### **Training Document for SIMIT SCE**

### MODULE G1

### 'Startup' Plant Simulation with SIMIT SCE

**Issued** 02/2008

#### Trademarks

SIMIT® is a registered trademark of Siemens AG.

The other designations in this document can be trademarks or registered names, whose use by third parties for their own purposes can violate the rights of the owners.

#### Copyright © Siemens AG 20097 All rights reserved

Transmitting, using or reproducing this document is only permitted within public training and educational facilities. Exceptions require the prior written approval of I&S IS E&C IT OOP 1 (E-mail: simit@siemens.com). Use or transmission of its contents, above and beyond this, are not permitted unless express written permission has been obtained. Offenders will be liable for damages. All rights, including the right to translate the document, are reserved, especially rights created by patent grant or registration of a utility model.

Siemens AG Industrial Solutions and Services Engineering & Construction Industrial IT Solutions Simulation Center

#### **Exclusion of liability**

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvements are welcomed.

© Siemens AG 2009

Subject to change.

This document has been written by Siemens I&S IT PS (Industrial Solutions and Services, IT Plant Solutions) for training purposes. We would like to thank Michael Dziallas Engineering for its support in preparing this document.

### **Contents**

1.	PREFACE	5
2.	GENERAL INFORMATION ABOUT SIMIT SCE	7
2.1	SIMIT SCE	7
2.2	Configuring the SIMIT SCE	8
3.	INSTALLING THE SIMIT SCE SOFTWARE	9
3.1	Installation	9
4.	STARTING SIMIT SCE	10
5.	MANAGING AND CREATING PROJECTS	11
5.1	The Operator Interface	
5.2	Status Bar	
5.3	Message Line	12
5.4	Index column	13
6.	VENTILATOR PROJECT	15
6.1	Setting up a new project	16
6.2	Opening the PLCSim Gateway	16
6.3	Setting up a diagram	19
6.4	Creating an operating window	25
6.5	Drawing the fan impeller	29
6.6	Creating a SIMIT SCE project simulation	32
6.7	Creating a PLC program	33
6.8	Starting PLCSIM and loading the PLC program	37
6.9	Simulation with SIMIT SCE	
6.1	0 Simulation by means of the operating window	40
6.1	1 Simulation by means of the diagram	41
7.	CONNECTION TO THE REAL PLC	42
7.1	Changing the address in the SIMIT SCE project	43
7.2	Address changes in the Step7 program	46
8.	SIGNAL GROUPS AND GRAPHS	48
8.1	Signal groups	48
8.2	Graph	51

### The following symbols provide guidance through Module G1:



### Information

General fundamentals

This symbol always appears when general information on a particular topic is provided before the details are elaborated.



Installation



#### Programming

Configuration for sample exercise. This symbol always appears when the sample projects are to be implemented.





### Notes

### 1. PREFACE

In terms of its contents, the SIMIT SCE module is part of the teaching unit entitled 'Plant Simulation with SIMIT SCE' and is intended to serve as a **quick introduction** to plant simulation.



### Learning Objective:

In Module G1, the reader learns how to use the SIMIC SCE software tool. The module explains the basic principles and shows the reader how to handle and create projects on the basis of detailed examples.

### **Requirements:**

To successfully work through Module G1, the following knowledge is assumed:

- Knowledge in the use of Windows
- Basics of PLC programming with STEP 7 (e.g. Module A3 'Startup' PLC Programming with STEP 7)

### Hardware and software required

- 1 PC, operating system Windows 2000 Professional starting with SP4/XP Professional starting with SP1 with 600 MHz and 512 RAM, free hard disk memory approx. 650 to 900 MB, MS Internet Explorer 6.0 and USB connection for the dongle
- 2 Software: SIMIT 5.0 SP1
- 3 Software: STEP7 V 5.4
- 4 Software: S7-PLCSIM V5.x (minimum prerequisite: Version 5.0, Service Pack 1, Hotfix 2)
- 5 MPI interface for the PC (e.g. PC adapter USB)
- 6 PLC SIMATIC S7-300 with at least one digital input module and one digital output module. The inputs have to be taken to a control panel Configuration example:
  - Power supply unit: PS 307 2A
  - CPU: CPU 314
  - Digital inputs: DI 16x DC24V
  - Digital outputs: DO 16x DC24V / 0.5 A
  - Analog inputs/outputs: AI4/AO2



### 2. GENERAL INFORMATION ABOUT SIMIT SCE

### 2.1 SIMIT SCE

i

With SIMIT SCE, you can create or import plant models that you interface with the SIMATIC simulation (S7 PLCSIM) or with real PLC hardware.

You can then test your automation program with illustrative, dynamic models. With SIMIT SCE, it is also possible to simulate complex process sequences and industrial processes.

SIMIT SCE is therefore the ideal supplement to the real SIMATIC hardware setup in the laboratory.

Together with the virtual SIMIT SCE plant model, the automation system is set up transparently, from the initial concept to the real control system.

In this way, SIMIT SCE supports vocational training with respect to projects and how they are handled. The following topics are described:

- 1. Configuring the plant (information phase).
- 2. Creating the PLC program in the SIMATIC Manager with STEP7 (execution phase).
- 3. Loading of the control program into the real PLC or the SIMATIC Simulator (PLCSIM).
- 4. Starting the dynamic plant model with interfacing to the PLC by means of SIMIT SCE.
- 5. First test at the computer simulated plant model (test and result backup).
- 6. Testing the program on a real PLC in conjunction with the controlled plant.

You can use SIMIT SCE as a convenient system for inputting and outputting test signals, but also as a sophisticated plant simulator. Even if you only use SIMIT SCE initially as a convenient user interface, you can later add models at any time in order to simulate plant performance and thus - through dynamic tests- profit from the full performance capability of the SIMIT SCE.



The following restrictions apply to the training version SIMIT SCE 5.0 SP1:

- 32 binary signals and 8 analog signals are available for communicating with the S7-PLCSIM, a PLC, etc.
- 250 components can be used in a simulation.
- 1000 internal signals are available for wiring these components.

### 2.2 Configuring the SIMIT SCE

i

A project in SIMIT SCE consists of several parts.

#### • Interfaces

Define the interface over which you want to connect SIMIT SCE to your automation unit, specifying the signals to which SIMIT SCE is to have access.

Signal assignments can also be imported from an existing table of symbols (ASC file) or from a database (CSV file).

In addition, export to a Step 7 table of symbols or to a database is possible. Several interfaces can be used in a project at the same time.

#### • Diagrams

Use project diagrams to generate and edit the process-related behavior of your plant model. In addition, use functions from a library for the mathematically exact calculation of pressures, temperatures, and mass flows in closed circulations. This library also contains ready-made components such as pipes, containers, pumps and valves. You simply assemble the existing components on a graphic interface and enter the appropriate parameters. Diagrams can consist of one or several pages, depending on how large your model is and how you want to organize it. If necessary, you can spread your plant model over several diagrams.

#### • Operating Screens

From existing plans, you can -either automatically from existing plans or manually by designing them individually- generate operating screens into which different operator control and display elements are placed. To design your plant, ready-made display elements and operator controls are provided. You can use operating windows to specify I/O signals and thus observe the reaction of your connected automation units.

### • Signal Groups

All I/O and process variables in your project can be directly viewed and specified during an ongoing simulation.

To facilitate a clear overview, any number of signals can be combined into so-called signal groups.

