

The SIMATIC PCS 7 Process Control System

Technical Brochure · April 2008

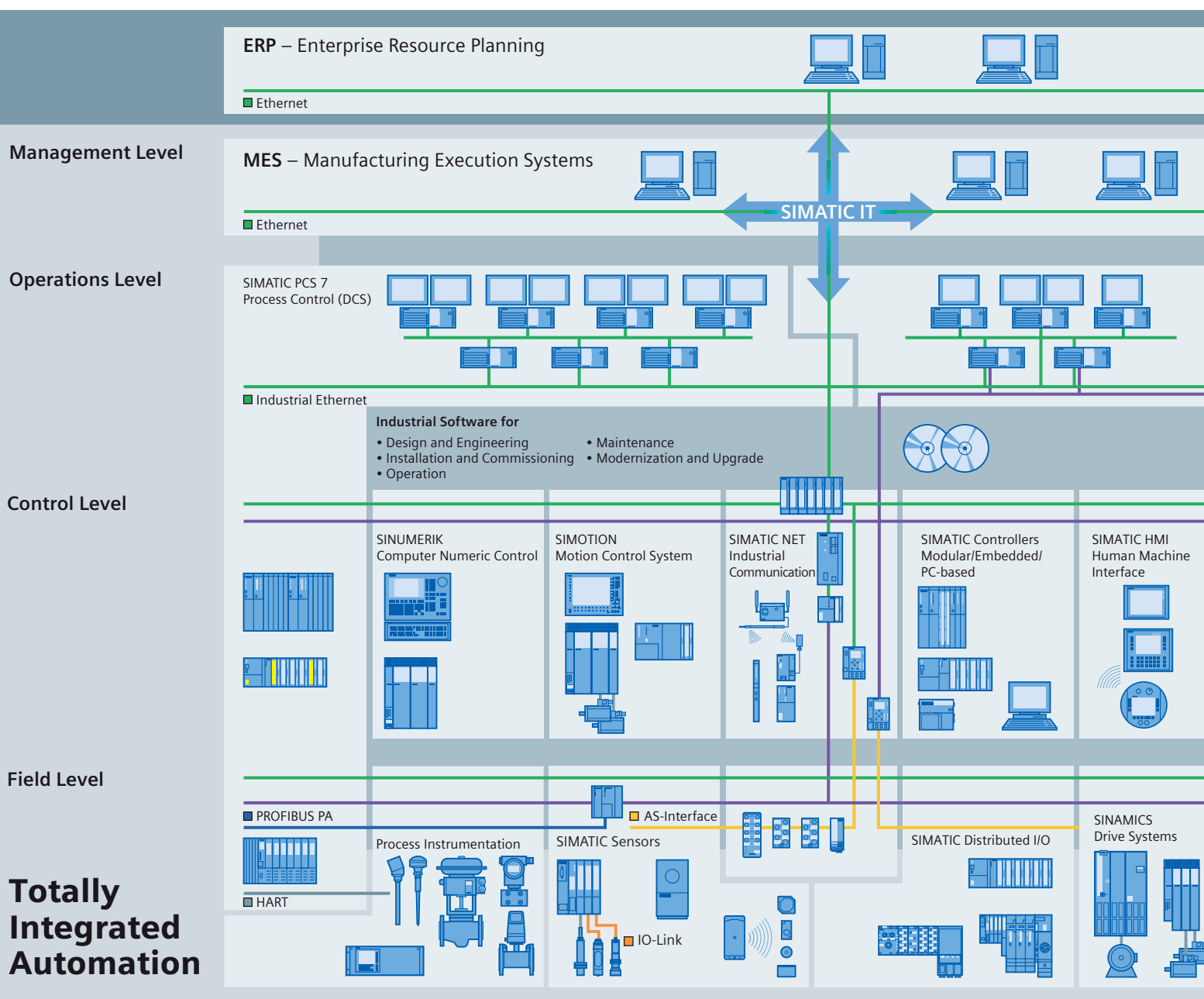


SIMATIC PCS 7

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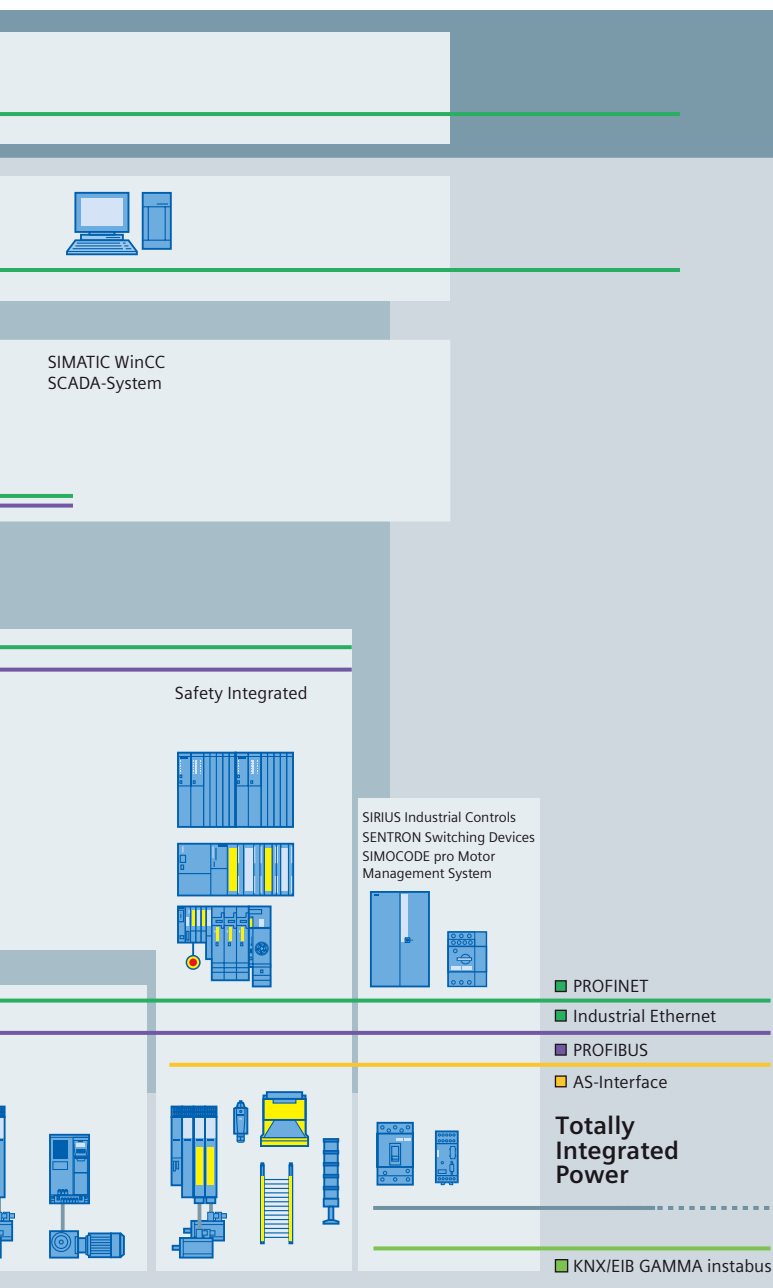
SIMATIC PCS 7 – Takes you beyond the limits!



As one of the leading international process control systems, the current version 7.0 of SIMATIC PCS 7 with its functional variety, flexibility, and capacity has the potential for implementing innovative solutions that meet the special challenges of the process industry. Since function spectrum and application area extend far beyond the limits of a typical process control system, SIMATIC PCS 7 opens undreamed of possibilities and many new perspectives.

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

Contents



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

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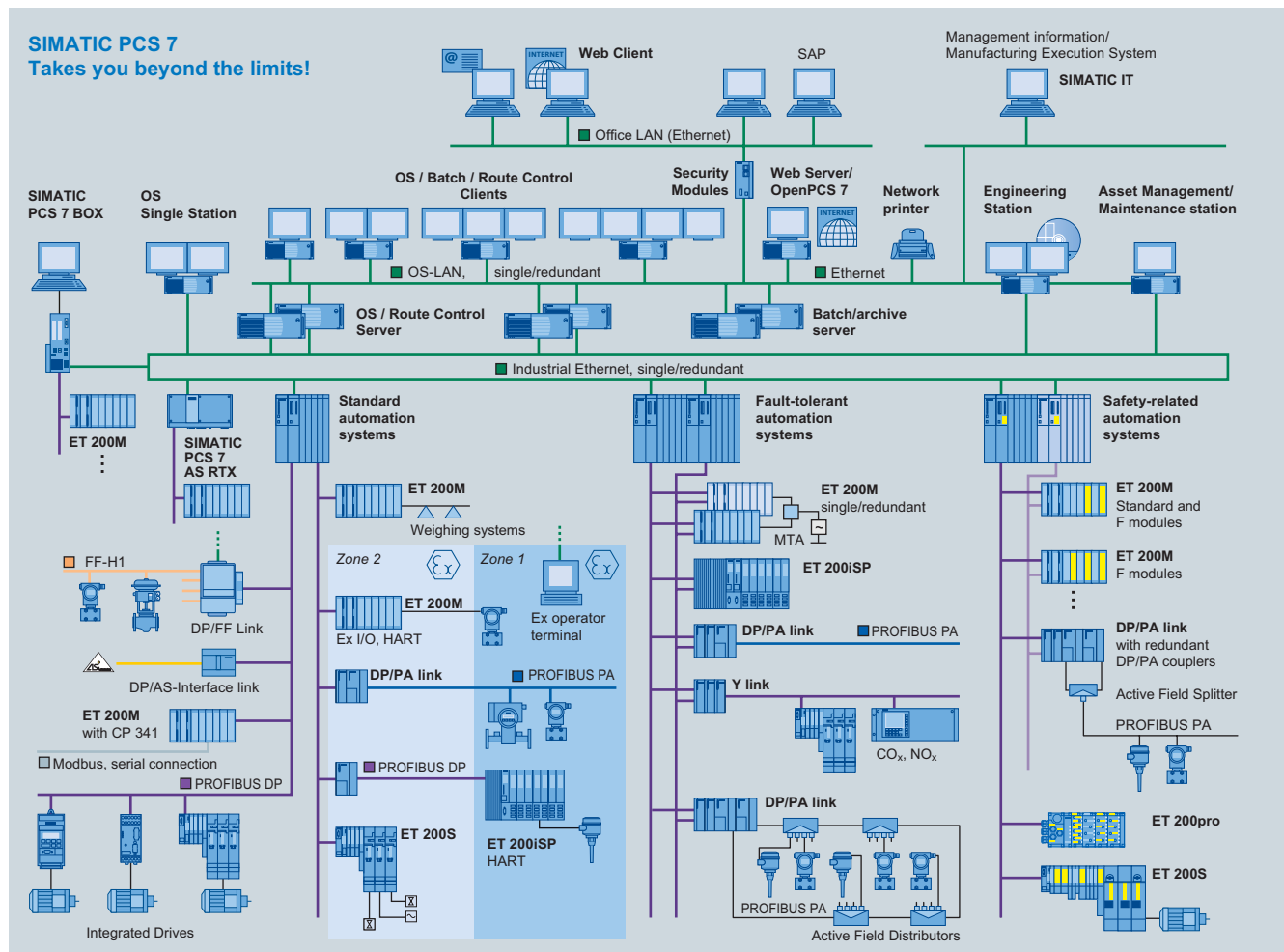
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Seven advantages

System advantages



SIMATIC PCS 7 system architecture

SIMATIC PCS 7 is a homogenous and uniform process control system with a unique scalable architecture and outstanding system characteristics that combines Flexible Modular Redundancy and high performance with consistent data storage, communication, and configuration. It offers the ideal basis for cost-effective implementation and economic operation of process control plants.

However, SIMATIC PCS 7 offers far more functionality than is offered by a typical process control system. The flexible system architecture enables specific extension of process control functions through seamless integration of extensive supplemental functionality, e.g. for batch process automation, material transport control, asset management, security applications, process data analysis/management or MES tasks.

There are seven advantages in favor of SIMATIC PCS 7:

- 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
- **Global Network of Experts** – 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 goods receiving 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 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 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 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 are optimally supported with 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 in 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 e.g. per

- Maintenance Station (Asset Management)
- SIMATIC BATCH (batch process automation)
- SIMATIC Route Control (material transport control)
- Safety Integrated for Process Automation (safety system)

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.

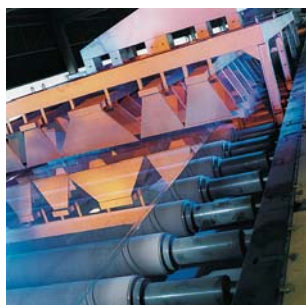
Integration of additional technical standards

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.

A variety of supplementing components have been developed by Siemens, as well as by external partners that are designated as PCS 7 add-on products. These are software packages and hardware components that are authorized by the system manufacturer, which enable cost-effective implementation of SIMATIC PCS 7 for special automation tasks.



High-performance and quality coupled 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 resounding success of SIMATIC PCS 7. SIMATIC components are characterized by an extremely high level of operational reliability, and they can also be operated redundantly if there are more rigorous availability requirements. Thanks to Flexible Modular Redundancy the level of redundancy can be defined separately for each level of architecture, so that custom, fault-tolerant, architectures tailored to the specific tasks can be implemented.

Proof of the high performance of SIMATIC PCS 7 is primarily provided by:

- **Compact runtime systems and complete systems**
with an outstanding price/performance ratio for applications in the lower performance range – with high processing speed and high availability
- **High-performance SIMATIC PCS 7 industrial workstations**
for systems on the operating level and process level 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
- **A broad spectrum 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

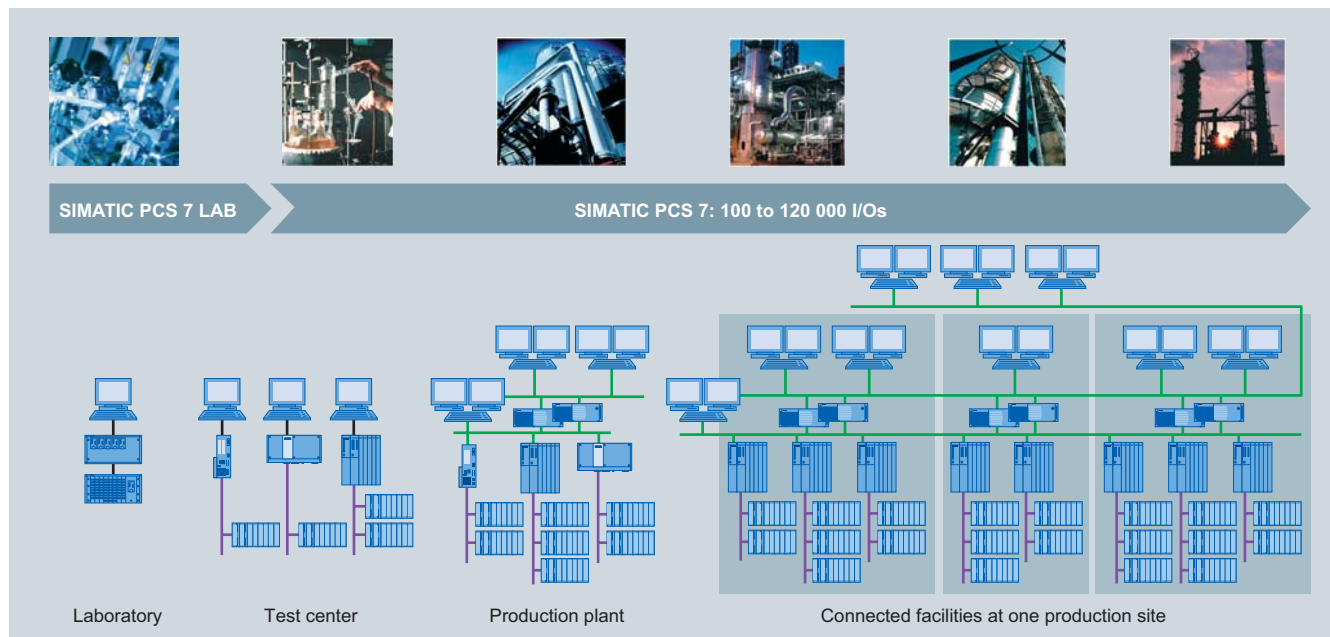


High performance and high quality



- **High communication performance**
 - Fast electrical/optical Fast Ethernet and Gigabyte Ethernet networks for plant bus and OS-LAN (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 the Ex area or for high availability and security
- **Short engineering times 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
- **Function-rich, extremely convenient, scalable Operator System** 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

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



Scalability of the SIMATIC PCS 7 process control system

SIMATIC PCS 7 customers 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 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; these are standard systems as well as high-availability and safety-related systems. Thus automation performance can be optimally matched to the requirements of the plant/plant unit. Thus expensive excess capacity is avoided.

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.

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.

