SIMATIC PCS 7 Process Control System

Product Brief · November 2003

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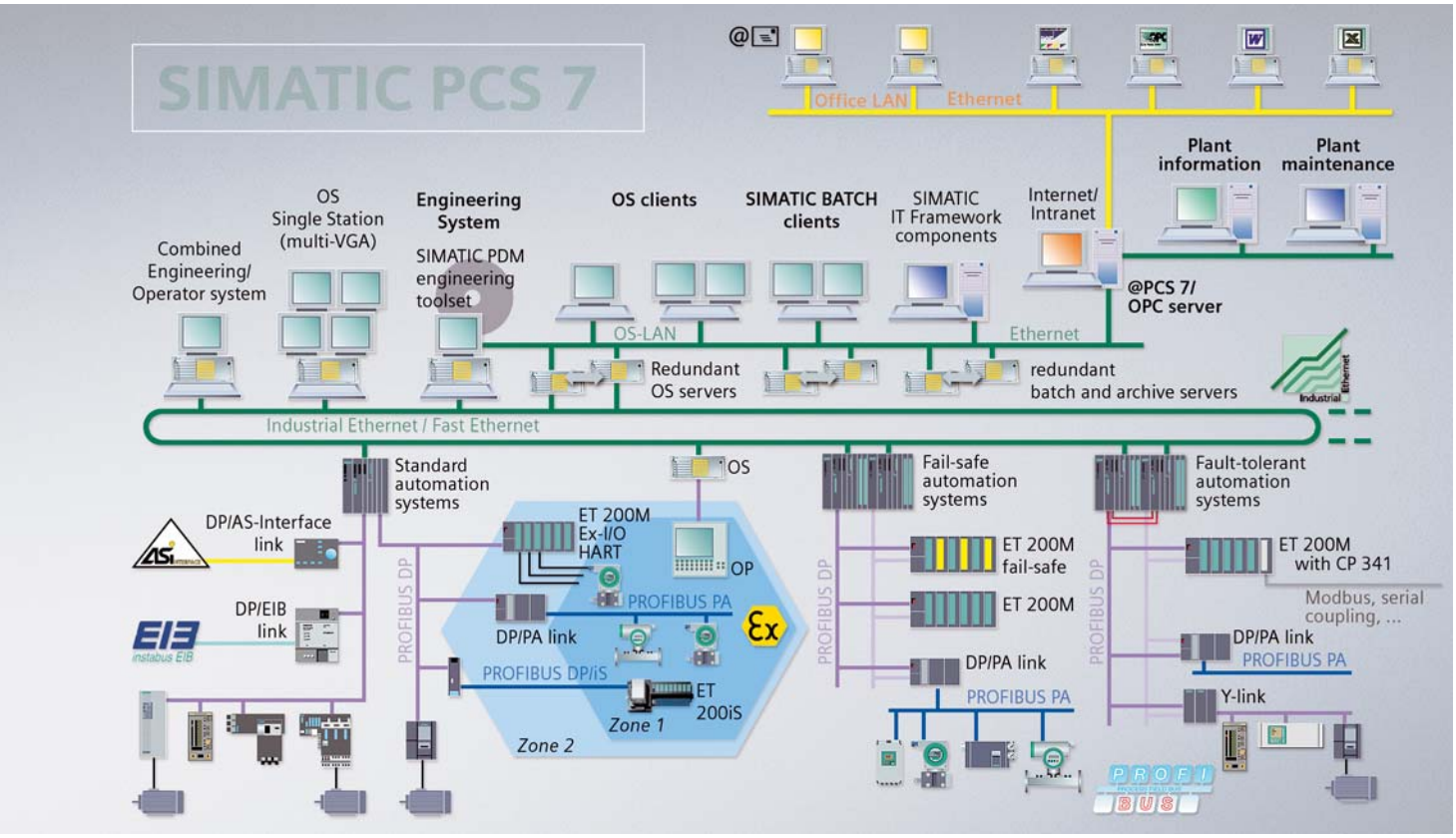
SIEMENS

SIMATIC PCS 7

The process control system for Totally Integrated Automation



Using Totally Integrated Automation® (TIA), Siemens provides uniform automation technology on one single platform for all applications of process automation, starting with input logistics, covering production or primary processes as well as downstream (secondary) processes, up to output logistics. This uniform automation technology also facilitates the optimization of all company operations, covering the enterprise resource planning (ERP) level, the management execution system (MES) level, the process control level, down to the field level.

As the process control system component of Totally Integrated Automation, SIMATIC PCS 7® uses standard hardware and software components from the SIMATIC TIA family. The uniform data management, communication and configuration capabilities of TIA offer an open platform for advanced, future-oriented and economical automation solutions in all sectors of the process industry, manufacturing industry and hybrid industries (which include a mixture of continuous/batch/discrete processes such as in the glass or pharmaceuticals industries).

Within the TIA network, SIMATIC PCS 7 not only handles standard (primary) process control tasks, but it can also automate secondary processes (e.g. filling, packaging) or input/output logistics (e.g. raw material distribution, storage) for a production location.

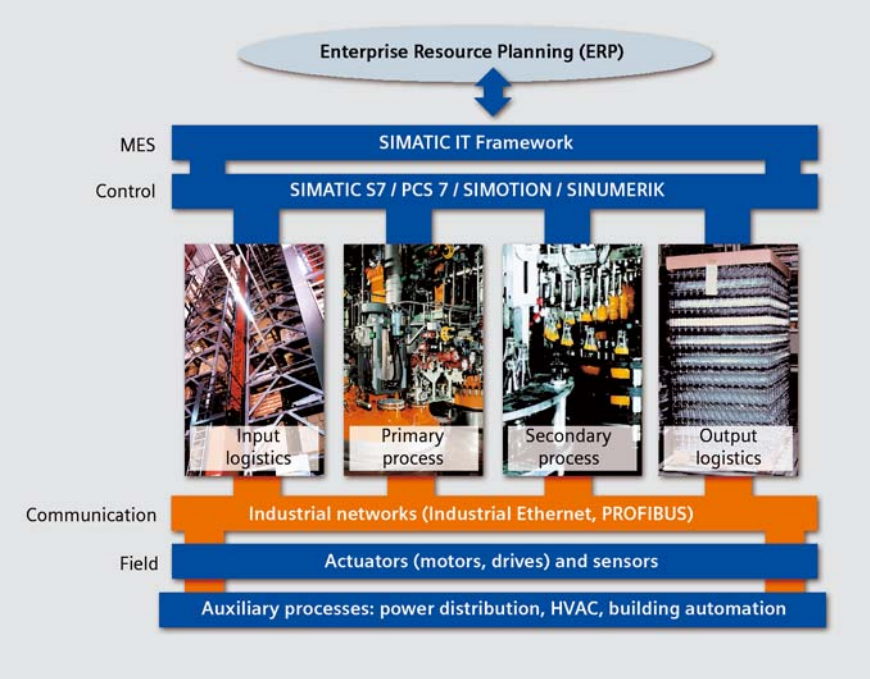
By linking the automation level to the IT world, process data becomes available throughout the company for evaluation, planning, coordination and optimization of operations, production processes and commercial processes. Also taken into account are the geographical requirements of distributed production facilities, as is the case with global companies.

The innovative design of SIMATIC PCS 7 is based on a modular and open architecture using state-of-the-art SIMATIC technology, consistent implementation of industrial standards and process automation functionalities, and high performance hardware and software. This means that with the SIMATIC PCS 7 process control system, users can achieve cost-effective implementation and economical operation of process automation facilities during all phases of their life cycle: planning, engineering, commissioning, training, operation, maintenance, servicing, expansion and renovation. In the process, SIMATIC PCS 7 unifies high performance and reliability, simple and safe operation, and maximum convenience.

Customers benefit from Totally Integrated Automation and the SIMATIC PCS 7 process control system through minimizing development, implementation and life cycle costs, the reduction of engineering resources, the facilities for process optimization, the flexibility to adapt quickly to changes in requirements, and the advantages of using standard SIMATIC components.

Horizontal integration

Horizontal integration means that common and standard hardware/software components from the SIMATIC product portfolio are used for the complete production process – covering input logistics, primary and secondary processes, up to output logistics. The SIMATIC PCS 7 components include HMI systems, automation systems, communication networks, distributed (remote) I/O, and engineering tools that are tightly integrated. SIMATIC PCS 7 systems can be customized by systems engineering personnel or for OEM equipment applications via standard interfaces. They can also be extended by choosing from a wide range of components from the extensive scope of Siemens Automation and Drives products.



Horizontal and vertical integration with SIMATIC PCS 7

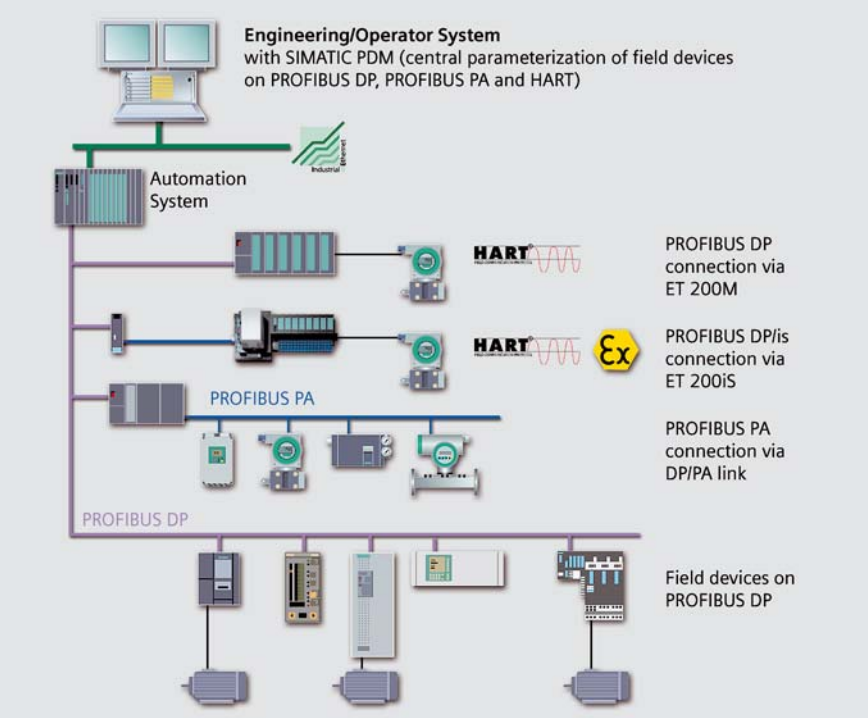
The extensive worldwide use of SIMATIC products and their large manufacturing quantities delivers increased scales of economy to Siemens, which results in advantages for you:

- Low hardware and engineering costs
- Proven quality and stability
- Simple, fast definition and selection of system components
- Low costs for spare parts
- Short delivery times for spare parts and expansion components
- Worldwide availability
- Savings in logistics, maintenance and training costs.

Vertical integration

The increased fusion of automation technology and information technology based on industry standards utilized by world class manufacturing companies requires uniform and transparent data communication across company-wide information and automation networks. SIMATIC PCS 7's modularity and standardization supports complete integration from ERP, MES, control and field levels resulting in increased production optimization and flexibility.

SIMATIC PCS 7
The process control system for Totally Integrated Automation



Integration of field systems

The SIMATIC PCS 7 process control system can be seamlessly incorporated into the company-wide information network using interfaces based on international industrial standards for data exchange such as Ethernet, TCP/IP, OPC or @aGlance. This makes the process data available at every location and at any time, for example:

- ERP (enterprise resource planning)
- MIS (management information systems)
- MES (manufacturing execution systems)
- Advanced process control
- Diagnostics and remote maintenance using the Internet.

SIMATIC PCS 7 can be incorporated into SIMATIC IT, Siemens Automation & Drives MES framework, and integrated into the company-wide information network.

The OPC interface for the SIMATIC PCS 7 operator stations and the @PCS 7 component simplify access to the IT world.

The SIMATIC PCS 7 operator station can either be an OPC server as the data source for Windows IT applications, or an OPC client which accesses the data of OPC server applications.

The @PCS 7 server and the corresponding Web@aGlance/IT client enables global online monitoring via Intranet or Internet. In addition to this, host information systems possessing an @aGlance interface can be connected to SIMATIC PCS 7 using @PCS 7.

Integration of field systems

SIMATIC PCS 7 is optimized for integration of distributed field systems into the process control system, and is based on PROFIBUS technology. PROFIBUS is simple, rugged and reliable, and is used worldwide in all sectors of the process, manufacturing and hybrid industries – for input/output logistics as well as primary and secondary processes. It supports redundancy and fail-safe architectures, in addition to online expansions, and can be used in standard environments or in hazardous areas. The plant can be equipped with classical signal inputs/outputs on the ET 200 distributed I/O station, or with state-of-the-art, intelligent field devices.

The intelligent field devices can be connected either directly to PROFIBUS or to the HART interface modules contained in racks of remote I/O, which can also be redundant. With PROFIBUS, field devices can be directly connected in hazardous areas (Ex zones 1 or 2, sensors/actuators also in zone 0). Communication between SIMATIC PCS 7 and the intelligent field devices is carried out on the basis of international standards and specifications such as IEC 61158.