#### • Simulation

SIMIT SCE generates the simulation entry automatically when you "create" your project. Creating a project means combining the diagrams and interfaces to generate a runnable program. In the simulation mode, you can control and monitor the states of your virtual plant by using the operating windows you created, and at the same time also control and monitor the logical links by using the associated diagrams.

### 3. INSTALLING THE SIMIT SCE SOFTWARE



SIMIT SCE software is protected by copyright. A so called dongle provides protection against copying. Depending on what type of dongle you have acquired, it is either plugged into the parallel printer port or a free USB slot.

The standard scope of supply of SIMIT SCE consists of

- 1 CD Cygwin C-Compiler
- 1 CD SIMIT SCE Software
- 1 dongle to protect against copying

### 3.1 Installation

To install SIMIT SCE, do the following:



 Insert the CD-ROM for the Cygwin C-Compiler in the drive of your PC. Start the setup program by double-clicking on the file → setup.exe. The setup program guides you through the entire Cygwin installation procedure.

- 2. Insert the CD-ROM for **SIMIT SCE** in the drive.
- 3. Start the setup program by double-clicking on the file → **setup.exe** in the SIMIT folder. The setup program guides you through the entire SIMIT installation procedure.

On all PCs, the following selection must be made while SIMIT SCE is being installed:

For USB dongle:

For LPT dongle (printer port):





### Note

The SIMIT SCE software CD contains a file entitled 'Installation\_instructions.pdf'. This describes the procedure for standard installation of SIMIT SCE.

If you have purchased a network license for SIMIT SCE, please read the installation instructions before completing the next steps for network installation.

### 4. STARTING SIMIT SCE



Before you start SIMIT SCE, you must plug the supplied dongle into the parallel printer port or a USB slot on your computer.

You can plug a printer cable into the parallel dongle. A dongle which belongs to other software can also be plugged into the SIMIT SCE dongle.

You can start the SIMIT SCE in several ways.

Starting the program by using the start menu:



Starting the program using the desktop:





### Note

When you start SIMIT SCE, the presence of a dongle is polled. This is why the dongle must be plugged in before starting.

Without the dongle, the starting process of SIMIT SCE will be stopped and an error message will appear.





Insert the dongle into your computer and start SIMIT SCE

### 5. MANAGING AND CREATING PROJECTS

### 5.1 The Operator Interface

1

After SIMIT SCE has been started successfully, the operator interface appears. The index column is located on the left hand side. Here, you can select the relevant topic by clicking on it with the mouse.

SIMIT SCE is shipped with eight examples of projects as a matter of standard. In the Projects index, you can set up new projects or open a project example and adapt it to your tasks.



Training document for SIMIT SCE

### 5.2 Status Bar

i

In the Status bar, messages are displayed that inform the user of the status of SIMIT SCE. In the case of processes that take longer, for example, information is provided on the progress that has been made, or error messages are displayed. The latest status message is always visible.

Types	
Equations optimized	
3 Implicit connections created	
Start compiler:	
Compiling finished.	*

The system messages can be filtered by means of the "View | Status Window" menu as follows:

#### Messages

Only system messages are displayed.

#### Warnings

All warnings output by the system are listed in the window.

#### • Errors

Errors that occurred during code generation or the simulation are shown.

These filters can be freely combined. By clicking on the items, you can enable or disable the corresponding messages.

#### • Delete

By clicking on this command, you can delete all the status messages that have accumulated up to now.

You can display or hide the status bar by means of the "View | Status Window | Display" menu.

### 5.3 Message Line

1

In the message line, information from the current simulation is displayed. It is therefore only visible if you have opened a simulation.



Control system. The model is simulated

You can display or hide the message line by using the "View | Message System" menu.

#### 5.4 Index column



The index column is divided into four topics:

- "Library" with the standard libraries
- "Control elements" with the available display and operator control elements
- "Projects" with a list of all projects that you have set up in SIMIT SCE
- "Types" with higher-level definitions of variables, enumerations and connections

Each index contains a hierarchical directory tree.

### 5.4.1 Library with the standard libraries



### 5.4.2 Widgets with the available display elements and operator controls



i

### 5.4.3 Projects with a list of all projects that you have set up with SIMIT SCE

The projects are managed in the "Projects" index column:

A project in SIMIT SCE consists of several parts.

These include:

- **Diagrams**, for configuring process-oriented functions.
- **Operating windows,** for operator control and monitoring of the plant model.
- Signal groups, for joint operator control of several signals
- **MPIs** for defining the interface.
- **Simulation,** for testing the virtual plant.



### 5.4.4 Types with higher-level definitions of enumerations, variables and connections



### 6. VENTILATOR PROJECT



### **Task Definition:**

A ventilator is started by means of an On/Off switch. In addition, a slider can be used to alter the ventilator's speed. The switch is to be operated and the speed is to be changed via a SIMIT SCE operating window. Via an interface to the SIMATIC S7 control unit, the SIMIT SCE transmits a binary and an analog input signal to the PLC. In the PLC control unit, these input signals are logically processed and routed to the binary motor output and the analog closed-loop control output for the speed of the fan impeller. SIMIT SCE records these signals via the interface and, with the help of a process-oriented diagram, simulates the rotation of the ventilator in the operating window.

#### How to set up the "Ventilator" project

- 1. Start SIMIT SCE and set up a new project.
- 2. Start the PLCSim interface and enter I/O connections.
- 3. Create a new diagram and insert process-oriented functions.
- 4. Create a new operating window and enter and interface widgets (operator control and display elements).
- 5. Draw the ventilator wheel and configure the rotating movement as an animation.
- 6. Create a SIMIT SCE project simulation.
- 7. Start SIMATIC Manager and create the PLC program.
- 8. Start PLCSIM and load the created PLC program.
- 9. Start the simulation in SIMIT SCE.
- 10. In the operating window, you can now control and monitor the model.
- 11. In the diagram, you can monitor the blocks of the process-oriented functions and you can also influence them by changing the parameters.





### 6.1 Setting up a new project



Right-click on the "Projects" folder and select "New Project". Give your project the name "Ventilator".  $(\rightarrow \text{Project} \rightarrow \text{New Project} \rightarrow \text{Name: Ventilator})$ 



### 6.2 Calling the PLCSim Gateway



Right-click on the project name "Ventilator" and select PLCSim as the new gateway. ( $\rightarrow$  Ventilator  $\rightarrow$  New  $\rightarrow$  Gateway  $\rightarrow$  PLCSim)





Expand the directory tree and select "Edit". This allows you to open the gateway for PLCSim.  $(\rightarrow PLCSim \rightarrow Edit)$ 





Here, basic settings can be made and the signal assignments for the binary and analog inputs and outputs can be entered. In addition, the I/O signals can be normalized in the case of the analog signal assignments.



### Note

For better assignment of the signals, all external signals and also the associated symbolic designations in this project example are written in CAPITAL LETTERS. All internal SIMIT SCE component designations are written in lower case letters. When signals are being assigned, make sure they are written correctly, i.e. in capital letters or lower case letters.

### PLC address assignments must be written in CAPITAL LETTERS.



Enter symbolic designations and address assignments.

