SIEMENS

SIMATIC

STEP 7 (TIA Portal)
Global library "Sample Library for Instructions"

Installation Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Disclaimer

Note

The examples are non-binding and do not claim to be complete in terms of configuration and equipment or any other eventualities. The examples do not represent customer-specific solutions but are merely intended as an aid to better understand the functions of the instructions in the TIA Portal.

You are solely responsible for proper operation of the described products. These examples do not relieve you of your obligation for safe handling during application, installation, operation and maintenance.

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We do not guarantee the contents of this document.

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Global library "Sample Library for Instructions"

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Basic information on the library

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This installation manual supports you in the use of the global library "Sample Library for Instructions".

Requirements

- Hardware:
  - S7-1500 CPU with firmware version V1.8 or later (or V2.0 or later)
  - or S7-1200 CPU with firmware version V4.1 or later
- Software:
  - SIMATIC STEP 7 Professional V15.1 (TIA Portal) or higher
  - or SIMATIC STEP 7 Basic V15.1 (TIA Portal) or higher

Note

Supported CPU and firmware version

The supported CPU is specified in the folder names of the instructions in the library. The firmware version is also specified for instructions which require at least a S7-1500 CPU with firmware version V2.0.

Note

Instructions not supported

It is possible to insert an example into a CPU, even if the CPU does not support one or more of the instructions. If an instruction in the example is not supported by the CPU, you will recognize this because:

- The affected instruction is displayed in red in the network.
- In the block called by the instruction, under "Information > Syntax" you will find the error message: The block is not supported by the CPU used.
- The same message is output at compilation.

Solution:

1. Open the comment area of the block for the example. Take note of the specified prerequisites for using the example.
2. Insert the example into a CPU with the specified or later firmware version.

Introduction to the library

The global library "Sample Library for Instructions" includes program examples for the instructions in the TIA Portal. Every sample program example has an instruction or a group of instructions for TIA Portal as subject.

The program examples were created in the programming language LAD or SCL. In the folder names of the library, the programming language is designated in English with "LAD".

Use the program examples to gain a better understanding of the functionality of the instructions in TIA Portal or to save work effort. The TIA Portal information system always offers you additional information on the used instructions as well as program examples.

The library is expanded further with each consecutive version.

Easy-to-use program examples

You can copy all program examples from the library to your CPU. To do so, download the library "Sample Library for Instructions" to TIA Portal. Using the program examples, you can try out the pre-interconnected and pre-parameterized instructions in TIA Portal. The program examples can be easily modified and extended.

You always use the program examples (program blocks) in the library in the same order:

① Sample Library for Instructions Open

② copy example

③ Call block and Compile project

Note

Adding program examples to a project correctly

Due to the differing preconditions and functions, program examples may contain not only program blocks but also other components (e.g. PLC tags, PLC data types, watch tables or the like). There are also program examples that require special hardware (multiple CPUs, distributed I/O, input modules etc.).

Please observe the following rules:

- Never simply add all program examples or the entire "Sample Library for Instructions" folder to a CPU.
- Make sure that the corresponding program example does not consist of components for multiple CPUs.
- Always add the individual components of the program examples one at a time to the appropriate project folder. Also make sure that you select the appropriate CPU.

Same structure/same name

The list of the instructions in the TIA Portal, the view in the TIA Portal information system and the structure in the "Sample Library for Instructions" are the same.

The names of the folders are in English.
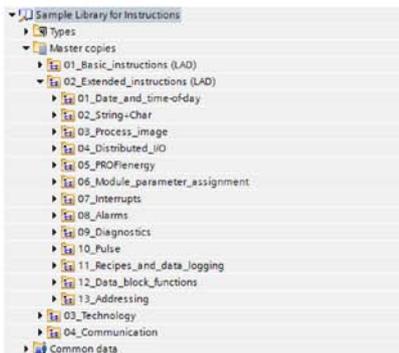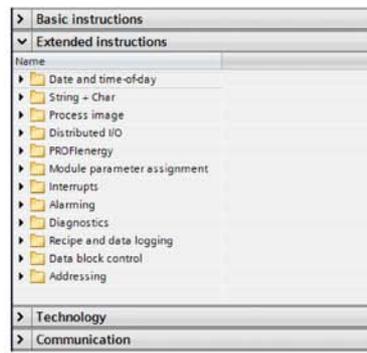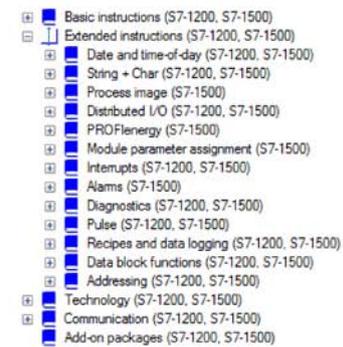
Interaction of information system and "Sample Library for Instructions"

