

The SIMATIC PCS 7 Process Control System

Brochure · March 2009

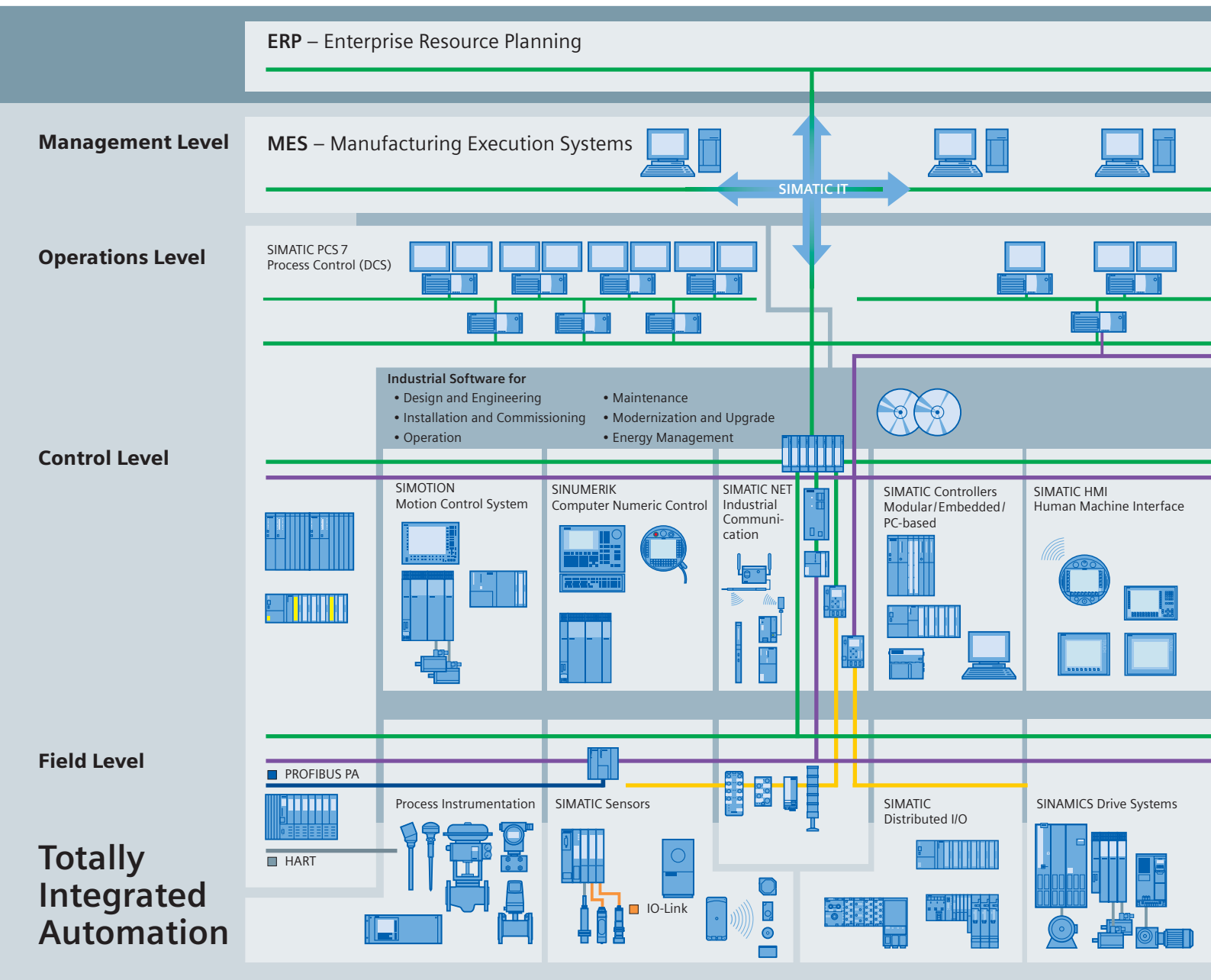


SIMATIC PCS 7

Answers for Industry.

SIEMENS

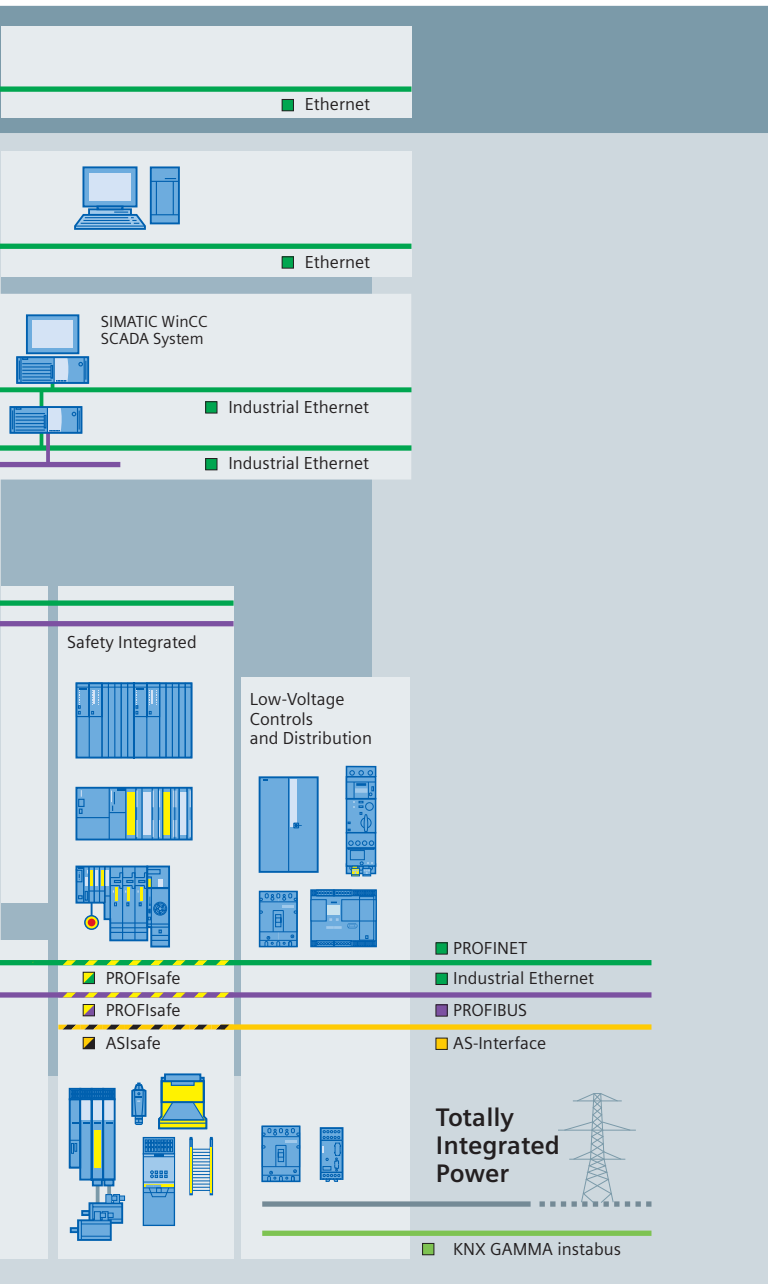
SIMATIC PCS 7 – Takes you beyond the limits!



As one of the leading international process control systems, SIMATIC PCS 7 with its functional variety, flexibility, and performance of the current version 7.1 has the potential for implementation of innovative solutions that meet the special challenges of the process industry. Since the range of available functions and the application area extend far beyond the limits of a typical process control system, SIMATIC PCS 7 permits 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 perfectly 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.

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An essential advantage of the integration of the product and system spectrum and the solutions based on 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. The perfect interplay of all components makes it possible for you to sustainably produce in higher quality.

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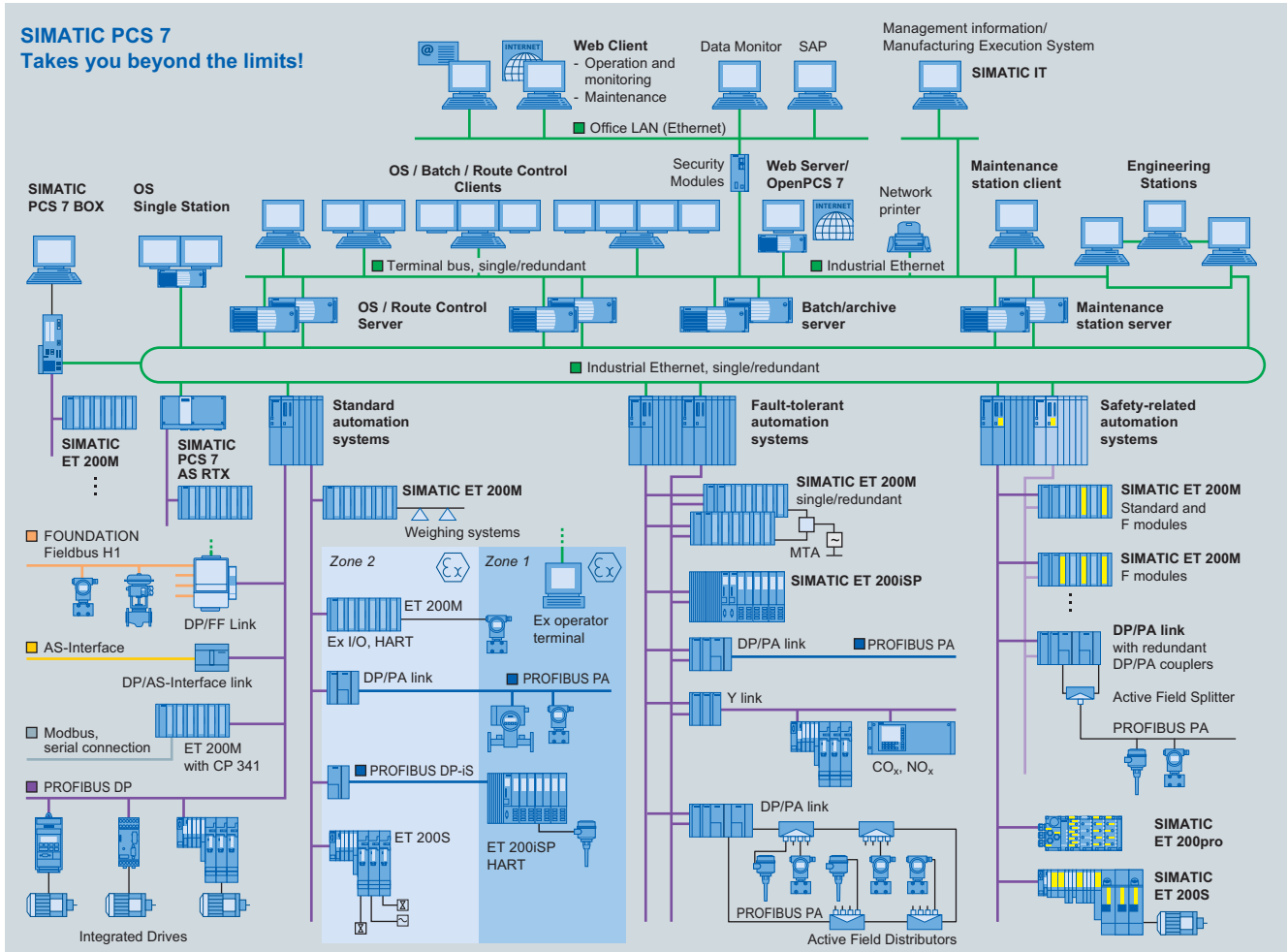
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Seven advantages



SIMATIC PCS 7 system architecture

The homogenous and uniform SIMATIC PCS 7 process control system with its unique scalable architecture and outstanding system characteristics is an ideal basis for cost-effective implementation and economic operation of process control plants.

SIMATIC PCS 7 can be specifically extended by seamless integration of additional functionalities, e.g. for batch process automation, material transport control, advanced process control, asset management, telecontrol and safety applications, process data analysis/management, or MES tasks. SIMATIC PCS 7 thus offers far more than a typical process control system.

There are **seven advantages** that stand out in particular:

- Reduction of total cost of ownership through **integration**
- High **performance** and quality coupled with efficient engineering, reliability, and availability
- Flexibility and **scalability** – from small laboratory system to large plant networks
- Protected investment thanks to incremental **modernization** of Siemens systems and third-party systems
- **Safety & security** – integrated safety technology and comprehensive IT security for reliable protection of personnel and environment, as well as process and plant
- Continuous technological **innovations** – from the world's leading provider of automation technology
- Local service and support through a **global network of experts** and authorized partners

Reduction of total cost of ownership through integration

Integration is a special strength of SIMATIC PCS 7. It significantly influences optimization of all enterprise processes over the entire life cycle of a plant, and thus it significantly influences reduction of total cost of ownership (TCO). There are many facets of integration in the context of SIMATIC PCS 7:

Horizontal integration in Totally Integrated Automation

Totally Integrated Automation (TIA) from Siemens is a seamless offering of perfectly matched products, systems, and solutions for all hierarchy levels of industrial automation. In TIA, SIMATIC PCS 7 is horizontally embedded in the uniform automation of an enterprise's entire process chain - from inbound to outbound logistics.

In this regard SIMATIC PCS 7 is particularly responsible for automation of the primary processes. But that is not enough, SIMATIC PCS 7 can also integrate auxiliary facilities and the existing electrical infrastructure, such as low-voltage and medium-high switchboards.

Since TIA guarantees compatibility of further developments continuity is always ensured. This offers the plant owner investment security as it enables him to extend and modernize his plant over the entire life cycle.

Vertical integration in hierarchical communication

SIMATIC PCS 7 can be integrated in the hierarchical communication of an enterprise via standardized interfaces for direct data exchange on the basis of international industrial standards and via internal system interfaces. In this manner, process data can be made available at any time and any location within the company for evaluation, planning, coordination, and optimization of operational procedures, production processes, and business processes.

SIMATIC PCS 7 supports the system interfacing to SIMATIC IT, the Manufacturing Execution System from Siemens. SIMATIC IT can be used to record data in real-time from the ERP and control levels, to model all the manufacturing know-how, and to precisely define the operating processes.

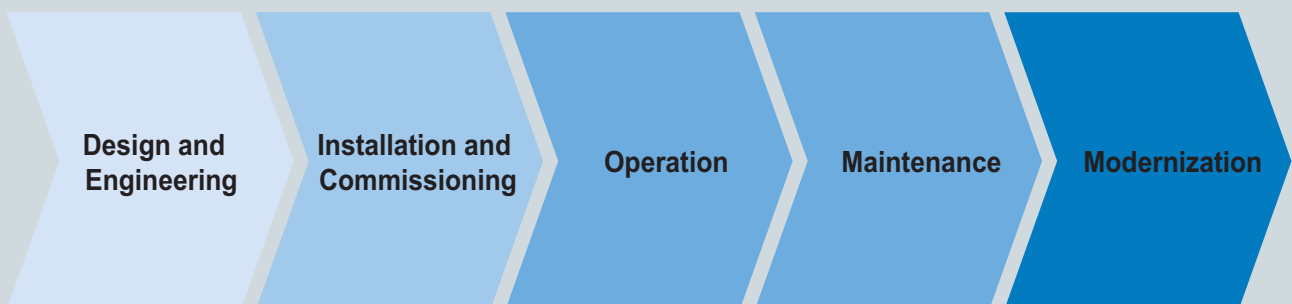
The OpenPCS 7 system interface based on OPC specifications (Openness, Productivity, Collaboration) allows easy exchange of data with higher-level systems for production planning, process data evaluation, and management (OPC clients).

The plant can be operated and monitored via the Internet/intranet using a PCS 7 Web Server. The PCS 7 Web Server collects the data of subordinate OS servers, and makes it globally available for remote monitoring, operation, diagnostics, and maintenance. Web access is subject to the same access protection mechanisms to which the client in the control room is subject.

Hierarchical enterprise communication extends from the management level to the operation/process level and control level to the field level. The following components are integrated in this communication:

- Field devices and analysis devices
- Weighing and dosing systems
- Drives (motor starters, motor circuit breakers, frequency converters)

This means that system diagnostics as well as efficient maintenance with the Maintenance Station are optimally supported for plant level SIMATIC PCS 7 Asset Management.



Reduction of operating costs over the entire life cycle of the plant

Reduction of total cost of ownership through integration

Integration of additional functionality into the process control system

Depending on the process-typical automation or customer-specific requirements the process control system can be functionally extended with additive hardware/software for special automation tasks, for example

- Maintenance Station (Asset Management)
- SIMATIC BATCH (batch process automation)
- SIMATIC Route Control (material transport control)
- Safety Integrated for Process Automation (functional safety)
- Advanced Process Control (APC)
- SIMATIC PCS 7 TeleControl
- SIMATIC PCS 7 LAB (laboratory automation)

All of these additional functions are seamlessly integrated in SIMATIC PCS 7.

A common central Engineering System with a uniform, matched, range of tools for uniform system configuration minimizes configuration effort.

Convenient, system-wide, uniform process visualization facilitates training as well as orientation and enables fast and focused operator intervention in the process operation as needed.

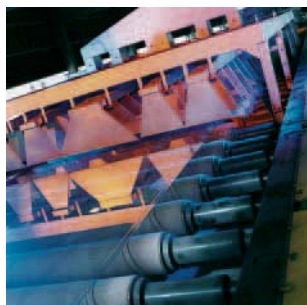
Integration of additional technical standards

SIMATIC PCS 7 is also capable of integrating technical standards that are not anchored in TIA. One example in this regard is the FOUNDATION Fieldbus H1 (FF-H1) that is established in specific industries, and which can be integrated in the control system via PROFIBUS. Hardware configuration and detailed diagnostics of the FF-H1 components are system conformant in this regard. Integration of the FF-H1 components in SIMATIC PCS 7 Asset Management is guaranteed.

Integration of authorized SIMATIC PCS 7 add-on products

Modularity, flexibility, scalability, and the openness of SIMATIC PCS 7 offer optimal prerequisites for integrating supplemental components and solutions in the Process Control System in an applicative manner and thus extend and round out its functionality.

Many supplementary components have been developed by Siemens as well as by external partners as add-ons for the SIMATIC PCS 7 process control system. These hardware and software products authorized by the system manufacturer enable cost-effective implementation of SIMATIC PCS 7 for special automation tasks.



High-performance and quality combined with efficient engineering, reliability, and availability

There is no doubt that perfect interaction of the extremely high-performance and high-quality SIMATIC system components is a major factor in the global success of SIMATIC PCS 7. They are extremely reliable, and can also satisfy increased availability requirements when operated redundantly.

Proof of the high performance, quality and availability of SIMATIC PCS 7 is primarily provided by:

High-performance SIMATIC PCS 7 Industrial Workstations

for systems at the operating and process levels such as Engineering System, Operator System, Maintenance Station, or other systems with modern Intel architecture, fast Core 2-Duo processors, large memory configuration, and excellent graphics for 1 to 4 monitors. All installed components are premium quality, have high MTBF values, and are suitable for 24-hour continuous operation in office and industrial environments at temperatures ranging from 5 to 40 °C.

Broad range of modular and scalable automation systems (controllers)

with finely graduated performance and matched memory capacity, all with outstanding processing speed and excellent communication performance even for high-availability, safety-related, and fault-tolerant applications

High communication performance

- Fast electrical/optical Fast Ethernet and Gigabyte Ethernet networks for plant bus and terminal bus
- Versatile PROFIBUS fieldbus architectures for process and manufacturing production areas:
For connection of sensors/actuators via distributed remote I/Os, or for direct connection of field devices/process devices and instruments including power supply, even in hazardous areas or for high availability and safety

Short engineering and turnaround times

for system-wide uniform hardware and software configuration with the central Engineering System:

- Technology-oriented configuration without requiring special programming skills
- Effective system functions that minimize engineering effort, particularly if there are many similar configuration sequences (bulk engineering)
- System-side support for sharing configuration tasks
- Numerous automatic configuration steps (auto-engineering) as well as compiling and loading in one pass
- Controlled access and change verification
- High-performance version management with version comparison and version history
- Advanced Process Control functions



High performance and high quality



Extremely user-friendly, scalable operator system with numerous functions

with a high level of operational reliability, optional redundancy

- As single-user system for up to 5 000 Process Objects (PO), or as multi-user system with up to 12 servers/server pairs, each with 8 500 POs and up to 32 clients per server/server pair
- Integrated user administration with access control and electronic signature
- Short screen selection and update times (< 2 s)
- Modifiable in running operation, selective redundant server
- High-performance message processing with up to 150 000 configurable messages/alarms per single station/server
- Intelligent alarm management for selecting and filtering relevant messages
- Integrated, high-performance archive system for short-term archival of up to 10 000 archive variables, expandable with long-term archive for up to 120 000 archive variables, also redundant

Compact runtime and complete systems

for subprocesses and autonomous small plants with excellent price/performance ratio – oriented for high processing speed or high availability

Flexible configuration of redundancy at all levels of the control system

SIMATIC PCS 7 supports redundant configurations on the

• Operating/process level

Redundant configurations possible for single-user and multi-user systems. With a multi-user system, up to 32 clients (OS/Batch/Route Control) can access the data of 1 to 12 servers/pairs of servers (OS/Batch/Route Control). In the case of configurations with redundant pairs of servers, the clients are switched over to the backup server in the event of a fault.

The following types of server can also be configured as redundant pairs of servers:

- OS Server
- Central Archive Server (CAS)
- Batch Server
- Route Control Server
- Maintenance Station Server

With regard to availability, ring topologies (especially redundant double rings) should be favored for client-server/ server-server communication (terminal bus) and for plant communication between the systems of the operating/process level and the control level (plant bus).

- **Control level**

Based on the two configuration variants "Single Station" (one CPU) and "Redundancy Station" (two redundant CPUs), the modularity of the fault-tolerant automation systems allows flexible scaling of the availability by means of:

- Double or quadruple (Redundancy Station only) power supply
- Double or quadruple (Redundancy Station only) plant bus communication

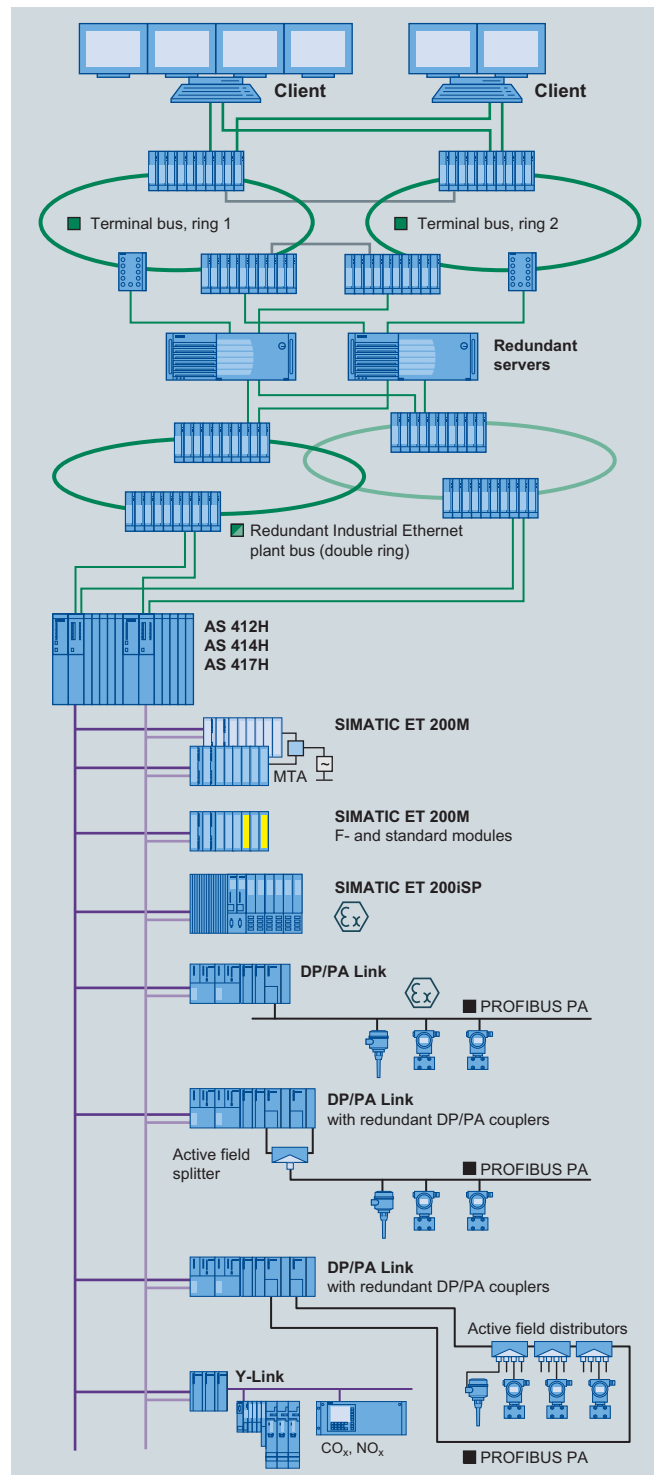
- **Field level**

Various redundant topologies can be implemented at the field level depending on the operating environment (hazardous zone). ET 200M/iSP remote I/O stations or field/process devices directly connected on PROFIBUS PA are connected to fault-tolerant automation systems via redundant PROFIBUS DP networks.

With PROFIBUS PA configurations, the ring topology offers the highest availability and flexibility.

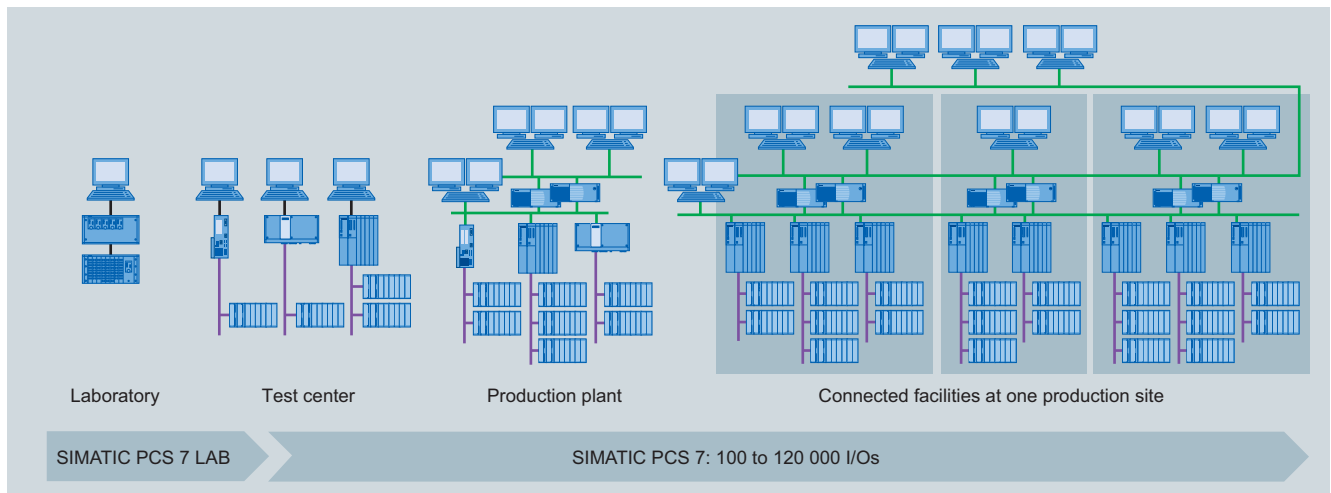
The ET 200M distributed I/O also supports module-granular and channel group-discrete redundancy. A sensor or actuator can be connected to two channels which are distributed on two redundant modules in separate stations.

Flexible Modular Redundancy (FMR) additionally allows separate definition of the degree of redundancy for automation system, fieldbus communication, and I/O. In this way, individual fault-tolerant architectures can be implemented which are precisely tailored to a task and which can tolerate several faults occurring simultaneously.



Redundant configurations at all levels of the control system

Flexibility and scalability – from a small laboratory system to a large plant network



Scalability of the SIMATIC PCS 7 process control system

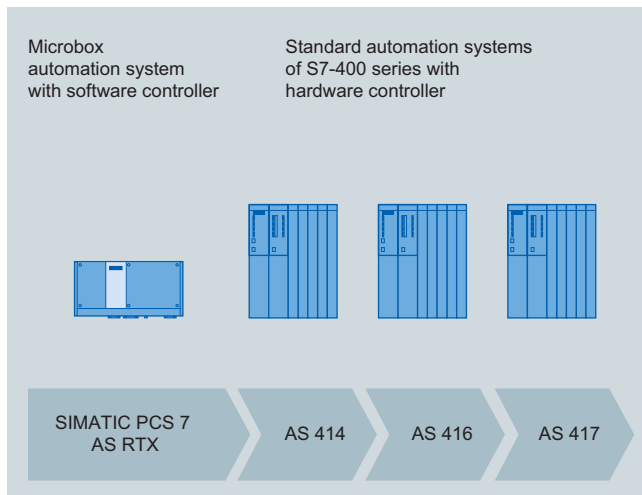
SIMATIC PCS 7 users lastingly profit from a modular system platform based on standard SIMATIC components. Its uniformity enables flexible scaling of hardware and software, as well as perfect interaction within the system, but also perfect interaction beyond system limits.