Classical and HART field devices can be connected to the PROFIBUS using distributed I/O from the ET 200 family of I/O. These field devices can also be used in the Ex zones 1 or 2, sensors/actuators also in zone 0. The connection can be made via ET 200M in standard environments or Ex zone 2, or via ET 200iS in Ex zone 1. Applications are also possible under special ambient conditions such as extended temperature ranges or increased condensation demands.

PROFIBUS can be used to integrate variable-speed drives, drive systems, motor management components, analyzers, and electric actuators directly into SIMATIC PCS 7. It is also possible to integrate local operator panels in the field using PROFIBUS – even in hazardous areas.

The use of communication standards such as PROFIBUS and HART enables problem-free use of SIMATIC PCS 7, and also of components from third party vendors in the context of Totally Integrated Automation, e.g. using a Modbus connection via CP 341 in the ET 200M.

PROFIBUS components can also be used to link simple actuators and sensors with an AS-Interface or building automation components on the EIB (European Installation Bus) to the system.

Using the SIMATIC PDM Process Device Manager, it is possible to parameterize, commission, diagnose or maintain any field device in the plant with a PROFIBUS or HART interface. The international standards and specifications of the PNO (PROFIBUS International), e.g. the EDDL technology, are the basis for the simple integration of field devices into SIMATIC PDM.

Common and integrated system

SIMATIC PCS 7 is an innovative process control system, which can be used on its own or in combination with motion control and SIMATIC components. Benefits from the use of SIMATIC PCS 7 grow parallel to the requirement for seamless and common automation technology as defined by continuing competition and price pressures, the demand for increasingly flexible production plants, and the necessity to increase productivity.

As automation and information technologies merge together, system platforms that can provide horizontal and vertical commonality (aka one-stop shopping) are becoming increasingly attractive compared to automation solutions made up of combinations of best-in-class products. Due to its incorporation into Totally Integrated Automation, SIMATIC PCS 7 is therefore excellently positioned to meet future demands.

High performance, flexibility and ease-of-use, together with common data management, communication and configuration guarantee that the typical demands placed on a process control system can be met and exceeded by SIMATIC PCS 7:

- Simple and safe process control
- Intuitive operation and visualization
- Powerful system engineering tools with a common interface
- Online modifications possible throughout the system
- System openness at all levels
- Flexibility and scalability
- Redundancy at all levels
- Fail-safe automation solutions
- Comprehensive fieldbus integration
- Flexible solutions for batch processes
- Direct interfacing to the IT world.

Open for the future

SIMATIC PCS 7 is based on modular hardware and software components from the SIMATIC product family, and are perfectly matched to one another due to their conformance with TIA. It is flexible and expandable, and is open for future enhancements through the use of standard interfaces with long-term stability. This means that it is possible to provide long-term protection for customer investments despite high innovation speeds and short product life cycles.

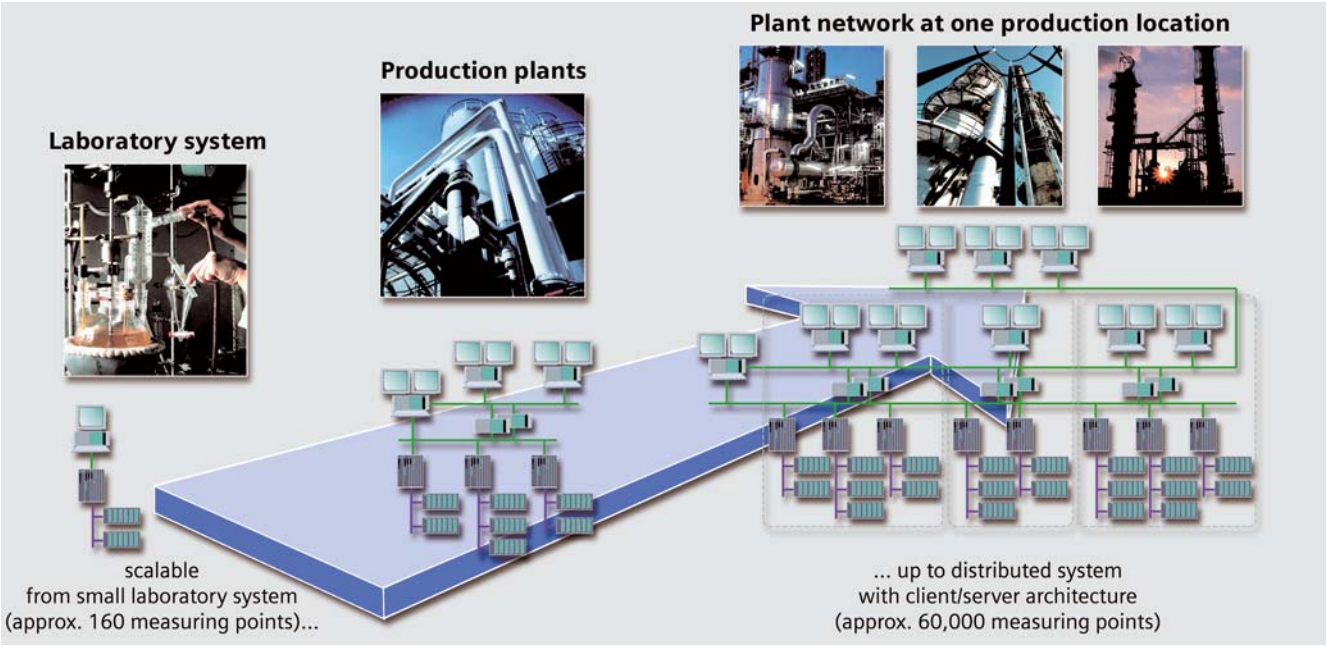
SIMATIC PCS 7 consistently applies state-of-the-art, powerful technologies together with internationally established industrial standards such as IEC, XML, PROFIBUS, Ethernet, TCP/IP, OPC, @aGlance, ISA S88 and ISA S95, just to mention a few.

SIMATIC PCS 7's openness covers all levels and applies equally to automation systems, process I/O and field devices just as to operator and engineering systems, industrial communication etworks or the SIMATIC IT framework.

However, the openness is not only characterized by the system architecture, horizontal/vertical integration and communication, but also by the programming and data exchange interfaces for user programs as well as import/export functions for graphics, text and data, e.g. from the CAD/CAE world.

SIMATIC PCS 7 can therefore also be combined with components from other vendors, and integrated into existing infrastructures.

Flexibility and scalability – from small laboratory system up to distributed client/server architecture



As a result of its modular and open architecture that is based on selected hardware and software components from the standard SIMATIC range, SIMATIC PCS 7 can be applied effectively in small and large plants alike. It allows easy expansion or system modification (online) to enable customers to meet the changing production requirements of their facility.

SIMATIC PCS 7 is scalable from a small single system consisting of approx. 160 measuring points (motors, valves, PID controllers), such as might be used for a laboratory system or a pilot plant, up to a distributed multi-user system with client/server architecture and approx. 60,000 measuring points, such as might be used for automation of a very large production plant or for groups of connected facilities.

Depending on the plant's requirements, the user and the planning engineer

- can select from various automation systems with graded performance characteristics,
- incorporate distributed (remote) or central I/Os step-by-step,
- layout an optimum architecture for the operator system: from single-user standalone stations up to distributed multi-user system,
- select the engineering and runtime system software according to the size of the system (scaled by process objects),
- configure communication networks and determine network components to support required levels of redundancy and availability,
- extend the functionality of the operator stations by adding various hardware and software modules, e.g. using SIMATIC BATCH or with a standalone, redundant archive server,
- integrate applications for connecting SIMATIC PCS 7 to the IT world.

Highlights

- Scalable from small laboratory systems with approx. 160 measuring points (250 I/O) up to a large plant with a distributed client/server architecture with up to 60,000 measuring points (> 100,000 I/O)
- Uniform control system platform based on standard field-proven SIMATIC components
  → Cost savings resulting from personnel know-how, reduced quantity of spare parts
  → Cost savings resulting from development and reuse of application standards
- Optimize selection of hardware and software based on the size of the plant
  → Minimize requirements for expensive spare hardware capacity
  → Supports plant expansions and modifications
- Maximum flexibility to support a wide range of expansion possibilities
  → Choose the best possible system solution for individual plant requirements
  → System can be tailored to balance price and performance

Redundancy at all levels

SIMATIC PCS 7 offers redundancy options at all levels of the process automation system. At the top level of the client/server architecture, the process control system permits up to 32 OS/SIMATIC BATCH clients to access the data of a single OS/batch server. Operator stations support multi-monitor operation, allowing up to 4 monitors to be connected to a client.

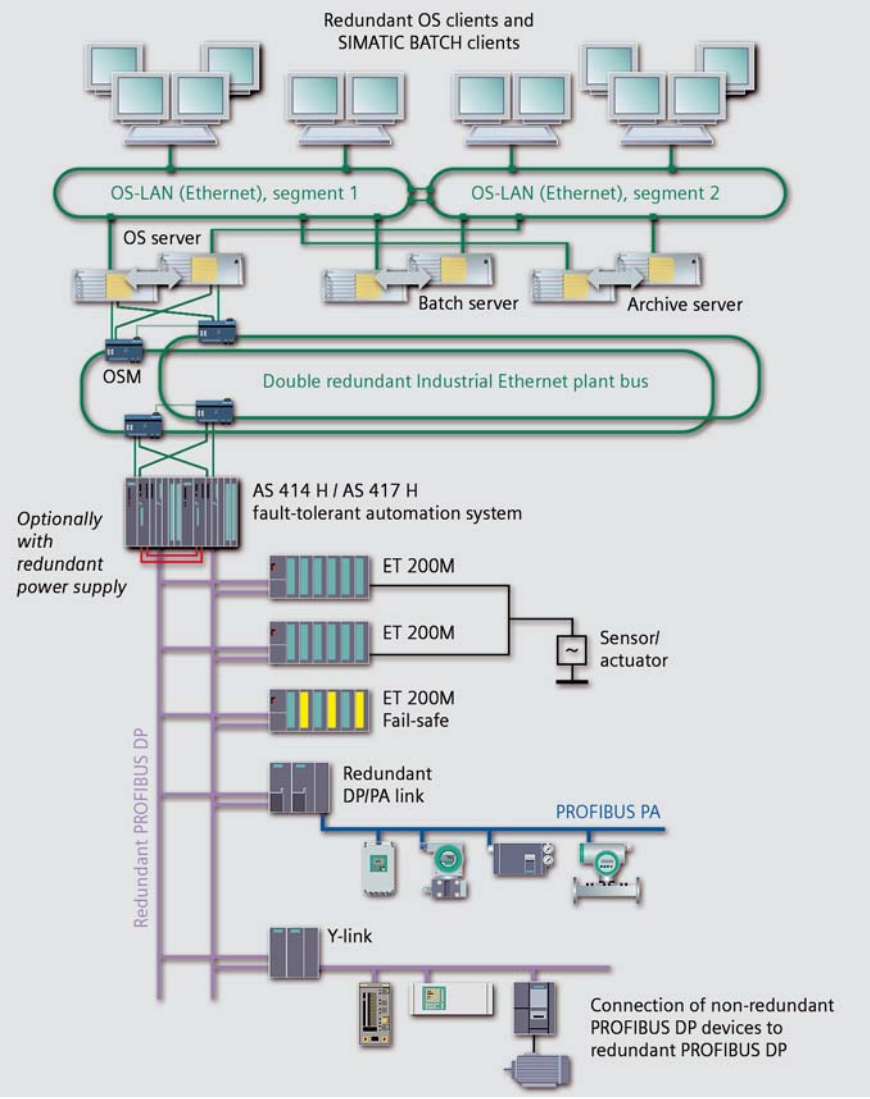
A dedicated Ethernet LAN can be used for client-server and server-server communication. This network, called the terminal bus, can be created using standard off-the-shelf components (switches and cards etc.).

To increase availability, it can be set up in a single ring architecture or divided into several LAN segments.

The OS and batch servers can also be redundant. In a system with redundant OS Servers, client stations will switch transparently from the primary to the backup server in the event of a system failure. As a background task, critical OS/SIMATIC BATCH running on the server are continuously monitored for faults that would result in a client switchover. Additionally the process data and alarm messaging archives can be automatically synchronized when a partner server is returned to service, thus eliminating data gaps. Process data can be archived on each OS Server or can be stored on a standalone, and optionally redundant, plant-wide historian.

Communication between individual automation systems and to the engineering / operator systems is carried out via the Industrial Ethernet plant bus which can be operated at 100 Mbit/s. The plant bus can be implemented using a bus or a ring topology. To increase availability even further, a redundant ring architecture may be setup where each individual station (AS, OS and ES) has two separate connections, one to each network ring.

The redundant, fault-tolerant AS 414H and AS 417H automation systems are connected to the plant bus using an Ethernet communications processor (CP). To achieve a higher level of redundancy, two CPs can be used with each half of the automation station, allowing each individual CPU to be connected to both networks of a redundant plant bus architecture.



