

SIEMENS



The SIMATIC PCS 7 Process Control System

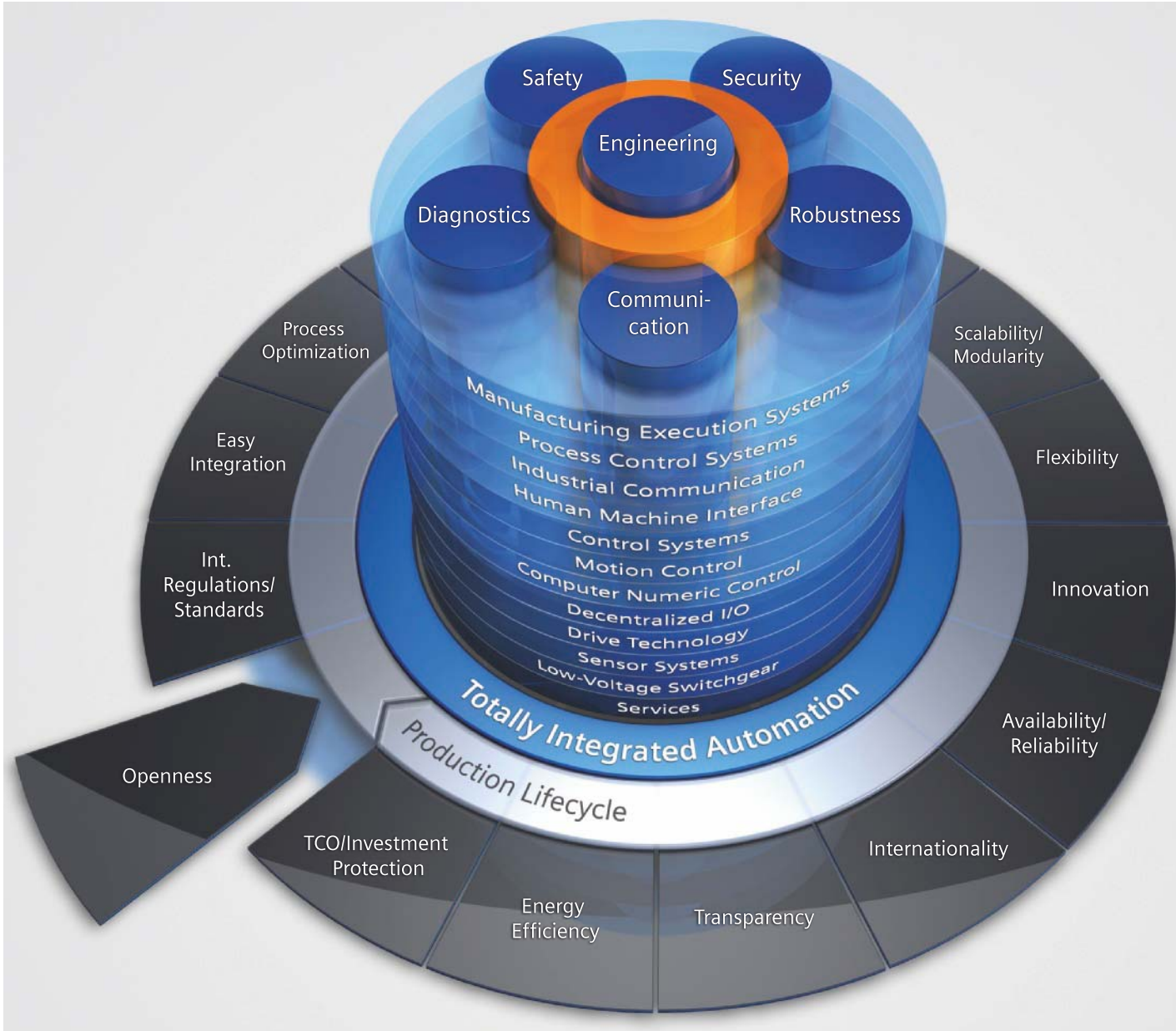
SIMATIC PCS 7

Brochure

April
2013

Answers for industry.

Totally Integrated Automation



As one of the leading international process control systems, SIMATIC PCS 7 with the functional variety, flexibility, and performance of the current version 8.0, has the potential for implementing innovative solutions that meet the special challenges of the process industry. Since function spectrum and application area extend far beyond the limits of a typical process control system, SIMATIC PCS 7 opens undreamed of possibilities and many new perspectives.

SIMATIC PCS 7 benefits from its seamless integration in Siemens Totally Integrated Automation (TIA), a complete range of matched products, systems, and solutions for all hierarchy levels of industrial automation - from the enterprise management level, to the control level, all the way down to the field level. This enables uniform, customer-specific automation in all sectors of manufacturing, process, and hybrid industry.

Contents

An essential advantage of the consistency of the product and system spectrum and the solutions based upon this spectrum is that faster and more precise control sequences, as well as integrated security functions of shared hardware, engineering, and engineering tools can be used for automation of continuous and discontinuous processes. Perfect interplay of all components makes it possible for you to sustainably produce in higher quality and to establish new products significantly faster on the market.

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Progress you trust

We at Siemens are oriented according to the requirements of our customers and their markets. We continuously optimize our products and services to secure the competitive edge of customers through systematic further development.

In doing so, we always keep our attention on the requirements and trends in process automation: Our products, systems and solutions ensure more sustainability, and help to save time and costs, and our control system know-how makes a crucial contribution to boosting plant performance.

We have years of experience in all process industries. Our experts know the processes and support you with their knowledge on a daily basis when optimizing your plants. Intelligent automation and service concepts contribute decisively to the value added. They increase plant availability, profitability, and process and plant safety, and they are designed to protect investments and sharpen your competitive edge.

We place high demands on process management and implementation. As a partner in plant projects of all kinds and sizes, we are at your side with our specialist knowledge – based on globally standardized quality, and with the help of specially trained experts for fast and efficient implementation.

Thanks to extensive research and development work, an innovative corporate culture, our understanding as a trendsetter in automation, and representation on international committees, we want to do justice to our role as a motor of innovation, and we consider ourselves capable, together with customers and partners, of leading the way with further developments in the process industry.

With consistent customer orientation, years of experience, high innovation, and a comprehensive product and service portfolio, we create a foundation for trustworthy business relationships and satisfied customers.

SIMATIC PCS 7 is one of the world's leading process control systems. An essential requirement for this leading position is the success of our customers who achieve maximum performance levels in their day-to-day work using ideas, products and solutions from Siemens. See for yourself:

Put your trust in performance – back SIMATIC PCS 7.



Performance you trust

In process plants, the process control system is the starting point for optimal value added: All procedures and processes can be operated, monitored and influenced with the process control system.

The process control system is the interface to the process, and it enables safe process and plant control and at the same time serves as the central database from which further optimization potential can be tapped into. The more powerful the process control system, the more effectively this potential can be used. For this reason, performance is in the foreground with SIMATIC PCS 7, alongside scalability, flexibility, and integration. Starting with planning and engineering, the process control system offers powerful tools, functions and features for cost-effective and efficient plant operation through all phases of the plant life cycle.

Performance through integration

Integration is one of the special strengths of SIMATIC PCS 7 and is evident in many aspects:

- Horizontal integration into TIA
- Vertical integration into hierarchical communication
- System-integrated tools for engineering tasks

- Integrated functions, e.g. for batch process automation, process safety, energy management, telecontrol tasks, etc.
- Integration of the fieldbus level including drives, switchgear, etc.

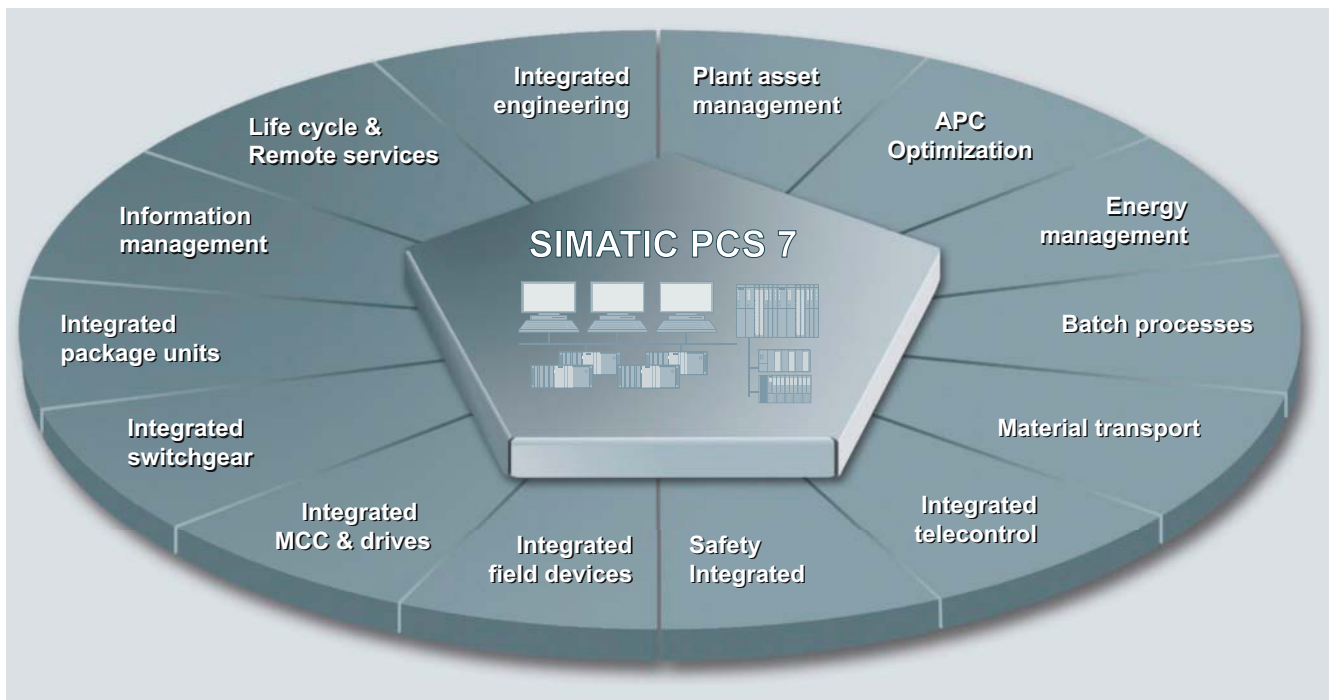
Horizontal integration

A system for integrated automation of the entire process chain, from incoming raw materials to outgoing goods – this is one of the decisive advantages resulting from the seamless integration of SIMATIC PCS 7 into Totally Integrated Automation.

The process control system is mainly responsible for automating the primary processes here, but it can do very much more: All ancillary facilities such as the electrical infrastructure in the form of low-voltage or medium-voltage switchgear, or the building management system, can also be integrated into the system.

Integration of selected SIMATIC standard components – automation systems, industrial PCs, network components, or distributed I/O units – into the process control system guarantees optimal interaction of individual components, and secures economic benefits such as simple selection, reduced stock keeping, or global support.





Vertical integration

The hierarchical communication of a company encompasses the field level, the control level, and the process level, up to management and enterprise resource planning (ERP). Thanks to standardized interfaces, based on international industry standards as well as internal interfaces, SIMATIC PCS 7 is able to provide process data for analysis, planning, coordination, and optimization of plant sequences or production and business processes – in real time, and at any location in the company!

Central engineering

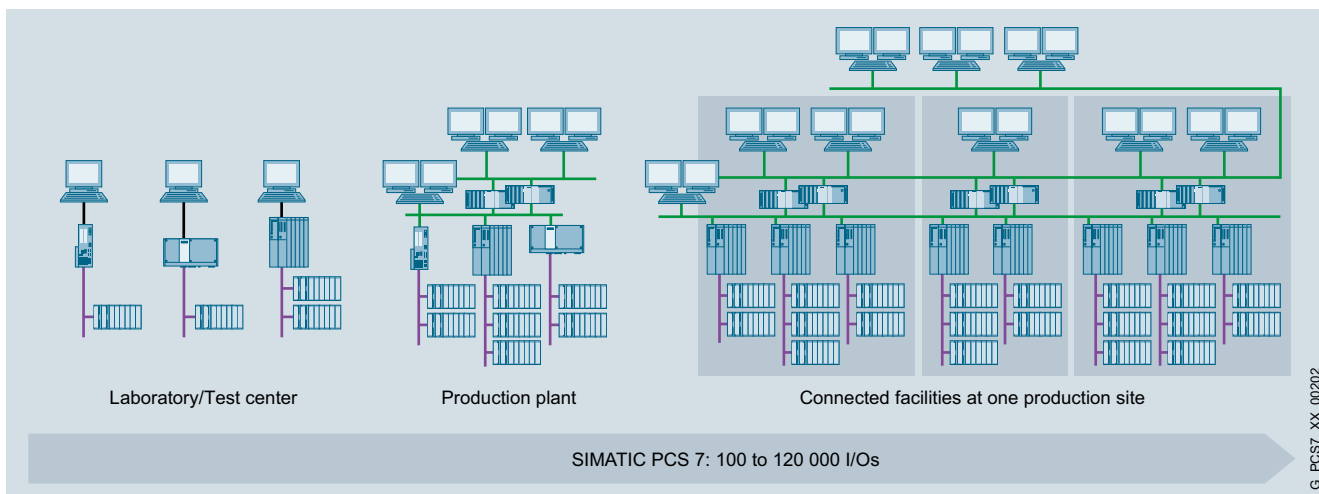
SIMATIC PCS 7 convinces with graded functional diversity, consistent operator control philosophy, and uniformly structured engineering and management tools. A central engineering system with a coordinated range of tools for integrated system engineering and configuring of batch automation, safety functions, material transport or telecontrol systems creates value added over the entire life cycle. Reductions in configuring and training costs result in minimization of total cost of ownership (TCO).

Functional diversity

Depending on the typical process automation or customized requirements, SIMATIC PCS 7 can be functionally expanded for the following, for example:

- Batch process automation (SIMATIC BATCH)
- Functional safety and protection functions (Safety Integrated for Process Automation)
- Route control for material transport (SIMATIC Route Control)
- Telecontrol of remote units (SIMATIC PCS 7 TeleControl)
- Automation of electrical switchgears (SIMATIC PCS 7 PowerControl)

Further additional functions that are also integrated, or can be integrated, seamlessly into the control system make optimization of processes and reductions in operating costs possible. SIMATIC PCS 7 has, for example, tools for energy and asset management, and it offers higher quality closed-loop control functions, as well as industry-specific automation solutions and libraries.



Scalability of the SIMATIC PCS 7 process control system

Customized performance

Thanks to a unique scalable system architecture, SIMATIC PCS 7 creates the ideal basis for cost-effective implementation of individual automation solutions, and economic operation of process plants.

SIMATIC PCS 7 users derive sustained profit from a modular system platform based on standard SIMATIC components. Its uniformity enables flexible scaling of hardware and software, as well as perfect interaction within the system – but also perfect interaction beyond system limits. The architecture of the SIMATIC PCS 7 process control system is designed in such a manner that instrumentation and control can be configured in accordance with customer requirements and optimally matched to the dimensions of the plant. The control system can be subsequently expanded or reconfigured at any time if there is an increase in capacity or a technological modification. When the plant grows, SIMATIC PCS 7 simply grows along with it – without the provision of expensive reserve capacities!

The scalability applies for all levels of the system. Just on the control level alone there are multiple function-compatible automation systems with graduated price/performance ratios that are available to the user:

- SIMATIC S7 AS mEC RTX modular embedded controller in S7-300 design with ready-to-use pre-installed Windows operating system as a low-cost automation system
- Compact SIMATIC PCS 7 AS RTX Microbox automation system
- Modular automation systems of the S7-400 range as standard, fault-tolerant and safety-related systems

The automation performance can be optimally matched to the requirements of the plant/unit. Expensive excess capacity can thus be avoided.

Performance in engineering

With regard to planning and engineering, performance can be equated with minimizing time and costs. SIMATIC PCS 7 offers a unique approach here in conjunction with COMOS: Integrated planning workflow from the description of the process to the automation program.

A standardized system interface, strictly object-oriented working, and centralized data management mean data consistency across all planning steps including automatically updated system documentation.

With the Advanced Engineering (AdvES) option package, SIMATIC PCS 7 also handles engineering with other planning tools with maximum efficiency since plant data can be imported without problems from CAD/CAE tools.

In addition, it also allows automatic generation of the AS configuration thanks to simple multiplication of process tag types and model solutions, as well as parameter processing.



Performance in operation

Process control also becomes more complex as the multi-layer nature of automation engineering increases and it merges more and more with information technology. At the same time, rising pressure of costs makes intuitive and error-free operator input increasingly important to enable efficiency in operating personnel and to minimize downtimes and service work. SIMATIC PCS 7 supports operators optimally in their tasks and enables safe and user-friendly process control. Versatile tools are available here for reliable process optimization.

Process control and maintenance

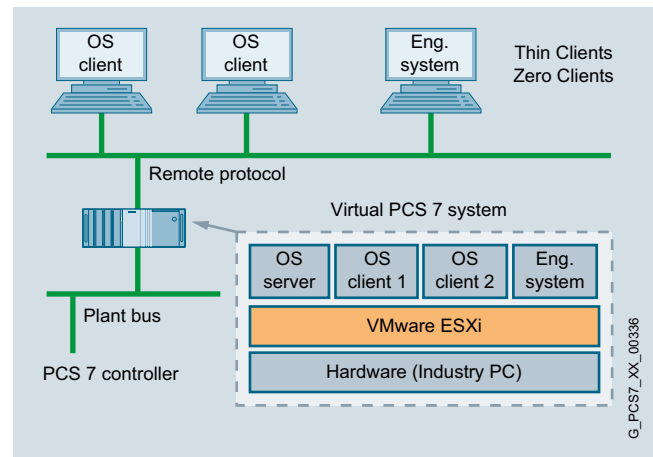
As well as transparent process control, SIMATIC PCS 7 also offers monitoring of product quality and key performance figures for the efficient operation of your process plants, and it ensures more flexible processes, higher plant availability, and investment security.

The operator system of SIMATIC PCS 7 is the window to the process and the basis for safe and intuitive control of plants: Its architecture is flexibly scalable – from single-user systems to multi-user systems with redundant client-server architecture. The operator interface takes account of the current specifications of NAMUR (user association of automation technol-

ogy in the process industries) and PI (Profibus International) and offers a high level of user-friendliness and simple, intuitive interaction with the plant. Ergonomic symbols, task-oriented faceplates, uniform representation of status information, and optimized alarm functions allow safe process control.

The integrated alarm management system of SIMATIC PCS 7 is a further performance feature for guaranteeing safe and cost-effective plant operation. It focuses on essentials alarms, allows selective operator prompting in exceptional situations, and consistently contributes towards reducing the work load of plant personnel.

Preventive and predictive maintenance strategies reduce total cost of ownership. With the plant asset management system of SIMATIC PCS 7, you always have a watchful eye on critical production equipment such as pumps, valves, distillation columns or motors, and you can carry out the relevant maintenance measures in good time before service is required – without an established maintenance plan and without the risk of an unplanned plant standstill.



Process optimization

As well as these functions for improving plant and process control, SIMATIC PCS 7 offers a wealth of tools and features that support optimization of the processes. These include

- Control Performance Monitoring
- Advanced Process Control and
- Process Historian

Monitoring of the quality of control loop ensures the maintenance of efficient plant operation. Control Performance Monitoring allows timely, and above all selective, maintenance or controller optimization when performance capability wanes.

With Advanced Process Control (APC), including multi-variable control, predictive control, or override controls, SIMATIC PCS 7 offers decisive levers for improving plant efficiency, cost effectiveness, product quality, safety, or environmental protection. These APC solutions are already stored in the standard block library, and can thus be implemented at very low cost.

Current and historic process data form the basis of all optimization. Secure and user-friendly real-time data storage and analysis is handled using Process Historian. The long-term archive for information such as process tags, process alarms, or batch data allows fast access to this historic plant data. The information server makes the information available to you again from the Process Historian – prepared in a clear and user-specific way with the standard reporting system of Microsoft Reporting Services.

Virtualization

Virtualization is an innovative software technology for emulation of hardware, operating system, data memory, and networks which is also increasingly finding its way into industrial automation. The initially higher investments for hardware, visualization software, service contracts, and infrastructure pay off as a result of long-term savings in operating costs in most cases during the plant's lifecycle. Important guarantees for the success of virtualization are capable IT departments with well-trained specialists as well as specific expertise in process automation.

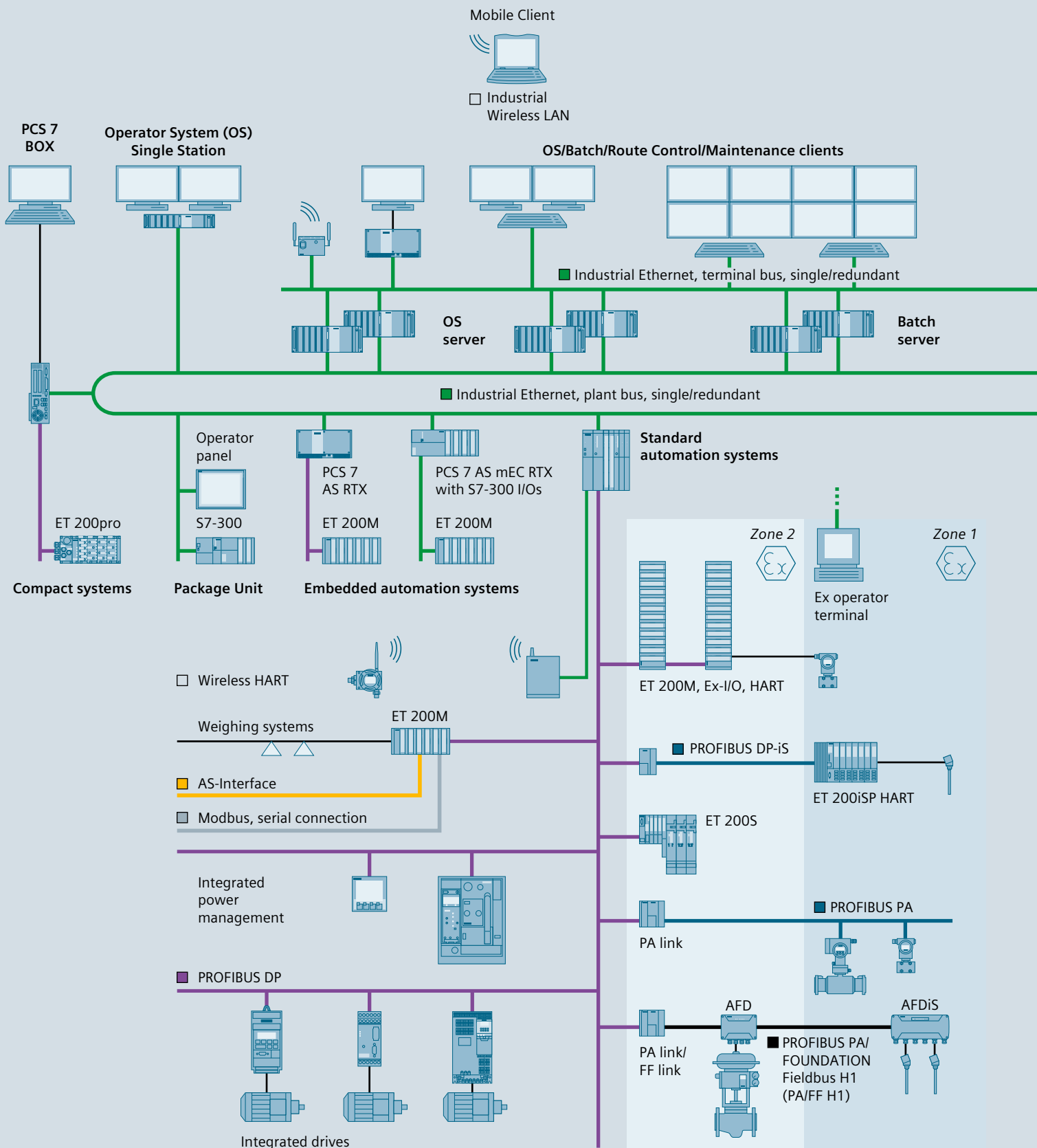
Profitability essentially depends on the special project requirements which are characterized by aspects such as space requirements, remote access, energy saving, validation, plant layout, infrastructure or by virtual operation of other applications such as evaluation tools and information/reporting systems.

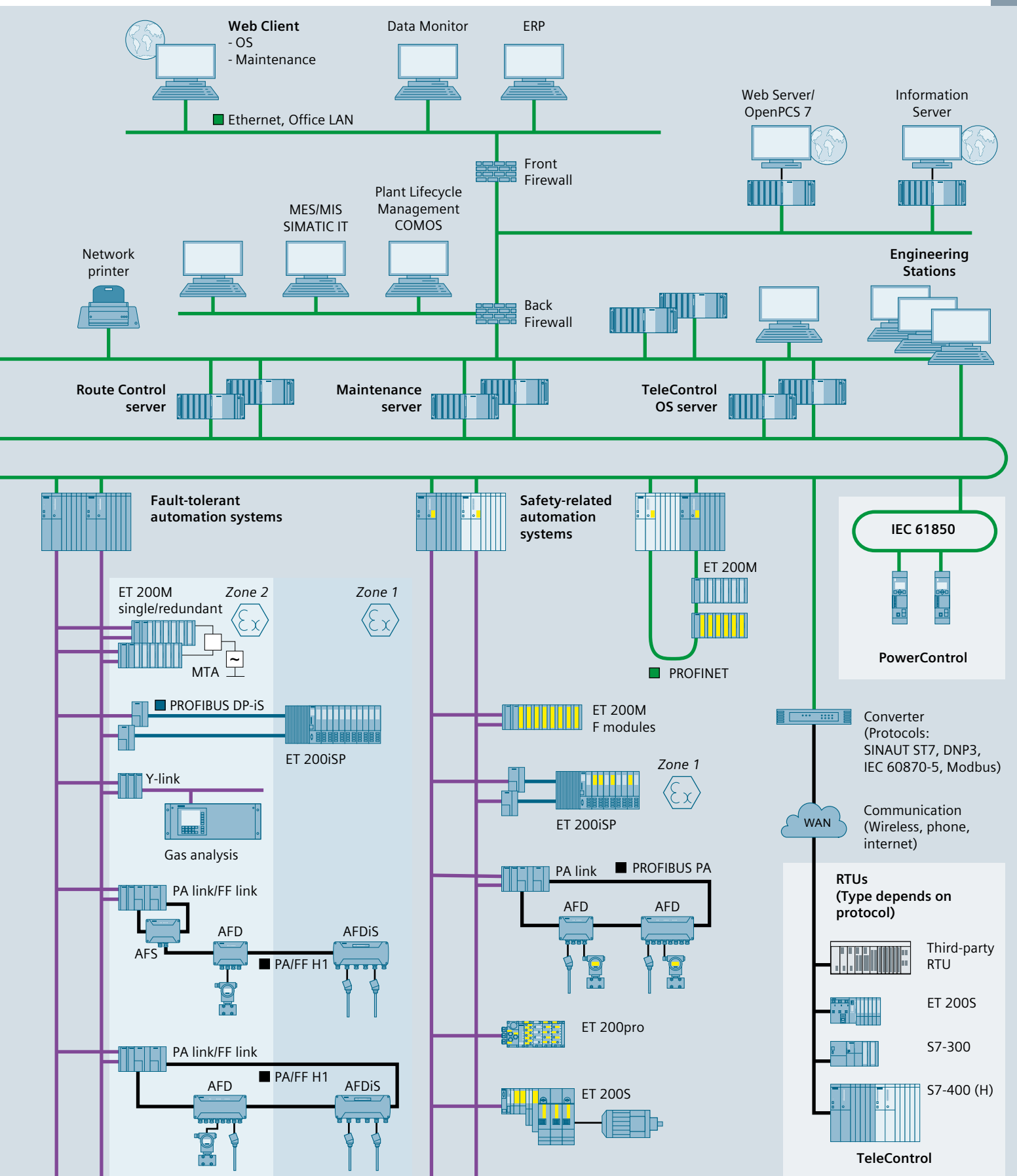
IT security is just as important in the virtual world as in the real environment. Therefore comparable security mechanisms and methods are applied, e.g. security patches, virus scanners, user management or access protection.

In the case of process automation with SIMATIC PCS 7, virtualization solutions have currently been approved for clients (OS, Batch, Route Control) and options such as SFC Visualization, OpenPCS 7/OS Client, PCS 7 Web Server or PCS 7 terminal server. Servers (OS, Batch, Route Control), engineering system or OS single station can also be operated in the virtual environment specific to the project.

Low-cost thin clients or zero clients serve as the hardware for the virtual clients and the optional virtual components. The operator stations configured in this manner are interfaced using remote protocols (VNC, VMware View). The operator control and monitoring functionalities known from the real plant are available to operators on these stations.

SIMATIC PCS 7 performance you trust





Process automation with Siemens – more than just reliable technology

Mature technologies, powerful SIMATIC hardware and software, and industry-specific automation solutions create the optimal basis for your success. In addition, you will find Siemens to be a globally positioned vendor of automation technology - one you can trust.

► Innovation you trust

Siemens backs continuous technological innovation for your economic success today and in the future. Siemens is currently carrying out worldwide research with approximately 29 500 employees at 188 locations, and is cooperating with research institutions of leading universities. In the 2012 fiscal year, investments for research and development amounted to approximately 4.2 billion Euros. As a result, approximately 8 900 inventions were registered – 41 per working day. This high innovative strength is channeled into the products and thus has a positive effect on your results. As a trendsetter, Siemens builds on sustainable development strategies, increased application of renewable energy forms, efficient use of raw materials, and minimization of environmental pollution. Sales achieved with the environmental portfolio increased to more than 33 billion Euros in 2012 and resulted in CO₂ savings of 332 million tons.

► Expertise you trust

Each sector makes special demands on automation technology, follows individual trends, and must meet special challenges. Siemens recognized this years ago and responded with special sector orientation: Our experts concentrate on individual branches of industry. This guarantees that your contact person will be familiar with your processes and your mar-

kets. Profit from this experience and know-how in process control and optimization, especially for your sector! Our comprehensive, industry-specific range of engineering and consulting services covers the entire life cycle of your plant, from planning to modernization, and it accompanies you in each phase with optimizing service.

► Partner you trust

When you choose SIMATIC PCS 7 from Siemens, you have opted for a strong, experienced partner who is at your side with sound know-how in process automation and project management. For efficient and fast project execution, we have set up tried and tested guidelines and processes with which our teams worldwide ensure a uniformly high quality standard, regardless of the size of the plant or the scope of the project. We have established a tightly woven network of experts to support our process control system customers throughout the world. This includes Siemens system specialists as well as highly qualified and authorized external partners who provide first-class service and support in more than 190 countries of the world – from the initial consulting discussion, through the entire project execution, right up to support for individual products or comprehensive life cycle services.

We regard our close cooperation with partners and system integrators as a key to success in process automation. In order to expand and intensify this collaboration, we have created the Siemens Solution Partner program with a bandwidth that is currently unique on the market. It combines outstanding technology and application expertise with experience and comprehensive product and system know-how to form a tailor-made overall package for each individual plant project.



System administration with the Management Console

An I&C plant comprises a large number of heterogeneous components with specific parameters and settings which are subject to a dynamic change process resulting from upgrades, modernization, and expansion. As the plant gets older, it becomes increasingly difficult to keep track of the current state of hardware and software. Without system support, achievement and retention of the required transparency is furthermore extremely complex.

The PCS 7 Management Console can be used to minimize the administrative requirements for a single SIMATIC PCS 7 plant or a plant network. The current status of the installed hardware and software components can be called at any time.

The PCS 7 Management Console permits:

- Central, standardized administration of SIMATIC PCS 7 software
- Creation of inventory for all installed hardware and software components of the SIMATIC PCS 7 system

With small plants, the PCS 7 Management Console can be installed and operated on the PCS 7 Engineering Station. However, a stand-alone PCS 7 Management Console on a PCS 7 Industrial Workstation of single station or server design is typical for medium-sized and large plants.

Each PCS 7 Industrial Workstation of the plant administered with the Management Console is licensed as a Management Console Agent.

Central software administration

New SIMATIC PCS 7 installations, upgrades, and service packs are administration components. The installation on the target station does not require active participation of the user. Security mechanisms prevent impairment of runtime operation.

- Provision of installation files on dedicated file server/PCS 7 Management Console
- Addition/removal of PCS 7 setups in the central setup management
- Creation of plant-specific or user-specific preconfigured setup packages

The screenshot displays the SIMATIC Management Console interface. The top section shows a tree view of installed software components. Below this is a table with columns for Product name, Version, Release version, Technical version, and Installation date. The bottom section shows a log of installation events with columns for Date/Time, Component name, and Description.

Product name	Version	Release version	Technical version	Installation date
SIMATIC PCS 7 FW	V10.0-SP1	V10.0.01.00_03.00.00.01		07.11.2012 16:22:39
PCS 7 Engineering				07.11.2012 16:22:39
AS-OS Engineering	19.0 + SP1	808.00.01.00.01.14.00.02	V9.0.1.0	
CYS	19.0 + SP1 + U	808.00.02.01.01.05.00.03	V9.0.1.1	
DOCOM	19.1 + SP1	805.01.02.00.01.05.00.01	V9.4.2.0	
FORUM			VERS. BECH	
SEAPD	19.0 + SP1	808.00.01.00.01.07.00.02	V8.0.1.0	
PCS 7 System Documentation ES	19.0 + SP1	808.00.01.01.02.04.00.01	V09.01.01.01	
PCS 7 System Documentation Runtime	19.0 + SP1 + U	808.00.01.01.02.04.00.01	V09.01.01.01	
PCS7NC	19.0	100.00.00.00.01.11.00.03	V6.0.0.0	
PI 2-Web-Server	19.0	100.00.00.01.22.00.00	V6.0.0.0	
SP 7 ConfigurationPack	19.5 + SP10	815.10.0.11.1.0.2	V9.5.10.0	
SP 7 Library	19.2 + SP1	813.2.10.1.0.0.3	V9.3.0.0	
SP4LCSM	19.4 + SP1 + U	806.04.00.01.01.02.00.01	V9.4.5.1	
SP 3-CL	19.3 + SP1	805.03.00.01.01.05.00.01	V9.3.0.0	
Safety Matrix AD-OS Engineering	19.2 + SP1	806.02.01.00.01.02.00.01	V9.2.1.0	
Safety Matrix Engineering Tool	19.2 + SP1	806.02.01.01.01.02.00.01	V9.2.1.0	
Safety Matrix Viewer	19.2 + SP1	806.02.01.01.01.02.00.01	V9.2.1.0	
Siemens Automation License Manager	19.2	1995.02.00.00.01.17.00.03	V9.2.0.0	
SIMATIC Configuration	19.1.1.4	199.01.01.00.01.01.00.01	V9.1.0.0	
SIMATIC ESReady	2003	1997.02.00.00.18.19.00.07	V6.0.1.0	
SIMATIC Management Agent	19.0 + SP1	808.00.01.00.01.23.00.03	V9.0.1.0	
SIMATIC PCS 7 HW	19.0 + SP1	100.00.00.00.01.00.00.01	V09.01.01.00	
SIMATIC PCS 7 Library	17.1 + SP5	807.01.03.00.01.11.00.01	V7.1.3.0	

Overview of installed software status

- Rollout of pre-configured setup packages to target stations
- Checking of target stations for installation readiness
- Implicit, remote disabling of a station for starting an update installation
- Status monitoring of complete installation, and continuation following restart or network fault
- Implicit, remote enabling of a station after completion of an update installation

Creation of system inventory

The central creation of an inventory of installed hardware and software components simplifies the production of a detailed inventory report and permits rapid determination of candidates for updating/replacement:

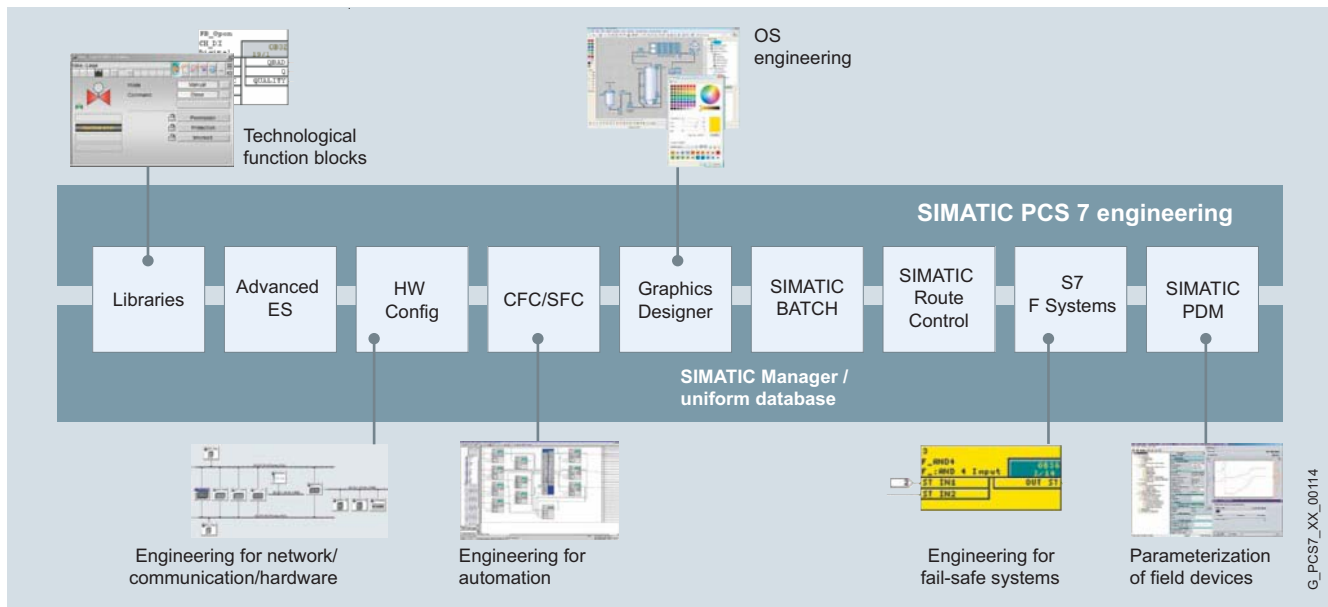
- Central recording of inventory data by reading out of the engineering system or the component
- Inventory report in Microsoft Excel format
- Proof of license with installed and actually used components

For additional information, see:

www.siemens.com/simatic-pcs7/managementconsole

Engineering System

System-wide engineering with the central engineering system



Engineering toolset of the engineering system

The use of a central engineering system with a uniform and matched range of tools minimizes the configuration overhead. The engineering tools for the application software, the hardware components and the communications functions are called from a central project manager (SIMATIC Manager). This is also the basic application for the creation, management, saving and documentation of a project.