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. SIMATIC PCS 7 instrumentation and control can be subsequently expanded or reconfigured with ease if there is an increase in capacity or a technological modification. If the plant grows, then SIMATIC PCS 7 simply grows along with it! Provision of expensive reserve capacity is unnecessary.

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:

- 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/plant unit. Thus expensive excess capacity is avoided.

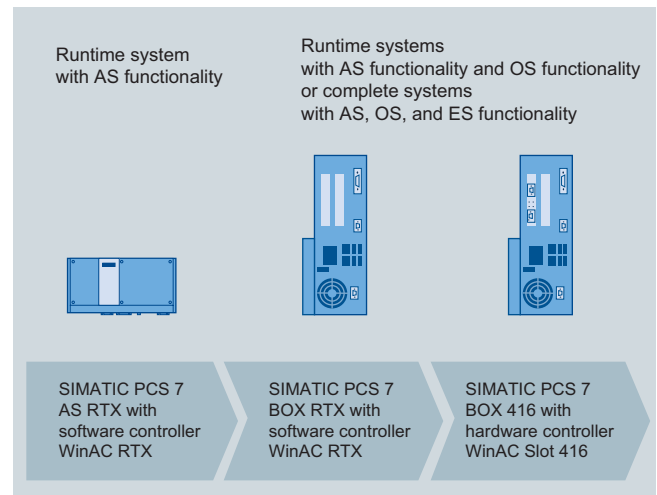


Grading of automation systems according to automation performance

However, scalability means more than just cost advantages in planning, engineering, commissioning, and operation, particularly in the area of service and training. The uniform system-wide engineering for the entire system platform ensures that engineering data once created can be used permanently.

For the automation of subprocesses and autonomous small plants, SIMATIC PCS 7 has several attractive compact systems which can be used at plant level and whose automation performance and functionality are graded as shown:

- SIMATIC PCS 7 AS RTX
- SIMATIC PCS 7 BOX RTX
- SIMATIC PCS 7 BOX 416
- SIMATIC PCS 7 LAB



Grading of compact systems with regard to automation performance and functionality (AS: Automation System, OS: Operator System, ES: Engineering System)

Since the SIMATIC PCS 7 LAB designed for the special requirements of laboratory automation is based on the SIMATIC PCS 7 BOX 416, it is graded analogously.

The compact systems with approx. 60 process tags are at the bottom end of the quantity framework scale of the SIMATIC PCS 7 process control system. This scale extends up to a distributed multi-user system with a client/server architecture and up to 60 000 process tags for automation of a very large production plant or a plant network at a production site. This corresponds approximately to a scale ranging from 100 to 120 000 I/Os.

Protected investment thanks to incremental modernization of Siemens systems and third-party systems

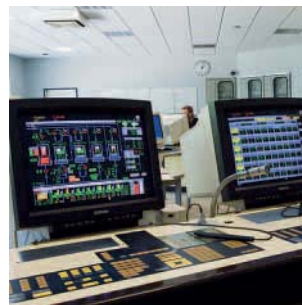
There are a variety of motivating factors for modernizing existing processes and plants. Whether these factors are higher productivity and quality, lower costs, shorter product introduction times, or environmentally compatible production processes and technologies based on optimum use of raw materials and energy: To reach these goals, processes must be optimized and systems and plants must be modernized and extended. A coordinated, incremental modernization strategy ensures that the value of the installed base relative to hardware, application software, and know-how of operating and maintenance personnel is retained and increased.

Siemens therefore offers a wide range of innovative products and solutions for its own control systems for migration to SIMATIC PCS 7, e.g. for

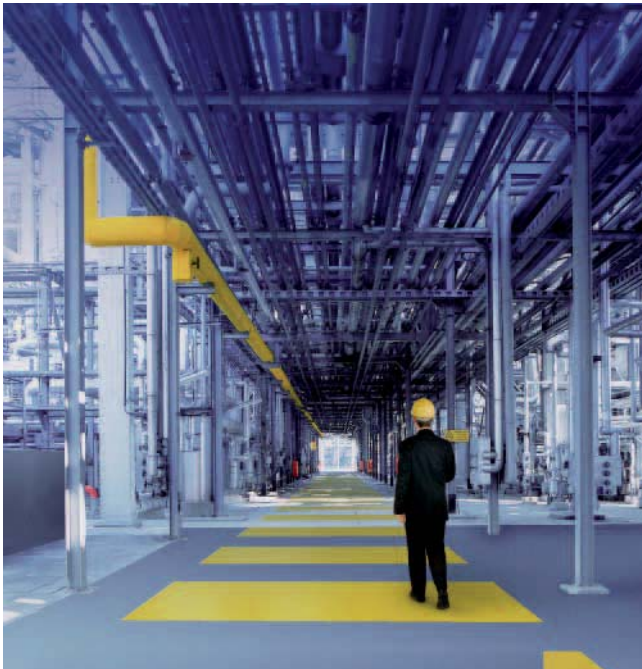
- TELEPERM M
- APACS
- SIMATIC PCS/TISTAR
- OpenPMC

Formative for the Siemens migration strategy is a successive procedure that permits modernization of the installed base without system discontinuity, and if possible without shutting down the plant, and in the process limiting expenditures for new investments. This strategy can be adapted to the special conditions of the respective plant and it is flexible relative to the plant operator's specifications. It is always aimed at maximizing the overall return on assets.

However, that's not all: Building on the Siemens migration portfolio that includes a variety of innovative products, tools, and services that have been proven in practice, migration solutions have also been developed for control systems supplied by other manufacturers, e.g. ABB or Bailey. Thus users of these control systems can also rely on the worldwide leading SIMATIC technology, and they can safeguard their automation technology investments for the future.



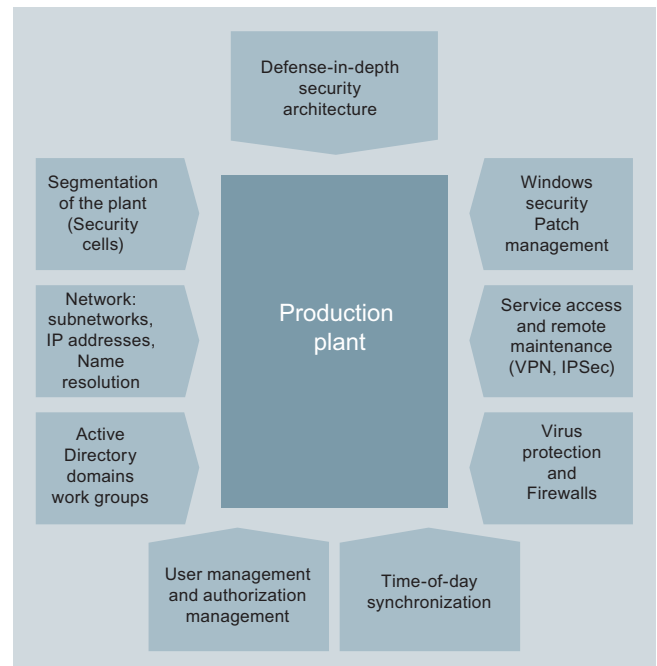
Integrated safety technology and comprehensive IT security for reliable protection of personnel and environment as well as process and plant



In the process industry flammable, highly explosive, or harmful substances and mixtures are often the raw material, intermediate products, or final products of a process. Handling such substances or mixtures requires extreme care and unusual safety measures because plant malfunctions or faults could have fatal effects for personnel and environment, machines, and plants.

Thus the objective of safety technology from Siemens is to neutralize existing hazard potential through technical equipment, or to restrict possible effects to a tolerable minimum. With "Safety Integrated for Process Automation", a comprehensive product and service offering is available for implementation of fault-tolerant applications in the process industry.

Based on the safety-related system from Siemens, "Safety Integrated for Process Automation" offers overall safety-related functionality, from sensors to controllers all the way to actuators.



Hacker attacks, computer viruses, worms, Trojans - these are the negative side effects of the advancing standardization and open, global networking. The hazard potential that this represents for the plant control systems has increased geometrically.

The threats posed by malicious programs or unauthorized persons is not limited to network overloads or failures and theft of passwords or data. Unauthorized process automation intervention and intentional sabotage are conceivable. The possible consequences would not be limited to material damage, but would also pose hazards for personnel and the environment.

To protect against these threats SIMATIC PCS 7 offers a trend-setting concept and comprehensive solutions to safeguard a processing plant, based on a defense-in-depth security architecture. The particularity of 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.

Continuous technological innovations – from the world's leading provider of automation technology



The prerequisite for innovation, and consequently the prerequisite for sustainable economic success is investment in research and development. Siemens is a trendsetter and responds to the challenges of our time such as the economical use of available energy or protection of the environment by developing innovative products and technologies.

Innovations in the Siemens Industry sector particularly underline the trend toward merging of virtual product/production planning and automation. This leads to increased flexibility and allows substantial saving of time and costs for development, market launching and production. The Siemens Industry sector implements research and development projects in affiliations around the world, often in cooperation with universities. In this process the endeavor to satisfy the customer desires in a manner that is as optimal as possible is the driving force.

Siemens increased its revenue for research and development by a further 300 million to a total of 3.4 billion euros in the fiscal year 2007. The Industry sector was the focal point with a share of 49%, i.e. approx. 1.67 billion euros.

In the fiscal year 2007, Siemens registered 8 267 inventions, thus increasing the number from the previous year by seven percent. During the same period, the number of patent applications was also increased by eleven percent to 5 060. This corresponds to an average of 38 inventions and 23 patent applications per working day.

Siemens also lastingly proves its enormous innovation power in that it occupies the top position in the patent statistics for Germany, is number 2 at the European Patent Office, and is one of the top 10 companies in the USA.

The result of this enormous effort is the most modern automation and drive technology product line on the market. Four out of five products are currently less than 5 years old.

Local service and support through a global network of experts and authorized partners



When you choose SIMATIC PCS 7, you have opted for a strong, reliable partner that is at your side with an immense reserve of process automation know-how and experience.

Siemens has established a tight-meshed network of experts to support its process control system customers throughout the world. This network includes system specialists from Siemens as well as highly-qualified external partners who provide first-class service and support in more than 190 countries around the world.

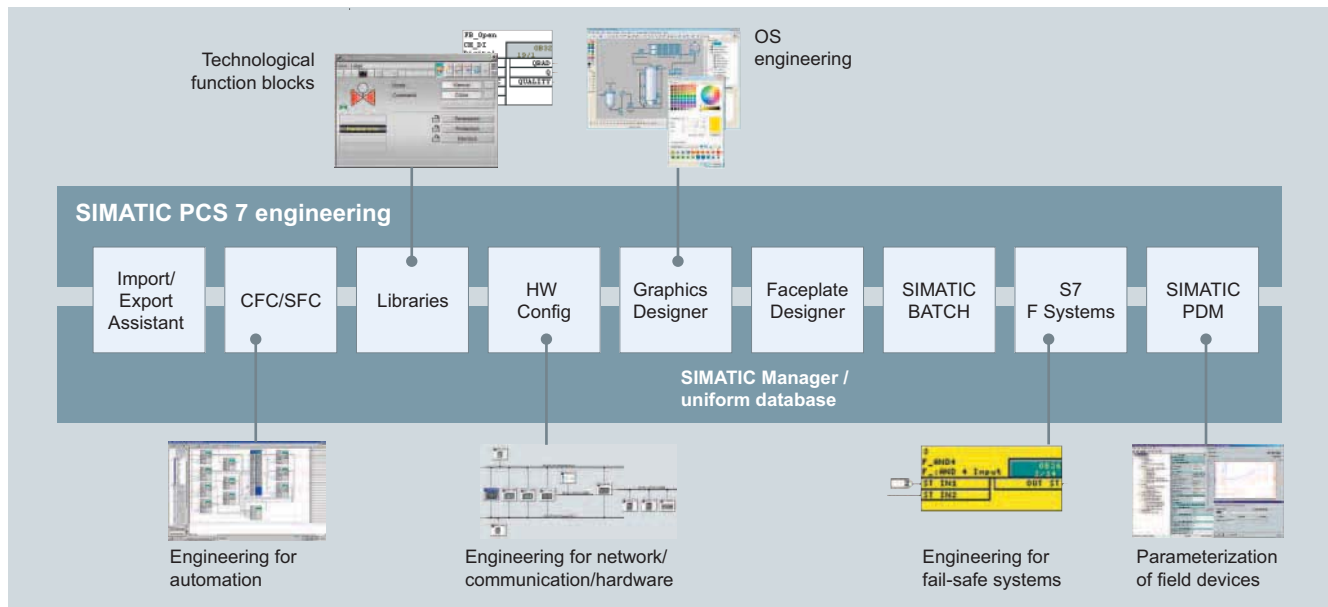
Due to their local presence they are optimally familiar with regional particularities; they are in direct contact with their customers, and they can react very quickly and with flexibility to enquiries from these customers. Their performance offerings are aligned to the overall life cycle of a plant, from planning and configuration, to commissioning and production, to modernization, or shutdown. The differentiated performance spectrum extends from the 24/7 helpline to support for commissioning, maintenance or upgrades, from repair/spare parts service to extensive technical consulting.

Because the field of process control technology is in a constant state of further development, ongoing continuing education is indispensable. This not only applies for our customers, it also applies for system specialists and local partners. This is why Siemens offers professional, target-group oriented training courses at training centers in more than 60 countries, or directly on-site at the plant.

In the close cooperation with partners and system integrators, Siemens sees a key to success in process automation. In order to expand and intensify this collaboration, Siemens has created a Solution Partner program with a bandwidth that is currently unique on the market. Thus outstanding skills in the areas of technology and application are perfectly combined with experience and comprehensive product and system know-how.

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)

The powerful SIMATIC PCS 7 Industrial Workstations in single station or server versions provide an optimum basis for this architecture together with the Windows XP Professional/Server 2003 operating system. 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.

The basis for the license definition and billing unit for the SIMATIC PCS 7 engineering is the number of configurable process objects (PO).

The licensing of the engineering software is oriented toward the following main applications of the engineering system:

- Use as a classic, exclusively engineering station; engineering of unlimited POs (cannot be used for OS productive operation; 2-hour OS test operation possible)
- Use as combined engineering/operator station; scalable engineering and runtime POs

The software licenses of the combined ES/OS station contain the corresponding volume of runtime licenses for AS and OS in addition to the licenses for the engineering. The number of POs can be subsequently increased at any time by means of engineering PowerPacks.

The basic functionality covered by the standard software can be expanded if necessary depending on the project-specific task and its implementation.

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 comprises tools for effective engineering of the following components and functions:

- Control system hardware including I/O and field devices
- Communication networks
- Automation functionality for continuous and batch processes (AS engineering)
- HMI functionality (OS engineering)
- Safety applications (Safety Integrated for Process Automation)
- Diagnostics and asset management functionality
- Batch processes, automated with SIMATIC BATCH
- Material transport, controlled by SIMATIC Route Control
- Cooperation with host CAD/CAE planning tools (import and export of process tags and example solutions).

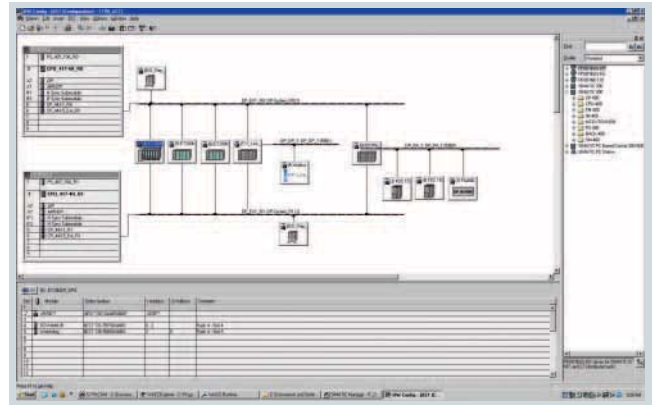
SIMATIC Manager

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 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 configuration tool.

In order to implement the automation logic, predefined function blocks are linked to other blocks in the graphic configuration tool CFC. This is easy to learn and quick to accomplish even by technologists without any programming experience.

Standardized function blocks (process tag types) are available for typical devices/components in an I&C library. The planning engineer need only select the predefined blocks, position them in the working area, link them graphically, and assign parameters.



Component view: hardware configuration with HW Config

Particularly with large projects, significant rationalization effects can be achieved through multiple application of standardized process tags and example solutions using the import/export assistant for data exchange with host planning systems and functions such as "Extended rename".

The uniform database of the engineering system guarantees that data which have been entered once are available system-wide.

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 turnaround times result in short waiting times for the commissioning engineer and have a positive impact on the commissioning costs. Changes to the configuration which are relevant to automation systems can be debugged in a test system before being downloaded into the target system of the running plant.

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

Engineering software

Hierarchy	Chart	Block	Block comm.	I/O name	I/O comment	Process tag	Value	Unit	Interconnection	Add fencing	Fencing	Fencing value
Prod_ModelPlantT101\Transfer	VA102	V	Single Drive	TIME_MON	Monitoring Time [s]		10.0	s		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LSH101	INPUT_LSH	Digital Input	MODE	Quality and mode		16800000203			<input type="checkbox"/>	<input type="checkbox"/>	16800000000
Prod_ModelPlantT101\LEVEL	LSH101	INPUT_LSH	Digital Input	LAST_ON	Tenable last valid value		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LSH101	LSH	Monitor a.b.	MSG_CLAS	Message class of signal		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	VHRANGE	High range of process value		6500.0			<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	VLRANGE	Low range of process value		0.0			<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	SIM_ON	1-activate simulation				Simulation	<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	SIM_V	Simulation value				Baghouse\SIMU_SW_SIMIT25_OUT	<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	LAST_ON	Tenable last valid value		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	SUBS_V	Tenable failure substitution		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LI102	INPUT	Analog Input	SUBS_V	Substitution value		0.0			<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	MO_PVHR	High Limit Bar Range	M MO_PVHR	6000.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	MO_PVLR	Low Limit Bar Range	M MO_PVLR	-10.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	U	Analog Input (Measured Value)	M U		L	Prod_ModelPlantT101\LEVEL\LI102\INPUT_V	<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	U_AH	HI Alarm Limit		1000.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	U_WH	HI Alarm Limit (warning)		980.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	U_WL	LL Alarm Limit (warning)		5.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LI102	M	Meas. value	U_AL	LL Alarm Limit		-10.0	L		<input type="checkbox"/>	<input type="checkbox"/>	0.0
Prod_ModelPlantT101\LEVEL	LSL103	INPUT_LSL	Digital Input	MODE	Quality and mode		16800000203			<input type="checkbox"/>	<input type="checkbox"/>	16800000000
Prod_ModelPlantT101\LEVEL	LSL103	INPUT_LSL	Digital Input	LAST_ON	Tenable last valid value		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\LEVEL	LSL103	LSL	Monitor a.b.	MSG_CLAS	Message class of signal		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\DRAIN	VA101	FB_CLOSE	Digital Input	MODE	Quality and mode		16800000203			<input type="checkbox"/>	<input type="checkbox"/>	16800000000
Prod_ModelPlantT101\DRAIN	VA101	FB_CLOSE	Digital Input	LAST_ON	Tenable last valid value		0			<input type="checkbox"/>	<input type="checkbox"/>	0
Prod_ModelPlantT101\DRAIN	VA101	FB_OPEN	Digital Input	MODE	Quality and mode		16800000203			<input type="checkbox"/>	<input type="checkbox"/>	16800000000

Process tags in the process object view

Process object view

The process object view of the SIMATIC Manager supports the work carried out by a process engineer by providing a universal view of the process tag. It shows the technological hierarchy of the plant (presented in tree form) in combination with a tabular view of all aspects of the process tag/object (general data, blocks, parameters, signals, messages, image objects, archive variables, hierarchy folders, equipment properties and global declarations). This provides the technologist with fast orientation.

All objects in the marked branch of the hierarchy are displayed in the table so that they can be directly processed with user-friendly edit, filter, replace, import and export functions.

A special test mode offers the facility for testing process tags and CFCs online and for starting them up.

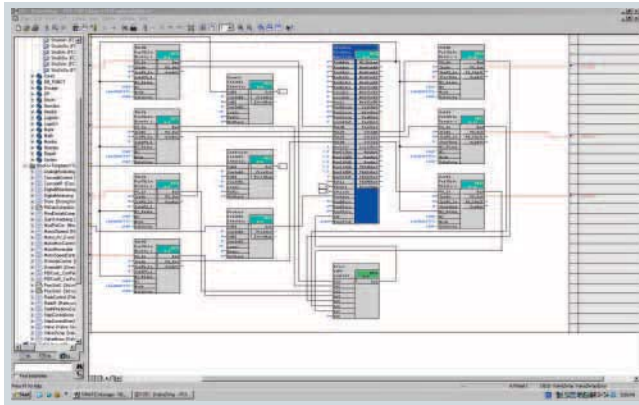
The OS areas and the image hierarchy for process control, as well as the SIMATIC PCS 7 asset management, can be derived from the technological hierarchy. Furthermore, this also forms the basis for plant-oriented identification of process objects.

Group displays can be positioned in pictures by means of the image hierarchy, and automatically linked to subordinate images. The configuration engineer only has to ensure the correct positioning. Since the number of group display fields and their semantics can be configured, it is also possible to implement customized alarm configurations.

Using the process object view, "Smart Alarm Hiding" can also be configured. This refers to the dynamic hiding of alarms that, under certain plant conditions, are of less importance to the safe and interference-free operation of the plant. Depending on the operating status of a plant unit (startup, service, etc.), messages of the technological blocks grouped in this plant unit are shown or hidden according to the preceding configuration. By checking various option boxes in the alarm matrix of the process object view, you can define the show/hide status of the alarms individually for as many as 32 operating states. Although hidden alarms are not signaled visually and audibly, they are still logged and archived as before.

Continuous Function Chart (CFC)

The CFC editor is the tool for graphical configuration and commissioning of continuous automation functions. Pre-engineered function blocks can be positioned, configured and interconnected within CFCs with the support of powerful autorouting and integral configuration of HMI messages. Special configuration techniques such as chart-in-chart for implementing hierarchical plans or the multiple usage of chart block types (chart compiled as block type) or SFC types (standardized sequential controls) in the form of instances offer an additional rationalization potential.



Continuous Function Chart

When creating a new CFC, a new runtime group with the same name as the chart is created. All the blocks that are subsequently entered in the chart are automatically added to this runtime group. Each block is therefore already assigned runtime properties when inserting, and configuration engineers can optimize these properties by means of modifications in the runtime editor or by using algorithms.

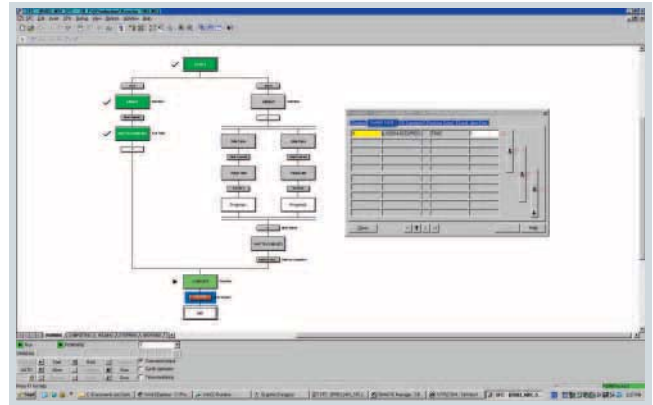
The algorithm first determines the optimum block sequence separately for each runtime group, and then the optimum sequence of runtime groups.

In addition to convenient editing functions, the scope of CFC functions also includes powerful test and commissioning functions as well as individually configurable documentation functions.

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.



Sequential Function Chart

SFC

The SFC can be used to implement sequential controls which can be applied once and which access several partial areas of the production plant.

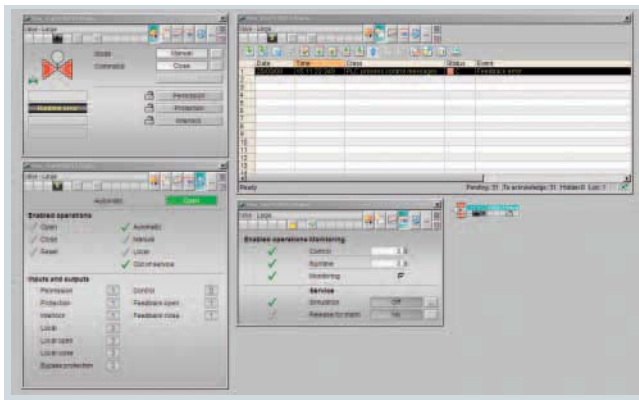
Each SFC contains standardized inputs and outputs for status information and for control by the user program or the user. The SFC can be positioned and linked as a block in the CFC. The required CFC block connections are selected by simple operations and connected to the steps or transitions of the step sequences.

A status manager conforming to ISA-88 enables the configuration of up to 8 separate sequences within a single SFC, e.g. for states such as HOLDING or ABORTING, for SAFE STATE, 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 plan. 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 symbols", a block symbol is automatically positioned and interconnected in the associated process display for all SFC instances with HMI features.

Engineering software



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

Process Control Libraries

Preconfigured and tested blocks, faceplates and symbols are organized in I&C libraries and form the basic elements for the graphic configuration of automation solutions. The use of these library elements plays a major role in minimizing the engineering input and project costs. Two I&C libraries are integrated in the standard engineering software of SIMATIC PCS 7:

- SIMATIC PCS 7 Standard Library
- Advanced Process Library

The comprehensive range of blocks of these two libraries 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 and 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

Advanced Process Library

The Advanced Process Library (APL) is a further development of the SIMATIC PCS 7 Standard Library, based on the extensive experience of planning engineers and plant operators, and taking into account current NAMUR recommendations and PI specifications. New and improved functionalities as well as visually attractive GUIs for a high level of operator convenience facilitate and also force interaction of operators with the plant. Some examples include:

- New operating modes:
 - "Local" for integration and application of local control options
 - "Out of service" for deactivating a process tag for maintenance and service
- New faceplate views:
 - "Preview" with status information on the I/O signals, the automatic control, and possible/permissible operator inputs
 - "Memo view" for temporary information from operating personnel
- Convenient interlocking blocks with initial signal information, can be directly called from the technological function blocks (e.g. from a motor block)
- Improved protection against maloperations as result of additional grading of user privileges
- Flexible adaptation of functions in the library blocks
- Commissioning support through direct simulation on the operator station

Graphics designer and faceplate designer

The project data for engineering of the operator systems are 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 is available for the generation of process displays.

In addition to the standard faceplates, the faceplate designer can be used to generate customized faceplates for operation and monitoring of process tags or plant components. Block symbols can be conveniently interconnected to process tags using drag & drop.



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, plans 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. A CFC plan 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 plant units copied into another project for editing, cross-project interconnections, typically e.g. for interlocks, become text-based interconnections. When merging, text-based interconnections – even ones which you have entered yourself – 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 in the current project and also automatically in all other projects. It cannot be modified there, but objects can be inserted. All block types used in a multiproject can also 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.

Engineering software

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.

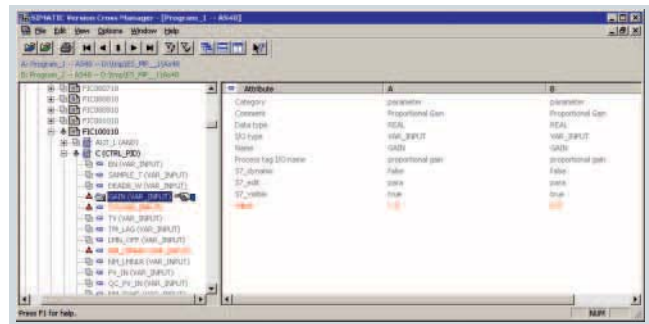
With SIMATIC Logon, the administrator can divide users into groups with different access rights and control the access to data in this way. Configurable modification reports allow the recording of all access operations to the engineering system as well as all online changes concerning the automation 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 at what exact time this was done. This is a great help when complying with special sector-specific requirements such as 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, technological 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 technological hierarchy of the plant
- Color-coded identification of the differences



Comparison of project versions using the Version Cross Manager

Data exchange with planning tools

With the aid of the Version Cross Manager, data can also be exchanged with planning tools (CAx data). It supports the following exchange functions:

- Export of CAx relevant data, e.g. global declarations, technological hierarchy, or tags
- Export of files in SIMATIC XML format (SML)
- Import of CAx data that exists in SIMATIC XML format

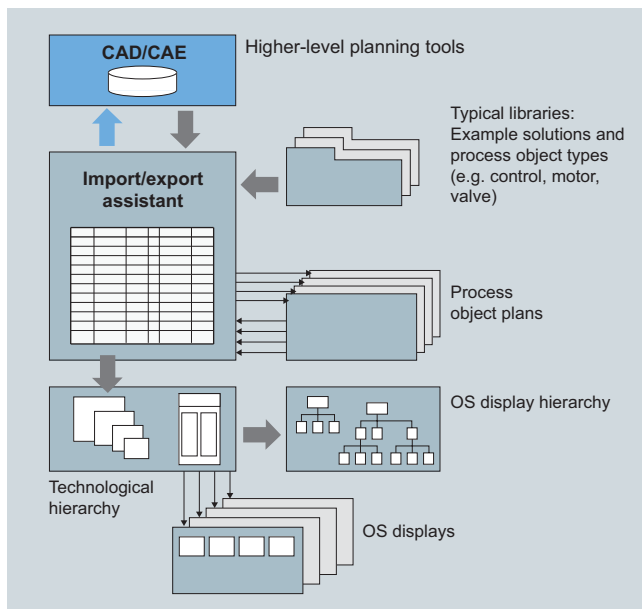
Version Trail

The SIMATIC Version Trail which operates together with SIMATIC Logon is suitable for version assignment of libraries, projects and multiprojects.