For entry in the lower performance range, SIMATIC PCS 7 has attractive complete systems with functionality for automation, operation, and monitoring, as well as engineering:

- SIMATIC PCS 7 BOX RTX
- SIMATIC PCS 7 BOX 416
- SIMATIC PCS 7 Lab

With approximately 60 tags, these systems represent the lower end of the scale. Scalability extends up to the distributed multi-user system in client/server architecture with up to 60 000 tags for automation of a very large production facility, or of a plant network at one production location. 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

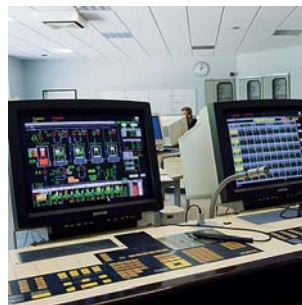
There are a variety of motivating factors for modernizing existing processes and plants. Whether these factors are higher productivity and quality, lower costs, shorter product introduction times, or environmentally compatible production processes and technologies based on optimum use of raw materials 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

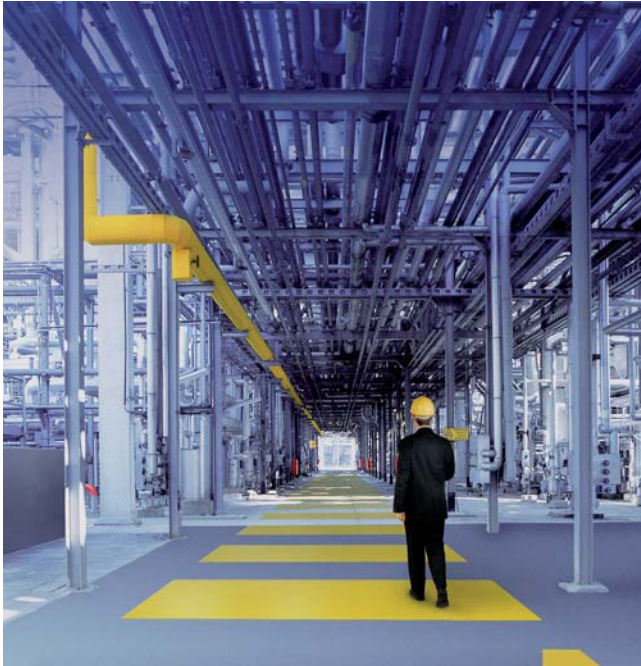
- TELEPERM M
- APACS
- SIMATIC PCS/TISTAR
- OpenPMC

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, Baily, Emerson, or Honeywell. 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.



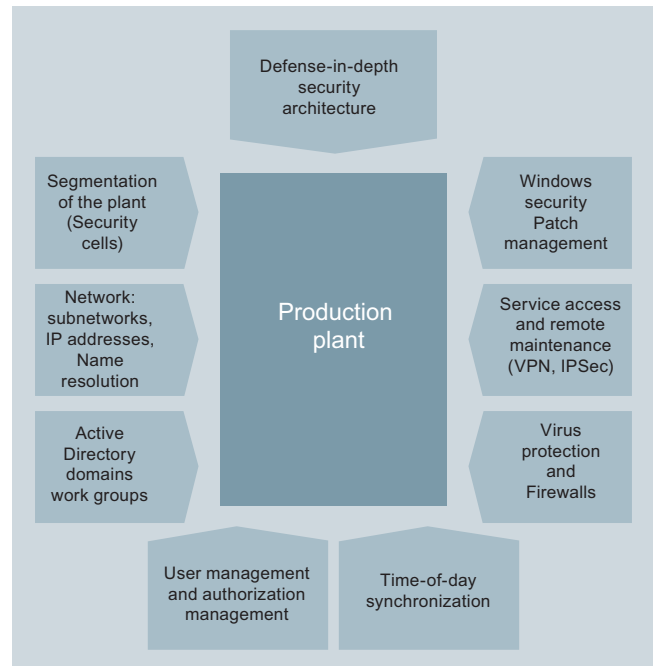
Integrated safety technology and comprehensive IT security for reliable protection of personnel and environment as well as process and plant



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 advancing standardization and open, global networking. The hazard potential that this represents for the plant control systems has increased geometricaly.

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

In Germany patent statistics show that Siemens has the top position, at the European Patent Office Siemens is number 2, and in the USA Siemens is one of the top 10 companies. Thus Siemens sustainably puts its incredible innovative strength to the test.

The prerequisite for innovation, and consequently the prerequisite for sustainable economic success is investment in research and development. Siemens Automation and Drives annually invests more than six percent of its revenue in research and development; in fiscal 2004/2005 for example this amounted to more than 650 million Euro.

5 500 employees in research and development are responsible for close to 1 000 patents annually. The result is the most modern automation and drive technology product line on the market. Four out of five products are less than 5 years old.

All innovations are focused on the requirements of the automation market. Siemens Automation and Drives realizes 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.



Global Network of Experts – local service and support through a worldwide 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.

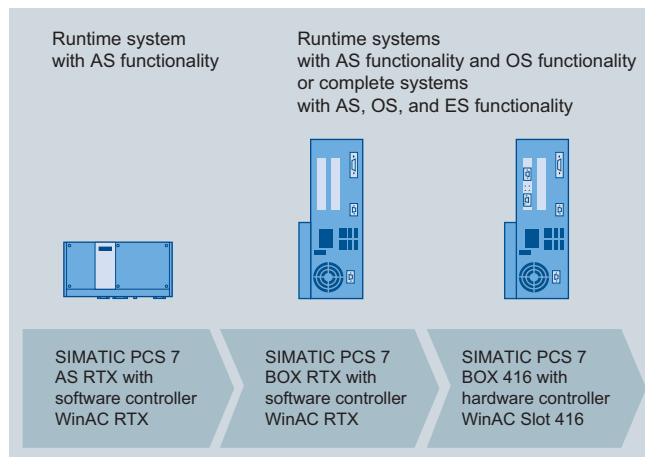
Due to their local presence they are optimally familiar with regional particularities; they are in direct contact with their customers, and they can react very quickly and with flexibility to enquiries from these customers. Their performance offerings are aligned to the overall life cycle of a plant, 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.

System features in focus

Flexibility in the lower performance range

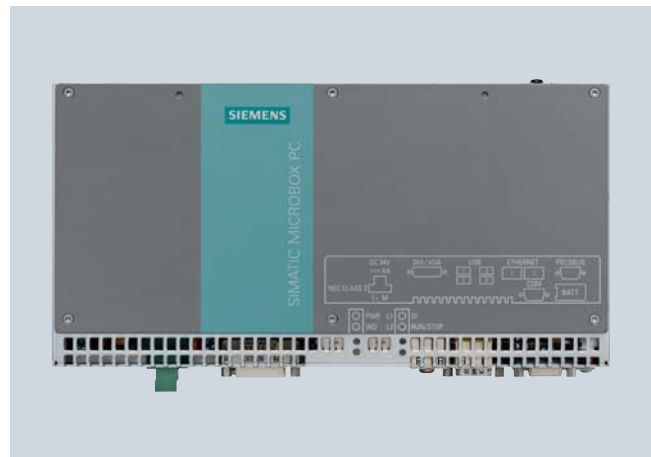


Scalable automation performance in the lower performance range of SIMATIC PCS 7 (AS: Automation system, OS: Operator System, ES: Engineering System)

The systems introduced here enable a cost-effective process automation entry with SIMATIC PCS 7. They are preferred for implementation of small applications in production, for package units, for lab automation, or for versatile tasks in the training area.

With a view to scalable automation performance the SIMATIC PCS 7 AS RTX Microbox automation system designed as AS runtime system is the entry-level system in the lower performance range of SIMATIC PCS 7. Together with the SIMATIC PCS 7 BOX RTX and SIMATIC PCS 7 BOX 416 that can be delivered as AS/OS runtime system or as complete system (AS, OS, and ES functionality), it enables finely graduated scaling in this performance segment.

The offering is rounded out with SIMATIC PCS 7 LAB, which has been especially developed for lab automation and combines a complete SIMATIC PCS 7 BOX 416 and selected I/O modules of the ET 200M I/O system in a compact, modular, and very rugged enclosure architecture.



Entry-level system SIMATIC PCS 7 AS RTX

SIMATIC PCS 7 AS RTX

The compact and rugged SIMATIC PCS 7 AS RTX Microbox automation system is designed for maintenance-free, 24-hour continuous duty at ambient temperatures up to 55 °C. The fact that there are no fans or rotating memory media means that it is resistant to vibration and shock stress. A buffered SRAM of 2 MB ensures that the process data can be securely saved.

Due to its excellent physical characteristics and its compact dimensions the SIMATIC PCS 7 AS RTX is well-suited for industrial use for plant level asset management.

The Windows XP Embedded operating system, the WinAC RTX controller software, and the SIMATIC PC DiagMonitor diagnostics software are pre-installed on a Compact 2GB flash card. The system is configured via the central SIMATIC PCS 7 Engineering System.

A PROFIBUS DP interface enables connection of ET 200 I/O systems with connected sensors/actuators and field devices/process devices on PROFIBUS DP/PA. The SIMATIC PCS 7 AS RTX can be integrated in a SIMATIC PCS 7 plant network via two 10/100/1000 Mbit/s Ethernet RJ45 interfaces for plant bus communication.



Entry-level system SIMATIC PCS 7 BOX RTX

SIMATIC PCS 7 BOX

SIMATIC PCS 7 BOX systems are cost-effective compact PC systems that have functionality for automation, operation, and monitoring, as well as engineering (optional). Combined with distributed ET 200 I/O systems and intelligent field devices/process devices on PROFIBUS they represent a complete process Process Control System that can be operated standalone as well as in the plant network. They are equipped with two PROFIBUS DP interfaces for connection of the distributed process I/O, as well as two 10/100/1000 Mbit/s RJ45 Ethernet interfaces for integration in the plant network.

As a full-fledged member of the SIMATIC PCS 7 family SIMATIC PCS 7 BOX systems work with the PCS 7 standard system software; they are scalable and they can be extended without a break in compatibility. The engineering and runtime licenses for AS and OS are limited to 2 000 process objects (PO).

SIMATIC PCS 7 BOX systems can be configured via the Engineering Software integrated in the system or via a central Engineering System.

The current offering includes two SIMATIC PCS 7 BOX performance classes:

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

With the integrated SIMATIC PC DiagMonitor diagnostics software SIMATIC PCS 7 BOX RTX and SIMATIC PCS 7 BOX 416 can be included in the PCS 7 Asset Management system. Both systems can also be operated as Maintenance Station.

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.

Flexibility in the lower performance range



SIMATIC PCS 7 BOX 416 starter system

SIMATIC PCS 7 BOX 416

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

The SIMATIC PCS 7 BOX 416 is particularly recommended if high availability or CIR (Configuration in Run) are relevant for the selection.

The SIMATIC PCS 7 BOX 416 can even be implemented for applications that extend beyond use as automation system, operator system, and engineering system, such as for batch processing automation with SIMATIC BATCH and 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.

SIMATIC PCS 7 LAB

Due to frequently changing experiments and test series, laboratory automation particularly demands a lot of flexibility in addition to quality, efficiency, and safety. SIMATIC PCS 7 LAB has been especially designed to meet these requirements.



Entry-level system SIMATIC PCS 7 LAB

A complete system; SIMATIC PCS 7 BOX 416 with AS, ES, and OS functionality including licenses for 250 PO as well as selected modules of the ET 200M I/O system are installed in separate 19 inch module cases:

- Processing station; WxHxD in mm: 562 x 211 x 540
- I/O station; WxHxD in mm: 562 x 344 x 540

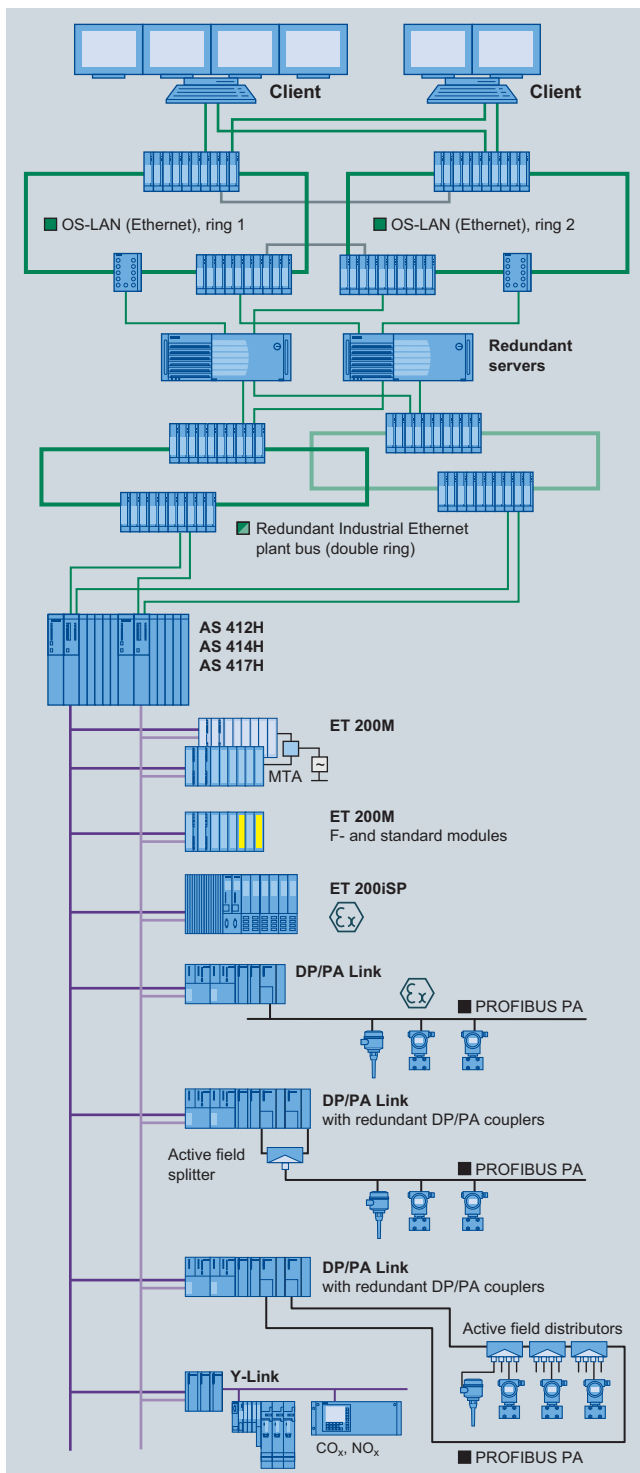
Both stations are compact, extremely stable, and flexible in terms of installation location. The technical station is technically comparable to the corresponding SIMATIC PCS 7 BOX 416, and like this unit it has 2 Ethernet and 2 PROFIBUS DP connections, as well as 4 USB interfaces (2 x high current). Similarly it can also be extended functionally with SIMATIC BATCH and SIMATIC Route Control.

The I/O station includes in addition to the 230 V AC power supply, the PROFIBUS connection, and the CP340 interface module (2x serial), 8 I/O modules of the ET 200M I/O system from the range:

- Analog input SM 331 for current measurement: AI 8 x 0/4 to 20 mA
- Analog input SM 331 for voltage measurement: AI 8 x ± 10 V
- Analog input SM 331 for temperature measurement: AI 4 x Pt100
- Analog output SM 332: AO 8 x 0/4 to 20 mA
- Digital input SM 321: DI 16 x 24 V DC
- Digital output SM 322: DO 16 x 24 V DC/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.

Redundancy at all levels



Possible connections for redundant systems in the SIMATIC PCS 7 process control system; distributed I/O here with redundant power supply in each case

SIMATIC PCS 7 offers a comprehensive redundancy concept which covers all I&C levels.

The client/server architecture of the process control system enables access from up to 32 clients (OS/Batch/Route Control) to the data of 1 to 12 servers/pairs of servers (OS/Batch/Route Control). Up to 4 process monitors can be connected to a client when using the multi-screen technology.

If needed the following services can be designed redundantly:

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

Synchronization of the redundant pairs of servers is carried out automatically and at high speed.

In the case of a system architecture with redundant OS servers, the OS clients are switched over to the backup server in the event of a fault. Background processes permanently monitor important server applications for faults which may then result in a redundant switchover. Automatic synchronization of process data and message archives is carried out when the partner server starts up again.

Client-server and server-server communication is carried out on a dedicated Ethernet LAN. The communication network identified as OS LAN or terminal bus can be implemented with standard SIMATIC NET components such as switches, network cards, communications processors (CP), cables etc.

A ring design avoids communication failures if e.g. the line is damaged or opened at a particular point. To increase the availability even further, the OS-LAN can also be distributed redundantly between two rings which are connected together by two pairs of switches. Each of the redundant servers and clients can then be connected to both rings via two separate interface modules. Communication is as standard on ring 1. Communication on ring 2 is only activated in the event of a fault on ring 1 which is relevant to the redundant switchover.

Redundancy at all levels

The automation systems (AS) communicate with one another and with the engineering system and operator systems (servers/single stations) over the Industrial Ethernet plant bus. The plant bus can also be implemented in the form of a ring topology, which can additionally be configured as a redundant double ring if the availability requirements are high (two CPs per AS CPU and OS server). Double faults, such as switch failure on ring 1 with simultaneous interruption in the bus cable on ring 2 can then be tolerated. The two rings are physically separated from each other in such a configuration. The coupling partners are linked together logically when configuring with NetPro by using a fault-tolerant S7 connection (4-way redundancy). One switch in each case takes over the function of the redundancy manager for each ring.

The redundant, fault-tolerant AS 412H, AS 414H, and AS 417H automation systems are connected by one communications processor (CP) per CPU (AS subsystem) to the plant bus. With a double ring designed for increased availability, each AS subsystem can be connected to both rings via two CPs.

OS LAN (terminal bus) and plant bus can be configured with bus components for transmission rates up to 100 Mbit/s or 1 Gbit/s.

When using internal PROFIBUS DP interfaces or additional communications processors, several PROFIBUS DP segments with distributed process I/Os can be operated on each AS subsystem.

Remote I/O stations of the ET 200M or ET 200iSP distributed I/O systems can be connected via two interface modules (IM) to redundant PROFIBUS DP segments. For the ET 200iSP system, RS 485-iS couplers convert the electrical PROFIBUS DP RS 485 transmission technology into the intrinsically-safe RS 485-iS transmission technology with a transmission rate of 1.5 Mbit/s.

With the ET 200M distributed I/O system, the redundancy extends down to the channel level of the input/output modules. Selected modules from the SIMATIC S7-300 system are available for redundant use – both standard and safety-related modules. A sensor or actuator can be connected to two channels which are distributed on two redundant modules in separate ET 200M stations.



