SIEMENS

SIMATIC

Engineering Tools
S7-PLCSIM V5.4 incl. SP3

Operating Manual

03/2009
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Introduction

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Purpose of this document

The information in this documentation enables you to simulate the operation of an S7 programmable logic controller. You can test control programs without connecting to S7 hardware.

Audience

This documentation is aimed at developers, programmers and maintenance staff with knowledge and experience of S7 programmable logic controllers and STEP 7 programming.

Required background

To understand this documentation, you require a general knowledge of automation engineering. Basic knowledge of the following is also necessary:

- STEP 7 basic software, particularly:
  - Working with the SIMATIC Manager
  - Hardware configuration with HW Config

Validity of the documentation

	Version	Order number
S7-PLCSIM	V5.4 incl. SP3	6ES7841-0CC05-0YA5 (Complete version)
S7-PLCSIM	V5.4 incl. SP3	6ES7841-0CC05-0YE5 (Upgrade)

Changes since the previous version

The S7-PLCSIM now has the following new properties:

- Optimization of the download scenario
- Support of an additional PG/PC interface: PCinternal (local)
- Simplified means of access
- Optimization of the communication with WinCC and WinCC flexible
- Display of all CPU access addresses in the status bar

Documentation classification

This document describes the functions and the operation of S7-PLCSIM.

For further information, refer to the STEP 7 Online Help and the following manuals:

Title		Contents
Getting Started		
	Getting started and exercises with STEP 7	This manual explains how to use the STEP 7 automation software. This manual provides you with an overview of the procedures used to configure a PLC and to develop control programs.
Reference Manual		
	System Software for S7-300/400 System and Standard Functions	This manual provides you with descriptions of the system functions, organization blocks, and standard functions that you use when developing a control program.
Manual		
	Programming with STEP 7 V5.4	This manual provides basic information on designing and programming control programs. Use this manual when creating a control program with the STEP 7 automation software.

This and other manuals can be found by selecting the menu command **Start > SIMATIC > Documentation** in the Windows Start menu on the computer on which STEP 7 is installed.

Guide

The present document describes the handling of the S7-PLCSIM simulation software. It consists of instructive sections and a reference section. The documentation includes the following subject areas:

- Product overviews
- Getting started
- Simulation tasks
- Definition of view objects
- Definition of error and interrupt OBs
- Reference information such as tips on troubleshooting

Service & Support on the Internet

A guide to the technical documentation for the various SIMATIC products and systems is available on the Internet (http://www.automation.siemens.com/simatic/portal/html_76/techdoku.htm).

In addition to our documentation pool, we offer our complete online knowledge base on the Internet (http://www.siemens.com/automation/service&support). Here you can find:

- our newsletter, providing the latest information on your products.
- the correct documents for your product via our Service & Support pages.
- the bulletin board, a worldwide knowledge exchange for users and experts.
- Your local contact for Automation & Drives in our contact database.
- Information about on-site services, repairs, spare parts, and lots more.

Product overview

2

2.1 Functional scope

Introduction

In S7-PLCSIM you can execute and test your STEP 7 user program in a simulated programmable logic controller (PLC). Simulation is executed on your PC or programming device, such as a Field PG. Since the simulation is implemented completely in the STEP 7 software, you do not require any S7 hardware (CPU or signal modules). You can use S7-PLCSIM to simulate STEP 7 user programs that were developed for S7-300, S7-400 and WinAC controllers.

S7-PLCSIM provides a simple interface to the STEP 7 user program for monitoring and modifying different objects such as input and output variables. You can also use the various applications of the STEP 7 software while you are running your program on the simulated CPU. This allows you, for example, to use such tools as the variable table (VAT) to control and monitor variables. S7-PLCSIM provides a graphical user interface for viewing and modifying control program variables, running the simulated PLC in single or continuous scan mode, and changing the operating mode of the simulated controller.

S7-PLCSIM also includes a COM object called S7ProSim that provides programmatic access to a simulated PLC. With S7ProSim, you can write software to perform such tasks as changing the key-operated switch position of the simulated PLC, stepping through the control program a scan at a time, reading or writing controller values, and many other tasks. The documentation on S7ProSim (http://support.automation.siemens.com/WW/view/en/1139855/0/en) is available in the Internet.

Functionalities

S7-PLCSIM offers the following range of functions:

- Open an existing simulation (Page 31) on startup
- Run programs intended for S7-300, S7-400, T-CPUs (Page 47) and WinAC PLCs on a simulated PLC
- Create view objects (Page 49) that allow you to access the input and output memory areas, accumulators, and registers of the simulated PLC.
- Access memory through symbolic addressing (Page 41).
- Automatically run timers
- Set timers manually or reset all timers or one timer (Page 40)
- Change the CPU operating mode (Page 50) (STOP, RUN and RUN-P)
- Halt the simulation using the Pause menu command without affecting the state of the program
- Test the behavior of your program using error and interrupt OBs (Page 59)
- Record (Page 42) a series of events (modify input and output memory areas, bit memories, timers and counters)
- Play back your program recording in order to automate tests

Integration in STEP 7

You can use all of the STEP 7 tools with the simulated PLC. Although the simulated PLC exists entirely in software, STEP 7 works as if the simulated PLC were a real S7 PLC, with few differences (Page 10).

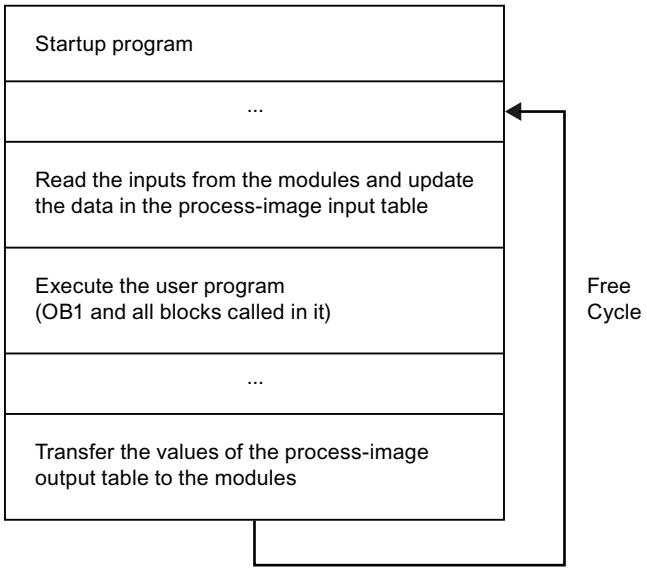
2.2 Differences from a "real" PLC

Features of the simulated PLC

The simulated PLC provides the following functionalities that are not available in a "real" PLC:

- The "Pause" command (Page 37) halts the simulated CPU and allows you to resume the execution of the program at the instruction where the program was halted.
- When you put the simulated CPU in STOP mode, S7-PLCSIM does not change the status of the outputs. When you select the RUN mode selector (Page 50) position you cannot download a STEP 7 user program or use the STEP 7 tools to change any parameters. A real S7 PLC allows program download and parameter changes when the RUN mode selector is set.
- S7-PLCSIM supports four accumulators (like an S7-400 CPU). In certain special cases, a program in S7-PLCSIM (with four accumulators) can behave differently from the same program running on an S7-300 CPU, (with only two accumulators).
- Any change that you make with a view object immediately updates the contents of the memory location. The simulated CPU does not wait until the beginning or end of the scan in order to update any changed data.
- Execution control options allow you to select how the CPU runs the program:
  - Single scan mode (Page 33)
  - Automatic (Page 33)
- Timers can be automatically processed or values can be entered manually. You can also reset (Page 40) timers globally or individually.

- You can manually trigger the error and interrupt OBs:
  - OB40 to OB47 (Page 60) (hardware interrupt)
  - OB70 (Page 61) (I/O redundancy error)
  - OB72 (Page 62) (CPU redundancy error)
  - OB73 (Page 63) (communication redundancy error)
  - OB80 (Page 64) (time error)
  - OB82 (Page 64) (diagnostic interrupt)
  - OB83 (Page 66) (insert/remove module)
  - OB85 (Page 67) (program sequence error)
  - OB86 (Page 68) (rack failure).
- Process image and peripheral memory: When you change a value in the process input image, S7-PLCSIM copies it immediately to I/O area of the inputs. This way, when the I/O area input value is written to the process input image at the beginning of the next scan, the desired change is not lost. Correspondingly, when you make a change to an I/O area output value, it is copied immediately to process output image. The following diagram illustrates the order of activities in the scan cycle:



When modifying variables in a simulated CPU from a STEP 7 variable table, you must ensure that process image updates do not overwrite or overlay your intended modification. Set the trigger points for modifying variables as follows:

- For inputs, select "Beginning of scan cycle" as the "Trigger Point for Modifying".
- For outputs, select "End of scan cycle" as the "Trigger Point for Modifying".

Further differences

The simulated PLC does not provide the following functionalities that are available in a "real" PLC:

- Diagnostic buffer: S7-PLCSIM does not support all of the error messages written to the diagnostic buffer. For instance, messages relating to bad batteries in the CPU or EPROM errors cannot be simulated. However, most I/O and program errors can be simulated.
- A change of operating mode (Page 50) does not change the I/O to a "safe" state.
- Function modules (FMs) are not supported.
- Point-to-point communication (such as between two S7-400 CPUs in the same rack) is not supported.
- S7-PLCSIM does not support forcing variables.
- S7-PLCSIM executes some SFBs (Page 16) and SFCs (Page 17) in the same way as a real S7 PLC; For others, S7-PLCSIM validates input parameters and returns output that is valid, but not necessarily what a real S7 PLC with a physical I/O would return; and otherwise S7-PLCSIM treats the remainder as NOPs.
- Multicomputing is not supported by S7-PLCSIM: S7-PLCSIM cannot simulate SIMATIC stations with several CPUs (multicomputing).
- H systems are not supported by S7-PLCSIM.

