

SIMATIC Controller Software

Tools for configuring and programming
SIMATIC Controllers

Brochure • November 2010



SIMATIC Software

Answers for industry.

SIEMENS

SIMATIC Controller Software

Universal development software

Automation projects require maximum efficiency. SIMATIC Controller Software provides an integrated engineering environment with top-class tools for the widest range of working methods and applications. These tools are based on an integrated system, offer open interfaces, generate reusable blocks and therefore save time.

STEP 7 – software for all SIMATIC Controllers

STEP 7 cannot only be used to program and configure programmable logic controllers, but also PC-based automation systems. Users can therefore select any hardware and use the same software even for mixed configurations.

Worldwide programming standard

STEP 7 is the world's best known and most widely used programming software in industrial automation. And: STEP 7 is compliant with the IEC 61131-3 standard. The aim of this international standard is to make user programs portable to devices from different manufacturers. It has been adopted as European and German standard DIN EN 61131.

PLCopen: The organization

Different manufacturers and users of control and programming systems have founded the international organization PLCopen, which promotes the use and distribution of programming in accordance with IEC 61131-3.

Siemens actively participates in PLCopen and has introduced controller programming to IEC 61131.

The following Compliance Classes have been defined:

- Base Level
- Conformity Level
- Reusability Level

Independent institutes issue the relevant certificates. S7-GRAPH (SFC) is certified to Base Level, and S7-SCL (ST) has the Reusability Level certificate.

Totally Integrated Automation Portal – intuitive, efficient, and future-oriented

The TIA Portal integrates the engineering for Totally Integrated into a shared Engineering Framework. The boundaries between STEP 7 and other software products such as the SIMATIC WinCC visualization software are dissolved by a uniform look and feel and functionality. Shared services contribute to engineering efficiency. A shared database for all software products ensures project consistency. The new Version 11 of STEP 7 is a component part of the TIA Portal. This is available in two versions: STEP 7 Basic for configuring and programming the SIMATIC S7-1200 microcontroller and STEP 7 Professional for the entire SIMATIC Controller range. More about STEP 7 in the new TIA Portal on page 24.

SIMATIC Controller Software Highlights

- Intuitive operation and use of standard languages make it easy for programmers and maintenance personnel to familiarize themselves with the software
- Design and implementation times are shortened by structured, process-oriented programming methodology
- The overhead for subsequent projects is reduced because blocks are easy to reuse
- The option to configure rather than program reduces the work load
- Portability of the user software thanks to a common engineering environment for all controllers
- Efficient process diagnostics increase plant availability

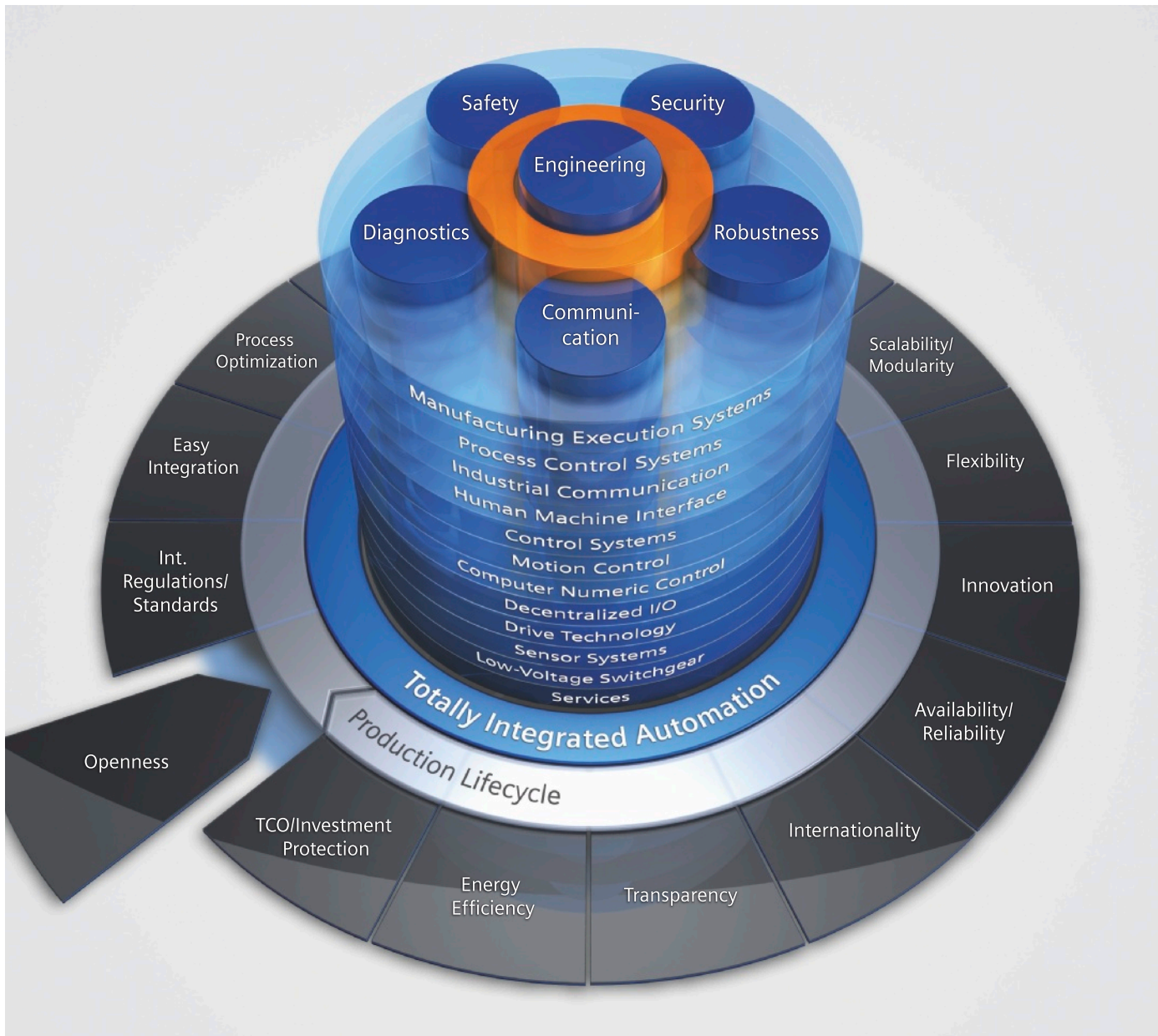


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Totally Integrated Automation

Rely on new productivity standards
for sustained competitive advantages



To be able to respond to the increasing international competitive pressure, it is more important than ever to consistently make full use of the potential for optimization – over the complete lifecycle of a machine or plant.

Optimized processes reduce the total cost of ownership, shorten the time to market, and improve quality. This perfect balance between quality, time, and costs is now, more than ever, the decisive success factor in industry.

Totally Integrated Automation is optimally aligned to all requirements and open for international standards and third-party systems. With its six characteristic system features, Totally Integrated Automation supports the complete lifecycle of a machine or plant. The complete system architecture offers holistic solutions for every automation segment on the basis of a comprehensive range of products.

SIMATIC: more efficient and systematic automation

SIMATIC, a core component of Totally Integrated Automation, includes a variety of standardized, flexible, and scalable products – such as the SIMATIC Controller Software presented in this brochure.

SIMATIC is currently considered to be the global number one in automation. One of the decisive reasons for this is that SIMATIC exhibits the six system features of Totally Integrated Automation:

- Engineering
- Communication
- Diagnostics
- Safety
- Security
- Robustness

In addition, SIMATIC features two additional system features:

- Technology
- High availability

You can find more about the system features and the resulting advantages in the following chapter "System features".



System features

Engineering



Maximum engineering efficiency – in all phases of the lifecycle of the machine and plant

With SIMATIC you rely on an integrated engineering environment. Efficient software supports you over the complete lifecycle of your machine or plant – from the planning and design stages through configuring and programming as far as commissioning, operation and up-grading. With its integration capability and harmonized interfaces, SIMATIC software supports a high degree of data consistency – throughout the entire engineering process.

Communications



Maximum data transparency on all automation levels – based on proven standards

SIMATIC creates the foundations for unlimited integration in communication – and thus for maximum transparency on all levels, from the field and control level to the operations management level all the way up to the corporate management level. SIMATIC relies on international, cross-vendor standards which can be combined flexibly: PROFINET, the leading Industrial Ethernet standard and PROFIBUS, the global No. 1 fieldbus.

Diagnostics



Minimization of downtimes – through efficient diagnostic concepts

All SIMATIC products feature integrated diagnostic functions with which a fault can be identified and eliminated to provide increased system availability. Even with larger plants, the Maintenance Station provides you with a uniform view of the maintenance-relevant information of all automation components.

Safety



Protection of personnel and machines – within the framework of an integrated complete system

SIMATIC Safety Integrated offers TÜV-certified products, which facilitate compliance with relevant standards: IEC 62061 up to SIL 3, EN ISO 13849-1 up to PL e, as well as EN 954-1. Due to the integration of safety technology in standard technology, only one controller, one I/O, one engineering, and one bus system are required. Thus the system advantages and comprehensive functionality of SIMATIC are also available for fail-safe applications.

Data security in the networked world – through harmonized, scalable security systems

With SIMATIC you can use all the advantages that result as the worlds of automation and of office grow together more and more: Seamless exchange of data across all levels (Collaborative Manufacturing), or access to production data via the Internet from any location. In order to meet the resulting increased security requirements, SIMATIC offers you IT Security for the protection of production and data, e.g. by means of firewall functions, access protection, encryption, and Virtual Private Networks.



