SCE Training Curriculum
for the end-to-end automation solution
Totally Integrated Automation (TIA)

TIA Portal Module 020-050
Simulation of SIMATIC S7-300 with S7-PLCSim
Suitable SCE trainer packages for these documents

SIMATIC controllers
- **SIMATIC S7-300 with CPU 314C-2PN/DP**
  Order no.: 6ES7314-6EH04-4AB3
- **SIMATIC S7-300 with CPU 314C-2PN/DP (upgrade)**
  Order no.: 6ES7314-6EH04-4AB4
- **SIMATIC S7-300 with CPU 315F-2PN/DP**
  Order no.: ES7315-2FH14-4AB1
- **SIMATIC ET 200S with CPU IM151-8 F PN/DP**
  Order no.: 6ES7151-8FB00-4AB1

SIMATIC STEP 7 software for training
- **SIMATIC STEP 7 Professional V11 - Single license**
  Order no.: 6ES7822-1CC01-4YA5
- **SIMATIC STEP 7 Professional V11 - Classroom license (up to 12 users)**
  Order no.: 6ES7822-1AA01-4YA5
- **SIMATIC STEP 7 Professional V11 - Upgrade license (up to 12 users)**
  Order no.: 6ES7822-1AA01-4YE5
- **SIMATIC STEP 7 Professional V11 - Student license (up to 20 users)**
  Order no.: 6ES7822-1AC01-4YA5

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**Additional information regarding SCE**
[siemens.com/sce](http://siemens.com/sce)

**Information regarding usage**

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1. Preface

The SCE_EN_020-050 module contents form part of the ‘Basics of PLC programming’ training unit and describe the use of S7-PLCSIM PLC simulation in the TIA Portal for testing programs for the SIMATIC S7-300.

Learning objective:

In this module, the reader will learn how to use the S7-PLCSIM simulation software to test a STEP 7 program. The module outlines the general procedure in the following steps on the basis of an example.

- Opening a program with the TIA Portal
- Starting S7-PLCSIM
- Testing a program with S7-PLCSIM

Requirements:

To successfully work through this module, the following knowledge is required:

- Proficiency in working with Windows
- Basic knowledge of PLC programming with the TIA Portal (e.g., module SCE_EN_020-010_R1201_Startup programming with SIMATIC S7-300)
Required hardware and software

1. PC Pentium 4, 1.7 GHz 1 (XP) – 2 (Vista) GB RAM, approx. 2 GB of free hard disk space
   Operating system Windows XP Professional SP3 / Windows 7 Professional / Windows 7
   Enterprise / Windows 7 Ultimate / Windows 2003 Server R2 / Windows Server 2008 Premium SP1,
   Business SP1, Ultimate SP1

2. Software: STEP 7 Professional V11 SP1 (Totally Integrated Automation (TIA) Portal V11) including
   S7-PLCSIM
2. **Notes on use of S7-PLCSIM**

S7-PLCSIM is used primarily for testing STEP 7 programs created for SIMATIC S7-300, SIMATIC S7-400, and SIMATIC WinAC which cannot be directly tested on the hardware straight away. This may be the case for various reasons:

- Smaller program modules which cannot yet be tested in a sequence on the machine.
- The program is a critical application that may pose a risk of personal injury or material damage in the event of programming errors. The purpose of a simulation is to eliminate such errors in the preparation stage.
- S7-PLCSIM may also be used for practice purposes when no hardware PLC is available.

The following must be observed when using SIMATIC PLCSIM:

- A STEP 7 Professional V11 (TIA Portal V11) software package is required
- **S7-PLCSIM is not included in STEP 7 Basic V11!**
- Projects for all SIMATIC S7-300 and S7-400 CPUs as well as for SIMATIC WinAC can be tested here.
- **S7 programs for the SIMATIC S7-1200 cannot be tested with S7-PLCSIM!**
- The use of function modules (FMs) and communication processors (CPs) cannot be simulated.

S7-PLCSIM is automatically included in the functions installed with STEP 7 Professional V11 (TIA Portal V11).
3. **Press control program**

Here, we want to use S7-PLCSIM to test a simple press control program.