Use the help (<F1>) in the TIA Portal to call up the documentation of the instruction as well as the description of the program example. The program examples for an instruction from the TIA Portal information system and the "Sample Library for Instructions" are identical.
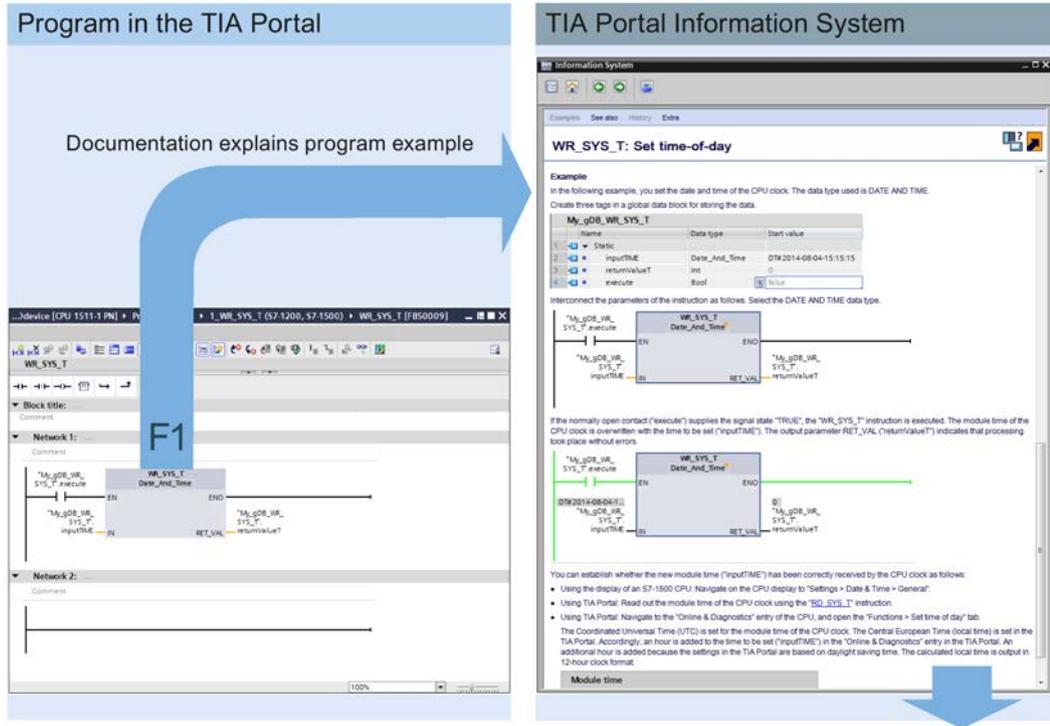
Target group

The global library "Sample Library for Instructions" and its program examples are designed for the following target groups:

Target group	**Advantages of the** Sample Library for Instructions
Beginners	• Support on how to use instructions via program examples, which are made up of pre-interconnected and pre-parameterized instructions. • The TIA Portal instructions can be easily tested without any significant extra effort. • Demonstrate the functionality of the respective instruction by using the description of the corresponding program example in the TIA Portal information system.
Advanced users, experts	• Programming support (reduced effort) via modifiable and extendable program examples.

Additional information

Additional information on the scope of the library can be found in the section "Library version (Page 21)".

Using a library

<div style="text-align: right; font-size: large;">2</div>

2.1 Downloading the library

Introduction

Below you will find the procedure for opening the "Sample Library for Instructions" library.

Requirement

The TIA Portal is open in the project view.

Procedure

To open the library, follow these steps:

1. Open the "Libraries" task card.

2. Click "Open global library".

   The "Open global library" dialog box is displayed.