### Binary input

Settings Binary In Binary Out Analog In Analog Out								
Symbol	Address =	Data type	Comment					
ON/OFF	10.0	BOOL	switch ON/OFF On=1					

#### Binary output

Settings Binary In Binary Out Analog In Analog Out								
Symbol	Address =	Data type	Comment					
MOTOR	Q4.0	BOOL	output for motor ventilator					

#### Analog input with normalization from 0 to 100

Settings Binary In Bi	inary Out Analog In	Analog Out				
Symbol	Address =	Data type	Comment	Туре	Lower	Upper
Setpoint	PM/288	WORD	presetting value	unipolar	0.0	100.0

#### Analog output with normalization from 20 to 100

Settings Binary In B	inary Out Analog In	Analog Out				
Symbol	Address =	Data type	Comment	Туре	Lower	Upper
Speed	PQW288	WORD	speed ventilator	unipolar	20.0	100.0

#### Save symbol assignment and export as an .asc file 🚝 PLCSim FLCSim File File Import (.asc) Import (.asc) Import (.csv) Import (.csv) Export (.asc) Export (.asc) Export (.csv) Export (.csv) Save Save Save & Exit Save & Exit Exit Exit

Select the "SIMIT" folder as the target memory and enter the file name "Ventilator".



Click on "Save" (The PLCSim gateway remains open in the background)

#### 6.3 Setting up a diagram



Set up a new diagram in the "Ventilator" project. ( $\rightarrow$  Ventilator  $\rightarrow$  New  $\rightarrow$  Diagram)



Enter "Diagram" as the name and open the diagram by double-clicking on the name.



Change the sheet size to 150 x 75 and confirm your entries with "OK". ( $\rightarrow$  Sheet  $\rightarrow$  Change Size  $\rightarrow$  150x75  $\rightarrow$  OK)

Sim S	IMIT												
File	Sheet	Edit	Placement	Simulation	View Ex	tra Wine	dow	Help					
	1	New 9	iheet			🚯 🏚	00		<b>1 1</b>	15 2	A AL		
		Remo	ve Sheet		ntilator	/ Diagra	m (+)	)					_8×
	-	Chan	ge Size										<b>A</b>
		Creat	e operating	window									
	63	Opera	atable										
		Turbele Lueften Presse SR_Flip vent2 /entilat Plo Zimmer	uchtung Jeberwachu JAWL KOP flop or gram Sim beleuchtung	ing •	4	1	F	Change New size 150 OK	size e (in g	rid point ( 75 Ca	s) ncel	]	
		Түре	8		- 52								
0 Imp	olicit con	nectior	s created										-



Enlarge the frame of the diagram to the sheet size and, in the library, open the "Operating" folder  $(\rightarrow \text{Library} \rightarrow \text{Library} \rightarrow \text{Operating})$ 

		<u>_0×</u>
File Sheet Edit Placement Simo	Jaction View Extra Window Help	
Library	> ₩ III 7 45 100 Y 9 9 % % 42 24 44	_ <del>_</del> <del>_</del>
Switch 1     System     System     User     Widgets     Projects     Types	I         1         >>1 of 1	¥ 

Here, the widgets and display elements are provided. Component designations and signal names are assigned to each object. With the F1 key, you can call up a description of the object in question.

Use Drag and Drop to pull a binary switch (B\_SWITCH 1) and an analog switch (A\_SWITCH 3) from the library into your diagram window.





Right-click on the binary switch (B-SWITCH) and open the Properties window. ( $\rightarrow$  B-SWITCH  $\rightarrow$  Properties)

🕒 Ventilator / Plan (+)		
B-SWITCH EXT Name anzeigen Hilfe A-SWITCH EXT OUT	Image: Figenschaften Ventilator/Plan#1/3         Allgemein       Parameter       Eingänge         Komponente:       Operating#B_SWITCH         Version:       1.0         Name:       Ventilator/Plan#1         Zusatz:       3         Zyklus:       2	
	OK Abbrechen Übernehmen Hilfe	
1€ € 1 ► 1 von 1		

Plan = diagram; Eigenschaften = properties; Name anzeigen = display name; Hilfe = help; Allgemein= general; Eingänge = inputs; Zusatz = extension; Abbrechen = cancel; Übernehmen = accept

Enter "on/off" as the name and remove the entry "3" as Extension. Confirm with "OK". (on/off  $\rightarrow$  [Del]  $\rightarrow$  OK)

Component: Version:	Operating#B_S	WITCH		
Name: Extension: Cycle:	on/off			Y

Select "Display name"

 $(\rightarrow B-SWITCH \rightarrow Display name)$ 





In the "Properties" box of the analog switch, enter the name "speed" and remove the entry in Extension. Confirm with OK. Select "Display name".

 $(\rightarrow \text{A-SWITCH} \rightarrow \text{Properties}).(\text{speed} \rightarrow [\text{Del}] \rightarrow \text{OK}) (\rightarrow \text{A-SWITCH} \rightarrow \text{Display name})$ 

B-SWITCH	Properties Ventilator/Diagram#1/2	×
EXT OUT	General Parameters   Inputs	
A-SWITCH	Component: Operating#A_SWITCH Version: 3.0	
	Name: speed	
	Extension:	
	Cycle: 2	<b>*</b>
		E E E

Now, a logical function has to be created for simulating the fan impeller's rotation. To this end, a value is repeatedly incremented from 0 to 360 by means of a ramp function. The counting process is to be started by means of the switched-on motor (A4.0). The counting speed is influenced by the speed output value (PQW 288).

From the IEC1131\Analog\Ramps directory under Library (Bibliothek), select the "ARAMP 1" function and insert it into your diagram.

Library	🕒 Ventilator / Diagram (+)	_
	A-SWITCH EXT OUT A-SWITCH EXT OUT SPEED PHY'S OUT	
Projects		
Types		



From the IEC1131\Binary directory under Library, select the "NOT 4" and "OR 5" functions and drag them into your diagram.

Library	🗣 Ventilator / Diagram (+)			_ 8 ×
Bibliothek         ▲                ← CONNECTORS          ← FlowNet                 ← Analog          ● Binary                 ← AnD 7          ● BooNST 5                 ← ● FTRIG 4          ● NOP 2                 ← ● R 5          ● FTRIG 4                 ← ● R 5          ● R 5                 ⊕ → SR 5          ● SR 5	A-SWITCH	NOT IN OUT	OR INI A IN2	ARAMP PRE LL SETP UL SPEED PHYS OUT

Enter the following names for the functions and select "Display name".

ARAMP = rotating movement, OR = or, NOT = not.

Make sure that the internal names for the SIMIT SCE components are written in lower case letters. Now, establish the connections of the blocks. To do this, first click on the output (red point) and then on the input (green point). The connecting lines will appear automatically.







#### Open your PLCSim gateway.

Now, use the Drag and Drop function to pull the symbolic name or the associated address of your binary input from your PLCSim gateway to the "OUT" terminal of the binary switch (B\_SWITCH).

B-SWITCH				
EXT OUT ON/OFF	not		rotation	
speed	NOT	OR	ARAMP	
A-SWITCH	OUT			
	100		OUT	
PLCSim				
File				
Settings Binary In Binary Out	Analog In Analog Out			
Symbol	Address	= Data	type	Comment
ON/OFF	10.0	BOOL	switch ON/OF	F On=1

Then, insert the remaining input and output signals into your diagram.



For the parameters of the ARAMP function, enter "360.0" in the LIMIT-UP field and "2.0" in the TIME field.