The architecture of the Engineering System depends on how the SIMATIC PCS 7 project is processed:

- Locally, on a central engineering station
- In the engineering network (concurrent engineering, multiproject engineering)

The powerful SIMATIC PCS 7 Industrial Workstations with pre-installed Windows 7 operating system offer an optimum starting point for this. These can be used in the office sector as well as in industrial environments, and can control up to four process monitors via a multi-monitor graphics card.

Licensing of the standard engineering software depends on use of the engineering station as:

- Classical, exclusive engineering station (2-hour OS test mode, but no OS productive operation possible)
- Combined engineering/operator station for small applications

Engineering toolset

The complete functionality for the system-wide and project-oriented engineering – which is also the basis for asset management of the I&C equipment – is available to the planning engineer as an optimally coordinated engineering toolset.

This engineering toolset encompasses tools for effective engineering of the following components and functions:

- Mass data engineering and cooperation with CAD/CAE planning tools (Advanced Engineering System)
- Control system hardware including I/O and field devices
- Communication networks
- Automation functionality for continuous and batch processes (AS engineering)
- HMI functionality (OS engineering)
- Diagnostics and asset management functionality
- Batch processes, automated with SIMATIC BATCH
- Material transport, controlled by SIMATIC Route Control
- Safety applications (Safety Integrated for Process Automation)

SIMATIC Manager

The SIMATIC Manager is the integration platform for the engineering toolset as well as the configuration basis for all engineering tasks of the SIMATIC PCS 7 process control system. All aspects of the SIMATIC PCS 7 project are managed, archived and documented here.

Technologists as well as process and production engineers can plan and configure in the environment they are familiar with by utilizing the engineering toolset designed for technological needs and the predefined blocks and charts. The uniform database of the engineering system guarantees that data which have been entered once are available system-wide.

Creating hierarchy folders implements a project structure, the technological hierarchy (TH). By storing CFC and SFC charts for automation systems, and pictures and reports for operator stations in a hierarchy folder along with additional documentation, the configuring engineer implicitly determines the hierarchical assignment.

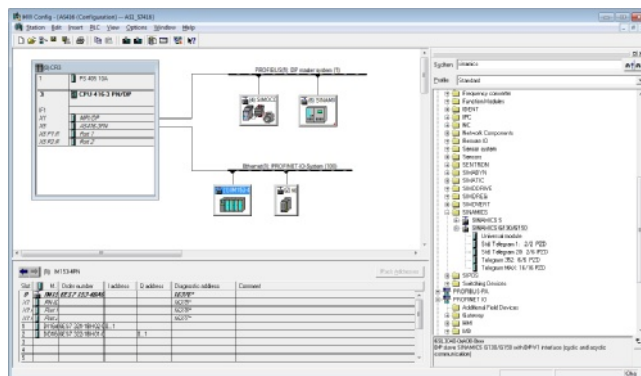
The hardware required for use in a SIMATIC project – such as automation systems, communication components and process I/Os – is stored in an electronic catalog, and is configured and parameterized using the HW Config application.

Function blocks (FBs) and functions (FCs) can be encrypted and decrypted with the S7-Block Privacy application to protect know-how. Following encryption, the blocks and their attributes can no longer be modified. Only the interfaces of the blocks are then visible.

In order to implement the automation logic, predefined function blocks are linked to other blocks in the graphic configuration tool CFC. An SFC editor is available for graphical configuration and commissioning of sequential controls.

The project data for engineering of the operator systems is also organized with the SIMATIC Manager. All the data relevant to operation and monitoring of a process tag are generated automatically during definition of the automation function.

A powerful Graphics Designer supports generation of the process displays. The basis for generating process displays is provided by static symbols and dynamic block icons and faceplates that are managed in libraries and linked to the parameters of the function blocks.



Component view: hardware configuration with HW-Config

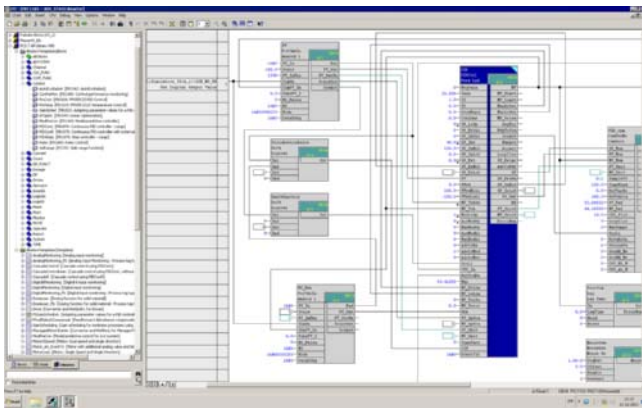
With the optional Advanced Engineering System, configuring and commissioning can be effectively rationalized, e.g. by means of automatic generation of the hardware configuration or multiple use of standardized software modules. The Advanced Engineering System can also exchange data with higher-level planning systems for this purpose.

Complete SIMATIC PCS 7 projects or all applications of a project can be compiled and loaded into the target systems in one operation. The engineering system automatically ensures the correct sequence. A central dialog displays and controls the operation.

Selective changes to the configuration can be loaded online into the corresponding system components. Short turn-around times result in short waiting times for the commissioning engineer and have a positive impact on the commissioning costs.

The SIMATIC Manager supports the various tasks when creating a plant project by providing the following project views:

- **Component view (HW Config)**
Configuration of hardware, such as automation systems, bus components, or process I/O
- **Process object view**
Central development environment for all aspects of process tags/process objects

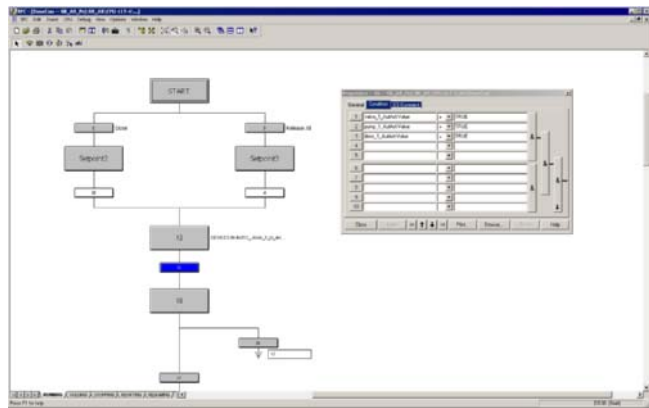


Continuous Function Chart

Special configuration techniques such as chart-in-chart for implementing hierarchical charts, or the multiple usage of chart block types (individual control units/process tag types) and SFC types (standardized sequential controls) in the form of instances, offer additional rationalization potential.

The CFC editor supports the following types of standardized software modules:

- Function block type**
 Function block types supplied with I&C libraries are used for I&C modeling of engineering equipment such as valves or motors. The smallest standardized software modules for multiple usage have connections for actuating and control signals and for parameter assignment and monitoring functions. Some also contain interlocking functions for automatic transition to defined safety settings.
- Process tag type**
 Process tag types implemented with function blocks each represent a standardized CFC for the basic automation of specific I&C functions, e.g. for a level controller. Their instances can be modified centrally by the type-instance concept, and also manually adapted and linked.
- Individual control module type**
 The individual control module type (CMT) marks a new type of standardized software module. In conjunction with the Advanced Engineering System, this offers even more efficient engineering than classic process tag types. A CMT can contain blocks, charts, control variables (block I/Os such as signals and parameters) and messages.



Sequential Function Chart

Sequential Function Chart (SFC)

The SFC editor is used for the graphical configuration and commissioning of sequential controls for batch production operations. It possesses convenient editing functions as well as powerful test and commissioning functions. Using a sequential control, basic automation functions usually created using CFC are controlled and selectively processed by means of changes in operating mode and status. Depending on the subsequent use, the sequential controls can be created either as a SFC or SFC type.

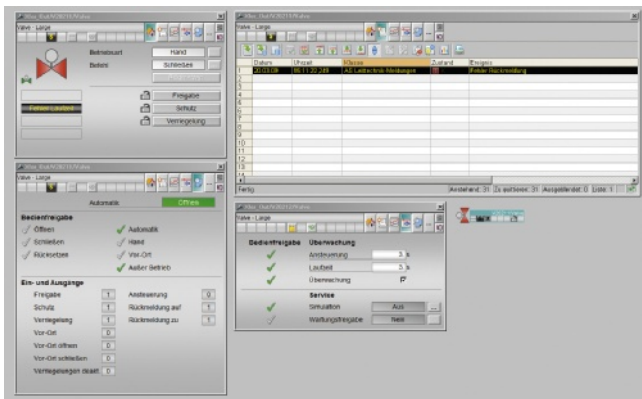
SFC

The SFC is used to implement sequential controls which can be applied once and which access several partial areas of the production plant. Each SFC contains standardized inputs and outputs for status information and for control by the user program or the user. The SFC can be positioned and interconnected as a block in the CFC. The required CFC block I/Os are selected by simple operations and connected to the steps and transitions of the step sequences.

A status manager conforming to ISA-88 enables the configuration of up to 8 separate sequencers within a single SFC, e.g. for states such as RUNNING, HOLDING or ABORTING, or for different operating modes.

SFC type

SFC types are standardized sequential controls which can be applied repeatedly and which access one partial area of the production plant. They can be organized in libraries, and handled like normal function blocks, i.e. they can be selected from a catalog and positioned, interconnected and parameterized as an instance in a CFC chart. Changes to the original automatically result in corresponding changes in all instances. An SFC type may contain up to 32 sequences. Using the function "Create/update block icons", a block icon is automatically positioned and interconnected in the associated process display for all SFC instances with HMI features.



Examples of OS standard displays (faceplates) from the SIMATIC PCS 7 Advanced Process Library, Valves

Process Control Libraries

The use of library elements plays a major role in minimizing the amount of engineering required and thus also the project costs. In the engineering standard software of SIMATIC PCS 7, two I&C libraries are integrated - the Advanced Process Library installed as standard, as well as the SIMATIC PCS 7 Standard Library installed as required.

Preconfigured and tested blocks, faceplates and symbols are organized in these libraries and form the basic elements for the graphic configuration of automation solutions. The comprehensive range of blocks can be categorized as follows:

- Blocks for mathematical operations, analog and digital logic
- Interlocking blocks
- Technological function blocks with integral display, operation and signaling functions, e.g.:
 - Standard control blocks
 - Advanced Process Control blocks
 - Motor and valve blocks
 - Counter blocks
 - Dosing blocks
- Blocks for integration of field devices
- Operator control and monitoring blocks
- Signaling and diagnostics blocks

Furthermore, preconfigured process tag types for process equipment such as pumps, valves, dosing units and controllers (cascade, spit-range) etc. extend the scope of library elements.

Advanced Process Library

The Advanced Process Library (APL) is the standard library for SIMATIC PCS 7. It is based on the extensive experience of project engineers and plant operators, taking into account current NAMUR recommendations and PI specifications.

Proven functions as well as visually attractive GUIs for a high level of operator convenience facilitate and also force interaction of operators with the plant. Alternative, small versions of function blocks reduced to core functions, whose block icons and faceplates take up less space in the process display, improve clarity in complex process displays. Other features worth mentioning are:

- Special operating modes
 - "Local" for integration of local control options
 - "Out of service" for deactivating a measuring point for maintenance
- Several faceplate views
 - "Preview" with status information on the I/O signals, automatic control and possible/permissible operator inputs as well as display of actual process values for simulation
 - "Memo view" for temporary information from operating personnel
- Convenient interlocking blocks with initial signal information, can be directly called from technological blocks
- Flexible scaling of functions in the library blocks
- Commissioning support through direct simulation on the operator station
- Protection against operator errors as the result of detailed grading of user privileges
- Explicit enabling/disabling of operations for a process tag for individual operator stations of the plant
- Integration of any compact drives and switch/starter objects via standard PROFIBUS profiles
- Coordination of multiple access operations, e.g. of SFC/SIMATIC BATCH, to the equipment such as valves, pumps etc.
- Tacking of operator input windows facilitates repeated, successive operations

Industry Library

The Industry Library expands the standard functionality of the APL with specific sector functionalities. This includes:

- Blocks for building automation (heating, air-conditioning, ventilation)
- Blocks for operating and monitoring using Touch Panels
- Blocks for integrating SIMATIC S7 package units (optimized for S7-300)
- Other technological blocks, e.g. for expanding measured value monitoring, or specifying a setpoint curve

All display icons, function blocks and faceplates of the Industry Library appear in the design of the APL style.



Shared configuration tasks

Concurrent engineering

With concurrent engineering, multiple project engineers can work concurrently on one project in CFC and SFC, without having to split the project up into sub-projects beforehand. During commissioning, for example, charts can be used in the online (debug) mode and at the same time changes can be made to the project.

The project is localized on one of the participating Engineering Stations, the project server. The Engineering Stations working as "Project Clients" can access the project data via LAN/WAN. CFC and SFC charts can be opened and viewed by multiple project engineers concurrently. However, the system rejects concurrent write accesses to the database.

Every Engineering Station in the network (project server/client) is able to download configuration data to a SIMATIC PCS 7 subsystem provided it has the required communication connections.

Multiproject engineering

Multiproject engineering permits division of a complex project into several subprojects in accordance with technological criteria in order to allow several teams to work on the project in parallel. To achieve this, a host "Multiproject" is defined in the SIMATIC Manager. The individual projects can be added or removed from a multiproject at any time.

The technological division and combination of projects is supported by the Branch & Merge functions. For the charts or units copied into another project for editing, cross-project interconnections, typically e.g. for interlocks, become textual interconnections. When merging, textual interconnections can be closed at the press of a button. Charts with the same name in the original object are overwritten.

Central configuration functions for multiprojects help to reduce the configuration overhead. For example, a hierarchy folder can be created automatically in all projects. Then, although only the original can be modified in the original project, objects can be inserted in all folders. All block types used in a multiproject can be updated centrally.

The subprojects in a multiproject are stored on a central server and moved to the local engineering stations for editing. The engineering performance is thus unaffected by network access.



Access check and change verification

SIMATIC Logon, the user administration and access control function integrated into the engineering system, offers the plant operator excellent system support when verifying changes in combination with the detailed recordings in the change logbook.

With SIMATIC Logon, the administrator can divide users into groups with different access rights, thus controlling the access to data. Access rights for stations of the process control system and operator privileges for blocks can both be set up. Configurable modification protocols can record all access operations to the engineering system as well as all online changes concerning the automation systems, operator systems, SIMATIC BATCH or SIMATIC Route Control.

If you link the modification reports during the evaluation with the data of SIMATIC Logon, it is possible to verify clearly who has made a particular change, and when. Such verifications are often the object of special sector-specific requirements, formulated, for example, in FDA 21 CFR Part 11 or GAMP.

Version Cross Manager

The Version Cross Manager is a user-friendly tool for determining the differences between various versions of individual projects or multiprojects by:

- Tracing missing, additional or differing objects by comparing hardware configuration, communication, plant hierarchy, CFCs/SFCs, SFC details, block types, alarms, global variables, signals and run sequences
- Graphic display of comparison results in a combination of tree and tabular formats
- Clear hierarchical structuring according to the plant hierarchy of the plant
- Color-coded identification of the differences

Version Trail

When used together with SIMATIC Logon, SIMATIC Version Trail permits version-specific archiving of libraries, projects, and multiprojects. SIMATIC Version Trail tags the with a version ID when archiving, and enters the following information in the version history:

- Version
- Version name
- Date and time
- Users
- Comment

Individual versions can be retrieved from the archive, and used further. SIMATIC Logon organizes the access protection.

Archiving and retrieval procedures can be automated on a time-driven basis. Retrieval of block parameters from the automation system can be coupled with the archiving procedure, but can also be performed independent of this on a time-driven basis and with version assignment.

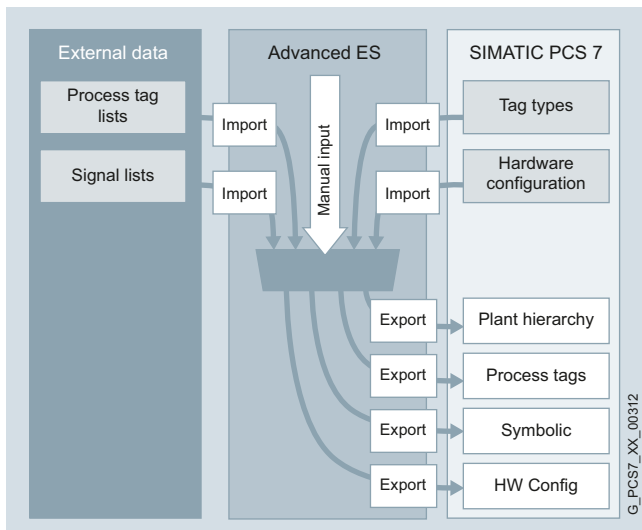
The version history managed by Version Trail can be displayed and printed. An already completed version cannot be modified at a later date. In conjunction with the Version Cross Manager, an archived version can be compared with an existing project or a second archived version.

Project documentation

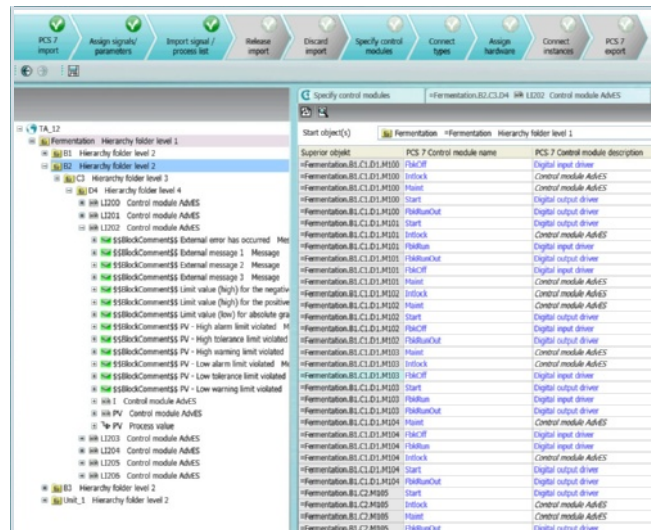
The reporting system integrated into the engineering system can be used to document the engineering project in accordance with standards. The project report records:

- Mimic diagrams and picture objects with properties, events, actions, and direct links
- Variables, properties, and communication links
- Message classes, message blocks, and messages
- Archive tags, and configuration data for archives
- User groups and users
- Source text of actions/functions
- Texts of text library
- Basic Process Control configuration data

The project data can be freely-structured, edited in the form of standardized circuit manuals, and printed in a uniform layout. You can incorporate your own cover sheets, layouts, graphics, logos or title block data. A convenient output control function allows you to select a complete project or individual parts of a project for printing.



Data flow when using the Advanced Engineering System



Integrated workflow management with progress indicator in the header bar

SIMATIC PCS 7 Advanced Engineering System (AdvES)

Using the AdvES, consulting engineers and planning offices as well as end customers can significantly reduce their configuration and commissioning costs while simultaneously improving the engineering quality.

The AdvES which can be called in the SIMATIC Manager from a SIMATIC PCS 7 project expands the functionality for plant configuration in cooperation with higher-level CAD/CAE planning tools. It acts as a link between standard engineering tools from the SIMATIC PCS 7 Engineering Toolset (CFC, HW Config, plant hierarchy) and tools for basic and detailed planning, e.g. EPlan, ELCAD or SmartPlant.

AdvES uses various data import options in order to collect existing engineering data from the SIMATIC PCS 7 process control system and from process tag and signal lists in Microsoft Excel format and to prepare these for utilization in the SIMATIC PCS 7 engineering system.

Data from process tag and signal lists can be automatically imported into AdvES. Integrated change management supports the repeated importing of modified data from Microsoft Excel.

AdvES recognizes process tags in Excel lists after the first assignment, automatically assigns them to process tag types of any PCS 7 project library, and then generates the following data:

- PCS 7 process tag instances with signal and parameter settings
- Plant hierarchy (PH)
- Hardware configuration

Inconsistencies can be detected quickly by means of plausibility and data consistency checks, displayed in a log, and then eliminated in a targeted manner.

Manual processing functions for editing plant hierarchies and process tags as well as for interconnection of signals between process tags allow completion of the imported data. Special editors for mass data processing offload the project engineer from time-consuming routine work.

With the support of integrated design templates, the different table views of the AdvES data can also be displayed as reports and printed.

The user is supported in carrying out tasks by integrated workflow management. The sequence and progress of execution are displayed in a header.



Mass data engineering

The AdvES rationalizes mass data engineering by means of multiplying standardized software modules. Both the individual control module types (CMTs) and the classic process tag types are supported. AdvES is optimized for working with the control module types.

A CMT library of the PCS 7 Basic Control Modules (BCMs) is integrated into AdvES. With system support, any user libraries with process tag types can be converted into control module types.

Blocks, links, connections or messages can be added later to a CMT or removed from it, even if instances (individual control modules (CMs)) already exist. In this way, versions of process tag types can be defined very easily for multiple use. The instances can be checked for deviations from CMT, and adapted if necessary.

Summary of basic AdvES functions

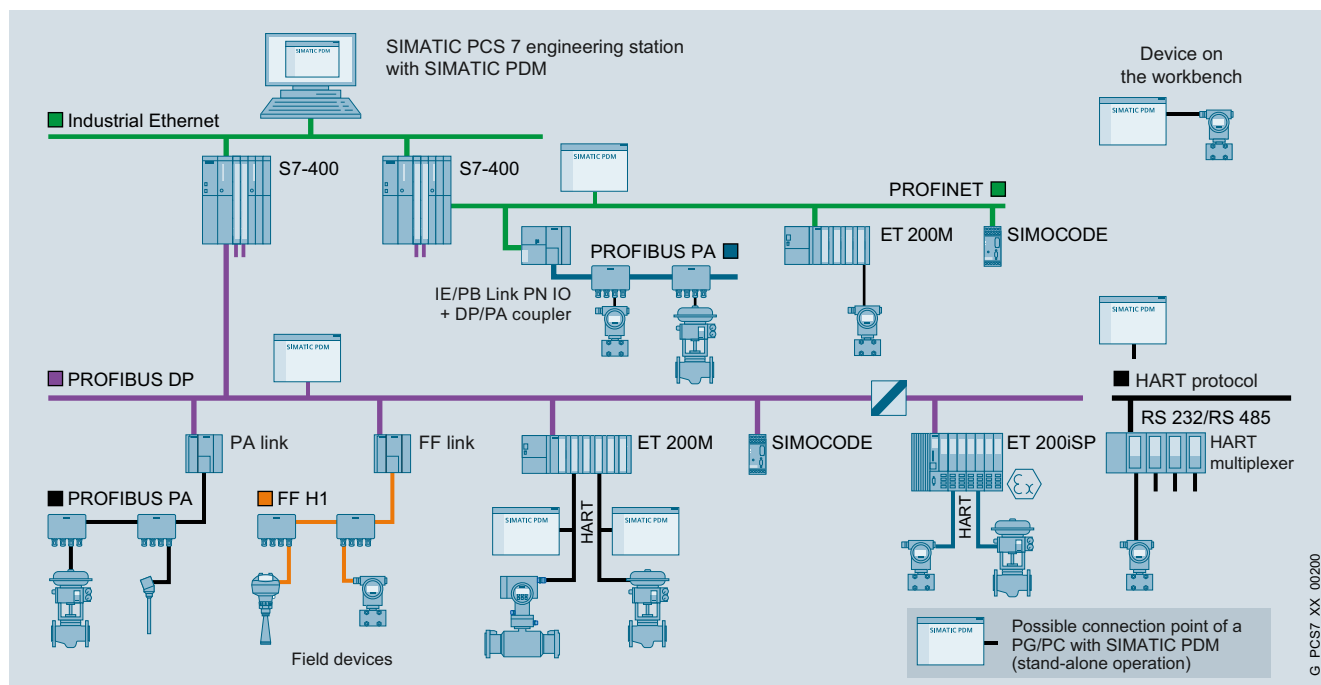
- Import of system planning data and SIMATIC PCS 7 engineering data
- Processing functions for the manual completion of imported data
- Simple interconnection of several process tags
- Generating of process tags from signal and process tag lists
- Generation of hardware configurations from signal lists
- Batch processing of process tags, signals, and parameters
- Automatic plausibility and consistency check
- Transfer of data into the SIMATIC PCS 7 Engineering System
- Reports for updates and tests

Engineering System highlights

- Central hardware and software configuration which is uniform throughout the system through use of one engineering system
 - User-friendly GUI
 - Low-effort parameterization of communication
 - Same configuration for redundant plants
 - Integrated configuration for field devices and safety-related applications
- Technology-oriented configuration
 - Functional hierarchy organized according to plants, units, and technical equipment
 - Hardware-independent engineering: AS assignment and I/O modules can be subsequently selected
 - Expandable on industry-specific basis using standard data exchange interfaces
- Integral user administration with access control
- Central dialog for compilation and loading of AS, OS, and SIMATIC BATCH modifications
 - Optimization of sequence and control by dialog with sequence control
 - Compilation and loading in one operation: minimum turnaround times
 - Online loading of selective changes in configuration
- Process object view for display and processing of all aspects of process tags/objects
 - Convenient editing in tables
 - Process library with import/export functions
 - Online mode for testing and commissioning
- Shared configuration tasks: Concurrent Engineering or Multiproject Engineering with Branch & Merge
- Configuration-dependent hiding of alarms for specific operating states
- Special SFC functionalities:
 - SFC type: sequential control for multiple use, instances as block in the CFC
 - SFC: sequential control for single use, also with chart I/Os
 - Separate sequences for statuses such as HOLD, ABORT or SAFE STATE, conforming to ISA-88
- Lower engineering/validation overhead:
 - Advanced Process Library (function blocks, faceplates, icons, process tag types)
 - Type-instance concept with central modification option for all instances
 - Advanced Engineering System for bulk engineering and data exchange with planning tools
 - Central updating of all block types of a multiproject
 - Many automatic configuration steps (auto engineering)
 - Simple duplication of units by copying, renaming and compilation
- High-performance version management with version comparison and version history
- Automatic generation of diagnostics displays for the maintenance station on the basis of the project data
- Integrated engineering workflow with COMOS planning tools

Process Device Manager

Engineering of intelligent field devices and field components using the SIMATIC PDM Process Device Manager



Possible connections of SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a universal, vendor-independent tool for the configuration, parameterization, commissioning, diagnostics and servicing of intelligent field devices (sensors and actuators) and field components (remote I/Os, multiplexers, control room devices, compact controllers), which in the following sections will be referred to simply as devices. Using only one software, SIMATIC PDM enables the processing of more than 2 500 devices from Siemens and over 200 manufacturers worldwide with an homogeneous user interface. Parameters and functions for all supported devices are displayed in a consistent and uniform fashion independent of their communications interface. From the viewpoint of device integration, SIMATIC PDM is the most powerful open device manager available in the world. Devices which previously were not supported can be integrated in SIMATIC PDM at any time by simply importing their device descriptions (EDD). This provides security and saves investment, training and consequential costs.

Integrated into SIMATIC PCS 7 Asset Management, SIMATIC PDM provides more detailed information for all devices described by means of an Electronic Device Description (EDD), e.g.

- Detailed diagnostics information (manufacturer information, information on error diagnostics and troubleshooting, further documentation)
- Information on changes (audit trail report)
- Parameter information

Possible applications

- Integrated in the SIMATIC PCS 7 Engineering System
- Stand-alone as a service tool on a mobile computer on PROFIBUS, PROFINET, or with direct connection to the device

Core functions

- Adjustment and modification of device parameters
- Comparing (e.g. project and device data)
- Validation of data input
- Device identification and testing
- Device status indication (operating modes, alarms, states)
- Simulation
- Diagnostics (standard, detail)
- Management (e.g. networks and computers)
- Export/import (parameter data, logs, documents)
- Commissioning functions, e.g. measuring circuit tests of device data
- Device management (lifecycle management)
- Global and device-specific change log for user operations (audit trail)
- Device-specific calibration reports
- Graphic presentations of echo envelope trends, trend displays, valve diagnostics results etc.
- Display of incorporated manuals
- Document manager for integration of up to 10 multimedia files

Support of system management

SIMATIC PDM supports the operative system management in particular through:

- Uniform presentation and operation of devices
- Uniform representation of diagnostic information
- Indicators for preventive maintenance and servicing
- Detection of changes in the project and device
- Increasing the operational reliability
- Reducing the investment, operating and maintenance costs
- Forwarding of device information to higher-level Maintenance Stations

Device Integration

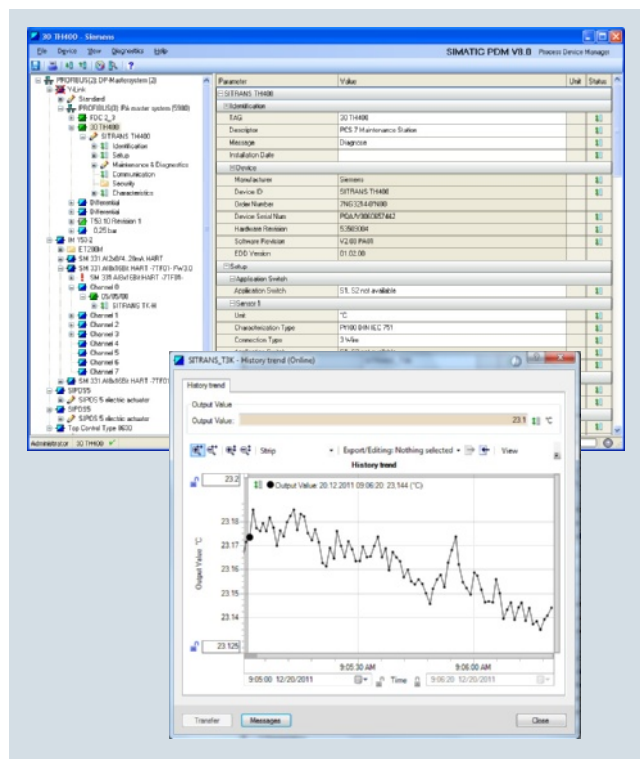
SIMATIC PDM supports all devices described by EDD (Electronic Device Description). Based on EN 50391 and IEC 61804, EDD is the most widely used standardized technology for device integration. At the same time, it is the guideline of the established organizations for

- PROFIBUS and PROFINET (PI – PROFIBUS & PROFINET International)
- HART (HCF: HART Communication Foundation)
- FF (Fieldbus Foundation)

The devices are integrated directly in SIMATIC PDM through a company-specific EDD, or the current HCF or Fieldbus Foundation libraries. To achieve improved transparency, they can be managed in project-specific device libraries.

PROFIBUS devices are described in the EDD in terms of functionality and construction using the Electronic Device Description Language (EDDL). Using this description, SIMATIC PDM automatically creates its user interface with the specific device data. The range of devices can be updated and expanded by simply importing the manufacturer's device-specific EDD.

Fieldbus Foundation provides pre-defined device descriptions (standard DD) for the basic functions of specific field device types. The basic functions are implemented using various standard function and transmission blocks.



SIMATIC PDM, parameter view and trend window

Communications and routing

SIMATIC PDM supports several communication protocols and components for communicating with devices that have the following interfaces (others on request):

- PROFIBUS DP/PA interface
- FOUNDATION Fieldbus (FF) interface
- PROFINET interface
- HART interface (modem, wireless)
- Modbus interface
- HART over PROFIBUS/PROFINET

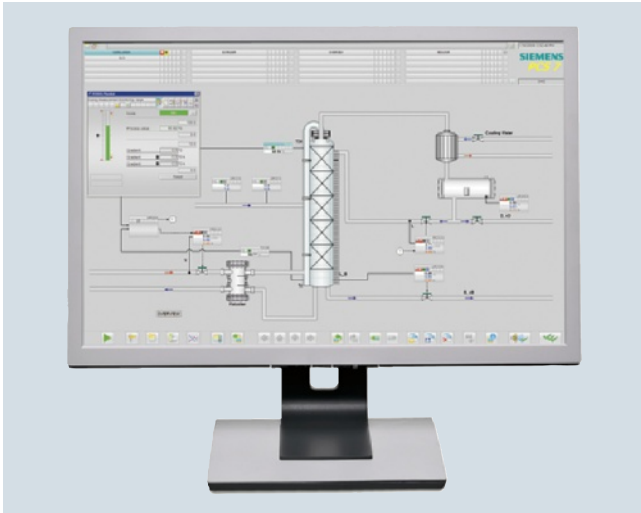
From the central engineering system of the SIMATIC PCS 7 process control system, one can use SIMATIC PDM to navigate to the connected devices via the various bus systems and remote I/Os. As a result of this plant-wide routing, each device which can be parameterized per EDD can be processed from a central position as follows:

- Read device diagnostics information
- Modify device settings
- Adjust and calibrate devices
- Monitor process values
- Generate simulation values
- Reassign device parameters

For additional information on SIMATIC PDM, see:
www.siemens.com/simatic-pcs7/pdm

Operator system

Safe and user-friendly process control with the SIMATIC PCS 7 Operator System



SIMATIC PCS 7 Operator Station

The operator system of the SIMATIC PCS 7 process control system permits user-friendly and secure execution of the process by the operating personnel. Operators can monitor the process sequence using various views, and intervene as necessary. The operator system architecture is extremely variable and can be flexibly adapted to different plant architectures and customer requirements.

The basis is formed by perfectly coordinated operator stations for single-user systems (OS Single Stations) and for multiple station systems with client/server architecture.

Operator stations

All operator stations are based on modern SIMATIC PCS 7 Industrial Workstations optimized for use as OS single station, OS client or OS server.

SIMATIC PCS 7 Industrial Workstations are characterized by powerful industrial PC technology combined with the Microsoft Windows 7 Ultimate 64-bit or Server 2008 R2 Standard 64-bit operating system. They can be used in harsh industrial conditions as well as in the office area. Standard components and interfaces from the PC world offer generous scope for system-, customer- or sector-specific options and expansions.

The connection of as many as 4 process monitors via an optional multi-monitor graphics card permits the user-friendly control of multiple plant areas from a single operator station.

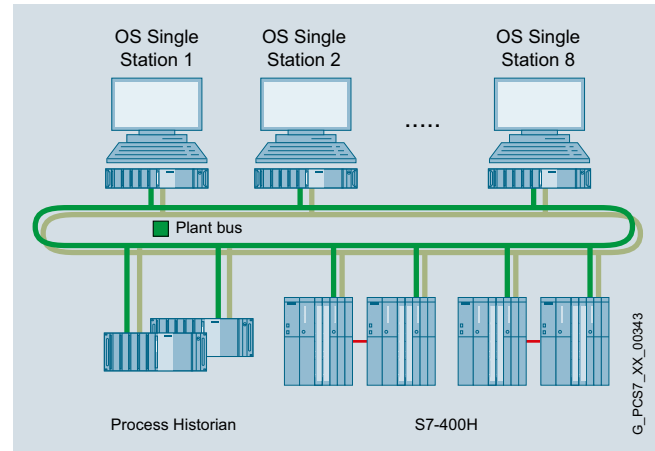
The system software of the operator stations can be expanded flexibly using cumulative SIMATIC PCS 7 OS Runtime licenses for 100, 1 000 and 5 000 process objects (POs) up to following configuration limits:

- 5 000 POs per OS Single Station
- 8 500 POs per OS Server (with client/server architecture)

Single-user system (OS single station)

In a single-user system architecture, all operator control and monitoring functions for a complete project (plant/unit) are concentrated in one station. A flat system configuration with up to 8 OS single stations can be implemented for small to medium-sized projects. In this case, two stations form a redundant pair of OS single stations that can be expanded by up to six OS single stations as reference stations. The configuration process can be rationalized in this case by duplication of a basic project.

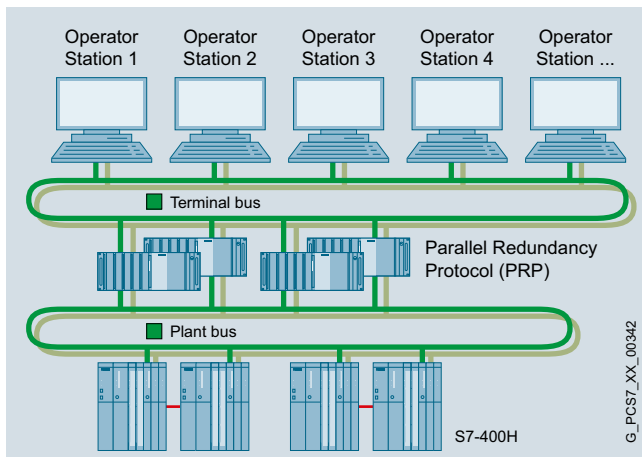
The Process Historian is used in this configuration for long-term archiving.



Example of a flat system architecture

The OS single station can be connected to the Industrial Ethernet plant bus in two ways:

- CP 1613 A2/CP 1623/CP 1628 communication module for communication with a maximum of 64 automation systems of any type
- Simple 10/100/1000 Mbit/s Ethernet network card and Basic Communication Ethernet for communication with up to 8 automation systems (single stations)



System architecture with redundant terminal and plant buses

Multiple station system with client/server architecture

With a multi-user system, one or more OS Servers supply up to 32 operator stations (OS clients) with data (project data, process values, archives, and messages) via a terminal bus. The terminal bus can share the transmission medium with the plant bus or it can be designed as a separate bus (Ethernet with TCP/IP).

In this architecture, redundant OS servers may be set up to meet higher availability requirements. Critical applications are monitored by health check for software faults. If a fault is detected, switchover to the redundant system is triggered. Synchronization of the redundant OS servers takes place automatically and at high speed.

OS clients can access the data of not only one OS server/server pair, but of several at the same time (multi-client mode). This makes it possible to divide a plant into technological units and to distribute the data accordingly to various OS servers/pairs of servers.

In addition to scalability, the advantage of distributed systems is the ability to decouple plant areas from each other, which results in higher availability.

SIMATIC PCS 7 supports multiple station systems with up to 12 servers or 12 redundant pairs of servers. In multi-client mode, OS clients can access data from one or more of the 12 servers/pairs of servers in parallel (up to 32 OS clients simultaneously can access all).

The OS servers are designed in addition with client functions which permit them to access the data (archives, messages, tags, variables) from the other OS servers of the multiple station system. This means that process graphics on one OS server can also be linked with variables on other OS servers (area-independent displays).