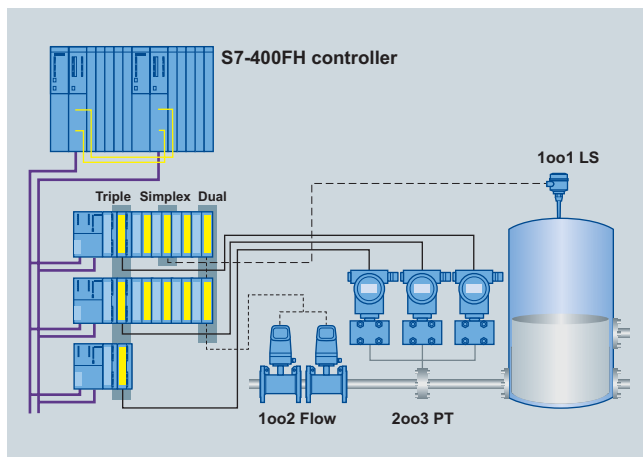
ET 200iSP station, redundant

Intelligent field/process devices on the PROFIBUS PA are preferably connected to a DP/PA link as a router to the redundant PROFIBUS DP. The configuration of the DP/PA link depends on the operating environment (Ex zone) and the selected redundancy architecture. Whereas only the linear architecture with individual couplers is possible for the PROFIBUS PA in the Ex zone 1, a linear architecture with coupler redundancy or a ring architecture can also be configured in environments up to Ex zone 2.

In the linear architecture with individual couplers, each PROFIBUS PA segment is connected to one DP/PA coupler of the DP/PA router. In the linear architecture with coupler redundancy, an active field splitter (AFS) switches the PROFIBUS PA segment to whichever of the two redundant FDC 157-0 couplers is active. In the case of the ring architecture, active field distributors (AFD) integrate PROFIBUS PA field devices via four short-circuit proof spur line connections into a PROFIBUS PA ring with automatic bus termination. This ring is connected to two FDC 157-0 DP/PA couplers of the DP/PA router.

It is also possible to connect non-redundant PROFIBUS DP devices to the redundant PROFIBUS DP by using the Y-link.

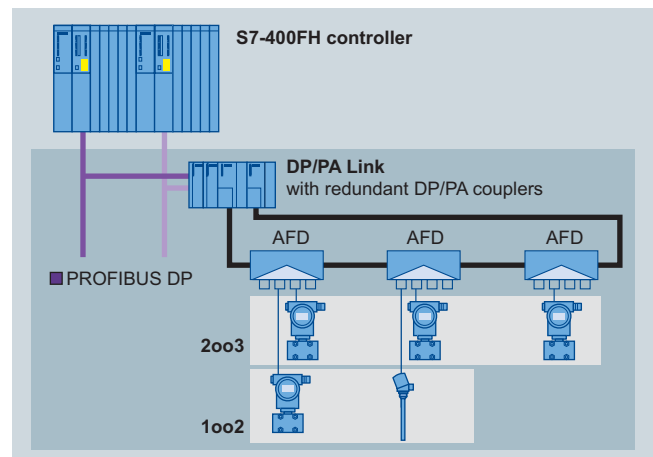
Flexible Modular Redundancy (FMR)



Flexible modular redundancy using the example of a safety-related, 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 which 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 (1oo1, 1oo2, 2oo3).

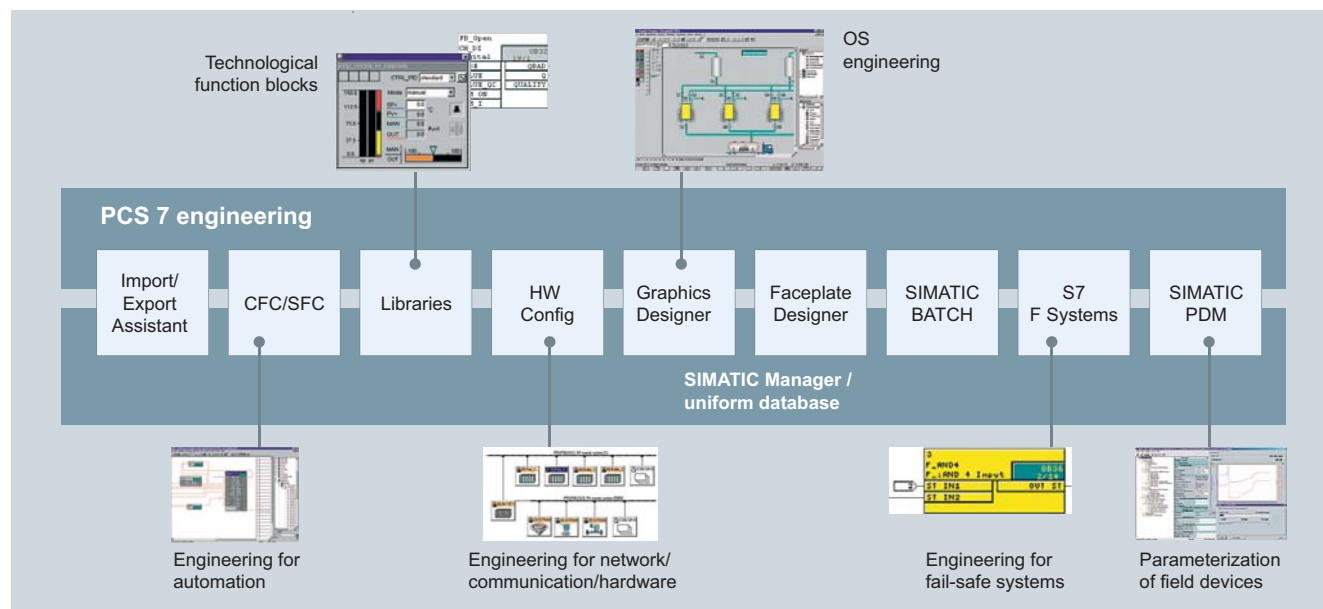


Safety-related and fault-tolerant architecture based on a PROFIBUS PA ring topology

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 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 central engineering system of the SIMATIC PCS 7 process control system is based on a powerful SIMATIC PCS 7 Industrial Workstation which can be used either in office applications or in industrial environments. Together with the Windows XP Professional operating system, this offers an ideal basis for the engineering. To improve the convenience when configuring, the working area of the planning engineer can be extended by connecting up to 4 process monitors via a multi-VGA 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; without PO limitation (cannot be used for OS productive operation; 2-hour OS test operation possible)
- Use as combined engineering/operator station; scalable 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 distributed 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 functionalities
- Batch processes automated using SIMATIC BATCH
- Material transport controlled using SIMATIC Route Control
- Cooperation with host CAD/CAE planning tools (import and export of process tags and example solutions).

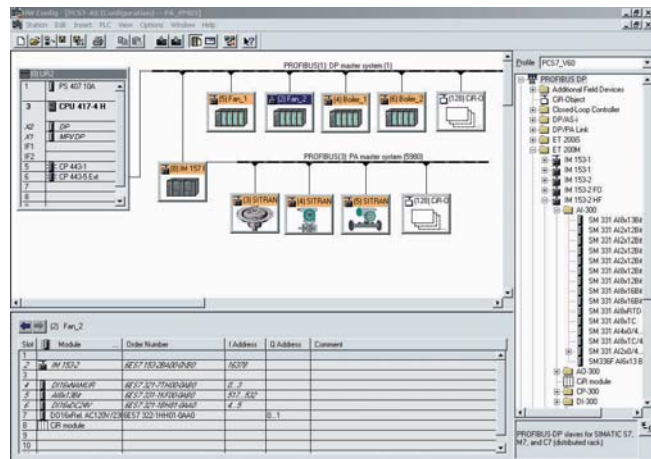
SIMATIC Manager

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.

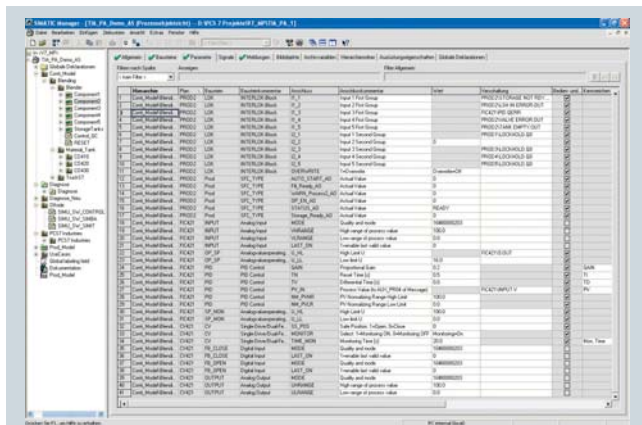
Selective changes to the configuration can be loaded online into the corresponding system components. Short turnaround times result in short waiting times for the commissioning engineer and have a positive impact on the commissioning costs. Changes to the configuration which are relevant to automation 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 IO
- Process object view
Central development environment for all aspects of process tags/process objects

Engineering System

Engineering Software



Process tags in the process object view

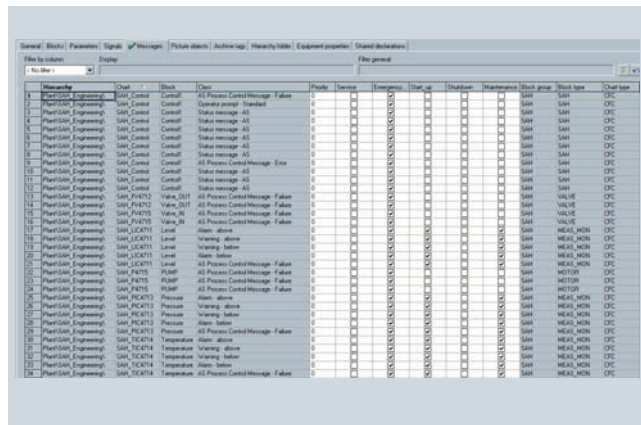
Process object view

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.

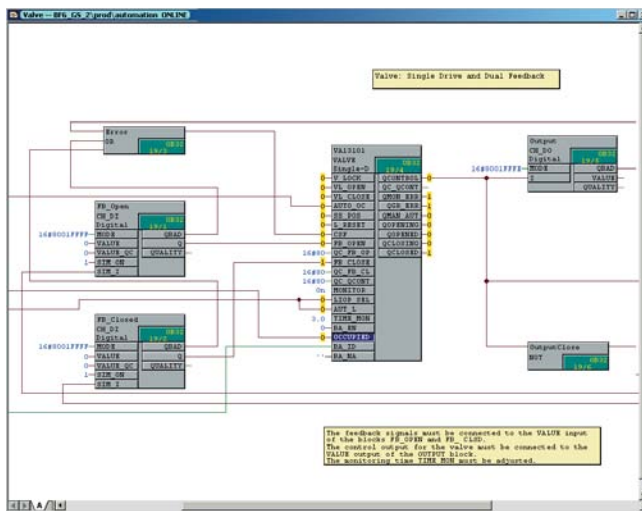


Configuration of "Smart Alarm Hiding" in the process object view

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.

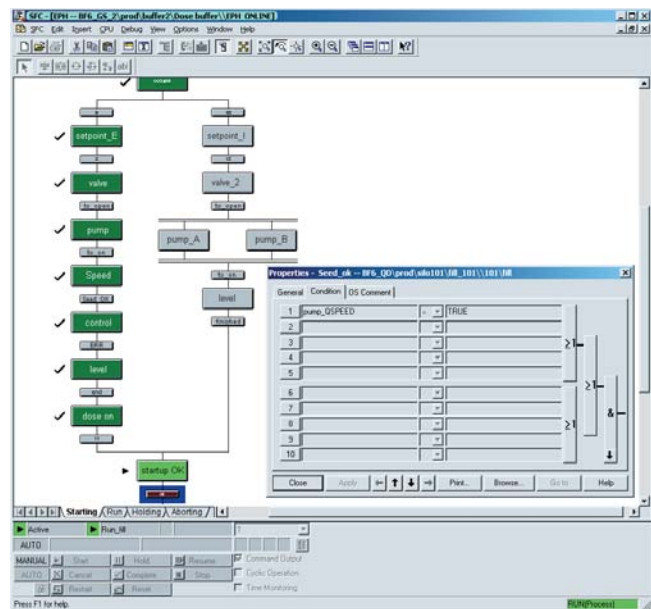
The algorithm first determines the optimum block sequence separately for each runtime group, and then the optimum sequence of runtime groups.

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 plan or SFC type.



Sequential function chart

SFC plan

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

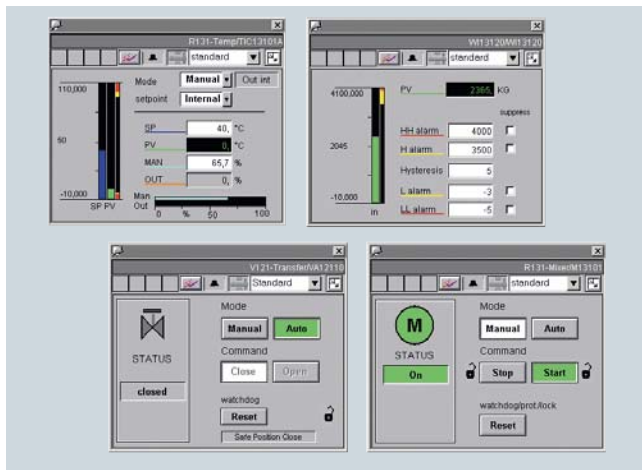
Each SFC plan contains standardized inputs and outputs for status information and for control by the user program or the user. The SFC plan can be positioned and linked as a block in the CFC. The required CFC block connections are selected by simple operations and connected to the steps or transitions 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 PCS 7 library

I&C 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. The range of blocks comprises:

- Simple logic and driver blocks
- Technological blocks with integral operation and signaling functions such as PID controllers, motors or valves
- Blocks for the integration of PROFIBUS field devices
- Components for Advanced Process Control (APC)

Components with APC functions

Model-based multivariable control systems

The model-based ModPreCon multivariable control system separately analyses the behavior of up to four interdependent values for complex processes over a longer period. A parameter matrix is calculated based on the results, which the ModPreCon then uses for optimized control of these values. Thus disadvantageous interplay when regulating dependent values does not occur.

Operating point-dependent regulating parameter control

The GainSched component enables infinite adjustment of the regulating parameters in non-linear processes depending on the operating point. The block, which works in a similar manner to the polygon block, can derive three separate output values from one input value, which serve as regulating parameters for an interconnected control block. Depending on the characteristic of the actual value the GainSched changes the regulating parameters of the combined closed-loop controller in a sliding manner.

Control quality monitoring

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

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.

Multi-project engineering

Multi-project 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 "Multi-project" is defined in the SIMATIC Manager. Individual (sub)projects can be inserted into or removed from a multi-project at any time. Similarly, projects can be divided or combined (Branch & Merge).

Central configuration functions for multi-projects 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 multi-project can also be updated centrally.

The (sub)projects belonging to a multi-project are saved on a central server and can be sent to local engineering stations for editing. The engineering performance is then not affected by network access.



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 OS LAN (terminal bus) or a different 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 via OS LAN and plant bus – provided it has the corresponding connections.

Branch & Merge

This function supports the division and merging of sub(projects) from the technological viewpoint. Charts or plant units can be copied into another project and edited there. Interconnections which are not specific to a project, typically for interlocking, become text interconnections. When merged, charts with the same name in the original object are overwritten, and text interconnections – even self-entered ones – can be closed by clicking a button.

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.

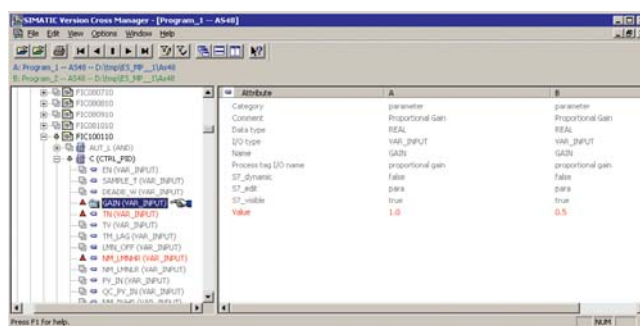
With SIMATIC Logon, the administrator can divide users into groups with different access rights and control the access to data in this way. Configurable modification reports allow the recording of all access operations to the engineering system as well as all online changes concerning the automation 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 industry-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 multi-projects by:

- Tracing missing, additional or differing objects by comparing hardware configuration, communication, technological hierarchy, CFC/SFC plans, 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

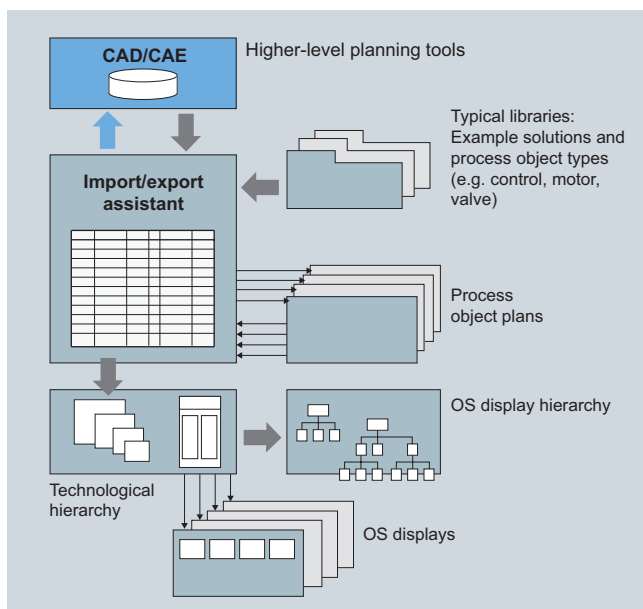
Version Trail

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

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

- Version
- Version name
- Date and time
- User
- Comment

The version history from SIMATIC Version Trail 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.