A press with protective equipment is to be activated with START button S3 only if the protective grid is closed and the EMERGENCY STOP button (NC) is not actuated. The "protective grid closed" state is monitored with sensor B1. If this state exists, a 5/2-way valve M0 for the press cylinder is actuated so that a plastic figure can be pressed. The press is to raise again when Start button S3 is released, the EMERGENCY STOP button (NC) is actuated, or the protective grid sensor B1 no longer responds.

**Assignment list:**

<table>
<thead>
<tr>
<th>Address</th>
<th>Symbol</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>%I 0.1</td>
<td>EMERGENCY STOP</td>
<td>EMERGENCY STOP button (NC)</td>
</tr>
<tr>
<td>%I 0.3</td>
<td>S3</td>
<td>Start button S3 (NO)</td>
</tr>
<tr>
<td>%I 0.4</td>
<td>B1</td>
<td>&quot;Protective grid closed&quot; sensor (NO)</td>
</tr>
<tr>
<td>%Q 0.0</td>
<td>M0</td>
<td>Extend cylinder A</td>
</tr>
</tbody>
</table>

![Press control program diagram]
4 Testing the program for the press with S7-PLCSIM

The following steps allow you to open the press control program, load it into S7-PLCSIM, and test it.

1. The central tool is the ‘Totally Integrated Automation Portal’, which is opened here with a double-click. (→ TIA Portal V11)

2. First, open the S7 program from the ‘SCE_EN_020-010_R1110_Startup programming with S7-300’ module. (→ Open an existing project → startup_S7-300.ap11 → Open)
3. Then, switch to the ‘Project view’. (→ Project view)
4. In order to start the simulation and load the entire program into S7-PLCSIM, first select the ‘Control press’ folder and then click the Start simulation icon. (→ Control press →)

5. Click OK to confirm the message that online interfaces will be disabled. (→ OK)
6. Next, set the interface to ‘PLCSIM (MPI)’ in S7-PLCSIM. (→ PLCSIM (MPI))

**Note:**
When using S7-PLCSIM with TIA Portal V11, the program must always be loaded initially via PLCSIM(MPI). Afterwards, the interface can be switched to PLCSIM(TCP/IP) and the program loaded.
7. In the following dialog, select ‘MPI’ as the type of the PG/PC interface and then ‘PLCSIM V5.x’ as the PG/PC interface. After a ‘Refresh’ of the accessible devices, you should see the ‘CPU 841(PLCSIM)’ simulation with MPI address 2 and be able to select this simulation as the target device. Then, click ‘Load’. (→ Type of the PG/PC interface: MPI → PG/PC interface: PLCSIM V5.x → Refresh → CPU 841 (PLCSIM) → Load)
8. The configuration is now compiled automatically, and a preview of the steps to be performed is displayed once again for checking before the program is loaded. Click ‘Load’ to start loading the program. (→ Load)
9. Now switch back to the S7-PLCSIM window, switch it to \[ \checkmark \text{RUN-P} \], and choose the ‘Always On Top’ option so that the simulation remains visible on the screen from then on. (\( \rightarrow \checkmark \text{RUN-P} \rightarrow \))
10. Next, you must use the 'Insert' menu item to insert all 'Inputs' and 'Outputs' that were used in the program to be tested. 'Bit Memory', 'Timer', and 'Counter' can also be represented. (→ Insert → Input Variable → Insert → Output Variable)
11. The desired addresses, here ‘IB0’ and ‘QB0’, must be entered and the number format, here ‘Bits’,
must be selected for each address. (→ IB0 → Bits → QB4 → Bits)

12. Clicking the icon (Monitoring on/off) allows you to monitor the state of the simulated input and
output variables on the "Program Press" block when testing the program. (→ )
13. Individual input bits can be switched in S7-PLCSIM with a mouse click. The active outputs, as well as switched inputs, are marked with a check mark '✓'. (→✓)
14. It is also possible to save a complete simulation including the loaded program from S7-PLCSIM in *.plc format. This simulation can then be started simply by double-clicking the *.plc file. (→ → startup_S7-300.plc → Save project)