Security

Maximum industrial suitability – through increased robustness

Each standard product from the SIMATIC range is characterized by the highest quality and robustness and is perfect for use in industrial environments. Specific system tests ensure the planned and required quality. SIMATIC components meet all relevant international standards and are certified accordingly. Temperature and shock resistance are defined in the SIMATIC quality guidelines, as are vibration resistance or electromagnetic compatibility. For demanding to extreme rated conditions, special versions such as SIPLUS extreme or special versions of SIMATIC ET200 are available. These include an increased degree of protection, extended temperature ranges, and exceptional environmental stress.



Robustness

More possibilities, less complexity – through integrated technology functionality

Counting and measuring, cam control, closed-loop control, or motion control: You can integrate technological tasks in many different combinations and with various degrees of complexity without a system changeover into the world of SIMATIC – easily, conveniently, consistently. Parameter assignment and programming are implemented in the familiar STEP 7 environment.



Technology

Maximum availability – with integrated high availability concepts

Siemens offers a comprehensive high availability concept to ensure high availability for the entire plant: from the field level to the control level all the way up to the management level. For example, field-tested controllers ensure high availability through bumpless switching with automatic event synchronization.



High availability

STEP 7 Professional

Tools and functions

STEP 7 contains numerous tools and functions for the most varied tasks in an automation project. STEP 7 Professional offers a wider choice of program editors than the base version.

The main components of STEP 7 are:

- SIMATIC Manager for administrating all tools and data of an automation project
- Hardware configuration for configuring and parameterizing the hardware
- Program editors for creating and testing structured user programs
- NetPro for setting up a data transfer over MPI or PROFIBUS/PROFINET
- Integrated system diagnostics for obtaining an overview of the automation system status
- Standard-compliant project documentation with DOCPRO
- PID Control and PID Temperature Control for parameterizing simple PID or temperature controllers
- Software test without controller with S7-PLCSIM (component part of STEP 7 Professional)
- Creation of programs for fault-tolerant and fail-safe controllers
- Tool Calling Interface (TCI) for integrating engineering systems from other manufacturers
- Open command interface for importing/exporting data from other Windows tools
- The SIMATIC Logon and SIMATIC Versiontrail options are available for increased traceability

SIMATIC Manager

SIMATIC Manager administers all data pertaining to an automation project. Furthermore, it is used for creating, copying, downloading and archiving of projects.

- **Multiproject**
With this function, a project can be generated out of different subprojects and processed locally by different users simultaneously. The convergence of the projects is system-supported. For example, the creation of a multi-project communications subnetwork can be implemented centrally for the entire multiproject.
- **Language Support**
This function supports the generation and administration of project texts in multiple languages. The texts to be translated are exported from STEP 7, edited with an ASCII editor or spreadsheet program (e.g. Excel) and then imported back into STEP 7.
- **Project data storage on the CPU**
In addition to the actual user programs, all project data can be stored in the memory card of the CPU. This data is then available on-site for service purposes.
- **Online help**
In the STEP 7 online help, an information portal is displayed via the "Start page" symbol. It permits direct access to the central topics of the online help, e.g.
 - How to get started with STEP 7
 - Configuring & programming
 - Testing and troubleshooting
 - SIMATIC on the Internet

Higher productivity with STEP 7 Professional

- One package – all IEC languages:
 - LAD, FBD, STL, S7-SCL, S7-GRAPH
 - and for offline testing: S7-PLCSIM
- Lower package price
- Low outlay for installation and updating
- Engineering workplaces with the same basic setup increase productivity:
 - Every employee working on the project can work on any device.
 - Every employee uses the tool, on which he/she can be the most productive.

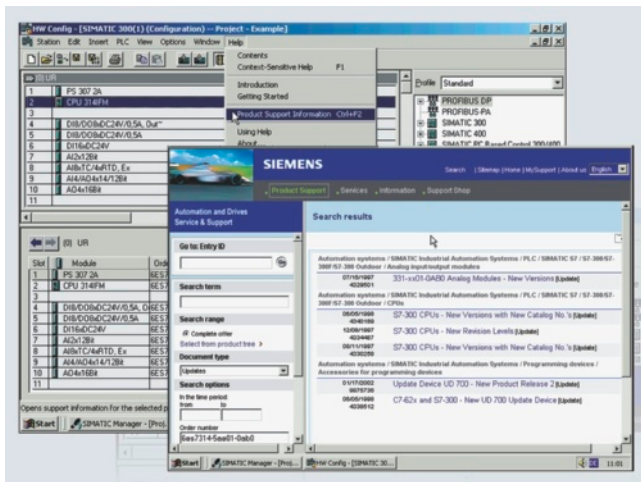
Basic functionality with STEP 7 Basis

- STEP 7 is also available as a basic package without S7-SCL, S7-Graph and S7-PLCSIM.

Action package for changeover to STEP 7 Professional

To facilitate your decision to upgrade from the STEP 7 basic package to STEP 7 Professional, we are offering an attractive STEP 7 Professional PowerPack and Software Update Service for STEP 7 Professional for one year at an extremely favorable price. The PowerPack enables you to upgrade from the STEP 7 basic package Version 5.4 and higher to the most recent STEP 7 Professional version.

Hardware configuration



Calling up detailed information over the Internet

The CPUs and modules of the SIMATIC do not need mechanical switches and adjusting screws anymore. All settings are implemented centrally using the software. To do so, the hardware (including central and distributed inputs/outputs) is configured and parameterized in the HW Config (Hardware Configuration) tool.

Special functions of HW Config are:

- Internet link
The most current information regarding the hardware used can be called up whenever required by accessing the product support information on the Internet. Technical data, FAQs or documentation on the modules used can be accessed directly via the help system of HW Config. New hardware components can be integrated direct into STEP 7 via the Internet without any additional service pack.
- Configuration in RUN (CiR)
With CiR certain modifications of the hardware configuration in a plant can be implemented while operation is ongoing. The process execution is interrupted for a maximum of one second. Prerequisite is the use of an S7-400 or S7-400H CPU.

Topology editor

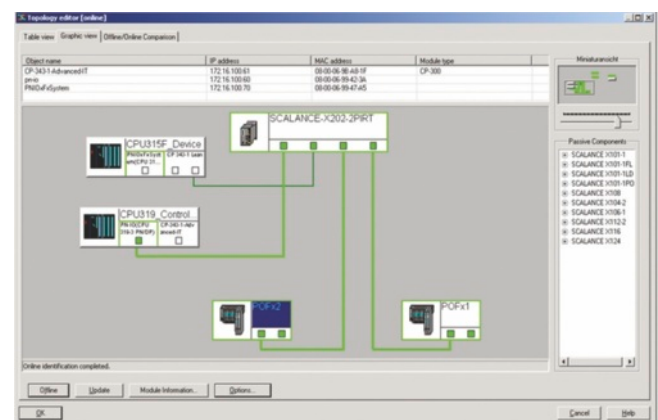
Graphical presentation of communicating ports

Distributed I/O on PROFINET is configured using the hardware configurator (HW Config). The controllers and the distributed I/O assigned to them can be graphically presented in the station view of HW Config.

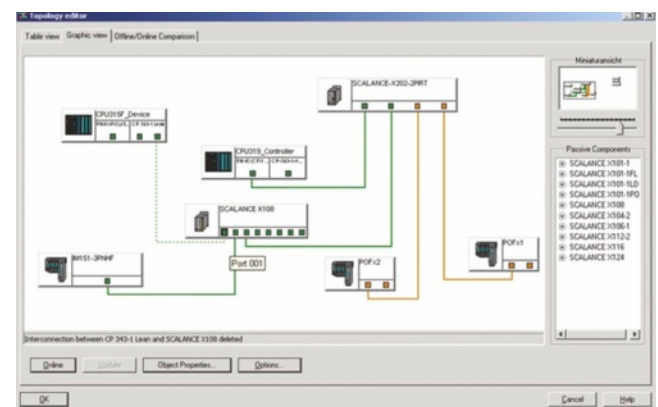
During normal operation, however, you cannot determine which ports are actually communicating with each other. But this is often extremely important for diagnostics.

For PROFINET networks, the Topology Editor now enables this information to be displayed quickly and easily. The editor is simply started by double-clicking the relevant Ethernet segment in HW Config. An offline/online comparison identifies the communicating ports and presents them in tabular or graphical form.

By detecting, presenting and monitoring the physical connections between devices on PROFINET IO, the administrator can monitor and service complex networks easily.



Topology editor



Topology: Graphical representation

The procedure on which it is based is standardized to IEEE802.1AB: Link Layer Discovery Protocol (LLDP) is a vendor-independent protocol that can be used by a connected device to report its identity and properties. LLDP executes on Layer 2 of the ISO/OSI reference model.

Structured programming

A central feature of STEP 7 Professional is the structured design of the programs created using the software.

In the case of comprehensive programs, it is recommended and sometimes necessary to divide the program into individual program sections. The program sections should be program parts that are self-contained and that have a technological or functional correlation. These program parts are called program blocks. A block is a part of the user program that is defined by its function, structure or application.