Confirm with "OK".

	rs   Inputs	 	 			
LIMIT_UP:	360.0				rota	ion
LIMIT DOWN:	0.0				ARA	MP
POS_DIRECTION:	TRUE		*	Speed	PRE	LI UI PHVS
TIME:	2.0			opeed		OU
		 1	 1			

### 6.4 Creating an operating window



Create a new operating window in the "Ventilator" project. ( $\rightarrow$  Ventilator  $\rightarrow$  New  $\rightarrow$  Operating Window)



Enter "Operating window" as the name and open it by double-clicking on the name.



Change the sheet size to 150 x 75 and confirm your entries with "OK". ( $\rightarrow$  Sheet  $\rightarrow$  Change sheet size  $\rightarrow$  150x75  $\rightarrow$  OK)





Enlarge the frame of the operating window to the sheet size and place it below the diagram.

sim SIMIT Elle Chant Edit Desenant Similation Menu Eules Minden Male	<u>_ 0 ×</u>
Laray         Wideds         Projekte         Projekte <td< th=""><th></th></td<>	
0 Implicit connections created	

### 6.4.1 Configuring widgets (display and control elements)



In order to configure the operating window, components (widgets) for display and control from the widget catalog have to be inserted.

Drag the change-over switch and the slider from the widget catalog in the "Operate (static)" directory and use the Drag and Drop function to place them in your operating window.





From the widget catalog under the "Display" directory, drag the binary display and the bar display to your operating window.



Now, open the Widget Properties box of the change-over switch by right-clicking on the change-over switch. Enter "on/off" as the component name and "EXT" as Signal Name Operation. In the diagram, the change-over switch is now connected to the B-SWITCH function. Confirm with "OK".

💦 Ventilator / OperatingWin	dow (+)	on/off B-SWITCH
	Widget properties	EXT OUT ON/OFF
	Component:	Name: Switch
	x-Coordinate: 90	x-Coordinate: 90
	y-Coordinate: 35 Operate Signal:	y-Coordinate: 35
	Color Feedback off:	Color Feedback off:
	Color Feedback on:	Color Feedback on:
		OK Cancel

Open the Widget properties box of the slider by right-clicking on the slider. Enter "speed" as the component name and "EXT" as the Signal Name Operation. Increase the width of the slider to "150". Confirm with "OK".

Name:     Silder       Component:     speed       x-Coordinate:     50       y-Coordinate:     100       Operat Signal:     EXT       Lower Bound:     0       Upper Bound:     100       Step width:     1		🏭 Widget p	roperties 🗙
Component: speed x-Coordinate: 50 y-Coordinate: 100 Operat Signal: EXT Lower Bound: 0 Upper Bound: 100 Step width: 1		Name:	Slider
x-Coordinate: 50 y-Coordinate: 100 Operat Signal: EXT Lower Bound: 0 Upper Bound: 100 Step width: 1		Component:	speed
y-Coordinate: 100 Operat Signal: EXT Lower Bound: 0 Upper Bound: 100 Step width: 1	0	x-Coordinate:	50
Operat Signal: EXT Lower Bound: 0 Upper Bound: 100 Step width: 1		y-Coordinate:	100
Lower Bound: 0 Upper Bound: 100 Step width: 1		Operat Signal:	EXT
Upper Bound: 100 Step width: 1		Lower Bound:	0
Step width: 1		Upper Bound:	100
		Step width:	1
Width: 150		Width:	150
OK Cancel		ок	Cancel



Next, the widget properties of the binary display and the bar display are entered. Use the "not" component and the "IN" input for the binary display. For the bar display, use "rotation" for the component, and "SPEED" for the input.

	10	<u></u>	or		rotation
	NOT		OR		ARAMP
IOTOR TOR IN	OUT	IN1 IN2	A	Speed Speed	PRE LL SETP UL SPEED PHYS OUT
ntilator / Operat	ingWindow (+)	sim Widget pror	nerties	×I	
Name:	Binary Display	Name:	Bar Display		
Component:	not	Component:	rotation		
		×-Coordinate:	510		
-Coordinate:	510				50 10
<-Coordinate: /-Coordinate:	510	y-Coordinate:	100		50 10
x-Coordinate: y-Coordinate: Display Signal:	510 35	- y-Coordinate: Display Signal:	100 SPEED		<u>50 10</u>
x-Coordinate: y-Coordinate: Display Signal:	510 35 IN	y-Coordinate: Display Signal: Lower Bound:	100 SPEED 0		<u>50 10</u>
x-Coordinate: y-Coordinate: Display Signal: Color off:	510 35 IN	y-Coordinate: Display Signat: Lower Bound: Upper Bound:	100 SPEED 0 100		<u>50 10</u>



### Note

For the widget properties, the direct addresses of the S7 control unit or the symbolic name can be also entered.

Write the signal to be displayed in capital letters and make no entry for the component.

💽 Ventilator / Bedienbild (+)					
	थ्यः Elementeigensch	aften 🗶	🏭 Elementeigensch	aften 🔀	
	Name:	Binäranzeige	Name:	Balkenanzeige	
	Komponente:		Komponente:		
	x-Koordinate:	510	x-Koordinate:	510	
57	v-Koordinate:	35	y-Koordinate:	100	
	) 1000 an iaio.		Anzuzeigendes Signal:	PAW/288	
	Anzuzeigendes Signal:	A4.0	Untergrenze:	0	
	Farbe aus:		Obergrenze:	100	
	Farbe an:		Breite:	150	
	OK Abbrect	hen	OK Abbreck	hen	

### 6.5 Drawing the fan impeller



Click on the 🛃 button (Graphics Editor on/off). In the Graphics mode, the additional buttons

Click on the (rectangle) button and draw a square in your operating window.

Click on the button (Select) to change the cursor back to select mode. Right-click on the square and select "Properties".



In the "Outline" tab, the line thickness, type and color can be set. Under "Filling", a filling color or an image can be assigned.

Preview:	
	- Outline: Color



Select blue as the filling color and click on "OK".





### Note

After you have used a drawing function, always click on the button (Select) to change the cursor back to select mode.



Next, draw an ellipse with a red filling. Select "None" under Outline.



Now, make a second ellipse with the same properties.

Draw a circle. In Properties under the "Outline" tab, change the line type to broken line and the line thickness to 7.



Now, use the mouse to frame the fan impeller. In the "Placement" menu, first select "Align center". Then, pull open a frame and select "Align middle".

Finally, pull open a frame and select "Group". Our ventilator impeller drawing is now finished.



Click on the *button to switch off the Graphics Editor.* 

#### 6.5.1 Animating the fan impeller



Right-click on the fan impeller and then left-click on "Animation".



There are various types of animation you can choose from. Only one variable has to be entered in the field behind the type of animation. The values of the variable can be adapted with the Scaling button. Also, several types of animation can be combined.

sim	×
Move X:	Scaling
Move Y:	Scaling
Stretch X:	Scaling
Stretch Y:	Scaling
Rotation:	Scaling
Show outline:	
Show fill:	
ОК Са	ncel Apply
	Move X: Move Y: Stretch X: Stretch Y: Rotation: Show outline: Show fill: OK Cai

In the "Rotation" field, enter the variable "rotation/PHYS". Confirm with "OK".



sim		×
Move X:		Scaling
Move Y:		Scaling
Stretch X:		Scaling
Stretch Y:		Scaling
Rotation:	rotation/PHYS	Scaling
Show outline:		
Show fill:	[	
	OK Cancel	Annly 1

### 6.6 Creating a SIMIT SCE project simulation



Our ventilator project is now completed as a plant model. Before a simulation can be carried out, the plant model has to be compiled into a simulation model; i.e. the executable simulation code. This step is performed by a code generator. The advantage to you of this SIMIT SCE procedure is that even large plant model simulations with very good performance can be calculated on a standard PC.