3. Select the library you want to open and click "Open".

Note

The "Open as read-only" option is selected by default.
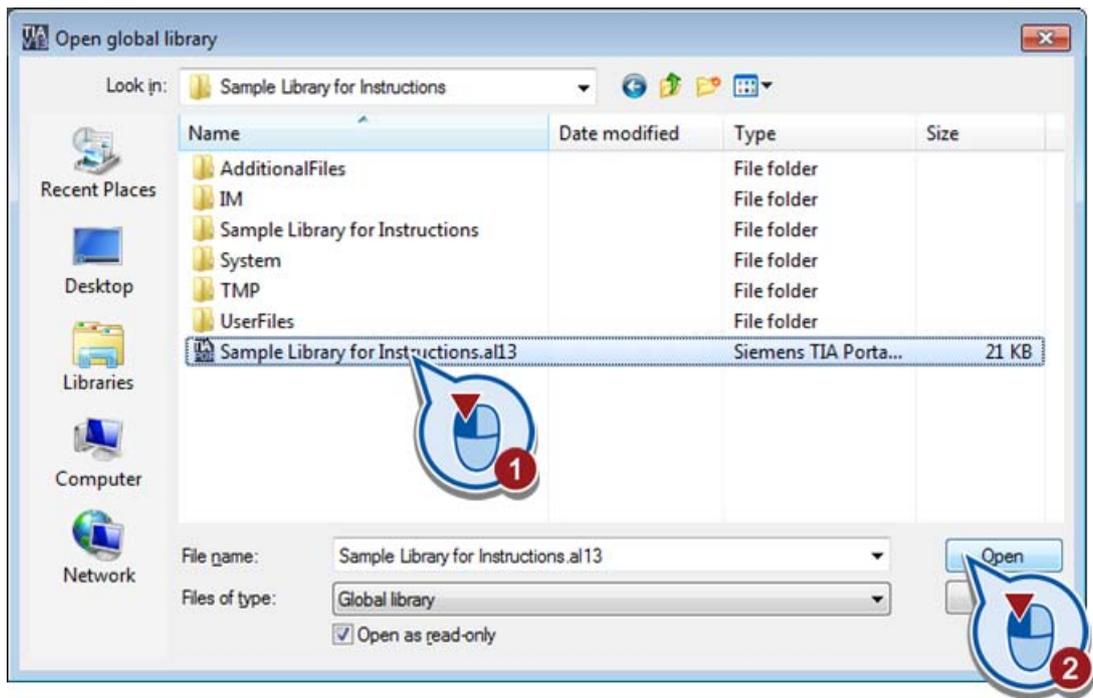
2.2   Switching the project language to English

Introduction

Below, you will find the procedure for switching the project language in the TIA Portal.

Requirement

A project as well as an S7-1500 or S7-1200 CPU has been created in the TIA Portal.

Procedure

To switch the project language to English, follow these steps:

1. In the project tree, click "Languages & Resources > Project languages".
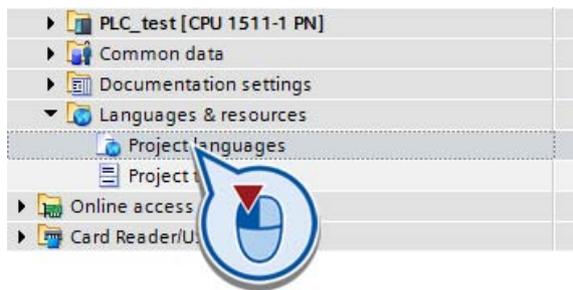
2. The desktop shows a list of all supported project languages.

    Make sure that the language "English (United States)" is enabled for use.

3. Click the drop-down list of the editing language and select "English (United States)".
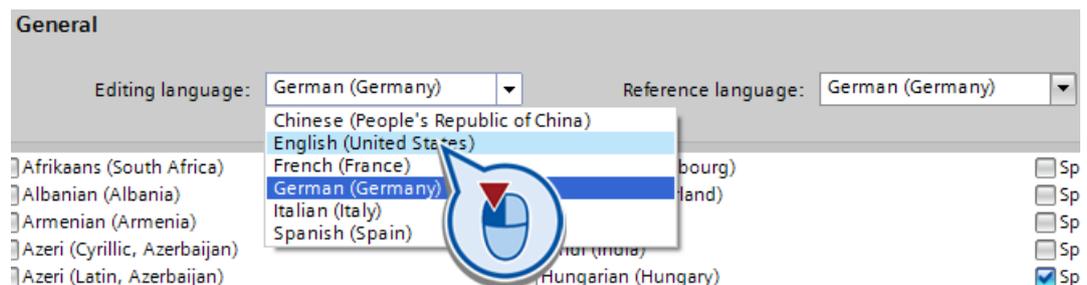
2.3 Using the examples

Introduction

Below you will find the procedure for using the program examples of the "Sample Library for Instructions" library.