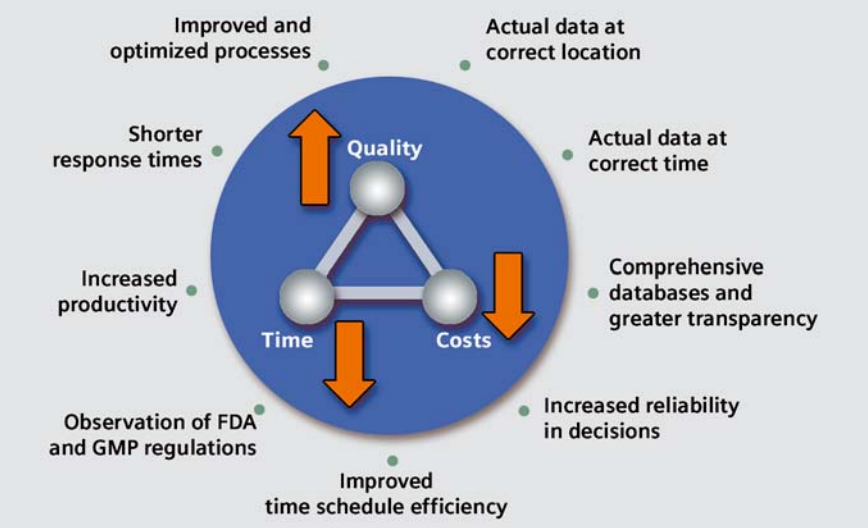
Multiple PROFIBUS DP segments (from each side of a redundant pair of CPUs) can be connected to distributed I/O via the onboard PROFIBUS DP interfaces or by using additional PROFIBUS communications processors.

In a system with redundant CPUs, each rack of ET 200M distributed I/O is connected to the redundant PROFIBUS DP segments via two IM 153-2 modules. Similarly, the intelligent field devices on PROFIBUS PA are connected via a redundant DP/PA link containing two IM 157 modules.

Using the Y-link it is also possible to connect non-redundant PROFIBUS DP devices to redundant PROFIBUS DP networks.

In the case of the ET 200M distributed I/O system, redundancy can be extended down to the I/O module level, whereby a single sensor or actuator can be connected to redundant I/O modules in both fail-safe and standard applications.

Interfacing to the IT world
with SIMATIC IT and @PCS 7



Advantages when using SIMATIC IT

For plant management and other executives, information technology (IT), process data management and production planning have become important elements for reducing costs and optimizing processes. Global competition means that companies distributed over several locations must be able to manufacture products that meet customer specifications and expectations, and to do this more quickly and with the flexibility to change schedules and recipes on short notice.

These new requirements for global competition, along with regulatory pressure and product tracking needs, make the integration of process automation systems with other business and ERP systems (such as SAP) increasingly significant.

The SIMATIC PCS 7 process control system provides an open and uniform system platform for vertical integration of the process automation, operational management and company management functions. This is a stable platform that is equipped to grow as your requirements change over time.

Integration and synchronization of all processes using SIMATIC IT

The integration of planning, procurement and manufacturing is a complex task, especially when location-specific equipment and procedural differences are taken into consideration. SIMATIC IT makes the integration of these processes transparent, and helps to optimize the complete system.

SIMATIC IT is a technology platform for e-manufacturing in compliance with the ISA S95 standard. It coordinates manufacturing functions according to explicit production rules such that an optimum workflow is achieved.

The main elements of SIMATIC IT are:

- SIMATIC IT Framework
- SIMATIC IT Components

SIMATIC IT Framework connects the process automation system to operational management, production management, company management, and enterprise planning functions.
SIMATIC IT Framework provides a cross-industry integration and coordination platform through the use of a hierarchical graphical modeling tool, an infrastructure for the exchange of data, and base services employed by the various SIMATIC IT components.

SIMATIC IT Framework permits integration of heterogeneous applications such as scheduling, material tracking, plant information management, and asset management. Processes and cross-functional communication are effectively synchronized, coordinated and optimized by SIMATIC IT Framework, both within and between locations.

SIMATIC IT Framework is not only able to integrate SIMATIC IT components, but also existing third party and legacy IT products. The SIMATIC PCS 7 process control system can be incorporated into the SIMATIC IT Framework using adapters.

SIMATIC IT components are standard software products that provide various industrial and IT functions. These components are a direct result of Siemens involvement in the development of the ISA S95 standard. Examples of SIMATIC IT components include scheduling, asset/maintenance management, material management, historical records/KPI management, and compliance management. These and other SIMATIC IT components perform specific functionality, while the framework coordinates and synchronizes this functionality.

Building on the SIMATIC IT Framework and Components, Siemens has developed SIMATIC IT Industry Suite libraries, providing basic units and procedures which facilitate the rapid implementation of a fully integrated system. This means you're not starting from scratch when you endeavor to integrate production; you're building on years of experience.

Company-wide availability of process data with @PCS 7

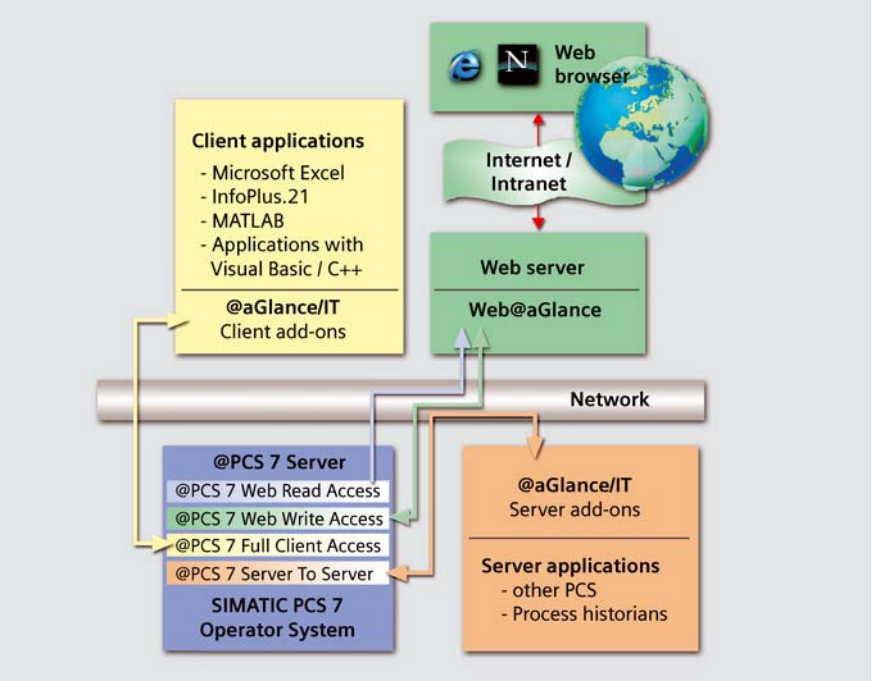
@PCS 7 offers a simple and cost-effective solution for remote access to the process data that is collected by a SIMATIC PCS 7 system. The data can be displayed and processed further on any computer using the standard software package @aGlance – even via intranet/Internet.

An @PCS 7 server is integrated in every SIMATIC PCS 7 operator system. To read the data, the target (client) PC requires a Web@aGlance package and a standard Web browser. For data write access and for communication with other @aGlance servers, the operator station must have a corresponding @aGlance license.

The integration of @aGlance/IT into PCS 7 means that SIMATIC PCS 7 is able to communicate with a wide range of software products designed to operate at the plant management and company management levels. @PCS 7 and the @aGlance interface provide access to the data of the PCS 7 operator systems, including archives and messages.

An intelligent log-on procedure provides the @aGlance product range with Plug-and-Play interfacing, while incorporating powerful security and access control features. Security and access privileges are configured using a Windows-like administration tool.

A further advantage of the open architecture of the @aGlance client/server system is the ability to select the operating systems or applications that run on the server and on the client side of the @aGlance/IT software system. Implementation of @aGlance is independent of hardware, software and operating system architecture. Thus for example a a Unix server hosting an IT application could communicate seamlessly with SIMATIC PCS 7 system (Windows 2000). This makes it easy to interface with systems that already exist in the company and ensures compatibility with future systems. As a result, the cost of change is minimized, and dependence on specific systems or suppliers can be eliminated.



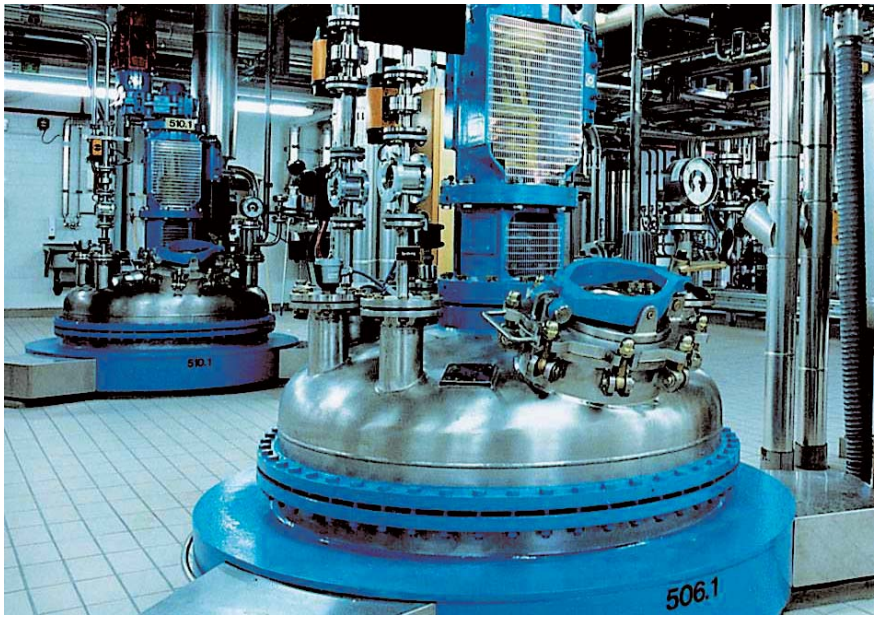
SIMATIC PCS 7 offers several different versions of @PCS 7 providing the following functions:

- Reading of OS data (process data, messages, archive data) via Internet/intranet
- Writing of OS data
- Communication with @aGlance/IT client applications, e.g. the InfoPlus.21 information management system
- Communication with server applications of the @aGlance/IT server add-ons

@PCS 7 offers the following benefits:

- @PCS 7 makes process data available throughout the company. All process data can then be visualized, analyzed and processed further from an office desktop
- @PCS 7 permits access to all data of PCS 7 operator stations, e.g. to archived data
- Any client/server application that has an @aGlance interface can be connected to @PCS 7
- @PCS 7 is based on @aGlance technology; @aGlance has established itself as one of the de facto standards for interface software (Middleware) for Internet applications
- @PCS 7 can provide process data to the operations management and company management levels; based on client/server technology
- Users can develop their own custom client/server applications based on the @aGlance product range.

Automation of batch processes with SIMATIC BATCH



Highlights

- Modular and flexible architecture with scalability of hardware and software
  → Allows optimum adaptation to plant size and individual requirements
  → Can grow with plant expansions; no extensive spare capacities needed
- High availability system architectures for Batch (via redundant batch servers)
  → No loss of batch data
  → Automatic synchronization of batch data
- Tight integration of SIMATIC BATCH into the HMI strategy and the SIMATIC PCS 7 engineering tools
  → Standard HMI faceplates provided
  → One-time entry of batch-specific engineering data
- Unit-independent recipes
  → Significant reduction in recipe administration and validation
  → Flexible mode of operation and optimum plant utilization resulting from assignment of units during runtime (dynamic allocation)
- Hierarchical recipes according to ISA S88.01
  → Process-oriented recipe creation
  → Simple, fast creation of recipe
- Saving, archiving and recording of batch data using XML format
  → All production information is captured in reports
  → Operator actions and responses are captured
- Reduction in engineering and validation time as result of: type/instance concept of SFC, separation of procedure and formula, ROP library and configuration of unit-independent recipes
  → Multiple usage (reuse), central modification
- Validation support according to 21 CFR Part 11 using audit trail (logbook of modifications), version tracking for recipes, recipe operations and formulas, user administration with access protection based on Windows 2000 and electronic signature

The SIMATIC PCS 7 process control system offers a modular approach for the low-cost, effective implementation of batch processes. Automation of simple batch processes with parameterizable sequential controls is carried out using the SFC and CFC tools included in the engineering system.

SIMATIC BATCH is the higher-level solution for more complex tasks with recipe-controlled operation. This permits simple, flexible processing of complex tasks with changing control sequences and/or formulas.

Modular architecture

SIMATIC BATCH is configured either as a single-user system or as a client/server system, and can be used in plants of any size due to its modular architecture and scalable licensing in four steps using 150, 600, 1800 and >1800 batch process objects (instances of units and equipment modules).