During archiving, SIMATIC Version Trail creates a version history with the following information:

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

This version history can be displayed and printed. Individual versions can be retrieved from the version history, and used further. SIMATIC Logon organizes the access protection.



Processing of mass data using the import/export assistant

Efficient processing of mass data

Import/Export Assistant

The import/export assistant (IEA) is an efficient tool for rational engineering of mass data. It is based on the multiple application of process tag types and example solutions, and is particularly suitable for large plants with many identical process tags or with several plant components of the same type. Plant data which have already been configured (such as process tag lists or charts from the CAD/CAE world) can be imported into the engineering system and used for automatic generation of process tags. The data of the host planning system can be subsequently matched with the parameters optimized during commissioning.

To permit simple and fast modification, the PCS 7 projects can also be exported, the data processed using the IEA editor or other programs (e.g. Microsoft Excel or Access), and subsequently reimported.

Application area of the import/export assistant

- Importing of previously configured plant data, e.g. process tag list, from the host CAD/CAE world
- Automatic, reproducible generation of process tags and copies on the basis of the imported process tag lists and example solutions
- Automatic derivation of the OS display hierarchy, interconnecting of blocks and positioning in displays
- Commissioning of individual process tags with the user-friendly CFC and SFC graphic tools
- Exporting of parameters optimized during commissioning back to the CAD/CAE world provides consistent data in host planning tools

Extended rename

When renaming objects, links affecting the visualization (image objects or variables in archives and scripts) are also changed accordingly. This function offers an enormous rationalization potential, especially for plants with repeated structures or plants requiring validation.

For example, if a completely configured and tested plant section is copied together with all charts, sequential controls and images, and if the copied charts/images are subsequently renamed, all internal connections are automatically adapted. In this manner, complex plant sections or complete production lines can be reproduced in the shortest possible time.

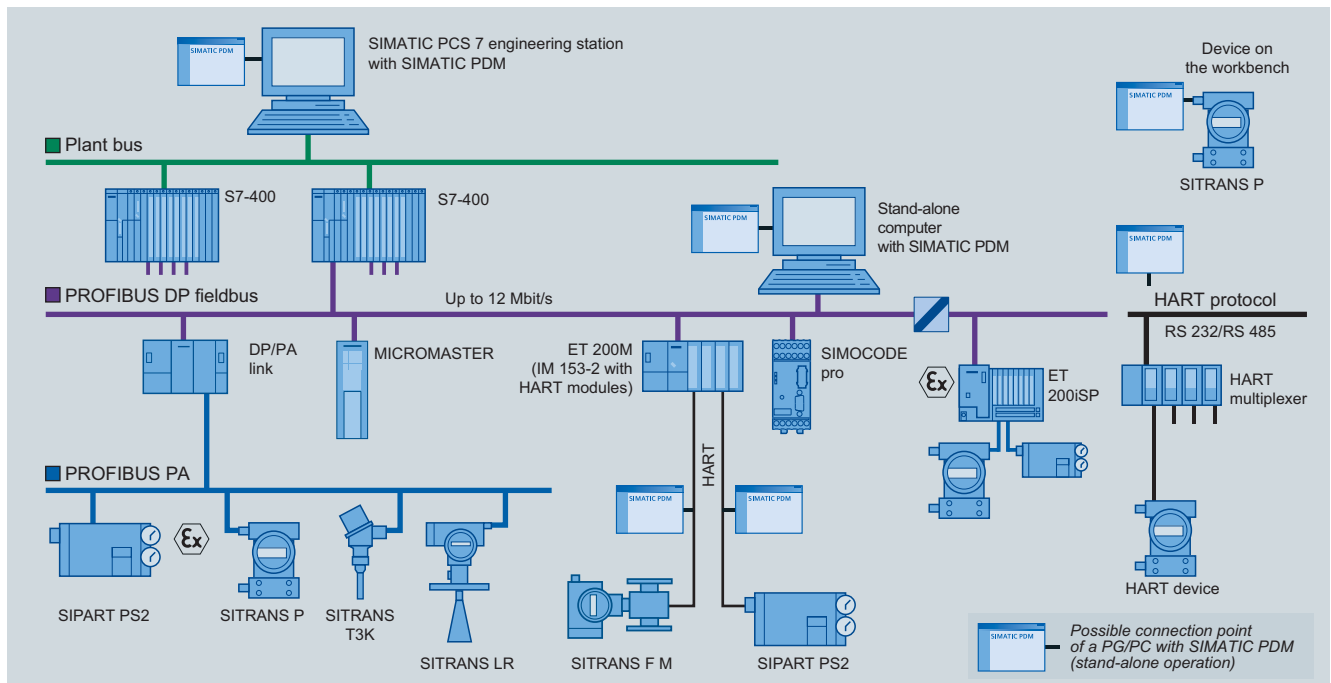
Project documentation

The integral reporting system can be used to document the engineering project in accordance with standards. The project report comprises:

- Mimic diagrams and image objects with properties, events, actions, and direct links
- Tags, 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.

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 one software, SIMATIC PDM enables the processing of more than 1 300 devices from Siemens and over 120 vendors worldwide on one homogeneous GUI. 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 easily integrated in SIMATIC PDM at any time by importing their device descriptions (EDD). This provides security and saves investment, training and consequential costs.

SIMATIC PDM is integrated in the asset management. The Process Device Manager provides wider information for all devices described by the Electronic Device Description (EDD), e.g. detailed diagnostics information (vendor information, information on fault diagnostics and troubleshooting, further documentation), modification logbook (audit trail) and parameter information.

Possible applications

- Integrated in the SIMATIC PCS 7 engineering system
- Stand-alone as a service tool on mobile PCs

Core functions

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

Engineering System highlights

- Central hardware and software configuration which is uniform throughout the system through use of one engineering system
 - User-friendly GUI
 - Configurable modification reports
 - Parameterization of communication without complex configuring
 - Same configuration for redundant and non-redundant plants
 - Integrated configuration for field devices and safety-related applications
- Integral user administration with access control
- Central dialog for compilation and loading of all AS, OS and SIMATIC BATCH modifications
 - Optimization of all steps and summary in a dialog with sequence control
 - Compilation and loading in one run with minimum turnaround times
- Online loading of selective configuration modifications into the corresponding system components
- Technology-oriented configuration without requiring special programming skills
 - Functional hierarchy with up to 8 levels, organized according to plants, plant sections and technical equipment
 - Hardware-independent engineering: AS assignment and I/O modules can be subsequently selected
 - Area-oriented OS compilation and loading of the server-relevant data
 - Expandable on industry-specific basis using standard data exchange interfaces
- Process object view for display and processing of all aspects of process tags/objects
 - Convenient editing in tables
 - Project library with process tag types and import/export functions
 - Online mode for testing and commissioning of process tags and CFCs
- Shared configuration tasks: Concurrent Engineering or Multiproject Engineering with Branch & Merge
- Customized alarm configuration through free configuration of up to 8 group display fields
- Configuration-dependent hiding of alarms for specific operating states
- Configurable archive variables (archiving, long-term archiving, no archiving)
- Special SFC functionalities
 - SFC type: standardized sequential control for multiple use, application of SFC instances as block in the CFC
 - SFC for sequential controls for single use, also with chart I/Os
 - Status management conforming to ISA-88 for configuration of separate sequences for statuses such as HOLDING, ABORTING or SAFE STATE
- Advanced Process Control functions with integrated blocks and templates
- Reduction in engineering and validation overhead through:
 - Libraries with predefined, standard blocks, faceplates, and symbols: PCS 7 Standard Library and Advanced Process Library
 - Pre-assembled charts from the library
 - Project library for process tag types with import/export function in the process object view
 - Simple duplication of plant sections by copying, renaming and compilation
 - Type-instance concept with central modification option for all instances
 - Import/export assistant for mass data configuration (bulk engineering)
 - Central updating of all block types used in a multi-project
 - Numerous automatic configuration steps (Auto Engineering)
 - Data exchange with planning tools
- High-performance version management with version comparison and version history
- Identification of MIS/MES-relevant information for interfacing to SIMATIC IT
- Automatic generation of diagnostics displays for the maintenance station on the basis of the project data

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 multi-user 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.

The SIMATIC PCS 7 Industrial Workstations are characterized by powerful PC technology combined with the Microsoft Windows XP Professional or Server 2003 operating system. They can be used in harsh industrial environments or also in offices.

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 in the OS single station or in the OS client permits the user-friendly control of several plant areas from one operator station.

The system software of the operator stations is scalable, based on the number of process objects (PO):

Number of process objects	250	1 000	2 000	3 000	5 000	8 500
- Per OS single station	●	●	●	●	●	
- Per OS server of a client/server system	●	●	●	●	●	●

Within the defined limits, the number of POs can be increased by means of PowerPacks to allow for higher requirements or system expansions.

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. This OS single station can be operated on the plant bus together with other single-user systems or in parallel with a multi-user system. Redundant operation of two OS single stations is also possible (SIMATIC PCS 7 Single Station Redundancy).

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

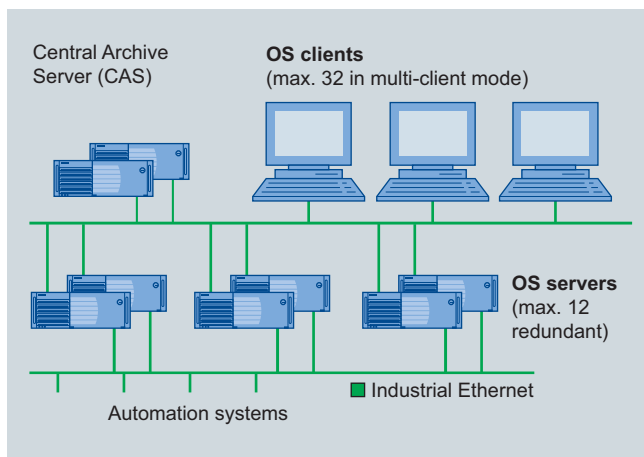
- CP 1613 A2/CP 1623 communications processor for communication with a maximum of 64 automation systems of any type
- Simple 10/100/1000 Mbit/s Ethernet network card and Basic Communication Ethernet for communication with up to 8 automation systems (single stations)

A 10/100/1000 Mbit/s Ethernet RJ45 port is also integrated onboard for use as desired.

Multi-user system with client/server architecture

A multi-user system consists of operator terminals (OS clients) which receive data (project data, process values, archives, alarms and messages) from one or more OS servers over 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.



Multi-user system with client/server architecture

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 multi-user 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 multi-user system. This means that process graphics on one OS server can also be linked with variables on other OS servers (area-independent displays).

Like the OS single stations, the OS servers can be connected to the plant bus using a CP 1613 A2/CP 1623 communications processor or a simple Ethernet network card. A 10/100/1000 Mbit/s Ethernet RJ45 port is integrated onboard and can be used for connecting to the terminal bus.

Performance and technical specifications

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.

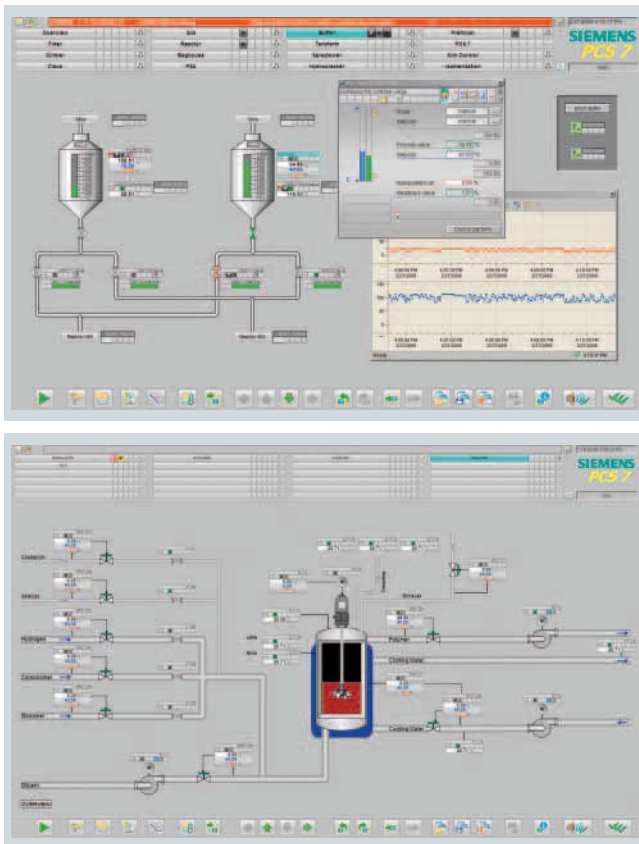
Operator system	
Max. number of OS servers/pairs of servers	12
Max. number of automation systems per OS server/pair of servers	64
Max. number of OS clients in multi-client mode ¹⁾ (per multi-user system)	32
Max. number of monitors per operator station with multi-channel operation	4
Max. number of OS 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 multi-user 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
Long-term archiving	
■ Process data archiving with StoragePlus	Process data from up to 4 single stations, servers or pairs of servers Approx. 1 000/s Approx. 1 600/s
- Process data of one server	
- Process data of all servers	
■ Process data archiving with Central Archive Server CAS	Process data from up to 11 servers/pairs of servers Approx. 1 000/s Approx. 10 000/s
- Process data of one server	
- Process data of all servers	

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

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 plant unit

OS software



Examples of OS process control, at top with freely-positionable windows

Graphical user interface

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 plant, 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

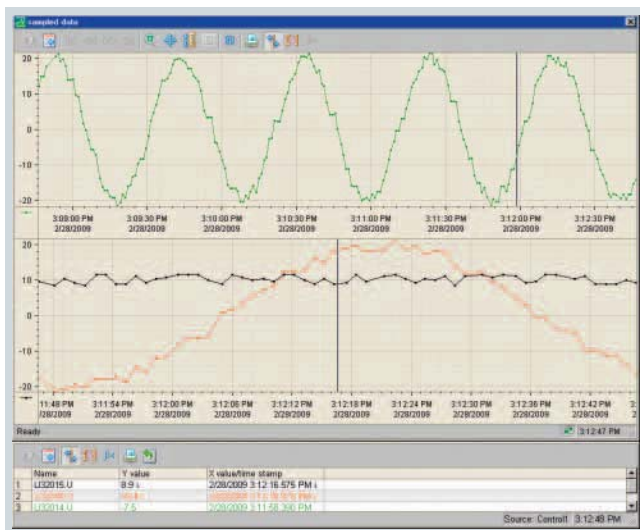
Based on this, the operator can combine and save individual image compositions, and recall them later.

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 image 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 from the I&C libraries: PCS 7 Standard Library and Advanced Process Library



Trend window on the operator station

TrendControls for table displays and trend views

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
- Options for adaptation during runtime:
 - Shifting, showing and hiding columns
 - Modification of time data
 - Manual modification of values, and archiving of modified values

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 curves
- Individual configuration of styles and colors, possibly with value-dependent change in color
- Grid lines and rulers for improvement of readability
- Curves can be grouped in one window with common time and value axes
- Several curves windows can be linked for comparison purposes (common time axis, zoom, scroll bar and ruler)
- Options for adaptation during runtime:
 - Enlarging of window section
 - Shifting of section along the time and value axis
 - Shifting, showing and hiding of time and value axes of individual curves
 - Showing/hiding of curve, and fetching into foreground
 - Changing the displayed time interval

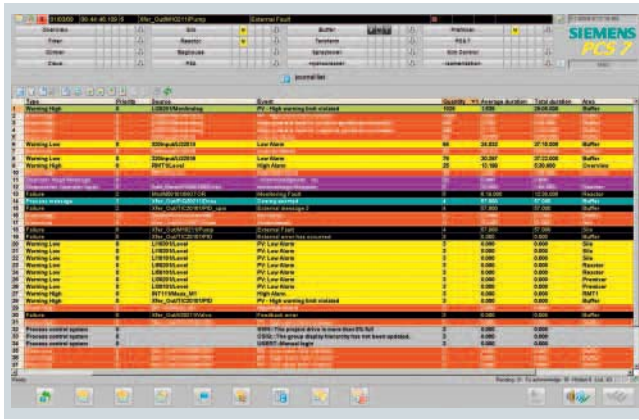
Function window

- 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 curve
- Optional consideration of setpoint curves from user archives
- Properties, functions and configuration options largely identical to trend window

Ruler window

TrendControls can also be combined with a ruler window. It shows additional information in three views depending on the selection of a time or time range in the trend/table window using rulers:

- Coordinate window with X and Y coordinates of the curve points at the points of intersection of the rulers
- Statistics range window with the values in the selected range
- Statistics window with statistical information on the selected range: minimum, maximum, average, standard deviation, integral



Message view of operator station

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

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 can be selected by the operator in the toolbar. They have an integral scrolling function, and display:

- Each message in a message line
- Message state and color according to the configured message class (e.g. fault requiring acknowledgment) and message type (e.g. alarm or warning)
- Selected message blocks, each in a separate column:
 - System blocks: System data such as date and time, priority, triggering CPU/station, user name, loop-in-alarm, message state (arrived/exited), acknowledgment status (acknowledged/not yet acknowledged, duration from "arrived" to "exited/acknowledged")
 - Process value blocks: Current process value at time of message, e.g. temperature
 - User text blocks: 255 characters of text, e.g. message text with fault location and cause of malfunction
- Status and information text represented as symbol

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.

Operators can individually adapt the AlarmControl function during runtime 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, and save the settings globally or user-specific. 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

After a power failure, the last messages (e.g. 60) 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 is reconstructed.

With large quantity frameworks and a high number of messages, the following measures can be used to noticeably reduce the operator workload by reducing the relevant messages and improving transparency:

- Visual and audible hiding of messages which are of reduced importance in certain situations for the safe and fault-free operation of the plant, e.g. operating messages (logging and archiving are not influenced):
 - Dynamically, i.e. 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 and enabling of messages from an individual process tag or all process tags of the display/area by the operator in the event of faults on a sensor/actuator or during commissioning (recording of blocking and enabling in the operator activity log)

The "Loop-in-alarm" and "Select display using process tag" functions support the quick evaluation and elimination of faults. Using "Loop-in-alarm", the operator can jump directly from a message selected in the message window to the mimic diagram with the object which caused the fault, and can then call up the associated faceplate (loop display) through the process tag whose block symbol is colored (cyan). The faceplate window (loop display) 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.

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:

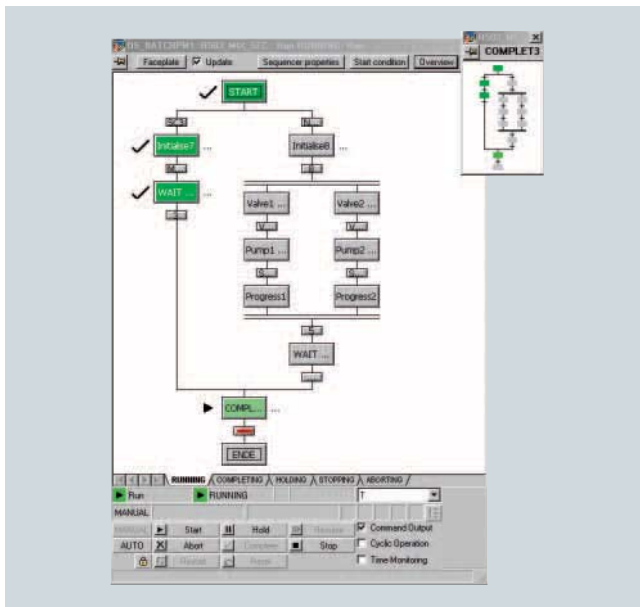
- Message sequence log
- Message and archive log
- Measured value log
- Operator activity log
- System message log
- User log

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 log objects are categorized as follows:

- Higher-level log objects, e.g.
 - Static objects (circle, rectangle, etc.)
 - Dynamic objects that are assigned current values during output
 - System objects (date/time, project name, etc.)
 - Special runtime log objects
- OS-specific log objects, e.g.:
 - Control objects (windows for messages, tables, trends, functions, and user data)
 - Current value of a process tag
 - Contents of user archives
 - Embedded layout
 - Hardcopy
- Log objects for integration of external data, e.g.:
 - CSV provider (CSV data as table or curve)
 - ODBC data source (field as text or table)
 - COM provider (COM objects as text, table or image)

The current data of the log defined in the page layout is output 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-controlled or event-controlled. Operators are able to scan the status of the print jobs online.



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.

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. In addition, SIMATIC Logon offers the "electronic signature" function.

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.

Operator system highlights

- Flexible, modular architecture with scalable hardware and software components for single-user and multi-user systems
- Powerful operator stations based on standard PC technology, can be used in office and industrial environments
- Client/server multi-user 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
- High-performance archiving system with short-term archives and integral archive backup, optionally with long-term archiving via StoragePlus/CAS
- 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
- User-friendly process control and high operational reliability
- Highly effective alarm management to offload operators
 - 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
- Central user management, access control, electronic signature
- Sign-of-life monitoring for subordinate systems connected to the plant bus

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.

OS archiving

An integral component of the OS software of OS single stations and OS servers is a high-performance archiving system that is configurable at runtime for the short-term archiving based on the Microsoft SQL server technology. It is used for recording process data (typical period of between 1 and 4 weeks) and alarms/events (typical period 2 months) in short-term archives.

Subject to time or event control, data – as well as OS reports and batch data from SIMATIC BATCH – can be swapped out of the short-term archive to a long-term archive.

Two alternatives with different features are available for the OS long-term archiving:

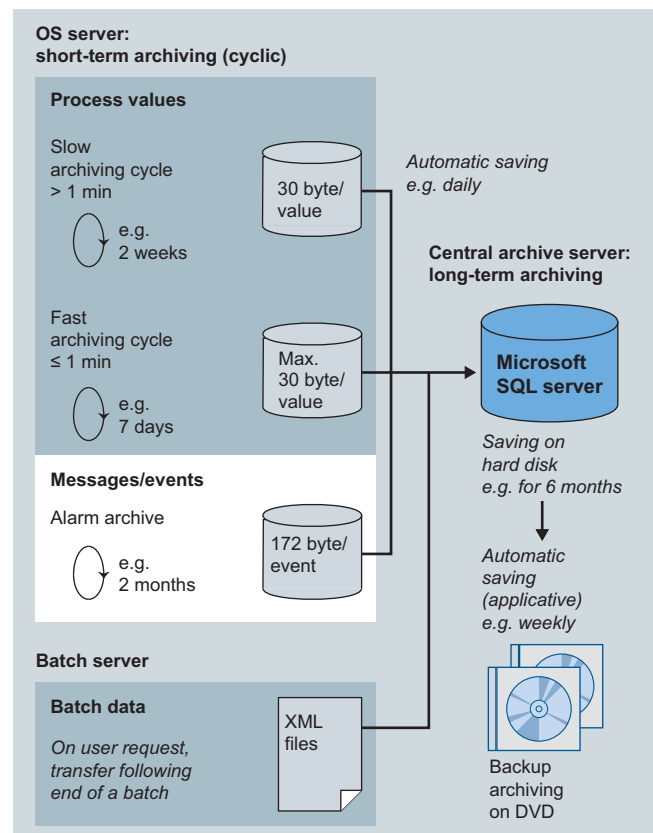
- **StoragePlus**
More economical version for the lower performance range; for the archiving of about 1 600 values/s from as many as four single stations, servers or pairs of servers
- **Central Archive Server (CAS)**
High-performance version for archiving about 10 000 values/s from as many as 11 servers or pairs of servers

During long-term archiving with StoragePlus, the archived data can be visualized by means of the StoragePlus viewer.

The operator can display the data swapped out to the central archive server directly on the OS clients or with the StoragePlus viewer of the CAS.

For both long-term archiving systems, data selection is supported by integral filter functions. Alarms and process data can be shown in table form, and process data also in graphic form. Tables of process data can be exported in CSV format for processing in other Windows applications, e.g. Microsoft Excel.

The archive tags defined as a common billing unit for short-term and CAS long-term archiving are available in the form of cumulative count relevant licenses "SIMATIC PCS 7 Archive". If no CAS is used, these archive licenses are installed on the OS single stations and OS servers of the plant. Otherwise they are only installed on the CAS, from whose tag inventory the OS single stations and OS server "debit" their archive tags. The short-term archive is limited to 10 000 archive tags, while the CAS long-term archive is limited to 120 000 archive tags.



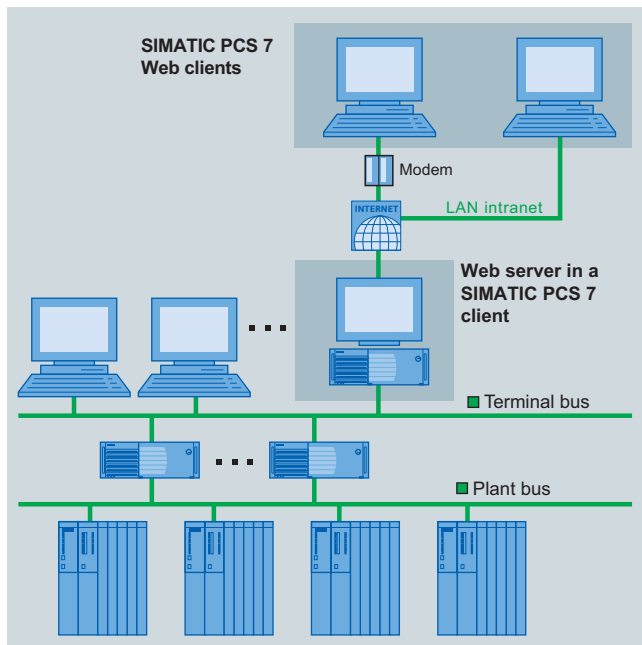
OS archiving

The SIMATIC PCS 7 Industrial Workstations are the hardware platforms for the StoragePlus computer and the central archive server. Both are nodes on the terminal bus and have no connection to the plant bus.

The central archive server can also have a redundant design. This increases the availability of the long-term data that are accessible from the OS clients or the OpenPCS 7 station. SIMATIC BATCH currently does not yet archive the batch data on both CAS systems. Through automatic archive synchronization, however, the batch data is available after archiving to both CAS systems.

With the aid of additional hardware and software for the corresponding operating system, e.g. with a DVD writer and appropriate software, the data managed in StoragePlus and in the central archive server can be backed up on commercially available storage media (e.g. DVDs).

Operation and monitoring via World Wide Web



PCS 7 Web Server for operator control and monitoring via the web

The PCS 7 Web Server based on the Microsoft Windows Server 2003 operating system permits operation and monitoring of a plant via intranet/Internet. The PCS 7 Web Server uses the mechanisms of a multi-client for accessing the subordinate OS servers, and makes the project data globally available via intranet/Internet. For this purpose it uses the Web View Publisher to convert mimic diagrams and scripts into a form suitable for display with the Internet Explorer.

When carrying out operation and monitoring via the World Wide Web, the operator can access project data made available by the SIMATIC PCS 7 Web Server via the web client. The web client uses Internet Explorer and plug-ins which can be installed via the World Wide Web.

Using a web client, the plant can be operated in the same manner as with an OS client. The user must log on to the web client in the same way as an OS client and the rules for assigning rights are also identical. The input operations made on the web client are recorded in the OS operating log.

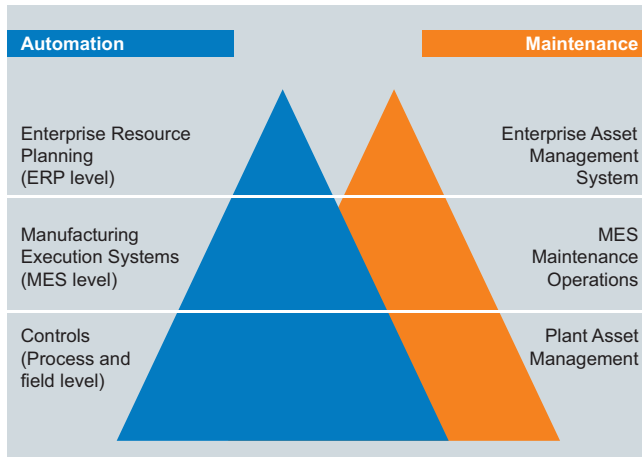
With regard to licensing, a distinction is made between the following constellations:

- **Standard**
Up to 50 web clients access the data of a SIMATIC PCS 7 Web Server over the intranet/Internet. The server license required for this is scalable for 3, 10, 25 or 50 web clients.
- **Diagnostics**
One or only a few web clients have access to several SIMATIC PCS 7 Web Servers/single-user systems for remote operation, diagnostics or monitoring. Each system involved requires a PCS 7 Web diagnostics license (server/client).

The integrated OS user management guarantees a high level of security when the PCS 7 Web Server accesses the OS servers. Corresponding to the safety requirements of the plant, further extensive protective measures can be implemented according to the SIMATIC PCS 7 safety concept.