Elements of a user program

User programs consist of the following elements:

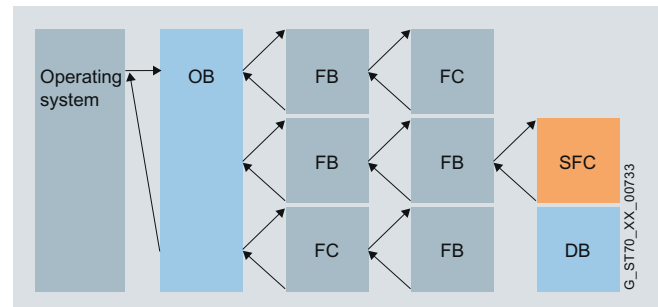
- **Organization blocks (OB)**
Organization blocks determine the structure of user programs. They represent the interface between the operating system and user program. They control the start-up behavior of the automation system, cyclic and interrupt-driven program execution and fault handling.
- **Function blocks (FB), Functions (FC)**
 - Function blocks are code blocks which contain the actual program. They have an assigned data block in which the input and output parameters as well as static data are stored. Thus the FBs can maintain the processed values throughout several cycles.
 - Functions have no assigned data block; when called, they always require current input values. They supply their function result after every call.
 - FBs and FCs can be self-programmed. The display of self-programmed blocks can also be suppressed. This is of interest, for example, to machine manufacturers to protect their know-how. FBs and FCs are therefore represented as black boxes, since the user does not need to know how their functions were implemented. Libraries with special, pre-generated blocks that only need to be interconnected, are available as an option, for example, IEC functions, controllers and blocks for converting SIMATIC S5 and S05 programs.
- **System functions (SFCs) and system function blocks (SFBs)**
Some functions that are repeatedly required are integrated into the operating system of the S7-CPU and can be called from there. Some of these functions are, for example, communication functions, clock functions and operating hours counter, or the transfer of data records. The system functions/system function blocks are supplied as a library with STEP 7 for offline programming.

NEW

Savings potential

- Even comprehensive programs can be programmed in a clear manner.
- Third parties that access structured programs for service, maintenance or a later modification are better able to understand and work with the program. Program testing may be performed in steps.
- Program sections can be standardized and reused.
- Several programmers can work on one project simultaneously.

- **Data blocks (DBs)**
Data blocks are data storage areas that contain user data. They can be assigned to individual function blocks or the complete project.
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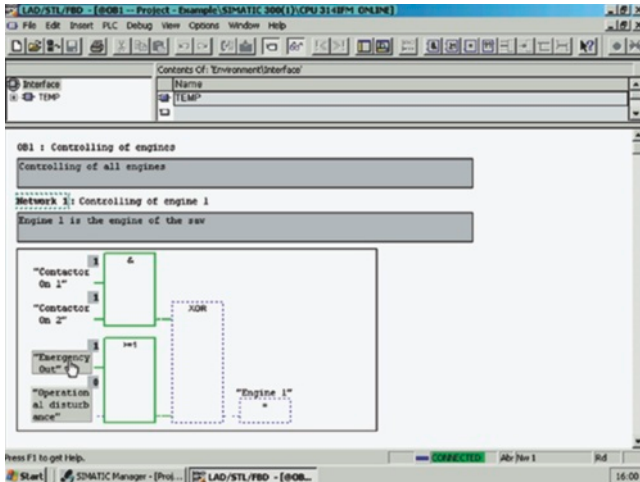


Structure of a user program

Program editors

STEP 7 Standard Package: LAD, FBD, STL

The program editor is the programming interface for the user program. The user can program in the STL (statement list), FBD (function block diagram), and LAD (ladder diagram) programming languages. The individual languages can be generally combined and merged.



Programming in function block diagram

S7-SCL

Programming complex algorithms

S7-SCL corresponds to the textual high-level language ST (Structured Text) defined in the standard IEC 61131-3 and fulfills base level and reusability level requirements acc. to PLCopen. S7-SCL is particularly suitable for programming complex algorithms and arithmetic functions or for data processing tasks.

Additional benefits over LAD, FBD, and STL:

- Simpler, faster, and less error-prone program development thanks to the use of powerful language constructs such as IF...THEN...ELSE
- Easier to read, clearer structuring
- Simpler program test using a high-level language and a debugger

```

FUNCTION SQUARE : INT
(*****
This function supplies the square of the input value as a
case of an overflow, the maximum value that can be repres
*****)
VAR_INPUT
value : INT;
END_VAR

IF value <= 181 THEN
    SQUARE := value * value; //Calculates function value
ELSE
    SQUARE := 32_767; // Sets maximum value if overflow
END_IF;

END_FUNCTION

```

Declaration and instruction part of a function block in S7-SCL

Functions

S7 SCL programs are programmed as ASCII sources. An exchange with other ASCII sources or targets is therefore possible. The S7-SCL editor offers various templates that only need to be filled in and inserted:

- Templates for blocks (e.g. function blocks, data blocks) and their calls
- Templates for block comments, block parameters and constants
- Templates for control structures (IF, CASE, FOR, WHILE, REPEAT) that contain the exact syntax.

S7-SCL offers the following functionalities:

- Language elements from programming in high-level languages, e.g. serial loops, alternative branches and jump lists
- S7-SCL blocks can be used in other STEP 7 languages
- PLC-typical language extensions, e.g. addressing of inputs and outputs, or start and scanning of timers and counters.

Program editors

S7-GRAPH

Programming sequence controls

The S7-GRAPH software package is used for describing procedures with alternative or parallel step sequences. The procedures are configured and programmed clearly and quickly in a standardized method of representation (to IEC 61131-3, DIN EN 61131).

Additional benefits over LAD, FBD, and STL:

- LAD, FBD and STL focus on logic control. S7-GRAPH places more importance on the process sequence.
- Clear graphical representation of the process using sequencers, providing easy maintenance and modification/adaptation of the programs if required.
- Process error troubleshooting with integrated diagnostics functions; expensive downtimes during production are minimized.

Example of an application

A typical example of a sequential operation is a drilling procedure with the following steps:

- Drilling machine ready
- Clamp workpiece
- Start drill motor, optionally coolant pump on
- Lower drill
- Raise drill
- Coolant pump off, motor off
- Open the clamp

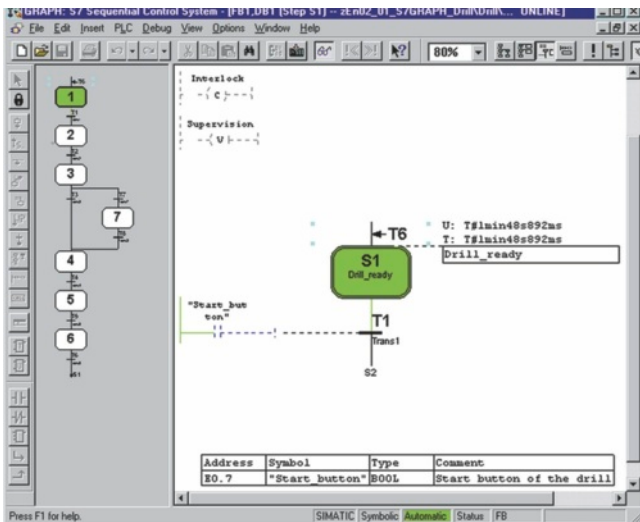
For programming compliant with IEC 61131-3 and PLCopen Base Level, the following functions are available:

Basic functions

- Flexible sequencer structure: Simultaneous and alternative branches, jumps within the sequencers, step enabling and disabling.
- Selective processing of steps. The processing time of a sequencer is thus independent of the number of steps.
- Synchronizing automatic and manual operation
The process is not synchronous anymore when it was placed into a different state manually.
S7-GRAPH supports the locating of synchronization points for restarting automatic operation. To do so, the relevant steps are marked. Step-enabling conditions or interlocks can be defined as criteria.

Test and diagnostics functions

- Online functions:
The online functions can result in considerable time savings, particularly during the start-up phase. For example, it is possible to display active steps, the status of the interlocking, monitoring and step enabling conditions, as well as past actions. Different diagnostic options are available in principle:
 - Sequencers can be displayed in SIMATIC WinCC online. The graphics for this are imported from S7-GRAPH (S7-GRAPH Viewer).
 - For detailed diagnostic functions it is possible to jump directly from SIMATIC WinCC to S7-GRAPH and the respective active step. This function is limited to read access only for safety reasons.
- Process fault diagnostics:
S7-GRAPH enables targeted and quick diagnostics of process faults (faults outside the automation system, e.g. "Limit switch not reached", "Fill level exceeded"). The operators and maintenance personnel are thus optimally supported with locating and eliminating disturbances. Downtimes are reduced, plant availability increases. The diagnostics is integrated and does not require programming. Additional diagnostics-relevant information, such as message texts and message numbers, can be stored during configuration. They are displayed like sequencers by ProAgent during operation. ProAgent is available as an option package to SIMATIC WinCC and WinCC flexible.

