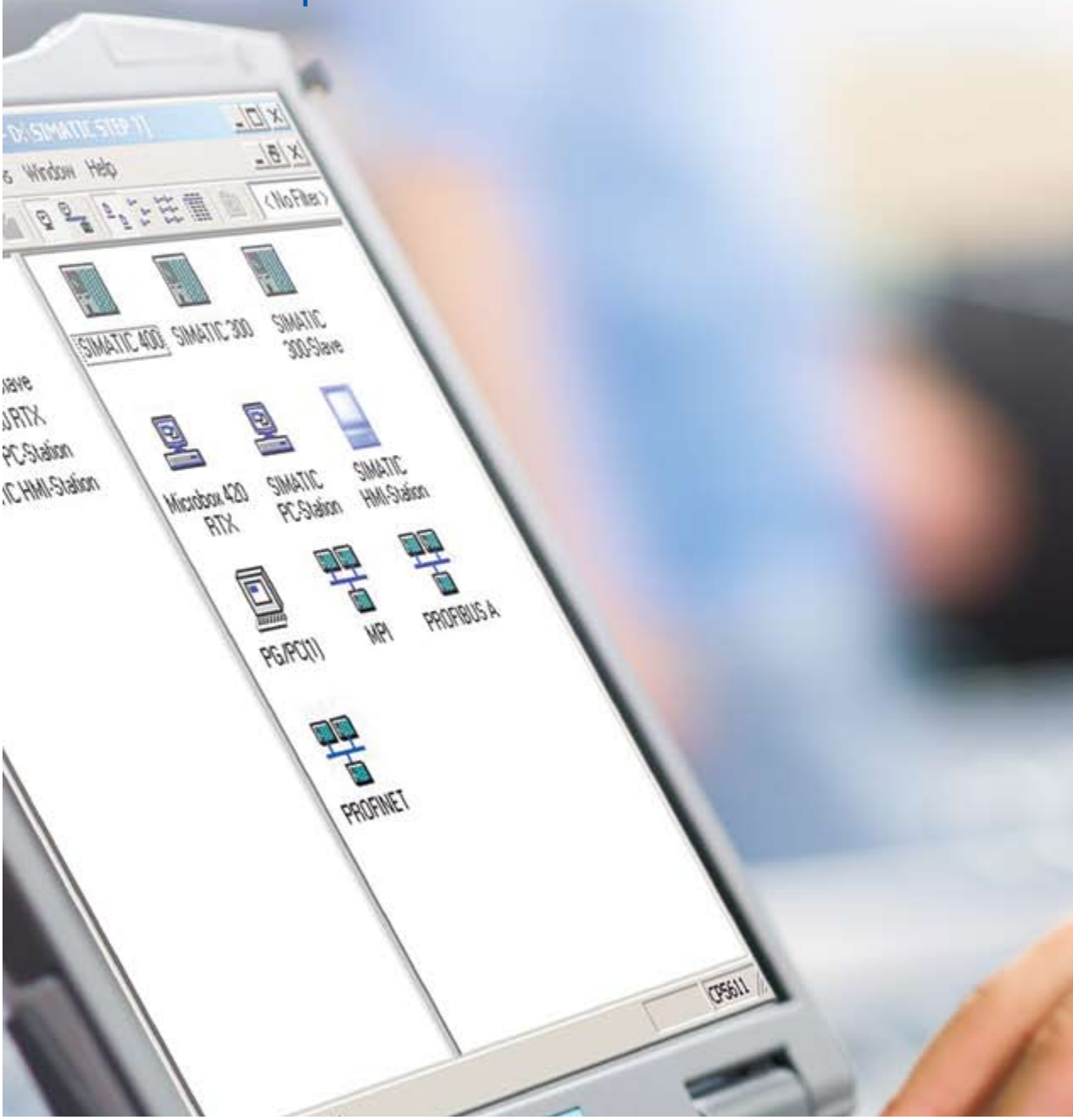
SIMATIC Software

Tools for configuring and programming SIMATIC Controllers

Brochure · April 2008

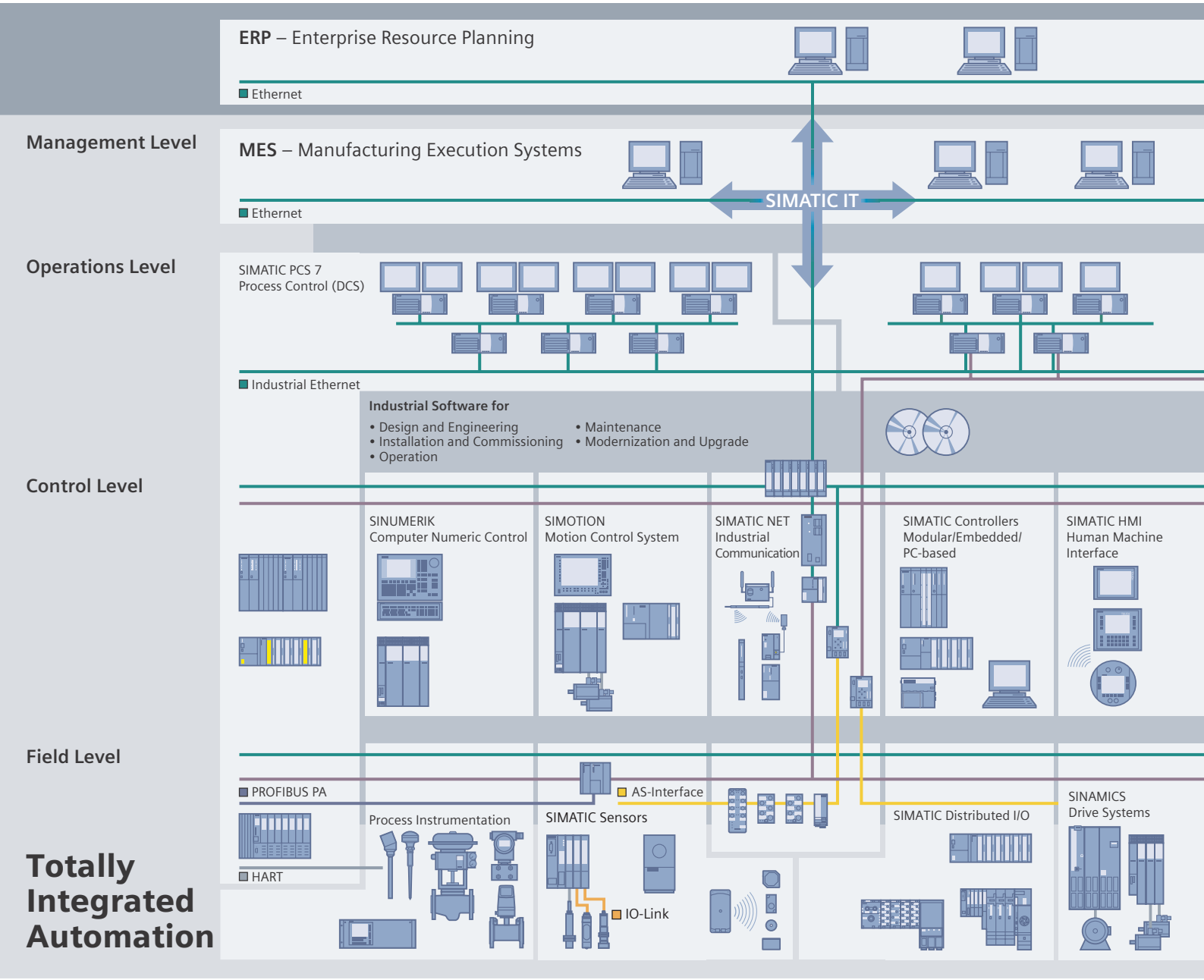


SIMATIC Software

www.siemens.de/simatic-software

SIEMENS

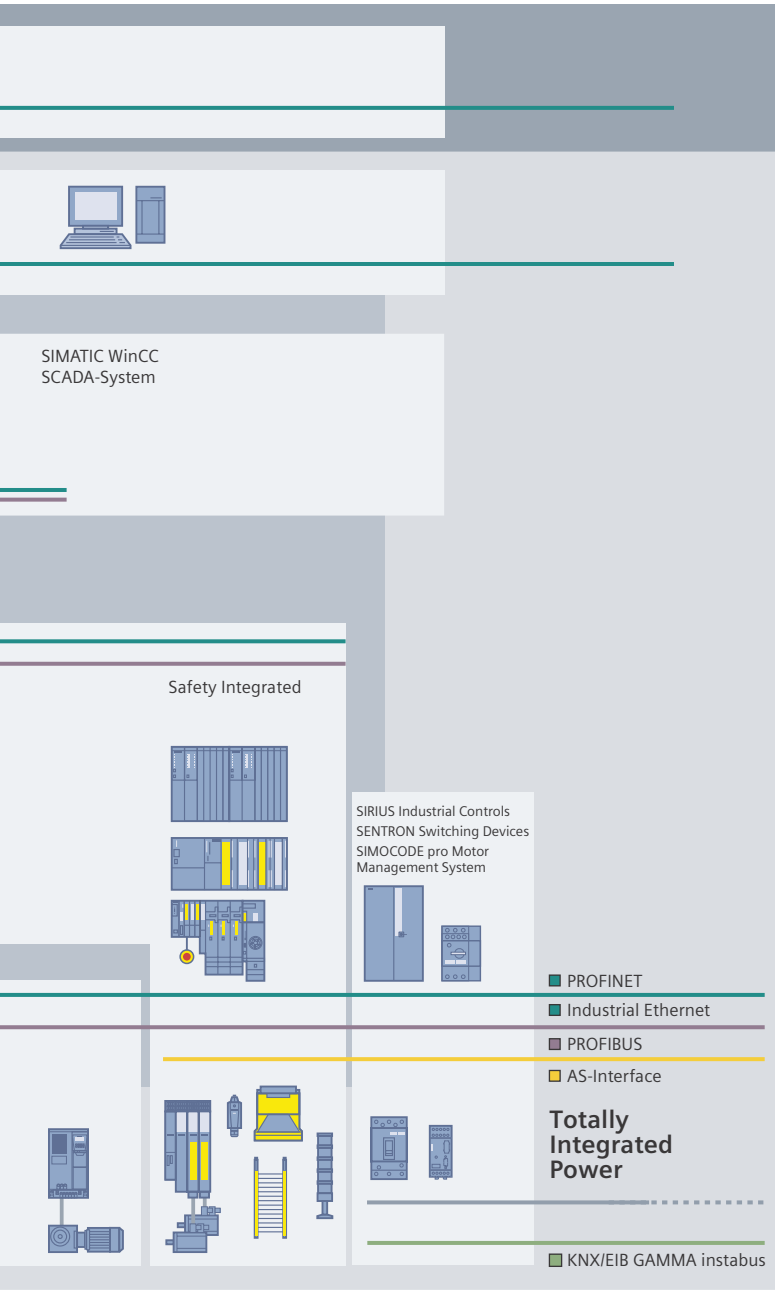
Totally Integrated Automation



To be able to respond to the increasing international competitive pressure, it is more important than ever that you focus on the core competencies of your company. The medium-term and long-term strategic focus on innovative automation concepts will be a key factor that helps you achieve sustained success.

Siemens offers the ideal basis for this purpose with Totally Integrated Automation (TIA) – for all sectors, from incoming to outgoing goods. Thanks to the unique integration of TIA, you can take advantage of the unrivalled interaction of all of our products and systems – even across different versions. Thus you protect your investments and simultaneously take advantage of future developments.

List of contents



As the core of Totally Integrated Automation, SIMATIC comprises a wide range of standardized products and systems. The software plays a central role.

SIMATIC Software supports all phases of the production lifecycle and makes a significant contribution towards increased productivity not just in the engineering phase, but also for maintenance, servicing, modification, and adaptation.

Read on to discover exactly how you can save time and costs by using SIMATIC Software

Introduction

SIMATIC Software – Universal development software for SIMATIC

Every automation project presents different individual tasks for solution, e.g. programming controllers and distributed I/O, defining communication links, and configuring visualization systems. Each requires maximum efficiency. SIMATIC Software provides an integrated engineering environment with first-class tools for the widest range of modes of operation 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 can not only be used to program and configure programmable controllers, but also PC-based automation systems and SIMATIC Embedded Automation. The user 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 complies with the IEC 61131-3 standard. This international standard 61131 is regarded as a worldwide and future-oriented standard in the area of programmable controllers. It has been adopted as European and German standard EN 61131. It replaces several international standards.