Differences with I/O

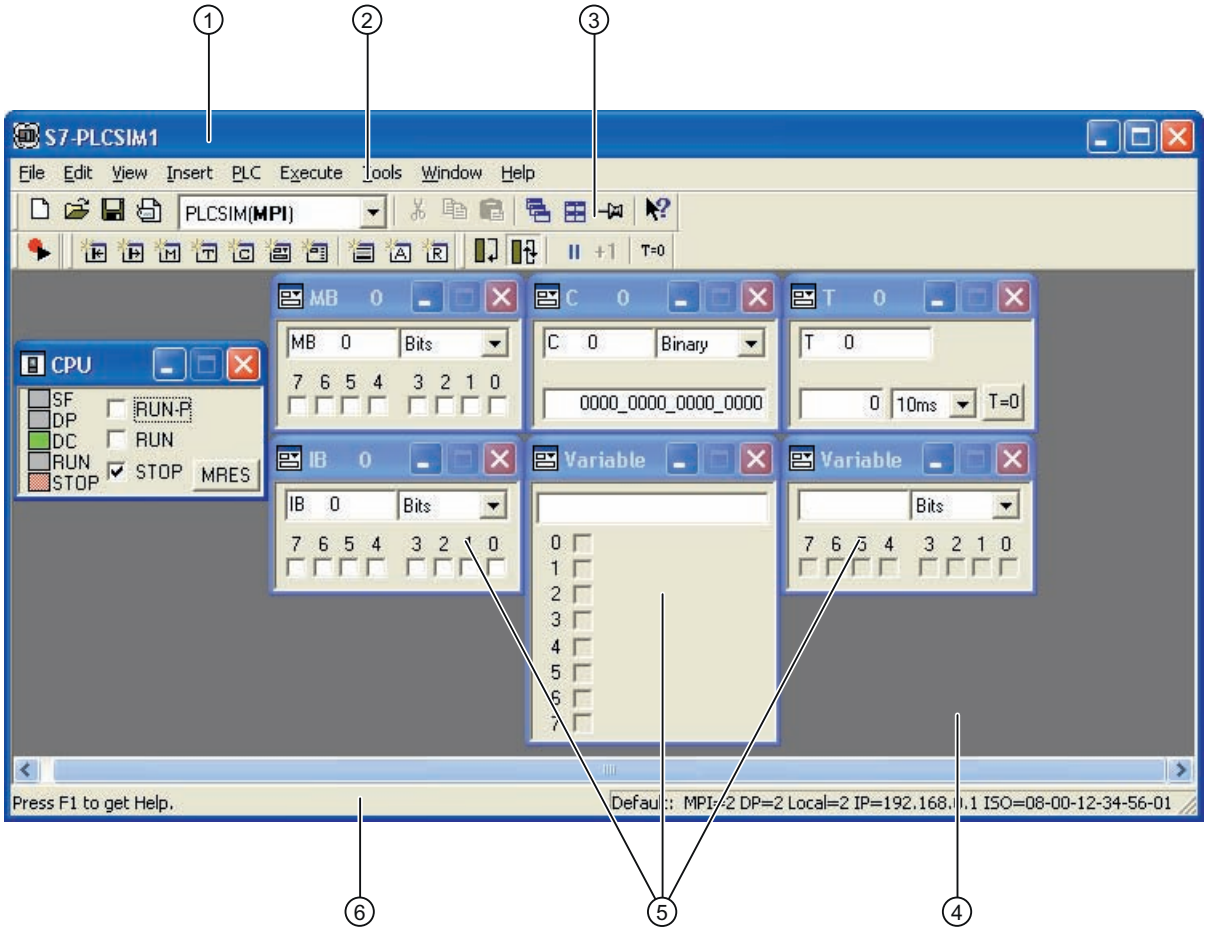
Most of the CPUs in the S7-300 family autoconfigure I/O: Once a module has been inserted into a physical controller, it is automatically recognized by the CPU. It is not possible to replicate the autoconfiguration feature with a simulated PLC. If you download a program to S7-PLCSIM from an S7-300 CPU that autoconfigures I/O, the system data does not include an I/O configuration. Therefore, you must first of all download a hardware configuration with configured I/O modules to the system data in order to define which modules the CPU should make available.

To do this, create a project and configure a S7-300 CPU in which the I/O are not automatically configured, e.g. the CPU 315-2DP, CPU 316-2DP or the CPU 318-2. Download this hardware configuration to the S7-PLCSIM. Then you can download the program blocks from any S7 projects. The I/Os are applied error-free.

2.3 Simulation view window

User Interface

The simulation view window of S7-PLCSIM includes the workspace, title bar, status bar, and S7-PLCSIM menus and toolbars (Page 71). The S7-PLCSIM layout is where you display view objects (Page 49) .



1 Title bar
2 Menu bar
3 Toolbars
4 Workspace
5 View objects
6 Status bar command

2.4 Memory areas

Memory areas with different functions

You access data in the S7 PLC by addressing specific areas of memory, which perform specific functions:

Memory area	Description	Addressing	S7-PLCSIM limits
Timers	Storage for timers	T	T 0 to T 2047
Counters	Storage for counters	C	C 0 to C 2047
Bit memory	Storage for data used within the STEP 7 user program	M	131,072 bits (16 Kbytes) of M memory
Addressable I/O	Direct access to input and output modules **Note:** The CPU updates the peripheral outputs at the end of every CPU scan cycle.	PI: peripheral input PQ: peripheral output	262,136 bits (32 Kbytes) of I/O memory
Process image (configurable; updated every scan)	Process image storage for inputs and outputs **Note:** The CPU updates the inputs at the beginning of every CPU scan cycle	I: Input Q: Output	Maximum: 131,072 bits (16 Kbytes) Default setting: 131,072 bits (16 Kbytes)
Local data (configurable)	Storage used by logic blocks, including temporary variables	-/-	Maximum: 32 Kbytes Default setting: 32 Kbytes
Data blocks	Memory for data blocks	DB: Data block	Maximum number> 65534 Max. length: 65570

2.5 Blocks

2.5.1 Organization blocks (OBs)

Supported OBs

S7-PLCSIM supports the OBs listed below:

OB	Description
OB1	Free cycle
OB10 to OB17	Time-of-day interrupt
OB20 to OB23	Time-delay interrupt
OB30 to OB38	Cyclic interrupt
OB40 to OB47	Hardware interrupts
OB55*	Status interrupt
OB56*	Update interrupt
OB57*	Manufacturer-specific interrupt
OB60*	Multiprocessor interrupt
OB61* to OB64*	Synchronous cycle interrupt
OB65*	Technology synchronization interrupt
OB70	I/O redundancy error
OB72	CPU redundancy error
OB73	Communication error
OB80	Timeout error
OB81*	Power supply error
OB82	Diagnostic interrupt
OB83	Insert/remove module interrupt
OB84*	CPU hardware fault
OB85	Priority class error
OB86	Rack failure
OB87*	Communication error
OB88*	Processing interrupt
OB90*	Background OB
OB100	Warm restart
OB101	Hot start
OB102	Cold restart
OB 121	Programming error
OB122	I/O access error

* OBs marked with an asterisk (*) are not called.

2.5.2 System function blocks (SFBs)

Supported SFBs

S7-PLCSIM supports the SFBs listed below:

SFB No.	Short name	SFB No.	Short name
SFB0	CTU	**SFB20**	STOP
SFB1	CTD	**SFB22**	STATUS
SFB2	CTUD	**SFB23**	USTATUS
SFB3	TP	**SFB31**	NOTIFY_8P
SFB4	TON	**SFB32**	DRUM
SFB5	TOF	**SFB33**	ALARM
SFB8	USEND	**SFB34**	ALARM_8
SFB9	URCV	**SFB35**	ALARM_8P
SFB12	BSEND	**SFB36**	NOTIFY
SFB13	BRCV	**SFB37**	AR_SEND
SFB14	GET	**SFB52**	RDREC
SFB15	PUT	**SFB53**	WRREC
SFB19	START	**SFB54**	RALRM

2.5.3 System Functions (SFCs)

Supported SFCs

S7-PLCSIM supports the SFCs listed below:

SFC No.	Short name	SFC No.	Short name	SFC No.	Short name
SFC0	SET_CLK	**SFC27**	UPDAT_PO	**SFC54**	RD_DPARM
SFC1	READ_CLK	**SFC28**	SET_TINT	**SFC55**	WR_PARM
SFC2	SET_RTM	**SFC29**	CAN_TINT	**SFC56**	WR_DPARM
SFC3	CTRL_RTM	**SFC30**	ACT_TINT	**SFC57**	PARM_MOD
SFC4	READ_RTM	**SFC31**	QRY_TINT	**SFC58**	WR_REC
SFC5	GADR_LGC	**SFC32**	SRT_DINT	**SFC59**	RD_REC
SFC6	RD_SINFO	**SFC33**	CAN_DINT	**SFC62**	CONTROL
SFC9	EN_MSG	**SFC34**	QRY_DINT	**SFC64**	TIME_TCK
SFC10	DIS_MSG	**SFC36**	MSK_FLT	**SFC78**	OB_RT
SFC11	DPSYC_FR	**SFC37**	DMSK_FLT	**SFC79**	SET
SFC12	D_ACT_DP	**SFC38**	READ_ERR	**SFC80**	RSET
SFC13	DPNRM_DG	**SFC39**	DIS_IRT	**SFC82**	CREA_DBL
SFC14	DPRD_DAT	**SFC40**	EN_IRT	**SFC83**	READ_DBL
SFC15	DPWR_DAT	**SFC41**	DIS_AIRT	**SFC84**	WRIT_DBL
SFC17	ALARM_SQ	**SFC42**	EN_AIRT	**SFC85**	CREA_DB
SFC18	ALARM_S	**SFC43**	RE_TRIGR	**SFC87**	C_DIAG
SFC19	ALARM_SC	**SFC44**	REPL_VAL	**SFC90**	H_CTRL
SFC20	BLKMOV	**SFC46**	STP	**SFC105**	READ_SI
SFC21	FILL	**SFC47**	WAIT	**SFC106**	DEL_SI
SFC22	CREAT_DB	**SFC49**	LGC_GADR	**SFC107**	ALARM_DQ
SFC23	DEL_DB	**SFC50**	RD_LGADR	**SFC108**	ALARM_D
SFC24	TEST_DB	**SFC51**	RDSYSST		
SFC26	UPDAT_PI	**SFC52**	WR_USMSG		

Getting Started

3

3.1 Start simulation

Requirement

- No other simulated PLC is open
- There are no connections to real PLCs

Introduction

The following procedures help you to get started. The simulation can be called from the SIMATIC Manager.

Procedure

To start a simulation, proceed as follows:

1. You can use one of the following methods to start S7-PLCSIM:
   - Open the SIMATIC Manager and click the  icon or select the menu command **Options > Simulate Modules**.

     S7-PLCSIM is opened. The user interface language and the mnemonic settings are the same as the STEP 7 settings.
   - From the Windows Start menu, select the menu command **SIMATIC > STEP 7 > S7-PLCSIM Simulating Modules**.

     S7-PLCSIM is opened. The user interface language is not the same as the STEP 7 settings. When you first launch S7/PLCSIM, the interface language is English. With subsequent starts, the S7-PLCSIM opens using the language that was used last. This setting is user-specific.

Result

Simulation is started. The view object "CPU" is opened.

The PLC must be in the original state. It has the following properties and standard settings:

- Supports any connection
- Supports any address
- Standard address
- Interface configuration on the basis of the interface last used
- immediately downloadable

Any new connection is automatically established with the simulated PLC. Any program that you download goes to the simulated PLC. If you click the "Accessible Nodes" button in the SIMATIC Manager, the node address for the simulated PLC is shown.

Note

S7-PLCSIM automatically changes the S7ONLINE Access Point to a simulation subnet. During simulation, do not change the access point to an access point that is unknown to S7-PLCSIM with "Set PG/PC interface". S7-PLCSIM will change the access point back to the original setting when you end the simulation.

3.2 Setting the PG/PC interface

Types of connection

In previous releases of S7-PLCSIM you could only simulate a PLC through an MPI connection. With S7-PLCSIM you can connect through any of the following interface configuration types:

- PLCSIM (ISO)
- PLCSIM (Local)
- PLCSIM (MPI)
- PLCSIM (PROFIBUS)
- PLCSIM (TCP/IP)
- ...