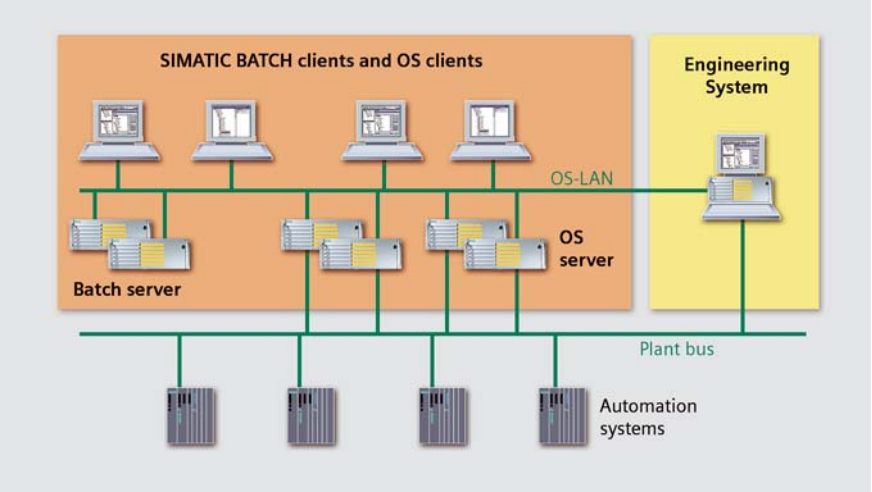
A typical batch automation process is comprised of a batch server and several batch clients. Batch server redundancy is also supported.

Integration in SIMATIC PCS 7

SIMATIC BATCH is tightly integrated with the other engineering tools of SIMATIC PCS 7. The physical plant model created using the engineering system during the configuration of the S7-400 controllers is available for use with SIMATIC BATCH without having to re-enter the data. The engineering system 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 (online/offline).

The hardware of the batch server can be separate from the OS servers. SIMATIC BATCH clients and OS clients can run on separate or common hardware. The PCS 7 operator stations relevant to the batch are made known to the batch server during configuring of the batch application.

SIMATIC BATCH communicates with the automation systems via the PCS 7 operator stations. Operator instructions and dialogs can also be integrated into the communication. These functions can be used to draw attention to necessary operator inputs, or to offer a facility for data input, e.g. for laboratory values. SIMATIC BATCH provides standard batch faceplates that can be used in OS graphics for monitoring and controlling batch units and recipe phases.



SFC instances derived from a SFC-type template are generally used as the interface between SIMATIC BATCH recipe phases and the actual equipment phases in the S7-400 controllers. The properties of the SFC-type, such as modes of operation, setpoints/actual values, instance parameters, times etc. can be defined through easy-to-use, predefined user interfaces associated with the SFC type block. However, it is also possible to use special batch interface blocks for communication with equipment phases in the automation systems, e.g. for plant expansions/ upgrades or when connecting non-SIMATIC systems.

The main components of SIMATIC BATCH:

- Batch Control Center (BatchCC)
- Recipe editor

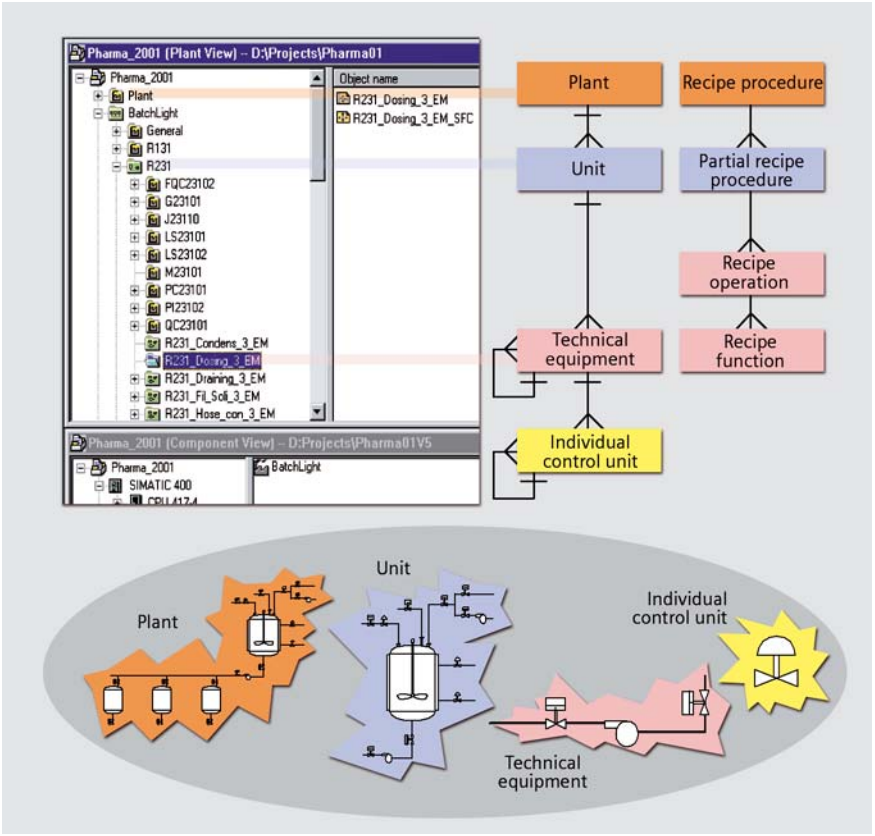
Batch Control Center

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 all data relevant to SIMATIC BATCH. This includes organizing and configuring master recipes, planning batches and monitoring and controlling the execution of the planned batches.

BatchCC offers powerful functions for the following tasks:

- Reading-in of the physical plant model created during the configuration of the S7-400 controllers
- Definition of user privileges for all functions, for clients, or for units of SIMATIC BATCH
- Definition of material names and codes
- Administration and development of master recipes
- Administration of libraries with recipe elements (library operations)
- Editing of formula categories, and administration of associated formulas (parameter sets)
- Planning of production orders with master recipes and batches
- Start and control batch processing
- Monitoring and diagnostics of batch processing
- Recording and archiving of recipes and batch data

Automation of batch processes with SIMATIC BATCH



Hierarchical recipes according to ISA S88.01

Recipe editor

The recipe editor is a convenient tool for simple, intuitive creation and modification of master recipes and library operations. Master recipes and library operations are created using graphical objects. SIMATIC BATCH provides a tool that a user can utilize to validate that the syntax of each master recipe and library operation created is correct. The batch objects created from the physical plant model configuration using the SIMATIC PCS 7 engineering system are the basis for recipe creation, i.e. units and recipe phases. The batch recipe editor can be started individually, but can also be called from BatchCC.

The recipe editor can be used to:

- Create new master recipes and library operations
- Modify existing master recipes and library operations (change structure or parameters)
- Document master recipes and library operations
- Carry out master recipe/library plausibility tests
- Assign releases for testing or production of master recipes and library operations

Batch Report

Batch Report is used to generate recipe and batch reports which can be displayed and printed using BatchCC. Batch reports contain the data required for reproduction of the batch process, for proof of quality, and for compliance with statutory requirements, e.g.

- Batch identification data,
- control recipe data,
- executed control recipe procedure information,
- step sequences,
- error messages and fault signals,
- operator actions and
- process values.

The recipe reports include the production data, e.g. recipe header data, list of raw material used and products produced, executed recipe procedure.

Batch data archiving and logging in XML format

The batch data which are only accessible for authorized persons or systems are saved in XML format. A batch report based on the XML data is available as standard. However, the XML data can also be processed further using an external logging system.

Hierarchical recipes according to ISA S88.01

Together SIMATIC BATCH and SIMATIC PCS 7 enable users to implement a plant equipment hierarchy and recipe procedure hierarchy that follows the models described in the ISA S88.01 standard.

The hierarchical recipe structure is mapped on the plant model as follows:

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

Unit Class based recipes

SIMATIC BATCH enables users to create master recipe procedures which are not unit-specific. As a result, the partial recipe procedures are only assigned unit classes when the recipes are created. Only one recipe need then be created if there are several units of the same type. This minimizes the engineering requirements, and provides substantial advantages for validation.

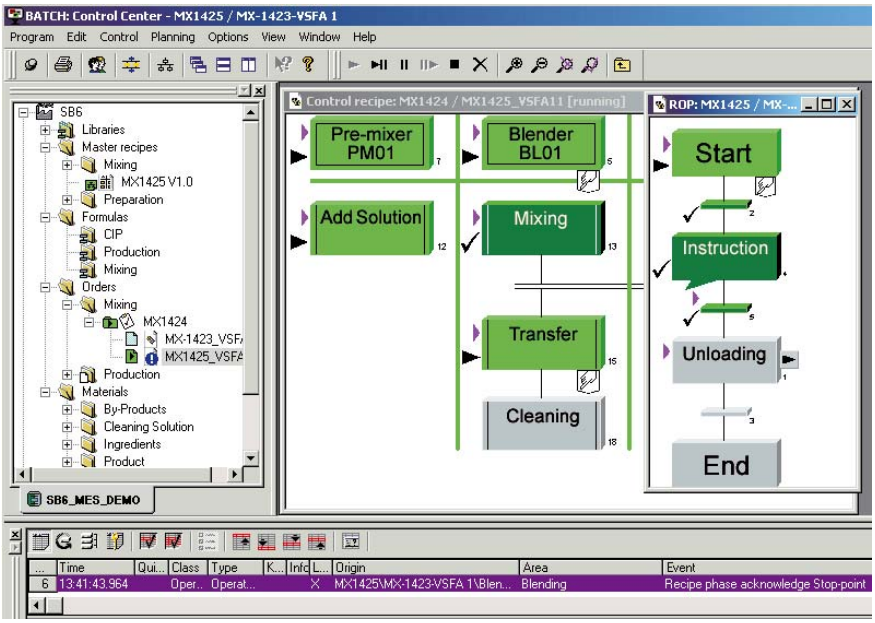
SIMATIC BATCH provides various dynamic unit allocation strategies:

- "Preferred unit" for preselection when the recipe is created
- Assignment of the unit which has not been used for the longest time in order to achieve uniform utilization
- The unit to be used can be defined for SIMATIC BATCH using an external module (e.g. scheduler) by means of process parameters.

The final assignment of the units is carried out during runtime. In the case of longer batches where the units are not to be assigned prior to when the batch is started, they are only assigned when they are required. Conflicts in assignment of the units are detected and indicated by the system.

Separation of procedure and formula

The flexibility achieved by recipes which are independent of 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.



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 (pointer which is linked to a master copy) in recipe procedures and can thus be modified from a central location. This reduces the requirements for engineering and validation. By breaking the link the recipe operation becomes a fixed component of the recipe procedure and its own unique instance, and is thus independent of further central modifications.

MIS/MES interfacing

Interfacing of MIS/MES systems is made possible by:

- Integration of SIMATIC PCS 7 in SIMATIC IT Framework
- An open interface (API) for customer-specific expansions

Validation according to 21 CFR Part 11

SIMATIC BATCH provides a number of functions that make it easier for users to satisfy the requirements of 21 CFR Part 11. Some of the available functions include:

- Audit trail (logbook of modifications):
  - Logging of modifications to recipes and recipe operations (stored when object changed)
  - Logging of modifications during production (in the batch report), including the operations at the individual control level associated with the corresponding batch
- Version assignment (recipe life cycle, recipe operations, formulas)
- Access protection using central user administration based on Windows 2000
- Electronic signature

Siemens as a manufacturer of process control systems has specially trained personnel with many years of experience in quality management and in the validation of plants. These resources are available to help you meet your validation needs.

Operation and monitoring
with the SIMATIC PCS 7 operator systems

Highlights

- Flexible, modular architecture with scalable hardware and software components for single-user and multi-user client/server architecture
- High-performance operator stations based on standard PC technology with Microsoft Windows 2000 can be used in office or industrial environments
- Client/server multi-user systems with up to 12 pairs of redundant OS servers, each with large capacity (approx. 5,000 process objects/server) and up to 32 OS clients per server
- High-performance archive system based on Microsoft SQL server with cyclic archives and integral data backup, optionally as a standalone plantwide Historian
- Rigorous OS system health check for monitoring critical server applications
- Online modifications without interrupting runtime operations, and online testing with optional selective loading of redundant servers
- Optimized AS/OS communication: Communication cycle can be 500 ms, change-based communication of process data; suppression of nuisance alarms
- Intuitive, easy-to-use operator interface together with multi-screen technology
- Extended status display for efficient communication and configuration of multi-state devices
- Alarm priority attributes for filtering important messages
- Central user management, access control, electronic signature
- Sign-of-life system status monitoring for subordinate systems connected to plant bus
- System-wide time synchronization based on UTC (Universal Time Coordinated)

The operator system or OS is the human-machine interface of the SIMATIC PCS 7 process control system, and thus represents the user's window into the process. The operator system is extremely flexible, and can be easily adapted to different plant architectures and customer requirements.

System architectures can be created using any mixture of single-user systems and/or multi-user systems with client/server architecture.

Operator stations

SIMATIC PCS 7 operator station hardware is based on standard PC technology combined with the Microsoft Windows 2000 operating system. PCs are offered with several different performance levels, which have been optimized for different functions in a PCS 7 architecture such as OS single station, OS client or OS server. The use of standard components and interfaces from the PC world means that the operator stations can be customized easily to meet customer-specific requirements. They can be used in harsh industrial environments as well as in the office. OS single stations and OS clients can be installed with multi-VGA graphic cards to permit operation of several different plant areas simultaneously using up to 4 monitors.