Right-click on the project name "Ventilator" and select "Create".

 $(\rightarrow Ventilator \rightarrow Create)$ 



Erstellen = create

Confirm the message box with "OK". The compiling process is displayed at the bottom edge of the screen.

Compiling "C:\\\\SIMIT\\\\projects\\Ventilator" for "winnt" \_\_\_\_\_\_. Joining equations created Component equations created Equations optimized 0 Implicit connections created Start compiler: Compiling finished.

After code generation is completed, the simulation appears in our "Ventilator" project.



Our ventilator is now configured with SIMIT SCE.

Click on the 🛄 button (Save All).

### 6.7 Creating a PLC program

J.	

Now, create the Step7 project with the control program for our ventilator. Here, it is sufficient to write only a test program to OB1 without hardware configuration.

Start the SIMATIC Manager and set up a new project. Assign the name "Ventilator" to the project. Select "Program" in the "Insert" menu to insert an S7 program. Click on the S7 Program folder and with a double click, open the symbol table. Click on "Import" in the "Table" menu.



Select the "Ventilator.asc" file from the C:\SIMIT directory.

Bin	implicit_connections	🚞 migration	
CbNetServer	import	projects	
comptype_include	🚞 jesika	C simulation	
export	🛅 jre	🚞 tmp	
help	🛅 library	🛅 Ventilator.asc	
) images	listener		



Confirm the following message windows with "OK".

The assignments from the gateway of SIMIT SCE are now inserted in the S7 symbol table. The "syimport.txt" information file is displayed.

	🕺 🖻 🖻 🖉	🖙 🛛 🗛 🖓	mbols	· 7/ K?	
Status	Symbol 🛆	Address	Data type	Comment	
	ON/OFF	1 0.0	BOOL	switch ON/OFF On=1	
	MOTOR	Q 4.0	BOOL	output for motor ventilator	
	Setpoint	PIW 288	WORD	presetting value	
	Speed	PQW 288	WORD	speed ventilator	
Da	tei Bearbeiten Forma	at Ansicht ?			
Da II m	tei Bearbeiten Forma port file: C:\:	at Ansicht ? SIMIT\Ven	tilator.a	sc	

Close the information file. Save and close the symbol table.



### Note

It is possible to transfer the symbolic assignments to the gateways of SIMIT SCE by clicking on "Export" in the "Table" menu.

For the gateway of SIMIT SCE, the created export file has to be simply imported.



Right-click on the "Blocks" folder and select "Object Properties".

- L							
	'₩ 👗 🖻 🖻   I		<u><u><u></u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	🎹   🔁     < No Fill	er>	- 10	
🕑 Ventilato	or 🕯	📑 0B1					
🖻 🛐 S7 I	Program(1)						
	Sources						
	Cut	Ctrl+X					
	Сору	Ctrl+C					
	Paste	⊂trl+V					
	Delete	Del					
	Insert New Object		•				
	PLC						
	Rewire						
	Compare Blocks						
	Reference Data		•				
	Check Block Consiste	ncy					
	Print		•				
	Rename	F2					
	Object Properties	Alt+Retur	m 🛛				
	Special Object Proper	rties	*				

Open the "Address priority" tab and next to "Symbol has priority", set to "For all accesses". Confirm with "OK".

	programming	
Symbols are applied from the symbol table and the DB for all accesses (I,Q,M,T,C and DB)	C Exception: symbol accesses on the DB remain as they were programmed in the code block	
Exception: for accesses in structurally unchanged data types, the current symbols will be applied	<ul> <li>For all accesses (I,Q,M,T,C and DB)</li> </ul>	
	Symbols are applied from the symbol table and the DB for all accesses (I,Q,M,T,C and DB) Exception: for accesses in structurally unchanged data types, the current symbols will be applied	Symbols are applied from the symbol table and the DB for all accesses (I,Q,M,T,C and DB)       C Exception: symbol accesses on the DB remain as they were programmed in the code block         Exception: for accesses in structurally unchanged data types, the current symbols will be applied       For all accesses (I,Q,M,T,C and DB)



### Note

As a result of this setting, the address assignments are stored in the blocks with the symbolic names. The PLC addresses are taken from the symbol table. Thus, you can rewire the symbol table through exchanges or modifications.

After this, the block only has to be opened, saved and closed again.



Enlarge the directory tree and highlight the Blocks folder. Double-click on OB1 and set the programming language to FBD. Enter the control program.

🛃 SIMATIC Manager - Ventilator		
Datei Bearbeiten Einfügen Zielsystem Ansicht Extras Fenster Hilfe		
	ein Filter > 💽 🏹 📍	
Ventilator (Komponentensicht) C:\Programme\Siemens\Step7\s7	proj∖¥entilat _□X	
	!«»! 🗖 🖬 📧 🗵	
OB1 : "Main Program Sweep (Cycle)" Kommentar: Netzwerk 1: Ventilator-Steuerung		Sitverknüpfung Sitverknüpfun
Kommentar:		DB DB-Aufruf Ca Sprünge
"EIN/AUS" - EN OUT -"DREHZAHL" "MOTOR" "SOLLWERT" - IN ENO		
📕 🚺 🖡 🕨 🔪 1: Fehler 👌 2: Info 🔏 3: Querverweise 👌	4: Operandeninfo 👌 5: Steur	ern $\lambda$ 6: Diagnose $\lambda$ 7: Vergle
Drücken Sie F1, um Hilfe zu erhalten.	© offline Abs < 5.	2 Nw 1 Einfg Änd //

KOP/AWL/FUP = LAD/STL/FBD

Click on "Save" and close the LAD/STL/FBD Editor.

### 6.8 Starting PLCSIM and loading the PLC program



Start PLCSIM by clicking on the button (Simulation on/off).

SIMATIC Manager - Ventilator					<u>_0×</u>
File Edit Insert PLC View Options Window Help					
) D 😅 🔡 🛲 👗 🖻 💼 🚵 🔍 🖕 🖽 🏥 🏥	👔 🚹 🛛 < No Filter >	• V	22 🛞 🚟	680	₩?
😰 Ventilator D:\0_57_Projekte\Ventilat					
🖃 🎒 Ventilator 📪 OB1					
⊡ sr S7 Program(1)					
Blocks					
S7-PLCSIM - Sim¥iew1					
File Edit View Insert PLC Execute Tools Window Help					
) D 🗳 🖬 👗 🖻 🖻 🖷 🖊 💘 🚺 🛅 🛅	to te te te te	ו			
□] <b>□</b> ] <b>□</b> ] <b>□</b> ] <b>□</b> ] <b>□</b> ] <b>□</b> ]					
<b>\$</b>					
	3 0 <b>_ 🛛 X</b> 🛛	PIW 288	. 🗆 🗙 🔛 P	QW 288	
SF ▼ RUN-P ▲ IB 0 Bits ▼ QB	0 Bits 🔻	PIW 288 Decim	al 🔻 🛛 PQ'	W 288 Deci	mal 💌
	543210			1.54	
	řře řřeř 📗		0		0 🔽
Press F1 to get Help.				MF	PI = 2 //.
Press F1 to get Help.	@ CP5611(M	IPI)			11.

