Training document for the company-wide automation solution Totally Integrated Automation (T I A)

MODULE A6

PLC simulation with S7-PLCSIM

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The following symbols stand for the specified modules:



Information



Installation

Programming



Example Exercise



1. FORWARD

The module A5 is assigned content wise to the basics of STEP 7- Programming.



Learning goal:

In this module, the reader will learn about the debugging of a STEP 7- Program with the simulation software S7-PLCSIM. The module shows the principle procedure in the following steps by means of a detailed example.

- Installation of the software
- Generation of a simple program
- Starting of S7-PLCSIM
- Debugging of a S7-PLCSIM program

Requirements:

For the successful use of this module the following knowledge is assumed:

- Knowledge in the use of Windows 95/98/2000/ME/NT4.0
- Basics of PLC- Programming with STEP 7 (e.g. Module A3 'Startup' PLC- Programming with STEP 7)

Forward	Notes	Installation	STEP 7- Program	Start from PLCSIM	Debugging of PLCSIM
i oi wai a	110103	installation			Debugging of LOOIM

Required hardware and software

- 1 PC, Operating system Windows 95/98/2000/ME/NT4.0 with
 - Minimal: 133MHz and 64MB RAM, approx. 65 MB free hard disk space
 - Optimal: 500MHz and 128MB RAM, approx. 65 MB free hard disk space
- 2 Software STEP7 V 5.x

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3 Software S7-PLCSIM V5.x



Forward Notes Installation STEP 7- Program Start from PLCSIM Debugging of PLCSIM

2. NOTES FOR THE APPLICATION OF S7- PLCSIM

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The area of application of S7-PLCSIM is mainly a test of the provided STEP 7- Programs for the SIMATIC S7-300 and SIMATIC S7-400 when one can not immediately and directly debug the hardware. This problem can have the following reasons:

- Smaller program modules, whose execution cannot yet be debugged at a machine.
- The application is so critical that damage for a person and a machine is feared if programming errors arise. With a simulation, these errors can be eliminated without causing physical harm.

There is also a possibility to use this application for the purpose of practice, if a hardware PLC is not present.

With the employment of SIMATIC-PLCSIM, the following points should be considered:

- The software package that should be used is the STEP 7 Professional or the STEP 7 Student version
 - (Not STEP 7 Mini !)
- Projects for all SIMATIC S7-300 and S7-400 CPUs as well as SIMATIC WinAC can be debugged here.
- The use of function modules (FMs) and communication processors (CPs) cannot be simulated.
- Timer functions do not correspond to the real time requirement, since their execution depends on the speed of the assigned computer.

Forward Notes Installation STEP 7- Program Start from PLCSIM Debugging of PLCSIM

3. INSTALLATION OF THE S7-PLCSIM SOFTWARE



S7-PLCSIM is an option package for STEP 7, which assumes that the professional or student version of STEP 7 is already installed. (See Module A2 – Installation of STEP 7 V5.x / Handling of authorization).

S7-PLCSIM is delivered on 5 disks or on one CD-ROM, and also includes a disk for authorization. This disk must transfer the appropriate authorization files to the PC in order to make the S7-PLCSIM software usable.

This authorization disk can be used on another PC or can be copied in order to authorize the software. For the topic and transmission of authorization, please see Module A2 - Installation of STEP 7 V5.x / Handling of Authorization.

To install S7-PLCSIM, please proceed to the following steps.

- 1. Place the first S7-PLCSIM disk or CD-ROM in the appropriate drive.
- 2. Start the setup program by double clicking on the **setup.exe** executable file.
- 3. The setup program will guide you through the whole installation process of the S7-PLCSIM software.
- 4. In order to use S7-PLCSIM, the software must be authorized on your computer. The files from the authorization disk must be transferred onto the PC. This process will execute at the end of the software installation. A dialog window will appear and ask you if you would like to authorize the software. If **Yes** is selected, the authorization disk must be inserted in order to transfer the proper files to the PC.

4. GENERATION OF A SIMPLE STEP7-PROGRAM



The program which can be debugged is generated with STEP 7. The example shown here turns a lamp (H1) off with an input-button (S1) and an output-button (S2).

Assignment list:

l 0.1	S1	Input-button
l 0.1	S2	Output-button
Q 4.0	H1	Lamp



The user must implement the following steps, in order to provide a project, in which the solution program can be written.

 The main tool in STEP 7 is the SIMATIC Manager, which can be opened with a double click on the icon (→ SIMATIC Manager).