Interface configuration	Type of connection
PLCSIM (ISO)	Via the MAC address
PLCSIM (Local)	Via the virtual backplane bus/Softbus
PLCSIM (MPI)	Via the MPI interface
PLCSIM (PROFIBUS)	Via the PROFIBUS interface
PLCSIM (TCP/IP)	via the IP address
...	unknown connection class

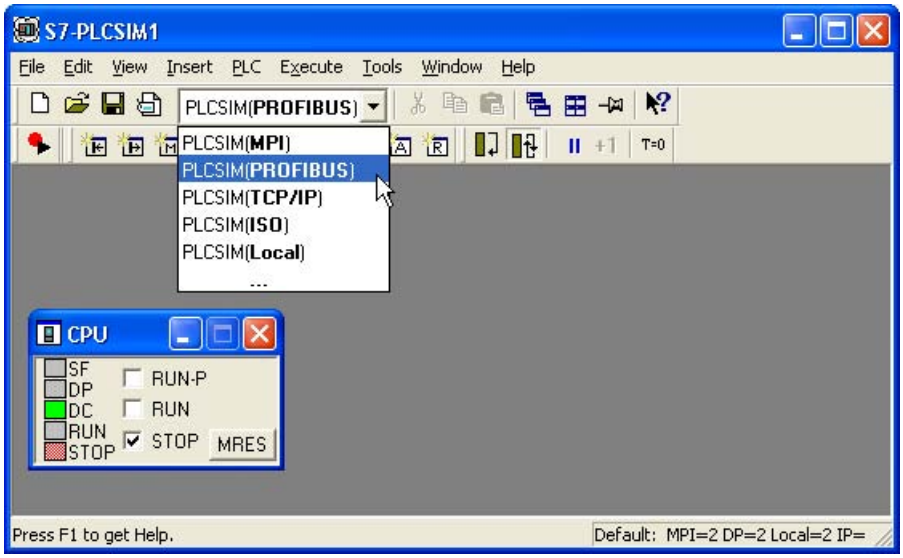
Note

The connection via the MPI interface is the default setting for the simulated PLC in S7-PLCSIM. Subsequently the simulated PLC will start with the last used connection class.

Procedure

To set a PG/PC interface, proceed as follows:

1. Configure your hardware configuration in STEP 7.
2. Start the S7-PLCSIM.
3. In the dropdown list of the "Standard" toolbar, select one of the configured connection classes for the virtual PLC.



Result

The PG/PC interface is created.

Note

Changes that are made in the dropdown list of the "Standard" toolbar will effect the function of the menu command **Tools > Setting the PG/PC interface** in the SIMATIC Manager. Changes will also be effected in the reverse case.

Color meanings in the dropdown entries

- Black **Black** (example: PLCSIM(**MPI**))

  This color means that the CPU supports this PG/PC interface. The CPU is clearly accessible via this interface.

- Grey **Grey** (example: PLCSIM(**MPI**))

  This color means that the CPU does not support this PG/PC interface. The CPU is not accessible via this interface.

  The interface can be selected. The CPU is however not accessible.

3.3 Downloading a STEP 7 project

Requirement

- Simulation was started from the STEP 7 SIMATIC Manager
- The appropriate connection type is configured
- Address in the STEP 7 corresponds with that in the S7-PLCSIM or the PLC is in original state

Procedure

To download the STEP 7 project, proceed as follows:

1. Navigate to the station in the SIMATIC Manager.
2. Click  or select the menu command **PLC > Download**.

Result

The blocks and hardware configuration are downloaded to the simulated PLC. The simulation system adopts the identity of the loaded CPU and all configured connection data.

The status bar gives an overview of the network addresses configured in the hardware configuration.

The simulation system resets to its original state with the "MRES" function.

Note

Independently configured CPs

It is not possible to simulate independently configured CPs.

3.4 Simulation and monitoring

Procedure

To simulate the application and to monitor and control the application, proceed as follows:

1. Open the SIMATIC Manager
2. Open the STEP 7 example project "ZEn01_09_STEP7__Zebra".
3. Click on the  symbol to apply the S7-PLCSIM.
4. Download (Page 22) the example project
5. Create additional "view objects" (Page 49) in S7-PLCSIM.

   The data in the simulated PLC can be monitored.

   – Click  or select the menu command **Insert > Input Variable**. The view object displays IB0 (Input Byte 0). Set the data format to "Bits."

   – Click  or select the menu command **Insert > Output Variable** to insert a second view object QB0 (Output Byte 0).

   – Click  or select the menu command **Insert > Timer** three times to insert three "Timer" view objects. Type 2, 3 and 4 (for timers T2, T3 and T4) in their respective text boxes, pressing the Enter key after each entry. (S7-PLCSIM will fill in the symbolic name for each of these three timers.)
6. Choose the menu command **PLC > Power On**
7. Choose the menu command **Execute > Scan Mode > Continuous Scan**
8. Select the menu command **Execute > Key Switch Position > RUN** or **RUN-P**.

   The simulated CPU is put into RUN mode.
9. Click bit 0 of IB0, to simulate turning on input 0.0.
10. Monitor the effects on the timers.
11. Click  or select the menu command **File > Save PLC As** to save the current state of the simulated PLC as a new file (Page 29).

3.5 Monitoring program simulation in STEP 7

Requirement

- View objects (Page 49) have been created
- Example project "Zebra" is opened and the station downloaded to the S7-PLCSIM

Procedure

To monitor the simulation of your program in STEP 7, proceed as follows:

1. Click  or select the menu command **View > Online**.
   The Online mode is activated.
2. Navigate to the "Blocks" object in the ZEBRA example project.
3. Open the function FC1.
   The "LAD/STL/FBD" application is called.
4. Put the simulated CPU in RUN mode.
5. Turn on Bit 0 of IB0.
6. Select the menu command **Debug > Monitor** in the LAD/STL/FBD Editor.
   The effects on your program can be monitored.

3.6 Using Help

Introduction

You can access the S7-PLCSIM online help through the **Help** menu or in any of the following ways:

- To get help about an object in the S7-PLCSIM window, click the Help button on the toolbar, and then click the object.
- To get help about any dialog or error message, click the Help button in the dialog or message box, or press F1.

The Help window provides the following buttons, menu commands and tabs:

Help Buttons

- **Hide Button** / **Show Button:** Toggles the display of the navigation area (Table of Contents, Index, and Search tabs). To reduce the overall size of the help window, you can hide the navigation area; When you are ready to view new topics, click the Show button to restore the navigation area.
- **Back Button:** If you have examined more than one topic, this button allows you to move back to the previous topic(s).
- **Forward button:** If you have examined more than one topic, this button allows you to move to the next topic(s).
- **Home page:** Opens the web page that is defined as the home page for the Online Help of S7-PLCSIM.
- **Print button:** Allows you to send a selected topic, or an entire book, to any printer that you have installed.

Help Browser Tabs

- Contents Tab: Choose this tab to view the table of contents for the help system. Double-click any book icon to expand it and view the topics that it contains.
- Index tab: Choose this tab to view an alphabetical list of index keywords for the help system.
- Search tab: Choose this tab and type in a term that you wish to find. Double-click a topic from the list to view the topic. By default, the term is highlighted every place that it appears in the topic to make it easy to locate the term. You can toggle highlighting off or on before displaying a topic. Use the Options button to do this.

Simulation Tasks

4

4.1 Attach Symbols

Predecessor method***

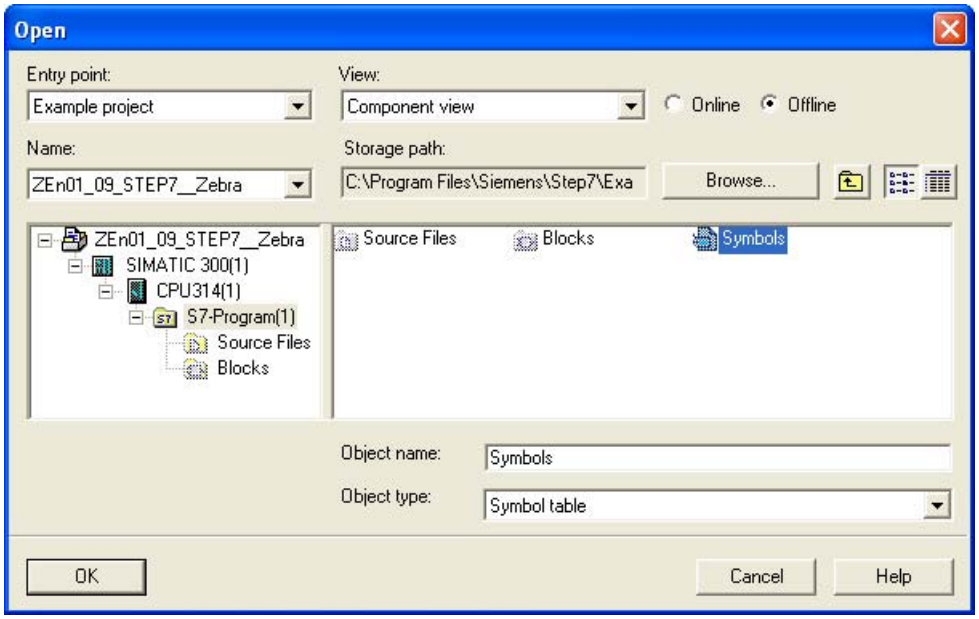
Up to now the symbols could be attached from the "Select CPU Access Node" dialog. To use the symbols from this STEP 7 project, you have to select the "Attach Symbols" check box.

Procedure

To use the symbols of a project, proceed as follows:

1. Start a simulation.
2. Select the menu command **Tools > Options > Attach Symbols** or click .

   The "Open" dialog is opened.



3. Navigate to the appropriate project or library entry.
4. Select the symbols.
5. Confirm with "OK".

   The symbols are attached.

See also

Using Symbolic Addressing (Page 41)

4.2 What Is the Difference between a .PLC File and a .LAY File?

PLC file

A file *.PLC is used to save the simulated PLC. The following information is saved:

- Program
- Hardware configuration
- Operating mode
- current status of the I/O

LAY file

A *.LAY file is used to save the current window arrangement of your workspace in S7-PLCSIM. If you arrange your view objects in a certain order and want to preserve that order for future work sessions, save the layout before you close S7-PLCSIM.

Sequence for opening

When you work in S7-PLCSIM, you can open both a .PLC file and a .LAY file.

1. Open the simulated PLC (.PLC file).
2. Then open the layout (.LAY file).

4.3 Save a simulated PLC

Saved data

The following data are saved when you save the PLC:

- Program
- Hardware configuration
- Simulated subnet and nodes
- The check box selection for the operating mode (key switch position) of the CPU: namely, RUN-P, RUN, or STOP
- Execution control option (continuous scan, single scan)
- The status of the I/O
- Timer values (T memory)
- Symbolic addresses
- Power on/off setting

Procedure

To save the current state of the simulated PLC under the current file name, proceed as follows:

1. Select the menu command **File > Save PLC**.

   Use the menu command **File > Save PLC As** to archive the configuration of the PLC to a new file.
2. To display symbolic addresses, use the **Tools > Options > Show Symbols** command.