The system software of the operator station is available in different levels based on the number of Process Objects that are used. A Process Object (PO) is defined as any control element such as a motor, or single-loop PID controller, that has a corresponding faceplate. Licensing thresholds allow for future expansions without penalizing the customer for minor system changes. OS Single station software is available in the following levels: 250, 2000, 3000 or 5000 POs, while the OS Server software supports the following levels: 250, 2000, 3000, 5000 or 8500 POs. The software license level (number of POs) can be increased at any time via PowerPacks to allow for 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 (self-contained). The OS single station can be connected to the Industrial Ethernet plant bus in two ways:

- via a CP 1613 communications processor or
- via a commercially available LAN card (Basic Communication Ethernet for communication with max. 8 automation systems).

The OS single station can be operated in parallel with other single-user systems or in conjunction with a multi-user system architecture.

Multi-user system with client/server architecture

A multi-user system architecture consists of operator terminals (OS clients) which receive project-specific data (graphics, process values, archives, alarms and messages) from one or more OS servers via an OS LAN (Local Area Network). The OS LAN can be combined with the plant bus into a single network, or it can be designed as a separate Ethernet network (terminal bus).

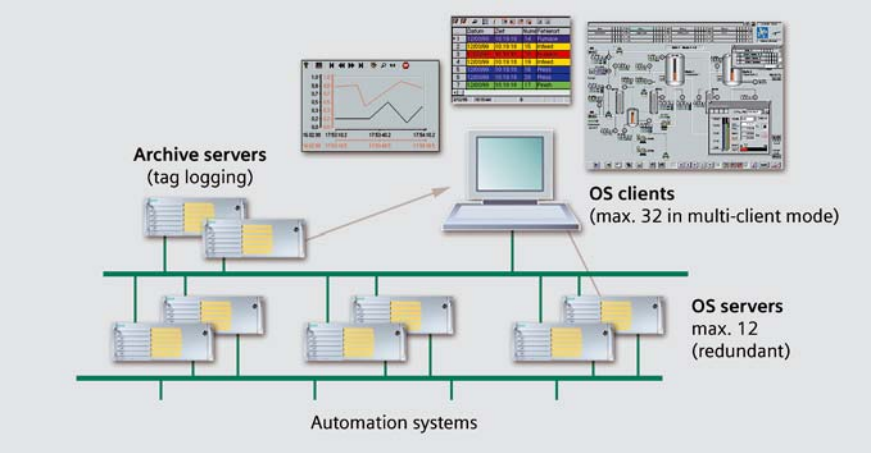
In this architecture redundant OS servers may be setup to allow for a hot standby design. Critical applications running on the OS server are monitored continuously for software faults. If a fault is detected, a client switchover is performed automatically and in a fashion that is transparent to the operator. Archived process data (such as alarms, events and process data for trending) is automatically synchronized between redundant OS servers when the backup is returned to service, thus ensuring that no gaps exist in the data.

OS clients can access the data from not only one OS server/pair of servers, but they can also access data from several OS servers/pairs of servers simultaneously (multi-client mode). This makes it possible to easily subdivide a plant into process areas or units, and to distribute the data accordingly to several different OS servers/pairs of servers. In addition to scalability, the advantage of distributed systems is the ability to decouple plant areas from each other, resulting in increased availability and easier maintenance/modification of the applications.

SIMATIC PCS 7 supports multi-user system architectures with up to 12 OS servers or 12 redundant pairs of OS servers. In multi-client mode, OS clients can access data in parallel from one or more of the 12 OS servers/pairs of servers in parallel (up to 12).

The OS servers have been designed with client-type functions which permit them to access the data (archives, messages, tags, variables) from the other OS servers in multi-user system architecture. This means that process graphics (pictures) on one OS server can also be linked to variables resident on other OS servers (area-independent displays).

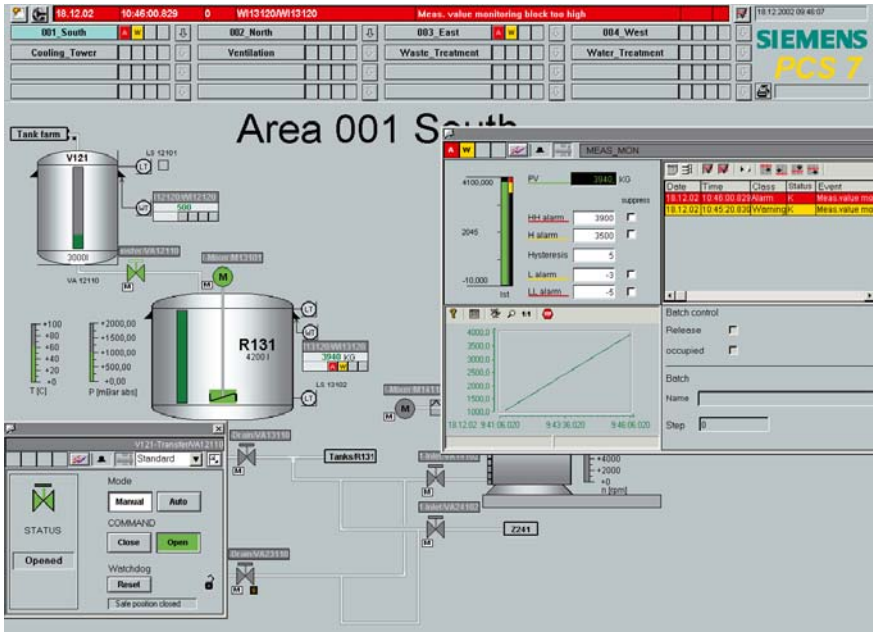
Like the OS single stations, the OS servers can be connected to the Industrial Ethernet plant bus using a CP 1613 communications processor or via a standard Ethernet card.



OS system capacity	
Max. number of OS servers/pairs of servers	12
Max. number of OS clients • In multi-client mode [1] within a multi-user system architecture	 32
Number of measuring points • Per OS server • Per multi-user system	 Approx. 5,000 Approx. 60,000 (equates to > 100,000 I/O)
High-performance archive system (Microsoft SQL server) for: • Process values • Messages	 Approx. 5,000/s (with archive server) Steady-State load approx. 10/s (per server) Shower/Flurry of messages approx. 1,500 / 10 s

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

Operation and monitoring
with the SIMATIC PCS 7 operator systems



GUI for OS process control with movable windows

High-performance archive system and central archive server

A high-performance archive system based on Microsoft SQL server technology is offered standard with SIMATIC PCS 7. It supports online configuration, storage of process values and messages in cyclic archives, data compression, and permits the exporting and saving of old data using an integral archive and backup utility. Each OS server in a multi-user system architecture is capable of archiving approx. 10 messages/s (e.g. alarms) during steady-state operations while also being able to handle a brief rush (transient) of approx. 1,500 messages in 10 s.

For large systems a central archive server can be created which is dedicated to the storage of process values for an entire plant or system. The central archive server, which also can be redundant, reads the process values directly from the 12 possible pairs of OS servers. It is capable of storing approx. 5,000 process values/s and can be configured to monitor more than 30,000 different variables.

Usability, system performance, and optimization of communication

The Operator Systems of the SIMATIC PCS 7 process control system are optimized for processing large quantities of data. Even in very large systems, they are characterized by high performance and reliability, yet are still simple and intuitive to use.

Often small system features have a significant effect on the total performance of an operator system:

- Extended status displays: discrete device status (e.g. Opened/Closed, Auto/Manual) or analog values can be combined with alarm information to form optimized communication packets which support simple multi-state HMI configuration without the application of scripts. Such extended status and analog-value displays reduce the system communication load and optimize the display of process pictures.
- Optimized communication between operator system and automation system: Process data values which are used for display on process pictures can be communicated from the automation station to the operator station using event-based communication (only when the value has changed). This allows the data communication cycle between the AS and the OS in a large system to be defined as 500 ms for example, without fear of communication overload or sluggish system performance.
- QTM message and alarm acknowledgment feature for suppressing communication of nuisance alarms: ensures that alarm chatter (point goes in and out of alarm frequently during a short period of time) is suppressed at the controller level by monitoring whether the current instance of an alarm has first been acknowledged before retriggering to the operator system.

Engineering

Engineering of the SIMATIC PCS 7 operator systems is performed using a central, integrated engineering toolset. In the single-user systems for small plants, engineering and runtime (operator) functionalities can be combined in one station.

All project modifications carried out on the engineering system can be loaded into the OS servers and clients while they are online without interrupting operations. A central dialog controls this incremental update procedure, and ensures that system changes are incorporated in the correct order.

Graphical User Interface (GUI)

The predefined GUI of the operator system provides runtime features out-of-the-box that are typical of a classic distributed control system (e.g. trending, navigation, faceplates, alarming etc.). It supports multilingual applications, is clearly structured, easy to understand, and is designed for intuitive and ergonomic operation. The operator can survey the process extremely easily, and rapidly navigate between different views of the plant. A picture tree manager organizes the picture hierarchy according to user requirements based on the layout of the control strategy, and permits direct selection of subordinate process pictures.

Process displays (pictures) and measuring points (faceplates) can also be called up directly from a filterable listbox. An online language selector permits the user to change the display language dynamically during runtime. Alarm status is automatically propagated upwards from lower level displays to overview displays allowing an operator to easily navigate to the source of the fault. Favorite screen compositions can be saved for callup in the future.

Standard client and server views are available for representing a plant to an operator, each type can have a different design. Both views are provided, with the following standards:

- Message line for display of last message (highest priority alarm)
- Date, time and name of logged-in operator
- Area overview with up to 36/49/64 buttons for quick access to process displays (depending on resolution of process monitor)
- Working area for plant displays and movable windows for faceplates, historical trends etc.
- System function keys

A special message status screen supports switching between the display of new alarm list, cleared alarm list, acknowledged alarm list, operator action list, and message history list.

Trends can be displayed as a full-size picture or as a window in the working area. Default variables / groups of variables are automatically selected for trending. The operator can also assign variables to a trend while online and to select from a list of preconfigured trends.

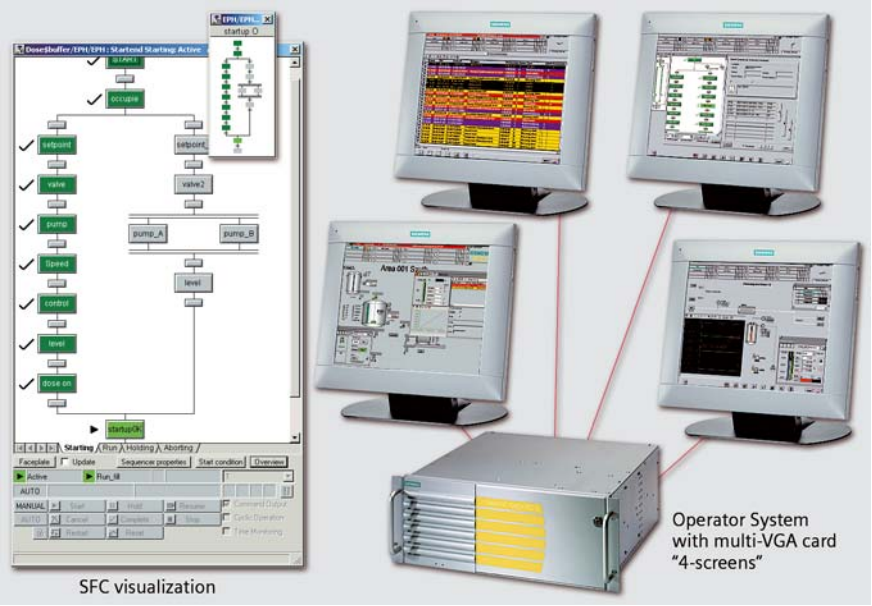
SFC visualization

The SFC visualization option for client stations permits display and operation during runtime of the sequential control strategies that have been configured using the SFC tool, providing the same visualization capabilities as on the engineering system. No additional engineering time is required to create these displays as they are created automatically from the ES configuration. In the SFC overview display, it is possible e.g. to open step and transition displays, and to display step comments or transition criteria.

Messages/alarms

Alarms support the configuration of individual message priority, which allows critical alarms to be filtered and prioritized for resolution and operator action.

Device alarm and message status is prebuilt into the standard symbol displays (block icons) that are provided with the PCS 7 technological (application) library.



SFC visualization

When alarm priorities are utilized, the single message displayed in the plant overview indicates the highest priority unacknowledged alarm. A configurable window which shows additional messages can be displayed using the "Extended message line" button.

The operator's runtime environment is designed to allow quick evaluation and resolution of faults using the "Loop-in-alarm" and "Select display using measuring point" functions. Using "Loop-in-alarm", the operator can call up the process display in which the fault has occurred or its associated faceplate (loop display) via a single mouseclick.

Audible annunciation of messages/ alarms is supported via the PC's sound card (standard) or by controlling external horns/beacons via a signal module (optional).

Central user management, access control and electronic signature

SIMATIC Logon offers central user administration of security and access control based on Windows 2000 for the SIMATIC PCS 7 system software components as well as non-SIMATIC components connected via API. It can be used to fulfill the validation requirements of 21 CFR Part 11. An electronic signature function can also be used in conjunction with SIMATIC Logon.

A chipcard reader can be used to provide an additional level of security for controlling access to the operator stations by checking the operator privileges stored on a chipcard.

Sign-of-life monitoring

The sign-of-life function monitors the operating status of all subordinate systems (such as CPUs) that are connected to the plant bus. A graphical system status display shows the status of each monitored component.