The diagram illustrates the connection of SIMATIC PDM to various industrial devices and networks. It is organized into three main horizontal sections representing different communication protocols:

- Plant bus (Green line):**
 - At the top left, a **SIMATIC PDM** is connected to a **SIMATIC PCS 7 engineering station with SIMATIC PDM**.
 - Below this, two **S7-400** PLC units are connected to the Plant bus.
- PROFIBUS DP fieldbus (Purple line):**
 - Below the S7-400 units, a **DP/PA link** and a **MICROMASTER** are connected.
 - Further right, an **ET 200M (IM 153-2 with HART modules)** and a **SIMOCODE pro** are connected.
 - A **Stand-alone computer with SIMATIC PDM** is also connected to this bus.
 - A diagonal line indicates a transition to the HART protocol section.
- PROFIBUS PA (Blue line):**
 - Below the DP/PA link, several devices are connected: **SIPART PS2**, **SITRANS P**, **SITRANS T3K**, and **SITRANS LR**.
- HART protocol (Black line):**
 - Below the ET 200M and SIMOCODE pro, two **SIMATIC PDM** units are shown connected via **HART** lines to **SITRANS F M** and **SIPART PS2** respectively.
 - On the right, a **HART multiplexer** is connected to the HART protocol line, which then connects to a **HART device**.
 - Labels **RS 232/RS 485** and **HART** are present near the multiplexer.

A legend at the bottom right shows a **SIMATIC PDM** icon with the text: **Possible connection point of a PG/PC with SIMATIC PDM (stand-alone operation)**.

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 1200 devices from Siemens and over 100 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.

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.

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

- 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.
- Display of integrated manuals
- Document manager for integration of up to 10 multimedia files

Support of system management

SIMATIC PDM supports the operative system management in particular through:

- Uniform presentation and operation of devices
- Indicators for preventive maintenance and servicing
- Detection of changes in the project and device
- Increasing the operational reliability
- Reducing the investment, operating and maintenance costs
- Graded user privileges including password protection

Device Integration

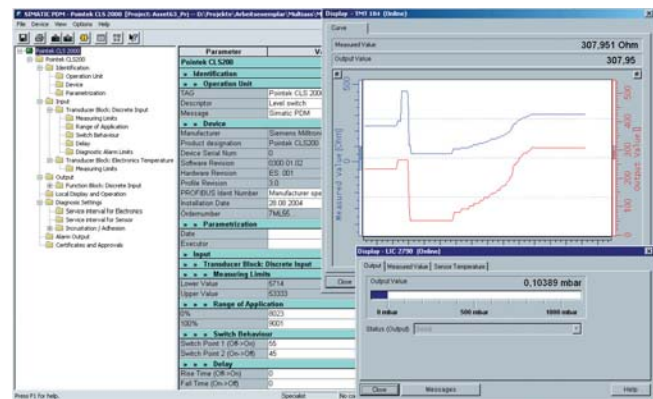
SIMATIC PDM supports all devices described by EDD (Electronic Device Description). EDD is standardized to EN 50391 and IEC 61804. Internationally it is the most widely used standardized technology for device integration. At the same time it is the directive of the established organizations for PROFIBUS (PNO: PROFIBUS International) and HART (HCF: HART Communication Foundation).

The devices are directly integrated in SIMATIC PDM through their EDD or the current HCF catalog. The device is described in the EDD in terms of its functions and construction using the Electronic Device Description Language (EDDL) specified by PNO. Using this description, SIMATIC PDM automatically creates its GUI with the specific device data.

The current device catalog of SIMATIC PDM covers more than 1 200 devices from over 100 manufacturers world-wide. In addition to the devices in the current SIMATIC PDM device catalog, devices from all manufacturers can be integrated in SIMATIC PDM by simply importing their EDDs. It is thus possible to keep the device range up-to-date at all times and to expand the number of manufacturers and devices supported by SIMATIC PDM. To permit improved transparency, SIMATIC PDM also allows the creation of project-specific device catalogs.

GUI

The GUI satisfies the requirements of the VDI/VDE GMA 2187 and IEC 65/349/CD directives. Due to expansion of the EDDL, it is also possible to display image elements in an excellent manner. Even complex devices with several hundred parameters can be represented clearly and processed quickly. Using SIMATIC PDM it is very easy to navigate in highly complex stations such as remote I/Os and even down to the connected field devices.



SIMATIC PDM parameter view with trend and online display

Several views are available to users:

- Hardware project view
- Process device network view (preferably for stand-alone application)
- Process device plant view as tag-related view, also with display of diagnostics information
- Parameter view for parameterizing the field devices
- Lifelist view for commissioning and service

Communication

SIMATIC PDM supports several communication protocols and components for communicating with devices that have the following interfaces:

- PROFIBUS DP/PA interface
- HART interface
- Modbus interface
- Special interface from Siemens

Routing

From the central engineering system of the SIMATIC PCS 7 process control system it is possible with SIMATIC PDM to reach every EDD-parameterizable device in the field plant-wide through the various bus systems and remote I/Os. SIMATIC PDM can thus perform the following from a central position:

- Read diagnostics information from the devices
- Modify device settings
- Adjust and calibrate devices
- Monitor process values
- Generate simulation values
- Reparameterize devices

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 program test
 - 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 measuring points 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 plan for sequential controls for single use, also with plan connections
 - 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
- Reduction in engineering and validation overhead through:
 - Libraries with predefined, standard blocks, faceplates, and symbols
 - Preconfigured 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 facility 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 asset management on the basis of the project data

Operator system

Safe and convenient 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. The operator can observe the process sequence by means of various views and intervene to control the system when 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 that are optimized for use as an OS single station, OS client or OS server.

Die SIMATIC PCS 7 Industrial Workstations are attractive thanks to high-performance PC technology, combined with the operating system Microsoft XP Professional or Server 2003. They can be operated in rough industrial environments as well as in the office.

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-VGA 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):

- 250, 1 000, 2 000, 3 000 or 5 000 POs per OS single station
- 250, 1 000, 2 000, 3 000, 5 000 or 8 500 POs per OS server of a client/server system

The number of POs can be increased at any time 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 operation and monitoring functions for a complete project (plant/unit) are concentrated in one station. A 10/100/1000 Mbit/s Ethernet RJ45 port is already onboard and can be used to connect to an OS LAN (local area network; terminal bus). The OS single station can be connected to the Industrial Ethernet plant bus in two ways:

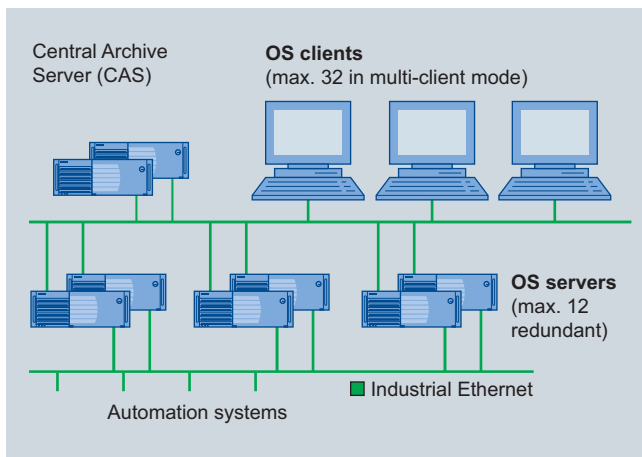
- CP 1613 A2 communications processor for communication with a maximum of 64 automation systems of any type
- Simple 10/100/1000 Mbit/s Ethernet network cards and Basic Communication Ethernet for communication with up to 8 standard automation systems

The OS single station can be operated on the plant bus in parallel with other single-user systems or with a multi-user system architecture. Two OS single stations can, however, also be operated redundantly (SIMATIC PCS 7 single station redundancy).

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 through an OS LAN. The OS LAN 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 to several 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 on 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 communications processor or a simple Ethernet network card. An Ethernet RJ45 port is already onboard and can be used for connecting to an OS LAN.

Performance and technical specifications

The SIMATIC PCS 7 operator system is optimized for processing large quantities of data. It has an impressively high performance – even with large quantity frameworks – and can be operated simply and intuitively at the same time.

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

Operator system

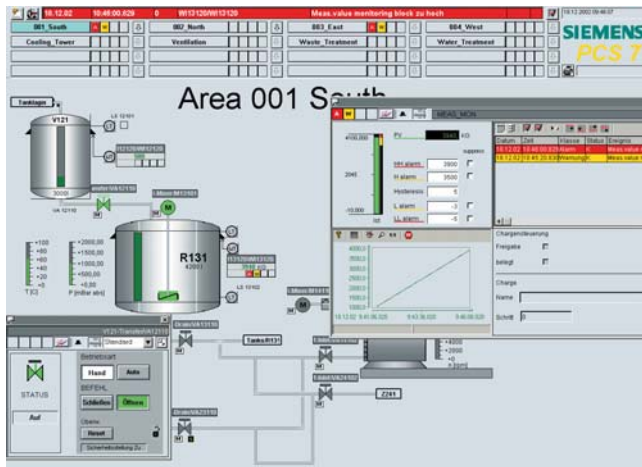
Max. number of OS servers/pairs of servers	12
Max. number of automation systems per OS server/pair of servers	64
Max. number of OS clients in multi-client mode ¹⁾ (per multi-user system)	32
Max. number of monitors per operator station with multi-channel operation	4
Max. number of OS areas	64
Max. number 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 (cyclic 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)	Steady-state 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

- 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

Operator system

OS software



OS process control with freely-positionable windows

GUI

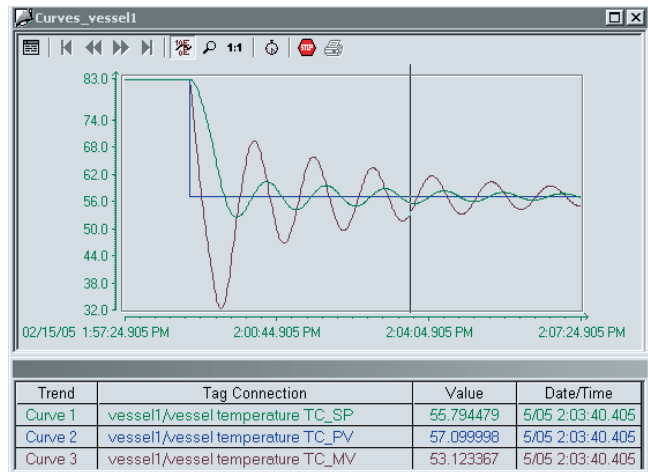
The predefined GUI of the operator system has all the features typical of a control system. It is multilingual, clearly structured, ergonomic and easy to understand. Operators can survey the process extremely easily, and rapidly navigate between different views of the plant. The system supports them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

Process displays and process tags can also be simply called up by name. 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 (display sequence configurable according to maximum message class or highest priority)
- Date, time and name of the operator
- Area overview with up to 36/49/64 areas
- Working area for plant displays and movable windows for faceplates, trends, messages etc.
- System function keys

In a special message view it is possible to switch between the control system message pages such as new list, old list, cleared alarm list, operator action list, control element list and message history list.



Trend window on the operator station

The display tools available permit the operator to assemble individual displays, to save them, and to recall them later.

Trends

Trends can be displayed as a full-size picture or as a window in the working area, and directly printed out. Some trends/trend groups are predefined during plant configuration. Particularly for comparisons, in addition to the absolute presentation standard curve displays with percentage scaling can also be created. The standard settings for units of measure and limit values (e.g. minimum/maximum) specified in the configuration can be transferred automatically for runtime mode. At runtime, operators can compose their own trends, select them by process tag name, and save them for reuse.

Messages and alarms

Up to 150 000 messages/alarms can be configured per OS single station/OS server. Message priorities are issued as an additional attribute to the known signal classes in order to make it easier to assess large quantities of signals and to be better able to distinguish important messages from less important ones.

Message view of operator station

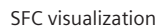
Insignificant alarms can be hidden in two ways:

- Dynamically, i.e. depending on preconfigured definition for up to 32 operating states (Smart Alarm Hiding)
- Manually, with time limit

Operators can specifically disable messages (alarms) from individual process tags or from all process tags of a display/area in the event of faults in a sensor/actuator or during startup. Disabling and enabling are recorded in an input report.

Active messages are signaled visually by group displays representing preconfigured views of message/alarm lists based on signal groups. The group displays also show whether messages are blocked or not.

The last message to have arrived – or the message with the highest priority when alarm priorities are utilized – is displayed at the top edge of the standard view. A predefined window with further messages can be called up with the "Extended message line" button.



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

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

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. No additional configuration work is necessary.

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 control and electronic signature

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 chipcard 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 asset management.

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.

Script languages

Users can also program their own OS applications on the basis of the Visual Basic and C script languages.

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
- Convenient process control and high operational safety
- Alarm suppression during startup or on malfunction of a sensor/actuator
- Dynamic or manual hiding of visual and acoustic alarms that are unimportant, depending on plant status
- Alarm priorities as additional attribute for filtering important messages
- Central user management, access control, electronic signature
- Sign-of-life monitoring for subordinate systems connected to the plant bus

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:

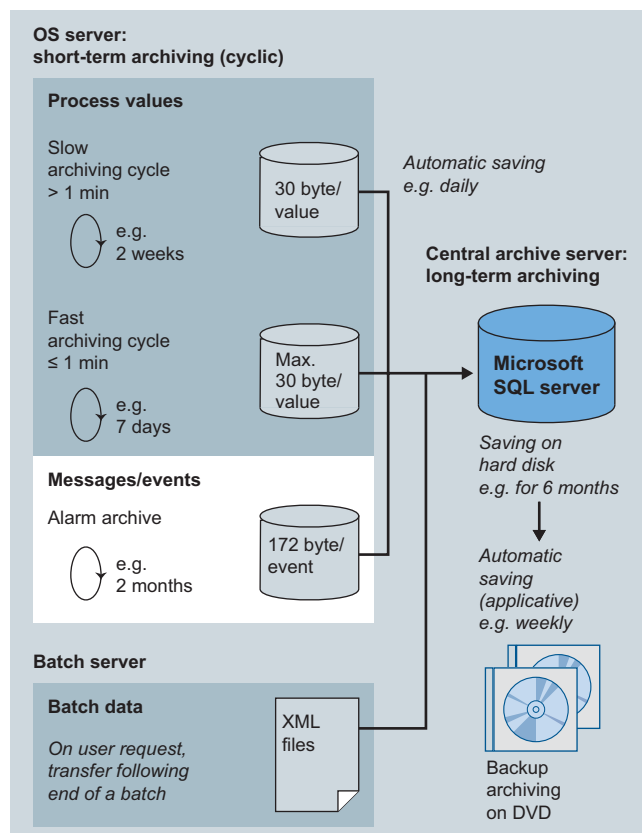
- **StoragePlus**
More economical version for the lower performance range; for the archiving of about 1 600 values/s from as many as four single stations, servers or pairs of servers
- **Central Archive Server (CAS)**
High-performance version for archiving about 10 000 values/s from as many as 11 servers 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 general billing unit for short-term and CAS long-term archiving are offered in the form of SIMATIC PCS 7 archive licenses and SIMATIC PCS 7 archive PowerPacks. If no CAS is used, the archive licenses and PowerPacks 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.



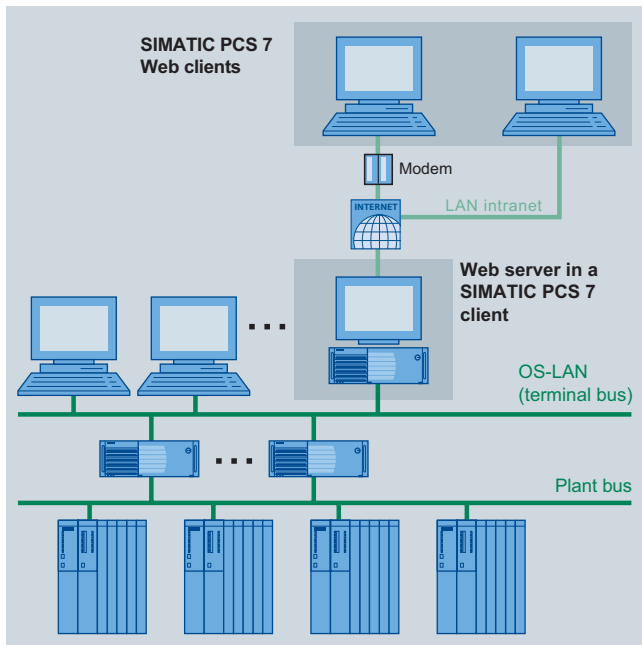
OS archiving

The hardware platforms for the StoragePlus computer and the central archive server are the SIMATIC PCS 7 Workstations. 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 process displays 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 requires 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.

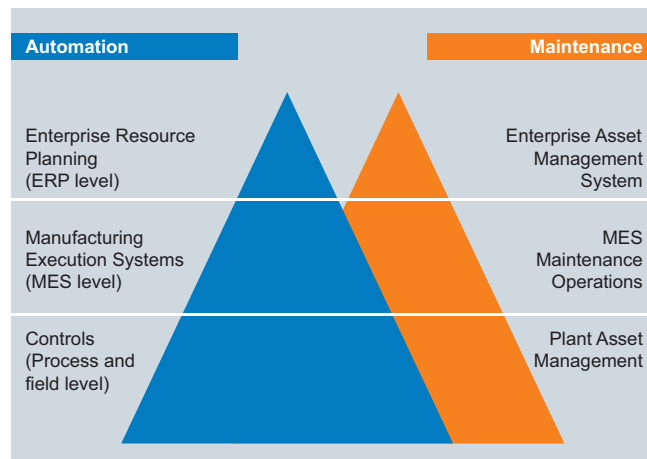
With regard to licensing, a distinction is made between the following constellations:

- **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.

Asset management

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 assets and process their diagnostic messages and maintenance requests per 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). These are represented by proxy objects in which the diagnostics rules are stored.

Maintenance cycle

The status of all components or of a device can be determined by monitoring (acquisition and analysis of process values and status values). For example, if a sensor no longer delivers a signal, the diagnostics function indicates that there is an open circuit. This triggers a maintenance request which in turn results in a maintenance measure. Following completion of maintenance the status displays are reset to the normal status on the Maintenance Station.

The complete maintenance cycle is documented on the maintenance station without gaps – automatically and without additional configuration overhead.



Architecture

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. For Asset Management it uses hardware and software components from 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 multifunctional station cannot only be used for asset management, but also for system engineering or HMI.

