupling_DOC_v10_de.pdf	This document
TIA Portal V16 project	109805252_SIMIT_TCP_UDP_Coupling_PROJ_v10_de.zip	TIA Portal sample project
SIMIT SP V10.2 Project	109805252_SIMIT_TCP_UDP_Coupling_DEMO_v10_de.zip	SIMIT SP sample project
TCP_Client coupling	109805252_SIMIT_TCP_UDP_Coupling_CODE_v10_de.zip	Folder with external coupling
TCP_Server coupling		Folder with external coupling
UDP coupling		Folder with external coupling

2 Engineering

2.1 Installation

To get access to external couplings within SIMIT SP, they have to be installed.

Proceed as follows for the installation:

SIMIT SP has not yet been started.

1. Navigate to the installation directory of SIMIT. This is normally
   `C:\Program Files (x86)\Siemens\Automation\SIMIT\SIMIT SF`
2. Within this directory, create the "Couplings" folder.

Note	If you already use external couplings in SIMIT SP, this step is no longer necessary.

3. Select the folders, "TCP_Client", "TCP_Server", or "UDP", which are necessary for your application, and copy the folders into the "couplings" directory. The folders "TCP_Client", "TCP_Server", and "UDP" are part of the application example.

Figure 2-1
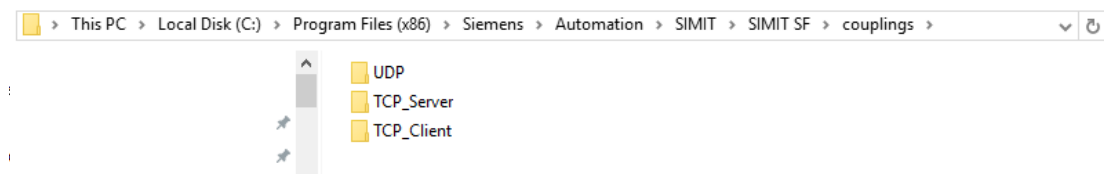
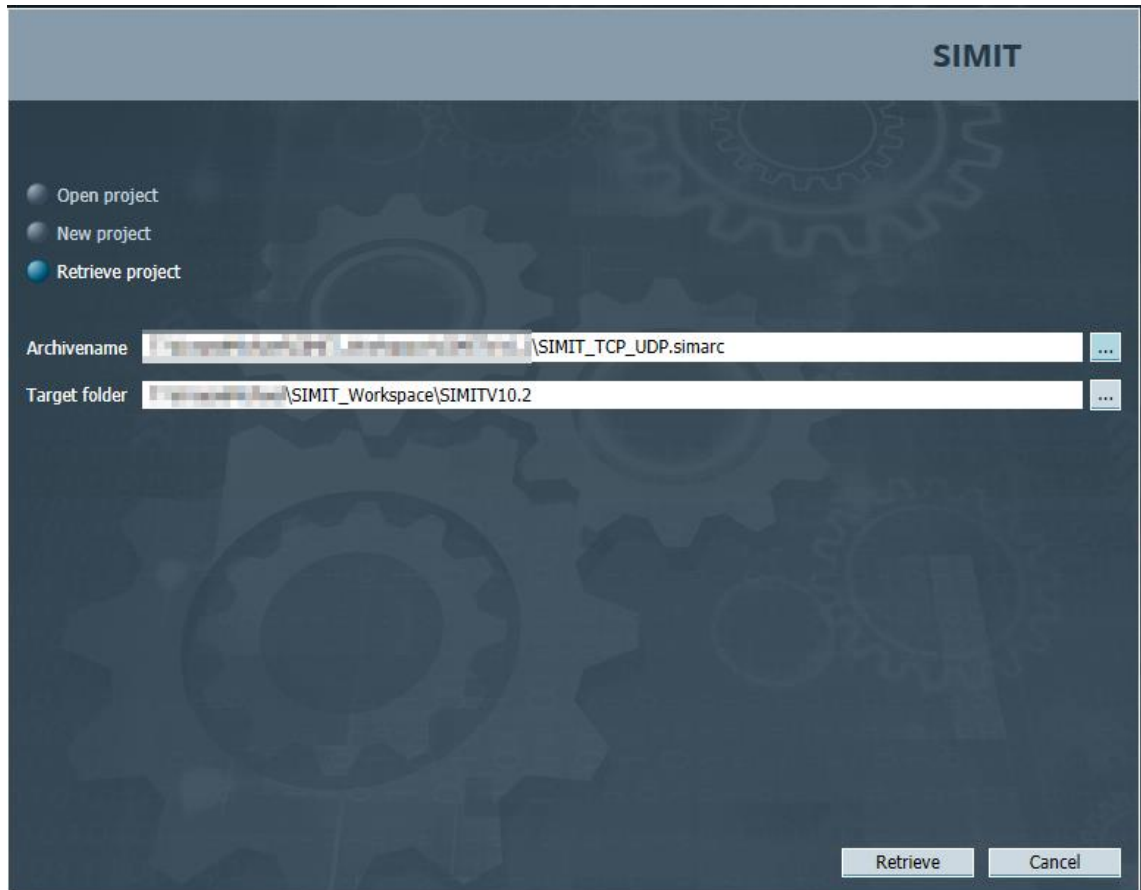| Note	External couplings cannot be used with the SIMIT demo version.