Note

Possible red interconnection in the network

After the insertion of certain program examples in the project folder, the following can occur: A red interconnection is shown in the network of a block (FB, FC or OB). This is normal, because system blocks (FBs, IDBs etc.) required for the program example are not supplied in addition.

To create the missing system blocks automatically, compile the program example (see step 6). If you then open the affected block again, the interconnection is no longer marked red.


Requirement

- The "Sample Library for Instructions" library is opened in the TIA Portal.
- A project as well as an S7-1500 or S7-1200 CPU has been created in the TIA Portal.
- The project language "English (United States)" has been set.

Procedure

To use the program examples, follow these steps:

1. Go to the required example in the folder hierarchy of the library.
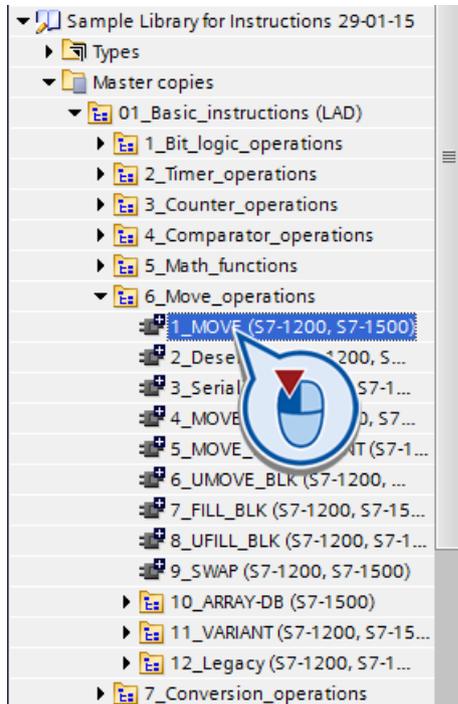
2. Use drag-and-drop to drag the folder object of the required example to your "Program blocks" project folder.
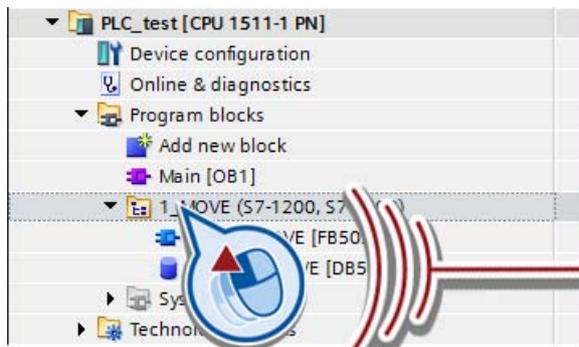
3. If the example includes additional objects:

   Use drag-and-drop to drag the additional objects according to their type to the matching folder of your project.

4. If the prerequisites (hardware created, hardware configured) are to be fulfilled for the example:

   Follow the instructions in the documentation of the example (<F1>). You can find this information in the comment area (usually in network 1) of a program block of the example.

5. Call the function / the function block of the example in your user program*.

Note

*Call environment

The call environment for testing is usually comes from a cycle OB (OB1), unless the documentation of the example specifies otherwise.

Note

Examples with multiple functions / function block

For more complex examples, the underlying program blocks are hidden in a "Details" folder. The top function (FC) / function block (FB) can therefore be recognized by the fact that the block is on the same level as the "Details" folder. In addition, the top FC/FB usually carries the name of the instruction.

If the example contains a block with the abbreviation "Call_" (for example "_FB_FBCall_"), this is the top FC / FB.