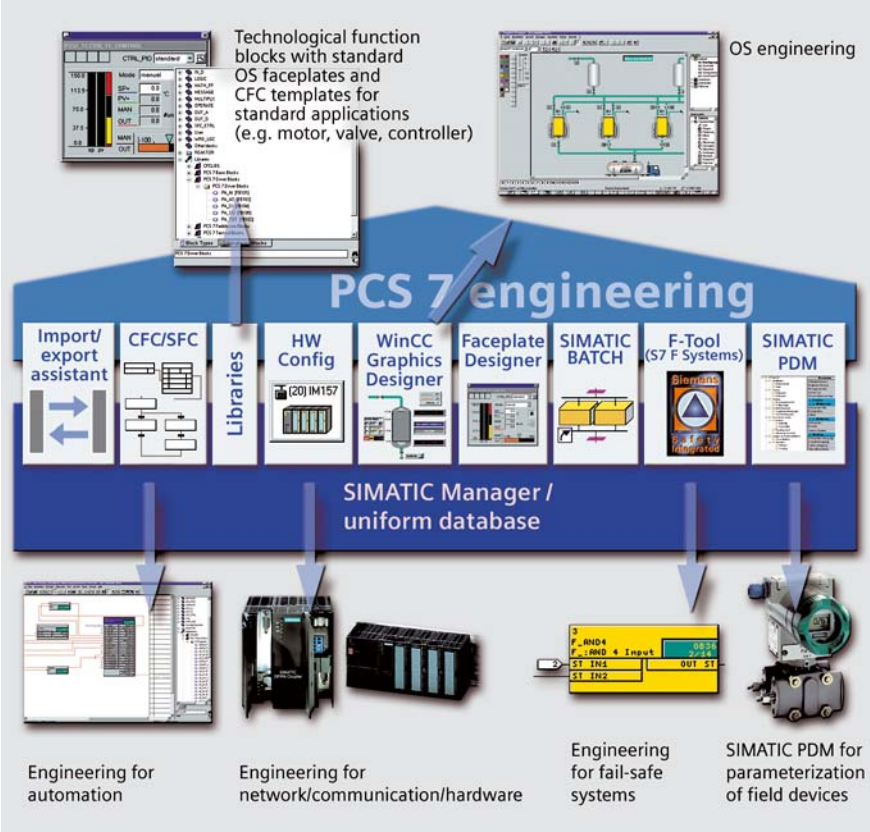
Time synchronization

Time synchronization is a standard feature within the SIMATIC PCS 7 process control system. The operator system can implement time synchronization based on UTC (Universal Time Coordinated) with or without a connection to a highly accurate time source such as GPS. This feature is especially beneficial for widely distributed plants present in different time zones, e.g. pipelines.

Script languages

Visual Basic and C are the scripting languages available for custom programming of OS applications.

System-wide engineering
with the central engineering system



The central engineering system (ES) of the SIMATIC PCS 7 process control system is based on the same PC hardware platform as the OS single station of the operator system. It employs powerful PC technology which can be used equally well in an office or industrial environment, and, together with the Windows 2000 operating system, provides an optimum engineering platform. Increased configuration capability can be provided by expansion of the working area by connecting up to four monitors via a special multi-VGA graphics card. The system software of the engineering system is available in different levels based on the size of the system (number of Process Objects). A Process Object (PO) is defined as any control element such as a motor, or single-loop PID controller, that has a corresponding faceplate. Licensing thresholds allow for future expansions without penalizing the customer for minor system changes: 250, 2000, 3000, 5000 or unlimited POs. The software license level (number of POs) can be increased at any time via PowerPacks.

The engineering system contains tools that are tightly integrated with one another to facilitate system-wide and project-oriented engineering:

- of the hardware and smart field devices,
- of the communication networks,
- of continuous and sequential process control strategies,
- of the displays for operation and monitoring of the process, and
- of SIMATIC BATCH.

The engineering toolset is designed so that engineers as well as process scientists and technicians can program, configure and troubleshoot in an environment that they are familiar with by utilizing pre-configured elements and powerful graphical configuration tools.

Typical process automation components such as motors, valves or PID controllers are pre-engineered and provided as standard software objects (measuring point types) in an technological (process control) library. Library elements can be incorporated into the user program via drag and drop and simple graphical interconnection, which can be executed easily and rapidly by personnel without programming knowledge. When configuring the user program (control strategy), the associated OS variables can be created automatically in the background. Fully operational, dynamic HMI symbols, which are prelinked to their corresponding control element, can be created automatically on process displays simply based on the hierarchy defined in the control strategy.

The uniform database of the engineering system ensures that data which has been entered once is accessible by all tools throughout the system, including the Batch system, thus eliminating double entry.

All configuration modifications associated with the automation systems, operator systems and SIMATIC BATCH can be compiled and loaded in a single step. The engineering system automatically ensures that the changes are incorporated in the correct sequence by display and control from a central dialog box.

The system supports short turnaround times for incorporation of configuration changes resulting in short waiting times and a streamlined workflow for the commissioning engineer, which reduces commissioning costs. Changes to the configuration can be loaded online into all system components (OS Clients, OS Servers, Automation Stations, Batch, Archive Server) without interrupting plant operations.

The engineering system supports the implementation of large projects, concurrent engineering and efficient bulk-engineering by providing appropriate functions such as:

- Plant hierarchy (plant view)
- Process control application library (Process Object View)
- Multi-project engineering
- Branch & merge
- Automatic Change Management and copying of process areas
- Version cross-checker
- Import/export assistant
- SFC type/instance concept

SIMATIC Manager

The SIMATIC Manager is the standard configuration interface for all PCS 7 engineering tools and is the launching point for all PCS 7 configuration tasks. All aspects of a SIMATIC PCS 7 project are managed, archived and documented here. The SIMATIC Manager provides the ability to select the required hardware from an electronic catalog via drag and drop, as well as tools for configuring the automation systems, I/O and network components.

The various tasks for creating an automation configuration, and roles for maintaining it are optimally supported by the three different views within SIMATIC Manager:

- The Component view for configuring hardware such as automation systems, bus components or process I/Os is ideal for the technician or maintenance engineer
- The Plant view for hierarchical structuring of the plant according to the process or to the physical areas/units is suited for a process scientist
- The Process object view for configuration of all aspects of a process control element (such as messages, alarm limits, HMI representation, archiving etc.) is designed for the controls engineer

Plant view (plant hierarchy)

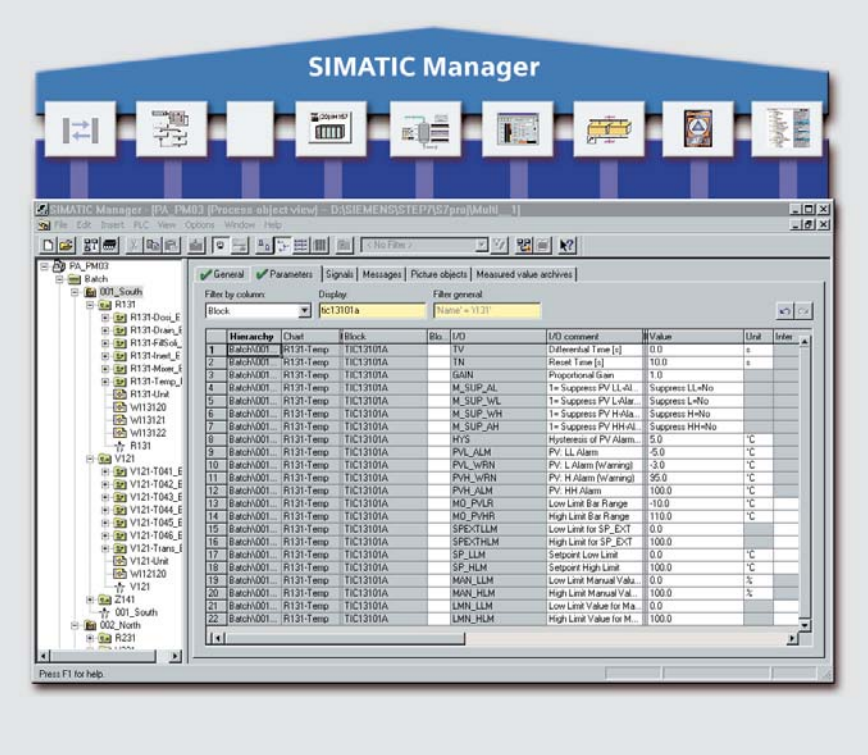
The plant view is used to layout and configure the user program based on the actual layout of the plant or process. The parts of a project are grouped logically and laid out hierarchically according to the plant structure (e.g. the valves and pumps associated with a tank) so that that process engineer has a clear overview of the configuration. It is created during configuration of the control strategy and can be used to automatically derive the HMI process display hierarchy and navigation structure, eliminating the need to engineer twice.

Process graphic displays (pictures) can be generated automatically from the control strategy based on the configuration of the plant view. HMI elements, such as symbols and faceplates, corresponding to Continuous Function Chart (CFC) blocks are automatically positioned in the graphic display and linked to the control strategy.

Highlights

- Common hardware and software configuration environment for all application development tasks
  - → Powerful HMI graphic development tools
  - → Integral configuration of field devices
  - → Configuration of communication and networking infrastructure
  - → Development the same for redundant and non-redundant applications
  - → Common tools for development of failsafe and process applications
- Central interface for compiling and distribution of all AS, OS and SIMATIC BATCH modifications
  - → Optimization of load sequence to ensure consistency and to streamline the workflow process
  - → Compilation and loading in one operation with minimum turnaround times
- Concurrent configuration of large applications using distributed, parallel multi-project engineering capabilities with branch & merge
- Configuration based on process control know-how without special programming knowledge
  - → Layout application program so that it reflects the organization of the plant and the process (hierarchically by process area, unit, control module, function etc.)
  - → Hardware-independent engineering: automation system assignment and I/O module selection can be incorporated based on project schedule
  - → Expandable using industry-specific add-ons such as special libraries
- Process object view for configuration of all aspects of a process object, including control, HMI, alarming, messaging, archiving etc.
  - → Tabular spreadsheet view for fill-in-the-blanks type configuration
  - → Project library with process object templates as well as import/export functions for customization
- Advanced SFC functionality
  - → Fully supports the ISA S88 SFC states and provides for the definition of up to 8 separate sequence chains within one SFC for management and coordination of operational states such as holding, aborting or safe state
  - → Instances can take the form of a CFC
  - → SFC master/copy capability for central change management
- Reduction in engineering and validation time/cost as result of:
  - → Comprehensive libraries with preengineered and tested function blocks, faceplates and symbols for process control applications
  - → Ready-made control strategies selectable from the library
  - → Project library of process object types with import/export function for support of configuration in the process object view
  - → Simple duplication of control elements or entire units by copying, automatic updating of HMI links and compiling
  - → Type/instance concept of SFCs with central modification capability for all instances
  - → Import/export wizard for effective bulk engineering
  - → Numerous project configuration steps are performed automatically by the system (auto-engineering)
- Auto-engineering for:
  - → Optimization of block execution sequence in the CFC
  - → Process graphics generated automatically from control strategy including instantiation of dynamic HMI symbols
  - → Picture tree hierarchy automatically generated from plant hierarchy
- Version cross-checker
  - → Documentation of engineering modifications by comparing versions and providing graphic display of differences

System-wide engineering
with the central engineering system



Filtering, sorting, editing in the process object view of the engineering system

Process object view

The process object view of the SIMATIC Manager permits an object-oriented approach to be used during configuration which is intuitive, powerful and easy-to-use. In combination with the plant view (hierarchy), the process object view provides a tabular view of all aspects of a process control element, such as alarm limits, I/O signals, operator message text, alarm priorities, HMI representation, block interconnections and archived variables.

All objects that have been selected in a branch of the plant hierarchy are displayed in tabular format so that they can be directly edited via fill in the blanks without calling up the detailed engineering tool. Alternatively, a single click on a row calls up the detailed engineering tool for the selected item.

The process object view maximizes engineering efficiency, helps to avoid configuration errors, and enhances overall engineering productivity by convenient functions such as

- block-by-block copying/insertion,
- search/replace,
- undo,
- two-stage filtering,
- import/export of process objects and creation of templates, or
- data exchange with Microsoft Excel/ Access using copy/paste.

An integral project library contains preconfigured types of process objects, and permits users to create their own custom objects.

Multi-project engineering

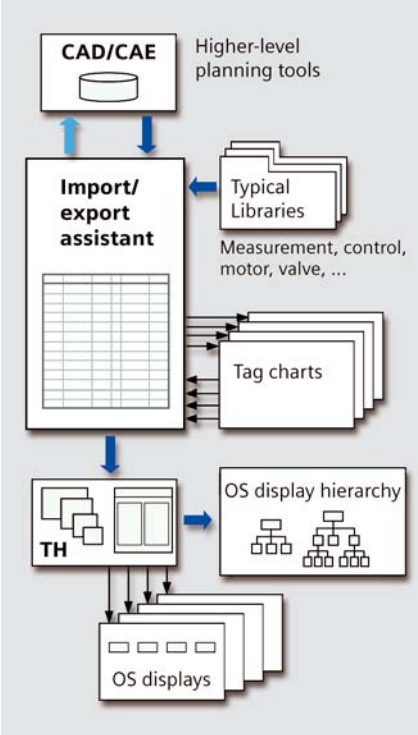
Multi-project engineering permits division of a large complex project into several subprojects in order to allow a project team to work more efficiently in parallel (concurrent engineering). To achieve this, a host "Multi-project" is defined in the SIMATIC Manager. Individual (sub)projects can be inserted at any time into a multi-project, or removed from it to allow an engineer to configure it locally on his PC. Furthermore, projects can be branched and merged.