2.2 Operation

2.2.1 SIMIT Coupling Configuration

The external couplings are available after the installation in SIMIT SP. To configure the coupling, start SIMIT SP.
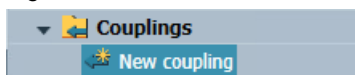
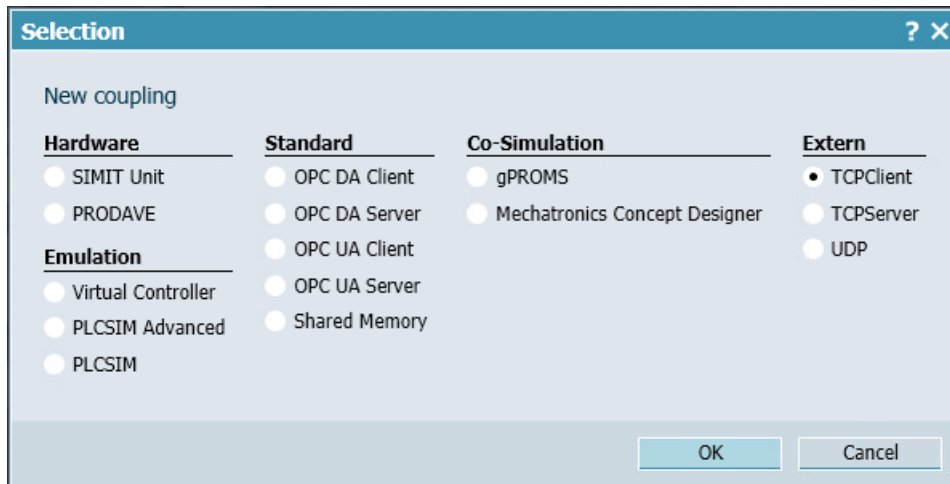1. Open the SIMIT archive "SIMIT_TCP_UDP.simarc" in the application example.

Figure 2-2

2. Create a new coupling in the opened simulation project.

Figure 2-3

3. Select one of the desired couplings

Figure 2-4

Note	Repeat this step for all required couplings

4. Afterwards, the IO image of the coupling can be configured.

    To do this, use the buttons located in the coupling bar. For the use of the application example, it is necessary that 4 input bytes and 4 output bytes are created in each used coupling. To do this, use either the "+Input_Byte" and "+Output_Byte" buttons, or "Generate I/O". For "Generate I/O", see 2.2.1.1.

Figure 2-5
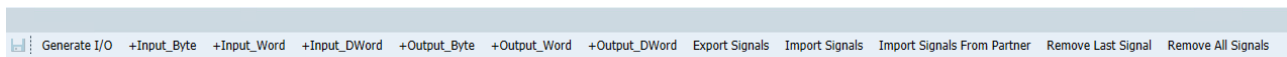
An overview of all buttons and their functions can be found in the following table:

Table 2-1

Button	Function
Generate I/O	Generates a preconfigured IO field, all previously created signals are deleted. The configuration is configured in the properties window of the coupling, see 2.2.1.1.
+Input_Byte	Adds an input signal with the data type byte.
+Input_Word	Adds an input signal with the data type Word.
+Input_DWord	Adds an input signal with the data type DWord.
+Output_Byte	Adds an output signal with the data type byte.
+Output_Word	Adds an output signal with the data type Word.
+Output_DWord	Adds an output signal with the data type DWord.
Export Signals	Exports all signals as a CSV file.
Import Signals	Imports signals from a CSV file.
Import Signals from Partner	Imports signals from a CSV file. Here, inputs are imported as outputs and outputs are imported as inputs.
Remove Last Signal	Deletes the last added signal.
Remove All Signals	Deletes all signals in the coupling.