Operator system, configuration limits

Max. number of OS single stations	8
Max. number of OS servers/pairs of servers	12
Max. number of automation systems per OS server/pair of servers	64
Max. number of OS clients in multi-client mode ¹⁾ (per multiple station system)	32
Max. number of monitors per operator station with multi-channel operation	4
Max. number of OS areas	64
Max. number of windows per monitor	1 to 16 (adjustable)
Number of trends per trend window	10
Selection time for OS area display (100 process symbols)	< 2 s
Max. number of process objects	
■ Per OS single station	5 000 POs
■ Per OS server	8 500 POs
Max. number of configurable messages per server	150 000
Number of process tags	
■ Per OS single station	approx. 3 000
■ Per OS server	approx. 5 000
■ Per multiple station system	approx. 60 000
Integral high-performance archive system (circular buffer), based on Microsoft SQL server, for:	
■ Process value archiving (per OS server/single station)	Approx. 1 000/s
■ Message archiving (per OS server/single station)	Continuous load approx. 10/s Message burst approx. 3 000/4 s

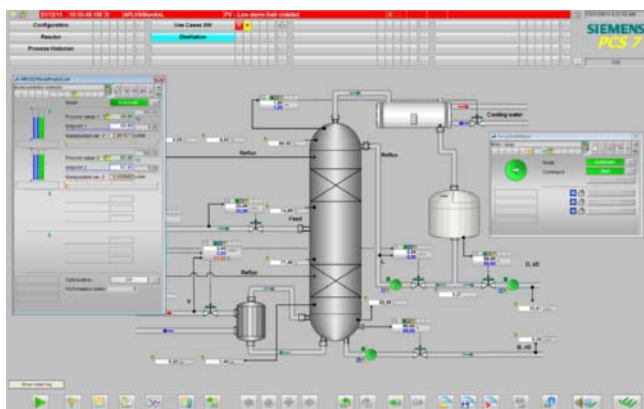
¹⁾ If every OS client has access to all OS servers/pairs of servers

Performance

The SIMATIC PCS 7 Operator System is optimized for processing large quantities of data. It impresses by means of its simple and intuitive operation and its high performance – even with large quantity frameworks. Many individual measures reduce the system load and improve the image selection and updating times, e.g.:

- Combination of status and analog values with alarm information into expanded status displays
- Suppression of nuisance alarms and triggering of renewed transmission via acknowledgment
- Data transmission from the automation system only following changes instead of with every cycle
- Blocking/enabling of messages for individual process tags or all tags of an area
- Hiding messages, depending on the operating state of the unit

OS software



Example of OS process control, with freely-positionable windows



Innovative display design for predictive and safe process control

Graphical User Interface (GUI)

The predefined GUI of the operator system has all the features typical of a control system. It is multilingual, clearly structured, ergonomic and easy to understand. Operators can survey the process extremely easily, and rapidly navigate between different views of the plant. The system supports them in this process with hierarchical display structures that can be configured as required. These facilitate the direct selection of lower-level areas during process control. The current position within the hierarchy can always be seen in a window of the Picture Tree Manager.

Mimic diagrams and process tags can also be called directly by their name, or by a "Loop-in-alarm" starting from a selected message. An online language selector permits the user to change the display language during runtime.

A standard view and a server view are available for the technological representation of a process cell, each with variously designed area overviews. Features provided in both views include:

- Message line for the last received message, configurable for priority-based display of message with highest message class or priority
- Date, time and name of the operator
- Area overview; number of displayed areas depends on resolution: up to 36 (lowest/XGA), up to 144 (highest/WQXGA)
- Working area for plant displays and movable windows for faceplates, trends, messages etc.
- System function keys

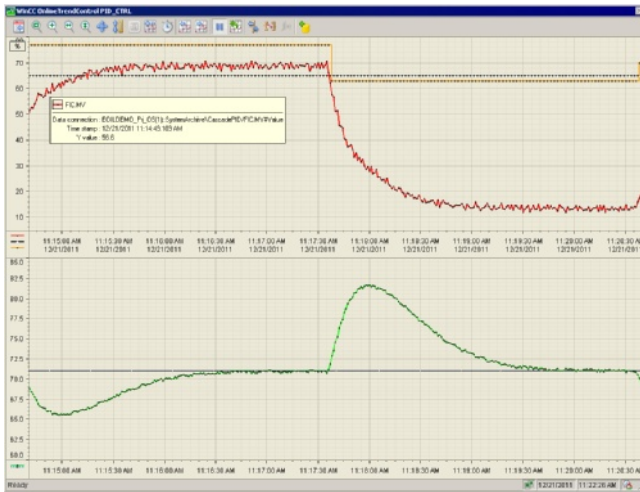
Based on this, the operator can combine and save individual image compositions, and recall them later.

The operator system software supports the representative functional display of the plant with a high-quality and modern design; depending on the versions of the graphics controller and process monitor, display is possible in:

- 4:3/5:4 formats with resolutions of 1024 x 768 to 1600 x 1200
- 16:9/16:10 panorama formats with resolutions of 1680 x 1050 to 2560 x 1600

The global appearance can be set using predefined or user-specific designs (color palette, colors, styles, optical effects, etc.). These central design settings can be changed locally for each picture object. In addition, the design can be fundamentally influenced using a wide range of attractive elements provided in the Engineering System for OS configuration:

- Object palettes with styles, controls, standard objects and smart objects
- Global symbol library with standardized display objects
- Symbols and faceplates of the Advanced Process Library



Trend window on the operator station

TrendControls for table displays and trend displays

The TrendControls function permits operators to display archived values of archive tags from the process value archive as well as online values of process tags from the tag management in relation to time (table/trend window) or in relation to another value (function window). The time can be defined statically or dynamically (in relation to the actual system time) as:

- Start and end times
- Start time and period
- Start time and number of measuring points

All TrendControls have scrolling functions and a function for directly selecting the start or end.

During runtime, operators can individually adapt the TrendControls functions which have already been predefined during plant configuration, and save the settings globally or user-specific. They are able to change the data link during runtime, and to access other data. It is also possible to integrate exported archive databases online.

The displayed data can be processed further by:

- Exporting per CSV file
- Output in a predefined print job

Table window

- Display of one or more process value columns in relation to a time column
- Each line displays the process values recorded at a particular time
- Several separate time/value relations can be combined in a table

Trend window

- One or more time axes correlate with one or more value axes (linear, logarithmic, percentage or freely-configurable scales)
- Freely-selectable number of displayed trends
- Individual configuration of styles and colors, possibly with value-dependent change in color
- Grid lines and rulers for improvement of readability
- Trends can be grouped in one window with common time and value axes
- Multiple trend windows can be linked for comparison purposes (common time axis, zoom, scroll bar and ruler)

Function window

- Display of process values in relation to other process values, e.g. pressure depending on temperature
- Fixed or dynamic value range with linear or logarithmic scaling for X and Y axes
- Displayed time range can be defined separately for each trend
- Optional consideration of setpoint trends from user archives
- Properties, functions and configuration options largely identical to trend window

A ruler window can display the following information for a time or time range selected by a ruler in the trend/table window:

- X and Y coordinates of the trend points at the points of intersection of the rulers
- Values in the selected range
- Statistical information on the selected range: minimum, maximum, average, standard deviation, integral

AlarmControl function for message display and processing

Up to 150 000 messages can be configured per OS single station/OS server:

- Predefined system messages, triggered by a system event
- Individual or group messages, initiated by a change in process states
- Operator input messages, resulting from the manual operation of objects



Message view of operator station

The message system integrated in the operator system records these process messages and local events, saves them in message archives, and displays them in various standardized lists by means of the freely-configurable AlarmControl function (message window):

- Entered state list: currently present, unacknowledged messages
- Acknowledged list: currently present, acknowledged messages
- Exited state list: unacknowledged messages, but already exited
- Operator list: current and archived operator input messages
- Process control list: current and archived I&C messages
- Chronicle: all currently present and archived messages arranged in chronological order
- List of manually or automatically suppressed messages
- List of messages to be suppressed when they occur

The lists are provided with a scrolling function and can be selected by the operator in the toolbar.

Parallel to the display, all messages recorded during runtime and their changes in state can be documented in chronological order in a message sequence log.

Flexible setting options for audible output and priorities which can be defined using signal variables additionally support the signaling of messages through a sound card or by controlling external horns via a signal module.

By filtering, selecting or sorting the display according to the contents of individual message blocks, e.g. chronologically according to message priority or fault location, the operator can individually adapt the AlarmControl function during runtime. It is also possible to integrate archive databases online. The settings can be saved globally or user-specific.

The data can be processed further by:

- Exporting per CSV file
- Output in a predefined print job

After a power failure, the last messages can be reloaded from the message archive to the message window. Thus, when the system is restarted, the last message map prior to the power failure can be reconstructed.

In the case of large quantity structures with a high volume of messages, the following measures can improve transparency and perceptibly offload the operating personnel:

- Situation-based hiding of visual and audible operating messages which are insignificant e.g. for safe and fault-free operation of the plant (complete logging and archiving):
 - Dynamically, depending on preconfigured definition for up to 32 operating states (Smart Alarm Hiding)
 - Manually, for a limited period
- Assignment of priorities using up to 16 message priorities as additional attribute to the known message classes
- Intentional blocking/enabling of messages from an individual process tag or all process tags of the display/area, e.g. in the event of faults on a sensor/actuator or during commissioning (recorded in operator activity log)

The "Loop-in-alarm" and "Select display using process tag" functions support the quick evaluation and elimination of faults. Via "Loop-in-Alarm", the operator goes directly from a message selected in the message window to the process image with the object that caused the fault. Here the operator can also call the associated block icon (loop display) via the tag for which the block icon is color highlighted. The faceplate window can be anchored so that it remains visible even when the display is changed.

Group displays visually signal the messages currently present in the mimic diagram. They do not provide information on whether messages are disabled or not.

The last received message is displayed at the top of the standard view. Using the button "Extended message line", the AlarmControl function can be displayed as a window with all received messages. A list of all messages currently present with maximum priority 16 can also be directly called using a button.

User-configurable message classes

In the case of new projects, the user can decide to apply six free-configurable alarm classes instead of the previous message concept. The connection between the event and an alarm class can be redefined specific to the instance.

Reporting and logging system

Whereas the reporting system is provided to document the project during its configuration, the logging system is used to print out the data recorded during operation in a clear manner. Different types of predefined logs are available:

- Message sequence log
- Message and archive log
- Measured value log
- Operator activity log
- System message log
- User log

However, a page layout editor can be used to create completely new page layouts or to individually adapt predefined ones. Log objects to be printed are simply selected from the editor's object palette, positioned and configured.

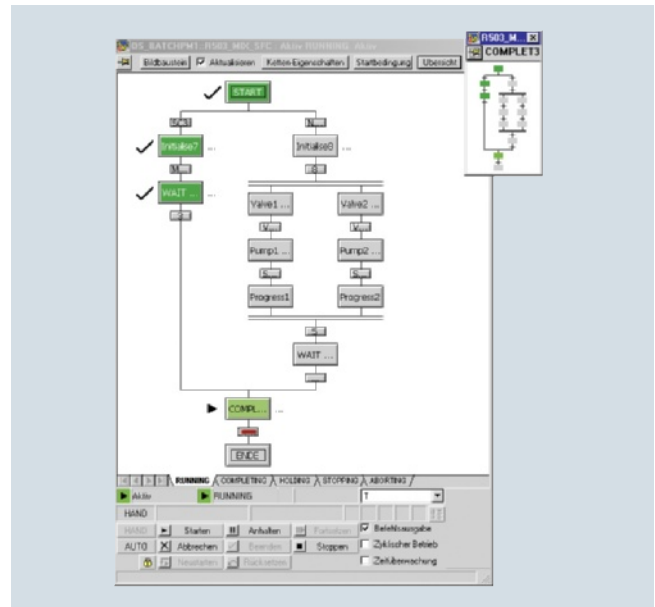
The current log data is output in the assigned page layout on the printer by means of a predefined or self-generated print job. Prior to output on the printer, the logs can be saved in EMF format and displayed as a preview on the screen. Print jobs can be started manually, time-driven or event-driven. Operators are able to scan the status of the print jobs online.

Archiving

The OS single stations and OS servers have an integral high-performance archiving system which can be configured during runtime and which is based on Microsoft SQL server technology. With this, process values and messages/events (alarms) can be temporarily recorded in circular archives. Data can be transferred from this historical alarm list to an archive server (Process Historian) for long-term archiving on a time-driven or event-driven basis.

Central user management, access protection and electronic signatures

With the integrated SIMATIC Logon, the operator system has central user administration with access control that complies with the validation requirements of 21 CFR Part 11. The administrator can divide the users into groups and assign differently defined access rights (roles) to these groups. The operator obtains the specific rights when logging on within the scope of the access control. Apart from the keyboard, an optional chip card reader, for example, can be used as the logon device.



SFC visualization

SFC visualization

The SFC visualization function of the operator system enables display and operation of the sequential controls configured with the SFC editor in the same way as on the engineering system. This does not involve any extra configuration effort.

In an overview display it is possible, for example, to open step and transition displays and to present step comments or dynamically supplied step enabling conditions.

Sign-of-life monitoring

With the "Sign-of-life monitoring function", the operator system is able to monitor the correct operation of all subordinate systems connected to the plant bus. A graphical plant configuration display shows the status of each monitored component. Additional functionality in this respect is offered by the SIMATIC PCS 7 Maintenance Station.

Clock synchronization

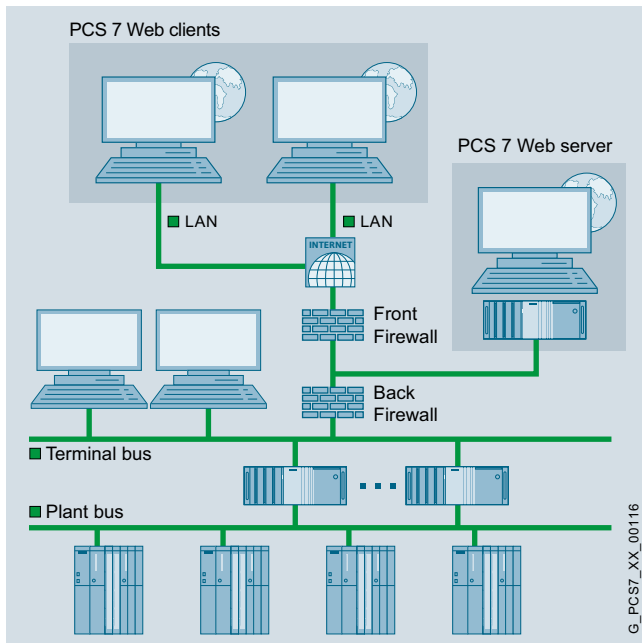
Together with a SICLOCK time generator, the operator system of the SIMATIC PCS 7 process control system can implement system-wide synchronization on the basis of UTC (Universal Time Coordinated). This feature is especially beneficial for widely distributed plants present in different time zones, e.g. pipelines.

Operator system highlights

- Flexible, modular architecture with scalable hardware and software components for single-user and multiple station systems
- Powerful, rugged operator stations based on standard PC technology, that can be used in office and industrial environments
- OS single stations and OS servers that can also be configured as redundant pairs
- Client/server multiple station systems with up to 12 OS servers/pairs of servers, each for 8 500 POs and up to 32 OS clients per server/pair of servers
- User-friendly process control and high reliability with ergonomic graphical user interface
- Health check for important server applications
- Modification and copying of modifications without interrupting runtime operations, and online testing with selective loading of redundant servers
- Optimized AS/OS communication:
Data transmission only following change in data, independent of AS reply cycle
- Versatile, user-friendly controls for alarms and trends
- Variable, customer-oriented logging system
- Highly effective alarm management provides support for operating personnel
 - Assignment of priorities with up to 16 message priorities as additional attribute to the message classes
 - Visual and audible hiding of messages which are irrelevant depending on the operating state (dynamic or manual)
 - Suppression of alarms from a sensor/actuator during commissioning or in event of malfunction
- High-performance archiving system with circular archives and integral archive backup, that can be combined with a separate archive server for long-term archiving (Process Historian)
- Central user management, access control, electronic signature
- Sign-of-life monitoring for subordinate systems connected to the plant bus
- System-wide time synchronization based on Universal Time Coordinated (UTC)



Operating and monitoring via Internet/intranet



PCS 7 Web Server for operator control and monitoring via Internet/intranet

The SIMATIC PCS 7 process control system also supports global operator control and monitoring of a plant via Internet/intranet. Here the operator has access via the PCS 7 Web client to the project data provided by the PCS 7 Web server. The PCS 7 Web client uses Internet Explorer and plug-ins which can be installed via Internet/intranet.

The PCS 7 Web server uses the Web View Publisher to convert process displays and scripts into a form suitable for display with the Internet Explorer. It accesses project-specific process data in the lower-level OS servers using the mechanisms of a multi-client. The integrated OS user management guarantees a high degree of security here.

Using the PCS 7 Web client, the plant can be operated as with a PCS 7 OS client. The operator must log on in the same way here, and the rules for assigning rights are also identical. The input operations made on the PCS 7 web client are recorded in the OS operating log.

When operating and monitoring via the World Wide Web, the plant is exposed to diverse threats to IT security. To guarantee safe operation, suitable protective measures must thus be taken (you can find more information on this in the section "Industrial Security").



Licensing

With regard to licensing, a distinction is made between the following constellations:

- Standard**
 Up to 50 PCS 7 web clients access the data of a PCS 7 web server over intranet/Internet. The number of PCS 7 Web clients that have simultaneous access to the PCS 7 Web server is scalable with cumulative 1, 5 and 10 PCS 7 Web server licenses. In addition, the PCS 7 Web server requires a SIMATIC PCS 7 Web Server Basic license.
- Diagnostics**
 One or only a few PCS 7 web clients have access to several PCS 7 web servers for remote operation, diagnostics or monitoring. Each system involved requires a PCS 7 Web diagnostics license (server/client).

Load balancing

If the project requires simultaneous operation of a large number of Web operator stations, several PCS 7 Web servers can also be configured and networked together. With the load balancing function, the load caused by the PCS 7 Web clients can be distributed evenly over the configured PCS 7 Web servers. This results at the same time in high availability of the PCS 7 Web clients. If a PCS 7 Web server fails, the PCS 7 Web clients assigned to it are automatically routed to one of the other participating PCS 7 Web servers. Load balancing can be used on up to 32 networked PCS 7 Web servers.

Process data archiving and reporting

Process Historian and Information Server

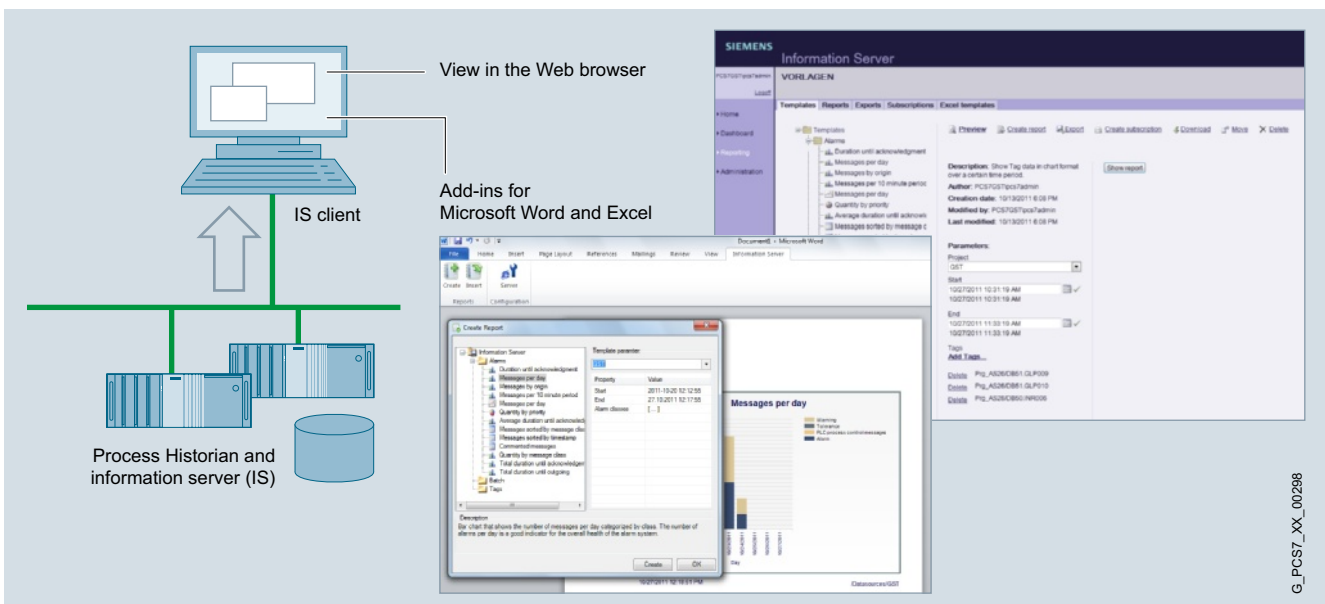


Process values and messages, as well as batch data from SIMATIC BATCH, can be swapped out of the circular logs from the operator stations to the Process Historian on a time-driven or event-driven basis for long-term archiving.

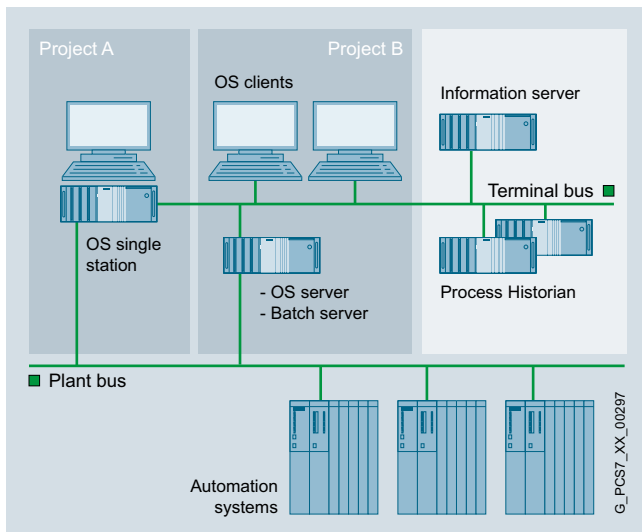
The Process Historian is suitable for all plant sizes. The number of archivable single stations, servers or server pairs is unrestricted.

The process values and alarms managed in the database of the Process Historian on the OS clients and OS single stations can be visualized in a user-friendly and clear manner. Data selection is supported by integrated filter functions. Alarms and process values can be shown in table form, and process values also in graphic form. Tables of process values can be exported to CSV format for processing in other Windows applications, e.g. Microsoft Excel.

The data managed by the Process Historian can be transferred to commercially available storage media (backup/restore). The operating system of the Process Historian supports additional hardware and software for this purpose, e.g. a DVD burner with appropriate burner software.



Methods of accessing the Process Historian data stock



Visualization of the data from the Process Historian database is supported by an additive reporting system, the Information Server. Based on the Microsoft Reporting Services, it allows Web-based thin-client access to historical data. Add-ins for Microsoft Word und Excel offer additional methods of accessing the Process Historian database. The number of clients that have access to the Information Server can be regulated with cumulative Client-Access licenses.

The Information Server is able to access one data source or multiple data sources in parallel. In addition to archive data of the Process Historian, these can also be archive data from operator stations (OS single station/OS server). It can therefore also be used for plant reporting independent of the Process Historian. Direct reading of data from operator stations is authorized by means of cumulative data source access licenses according to the number of sources.

Depending on how important the availability of archive data is for the plant operator, the Process Historian can be configured either as a single server or a redundant pair of servers.

Suitably, either the server version of the most powerful SIMATIC PCS 7 Industrial Workstation (IPC847C) or a Fujitsu Primergy Server is used for the Process Historian. A RAID 5 hard disk configuration with high data transfer rates is used for the database. An additional, separate hard disk must be provided for the operating system and the SIMATIC PCS 7 software.

The Information Server can be operated on the Process Historian hardware or on separate hardware. Any OS client version of the SIMATIC PCS7 Industrial Workstation is suitable for separate operation.

The Process Historian and Information Server do not need a connection to the plant bus. They can be connected to the OS and batch stations of the SIMATIC PCS 7 system via the terminal bus.

Both can run under the Windows Server 2008 R2 Standard 64-bit operating system, and the Information Server can also run on separate hardware under Windows 7 Ultimate 32/64-bit or Windows Server 2003 R2 Standard 32/64-bit.

The change in product from an existing Central Archive Server (CAS) to the Process Historian is supported by conversion packs and a wizard for CAS database migration.

Archiving and visualization functions

- Real-time archiving of the process values and messages of OS single stations und OS servers
- Archiving the batch data of SIMATIC BATCH
- Support of multiple SIMATIC PCS 7 projects
- Scaling of the performance and configuration limits of the basic hardware employed
- Swapping out of the data to external storage media
- Reading in of swapped-out data from external storage media
- Data visualization on the OS clients/OS single stations:
 - Configuration of views (picture windows and masks) including the selection criteria for displaying the data
 - Visualizing of messages in table form dependent on filter functions
 - Displaying of process values in table or graphic form dependent on filter functions
 - Visualizing a batch overview (it is possible to select the detailed log of a batch from the batch overview)

Reporting functions

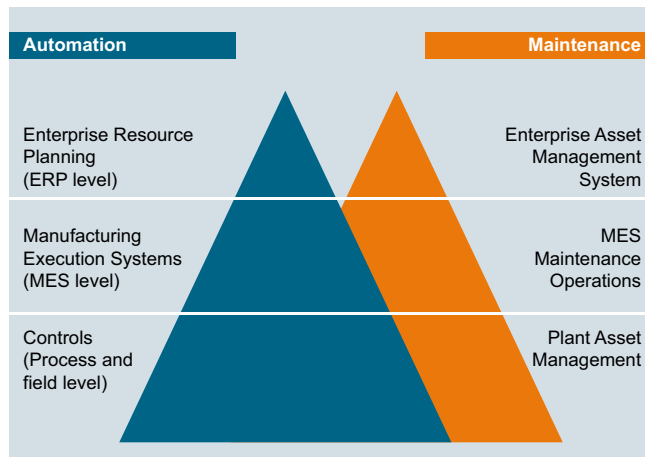
- Set of conventional report templates for process values, alarms and batches
- Free creation of any number of new report templates
- Storage of configured report templates for fast access
- Report export in common document formats
- Subscriptions for cyclic report generation including e-mail service
- Creation and storage of role-based dashboards
- Role management for Windows users
 - Active Directory and workgroups are supported
 - Access authorization can be assigned for each project
- Integrating reports into Word documents as pictures
- Creation and storage of Excel report templates for historic process values and alarms
- Subscriptions for Excel report templates

For additional information, see:

www.siemens.com/simatic-pcs7/processhistorian

Diagnostics and maintenance

Plant Asset Management with the Maintenance Station



Plant automation and maintenance in process engineering

The Maintenance Station supplements SIMATIC PCS 7 with a valuable instrument for minimizing the total cost of ownership of a plant.

If one considers the total maintenance involved in an enterprise then the Maintenance Station is focused on the area of "Plant Asset Management". Asset management for plant engineering is the administration and management of plant equipment, particularly the I&C equipment, as well as all activities and measures that serve to retain or increase the value of a plant. This includes the following maintenance strategies:

- **Corrective maintenance:**
Response to existing fault and diagnostics messages
 - Failures are risked or minimized by redundant configurations
 - Maintenance in the form of a repair or replacement
- **Preventative maintenance:**
Preventative diagnostics and maintenance
 - Appropriate maintenance measures are initiated before a fault even occurs
 - Maintenance in the form of time-dependent or status-dependent maintenance (dependent on degree of wear)
- **Predictive maintenance:**
Predictive diagnostics for timely detection of potential problems and to determine the remaining service life.

While the plant operator obtains all relevant information that is necessary for focused intervention in a process via the operator system, maintenance and service personnel can check the hardware components of the automation system (assets) and process their diagnostic messages and maintenance requests using the Maintenance Station. For this the Maintenance Station offers access to:

- Components of the process control system: Intelligent field devices and I/O modules, fieldbus, controller, network components, and plant bus, as well as servers and clients of the operator systems
- Assets that do not belong directly to the process control system, such as pumps, motors, centrifuges, heat exchangers (mechanical assets) or control loops – represented by proxy objects in which the diagnostics rules are stored

Typical maintenance cycle

A typical maintenance cycle has the following actions:

- **Monitoring the status of components/devices:**
 - Recording of diagnostics information via network components and PC basic devices per OPC coupling
 - Intelligent sensors detect and signal impending failures long before the actual failure
- **Signaling the "maintenance required" in a group display, in symbol displays of the affected components/devices, and in an alarm log**
- **Navigation to component/device requiring maintenance, and information on specific data such as measuring-point number, mounting location and device type**
- **Display of detailed diagnostic information (depending on device type and vendor), e.g.**
 - Error description
 - Error cause
 - Trend statement
 - Operating instruction
- **Evaluation, commenting and, if applicable, changing the priority of the maintenance requirement**
- **Initiation of a maintenance measure per maintenance request and tracking of execution; symbolic visualization of current status of maintenance measure**
- **Conclusion of maintenance measure; all status displays are reset to their normal state**

All activities are documented on the maintenance station without gaps – automatically and without additional configuration overhead.



Architecture

For asset management, the Maintenance Station uses hardware and software components of the Engineering System (ES) and Operator System (OS). As a result of the close interlacing, ES, OS, and Asset Management functions execute on common hardware. Such a multi-functional station cannot only be used for asset management, but also for system engineering or HMI.

Depending on the project-specific SIMATIC PCS 7 architecture, the Maintenance Station can be implemented on the basis of a SIMATIC PCS 7 BOX, a Microbox (as stand-alone maintenance station), a SIMATIC PCS 7 Single Station, or a client/server combination. In client/server combinations, the Maintenance Station server can also have a redundant design. In this case, they must be configured like redundant OS servers.

Message system, GUI, picture hierarchy and operator prompting are oriented according to the HMI philosophy of the operator system. The diagnostics data of all assets are displayed on uniform faceplates whose functions and information depend on the components. This means that working with the Maintenance Station is simple and intuitive, complex familiarization is not required.

The diagnostics screens structured according to the process cell hierarchy with the operating states of the SIMATIC PCS 7 components can be displayed on the Maintenance Station and also on the OS clients. More detailed diagnostic information determined by SIMATIC PDM is also displayed on the faceplates of these stations. Enhanced online diagnostics functions in conjunction with HW Config can also be called from the Maintenance Station.

The user management and access control for the Maintenance Station is handled by SIMATIC Logon integrated in SIMATIC PCS 7.

Configuration

For asset management, the Maintenance Station uses the relevant data from the hardware and software project of the application which is generated during the standard configuration with the Engineering System. Simply by pressing a button, these data are derived with system support from the project data of the application, and the diagnostics screens are generated. The procedure is simple, and no additional overhead is required for configuration of the asset management:

- Generation of the hardware and software project of the application
- Configuring/parameter assignment of specific Maintenance Station functions and connections (optional)
- System-supported generation of the diagnostics screens with all components present in the project, including the picture hierarchy based on the project's hardware structure
- Compilation of the configuration data, and downloading to the operator station and Maintenance Station with subsequent test and commissioning phase.

The names of imported pictures, icons, etc. can be permanently changed for further use in the maintenance project.

Conformity to international standards, specifications, and recommendations

Asset Management with the SIMATIC PCS 7 Maintenance Station conforms to international standards, specifications, and recommendations. It takes into account the NAMUR requirements (standardization association for measurement and control in chemical industries) defined for systems for asset management at plant level and for status messages from field devices.

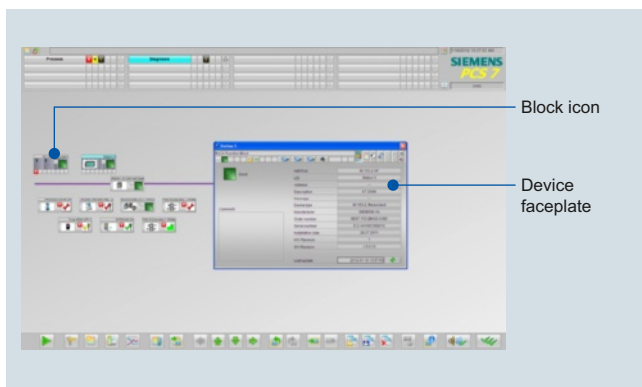
In addition, it follows the IEC 61804-2 for describing devices by means of the Electronic Device Description Language (EDDL) and specifications made by the PROFIBUS & PROFINET International (PI) organization, e.g.:

- PROFIBUS Profile Guidelines Identification & Maintenance Functions
- PROFIBUS PA Profile for Process Control Devices

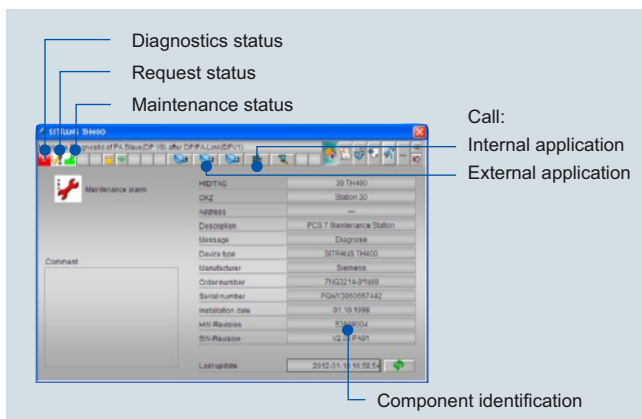
Asset Management function characteristics



Plant overview with symbol displays for components



Overview of components on a PROFIBUS segment with symbol displays



ID view of component

As the system interface to the maintenance engineer, the Maintenance Station provides integrated maintenance functions and information.

Standard diagnostics functions

Starting from the overview display, maintenance engineers can navigate to the diagnostics displays of the subordinate hardware levels to obtain information on the diagnostics status of individual plant areas or components. If a fault is sig-

naled in the overview display, the "loop in alarm" function permits rapid switching to the diagnostics faceplate of the associated component. The information is filtered according to the area of responsibility of the user.

The following information can be displayed if applicable:

- Diagnostics status determined by the system
- Information on the component, such as process tag name, manufacturer or serial number
- Diagnostics messages of a component
- Detailed diagnostics information of a component
- Enabling of maintenance measure by the process operator
- Type and current status of initiated maintenance measure

Information on mechanical assets

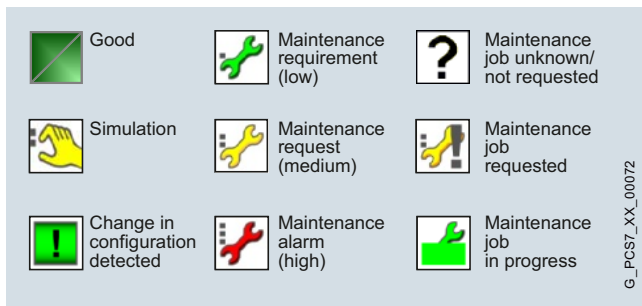
A function block acting as a proxy for mechanical assets without self-diagnostics (pumps, motors, etc.) can determine impermissible operating states from different measured values and their deviations from a defined normal status. These are then displayed as a maintenance alarm. This function block is also suitable for implementing individual diagnostics structures, project-specific diagnostics rules, and condition monitoring functions.

In addition to this, individual asset management blocks are available with which maintenance engineers can monitor plant components such as pumps, heat exchangers or control valves.

Extended information for assets according to IEC 61804-2

Additional information can be called for assets described by the electronic device description (EDD) according to IEC 61804-2. This information is automatically read out of the components and made available by SIMATIC PDM in the background.

- Detailed diagnostics information
 - Device-specific information from the vendor
 - Information on fault diagnostics and troubleshooting
 - Additional documentation
- Results of internal condition monitoring functions
- Status information (e.g. local operation, local configuration changes)
- Display of modification logbook (audit trail) of the component with all entries on the persons, times and types of operator intervention on the component
- Parameter view of the assets (display of parameters saved in the component and in the project; if required, also differences between them)



Extract from the PCS 7 asset management symbol set

Visualization of the maintenance information

The hierarchical structuring of information and the uniform symbols support the overview, facilitate orientation, and permit the maintenance engineer to rapidly access detailed information starting from the plant overview. The symbol set defined for asset management with the SIMATIC PCS 7 Maintenance Station contains symbols which identify the diagnostics status of the devices/components, the relevance of the maintenance request, and the status of the maintenance measure. Group displays in the plant overview visualize the diagnostics status of the subordinate structures/components according to a type of traffic light with red, yellow or green.

Diagnostics screens represent the status of components and subordinate devices/components through standardized symbols. These contain the following elements:

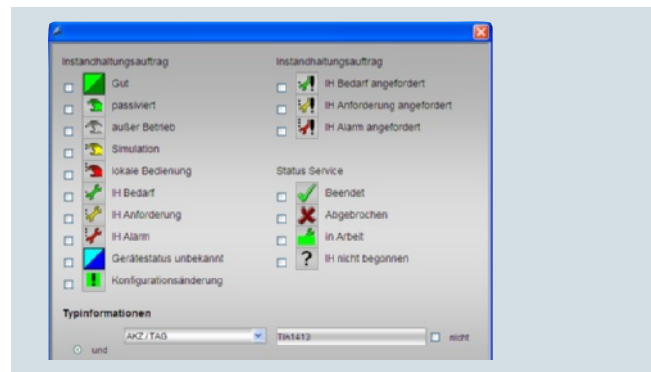
- Bitmap of component
- Tag identification of component
- Maintenance state display
- Group display for diagnostics status of subordinate components

Clicking an element in the symbol display either opens the subordinate hierarchy level or a component faceplate. The component faceplate offers various views of the associated component with additional device-specific information, e.g. an identification, message or maintenance view.

Information management

With the following functions, the maintenance engineer can forward classified information quickly and simply, access project-specific information databases, or request maintenance measures:

- Export of identity data (electronic rating plate) and associated diagnostics status for devices/components determined by filter (total export)
- Export of all the relevant information of a component (including the action defined in the project for the maintenance measure) to defined destinations, e.g. mail system, printer or pager (single export)
- Calling up to three applications (Web pages, programs, or databases) defined in the project, e.g. shift logs, documentation or enterprise asset management console



Filters for diagnostics statuses

For additional information, see:

www.siemens.com/simatic-pcs7/plant-asset-management

Asset Management highlights

- Instrument for minimization of the total cost of ownership for the complete lifecycle of the plant
- Diagnostics and maintenance management for the components of the process control system and for mechanical assets such as pumps, motors or heat exchangers
- Maintenance station as system interface for maintenance engineer
- Uniform display of diagnostics and maintenance status throughout the plant
- Automatically generated overview of ID data with firmware and software versions for planning upgrades
- Function block for mechanical assets, individual diagnostics, and condition monitoring functions
- Additive blocks for plant components (pumps, heat exchangers, control valves, etc.)
- Recording of changes in configurations and parameters of EDD-based devices in the change log
- Generation of overviews on diagnostics statuses
- Integration of internal and external applications for special diagnostics and additional information
- Consideration of international standards and directives

Automation systems

Scalable performance for every requirement



Designs of the SIMATIC PCS 7 automation systems: S7-400 system (left), modular embedded system (center), and Microbox system (right)

Automation systems in the three designs shown above are available for the SIMATIC PCS 7 process control system. The automation performance can therefore be finely scaled within wide limits.

SIMATIC S7-400 modular automation systems with hardware controller

The automation systems of the SIMATIC S7-400 range are extremely rugged, and are characterized by high processing and communications performance. With consideration of the price/performance ratio, selected components of the SIMATIC S7-400 are combined in bundles depending on the task. These "AS bundles" are available in two versions:

- Individual components bundled per system in one delivery
- Preassembled and tested all-in-one systems (no extra charge compared to delivery of individual components)

They are configured by selecting predefined ordering units.