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. PLCopen aims to make application software portable between the hardware of different manufacturers. Siemens is actively participating in PLCopen and has introduced PLC programming to IEC 61131.

The certification of programming systems from different manufacturers is an important prerequisite for making software portable. To allow this, the standard compliance classes were redefined by PLCopen:

- Base Level
- Conformity Level
- Reusability Level.

Independent institutes carry out the test procedures and issue the respective certificates. Siemens has been awarded the base level certificate for S7-GRAPH (SFC) and the base level and reusability level certificate for S7-SCL (ST).

SIMATIC 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 costs of subsequent projects are 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 common engineering environment for all controllers
- Efficient process diagnostics increase plant availability

STEP 7

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 Standard Package.

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 editor for creating and testing the user program
- 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 Version Trail options are available for increased traceability

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.

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. 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.

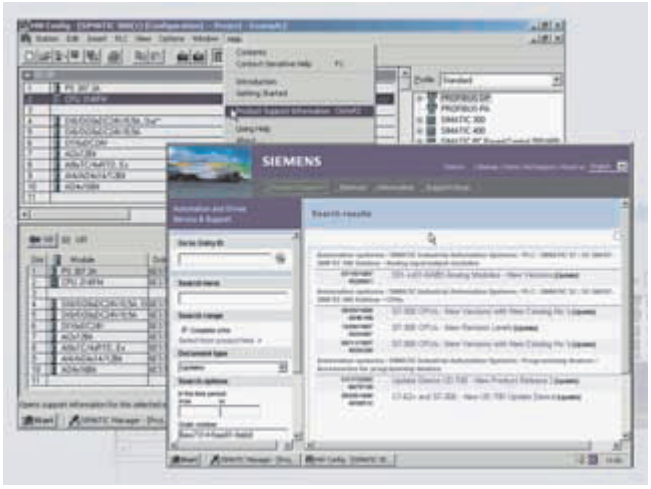
- Language Support
  This function supports the generation and administration of project texts in multiple languages. The texts to be translated are exported from STEP 7, edited with an ASCII editor or spreadsheet program (e.g. Excel) and then imported back into STEP7.

- 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.

- Creating PROFINET components
  PROFINET components are encapsulated programs which can contain the function of a whole machine or plant. They are used to implement distributed intelligence in the context of Component Based Automation.
  PROFINET components are created in the SIMATIC Manager at the click of a mouse. See also p. 22 for Component Based Automation

- 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

Hardware configuration



Calling up detailed information over the Internet

The CPUs and modules of the SIMATIC don't 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

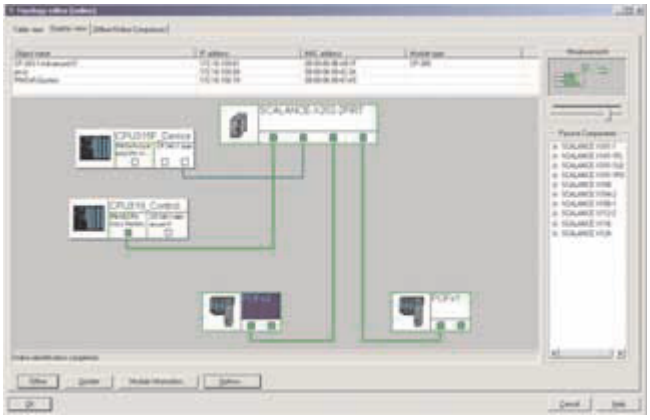
Graphical presentation of communicating ports

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.