Adhere to the following procedure:

1. Open the top FC / FB and look for a description of the block call in the comment area (usually in network 1).
2. Call the described FC / FB in the described OB.
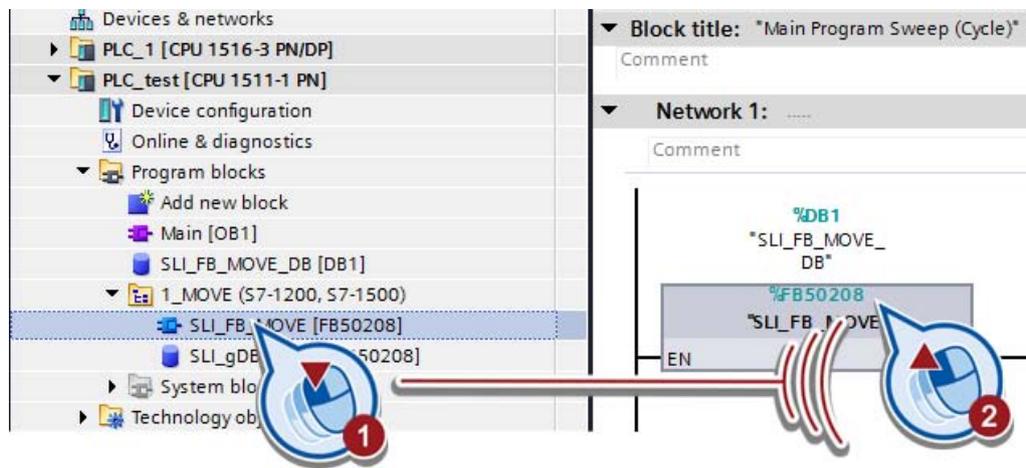
6. Compile the project and download it to the CPU.
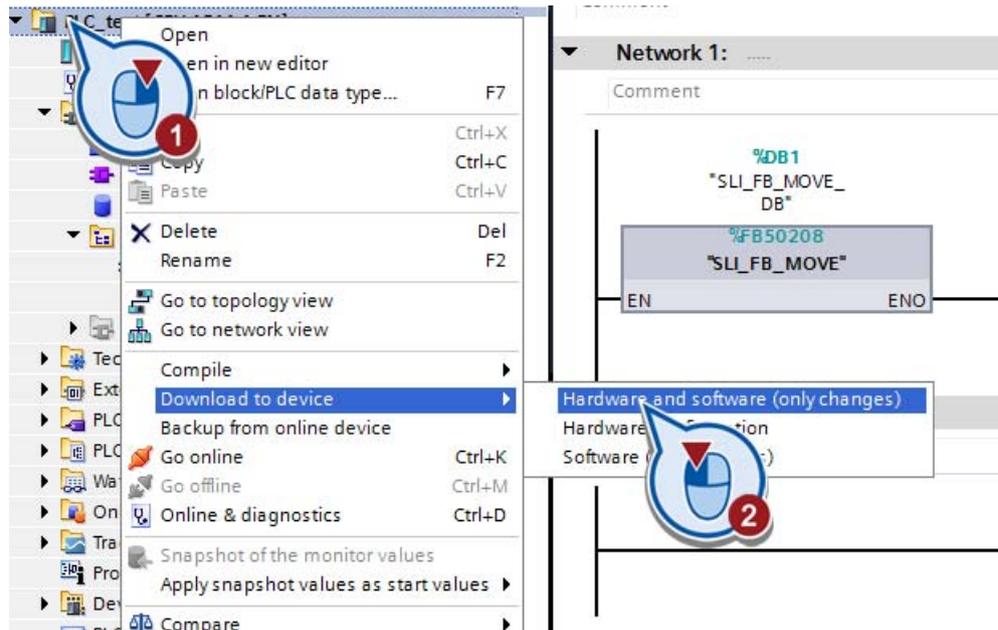
7. Test the example in online mode.

Note

The examples usually include an NO contact so that they do not start up automatically after download to the CPU. The NO contact must be set to TRUE for the program example to be processed.

Library version

<div style="text-align: right; font-size: 3em;">A</div>
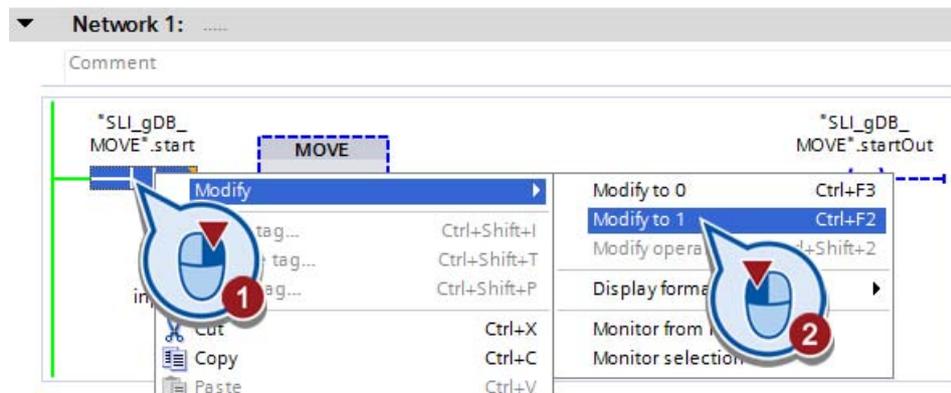
Below you will find the versions and the scope of the version of the "Sample Library for Instructions" library.