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. This means that working with the maintenance station is simple and intuitive, complex familiarization is not required.

The diagnostics displays structured according to the plant hierarchy with the operating states of all SIMATIC PCS 7 components can be displayed on the maintenance station and also on an OS client. However, enhanced online diagnostics functions in conjunction with HW-Config or SIMATIC PDM can only be called from the maintenance station.

The user management and access control for the maintenance station accept the SIMATIC Logon integrated in SIMATIC PCS 7.

Configuration

The SIMATIC PCS 7 asset management is based on the hardware and software project of the application which is generated during the standard configuration with the engineering system. With system support, all data relevant to the asset management are derived from the project data of the application, and the diagnostics displays are also generated, simply by pressing a button. The procedure is simple, and no additional overhead is required for the asset management. It is composed as follows:

- Generation of the hardware and software project of the application
- System-supported generation of the diagnostics displays 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

Conformity to international standards, specifications, and recommendations

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

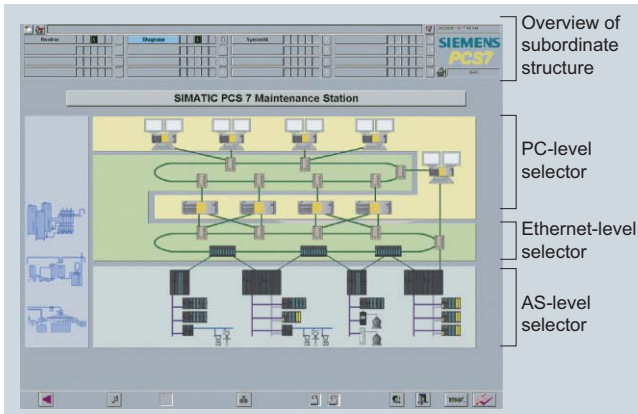
- NAMUR recommendation NE91 (requirements for systems for asset management at plant level)
- NAMUR recommendation NE105 (requirements for the integration of fieldbus devices in engineering tools)
- NAMUR recommendation NE107 (status messages from field devices): "Device failure", "Maintenance requirement",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

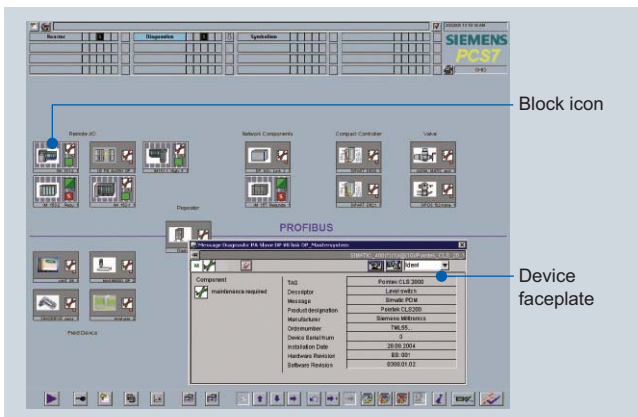
- PROFIBUS Profile Guidelines Identification & Maintenance Functions
- PROFIBUS PA Profile for Process Control Devices

Asset Management function characteristics

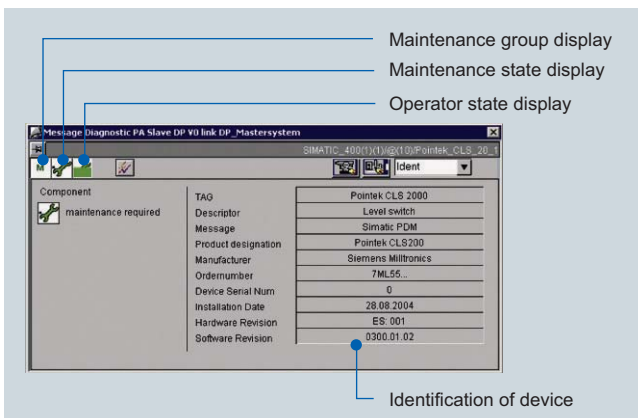
As system interface for the maintenance organization the Maintenance Station with the integrated Asset Management software makes consistent maintenance functions and information available.



Plant overview with symbol displays for components



Overview of components on a PROFIBUS segment with symbol displays



Diagnostics display of component

Standard diagnostics functions

In order to obtain information on the diagnostics status of individual plant areas or components, maintenance engineers can change from the overview display to the respective diagnostics display of the subordinate hardware level. 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

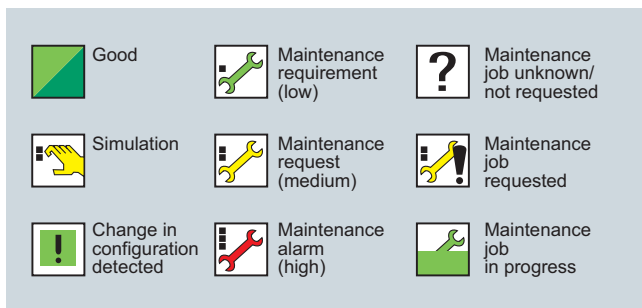
Information on passive or indirect assets

For passive or indirect assets without self-diagnostics (pumps, motors, control loops etc.), inadmissible operating states can be derived from various measured values and their deviations from a defined normal status using the programmable logic block AssetMon. These are displayed as a maintenance alarm on the maintenance station. With the aid of the AssetMon, individual diagnostics structures, project-specific diagnostics rules and condition monitoring functions can be implemented.

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 the SIMATIC PCS 7 asset management 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.

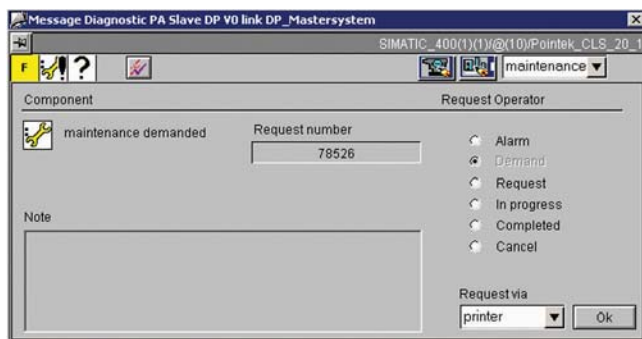
Diagnostics displays represent the status of components and subordinate devices/components through standardized symbols. These contain the following elements:

- Bitmap of component
- Tag identification of component
- Maintenance status 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.

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
- Consistent utilization of architecture and basic performances of 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
- Consideration of international standards and directives



Faceplate for maintenance view

Automation systems

Based on selected SIMATIC S7-400 components



Standard automation systems

Highlights Automation systems

- Flexibility through different levels of availability and safety:
 - Standard systems (S-systems)
 - Fault-tolerant systems (H-systems)
 - Safety-related systems (F-systems)
 - Safety-related and fault-tolerant systems (FH-systems)
- Wide range of individually configurable automation systems with CPUs in graded performance classes, optionally as:
 - Single station
 - Redundant station
- Delivery as preassembled and tested bundles
- Changes to the configuration during operation
- Fully redundant automation systems:
 - Simultaneous (synchronous) processing of identical user programs in the two CPUs
 - Bumpless switchover
 - Can also be fitted in two racks for spatial separation of redundant subsystems

Selected SIMATIC S7-400 components can be combined in the automation systems (AS) of the SIMATIC PCS 7 process control system.

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

Various automation systems are available with a price/performance ratio which can be tailored to your system requirements. All automation systems are equipped with an onboard PROFIBUS DP fieldbus connection. Additional PROFIBUS communication modules can be fitted if required.

The AS firmware can be updated per Flash EPROM memory card (8 MB) or from the central Engineering System via the plant bus.

Components

The automation systems are delivered as preassembled and tested bundles without surcharge. Through the selection of predefined ordering units, they can be individually configured as single or redundant stations, and then 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/DC, each including backup batteries
- 1 or 2 work memories from 0.768 MB to 30 MB
- 1 or 2 memory cards with 2 to 16 MB RAM
- 1, 2 or 4 interfaces for Industrial Ethernet plant bus (via CP or integrated in CPU)
- Additive PROFIBUS communication modules (per configurator up to 4 per single station, up to 8 per redundant station)
- 4 Sync modules for range of 10 m or 10 km and 2 fiber-optic Sync cables

Each of these bundles 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.

Standard automation systems

The AS 414-3 / 414-3IE automation systems are tailored for small applications with small quantity frameworks. They therefore meet the demand for low-cost initial implementation with a 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, but differ in terms of the time synchronization (NTP instead of S7 synchronization).

Fault-tolerant automation systems

Fault-tolerant automation systems are used to minimize the risk of production failures. The higher investment in fault-tolerant automation systems is often negligible compared to the costs resulting from production stoppages. The higher the costs resulting from loss of production, the more important a fault-tolerant system becomes.

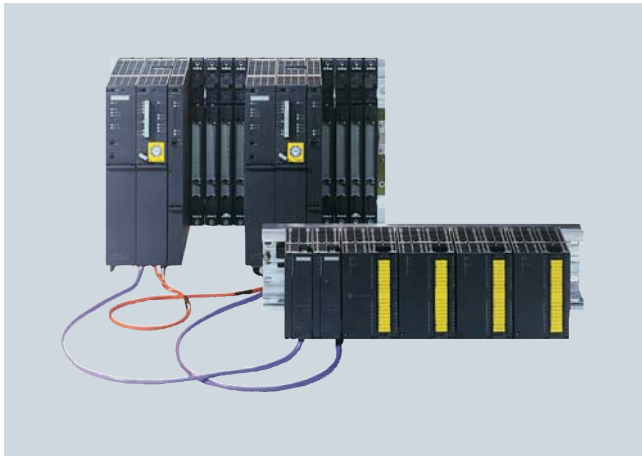
The AS 412H, AS 414H and AS 417H models are the fault-tolerant automation systems for use with SIMATIC PCS 7. They are based on the 1-out-of-2 principle and switch to the backup system in the event of a fault. These systems use a completely redundant design to maximize availability. This means: all major components such as CPU, power supply and hardware for coupling the two CPUs are present in pairs. Which other components are also made available in pairs in the interest of availability depends on the particular automation task.

The two subsystems of a redundant automation system are electrically isolated from one another. This increases the system stability with respect to electromagnetic interference. A partial AS can either share a rack with its redundant partner system or it can be mounted by itself on a rack. For example, racks that each have a partial AS are useful in the following situations:

- For security reasons spatial separation of both partial AS units is required.
- The customer initially operates a partial AS alone, but wants to keep the option open of converting to redundant operation at some time in the future.

Bundles appropriate to each application are available as single or redundancy stations. Mixed use of the two versions is also possible.





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 systems collaborate with the safety-related F modules of the ET 200 distributed I/O systems or the 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 based on the hardware of the AS 412H, AS 414H or AS 417H automation systems that are extended by the S7 F Systems software package to include safety functions.

They are available in two versions:

- 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

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

The safety-related automation systems are TÜV-certified and conform to the safety requirements up to SIL 3 in accordance with IEC 61508.

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. Even special tasks with very short response times can be implemented.

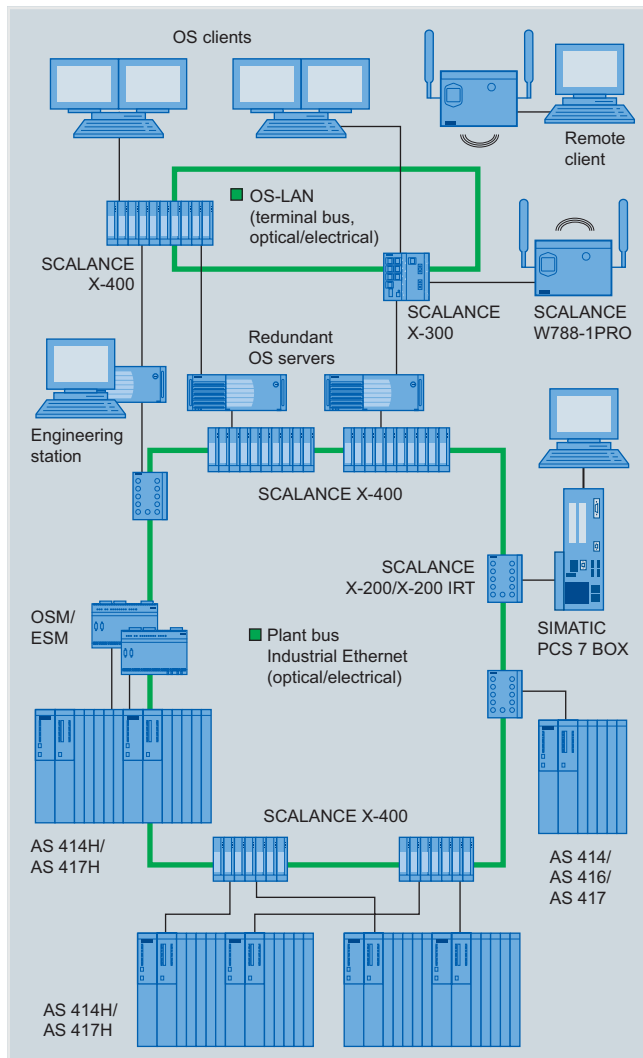
For parallel processing of BPC and safety functions in one CPU, mutual interference is prevented by ensuring that the BPC programs and the safety-related programs are kept strictly separate and that the data is exchanged by means of special conversion function blocks. The safety functions are processed twice in different sections of a CPU by means of redundant, diverse instruction processing. Potential errors are detected by the system during the subsequent comparison of results.

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	125	125	150		700	
Digital value measurements	15	110			350	350	350	400		1 200	
PID controls	6	35			110	110	110	130		300	
Motors	10	50			125	125	125	150		450	
Valves	10	50			125	125	125	150		450	
SFC	0	15			40	40	40	50		200	
Steps	0	150			400	400	400	500		2 000	
Dosing	0	3			15	15	15	15		45	
Digital inputs DI	50	220			800	800	800	850		2 000	
Digital outputs DO	25	110			300	300	300	315		1 000	
Analog inputs AI	20	80			250	250	250	275		800	
Analog outputs AO	10	40			110	110	110	130		400	
Process objects (PO)	50	283			890	890	890	995		3 145	

Typical mixed quantity frameworks for SIMATIC PCS 7 automation systems

Communication

Fast and safe communication
with Industrial Ethernet for plant bus and OS LAN



Industrial Ethernet, connection examples

SIMATIC NET

With the network components of SIMATIC NET that are based on established worldwide standards, SIMATIC PCS 7 has a powerful and rugged product spectrum for implementation of uniform communication networks for reliable data exchange between all system components and all levels of a plant.

The SIMATIC NET products specially designed for industrial use are optimally suitable for plants from all sectors. They are matched to one another, and meet high 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 guarantee expandability and safeguard investments through compatible further developments as well as uniformity from incoming goods to outgoing goods and from field devices up to the management information system.

Industrial Ethernet

Industrial Ethernet, a powerful area and cell network for industrial applications in line with the international IEEE 802.3 standard (Ethernet), is used as the plant bus as well as the OS LAN (terminal bus) for multi-user systems in client/server architecture.

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) are used as communication interfaces. For small systems, the "Basic Communication Ethernet" integrated in the SIMATIC PCS 7 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 communications processors 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 OS LAN (terminal bus).

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

- With the OS LAN, the two rings are connected together by two 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)



For electrical or optical gigabit rings (single and redundant):

- 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)



For optical line, star or ring structures (up to 1 Gbit/s):

- 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) each with 3 optical Gigabit Ethernet ports and 7 electrical FastEthernet ports
- 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) each with 2 optical Gigabit Ethernet ports, 1 electrical Gigabit Ethernet port and 7 electrical FastEthernet ports

For electrical line, star or ring structures (up to 1 Gbit/s):

- SCALANCE X310 with 3 electrical Gigabit Ethernet ports and 7 electrical FastEthernet ports

For electrical line, star or ring structures (up to 100 Mbit/s):

- SCALANCE X310FE with 10 electrical FastEthernet ports

SCALANCE X-200 IRT (up to 100 Mbit/s)



For line, star or ring structures (electrical/optical, depending on type of port):

- 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 plastic optical fiber (POF) cable ports
- SCALANCE X201-3P IRT with 1 electrical port and 3 plastic optical fiber (POF) ports
- SCALANCE X200-4P IRT with 4 plastic optical fiber (POF) ports

SCALANCE X-200 (up to 100 Mbit/s)



For electrical line, ring, or star structures:

- SCALANCE X224 with 24 electrical ports
- SCALANCE X216 with 16 electrical ports
- SCALANCE X208 with 8 electrical ports

For optical line or ring structures:

- 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

For star structures as well as line or ring structures with electrical and optical transmission links:

- 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 OS-LAN via a SCALANCE W788-1PRO 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 W746-1PRO Ethernet client module.

The following applications can then be implemented:

- Setup of additional remote OS clients (1 or 2 on IWLAN)
- Linking of Web clients to a PCS 7 Web server (1 or 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 / OS LAN	Industrial Ethernet
Number of stations	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

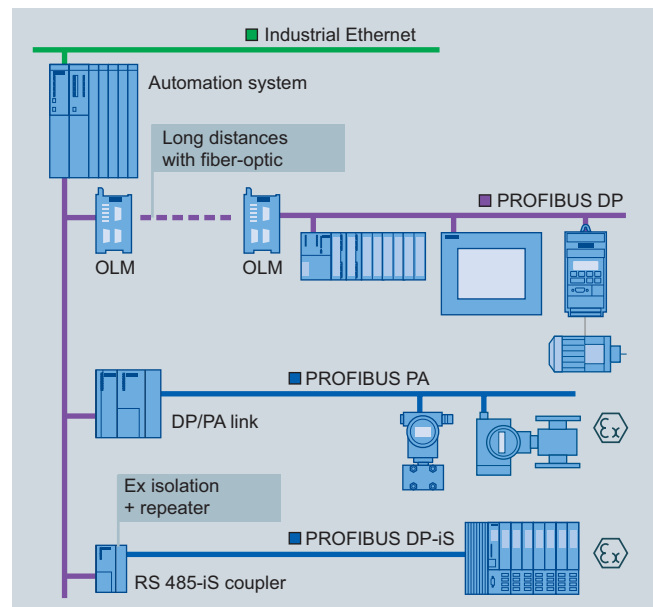
Distributed peripherals such as remote I/O stations with their I/O modules, transmitters, drives, valves or operator terminals communicate with the automation systems at field level through a powerful real-time bus system. This communication is characterized by:

- 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.