Note	All three couplings mentioned in the application example behave identically in the IO configuration.

2.2.1.1 Coupling type-specific connection configuration

The final configuration is connection-specific and differs in the couplings TCP Client, TCP Server, and UDP.

TCP Client

For the connection-specific configuration of the TCP Client coupling, enter the IP address and port of the remote partner. In the case of the application example, the PLC_TCP_Server with the IP address 192.168.0.2 and port 2001 is available as a partner.

Figure 2-6

Property	Value
Time slice	2
Remote IP	192.168.0.2
Remote Port	2001
Input data type	BYTE
Input data length	4
Output data type	BYTE
Output data length	4
Data Swap	✔
Debug	
Version	1.0

An overview of all coupling properties and their functions can be found in the following table:

Table 2-2

Property	Function
Time Slice	Time slice in which the coupling is calculated.
Remote IP	IP address of the communication partner.
Remote port	Port of the communication partner.
Input data type	Data type for the generation of the Input IO field.
Input data length	Number of selected input data types to be generated.
Output data type	Data type for the generation of the output IO field.
Output data length	Number of selected output data types to be generated.
Data Swap	Enables/disables reading of the data with reversed bit order
Debug	Enables/disables extended output in the command line window.
Version	Current version of the coupling.

TCP Server

For the connection-specific configuration of the TCP Server coupling, enter the port to which the partner can connect during the running simulation. In the case of the application example, the PLC_TCP_Cient expects to connect to port 2000.

Figure 2-7

Property	Value
Time slice	2
Local Port	2000
Input data type	BYTE
Input data length	4
Output data type	BYTE
Output data length	4
Data Swap	✔
Debug	☐
Version	1.0

An overview of all coupling properties and their functions can be found in the following table:

Table 2-3

| Property	Function
Time Slice	Time slice in which the coupling is calculated.
Local Port	Communication port that is opened for the partner.
Input data type	Data type for the generation of the Input IO field.
Input data length	Number of selected input data types to be generated.
Output data type	Data type for the generation of the output IO field.
Output data length	Number of selected output data types to be generated.
Data Swap	Enables/disables reading of the data with reversed bit order
Debug	Enables/disables extended output in the command line window.
Version	Current version of the coupling.

UDP

For the connection-specific configuration of the UDP coupling, enter the IP address and port of the remote partner. You also enter the local port to which the partner should connect during the running simulation. In the case of the application example, the PLC_UDP with the IP address 192.168.0.3 and remote port 7001 is available as a partner. The partner expects to connect to port 7000.

Figure 2-8

Property	Value
Time slice	2
Remote IP Address	192.168.0.3
Remote Port	7001
Local Port	7000
Input data type	BYTE
Input data length	4
Output data type	BYTE
Output data length	4
Data Swap	✔
Debug	☐
Version	1.0

An overview of all coupling properties and their functions can be found in the following table:

Table 2-4

Property	Function
Time Slice	Time slice in which the coupling is calculated.
Remote IP	IP address of the communication partner.
Remote port	Port of the communication partner.
Local Port	Communication port that is opened for the partner.
Input data type	Data type for the generation of the Input IO field.
Input data length	Number of selected input data types to be generated.
Output data type	Data type for the generation of the Output IO field.
Output data length	Number of selected output data types to be generated.
Data Swap	Enables/disables reading of the data with reversed bit order
Debug	Enables/disables extended output in the command line window.
Version	Current version of the coupling.

2.2.2 S7-PLCSIM Advanced Setting

Coupling

In the dearchived project, you will find three deactivated S7-PLCSIM Advanced couplings. These serve as communication partners, and can be activated as required.

Figure 2-9
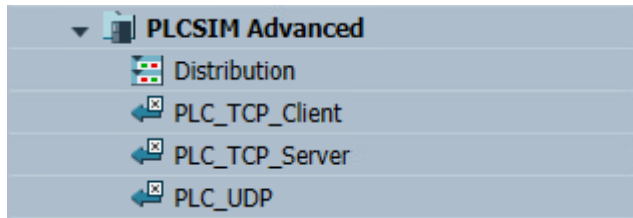
Right-click the desired coupling to access its context menu. Then select the "Activate" option.