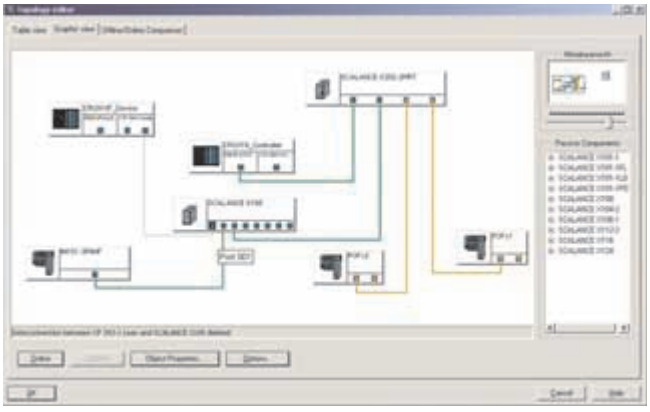
During normal operation, however, you cannot determine which ports are actually communicating with each other. But this is often extremely important for diagnostics.

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 the STEP 7 programming software 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.

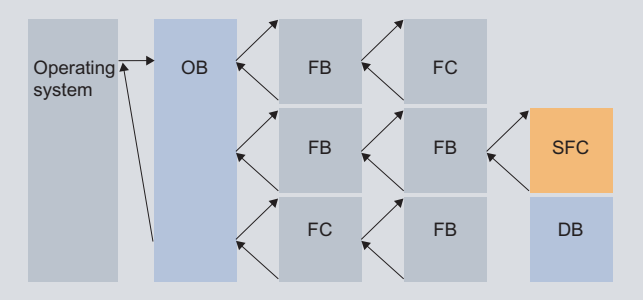
- Function blocks (FB), Functions (FC)
  - Function blocks are code blocks which contain the actual program. They have an assigned data block in which the input and output parameters as well as static data are stored. Thus the FBs can maintain the processed values throughout several cycles.
  - Functions 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 blackboxes, 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 505 programs.

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 re-used.
- 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.

- System functions (SFCs) and system function blocks (SFBs)
  Some functions that are repeatedly required are integrated into the operating system of the S7-CPUs 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.

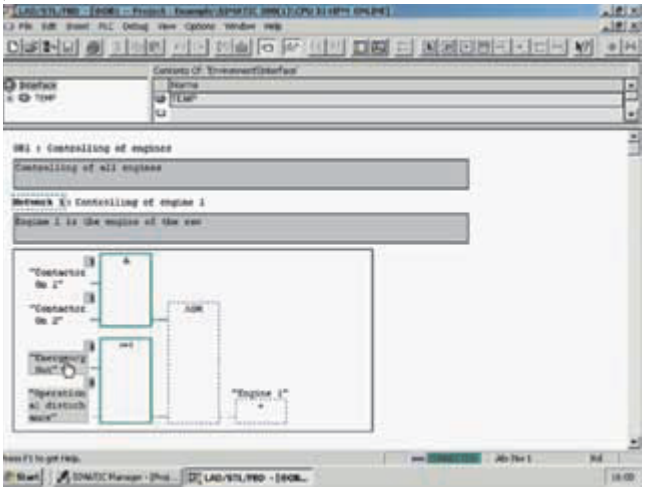


Structure of a user program

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.



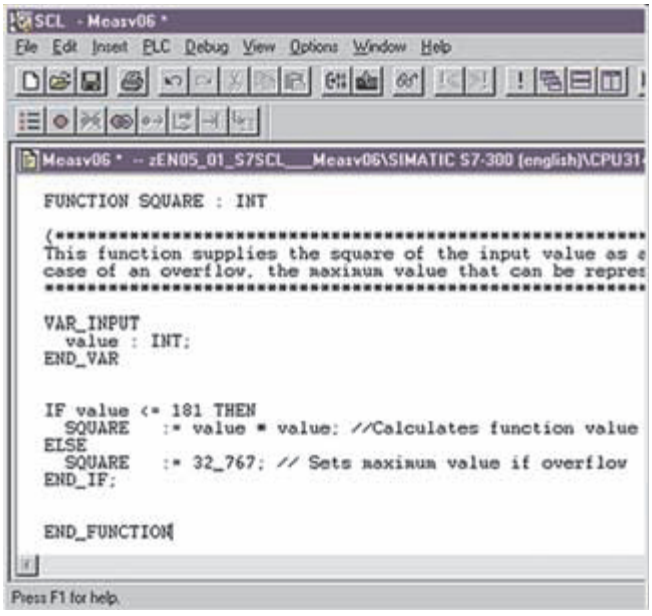
Programming in function block diagram

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.



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 branch distributors
- 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.

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).

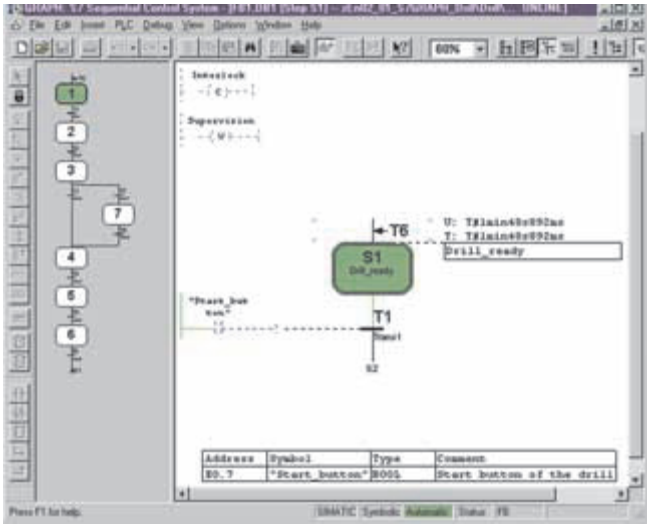
Additional benefits over LAD, FBD, and STL:

- 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



Test and diagnostics functions: S7-GRAPH in monitoring mode

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

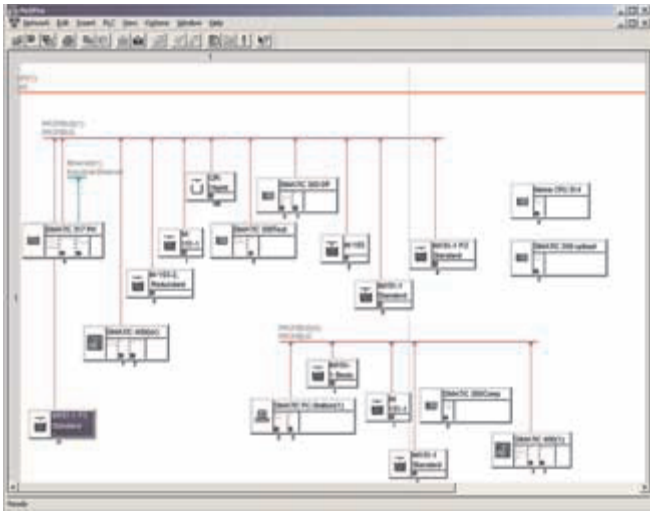
- Online functions:
  The online functions can result in considerable time savings, particularly during the start-up phase. For example, it is possible to display active steps, the status of the interlocking, monitoring and step enabling conditions, as well as past actions. Different diagnostic options 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.

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 STEP7. Faults in components linked to the PLC over PROFIBUS or PROFINET are also scanned here.

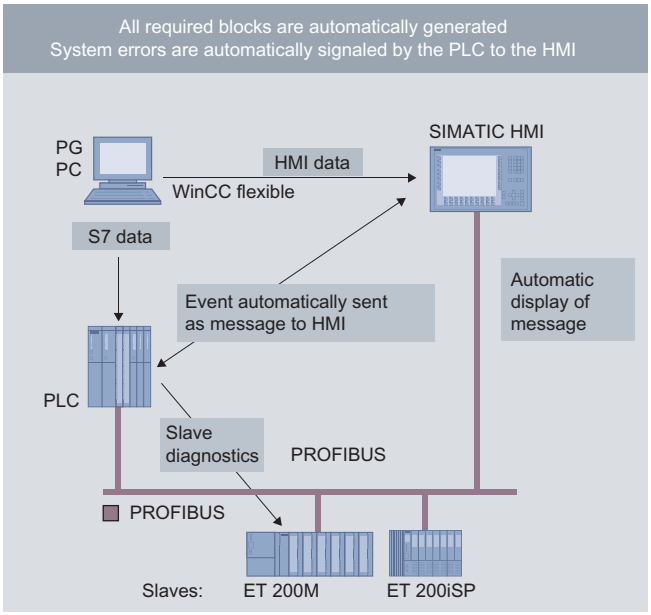
One function of the hardware diagnostics is, for example:

- Reporting system errors:
  The function "Report system error" offers the convenient 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 fault analysis is possible with 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



System diagnostics

Control configuring and software test

PID control and PID temperature control

The following functions support parameterization of controllers:

- 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 controller 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 controller

Simulation systems provide effective support with the development of programs and the following actual application. In the automation environment, a simulated test environment including PLC and process reduces start-up times and thus costs, for example.