Result

S7-PLCSIM saves your files in the associated project directory of STEP 7.

If no project data is available for the simulation (e.g.: default CPU), the PLC file is saved under the following path: [Installation directory]\Siemens\PLCSIM\S7WSI\Archive

4.4 Save Layout Command

Introduction

A layout is simply an arrangement of view objects (Page 49). The .LAY file archives only the position and selected data format of the view objects in your simulation. The data values that are displayed in the view objects are not saved as part of the layout.

Procedure

To save the current position of the view objects in S7-PLCSIM, proceed as follows:

1. Select the menu command **File > Save Layout As**.

   Select the menu command **File > Save Layout** to save the layout in the current file.

   The "Save Layout As" dialog is opened.
2. Confirm with "Save".

Result

S7-PLCSIM saves your files in the associated project directory of STEP 7.

If no project data is available for the simulation (e.g.: default CPU), the PLC file is saved under the following path: [Installation directory]\Siemens\PLCSIM\S7WSI\Archive

4.5 Open the simulated PLC

Requirement

- The simulated PLC was previously saved in a PLC file.
- The file is not read-only.
- The file is not opened in another application.

Procedure

To open an existing simulation of a PLC, proceed as follows:

1. Select one of the following options:
   - Select the **Simulation > Recent Simulation** menu command and choose the entry of a saved PLC.
   - Select the **File > Open PLC** menu command and then browse to and select an existing .PLC file.
2. Confirm with "OK".

Note

If you see a dialog stating that the file is read-only and cannot be opened, you must use Windows Explorer to remove the read-only designation for the file.

Files from older versions

To open a file from S7-PLCSIM V5.3 or earlier, S7-PLCSIM must convert the file to the current file format. During the conversion, a back-up copy of the original file is created with the extension *.BAK. The original PLC file is then converted to the current format. The conversion will fail if a read-only backup file already exists. If so, use Windows Explorer to delete the pre-existing backup file and then open the .PLC file in S7-PLCSIM.

In some cases, S7-PLCSIM will not be able to open an old .PLC file. Simulation files that included multiple DP networks, hot backup systems, or fault tolerant CPUs are potentially incompatible with S7-PLCSIM V5.4.

Note

When you open a new or archived PLC simulation, any view objects that were displayed in S7-PLCSIM are automatically closed. If you intend to open an archived layout as well as a new or archived PLC simulation, open the simulated PLC before opening the layout.

Operating mode after opening

When opening an archived simulated PLC, the saved operating mode is restored.

4.6 Open Layout Command

Introduction

A layout is an arrangement of view objects. The *.LAY file archives only the position and selected data format of the view objects in your simulation. The data values that are displayed in the view objects are not saved as part of the layout.

Requirement

- The layout was previously saved in a LAY file.

Procedure

To open a layout, proceed as follows:

1. Select one of the following options:
   - Select the menu command **Simulation > Recent Layout** and select a layout.
   - Select the **Simulation > Open Layout** menu command and then browse to and select an existing *.LAY file.
2. Select the **Simulation > Open Layout** menu command and the "Open" dialog opens.
3. Navigate to the storage location of the file.
4. Select the file.
5. Confirm with "Open".

   The layout is opened.

4.7 Select scan mode

Introduction

There are 2 options for running the simulated program:

- **Single Scan**: The CPU executes one scan and then waits for you to initiate another scan. Each scan consists of the CPU reading the peripheral inputs (PI), executing the program, and then writing the results to the peripheral outputs (PQ). The CPU then waits for the command to run the next scan. Accessing a program one scan at a time allows you to see the changes in each scan. While a real CPU can execute faster than the editor can display data, the S7-PLCSIM Single Scan option allows you to "freeze" the state of the program from scan to scan.
- **Continuous Scan**: The CPU executes one complete scan and then starts another scan. Each scan consists of the CPU reading the peripheral inputs (PI), executing the program, and then writing the results to the peripheral outputs (PQ).

The default setting is Continuous Scan.

Procedure

To set the Single Scan Mode, proceed as follows:

1. Click  or select the menu command **Execute > Scan Mode > Single Scan**.
2. To run the next scan, select the menu command **Execute > Next Scan** or  .

To set the Continuous Scan Mode, proceed as follows:

1. Click  or select the menu command **Execute > Scan Mode > Continuous Scan**.

4.8 Changing the CPU operating mode

Introduction

The simulated PLC responds to changes in the operating mode like a "real" PLC. The check boxes in the "CPU" view object of the simulated PLC show the current operating mode.

Procedure

To change the CPU operating mode, proceed as follows:

1. Click the appropriate check box or select the menu command **Execute > Key Switch Position >** [**mode**].

   The CPU changes the operating mode.

Comparison with a real CPU

The CPU operating modes on the simulated CPU function like the key switch on a real CPU: if you use the STEP 7 tools to change the operating mode, or if the CPU automatically changes mode (for example, encounters an error condition that causes the CPU to change from RUN to STOP), the check boxes on the simulated CPU view object do not change. The LED indicator changes, but not the key switch. This alerts you that the CPU changed operating mode, possibly because of some error in the program.

4.9 Simulating a STEP 7 user program

View object

You can display different types of view objects that allow you to monitor and modify the STEP 7 user program running in the simulated PLC.

S7-PLCSIM provides view objects that you use to monitor and modify program objects. You can also use symbolic addressing to address these view objects. The following view objects are activated from the **Insert** menu:

- Input Variable (Page 53)
- Output Variable (Page 54)
- Bit Memory (Page 55)
- Timer (Page 55)
- Counter (Page 56)
- Generic (Page 56)
- Vertical Bits (Page 57)

The following three view objects are activated from the **View** menu:

- Accumulators (Page 51)
- Block Registers (Page 52)
- Stacks (Page 52)

Procedure

To also simultaneously monitor the program in the STEP 7 "LAD/STL/FBD" application, proceed as follows:

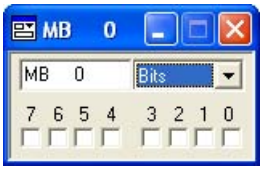
1. In the SIMATIC Manager, click  or select **View > Online** to switch to online mode.
2. Navigate to the "Blocks" object of the STEP 7 project and open a logic block. (Example: In the S7_ZEBRA example project open FC1).

   The "LAD/STL/FBD" application displays the program that the simulated PLC is executing. Use the menu commands to view the status of the instructions.

4.10 Slider Control

Introduction

The Slider Control is a tool which is available to different numeric formats (Page 74). Values are not entered using the numeric keypad, but using the slider control.

Without Slider Control	With Slider Control
	

Simulating Values

The slider control allows you to simulate values that change gradually or have a specific range, such as analog values.

Procedure

To work with slider control, proceed as follows:

1. Select one of the following view objects for which slider control is available.
   - Input Variable (Page 53)
   - Output Variable (Page 54)
   - Bit Memory (Page 55)
2. You can access the memory area with either a memory address or a symbolic address (Page 41).
3. To specify a slider control for one of the view objects, you select a slider control representation from the "Select Numeric Format" drop-down list.
4. Select whether to represent the values as decimal (positive integers), integer (positive and negative integers), or real numbers.

   The selection options are determined by the size of the memory location being accessed:
   - Byte (B): Decimal
   - Word (W): Decimal and integer
   - Double word (D): Decimal, integer, and real
5. You can use either the mouse or the arrow keys to change the position of the slider control indicator or enter a specific value in the "Value" field.

   The value of the variable stored in the memory location changes.

Configuring a minimum and maximum value

To select a minimum value for the slider, select "Min" from the "Display Value, Min, or Max" drop-down list of the view object. Then, enter the numeric value for the minimum in the Min field.

To select a maximum value for the slider, select "Max" from the "Display Value, Min, or Max" drop-down list of the view object. Then, enter the numeric value for the maximum in the Max field.

Benefits of a range of values

Selecting a range of values provides the following benefits:

- A range of values does not affect the values that can be stored in the variable. The minimum and maximum values affect only the values that can be entered or displayed by the slider control.
- You can simulate a specific range of values, for example, the range of values that would be generated by a specific analog module.
- By limiting the range of values between the minimum and maximum, you can provide better resolution for entering data with the slider control. You can always enter an exact value in the Value field of the view object.

4.11 Debugging a program

Features for testing

S7-PLCSIM provides the following features to help you debug your program:

- The "Pause" command interrupts the simulated CPU immediately and allows you to resume the execution of the program at the instruction where the program was halted.
- Any change that you make with a view object (Page 49) immediately updates the contents of the memory location. The CPU does not wait until the beginning or end of the scan to update any changed data.
- Scan mode (Page 33) options allow you to select how the CPU runs the program:
  - Single Scan executes the program for one scan and then waits for you to start the next scan.
  - Continuous Scan executes the program like a real PLC: It starts a new scan immediately after the previous one finishes.

4.12 Using error OBs in your program

Introduction

You can use S7-PLCSIM to test how your program handles different interrupt OBs.

Requirement

To be able to simulate error OBs, you must have downloaded an appropriate hardware configuration in the S7-PLCSIM.

Procedure

To trigger error OBs, proceed as follows:

1. Choose the menu command **Execute > Trigger Error OB**
2. Select a specific OB.

   The dialog for the OB is opened.
3. Select the corresponding options.
4. Confirm with "OK" or "Trigger" .

Result

The simulated PLC generates the appropriate event and runs the program in the associated OB.

Note

The OBs that are available from the "Trigger Error OB" menu depend on the hardware configuration loaded in the simulation.

Supported OBs

S7-PLCSIM supports the following error and interrupt OBs:

- OB40 to OB47 (Page 60) (hardware interrupt)
- OB70 (Page 61) (I/O redundancy error) {417-H systems only}
- OB72 (Page 62) (CPU redundancy error) {417-H systems only}
- OB73 (Page 63) (communication redundancy error) {417-H systems only}
- OB80 (Page 64) (time error)
- OB82 (Page 64) (diagnostic interrupt)
- OB83 (Page 66) (insert/remove module)
- OB85 (Page 67) (priority class error)
- OB86 (Page 68) (rack failure)

S7-300 CPUs

The project PI/PQ information is required to be able to simulate error and interrupt OBs in S7-PLCSIM. The majority of CPUs in the S7-300 family configure the I/O themselves. If a module is connected to the controller, the CPU automatically detects the module. It is not possible to replicate the autoconfiguration feature with a simulated PLC. If you download a program to S7-PLCSIM from an S7-300 CPU that autoconfigures I/O, the system data does not include an I/O configuration. Therefore, you must first of all download to the system data a hardware configuration with configured I/O modules. This way you can define which CPU modules should be made available.