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

Branch & Merge

Branch & Merge capability is provided in conjunction with multi-project engineering, and supports the effective breaking apart and recombining of pieces of the user program. Individual charts or whole units can be broken out or copied into another project and edited there They can then be reinserted seamlessly back into the master project and all chart-to-chart connections are automatically re-established.

Charts with the same name in the master project are overwritten during Branch & Merge. Interconnections which are not specific to a project, typically for interlocking, become text interconnections when branched. When merging, these text interconnections – including those entered by the user as a placeholder – can be closed by pressing a key.



Editing of mass data with import/export assistant

Efficient bulk engineering using the import/export assistant

The import/export assistant is a tool for replicating common configuration elements (like motors, valves or entire units) throughout an application. It can significantly shorten the time required for configuration by allowing users to import plant/project data which have already been configured (such as tag and alarm lists or charts from the CAD/CAE world) directly into the engineering system and automatically generating the corresponding user program. Existing PCS 7 projects can be both exported and reimported.

The import/export wizard offers the following benefits:

- Importing of pre-existing plant layout and project data such as tag lists, alarm lists or other plant design data from the process and instrumentation design world
  → No multiple inputs, minimizes configuration errors
  → Simple handling, easy-to-use tabular editing environment
- Automatic generation of device and unit control strategy based on imported tag lists and device control logic templates
  → Generation of plant hierarchy
  → Creation of Function Blocks and Charts from an external source file including configuration of instance-specific values and attributes
  → Reductions in engineering time, and avoidance of errors as result of automatic/reproducible generation
- Automatic derivation of the OS display hierarchy, creation of HMI symbols in displays, and linking of the HMI symbols to control system blocks
  → Eliminates time-intensive HMI development tasks
- Cloning of device or unit control strategies created using the CFC and SFC tools
- Exporting of parameters optimized during commissioning for documentation of as-built configuration
  → Powerful method for documenting project configuration in an efficient manner

Automated Change Management and Copying of Process Areas

When renaming or copying objects within the control strategy, the system can automatically update or modify all corresponding references and links within the HMI. This function offers enormous cost-saving potential for engineering and for validation especially for plants with repetitive structures.

For example, if a fully configured and tested unit consisting of Function Blocks, CFCs, SFCS, process displays, faceplates, scripts and archive parameters etc. is copied and the function blocks / charts are renamed, then all links and connections between control / HMI elements are automatically updated. Complex units or individual process control elements can be multiplied or modified quickly while minimizing the number of steps to fully incorporate the change and the chance of making a configuration error.

Version cross-checker

The version cross-checker tool allows the user to quickly determine the differences between two versions of an application:

- Comparison of CFCs/SFCs, block types, signals and sequences in order to determine what is new, what has been deleted, and what has been changed
- Graphic display of comparison results in a combination of tree and tabular format
- Color-coded identification of changes

Continuous function chart (CFC)

CFC is the tool for graphical configuration of continuous automation functions. Preengineered function blocks can be positioned, configured and interconnected within CFCs. The CFC editor minimizes configuration time via the use of drag-and-drop techniques, autorouting (the ability to interconnect function blocks together via two point-and-click operations) and via integral configuration of HMI messages.

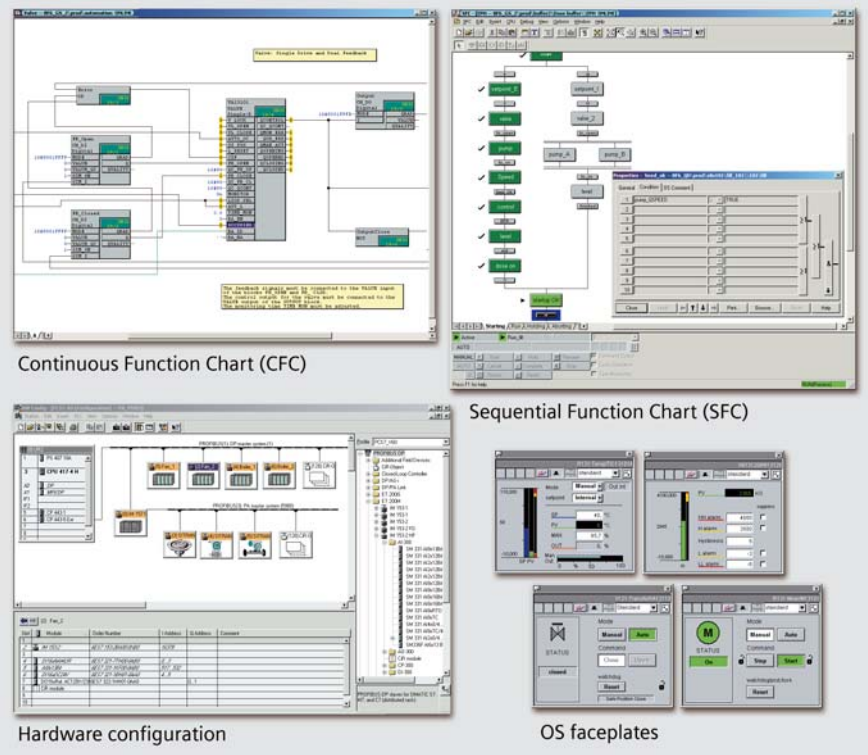
When creating a new CFC, a new runtime group for controlling scan rates and execution order is also automatically generated with the same name as the chart. This allows for control and optimization of the execution order of the control strategy and helps to minimize the time for downloading configuration changes to the controller. All subsequent blocks that are added to a CFC chart are automatically added to this runtime group. The system also provides the ability to automatically optimize the execution (scan) order of the user program, including CFCs, SFCs and function blocks, based on the logical flow of data through the configuration. This feature can be used to improve the effectiveness of the control strategy by ensuring that the user program is executed in an optimal order.

Libraries for Process Control Applications

Standard libraries containing preconfigured function blocks, CFCs, faceplates and symbols are provided to permit effective implementation of automation strategies and to significantly reduce engineering time and overall project costs.

The comprehensive range of blocks includes simple logic and driver blocks, process control application blocks with integral alarming and HMI features such as PID controllers, motors or valves, and also blocks for easy integration of PROFIBUS (smart) field devices according to PROFIBUS PA Profile 3.0. Additionally users can develop their own custom project-specific library elements in the language of their choice; function blocks, ladder logic, Structured Control Language (a high-level structured text language similar to PASCAL), SFC, and others.

System-wide engineering
with the central engineering system



Sequential function chart (SFC)

SFC is a graphical configuration tool that is used to define control sequences (in continuous processes) and phases (in batch processes). Each SFC has an external shell consisting of inputs and outputs for controlling it and for passing of status information. SFCs can be directly positioned in a CFC and can be directly connected to other logic in the user program (other CFCs). Simple operations such as drag-and-drop, point-and-click, and browse can be used to connect to a CFC and to program the SFC steps and transitions.

SFC implementation fully supports all states of the ISA S88 standard and permits configuration of up to 8 separate sequence chains within a single SFC. This makes it easy to coordinate and control sequences with multiple operational modes such as heating and cooling, and for sequences with important conditional logic such as holding, aborting, or safe state.

The SFC editor also provides powerful testing and commissioning functions.

SFC type

An SFC type/instance concept is provided to allow SFCs to be treated just like a normal function block in that instances of an SFC, which are linked to a master copy, can be placed in a CFC and then can be interconnected and configured just like a CFC. An SFC type (template) can therefore be reused (copied) throughout a user program and can be modified centrally. A change to the SFC type (master) causes all instances to be automatically updated without interrupting operation of the CPU. This saves engineering time, and is particularly advantageous for plants requiring validation.

An SFC type can also be provided with chart connections analogous to the CFC. The status of a running SFC or SFC type (transition conditions, actions etc.) can be accessed and monitored by the operator using the SFC faceplate and the SFC visualization of the operator system. SFC test mode can also be used without limitation for SFC instances.

Automatic interconnection of blocks

The function "Generate module driver" can be used to automatically generate system diagnostic logic and to connect the user program to the status information of the various components of the I/O subsystem of the S7-400 automation system, the ET 200M, ET 200iS, ET 200S, ET 200X distributed I/O systems, and for PROFIBUS field devices according to the PROFIBUS PA Profile 3.0 and field devices with HART communication. The diagnostic blocks are interconnected by a wizard automatically on the basis of the symbolic addresses.

Graphics designer and faceplate designer

The applications of the operator system (HMI) are also organized and accessed using the SIMATIC Manager. All data relevant to operation and monitoring of a control element, such as messages and HMI variables, are generated automatically during definition of the control strategy. A powerful graphics designer is available for the generation of process displays (pictures).

The faceplate designer can be used to generate customer-specific faceplates for operation and monitoring of any component in the user program.

F-Tool (S7 F systems)

The F-Tool (S7 F systems) is used to automatically supplement user-defined CFCs with the functions required for fault detection and response (fail-safe systems).

PCS 7 PID-Tuner

The PCS 7 PID-Tuner, which is accessible directly from within the CFC editor, determines optimum parameters for PID, PI and P control algorithms. Optimization can be carried out in manual or automatic mode.

DOCPRO

DOCPRO is a tool that can be used to automatically document your configuration in accordance with the standards for SIMATIC PCS 7 projects or according to user-defined requirements.

Engineering
SIMATIC PDM engineering tool

SIMATIC PDM (Process Device Manager) is a tightly integrated component of the SIMATIC PCS 7 tool kit that is used to perform engineering and maintenance functions necessary for intelligent field device management. It is a software tool for parameterizing and commissioning PROFIBUS and HART field devices as well as accessing detailed diagnostic-information from these devices in a easy to understand format. SIMATIC PDM enables you to configure a large number of field devices from Siemens, as well as other vendors, using one software and with a uniform GUI (Graphical User Interface). With respect to the breadth of devices that can be managed using this tool, SIMATIC PDM is the most powerful process device manager available worldwide.

Parameters and functions for all supported field devices are displayed in a consistent and uniform fashion independent of their communications interface.

SIMATIC PDM allows you to monitor real time process variables with associated device alarms and status information, make on-line changes to device parameters, initiate a calibration routine, and simulate process measurements necessary to complete a loop check in a fraction of the time needed to commission a traditional 4-20 mA loop.

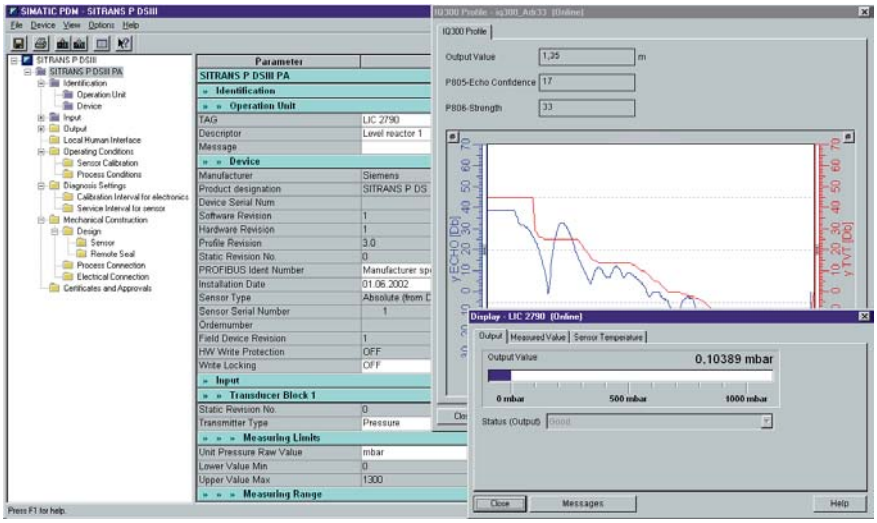
SIMATIC PDM can also be used as a stand-alone version on a desktop or portable personal computer (Windows 95/98 or NT/2000/XP) to allow connection to a device locally in the field or in the maintenance shop.

GUI

The SIMATIC PDM GUI complies with the VDI/VDE GMA 2187 and IEC 65/349/CD guidelines. Accessing device parameters and diagnostics is easy with SIMATIC PDM even for highly complex devices such as remote I/Os, analyzers or motor control devices.

The GUI supports several views:

- Hardware project view (integrated in SIMATIC PCS 7)
- Process device plant view – a tag-based view that includes display of diagnostics information



Parameter view of SIMATIC PDM with curve and online display

- Parameter view for configuration of field devices
- Lifelist view for auto-sensing and commissioning of new devices
- Process device network view for stand-alone application

Communication

SIMATIC PDM supports several communication protocols and components for communication with:

- Devices with PROFIBUS DP/PA interface
- Devices with HART interface
- Devices with Modbus interface
- Devices with special interface from Siemens

Routing

Routing allows access from a central location – commonly from the engineering station – to device parameters and to the status of any field device that is part of an installation. It is then possible from a central position to:

- Read diagnostics information from the field devices
- Modify device settings
- Calibrate and adjust field devices
- Monitor process values
- Generate simulation values in the field device
- Modify the field device parameters.