On account of these characteristics, PROFIBUS is now established in all sectors of the production, process and hybrid industries and has become the most successful open fieldbus in the world. This is proven by more than 20 million installed PROFIBUS nodes, of which 3.3 million are in the process industry with a share of approx. 630,000 installed PROFIBUS PA nodes (as of July 2007).



PROFIBUS transmission technologies

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 tagging

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 be run as an intrinsically-safe fieldbus in all environments up to Ex zone 1 or 21.

The PROFIBUS PA – which is ideal for integrating pneumatic actuators, solenoid valves, and sensors in operating environments up to Ex 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 technologies

PROFIBUS DP

- RS 485:
Simple and low-cost electrical transmission system based on shielded two-wire cable.
- RS 485-iS:
Intrinsically-safe electrical transmission system for hazardous areas up to Ex zone 1, implemented using a shielded two-wire cable 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 Ex zone 0, 1, or 21.

PROFIBUS PA architectures for high availability and safety

Linear architectures with single couplers

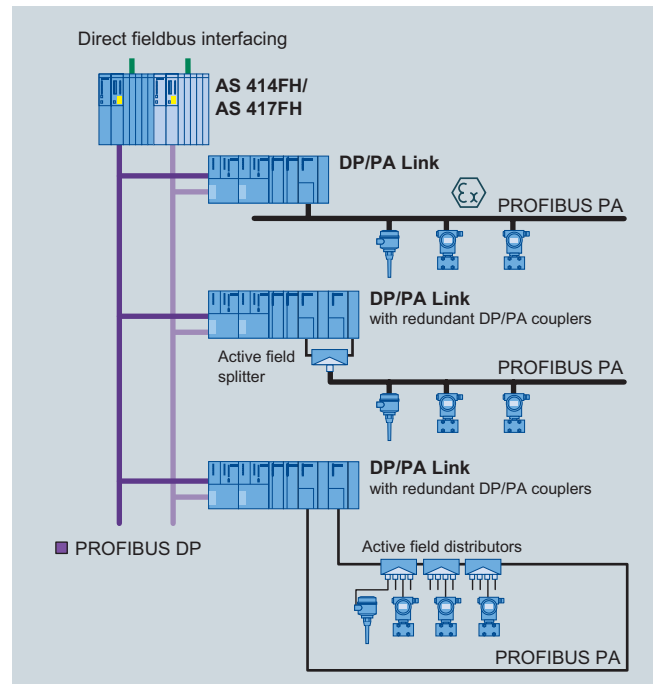
Each PROFIBUS PA line is linked with one DP/PA coupler Ex [i] (PA line up to Ex zone 1/21) or FDC 157-0 (PA line up to Ex zone 2/22) of a DP/PA router. This router can be operated on a single or redundant PROFIBUS DP.

Linear architectures with redundant couplers

The active field splitter (AFS) connects a PROFIBUS PA line with two FDC 157-0 DP/PA couplers of a DP/PA router, operable on a single or redundant PROFIBUS DP. The AFS switches the PROFIBUS PA line to the active one of the two redundant couplers.

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.



PROFIBUS PA architectures

Particular advantages of the ring architecture:

- Highest 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
Transmission 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 explosion protection		EEx(ib)		EEx(ia/ib)
Topology	Linear, tree	Linear	Ring, star, linear	Linear, tree, ring
Participants per segment	32	32 ¹⁾	–	32
Participants per network (with repeater)	126	126	126	–
Cable length per segment depending on transmission 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

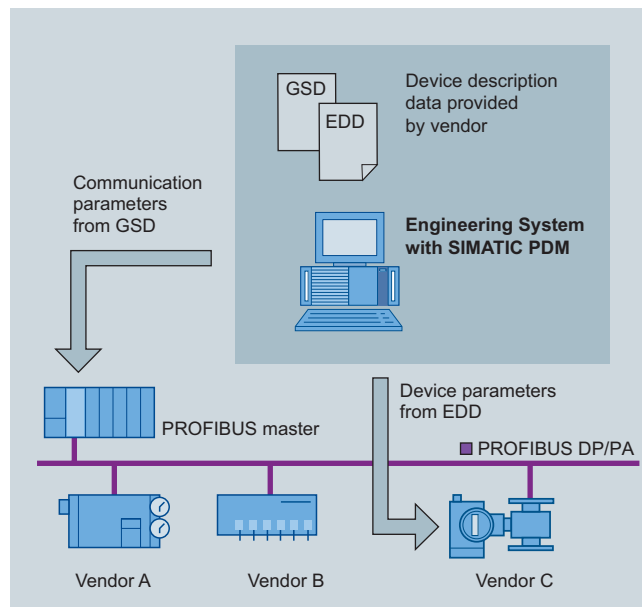
Device interfacing with GSD and EDD

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 transmission rate
- Lifelist of all bus participants
- Operating states of all bus participants
- 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 values on the main cable
- Redundancy status
- Wire breakage
- Short-circuit
- Signal level

For this purpose, each FDC 157-0 DP/PA coupler 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
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

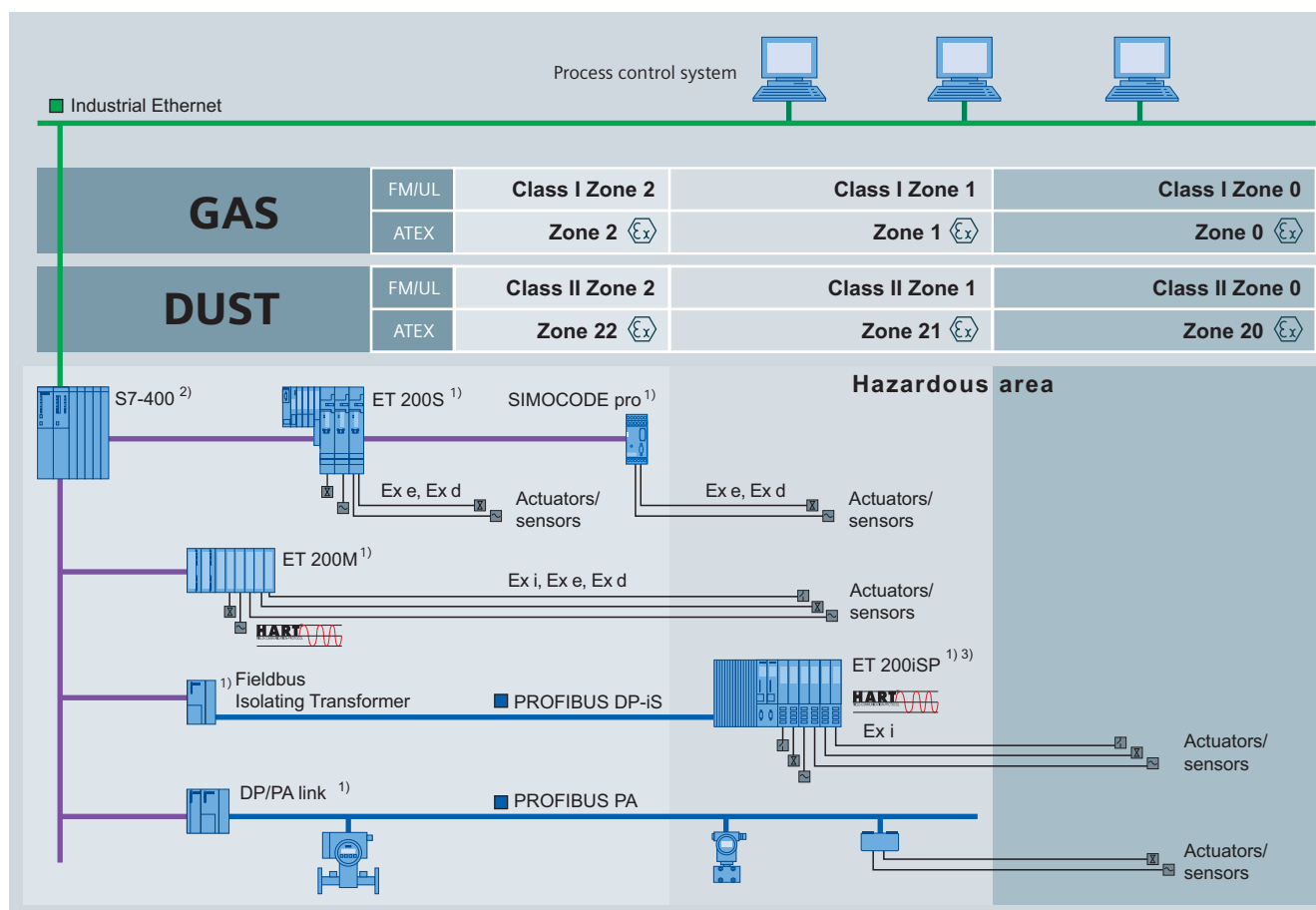
Further process I/Os can be integrated into SIMATIC PCS 7 via the PROFIBUS using add-on blocks. Examples of this are devices of drive and weighing systems such as:

- SIMOCODE pro motor management system
- MICROMASTER 4 frequency inverters
- SIWAREX M/U/FTA/FTC weighing systems

SIMATIC PCS 7 MTA terminal modules

The SIMATIC PCS 7 MTA (Marshaled Termination Assemblies) enable field devices, sensors and actuators to be connected quickly, reliably and securely to I/O modules of ET 200M remote I/O stations. MTA versions for standard I/O modules are also available, 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

¹⁾ Dust atmospheres: components should always be installed in an enclosure with IP6x degree of protection

²⁾ With 10 A DC standard power supply

³⁾ Also satisfies FM/UL in accordance with Class I Division 2

The diagram above shows the various interfacing possibilities for the distributed I/Os of SIMATIC PCS 7 with consideration of various ambient 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 A&D Sensors and Communication Division.

These include, for example:




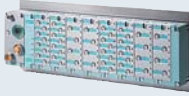


- Devices for measurement of pressure, flow, temperature or level
- Positioners
- Gas analyzers
- SIWAREX weighing systems

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/fielddevices

Distributed I/O systems

Recommended devices for field automation

<div><div></div><div>DP</div><div>PDM</div><div>Safety</div></div>		Description	Functions
Distributed I/O systems			
	● ●	<div>ET 200M</div> <div>Modular remote I/O system with high-channel modules; IP20 degree of protection</div> <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s■ Redundant PROFIBUS connections are possible■ Can be installed in Ex zone 2 or 22, and the connected actuators and sensors can also be installed in Ex zone 1 or 21	<div>I/O modules in S7-300 design (up to 12 per station):</div> <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 in Ex version)■ F modules for safety-related applications: F-DI, F-DO and F-AI <div>Supports online modifications:</div> <ul style="list-style-type: none">■ Addition of station■ Addition of I/O modules■ Parameter assignment
	●	<div>ET 200iSP</div> <div>Intrinsically safe modular remote I/O system with "permanent wiring"; degree of protection IP30</div> <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 1.5 Mbit/s■ Redundant PROFIBUS connections are possible■ Can be installed directly in Ex zones 1, 2, 21 or 22, and the connected sensors/actuators can also be installed in Ex zone 0 <div>Replacement of individual modules during operation without fire certificate</div>	<div>Electronic modules (up to 32 per station):</div> <ul style="list-style-type: none">■ DI NAMUR and DO■ AI for temperature measurements using resistance thermometer/thermocouple■ AO■ AI HART (for two-wire and four-wire transducers) and AO HART <div>Supports online modifications:</div> <ul style="list-style-type: none">■ Addition of station■ Expansion of station with modules■ Modification of module parameters
	● ●	<div>ET 200S</div> <div>Discretely modular, extremely compact, remote I/O system with "permanent wiring"; degree of protection IP20</div> <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s■ Can be installed in Ex zone 2 or 22	<div>Electronic modules (up to 63 per station) and motor starters up to 7.5 kW:</div> <ul style="list-style-type: none">■ DI, DO, AI and AO signal modules■ Motor starters■ F modules F-DI, F-DO, and F-motor starters for safety-related applications <div>Supports online modifications</div> <ul style="list-style-type: none">■ Addition of station
	● ●	<div>ET 200pro</div> <div>Small, modular, remote I/O system with "permanent wiring"; via connection modules; degree of protection IP65/66/67</div> <ul style="list-style-type: none">■ Transmission rates on the PROFIBUS up to 12 Mbit/s	<div>Electronic modules (up to 16 per station):</div> <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			
	● ●	<div>SIMOCODE pro motor management and control devices</div> <div>(can be integrated in SIMATIC PCS 7 using the PCS 7 block library)</div>	<div>Flexible, modular motor management system for constant-speed motors in the low-voltage range</div> <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 <div>Can be used wherever solid, liquid, or gaseous materials must be moved, conveyed, pumped or compressed, e. g. for operation of:</div> <ul style="list-style-type: none">■ Pumps and fans■ Compressors■ Extruders and mixers■ Mills
	● ●	<div>MICROMASTER 4 frequency inverters</div> <div>(can be integrated in SIMATIC PCS 7 using the PCS 7 block library)</div>	<div>Standard frequency inverters with high dynamics for variable speed AC motors and geared motors</div> <ul style="list-style-type: none">■ Power range 0.12 to 250 kW■ Voltages from 200 to 600 V <div>For universal use, especially for:</div> <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

SIMATIC BATCH

Automation of batch processes with SIMATIC BATCH



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

- Simple batch processes with parameterizable sequential controls 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

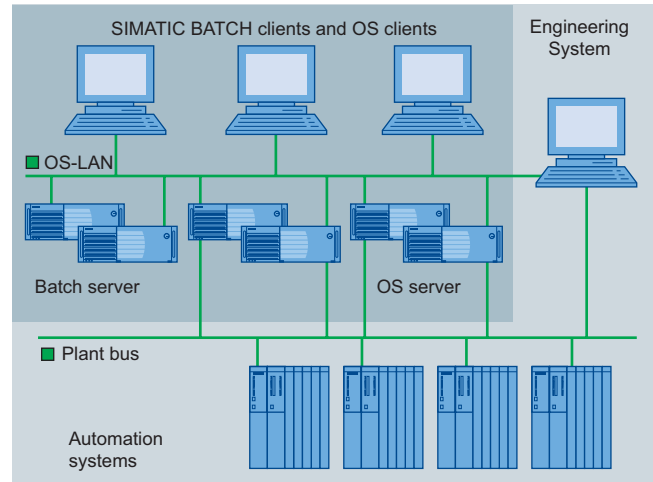
SIMATIC BATCH can be configured as a single-user system or as a client/server system, and can be used in plants of any size thanks to its modular architecture and scalability in multiple steps with 10, 20, 40, 100 and unlimited units (instances of plant units).

For small applications, e.g. for laboratory automation, SIMATIC BATCH can also be combined with the PC-based starter system SIMATIC PCS 7 BOX 416. 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.

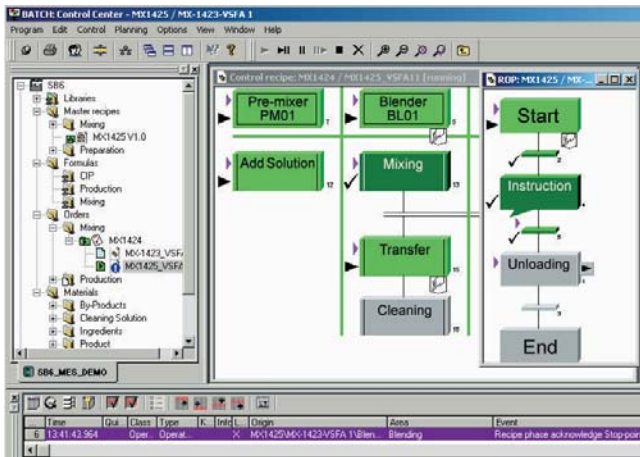
The batch server software usually runs on an autonomous server hardware (batch server), separated from the OS servers. Depending on the capacity utilization of the Operator System, OS and batch server software can also be operated on shared server hardware (OS/batch server). SIMATIC BATCH clients and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

SIMATIC BATCH uses the SIMATIC logon integrated in the Process Control System for central user administration and authentication, as well as for the "electronic signature" to release basic 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



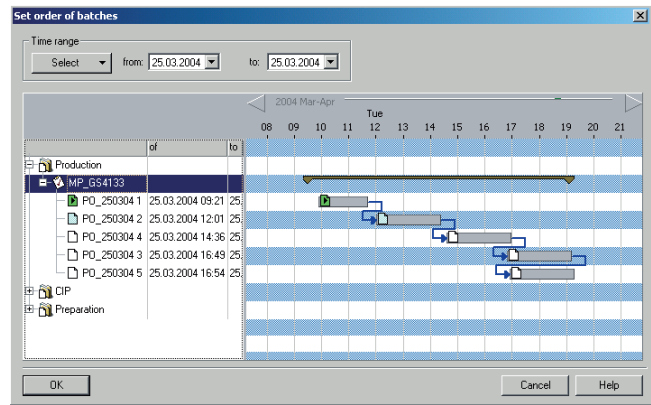
SIMATIC BATCH batch control center

SIMATIC BATCH provides special faceplates for controlling and monitoring plant units and equipment modules. 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
- Management of libraries with recipe elements (library operations)
- Exporting and importing of basic 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.