Each AS bundle is combined with a SIMATIC PCS 7 Industry Library Runtime license and a SIMATIC PCS 7 AS Runtime license for 100 process objects (PO). The number of POs can be extended with cumulative Runtime licenses for 100, 1 000 or 10 000 POs.

Up to 8 PROFIBUS interfaces (single or redundant) can be configured for an automation system. By default the CPU of the automation systems comes with an onboard PROFIBUS DP fieldbus connection. Depending on the type of CPU, 1 or 2 further PROFIBUS DP interfaces are possible using additive IF 964 DP interface modules. PROFIBUS communications cards can be additionally fitted if required.

The PROFINET IO connection depends on the type: via CPU interface or via CP 443-1 communication module.

The following properties should be highlighted:

- Modular, fan-free design
- Extremely rugged and expandable
- Single and redundant versions
- Comprehensive communication facilities
- Integrated system functions
- Integratable safety functions (Safety Integrated)
- Simple linking of central or distributed I/O
- PROFINET IO support

In accordance with their functionalities, the modular automation systems of the S7-400 range can be classified into

- Standard automation systems
- Fault-tolerant automation systems
- Safety-related automation systems

The AS 410 all-round system offers maximum flexibility and covers the functionalities of all three classes.

Standard automation systems

The modular standard automation systems of the S7-400 are available for universal use. These are always your first choice if fault tolerance or Safety Instrumented Functions are negligible.

Fault-tolerant automation systems

Fault-tolerant automation systems are used to reduce the risk of production failures. The higher investment costs are frequently negligible compared to the costs resulting from production failures. The higher the costs of a production failure, the more worthwhile it is to use a fault-tolerant system.

The two redundant and electrically isolated subsystems of the Redundancy Station can be mounted on one compact rack with divided backplane bus or on two separate racks. The design with two racks allows physical separation of the redundant subsystems over distances up to 10 km, e.g. separated by a fireproof partition. As a result of the electrical isolation, the system is insensitive to electromagnetic interferences.

Fault-tolerant SIMATIC PCS 7 automation systems can be used on their own or together with standard and safety-related automation systems.

Safety-related automation systems

Safety-related automation systems are used for critical applications in which an incident can cause danger to personnel, plant damage, or environmental pollution. These F/FH systems collaborate with safety-related F modules of the ET 200 distributed I/O systems or fail-safe transmitters connected directly via the fieldbus to detect not only faults in the process, but also their own, internal faults. They automatically bring the plant into a safe state in the event of a fault.

The safety-related automation systems are TÜV-certified and comply with the safety requirements up to SIL 3 in accordance with IEC 61508. They are based on the hardware of the fault-tolerant automation systems that has been expanded by safety functions by means of S7 F Systems.

Analogous to the basic systems, they are available in two versions:

- Single stations with one CPU, safety-related
- Redundancy stations with two redundant CPUs, safety-related and fault-tolerant

The redundancy of the FH systems is only used to increase the availability. It is not relevant to processing of the safety functions or the associated fault detection.





Safety-related automation system, ET 200M with F modules

In the multitasking systems, several programs can run simultaneously in one CPU, Basic Process Control System (BPCS) applications as well as safety-related applications. The programs are reaction-free, this means that faults in BPCS applications have no effect on safety-related applications, and vice versa. Special tasks with very short response times can also be implemented.

With parallel processing of BPCS and safety functions in one CPU, mutual interference is prevented by ensuring the BPCS programs and the safety-related programs are kept strictly separate and the data exchange is by means of special conversion function blocks.

The safety functions are processed twice in different processor sections of the CPU by means of redundant, diverse instruction processing. Potential errors are detected by the system during the subsequent comparison of results.

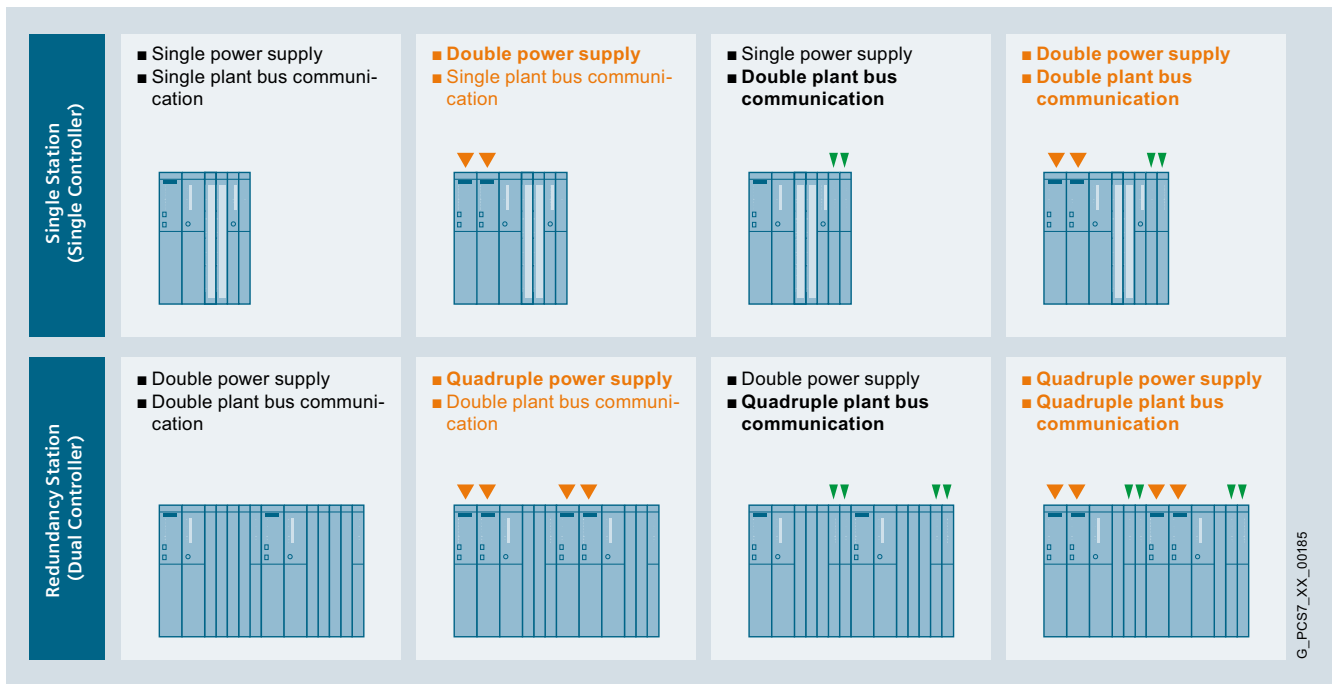
Safety programs executed on different F/FH systems of a plant are also able to carry out safety-related communication with one another over the Industrial Ethernet plant bus.

Flexible and scalable availability

A particular characteristic of the modular S7-400 systems is the flexible and scalable availability of various modules.

When planning a system, it is even possible with a Single Station to increase the availability at a specific point by means of redundant configuration of the power supply, or for the Industrial Ethernet communication module, and to combine these measures.

The Redundancy Station with its two redundant CPUs already offers a higher level of availability. It operates according to the 1-out-of-2 principle, where a switchover is made from the active subsystem to the standby subsystem in the event of a fault. Based on this, as with the Single Station the power supply or the Industrial Ethernet communication module can be doubled for each subsystem, and these measures can be combined.



Flexible and scalable availability

AS 410 automation system

The AS 410 is a new AS type in the SIMATIC S7-400 range which is exclusively envisaged for use in the SIMATIC PCS 7 process control system. With its innovative "CPU 410-5H Process Automation" and the appropriately optimized firmware, the AS 410 is able to cover the complete performance range of the SIMATIC PCS 7 automation systems (from AS 412H, via AS 414-3 and AS 416, up to the AS 417H). The performance is ultimately defined using process objects (PO). The resulting reduction in the number of types not only simplifies the stocking of spare parts, but also provides advantages for the complete lifecycle of the process control system.

The CPU 410-5H Process Automation already differs optically from all other current automation systems of the S7-400 range. It is equipped with one interface each for PROFINET and PROFIBUS DP. A second PROFINET interface is prepared for future use. Memory cards are not required since a load memory of 48 MB is integrated. A reset button replaces the previously used RUN/STOP switch.

Established SIMATIC S7-400 automation systems

AS type	Characteristics
Standard systems	
AS 414-3	Standard CPU, interfaces: 1 x MPI/DP, 1 x DP, 1x DP module can be inserted as option
AS 414-3IE	Standard CPU, interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1x DP module can be inserted as option
AS 416-2	Standard CPU, interfaces: 1 x MPI/DP, 1 x DP
AS 416-3	Standard CPU, interfaces: 1 x MPI/DP, 1 x DP, 1 x DP module can be inserted as option
AS 416-3IE	Standard CPU, interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1x DP module can be inserted as option
AS 417-4	Standard CPU, interfaces: 1 x MPI/DP, 1 x DP, 2 x DP module can be inserted as option
Fault-tolerant and safety-related systems	
AS 412H/F/FH	H-CPU (1 x or 2 x), interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1 x DP
AS 414H/F/FH	H-CPU (1 x or 2 x), interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1 x DP
AS 416H/F/FH	H-CPU (1 x or 2 x), interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1 x DP
AS 417H/F/FH	H-CPU (1 x or 2 x), interfaces: 1 x PN/IE (2 ports), 1 x MPI/DP, 1 x DP

Automation system with APL	AS 412H	AS 414-3	AS 414-3IE	AS 414H	AS 416-2	AS 416-3	AS 416-3IE	AS 416H	AS 417-4	AS 417H	AS RTX	AS mEC
	AS 410											
Analog value measurements	10	50	100	100	200	400	400	400	500	600	300	300
Digital value measurements	20	160	250	250	450	800	800	800	1 000	1 000	600	600
PID controls	5	35	50	50	75	150	150	150	180	200	200	200
Motors	7	40	75	75	100	200	200	200	350	400	150	150
Valves	7	40	75	75	100	200	200	200	350	400	250	250
SFC	0	15	15	15	40	100	100	100	200	200	100	100
Steps	0	150	150	150	400	1 000	1 000	1 000	2 000	2 000	800	800
Dosing	0	3	3	3	15	25	25	25	50	50	50	50
Digital inputs DI	30	200	350	300	600	1 200	1 200	1 200	1 700	1 800	1 200	1 200
Digital outputs DO	10	60	100	110	200	400	400	400	550	650	400	400
Analog inputs AI	15	100	175	150	300	600	600	600	800	900	600	600
Analog outputs AO	5	30	75	50	100	200	200	200	250	350	200	200
Process objects (PO)	30	200	350	350	600	1 200	1 200	1 200	1 800	2 000	1 200	1 200

Typical mixed configuration limits for SIMATIC PCS 7 automation systems, based on the SIMATIC PCS 7 Advanced Process Library (APL)

SIMATIC PCS 7 AS RTX Microbox automation system with software controller

The compact and rugged automation system based on the SIMATIC IPC 427C represents the starter system for the low to mid-performance range of SIMATIC PCS 7. The SIMATIC PCS 7 AS RTX designed for maintenance-free 24-hour continuous operation at ambient temperatures up to 55 °C works without fans and rotating storage media. This results in a high resistance to vibration and shock. Due to its excellent physical characteristics and compact dimensions the SIMATIC PCS 7 AS RTX is particularly suitable for small applications at plant level.

ET 200 remote I/O systems with connected sensors/actuators and field devices/process devices on PROFIBUS DP/PA can be connected over a PROFIBUS DP interface which also supports routing. Two 10/100/1000 Mbit/s Ethernet RJ45 interfaces allow integration into a SIMATIC PCS 7 plant bus.

Parameterizable monitoring functions for program execution/watchdog, processor and board temperatures, as well as enhanced diagnostics/alarms (e.g. runtime meter, system status) can be recorded and evaluated via SIMATIC IPC DiagMonitor and PCS 7 Maintenance Station or signaled by LED.

The SIMATIC PCS 7 AS RTX is supplied with an AS Runtime license for 100 POs which can be expanded up to 2 000 POs. The Windows XP Embedded 2009 operating system, the WinAC RTX controller software, and the SIMATIC IPC DiagMonitor diagnostics software are pre-installed on a 4 GB CompactFlash card. The system is configured using the SIMATIC PCS 7 Engineering System.

SIMATIC PCS 7 AS mEC RTX Embedded automation system with software controller

The SIMATIC PCS 7 AS mEC RTX is a rugged, fan-free automation system in S7-300 format. Its special feature is centralized expandability by means of adding up to 8 I/O modules from the S7-300 I/O range on the same mounting rail. This merges the controller and I/Os into a low-cost compact unit that can be used preferably in small applications and as an OEM product, e. g. in package units.

Sensors/actuators integrated via distributed ET 200M remote I/O stations can also be connected via PROFINET IO.

The SIMATIC PCS 7 AS mEC RTX can be connected to the SIMATIC PCS 7 plant bus via a 10/100/1000 Mbit/s Ethernet interface.

The SIMATIC PCS 7 AS mEC RTX can be fully integrated into SIMATIC PCS 7 and is configured using the SIMATIC PCS 7 Engineering System. The scope also includes an AS Runtime license for 100 POs which can be expanded up to 2 000 POs. The Windows XP Embedded 2009 operating system and the WinAC RTX controller software are pre-installed on a CompactFlash card.

Since SIMATIC PCS 7 AS mEC RTX and SIMATIC PCS 7 AS RTX use the same controller software, and both have a similar performance level.

Highlights of the automation systems

Modular systems of the SIMATIC S7-400 range

- Individually configurable AS bundles, available as:
 - Individual components, bundled in stations
 - Pre-assembled and tested stations
- Flexible and scalable availability:
 - Standard systems as Single Station, optionally with redundant power supply
 - Fault-tolerant and safety-related systems as single/redundancy station; redundant power supply and/or Industrial Ethernet interface as options
- Redundancy Station with two electrically isolated subsystems
 - One or two racks (distances up to 10 km)
 - Synchronous processing of identical user programs
 - Bumpless switchover
- Changes to the configuration during operation

SIMATIC PCS 7 AS RTX Microbox system

- Compact and rugged system for use at plant level
- Resistant to vibration and shock since there are no fans or rotating storage media
- Maintenance-free 24/7 operation at ambient temperatures up to 55 °C

SIMATIC PCS 7 AS mEC RTX modular embedded system

- Compact system in S7-300 format for small applications and package units
- Centrally expandable thanks to the direct addition of up to 8 S7-300 I/O modules
- Distributed ET 200M remote I/O stations can be connected via PROFINET IO

Compact systems

SIMATIC PCS 7 BOX – complete control system in compact design



SIMATIC PCS 7 BOX RTX compact system with portrait assembly kit

SIMATIC PCS 7 BOX enhances the SIMATIC PCS 7 range with low-price, rugged and space-saving industrial PC systems with versatile application options, e.g. as:

- Client in an operator system or in SIMATIC BATCH
- Compact process control system with system functionality for engineering (ES), automation (AS), HMI (OS)
- Runtime system with system functionality as above, but without engineering

SIMATIC PCS 7 BOX systems are compact systems and are focused to the last two applications listed above.

With the SIMATIC PCS 7 OS Runtime software limited to 2 000 process objects (POs), excellent physical properties, and small dimensions, they are designed for automation at plant level for:

- Small applications/units in production processes
- Package units (enclosed subprocesses)
- Laboratories or institutes

They are also highly suitable as training systems for operators and service engineers.

The application of standard SIMATIC PCS 7 components ensures scalability and unlimited expansion without a change in compatibility. With increasing requirements, e.g. if a test system is subsequently to be operated as a productive system of larger scale, expansion with SIMATIC PCS 7 system components is possible without problem, as is integration into the production plant.

The product range is differentiated primarily via the automation functionality, that is, via the controller type:

- **SIMATIC PCS 7 BOX RTX**
with integrated WinAC RTX software controller
- **SIMATIC PCS 7 BOX**
in combination with a separate external controller:
 - PCS 7 AS RTX Microbox automation system
 - PCS 7 mEC RTX automation system
 - Modular automation system of the S7-400 series as single or redundancy station

The selection depends on the price/performance ratio and on the supported hardware and software functionalities.


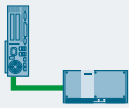
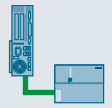
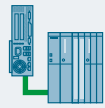

The two basic types can be differentiated further depending on whether the engineering is concentrated in a central engineering system or integrated in the compact system:

- SIMATIC PCS 7 BOX RTX
 - ES/OS system with ES + OS + AS functionality
 - OS Runtime system with OS + AS functionality
- SIMATIC PCS 7 BOX
 - ES/OS system with ES + OS functionality
 - OS Runtime system with OS functionality

A complete process control system for small applications can be implemented by expanding with distributed process I/Os. Depending on the type of automation system, the distributed process I/O can be connected via PROFIBUS, FOUNDATION Fieldbus H1 or PROFINET IO. Depending on the type of field communication, the ET 200M, ET 200iSP, ET 200S and ET 200pro remote I/O stations are supported by a comprehensive range of low-cost signal/function modules, but also by field/process devices connected directly over the fieldbus. S7-300 I/O modules can also be directly attached to the mounting rail of the PCS 7 AS mEC RTX.

The compact systems can be incorporated into the PCS 7 asset management using the integrated SIMATIC PC DiagMonitor diagnostic software. Equipped as an ES/OS system with additional software licenses for SIMATIC PDM and SIMATIC PCS 7 Maintenance Station, a compact system can also be operated as a maintenance station.

SIMATIC PCS 7 BOX systems with an external controller are also suitable for SIMATIC BATCH (up to 10 units) or as a Web server for up to two Web clients.

System configuration	PCS 7 BOX RTX	PCS 7 BOX				
						
	Integrated WinAC RTX Controller	PCS 7 AS RTX (Microbox) as separate controller	PCS 7 AS mEC RTX as separate controller	Modular AS 41x (AS Single Station) as separate controller	Modular AS 41xH or AS 41xF (AS Single Station or AS Redundancy Station) as separate controller	
Supported functions and limits	Software					
	AS/OS Engineering	●	●	●	●	●
	OS Runtime Single Station up to 2 000 OS runtime POs	●	●	●	●	●
	PCS 7 APL	●	●	●	●	●
	SIMATIC PDM PCS 7	●	●		●	●
	SIMATIC PCS 7 Maintenance Station	●	●		●	●
	SIMATIC BATCH up to 10 units		●	●	●	●
	Web server, for up to 2 Web Clients		●	●	●	●
	OS Single Station Redundancy		●	●	●	●
	S7 F Systems					●
	SIMATIC Safety Matrix					●
	Hardware					
	Controller (AS) independent of BOX PC system		●	●	●	●
AS-AS Communication	●	●	●	●	●	
Routing	● ¹⁾	● ¹⁾		●	●	
PROFIBUS DP/PA	●	●		●	●	
FOUNDATION Fieldbus (FF)				●	●	
PROFINET IO with ET 200M			●	●	●	
Configuration in Run (CiR)				●	●	
High-Precision Time Stamping				●	●	
S7 Block Privacy				●	●	
Retentive AS Data	only with UPS	only with UPS	only with UPS			
AS Configuration Limits ²⁾	WinAC RTX 2010 up to 1 200 AS runtime POs	WinAC RTX 2010 up to 1 200 AS runtime POs	WinAC RTX 2010 up to 1 200 AS runtime POs	Depending on the AS 41x type, up to 1 800 AS runtime POs	Depending on the AS 41xH or AS 41xF type, up to 2 000 AS runtime POs	

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- ¹⁾ The routing functionality of WinAC RTX 2010 can only be used with the onboard CP 5611 of the SIMATIC IPC627C (PCS 7 BOX RTX) and IPC427C (PCS 7 AS RTX).
²⁾ Typical mixed configuration limits, based on the SIMATIC PCS 7 Advanced Process Library (APL)

Design versions

The compact systems are operated and monitored as standard using separate control units (mouse, keyboard, process Monitor).

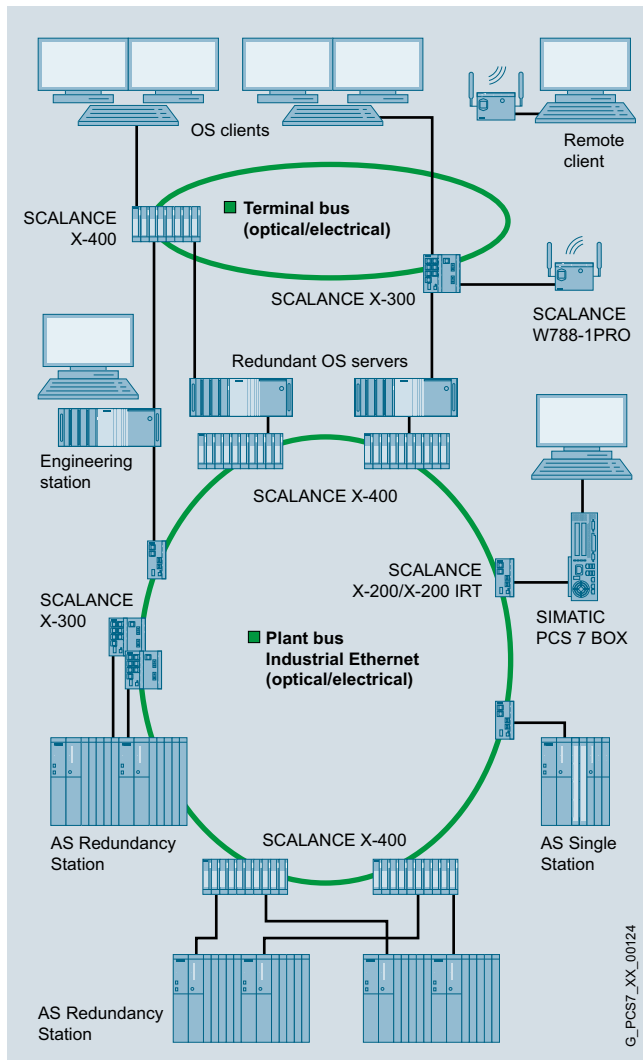
An alternative design version with panel (photo on right) also permits operation and monitoring using a 19" TFT Touch Panel with a resolution of 1280 x 1024 pixels.



SIMATIC PCS 7 BOX with Panel Front, side and front views

Communication

Fast and reliable communication
with Industrial Ethernet for plant bus and terminal bus



Industrial Ethernet, connection examples

Technical specifications for Industrial Ethernet

Plant bus/terminal bus	Industrial Ethernet
Number of nodes	1 023 per network segment (IEEE 802.3 standard)
Number of switches	up to 50
Length of the network	
- Local network	Electrical up to approx. 5 km Optical up to approx. 150 km
- WAN	Worldwide with TCP/IP
Topology	Linear, tree, ring, star

SIMATIC NET

Through application of SIMATIC NET network components based on globally established standards, SIMATIC PCS 7 is provided with a powerful and rugged range of products for implementing integrated communications networks for reliable data exchange between the system components in different levels of a plant.

The SIMATIC NET products specially developed for industrial applications provide optimum suitability for plants in all sectors. They are matched to one another and meet the highest standards, especially in areas where they are subject to extreme influences, such as:

- Electromagnetic interference fields
- Corrosive liquids and atmospheres
- Explosion hazards
- High mechanical loads

The SIMATIC NET products ensure expandability and the protection of investments due to compatible further developments, as well as integration from inbound logistics to outbound logistics and from field devices up to the management information system.

Industrial Ethernet

The plant bus and the terminal bus for multiple station systems with client/server architecture are implemented with Industrial Ethernet, a powerful area and cell network for industrial applications in line with the international IEEE 802.3 standard (Ethernet).

In the various SIMATIC PCS 7 subsystems (ES, OS, AS, etc.), onboard interface modules, simple network cards or special communication modules (CP 1613 A2, CP 1623, CP 1628) are used as communication interfaces. For small systems, the "Basic Communication Ethernet" integrated in the PCS 7 Industrial Workstations permits economical operation of single stations and servers on the plant bus with simple network cards.

In medium and large plants characterized by high requirements, SIMATIC PCS 7 relies on powerful CP 1613 A2/CP 1623/CP 1628 communication modules as well as modern Gigabit and FastEthernet technology which combines the high security provided by optical rings with the scalable performance provided by switching technology and high transmission rates up to 1 Gbit/s.

Industrial Ethernet Switches / Industrial Wireless LAN

Industrial Ethernet switches

Industrial Ethernet switches are used for integration of communication participants in the plant bus. These switches from the SCALANCE X family are particularly suitable for this and offer scalable performance at an attractive price while supporting versatile configuration possibilities.

A multi-faceted range of products from the SCALANCE X product lines SCALANCE X-100, X-200, X-300 and X-400 is authorized for SIMATIC PCS 7. The number of ports, and levels of modularity, flexibility and functionality increase with ascending type number. While the switches of the SCALANCE X-100 and X-200 product lines are only equipped with Fast Ethernet ports for data rates up to 100 Mbit/s, switches from the SCALANCE X-300 and X-400 product lines are mainly equipped with Gigabit Ethernet ports. The designs vary even within one product line: Compact and flat design on X-200/ X-200 IRT, as well as compact and rack design on X-300.

Ring topologies are preferred for the plant bus and terminal bus thanks to their high availability. An additional benefit of optical rings is their electromagnetic compatibility.

Redundant ring topology

If availability requirements are particularly high, it is possible to distribute the communication on two physically separated redundant rings. One switch in each case takes over the function of the redundancy manager for each ring. The current SCALANCE X-400, X-300, X-200 IRT und X-200 switches (except X208PRO) are suitable for this.

- **Terminal bus:**

The PCS 7 stations are connected via a separate Industrial Ethernet interface to each of the two rings. On the PCS 7 stations, the SIMATIC NET SOFTNET IE RNA communication software organizes the communication processes by means of the Parallel Redundancy Protocol (PRP) in accordance with IEC 62439-3. Terminal equipment with only one Industrial Ethernet connection, e.g. the SICLOCK TC 400 central plant clock, can be integrated via SCALANCE X204RNA.

- **Plant bus:**

The link partners connected to the two rings by means of two CPs per AS CPU and OS server are linked together logically when configuring with NetPro by using a fault-tolerant S7 connection (4-way redundancy).



SCALANCE W740 Ethernet client module for indoor use

Industrial Wireless LAN (IWLAN)

SIMATIC PCS 7 offers the option of integrating mobile or stationary remote clients into the terminal bus. Industrial Wireless LAN (IWLAN) access points are used for this:

- SCALANCE W784 (in the control cabinet)
- W786 (outdoors) or
- W788 (indoors)

Mobile remote clients (e.g. notebooks) can communicate with the IWLAN access point using a WLAN interface module, and stationary remote clients in a desktop/tower housing (PCS 7 Industrial Workstations) can communicate using a SCALANCE W740 IWLAN client module.

The following applications can then be implemented:

- Use of additional remote OS clients (1 or 2 on IWLAN)
- Linking of web clients to a PCS 7 Web Server (up to 2 on IWLAN)
- Remote access to an engineering station using the "RealVNC" software (Enterprise Edition), e.g. during commissioning.

All components used are very rugged, apply state-of-the-art authentication and encryption procedures, and guarantee high reliability of the radio channel.

PROFINET – The Industrial Ethernet standard for automation

PROFINET is based on the international standards IEC 61158 and IEC 61784 and combines the advantages of the open network standard, Ethernet, and the PROFIBUS fieldbus system. PROFINET stands for maximum transparency, open IT communication, network security, and real-time communication down to the field level. Together with the PROFI-safe profile it supports safety-related communication between automation system (controller) and process I/O. This makes PROFINET the ideal basis for a uniform automation network in the plant, into which existing field buses implemented with PROFIBUS can be easily integrated.

In the context of the SIMATIC PCS 7 process control system, the application of PROFINET mainly focuses on PROFINET IO, the field communication between the automation systems (controllers) and the process I/O.

The S7-400 automation systems can be integrated into PROFINET IO via the PROFINET interface in the CPU or via a CP 443-1 communication module, the SIMATIC PCS 7 AS mEC RTX via the PROFINET interface in the EC31 embedded controller, and the ET 200M remote I/O stations via an IM153-4PN High Feature interface module. Different Industrial Ethernet products such as SCALANCE X switches and media converters, FastConnect connection elements, electrical and optical transmission media can be used as network components.

The PROFIBUS fieldbus or the FOUNDATION Fieldbus H1 can be integrated via a CP 443-5 communication module or a PROFIBUS DP interface in the CPU of the automation system, and the PROFIBUS in addition via IE/PB Link PN IO.

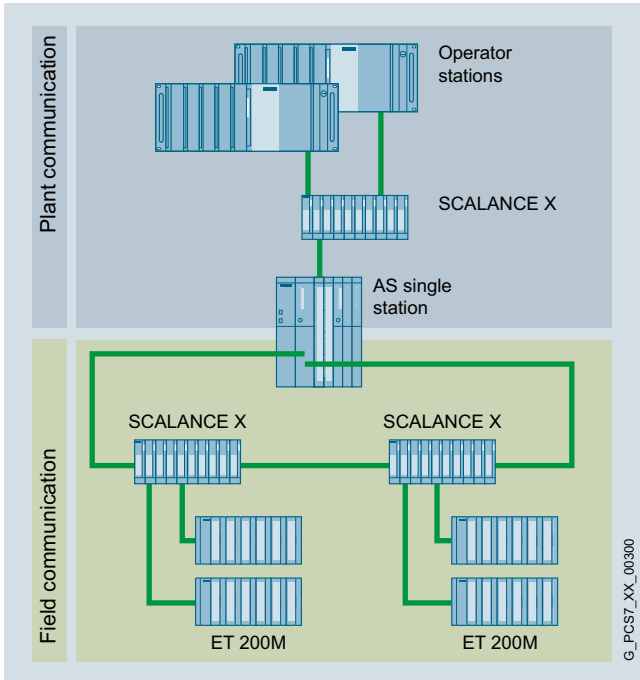
A wide variety of network configurations can be implemented in the field, based on line, star, tree, and ring topologies. PROFINET IO configurations with ring topology guarantee a higher availability of the I/O devices than other topologies.

In the case of PROFINET IO ring topologies with AS single stations, the media redundancy of the ring prevents failure of the complete segment. If there is an interruption in the ring or if one of the stations fails, the redundancy manager immediately activates the alternative communication path. It is insignificant here whether networking is carried out via SCALANCE X switches or direct via the PROFINET interfaces of the automation system and remote I/O station.

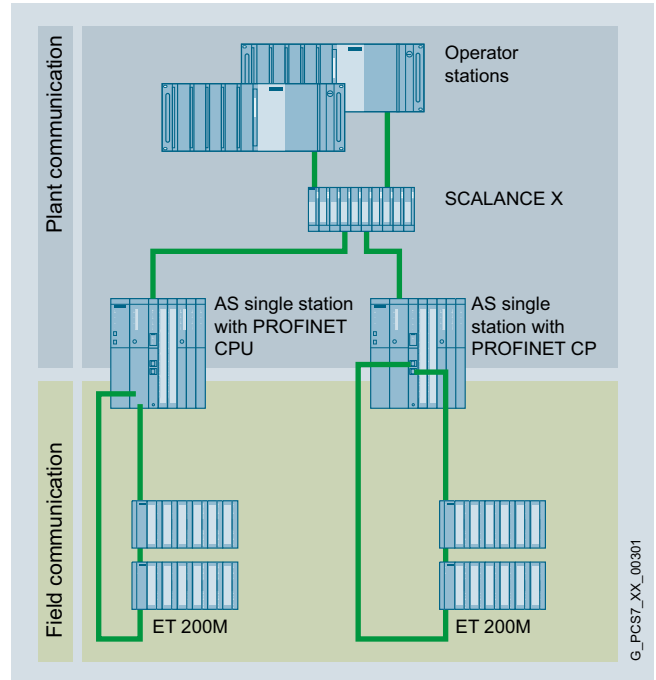
The maximum availability with minimum error handling times is achieved by AS Redundancy Stations in conjunction with the system redundancy of the I/O devices. System redundancy refers to a type of PROFINET IO communication where each I/O device establishes a communication connection to the two CPUs of an AS Redundancy Station over the topological network. In contrast to the single-sided I/O device connection to only one CPU, failure of a CPU in this case does not automatically lead to failure of the I/O devices.



Typical PROFINET IO configurations with AS single station

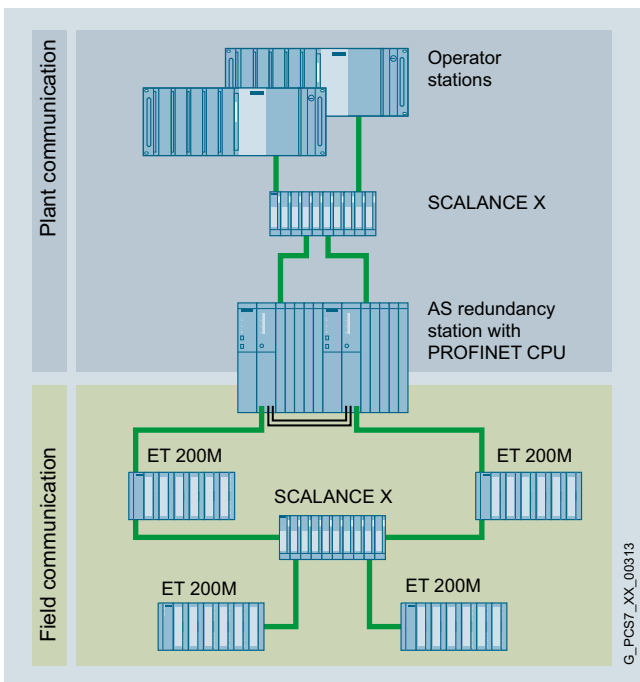


Networking the PROFINET stations via SCALANCE X switches



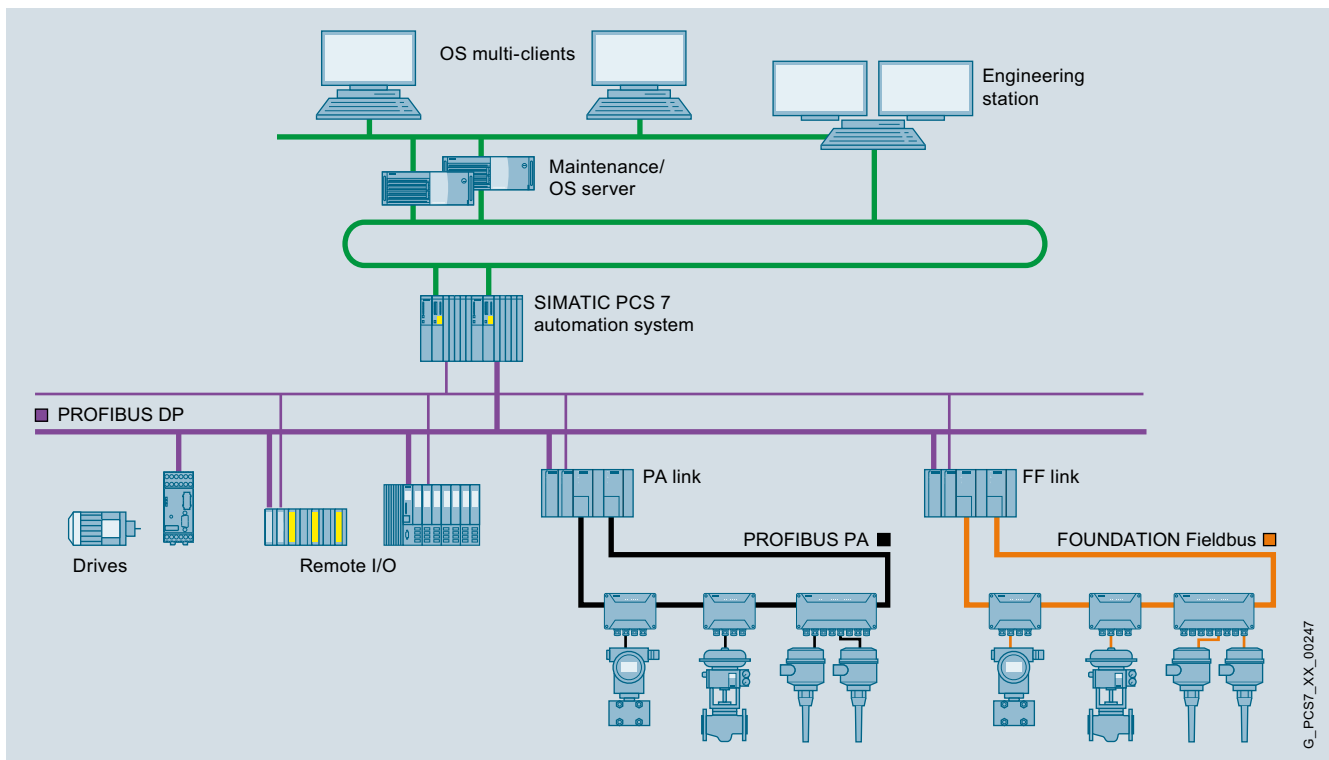
Direct networking of the PROFINET stations via integrated interfaces

Typical PROFINET IO configurations with AS redundancy station



PROFINET ring configuration with AS redundancy station

Fast and rugged fieldbus communication



System integration of PROFIBUS PA and FOUNDATION Fieldbus H1 via PROFIBUS DP

Distributed peripherals such as remote I/O stations with their I/O modules, transmitters, drives, valves or operator terminals communicate with the automation systems at field level through a powerful real-time bus system. This field communication is characterized by:

- Cyclic transmission of process data
- Acyclic transfer of alarms, parameters and diagnostics data

The universal PROFIBUS has proven itself as a rugged and reliable communication medium at field level. Based on the IEC 61158 and IEC 61784 standards, it can cover all requirements of the production and process industries, with:

- Complementary transmission technologies
- Uniform communication profile
- Additive application profiles for typical device functions, e.g. PA Devices, PROFIdrive, PROFIsafe or PROFIenergy.

PROFIBUS DP

PROFIBUS DP is designed to provide high data transmission rates and short response times (up to 1 ms) and is at the same time:

- Communication medium for data transmission between automation systems (controllers) and distributed I/O devices of the ET 200 series (remote I/Os), as well as field/process devices, drives, analyzers, CPUs/CPs, operator panels etc. that have a PROFIBUS DP interface.

- Integrator for the PROFIBUS PA fieldbus and FOUNDATION Fieldbus H1 which are typical in the process industry

Since PROFIBUS DP supports the HART protocol, it is also possible to integrate HART field devices into the PROFIBUS DP communication via HART remote I/Os.

The PROFIBUS DP is available for electrical or optical transmission:

- RS 485
Simple and low-cost electrical transmission technology based on shielded two-wire cable
- Fiber-optic
Optical transmission system with glass or plastic fiber-optic cables, for fast transmission of large quantities of data in environments with high interferences or for covering long distances

With the aid of the fieldbus isolating transformer (RS 485-iS coupler) and the RS 485-iS electrical transmission technology, PROFIBUS DP can also be run as an intrinsically-safe fieldbus in all environments up to hazardous zone 1 or 21.