Early discovery of programming errors and optimization of program sections enable the optimized and error-free use of the programs in the actual system.

If a program is modified, it can be tested prior to loading it onto the plant control 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 carried out on-site in the development office.

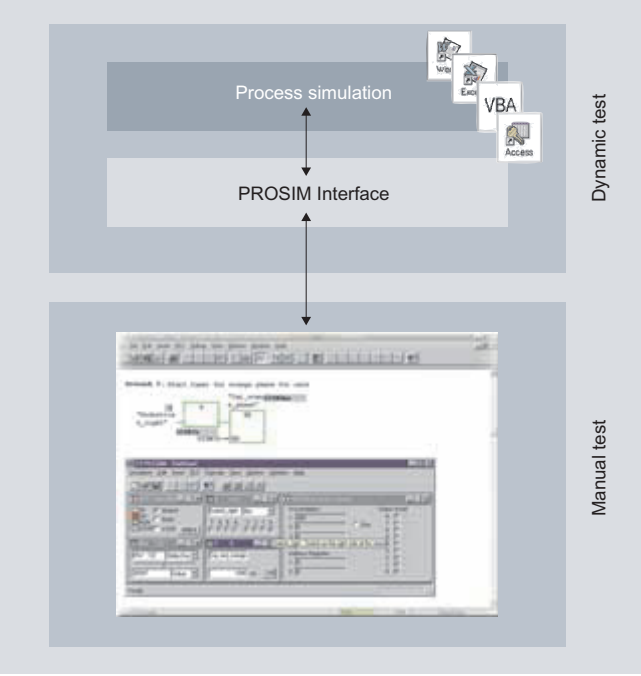
The facilty for communicating via MPI, PROFIBUS DP and TCP/IP is new and ensures a high degree of flexibility in the simulation.

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.

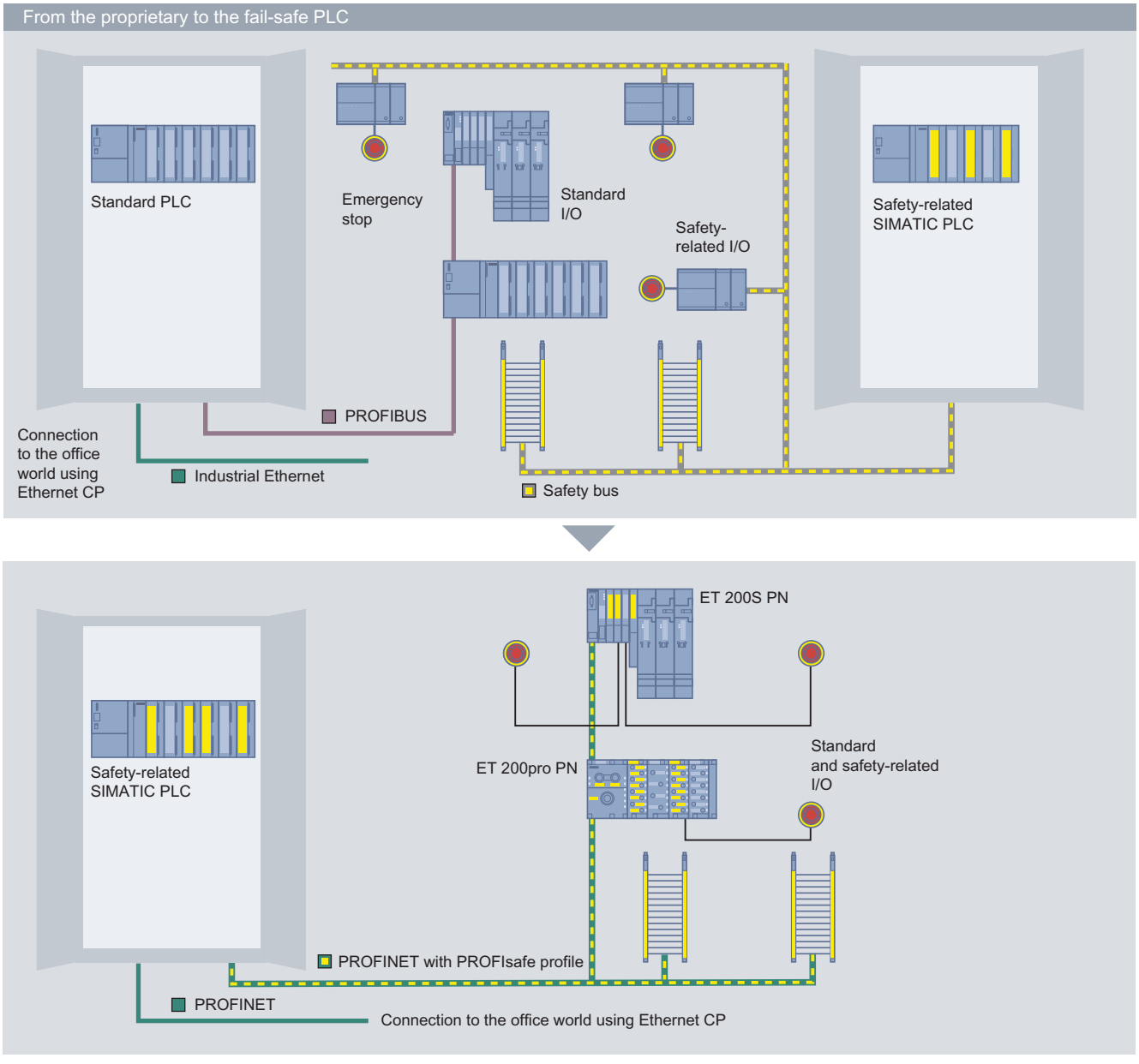
Tools and functions for special tasks

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 into 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

Open interfaces

Integration of engineering systems from other manufacturers: Tool Calling Interface TCI

The Tool Calling Interface is an open interface supported by PI (PROFIBUS and PROFINET International) via which engineering tools from other manufacturers can be easily integrated into STEP 7.

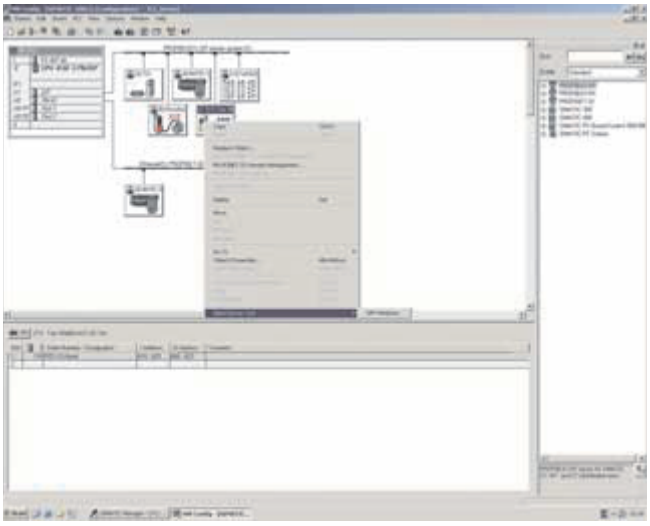
It enables simple call-up of programming or parameterization tools for sensors or actuators driven via SIMATIC Controllers. Use of the familiar device tool is a significant time-saving for users when configuring and when archiving the configuration data.

TCI is outside the control/engineering system so release changes or updates can have no effect.