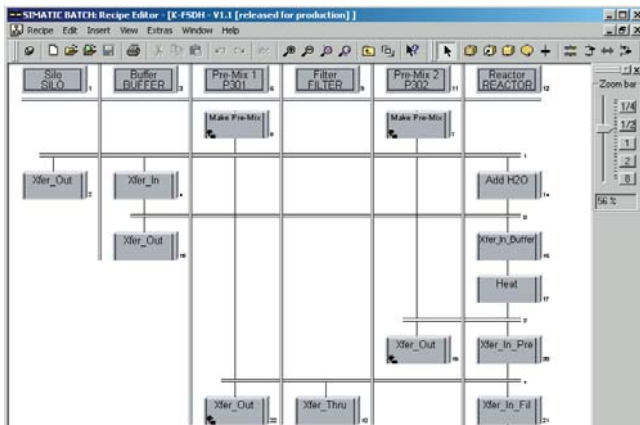
In addition to planning, the scope of functions include the modification, cancellation, deletion and enabling of batches. Creation and distribution of the batches for a production order are possible manually, but can also be carried out automatically depending on definition of the batch number or production 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)
- Execution 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 basic 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 technological functions. 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 basic recipes and library operations
- Modification of existing basic 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 basic 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 basic recipes and library operations for test or production
- Configuring arithmetic expressions for calculating setpoints 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	- / -		
Product order	Prod. ORDER		
Duration (sbatch)	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	0	
Batch1	0	2	0	0	
Silo	8102	0	0	0	49 (s/s)
Buffer	B201	0	0	0	01:23 (mm:ss)
Pre-Mix 1	P301	0	0	0	01:29 (mm:ss)
Filter	F401	0	0	0	11 (s/s)
Pre-Mix 2	P302	0	0	0	01:16 (mm:ss)
Reactor	R501	0	0	0	01:49 (mm:ss)

Input materials:					
No.	Name	Material	Code	Setpoint	Act
No input materials available					

Output material:					
No.	Name	Material	Code	Setpoint	Act
1	X-FSDH	Poly_ASDF	1324	5000	-

Messages:	
Time	Event
Wednesday, March 12, 2005 5:12:33 AM	Batch enabled
Wednesday, March 12, 2005 5:12:41 AM	Batch running
Wednesday, March 12, 2005 5:14:40 AM	Batch completed

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 reproduction of the batch process, for proof of the quality, and for compliance with statutory directives. These include, for example:

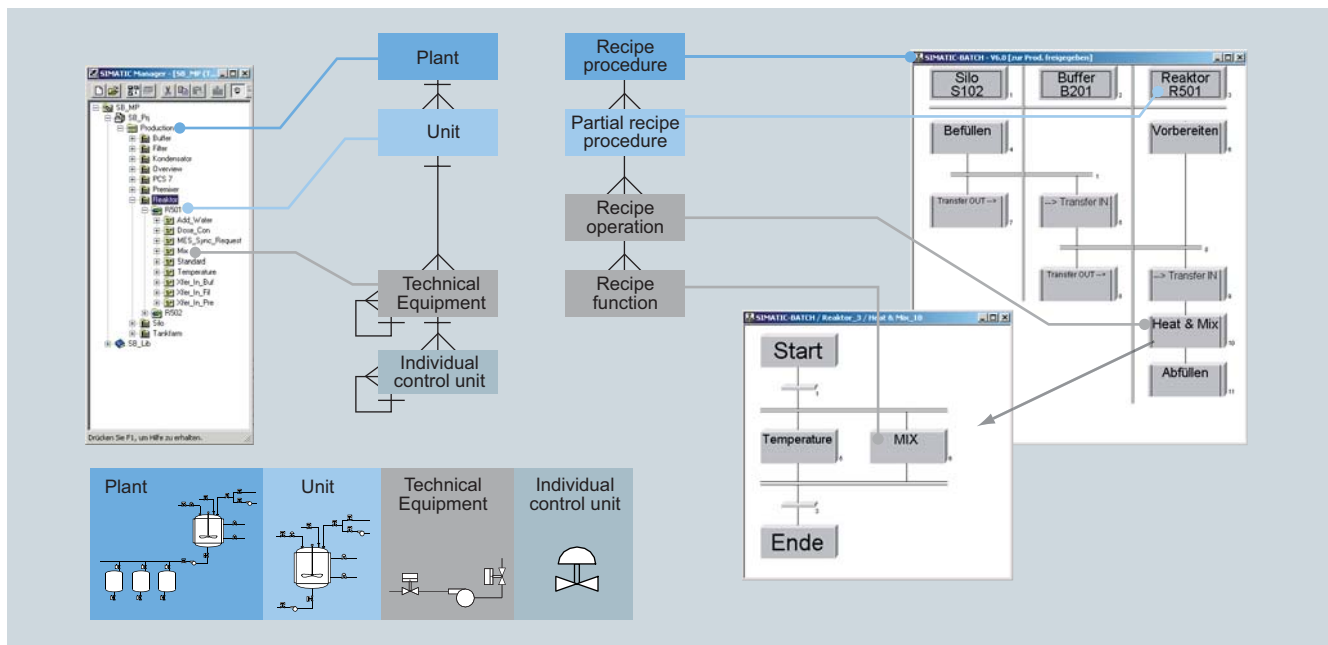
- Identification data
- Control recipe data
- Effective production data
- Time sequence of steps
- Status messages, fault messages and alarms
- Operator interventions
- Process values

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 module as follows:

- Recipe procedure for controlling the process or the production in a plant
- Partial recipe procedure for controlling a process step in a plant unit
- Recipe operation/function for the process engineering task/function in an equipment module

Neutrality and assignment of plant units

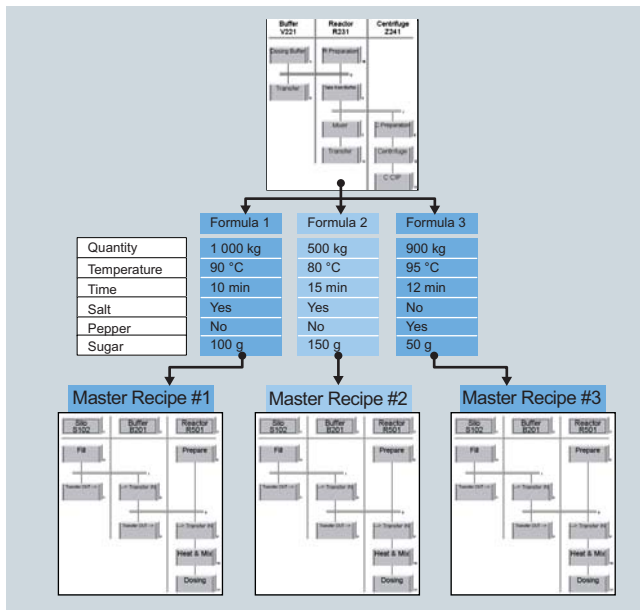
Creation of a recipe which is neutral to the plant unit minimizes the engineering overhead and provides significant advantages for validation. During creation of the recipe, the partial recipe procedures are only assigned plant unit classes. The final assignment of the plant units is only carried out 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 special 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 are only accessible to authorized persons or systems are 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 inserted 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 (modification logbook):
 - 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
 - Great 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 (modification logbook)
 - 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

SIMATIC Route Control

Material transport control



SIMATIC Route Control (RC) expands the SIMATIC PCS 7 process control system with a tool for the configuration, control, monitoring and diagnostics of material transport in pipeline networks. It is not specialized on any particular industry.

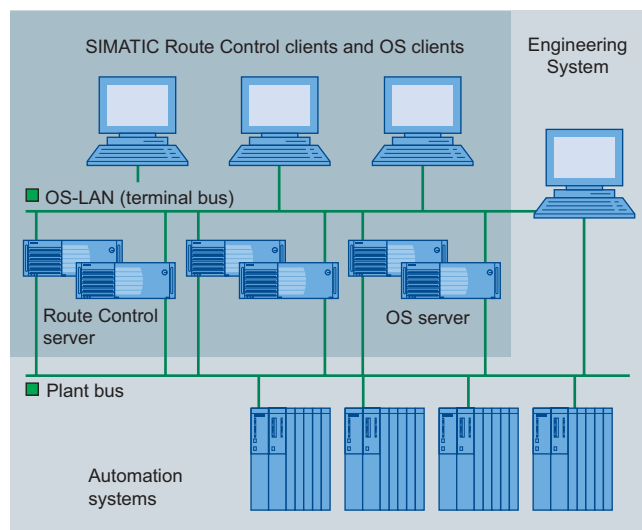
With SIMATIC Route Control, users of SIMATIC PCS 7 are capable of automating not only their production processes and associated warehouses but also the material transport linking both areas.

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 either be installed alone or together with the OS software on a single-user system (single station) or on a SIMATIC PCS 7 BOX 416. Distributed multi-user systems with client/server architecture, expandable with up to 32 clients per server, are typical of the automation of material transport with SIMATIC Route Control.

SIMATIC Route Control Engineering

SIMATIC PCS 7 supports multi-user systems with up to 12 servers/pairs of servers. 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:

- Controller WinAC slot 416 of the SIMATIC PCS 7 BOX 416 and AS 416-3 (up to 30 concurrent material transports)
- AS 417-4 and AS 417H (up to 300 concurrent material transports)

In the process display 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.

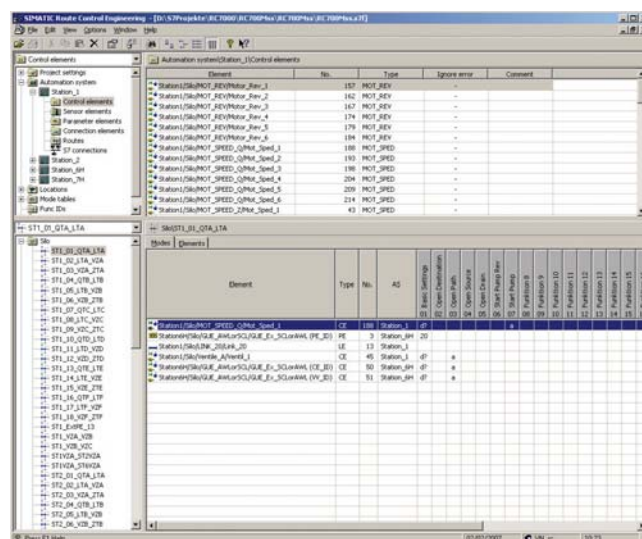
For access control and for managing the graded user rights for engineering, operating and maintenance personnel, SIMATIC Route Control uses the SIMATIC Logon integrated in the process control system.

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 routes)



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.

The configuration of the partial routes and the assignment of the RC elements to the partial routes is 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)

The screenshot shows the Route Control Center (RCC) interface. The top part is a large table with columns for 'Route', 'Station', 'Function', 'Status', 'Priority', 'Destination', and 'Description'. It lists various routes and their associated stations and functions. Below this is a smaller table with columns for 'Function', 'Elements', and 'Parameters', which provides a summary of the configured functions and their parameters.

Route Control Center (RCC)

Route Control Center (RCC)

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

- Overview of all RC elements and request details
- Operation of selected material transport depending on the mode (manual/automatic). The following applies to 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 Centers) with the necessary data and transfers their operations to the automation systems.

If a material transport is waiting, a route is requested either via the controller or by the operator at the Route Control Center (RCC). Apart from specifying the source, destination and up to 10 optional locations, this also includes creating a start signal

on the route control block of the automation system. 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 runtime
- 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

Process safety

Safety Integrated for Process Automation with SIMATIC PCS 7

The process industry frequently features complex production sequences where materials and mixtures which are explosive or dangerous to health are produced or processed. A failure or error could have fatal consequences for personnel, machines, plants, and environment.

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. This requires a reliable safety instrumented system (SIS) that guides the plant into a safe state whenever necessary.

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, to safe and fault-tolerant control, to the actuator (e.g. positioners, valves and pumps).

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 number of cost advantages - viewed over the entire life-cycle of a plant.

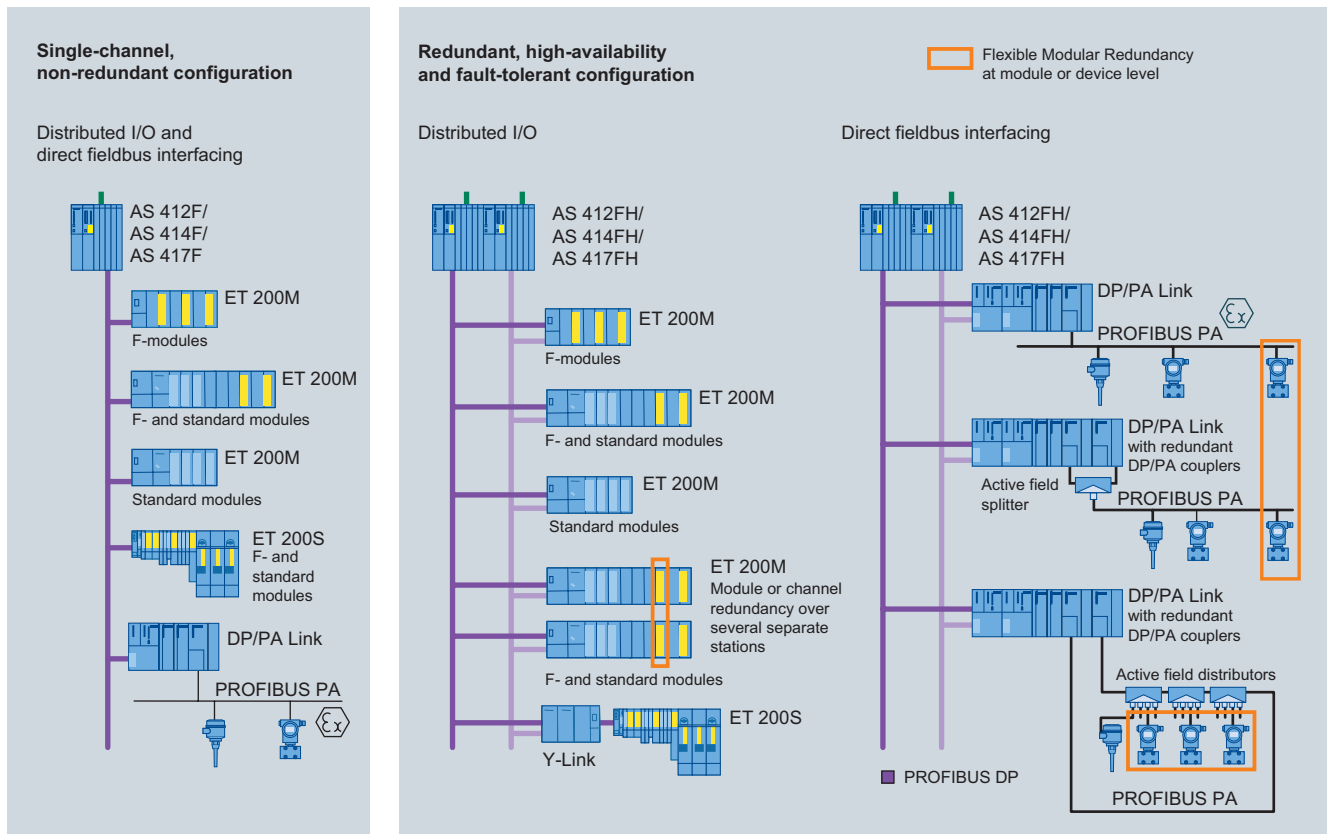
Both the safety technology and the safety applications implemented with it are characterized by great efficiency and comply with both national and international standards, such as:

- 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	Safe, fault-tolerant controllers in single and redundant design (up to SIL 3) for the bottom, mid and upper performance ranges
	Engineering	Safety functions are configured by means of 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 high-density applications with digital input and output modules 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 pressure transmitters (SIL 2) 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 for preventive valve diagnostics without interfering with 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 very variable and offer a wide scope for design with regard to different customer requirements. 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.

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.

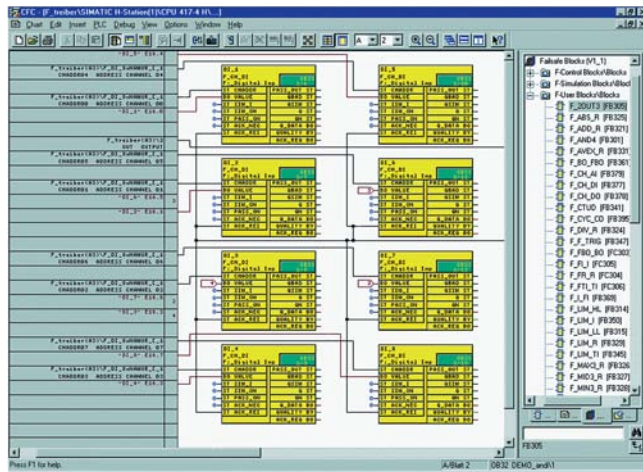
Safety-related automation systems

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 also able to carry out safety-related communication with one another over the Industrial Ethernet plant bus.

Safety Integrated for Process Automation with SIMATIC PCS 7



Engineering of safety-related applications with CFC

Engineering tools for safety functions

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
- Detection 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 robust and intercept programming errors such as division by zero or out-of-range values. They avoid the need for diverse programming tasks for detecting and reacting to errors.