PROFIBUS PA and FOUNDATION Fieldbus H1

The direct connection of transmitters and actuators including power supply via the communication medium, as well as detailed diagnostics, are particularly relevant to the automation of industrial processes that frequently take place in corrosive, harmful, and hazardous environments.

Both the PROFIBUS PA fieldbus and the FOUNDATION Fieldbus H1 (FF H1) meet these requirements. Both fieldbuses are optimally suitable for directing integrating actuators and sensors in operating environments up to hazardous zone 1/21 or 0 into the process system. The intrinsically-safe transmission technology MBP (Manchester Coded; Bus Powered) provides the power supply to the field devices as well as digital data

transmission with a constant transfer rate of 31.25 kbit/s over a two-wire cable.

The physical bus systems of PROFIBUS PA and FF H1 are largely identical in accordance with IEC 61158. Both can be integrated seamlessly in the SIMATIC PCS 7 process control system using PROFIBUS DP as link. PROFIBUS PA and FOUNDATION Fieldbus H1 thus profit equally from the higher-level PROFIBUS DP architecture. SIMATIC PCS 7 customers are therefore not limited to a specific fieldbus but can select this freely matching the optimum field instrumentation.

Technical data	PROFIBUS DP		
	RS 485	RS 485-iS	Fiber-optic
Data transmission	RS 485	RS 485-iS	Fiber-optic
Transfer rate	9.6 kbit/s... 12 Mbit/s	9.6 kbit/s... 1.5 Mbit/s	9.6 kbit/s... 12 Mbit/s
Cable	Two-wire shielded	Two-wire shielded	Plastic as well as multi-mode and single-mode glass-fiber
Type of protection		EEx(ib)	
Topology	Line, tree	Line	Ring, star, linear
Nodes per segment	32	32 ¹⁾	–
Nodes per network (with repeater)	126	126	126
Cable length per segment depending on transfer rate	1 200 m at max. 93.75 kbit/s 1 000 m at 187.5 kbit/s 400 m at 500 kbit/s 200 m at 1.5 Mbit/s 100 m at 12 Mbit/s	1 000 m at 187.5 kbit/s ¹⁾ 400 m at 500 kbit/s ¹⁾ 200 m at 1.5 Mbit/s ¹⁾	Max. 80 m (plastic) 2 ... 3 km (multimode glass-fiber) >15 km at 12 Mbit/s (single-mode glass-fiber)
Repeater for signal boosting with RS 485 networks	Max. 9	Max. 9 ¹⁾	Not relevant

¹⁾ Conforming to PROFIBUS installation guideline 2.262

Technical data	PROFIBUS PA	FOUNDATION Fieldbus H1
Data transmission	MBP	MBP
Transfer rate	31.25 kbit/s	31.25 kbit/s
Cable	Two-wire shielded	Two-wire shielded
Type of protection	EEx (ia/ib)	EEx (ia/ib)
Topology	Linear, tree, ring	Linear, tree, ring
Safety Integrated	●	–
Control in the field	–	●
Interoperability	●	●
Field devices per segment/coupler	31	31
Field devices per link	64	31
Active field distributor per segment/coupler		
- AFD4/AFD8	8	8
- AFDiS or combination of AFDiS with AFD4/AFD8	5	5
Max. total current consumption of all field devices	1 A	1 A
Cable length per segment depending on transfer rate	1 900 m: standard 1 900 m: EEx (ib) 1 000 m: EEx (ia)	1 900 m

Fieldbus architectures

With the displayed fieldbus architectures, the network transition from PROFIBUS PA or FF H1 to PROFIBUS DP is via a link (PA link/FF link) which is equipped with 1 or 2 couplers.

A maximum of 5 bus segments can be operated via individual couplers on a PA link which can be equipped with up to 5 couplers (max. 3 for mixed configurations with ring or with coupler redundancy). Only 1 segment can be operated on the FF link which can be equipped with 2 couplers, independent of the configuration.

Due to the identical physical bus systems, the same active field distributors can be used for PROFIBUS PA and FF H1: AFS (active field splitter), AFD (active field distributor) for Ex-Zone 2/22 and AFDiS (active field distributor intrinsically safe) for Ex-Zone 1/21 and 2/22.

Linear architectures with single couplers

Active field distributors (up to 8 without AFDiS, up to 5 with) integrate the field devices in a line segment. Connection to these field distributors is made via short-circuit-proof spur lines. In contrast to AFD4/8, the spur line lengths with AFDiS are independent of the total number of spur lines in the segment and need not be taken into account for the total length of the segment. The line segment can be connected to a single or redundant PROFIBUS DP via a link. The last AFD4/AFD8/AFDiS at the end of the line leading away from the link automatically activates its bus terminating resistor.

Linear architectures with redundant couplers

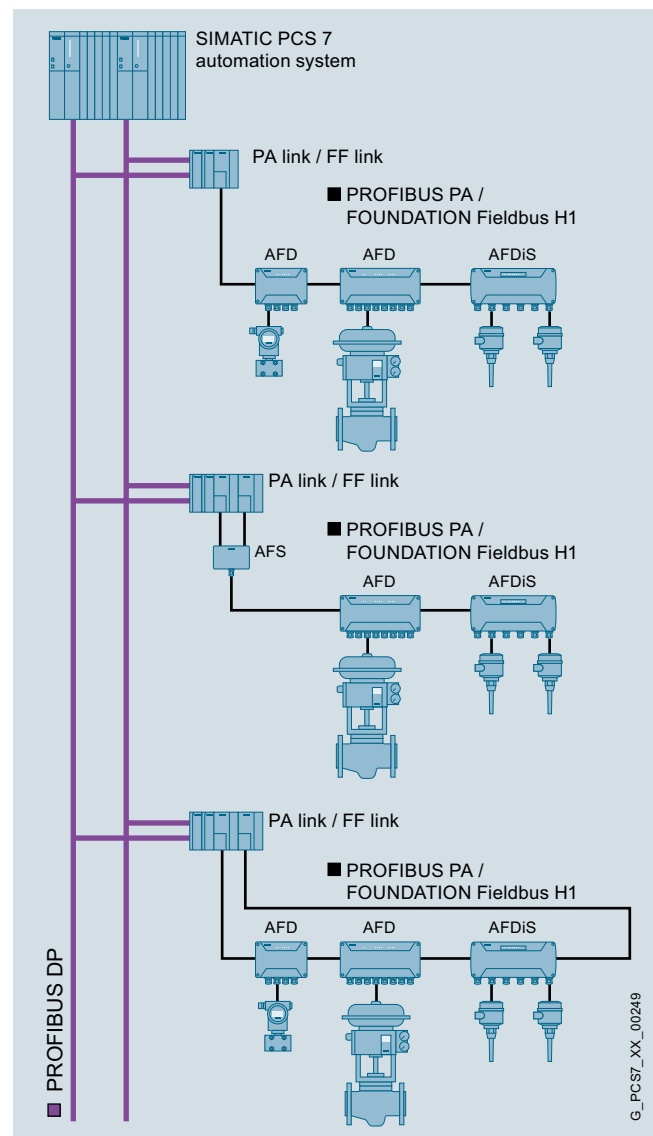
The active field splitter AFS is connected with a redundant coupler pair (2 x FDC 157) in the link. It interconnects a line segment with the respective active coupler. A coupler can be replaced during operation. The field devices are integrated in the line segment as described in the section "Line architecture with single coupler".

Ring architecture with coupler and media redundancy

Maximum availability can be achieved with a ring segment that is created by means of a redundant coupler pair (2 x FDC 157) in the link. Active field distributors AFD4/AFD8/AFDiS (up to 8 without AFDiS, up to 5 with) integrate the field devices in this ring segment via short-circuit-proof spur lines. The bus is terminated automatically and is immediately adapted in the event of changes or faults on the bus. An extension on the fieldbus or replacement of a coupler during operation is possible.

Advantages of the ring architecture

- Maximum availability avoids unplanned plant downtimes
- Simple and safe installation
- Automatic termination
- Automatic, bumpless isolation of faulty subsegments
- Topology can be repaired or expanded during ongoing operation



Fieldbus architectures with PROFIBUS PA and FOUNDATION Fieldbus H1

Max. spur line length

Number of spur lines per bus segment (1 device per spur line)	AFD		AFDiS	
	Non-intrinsically-safe devices		Intrinsically-safe devices in accordance with FISCO	
1 through 31	1 ... 12	120 m	120 m	60 m
	13 ... 14	90 m		
	15 ... 18	60 m		
	19 ... 24	30 m		
	25 ... 31	1 m		

Process I/O

The right solution for every requirement



ET 200iSP with redundant power supply

SIMATIC PCS 7 offers a variety of options for detecting and outputting process signals via sensors and actuators as well as for connecting process I/O to the automation systems:

- ET 200 remote I/O stations with an extensive range of cost-effective signal and function modules on PROFIBUS DP
- ET 200M remote I/O stations on PROFINET
- Intelligent, distributed field/process devices and operator terminals direct on PROFIBUS DP, PROFIBUS PA or FOUNDATION Fieldbus H1, also redundant or in hazardous areas of Zones 0, 1, 2 or 20, 21, 22
- Analog and digital I/O modules of the SIMATIC S7-400 operated centrally in the automation system

In practice, automation in the field area is largely characterized by distributed process I/Os:

- ET 200 remote I/Os in conjunction with classic field/process devices and HART field devices
- Intelligent field/process devices for direct fieldbus connection

In addition to the wide technical bandwidth, the following properties characterize the distributed process I/Os:

- Modularity and uniformity
- Flexible adaptability to the plant structure
- Minimum cabling and engineering requirements
- Low commissioning, servicing and lifecycle costs

S7-400 signal modules that can be operated centrally in the automation system are an alternative to distributed I/Os for small applications or plants with limited distributed expansion.

Modifications possible online

ET 200M/ ET 200iSP	<ul style="list-style-type: none"> ■ Adding of ET 200M/ET 200iSP stations ■ Adding of I/O modules to the station ■ Changing the parameter settings of I/O modules ■ Parameterization of connected HART field devices with SIMATIC PDM
ET 200S	<ul style="list-style-type: none"> ■ Adding of ET 200S stations
ET 200pro	<ul style="list-style-type: none"> ■ Adding of ET 200pro stations
PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus H1	<ul style="list-style-type: none"> ■ Adding of PROFIBUS DP stations ■ Adding of PA links and PA field devices ■ Parameter assignment of PA or FF field devices with SIMATIC PDM

Standard process I/Os for SIMATIC PCS 7

The following standard process I/Os are recommended for the SIMATIC PCS 7 process control system for automation in the field area:

- ET 200M distributed I/O system
- ET 200iSP distributed I/O system
- ET 200S distributed I/O system
- ET 200pro distributed I/O system
- PROFIBUS PA devices with PA profile 3.0 or later

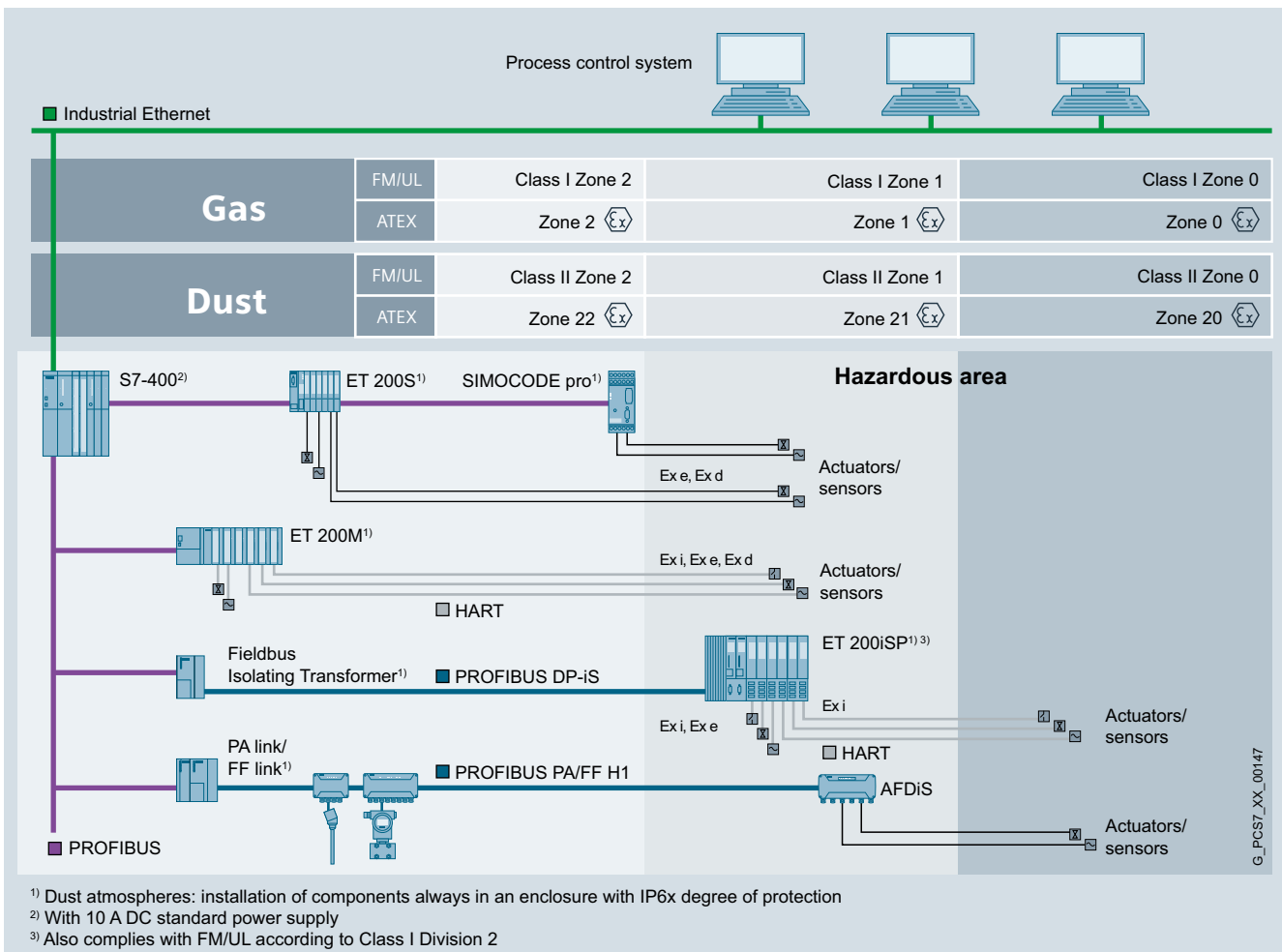
Further process I/O can be integrated into SIMATIC PCS 7 with standard blocks from the Advanced Process Library or special add-on blocks. Examples of this are devices of drive and weighing systems such as:

- SIMOCODE pro motor management system
- SINAMICS G120 frequency inverter
- SIWAREX U/FTA/FTC weighing systems

MTA terminal modules

Field devices, sensors and actuators can be connected simply, rapidly and reliably to I/O modules of the ET 200M remote I/O stations using MTA terminal modules (Marshaled Termination Assemblies). MTA versions are available for standard I/O modules as well as for redundant and safety-related I/O modules. The use of the MTA achieves a significant reduction in costs for cabling and commissioning and avoids wiring errors.

Use of the process I/Os for SIMATIC PCS 7



ET 200 in potentially explosive gas and dust atmospheres

The graphic above shows the possibilities for connecting distributed SIMATIC PCS 7 process I/Os with consideration of different environmental conditions.

Sensors/actuators, analyzers as well as weighing and dosing systems

Siemens Sensors and Communication offers a comprehensive range of devices for operation with the SIMATIC PCS 7 process control system. These include, for example:

- Devices for measurement of pressure, flow, temperature or level
- Positioners
- Gas analyzers
- SIWAREX weighing systems

These devices are available in versions with PROFIBUS DP/PA interface and for HART communication. The majority of devices is already included in the device library of the SIMATIC PDM process device manager.





Range of devices from Siemens Sensors and Communication

Overview of the current range of devices with additional information, technical specifications and ordering data:
www.siemens.com/processinstrumentation

Distributed I/O systems



Recommended devices for field automation

I/O system	ET 200M	ET 200iSP	ET 200S	ET 200pro
				
Design				
Degree of protection	IP20	IP30	IP20	IP65/IP66/IP67
Design	Modular	Modular	Bit modular, expandable block	Modular
Mounting	Mounting rail	Mounting rail	Standard sectional rail	Mounting rail
Connection system for sensors/actuators	Single-wire connection Cage-clamp/screw-type connection, FastConnect, Top-Connect	Multi-wire connection Cage-clamp/screw-type connection	Multi-wire connection Cage-clamp/screw-type connection, FastConnect	M8, M12, M23
Special applications				
Safety	●	●	●	●
For use in hazardous areas	Zones 2, 22	Zones 1, 21	Zones 2, 22	–
Increased availability	Switched, redundant	Switched, redundant	–	–
Temperature range	0 ... +60 °C ¹⁾	-20 ... +70 °C	0 ... +60 °C ¹⁾	-25 ... +55 °C
Vibration resistance (continuous)	1 g	1 g	2 g	5 g (module-dependent)
Communication				
PROFIBUS (copper/fiber-optic)	● / – (12 Mbit/s)	● / – (1.5 Mbit/s)	● / ● (12 Mbit/s)	● / ● (12 Mbit/s)
System functions				
Permanent wiring	● (plugging and removal)	●	●	–
Hot swapping	● (with active backplane bus)	●	●	●
Expansion/configuration during ongoing operation	● / ●	● / ●	● / –	– / –
Diagnostics (module-dependent)	Channel-discrete	Channel-discrete	Channel-discrete	Channel-discrete
Functions				
Digital channels	●	●	●	●
Analog channels	●	●	●	●
incl. HART	●	●	–	–
Motor starter	–	–	●	–
Pneumatic interface	–	●	–	–
Technological functions	Counting/measuring, controlling, weighing	Counting, frequency measuring	Counting/measuring	–

¹⁾ Also available as SIPLUS component for expanded temperature range -25 ... +60/70 °C and corrosive atmosphere/condensation (exact details at www.siemens.com/siplus)

Drives

Recommended devices

Drives	SIMOCODE pro  Motor management system for constant-speed motors in the low-voltage range	SINAMICS G120  Frequency converter for three-phase asynchronous and synchronous motors
Degree of protection	IP20 (module-dependent)	IP20
Design	Modular	Modular (control unit, power unit)
Performance range	0.1 ... 700 kW	0.37 ... 250 kW
Voltages	Up to 690 V AC	380 ... 480 V or 660 ... 690 V AC \pm 10 %
Rated motor currents	Up to 820 A	–
PROFIBUS communications	●	●
Block library for integration in SIMATIC PCS 7	●	●
Application	Protection and control of motors <ul style="list-style-type: none"> - In hazardous areas for types of protection EEx e/d corresponding to ATEX directive 94/9/EC - With heavy-duty starting (paper, cement, metal and water industries) - In high-availability plants (chemical, oil, raw material processing industry, power plants) 	For universal use in all industrial and trade sectors



Batch automation with SIMATIC BATCH

Modular, flexible, scalable and fully integrated in SIMATIC PCS 7



SIMATIC BATCH's recipe-driven control strategies enable efficient and flexible execution of simple and complex batch processes with changing control sequences. SIMATIC BATCH meets all the associated high requirements without exception:

- Optimum capacity utilization of production plants
- Uniform product quality
- Traceability
- Compliance with statutory standards and directives
- Fast response to changing market conditions

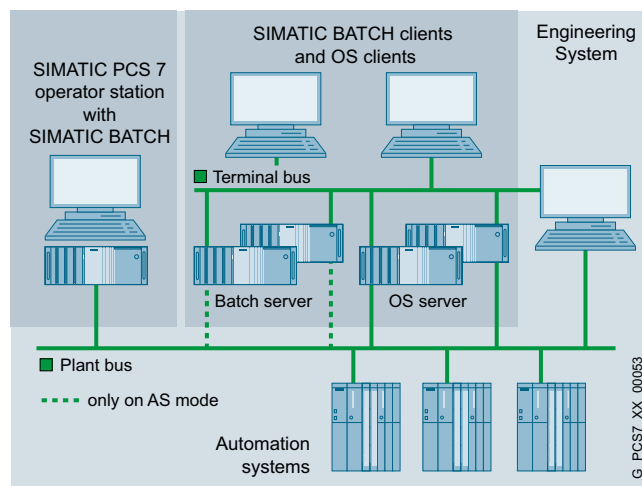
Modular architecture

SIMATIC BATCH is configured as a single station system or as a client/server system and can be used in plants of any size due to its modular architecture and scalability in cumulative SIMATIC BATCH UNITS (sets of 1, 10 and 50 plant unit instances).

With small batch applications, a SIMATIC PCS 7 BOX can be combined with a separate controller, e.g. a SIMATIC PCS 7 AS RTX or SIMATIC PCS 7 AS mEC RTX.

However, characteristic for the automation of batch processes using SIMATIC BATCH are client/server architectures with which one batch server and several Batch Clients process a plant project together. The batch server can also be configured with redundancy in order to increase availability.

In addition to the SIMATIC PCS 7 Industrial Workstations, the more compact SIMATIC PCS 7 OS clients 627C and 427D are also suitable for use as batch clients.



SIMATIC BATCH, scalable from single-user up to client/server system

Integration in SIMATIC PCS 7

SIMATIC BATCH is completely integrated in SIMATIC PCS 7. Connection to the production control level is supported by direct communication with SIMATIC IT or by an open interface to any manufacturing execution system (MES).

The plant data can be configured entirely using the Engineering System. This passes on all data required for recipe creation to the batch server, making recipe processing possible separate from the Engineering System. Changes to the configuration which are made on the Engineering System are available to the batch server using an update function.

The SIMATIC BATCH server software usually runs on an autonomous server hardware (batch server), separate from the OS servers. Depending on the capacity utilization of the operator system, OS and batch server software can also be operated on shared server hardware (OS/batch server). SIMATIC BATCH clients and OS clients can run on separate or common basic hardware.

SIMATIC BATCH uses SIMATIC Logon integrated in the process control system for central user administration and authentication, as well as for the "electronic signature" to release master recipes, formulas, and library objects through enabled Windows users/user groups. Individual configuration settings of the Batch Control Center and recipe editor are saved as a user-specific profile when logging off. This means that you can work in a familiar environment as soon as you log on again at any client in the plant.

Communication with the automation systems

Depending on the operating mode, SIMATIC BATCH communicates with the automation systems (AS) via the PCS 7 operator system (OS) or direct via S7 DOS.

SIMATIC BATCH provides special faceplates and OS controls for controlling and monitoring units and equipment phases. As a rule, instances of an SFC type are used as the interface to the lower automation level.

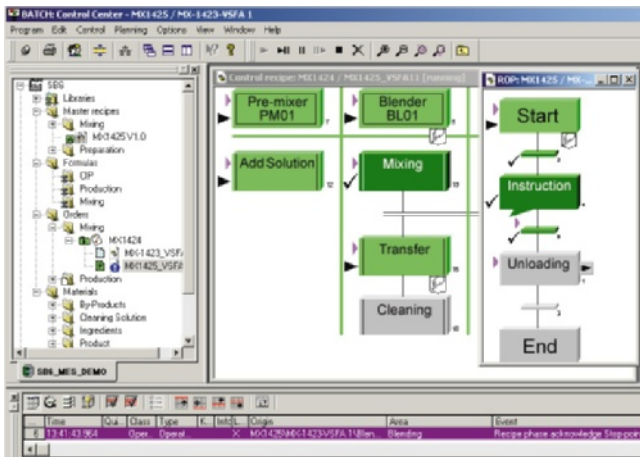
Operating modes for recipe processing

- PC mode: execution of complete recipe logic in the batch server
- AS mode: execution of unit recipe logic in the automation system:
 - Very fast step changing times
 - Improved determinism during batch processing
 - Enhanced availability
- Mixed mode: parallel application of PC and AS modes in one batch

SIMATIC BATCH highlights

- Modular architecture with flexible scalability (hardware and software)
 - Optimum scaling to plant size and individual requirements
 - Grows with the plant configuration; no expensive spare capacities
- High availability thanks to redundant batch servers
 - No loss of batch data
 - Automatic synchronization of batch data
- PC and AS modes
- Homogenous integration of SIMATIC BATCH into the HMI strategy and the engineering of SIMATIC PCS 7 via system interface
 - No customized interfaces
 - No double configuring for batch-specific engineering data
 - OS Controls for integration in process displays
- Recipes independent of unit
 - Considerable simplification in recipe management and validation
 - Flexible control strategy and optimum plant utilization through occupation strategies and assignment of units during batch runtime
- Flat and hierarchical recipes according to ISA-88.01
 - Creation of recipes oriented according to process engineering
 - Quick, easy and fault-minimized creation
- Importing and exporting of master recipes, formulas and library objects
- Saving and archiving in the Process Historian and in XML format as well as comprehensive reporting of batch data
 - Production becomes transparent and comprehensible
 - Reliable operator prompting, safe response to process faults
 - Viewer for archived batches
- Reduction in engineering and validation overhead through:
 - Type/instance concept of SFC
 - Separation of procedure and formula
 - ROP library and configuration independent of unit
 - Multiple usage, central modification
- Validation support according to 21 CFR Part 11 through:
 - Audit Trail (change log)
 - Free and system-aided versioning
 - Libraries with recipe operations and formulas
 - User administration with access protection and electronic signature
- Interfacing an SIMATIC IT or any other MES systems

Batch client functionality



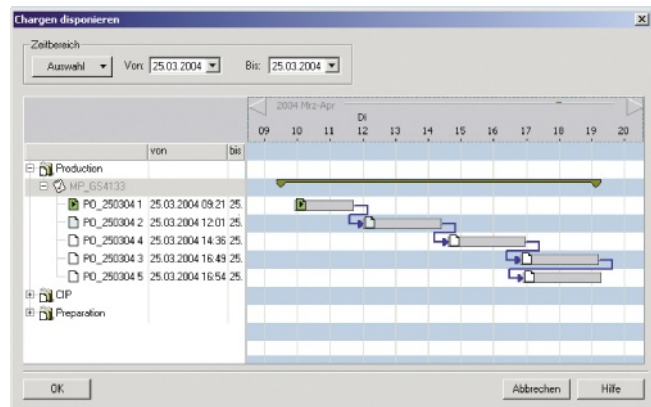
Batch Control Center

The Batch Control Center (BatchCC) is the "command center" for monitoring and controlling batch processes. The data relevant to SIMATIC BATCH are managed using a GUI. BatchCC offers powerful functions for the following tasks:

- Reading in and updating the process cell data of the basic automation
- Definition of user privileges for all functions, for clients, or for units of SIMATIC BATCH
- Definition of material names and codes
- Management of master recipes
- Management of libraries with recipe elements (library operations)
- Editing of formula categories and management of associated formulas (parameter sets)
- Creation of master recipe from control recipe
- Exporting and importing of master recipes, formulas and library objects
- Creation of batches with master recipes
- Starting of batch processing and controlling of batches
- Monitoring and diagnostics of batch processing
- Occupation strategy during creation of the recipe, and assignment of units during batch runtime
- Modification/deletion/insertion of objects and structure elements (loops, transitions etc.) of the recipe online
- Recording and archiving of recipes and batch data
- Calling of SFC visualization directly from the control recipe

Batch Planning

BatchCC can be used to create production orders and batches individually. However, Batch Planning offers significantly more planning functions. The batches for a large number of production orders can then be planned in advance. In addition to planning, the scope of functions include the modification, cancellation, deletion and release of batches.



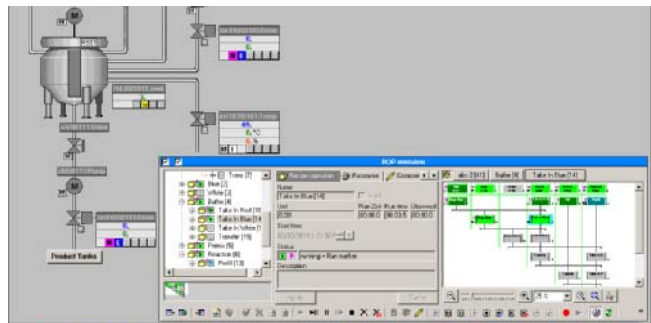
Batch planning

Special list representations for order categories, production orders, batch planning, batch status or batch result support and simplify batch planning and batch control. Creation and distribution of the batches for a production order are possible manually, but can also be carried out automatically depending on the definition of the batch number or production quantity. All batches including their unit allocation can be clearly presented in a combination of Gantt diagram and table. Time conflicts or those resulting from multiple allocation of units are identified by symbols. Time conflicts can be eliminated simply by shifting the associated batches in the Gantt diagram. The following batch properties can be set and changed:

- Quantity
- Start mode (immediately, following operator input, or time-driven)
- Unit allocation
- Formula (parameter set)
- Run sequence (chaining to previous or subsequent batch)
- Display of planned runtime for a batch
- Definition of minimum time interval for batch chaining

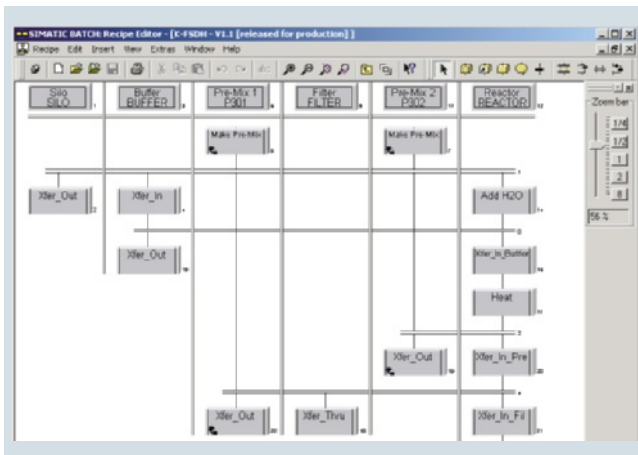
Batch OS Control

Batch OS Controls output in the process display permit operation and monitoring of batch processes.



Process picture including Batch OS Control

Recipe system, archiving and logging



SIMATIC BATCH Recipe Editor

Recipe Editor

The Recipe Editor is used for easy, intuitive creation and modification of master recipes and library operations. It possesses a GUI, processing functions for individual and grouped objects, and a structural syntax check. The basis for recipe creation are the batch objects created from the plant configuration using the SIMATIC PCS 7 Engineering System, e.g. units and equipment phases. The Recipe Editor can be called from BatchCC, or it can be started individually.

The following tasks can be performed with the Recipe Editor:

- Creation of new master recipes and library operations
- Modification of existing master recipes and library operations (changes to structures or parameters)
- Querying of statuses of the recipe objects and of process values in transition conditions
- Assignment of route control locations to the transport phases as transfer parameters (source, target, via), in order to direct products of one batch into other units (local or external plants)
- Configuring arithmetic expressions for calculating set-points for transitions and recipe parameters from recipe variables and constants
- Documentation of master recipes and library operations
- Validation under inclusion of user-specific plausibility checks
- Selection of appropriate units using static equipment properties and dynamic attributes
- Releasing master recipes and library operations for test or production

SIMATIC BATCH						
Batch / Batch ID	Batch 1 / 11	Printed	Wednesday, March 9, 2012 10:50:15 AM			
Product / Quality	Poly_ASDH - For Sale	Page	1/10			
Status	Finished					
Desired qty.	1000 Kg					
Recipe / Version	K-FSDH / V1.1					
Formula / Version	-					
Product order	Prod_OMER					
Duration (set/cp)	03:05:20 (Automatic) / 02:00 (manual)					
Run time	Wednesday, March 9, 2012 5:12:40 AM / Wednesday, March 9, 2012 5:14:40 AM					
No. of events:						
	Unit	Error	Op. Intervention	Limit value violation	Length of interruption	
Summary	0	2	0	0		
Batch 1	0	2	0	0		
Site	S102	0	0	0	49 (ss)	
Buffer	B201	0	0	0	01:23 (mm:ss)	
Pre-Mix 1	P301	0	0	0	01:29 (mm:ss)	
Filter	F401	0	0	0	11 (ss)	
Pre-Mix 2	P302	0	0	0	01:18 (mm:ss)	
Reactor	R501	0	0	0	01:48 (mm:ss)	
Input materials:						
No.	Name	Material	Code	Setpoint	Act	UOM
No input materials available						
Output Material:						
No.	Name	Material	Code	Setpoint	Act	UOM
1	K-FSDH	Poly_ASDH	1324	5009	-	-

Example of a batch report

Recipe elements for handling of exceptions

Monitoring of process states is possible during runtime by marking freely selectable recipe sections. It is possible to react to evaluated events or faults using a command block or jump function in a special container.

Batch reports

Batch reports comprise all data required for the reproduction of batch process, for proof of the quality, and for compliance with statutory directives, including

- Identification data
- Control recipe data
- Effective production data
- Time sequence of steps
- Status messages, fault messages and alarms
- Operator interventions
- Process values

Recipe reports

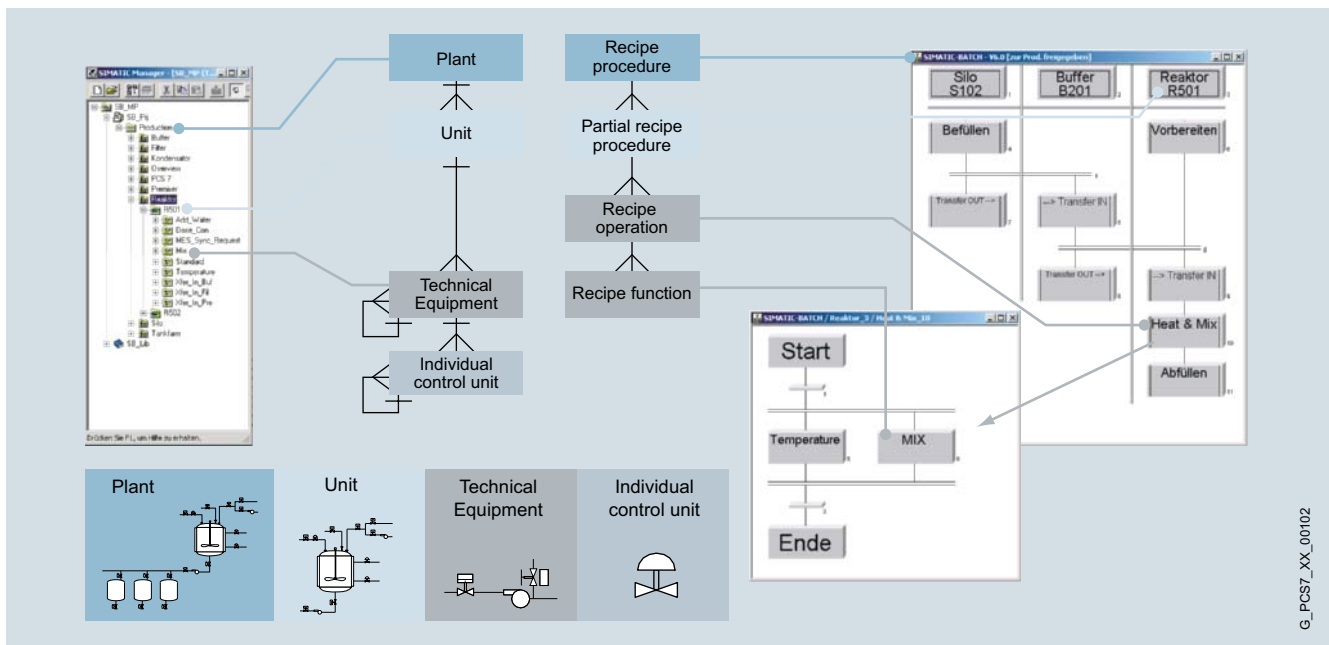
The recipe reports contain the production data, e.g.

- Recipe header data
- Recipe topology
- Input material, output material and parameter lists

Viewer for archived batches

The batch data which is only accessible to authorized persons or systems can be saved in XML format – locally, on a network drive, or on a central archive server. It is insignificant whether the connected batches originate from a single SIMATIC BATCH plant or from several plants. The batches archived in this manner can be displayed again as a control recipe in the Batch Control Center using a Viewer.

Hierarchical and recipes not specific to the unit



Representation of hierarchical recipe structure in the plant model

Hierarchical recipes according to ISA-88.01

SIMATIC BATCH and SIMATIC PCS 7 form a functional unit that fully covers the models described in the ISA-88.01 standard. The hierarchical recipe structure is mapped on the plant model as follows:

- Recipe procedure for controlling the process or production in a process cell
- Recipe unit procedure for controlling a process step in a unit
- Recipe operation/recipe phase to implement the process engineering task/function in an equipment module facility

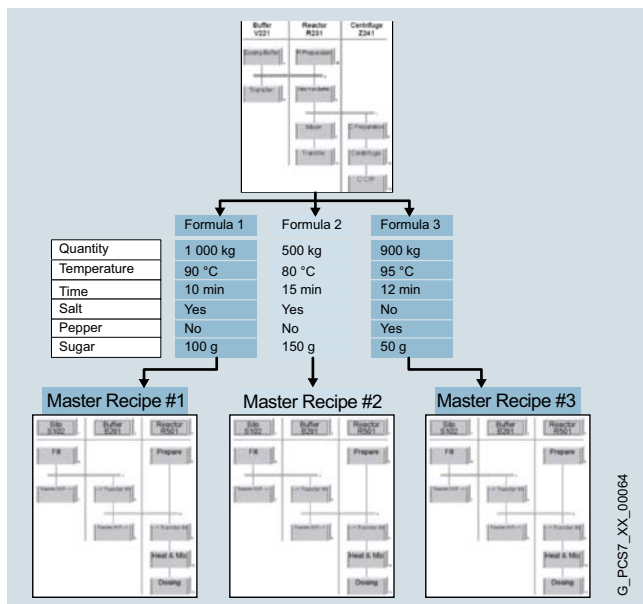
Non-specificity and assignment of units

Creation of recipes that are not bound to a specific unit minimizes the engineering overhead and provides significant advantages for validation. During creation of the recipe, the recipe unit procedures are only assigned selection criteria. The final assignment of the units following evaluation of the static and dynamic properties (e.g. vessel size and cleaning status) is then carried out during runtime. In the cases of batches which run for a longer period and where the units are not to be already determined and occupied at the start of a batch, the assignment is only carried out at the time of use. Conflicts in the unit allocation are detected by the system, and displayed.

The following occupation strategies for unit assignments permit optimum orientation according to the specific plant situation:

- "Manual selection of unit" when the units are occupied
- "Preferred unit" for preselection at time of recipe creation
- Determination of "Unit unused for longest time" to achieve uniform utilization
- Assignment of unit to be used by means of "Process parameters" from external module (e.g. scheduler)

Rationalization of recipe creation and supporting of validation



Separation of procedure and formula

Library with recipe operations (ROP)

Recipe operations managed in a user library (ROP library) can be installed in the recipe procedures of hierarchical recipes as a reference and thus modified centrally. With flat recipes, referencing is possible in an analogous manner to so-called substructures in the user library.