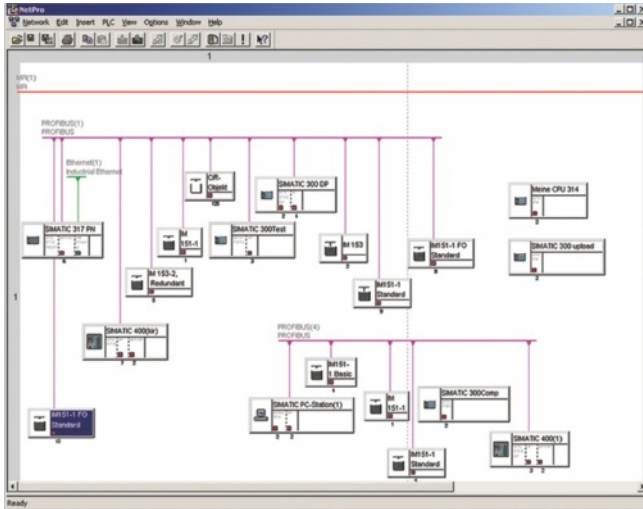


Test and diagnostics functions: S7-GRAPH in monitoring mode

Network configuring, system diagnostics, documentation

Configuring system communication with NetPro

The STEP 7 tool NetPro enables the configuration of the system communication. Here the communication links between individual stations is configured graphically and very vividly. NetPro contains all the drivers required for PROFINET and PROFIBUS CPs (NCM).



Graphic configuration of the communication links in NetPro

System diagnostics

System diagnostics provide an overview of the current automation system status. To do so, the hardware components generate corresponding diagnostics information that can be analyzed in STEP 7. Faults in components linked to the PLC over PROFIBUS or PROFINET are also scanned here.

The functions of the hardware diagnostics are, for example:

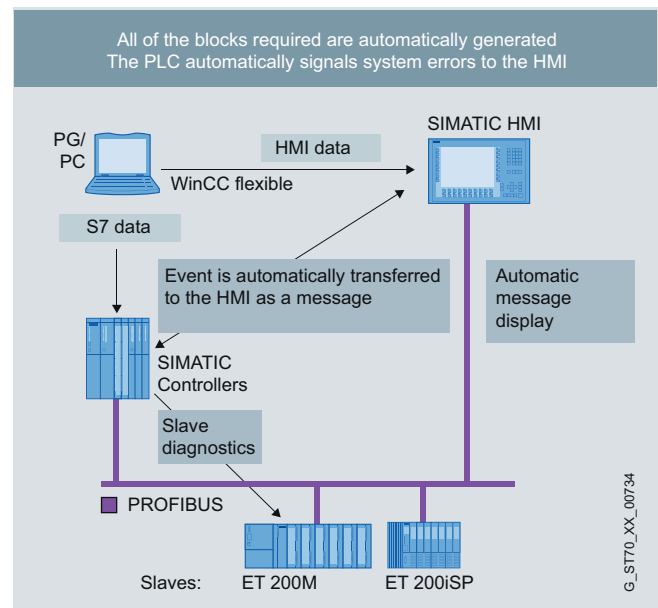
- **Reporting system errors:**
The function "Report system error" offers the user-friendly possibility of displaying the diagnostics information provided by the hardware components of the PLC in the form of signals. The required blocks and message texts are automatically generated by STEP 7. They only need to be loaded into the CPU. The transfer of diagnostics texts to connected SIMATIC HMI devices does not entail any programming overhead. Since STEP 7 and the SIMATIC HMI systems SIMATIC WinCC and WinCC flexible use a common database, the same plaintext error messages will be displayed in STEP 7 and on the HMI system.

- Detailed system diagnostics with the programming device: Detailed troubleshooting is possible using the programming device. This facilitates setup and commissioning. During operation, faults can be precisely located and diagnosed.
- Summary diagnostics: The topology of the control is displayed graphically in a window. Display of the module's status in this window supplies additional information directly and quickly.
- Detailed diagnostics: A detailed window that contains comprehensive error details in plaintext about the individual modules can be called direct from the overview.
- Status/control: Inputs and outputs can be directly monitored and controlled from the topology view of HW Config.

All errors are entered in the controller's diagnostics buffer. In the case of critical errors, the CPU is switched to the STOP state and all I/O output signals assume configured substitute values.

Standard-compliant project documentation with DOCPRO

- Uniform project documentation with standardized footer and border
- Selective combinations of print requests from sub-projects
- Saving print requests
- Processing saved print requests



Control configuring and software test

PID Control

Part of STEP 7; this is a simple PID algorithm with which simple control tasks can be solved immediately. This control algorithm is parameterized with the help of a clearly structured table. The algorithm can be used to implement continuous-action controllers, step controllers, and pulse shapers which are loaded into the CPU in the form of function blocks.

PID Temperature Control

In addition to the universally applicable PID Control function blocks, STEP 7 also includes two specialized control blocks for temperature control. They can be used as heating or cooling controllers. Other systems with similar requirements can also be implemented using these controller blocks. An integrated online self-optimizing function allows the controller to be adjusted during operation without a programming device.

S7 PLCSIM – software test without a controller

Simulation systems provide effective support with the development of programs and the actual application. A simulated test environment including controller and process reduces, for example, commissioning times and thus costs. Early discovery of programming errors and optimization of programs enable the optimized and error-free use of the programs in the actual system.

Application

SIMATIC S7 PLCSIM simulates a controller for functional testing of user blocks and programs for S7-300 and S7-400 on the programming device/PC. Online access and test functions of the programming tools can be carried out in exactly the same manner as with a real controller. This allows the entire program test to be performed on-site in the development office.

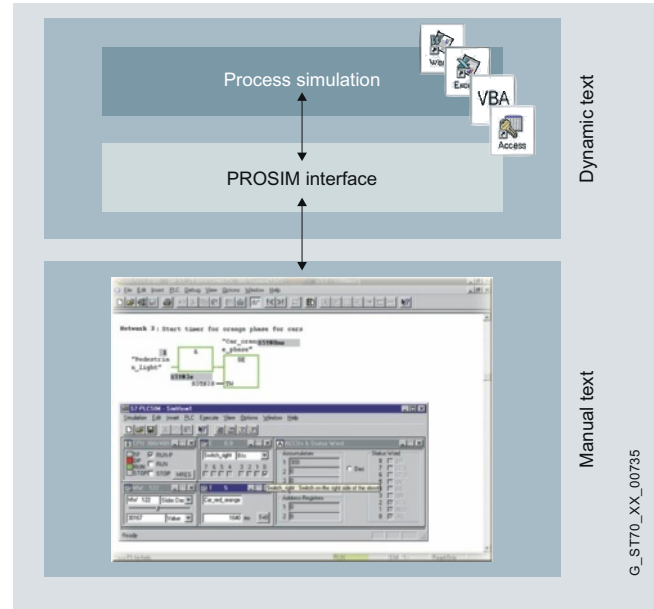
S7-PLCSIM can be started several times to enable several controllers to be tested simultaneously in a network. After the program has been downloaded, the instance assumes the name of the associated station. The ability to communicate via MPI, PROFIBUS DP and TCP/IP ensures a high degree of flexibility.

Function

S7 PLCSIM executes the user program just like a real controller (special functions such as F technology only conditionally). During program execution, different process values can be monitored and changed via a simple user interface (e.g. switching inputs/outputs on or off).

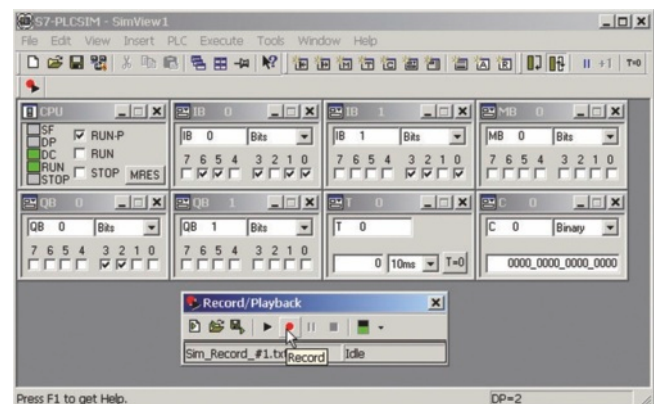
Link-up with an external process simulation

The S7-ProSim interface is used for linking up to external process simulation systems. Dynamic access to process values is possible via this interface. S7-ProSim is implemented as ActiveX-Control and can therefore be used with all ActiveX-capable Windows applications, e.g. Visual Basic for Application or Excel.



S7 PLCSIM offers a user interface for link-up with a process simulation

In S7-PLCSIM, possible faults (e.g. a rack failure) can be simulated within the framework of the S7 program test in order to test the response of the user program in case of a fault. The recording function can be used to record the simulation process and thus implemented simulations can be reproduced later.