Insert the input and output signals in PLCSIM. Load the program into PLCSIM and start the simulator with RUN-P. Then, drag PLCSIM into the task bar.

Now, change back to SIMIT SCE.

Training document for SIMIT SCE

### 6.9 Simulation with SIMIT SCE



While the simulation is running, you can actively intervene in it by controlling the simulation process. This means you can place the simulation on hold, continue it or stop it. You can control individual components, e.g. switch a motor on and off. In addition, you can view and analyze the simulation process in various ways.

Right-click on "Simulation" and select "Open".



### 6.9.1 Control system



The control system in SIMIT SCE ensures that a simulation model is executed in an orderly manner and in the correct time sequence. The individual parts of the model are started at the right time intervals and they are monitored to make sure they end at the specified time. The control system can be used to place the simulation on hold, to continue it in the single-step mode or to restart it. At defined points in time, the overall state of the simulation model can be recorded and stored in the database. These states can be loaded again later in order to initialize a simulation model.



The following operator actions can now be performed:

- Initializing a simulation
- Resetting a simulation
- Starting a simulation
- Setting the dynamic behavior
- Placing a simulation on hold
- Stopping a simulation
- Simulation in single-step mode
- Setting up snapshots

### 6.9.2 Initializing a simulation



The next step after opening a simulation is to initialize it. This is necessary for reasons internal to the system. The system triggers the initialization calculation of the individual components and sets the simulation time to zero. With the "Reset" function, initialization can be undone.

Click on "Initialize"



### 6.9.3 Starting a simulation



This control function is used to start cyclical processing of the simulation model. The simulation model cannot be started until the simulation has been opened and initialized.

In order to start the initialized simulation, click on the ▶ function button (Start) in the control field.



### 6.9.4 Setting the dynamic behavior



SIMIT SCE provides you with several ways of setting the dynamic behavior of the simulation:

Realtime

In this mode, the simulation time is the same as the real time. This means: after a real second, a second of simulation time has passed.

Maximum speed

The model is calculated with the maximum computing power. This is helpful, for example, if you want to reach a stationary state of the model quicker.

• Slow 2 – Slow 16

The module is calculated more slowly than real time by a factor of 2, 4, 8 or 16. This is helpful, for example, if you want to show very fast processes in slow motion.



When you open a simulation, the default calculating mode is "Realtime".



### Note

It is only possible to change between these modes during a simulation run. The dynamic behavior (real time, maximum speed or slow) depends on the calculating mode selected.

#### 6.9.5 Placing a simulation on hold

SIEMENS



You can place a simulation that is running on hold in order to "freeze" the current plant state, for example. During this interruption, you can continue to trigger control functions via the operating window but they do not have any effect until the simulation is started again.



#### 6.9.6 Stopping a simulation



You can stop the simulation mode by clicking on the "Close" button.



#### 6.10 Simulation by means of the operating window



Drag your PLCSIM into the operating window also, and you can now test the input and output signals of your ventilator control system in addition to its functioning.



### 6.11 Simulation by means of the diagram



Highlight the diagram window and click on the button (operator-controllable).



Now, the current values are visible in the diagram also. Right-clicking on the diagram opens an operating window. In it, the blocks in the diagram can be controlled or viewed. You can also alter parameters by clicking on the ">>" button.



### 7. CONNECTING TO THE REAL PLC

1

An interface connection to a real PLC can be set up by inserting the "MPI" gateway.

The address indicates the MPI address of the PLC and must agree with the address set for the PLC. The slot address is the module slot of the CPU. This is always Slot 2 for the S7-300.

Do not set up an MPI yet. This page is for information purposes only.





### Note

Since in this example, the address areas are accessed by inserted modules at the real PLC, it has to be ensured that the SIMIT SCE uses inputs and outputs that are not accessed by inserted modules, but are located in the CPU's process image. This also applies to analog addresses.

The consequence of this is that the inputs and outputs in the PLC program, in the gateway, in the diagram and in the operating window have to be adapted to the new addresses.

### 7.1 Changing the address in the SIMIT SCE project



In our "Ventilator" project, we have performed our programming with symbolic addressing only. It is therefore necessary to change the address at the interface and the S7 symbol table.

Open the PLCSim gateway and Export the assignments as a .csv file entitled "Ventilator\_PLCSim". This causes the normalization in each case to be saved also.

Select the SIMIT folder as the destination path. Exit the PLCSim gateway.

PLCSim	🗱 Speichern	×
File	Speichern in: 🔁 SIMIT	💌 🤌 📁 📼
Import (.asc) Import (.csv) Export (.asc) Export (.csv)	Zuletzt verw     ChNetServer     Imp       Zuletzt verw     comptype_include       Destor     mages       Begene Dotaten     implicit_connections       Diseka     import       Diseka     import       Diseka     import	
Save Save & Exit Exit	Arbetzplatz migration Netzwerkum File name: Vertildor_PLCSM Type of file: CSV-Conflauration	Save Cancel

Export your "Ventilator" project. Select the SIMIT folder as the destination path.



Change the name of the project from "Ventilator" to "Ventilator\_PLCSim". Mark the "Projects" folder and import the "Ventilator" project from the SIMIT folder. Now change the project name of the imported project to "Ventilator\_MPI". Delete the PLCSim gateway in the "Ventilator\_MPI" project. Create a new gateway for MPI.





Open the "MPI" by double-clicking on it.

Import the "Ventilator\_PLCSim.csv" file from the SIMIT folder.

Confirm with "Open". Now, all address assignments with normalization have been imported.

MDT	Cifnen	
Inter	Search in: 🔁 SMT	3 19 🖪
e	Din Castrolation	
Import (.asc)	Zvietzt verw Comptype_include Versistor_PLCSM	
Import (.csv)	Desistop	
Export (.asc)	implicit_connections	
Export (.csv)		
Save	Arbetspikz	
Save & Exit	Netzwerium.	
Exit	Type of file: CSV-Configuration	- Car

Change the input and output addresses of the MPI.

I0.0 becomes I24.0, Q4.0 becomes Q24.0, PIW288 becomes IW28, PQW288 becomes QW28.