This reduces the requirements for engineering and validation. If the reference link is broken, the recipe operation or the substructure becomes a fixed component of the recipe procedure, and is thus independent of further central modifications.

Separation of procedure and formula

The flexibility achieved by recipes which are independent of specific units can be increased even further if the procedure and parameter sets (formulas) are separated from one another. Various master recipes can be created by linking several formulas using a recipe procedure. This enables central modification of procedures. The formula structure is determined by the formula category defined by the user.

Application Programming Interface (API)

The SIMATIC BATCH API Application Programming Interface is an open interface for customer-specific extensions. To program special industry-specific or project-specific applications it offers the user access to data and the functions of SIMATIC BATCH.



Validation according to 21 CFR Part 11

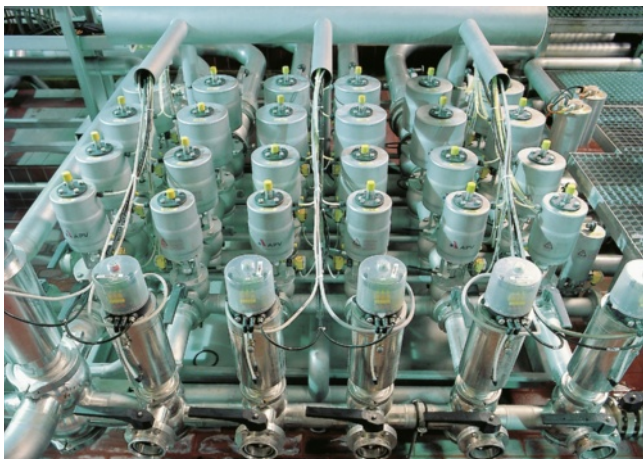
As a manufacturer of process control systems, Siemens has specially trained personnel, as well as many years of experience in quality management and plant validation. SIMATIC BATCH particularly supports validation according to 21 CFR Part 11 through:

- Consistent standardization, e.g. with
 - Type/instance concept of SFC
 - Recipe creation independent of a specific unit
 - Separation of procedure and formula
 - Library recipe operations
- Audit Trail (change log):
 - Recording of changes in recipes and recipe operations (saved with modified object)
 - Recording of changes during production (in the batch report), including the operations of the individual control level belonging to the corresponding batch
- Free and system-aided versioning of recipes, formulas, and library elements
- Central user administration with access control through SIMATIC Logon
- Electronic signature for release of master recipes, formulas and library objects based on SIMATIC Logon

For additional information on SIMATIC BATCH, see:
www.siemens.com/simatic-batch

Route control with SIMATIC Route Control

SIMATIC PCS 7 rationalizes material transport



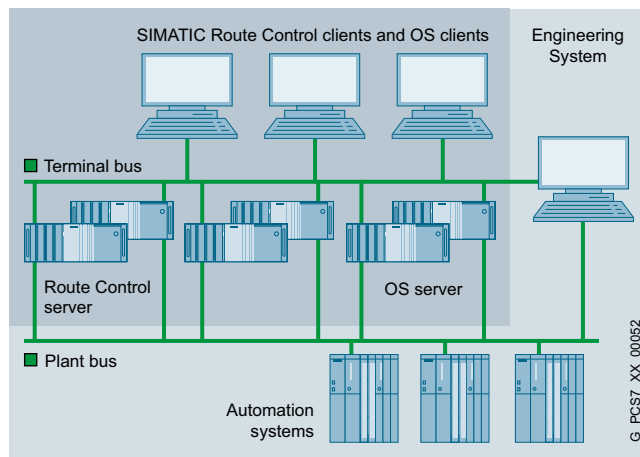
SIMATIC Route Control (RC) expands the SIMATIC PCS 7 process control system with a sector-independent tool for the configuration, control, monitoring and diagnostics of material transport in pipeline networks or on conveyor belts. Thus SIMATIC PCS 7 is capable of automating not only production processes and associated warehouses but also the material transport linking both areas.

SIMATIC Route Control is suitable for small plants with simple, static transport routes or also for plants in the medium and top performance ranges possessing comprehensive, complex routes and pipeline networks.

SIMATIC Route Control is particularly predestined for the following requirements:

- Frequent conversions and extensions of the transport network including actuators and sensors
- Transport routes with high flexibility, characterized by:
 - Regularly changing materials
 - Dynamic selection of the origin and destination of the material transport (including reversal of direction on bidirectional transport routes)
- Numerous simultaneous material transports
- Dynamic occupation of units using SIMATIC BATCH

This requirement profile particularly applies to plants with numerous branched pipelines or comprehensive tank farms typical for the chemical, petrochemical or food and beverage industries.



SIMATIC PCS 7 multiple station system with SIMATIC Route Control

When transporting solid materials on conveyor belts, the sequence for switching actuators on and off can be cascaded using WAIT elements. When transporting liquids in pipelines, the valves can be cleaned by means of pulses, with the sequence and time intervals being set using WAIT elements.

Modular architecture

Thanks to its modularity and discrete scalability with cumulative SIMATIC Route Control (10, and 50 quantity options for simultaneously active material transports), SIMATIC Route Control can be flexibly adapted to different plant sizes and architectures (single-user/multi-user systems) up to the project upper limit of 300 routes.

Integration in SIMATIC PCS 7

The Route Control Engineering software, consisting of engineering tool, wizard and block library, is concentrated together with the other engineering tools in the central SIMATIC PCS 7 engineering system.

For small plants, SIMATIC Route Control can be installed either alone or together with the OS software on a single station system. Distributed multiple station systems with client/server architecture, expandable with up to 32 clients per server, are typical for the automation of material transports with SIMATIC Route Control.

SIMATIC PCS 7 supports a Route Control server or pair of Route Control servers in the multiuser system which is limited to 12 servers/pairs of servers. In the case of multiple station systems with small quantity frameworks it is also possible to operate the Route Control Server, Batch Server and OS Server on shared basic hardware. However, availability will be higher and performance better if the subsystems are installed on separate servers or redundant pairs of servers.

A synonym for the Route Control client is the Route Control Center (RCC). It can be installed on an OS client, a batch client or separate client hardware.

In the mimic diagram of the SIMATIC PCS 7 operator system, each route block is represented by an RC block symbol and an RC faceplate. The selection of locations (synonyms: nodes, plant points) for partial routes and routes is facilitated by drop-down list boxes. Locations are parameters for requesting a material transport (source, destination, intermediate points). They mark the start and end of each partial route and thus also the source and destination of a material transport.

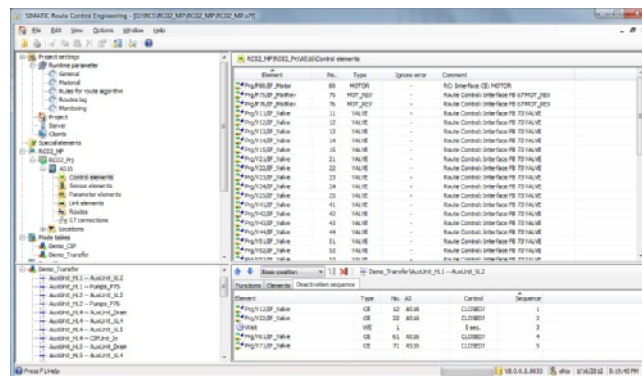
For access control and for managing the graded user rights for engineering, operating and maintenance personnel, SIMATIC Route Control uses the SIMATIC Logon integrated in the process control system.

Route Control Engineering

Route Control configuring supplements basic configuring with blocks from the SIMATIC PCS 7 library. Even existing SIMATIC PCS 7 plants are therefore easy to expand with SIMATIC Route Control.

Technological elements of relevance to control of material transport (RC elements) are adapted in the CFC editor using uniform interface blocks from the Route Control library. The RC elements include:

- Control elements (actuators)
- Sensor elements (sensors)
- Parameter elements (setpoints)
- Connection elements (material information related to partial route)
- WAIT elements



Configuration with the Route Control engineering tool

Locations of partial or complete routes are configured in the SIMATIC Manager as "Equipment properties of units" and transferred to the RC project together with the other RC-relevant basic data of the SIMATIC PCS 7 project.

Route Control library

The Route Control library contains blocks for RC and transport route configuration and interface blocks for RC elements. It is provided in the catalog of the CFC editor.

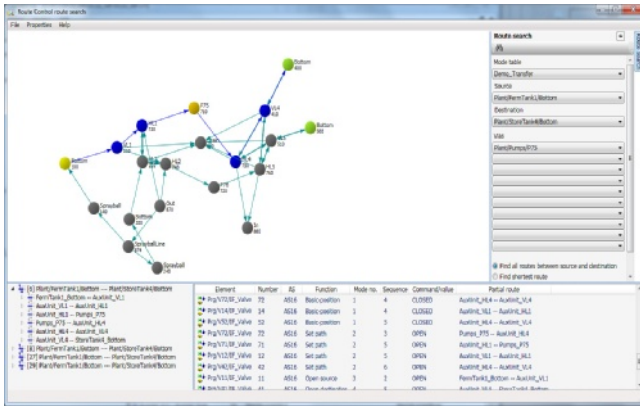
Route Control wizard

The Route Control wizard constitutes the interface between the SIMATIC PCS 7 basic configuration supplemented with RC interface blocks and the actual RC configuration in the RC engineering tool. The wizard, which can be called up from the SIMATIC Manager menu, accepts the RC-specific configuration data of the SIMATIC PCS 7 project into the Route Control engineering. In doing so, it carries out a plausibility check, defines the AS-OS and AS-AS communication connections (NetPro and CFC), and configures the RC server signals.

Route Control Engineering tool

Once the RC-relevant basic data of the PCS 7 project has been transferred to the RC project, the next step is to configure the RC-specific objects with the Route Control engineering tool:

- Subdivision of the transport routes into flexible partial routes; parameters "bidirectional" and "priority"
- Interconnection of the RC elements by means of installing in a partial route and thus transfer of type-specific additional properties to these RC elements, e.g. in the base position "Close valve"
- Assignment of the partial routes to mode tables, e.g. "cleaning" or "product transport", that operate as a criterion in the route search to restrict the resulting quantity
- Assignment of up to 32 technological sequence functions (function stages) that determine the sequence of material transport by means of the RC elements interconnected in the partial routes, e.g. base position of the control elements, open transport valves, open origin valve, switch on pump



Graphical offline route search to determine all possible route combinations

Configuration of the partial routes and assignment of the RC elements to the partial routes are performed in a matrix of the Route Control engineering tool. With the aid of generic elements, objects or blocks generated on a user-specific basis can be integrated into the RC project and handled like RC elements.

Similarly to a navigation system, the graphically visualized offline route search determines all possible route combinations. Errors in the route network or undesired routes can be detected in advance. A preferred route can be selected from the results of the offline route search, and saved as a static route. An active route can also be saved for re-use via the Route Control Center. A saved route takes priority in a route request.

Special configuration functions make it easier to perform repetitive routine work and extend the range of options for controlling material transport, e.g.:

- Exporting configuration data in the form of CSV files to Microsoft Excel, copying and editing the data there, and then re-importing the files into Route Control
- Controlling the joint use of partial routes by configurable function IDs
- Checking of material compatibilities by evaluating the partial route material IDs and interlocking of partial routes in the case of incompatible material sequences
- Injection of setpoints coming from the process at runtime into the route block (e.g. weighed quantity)

Route ID	Material	Function	Mode table	Material	Stop	Batch name	Source	Destination	Description
Pr_001	AS08	(3)							Route inactive
Pr_002	AS08	(2)							Route inactive
Pr_003	AS08	(1)							Route inactive
Pr_004	AS08	(1)							Route inactive

Function name	AG	No.	Clearing	Feedback	Open mode	Close mode	Interlock	Interlock	Interlock
Prog7032F_Value	AS08	70	Auto	OFF					
Prog7149F_Value	AS08	34	Auto	ON					
Prog7032F_Value	AS08	32	Auto	ON					
Prog7032F_Value	AS08	70	Auto	ON					
Prog7032F_Value	AS08	71	Auto	ON					
Prog7123F_Value	AS08	32	Auto	ON					
Prog7032F_Value	AS08	42	Auto	ON					
Prog7032F_Value	AS08	11	Auto	ON					
Prog7032F_Value	AS08	41	Auto	ON					

Route Control Center (RCC)

Route Control Center (RCC)

The RCC can be called from the RC faceplate of the route block or from the keyset on the operator station. It displays all route data and error information relevant to material transport in several coordinated views. Key functional features are:

- Overview of all RC elements and request details
- Selection of manual/automatic mode
- Operation of the material transport in manual mode:
 - Request, start, stop, continue and terminate material transport
 - Set/modify requirement parameters (locations, origin, destination, intermediate points)
 - Set/modify general properties (mode table, function ID, material ID and "ignore error")
 - Enable/disable sequence functions
- Diagnostics of material transport request errors caused by locked RC elements, locked partial routes, inconsistent actuations or prohibited sequential material
- Diagnostics of currently running material transports:
 - Transport route status display shown in color and text in the route view of the RCC
 - Detailed analysis of feedbacks from RC elements
- Server functions: select RC server, display RC server status, update view
- Display of operator who has logged on
- Definition of route parameters (source, destination, material, function ID etc.), and saving and loading these settings with names
- Switchover between "AS in maintenance" and "AS in operation"

Route Control Server

After the transport network has been configured and the variants of a material transport tested, the Route Control project engineering data are transferred to the Route Control Server where they can then be activated at a suitable time. The new data are then considered when searching for a route.

The Route Control Server (RC Server) supplies the Route Control Clients (Route Control Centers) with the necessary data and transfers their operations to the automation systems.

If a material transport is waiting, a route is requested either via the controller or by the operator at the Route Control Center (RCC). Apart from specifying the source, destination and up to 10 optional locations, this also includes creating a start signal on the route control block of the automation system. If no saved route is available, the RC Server starts the route search and, if possible, combines the statically defined partial

routes into one complete transport route. From there on, Route Control takes over the control and monitoring of all RC elements involved in the transport route. The process cell control only has to switch the individual technological functions. When errors occur, the operator receives detailed diagnostics information about the cause, e.g. why the search for a transport route failed.

For maintenance purposes, an automation system can be specifically set to "in maintenance" (out of service). The material transports operating via this automation system are then completed, but no more new ones are permitted.

For additional information, see:
www.siemens.com/simatic-pcs7/routecontrol

SIMATIC Route Control highlights

- Flexible, modular, and scalable architecture for single-user and multiple station systems
 - Optimum adaptability to plant size and individual requirements
 - No expensive reserve capacities
 - High availability thanks to redundant Route Control Servers
- Homogenous integration into the HMI strategy and the engineering of SIMATIC PCS 7
- Can be combined with SIMATIC BATCH – material transport from batch control recipe
- Mapping of route network of the plant through partial routes
- Fast response to plant modifications during configuration, commissioning or runtime
- Exclusive assignment of RC elements and partial routes involved in material transport
- Reduction in configuration overhead and commissioning times
 - Configuring partial routes by means of repeated application
 - Data export to Microsoft Excel and reimporting
 - Reduction in complex, repeated tasks through RC wizard
 - Graphical offline route search determines all route combinations in advance and finds undesired routes
- Consideration of material compatibilities to avoid undesired mixing
- Offline testing for completeness, inconsistencies, and undesired combinations
- Detailed diagnostics of material transport requirement faults and current material transport
- Saved static routes are executed with priority when a route is requested
- Definition of on/off switching sequences using staggered control of actuators, e.g. for conveyor belts

Safety Integrated for Process Automation

Comprehensive range of products and services for process safety



The process industry frequently features complex production sequences where materials and mixtures which are explosive or dangerous to health are produced or processed. A fault or failure could have disastrous consequences.

Therefore the objective of Siemens safety technology is to minimize potential hazards for personnel, plant and environment by means of technical measures, without adversely affecting the production process. A reliable Safety Instrumented System (SIS) is therefore required which is able to automatically place the plant into a safe state should critical events occur, to continue operating it safely under defined conditions, and to limit any negative effects in the event of a safety-related event.

Safety Integrated for Process Automation provides a comprehensive range of products and services for safe, fault-tolerant applications in the process industry – based on the Siemens safety-related system. It offers complete safety-related functionality – extending from safe instrumentation for signal recording and conversion, to safe and fault-tolerant control, up to the actuator (e.g. positioner, valve, or pump).

The enormous potential of Safety Integrated for Process Automation can best be exploited in conjunction with SIMATIC PCS 7. Thanks to the modularity and the flexibility of the safety-related products this combination is extremely variable. It is not just the degree of integration of safety-related systems that can be individually defined in the process control system, it is also the degree of redundancy for controllers, fieldbus and process I/O (Flexible Modular Redundancy). Thanks to the reduced spatial requirements, the scope of hardware and wiring, as well as reduced mounting, installation and engineering overhead, complete (common) integration of the safety-relevant systems in SIMATIC PCS 7 offers the greatest cost advantages viewed over the entire life-cycle of a plant.

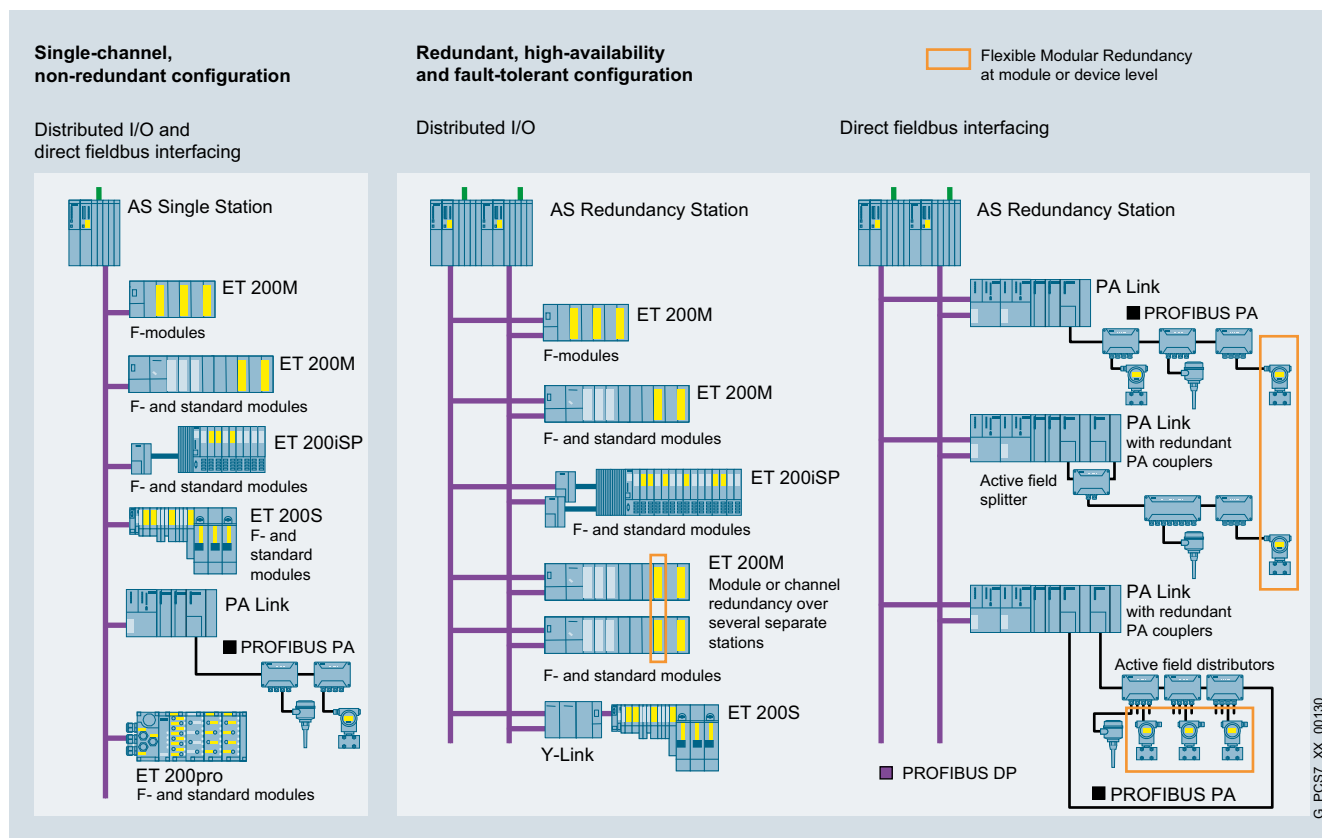
Both the safety technology and the safety applications implemented with it are characterized by great efficiency and comply with both national and international standards, such as:

- IEC 61508 – basic standard for specifications, as well as for the design and operation of safety-related systems
- IEC 61511 – application-specific standard for the process industry

Product range

Safety Integrated for Process Automation – Product spectrum for SIMATIC PCS 7		
	Engineering	Configuration of safety functions (up to SIL 3) using TÜV-certified function blocks and Continuous Function Chart (CFC) or SIMATIC Safety Matrix (Cause&Effect matrix)
	Automation systems AS 410F/FH, AS 412F/FH, AS 414F/FH, AS 416F/FH, AS 417F/FH	Fail-safe, fault-tolerant controllers with a redundant or non-redundant design (SIL 3) for the bottom, mid and top performance ranges
	PROFIsafe with PROFIBUS PROFIsafe with PROFINET	For standard and safety-related communication on just one bus cable, certified according to IEC 61508 (SIL 3)
	SIMATIC ET 200	<p>ET 200M: Modular I/O for multi-channel applications with safety-related signal modules (F-DI, F-DO, F-AI), SIL 2/SIL 3; IP20 degree of protection</p> <p>ET 200iSP: Modular, intrinsically-safe I/O with safety-related electronic modules (F-DI Ex, F-DO Ex, F-AI Ex), SIL 3, IP30 degree of protection</p> <p>ET 200S: Bit-modular I/O with safety-related electronic modules (F-DI, F-DO) and safety-related motor starters, SIL 2/SIL 3; IP20 degree of protection</p> <p>ET 200pro: Modular, very compact I/O with safety-related electronic modules (F-DI, F-DI/F-DO), SIL 2/SIL 3; F-switch for switch-off of standard I/O and control of motor switches; IP65/66/67 degree of protection</p>
	Process instruments/ process devices	<p>Safe process instruments/devices on PROFIBUS: SITRANS P DS III PA pressure transmitters (proven in use SIL 2) with PROFIsafe, SIPART PS2 PA (SIL 2), SIMOCODE pro with DM-F local/PROFIsafe (SIL 3)</p> <p>Safe process instruments/devices for connection to ET 200M remote I/Os: SITRANS P DS III analog/HART (SIL 2/SIL 3), SITRANS TW series (SIL 1), SITRANS TH200/300 (SIL 2/SIL 3), SITRANS TR200/300 (SIL 2/SIL 3), SITRANS LR250 HART (SIL 2), SIPART PS2 2/4-wire (SIL 2)</p>
	Applications	<p>Partial Stroke Test</p> <p>Predefined function blocks and faceplates for online valve test to enable preventive valve diagnostics without affecting production</p>

Safety-related design versions



Safety-related design versions with PROFIBUS communication

The PROFIsafe profile allows safety-related communication for between the controller and the process I/O via the open standard buses PROFIBUS and PROFINET. The decision between these two standard buses seriously influences the architecture of the safety-related system.

Safety-related design versions with PROFIBUS

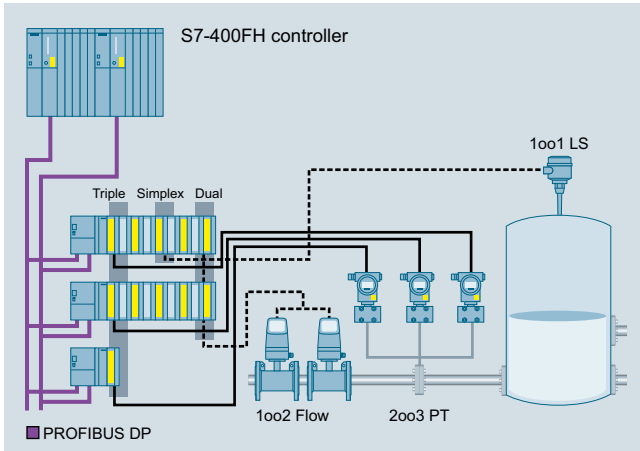
In the case of a safety-related system with PROFIBUS communication integrated into SIMATIC PCS 7, a distinction is made across all architecture levels between two design versions:

- Single-channel, non-redundant design
- Redundant, high availability, and fault-tolerant design

Both alternatives are extremely variable and offer generous scope for design. At the individual architectural levels (controller, fieldbus, distributed I/O), the configuration options shown in the diagram are available depending on the process I/O used.

Standard (basic process control) and safety-related functions can be combined flexibly, not only in the area of the distributed I/O. Even at the controller level, they can be combined in one system or separate. In addition, there are numerous possibilities using flexible modular redundancy (FMR).

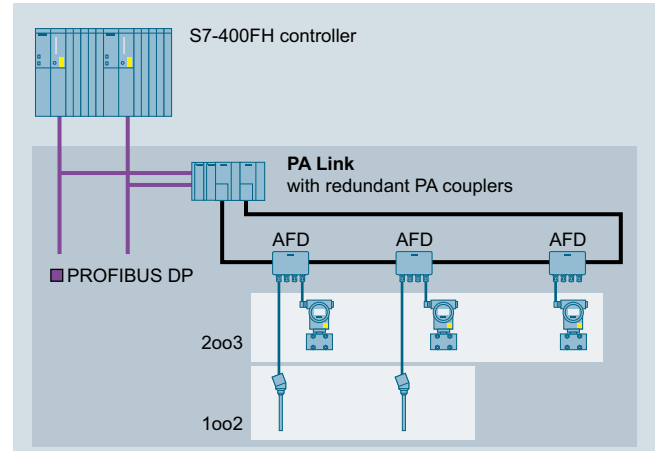
Flexible Modular Redundancy (FMR)



Flexible Modular Redundancy using the example of a safety-oriented, fault-tolerant plant configuration

Depending on the automation task and the associated safety requirements, the degree of redundancy may be defined separately for the controller, fieldbus and distributed I/O level, and coordinated with the field instrumentation. In this way, individual fault-tolerant architectures which are precisely tailored to the individual tasks can be implemented, and tolerate several faults occurring at once. As FMR provides redundancy only where it is actually required, comparatively more attractive and cost-effective applications are possible than with conventional redundancy architectures.

As shown in the example of a process cell with ET 200M distributed I/O, the total of the tasks can produce a mix of different degrees of redundancy within one architecture level (1001, 1002, 2003).

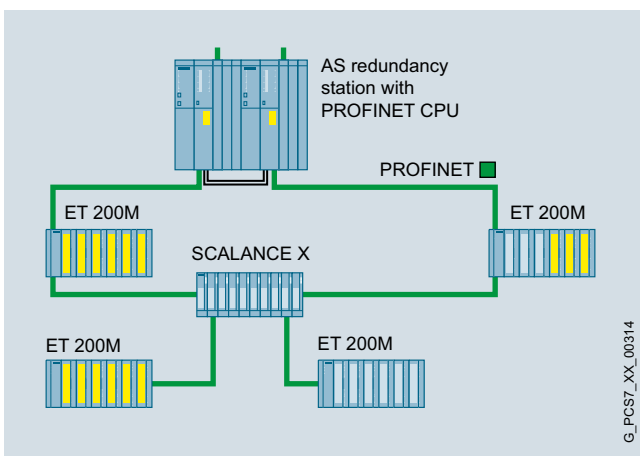


Safety-related and fault-tolerant architecture based on a PROFIBUS PA ring topology

Not only can FMR be applied to plant configurations with distributed I/O systems, but it can also be transferred to configurations with direct connection of devices via the PROFIBUS PA fieldbus. As shown in the example diagram, the PROFIBUS PA ring architecture likewise permits cost-effective, safety-related and fault-tolerant applications with minimum use of devices and cables.

Active field distributors AFD4/AFD8 can be used in operating environments up to Ex Zone 2/22, and active field distributors AFDiS in operating environments up to Ex Zone 1/21. The AFDiS spur lines can be laid up to Zone 0/20 for connecting appropriate devices.

Safety-related design versions with PROFINET

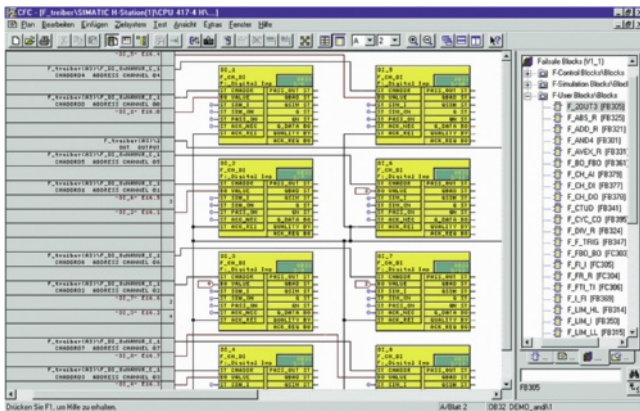


Safety-related design versions with AS redundancy station and PROFINET IO communication

PROFINET supports safety-related systems on the basis of safety-related SIMATIC PCS 7 automation systems (F/FH) and ET 200M remote I/Os. With a safety-related system with PROFINET communication, the ring is the topology of choice from the point of view of availability. The media redundancy of the ring means that bus interruptions or failure of a node will not result in failure of the entire segment.

The maximum availability level is achieved with a PROFINET ring on a redundant controller (AS Redundancy Station). In such a configuration, the structure of PROFINET IO communication referred to as system redundancy enables the I/O devices to establish a communication connection to each CPU of the AS Redundancy Station over the topological network.

Engineering tools for safety functions



Engineering of safety-related applications with CFC

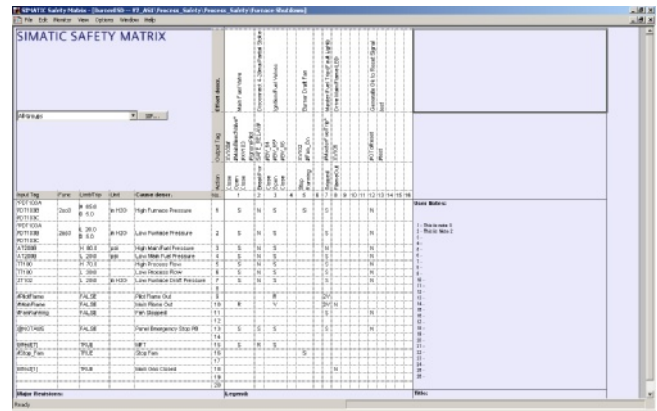
The F-block library in S7 F Systems and the SIMATIC Safety Matrix are available for configuring and programming safety-related controllers.

S7 F Systems with F-block library

The S7 F Systems engineering tool permits parameterization of safety-related controllers as well as safety-related F-modules of the ET 200 series. It supports configuration by means of functions for:

- Comparison of safety-related F-programs
- Recognition of changes in the F-program using the checksum
- Separation of safety-related and standard functions.

Access to the F-functions can be password-protected. The F block library integrated in S7 F Systems contains predefined function blocks for generation of safety-related applications with the CFC or the Safety Matrix based on it. The certified F-blocks are extremely rugged and intercept programming errors such as division by zero or out-of-range values. Diverse programming tasks for detecting and reacting to errors can thus be omitted.



Safety Matrix: assignment of exactly defined reactions (effects) to occurring events (causes)

SIMATIC Safety Matrix

The SIMATIC Safety Matrix which can be used in addition to S7 F Systems is an innovative safety lifecycle tool from Siemens, that can be used not only for the user-friendly configuration of safety applications, but also for their operation and service. The tool, which is based on the proven principle of a cause & effect matrix, is ideally suited to processes where defined statuses require specific safety reactions.

The Safety Matrix not only means that programming of the safety logic is significantly simpler and more convenient, but also much faster than in the conventional manner.

During the risk analysis of a plant, the configuration engineer can assign exactly defined reactions (effects) to events (causes) which may occur during a process. The possible process events (inputs) are initially entered in the horizontal lines of a matrix table comparable to a spreadsheet program, and then their type and quantity, logic operations, any delays and interlocks as well as any tolerable faults are configured. The reactions (outputs) to a particular event are then defined in the vertical columns.

The events and reactions are linked by simply clicking the cell at the intersection point of line and column. Using this procedure, the Safety Matrix automatically generates complex, safety-related CFC programs. Special programming knowledge is not required, and the configuration engineer can concentrate fully on the safety requirements of his plant.

Safety-related controllers and process I/O

Safety-related automation systems

The safety-related SIMATIC PCS 7 automation systems are available in two design versions:

- **AS Single Station** of type AS 410F, AS 412F, AS 414F, AS 416F, and AS 417F, with only one CPU, safety-related
- **AS Redundancy Station** of type AS 410FH, AS 412FH, AS 414FH, AS 416FH, and AS 417FH, with two redundant CPUs, safety-related and fault-tolerant

All these systems have multitasking capability, i.e. several programs can be executed simultaneously in one CPU, both basic process control applications and safety-related applications. Working together with the safety-related signal modules of the ET 200 distributed I/O systems or directly via fail-safe transmitters connected via the fieldbus, they detect faults both in the process and their own internal faults and automatically set the process cell to a safe state in the event of a fault. Safety programs executed on different automation systems of a plant are able to carry out safety-related communication with one another over the Industrial Ethernet plant bus.

The standard PROFIBUS or PROFINET is used together with the PROFIsafe profile for safety-related communication between the CPU of the automation system and the safety-related process I/O. In both cases, operation of standard and safety-related components on the same bus is possible. This makes a separate and expensive safety bus unnecessary.

The PROFIsafe profile is implemented as an additional software layer within the devices/systems without modifying the communication mechanisms of the standard PROFIBUS. PROFIsafe expands the frames by additional information with which the PROFIsafe communications partners can recognize and compensate transmission errors such as delays, incorrect sequences, repetitions, losses, addressing errors, or data falsification.

Safety-related F-modules

The safety functions of the F/FH automation systems are perfectly matched to the following safety-related F-modules of the ET200 range:

ET 200M	<ul style="list-style-type: none"> ■ F-DI 12/24 x 24 V DC ■ F-DI 4/8 x NAMUR [EEx ib] ■ F-DO 10 x 24 V DC/2 A ■ F-DO 8 x 24 V DC/2 A; ■ F-AI 3/6 x 0 ... 20 mA or 4 ... 20 mA (HART)
ET 200iSP	<ul style="list-style-type: none"> ■ F-DI Ex 4/8 x NAMUR ■ F-DO Ex 4 x 17.4 V DC/40 mA ■ F-AI Ex HART 4 x 0 ... 20 mA or 4 ... 20 mA
ET 200S	<ul style="list-style-type: none"> ■ F-DI 4/8 x 24 V DC ■ F-DO 4 x 24 V DC/2 A
ET 200pro	<ul style="list-style-type: none"> ■ F-DI 8/16 x 24 V DC ■ F-DI/DO 4/8 x 24 V DC (DI) and 4 x 24 V DC/2 A (DO)

Safety-related F-motor starter for ET 200S

Safety-related motor starters up to 7.5 kW, can be expanded by brake control module:

- F-DS1e-x direct-on-line starter
- F-RS1e-x reversing starter

Initiated by a switch-off signal, safety-related ET 200S motor starters can be selectively switched off by the series-connected PM-D F PROFIsafe power module. In addition to a circuit-breaker/contactator combination, the safety-related motor starters have a safe electronic evaluation circuit for fault detection.

If the contactor to be switched in the case of an emergency stop fails, the evaluation electronics detects a fault and deactivates the circuit-breaker in the motor starter in a safety-related manner.



PROFIBUS PA devices for safety shutdowns

The SITRANS P DSIII digital pressure transmitter which can be used on the PROFIBUS PA fieldbus is suitable for SIL 2 safety shutdowns conforming to IEC 61508/ IEC 61511-1. For this reason, Siemens has extended its standard instrument for measuring pressure, absolute pressure and differential pressure to include a PROFIsafe driver.

In a safety application, the pressure transmitter can be interconnected via PROFIBUS PA with a safety-related automation system (F/FH). The digital input of the PROFIBUS PA SIPART PS2 electropneumatic positioner can be used for the safe shutdown. With a redundant, multi-channel design, measuring circuits can also be implemented up to safety integrity level SIL 3.