Recording: documentation of the simulation

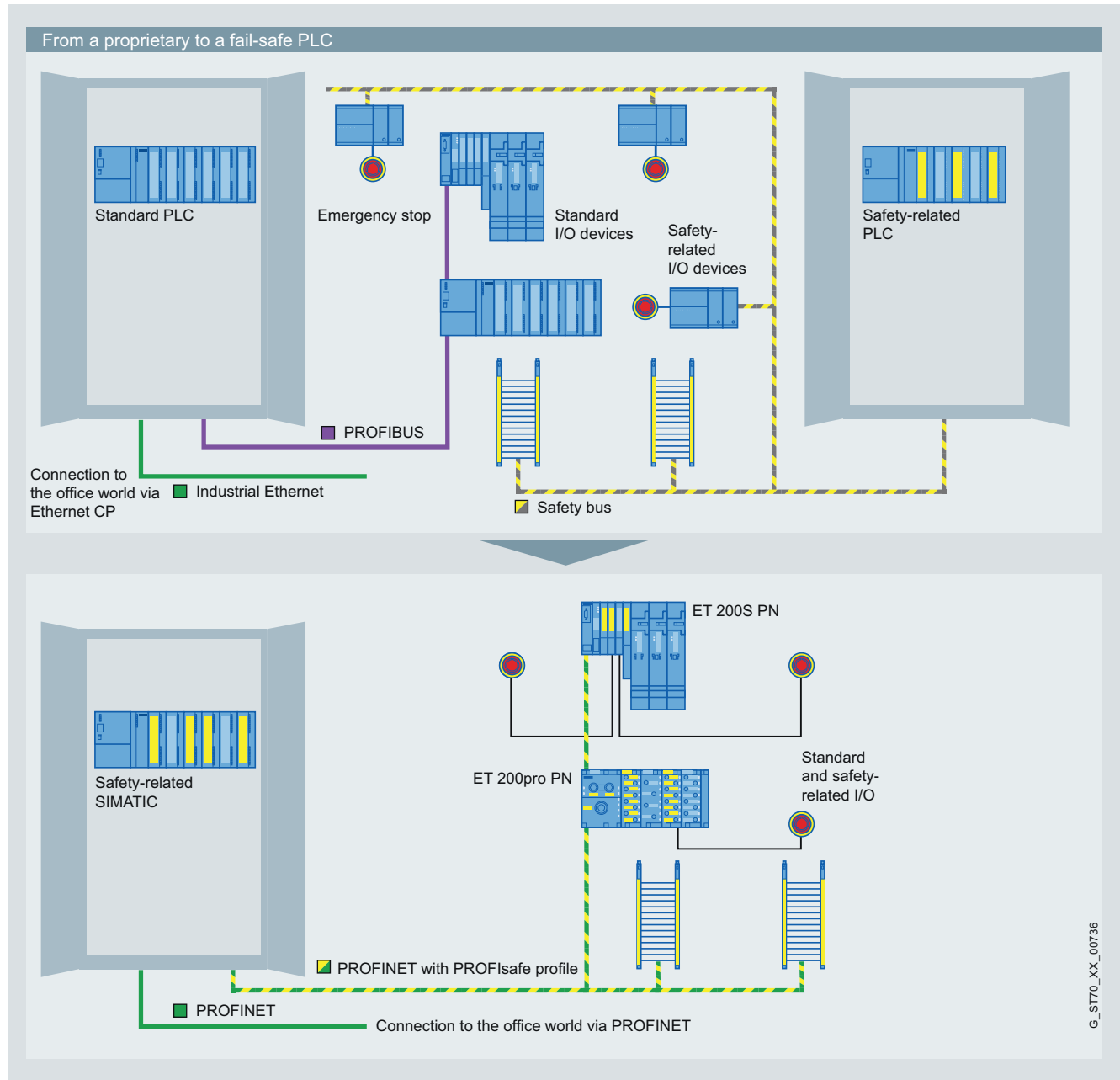
Tools and functions for special tasks

Creating programs for high-availability controllers

Users of high-availability SIMATIC Controllers, so-called H systems, do not require any additional engineering software. The corresponding functionality is integrated in STEP 7.

Configuring safety functions for fail-safe controllers

Fail-safe controllers (F systems) handle both safety functions and standard functions. STEP 7 is used as the common configuring tool. The optional software package S7 Distributed Safety contains off-the-shelf, certificated blocks that provide support for parameterizing the fail-safe I/O and for programming.



Standard and safety engineering in one CPU

Option packages

For increased data security and traceability

Data protection and traceability are becoming more and more important in many sectors. Customers need tools to support them in documenting the quality of their processes - not just in those areas which are governed by the strict requirements of the Food and Drug Association (FDA). SIMATIC Logon and SIMATIC Version Trail are option packages for STEP 7 that provide these functions.

SIMATIC Logon

Security through access protection

The option package SIMATIC Logon serves to create access privileges for projects and libraries in STEP 7. When access protection is activated, a change log can be recorded. The following is recorded, for example:

- Activation
- Deactivation
- Configuration of access protection and change log
- Opening and closing of projects and libraries, including loading onto the target system and activities for changing the operating state.

The changes can also be accompanied by a reason or other remarks.

SIMATIC Logon can be used to determine who is permitted to use a license (e.g. external personnel) or who can transfer a license and therefore has permission to download it from the server for servicing purposes.

Functions for meeting the requirements of the Food and Drug Administration (FDA)

With S7-Graph, S7-SCL and S7-HiGraph (from STEP 7 V5.4) in combination with the SIMATIC Logon option package, functions can be implemented that support tracking and tracing as required by the FDA:

Project password

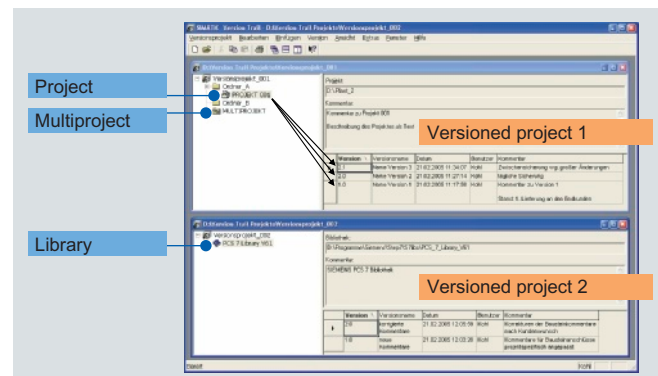
Access to projects and libraries can be protected by a project password.

Change log

Access protection for projects and libraries can be used to maintain a change log. Online actions such as downloading, operating status changes, or memory reset are then logged. When executing these actions, operators are prompted to enter a comment giving a reason for the action.

SIMATIC Version Trail – reliably manage versions

Changes to the user program cannot be avoided. The need to access earlier versions is just as unavoidable. SIMATIC Version Trail supports the user in uniquely identifying versions during archiving to enable them to be clearly identified later. This significantly reduces the probability of error.



Version management with SIMATIC Version Trail

Version Cross Manager – Comparison of versions

What has changed in detail between two archive versions of a project? The Version Cross Manager compares objects and their attributes that are hierarchically structured or which can be mapped in a tree structure. The Version Cross Manager graphically displays the differences. This is required, for example, after an acceptance test by the customer, the TÜV or the FDA representative. The following objects are compared:

- Project, library, HW configuration
- CFC/SFC engineering data, such as charts, types, chart folders, block folders
- Shared declarations
- S7 program, S7 blocks, S7 symbols, messages



Simply interconnect and parameterize instead of programming

The CFC engineering tool (Continuous Function Chart) is available as a STEP 7 option package, particularly for technologists who also configure the user program of the plant. CFC permits technological requirements to be transformed into executable automation programs with minimal outlay. To do this, predefined blocks must simply be interconnected and then parameterized. Extensive programming experience is not required.

CFC – interconnecting blocks

Technology functions are only parameterized by linking function blocks (e.g. AND, OR, PID controllers, limiting functions etc.). Time-consuming programming is not necessary. Creating programs by linking standard blocks is faster and less error-prone than conventional programming. Function blocks created with other STEP 7 programming languages can also be integrated. Executable code is generated more or less "at the press of a button" and transferred online to the programmable controller.

The configuration interface is a type of graphical drawing interface onto which predefined blocks are placed and connected with each other according to technological rules. Only the connections to be linked need to be marked. The CFC editor automatically determines the path to be followed by the lines and composes the lines (even across the boundaries of the page/chart).

The following structure elements increase clarity:

- Hierarchical CFCs (chart-within-a-chart technique): Other CFCs can be integrated into a CFC. Integrated charts can be changed without affecting the inserted sections.
- Creation of block types: Centrally created blocks can be changed centrally and can be reused anywhere.
- Extending the chart size through chart partitions (up to 26 chart partitions are possible)

CFC fulfills increased requirements during operation:

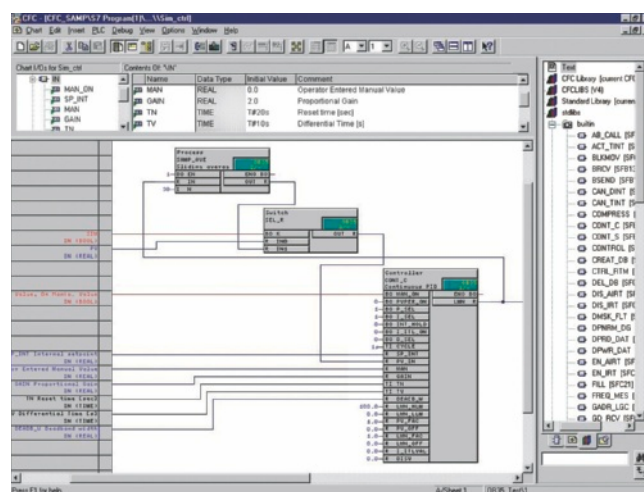
- Delta online loading is supported. Changes to the configuration are loaded in the CPU state "RUN-P".
- The program sequence can be influenced:
 - Current measured values can be easily overwritten online by the user.

Block library

CFC is supplied with a library of predefined blocks for essential functions:

- Elementary blocks: e.g. arithmetic blocks (sine, cosine, tangent, etc.), AND, OR functions, subtracting, multiplying, etc.
- Blocks for SIMATIC S7-300 and S7-400: e.g. controller blocks, clock generators, counter blocks, timer blocks, etc.

In addition, blocks from STEP 7, PCS 7 or D7-Sys, for example, can also be linked and parameterized. Furthermore, custom blocks can be created and managed in libraries.



Representation of a CFC with chart connections and CFC catalog

Option packages for configuring closed-loop controls

Small and medium-sized control tasks have up to now often been implemented with compact controllers. This additional hardware requires space in the cabinet and is not very flexible. Software controllers which can be integrated into the control program are a good alternative.