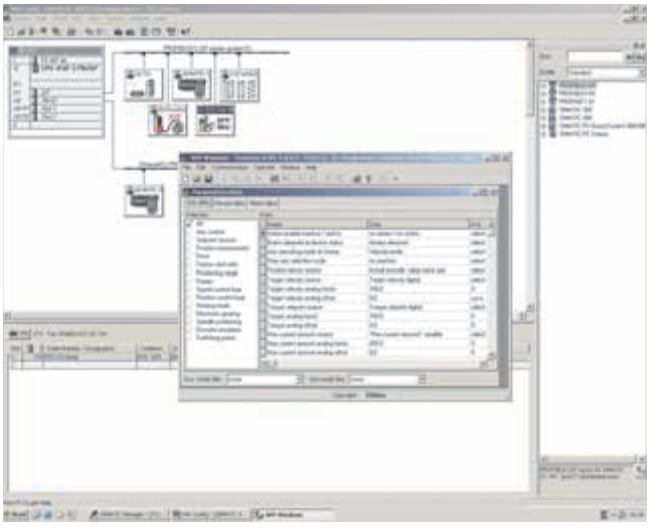
TCI already enjoys the support of a large number of field device manufacturers today. The Automation Initiative of the German Automobile Industry (AIDA) also approves TCI.

Open command interface

Data, calculations or sequence steps that are required repeatedly can be easily integrated in the form of scripts via the open instruction interface. Engineering overhead is thus reduced and input errors are avoided.



TCI: The parameterization tools are called via the context menu



TCI: Example of a device tool

Options

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 and 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 options 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 are 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, functions can be implemented that support tracking and tracing as required by the FDA:

Project password

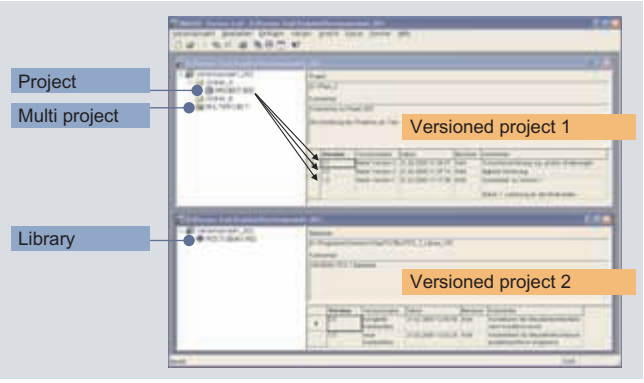
Access to projects and libraries can be protected by a project password.

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 – Reliable version management

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.

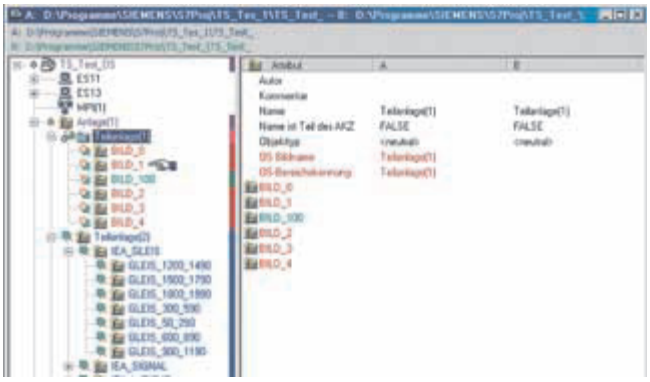


Version management with SIMATIC Version Trail

Version Cross Manager

What details have changed from one archive version of a project to the next version? The Version Cross Manager compares objects and their attributes that are grouped hierarchically or can be mapped to a tree structure. The Version Cross Manager displays the differences in graphical form. This becomes necessary, for instance, after acceptance by the customer, the German Technical Inspectorate (TÜV) or FDA representatives. The following objects are compared:

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



S7 HiGraph for state diagrams

S7-HiGraph is a STEP 7 option for automating function units at equipment levels such as valves, motors, or workholders that can assume a clearly defined number of states (e.g. open, closed). Typically, only a few processes are repeated (e.g. switching on/off, traversing up/down).

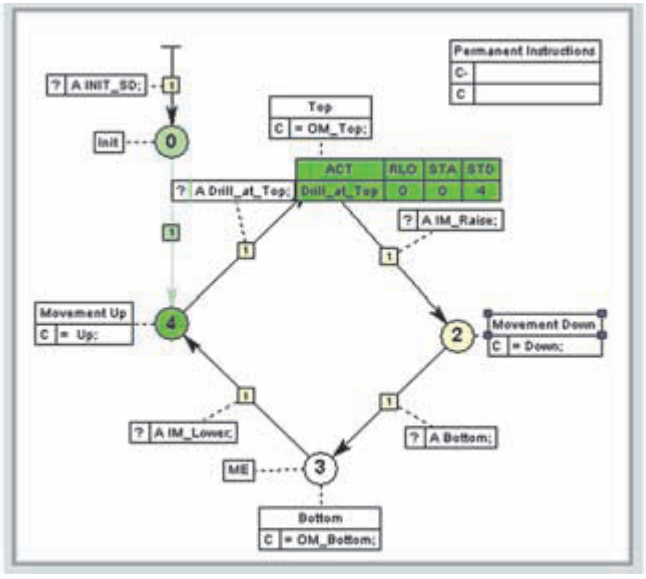
Machines and plants that are mainly made up of such function units are, for example: Assembly cells; presses with simple functions such as clamping, pressing, releasing; drill units without NC functionality; transfer lines and conveyor systems.

Mode of operation

The following procedure replaces the actual programming:

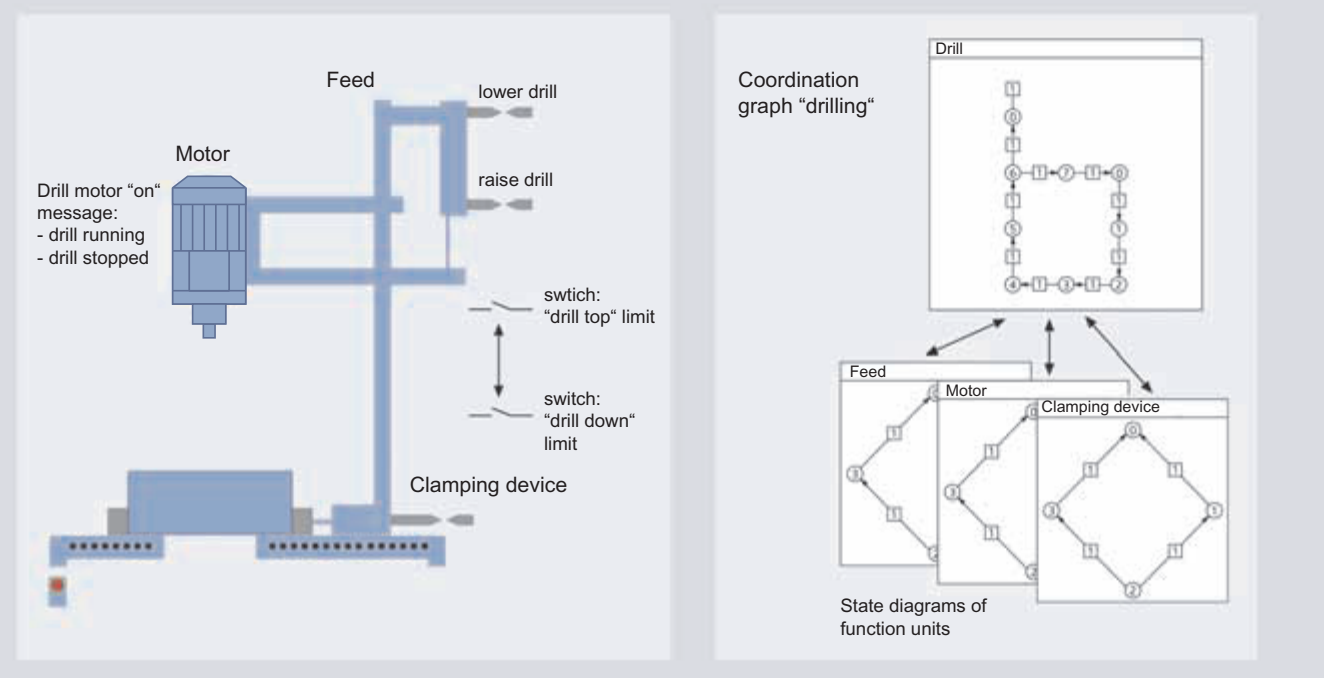
- Possible function unit states are defined.
- The programmer generates the program by graphically connecting the states and defining the step enabling conditions.