Note

You will find the version in the properties of the "Sample Library for Instructions" library.

Versions

Version	Description		
	Change	Instruction category (*)	Program example (*)
1.0.4	Modified	Basic instructions (LAD)	Comments and block numbers changed for:
			Bit logic operations (complete)
			Move operations (complete)
			Conversion operations (complete)
			Program control operations (Runtime control)
			Legacy (DRUM, DCAT, MCAT, LEAD_LAG)
		Extended instructions (LAD)	Block numbering changed and comments in the DB extended for:
			Distributed IO (RDREC for Diag)
			Interrupts (complete)
			Alarms (Program_Alarm, Get_AlarmState, Gen_UsrMsg)
			Diagnostics (complete)
			Data block functions (complete)
			Addressing (complete)
			Functional scope extended for:
			Data Logging (complete)
		Basic instructions (SCL)	Comments and block numbers changed for:
			Bit logic operations (complete)
			Timer operations (complete)
			Counter operations (complete)
			Math functions (complete)
			Conversion operations (complete)
			Legacy (DRUM, DCAT, MCAT, LEAD_LAG)

Version	Description		
	Change	Instruction category (*)	Program example (*)
	New	Basic instructions (LAD)	Comparator operations > Variant (EQ_TypeOfDB, NE_TypeOfDB)
			Move operations (AssignmentAttempt)
			Program control operations > Runtime control (ENDIS_PW, RE_TRIGR, STP, WAIT)
		Extended instructions (LAD)	String+Char (ATH, HTA)
		Basic instructions (SCL, LAD)	Move operations (SCATTER, SCATTER_BLK, GATHER, GATHER_BLK)
		Extended instructions (SCL)	Date and time-of-day (complete)
			String and Char (complete)
			Process Image (UPDAT_PI, UPDAT_PO)
			Distributed IO (RDREC for I&M, RDREC for Diagnostics, WRREC & RDREC for Parameter, WRREC & RDREC for ControlCfg, GETIO & SETIO, GETIO_PART & SETIO_PART, RALRM, ReconfigIOSystem)
			Module parameter assignment (RD_DPAR)
			Interrupts (complete)
			Alarms (complete)
			Diagnostics (LED, DeviceStates, ModuleStates, GET_DIAG, GET_DIAG for CPU display, RT_INFO, RD_SINFO, Get_IM_Data, GET_NAME, GetStationInfo)
			Recipe functions, Data logging (complete)
			Data block functions (READ_DBL, CREATE_DB, DELETE_DB, WRIT_DBL, ATTR_DB)
			Addressing (GEO2LOG, LOG2GEO, IO2MOD, RD_ADDR)
		Technology (SCL)	PID control (PID_Compact)
		Communication (SCL)	S7 communication (GET, PUT, USEND & URCV, BSEND & BRCV)
			Open user communication (TSEND_C & TRCV_C, TCON, TDISCON, TSEND & TRCV, TUSEND & TURCV, T_RESET, T_DIAG, T_CONFIG)
			Webserver (WWW)