Standard PID Control

Standard PID Control comprises two components: A parameterization tool as an option package for STEP 7 and function blocks for the CPU.

Functions

The following controller types can be implemented:

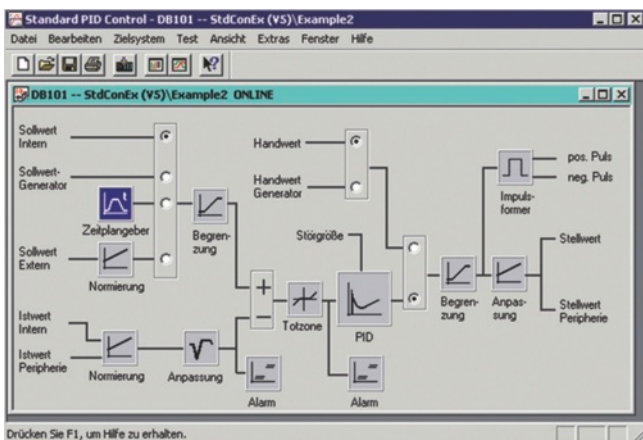
- Continuous-action PID controllers, pulse controllers including pulse-pause signal (pulse shapers), step controllers.

Frequently used controller structures are included in the scope of supply as application examples in the form of function blocks:

- Step controllers with controlled system simulation, continuous-action controllers with controlled system simulation, multi-loop ratio control, blending control, cascade control

Parameterization

The user-friendly controller structure allows functions to be switched on and off with software switches. With the parameterization interface, parameters can also be changed while the CPU is in the RUN state.



Standard PID control

Modular PID Control

Regardless of the size of the controller the usual requirement is for saving memory space. Scalability and flexibility can be achieved with modular solutions. Modular PID Control is suitable for configuring modular controls based on the modular design principle.

Modular PID Control comprises two components: A parameterization tool as an option for STEP 7 and control blocks for the CPU.

The main fields of application for Modular PID Control are process plants with high control requirements.

Functions

The following controller types can be implemented:

- Continuous-action PID controllers, pulse controllers, step controllers

The following ready-to-use examples are included in the scope of supply:

- Fixed-setpoint controllers with different outputs, single-loop and multi-loop ratio controllers, blending controllers, cascade controllers, controllers with feedforward control, range selection controllers, override controllers, multivariable controllers

The blocks can be linked with STEP 7, SCL and – especially user-friendly – CFC. Sampling times of less than 5 ms can be achieved.

PID Self-Tuner

PID Self-Tuner is a function block with which PID or PI controllers can be set online and adapted during operation. PID Self-Tuner is especially suited for optimizing temperature controllers, level controllers and flow controllers.

S7 PDIAG and ProAgent – for effective process diagnostics

SIMATIC HMI (human machine interface) devices report faults in the automation systems automatically as system diagnostics: No configuration costs are involved. However, 80 % of faults during operation are process faults. Your diagnostics are plant-specific and cannot therefore be integrated into the controller hardware or firmware. Instead, this must be programmed. To keep the overhead low, the use of diagnostics tools is recommended.¹⁾

Conventional development of process diagnostics

Process diagnostic functions are programmed separately from the actual control program. In addition, appropriate error messages must be displayed on the display equipment. The associated program code can easily be as extensive as the control program. If the control program is modified, the monitoring functions usually have to be reprogrammed.

Process error diagnostics for SIMATIC

The outlay can be considerably reduced by using the SIMATIC diagnostic tools.

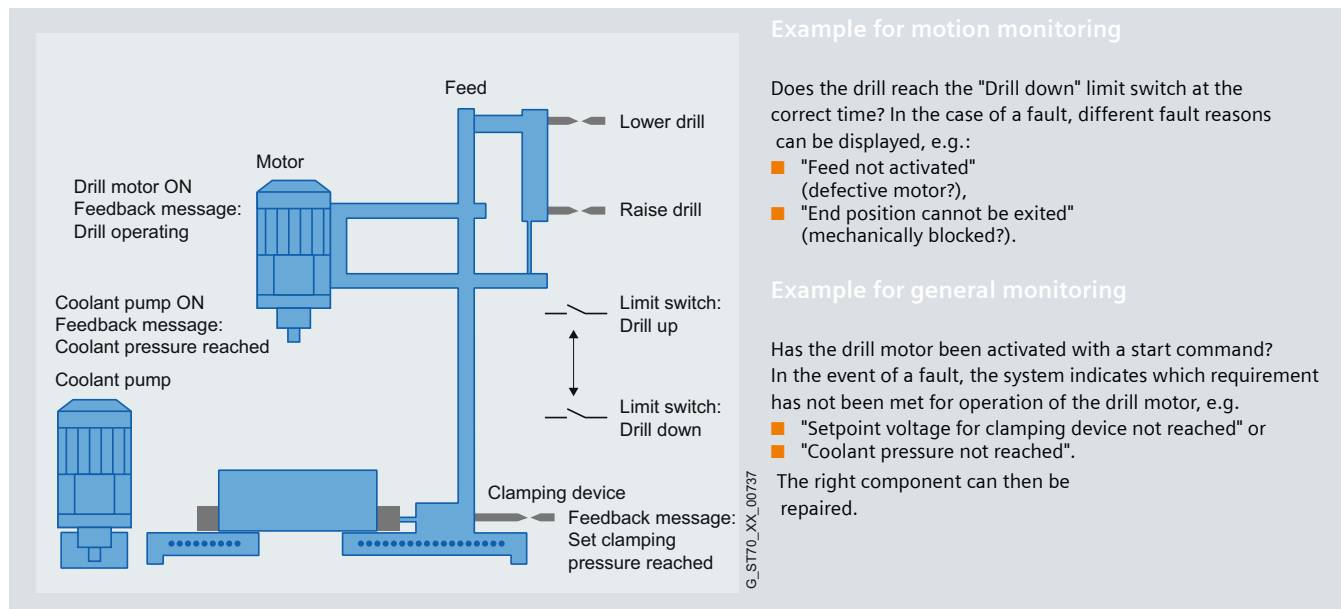
- Simple configuration
The process diagnostics are configured in one step when the automation solution is programmed and are very simple. The variables to be monitored are marked. Then the error state is defined and a comment is assigned to it - and that's it.

¹⁾ For further details of system diagnostics, see Page 12

- Automatic change management
The monitoring functions are automatically updated when the control functions are modified.

Process diagnostics support maintenance personnel with troubleshooting and fault avoidance:

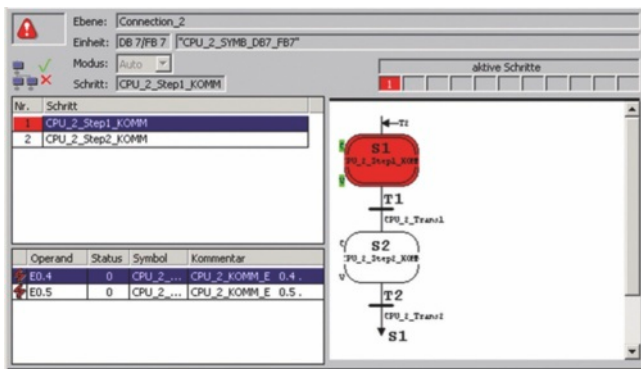
- User-friendly criteria analysis
When an error occurs, the precise criteria in the network or the logical operation that resulted in the error can be displayed. For this criteria analysis, a programming device is not required. It is performed on the HMI device and accelerates error detection and rectification considerably. If SIMATIC diagnostic tools are not used, the same efficiency and especially quality cannot be achieved for the criteria analysis with acceptable outlay.
- Preventive maintenance
Within the context of preventive maintenance, disturbances in the process sequence can be detected at an early stage and interpreted. This means that faults are prevented. As a tool wears, for example, this is indicated by increasing frictional forces. The process diagnostics can monitor these forces and a new tool can be obtained and used to replace the old one before it wears out.



The SIMATIC diagnostics tools

- **SIMATIC S7-PDIAG**
For configuring signal monitoring for process diagnostics. S7-PDIAG is loaded in addition to STEP 7 and makes the required functions available in the editor. Messages are configured with S7-PDIAG directly in STEP 7, which means that no outlay at all is required on the HMI side.
- **SIMATIC ProAgent**
Runtime software for displaying process fault messages on an HMI device. The messages are displayed in standard windows.

S7-PDIAG and ProAgent update the database automatically at runtime.



Process diagnostics with SIMATIC Engineering Tools

Signal monitoring functions can also be configured with the engineering tools S7-GRAF for graphical sequencer programming and S7-HiGraph for graphical configuration of state diagrams. The process diagnostics functionality has already been integrated.

Monitoring of the process with S7-PDIAG

S7-PDIAG can be used to monitor Boolean operands for possible errors. For these errors, error definitions can be configured during or after programming in LAD, FDB or STL. The following monitoring modes are available for signal monitoring:

Operand monitoring

Signals are monitored for a change in level or edge, if necessary with a delay time. Operand monitoring can be implemented without the need for the user program to be changed or adapted.

Motion monitoring

This is used to check that, for example, mechanical movements in the process are implemented correctly and quickly enough.

General monitoring

In the case of general monitoring, errors are defined by means of the logical combination of different operands. The definition is generated by describing the monitoring logic, program-

ming is not necessary. An error message is only output when the monitoring logic produces a true result. The error definition has no effect on the user program itself. No modification is required.