The decisive advantage is that the program structure is geared to the process-oriented objects and can therefore be easily understood. Once the state diagrams have been generated, they can be reused as many times as required and also be modified centrally. Process diagnostic functions are integrated as in S7-GRAPH.



State diagram for the feeder in monitoring mode for program testing and diagnostics

Depending on the application, up to 50 % less engineering overhead can be achieved with S7-HiGraph. At the same time, the program execution times are reduced when S7 HiGraph programs are executed. Thus the operating times of a machine can be reduced by up to 10 %.



Schematic representation of function units of a drill and their states. The graph group "Drilling" is generated from the state diagrams of these units.

CFC – Interconnection and parameterization instead of programming

The CFC engineering tool (Continuous Function Chart) is available as a STEP 7 option, 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 connected to each other and then parameterized. Extensive programming experience is not required.

Function

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 CFC charts (chart-within-a-chart technique): Other CFC charts can be integrated into a CFC chart. 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 subcharts (up to 26 subcharts are possible)

CFC fulfills increased requirements during operation:

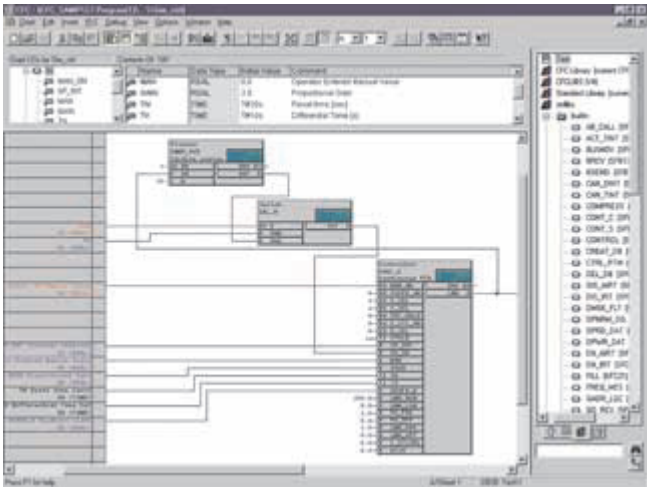
- Delta online loading is supported. Changes to the configuration are loaded in the CPU state "RUN-P".
- The program sequence can be influenced:
  - Currently measured values can be easily overwritten online by the user.

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, ...
- Blocks for SIMATIC S7-300 and S7-400: e.g. controller blocks, clock generators, counter blocks, timer blocks, ...

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 chart with chart connections and CFC catalog

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 for STEP 7 and function blocks for the CPU.

Functions

The following controller types can be implemented:

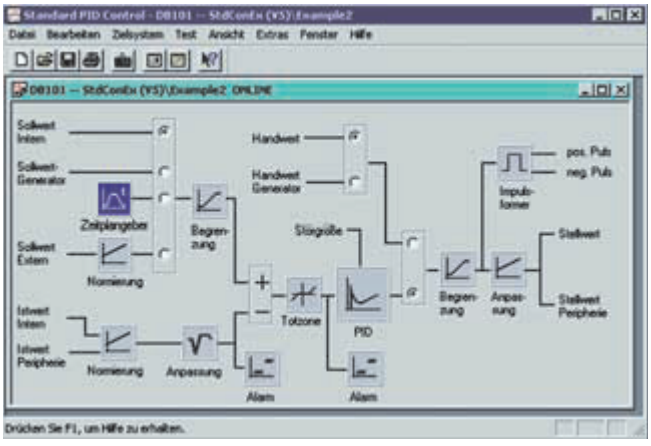
- Continuous-action PID controllers, Pulse controllers including pulse-pause signal (pulse shaper), step controllers.

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-oriented 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 mit feedforward control, range selection controllers, override controllers, multivariable controllers

The blocks can be linked with STEP 7, S7-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: Configuring is not required for this (see also page 10 for system diagnostics).

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 related costs low, the use of diagnostics tools is recommended.

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 will usually have to be reprogrammed.

Process diagnostics for SIMATIC

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

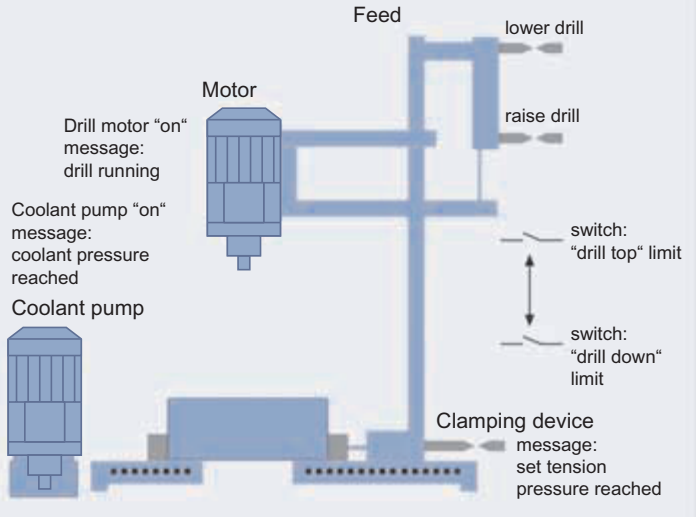
- Simple configuration
  The process diagnostics are configured in one step when the automation solution is programmed and is very simple. The variables to be monitored are marked. Then the error state is defined and a comment is assigned to it – and that's it.

- 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:

- Comfortable 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 provided to replace the old one before it wears out.



Example for motion monitoring

Does the drill reach the "Drill down" limit switch at the correct time?
In the case of a fault, different reasons can be displayed, e.g.:
- "Feed not activated" (defective motor?),
- "Movement out of limit position not possible" (mechanically blocked?).

Example for general monitoring

Has the drill motor been activated with a start command?
In the event of a fault, the system indicates which requirement has not been met for operation of the drill motor, e.g.
- "Setpoint voltage for clamping device not reached" or
- "Coolant pressure not reached".

The right component can then be repaired.

The SIMATIC diagnostics tools:

- SIMATIC S7-PDIAG
  For configuring signal monitoring for process diagnostics. S7-PDIAG is loaded in addition to STEP7 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-GRAPH 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, programming 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 WinCC or WinCC flexible and SIMATIC ProAgent. All text strings, symbols and addresses are automatically read from the PLC program. 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:

- Diagnostics 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 via TeleService

Machines and plants are increasingly operated in places which are far away from the place of manufacture. Manufacturers of plants 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 connection

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 messages by SMS from a plant to a mobile phone. TeleService can also send the SMS to a provider which then forwards the message as a fax or e-mail. The TeleService Adapter IE is used to send e-mails direct.

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@rt-Service/Sm@rtAccess is required for human machine interfacing. Internet Explorer or the SmartClient option is used.