To do this, create a project and configure a S7-300 CPU in which the I/O are not automatically configured, e.g. the CPU 315-2DP, CPU 316-2DP or the CPU 318-2. Download this hardware configuration to the S7-PLCSIM. Then you can download the program blocks from any S7 programs. The I/Os are applied error-free.

4.13 Resetting the CPU memory

Introduction

Resetting has the following effect:

- the memory areas are reset
- the program blocks are deleted
- the hardware configuration of the simulated PLC is deleted

Procedure

To reset the memory of the simulated CPU, proceed as follows:

1. Select the menu command **PLC > Clear/Reset**, or click the MRES button on the CPU view object.

   The "Clear/Reset" dialog is opened.

2. Confirm with "Yes".

   The CPU automatically goes to STOP mode and all existing connections are disconnected.

4.14 Reset Timers

Procedure

To reset the timers in your program, proceed as follows:

1. Choose the menu command **Execute > Reset Timers**

   The "Reset Timers" dialog is opened.
2. Select one of the following options:
   - Select "All Timers" to reset all of the timers in the program
   - Select "Specific Timer" to specify a specific timer to reset.
3. Confirm with "OK".

   The timers are reset

Alternative procedure

The CPU Mode toolbar also provides a button for resetting timers.

- To reset all of the timers in your program, use the Reset Timers  toolbar button.
- To reset an individual timer, use the Reset Timer  button on the view object for that timer.

Manual Timers Command (Execute Menu)

Select the menu command **Execute > Manual Timers** to set up the CPU to allow you to enter a specific value or to reset the timers in the program. Select the menu command **Execute > Automatic Timers** to return to running the timers automatically

4.15 Turning power on/off for a simulated CPU

Procedure

To turn power on/off for a simulated CPU, proceed as follows:

1. Select the **PLC > Power On** and **Power Off** menu commands to simulate turning power on and off to the CPU.

4.16 Using Symbolic Addressing

Introduction

By default, the S7-PLCSIM uses the symbols of the loaded STEP 7 program. If you did not attach symbols when you started the simulation or you want to use symbols from another STEP 7 program, you can specify a symbol table to attach.

Procedure

To use symbolic addressing in your simulated program, proceed as follows:

1. Select the menu command **Tools > Options > Attach Symbols**.

   The "Open" dialog is opened.
2. Browse to the storage location of the STEP 7 symbol table to be referenced.
3. Confirm with "OK".
4. Create view objects for variables that you want to address symbolically.
5. To turn on symbols for all view objects, select the menu command **Tools > Options > Show Symbols**.

   To hide the symbols, select the command again.

Tooltips for symbols

When you use symbolic addressing to monitor your program, tooltips are available for all view object fields that have symbolic addresses assigned to them. Point to a field with the mouse to see its symbolic address and comment (separated by a colon) in a tooltip box.

See also

Vertical Bits Variable View Object (Page 57)

4.17 Record/Playback

Introduction

The Record/Playback dialog box allows you to record or play back a series of data changes.

Requirement

- CPU is in RUN or RUN-P mode

Procedure

To call the "Record/Playback" dialog, proceed as follows:

1. Select the menu command **Tools > Record/Playback** or click the Record/Playback symbol.

   The dialog is opened.
2. To record a series of events, click the "Record" button.
3. To finish recording, remember to save it by using the Save Event File button before you close S7-PLCSIM.

Note

The key sequence Alt + F5 toggles the display of the Record/Playback toolbar button.

How to Record or Play Back an Event File

Click the New Event File button to create a new event file.

Click the Open Event File button to locate and open an existing event file.

Click the Save Event File button to save the events that you have just recorded.

Click the Play button to play back an existing recording of events.

Click the Record button to begin recording a series of events. Use the view objects in your simulation to turn bits on and off or assign data values as desired. The recorder captures every change you make to memory areas.

Click the Pause button to temporarily suspend recording or playback. The Pause function is convenient because it allows you to pause the recording of events and resume later. If you need to perform some other activity (for instance, add new view objects or answer the telephone) before you are finished generating events, you can click Pause and thus avoid a long delay in your recording. Pause allows you to minimize the time lag between events as you record, in contrast to the Delta button, which affects the overall rate at which the recording is played back.

Click the Stop button to stop recording or playing back events.

The Delta button allows you to select a rate of speed before you play back a recording. Your selection affects the overall playback duration. However, if some events were recorded closer together, or further apart than others, the relative time intervals are preserved even as the overall playback time is reduced or increased by your Delta selection.

Check

There are two ways for you to confirm that you are successfully recording or playing back events:

- Check the status bar of the Record/Playback dialog to see whether it is in Recording, Playing, or Idle mode.
- Watch the title bar of the Record/Playback dialog. It should display a numeric value that increments each time you record or play back an event.

Troubleshooting Tips

Problem	Solution
The Play button is de-activated and I cannot play back a recording.	You must have an open event file before you can play back the recording of the events. Use the Open Event File button to select and open an event file.
I recorded a series of events and then closed S7-PLCSIM. The next time I opened S7-PLCSIM, I could not find the events.	If you close S7-PLCSIM without saving the recorded events in an event file, your work is lost. Use the Save Event File button to save your work before you close S7-PLCSIM.
I recorded a series of events, but when I tried to play them back, nothing happened.	Check the status bar of the Record/Playback dialog to see what mode it is in. If it says Playing, watch the title bar to see when a numeric value appears. When events are played back, a counter in the title bar keeps track of how many have been played back. Note that if you start a recording but do not promptly begin to trigger events, the recorder captures the time lag. When you play back the recording, the first event will take an equally long time to occur. You can examine the event file to verify that in fact, your events have been properly recorded. You can adjust the playback speed of the recording by using the Delta button.
I cannot remember which event file contains the sequence of events that I want to play back.	You can use long, descriptive file names to help differentiate your event files. If necessary, you can use a text editor to examine your files and locate the one with the correct sequence. The default storage location for event files is [Program Folder]\Siemens\PLCSIM\S7wsi\events.
I changed a single bit, but when I played back my recording, the entire byte changed.	If an Input Variable, Output Variable, Bit Memory, Generic Variable, or Vertical Bits View Object shows only one bit (e.g., Q0.0, Bits), a bit change is recorded correctly as only a change in that particular bit. However, if the view object displays all eight bits (e.g., QB0, Bits), a change to a single bit is recorded as a change in byte value instead of a change in that bit only. Consequently, it is possible that during playback of the recording, other bits within the byte could be represented as changing (for instance, process flags or Boolean inputs), when in fact they would not be affected during operation of a real PLC.
I am trying to record events in Single Scan mode but the recorder does not function as I would expect.	When recording events with the CPU view object in Single Scan mode, note the following: You cannot start a recording in Single Scan mode unless you click the Next Scan +1 button to increment the scan count. The first event in your recording must have a Delta value of 1 or higher. The Delta value is based on the number of scan cycles that have occurred since the previous event (which in this case was when you clicked the Record button). However, if you are beginning the recording in Single Scan mode, no scan cycles have elapsed. You must increment the scan. When you record events in Single Scan mode, they have a Delta value of zero (because they are all occurring within the same scan). Therefore, when you play back the recording, all the events that you recorded during a single scan are displayed in such rapid sequence that they appear to occur simultaneously. To provide a discernable time lag between events, you would have to click the Next Scan button or switch between Continuous Scan mode and Single Scan mode for each event.

Problem	Solution
My event file contains German mnemonics even though that is not my selection in STEP 7.	Events are recorded with German mnemonics in S7-PLCSIM regardless of your STEP 7 selection. You can disregard this phenomenon.

4.18 Monitor cycle time

Introduction

Program execution may be significantly slower in S7-PLCSIM than with an actual CPU (especially when other applications are running at higher priority). You may experience annoying timeouts because of this. This dialog makes it possible for you to disable or extend the scan cycle monitoring without modifying the program for the target PLC.

Procedure

To monitor the scan cycle, proceed as follows:

1. Choose the menu command **Execute > Scan Cycle Monitoring**

   The "Scan Cycle Monitoring" dialog is opened.

2. Activate the option "Enable Scan Cycle Monitoring".
3. Enter a monitoring time to any value between 1 second (1000 ms) and 1 minute (60000 ms), inclusive.

   The default scan cycle monitoring time is 6000 ms.

4. Confirm with "OK"

Definition - Maximum scan cycle time

The maximum scan cycle time is the maximum time the process is allowed to take for one full scan cycle of the S7 user program in OB1 and for the update of the relevant I/O. If this time is exceeded, the simulated PLC goes into STOP mode.

Note

Note that the "Scan Cycle Monitoring" dialog does not reflect the monitoring time set in the hardware configuration. Changes only affect the simulation.

4.19 Close simulated PLC

Introduction

When a simulated PLC is closed, a new CPU is automatically generated in the original state.

Requirement

- The simulation was saved (Page 29).

Procedure

To close the simulation of a program, proceed as follows:

1. Select the menu command **File > Close PLC**.

Result

The simulated subnet, nodes, and all opened view objects are closed. A new PLC in original state is automatically opened.

Note

Closing a simulated program can result in errors in applications which are currently connected to the simulator.

4.20 Close Layout

Introduction

Closing the layout does not end the simulation session. The current PLC is still open. S7-PLCSIM is still active. You can open another layout.

Requirement

- The layout was saved (Page 30).

Procedure

To close the layout of a program, proceed as follows:

1. Select the menu command **File > Close Layout**.

   All view objects except "CPU" are closed.

4.21 End a simulation

Introduction

Ending the simulation ends the simulation session. S7-PLCSIM is closed.

Requirement

- Save a simulated PLC (Page 29)
- Save Layout Command (Page 30)

Procedure

To end a simulation, proceed as follows:

1. Close any STEP 7 applications involved in the monitoring of the simulation.
2. Select the menu command **File > Exit**.

   The simulated subnet, nodes, and all opened view objects are closed.

Note

Exiting S7-PLCSIM, like closing a simulated PLC, can result in errors in applications that are currently connected to the simulation.

4.22 Simulating T-CPU

Introduction

S7-PLCSIM can simulate control programs, which, for example, have been developed for a CPU S7-317T, with limitations.

Special features

The simulation does not access any motion control devices. Calls to motion control function blocks simply return to the calling block with some limited error checking. Error checking includes:

- Existence of instance DB
- Existence of technology DB
- Range checking of parameters with defined ranges

S7-PLCSIM sets, for some of the MC commands, parameters, provided the input parameters are valid (example: CPU S7-317T):

MC Command	Parameter	Value(s) set
MC_Power	Statusword.DriveEnabled Statusword.Standstill (Technology DB parameters)	True for enabled, false for disabled True
MC_Stop	Statusword.Stopping Statusword.Standstill (Technology DB parameters)	True True
MC_MoveAbsolute (MC_MvAbs)	Position	Input parameter position
MC_ExternalEncoder (MC_ExEnc)	Position	Input parameter position

View objects

5

Introduction

S7-PLCSIM provides several view objects that allow you to monitor and modify various components of the simulated PLC. These view objects are listed below:

- CPU (Page 50) View Object
- ACCUs & Status Word (Page 51) View Object
- Block Regs (Page 52) View Object
- View Object "Stacks" (Page 52)
- Input Variable (Page 53) View Object
- Output Variable (Page 54) View Object
- Bit Memory (Page 55) View Object
- Timer (Page 55) View Object
- Counter (Page 56) View Object
- Generic (Page 56) View Object
- Vertical Bits (Page 57) View Object

Symbolic addressing in view objects

You can use symbolic addressing (Page 41) with view objects. If you do, tooltips are available for all view object fields that have symbols assigned to them. Point to a field with the mouse to see its symbolic address and comment (separated by a colon) in a tooltip box.