Error recognition and indication on the HMI unit

Setpoint values and actual values for the process signals are compared in the user program for the purposes of error recognition. If an error is detected, the configured text message complete with date and time is sent to all connected display units.

Process errors are indicated by SIMATIC ProAgent for WinCC or WinCC flexible. All text strings, symbols and addresses required for error indication are automatically read from the controller program. The graphical representation of step sequences permits an optimum overview. They do not have to be configured separately.

Process diagnostics upgrade

In existing STEP 7 projects, process diagnostics can be retrofitted without any problems. In this case, the option packages are simply reloaded. The operands to be monitored are marked and the fault definitions are configured and loaded. It is not usually necessary to make any changes in the user program.

Increased availability – without significant overhead

Conventional development of process diagnostics:

- Programming: If ..., Then...
(Diagnostics program can become very large and must be updated when the user program is modified.)

- Configuring fault messages

Process diagnostics for SIMATIC:

- Diagnostic messages are assigned to the variables of the user program.
- They are accepted automatically by the HMI system and updated automatically in the case of program changes.

The benefits:

- Significantly lower overhead
- Unique assignment of fault states – lower probability of faults
- Significantly lower memory requirements

Remote maintenance and remote link via TeleService

Machines and plants are increasingly operated in places which are far away from the place of manufacture. Plant constructors must nevertheless be able to provide support in the event of a fault. Especially during the warranty period this can result in high costs. TeleService helps to reduce this risk.

Highlights

- Shorter response times for service call-outs
- On-site service call-outs can be reduced by up to 60%
- Easy-to-handle solution, tailored to industrial automation
- Support for SIMATIC-specific services
- Support for PROFIBUS and Ethernet analog networks

The possible applications for TeleService are manifold. Plants can be diagnosed, values set and data transmitted from any place on earth via a telephone cable.

TeleService contributes significantly to reduce travel and personnel costs for service calls and has therefore been a standard tool in automation for a long time.

SIMATIC TeleService comprises the following coordinated components:

- TeleService adapter with integral analog or ISDN modem and serial interface for external modem, e.g. wireless modem
- TeleService software with access data management, enabling user-friendly establishment of the connection to the automation components.
- Function blocks for remote maintenance, remote link, and alarm via SMS or fax

Application

Remote maintenance

For remote maintenance a technician dials into a remote plant by telephone. STEP 7 can be used to read status information or to correct the user program remotely.

Remote link

Remote connections are used to transmit data over the telephone network. TeleService supports program-controlled connection buildup between the PG or PC and automation system. Process data exchanges between several automation systems can also be coordinated.

Three types of remote connection are possible:

- Remote connections to a plant which are initiated by a programming device or PC, for example, to transmit recipes to a remote plant or to transmit process or plant files for analysis or processing at a central office
- Remote connections to the PG or PC initiated by the plant
- Remote connections between two plants for exchanging process data.



TeleService adapter with integrated modem

Sending a text message or e-mail from a plant

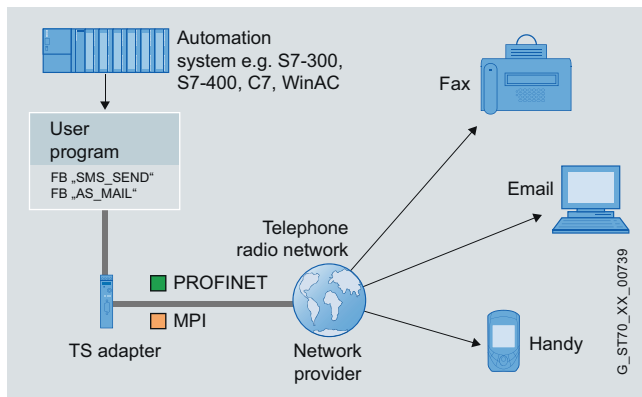
This function can be used to send text message from a plant to a mobile phone. TeleService can also send the text message to a provider which then forwards the message as a fax or e-mail. The TeleService Adapter IE is used to send e-mails directly.

Remote access to HMI device

With the TeleService Adapter IE, it is possible to access an HMI device for remote maintenance. WinCC flexible with Sm@rtService/Sm@rtAccess is required for operator control and monitoring. Internet Explorer or the SmartClient option is used.

NEW TeleService Adapter IE Basic

The new generation of the SIMATIC TeleService comprises matched components: TS Adapter IE Basic and TS module. The modular concept enables use for different communication networks and connection methods. Four different TS modules are available for this purpose: Modem (analog telephone network), ISDN (digital telephone network), GSM (mobile wireless network), and RS232 (for external modems). The new TeleService software is fully integrated into STEP 7 Professional V11 and available to users without additional option packages and costs. The new engineering also supports the previous TeleService versions.



Direct transmission of text message, e-mail or fax

Supported bus links

Adapter	TeleService Adapter II		TeleService Adapter IE		TeleService Adapter IE Basic			
Bus link	Analog	ISDN	Analog	ISDN	Analog	ISDN	GSM	RS232
MPI	●	●						
Profibus	●	●						
PPI	●	●						
PROFINET			●	●	●	●	●	●
Industrial Ethernet			●	●	●	●	●	●

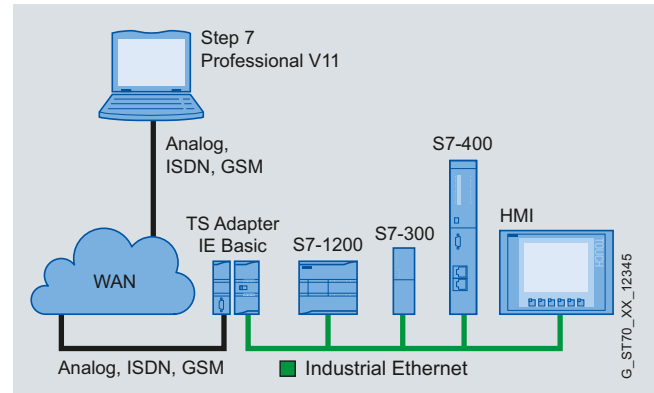
Overview of functions

Adapter	TeleService Adapter II	TeleService Adapter IE	TeleService Adapter IE Basic
Remote maintenance			
Remote maintenance on CPU	●	●	●
Remote maintenance and operation on HMI		●	●
Remote link			
Controller-controller	●		
Controller-programming device/PC	●		
Message transmission			
SMS	●	*	*
E-mail	**	●	●

* Via external e-mail to SMS gateway ** Via external SMS to e-mail gateway

Security against undesired access

- Login via dial-in
- User login using CHAP
- Call-back possible
- With TeleService Adapter IE, a firewall ensures that only SI-MATIC-specific services are routed through.



System configuration for remote maintenance. A programming device/PC is not required on the plant side. Connection is made direct to PROFINET. Routing enables access across network boundaries.

NEW Totally Integrated Automation Portal

Integrated Engineering Framework for Totally Integrated Automation

Different configuring tools have proved their worth for engineering an automation solution. The Engineering Framework with the Totally Integrated Automation Portal (TIA Portal) virtually removes the boundaries between these software products. The Engineering Framework will in future form the basis of all engineering systems for configuring, programming and commissioning programmable controllers and drives from the range of Totally Integrated Automation.

Engineering Framework for efficient engineering

Uniform look and feel

The shared Engineering Framework into which the software products are integrated standardizes all shared functions – also in their onscreen representation.

Uniform operation of different editors saves on training costs and makes it easy for users to concentrate on essentials.

Integral intelligence

Intelligent editors are context-sensitive and show precisely what operators require for the task at hand: Functions, properties, libraries. Split-screen technology makes it possible to open several editors simultaneously and to exchange data between them. Data is exchanged using drag and drop.

Maximum data transparency

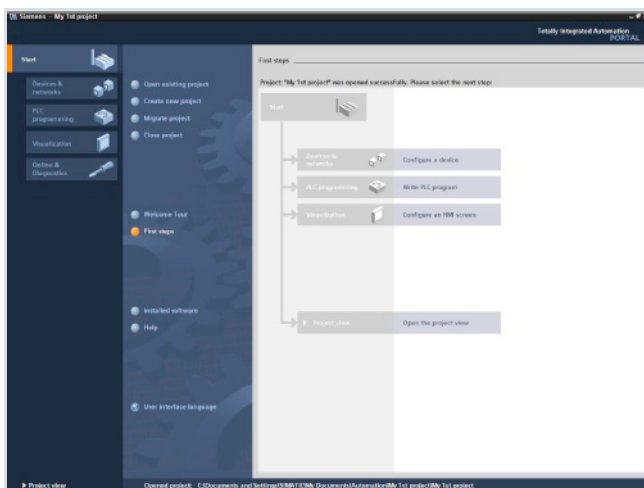
Data only has to be entered once, even when it is used in different editors for different target systems. Thanks to object-oriented, centralized data management in the TIA Portal, modified application data is updated automatically for all devices (PLC and HMI) within the project. The shared database ensures absolute consistency throughout the entire automation project. This reduces the probability of error, and compact and transparent projects are created.