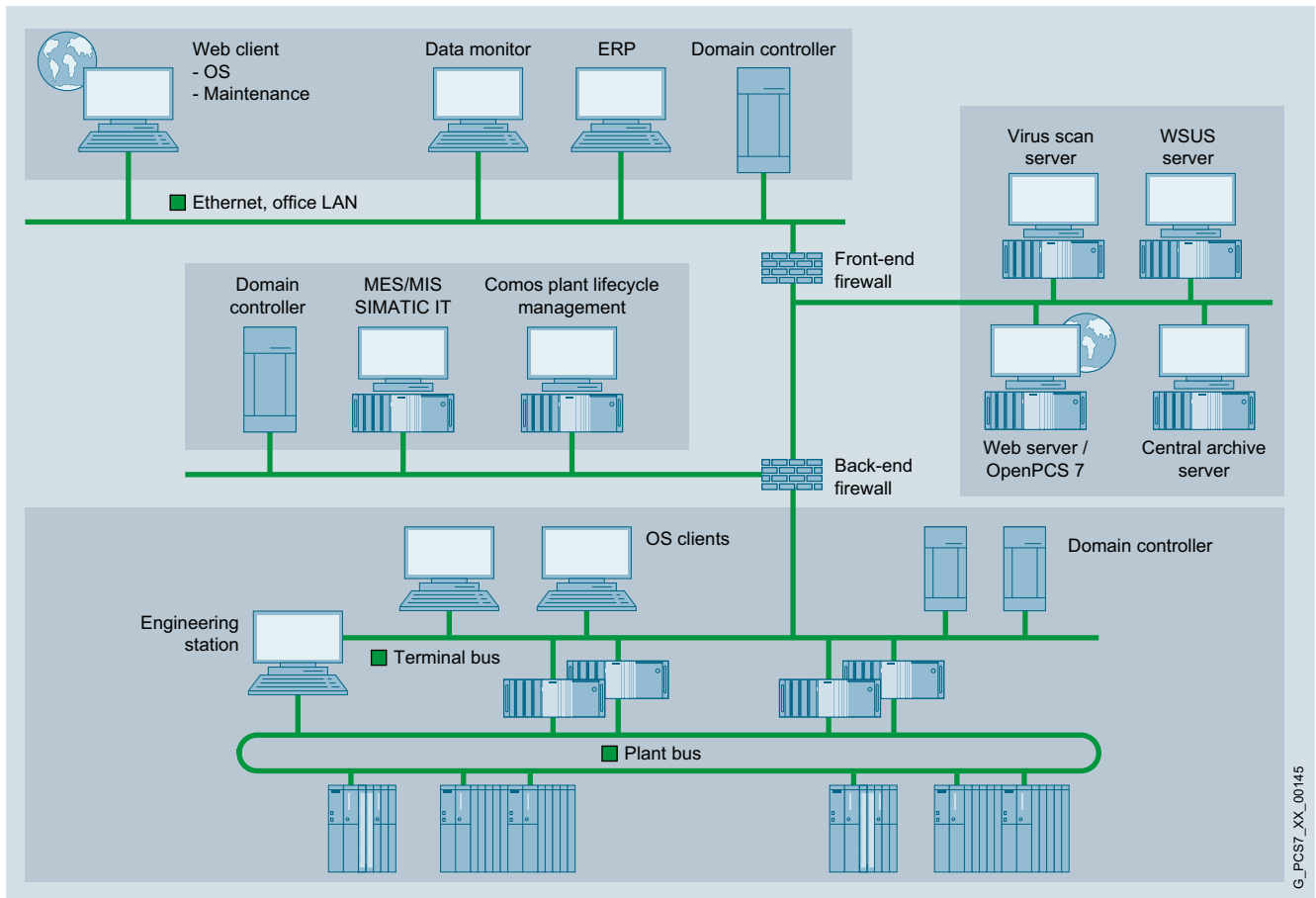
For additional information, see:
www.siemens.com/simatic-pcs7/process-safety

Highlights of Safety Integrated for Process Automation

- Comprehensive range of products and services for safe, fault-tolerant, and high-availability applications in the process industry
 - Easy implementation, operation, and maintenance of safety applications
 - Reliable elimination of dangers and risks
 - Adaptable and high level of innovation security
- Homogenous integration of safety technology in the SIMATIC PCS 7 Process Control System
 - Processing of basic process control functions and safety functions in one controller
 - Safety integrity level SIL 3 possible with only one CPU
 - Standard and safety-related communication via PROFIBUS/PROFINET with PROFIsafe; no separate safety bus
 - Mixed operation of standard and safety-related F-modules in ET 200 stations
 - Uniform data management for basic process control and safety-related automation; no complex data management
- Integration of safety-related application into process visualization of PCS 7 operator station
- Automatic consideration of safety-related fault messages with their time stamp
- Configuration of safety functions is part of the integrated SIMATIC PCS 7 system configuration
 - S7 F systems, CFC, and SIMATIC Safety Matrix are anchored in the engineering toolset
 - Uniform configuration of basic process control functions and safety functions with CFC
 - Safety Matrix for creation of safety functions even faster, simpler and more user-friendly, without programming know-how
- Uniform diagnostics and maintenance from sensor/actuator via automation system up to the operator system
- Integration of safety-related technology in diagnostics and maintenance with the PCS 7 Maintenance Station
- Minimization of total lifecycle costs
 - Costs for hardware, mounting, wiring, installation, engineering, and commissioning decrease as the level of integration increases
 - Low acquaintance and training requirements as result of uniform system/tool landscape
 - Cost-effective stocking of spare parts through reduction of types and parts

Industrial security

Comprehensive protective measures for I&C plants



Example of staggered security architecture

Progressive standardization, opening and networking of control systems has been accompanied by an enormous increase in security risks for a process control plant. The potential dangers arising from destructive programs and access by unauthorized personnel range from network overloads or failures, theft of passwords and data, to unauthorized access to process automation. Apart from material damage, specifically targeted sabotage can also have dangerous consequences for personnel and the environment.

SIMATIC PCS 7 security concept

SIMATIC PCS 7 offers comprehensive solutions for safeguarding a process engineering plant that are based on a hierarchical security architecture. What is special about this concept is its holistic approach. It is not restricted to use of individual security methods (e.g. encryption) or devices (e.g. firewalls). Rather its strengths are the interaction of a host of security measures in the plant network.

The SIMATIC PCS 7 security concept comprises advice and recommendations (best practices) on the following topics:

- Design of a network architecture with graded security levels (defense in depth), combined with segmenting of the plant into security cells
- Network management, network segmentation
- Operating plants in Windows domains
- Administration of Microsoft Windows and SIMATIC PCS 7 operator privileges; integration of SIMATIC PCS 7 operator privileges into the Windows administration
- Reliable control of time synchronization
- Management of security patches for Microsoft products
- Use of virus scanners and firewalls
- Support and remote access (VPN, IPSec)

The security aspects and the recommendations for safeguarding the automation plant are described in detail in the manual "PCS 7 & WinCC Security Concept basic document" and the further detailed documents.

System support for the security concept

On the system side, SIMATIC PCS 7 supports the implementation of guidelines and recommendations of the security concept:

- Compatibility with current versions of virus scanners
 - Trend Micro OfficeScan Client-Server Suite
 - McAfee VirusScan Enterprise
 - Symantec Endpoint Protection
- Use of the local Windows firewall
- Automatic setting of security-relevant parameters such as DCOM, registry and Windows firewall already during setup
- User administration and authentication using SIMATIC Logon
- CP 1628 Industrial Ethernet interface with integrated security functions (firewall, VPN)
- Integration of SCALANCE S industrial security modules
- Automation firewall
- Application whitelisting with McAfee Application Control

SCALANCE S industrial security modules

The rugged SCALANCE S602, S612, and S623 industrial security modules can be used, for example, to safeguard the cross-cell data exchange between components of automation and process control systems. They possess security functions such as stateful inspection firewall, port filter, NAT and NAPT address conversion, and DHCP server. In addition to this, S612 and S623 provide authentication and data encryption with Virtual Private Network (VPN) via IPsec tunnel.

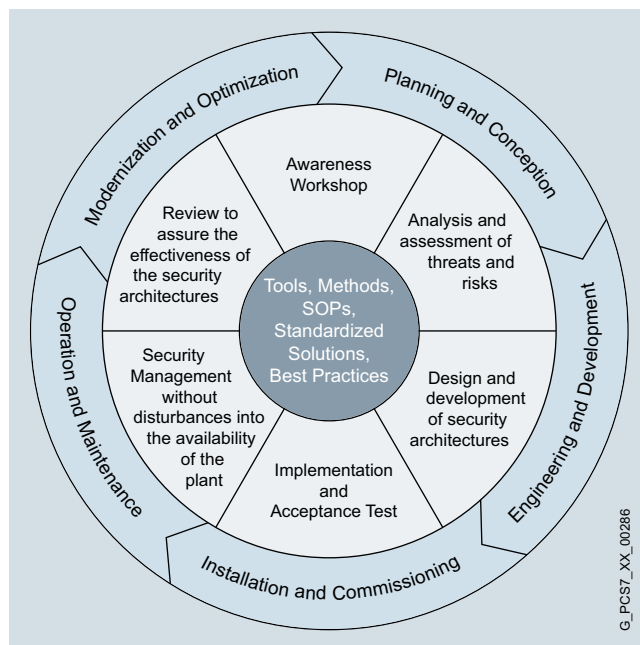
Automation firewall

The automation firewall is provided with stateful inspection packet filters, application layer firewall, VPN gateway functionality, URL filtering, Web proxy, virus scan, and intrusion prevention. It thus protects the access point to the production environment, e.g. from the office or intranet/Internet networks. It can be used as follows, depending on plant size:

- Access point firewall for small plants and secure remote access
- Three-homed firewall for small to medium-sized plants with minimal perimeter network
- Front and back firewall for maximum protection in larger plants with extensive perimeter network

Integrated services such as hotline support, replacement service, and Software Update Service enhance the automation firewall even more. Additive services permit customized firewall solutions or support integration of the firewall into customer systems.

For additional information, see:
www.siemens.com/industrial-security



Industrial security services

Application whitelisting

Application whitelisting protection mechanisms guarantee that only trustworthy applications and programs are executed on a station of the SIMATIC PCS 7 process control system. They prevent the execution of illegal software and the modification of installed applications, and thus add to the existing protection against malware (malicious software).

Industrial security services

Siemens Industry Automation not only offers products and systems but also professional services and solutions for protection of industrial plants against the manifold threats to IT security. These industrial security services are not only oriented according to individual phases but are provided for the complete lifecycle of the plant.

Specific consulting concerning secure plant configurations and concepts support customers in the individual planning of their I&C plant.

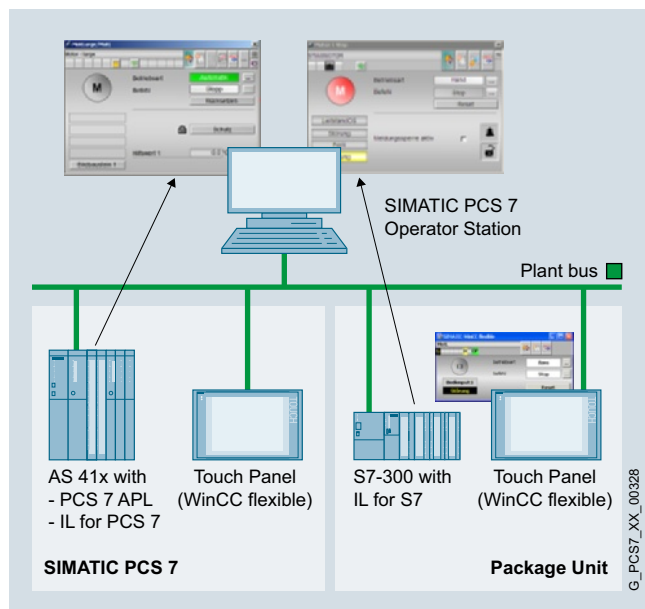
Security certification

Siemens is the first manufacturer of automation equipment to obtain the Achilles Level 2 certificate for communication ruggedness for the following products:

- SIMATIC S7-400
- CP 443-1 Advanced and CP 1628 communication modules

Package units and panel integration

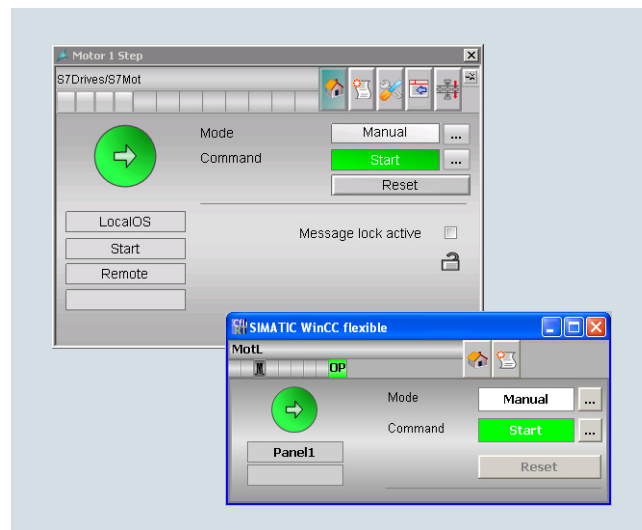
SIMATIC PCS 7 Industry Library (IL)



The standard functionality for graphic configuration of automation solutions already defined in the SIMATIC PCS 7 Advanced Process Library (APL) can be expanded by specific technological functions using the SIMATIC PCS 7 Industry Library (IL). In addition to individual blocks, faceplates, and symbols which are specifically designed for special I&C tasks in various industrial sectors, the IL also provides sector-specific package units, e.g. for the water/wastewater or building automation sectors. The uniformly styled blocks of IL and APL can be used to create harmonic HMIs which provide a uniform look and feel.

Operator control and monitoring using panels

Operator control and monitoring of automation functions (APL/IL) on a panel are possible using IL interface blocks. Configuration takes place in the CFC by linking to the technological block, e.g. a motor. Taking operating rights and hierarchical operating concepts (multi-control room operation) into consideration, the technological function executed in a SIMATIC PCS 7 automation system or SIMATIC S7-300 controller can then be operated from an operator station and also from a Touch Panel.



Faceplates of a motor control for operator station (top) and panel (bottom)

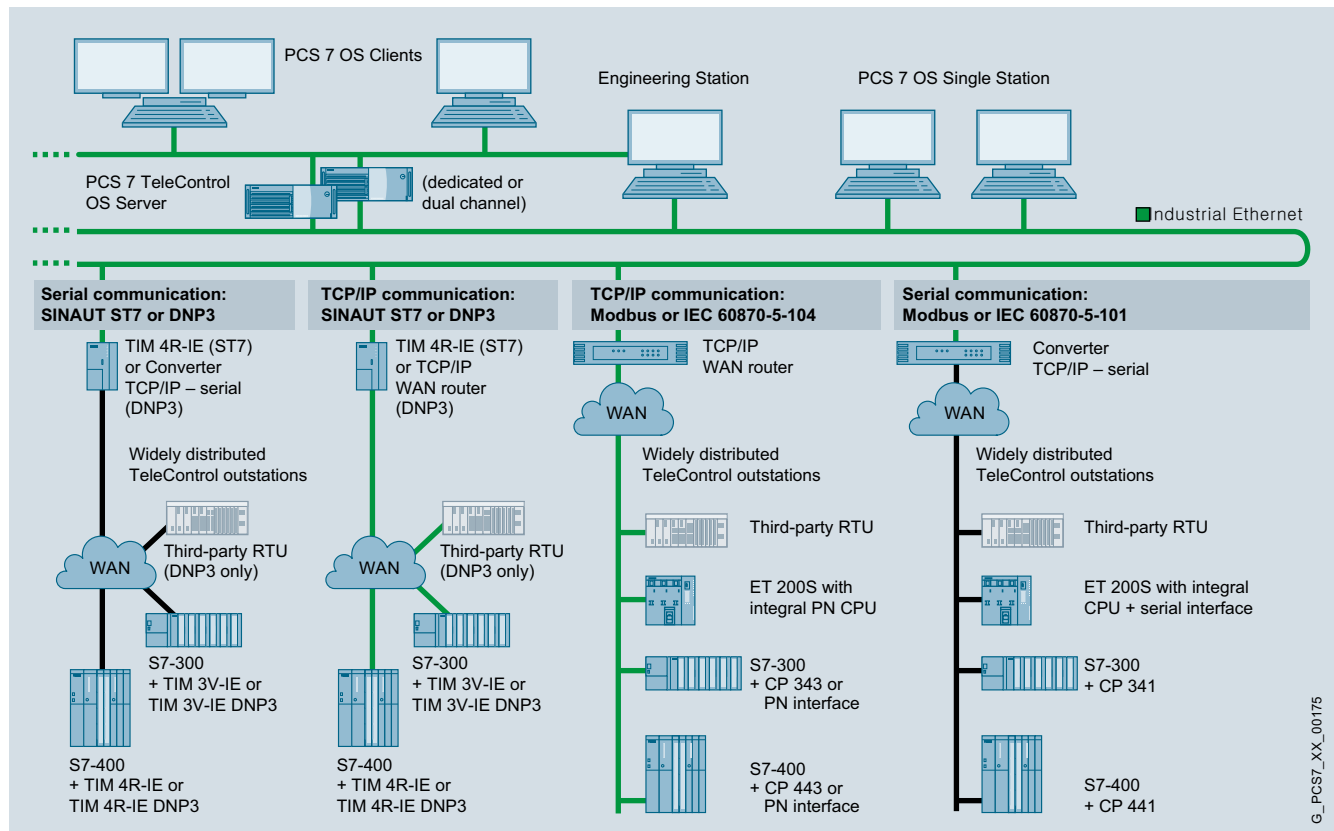
S7-300 package units

The IL not only supports the engineering of automation systems and operator stations of the SIMATIC PCS 7 process control system, but also the configuration of package units based on SIMATIC S7-300 controllers. The S7-300 package units can be seamlessly integrated into the process control system using IL blocks and homogeneously embedded in the HMI of the SIMATIC PCS 7 operator station. The function blocks are configured in CFC. The following are available for this:

- Panel interface blocks for IL functions
- Analog monitoring of 8 freely selectable limits
- Analog monitoring with additional binary limit monitoring
- Equipment monitoring for up to 8 units
- Analog measured value monitoring
- Digital measured value monitoring
- 3-point actuator (flaps, motors, valves, etc.)
- PID controller (SP1)
- Operator control blocks
- Valve control
- Motor control (standard motor, with 2 directions of rotation, with variable speed)
- Functions for building automation
- AS-to-AS communication for reading/writing of data

Telecontrol

Telecontrol with SIMATIC PCS 7 TeleControl



Integration and communication options with SIMATIC PCS 7 TeleControl

Plants often extend over huge areas, especially in the water & wastewater and oil & gas industries. In such cases it is necessary to integrate outstations for monitoring and controlling highly remote units (usually with a small or medium degree of automation) into the control system of the complete plant. This is carried out by means of telecontrol protocols over a WAN (Wide Area Network).

The telecontrol center for the outstations (consisting usually of simpler remote terminal units (RTUs)) can be integrated directly into the process control system using SIMATIC PCS 7 TeleControl.

This results in significant advantages compared to conventional solutions in which central and remote plant areas are configured as separate units and then combined in a higher-level network control system. Benefits include:

- Uniform process control
- Simple and user-friendly data management
- Integrated engineering for central and remote plant units
- Lower service and training costs

The telecontrol center is integrated into the SIMATIC PCS 7 process control in the form of an operator station in single station or server design (also redundant as option). This PCS 7 TeleControl Operator Station is dedicated to telecontrol operation. However, with smaller configurations, it can also control SIMATIC PCS7 automation systems in central plant areas in parallel with telecontrol systems (dual-channel operation).







There are no differences between central and remote automation with regard to operating philosophy and alarm response. Data from the RTUs of the telecontrol system can be displayed in one process picture together with data from SIMATIC PCS 7 automation systems.

To enable engineering of the TeleControl Operator Station (single station/server), the functions of the central Engineering Station of the SIMATIC PCS 7 process control system are expanded by DBA technology (DBA) and the object library "SIMATIC PCS 7 TeleControl".

In addition to technological objects for processing and displaying process data, the library also contains diagnostics objects for communication diagnostics and control. These blocks support SIMATIC PCS 7 compliant operator control by means of symbols and faceplates, as well as the hierarchy of SIMATIC PCS 7 fault messages. If necessary, the DBA Type Editor can be used to expand the library project-specifically with new script-based object types.

For additional information, see:
www.siemens.com/simatic-pcs7/telecontrol

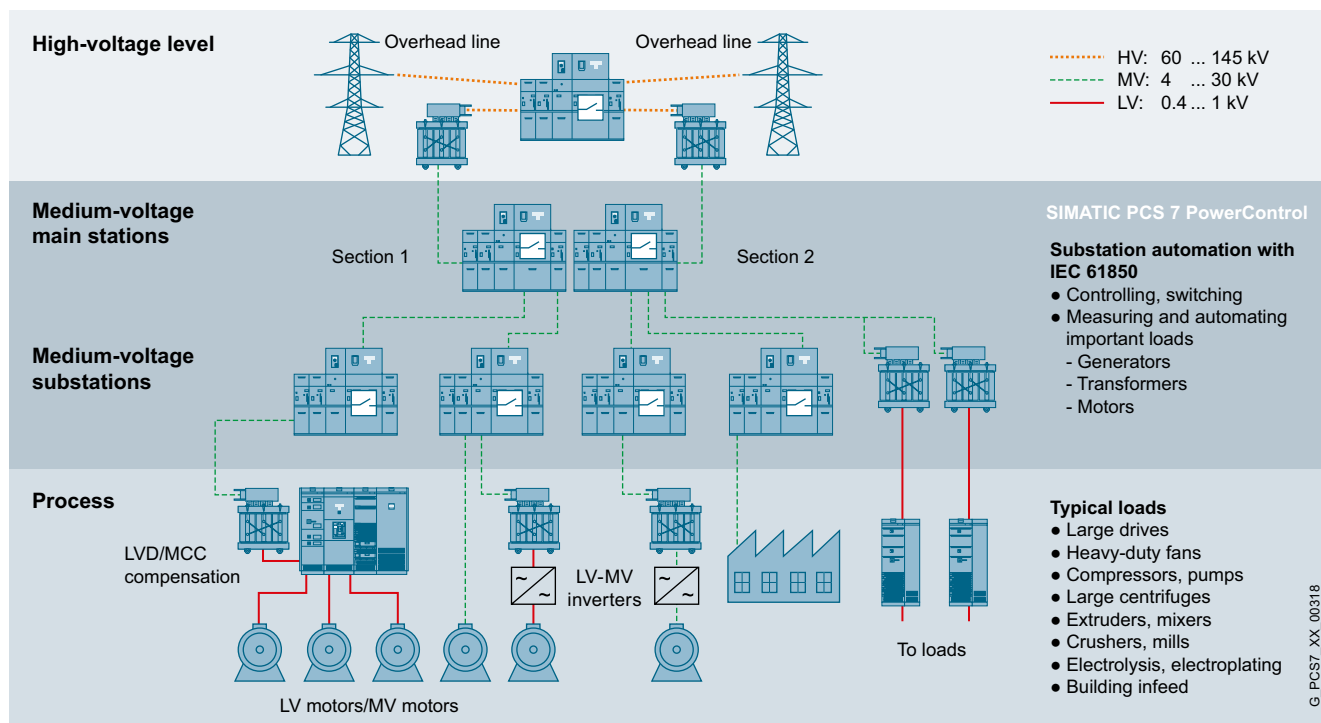
	RTU type ¹⁾	RTU category	Possible telecontrol protocols
	controller integrated in SIMATIC ET 200S	Small with 30 ... 200 I/Os ²⁾ for small applications	<ul style="list-style-type: none"> • Modbus • IEC 60870-5-101, IEC 60870-5-104
	SIMATIC S7-300/S7-300F controller	Medium with 100 ... 2 000 I/Os ²⁾ for medium-sized applications	<ul style="list-style-type: none"> • SINAUT ST7 • DNP3 • Modbus • IEC 60870-5-101, IEC 60870-5-104
	SIMATIC S7-400/S7-400F controller	Large with 500 ... 5 000 I/Os ²⁾ for larger applications requiring higher performance	<ul style="list-style-type: none"> • SINAUT ST7 • DNP3 • Modbus • IEC 60870-5-101, IEC 60870-5-104
	SIMATIC S7-400H/S7-400FH controller		<ul style="list-style-type: none"> • DNP3 • IEC 60870-5-101, IEC 60870-5-104

¹⁾ Also in SIPLUS extreme version, e.g. for environments with temperature from -25 °C to +70 °C, condensation, or medial loading

²⁾ Dependent on CPU size, protocol type and application

Switchgear/controlgear automation

Integration of switchgear/controlgear automation in the process industry with SIMATIC PCS 7 PowerControl



Automation levels in power supply and distribution

Historically, systems for automating a process and systems for automating the power supply to this process were always strictly segregated. With SIMATIC PCS 7 PowerControl, it is now possible to combine process automation and the automation of electrical switchgears for medium voltages ranging from 4 to 30 kV in one control system. This results in a host of benefits that provide huge cost savings over the entire life cycle of the plant, by means, for example, of:

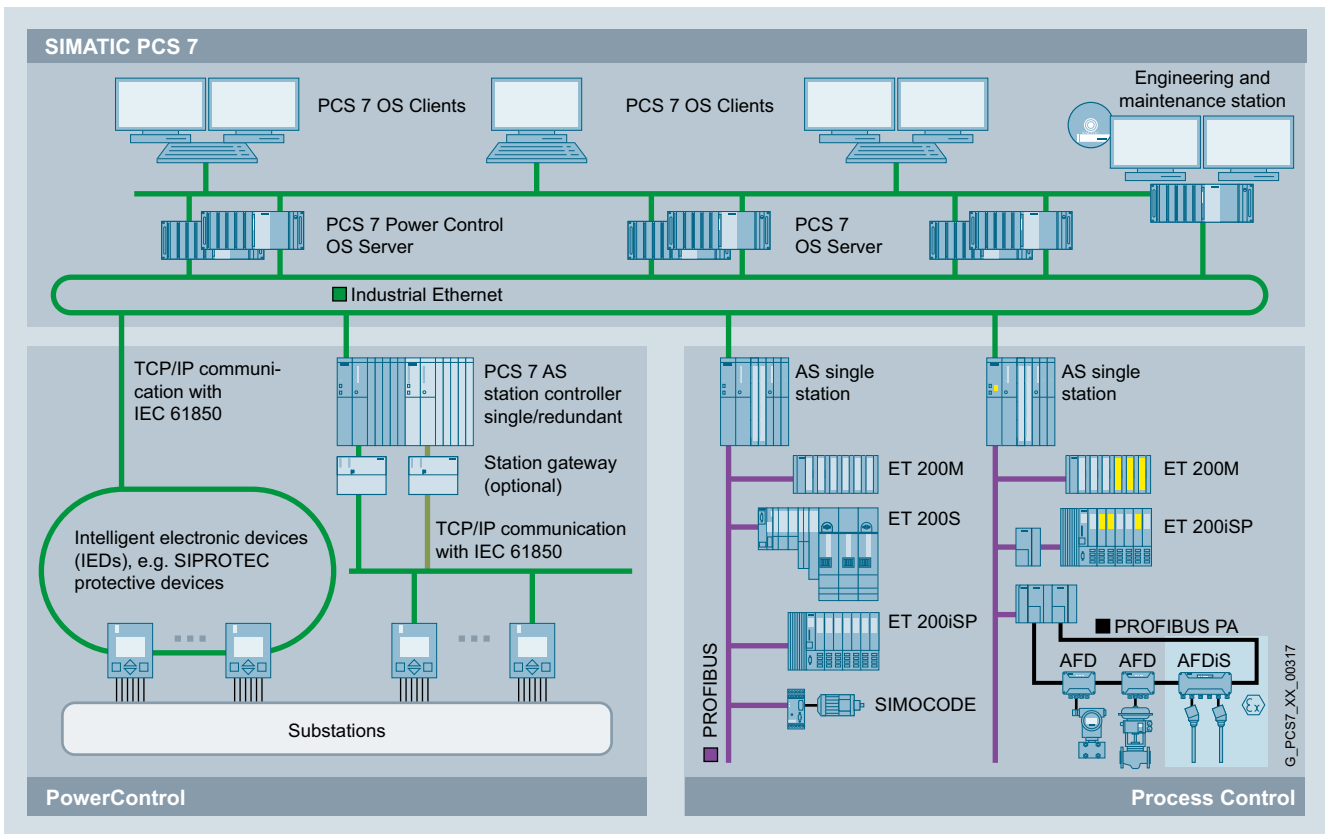
- Simpler plant structures with more transparency in the technological dependencies
- Further increase in the level of integration of the plant
- Uniform process control and further expansion of the operator's task area
- Long-term investment security thanks to globally valid standard IEC 61850
- Rational, integrated engineering and fast commissioning
- Lower administration, service and training costs thanks to uniform holistic view
- Effective energy management (load management, consumption optimization)

These are gaining even more in importance given the increasing decentralization resulting from greater use of renewable energies. One example of this is provided by wind farms.

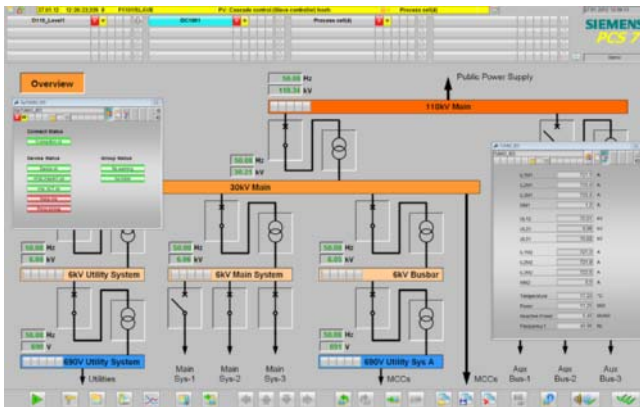
An electrical switchgear distributes or transforms electrical energy, bundling loads/consumers into load groups. With the help of switching devices, network nodes implemented as busbars connect incoming and outgoing cables known as feeders. When the substation is dimensioned, account is taken of changes to the network topology in the event of faults, and the isolation and grounding of equipment for maintenance work.

Integration of intelligent electronic devices into SIMATIC PCS 7

Electronic devices (IEDs) such as SIPROTEC protective devices or interoperable third-party devices are used for automating switchgears, that is, for protection, control, measuring and monitoring functions in electrical energy transmission and distribution. IEDs can be integrated into the SIMATIC PCS 7 process control system via Ethernet TCP/IP communication with the IEC 61850 transmission protocol for protection and control technology in electrical switchgears.



Integration options for automating medium voltage switchgears



IEDs can be integrated in two ways:

- Direct on the plant bus
- Via a station controller (PCS 7 AS) on the plant bus

IEC 61850 provides the Manufacturing Messaging Specification (MMS) for data exchange between the process control system and IEDs, and Generic Object Oriented Substation Events (GOOSE) for high-speed real-time communication between the IEDs.

Performance features of SIMATIC PCS 7 PowerControl for integrating switchgear automation into

SIMATIC PCS 7 Engineering

- Object library with function blocks, symbols and faceplates
- Object-oriented type-instance concept
- Automatic generation of the objects for the operator station
- Integration of new IEDs by importing their IEC 61850 Device Description (ICD)

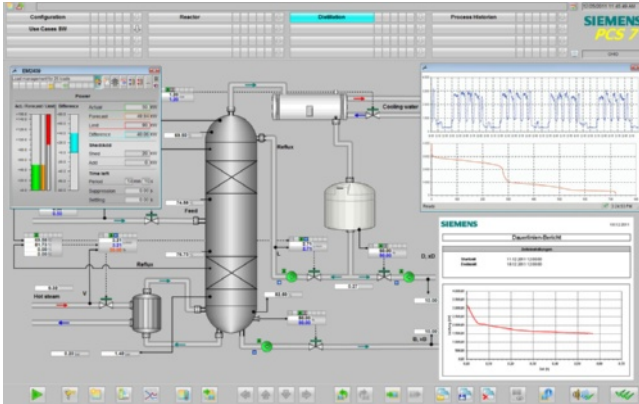
SIMATIC PCS 7 process control

- Faceplates for SIPROTEC protective devices in the SIMATIC PCS 7 APL style (look&feel)
- Standardized behavior in the case of alarms, messages, and operator control and monitoring
- Diagnostics functionality for every IED
- Library of technological objects such as motor, generator, feeder

For additional information, see:

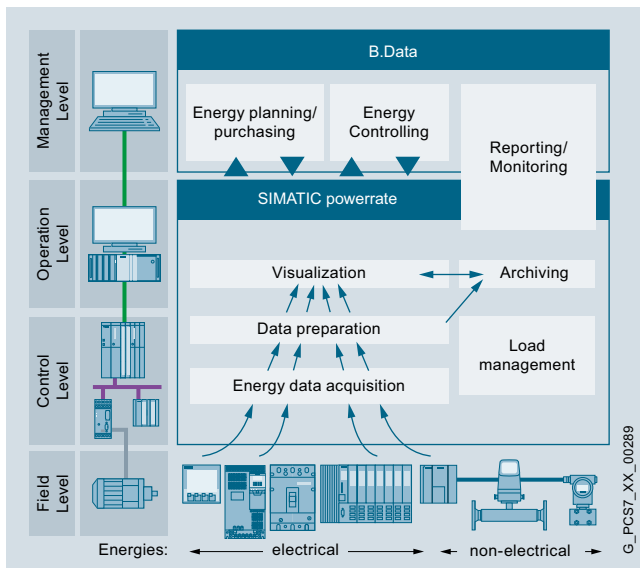
www.siemens.com/simatic-pcs7/powercontrol

Energy management with SIMATIC PCS 7



Resources which are becoming scarcer, increasing energy prices, an increased sensitivity for environmental matters, and tighter statutory constraints significantly emphasize the importance of efficient energy management. All aspects concerning the generation, procurement, distribution, and consumption of energy must be considered.

Companies operating in the process industry must be able to plan, monitor and record their energy consumptions, to define and implement possible energy saving measures, and to prove the efficiency through regular evaluation of indicators.



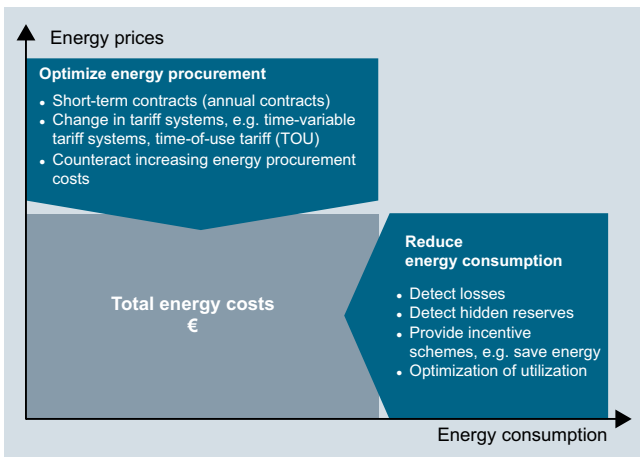
Energy management with SIMATIC PCS 7

Identification and evaluation of energy data

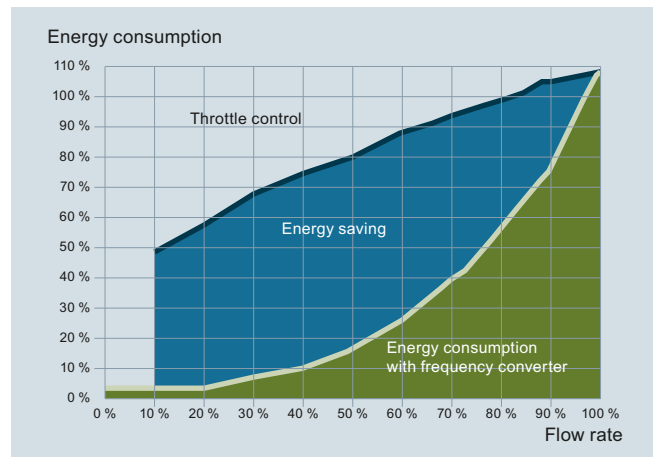
Transparency is a basic prerequisite for improving the energy balance, i.e. the measurement and recording of consumption data and the presentation of the flows of energy and media within the company. It is only possible to define potential savings and the required efforts when the consumption of each type of energy is known.

This is supported in the context of the SIMATIC PCS 7 process control system by:

- Basic power monitoring with SIMATIC PCS 7 standard functionality:
 - Data of process-related energies measured using process instruments, such as steam, cooling media or gas
 - Data provided directly by electric components such as circuit-breakers (SENTRON), frequency converters (SINAMICS), motor starters (ET 200S) etc.
 - Data of other energy consumers measured using power monitoring devices of the SENTRON PAC range
- SIMATIC powerrate for analysis and evaluation of the flows of energy with automatic reporting
 - Recording of energy and performance data from the field using additional function blocks
 - Data preparation, data visualization per faceplate, and data archiving
 - Automatic assignment of energy consumptions/costs to cost centers, units or batches
 - Monitoring of performance limits according to process/user-specific definitions
- B.Data software for optimization of operational energy management with division and transfer to the accounting system in accordance with the causer
 - Company-wide transparency thanks to gap-free energy and material balancing of power generation and consumption plants
 - Generation of key performance indicators (KPIs) for reliable statements on raising the efficiency of energy generation, distribution, and consumption systems
 - Distribution of energy costs and revenues based on causer, and transfer of such to ERP systems (e.g. SAP R/3)
 - Production-based prediction of loads and requirements to improve planning security
 - Support of cost-effective purchasing of energy



Reduced energy costs



Energy saving potential through frequency converters

Optimization of energy utilization

SIMATIC PCS 7 and SIMATIC powerrate can be used to optimize the energy utilization such that previously unused resources can be accessed, and consumption peaks avoided. SIMATIC powerrate with the integrated load management function permits active monitoring of performance limits. SIMATIC PCS 7 standard blocks use the current consumption to calculate a prediction for the running 15-minute average, and compare this with defined limits. Consumers can be specifically switched off or on, for example, in order to smoothen larger peaks or to observe limits agreed by contract with the energy supplier. In the case of unstable power supplies, loads can also be rapidly disconnected in order to guarantee the operation of critical plant components using the remaining in-feed capacity.

Furthermore, the optimization of processes using Advanced Process Control (APC) as well as plant-level asset management with the PCS 7 Maintenance Station provide a significant contribution to energy-efficient plant operation.

Energy saving with innovative technology

The application of low-energy motors or frequency converters is a further large potential for savings, especially with energy-intensive production processes, e.g. in the chemical or pharmaceutical industry.

Energy-saving motors

Energy-efficient motors have a power loss reduced by up to 42%. Since the share of energy costs in the total costs of a motor over its complete lifecycle is approximately 98%, enormous cost savings can be achieved for new plants or when modernizing existing plants.

Frequency converters with braking energy recovery

Frequency converters make it possible for the equipment in plants, such as pumps, fans or compressors, to always operate within the optimum working range. Energy savings of up to 50% can then be achieved compared to conventional control procedures.



B.Data software for optimizing operational energy management

For additional information, see:

www.siemens.com/simatic-pcs7/energy-management

Optimization with Advanced Process Control

With complex processes, control concepts based on PID controllers often reach their limits quickly. Advanced Process Control (APC) functions are integrated in the SIMATIC PCS 7 process control system and provide significantly more options. The application of these advanced control functions permits the following:

- Drastic reduction of undesirable variations in critical process variables
- Noticeable reduction in use of raw materials and consumption of energy
- Increase in throughput and product quality
- Reduction in demands placed on operating personnel

Integrated Advanced Process Control functions

In addition to numerous basic control functions, e.g. PID control, cascade control, split range control and ratio control, the I&C libraries of SIMATIC PCS 7 provide function blocks and templates at no extra cost for the advanced control functions described below.

Using these model solutions already included in the standard, complex APC applications can be implemented simply and cost-effectively for small and medium-sized plants.

Override control

With override control, the outputs of two or more controllers are connected to a common final controlling element. The decision concerning which controller actually has access to the final controlling element is made depending on the evaluation of the current process state.

- Two or more controllers share a final controlling element
- Decision for the active controller based on:
 - Measurable output variables, e.g. one of the controlled variables
 - Manipulated variables of the controllers

Gain scheduling

Gain scheduling enables infinite adjustment of the controller settings in non-linear processes depending on three operating points.

Linear interpolation effects soft, bumpless transitions between the operating points so that the parameters can be infinitely modified dependent on the course of the measured variable X.

- Suitable for non-linear processes
- Three complete parameter sets for three operating points



Dynamic feedforward control

Feed-forward control can compensate a strong, measurable interference in advance so that the control is limited to model uncertainties and non-measurable interferences.

- Compensation of strong, measurable interferences
- Eliminating faults before the appearance of negative effects

Monitoring of the control performance

The ConPerMon block determines the control quality of the PID controller block. Depending on the deviation from the comparison value, e.g. the control quality during commissioning, it triggers warnings or alarms which can be combined clearly in OS displays for a plant or unit. In this way, problems can be detected, analyzed and specifically corrected at an early stage.

- Online monitoring of the control performance
- Identification of control loops according to the criteria:
 - Maximum urgency for optimization
 - Imminent fault
- Configurable alarm limits for standard deviation
- Graphic evaluation

PID controller optimization

A model of the process is initially generated using the PID Tuner integrated in the engineering system. Based on this, the most favorable controller settings can be determined, while differentiating between the optimum response to disturbance variable changes or setpoint changes.