Eil-								
File								
Settings Binary In	Binary Out Analog I	h Analog Out						
Sym	ibol	Address	:= D;	ata type		Comment		
ON/OFF	124	.0	BOOL		switch ON/0	DFF On=1		-
								*
MPI (+)								Ľ×
File								
Settings Binary In	Binary Out Analog I	h Analog Out						
Svm	bol	Address	:= D	ata type	Comment			T
				BOOL		output for motor ventilator		
MOTOR	Q24	4.0	BOOL		output for m	iotor ventilator		+
MOTOR	Q24	4.0	BOOL		output for m	iotor ventilator		+
	Q24	4.0	BOOL		output for m	otor ventilator		÷
MOTOR	02	4.0	BOOL		output for m	otor ventilator		÷
MOTOR MPI (+) File Settings   Binary In	Q2	4.0	BOOL		output for m	otor ventilator		×
MOTOR	Binary Out Analog I	1.0	Comment		joutput for m	otor ventilator		
MOTOR MPI (+) File Settings   Binary In Symbol Setnoirt	Binary Out Analog I Address =	1.0 Analog Out	Comment	uninolar	Joutput for m	Lower	[	
MOTOR MPI (+) File Settings Binary In Symbol Setpoint	Q2 Binary Out Analog I Address = IW28	4.0 Analog Out Data type WORD	Comment presetting value	unipolar	output for m	otor ventilator	 Upper 100.0	
MOTOR MPI (+) File Settings Binary In Symbol Setpoint	Binary Out Analog I Address =	4.0 Analog Out Data type WORD	Comment presetting value	unipolar	Output for m	otor ventilator	[ Upper 100.0	
MOTOR MPI(+) File Settings Binary In Symbol Setpoint MPI(+)	Q2 Binary Out Analog I Address = IVV28	1.0 Analog Out Data type WORD	Comment presetting value	unipolar	output for m	otor ventilator	 Upper 100.0	
MOTOR HPI (+) File Settings Binary In Symbol Setpoint HPI (+) File	Q2 Binary Out Analog I Address = IW28	1.0 Analog Out Data type WORD	Comment presetting value	unipolar	Output for m	otor ventilator	 Upper 100.0	
MOTOR MPI (+) File Settings   Binary In Symbol Setpoint MPI (+) File Settings   Binary In	Q2 Binary Out Analog I Address = IVV28 Binary Out Analog I	1.0 Analog Out Data type WORD WORD	Comment presetting value	unipolar	Type	otor ventilator	 Upper 100.0	
MOTOR MPI (+) File Settings   Binary In Setpoint MPI (+) File Settings   Binary In Symbol	Q2 Binary Out Analog I Address = IW28 Binary Out Analog I Address =	1.0 Analog Out Data type WORD Analog Out Data type	Comment presetting value	unipolar	Type	otor ventilator	 Upper 100.0	

Save your MPI and export the assignments as an .asc file. Assign the file name "Ventilator\_MPI. Exit the MPI.



Speichern in:	SMT	- 3 9 🗆 🗆
Lidetat verve.	Bin Entwick     Childson     Childson	
Netzwerkum	File name. Vertilator_MPLasc	Save

Training document for SIMIT SCE



Now, you only have to create a simulation in SIMIT SCE.

Right-click on the "Ventilator\_MPI" project and select "Create".

	Schließen		
🖓 Bei	Neu	۲	
H H MPI	Einfügen		
	Importieren	١	
	Exportieren		🔁 🚭 Ventilator_MPI
- E PLC	Aktualisieren		Plan
」 日 Sirr	Komponenten Austauschen		Bedienbild
└──────── Zimmer	Erstellen		

Erstellen = create

In SIMIT SCE, the project "Ventilator\_MPI" is now complete.

### 7.2 Address changes in the Step7 program



In the Step7 project, open the symbol table. Highlight the rows and click on "Delete" in the "Edit" menu.

🗟 Syml	ool Editor - :	S7-Progra	mm(1) (	le)				
Tabelle	Bearbeiten	Einfügen	Ansicht	Extras	Fen	ster	Hilfe	
😂 🖥	Rückgäng Wiederha	gig: Symbole erstellen	e löschen	Ctrl+Z Ctrl+Y		nbole	•	<b>_</b> ∑⁄ <b>№</b> ?
	Ausschne Konieren	eiden		Ctrl+X Ctrl+C		Da	tentyp	Kommentar
1	Einfügen			Ctrl+∀		BC BC		Ein/Aus Schalter, Ein=1 Ausgang für Ventilator
3	Löschen			Del		W	DRD	Vorgabewert
Löscht die	Markierer Markierur	n ng aufheber	n		•		JRU	

Import the address assignments for "Ventilator\_MPI.asc" from the SIMIT folder.

<mark>ເຈີ 5</mark> ງ ເອີ 5	r <mark>mbol Edit</mark> ymbol Table	or - [S7 Program(1) Edit Insert View	(Symbols) Options Wir	- Ventilator] ndow Help	
B	88	X B B 0	🖙 🛛 🗛 🖓	mbols	Y №
	Status	Symbol 🗠	Address	Data type	Comment
1		ON/OFF	1 24.0	BOOL	switch ON/OFF On=1
2		MOTOR	Q 24.0	BOOL	output for motor ventilator
3		Setpoint	INV 28	WORD	presetting value
4		Speed	QW 28	WORD	speed ventilator
5		- 22			
Press	=1 to get Hi	elp.	1	L.	

Save and close the symbol table.



In the Blocks folder, open OB1.

Confirm the message window with "OK".



KAD/STL/FBD - [OB1 Ventilator\S7 Program(1)]	CONTRACTOR OF STREET, STRE	
E File Edit Insert PLC Debug View Options Window	Help	×
	<b>- <u>*</u></b> % !<>! <b>- E</b>	
OB1 : "Main Program Sweep (Cycle)"		
Comment:		New network      Bit logic
		Comparator
Network 1: Ventilator Control		Converter
Comment:		E Counter
		E Jumps
MOVE		Eloating-point fct.
"ON/OFF" EN OUT "Speed"	"MOTOR"	
"Sataoiat" IN RNO	=	<u><u><u></u></u></u>
		Program alamanta BE Call structure
2: Info A 3: Cross-reference	ices 入 4: Address info.	$\lambda$ 5: Modify $\lambda$ 6: Diagnostics $\lambda$ 7: Comparison
Press F1 to get Help.	🕲 🔍 🕄 offline	Sym >= 5.2 Insert Chg

Click on "Save" and confirm in the message windows until the red designations are included in the program.

KAD/STL/FBD - [OB1 Ventilator\S7 Program(1)]				
E File Edit Insert PLC Debug View Options Window Hel	p			_ @ ×
	9 <b>6</b> 6		HHO HHO	
OB1 : "Main Program Sweep (Cycle)"				
Comment:				New network
Network 1: Ventilator control				Endogic     Gomparator
Comment:				Eren Converter
				⊡⊡ GB call
"ON/OFF" EN OUT "Speed"		"MOTOR"		
"Setpoint" IN ENO		=		±
20.59 20.089/0001				
•			₽	Program elements
2: Info A 3: Cross-reference	sλ	4: Address info.	5: M	odify $\lambda$ 6: Diagnostics $\lambda$ 7: Comparison
Press F1 to get Help.		9 offline	Sym >=	= 5.2 Nw 1 Insert /

Now, load the program into the PLC and start the simulation in SIMIT SCE.

### 8. SIGNAL GROUPS AND GRAPHS

#### 8.1 Signal groups



Signal groups allow fast and easy access to all the signals in your model. They include all I/O signals as well as the inputs, outputs, states and parameters of the model components. You can set up any number of signal groups. Signal groups are also the basis for graphs shown on the screen.

#### 8.1.1 Creating a signal group



In the "Ventilator\_PLCSim" project, create a new signal group and assign the name "Signal Group" to it.



P- () Ventilator_MPI	1			- Jan Ventilator, DLCSIM
Diagram	Close			
Operating//v	New	•	Folder	
PLCSim	Paste		Diagram	Operating/Vindow
- A Zimmerbeleucht	Import	•	Operating Window	SignalGroup
	Export		Signal Group	PLCSim
	Update		Gateway 🕨	└──∰ Simulation

Start the Edit Mode of the signal group by double-clicking on it.

ir						
nponent Name	Component Ty	rpe Conr	ection Name	Connection Type		
		l		all	<u> </u>	Searcl
rch Results						
Component Name		Component Type		Connection Name	Connection Ty	
ected Signals						
ected Signals	Component Type	Connection Na	Connection Ty	. 🗯 Interval	Delta	
ected Signals	Component Type	Connection Na	Connection Ty	. 🞾 Interval	Detta	
ected Signals Component Name	Component Type	Connection Na	Connection Ty	. Minterval	Detta	
ected Signals Component Name	Component Type	Connection Na	Connection Ty		Detta	
ected Signals	Component Type	Connection Na	Connection Ty	. Minterval	Detta	

### 8.1.2 Editing the signal group



First, click on the "Search" button.