SIMATIC SAFETY MATRIX

All Groups: Select

Multiple Groups: 01: High Pressure SIF, 02: High Tank Level SIF, 03: Low Hopper Level SIF, 04: High Tank Temp SIF, 05, 06

Input Tag	Func	Limit/Trip	EngUnit	Cause Description	Num	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PS_100	FALSE			Feed Pump High Pressure Switch	1	N													
LSH_100	TRUE			Tank_100 Level switch high	2	S	S	S	R	2N									
LSL_200	TRUE			Hopper_200 Level switch Low	3	N	N	N	2S										
PSH_200	TRUE			Hopper_200 High Pressure	4	N	N	N	V										
PT_100	H 38.00	PSIG		Feed pressure	5	S	S	S											
LT_100	H 50.00	Feet		Tank Level	6	S	S	N		2N									
PT_101	Vote	H 25.00 D 3.0	in_H20	Tank Pressure	7				N	2N	S								
LT_200	H 50.00	FT		Hopper Level	8				2S										
TS_101	FALSE																		
TS_102	AND	FALSE		Tank_100 High Temperature switch	9						3S								
TS_103	FALSE																		

Ready

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 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 message frames by additional information with which the PROFIsafe communications partner 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, e.g. 2oo3 evaluation for analog inputs, are carried out by the CPU. 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	Digit input SM 326 F	Digital input SM 326 F NAMUR [Ex ib]	Digit output SM 326 F	Digit output SM 326 F	Analog input 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) 15 bit + sign 2-wire or 4-wire connection
Max. achievable safety class in accordance with IEC 61508/EN 954-1	1-channel: SIL 2 2-channel: SIL 3	1-channel: SIL 2 2-channel: SIL 3	SIL 3	SIL 3	SIL 3
Input or output voltage	24 V DC	NAMUR	24 V DC	24 V DC	–
Input or output current	–	–	2 A per channel for "1" signal	2 A per channel for "1" signal	4 ... 20 mA or 0 ... 20 mA
Short-circuit proof sensor supply	4 for every 6 channels, isolated in groups of 2	8 for each channel, individually isolated	–	–	6 for each channel
Redundancy	Module redundancy	Module redundancy	Module and channel redundancy	–	Module and channel redundancy
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		
Supply voltage	24 V DC/10 A	24 ... 48 V DC; 24 ... 230 V AC; with fuse
Applications	All electronic module types, including safety-related (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 4/8 F-DI	Digital output 4 F-DO
Number of I/Os	4 (2-channel SIL 3-sensor) 8 (1-channel 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 I/O modules

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 detect a fault and deactivate 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.

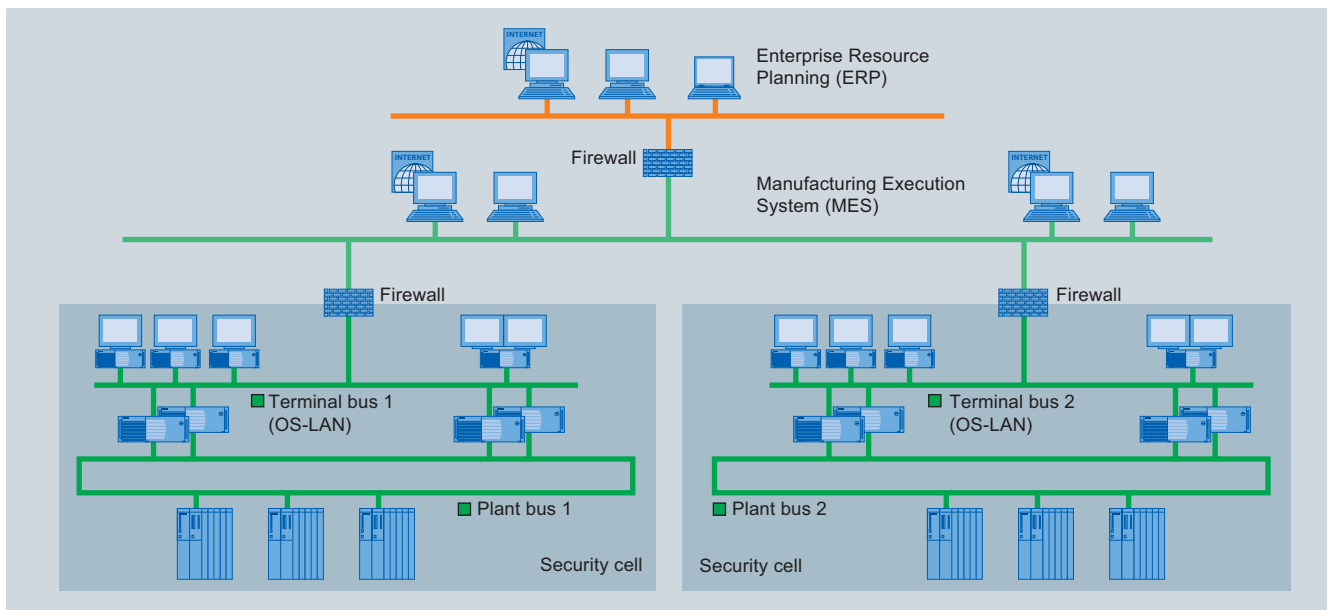
In a safety application, the pressure transmitter can be connected via PROFIBUS PA to an AS 412F/FH, AS 414F/FH or AS 417 F/FH. For safe shutdown, the digital input of SIPART PS2 PA, the electropneumatic PROFIBUS PA positioner, can be used.

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 storage for basic process control and safety safety related automation, including process visualization and diagnostics - no cumbersome data handling
- 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 tagging
- 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

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 controlled 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 safeguarding a process engineering plant that are based on a hierarchical security architecture (defense in depth). 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.

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

- Creation of a network architecture with defense in depth, combined with the segmentation 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 the Windows and SIMATIC PCS 7 operator privileges; integration of the SIMATIC PCS 7 operator privileges in the Windows administration
- Reliable control of the clock synchronization in the Windows network
- Management of security patches for Microsoft products
- Use of antivirus software 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".

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

Comprehensive protective measures for IT security



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.

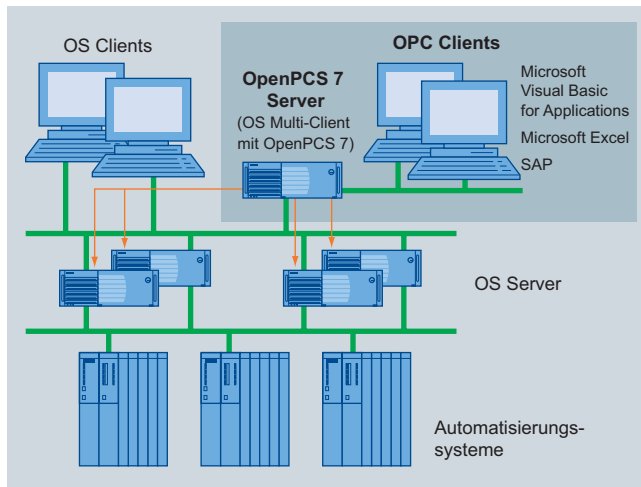
System support for the security concept

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 during setup
- User administration and authentication by means of SIMATIC Logon
- Integration of Industrial Security Modules SCALANCE S602, S612, S613

OpenPCS 7 and MES interfacing

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). The OpenPCS 7 server covers the distribution of data with regard to:

- Period (OS1 / OS2 / ... / CAS)
- Location (OS1 / OS2 / ...) and
- 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 towards 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, safeguards investments, 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:

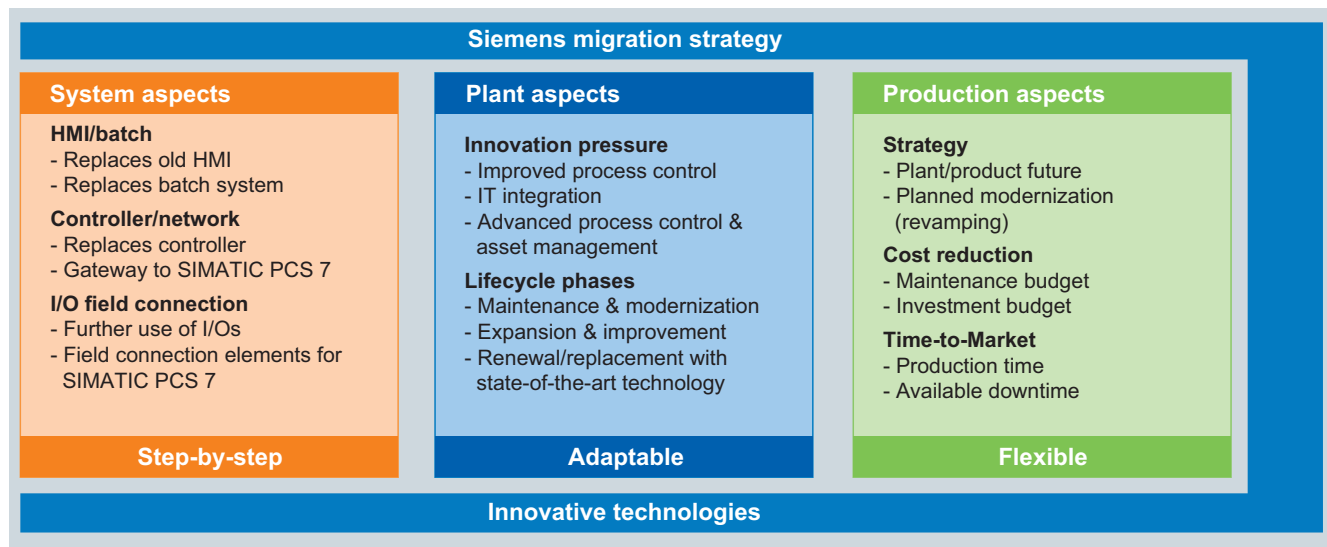
- SIMATIC IT PDS-I (Predictive Detailed Scheduler - Interactive)
- SIMATIC IT Report Manager
- SIMATIC IT OEE-DTM Option (Overall Equipment Efficiency / Down Time Management)
- SIMATIC IT SPC (Statistical Process Control)

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

Migration

The investment in the future



Migration strategy

Globalization and permanently increasing competitive pressures are forcing companies to continuously increase productivity and shorten market 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 migration is decisively determined by the provision of 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 the prime objectives. The different life cycles of the 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:

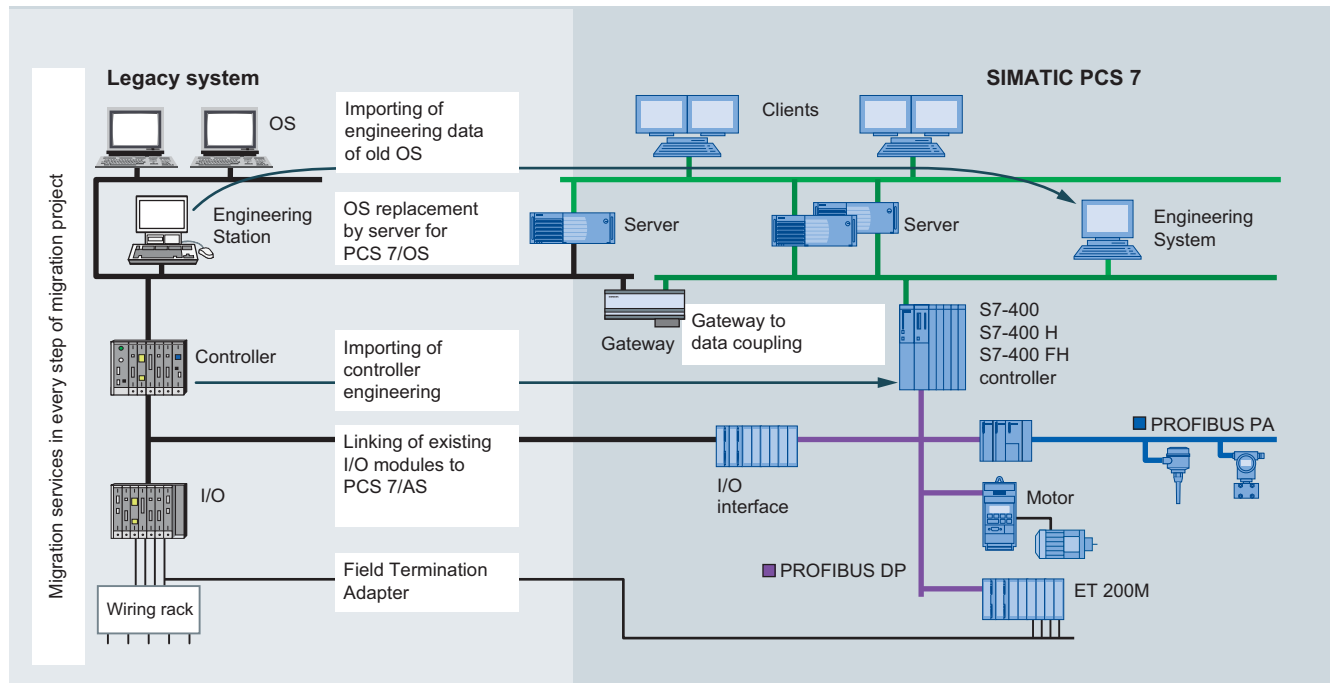
- **Step-by-step** system innovation
- **Adaptable** to the specific conditions of the plant
- **Flexible** according to production requirements

Portfolio of the migration products

Siemens recognized the significance of migration for process automation at an early stage and has already been offering a wide range of innovative migration products and solutions for its globally proven systems for many years. 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 shut-down or with minimum production downtimes. In this manner, Siemens supports customers' endeavors to achieve long-term safeguarding of investments and maximize return on assets.

Siemens' know-how in the migration sector has continuously grown as time has passed. 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.



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

Migration components	Description
OS migration products	<ul style="list-style-type: none"> Interface from SIMATIC PCS 7 OS to the system bus of the legacy 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-oriented conversion of AS engineering data in accordance with 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 the legacy I/Os on SIMATIC PCS 7 automation systems usually for Siemens systems) Field Termination Assemblies (FTAs) for field level wiring

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, process I/O, and application software are retained.

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

Scenario 2: Expansion of existing plant

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

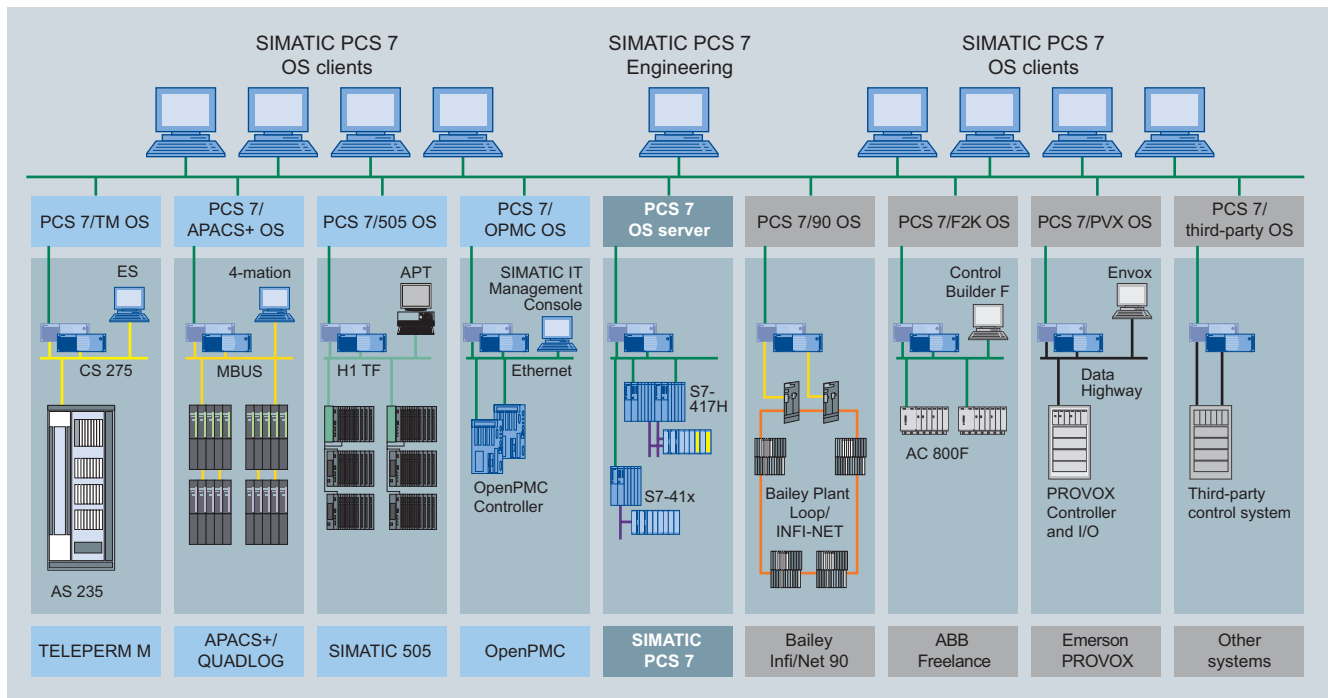
- Simple, step-by-step increase in production capacity
- Clear risk
- Introduction of new technologies (e.g. PROFIBUS fieldbus, HMI)
- Opening of system for IT world
- Together with scenario 1, enables process control using a uniform operator system

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 force 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 system for IT world
- Lengthening of service life of complete plant
- Reduction in number of system suppliers
- Elimination of bottlenecks and dependencies

Migration spectrum



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, Honeywell, or Emerson.

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 through expertise, service 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
- Preparing bids
- Engineering/project handling

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

Services



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

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

Online support

Comprehensive information system available at all times via Internet:

www.siemens.com/automation/service&support

Technical support

Competent advice on technical issues with a broad spectrum of carefully tailored services based on our products and systems.

Technical consulting

Support in planning and designing your project: covering detailed analysis of the current situation and definition of objectives, advice on products and systems, and design of the automation solution.

Field service

All services concerning commissioning and maintenance to guarantee availability of automation plants and systems.

Optimization and modernization

High-quality services for optimization and modernization in order to increase productivity or save costs.

Project engineering and software engineering

Support during development and project engineering with services tailored to your requirements from the configuration stage through to implementation of an automation project.

Repairs and spare parts

Comprehensive repair and spare parts services offer a maximum of operational safety.

Get more information

Comprehensive information concerning the SIMATIC PCS 7 process control system is available on the Internet at:

www.siemens.de/simatic-pcs7

You can find more detailed information in the SIMATIC Guide manuals:

www.siemens.de/simatic-doku

You can order further documents on the topic of SIMATIC at:

www.siemens.de/simatic/druckschriften

More detailed technical documentation at our Service & Support portal:

www.siemens.de/automation/support

For a personal discussion, you can find your nearest contact at:

www.siemens.de/automation/partner

In the A&D Mall you can place orders electronically via the Internet:

www.siemens.de/automation/mall

Siemens AG
Industry Sector
Industrial Automation Systems
P.O. Box 4848
D-90327 NUREMBERG
GERMANY

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