Security against undesired access

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

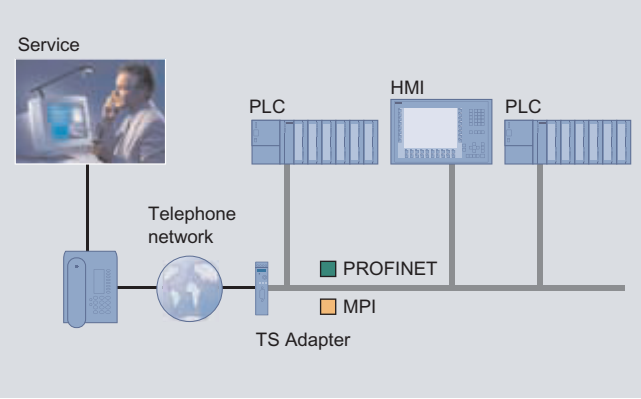
Supported bus links

Adapter	TeleService-Adapter II		TeleService.-Adapter IE	
Bus link	**Analog**	**ISDN**	**Analog**	**ISDN**
MPI	●	●		
Profibus	●	●		
PPI	●	●		
PROFINET			●	●
Industrial Ethernet			●	●

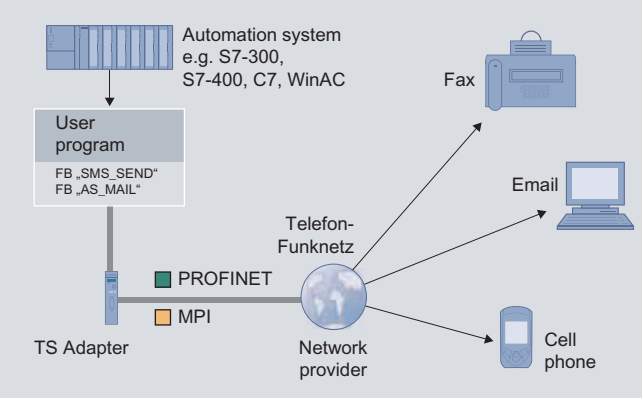
Function overview

Adapter	TeleService-Adapter II	TeleService.-Adapter IE
Remote maintenance		
Remote maintenance on CPU	●	●
Remote maintenance and operation on HMI		●
Remote connection		
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*



System configuration for remote maintenance. A programming device/PC is not required on the plant side. Connection is made direct to PROFIBUS up to 12 Mbit/s, MPI or Industrial Ethernet. Routing enables access across network boundaries.



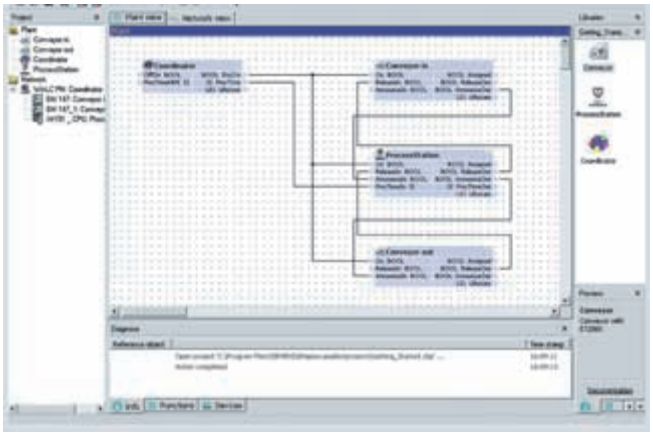
Direct transmission of SMS, e-mail or fax

Engineering for Component Based Automation with SIMATIC iMap

In mechanical engineering parts which are used over and over again are preassembled. These can then be quickly combined into individual units when an order is received. Component Based Automation makes it possible to also expand this modularization to the automation technology of the plant. The function of a machine or plant module is encapsulated and can then be reused as a complete component when required. When the communication links are configured the programs of the individual components are not affected. Communication between the components is carried out exclusively via the component interfaces. On the outside, only those variables are accessible on these interfaces which are required for interaction with other components.

The individual machines of a plant can also be regarded as components of Component Based Automation. Here, too, it is advantageous if the program can be encapsulated by the mechanical engineer and is not accessed when integrated into the local plant. This reduces the likelihood of errors and significantly shortens the time required for commissioning.

Encapsulation of programs or program sections is possible with STEP 7. The higher-level connection editor SIMATIC iMap is used to define the communication relationships.
SIMATIC iMap complies with the PROFINET standard can therefore be used by different manufacturers. PROFINET components which have been generated with programming tools of other manufacturers and communicate over Ethernet can also be imported via open interfaces.



Interconnection of PROFINET components with SIMATIC iMap

Application

Many production plants already use distributed automation solutions today. With SIMATIC iMap Component Based Automation simplifies configuring communication links between intelligent modules connected to each other via PROFINET. These can be part of a production line or represent individual machines which, in addition to the control, can also include lower-level fieldbus systems as well as intelligent I/O devices on the PROFIBUS.

In the areas of conveyor technology, assembly technology, material handling as well as in printing and paper machines modularization is widespread because Component Based Automation has many advantages.

SIMATIC iMap features

- SIMATIC i-Map builds on the open and component-based architecture of PROFINET.
- Each intelligent machine/plant module is represented by a "PROFINET" component in the connection editor. This is displayed in the form of a software function.
- SIMATIC i-Map connects technology-oriented library elements regardless of manufacturer and functionality.
- Online functions and diagnostics options for the communication functions make commissioning easier.
- PROFINET components can be used several times in SIMATIC iMap (reusability of library elements) or once if they have been designed as so-called singletons. Multiple-use components can be changed centrally which saves engineering outlay.
- The machine/plant can be structured hierarchically to any depth with subdiagrams.
- All variables which are required for general data accesses, e.g. by the visualization or from the MES level, etc. are generated automatically from the engineering information.

SIMATIC Software – Supplements

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

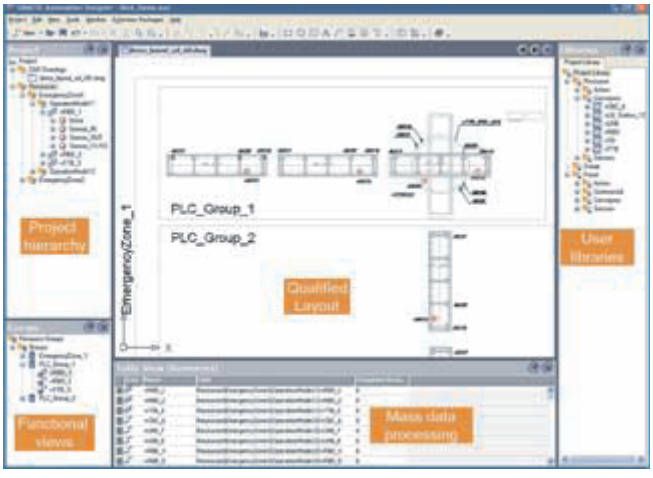
www.siemens.com/simatic/printmaterial

Here is a selection of SIMATIC software products that could be of special interest to you:

SIMATIC Automation Designer

SIMATIC Automation Designer combines electromechanical design and automation engineering into an integrated process chain. The original plant layout is a central component part of the operator interface. It is created back at the planning phase. The graphical representations of the individual operating resources in this layout are assigned to the prepared re-usable templates (data, user programs). The transparent plant view with intuitive navigation facilities generated in this way facilitates engineering both in program creation and in maintenance, or in the case of later modifications. Data is entered only once and it is consistent and always up-to-date.

SIMATIC Automation Designer is a first step towards the Digital Factory. The aim of the Digital Factory is to visualize and simulate a production system entirely virtually before the real system is implemented.



Integrations-Oberfläche von SIMATIC Automation Designer

SIMATIC HMI software

SIMATIC WinCC flexible
Innovative HMI software for all applications at the machine level and the process level with SIMATIC operator panels and PCs.

SIMATIC WinCC
- Process visualization with Plant Intelligence
- Multi-user SCADA system, open, scalable, and flexible.

www.siemens.com/simatic-hmi

CAx: SIMATIC product data in electronic form
Automatic data transfer from and to planning/design tools minimizes potential sources of error and ensures merging of the disciplines of electrical planning and automation.
The technical and business data as well as the dimension drawings of the SIMATIC Controllers are thus available on CD ROM (CAx data):

- Technical data in accordance with ECAD component standard (e.g., size, weight) for the bid phase
- Business data (e.g. order number, price – following import of prices from the national CA01 catalog, the interactive catalog on CD ROM) during the the bid phase
- Device drawings for creating documentation
- Dimension drawings of the devices for integration into design drawings (when constructing the control cabinet, for example)
- Device connection descriptions as macros for circuit diagrams

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.

Licensing and Update Service

Application-oriented licensing

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

Trial license – the license for evaluation.
The trial license allows limited use of the software

- 14 days
- for test and evaluation purposes

Floating license - the license per user.
The floating license

- enables any user access
- regardless of the number of installations.

Single license – the license per installation.
The single license

- releases 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

What is the Software Update Service?

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

Premium Studio – All the important software tools for automation

Premium Studio offers all of the important software tools for automation technology. The DVD includes comprehensive engineering and runtime software for SIMATIC and SINUMERIK – e.g. STEP 7 Professional, WinCC flexible, etc. The DVD also contains the following: graphical programming languages, HMI software, offline simulation, and software for integrating the drive technology.