Figure 2-10
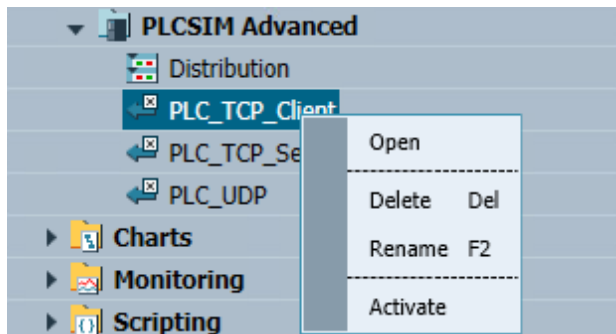
Note	Activate only the S7-PLCSIM Advanced coupling you need as communication partner, deactivate the coupling if you do not need it anymore. Each activated S7-PLCSIM Advanced coupling starts an S7-PLCSIM Advanced instance. The general system requirements of S7-PLCSIM Advanced apply.

Readme	**References** For more information on the system requirements, see Section 3.1.1 in the S7-PLCSIM Advanced manual \7\.

The following table provides an overview of which S7-PLCSIM Advanced coupling is to be used for testing the respective external coupling.

Table 2-5

External coupling	S7-PLCSIM Advanced Partner
TCP_Client	PLC_TCP_Server
TCP_Server	PLC_TCP_Client
UDP	PLC_UDP

Distribution editor

In order for the S7-PLCSIM Advanced instances to communicate with the SIMIT couplings, the communication in S7-PLCSIM Advanced must at least be set to local TCP/IP. In SIMIT SP, this type of communication can be set in the S7-PLCSIM Advanced distribution editor. For this purpose, the communication interface must be set to "TCPIP". In the case of the application example, the host address remains at localhost / 127.0.0.1.

Figure 2-11

Localhost	
Property	**Value**
Host address	127.0.0.1
Communication interface	TCPIP

Virtual Ethernet Adapter

To enable the S7-PLCSIM Advanced instances to communicate with the external couplings in SIMIT, the virtual Ethernet adapter must be placed in the same subnet as the configured PLCs.

It is recommended to use the TCP Client IP address configured in the PLC_TCP_Client. This is mandatory for the communication between the PLC_TCP_Client and the TCP Server coupling configured in SIMIT. Consequently, the IP address 192.168.0.200 with the subnet mask 255.255.255.0 must be entered in the virtual Ethernet Adapter.

Figure 2-12
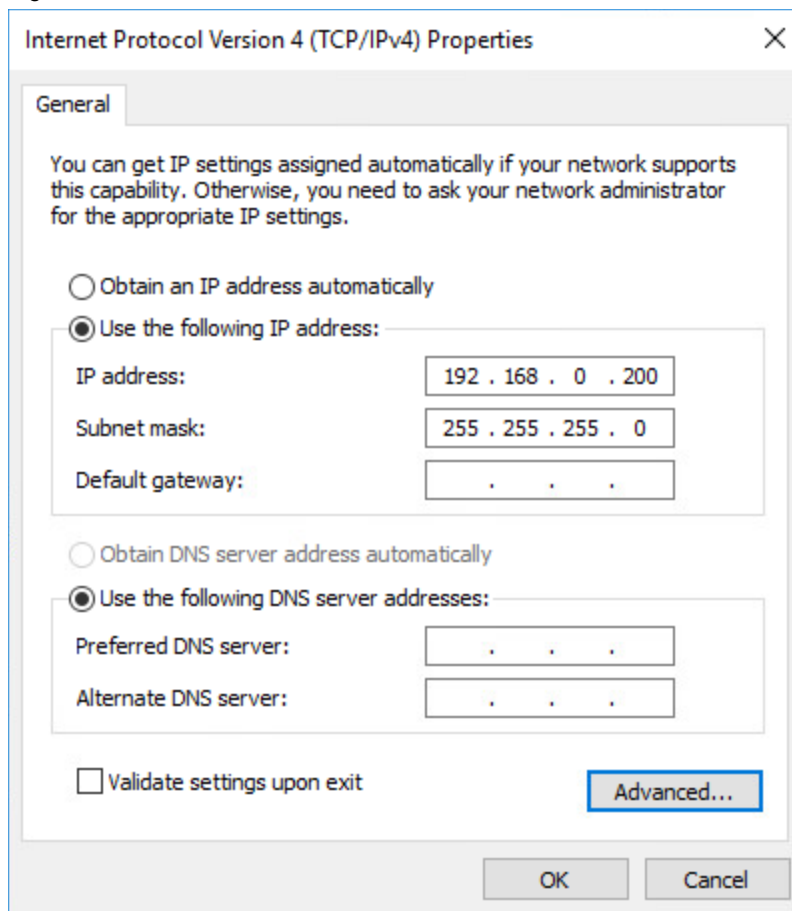
Note	This IP address is also required if you want to go online with the supplied TIA Portal project or reload the PLCs.