Reusable solutions

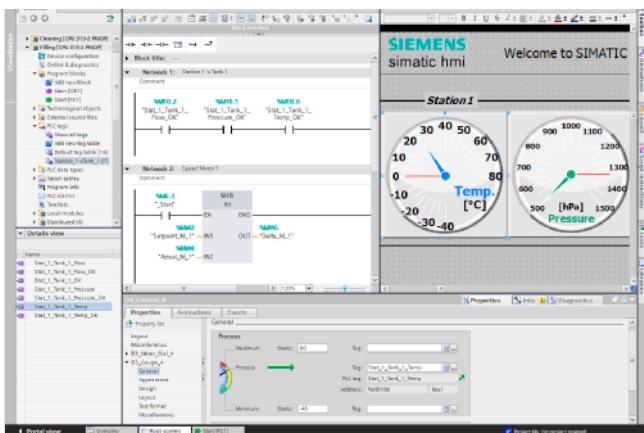
Supplied and proprietary program blocks and faceplates, as well as off-the-shelf modules and devices, are managed in structured libraries. This data can be reused again at any time, within a project, in local libraries, or across project boundaries in the global libraries. The central modifiability of the blocks ensures consistency.

Blocks or entire projects created with predecessor versions of the software products integrated into the TIA Portal can also be reused in the TIA Portal.

Reuse saves on engineering costs and simultaneously increases the quality of the solution.



Clearly structured user interface on startup screen



Perfect interplay between STEP 7 and WinCC

SIMATIC STEP 7 V11 – the new engineering system for all SIMATIC Controllers

The current version of the SIMATIC Controller Software, STEP 7 V11, has a user interface that has been optimized for maximum user-friendliness according to the latest usability studies.

And: STEP 7 V11 is an integral component part of the centralized TIA Portal Engineering Framework. Thanks to complete integration into the centralized TIA Portal Engineering Framework, SIMATIC STEP 7 V11 has a uniform operator input concept across all automation tasks with shared services (e.g. configuration, communication, diagnostics), as well as automatic data consistency.

The highlights of STEP 7 V11:

- Efficient and newly developed programming editors S7-SCL, S7-GRAPH*, LAD, FBD and STL* enable intuitive programming.
- Optimized SCL Compiler for S7-300/400
- SCL as third programming language for S7-1200
- Safety functionality as fully integratable option package for STEP 7 Professional V11. This means: intuitive engineering and uniform operating concept for standard and safety-related programs.

STEP 7 V11 is available in two versions:

- **SIMATIC STEP 7 Basic V11 – shared engineering for SIMATIC S7-1200 and the SIMATIC HMI Basic Panels**
The SIMATIC S7-1200 microcontrollers can be configured and programmed with STEP 7 Basic. SIMATIC WinCC Basic is included in the scope of supply for simple visualization tasks with the SIMATIC Basic Panels.
- **STEP 7 Professional – one engineering system for all SIMATIC Controllers**
STEP 7 Professional is suitable for configuring and programming the SIMATIC Controllers S7-1200, S7-300, S7-400, and WinAC for PC-based control. SIMATIC WinCC Basic is also included here for simple visualization tasks with the SIMATIC Basic Panels.
The supplied block library contains a range of technology functions, including a simple PID control.
The SCL, GRAPH, PLCSim, DocPro, and TeleService option packages familiar from STEP 7 V5.5 are already integrated into STEP 7 Professional V11 and do not require additional licenses. Purchasers of the STEP 7 Professional Software Update Service automatically receive SIMATIC STEP 7 Professional V11.

STEP 7 Professional V11 options

The following are available as option packages

- STEP 7 Safety V11 for fail-safe SIMATIC Controllers
- PID Professional V11, a package for controller configuring that combines the functionality of the previous Standard PID Control and Modular PID Control options.
- Easy Motion Control

SIMATIC WinCC V11 – one software for HMI and SCADA

SIMATIC HMI operator panels range from Basic Panels providing basic functionality for smaller visualization tasks, through high-performance Mobile Panels and Multi Panels, right up to Panel PCs that can also be used to solve SCADA tasks.

In the TIA Portal, you configure all SIMATIC Operator Panels with SIMATIC WinCC V11. WinCC V11 offers system-wide engineering, from simple HMI tasks all the way to SCADA applications. A scalable range of packages ensures a price-performance ratio that is optimized to the relevant target system and the relevant task. As with STEP 7, upward compatibility is guaranteed here too, so that upgrading is possible at any time.

* STL and S7-GRAPH are not available for S7-1200.

Programming devices

SIMATIC Field PG M3, the rugged and powerful industrial notebook

SIMATIC programming devices are the first choice as the hardware base for configuring and programming with SIMATIC Controller Software. The SIMATIC Field PG M3 boasts wireless technology, a powerful Intel Core i5 processor, and a 15.6" widescreen display. In addition, the new device has a long battery life, large work memory, SIMATIC interfaces, and all common interfaces for industrial applications.

Another decisive advantage of the SIMATIC Field PG M3 is its ruggedness and the pre-installed SIMATIC Software. The programming device can be used immediately after it has been licensed.

Ruggedness

- The rugged magnesium injection-molded enclosure and the shock absorbers on the edges of the device protect the Field PG M3 against shock and vibration. State-of-the-art materials technology ensures low energy consumption during manufacturing of the enclosure.
- The robust, ergonomic carrying handle ensures a safe grip during transport on the shopfloor.
- The metalized plastic components on the inside of the enclosure protect against electromagnetic interference – comparable with a Faraday Cage (EMC/EMS-compliant).
- The keyboard is ergonomically designed, and inscribed by laser for abrasion resistance.

Interfaces

- All common interfaces for industrial applications are integrated.
- 5 x high current USB 2.0
- Bluetooth and Industrial WLAN, based on the WLAN standards 802.11 a, b, g and n, permit secure and wireless communication with programmable controllers.
- 2 fully-featured Industrial Ethernet ports with high data throughput (10 Mbit, 100 Mbit, 1000 Mbit)
- DVI-I graphics interface

Hardware components

- The Intel Core i5 processor offers maximum performance with low energy consumption.
- The lithium ion battery supplies the Field PG M3 with up to three hours of power.
- The high-resolution 15.6" widescreen display in 16:9 format (HD Ready or Full HD) reduces eye strain and supports ergonomic working.
- The high-performance work memory (3 or 2 GB, DDR3, 1066 MHz) supports high-speed execution and parallel processing of several applications.
- The 250 or 500 GB hard disk can be replaced easily depending on the environment and software version required.
- The status LED can also be read when the device is closed up.

Software

- A uniform data backup concept with SIMATIC IPC Image & Partition Creator (option) can generate an automatic backup at configurable intervals and allows backed-up data to be easily loaded if required.
- Operating systems:
 - Windows XP Professional (32 bit), Windows 7 Ultimate (32 bit)
- SIMATIC Software – Pre-installed, with license key for activation:
 - STEP 7 Basic, STEP 7 Professional, STEP 7 Micro/Win, WinCC flexible Advanced, optionally STEP 5
- Every Field PG M3 is delivered with a trial license for the installed software as standard. The type and extent of additional licenses can be selected when purchasing the device.



The latest information on SIMATIC programming devices can be found at: www.siemens.com/simatic-pg

Additions

SIMATIC Software for further engineering tasks

SIMATIC offers products and systems for just about all automation tasks. Tailor-made software solutions support all phases of the engineering workflow, from engineering to service and maintenance.

You can find brochures on other SIMATIC products and systems at

www.siemens.com/simatic/printmaterial

SIMATIC Manual Collection

The SIMATIC Manual Collection brings together all SIMATIC manuals on DVD. It offers you the opportunity of gathering comprehensive information before purchasing. For your work with SIMATIC, you can use the Update Service to ensure you always have all the latest versions of the relevant manuals.

My Documentation Manager

The My Documentation Manager facilitates the compiling of proprietary documentation from manuals.

In the My Documentation Manager, you have the option of creating and managing your own compilations in your own structure.

You can output the documentation compiled in one language automatically in another available language.

www.siemens.com/automation/support

CAX: SIMATIC product data in electronic form

Automatic transfer of data to and from planning and design tools saves time, minimizes potential sources of error and enables the disciplines of electrical planning and automation to grow together. In this way, technical data in accordance with the ECAD component standard and commercial data are available for download on the Internet, along with the device dimension drawings of SIMATIC Controllers and distributed I/O.

www.siemens.com/automation/bilddb or
www.siemens.com/automation/support (→ my Support)

Application-oriented licensing

The licensing model for SIMATIC software offers a tailor-made solution for each application:

Trial License – the license for evaluation

- For a limited period (14 days)
- For test and evaluation purposes

Floating License - the license per user

- Enables access for any user
- Regardless of the number of installations

Single License – the license per installation

- Enables one installation

Software types	Engineering Software		Runtime Software
What is licensed?	User	Installation	Installation
License types	Floating License	Trial License	Single License

Engineering Software includes all software products for creating user software (e.g. configuring and programming).

Runtime Software includes software products required to operate the plant (e.g. operating system, base system, system expansions).

The Software Update Service always keeps you up to date

The SIMATIC software is subject to continuous further development and improvement. The Software Update Service is the most convenient way of benefiting from these improvements.

It ensures automatic delivery of all new software versions that are released after ordering the Software Update Service. As a result, your software is always up-to-date.

Further information

System features:

www.siemens.com/simatic-system-features

SIMATIC Guide manuals:

www.siemens.com/simatic-docu

Information material to download:

www.siemens.com/simatic/printmaterial

Service & Support :

www.siemens.com/automation/support

SIMATIC contacts:

www.siemens.com/automation/partner

Industry Mall for ordering on the Internet:

www.siemens.com/industrymall

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Industry Sector
Industrial Automation Systems
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