Under Search Result, use the left-hand mouse button to select the "rotation" component with the connection name "PHYS". Right-click on the highlighted row. Now left-click on "Select signal".

Filter					-	
component Name	Component Typ		nnection Nam	e Connectio	in Type	Search
Search Results						
Component Na	ame	Component Typ	be	Connection N	lame Connecti	on Type
otation		g#Ramps#/	RAMP#1.0	PHYS	A Out	
otation	select sig	nal g#Ramps#/	ARAMP#1.0	POS_DIRECTIO	N B Para	
otation	IEC1131;	#Analog#Ramps#/	RAMP#1.0	PRE	B In	
otation	IEC1131;	#Analog#Ramps#/	RAMP#1.0	SETP	A In	
otation	IEC1131	#Analog#Ramps#/	ARAMP#1.0	SPEED	A In	
otation	IEC1131	#Analog#Ramps#/	ARAMP#1.0	UL	B Out	
otation	IEC1131;	#Analog#Ramps#/	RAMP#1.0	Z	A State	
peed	Operatin	ig#A_SWITCH#3.0		A_BMAN	B Out	
peed	Operatin	iq#A_SWITCH#3.0		A EXT	A Out	
Selected Signals				tanta dat		110.11
Component Name	Component Type	Connection Na.	Connection	n Tv. 🞾	Interval Delta	
component riamo	component ()po	Connochonnua.	comicolion		interior point	

In the "Interval" column, change the high value to "360". In the "Delta" column, change the value to "1.0". Place a checkmark in the box for the graphic plotter. Select dark blue as the color in which the graph is to be displayed.

Component Name	Component Type	Connection Na	Connection Ty	20	Interval	Detta	
rotation	EC1131#Analog#Ramp	PHYS	A Out	V	0.0 360.0	1.0	

#### Note



In the "Interval" column, a value normalization of 0 to 100 % is entered; i.e. if the "PHYS" ramp value is 360, a value of 100 is shown in the graph.

Delta 1.0 means that the value in the graph is updated every 100 milliseconds.



Now, insert the "SETPOINT" and "SPEED" signals.

-Selected Sid

Component Name	Component Type	Connection Na	Connection Ty	7º	Interval	Delta	
rotation	EC1131#Analog#Ramp	PHYS	A Out	V	0.0 360.0	1.0	
		Setpoint	I/O A In	V	0.0 100.0	1.0	
		Speed	I/O A Out	V	0.0 100.0	1.0	

Click on the "X" button to close the window.

Click on the "Yes" button to confirm the dialog box asking you whether you want to save your entries.

Component Name	Component Ty	rpe Con	nection Name	Conne	ection Type		
				all		-	Searc
earch Results							
Component Name		Component Typ	Component Type Con		on Name	Connection Type	
			Q4.	4		I/O B Out	
			Q4.	5		I/O B Out	
			Q4.	6		I/O B Out	
	Save?			XI		I/O B Out	
	Save?			×		I/OBOut I/OAIn	
	Save?		boforo docina?	×		1/0 B Out 1/0 A In 1/0 A Out	
DN	Save?	Do you want to save	before closing?	×		1/0 B Out 1/0 A In 1/0 A Out 1/0 B In	
DN Iot	Save?	Do you want to save	before closing?	× -		I/OBOut I/OAIn I/OAOut I/OBIn BIn BOut	
DN lot lot	Save?	Do you want to save	before closing?	× -		I/OBOut I/OAIn I/OBIn BIn BOut	
DN ot ot selected Signals	Save?	Do you want to save	before closing?			I/OBOut I/OAIn I/OAOut I/OBIn BIn BOut	
on iot Selected Signals Component Name	Save?	Do you want to save	before closing? Cancel Connection Ty.	× -	Interva	I/O B Out I/O A In I/O A Out I/O B In B In B Out B Out	
on ot selected Signals Component Name otation	Component Type	Do you want to save	before closing? Cancel Connection Ty. A Out	X	Interva 0.0 360	I/O B Out I/O A In I/O B In B In B Out B Out al Detta .0 1.0	
on ot selected Signals Component Name otation	Component Type	Do you want to save Yes No Connection Na D PHYS Setpoint	Cancel Connection Ty A Out VO A In	<u>र</u> रा रा रा	Interva 0.0 360 0.0 100	I/O B Out I/O A In I/O B In B In B Out B Out 0 1.0 .0 1.0	

### 8.1.3 Creating and starting a simulation



Now, it is only necessary to create a simulation in SIMIT SCE.

Right-click on the "Ventilator\_PLCSim" project and select "Create". Then, start the simulation by double-clicking on "Simulation".

□- 🔁 Ventilator_PL(	Schließen
	Neu 🕨
SignalGru	Einfügen
PLCSim	Importieren 🕨
	Exportieren
	Aktualisieren
	Komponenten Austauschen
	Erstellen
E	Erstellen = Create

**Note:** Before starting the simulation, you should open the "PLCSIM" PLC simulator and load the control program. Switch the PLC simulator to the "RUN-P" mode.

### 8.1.4 Opening the operating window and the signal group



Open the operating window by double-clicking on it.

Double-click on the "SignalGroup" to open the Operate/Monitor mode.

Here, you can control and monitor the signals in the Simulation mode. In addition, the values for the I/O signals can be set permanently.



### 8.2 Graph



Curve displays make to possible to graphically show the signal characteristics of connections of the components in your model with respect to their time sequence.

### 8.2.1 Opening a Graph



Right-click on "SignalGroup" and select "Graph".



### 8.2.1 Graph window



i

The graph window contains a diagram in which the signal characteristics are shown graphically. It also contains some control elements and a table with the signals currently being shown in the graph.



### Moving the inspection window

With the horizontal slide control on the left-hand side and with the upper vertical slide control on the right-hand side, the inspection window to the signal characteristics can be moved. The horizontal slide control moves the inspection window between older (towards the left) and newer (towards the right) values. The vertical slide control moves the inspection window to the inspection window upwards or downwards.

### Setting the time resolution

The horizontal slide control on the right-hand side can be used to alter the time resolution in which the signal characteristics are shown in the diagram. It is possible to select from 1 millisecond to 0.01, 0.1, 1, 10 seconds; 1 to 10 minutes; 1 to 10 hours and 1 to 10 days.

### Setting the value range

The lower vertical slide control can be used to change the value range for analog signals. It is possible to select from 1% to 900%. Depending on the setting, the signal characteristics for analog signals are either stretched or compressed.

### Resetting the view

The view can be reset to the standard settings by clicking on the "Reset" button. These settings are for a time resolution of 10 minutes and a value range of 100%. Freeze/Update view

### Note

The signal characteristics are put on hold -that is, there is no updating- by clicking on the "Freeze" button. Updating the signal characteristics can be restarted by clicking on the "Update" button.