2.2.3 Starting the Simulation

After all configuration steps have been completed, start the simulation.

Figure 2-13
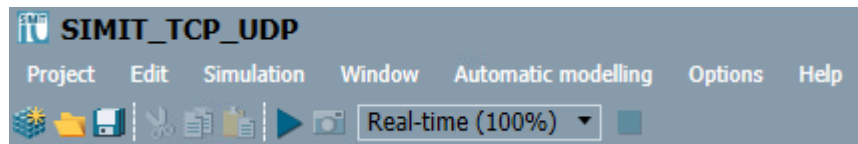
When starting the simulation, a command line window opens for each external coupling. In this window, you can trace the connection setup. When the RX counter counts up, a connection has been established with the communication partner.

TCP Client

Command line window of the external TCP Client coupling

Figure 2-14

TCP Server

Command line window of the external TCP Server coupling

Figure 2-15

UDP

Command line window of the external UDP coupling.

Figure 2-16

⚠ **CAUTION**	**Do not close the opening command line window while the simulation is running.** In case the command line window is closed, the external coupling and the connection with the communication partner is terminated. The simulation must be restarted to re-establish the connection.

After starting the simulation, it is possible to see how the communication partners exchange data with SIMIT on the three SIMIT diagrams included in the project. Here, the 4 created bytes in the simulation program as well as in the automation program are incremented by the value 1.

Figure 2-17
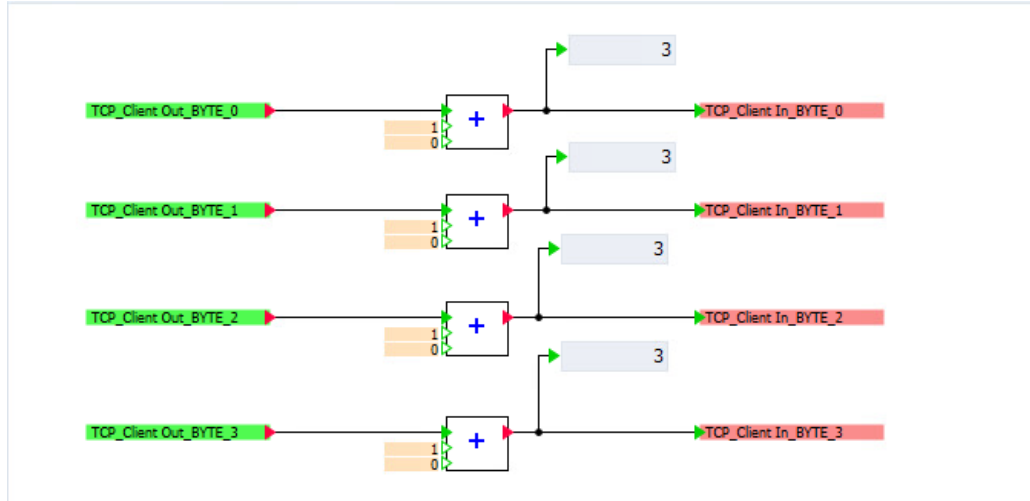
3 Appendix

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3.3 Links and literature

Table 3-1

No.	Subject
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/109805252
\3\	SIMIT Simulation Platform – Overview (landing page) https://support.industry.siemens.com/cs/ww/en/view/109746429
\4\	Overview page of all external SIMIT couplings https://support.industry.siemens.com/cs/ww/en/view/109795246
\5\	First Steps with SIMIT V10.0 and STEP 7 (TIA Portal) https://support.industry.siemens.com/cs/ww/en/view/109767324
\6\	TIA Portal – An Overview of the Most Important Documents and Links – Controller https://support.industry.siemens.com/cs/ww/en/view/65601780
\7\	SIMATIC S7-1500 S7-PLCSIM Advanced V3.0 Function Manual https://support.industry.siemens.com/cs/ww/en/view/109773484

3.4 Change documentation

Table 3-2

Version	Date	Change
V1.0	12/2021	First version