Maintenance Station

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 or control loops (passive or indirect assets) – represented by proxy objects in which the diagnostics rules are stored

Typical maintenance cycle

A typical maintenance cycle has the following actions:

- **Monitoring of the status of a component or device:**
 - Recording of diagnostic information via network components and PC basic devices per OPC SNMP coupling
 - Intelligent sensors detect and signal impending failures long before the actual failure
- **Signaling of "maintenance requirement" in:**
 - Group display
 - Symbol graphics of affected components/devices, e.g. of a sensor
 - Alarm log
- **Navigation to component/device with "maintenance requirement", and information on specific data such as process tag 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 RTX/416, a SIMATIC PCS 7 Single Station, or on the basis of 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, display 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 plant 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. However, enhanced online diagnostics functions in conjunction with HW Config can only 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
- System-supported generation of the diagnostics screens with all components present in the project, including the display hierarchy according to 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 images, symbols, 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:

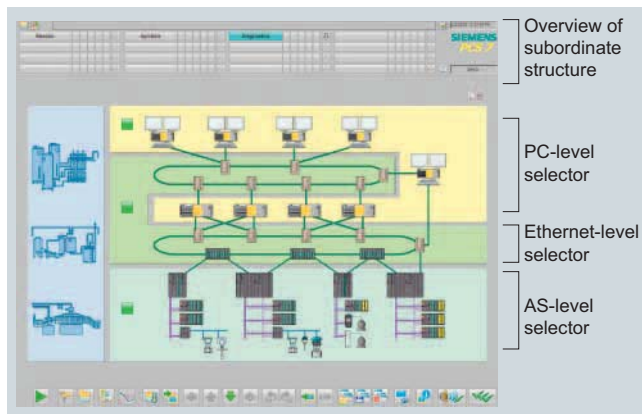
- NAMUR recommendation NE91 (requirements for systems for Asset Management at plant level)
- NAMUR recommendation NE105 (requirements for the integration of fieldbus devices in engineering tools)
- NAMUR recommendation NE107 (status messages from field devices): "Device failure", "Maintenance requirement", "Function check"

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.:

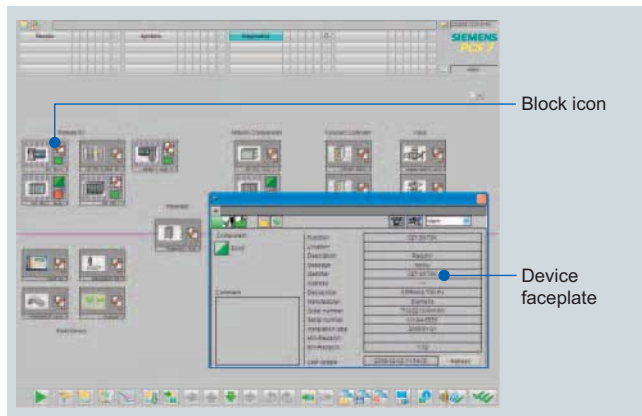
- PROFIBUS Profile Guidelines Identification & Maintenance Functions
- PROFIBUS PA Profile for Process Control Devices

Asset Management function characteristics

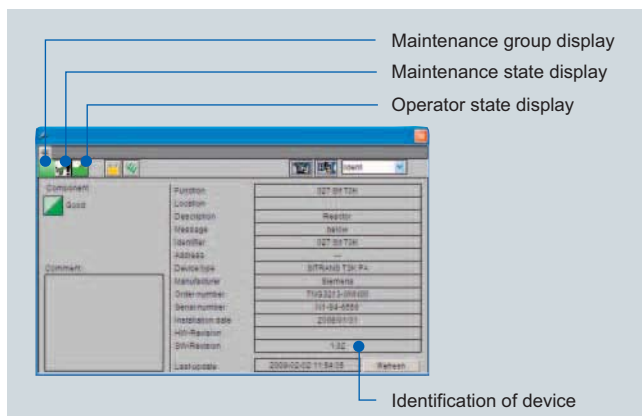
As the system interface to the maintenance engineer, the Maintenance Station provides integrated maintenance functions and information.



Plant overview with symbol displays for components



Overview of components on a PROFIBUS segment with symbol displays



ID view of component

Standard diagnostics functions

Starting from the overview display, the maintenance engineer can navigate to the diagnostics screens of the subordinate hardware levels in order to obtain information on the diagnostics status of individual plant areas or components. If a fault is signaled 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 offered:

- Display of diagnostics status determined by the system
- Information on the component, such as process tag name, manufacturer or serial number
- Display of diagnostics messages of a component
- Visualization of type and current state of initiated maintenance measure

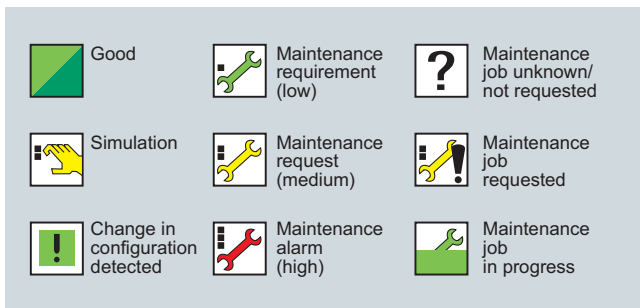
Information on passive or indirect assets

For passive or indirect assets without self-diagnostics (pumps, motors, control loops, etc.), the programmable logic block AssetMon can determine inadmissible operating states from various measured values and their deviations from a defined normal status. These are displayed as a maintenance alarm on the Maintenance Station. AssetMon is able to process up to 3 analog values and up to 16 binary values. It is also suitable for implementing individual diagnostic structures, project-specific diagnostics rules, and condition monitoring functions.

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.

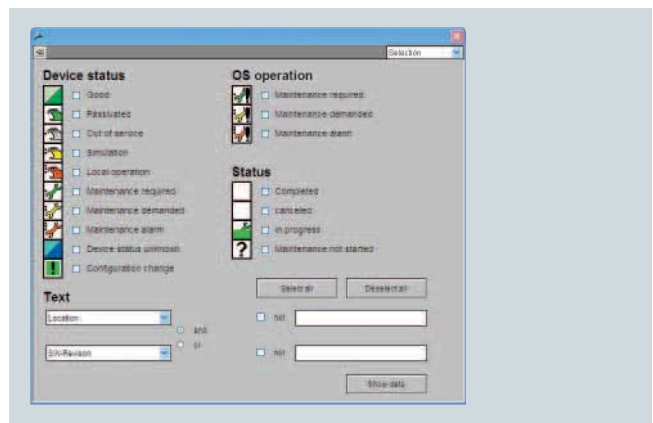
The symbol set defined for asset management with the SIMATIC PCS 7 Maintenance Station contains symbols which identify the diagnostics status of the devices/components, the relevance of the maintenance request, and the status of the maintenance measure.

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 further device-specific information, e.g. an identification, message or maintenance view.



Filters for diagnostics statuses

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 not directly associated passive or indirect assets such as pumps, motors or heat exchangers
- Homogenous integration of maintenance functionality in SIMATIC PCS 7
- Maintenance station as system interface for maintenance engineer
- Same look & feel as with process control on the operator system
- Uniform display of diagnostics and maintenance status throughout the plant
- Automatically generated ID data overview with firmware and software versions for planning upgrades
- Programmable logic block "AssetMon" for passive or indirect assets, individual diagnostics, and condition monitoring functions
- Recording of changes in configurations and parameters of EDD-based devices in the change logbook
- Generation of overviews on diagnostics statuses
- Consideration of international standards and directives

Automation systems

Scalable performance for every requirement



SIMATIC PCS 7 AS RTX Microbox automation system

The SIMATIC PCS 7 process control system offers a wide range of automation systems whose performances are finely matched to one another within wide limits.

The range can be categorized as follows in accordance with the design:

- SIMATIC PCS 7 AS RTX Microbox automation system with software controller
- Modular automation systems of the S7-400 range with hardware controller

SIMATIC PCS 7 AS RTX Microbox automation system

The compact and rugged automation system based on the SIMATIC Microbox PC 427B has been designed for maintenance-free 24-hour continuous operation at ambient temperatures up to 55 °C. Since there are no fans or rotating storage media, it is resistant to vibration and shock.

The SIMATIC PCS 7 AS RTX is delivered with an AS Runtime license for 250 POs and a 2 GB CompactFlash card on which the Windows XP Embedded operating system, the WinAC RTX controller software, and the SIMATIC PC DiagMonitor diagnostic software are preinstalled. The system is configured using the SIMATIC PCS 7 Engineering System.

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



Standard automation systems of the S7-400 range

Parameterizable monitoring functions for program execution/watchdog, processor and board temperatures, as well as enhanced diagnostics/messages, e.g. runtime meter, hard disk/system status, can be recorded and evaluated via SIMATIC PC DiagMonitor and Maintenance Station or signaled by LED.

If one considers only the scalable automation performance, the SIMATIC PCS 7 AS RTX Microbox automation system is located at the bottom end of the scale for the SIMATIC PCS 7 process control system. However, this assignment is relativized by the fast program execution in the software controller, the excellent physical properties, and the compact dimensions of the SIMATIC PCS 7 AS RTX. It is therefore an excellent alternative to standard automation systems of the S7-400 range, especially for small applications and at machine level.

Modular automation systems of the S7-400 range

Components

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. A distinction is made between Single Stations and Redundancy Stations. Depending on this, the AS bundles usually comprise:

- 1 or 2 racks with 9 or 18 slots
- 1 or 2 SIMATIC S7-400 CPUs
- 1, 2 or 4 power supplies 24 V DC or 120/230 V AC, each without backup batteries
- 1 or 2 work memories from 0.768 MB to 30 MB
- 1 or 2 memory cards with 1 to 64 MB RAM
- 1, 2 or 4 interface modules for Industrial Ethernet plant bus (via CP or integrated in CPU)
- Additive PROFIBUS communications cards (by means of configurator up to 4 per Single Station, up to 8 per Redundancy Station)
- 4 Sync modules for a range of 10 m or 10 km, and 2 fiber-optic Sync cables

Each AS bundle is combined with 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 AS firmware can be updated by means of a Flash EPROM memory card (8 MB) or from the central Engineering System via the plant bus.

The following characteristics make the SIMATIC S7-400 predestined for use as a SIMATIC PCS 7 automation system:

- Modular design without fans
- High expansion capability and ruggedness
- Single or redundant design
- Comprehensive communication facilities
- Integral system functions
- Integrable safety functions (Safety Integrated)
- Simple linking of central or distributed I/O

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

Automation system	AS 412 H/F/FH	AS 414-3IE	AS 414-3	AS 414 H/F/FH	AS 416-2	AS 416-3	AS 416-3IE	AS 417-4	AS 417-4 H/F/FH	AS 417-4	AS 417-4 H/F/FH
Memory card [in MB]	2	2/4			4	8/16	16	4	16		
Analog value measurements	10	35			125	200	200	150	700		
Digital value measurements	15	110			350	450	450	400	1 200		
PID controls	6	35			110	150	150	130	300		
Motors	10	50			125	250	250	150	450		
Valves	10	50			125	250	250	150	450		
SFC	0	15			40	100	100	50	200		
Steps	0	150			400	1 000	1 000	500	2 000		
Dosing	0	3			15	25	25	15	45		
Digital inputs DI	50	220			800	1 200	1 200	850	2 000		
Digital outputs DO	25	110			300	500	500	315	1 000		
Analog inputs AI	20	80			250	400	400	275	800		
Analog outputs AO	10	40			110	180	180	130	400		
Process objects (PO)	50	283			890	1 400	1 400	995	3 145		

Typical mixed quantity frameworks for SIMATIC PCS 7 automation systems of the S7-400 range

Automation systems

Standard automation systems

The AS 414-3 / 414-3IE, AS 416-2, AS 416-3 / 416-3IE and AS 417-4 standard automation systems are extremely rugged and stand out due to their high processing and communications performance.

The AS 414-3 / 414-3IE automation systems are tailored for smaller applications with smaller quantity frameworks and fulfill the requirements for a low-cost, modular and scalable system. Larger quantity frameworks can be implemented with the AS 416-2, AS 416-3 / 416-3IE and AS 417-4 automation systems. These systems are preferred for medium-sized or larger systems.

In the AS 414-3IE and 416-3IE, the Industrial Ethernet interface is integrated in the CPU. They offer the same performance as the comparable AS 414-3 and AS 416-3 with Industrial Ethernet CP 443-1, but differ in terms of time synchronization (NTP instead of S7 synchronization).

If two separate power supply systems are used for supplying the plant, the availability of the standard automation systems can be increased by using two redundant power supplies.

Fault-tolerant automation systems

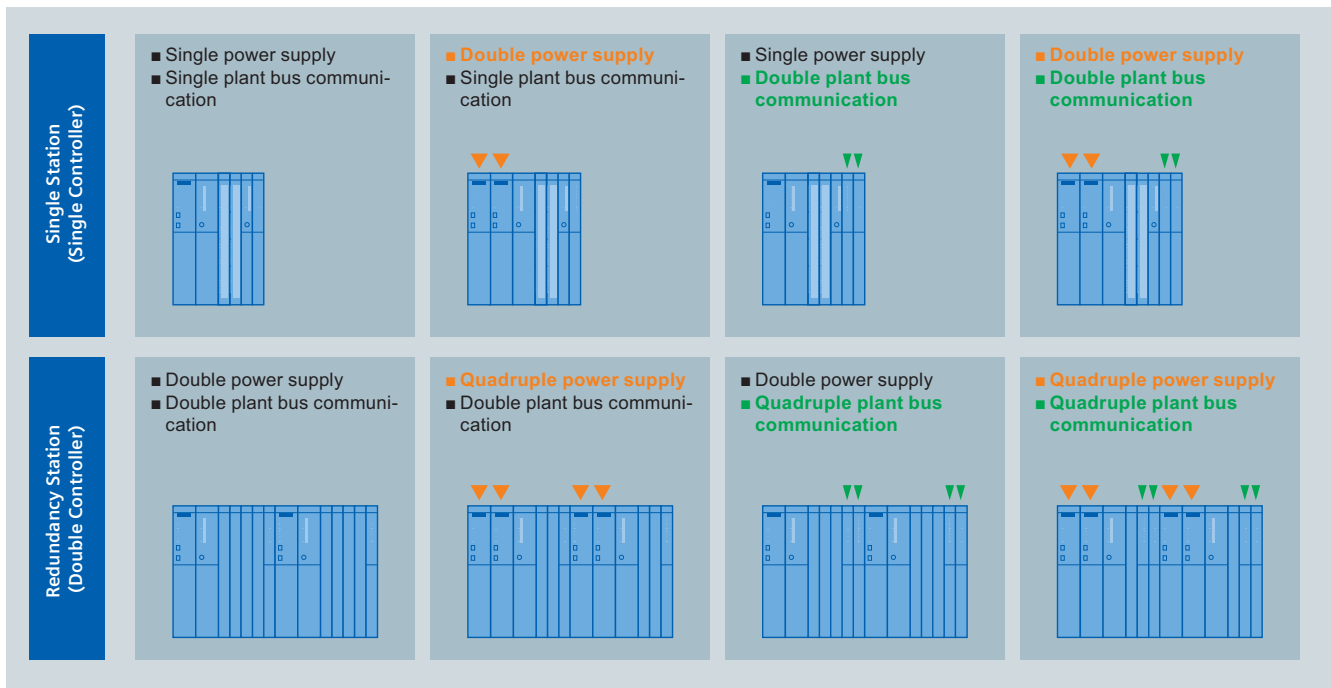
Fault-tolerant automation systems are used to reduce the risk of production failures. The higher investment costs are frequently negligible compared to the costs resulting from production failures. The higher the costs of a production failure, the more worthwhile it is to use a fault-tolerant system.

Fault-tolerant SIMATIC PCS 7 automation systems can be used on their own or together with standard and safety-related automation systems. In accordance with their basic design, they can be distinguished as:

- Single Stations:
AS 412-3-1H, AS 414-4-1H and AS 417-4-1H with only one CPU
- Redundancy Stations:
AS 412-3-2H, AS 414-4-2H and AS 417-4-2H with two redundant CPUs

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 a distance of 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.





Flexible and scalable availability

The use of a Single Station instead of a standard automation system provides the option for a redundant configuration at a later date.

A particular characteristic of the fault-tolerant SIMATIC PCS 7 automation 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.



Safety-related automation system

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 AS 412H, AS 414H or AS 417H automation systems, which have been expanded by safety functions by means of S7 F Systems.

Analogous to the basic systems, two versions can be distinguished:

- **Single Station:**
AS 412F/AS 414F/AS 417F with one CPU, safety-related
- **Redundancy Station:**
AS 412FH/AS 414FH/AS 417FH with two redundant CPUs, safety-related and fault-tolerant

As a result of a redundant design of the power supply or of the Industrial Ethernet communication module, the availability of the safety-related Single/Redundancy Stations can be increased flexibly as with the fault-tolerant automation systems on which they are based.

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

In the parallel processing of BPC and safety functions in one CPU, mutual interference is prevented by ensuring that the BPC programs and the safety-related programs are kept strictly separate and data is exchanged via special conversion function blocks. The safety functions are processed twice in different processor sections 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.

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.

Highlights Automation systems

- Wide range of products in two designs and with finely graded performances:
 - Microbox automation system with software controller
 - Modular automation systems of the S7-400 range with hardware controller

Microbox automation system

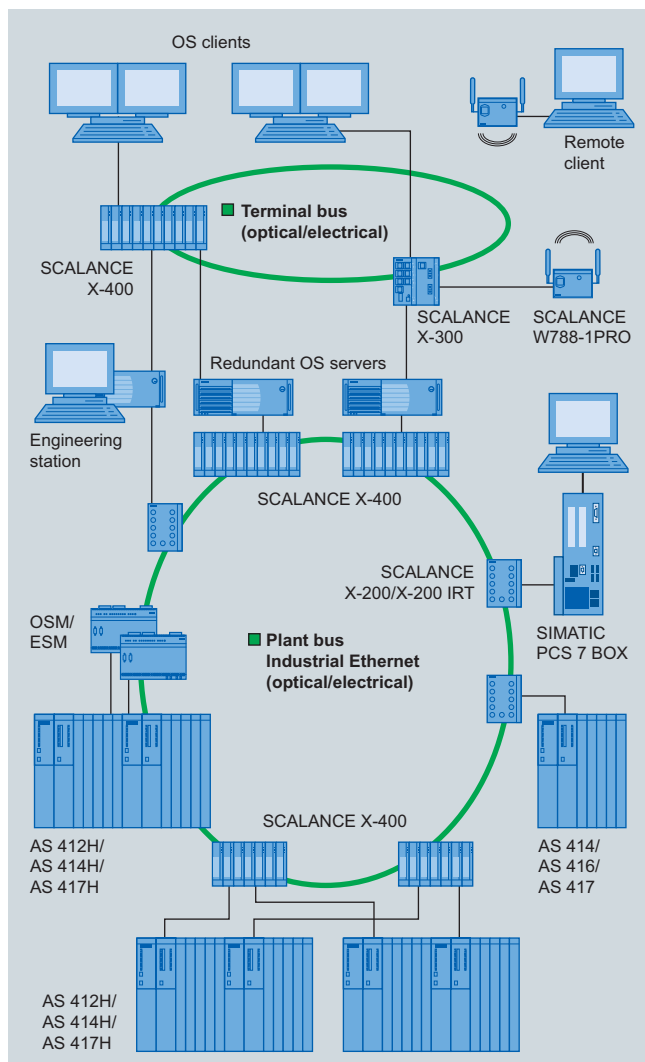
- Compact and rugged system for use at plant level
- Resistant to vibration and shock since there are no fans or rotating storage media
- Maintenance-free 24/7 operation at ambient temperatures up to 55 °C

Modular automation systems

- Individually configurable AS bundles, available as:
 - Individual components bundled per station in one delivery
 - Pre-assembled and tested systems
- Flexible and scalable availability:
 - Standard systems as Single Station, optionally with redundant power supply
 - Fault-tolerant systems as Single/Redundancy Station, optionally with redundant power supply and/or redundant Industrial Ethernet communication for each system/subsystem
 - Safety-related systems as Single/Redundancy Station, optionally with redundant power supply and/or redundant Industrial Ethernet communication for each system/subsystem
- Redundancy Station with two electrically isolated subsystems:
 - One or two racks separated by up to 10 km
 - Simultaneous (synchronous) processing of identical user programs in the two CPUs
 - Bumpless switchover
- Changes to the configuration during operation

Communication

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



Industrial Ethernet, connection examples

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 all system components and 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 multi-user 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 communications processors (e.g. CP 1613 A2/CP 1623) are used as communication interfaces. For small systems, the "Basic Communication Ethernet" integrated in the SIMATIC 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 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.





SCALANCE X Industrial Ethernet switches

Industrial Ethernet switches are used for integration of communication participants in the bus. We particularly recommend the SCALANCE X family of Industrial Ethernet Switches, which offer scalable performance at an attractive price and which support versatile configuration possibilities.

As a result of their interference resistance and high availability, optical rings are preferably used for the plant bus and terminal bus.

If particularly high availability requirements exist, it is also possible to distribute the communication on two redundant rings:

- With the terminal bus, the two rings are connected together by 2 pairs of SCALANCE X switches. Switches from the SCALANCE X-400, X-300 and X-200 IRT product lines have the "standby redundancy" function that is necessary in this regard. The redundant servers and clients are connected to the two rings by means of two separate interfaces (Redundant Terminal Bus Adapter Package).

Industrial Ethernet switches	
SCALANCE X-400 (up to 1 Gbit/s)	
	<p>For electrical or optical gigabit rings (single and redundant):</p> <ul style="list-style-type: none"> ■ SCALANCE X414-3E with 2 Gigabit Ethernet ports (electrical/optical), 12 electrical FastEthernet ports and optionally 4 optical FastEthernet ports; expandable with 8 electrical or 8 optical FastEthernet ports ■ SCALANCE X408-2 with 4 Gigabit Ethernet ports (electrical/optical) and 4 FastEthernet ports (electrical/optical)
SCALANCE X-300 (up to 1 Gbit/s)	
	<p>For optical line, star or ring structures (up to 1 Gbit/s):</p> <ul style="list-style-type: none"> ■ SCALANCE X307-3 (optical ports for glass multi-mode fiber-optic cable up to 750 m) ■ SCALANCE X307-3LD (optical ports for glass single-mode fiber-optic cable up to 10 km) <p>each with 3 optical Gigabit Ethernet ports and 7 electrical FastEthernet ports</p> <ul style="list-style-type: none"> ■ SCALANCE X308-2 (optical ports for glass multi-mode fiber-optic cable up to 750 m) ■ SCALANCE X308-2LD (optical ports for glass single-mode fiber-optic cable up to 10 km) ■ SCALANCE X308-2LH (optical ports for glass single-mode fiber-optic cable up to 40 km) ■ SCALANCE X308-2LH+ (optical ports for glass single-mode fiber-optic cable up to 70 km) <p>each with 2 optical Gigabit Ethernet ports, 1 electrical Gigabit Ethernet port and 7 electrical FastEthernet ports</p> <p>For electrical line, star or ring structures (up to 1 Gbit/s):</p> <ul style="list-style-type: none"> ■ SCALANCE X310 with 3 electrical Gigabit Ethernet ports and 7 electrical FastEthernet ports <p>For electrical line, star or ring structures (up to 100 Mbit/s):</p> <ul style="list-style-type: none"> ■ SCALANCE X310FE with 10 electrical FastEthernet ports
SCALANCE X-200 IRT (up to 100 Mbit/s)	
	<p>For line, star or ring structures (electrical/optical, depending on type of port):</p> <ul style="list-style-type: none"> ■ SCALANCE X204 IRT with 4 electrical ports ■ SCALANCE X202-2 IRT with 2 electrical ports and 2 glass fiber-optic cable ports ■ SCALANCE X202-2P IRT with 2 electrical ports and 2 POF (Polymer Optical Fiber) fiber-optic cable ports ■ SCALANCE X201-3P IRT with 1 electrical port and 3 POF fiber-optic ports ■ SCALANCE X200-4P IRT with 4 POF fiber-optic ports
SCALANCE X-200 (up to 100 Mbit/s)	
	<p>For electrical line, ring, or star structures:</p> <ul style="list-style-type: none"> ■ SCALANCE X224 with 24 electrical ports ■ SCALANCE X216 with 16 electrical ports ■ SCALANCE X208 with 8 electrical ports <p>For optical line or ring structures:</p> <ul style="list-style-type: none"> ■ SCALANCE X204-2 with 2 optical ports for glass multi-mode fiber-optic cable up to 3 km and 4 electrical ports ■ SCALANCE X212-2 with 2 optical ports for glass multi-mode fiber-optic cable up to 3 km and 12 electrical ports ■ SCALANCE X212-2LD with 2 optical ports for glass single-mode fiber-optic cable up to 26 km and 12 electrical ports <p>For star structures as well as line or ring structures with electrical and optical transmission links:</p> <ul style="list-style-type: none"> ■ SCALANCE X206-1LD with 1 optical port for glass single-mode fiber-optic cable up to 26 km and 6 electrical ports

- With the plant bus, the two rings are physically separate. One switch in each case takes over the function of the redundancy manager for each ring. The current switches from the SCALANCE X-400, X-300, X-200 IRT and X-200 product lines can be used as redundancy manager. The coupling 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).

Industrial Wireless LAN (IWLAN)

SIMATIC PCS 7 allows you to integrate mobile or stationary remote clients into the terminal bus via a SCALANCE W788-1PRO or W788-2PRO access point.

Via IWLAN, mobile remote clients (e.g. notebooks) can communicate with the access point using a WLAN interface module, and stationary remote clients in a desktop/tower housing can communicate using a SCALANCE W744-1PRO or W746-1PRO Ethernet 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 with application of Remote Desktop or PC Anywhere, e.g. during commissioning

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



SCALANCE W Ethernet client module

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

Industrial Ethernet highlights

- Universally implementable:
 - In all sectors
 - In office environments as well as in harsh industrial environments
- Fast commissioning through:
 - Simple connection system
 - Local assembly using the FastConnect cabling system together with RJ45 technology
- EMC interference resistance through optical transmission media
- Continuous monitoring of network components through a simple yet effective signaling concept
- Plant-wide clock system for exact assignment of events within the complete plant
- High availability thanks to redundant network topologies
- Resistant to power failure through fast switchover to redundant system
- High flexibility through reaction-free expansion of existing plants
- Scalable performance with switching technology
- Modern and future-oriented network components, e.g. SCALANCE X Industrial Ethernet switches
- Investment security due to compatible developments

Fast and secure communication with PROFIBUS for the field area



Components for PROFIBUS PA ring architecture

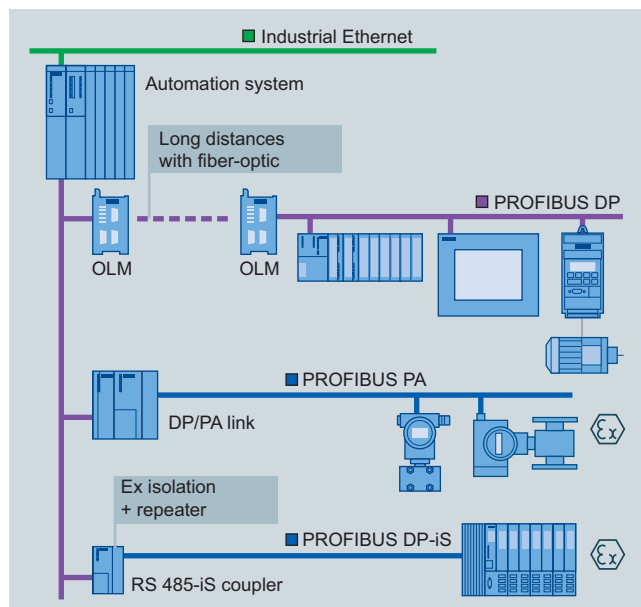
Distributed peripherals such as remote I/O stations with their I/O modules, transmitters, drives, valves or operator terminals communicate with the automation systems at field level through a powerful real-time bus system. This communication is characterized by:

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

PROFIBUS is predestined for these tasks because it enables high-speed communication with the intelligent distributed I/Os by means of a communications protocol (PROFIBUS DP) as well as communication and simultaneous power supply for transmitters and actuators (PROFIBUS PA).

PROFIBUS is simple, rugged and reliable, can be expanded on-line by further distributed components, and can be used in both standard environments and hazardous areas. The standardized communication services guarantee exchangeability of devices from one family and coexistence of devices from different vendors (interoperability) on one PROFIBUS PA line as well as the remote parameterization of the devices during system operation.

As a result of these properties, it has become established in all sectors of the manufacturing, process and hybrid industries, and with more than 25 million installed devices worldwide (as of 2008), it is currently the most successful open fieldbus.



PROFIBUS transmission systems

In addition to the properties already referred to, the following PROFIBUS functions are particularly relevant to process automation:

- Integration of previously installed HART devices
- Redundancy
- Safety-related communication with PROFIsafe up to SIL 3 according to IEC 61508
- Clock synchronization
- Time stamping

The PROFIBUS DP permits communication between the automation systems (controllers) and distributed I/O devices of the ET 200 series (remote I/Os), as well as with field/process devices, CPUs/CPs and operator panels that have a PROFIBUS DP interface. With the aid of the fieldbus isolating transformer (RS 485-iS coupler) and the RS 485-iS transmission technology, PROFIBUS DP can also be run as an intrinsically-safe fieldbus in all environments up to hazardous zone 1 or 21.