Note

If you use an address in a view object that corresponds to F-System peripheral I/O, S7-PLCSIM displays a yellow background for that view object.

5.1 CPU View Object

Introduction

This view object is displayed by default when you open a new simulation.

Function

- Display status
- Change operating mode
- Reset memory with MRES
- Delete blocks and the hardware configuration with MRES

Note

The operating modes on the CPU view object function like the key switch on a real CPU: if you use the STEP 7 tools to change the operating mode, or if the CPU automatically changes mode (for example, encounters an error condition that causes the CPU to change from RUN to STOP), the RUN/STOP indicators also change. The key switch does not change. This alerts you that the CPU operating mode changed, possibly because of some error in the program.

5.1.1 CPU Operating Mode Switch Positions

RUN-P

The CPU runs the program, and you can change the program and its parameters. In order to use the STEP 7 tools for modifying any of the parameters of the program while the program is running, you must put the CPU in RUN-P mode. You can use the view objects created within S7-PLCSIM to modify any data used by the program.

When you select RUN-P, the operating mode status indicators on the CPU view object and STEP 7 display RUN.

RUN

The CPU runs the program by reading the inputs, executing the program, and then updating the outputs. By default, you cannot download any program or use the STEP 7 tools to change any parameters (such as input values) when the CPU is in RUN mode. If you have configured CiR (Configuration in Run) elements in your STEP 7 project, however, you can download the CiR objects in RUN mode. With the simulated CPU in RUN mode, you can use the view objects created within S7-PLCSIM to modify any data used by the program.

STOP

The CPU does not run the program. Unlike STOP mode for real CPUs, the outputs are not set to predefined ("safe") values but remain at the state they were in when the CPU changed to STOP mode. You can download programs to the CPU while the CPU is in STOP mode. Changing from STOP mode to RUN mode starts execution of the program from the first instruction.

The CPU operating modes, the CPU indicators (Page 51), and the Memory Clear/Reset (Page 39) button are all displayed on the CPU view object (Page 50). You can set the CPU operating mode with the Key Switch Position command. You can pause execution of the simulated PLC program when the CPU is in RUN or RUN-P mode.

5.1.2 CPU Indicators

Displaying a simulated CPU

The CPU view object (Page 50) provides a set of indicators that correspond to the LED indicators on a real CPU:

- **SF** (system fault) alerts you that the CPU encountered a system error, causing a change in the operating mode.
- **DP** (distributed peripherals, or remote I/O) indicates the status of communication with distributed (remote) I/O.
- **DC** (power supply) indicates whether power to the CPU is on or off.
- **RUN** indicates that the CPU is in RUN mode.
- **STOP** indicates that the CPU is in STOP mode.

5.2 ACCUs & Status Word View Object

To add this view object to the simulation, proceed as follows:

- Choose the menu command **View > Accumulators**
- Click the CPU Accumulators button: 

Function

This view object allows you to monitor and modify the following data:

- **Accumulators**: Allows you to monitor the contents of the CPU accumulators. The view object displays four accumulator fields to also accommodate programs for the S7-400 CPU; Programs for the S7-300 CPU use only two accumulators.
- **Status word**: Allows you to monitor the bits of the status word.
- **Address registers**: Allows you to monitor the contents of the two address registers (AR1 and AR2). These address registers are used for the indirect addressing of data.

5.3 Block Regs View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **View > Block Registers**
- Click the Block Registers button: 

Function

This view object allows you to monitor the contents of the data block address registers (DB1 and DB2). This view object also displays the number of the current logic block and the previous logic block, along with the number of the instruction (step address counter, or SAC) for each block.

5.4 Nesting Stacks View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **View > Stacks**
- Click on the "Stacks" symbol: 

Function

This view object allows you to monitor information stored in the following stacks of the CPU:

- The nesting stack stores up to seven entries. For each entry, the nesting stack stores the states of the RLO and OR bits of the status word. An entry in the nesting stack is made for each instruction that starts a new logic string. These instructions are: And (A), And Not (AN), Or (O), Or Not (ON), Exclusive Or (X), and Exclusive Or Not (XN).
- The MCR stack stores up to eight levels of nesting for a master control relay (MCR). Each level shows the status of the RLO bit for an MCR instruction, which begins an MCR area.

5.5 Input Variable View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Input Variable**
- Click the Insert Input Variable button: 

Note

The CPU reacts immediately to any changes made with this view object. (Any modifications made with a STEP 7 variable table take effect at the proper time in the CPU scan: Inputs are read at the beginning of the scan, and outputs are written at the end.)

Function

This view object allows you to monitor and modify the following data:

- **Peripheral (external) input variables**: You can access the peripheral input (PI) memory areas of the CPU. S7-PLCSIM displays a yellow background for the view object if the variable address corresponds to F-System peripheral I/O.
- **Process input images**: You can access the input (I) memory areas of the CPU. By default, the CPU overwrites the I memory with the PI memory at the beginning of every scan. If you change an I memory value, the simulation immediately copies the changed value to the peripheral area. This way, the desired change is not lost when the peripheral value overwrites the process input value on the next scan.

Note

You can choose the numeric data format for the input variable and you can also use symbolic addressing if you have attached symbols. You can also view input variables with a Vertical Bits View Object.

Display of S7-300 PIs and PQs is not supported by S7-PLCSIM if connected via a CP card

S7-PLCSIM cannot display PIs and PQs for a simulated S7-300 if the PIs and PQs are connected via a CP card. The configuration of a CP card of a S7-300 differs from a S7-400. S7-PLCSIM only supports the CP card configuration of a S7-400.

5.6 Output Variable View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Output Variable**
- Click the Insert Output Variable button: 

Note

The CPU reacts immediately to any changes made with this view object. (Any modifications made to a STEP 7 variable take effect at the same time in the CPU scan: Inputs are read at the beginning of the scan, and outputs are written at the end.)

Function

This view object allows you to monitor and modify the following data:

- **Peripheral (external) output variables**: You can access the peripheral output (PQ) memory areas of the CPU. Any change to a PQ memory value immediately updates the corresponding output (Q) memory value. S7-PLCSIM displays a yellow background for the view object if the variable address corresponds to F-System peripheral I/O.
- **Process output images**: you can access the output (Q) memory areas of the CPU. During the scan cycle, the program calculates output values and places them in the process-image output table. At the end of the scan cycle, the operating system reads the calculated output values from this table and sends them to the process outputs. The process output image table maps the first 512 bytes (CPU-dependent) of the peripheral output memory.

Note

You can choose the numeric data format for the output variable and you can also use symbolic addressing if you have attached symbols. You can also view output variables with a Vertical Bits View Object.

Display of S7-300 PIs and PQs is not supported by S7-PLCSIM if connected via a CP card

S7-PLCSIM cannot display PIs and PQs for a simulated S7-300 if the PIs and PQs are connected via a CP card. The configuration of a CP card of a S7-300 differs from a S7-400. S7-PLCSIM only supports the CP card configuration of a S7-400.

5.7 Bit Memory View Object

To access this view object, do one of the following:

- Choose the menu command **Insert > Bit Memory**
- Click on the Insert Bit Memory button: 

Function

This view object allows you to monitor and modify bit memory:

- variables that are stored in the bit memory (M) area of the CPU.
- The bit memory (M) area provides storage for interim results calculated in the program.
- Data format to be used to access the data

Note

You can choose the numeric data format for the bit memory and you can also use symbolic addressing if you have attached symbols. You can also view bit memory with a Vertical Bits View Object.

5.8 Timer View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Timer**
- Click the Insert Timer button: 

Function

This view object allows you to monitor and modify any timer used by your program. The timer view object displays the name of the timer, the actual timer value, and the time base.

Note

If you change the time base, the actual timer value changes, while the displayed value remains the same. This is because the actual timer value is the product of the displayed value and the time base. For example, if the value of timer T 0 is 600 and the time base is 10 ms, this represents a timer of 6 seconds. If you change the time base to 100 ms, then the actual timer value becomes 60 seconds. (600 * 100 ms = 60 seconds)

You can use symbolic addressing for the timers if you have attached symbols. You can also configure the timers to be under either automatic or manual control. Use the commands on the "Execute" menu for this.

5.9 Counter View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Counter**
- Click the Insert Counter button: 

Function

This view object allows you to monitor and modify the counters used by your program. This view object opens with a default memory location of C 0.

You can choose the numeric data format for the counter and you can also use symbolic addressing if you have attached symbols.

5.10 Generic View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Generic**
- Click the Insert Generic Variable button: 

Result: The view object "Variable" is opened.

Function

This view object allows you to monitor and modify the following data:

- Peripheral (external) input and output variables: you can access the peripheral input (PI) and peripheral output (PQ) memory areas of the CPU. S7-PLCSIM displays a yellow background for the view object if the variable address corresponds to F-System peripheral I/O.
- Process-image input and output variables: You can access the input (I) and output (Q) memory areas of the CPU. By default, the CPU overwrites the I memory with the PI memory at the beginning of every scan. If you change an I memory value, the simulation immediately copies the changed value to the peripheral area. This way, the desired change is not lost when the peripheral value overwrites the process input value on the next scan.
- Bit memory: You can access the variables stored in the bit memory (M) area of the CPU.
- Timers and counters: You can access the timers and counters used by the program.
- Data blocks: You can access the data stored in the data blocks of the program, for example, DB1.DBX 0.0 or DB1.DBW 0.

The CPU reacts immediately to any changes made with this view object. Any modifications made with a STEP 7 variable table take effect at the proper time in the CPU scan; Inputs are read at the beginning of the scan, and outputs are written at the end.

You can choose the numeric data format for the generic variable and you can also use symbolic addressing if you have attached symbols.

5.11 Vertical Bits Variable View Object

To add this view object to a simulation, do one of the following:

- Choose the menu command **Insert > Vertical Bits**
- Click the Insert Vertical Bits button: 

Result: The view object "Variable" is opened.

Function

You can use the Vertical Bits view object with bit or byte addresses. You can see the symbolic or absolute addresses of all bits in the "Vertical Bits" view object. You can monitor and control the following data:

- Peripheral (external) input and output variables: You can access the peripheral input (PI) and peripheral output (PQ) memory areas of the CPU. S7-PLCSIM displays a yellow background for the view object if the variable address corresponds to F-System peripheral I/O.
- Process-image inputs and outputs: You can access the input (I) and output (Q) memory areas of the CPU. By default, the CPU overwrites the I memory with the PI memory at the beginning of every scan. If you change an I memory value, the simulation immediately copies the changed value to the peripheral area. This way, the desired change is not lost when the peripheral value overwrites the process input value on the next scan.
- Bit memory: you can access the variables stored in the bit memory (M) area of the CPU.
- Data blocks: you can access the data stored in the data blocks of the program.