2. STEP 7- Programs are managed in projects. Each project can be newly created (\rightarrow File \rightarrow New).

PLC View Options Window Help New. Clif+N New Project Wgard Clif+O Open. Clif+O Open Versjon 1 Project Clif+O S7 Memory Card Mamory Card Memory Card Elle Mamory Card Elle Delete Regranize Manage Archive Page Setup Lebeleng rights Page Setup Lebeleng rights Pint Setup 1 statup (Project) - C:\Siemens\Step7\Examples\Zen01_03 2 Hardware (Project) - C:\Siemens\Step7\Examples\Zen01_01 3 PROJECT-PROFIBUS (Project) - C:\Siemens\Step7\Examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\examples\ex	PLC View Options Window Help New Noject Wigad Open Cti+O Open Version 1 Project S7 Memory Card Memory Card Memory Card Elle Memory Card Elle Qelete Regramate Reportanze Manage Archive Retizes Page Bettor Labeleng rifedis Print Setup 1 startup (Project) - C:\Siemens\Step7\Examples\Zen01_03 2 Hadware (Project) - C:\Siemens\Step7\Examples\Zen01_03 2 Hadware (Project) - C:\Siemens\Step7\Examples\Zen01_04 2 PROJECT-PROFIBUS (Project) - C:\Siemens\Step7\Examples\Zen01_04 Atk+F4	PLC View Options Window Help New Project Wigad Open Cti+O Open Version 1 Project Cti+O S7 Memory Card Memory Card file Memory Card Elle Memory Card file Ageotex Memory Card file Petete Regraphice Manage Ageotex Agrohive Page Setup I startup (Project) - C:\Siemens\Step7\Examples\Zen01_013 2 Hardware (Project) - C:\Siemens\Step7\Examples\Zen01_01 3 PROUECT-PROFIBUS (Project) - C:\Siemens\Step7\Examples\zen01_01 2 Hardware (Noise) 4 Accessible Nodes Egit Alk-F4	PLC View Options Window Help New Project Wigard Open Ctit+O Open Versjon 1 Project Ctit+O S7 Memory Card • Memory Card Elle • Delete • Reorganize Manage Archive Poge 6ettrp Labeleng rindfals Pige 6ettrp Labeleng rindfals Pige 72.5xamples/Zen01_03 2 Hadtware (Project) - C:\Siemens\Step7/Examples/Zen01_01 3 9 ROUECT PROFIBUS (Project) - C:\Siemens\Step7/Examples/Zen01_01 4Accessible Nodes Exit Alk+F4	SIMATIC Manager	
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			reates a new project or a new library.	Exit	Alt+F4

Forward	Notes	Installation	STEP 7- Program	Start from PLCSIM	Debugging with PLCSIM	



- 3. Give the project the Name PLCSIM_1 (\rightarrow PLCSIM_1 \rightarrow OK).

Ne	w		×
	User projects	Libraries	1
	Name	Storage path	
	315_2DPCPU startup	C:\Siemens\Step7\S7proj\315_2dp C:\Siemens\Step7\S7proj\startup	be
N	la <u>m</u> e:		<u>T</u> ype:
Ī	PLCSIM_1		Project 💌
	∑torage location C:\Siemens\Ste	(path): p7\S7proj	<u>B</u> rowse
	OK	Cance	el Help

4. Insert a new **S7-Program** into the project **PLCSIM_1**. (\rightarrow PLCSIM_1 \rightarrow Insert \rightarrow Program \rightarrow S7-Program).



Forward	Notes	Installation	STEP 7- Program	Start from PLCSIM	Debugging with PLCSIM
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5.



In the SIMATIC Manager, double click the block **OB1** (\rightarrow OB1).

SIMATIC Manager - SIMATI	IC Manager - [PLCSIM_1 C:\Siemens\Step7\S7proj\Plcsim_1]	. 🗆 🗙
B Eile Edit Insert PLC View	v <u>O</u> ptions <u>W</u> indow <u>H</u> elp	. B ×
D ₽₽ ₩ ¥₽₽	🚵 🖻 📲 🏝 📰 🛅 < No Filter > 💽 📝 🎇 🥮 🕅	
PLCSIM_1 S7 Program(1) Sources Blocks	Small Icons	
Displays objects as small icons.		

6. Accept the options of the OB1 block with **OK** (\rightarrow OK).

Properties - Organisation	nsbaustein			×
General - Part 1 General	- Part 2 Calls Attributes			
<u>N</u> ame:	OB1			
<u>Symbolic Name:</u>				
Symbol <u>C</u> omment:				
Created in <u>L</u> anguage:	STL			
Project path:				
Storage location of project:	C:\Siemens\Step7\S7proj\Plcsim_	1		
- · · · ·	Code	Interface		
Date created:	15/08/2002 05:15:51	15/02/1996 04:5	1.12	
Comment:		13/02/1330 04:3		
C <u>o</u> nment.	Main Program Sweep (Lycie)		<u> </u>	
	1			
(OK			Cancel	Help

Forward	Notes	Installation	STEP 7- Program	Start from PLCSIM	Debugging with PLCSIM

7. Now a simple program can be written in OB1 to e.g. the statement list (STL). This program must then be saved \square and the OB1 must be closed with **X** (\rightarrow Save $\square \rightarrow X$).