The PROFIBUS PA – which is ideal for integrating pneumatic actuators, solenoid valves, and sensors in operating environments up to hazardous zone 1/21 or 0 directly into the process control system – is linked to the automation system via the PROFIBUS DP. The DP/PA router is implemented either by a DP/PA coupler or DP/PA link (preferred version). When using the DP/PA link, the transmission rate on the PROFIBUS DP is independent of the lower-level PROFIBUS PA segments.

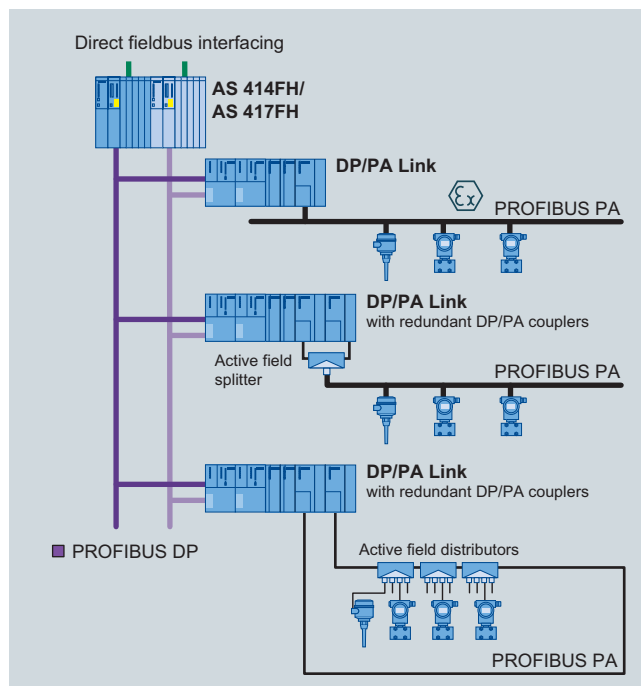
PROFIBUS transmission systems

PROFIBUS DP

- RS 485:
Simple and low-cost electrical transmission technology based on shielded two-wire line.
- RS 485-iS:
Intrinsically-safe electrical transmission system for hazardous areas up to hazardous zone 1, implemented using a shielded two-wire line with a transmission rate of 1.5 Mbit/s.
- 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.

PROFIBUS PA

- MBP (Manchester Coded; Bus Powered):
Intrinsically-safe transmission system that permits simultaneous transmission of digital data and powering of the field devices on a single two-wire cable; suitable for direct connection of devices in environments up to hazardous zone 0, 1, or 21.



PROFIBUS PA architectures

PROFIBUS PA architectures for high availability and safety

Linear architectures with single couplers

Each PROFIBUS PA line is linked with one DP/PA coupler Ex [i] (PA line up to hazardous zone 1/21) or FDC 157-0 (PA line up to hazardous zone 2/22) of a DP/PA router. This router can be operated on a single or redundant PROFIBUS DP.

Linear architectures with redundant couplers

The active field splitter (AFS) connects a PROFIBUS PA segment (line) to two DP/PA couplers FDC 157-0 of a DP/PA router which can be operated on a single or redundant PROFIBUS DP. The AFS switches over the PROFIBUS PA segment to the active coupler.

Ring architecture

Active field distributors (AFD) integrate PROFIBUS PA field devices via 4 short-circuit proof spur line connections into a PROFIBUS PA ring with automatic bus termination. The PROFIBUS PA ring is connected to two FDC 157-0 DP/PA couplers of a DP/PA router that can be operated on a single or redundant PROFIBUS DP.

Special advantages of ring architecture in comparison:

- Maximum availability
- Redundancy management of the intelligent DP/PA couplers that is transparent for the higher-level system
- Active bus terminations for automatic bus termination in the DP/PA couplers and the AFDs permit:
 - Automatic, bumpless isolation of defective sub-segments in event of short-circuit or wire breakage
 - Changing of the ring configuration and the instrumentation during operation; addition or removal of ring segments
- Safety-oriented and fault-tolerant applications with minimal device and cabling overheads

PROFIBUS

Technical specifications	PROFIBUS DP			PROFIBUS PA
Data transmission	RS 485	RS 485-iS	Fiber-optic	MBP
Transfer rate	9.6 Kbit/s... 12 Mbit/s	9.6 Kbit/s... 1.5 Mbit/s	9.6 Kbit/s... 12 Mbit/s	31.25 Kbit/s
Cable	Two-wire shielded	Two-wire shielded	Plastic as well as multi-mode and single-mode glass fiber	Two-wire shielded
Type of protection		EEx(ib)		EEx(ia/ib)
Topology	Line, tree	Line	Ring, star, linear	Linear, tree, ring
Nodes per segment	32	32 ¹⁾	–	32
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 (multi-mode glass fiber) >15 km at 12 Mbit/s (single-mode glass fiber)	1 900 m: standard 1 900 m: EEx(ib) 1 000 m: EEx(ia)
Repeater for signal boosting with RS 485 networks	Max. 9	Max. 9 ¹⁾	Not relevant	Not relevant

¹⁾ Conforming to PROFIBUS installation guideline 2.262

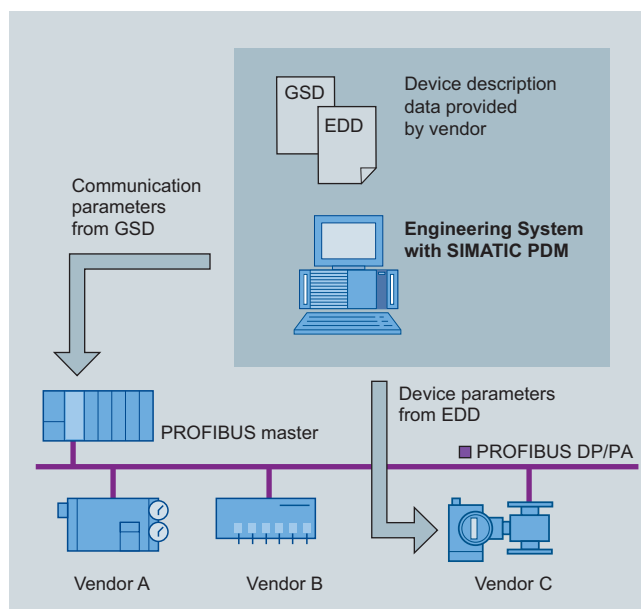
Device interfacing with GSD and EDD

Automation systems (PROFIBUS master) and process device managers such as SIMATIC PDM communicate with field devices and distributed I/O components (PROFIBUS slaves) on the basis of an exact and complete description of the device-specific data and functions, e.g.

- Type of application function
- Configuration parameters
- Dimensional units
- Limits and default values
- Ranges

This description is provided by the vendor in the following form:

- GSD file for the cyclic data exchange between the PROFIBUS master and the PROFIBUS slaves
- Optional: Electronic Device Description (EDD) with standard and vendor-specific properties for acyclic communication, e.g. for enhanced configuration, commissioning, diagnostics, measured-value monitoring, asset management or documentation.



The device-specific GSD and EDD files are either already included in the catalogs of the configuration tools or can be simply integrated by importing. New GSD and EDD files are published by the vendors on the Internet – both in their own presentation and in that of PROFIBUS & PROFINET International: www.profibus.com

Comprehensive diagnostics possibilities with PROFIBUS

Communications and line diagnostics

Diagnostics tools from various vendors (e.g. Amprolyzer) which are directly connected to the PROFIBUS network by means of a PC/notebook interface offer comprehensive functions for bus diagnostics and analysis, including:

- Recording and interpretation of message frames
- Automatic detection of the transmission rate
- Life list of all bus nodes
- Operating states of all bus nodes
- Statistical evaluation of bus events

The diagnostics repeater available for the connection of PROFIBUS DP segments with RS 485 technology also includes functions for online fault monitoring of the connected segments. It passes on the cause of the fault to the PROFIBUS master (e.g. line interruption, short-circuit, terminating resistor absent, too many participants, or participants too far away) as well as detailed information on the fault location.

FDC 157-0 DP/PA couplers configured as PROFIBUS diagnostics slaves supply extensive diagnostic and status information via PROFIBUS for swift location and clearance of faults:

- I&M data (Identification & Maintenance)
- Current and voltage value on the main conductor
- Redundancy status
- Wire break
- Short-circuit
- Signal level

To this end, each of these DP/PA couplers FDC 157-0 requires its own PROFIBUS address.

Diagnostics of intelligent field devices

The standardized diagnostics mechanism of the PROFIBUS permits the user to rapidly recognize and eliminate faults in the devices connected to the bus.

The diagnostics messages from the field devices can also be utilized e.g. for early initiation of preventive maintenance measures as a result of abnormalities detected long before a device fails. If a fault occurs on the field device or if maintenance becomes necessary, e.g. through contamination of a capacitive level sensor, diagnostics information is transmitted and a corresponding message sent to the operator station and the maintenance station.

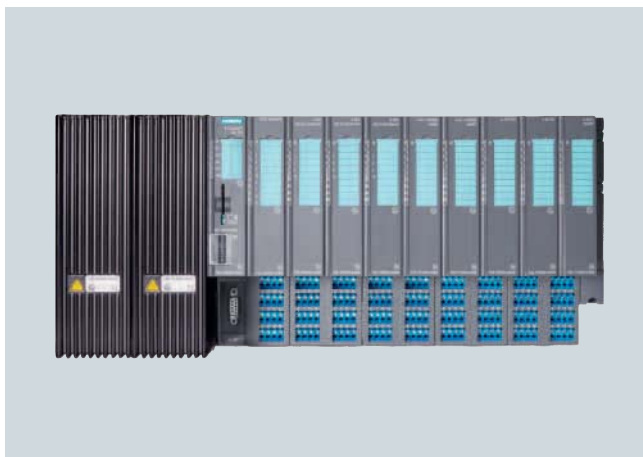
PROFIBUS highlights

- Simple and rugged fieldbus
- Small planning and engineering overheads as well as low commissioning costs
- Optimum distributed system structure with low hardware and space requirements
- High-availability and security in the field level
- Minimum overhead for wiring, jumpering, distribution, power supply, and field mounting
- Flexible Modular Redundancy with support through PROFIBUS architecture
- High-speed communication with high measurement accuracy
- Efficient engineering, interoperability and replaceability of devices through vendor-independent device description
- Short commissioning times through short loop tests, easy parameterization and the absence of calibration work
- Bidirectional communication and high amounts of information permit enhanced diagnostics functions for fast fault locating and troubleshooting
- Optimum life cycle management through processing and evaluation of diagnostics and status information by an asset management system

Enhanced diagnostics information with detailed information about the devices on the PROFIBUS (e.g. production date, operating hours counter or vendor information) can be made available via SIMATIC PDM on the basis of an EDD provided by the vendor.

Process I/O

The right solution for every requirement



ET 200iSP with redundant power supply

SIMATIC PCS 7 offers a variety of possibilities for connecting peripheral devices as well as for acquisition and output of process signals via sensors and actuators.

- Analog and digital I/O modules of the SIMATIC S7-400 operated centrally in the automation system
- ET 200 remote I/O stations with an extensive range of cost-effective signal and function modules, connected over PROFIBUS DP to the automation system (AS)
- Direct AS connection of operator terminals and intelligent, distributed field/process devices (including sensors/actuators) over PROFIBUS (also redundant or in hazardous areas of zones 0, 1, 2 or 20, 21, 22)

SIMATIC S7-400 signal modules used centrally in the automation system have little significance in the context of SIMATIC PCS 7. These modules are at most an alternative to distributed I/Os for small applications or plants with limited distributed expansion.

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 directly on PROFIBUS

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

Modifications possible online

ET 200M	<ul style="list-style-type: none"> ■ Adding of ET 200M stations ■ Adding of I/O modules for the station ■ Reparameterization of I/O modules ■ Parameterization of connected HART field devices with SIMATIC PDM
ET 200iSP	<ul style="list-style-type: none"> ■ Adding of ET 200iSP stations ■ Adding of modules for the station ■ Reparameterization of 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	–
PROFIBUS DP, PROFIBUS PA	<ul style="list-style-type: none"> ■ Adding of PROFIBUS DP stations ■ Adding of DP/PA links and field devices ■ Parameterization of 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:

- Distributed I/O system ET 200M
- Distributed I/O system ET 200iSP
- Distributed I/O system ET 200S
- Distributed I/O system ET 200pro
- PROFIBUS PA devices according to PA profile 3.0

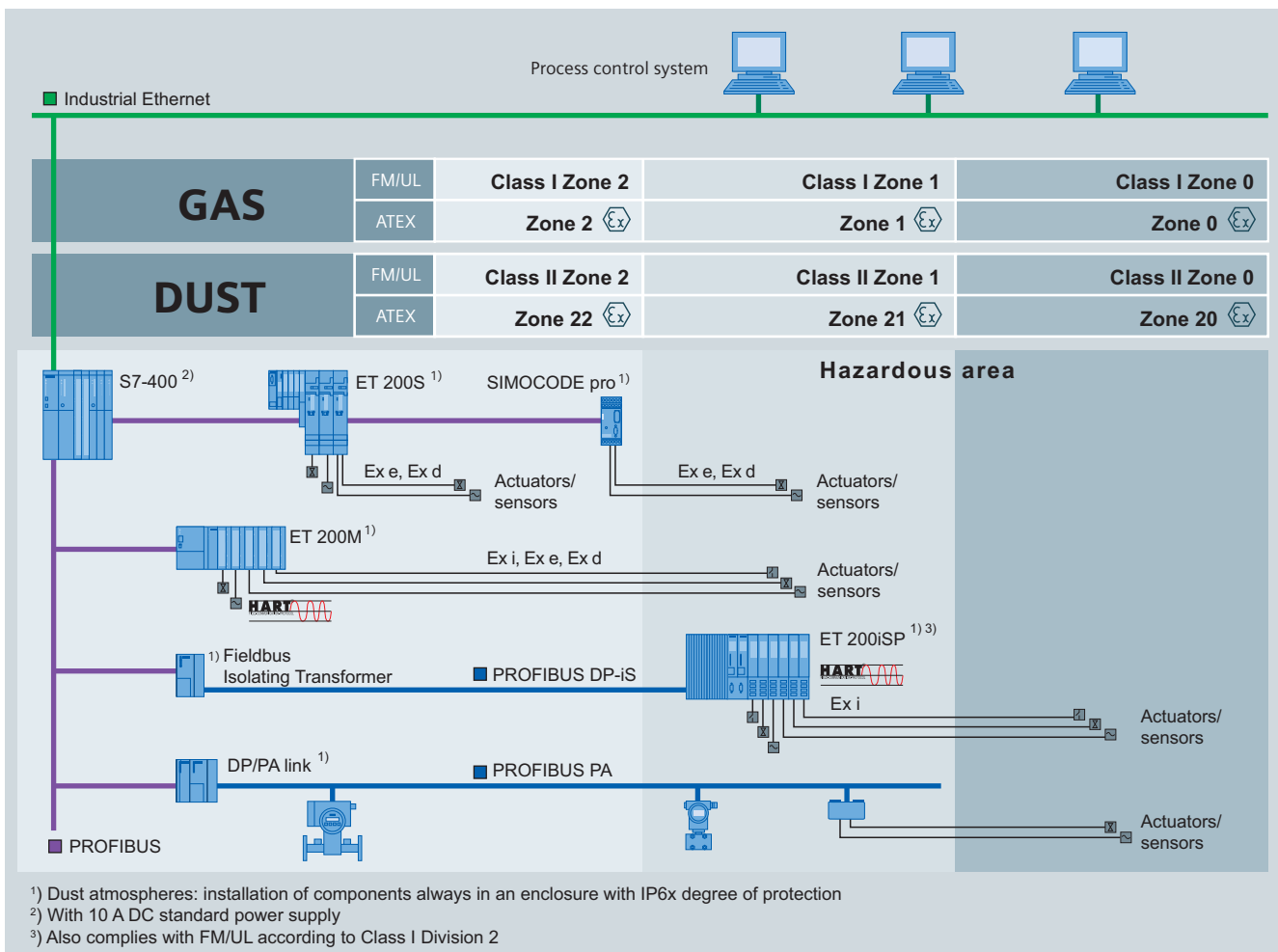
Further process I/Os can be integrated into SIMATIC PCS 7 via the PROFIBUS using add-on blocks. Examples of this are devices of drive and weighing systems such as:

- SIMOCODE pro motor management system
- MICROMASTER 4 frequency inverters
- SIWAREX M/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 various 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

For operation with the SIMATIC PCS 7 process control system, Siemens offers a comprehensive range of devices through the Industry Sensors and Communication Division.

These include, for example:

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



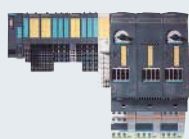



These devices are available in versions with PROFIBUS DP/PA interface and for HART communication. The majority of devices is already included in the device catalog of the SIMATIC PDM process device manager.

An overview of the current range of devices with further information, technical specifications and ordering data is available at the following Internet site:

www.siemens.com/processinstrumentation

Distributed I/O systems

Recommended devices for field automation

		DP PDM safety	Description	Functions
Distributed IO devices				
	●	●	ET 200M Modular remote I/O system with multi-channel modules; IP20 degree of protection <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s■ Redundant PROFIBUS interfaces possible■ Can be installed in hazardous zone 2, and the connected actuators and sensors can also be installed in hazardous zone 1	I/O modules of S7-300 design (up to 12 per station): <ul style="list-style-type: none">■ DI, DO, DI/DO, AI, AO signal modules (simple, with diagnostics capability, redundant and Ex version)■ Function modules (controllers, counters)■ HART modules (AI, AO; also as Ex version)■ F modules for safety-related applications: F-DI, F-DO and F-AI HART
	●		ET 200iSP Intrinsically-safe, modular remote I/O system with permanent wiring; IP30 degree of protection <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 1.5 Mbit/s■ Redundant PROFIBUS interfaces possible■ Can be installed directly in hazardous zones 1, 2, 21 or 22, connected sensors/actuators also in hazardous zone 0 Replacement of individual modules during operation without fire certificate	Electronic modules (up to 32 per station): <ul style="list-style-type: none">■ DI NAMUR■ DO with external actuator disconnection or relay outputs■ AI for resistance thermometer/thermocouple■ AI HART (for 2-wire and 4-wire transducers)■ AO I HART (HART function optional)
	●	●	ET 200S Bit-modular, extremely compact remote I/O system with permanent wiring; IP20 degree of protection <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s■ Can be installed in hazardous zone 2 or 22	Electronic modules (up to 63 per station) and motor starters to 7.5 kW: <ul style="list-style-type: none">■ DI, DO, RO, AI and AO signal modules■ Counter module 1 COUNT■ Motor starter■ F modules F-DI, F-DO and F motor starters for safety-related applications
	●	●	ET 200pro Small, modular remote I/O system with permanent wiring via connection modules; IP65/66/67 degree of protection <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s	Electronic modules (up to 16 per station) <ul style="list-style-type: none">■ DI, DO, AI and AO signal modules■ F modules for safety-related applications: F-DI and F-DI/DO
Drives				
	●	●	SIMOCODE pro motor management and control devices (can be integrated in SIMATIC PCS 7 using the PCS 7 block library) Flexible, modular motor management system for constant-speed motors in the low-voltage range <ul style="list-style-type: none">■ Power range 0,1 to 700 kW■ Voltages up to 690 V AC■ Rated motor currents up to 820 A Functions expandable using expansion modules	Can be used wherever solid, liquid, or gaseous materials must be moved, conveyed, pumped or compressed, e.g. for operation of: <ul style="list-style-type: none">■ Pumps and fans■ Compressors■ Extruders and mixers■ Mills
	●	●	MICROMASTER 4 frequency inverters (can be integrated in SIMATIC PCS 7 using the PCS 7 block library) Standard frequency inverters with high dynamics for variable speed AC motors and geared motors <ul style="list-style-type: none">■ Power range 0.12 to 250 kW■ Voltages from 200 to 600 V	For universal use, especially for: <ul style="list-style-type: none">■ Operation of pumps and fans■ Conveyor technology

Columns 2-4: DP: can be connected to PROFIBUS DP, PDM: parameters can be assigned using SIMATIC PDM, Safety: with PROFIsafe profile

Batch automation with SIMATIC BATCH

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



SIMATIC PCS 7 always offers the right solution for attractively priced and effective implementation of batch processes:

- Simple batch processes with parameterizable procedural control are automated using the SFC and CFC tools included in the Engineering System.
- SIMATIC BATCH with recipe-guided operation enables easy and flexible processing of complex tasks with varying control sequences.

Modular architecture

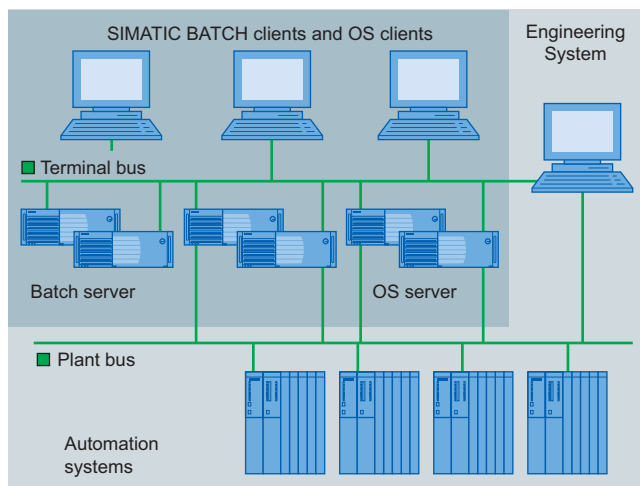
SIMATIC BATCH can be configured as a single-user system or as a client/server system, and can be used in plants of any size thanks to its modular architecture and scalability in multiple steps with 10, 20, 40, 100 and unlimited units (instances of plant units).

For small applications, e.g. for laboratory automation, SIMATIC BATCH can also be combined with the SIMATIC PCS 7 BOX 416 compact system or the SIMATIC PCS 7 LAB based on it. The capacity of SIMATIC BATCH is limited to 10 units in this case.

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.

Integration in SIMATIC PCS 7

SIMATIC BATCH is fully integrated in SIMATIC PCS 7. Connection to the production management level is supported through direct communication with SIMATIC IT, the Manufacturing Execution System (MES) from Siemens.



SIMATIC PCS 7 multi-user system with SIMATIC BATCH

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.

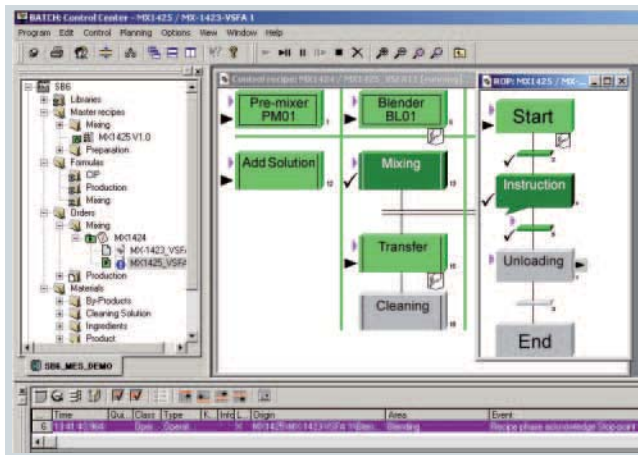
The batch server software usually runs on an autonomous server hardware (batch server), separated from the OS servers. Depending on the capacity utilization of the operator system, OS and batch server software can also be operated on shared server hardware (OS/batch server). SIMATIC BATCH clients and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

SIMATIC BATCH communicates with the automation systems (AS) through the PCS 7 operator system (OS). Operator instructions and dialogs can also be integrated into the communication. For small applications, AS, OS and SIMATIC BATCH can be concentrated in one SIMATIC PCS 7 BOX 416.

Batch Control Center and Batch Planning



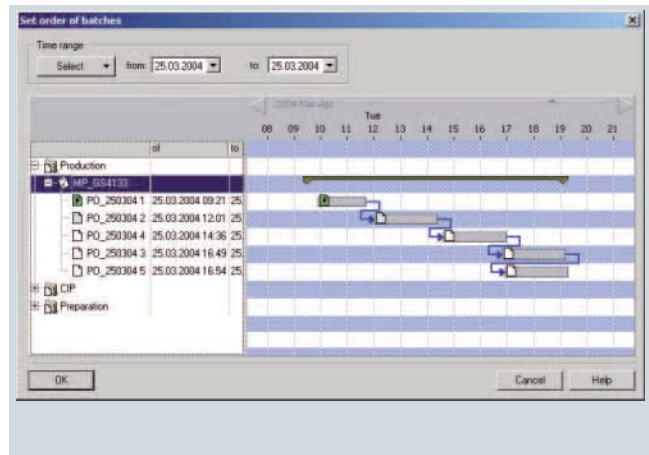
SIMATIC BATCH Batch Control Center

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

Batch Control Center

The Batch Control Center (BatchCC) is the "command center" for monitoring and controlling batch processes with SIMATIC BATCH. Using BatchCC it is possible to manage the data relevant for SIMATIC BATCH from a GUI. BatchCC offers powerful functions for the following tasks:

- Reading in and updating the plant data of the basic automation
- Definition of user privileges for all functions, for clients, or for plant units of SIMATIC BATCH
- Definition of material names and codes
- Management of master recipes, and starting the recipe editor in order to enter the recipe structure
- Creation of master recipe from control recipe
- Online modification, deletion or insertion of objects (RPH, ROP, RUP) and structure elements (loops, transitions, etc.) of the recipe (special privileges and explicit authorization required)
- Management of libraries with recipe elements (library operations)
- Exporting and importing of master recipes, formulas and library objects
- Editing of formula categories and management of associated formulas (parameter sets)
- Creation of batches with master recipes
- Starting of batch processing and controlling of batches
- Monitoring and diagnostics of batch processing
- Changing assignment strategy and plant unit assignment online during batch runtime
- Recording and archiving of recipes and batch data



Batch planning with SIMATIC BATCH

Batch Planning

BatchCC enables the creation of individual production orders and batches. A greatly increased planning functionality is offered by the Batch Planning option package with which the batches can already be planned in advance for a large number of production orders.

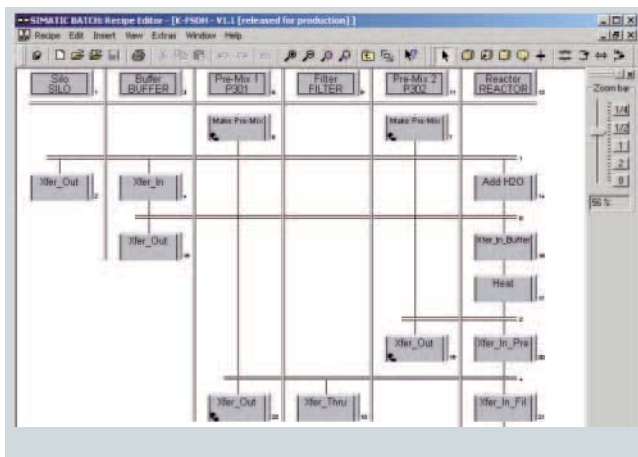
In addition to planning, the scope of functions includes the modification, cancellation, deletion and release of batches. Creation and distribution of the batches for a production order are possible manually, but can also be carried out automatically depending on the definition of the batch number or production quantity.

All batches including their occupation of plant units can be clearly presented in a combination of Gantt diagram and table. Time conflicts or those resulting from multiple occupation of plant units are identified by symbols. Time conflicts can be eliminated simply by shifting the associated batches in the Gantt diagram.

Until enabled, the following batch properties can be set and modified:

- Quantity
- Start mode (immediately, following operator input, or time-controlled)
- Occupation of plant units
- Formula (parameter set)
- Run sequence (linking to previous or subsequent batch)
- Display of planned runtime for a batch

Recipe Editor and Batch Report



SIMATIC BATCH Recipe Editor

Recipe Editor

The Recipe Editor is a user-friendly tool for the easy, intuitive creation and modification of master recipes and library operations. It has 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 batch plant configuration using the SIMATIC PCS 7 Engineering System, e.g. plant units and equipment phases. The Batch 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 plant units
- Documentation of master recipes and library operations
- Checking the plausibility under inclusion of user-specific plausibility checks
- Selection of plant unit candidates through limitation of equipment properties
- Releasing master recipes and library operations for test or production
- Configuring arithmetic expressions for calculating set-points for transitions and recipe parameters from recipe variables and constants

SIMATIC BATCH					
Batch / Batch ID	Batch1 / 11		Printed	Wednesday, March 12, 2005 10:50:15 AM	
Product / Quality	Poly_ASDF / For Sale		Page	1/19	
Status	beendet				
Desired qty.	1000 kg				
Recipe / Version	K-FSDH / V1.1				
Formula category	-				
Formula / Version	..F..				
Product order	Prod_OWER				
Duration (selfact)	03:45:20 (minutes) / 02:00 (mm:ss)				
Run time	Wednesday, March 12, 2005 5:12:40 AM / Wednesday, March 12, 2005 5:14:40 AM				
No. of events:					
	Unit	Error	Op. intervention	Limit value violation	Length of interruption
Summe	0	2	0		
Batch1	0	2	0		
Silo	S102	0	0		49 (ss)
Buffer	B201	0	0		01:23 (mm:ss)
Pre-Mix 1	P301	0	0		01:29 (mm:ss)
Filter	F401	0	0		11 (ss)
Pre-Mix 2	P302	0	0		01:16 (mm:ss)
Reactor	R501	0	0		01:49 (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_ASDF	1324	5000	-

Example of a batch report

Batch Report

The Batch Report function integrated in BatchCC is used to produce recipe and batch reports. These can be displayed and printed using BatchCC or the separate report viewer.