Version	Description		
	Change	Instruction category (*)	Program example (*)
1.0.3	Modified	Useful tools (LAD)	HexIntBool_Converter
		Extended instructions (LAD)	Date and time-of-day,
			String and Char (GetSymbolName, GetInstanceName, GetInstancePath, GetBlockName),
			Process Image (UPDAT_PI, UPDAT_PO),
			Distributed IO (WRREC & RDREC for Parameter, GETIO & SETIO, GETIO_PART & SETIO_PART),
			Module parameter assignment (RD_DPAR),
			Interrupts (ATTACH, DETACH, Cyclic interrupt, Time-of-day interrupt, Time-delay interrupt)
			Alarms (Program_Alarm, Get_AlarmState, Gen_UsrMsg, GetAlarm & AckAlarms [V14]),
			Diagnostics (LED, DeviceStates, ModuleStates, GET_DIAG, RT_INFO, RD_SINFO),
			Recipe functions,
			Data block functions (READ_DBL, WRIT_DBL, CREATE_DB, DELETE_DB, ATTR_DB),
			Addressing (GEO2LOG, LOG2GEO, IO2MOD, RD_ADDR),
		Communication (LAD)	Webserver (WWW)
	New	Extended instructions (LAD)	String and Char (GetSymbolPath),
			Diagnostics (GetSMCinfo [V14.1], GetChecksum [V14]),
			Interrupts (MSK_FLT & DMSK_FLT & READ_ERR, DIS_IRT & EN_IRT, DIS_AIRT & EN_AIRT)
		Communication (LAD)	S7 communication (USEND & URCV, BSEND & BRCV),
			Open user communication (TCON, TDISCON, TSEND & TRCV, TUSEND & TURCV, T_RESET, T_DIAG, T_CONFIG)
		Useful tools (SCL)	HexIntBool_Converter, CMYK_TO_RGB_Converter, Sort_elements_ascending
		Basic instructions (SCL)	Bit logic operations (complete),
			Timer operations (complete),
			Counter operations (complete),
			Comparator operations (complete),
			Math functions (complete),
			Move operations (Deserialize, Serialize, MOVE_BLK, MOVE_BLK_VARIANT, UMOVE_BLK, FILL_BLK, UFILL_BLK, SWAP; Array DB; Read/write Access),
			Conversion operations (complete),
			Program control operations (complete),
			Word logic operations (complete),
			Shift and rotate (complete),
			Legacy (complete)

Version	Description		
	Change	Instruction category (*)	Program example (*)
1.0.2	Modified	Useful tools	HexIntBools_Converter
		Extended instructions	Date and time-of-day (SET_TIMEZONE)
			Move operations (SWAP)
		Technology	PID control (PID_Compact)
	New	Extended instructions	Distributed IO (RDREC for I&M, RDREC for Diagnostics, WRREC & RDREC for Parameter, WRREC & RDREC for ControlCfg, GETIO & SETIO, GETIO_PART & SETIO_PART, RALRM, ReconfigIOSystem),
			Module parameter assignment (RD_DPAR),
			Alarms (Get_Alarm & Ack_Alarms [V14]),
			Diagnostics (RD_SINFO),
		Communication	Webserver (WWW)
	Remote	Extended instructions	Distributed IO (RDREC for Parameter)
1.0.1	Modified	Extended instructions	Diagnostics (GET_DIAG)
	New	Extended instructions	Process Image (UPDAT_PI, UPDAT_PO),
			Distributed IO (RDREC),
			Interrupts (ATTACH, DETACH, SET_CINT, QRY_CINT, SET_TINT, CAN_TINT, ACT_TINT, QRY_TINT, SRT_DINT, CAN_DINT, QRY_DINT),
			Diagnostics (second example on GET_DIAG; RT_INFO, Get_IM_Data, GET_NAME, GetStationInfo),
			Data block control (CREATE_DB, DELETE_DB, WRIT_DBL, ATTR_DB),
			Addressing (GEO2LOG, LOG2GEO, IO2MOD, RD_ADDR),
			Useful tools (HexIntBools_Converter, CMYK_TO_RGB_Converter)
		Technology	PID control (PID_Compact)
		Communication	S7 communication (GET, PUT),
			Open user communication (TSEND_C, TRCV_C)

Version	Description		
	Change	Instruction category (*)	Program example (*)
1.0.0	New	Basic instructions	Bit logic operations (complete),
			Timer operations (complete),
			Counter operations (complete),
			Comparator operations (complete),
			Math functions (complete),
			Move operations (complete),
			Conversion operations (complete),
			Program control operations (complete),
			Word logic operations (complete),
			Shift and rotate (complete)
	New	Extended instructions	Date and time-of-day (complete),
			String and Char (complete),
			Alarms (Program_Alarm, Get_AlarmState, Gen_UsrMsg),
			Diagnostics (LED, DeviceStates, ModuleStates, GET_DIAG),
			Recipe and data logging (complete),
			Data block functions (READ_DBL)

* The name corresponds to that specified in the library and is in English.