The Installation Wizard reduces the administrative overhead

The user does not have to install and configure every software tool individually. Instead, he defines the language and configuration once centrally. This selection is then automatically adopted for all of the selected software tools. The selected software is automatically installed in the correct order, taking into account existing programs. A display of any interactions with existing installations provides even more user security.

Identical configuration on all PGs/PCs

The settings for an installation are saved and can be used for identical installation on other workstations.

Thanks to server functionality, the DVD can be stored on a server and your programming devices installed from there. This ensures that the same configuration and software version is stored on all workstations.

Update service

In order to keep the workstations up to date, a Software Update Service is available for Premium Studio. Beginning immediately, the Premium Studio DVD will appear every six months with updates and with a constantly expanding range of software tools. .

Further important software tools

In addition to software for SIMATIC and SINUMERIK, the CD contains the SIMOTION SCOUT software for the motion control system SIMOTION.

With SIMOTION, motion tasks in many different machines are performed easily and uniformly. To facilitate this, a very special, multi-layer architecture was chosen as the runtime system.

All SIMOTION devices provide the basic functionality, such as PLC functionality with a command set to IEC 61131-3 and a cam controller.

Highlights

- Configuration for all software packages only has to be specified once at the start of the installation
- Existing software packages are identified and taken into account
- Automatic installation in the correct sequence
- Storing of the installation selection – all programming stations can be easily updated to the same software version
- Trial License included for most products, allowing the original software to be tested for a period of 14 days
- Two editions per year

For SIMOTION programming, the SCOUT engineering software offers the full range: Graphical configuration with Motion Control Chart (MCC), Ladder Diagram (LAD) / Function Block Diagram (FBD) familiar from the PLC or the high-level language Structured Text (ST). In addition to Motion Control commands (e.g., referencing of axis), commands for I/O access, logic and calculations, subroutine calls and open-loop control of the program flow are also available.

Newly added to the DVD from Edition 2007 are the SIMATIC RF-Manager 2007 software and the parameterization and configuring software for SIRIUS motor starters. SIMATIC RF-Manager 2007 makes it particularly easy to parameterize RFID readers and to start them up in the shortest possible time and operate them efficiently. The new SIRIUS software enables fast and simple configuring and programming of motor starters

A further important software tool has therefore been added to the Premium Studio DVD for solving complex automation tasks.

www.siemens.de/premium-studio

Programming devices – SIMATIC Field PG M2, the ideal industrial notebook

SIMATIC programming devices are the first choice when it comes to configuring and programming SIMATIC software. The SIMATIC Field PG M2 boasts wireless technology, powerful Intel Core 2 Duo processor, large display, and integral data backup concept. In addition, the new device has a long battery life, large working memory and all common interfaces for industrial applications.

Another decisive advantage of the SIMATIC Field PG M2 is its ruggedness and the pre-installed STEP 7 Professional and WinCC flexible software. The programming device can be used immediately after it has been licensed.

Robustness

- The rugged magnesium die-cast housing and the shock absorbers on the edges of the device protect the
- Field PG M2 against shock and vibration.
- The fold-out carrying handle ensures a safe grip during transport in the production hall.
- The new industrial design with its dark color is dirt-resistant.
- The metallized plastic components on the inside of the housing protect against electromagnetic interferences – comparable with a Faraday Cage (EMC/EMS compliant).

Interfaces

- All common interfaces for industrial applications are integrated.
- 2 x 2 USB 2.0 interfaces – Each pair makes 1 A available for supplying external devices with power.
- Industrial WLAN, based on WLAN standards 802.11 a, b and g, permits secure and wireless communication with automation devices.

Hardware components

- The Intel Core 2 Duo processor offers maximum performance with low energy consumption.
- The lithium ion battery supplies the Field PG M2 with up to five hours of power.
- The brilliant 15" display with XGA or SXGA+ resolution with up to 1400 x 1050 pixels puts less strain on the eyes and supports ergonomic work practices.
- The working memory with 1 x 2 GB DDR 2 RAM and a 667 MHz clock cycle permits fast execution and parallel processing of several applications.
- The 160 GB S-ATA hard disk can be replaced easily depending on the environment and software versions required.
- The data are written straight onto the optical data carrier with multi-standard DVD RW.

Software

- The integral data backup function can generate an automatic backup in configurable intervals and allows backed up data to be easily loaded if required.
- STEP 7 Professional and WinCC flexible are already installed on the Field PG M2 and can be enabled with license keys.
- Every Field PG M2 is delivered with a trial license for the installed software as standard. The type and extent of additional licenses are decided when purchasing the device.

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

Siemens Solution Partner Automation – Experts for outstanding, tailor-made, and future-oriented solutions

Solution Partner

Automation

SIEMENS

Siemens Solution Partners are system integrators and systems houses with extensive technical expertise and process know-how. They develop tailor-made, future-oriented solutions based on the internationally successful range of products from Siemens Automation and Drives.

Thanks to close cooperation, qualification, certification and the intensive exchange of information, the Solution Partners are always at the forefront of technology and its further development.

Tailor-made solutions

Siemens Solution Partners are highly qualified in the creation of tailor-made, future-oriented automation and power distribution solutions. They ensure your competitive advantage. The benefits:

- State-of-the-art systems in automation and power distribution increase the productivity of a plant.
- The latest technology is used in an optimized configuration.
- Experience gained from project design, engineering, commissioning, and plant operation flows back into product development.
- High degree of investment security – Solution Partners implement solutions that are optimized to the challenges and developments of the future.
- The Solution Partner Finder makes it easy to find the right Solution Partner quickly, worldwide.

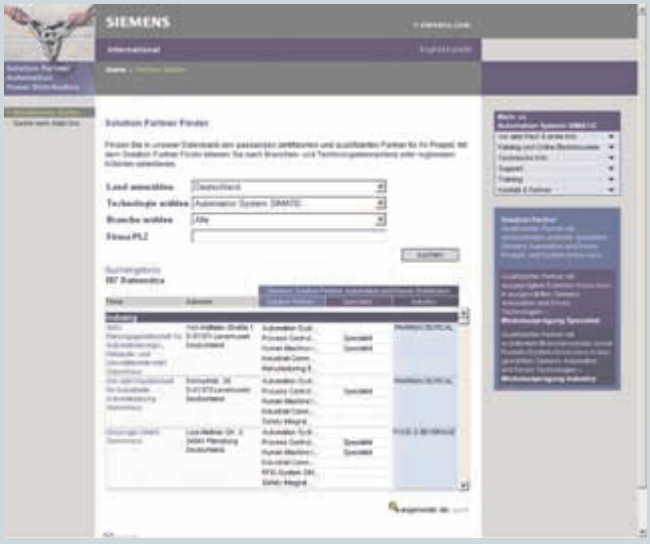
The perfect partner for your requirements is just a mouse click away

The Siemens Solution Partner Program helps you to find the optimum partner for your specific requirements. More than 740 companies around the world belong to the program, which means you can count on skilled support on your doorstep.

The Solution Partner Finder is a comprehensive online database that showcases the profiles of all our Solution Partners. You can filter searches according to company and postal code in addition to the technology, industry or country. Once you have located a partner, you are only one small step from contacting them.

www.siemens.com/automation/partnerfinder

For further information on Siemens Solution Partners, visit:
www.siemens.com/automation/solutionpartner



Get more information from

www.siemens.de/simatic-software
www.siemens.de/simatic-pg

For further details, see SIMATIC Manuals Guide:
www.siemens.com/simatic-doku

You can order more publications on the subject of SIMATIC at:
www.siemens.com/simatic/printmaterial

For further technical documentation, see our
Service & Support portal:
www.siemens.com/automation/support

For a personal discussion, you can locate your nearest contact at:
www.siemens.com/automation/partner

In the A&D Mall you can place orders electronically via the Internet:
www.siemens.com/automation/mall

Siemens AG
Industry Sector
Industrial Automation Systems
Postfach 48 48
90026 NÜRNBERG
GERMANY

www.siemens.com/automation

Subject to change without prior notice
Order No.: 6ZB5310-0MM02-0BA4
Dispo 26100
BS 0408 5. ROT 28 En / 801467
Printed in Germany