Batch reports

The batch reports contain all data required for the reproduction of batch process, for proof of the quality, and for compliance with statutory directives. These include, for example:

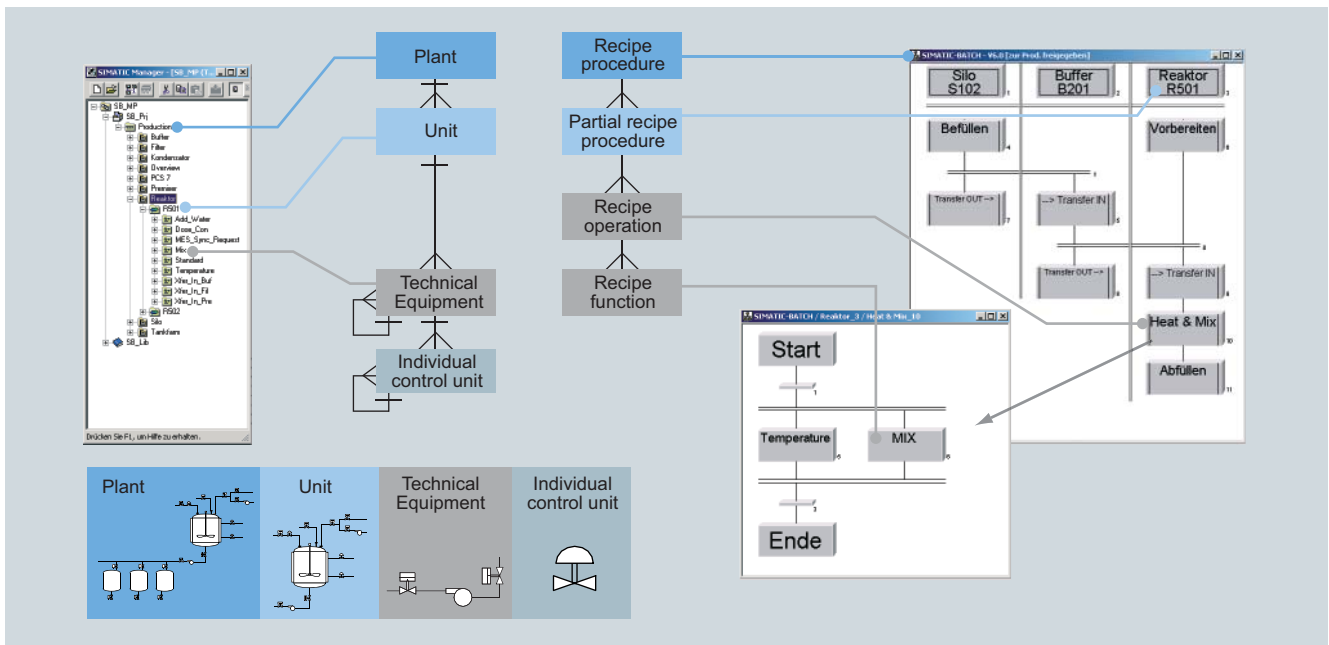
- Identification data
- Control recipe data
- Effective production data
- Time sequence of steps
- Status messages, fault messages and alarms
- Operator interventions
- Process values

Recipe reports

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

- Recipe header data
- Recipe topology
- Used material, rejected material and parameter lists
- Procedure directives

Hierarchical and plant-unit neutral recipes



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 plant
- Recipe unit procedure for controlling a process step in a plant unit
- Recipe operation/recipe phase to implement the process engineering task/function in a technical facility

Neutrality and assignment of plant units

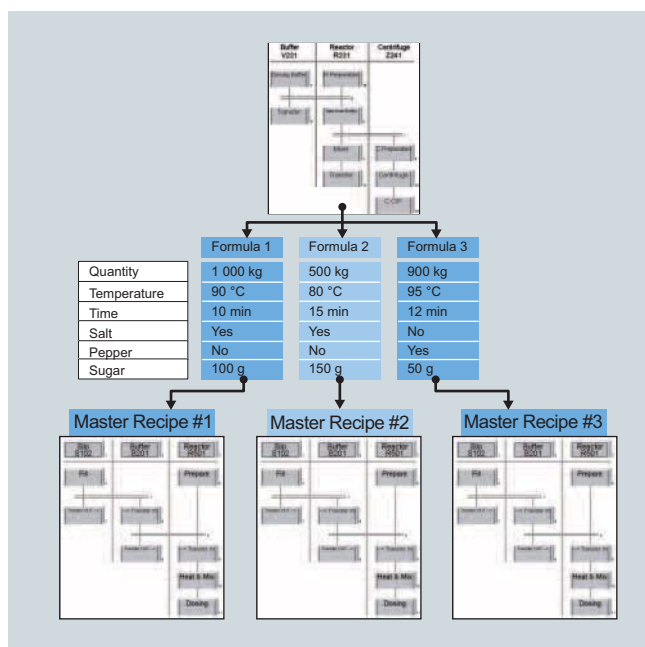
Creation of a recipe which is neutral to the plant unit minimizes the engineering overhead and provides significant advantages for validation. During creation of the recipe, the recipe unit procedures are only assigned plant unit classes. The final assignment of the plant units is only carried out during runtime. In the cases of batches which run for a longer period and where the plant 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 occupation of plant units are detected by the system, and displayed.

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

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

The occupation strategy can also be modified during the batch runtime, just like the plant unit assignment.

Rationalization, logging, validation



Separation of procedure and formula

Batch data archiving and logging in XML format

The batch data which is only accessible to authorized persons or systems is saved in XML format. The batch report function provides an XML-based batch report as standard which can be displayed and printed by means of BatchCC or the report viewer. In addition, the XML data can also be processed further by an external report system.

Library with recipe operations (ROP)

The management of recipe operations is conveniently supported by a user library (ROP library). Library recipe operations can be integrated as a reference in recipe procedures and can thus be modified from a central location. This reduces the requirements for engineering and validation. If the reference link is broken, the recipe operation 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 plant 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.

Validation according to 21 CFR Part 11

The number of plants which have to be validated for observance of quality standards because of marketing and statutory requirements is permanently increasing. The process control system and its manufacturer play an important role in the validation procedure.

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 plant 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-supported versioning of recipes, recipe operations, 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

Furthermore, Siemens as a manufacturer of process control systems has specially trained personnel as well as many years of experience in quality management and plant validation.

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.

SIMATIC BATCH highlights

- Modular architecture with flexible scalability (hardware and software)
 - Optimum adaptation 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 matching of batch data
- 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
- Recipes independent of plant unit
 - Considerable simplification in recipe management and validation
 - Flexible operation and optimum plant utilization through modification of occupation strategy and assignment of plant units during batch runtime
- Hierarchical recipes according to ISA-88.01
 - Creation of recipes oriented according to process engineering
 - Quick, easy and fault-minimizing creation
- Importing and exporting of master recipes, formulas and library objects
- Saving, archiving and comprehensive reporting of batch data in XML format
 - Production becomes transparent and comprehensible
 - Reliable operator prompting, safe response to process faults
- Reduction in engineering and validation overhead through:
 - Type/instance concept of SFC
 - Separation of procedure and formula
 - ROP library and configuration independent of plant unit
 - Multiple usage, central modification
- Validation support according to 21 CFR Part 11 through:
 - Audit Trail (change log)
 - Free and system-supported versioning
 - Libraries with recipe operations and formulas
 - User administration with access protection and electronic signature
- Direct connection to the MES system SIMATIC IT via internal system interfaces

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.

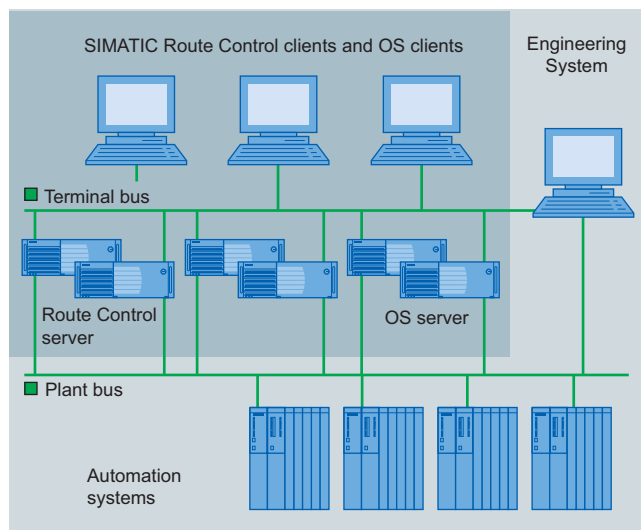
With SIMATIC Route Control, users of SIMATIC PCS 7 are capable of automating not only their production processes and associated warehouses but also the material transport linking both areas.

SIMATIC Route Control can handle complex networks as well as simple transport routes. In particular, SIMATIC Route Control is predestined for plants with a multitude of complex route combinations or extensive tank farms such as are found above all in the chemical, petrochemical and food and drinks industries.

The possible applications of SIMATIC Route Control extend from small plants with simple/static lines up to plants in the medium and upper performance range with an extensive network of routes/pipes.

SIMATIC Route Control is particularly recommended for the following conditions:

- 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
- Plant projects in combination with SIMATIC BATCH



SIMATIC PCS 7 multi-user system with SIMATIC Route Control

Modular architecture

SIMATIC Route Control is represented by the following software modules:

- Route Control Engineering (component of the SIMATIC PCS 7 Engineering System)
- Route Control Server
- Route Control Center (RCC)

Thanks to its modularity and 3-step scalability for up to 300 simultaneous material transports, SIMATIC Route Control can be flexibly adapted to various plants sizes and architectures (single-user/multi-user systems).

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, a SIMATIC PCS 7 BOX 416, or a SIMATIC PCS 7 LAB. Distributed multi-user 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 Route Control Engineering

SIMATIC PCS 7 supports multiple-station systems with up to 12 servers/server pairs. In the case of multi-user systems with small quantity frameworks, it is 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.

SIMATIC Route Control can work together with the following controllers of the SIMATIC PCS 7 Process Control System:

SIMATIC PCS 7 controller	Max. number of simultaneous material transports
AS 416-3	up to 30
WinAC Slot 416 of SIMATIC PCS 7 BOX 416 and SIMATIC PCS 7 LAB	up to 30
AS 417-4 and AS 417H	up to 300

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) is facilitated by drop-down list boxes. Locations of partial routes and routes are parameters for requesting a material transport (source, destination, intermediate points/via) that mark the start and end of each partial route, and thus also mark the source and destination of a material transport.

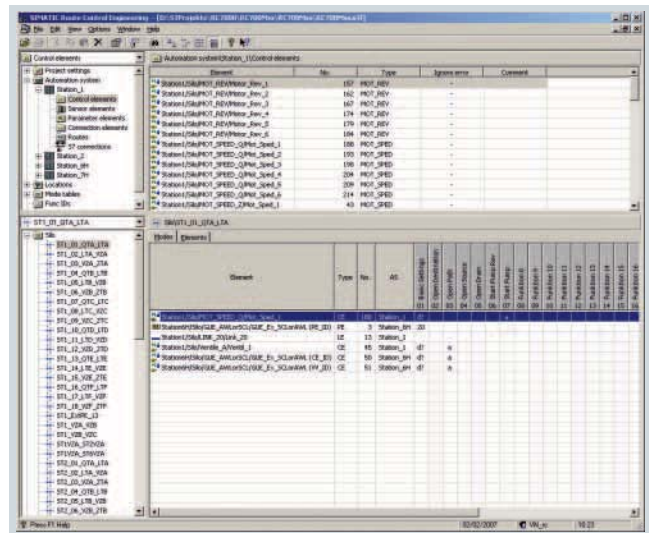
For access control and for managing the graded user rights for engineering, operating and maintenance personnel, SIMATIC Route Control uses the SIMATIC Logon integrated in the process control system.

Route Control Engineering

The Route Control configuration supplements the basic SIMATIC PCS 7 plant configuration with blocks from the PCS 7 standard 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)



Configuration with the Route Control engineering tool

Locations of partial or complete routes are configured in the SIMATIC Manager as "Equipment properties of plant 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

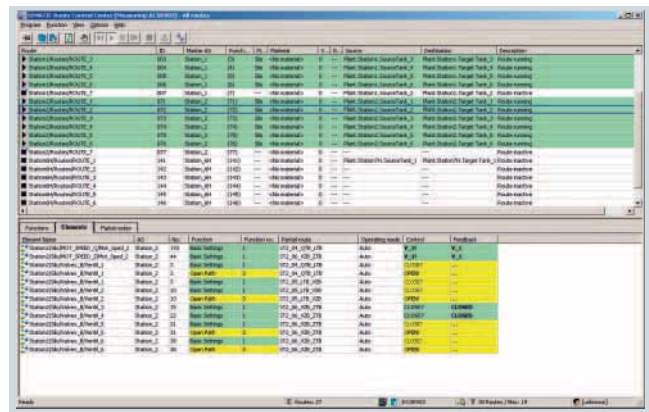
Once the RC-relevant basic data of a PCS 7 project have been adopted in an RC project, the next step is to configure the RC-specific objects with the Route Control Engineering tool:

- **Partial routes:** through division of the transport paths into partial routes, it is possible to increase the flexibility and reduce the configuring overhead by means of repeated application. Relevant partial route parameters: "bidirectional" and "priority" (lowest total of partial route priorities is decisive when searching for the overall route)
- **Interconnections:** through installation in a partial route; the RC elements acquire additional properties depending on their type (e.g. "close valve" in base position). These properties can be edited in configuration windows.
- **Function catalogs:** Partial routes can be assigned technologically and product-specifically to function catalogs, e.g. "cleaning" or "product transport", with which the resulting quantity in the route search is restricted to the type of material transport.
- **Function steps/sequence functions:** Function catalogs contain as many as 32 configurable technological sequence functions 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.

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.

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 material compatibilities and interlocking partial routes in case of incompatible material sequences based on the material ID saved in the connection element of the partial route
- Injection of setpoints coming from the process at runtime into the route block (e.g. weighed quantity)



Route Control Center (RCC)

Route Control Center (RCC)

The RCC can be called from the RC faceplate of the route block or from the keypad 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 selected 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 (function catalog, function ID, material ID and "ignore fault")
 - 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 configuration 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 Center) with the necessary data and transfers their commands 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. The RC Server then 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 plant 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.

SIMATIC Route Control highlights

- Flexible, modular architecture with scalable hardware and software components for single-user and multi-user systems
 - Optimum adaptation to plant size and individual requirements
 - Grows with the plant configuration; no expensive spare capacities
- High availability thanks to redundant Route Control Servers
- Homogenous integration into the HMI strategy and the engineering of SIMATIC PCS 7
 - No customized interfaces
 - No double configuring
 - Subsequent integration into existing projects
- Can be combined with SIMATIC BATCH
- Plant transparency
 - Identical mapping of route network of the plant through partial routes
 - Simple assignment of RC elements to the partial routes using plant plans
- Fast response to plant modifications (e.g. additional valves) during configuration, commissioning or run-time
- Exclusive assignment of RC elements and partial routes involved in material transport
- Reduction in configuration overhead and commissioning times
 - Division into partial routes and their configuration through repeated application
 - Export of configuration data to Microsoft Excel, re-import of edited data from Excel
 - Reduction in complex, repeated tasks through RC wizard
 - Encapsulation of functionality from viewpoint of user program, control as entity
- Material transport using common partial routes (several origins or destinations with bumpless switchover facility)
- Consideration of material compatibilities to avoid undesired mixing or material sequences
- Automatic calculation of shifted quantities
- Recording of route reports with filter functions, screen output and printer output
- Offline testing for completeness during configuration, as well as for inconsistencies and undesired combinations
- Detailed diagnostics of material transport requirement faults and current material transport

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, the 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.

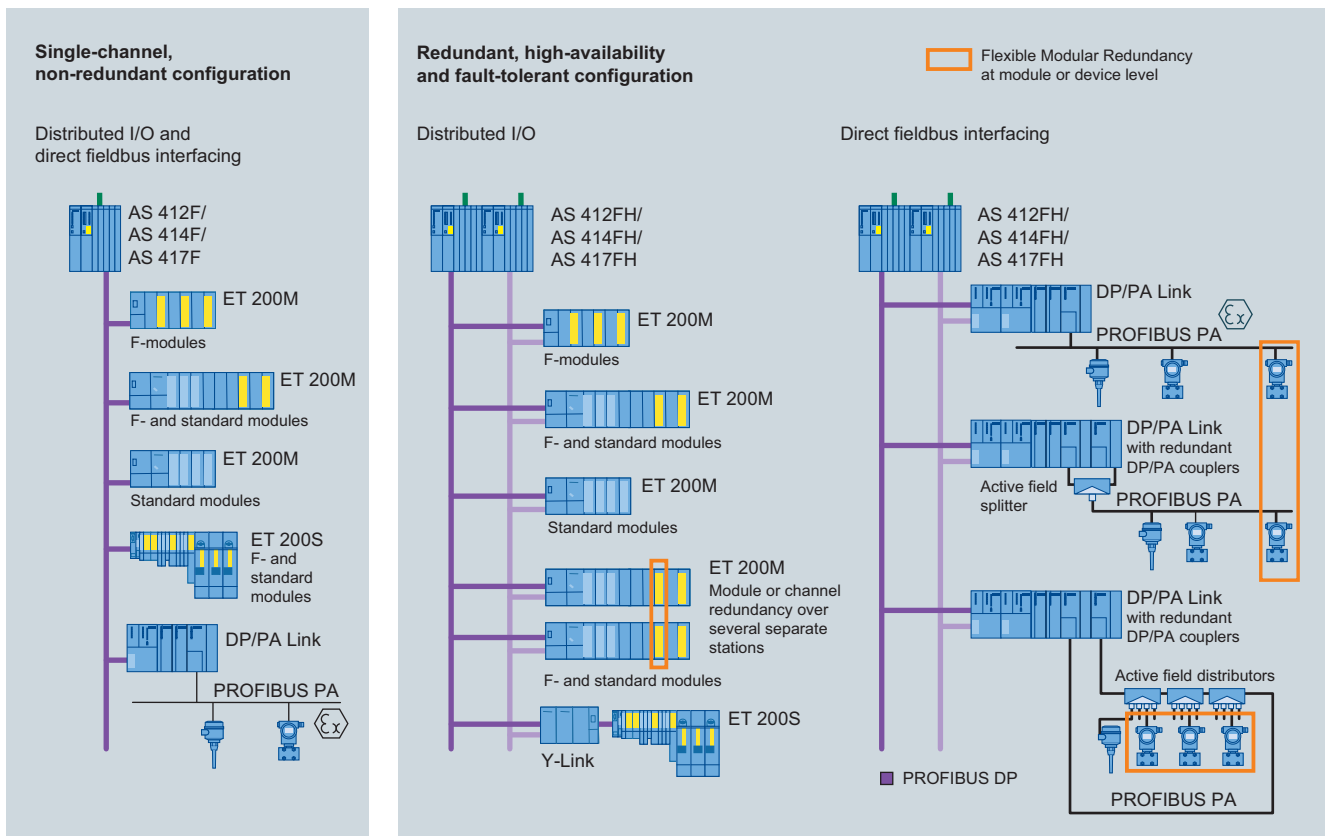
Both the safety technology and the safety applications implemented with it are characterized by great efficiency and comply with both national and international standards, such as:

- IEC 61508 (up to SIL 3) – 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



Safety Integrated for Process Automation with SIMATIC PCS 7

Safety Integrated for Process Automation – Product spectrum for SIMATIC PCS 7		
	Automation systems AS 412F/FH AS 414F/FH AS 417F/FH	Fail-safe, fault-tolerant controllers with a redundant or non-redundant design (up to SIL 3) for the bottom, mid and top performance ranges
	Engineering	Configuration of safety functions using Continuous Function Chart (CFC) or SIMATIC Safety Matrix (Cause&Effect matrix) and TÜV-certified function blocks (up to SIL 3)
 	SIMATIC ET 200 ET 200M Modular I/O for multi-channel applications with digital input and output modules as well as analog input modules (up to SIL 3) ET 200S Bit-modular I/O with digital input and output modules as well as safety-related motor starters (up to SIL 3)	
	PROFIBUS with PROFIsafe	For standard and safety-related communication on just one bus cable, certified according to IEC 61508 (SIL 3)
	Process instruments/ process devices	Safe process instruments/devices on PROFIBUS PA: SITRANS P DS III (SIL 2) pressure transmitters on PROFIBUS PA with PROFIsafe (proven in use SIL 2) Safe process instruments/devices for connection to ET 200M remote I/Os: Pointek CLS 200/300 analog (SIL 2), Pointek ULS 200 (SIL 1), SITRANS P DS III analog/HART (SIL 2), SITRANS TW series (SIL 1), SIPART PS2, 2/4-wire (SIL 2)
	Applications - Partial stroke test - Burner libraries	Predefined function blocks and faceplates for online valve test to enable preventive valve diagnostics without affecting production Libraries with TÜV-certified function blocks for burner management systems



Design versions for safety-related SIMATIC PCS 7 systems

In general, two design versions are differentiated across all architectural levels of a SIMATIC PCS 7 system based on Safety Integrated for Process Automation:

- Single-channel, non-redundant design
- Redundant, fault-tolerant design

These two design versions are highly variable and offer a wide scope for design with regard to different customer requirements. At the individual architectural levels (controller, fieldbus, distributed I/O), the configuration alternatives shown in the diagram are available, depending on the process I/O used.

Thus 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 arising from the use of flexible modular redundancy.

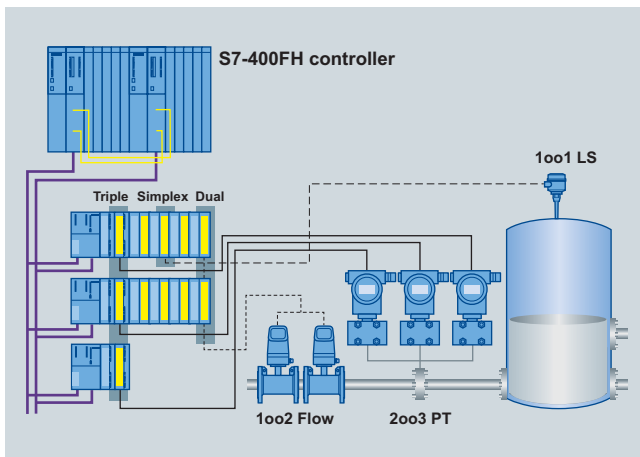
Safety-related automation systems

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

- **Single Station AS 412F/AS 414F/AS 417F**
with only one CPU, safety-related
- **Redundancy station AS 412FH/AS 414FH/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. In interaction with the safety-related signal modules of ET 200M/S distributed I/O systems or safe transmitters connected directly via fieldbuses, they not only detect errors in the process, but also their own internal errors, and will automatically transition the plant to a safe state if an error is detected. 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.

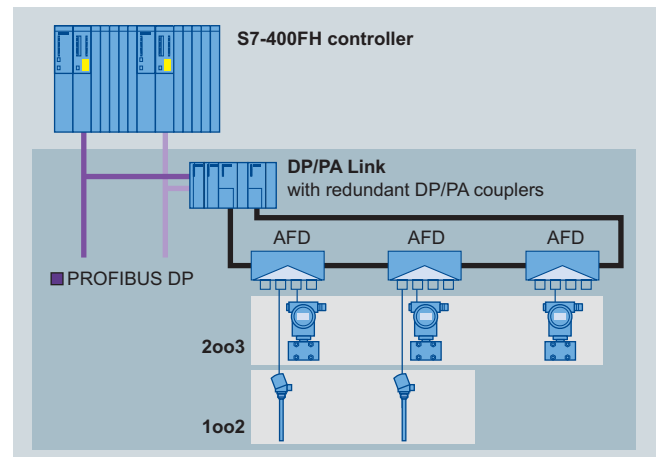
Flexible Modular Redundancy (FMR)



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.

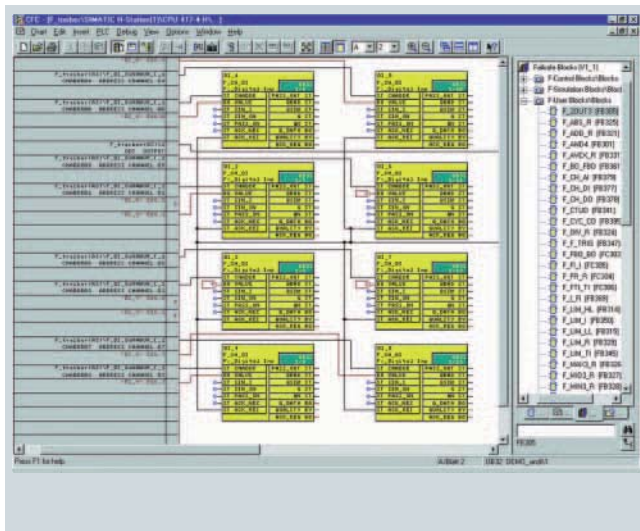
As shown in the example of a plant with ET 200M distributed I/O, the total of the tasks can produce a mix of different degrees of redundancy within one architecture level (1001, 1002, 2003).



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

Flexible modular redundancy, however, cannot only be applied to plant configurations with distributed I/O systems, but 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 in operating environments up to Ex zone 2 likewise permits cost-effective, safety-related and fault-tolerant applications with minimum use of devices and cables.

Engineering tools for safety functions



Engineering of safety-related applications with CFC

For configuration and programming of the safety-related AS 412F/FH, AS 414 F/FH and AS 417 F/FH, the F-block library in S7 F Systems and the SIMATIC Safety Matrix are available.

S7 F Systems with F-block library

The S7 F Systems engineering tool allows parameter assignment of the AS 412F/FH, AS 414 F/FH, and AS 417 F/FH as well as the safety-related F-modules from the ET 200M/S 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.

Input Tag	Func	Limit/Trip	EngUnit	Cause Description	Shut down	Close	Open	...
PS_100	FALSE			Feed Pump High Pressure Switch	1	N		
LSH_100	TRUE			Tank_100 Level switch high	2	S	S	R
LSL_200	TRUE			Hopper_200 Level switch Low	3	N	N	S
PSH_200	TRUE			Hopper_200 High Pressure	4	N	N	V
PT_100	H 30.00	PSIG		Feed pressure	5	S	S	S
LT_100	H 50.00	Feet		Tank Level	6	S	N	N
PT_101	H 26.00	D 3.0	PSI_H20	Tank Pressure	7		N	N
PT_102								
PT_103								
LT_200	H 50.00	ft		Hopper Level	8			
TS_101	FALSE							
TS_102	FALSE							
TS_103	FALSE			Tank_100 High Temperature switch	9			

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 the CFC 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.

PROFIsafe, safety-related I/O modules

PROFIBUS with PROFIsafe

The standard PROFIBUS 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. This solution supports operation of standard and safety-related components on the same bus. A separate and expensive safety bus is 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 telegrams by additional information with which the PROFIsafe communication peers can recognize and compensate transmission errors such as delays, incorrect sequences, repetitions, losses, faulty addressing or data falsification.

Safety-related F-modules/submodules

The safety functions of the F/FH automation systems are perfectly matched to the safety-related I/O modules of the ET 200M and ET 200S distributed I/O systems. The redundant F signal modules/submodules of ET 200M/S (DI/DO/AI) can be used for diagnostics of both internal and external faults. They carry out self-tests, e.g. for short-circuit or open-circuit, and automatically monitor the discrepancy time defined in the parameter settings.

Depending on the version, the input modules support 1oo1 and 2oo2 evaluation on the module. Further evaluations are carried out by the CPU, e.g. 2oo3 evaluation for analog inputs. The digital output modules enable safe disconnection through a second disconnect path in the event of a faulty output.