The CPU reacts immediately to any changes made with this view object. Any modifications made to a STEP 7 variable take effect at the same time in the CPU scan. inputs are read at the beginning of the scan, and outputs are written at the end. You can use symbolic addressing if you have attached symbols for variables represented with a Vertical Bits view object.

Error and Interrupt OBs

6

Introduction

S7-PLCSIM supports the following interrupt and error OBs:

- OB40 to OB47 (Page 60) (hardware interrupt)
- OB70 (Page 61) (I/O redundancy error) {417-H systems only}
- OB72 (Page 62) (CPU redundancy error) {417-H systems only}
- OB73 (Page 63) (communication redundancy error) {417-H systems only}
- OB80 (Page 64) (time error)
- OB82 (Page 64) (diagnostic interrupt)
- OB83 (Page 66) (insert/remove module)
- OB85 (Page 67) (priority class error)
- OB86 (Page 68) (rack failure)

Procedure

To trigger the simulation of one of these OBs, proceed as follows:

1. Choose the menu command **Execute > Trigger Error OB**.
2. Select the desired OB or OB group.

   The OBs that are available depend on the hardware configuration loaded in the simulation.

   Note

   If an OB dialog is already open, changed system data that have been loaded in the simulation will not be taken into consideration. To cause the OB to use the changed data, you must close the OB dialog and reopen it.

6.1 Logical base addresses

Function

Logical addresses will be used as identification addresses of modules. The following OBs require the logical address of an input or output module in order to be able to identify them:

- OB40 - OB 47
- OB82
- OB83
- OB86

Definition

A logical address is the smallest address of an inserted module that can be configured in STEP 7 HW Config. The logical base address is always the smallest integer address.

Logical address for different module types

The inserted modules have 32 bits. This corresponds to 4 bytes

The logical address is always the smallest address of a module:

- Input module = smallest input address
- Output module = smallest output address
- I/O module = smallest input address

6.2 Hardware Interrupt (OB40-OB47)

This dialog allows you to trigger an interrupt OB and test the program that you downloaded in OB40 to OB47.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Description
Module Address	OB4x_MDL_ADDR	WORD	Logical base address of the module that triggers the interrupt.
Module status	OB4x_POINT_ADDR	DWORD (Hex)	In the case of digital modules: bit field with the status of the inputs on the module. (Bit 0 corresponds to the first input.) For analog modules, CPs or FMs: interrupt status of the module (irrelevant to user).
Interrupt OB (read-only)	OB4x_OB_NUMBR	BYTE	OB number (40 to 47).

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.3 I/O Redundancy Error (OB70)

This dialog allows you to trigger a loss of redundancy on the PROFIBUS-DP which calls the OB70. The menu command for opening this dialog can only be selected if the configuration of an H-CPU is loaded in the simulation.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter (Input/Output)	Variable	Data type	Description
Error Event Class	OB70_EV_CLASS	BYTE	Event class and IDs: * B#16#72: Incoming event * B#16#73: Outgoing event
Error Code	OB70_FLT_ID	BYTE	Error code (possible values): * B#16#A2 * B#16#A3

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

Also enter the following parameters:

- DP Master Base Address
- DP Master System ID
- DP Slave Base Address
- DP Station Number

The field entries must match the values in the STEP 7 hardware configuration of the simulated CPU.

Note

The DP Slave Base Address, DP Station Number, and the Input/Output selection are only available for Error Code 0xA3.

6.4 CPU redundancy error (OB72)

This dialog allows you to trigger a CPU loss of redundancy which calls the OB72. The menu command for opening this dialog can only be selected if the configuration of an H-CPU is loaded in the simulation. The operating system of the H CPU calls OB72 when one of the following events occurs:

- Loss of redundancy on the CPUs
- Reserve-master switchover
- Synchronization error
- Error in a SYNC module
- Data update abort
- Comparison error (e.g. RAM, PAA)

OB72 is executed by all H CPUs that are in the RUN mode following a suitable start event.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	ID
Error Event Class	OB72_EV_CLASS	B#16#73
		B#16#75
		B#16#78
		B#16#79
Error Code	OB72_FLT_ID	see fault ID table

OB72 Fault IDs (Error Codes)

The error code in OB72_FLT_ID indicates which event occurred that caused the OB72 call:

OB72_FLT_ID	Start Event of OB72
B#16#01	Loss of redundancy (1 of 2) due to a CPU failure
B#16#02	Loss of redundancy (1 of 2) due to STOP on the reserve triggered by user
B#16#03	H system (1 of 2) changed to redundant mode
B#16#20	Error in RAM comparison
B#16#21	Error comparing process image output value
B#16#22	Error comparing memory bits, timers, or counters
B#16#23	Different operating system data recognized
B#16#31	Standby-master switchover due to master failure
B#16#33	Standby-master switchover due to operator intervention
B#16#34	Standby-master switchover due to sync module connection problem
B#16#35	Standby-master switchover triggered by 90 "H_CTRL"
B#16#40	Synchronization error in user program due to elapsed wait time
B#16#41	Synchronization error in user program due to waiting at different synchronization points

OB72_FLT_ID	Start Event of OB72
B#16#42	Synchronization error in operating system due to waiting at different synchronization points
B#16#43	Synchronization error in operating system due to elapsed wait time
B#16#44	Synchronization error in operating system due to wrong data
B#16#50	Missing SYNC module
B#16#51	Modification at SYNC module without Power On
B#16#52	SYNC module removed/inserted
B#16#53	Modification at SYNC module without reset
B#16#54	SYNC module: rack number assigned twice
B#16#55	SYNC module error/eliminated
B#16#56	Unauthorized rack number set on SYNC module
B#16#C1	Data update abort
B#16#C2	Abort of update attempt because a monitoring time was exceeded during the *n*th attempt (1 <= *n* <= maximum possible number of update attempts after an abort due to the monitoring time being exceeded)

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.5 Communication Redundancy Error (OB73)

This dialog allows you to trigger a loss of redundancy for a fault-tolerant S7 connection. The menu command for opening this dialog can only be selected if the configuration of an H-CPU is loaded in the simulation.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Description
Error Event Class	OB73_EV_CLASS	BYTE	Possible value of B#16#73 (loss of redundancy in communication) or B#16#72 (problem eliminated)
Error Code	OB73_FLT_ID	BYTE	Possible value of B#16#E0

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.6 Time Error (OB80)

This dialog allows you to trigger a time error which calls the OB80.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Description
Cycle time exceeded	OB80_FLT_ID	BYTE	Error code: B#16#01
Requested OB is still being processed	OB80_FLT_ID	BYTE	Error code: B#16#02
OB call buffer overflow for the current priority class	OB80_FLT_ID	BYTE	Error code: B#16#07
Expired time of day interrupt:			
* Due to a time jump	OB80_FLT_ID	BYTE	Error code: B#16#05
* on return to RUN after STOP	OB80_FLT_ID	BYTE	Error code: B#16#06

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.7 Diagnostic interrupt (OB82)

This dialog allows you to trigger a diagnostic interrupt which calls the OB82.

Error conditions

Default Tests: (Optional) In this drop-down box, choose from the list to set the fault conditions for the desired test automatically.

For all fault conditions the event class (OB82_EV_CLASS) is set to B#16#39 (incoming event) and OB82_FLT_ID uses the error code B#16#42. If no fault condition is selected (Module OK), the event class is set to B#16#38 (outgoing event).

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Module Address

The module address in which the error occurred is the logical base address of the module: it is the first input, if any; otherwise first output address. (Example: PIB 0)

Parameter	Variable	Data type
Module Address	OB82_MDL_ADDR	Int

Error conditions

Check the appropriate check boxes to enable the following fault conditions:

Parameter Check box	Variable	Data type
Module defect (*read-only*)	OB82_MDL_DEFECT	BOOL
Internal error	OB82_INT_FAULT	BOOL
External error	OB80_EXT_FAULT	BOOL
Channel error	OB82_PNT_INFO	BOOL
External auxiliary supply missing	OB82_EXT_VOLTAGE	BOOL
Front panel connector not plugged in	OB82_FLD_CONNCTR	BOOL
Module not configured	OB82_NO_CONFIG	BOOL
Incorrect parameters on module	OB82_CONFIG_ERR	BOOL
Channel information available	OB82_MDL_TYPE	BYTE (Bit 4)
User information available	OB82_MDL_TYPE	BYTE (Bit 5)
Diagnostic interrupt from substitute	OB82_MDL_TYPE	BYTE (Bit 6)
User module is missing or has an error	OB82_SUB_MDL_FAULT	BOOL
Communication problem	OB82_COMM_FAULT	BOOL
Operating mode is STOP	OB82_MDL_STOP	BOOL
Watchdog timer responded	OB82_WTCH_DOG_FLT	BOOL
Internal power supply failed	OB82_INT_PS_FLT	BOOL
Battery exhausted	OB82_PRIM_BATT_FLT	BOOL
Entire backup failed	OB82_BCKUP_BATT_FLT	BOOL
Expansion rack failure	OB82_RACK_FLT	BOOL
Processor failure	OB82_PROC_FLT	BOOL
EPROM fault	OB82_EPROM_FLT	BOOL
RAM fault	OB82_RAM_FLT	BOOL
ADC/DAC error	OB82_ADU_FLT	BOOL
Fuse tripped	OB82_FUSE_FLT	BOOL
Hardware interrupt lost	OB82_HW_INTR_FLT	BOOL

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.8 Insert/Remove Module Interrupt (OB83)

This dialog allows you to trigger an insert/remove interrupt which calls the OB83.

Error conditions

For all fault conditions, the event class (OB83_EV_CLASS) is set to B#16#39 (incoming event). If no fault condition is selected (Module OK), the event class is set to B#16#38 (outgoing event).

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Value / Description
Module removed or not responding	OB83_FLT_ID	BYTE	B#16#61
Module inserted: module type OK	OB83_FLT_ID	BYTE	B#16#61
Module inserted: incorrect module type	OB83_FLT_ID	BYTE	B#16#63
Module inserted: type ID cannot be read	OB83_FLT_ID	BYTE	B#16#64
Module inserted: error in module parameter assignment	OB83_FLT_ID	BYTE	B#16#65
Module Address	OB83_MDL_ADDR	WORD	Logical base address of the module affected. If it is a mixed module, it is the smallest logical address used in the module. If the I and O addresses in the mixed block are equal, the logical base address is the one that receives the event identifier. Example: PQW 0

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.9 Priority Class Error (OB85)

This dialog allows you to trigger a program sequence error which calls the OB85. The OB85 is automatically triggered if an error occurs while the operating system is accessing a block (error code B#16#A3).

Note that events B#16#A1, B#16#A2, B#16#B1, and B#16#B2 must be generated by other means, for example, by deleting one of the required blocks from your program.