- Optimization of PID control loops
- Can be used for standard PID controllers and blocks from user-specific libraries
- Simulation of closed control loops

Smith Predictor

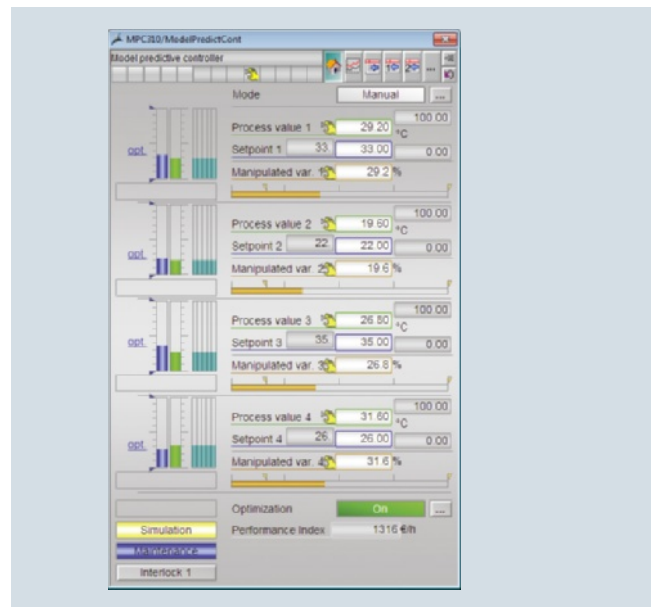
The Smith predictor can significantly improve the control quality of processes with long and relatively constant dead times. The dead time component is eliminated using a process model running parallel to the actual process. The controller can then be designed for a process free of dead time, and set more effectively.

- Can be used on processes with long, known and relatively constant dead times:
 - Process model runs parallel to the actual process
 - Feedback of virtual controlled variable free of dead time
 - Feedback of deviation between the measured actual value and the virtual value with dead time
- Draft PI(D) controller:
 - Based on component of process model that is free of dead time
 - Allows significantly more precise controller setting

Model-based predictive multi-variable control

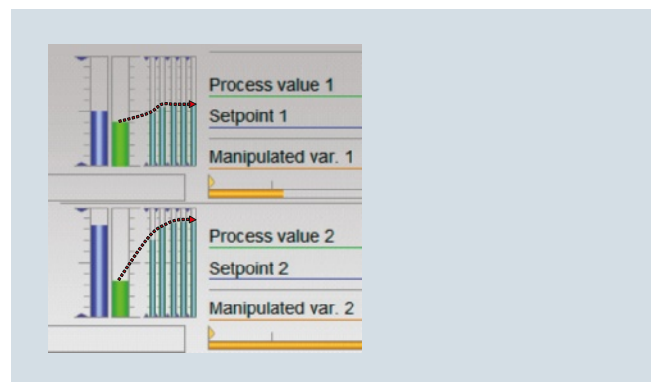
The model-based predictive multi-variable controller (MPC) separately analyses the behavior of up to four interdependent variables for complex processes over a longer period. The MPC then uses the parameter matrix calculated using the results for optimized control of these variables. Adverse interactions which occur with separate control of the interdependent variables are thus eliminated.

- Most powerful APC function
- Scalable MPC applications:
 - Internal ("lean") MPC: up to 4 x 4
 - External "full-blown" MPC: more than 4 x 4 (add-on)
- "Lean" and "easy to use"; requires neither communication monitoring nor backup strategies
- Application examples:
 - 2 x 2 application: two-material distillation
 - 3 x 2 application: steel bleaching process
 - 3 x 3 application: loop-type bubble column, vaporizer
 - 3 x 4 application: cement mill
 - 4 x 4 application: three-material distillation, oven with 4 burners



Faceplate for predictive multi-variable controller

In a tolerance range specified instead of the precise setpoint, the integral static operating point optimization can calculate the economically optimal operating point. Prediction mode predicts future process behavior within the entire prediction horizon, assuming the current values of the manipulated variables are frozen.



Graphical representation of the process behavior prediction

Advanced Process Control with SIMATIC PCS 7 add-ons

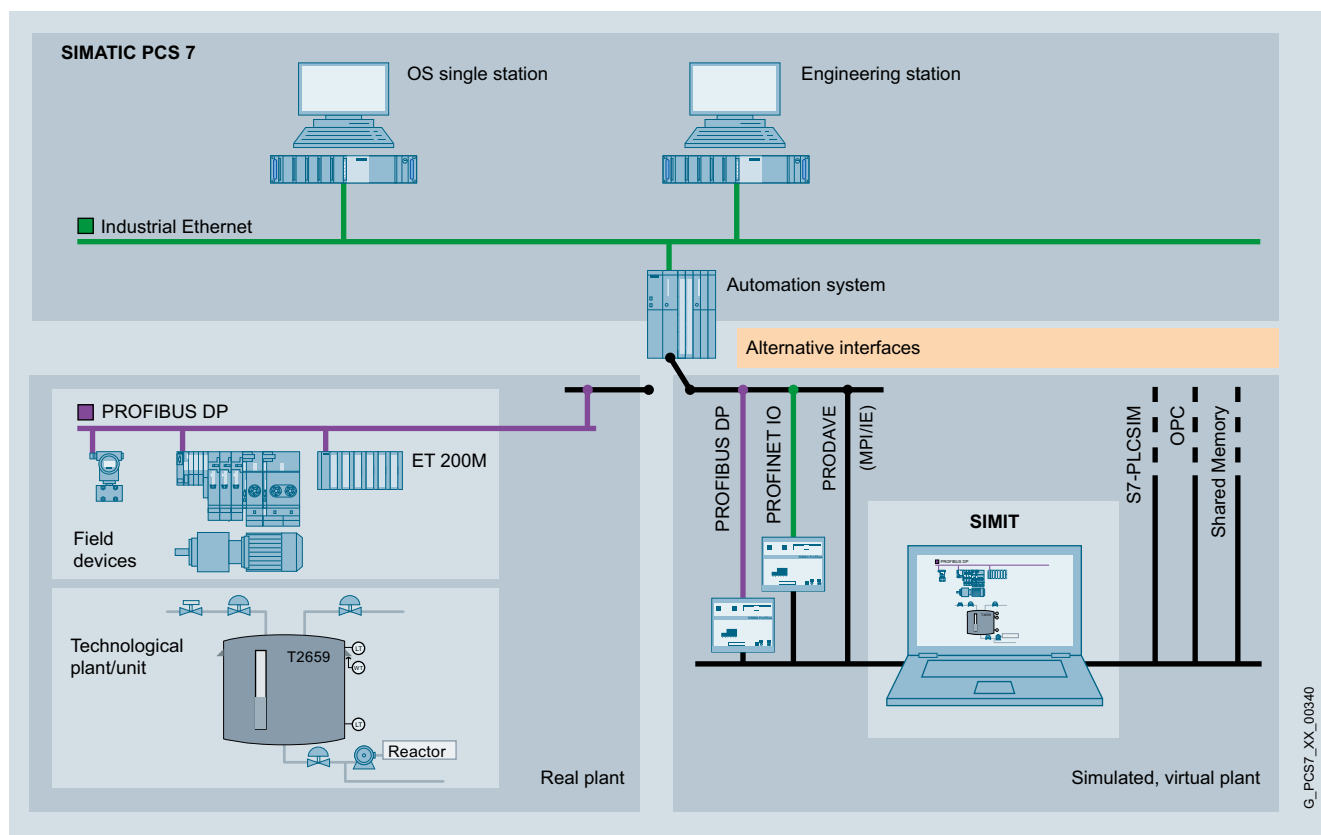
Add-ons which can be seamlessly integrated into the process control system expand the range of advanced control functions for SIMATIC PCS 7, e.g. FuzzyControl++, INCA Sensor, INCA MPC or ADCO.

For additional information on Advanced Process Control, see:

www.siemens.com/simatic-pcs7/apc

Simulation and training systems

Simulation and virtual commissioning with SIMIT



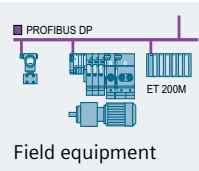
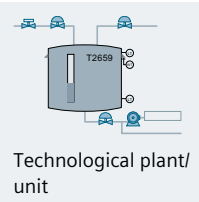
Application and integration options of SIMIT

In the process industry, automation projects are characterized by tight budgets, increasing complexity, and a tightly organized implementation timeframe. The challenges are therefore the planning, installation, and commissioning of I&C plants within the shortest possible time, but at the same time satisfying the increasing quality and cost demands. The shortening of commissioning times as a result of simulation of the I&C and technological functionalities using SIMIT can make a decisive contribution toward achieving the planned efficiency and productivity of new plants, expansions, and modernizations as rapidly as possible.

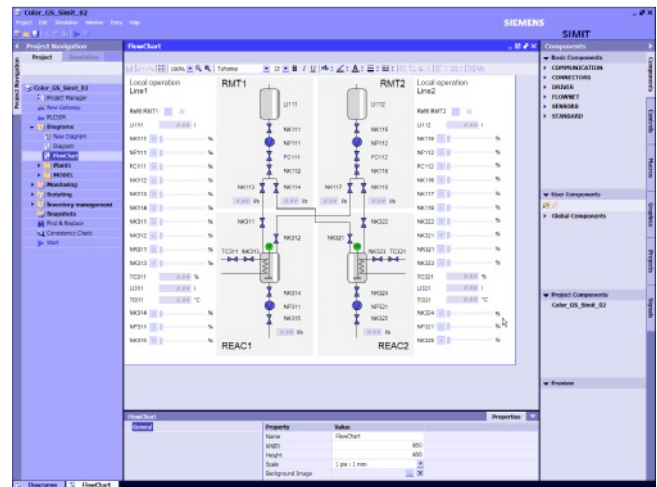
SIMIT permits testing and commissioning of the plant-specific user software on a partially virtual plant. To achieve this, the response of the field technology as well as the technological plant/unit can be simulated in SIMIT. Either a real or virtual automation system is used for the control.

Many efficient tests for detection and elimination of potential faults can already be carried out before the real plant is even available, e.g. application of correct identifications, testing of interconnection or interlocking logic. In this manner it is possible to optimize the quality of the configuration process without a risk for the real plant.

SIMIT can be used on up-to-date notebooks or desktop computers with Windows XP Professional or Windows 7 Professional/Ultimate. It can be integrated and flexibly used in SIMATIC PCS 7 via open interfaces. It is possible to link further simulation models to SIMIT via standardized interfaces such as OPC and Shared Memory.

Real plant	Simulation with SIMIT	
 <p>Field equipment</p>	Signals	Import (e.g. symbol table)
	Devices	Basic library for: <ul style="list-style-type: none"> ■ DRIVES ■ SENSORS
 <p>Technological plant/ unit</p>	Technological response	Additive libraries <ul style="list-style-type: none"> ■ FLOWNET ■ CONTEC

Abstraction levels of the simulation



SIMIT Graphical User Interface (GUI)

SIMIT can be connected to SIMATIC PCS 7 automation systems via PROFIBUS DP or PROFINET IO. Interface modules simulate the devices on the PROFIBUS DP/ PROFINET IO. As an alternative, additional connections are possible e.g. with:

- Specific applications such as S7-PLCSIM (AS simulation) or PRODAVE (MPI/IE)
- OPC data sources
- Shared Memory

Modeling of the plant based on components and signal flows is carried out on the SIMIT GUI. Basic libraries which can be expanded are available. Special simulation expertise is unnecessary.

Efficient simulation with SIMIT is based on abstraction at three different levels: Signals, devices (e.g. drives and sensors), and technological response.

The signals can be created simply by importing the symbol table. Files of the import/export wizard and simulation templates can be used to simulate the devices. Additive libraries support simulation of the technological response. An example of this is the FLOWNET library with which the dynamic responses of pressures, flows, and temperature distributions of water in pipeline networks can be simulated rapidly and simply.

In addition, a CONTEC library is available for simulation of mixed consignment conveyor technology plants.

SIMIT services

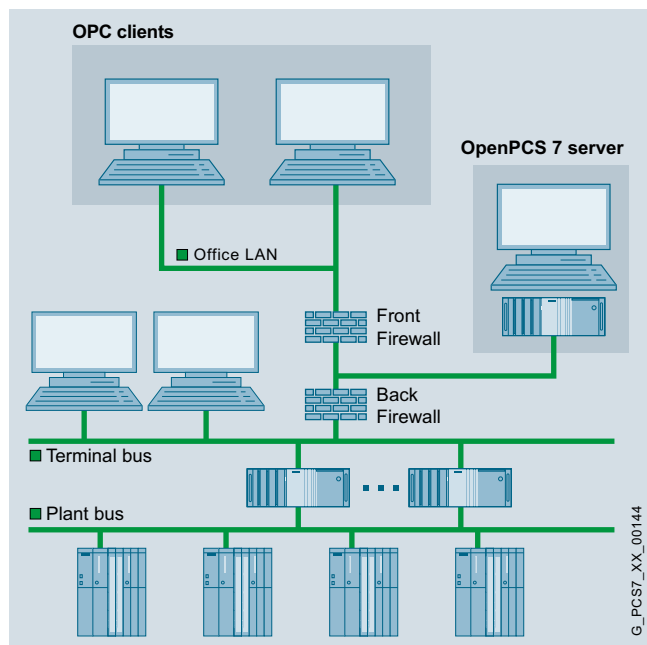
Experienced specialists in the plant simulation sector with profound knowledge of SIMIT provide comprehensive consulting, training, and support for customized plant modeling.

Arguments supporting the use of SIMIT

- High quality thanks to early detection and elimination of faults in the I&C project
- Virtual commissioning shortens project commissioning times and reduces project costs
- No simulation-specific programming required in the automation project

Interfacing to IT systems

Evaluating and managing process data with OpenPCS 7



OpenPCS 7 server for data exchange via OPC

Systems for production planning, process data evaluation and management (OPC clients) that are at a higher level than the process control system can access SIMATIC PCS 7 process data by means of an OpenPCS 7 server.

The OpenPCS 7 server collects data for the OPC clients. Depending on the system configuration, these data may be distributed across different SIMATIC PCS 7 stations (OS server, archive server). It covers the distribution of data with respect to

- Period (OS1 / OS2 / ... / archive server)
- Location (OS1 / OS2 / ...)
- Redundancy (OS1 master / OS1 standby...)

The OpenPCS 7 interface is based on the OPC specifications (Openness, Productivity, Collaboration) that mainly make use of Microsoft's DCOM technology (Distributed Component Object Model) for communication between the applications. It supports the following standardized access options:

OPC DA (data access server)

For read and write access to process values according to OPC specification OPC DA V2.05a and V3.0.

As an OPC DA server, the OpenPCS 7 server provides other applications with current data from the OS data management. The OPC client can log itself on to ongoing changes or also write values.

OPC HDA (historical data access server)

For read-only access to archived process values according to OPC Specification OPC HDA V1.2

As an OPC HDA server, the OpenPCS 7 server provides other applications with historical data from the OS archive system. The OPC client, e.g. a reporting tool, can specifically request the required data by defining the start and end of a time interval. Numerous functions, e.g. variance, mean value or integral, already permit preprocessing by the HDA server and thus contribute toward reduction of the communications load.

OPC A&E (alarm & events server)

For read-only access to messages, alarms and events according to OPC Specification OPC A&E V1.1

As an OPC A&E server, the OpenPCS 7 server passes on OS messages together with all accompanying process values to the subscribers at the production and corporate management levels. They can of course also be acknowledged there. Filter mechanisms and subscriptions ensure that only selected, modified data are transmitted.

OPC "H" A&E (Historical Alarm & Events Server)

For read access to archived alarms and messages

Thanks to a Siemens extension of the OPC standard interface, the OpenPCS 7 server is able to transmit historic alarms and messages from the archive to subscribers in the production control and corporate control level.

OLE-DB

Simple, standardized direct access to the archive data in the Microsoft SQL server database of the operator system is possible with the OLE-DB. Through this, all OS archive data are accessible with the accompanying process values, message texts and user texts.

Integration and synchronization of all business processes with SIMATIC IT



The competitiveness of a company depends on a quick response to market requirements and optimization of the supply chain. At the interface between production and management, Manufacturing Execution Systems (MES) ensure uniform optimization of corporate processes - and therefore greater efficiency, integrated transparency and consistent quality.

With SIMATIC IT, Siemens has one of the most powerful and flexible MES systems on the market. As a component of Totally Integrated Automation, SIMATIC IT is based on consistent standardization of interfaces and clear ISA-95-compatible structuring and works homogeneously with all commonly available ERP and process control systems. Modeling of the entire product manufacturing know-how, precise definition of the operating processes, and real-time data acquisition from the ERP and the production level enable SIMATIC IT to control operating processes more effectively, to minimize downtimes, production waste and reworking, and to optimize stockholding.

With three SIMATIC IT suites, independent components, and SIMATIC IT libraries (reusable MES applications), SIMATIC IT can be quickly and flexibly aligned to the specific requirements of companies in different sectors of the process and life sciences industry.

As well as normal technical support, the range of services also encompasses predictive and preventive service and support. It supports the customer in optimizing the availability of IT resources in the production plant, whether by automatic management of software updates or by predicting potential server problems.

SIMATIC IT Suites

SIMATIC IT Production Suite

is a manufacturing execution system in accordance with ISA-95 that combines ERP systems with process control technology, and visualizes production performance in real time at the corporate management level

SIMATIC IT R&D Suite

combines research and development with the production plant for system-wide optimization of research and development processes, and for reducing product launch times.

SIMATIC IT Intelligence Suite

analyzes the production data acquired in real time in combination with the business data, and thus derives improvement measures.

SIMATIC IT Components

The following SIMATIC IT components provide MES basic functionality in accordance with ISA-95 for specific task areas such as order management, materials management, message management, personnel management or report management:

- SIMATIC IT Product Definition Manager
- SIMATIC IT Production Order Manager
- SIMATIC IT Material Manager
- SIMATIC IT Personnel Manager
- SIMATIC IT Messaging Manager
- SIMATIC IT Data Integration Service
- SIMATIC IT Client Application Builder (CAB)
- SIMATIC IT Report Manager

Other SIMATIC IT components can be used in stand-alone mode and can also be combined with other MES functionalities:

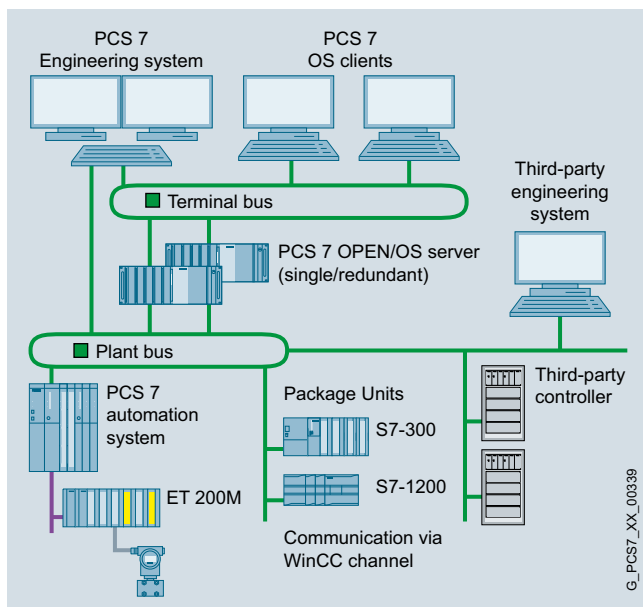
- SIMATIC IT Historian - PIMS (Plant Information Management System)
- SIMATIC IT Unilab - LIMS (Lab Information Management System)
- SIMATIC IT Interspec - Product specification management
- SIMATIC IT Unicam - Solution for manufacturers of electronic components

SIMATIC IT Libraries

Sector-specific SIMATIC IT function packages

SIMATIC IT also offers specific function packages, including packages for life sciences and various sectors of the process industry. Pre-configured best-practice applications in SIMATIC IT libraries already cover 80% of sector-specific customer requirements as standard.

Controller integration with PCS 7/OPEN OS



Example of connection of third-party controllers and package units to PCS 7/OPEN OS

As a result of developments over many years, I&C plants frequently have heterogeneous structures in which system components from different manufacturers are combined. During plant modernizations, owners endeavor to increase the efficiency of process control by simplifying the HMI level. In the case of plant expansions where control desks are merged or existing plants are migrated step-by-step, the challenge is to integrate different types of controller in one HMI system.

The SIMATIC PCS 7 operator system can be expanded by PCS 7/OPEN OS for such purposes. It can be used to integrate the following controllers into the process management:

- Third-party controllers (DCS)
- PLCs from Siemens and other manufacturers
- Package units

Depending on the technical situation of the controller to be integrated, connection to the PCS 7/OPEN OS operator station (single station / server / redundant pair of servers) is possible via OPC (OPC DA and OPC A&E) or the existing WinCC channels (e.g. S7 channel or Modbus TCP channel). In the case of OPC communication, the OPC server can be executed on separate hardware or together with the OPC client on the PCS 7/OPEN OS operator station.

The existing engineering system of the controller can be used further to configure the automation functions.

The basis for OS engineering with the PCS 7 engineering system is the Toolset Database Automation (DBA) of PCS 7/OPEN OS. It is then possible to rapidly and simply create OS objects in SIMATIC PCS 7 design for the controller to be integrated. Manual inputs are limited to organization of the project, the creation of static display elements, archive definition, user management, and customized adaptations.

DBA functions

- Generating the display hierarchy
- Automatic creation of displays with icons and faceplates in the hierarchy tree
- Automatic creation of the variables function in the operator station
- Automatic creation of messages
- Assignment of message priorities
- Definition of the process variables to be archived
- Creation of trends
- Export/import for mass data processing
- Type editor for creation of function block images of the existing controller
 - Creation of data structures (structure types)
 - Import/export and documentation of types
 - Creation of type from instance
 - Integration of type into another type

Further relevant PCS 7/OPEN OS functions

- PH synchronization: alignment of plant hierarchy with existing PCS 7 project
- Multi-project engineering: division into several DBA projects, e.g. system-granular
- Online scripting: creation of scripts for supplementary functions, for execution during runtime

Handling of package units

Package units can be created once in PCS 7/OPEN OS and supplied as an OS typical on CD or per download. On site, the configuration engineer imports this typical and generates instances from it according to the number of units. The package units can subsequently be visualized in the SIMATIC PCS 7 process displays.

Migration of own and third-party systems

An investment for the future

Migration strategy

Globalization and the intensified competition that accompanies it are forcing companies to continuously increase productivity and shorten product launch times. Existing systems and plants have to be repeatedly expanded and modernized to ensure that companies can also satisfy tomorrow's market requirements. However, since the installed basis of hardware, application software and know-how of the operating and maintenance engineers represents an enormous value, the safeguarding of investments for companies operating the plants is always assigned a high priority during all modernization plans.

Experience has shown that the success of a migration process greatly depends on a technical solution optimally matched to customer requirements and the respective plant. The following fundamental aspects apply:

- Minimization of the financial and technical risks
- Long-term safeguarding of investments already made
- The different lifecycles of the system components must also be considered, e.g.:
 - 5 years for PC-based workstations
 - 15 years for controllers
 - 25 years for input/ output components and wiring

Added value due to migration

The reasons for modernization of the process control technology are just as diverse as the objectives to be achieved by using a modern process control system such as SIMATIC PCS 7:

- Guaranteeing automation functionality in aging components
- Optimization of stocking of spare parts
- More flexible production with higher capacities
- Increased system performance and process transparency
- Increase in product quality and saving of resources by using modern control strategies
- Reduced engineering requirements
- Simpler process control with reduced demands on operators
- Improved system reliability thanks to more comprehensive diagnostics and plant asset management
- Powerful interfaces and plant networks with high potential for protection against IT security threats

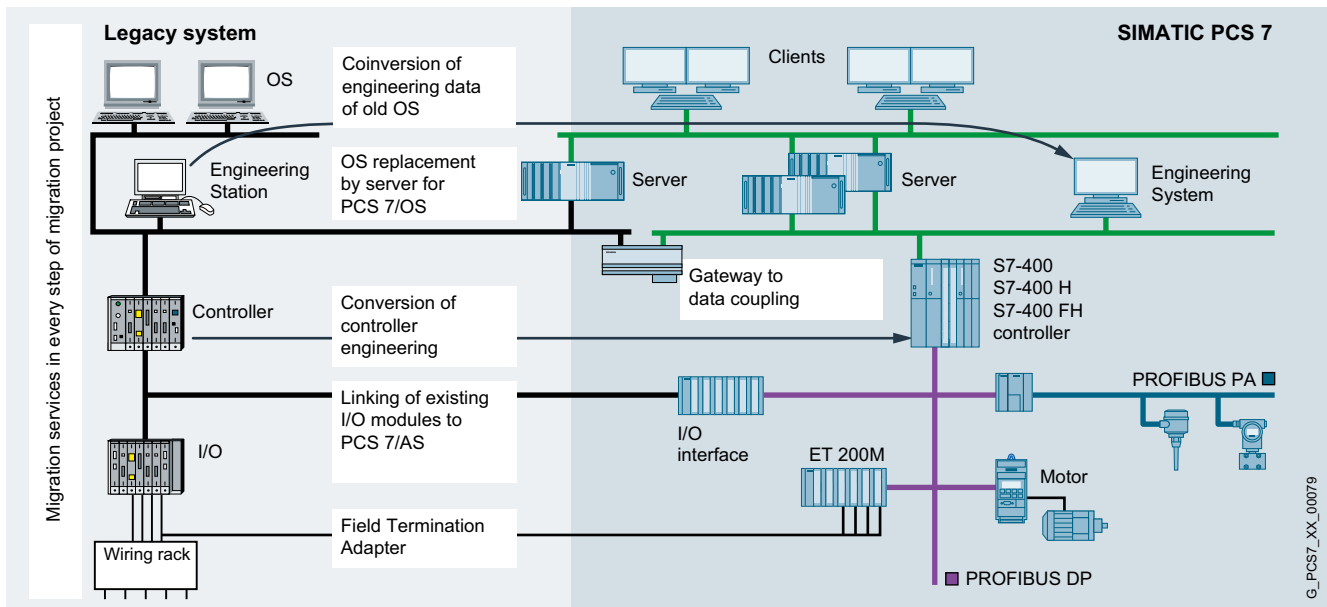


Siemens sees its task in the case of migration to be not simply the complete replacement of an existing system, but also, in close collaboration with customers and their system integrators, the production of an individual, future-oriented solution based on the state-of-the-art SIMATIC PCS 7 process control system – always under the directives:

- Step-by-step system innovation
- Adaptable to the special conditions of the plant
- Flexible according to production demands

The first and most important task of an optimal migration concept for a plant is to analyze the starting point, and from this to derive the goals of the modernization.

With very old systems, complete replacement by the new process control system is usually the preferred method. However, it is often possible to continue using components such as controllers or I/O modules if they are still supported by the supplier and if sufficient spare parts are still available. By integrating components that are worth keeping into the migration concept, significant investment savings can be achieved and conversion times shortened.



Step-by-step migration with the right products and services

Even if the hardware is largely obsolete, the available controller engineering can still represent significant value. The entire process automation know-how, often optimized over a period of years, is concentrated here. Intelligent tools help to analyze this data, and in certain circumstances, they can significantly reduce costs for re-engineering the new system thanks to functional implementation (typicals).

Experts with experience of migration

In view of the complexity of many migration projects, decisive prerequisites for migration success include the analysis and design of the correct procedure, including a realistic assessment of the opportunities and risks. The migration experts at Siemens have already acquired relevant experience in migrating the most diverse systems. This know-how is concentrated in Migration Support Centers.

If desired, Siemens works closely with the customer's system integrators when implementing migration projects, for they have the know-how gained over many years, coupled with precise knowledge of the plant and the customer's requirements.

For additional information, see:
www.siemens.com/simatic-pcs7/migration

Migration spectrum

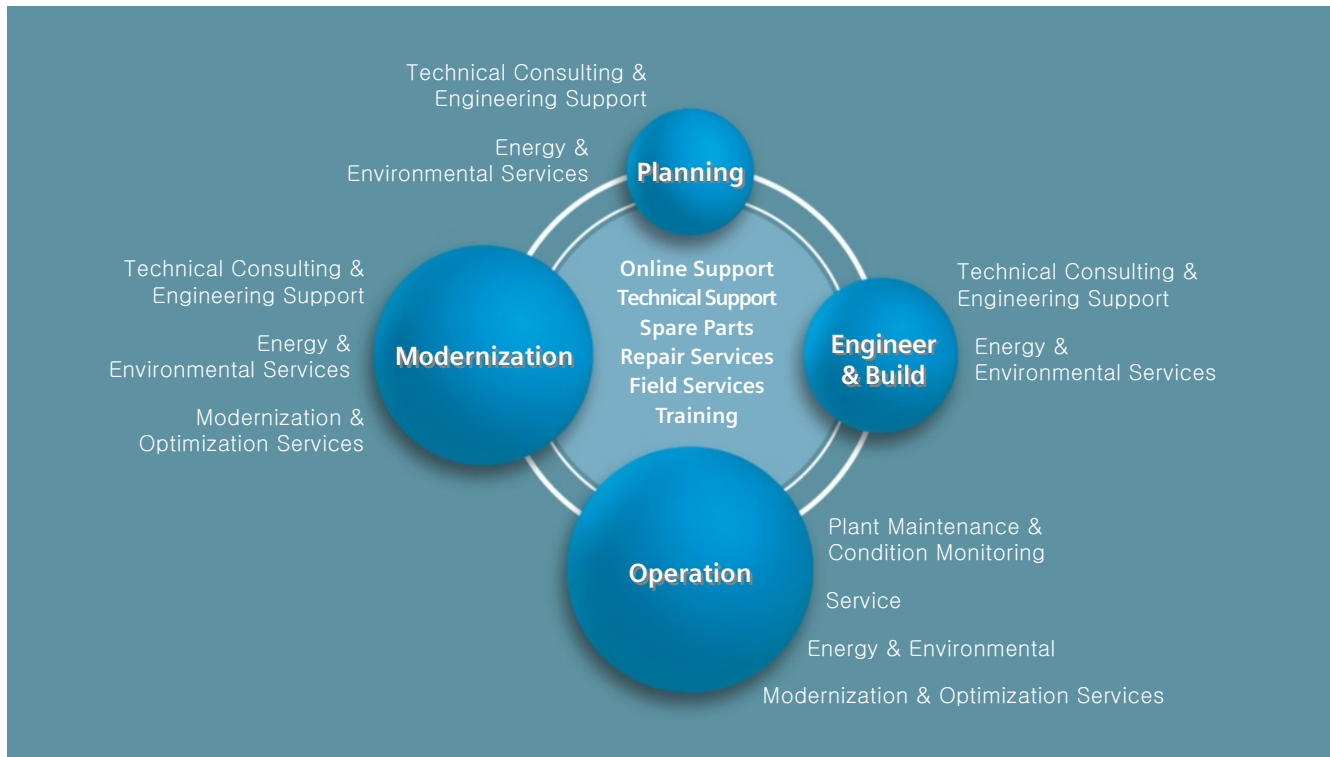
Siemens recognized the significance of migration for process automation at an early stage, and has for many years offered a wide range of innovative migration products and solutions for its globally proven systems, such as APACS+ or TELEPERM M.

Migration of old systems from other manufacturers such as ABB, Honeywell, Emerson or Invensys has since become firmly established. Here too, various products and solutions support the step-by-step transition to SIMATIC PCS 7. Increasingly, the universal, OPC-linked SIMATIC PCS 7/Open OS is used here. Additional solutions supplement the portfolio, including those for communication between old and new systems or for fast switchover of field wiring in migration projects, e.g. specific gateways, connectors, cables, and field termination assemblies (FTA).

With the future-oriented SIMATIC PCS 7 process control system, innovative migration solutions and services, many years of expertise in process automation and migration, as well as continuous worldwide servicing, Siemens demonstrates its expertise and offers the security of a reliable partner.

Services

Global service & support



Whether in the production or processing industry, the services provided for the industry have become a decisive factor toward successful competitiveness when considering the high cost pressures, increasing energy costs, and increasingly strict environmental regulations. Siemens supports its customers worldwide with appropriate product, system, and application services for the complete lifecycle of a plant. Whether planning and development, operation or modernization are concerned, customers profit from the services thanks to the comprehensive technological and product know-how and the sector competence of the Siemens experts.

This leads to a reduction in downtimes and to optimized usage of resources. The result: increased productivity, flexibility, and efficiency along with lower total costs.

Discover all the advantages of our service portfolio:
www.siemens.com/industry-services

Online support

Rapidly available technical information in the form of manuals, FAQs, and application examples for all products from Siemens Industry mean that it is usually unnecessary to contact an expert.

The Siemens Industry Online Support additionally provides a platform for exchanging information with other users.

Technical support

Technical questions concerning products and systems can arise at any time – ranging from optimum usage up to troubleshooting.

The specialists at Technical Support provide 24/7 support and answer any questions concerning the functionality and operation of products and systems.



Spare parts

A missing spare part can impair the plant availability and result in production failures. It is good to know that the Siemens experts can provide a rapid and smooth exchange process.

Repair services

Reliable motors and converters are of great importance in every plant. To ensure that they always operate at maximum efficiency, the Siemens specialists worldwide provide comprehensive maintenance and look after any required repairs.

Field services

Downtimes must be avoided as much as possible. The field services from Siemens guarantee trouble-free commissioning and repair, including rapid interference suppression in industrial plants if necessary.

Training

Participation in professional training oriented according to target groups in more than 60 countries worldwide enables the acquisition of profound SIMATIC PCS 7 system knowledge as well as the expansion of existing know-how. In practice-oriented courses, participants receive excellent training directly from the manufacturer, and this enables them to efficiently use the process control system within the shortest possible time. The range of courses also includes special hands-on training directly on site at the customer's plant.

For additional information on SIMATIC PCS 7 training, see: www.siemens.com/sitrain

Service programs

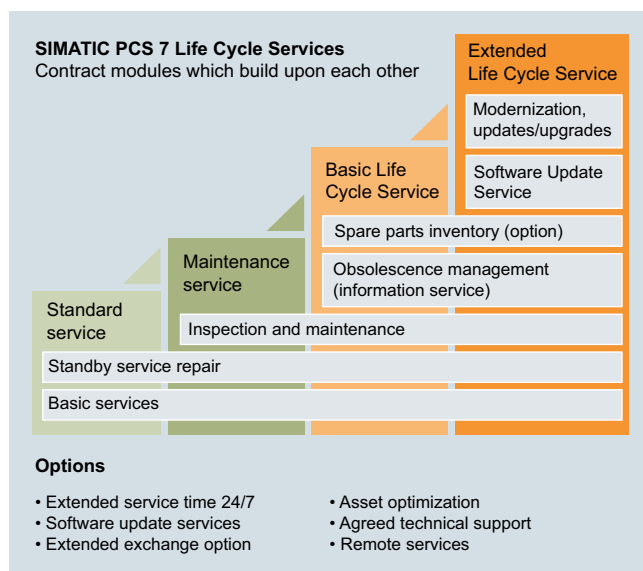
As well as global service and support, the range of services of Siemens Industry Automation and Drive Technologies also includes special service programs for the process industry that can be used independently of each other and flexibly adapted.

SIMATIC PCS 7 Life Cycle Services

When making decisions concerning investments in new or innovative control technology, the associated costs must always be evaluated in relation to the total cost of ownership (TCO) of the plant. Support, maintenance, servicing, and modernization make a significant contribution to these costs. The short innovation cycles associated with the introduction of PC technology to process automation must also be taken into consideration. It is all the more important to keep servicing costs transparent and plannable. Indispensable in this regard is a cost-optimized life cycle service which guarantees the functionality of the control technology for a defined time period. By using active obsolescence management, Siemens takes into account the aging process of the I&C plants and supports its control system customers during the elaboration of specific substitute solutions as well as appropriate maintenance and spare parts strategies.

Based on many years of experience, the service specialists from Siemens have identified four fundamental requirement profiles and developed appropriate service modules which build upon each other: Standard Service, Maintenance Service, Basis Life Cycle Service and Extended Life Cycle Service (see graphic).

The scope of services agreed individually on the basis of service modules and additive supplementary services is stipulated in a contract. The contracts are flexible enough to allow adaptation in the event of plant modifications. The service contract management includes documentation, planning of measures, and performance controlling.



Safety Life Cycle Services

The safety life cycle is divided into analysis, implementation and operation, and it follows the life cycle of the I&C systems. Operators of safety-related I&C systems, e.g. chemical plants, refineries, and distilleries, who use safety-related systems and equipment to reduce the risk and effects of a safety event are obliged in accordance with IEC 61511 to verify the effectiveness of their protection measures in the safety life cycle.

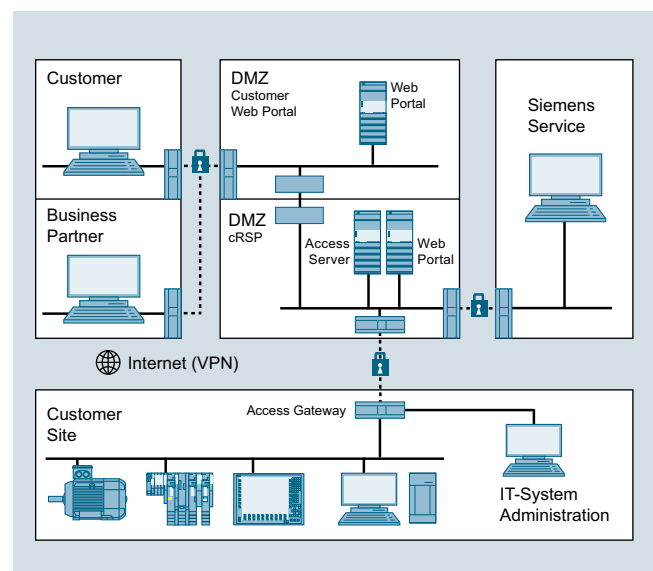
In addition to the correct hardware and software, applied planning, operating, and modification processes are decisive in ensuring that the safety engineering effectively maintains its intended function throughout the complete life cycle of the plant. With Safety Life Cycle Services, Siemens provides not only the necessary expert know-how for safety verification, but also progressive tools and methods that exclude systemic errors in all project phases. This is all the more important since errors in an early project phase are often costly and time-consuming to correct at a later date.

In addition, plant operators do not have to acquire the expert know-how themselves and permanently adapt to the latest guidelines and technologies.

SIMATIC Remote Support Services

Using modern IT structures and secure Internet connections, SIMATIC Remote Support Services offer preventive, system-specific support, which is highly efficient, flexible and profitable.

The SIMATIC Remote Support Services are based on the high-performance Siemens Remote Service (SRS) platform, that enables secure remote access to the automation system - both by Siemens experts as well as by your own system specialists or system integrators.



Get more information

Comprehensive information concerning the SIMATIC PCS 7 process control system:

www.siemens.com/simatic-pcs7

Totally Integrated Automation:

www.siemens.com/totally-integrated-automation

SIMATIC Manual Overview:

www.siemens.com/simatic-docu

Information material to download:

www.siemens.com/simatic/printmaterial

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www.siemens.com/automation