F-signal modules for ET 200M	Digital input module SM 326 F	Digital input module SM 326 F NAMUR [EEx ib]	Digital output module SM 326 F	Digital output module SM 326 F	Analog input module SM 336 F HART
Number of inputs/outputs up to	24 (1-channel for SIL 2 sensors) 12 (2-channel for SIL 3 sensors)	8 (1-channel) 4 (2-channel)	10, isolated in groups of 5 P/P switching	8, isolated in groups of 4 P/M switching	6 (1-channel) 3 (2-channel) 15 bits + sign 2-wire or 4-wire connection
Max. achievable safety class according to IEC 61508/EN 954-1	1-channel/1oo1: SIL 2 2-channel/2oo2: SIL 3	1-channel/1oo1: SIL 2 2-channel/1oo2: SIL 3	SIL 3	SIL 3	SIL 3 (1-channel/1oo1 and 2-channel/1oo2)
Input or output voltage	24 V DC	NAMUR	24 V DC	24 V DC	–
Input or output current	–	–	2 A per channel for signal "1"	2 A per channel for signal "1"	4 ... 20 mA or 0 ... 20 mA
Short-circuit proof encoder supply	4 for every 6 channels, isolated in groups of 2	8 for each channel, individually isolated	–	–	6 for each channel
Redundancy	Channel-discrete	Channel-discrete	Channel-discrete	–	Channel-discrete
Module and channel diagnostics	●	●	●	●	●
Dimensions	80 x 125 x 120	80 x 125 x 120	80 x 125 x 120	80 x 125 x 120	40 x 125 x 120

ET 200S power module PM-E for electronic modules

Power supply	24 V DC / 10 A	DC 24 ... 48 V; AC 24 ... 230 V; with fuse
Field of application	All electronic module types, including safety-oriented (4/8 F-DI, 4 F-DO); restrictions due to voltage range	
Diagnostics	Load voltage	Load voltage and fuse

Safety-related ET 200S electronic modules (F-modules)

Module types	Digital input module 4/8 F DI	Digital output module 4 F DO
Number of I/Os	4 (2-channel/1oo2 for SIL 3 sensors), 8 (1-channel/1oo1 for SIL 2 sensors)	4 for 24 V DC/2 A, current sinking/sourcing, up to SIL 3 P/M: for ungrounded loads (mass and ground separated)
Input or output voltage	24 V DC	
Module and channel diagnostics	●	●

Safety-related F-motor starter for ET 200S

- PM-D F PROFIsafe power module for fail-safe motor starters
- 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/contactors 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

- SITRANS P DS III PROFIsafe

The SITRANS P DSIII digital pressure transmitter is the first commercially available PROFIBUS PA device for SIL2 safety shutdowns conforming to IEC 61508/ IEC 61511-1. For this reason, Siemens has extended its standard measuring instrument for pressure, absolute pressure, differential pressure to include a PROFIsafe driver.

In a safety application, the pressure transmitter can be connected via PROFIBUS PA to an AS 412F/FH, AS 414F/FH or AS 417 F/FH. The digital input of the PROFIBUS PA SIPART PS2 electropneumatic positioner can be used for the safe shutdown.

In the case of a diverse redundant design, measuring circuits up to safety level SIL3 can be implemented.

Process safety highlights

- Safety Integrated for Process Automation – the comprehensive product and service offering for safe, fault tolerant, and high-availability applications in the process industry
 - Easy implementation, operation, and maintenance of safety applications
 - Innovation safe thanks to high-level adaptability to changed conditions
 - Reliable in elimination of dangers and risks
- 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 level SIL 3, AK 6 with only one CPU is possible
 - Standard and safety-related communication between controller and I/O via a common fieldbus PROFIBUS with PROFIsafe – no separate safety bus
 - Mixed operation of standard and safety-related F-modules in ET 200M/S stations
 - Uniform data management for basic process control and safety-related automation, including process visualization and diagnostics – no complex data management
- Integration of safety-related applications in the convenient process visualization on the SIMATIC PCS 7 operator station
- Configuration of safety functions is part of the uniform system configuration with the PCS 7 Engineering System
 - S7 F systems, CFC, and SIMATIC Safety Matrix are anchored in the engineering toolset
 - Configuration of basic process control functions and safety functions with one engineering tool, the CFC
 - Safety Matrix for creation of safety functions without special programming skills - even faster, easier, and with more convenience than is possible with the CFC
- Automatic consideration of safety-related fault messages in process visualization, with identical time stamp
- 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 Asset Management system
- Minimization of total lifecycle costs
 - Reduction of costs for hardware, mounting, wiring, installation, engineering, and commissioning 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

Optimization with Advanced Process Control

With complex processes, control concepts based on PID controllers often reach their limits quickly. Advanced Process Control (APC) functions which enable a mathematical description even of complicated relationships between process parameters 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

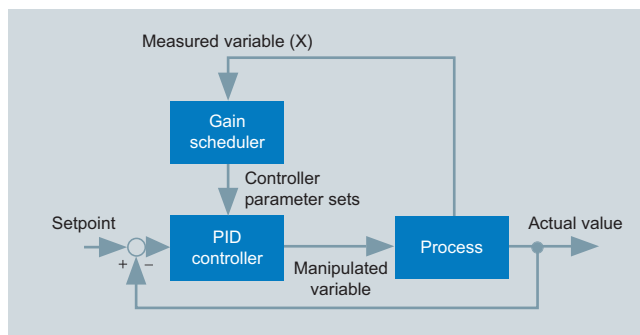
In addition to numerous basic control functions, e.g. PID control, cascade control, split range control and ratio control, the I&C libraries of SIMATIC PCS 7 also provide function blocks and templates for advanced control functions at no extra cost:

- Gain scheduling (GainSched)
- Override control
- Lead-lag/feed-forward control
- PID tuning
- Control performance monitoring (ConPerMon)
- Smith predictor
- Model-based predictive control (ModPreCon)

Using these standard solutions, complex APC applications can be implemented simply and cost-effectively even for small and medium-sized plants. A standardized APC process tag type selected from the library in accordance with the control requirement can be modified in a simple manner to allow problem-oriented determination of optimized solutions for special tasks.

Additional advanced control functions cannot only be linked over interfaces, as is normally the case, but they can also be integrated seamlessly into the process control system as add-on products, e.g.:

- Fuzzy Control++
- Soft sensors (Presto)
- Model-predictive multi-variable controller (INCA)
- Adaptive controller (ADCO)

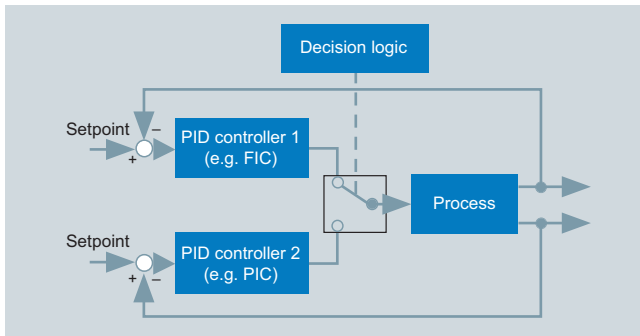


Gain scheduling

The GainSched block enables infinite adjustment of the controller parameters in non-linear processes depending on the operating point.

Similar to the polygon block, it can derive output variables at three operating points from a continuously measurable input variable (measured variable X) which describes the process status. These output variables serve as control parameters for a connected control block. Bumpless transitions between the operating points are achieved by linear interpolation. GainSched can therefore infinitely change the parameters of the combined PID controller depending on the response of the measured variable X.

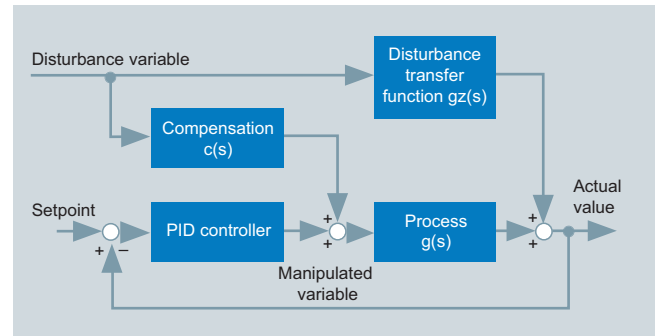
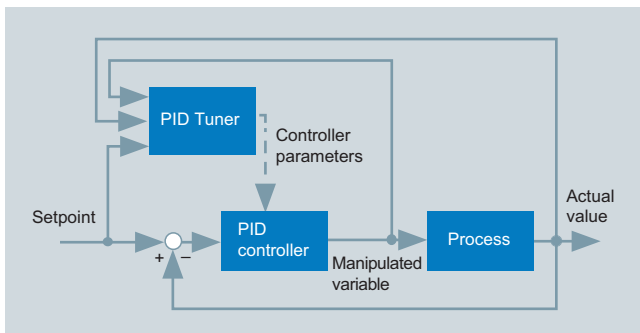
- Suitable for non-linear processes
- Three complete parameter sets for three operating points
- Application examples:
 - Control of pH value (neutralization) with non-linear titration curve
 - Temperature control of boilers
 - Batch processes with chemical reactions (non-linear reaction kinetics)



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
- The decision concerning which controller is active can depend on:
 - Measurable output variables, e.g. one of the controlled variables
 - Manipulated variables of the controllers
- Application examples:
 - Primary controlled variable: flow
Secondary controlled variable: pressure limiting (for safety reasons)
 - Primary controlled variable: steam pressure
Secondary controlled variable: level



Lead-lag/feed-forward control

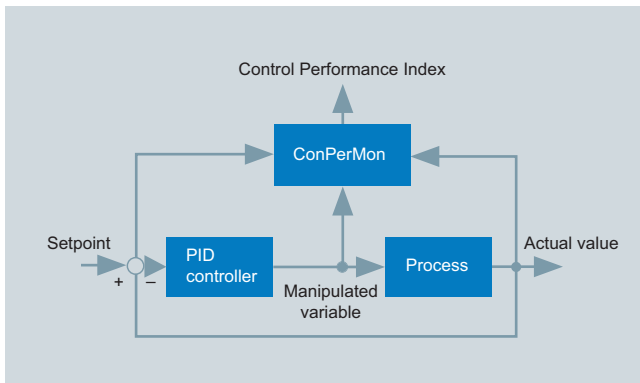
Feed-forward control can compensate a strong, measurable interference in advance so that the control is limited to model uncertainties and non-measurable interferences. The transfer function $g_z(s)$ for the effect of the measurable disturbance variable on the process can be determined with the controller in manual mode. It is then possible to derive the transfer function $c(s)$ for the control element for compensation of the disturbance variable.

- Compensation of strong, measurable interferences
- Interferences are eliminated before they have a negative effect
- Application examples:
 - Temperature control on an industrial furnace (disturbance variable: flow rate)
 - Concentration control in a stirring vat reactor (disturbance variable: inlet concentration)

PID tuning

Using experimental trial and error, a model of the process is initially generated using the PID Tuner integrated in the engineering system. Based on this, the most favorable controller parameters can be determined by means of value optimization. It is possible to select either an optimum response to disturbance variable changes or an optimum response to setpoint changes.

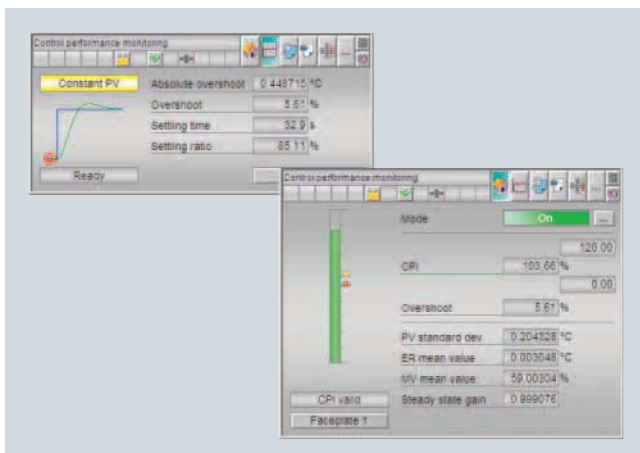
- Optimization of PID control loops
- Can be used for standard PID controllers and blocks from user-specific libraries
- Simulation of closed control loops
- Application example: Optimization of PID controller parameters in any applications



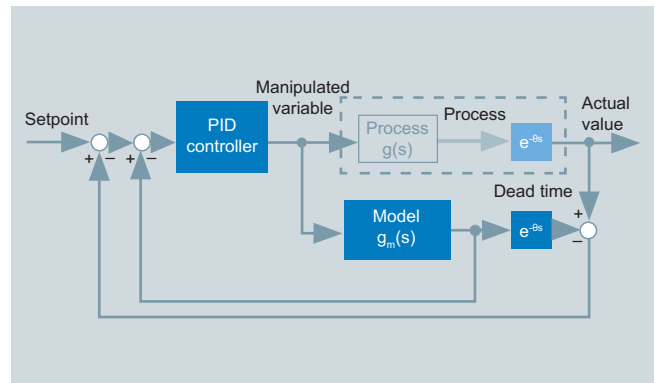
Control performance monitoring

The ConPerMon block is interconnected with setpoint, actual value, and manipulated variable of the control block (e.g. PID controller) and determines its control performance. Depending on the deviation from the comparison value, e.g. the control performance during commissioning, it can trigger a warning or an alarm. The faceplates of all control performance monitoring actions of a plant or a plant unit can be summarized in OS screens. This enables problems to be detected early on, analyzed, and specifically corrected.

- Online monitoring of the control performance
- Identification of control loops in a plant according to the criteria:
 - Maximum urgency for optimization
 - Imminent fault
- Configurable alarm limits for standard deviation and overshoots for preventive maintenance and fast fault locating
- Graphic evaluation
- Application example: large plants with many control loops, e.g. refineries



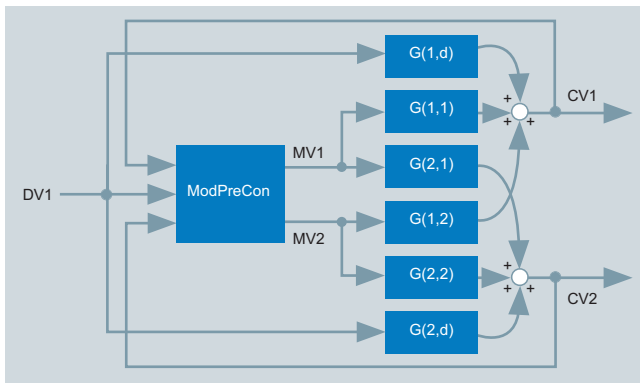
Faceplates for ConPerMon (setpoint and standard views)



Smith predictor

As an alternative to a model-based predictive controller, the Smith predictor can significantly improve the control performance of processes with long and relatively constant dead times. By eliminating the dead time component using a process model running parallel to the actual process, the controller can be designed for a process free of dead time, and set more effectively.

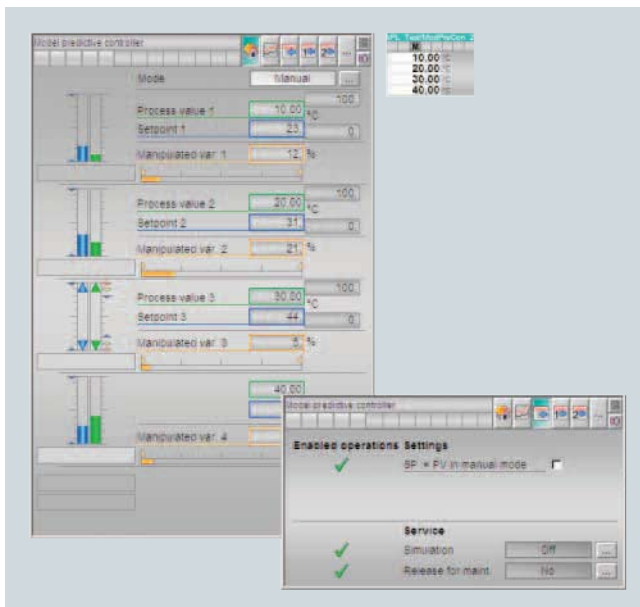
- For processes with long, known dead times which are usually constant; "internal model control" concept:
 - Process model runs parallel to the actual process
 - Feedback of virtual controlled variable free of dead time from the process model to the controller
 - Feedback of deviation between the measured actual value of the controlled variable and the virtual value with dead time at the model output
- Draft PI(D) controller:
 - Based on component of process model that is free of dead time
 - Allows significantly more precise controller setting
- Application examples:
 - Polymerization
 - Control of analyzed values (as result of dead time associated with analyses)
 - Temperature control through supply of water or heating steam as well as via external heat exchangers



Model-based predictive control (MPC)

The model-based predictive multi-variable controller ModPreCon separately analyses the behavior of up to four interdependent variables for complex processes over a longer period. The parameter matrix calculated from the results is then used by the ModPreCon for optimum control of these variables, and thus eliminates the disadvantageous interactions which occur with separate control of the interdependent variables.

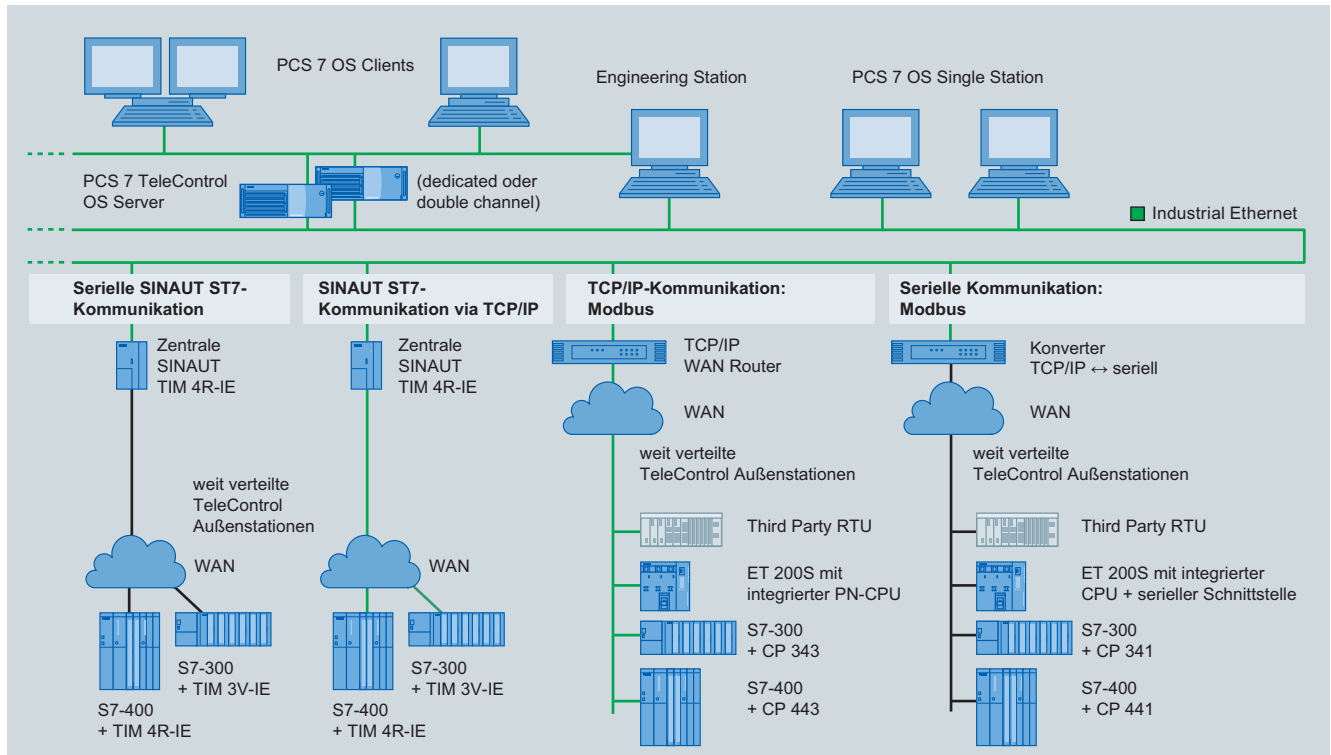
- Most powerful APC function
- Scalable MPC applications:
 - Internal ("lean") MPC: up to 4 x 4
 - External "full-blown" MPC: more than 4 x 4
- "Lean" and "easy to use"; requires neither communication monitoring nor backup strategies
- Application examples:
 - 2 x 2 applications: two-material distillation,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



Faceplates for ModPreCon
(standard view, block icon, parameter view)



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 plant 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).

Conventional solutions use process control systems for the more complex areas of the plant, and simpler Remote Terminal Units (RTU) for the outstations, and then combine these separately configured plant units in a host network control system. By directly integrating the automation of the distributed outstations into the SIMATIC PCS 7 process control system for automation of the central plant areas, SIMATIC PCS 7 TeleControl allows far more effective solutions. The higher-level integration level becomes superfluous, and numerous further advantages result from the joint process control, simple and user-friendly data management, and integrated engineering.

Integration into the SIMATIC PCS 7 process control is possible in the form of an operator station in single station or server design (also redundant as option). An additional automation system for processing and routing TeleControl-specific data is unnecessary.

The PCS 7 TeleControl Operator Station is preferably used just for telecontrol functions (dedicated), but can also access central SIMATIC PCS 7 plant areas via an additional second channel in the case of small quantity frameworks (double-channel operation).

There are no differences between central and remote automation with regard to operating philosophy and alarm response. Data from SIMATIC PCS 7 automation systems can be displayed together with data from the outstations of a telecontrol system on the OS clients in one process display. The data is obtained either from a server with double-channel functionality or from two separate servers.

The SIMATIC PCS 7 TeleControl blocks for processing and displaying the data on the PCS 7 TeleControl Operator Station (single station/server) are managed in a library together with blocks for diagnostics and control of communication. These blocks support both operator prompting in conformance with SIMATIC PCS 7 using symbols and faceplates and the hierarchy of the SIMATIC PCS 7 alarms. The supplied basic library can be extended if necessary by new script-based block types specific to the project.

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 the engineering tool "Data Base Automation" (DBA) and the block library "SIMATIC PCS 7 TeleControl". DBA efficiently automates the engineering function in conformance with the SIMATIC PCS 7. It facilitates project-specific adaptation of the system and importing of existing configurations during migration, and supports expansion of plants during ongoing operation.

Outstations for integration (RTU)					
Communication protocol		SINAUT ST 7		Modbus	
Type of communication		Serial	Ethernet TCP/IP	Serial	Ethernet TCP/IP
Interface on the PCS 7 TeleControl OS		TIM 4R-IE	TCP/IP WAN router or/and TIM 4R-IE	TCP/IP converter - serial	TCP/IP WAN router
RTU/interface	S7-300	TIM 3V-IE	TIM 3V-IE	CP 341	CP 343 + SW library
	S7-400	TIM 4R-IE	TIM 4R-IE	CP 441	CP 443 + SW library
	ET 200S with integral CPU (corresponds to S7-314)			DP master module + 1SI Modbus module + IM 151-7 CPU or IM 151-8 PN/DP CPU	IM 151-8 PN/DP CPU + S7-OpenModbus software/TCP PN-CPU
	Third-party station			Depends on type of station	Depends on type of station
Dialup lines		●			
Dedicated line and radio networks		●	●	●	●
Master-slave		●	●	●	●
Peer-to-peer		●	●		
Mesh networks		●	●		
Time tagging in RTU		●	●		
RTU time synchronization		●	●		
Data buffering in RTU		●	●		
International standard				● (many versions)	● (many versions)

Current range, communication options and features of the outstations for integration (RTU)

Category	Typical number of I/Os	RTU type
Small	Up to approx. 30	ET 200S with integral CPU, Modbus; optionally also for extended temperature range -25 °C to +70 °C
Medium	Up to approx. 100	S7-300 with SINAUT ST7, Modbus; optionally also Safety Integrated with S7-300F
Large	Up to approx. 500	S7-400 with SINAUT ST7, Modbus; optionally also Safety Integrated with S7-400F

Categories of outstations (RTU) with regard to performance

Laboratory automation

SIMATIC PCS 7 LAB for high flexibility, quality, efficiency and safety in laboratories



Modules of the SIMATIC PCS 7 LAB laboratory automation system, shown here: ET 200pro I/O module (front), ET 200M I/O module, and PC module (top)

In addition to high quality, efficiency and safety, laboratory automation necessitates fast and flexible adaptation of the laboratory equipment to the automation technology. The simple and universal SIMATIC PCS 7 LAB is explicitly tailored to these requirements. Ready-to-use solutions for typical laboratory applications such as dosing, temperature control or inertization procedures greatly support laboratory personnel in their work with the integral control technology.

SIMATIC PCS 7 LAB not only permits autonomous automation of a laboratory. Integration into a SIMATIC PCS 7 plant network additionally allows effective exchange of information and simple transmission of laboratory results to the production department.

Basic components

The basic components for configuring a SIMATIC PCS 7 LAB are five rugged modules which can be integrated into any laboratory as a result of their compact design. This allows a very flexible design in a variety of environments, either centrally or distributed. Mobile use at changing locations is also possible.

Standard configurations

The following module combinations are available as standard configurations:

- **SIMATIC PCS 7 LAB ET 200M**
comprising:
 - PC module
 - ET 200M I/O module
- **SIMATIC PCS 7 LAB ET 200pro**
comprising:
 - PC module
 - ET 200pro I/O module
 - POWER module

The PC module consists of a SIMATIC PCS 7 BOX 416 including AS, ES and OS functionality and licenses for 250 POs.

The POWER module provided with the standard SIMATIC PCS 7 LAB ET 200pro configuration supplies 24 V DC to the I/O module via a hybrid ECOFAST bus cable.

The standard configurations can also be modified and expanded if required. For example, the optional SER module can be used in addition to or as an alternative to the I/O modules on the PC module. The module is equipped with four CP 341, and offers a total of eight serial RS 232C interfaces for connecting third-party devices.



Basic components	Dimensions W x H x D in mm
PC module	585 x 300 x 332
ET 200M I/O module	585 x 300 x 332
ET 200pro I/O module	500 x 180 x 85
POWER module	370 x 300 x 316
SER module	585 x 300 x 332

SIMATIC PCS 7 LAB basic components with dimensions

PC module

The technology of the PC module is comparable with that of the integral SIMATIC PCS 7 BOX 416. It has a PROFIBUS DP connection for the I/O modules, two Industrial Ethernet connections, four USB interfaces (2 x high current, 2 x for keyboard and mouse), and a serial COM1 port. A suitable monitor can be connected via the DVI port. The integral functionalities for automation, engineering, operator control and monitoring can be extended by SIMATIC BATCH and SIMATIC Route Control.

ET 200M I/O module

The ET 200M I/O module contains the following components:

- 100 ... 240 V AC/24 V DC power supply (10 A)
- PROFIBUS DP connection
- CP 341 serial interface module (2 x RS 232C)
- Six I/O modules from the ET 200M I/O system:
 - SM 331 analog input module for current measurements: AI I 8 x 0/4 ... 20 mA
 - SM 331 analog input module for voltage measurements: AI U 8 x ± 10 V
 - SM 331 analog input module for temperature measurements: AI RTD 4 x Pt100
 - SM 332 analog output module: AO I 8 x 0/4 ... 20 mA
 - SM 321 digital input module: DI 16 x 24 V DC
 - SM 322 digital output module: DO 16 x DC 24 V/0.5 A

The I/O modules are wired on front panels with color-coded laboratory sockets (4 mm). These tab connections enable fast and flexible interconnection with the sensors and actuators and are particularly advantageous if there are frequent changes or rebuilding.

ET 200pro I/O module

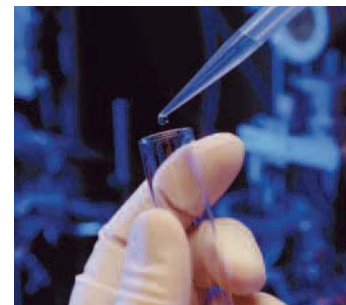
The ET 200pro I/O module with high IP 65 degree of protection can be installed directly in laboratory equipment. In addition to the PROFIBUS DP interface module, the following seven electronics modules are fitted side by side on the rack:

- EM 144 analog input module for current measurements: AI I 4 x ± 20 mA
- EM 144 analog input module for voltage measurements: AI U 4 x ± 10 V
- EM 144 analog input module for temperature measurements: AI RTD 4 x Pt100
- EM 145 analog output module: AO I 4 x ± 20 mA
- EM 141 digital input module: DI 8 x 24 V DC
- 2 x EM 142 digital output module: DO 4 x 24 V DC/2 A

Actuators and sensors are connected to the connection modules of the electronic modules using 5-pin M12 connectors.