Programmable parameters

The parameters that you select with this dialog are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Value
Integrated function:	OB85_Z1	WORD	
No error resolution			W#16#0100
Block not loaded			W#16#0101
Range length error			W#16#0102
Write protect error			W#16#0103
IEC timer:	OB85_Z1	WORD	
No error resolution			W#16#0200
Block not loaded			W#16#0201
Range length error			W#16#0202
Write protect error			W#16#0203

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

6.10 Rack Failure (OB86)

This dialog allows you to trigger a rack failure which calls the OB86.

Error conditions

For all fault conditions the event class (OB86_EV_CLASS) is set to B#16#39 (incoming event). If no fault condition is selected (Rack Return, Rack Return with Discrepancy, DP Station Return and DP Station OK), the event class is set to B#16#38 (outgoing event).

The two tabs of the dialog provide the following options:

- Expansion Rack FailureTab
- DP Failure Tab

Expansion Rack FailureTab

The parameters that you select in this tab are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Value
IM address	OB86_MDL_ADDR	WORD	Address of the interface module to which expansion racks are connected.
Failure	OB86_FLT_ID	BYTE	B#16#C1
Return	OB86_FLT_ID	BYTE	B#16#C1
Return with discrepancy	OB86_FLT_ID	BYTE	B#16#C2
Expansion Rack operational again but error in module parameter assignment	OB86_FLT_ID	BYTE	B#16#C6
Rack Status	OB86_RACKS_FLTD	ARRAY OF BOOL	Shows the status of up to twenty-one expansion racks connected to the interface module (IM). In the array, you must select the rack with the fault conditions. Green = Good Red = Fault Gray = Not configured

DP Failure Tab

This tab allows you to trigger faults in the DP system and view the status of the DP under various error conditions. The parameters that you select in this tab are passed to the following variables when the OB is called:

Parameter	Variable	Data type	Value
Subnet	OB86_MDL_ADDR	WORD	Logical base address of the DP master system.
Failure of DP master system	OB86_FLT_ID	BYTE	B#16#C3
Station failure	OB86_FLT_ID	BYTE	B#16#C4
Station return	OB86_FLT_ID	BYTE	B#16#C4
All station return	OB86_FLT_ID	BYTE	B#16#C4 Triggers a "station return" for all faulty DP slaves. No message is issued.
Station operational again but error	OB86_FLT_ID	BYTE	B#16#C7
Station return with discrepancy	OB86_FLT_ID	BYTE	B#16#C8
DP Status	OB86_RACKS_FLTD	ARRAY OF BOOL	Shows the status of up to 126 DP stations. In the array, you must select the rack with the fault conditions. Green = Good Red = Fault Gray = Not configured

For further information, refer to the STEP 7 Help on Organization Blocks help system or to the *SIMATIC System Software for S7-300/400 System and Standard Function*s manual.

Reference information

7

7.1 Icons and menu commands

S7-PLCSIM Menu Commands

Icon	Toolbar	Menu command	Description
		Simulation	
	Standard	File > New PLC	Generates a new instance with a new CPU in original state.
	Standard	File > Open PLC	Closes the current simulation and generates a new CPU from the saved data in the same instance.
		File > Close PLC	Closes the current simulation and generates a new CPU in the original state in the same instance.
	Standard	File > Save PLC	Saves the current simulation.
		File > Save PLC As	Saves the current simulation under a new name.
		File > Open Layout	Opens a saved layout.
		File > Close Layout	Closes the current layout.
		File > Save Layout	Saves the current arrangement as a layout.
		File > Save Layout As	Saves the current layout under a new name.
		File > Recent Simulation	Opens a recent simulation.
		File > Recent Layout	Opens a recent layout.
		File > Exit	Closes all the windows of the application and exits the application.
		Edit	
		Edit > Undo	Undoes the last action.
	Standard	Edit > Cut	Deletes the selected objects and saves them to the clipboard.
	Standard	Edit > Copy	Copies the selected objects and saves them to the clipboard.
	Standard	Edit > Paste	Inserts the contents of the clipboard at the cursor position.

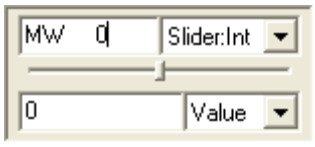
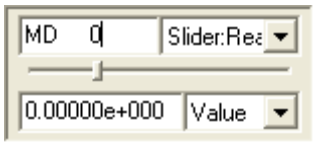
Icon	Toolbar	Menu command	Description
		View	
	Insert an object	View > Accumulators	Displays Accumulators 1 to 4 and the status word.
	Insert an object	View > Block Registers	Displays the address registers and data blocks registers.
	Insert an object	View > Stacks	Displays the MCR stacks and nesting stacks.
		View > Toolbars	Displays specific toolbars (on/off).
		View > Status Bar	Displays the status bar (on/off).
	Standard	View > Always On Top	Always displays the simulation on top.
		Insert	
	Insert an object	Insert > Input Variable	Displays an input variable.
	Insert an object	Insert > Output Variable	Displays an output variable.
	Insert an object	Insert > Bit Memory	Displays a bit memory.
	Insert an object	Insert > Timer	Displays a timer.
	Insert an object	Insert > Counter	Displays a counter.
	Insert an object	Insert > Generic	Displays a numeric display.
	Insert an object	Insert > Vertical Bits	Displays a byte.
		Target system	
		PLC > Power On	Turns on the PLC.
		PLC > Power Off	Turns off the PLC.
		PLC > Clear/Reset	Deletes the control program and variable memory.
		Execute	
		Execute > Key Switch Position	Puts the key switch of the CPU in the selected mode.
		Execute > Startup Switch Position	Sets the startup switch position.
 	CPU Mode	Execute > Scan Mode	Sets the mode.
	CPU Mode	Execute > Next Scan	Runs the next scan.
	CPU Mode	Execute > Pause	Halts the program immediately.
		Execute > Automatic Timers	Sets all timers to automatic mode.
		Execute > Manual Timers	Sets all timers to manual mode.
	CPU Mode	Execute > Reset Timers	Resets one or all timers.
		Execute > Trigger Error OB	Triggers an error OB.
		Execute > Scan Cycle Monitoring	Is used to set and activate the scan cycle monitoring time.

Icon	Toolbar	Menu command	Description
		Tools	
	Record/ playback files	Tools > Record/Playback	Record or play back a series of events.
	Standard	Tools > Options > Attach Symbols	Searches for the symbol table of the downloaded program.
		Tools > Options > Show Symbols	Displays the symbol of a variable.
		Tools > Options > Reference Data	Displays current reference data for the current program.
		Tools > Options > Symbol Table	Opens the current symbol table.
		Window	
	Standard	Window > Cascade	Arranges all of the open windows so that they are overlapping.
	Standard	Window > Tile Ordered	Arranges all of the open windows in a logical order.
		Window > Arrange Icons	Arranges the symbols along the bottom edge of the window.
		Window > 1,2,3 ... 9	Activates a view object that is already open.
		Help	
		Help > Contents	Displays the index of help topics.
		Help > Introduction	Describes the functional scope of this application.
		Help > Getting Started	Describes the essential steps for using this application.
		Help > Using Help	Displays information about using the Help.
		Help > About	Displays information about the current version of this application.
	Standard		Displays help on buttons, menus and dialogs.

7.2 S7-PLCSIM Numeric Data Formats

Supported Numeric Data Formats

Refer to the table below for the numeric data formats supported by S7-PLCSIM.

Numeric Data Formats	Size	Example
Bit	Bit, Byte	☐ = off, ☑ = on
Binary	Byte, Word	1001_0011
Decimal	Byte, Word, Double Word	232
Hex (Hexadecimal)	Byte, Word, Double Word	9A
S7 format	Byte, Word, Double Word	dw#16#9a2ff23
Integer	Word, Double Word	632, –2370
BCD (Binary-coded Decimal)	Word, Double Word	400
Real	Double word	1.234567e+023
Char (Character)	Byte, Word, Double Word	'C', 'AB'
String	254 Alphanumeric Characters	This is a string
DT (DATE_AND_TIME)	8 bytes	2006-12-25-08:01:01 **Note:** The DT numeric data format is does not support milliseconds. If all 8 bytes are 0, the default DT display is: 1999-11-30-00:00:00.
S5TIME	WORD	3m5s00ms
Date	WORD	1998-06-18
Timer	Double word	9h26m53s703ms
TOD	Double word	9:26:53.702
Slider: Dec	Byte, Word, Double Word	
Slider: Int	Word, Double Word	
Slider: Real	Double word	

7.3 Troubleshooting Tips

Problems and Recommended Corrective Actions

The following table describes some problems that you can encounter when using S7-PLCSIM. The possible causes of the problem and recommended corrective actions are listed.

Problem	Possible Causes and Corrections
Your program does not download to the simulated CPU.	Verify that the CPU is in either STOP mode or RUN-P mode. You cannot download your program if the simulated CPU is in RUN mode, unless you have configured CiR (Configuration in RUN) elements in STEP 7. CiR objects are the only objects that can be downloaded to S7-PLCSIM in RUN mode.
	If your program contains a System Data Block (SDB), verify that the CPU is in STOP mode. As with a real CPU, you can download SDBs only when the CPU is in STOP mode. **Note:** If the CPU view object is in RUN-P mode, STEP 7 prompts you to change to STOP mode so that the hardware configuration can be downloaded.
	Verify that the CPU and the program use the same node address and subnet name. The node address defined for the program must match the node address of the CPU.
When you attempt to close the simulated CPU, a message alerts you that there is a connection open.	If you attempt to close the simulated CPU while one of the STEP 7 tools (such as S7 Status) is monitoring the program, STEP 7 alerts you to disconnect the STEP 7 tool from the simulated CPU. Always disconnect any STEP 7 tool by turning off the monitoring of the program status or by closing the tool before closing the simulated CPU.
The S7-PLCSIM application does not respond and appears to be "locked up."	Check the execution mode. S7-PLCSIM can appear to be locked up when paused or in Single Scan mode.
You enter a peripheral variable and get an "Invalid Address" error, even though the address value is valid. **- or -** You get a peripheral access error in your program, even though your S7-300 project contains the correct configuration.	Only the CPU 315-2DP, CPU 316-2DP, and CPU 318-2 CPUs download an I/O configuration. If you download a program from another S7-300 CPU, the system data does not include the I/O configuration. This causes errors when you attempt to access peripheral I/O in S7-PLCSIM. To avoid these errors, first of all create a hardware configuration with configured I/O modules in the system data. This way you can define which CPU modules should be made available. To do this, create a project and configure a S7-300 CPU in which the I/O are not automatically configured, e.g. the CPU 315-2DP, CPU 316-2DP or the CPU 318-2. Download this hardware configuration to the S7-PLCSIM. Then you can download the program blocks from any S7 programs. The I/Os are applied error/free.
Scan exceeded with cyclic interrupts	When simulating systems you must ensure that there is sufficient time between the start events of the individual cyclic interrupt OBs for processing the cyclic interrupts. It may be necessary to extend the intervals of the cyclic interrupts proportionally.

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