丧	LAD/STL/	/FBD - OB1							_ 🗆 X
E	ile <u>E</u> dit <u>I</u> ns	sert PLC <u>D</u> ebug	<u>V</u> iew <u>O</u> ptions <u>W</u> ir	dow Help					
Ľ	_ ⊳ ₽~					사사이앱 나스너	<u>N</u>		
Γ	🔳 081 P	LCSIM_1\S7 Pro	ogram(1)				_ 🗆 🗡	Program elements	×
I	Address	Declaration	Name	Туре	Initial value	Comment	<u> </u>	New network	
I	0.0	temp	OB1_EV_CLASS	BYTE		Bits 0-3 = 1 (Coming ev	ent), Bit	E FC blocks	
I	1.0	temp	OB1_SCAN_1	BYTE		l (Cold restart scan l	of OB 1),	E E SFB blocks	
I	2.0	temp	OB1_PRIORITY	BYTE		l (Priority of 1 is low	rest)	E GSFC blocks	
I	3.0	temp	OB1_OB_NUMBR	BYTE		l (Organization block l	., OB1)	Multiple instances	
I	4.0	temp	OB1_RESERVED_1	BYTE		Reserved for system			
I	5.0	temp	OB1_RESERVED_2	BYTE		Reserved for system			
I	6.0	temp	OB1_PREV_CYCLE	INT		Cycle time of previous	OB1 scan		
I	8.0	temp	OB1_MIN_CYCLE	INT		Minimum cycle time of O	Bl (milli		
I	10.0	temp	OB1_MAX_CYCLE	INT		Maximum cycle time of O	Bl (milli		
Ił	<u>12.0</u> ∢	tem	OBI DATE TIME	DATE AND TIME	I	Date and time OB1 start	▼ he		
ľ									
l	OB1 : :	Switch lamp Or	n/Off				-		
l	Comment	:							
l									
l	Network	1: Control 1	amp Hl						
l	Common t								
l	comment								
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Pr	ess F1 to get	Help.					© offline	Abs Nw 1 Ln 5 Inser	t

Forward Notes Installation STEP 7- Program Start from PLCSIM Debugging with PLCSIM

START AND CONFIGURATION OF S7-PLCSIM



5.

If this program is to be debugged without a connection between a PC and a hardware PLC, the simulation must be activated. Then all the accesses that are implemented on the interface of the hardware PLC will be simulated internally in the S7-PLCSIM.

8. In order to start a PLCSIM, click on the Simulator button 1 (\rightarrow Simulation on/off 1).



Forward Notes Installation STEP 7- Program Start from PLCSIM Debugging with PLCSIM



9. Now an input and output need to be placed in the program in order to debug it. This is done by calling **Insert** and selecting **Input** and **Output**. **BIT MEMORY** and **Counters** can also be inserted (→ Insert → Input → Insert → Output).

💓 S7-PLCSII	- SimView1	
SF CO SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF CC SF SF CC SF SF SF SF SF SF SF SF SF SF	SimView1 Inset PLC Execute Tools Window Help Input Variable F2 Qutput Variable F3 Bit Memory F4 Imer F11 Counter F12 Generic Ctrl+F2 Vertical Bits	
Shows an Input	ariable. MI	PI = 2 //.

10. The desired addresses **IB0** and **QB4** ,and the demonstration method **Bits** must be chosen here (\rightarrow IB0 \rightarrow Bits \rightarrow QB4 \rightarrow Bits).



Forward	Notes	Installation	STEP 7- Program	Start from PLCSIM	Debugging with PLCSIM	
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DEBUGGING OF THE STEP7- PROGRAM WITH S7-PLCSIM



6.

The STEP7- Program to be debugged can now be loaded into the PLC simulator. For this example, only OB1 will be debugged. In addition, SDBs (System function blocks), FBs, FCs and DBs can also be downloaded.

11. Highlight **OB1**, and click **Download** $(\rightarrow OB1 \rightarrow Download)$.



12. Now switch the simulated PLC to **RUN** and switch the individual input bits with the mouse when needed. The active outputs appear similar to switched inputs, but include a check mark \mathbf{U} , which means that they are active(\rightarrow RUN $\rightarrow \mathbf{U}$).



Forward Notes Installation STEP 7- Program Start from PLCSIM Debugging with PLCSIM