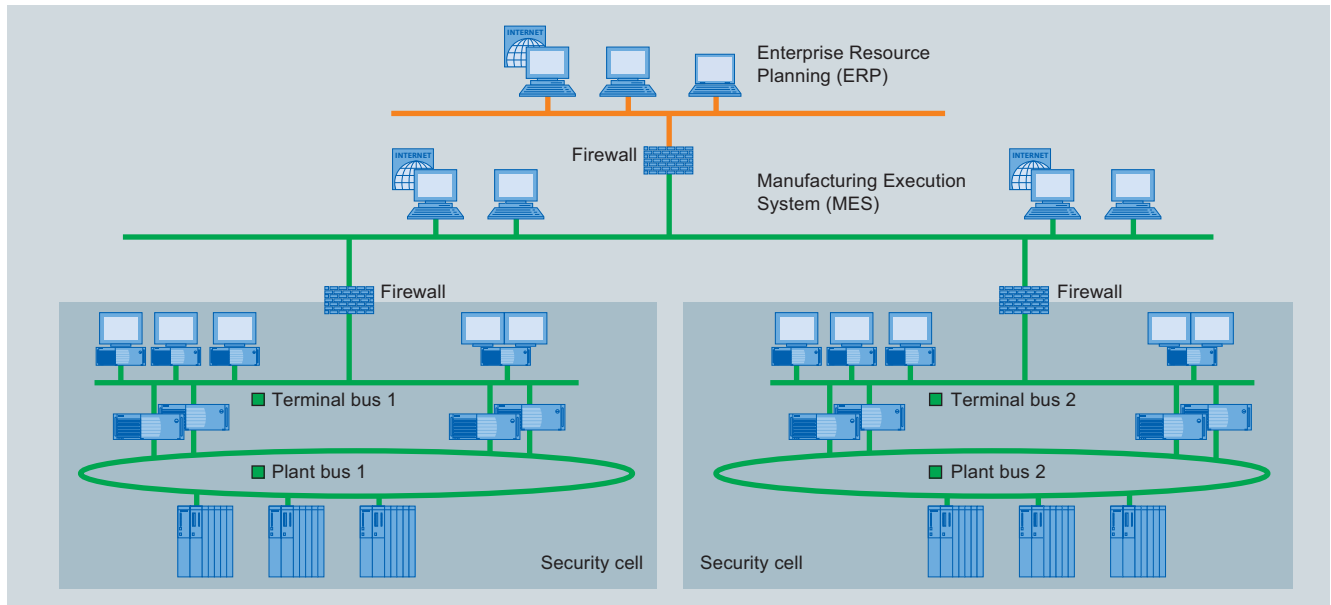


POWER module (supplied with the SIMATIC PCS 7 LAB ET 200pro standard configuration)



IT security

Comprehensive protective measures for IT security



Example of "defense in depth" 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 such as computer viruses, worms or Trojans or from 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

With its pioneering security concept, SIMATIC PCS 7 offers comprehensive solutions for protecting a process engineering plant which are based on a graded security architecture (defense in depth). 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:

- Generation of a network architecture with graded security (defense in depth), combined with segmenting of the plant into security cells
- Network administration with name resolution, assignment of IP addresses and division into subnetworks
- Operation of plants in Windows domains (Active Directory)
- Administration of Windows operator privileges and SIMATIC PCS 7 operator privileges; integration of SIMATIC PCS 7 operator privileges into the Windows administration
- Reliable handling of time synchronization in the Windows network
- 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 "SIMATIC PCS 7 Security Concept, Recommendations and Advice".



SCALANCE S industrial security modules

SCALANCE S industrial security modules

In operation as a firewall, the SCALANCE S602, S612 and S613 industrial security modules can safeguard industrial systems/devices or network segments of an Ethernet against unauthorized access. In addition, SCALANCE S612 and S613 use encryption and authentication (VPN) to protect data transmission between systems/devices, or network segments against data manipulation and espionage.

System support for the security concept

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

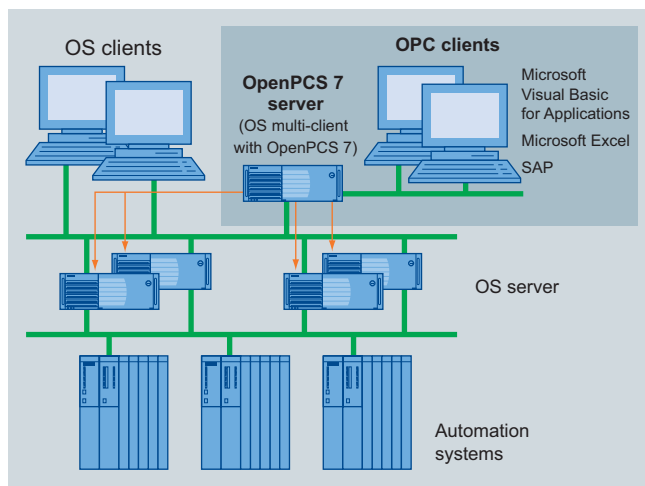
- Compatibility with current versions of the antivirus software: Trend Micro OfficeScan, McAfee Virusscan, and Symantec Norton AntiVirus
- Use of the local Windows XP firewall
- SIMATIC Security Control (SSC) for automatic setting of safety-related parameters of DCOM, registry and Windows firewall already during setup
- User administration and authentication using SIMATIC Logon
- Integration of Industrial Security Modules SCALANCE S602, S612, S613

In the study "IT Security for Process Control Using Siemens SIMATIC PCS 7" dated September 2007, the ARC Advisory Group confirmed that Siemens provides an efficient, holistic safety concept for the SIMATIC PCS 7 process control system. For further information, go to:

www.siemens.com/pcs7/safety_security

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 the 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, central archive server CAS). It covers the distribution of data with respect to

- Period (OS1 / OS2 / ... / CAS)
- 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 V1.00, V2.05a, V3.00

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 V1.20

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 V1.10

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



Manufacturing Execution Systems (MES), such as SIMATIC IT from Siemens, enable effective integration of product processes and production planning systems. They offer support in each phase of production for coordinating all manufacturing-relevant resources and applications.

SIMATIC IT can be used to model the complete production know-how, to precisely define the operating processes, and to record data from the ERP and production levels in real-time. It is then possible to control processes more effectively, to minimize downtimes, production waste and rework, to optimize stock keeping, and to react rapidly and flexibly to different customer requirements.

Modeling of the business and production processes is transparent, understandable and independent of the control systems. Even complex business and production processes can easily be modeled. Subsequent changes can be incorporated efficiently and without difficulty.

Modeling of the business and production processes with SIMATIC IT facilitates effective protection of the know-how used, in addition to seamless documentation.

The plant and production models can be stored in libraries and then used again in other projects. This means they can be used at any location within the business for standardizing the processes. "Best practices" are therefore available throughout the company. This prevents implementation errors, provides security of investment, reduces introductory and maintenance costs and results in a significant shortening of the project duration.

SIMATIC IT's product architecture and functionality are in conformance with ISA-95, the internationally recognized standard for Manufacturing Execution Systems and Manufacturing Operation Management.

SIMATIC IT bundles

SIMATIC IT consists of various components designed for dedicated tasks that are coordinated by the SIMATIC IT Production Modeler. The basic functions are implemented using SIMATIC IT components in the form of the following product bundles:

SIMATIC IT Plant Intelligence

Defines key performance indicators conforming to the plant model for realistic assessment of the plant.

SIMATIC IT Genealogy Management

For materials management in the entire company, taking into account the legal terms and conditions.

SIMATIC IT Order Management

For job management from planning to execution, including scheduling, dispatch, monitoring, and recording.

The product portfolio is completed with further bundles, such as SIMATIC IT Basic Tracking & Tracing, SIMATIC IT Basic Production Management or SIMATIC IT Production Suite.

Each bundle can be additionally extended by options such as:

- SIMATIC IT PDS-I (Predictive Detailed Scheduler - Interactive)
- SIMATIC IT Report Manager
- SIMATIC IT OEE-DTM Option (Overall Equipment Efficiency / Down Time Management)
- SIMATIC IT SPC (Statistical Process Control)

The MES product range is completed by SIMATIC IT with components for special ISA-95 functions:

- SIMATIC IT Unilab
- SIMATIC IT Interspec
- SIMATIC IT XHQ

Compact systems

SIMATIC PCS 7 BOX - complete control system in compact design

SIMATIC PCS 7 BOX extends the SIMATIC PCS 7 product range by low-cost and versatile compact systems which can be used as stand-alone devices or also in the plant network. They are equipped with functionalities for automation, operator control and monitoring, and optionally also for engineering. Combined with distributed process I/O on the PROFIBUS, they each represent a complete SIMATIC PCS 7 process control system.

With the SIMATIC PCS 7 Engineering and Runtime software limited to 2000 process objects (PO), excellent physical properties, and small dimensions, SIMATIC PCS 7 BOX is predestined for automation at plant level for:

- Small applications/plant 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 current offering includes two SIMATIC PCS 7 BOX performance classes:

- **SIMATIC PCS 7 BOX RTX**
with WinAC RTX software controller;
implementable AS-quantity framework comparable to AS 414
- **SIMATIC PCS 7 BOX 416**
with WinAC Slot 416 hardware controller;
implementable AS-quantity framework comparable to AS 416

These can each be delivered in two equipment variants:

- **SIMATIC PCS 7 complete system**
with AS, ES and OS functionality including licenses for 250 POs
- **SIMATIC PCS 7 runtime system**
with AS and OS functionality including licenses for 250 POs

All are equipped with two PROFIBUS DP interfaces for connection of the distributed process I/O, as well as two 10/100/1000 Mbit/s Ethernet RJ45 interfaces for integration in the plant network.

Configuration is possible either using the engineering software integrated in SIMATIC PCS 7 BOX or the SIMATIC PCS 7 Engineering System.

The SIMATIC PCS 7 BOX can be incorporated into the PCS 7 Asset Management using the integral SIMATIC PC DiagMonitor diagnostics software. In this context, they can also be operated as Maintenance Station.





SIMATIC PCS 7 BOX RTX compact system

SIMATIC PCS 7 BOX RTX

SIMATIC PCS 7 BOX RTX is characterized by an outstanding price/performance ratio. In terms of automation performance, it is positioned just below the SIMATIC PCS 7 BOX 416. Its standout feature is extremely fast program execution.

The WinAC RTX software controller generates only a low base load, and shows its strengths particularly with applications that involve real-time requirements and deterministic dynamic response.



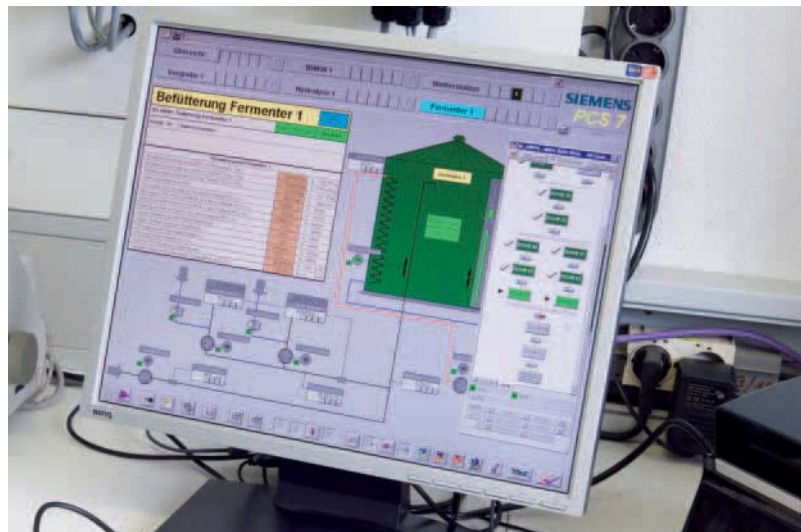
SIMATIC PCS 7 BOX 416 compact system

SIMATIC PCS 7 BOX 416

The SIMATIC PCS 7 BOX 416 is equipped with an autonomous WinAC Slot 416 V4.0 hardware controller, and the distributed process I/O is connected via its PROFIBUS DP ports. An automation program runs in this controller completely independent of the base PC and its Windows operating system.

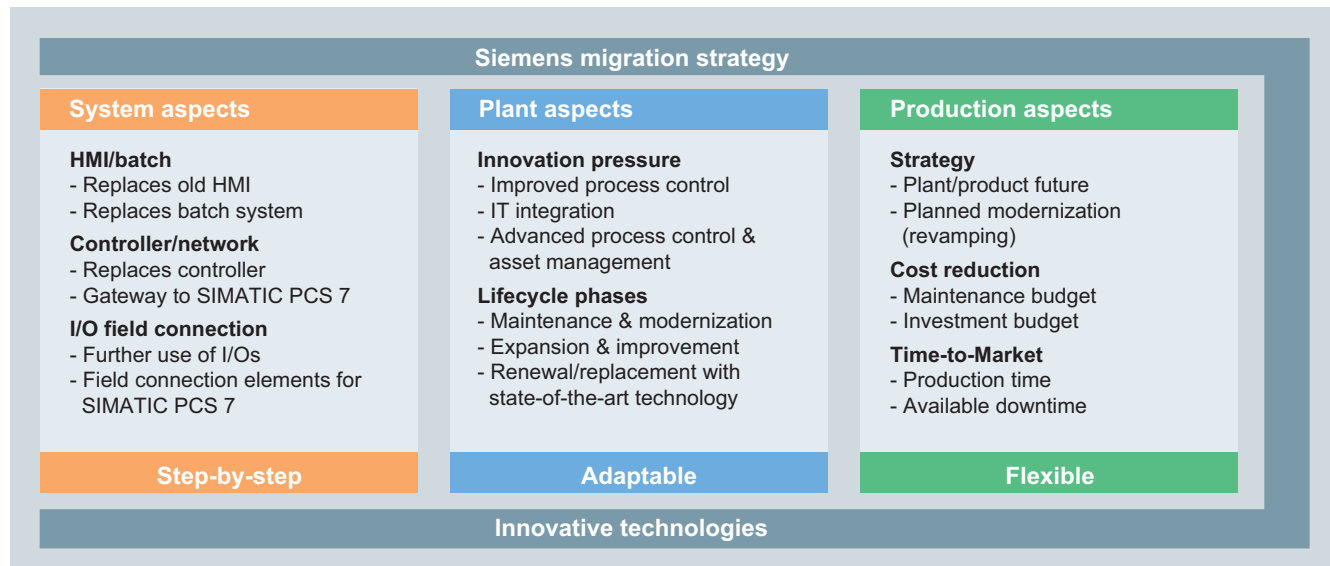
It is particularly recommended if high availability or CiR (Configuration in Run) is relevant for the selection.

A further advantage of SIMATIC PCS 7 BOX 416 systems is that they can be used for automation of batch processes with SIMATIC BATCH and for control of material transports with SIMATIC Route Control. In this case the capacity of SIMATIC BATCH is limited to 10 units (instances of plant units), and the capacity of SIMATIC Route Control is limited to 30 concurrent material transports.



Migration of own and third-party systems

An investment for the future



Migration strategy

Globalization and permanently increasing competition are forcing companies to continuously increase productivity and shorten product launch times. To achieve this, it is necessary to continuously optimize the engineering and process, with simultaneous observation of new industrial requirements and regulations.

Many systems and plants must now be expanded and modernized to ensure that companies can continue to provide products complying with 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.

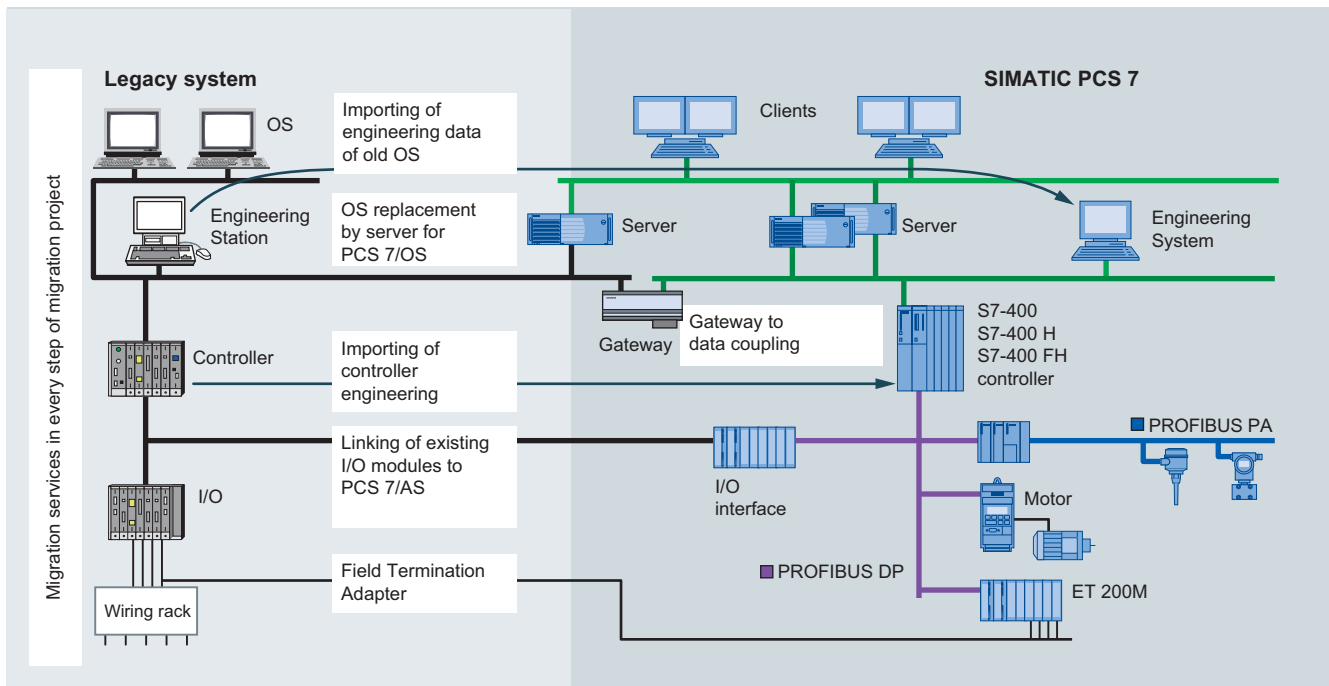
Experience has shown that the success of a migration process greatly depends on a technical solution optimally matched to customer requirements and the respective plant. Minimization of the technical and financial risks together with safeguarding of investments for as long a period as possible are always fundamental aspects. The different lifecycles of the various system components must also be considered, which currently vary from 5 years for PC-based workstations, 15 years for controllers, up to 25 years or more for input/output components and wiring.

Therefore Siemens does not consider its task to simply be the complete replacement of an existing system, but in the close collaboration with customers and their system integrators to produce 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 specific conditions of the plant
- **Flexible** according to production requirements

Portfolio of the migration products

Siemens already recognized the significance of migration for process automation at an early point in time, and has offered a wide range of innovative migration products and solutions for its globally proven systems for many years already. Through consistent extension of this migration offering Siemens has become more and more capable of also modernizing legacy systems from other manufacturers with SIMATIC PCS 7. Right from the start, the principle of Siemens' migration strategy is to modernize the existing installed base step-by-step without completely changing the system – if possible without a plant shutdown or with minimum production downtimes. In this manner, Siemens supports customers' endeavors to achieve long-term safeguarding of investments and maximize return on assets.



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

Migration component	Description
OS migration products	<ul style="list-style-type: none"> Interface from SIMATIC PCS 7 OS Server to system bus of old system OS conversion tool (e.g. DBA) Faceplate library
Services for OS migration	Tools/services for converting process displays
Services for AS migration	Tools/services for function-based conversion of AS engineering data to SIMATIC PCS 7
BATCH migration components	Enables existing systems to use SIMATIC BATCH
Gateway	<ul style="list-style-type: none"> Gateway between the system bus of the legacy system and SIMATIC PCS 7 (mainly for AS-AS communication) Engineering tool for gateway
Reuse of legacy system I/Os or Field Termination Assembly (FTA)	<ul style="list-style-type: none"> Reuse of I/Os (connection of old I/Os to SIMATIC PCS 7 automation systems, mostly for Siemens systems) Field Termination Assemblies (FTAs) for field cabling

Data Base Automation

Siemens' expertise in the migration sector has continuously grown. The experience gained in numerous migration projects has been incorporated into new products and technologies which are even more efficient. A good example of this principle is "Database Automation" (DBA). Using DBA and a plug-in interface, it is possible to download configuration data and to display and configure it using a standardized user interface.

Thus DBA enables system-supported migration of uniform operator system data from different output systems. The results are uniform software quality, security, and traceability.

Typical migration scenarios

A large number of different migration scenarios is imaginable depending on the specific technical and economical factors of each migration project. The migration products offer the modularity and flexibility required to implement such scenarios.

Typical migration scenarios which can be implemented using these migration products:

Scenario 1: Replacement of existing HMI system by a SIMATIC PCS 7 operator system

If the HMI (Human Machine Interface) system is technically obsolete, if the stocking of spare parts is too expensive, if it no longer complies with current directives and standards for operator workstations, or if functional expansions are required (e.g. IT integration), it is possible to simply replace the existing HMI system with a SIMATIC PCS 7 operator system. The controller with application software and the process I/O are retained.

- Minimum costs
- Clear risk
- Lengthening of service life of complete plant
- New application possibilities
- Opening of the system for the IT world

Scenario 2: Expansion of an existing plant

The existing plant is initially retained, and is modernized by expanding with further sections/units with SIMATIC PCS 7.

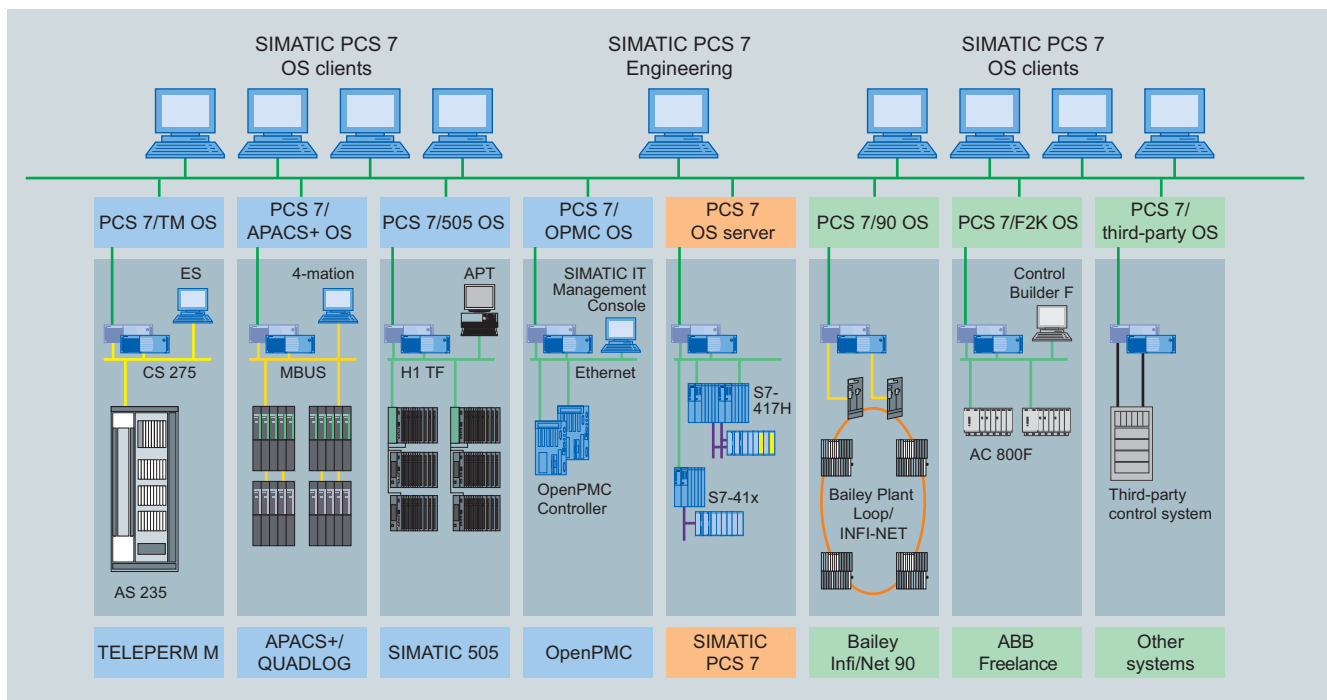
- Simple, step-by-step increase in production capacity
- Clear risk
- Introduction of new technologies (e.g. PROFIBUS fieldbus, HMI)
- Opening of the system for the IT world
- Together with scenario 1, enables process control using a uniform operator system

Scenario 3: Comprehensive modernization

Bottlenecks in the provision of spare parts, insufficient support, and the necessity for functional expansions (e.g. fieldbus technology or IT integration) can also necessitate comprehensive modernization of the old system using the future-oriented SIMATIC PCS 7 process control system. Conversion may also be possible during operation. Further use of the existing I/O level is supported, and the investments made for wiring, hardware components or application engineering are safeguarded.

- Increase in performance
- Introduction of new technologies (e.g. PROFIBUS fieldbus, HMI)
- Opening of the system for the IT world
- Lengthening of service life of complete plant
- Reduction in the number of system suppliers
- Elimination of bottlenecks and dependencies

Migration spectrum



Migration spectrum for SIMATIC PCS 7

The migration of own process control systems with the modern SIMATIC PCS 7 is a matter of course for Siemens, and a significant component of the continued supplier/customer relationship. Siemens is additionally able to offer migration solutions for control systems from other vendors, e.g. for systems from ABB or Bailey.

Siemens works closely with the customer's system integrators when implementing migration projects, for they have the know-how gained over many years and exactly know the plant as well as the customer's requirements. This partnership is a guarantee for the companies operating plants that they will receive an optimum migration solution.

A further important aspect is that Siemens supports the migration products as well as the standard products by means of product updating and customer support. A special strength of Siemens compared to other migration providers is the ability to offer customers long-term support concerning expertise, servicing, and delivery of components, spare parts and upgrades.

Multiple Migration Support Centers distributed worldwide provide the customer with additional support that extends beyond product support for:

- Working out migration concepts
- Quotation preparation
- Engineering/project handling

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

Training



If you choose the SIMATIC PCS 7 process control system, you can rely on first-class services with fast and reliable support worldwide. Whatever type of service is concerned: we can promptly provide the right, competent partner anywhere in the world and with the minimum of bureaucracy.

The right training – tailored precisely to your requirements!

Correct training helps toward using the process control system particularly efficiently – in the shortest possible time. Irrespective of whether you are converting within the PLC world, whether you wish to start with process automation, or whether you already have sound knowledge in this field: we offer you professional training geared toward the target group.

Training centers in more than 60 countries worldwide will help you to gain profound knowledge of the SIMATIC PCS 7 system or to expand your existing expertise. Regardless of whether you attend a standard course or a special user-specific course: SIMATIC courses quickly provide you with qualifications and comprehensive know-how direct from the manufacturer – in a modular structure, and all with a thoroughly practical content. Hands-on training with system specialists can also be carried out directly on site on your plant.

More information on the Internet:
www.siemens.com/sitrain

Global Service & Support – our services in every phase of a project

Our experienced specialists and proven global service processes are available to you in more than 100 countries.

Online support

You have global 24/7 access on the Internet to state-of-the-art expertise. Our Service & Support portal provides a complete range of information on our products in several languages: covering product support, services, and regional representatives. This is rounded-off by country-specific information in the respective language.

Technical support

You obtain regional support in your respective language.

Our uniform support strategy is based on a proven graded concept for processing technical inquiries. Regional technical support is extended by central technical support in Europe, the USA and Asia.

By taking advantage of the time difference between the continents – follow the sun – you can reach us 24 hours a day. This is a special service offered to you via our Automation Value Card.

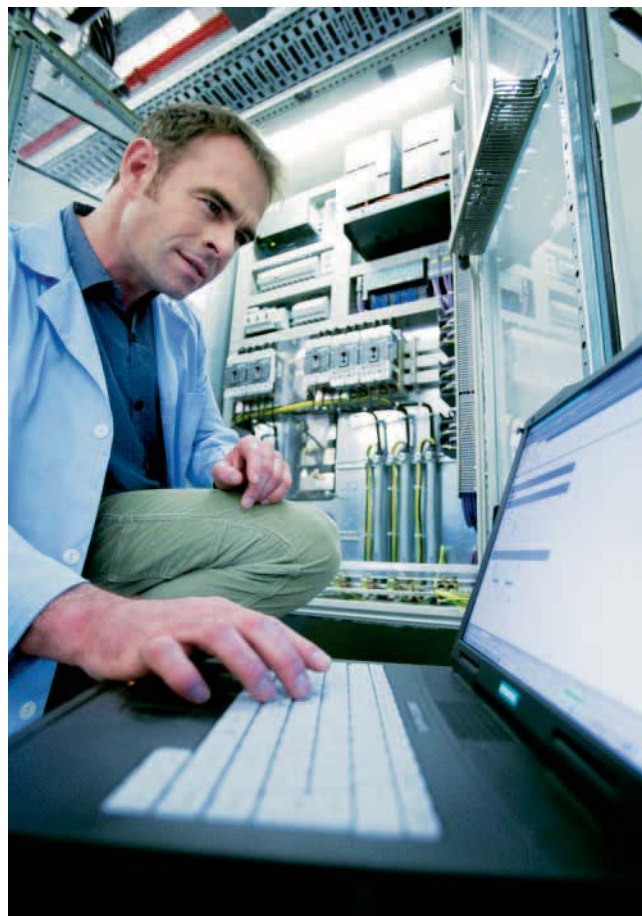
Inquiries are processed in an international, IT-based network. Whenever required our specialists therefore have access to all globally available information concerning your inquiry.

Technical consulting

We also support you in project planning and design: covering detailed analysis of the current situation and definition of objectives, advice on products and systems, and design of the automation solution.

Field service

Experts on our comprehensive product and system portfolio are available in your vicinity and can be present on site rapidly. Field service is coordinated by regional control centers which can be reached round-the-clock.



Spare parts and repairs

A global network of regional stores – supported by high-performance logistics – ensures fast provision of spare parts. In many countries, a spare parts emergency service is available in addition.

Repairs are also carried out rapidly, reliably and with a high quality – either in our repair centers or by means of a mobile repair service available in many countries.

Optimization and upgrading

Our Service & Support will support you in all life phases of your machines and plant. Also if you wish to carry out optimization or upgrading. Our local experts will provide you with professional and competence advice, for example how you can increase productivity or permanently reduce costs.

Further information

Comprehensive information concerning the SIMATIC PCS 7 process control system is available on the Internet at:
www.siemens.com/simatic-pcs7

For further details, see SIMATIC Guide manuals:
www.siemens.com/simatic-docu

You can order further documents on the subject of SIMATIC from:
www.siemens.com/simatic/printmaterial

For further technical documentation, see our Service & Support portal:
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