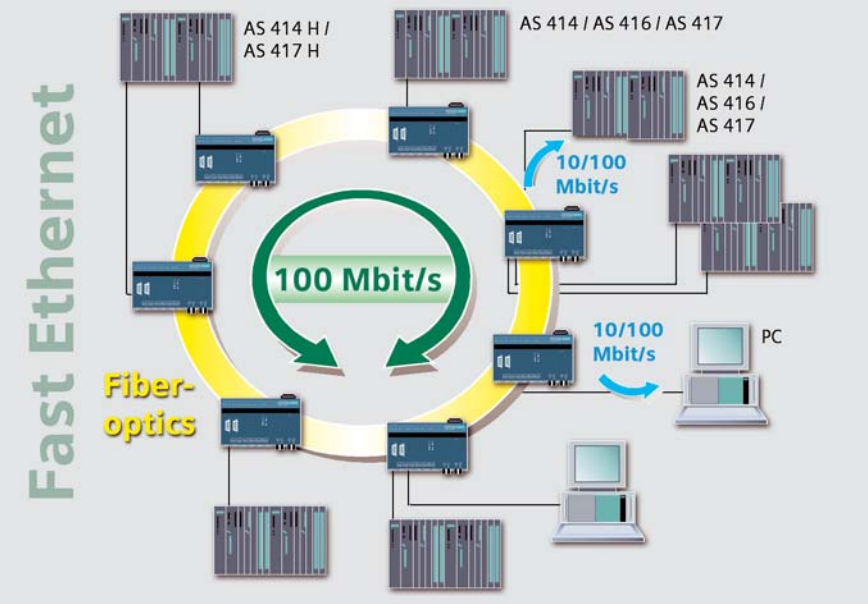
Device integration

SIMATIC PDM supports field devices conforming to the PROFIBUS PA profile descriptions provided by PROFIBUS International (PNO), as well as field devices which are supported by an Electronic Device Description (EDD) and HART Device Description (HART-DD).

The design and functions of the field devices are described by the Electronic Device Description Language EDDL specified by the PNO. SIMATIC PDM automatically creates its GUI with the corresponding field device information using these descriptions. The HART field devices described by HART-DDL are integrated into SIMATIC PDM using the HCF catalog (Hart Communication Foundation). HART-DDL is a widely accepted standard and is strongly supported by device vendors.

Additional field devices from Siemens as well as devices from other vendors can be simply integrated into SIMATIC PDM by importing their device descriptions (EDD, GSD).

Communication
Industrial Ethernet for plant bus and OS-LAN



Plant bus / OS-LAN	Industrial Ethernet	
Number of stations	Up to approx. 1,000	
Network size • Local network • WAN	 Electrical: up to approx. 1.5 km Fiber Optic: up to approx. 150 km Worldwide with TCP/IP	
Topology	Linear, tree, ring, star, redundant	
Fieldbus	**PROFIBUS DP**	**PROFIBUS PA**
Number of stations	32 per segment max. 125	32 per segment 64 per DP/PA link, max. 125
Network size	Electrical: up to approx. 10 km Fiber Optic: up to approx. 100 km	Electrical: up to approx. 1.9 km
Topology	Linear, tree, ring, star, redundant	Linear, tree, star

The SIMATIC PCS 7 communication subsystem is based on proven worldwide standards, and has been designed to guarantee reliable data transfer between all levels, and all components in all areas of a plant. Powerful and rugged network components from SIMATIC NET are used for communication. All SIMATIC NET products have been specially developed for industrial applications, therefore they can be applied optimally in all types of plants in all process automation industries. The network hardware components meet high standards, allowing them to be used in areas subject to extreme environmental conditions (electromagnetic fields, corrosive liquids and atmospheres, explosion hazards, high degree of contamination or mechanical loads).

The SIMATIC NET communication buses promote uniform, deterministic and trouble-free communication between all system components: engineering systems, operator systems, automation systems, I/O and field devices.

Industrial Ethernet networking is typically used for the plant bus. Off-the-shelf commercial networking components can also be used with PCS 7. This networking technology is particularly suited for small process control systems and for communication between clients and servers on the terminal bus.

Fast Ethernet technology

State-of-the-art Fast Ethernet technology is used by SIMATIC PCS 7 to support the higher communication requirements of medium and large-sized plants.

Benefits of Fast Ethernet:

- High communication speed of 100 Mbit/s
- Switching technology (supports fast rerouting of data)
- Redundancy using optical or electrical rings

The increasing acceptance of Fast Ethernet (100 Mbit/s) is due to its great similarity with standard Ethernet. The data format and access procedure are identical. Industrial twisted pair (ITP) and fiber-optic (FO) cables can be used and existing IT technical expertise can be leveraged further. This significantly reduces the costs and the workload associated with a Fast Ethernet implementation.

Existing plants or sections of a plant with 10 Mbit/s Ethernet (triaxial cables, OLMs, star couplers) can be incorporated into communication networks which support 100 Mbit/s Fast Ethernet simply and cost-effectively by using SIMATIC NET switches such as the optical switch module OSM®. The OSM thus permits step-by-step conversion to the 100 Mbit/s technology with continued use of existing networking components. Additionally, SIMATIC NET switches provide redundancy management and network management capabilities. In a ring configuration, a network failure can be bypassed (via an alternate route) in less than 0.3 s. Network management capabilities can be configured quickly and easily using SNMP.

Communication
at the field level with PROFIBUS

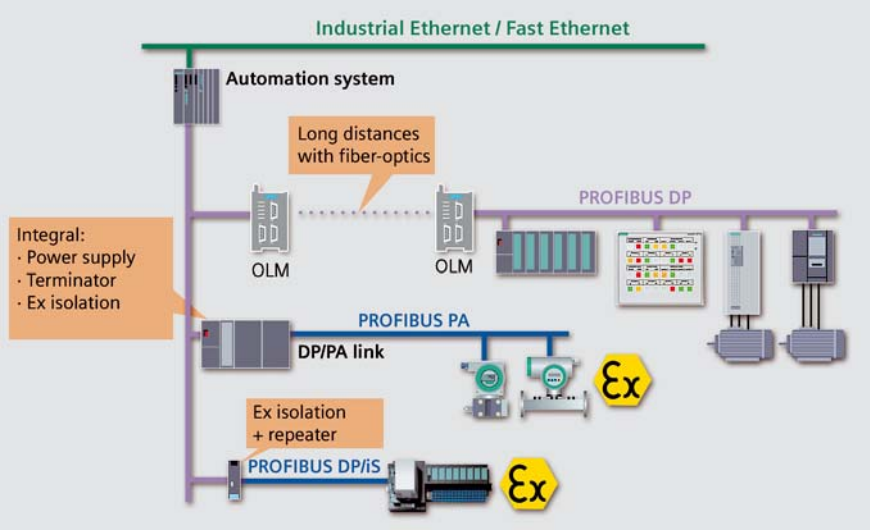
At the field level, remote I/O racks, measurement transmitters, variable frequency drives, control valves or operator terminals communicate with the automation stations via PROFIBUS – a powerful real-time bus system. This communication includes cyclic transmission of process data plus acyclic transfer of alarms, parameters and diagnostics data.

PROFIBUS supports fast deterministic communication with field devices such as remote I/O, drives, operator terminal etc., up to a maximum of 12 Mbit/s (PROFIBUS DP). Common field devices such as transmitters and valves are hosted on PROFIBUS PA per the IEC standard 61158, which allows power to be provided for each device over the bus.

PROFIBUS is easy to work with, rugged and reliable, and supports online addition and parameterization of the distributed components. This bus technology supports redundancy at various levels such as redundant masters, redundant media (bus) and redundant slaves - for enhanced overall system reliability. It is also the only bus technology that performs fail-safe functions for safety applications via use of PROFISafe. New devices may be added online without interrupting data flow to and from existing field devices. PROFIBUS devices are available for applications in general purpose areas as well as electrically hazardous locations. These key features of PROFIBUS have made it the most successful open fieldbus worldwide and has wide acceptance in manufacturing, process and hybrid industries. This leadership position is reflected by more than 9 million installed PROFIBUS DP nodes and more than 210,000 installed PROFIBUS PA field devices worldwide.

SIMATIC PCS 7 uses PROFIBUS as one of its basic building blocks and hence benefits from all the advantages of this bus technology:

- Distributed system architecture and remote I/O: reduced space requirements, lower cabling costs
- Easy and efficient engineering resulting from standardization of process signals, diagnostics and profiles



- Improved commissioning times resulting from faster loop checks via use of centrally located SIMATIC PDM
- Lower maintenance cost resulting from useful device diagnostic information enabling proactive, predictive and preventive maintenance

PROFIBUS PA profile

PROFIBUS PA is tailored to serve applications in the process industry. The standardized communication services guarantee interoperability between field devices from different vendors. Devices are powered over the same pair of wires that serves as the bus to transport digital signals between the devices and the host system.

In the case of SIMATIC PCS 7, communication between the automation systems and the field devices is carried out by proxy blocks in the CPU which cover all types of field devices. Parameterization, commissioning and diagnostics are handled by the SIMATIC PDM Process Device Manager integrated in the engineering system.

Advantages of distributed field automation using the PROFIBUS PA profile include reduced hardware labor and material costs, cost-effective engineering, increased operational reliability and diagnostics-driven maintenance. These advantages are underlined by the following features:

- Modularity and uniformity from sensor up to the control level
- Implementation of intrinsically-safe applications by using the fieldbus in potentially explosive atmospheres
- Reduced configuration costs as result of simple, centralized engineering of field devices
- Simple installation using a two-wire common bus for device power supply and data transmission
- Reduced commissioning costs as result of simplified loop check
- Low maintenance costs resulting from simple wiring and availability of comprehensive diagnostics

PROFIBUS DP/PA gateway

The DP/PA link is a very simple gateway which connects the PROFIBUS DP and PROFIBUS PA bus systems together, yet decouples their transmission rates. This means that the high speed PROFIBUS DP and the lower speed PROFIBUS PA can be combined together without any mutual interference.

The DP/PA link can be used on PROFIBUS DP standard masters, and permits the design of plant control systems with large number of I/O that are scanned at a rate sufficiently fast for real time process control.

Automation
with selected SIMATIC S7-400 components

Highlights

- Flexibility at various availability and safety levels:
  - Standard systems (S systems),
  - Fault-tolerant systems (H systems),
  - Fail-safe systems (F systems),
  - Fail-safe and fault-tolerant systems (FH systems)
- Wide range of automation systems with different CPUs in all performance classes
- Complete ordering units for automation systems with CPU, memory card, subrack, power supply and PROFIBUS DP interface; the systems are delivered completely assembled and tested
- Changes to the configuration are possible during runtime
- Complete redundancy of the AS 414H / AS 417H automation systems:
  - Identical application program in both CPUs; simultaneous processing of both CPUs (synchronous)
  - Bumpless switchover
  - Total physical and electrical separation is possible to minimize potential for common-cause failures

Changes to configuration during runtime (Online)	
Functionality for all automation systems	• Add new slave/remove slave (DP or PA) • Add new module/remove module • Modify parameters of existing module
Additional functionality for fault-tolerant automation systems	• Modification of memory configuration • Modification of CPU parameters • Add/remove S7-400 modules (CPs)

Standard SIMATIC S7-400 hardware components are combined together to make up the automation systems (AS) of the SIMATIC PCS 7 process control system. SIMATIC S7-400 components are modular, powerful, have a fan-free and rugged design, a high degree of expandability, non-redundant or redundant design, comprehensive communication capabilities, integral system functions and diagnostics, and simple connection of central or distributed I/O; this makes them extremely well suited for process automation applications.

Various automation systems are available to choose from, allowing a user to select based on system requirements and price/performance ratio. All automation systems are equipped with an onboard PROFIBUS DP fieldbus connection. If necessary, additional PROFIBUS communication modules can be added in the rack.

Components

The automation systems are delivered preassembled and tested. They are made up of:

- Subracks with 9 or 18 slots, also can be physically separated for redundant systems
- Standard CPU 414-3, 416-2, 416-3 or 417-4 as well as redundant CPU 414-4H or 417-4H
- 24 V DC or 120/230 V AC power supply
- Main (programming) memory from 768 KB to 20 MB
- Memory card with 1 to 8 MB RAM
- Runtime license for the PCS 7 library
- Communication Processor for interfacing to Industrial Ethernet

Automation
Fault-tolerant automation systems

Fault-tolerant and high-availability automation systems can be used to minimize or eliminate system downtime or production losses. The higher initial investment costs for fault-tolerant automation systems are often negligible compared to the costs resulting from losses in production. Consequently, the higher the costs resulting from a production stoppage, the more applicable the use of a fault-tolerant system.

The AS 414H and AS 417H models are the fault-tolerant automation systems for use with SIMATIC PCS 7. These fully redundant 1-out-of-2 systems reduce the probability of production failures by seamlessly switching from the primary to the backup system in the event of a fault. These automation systems utilize a completely redundant design to maximize availability. This means that all major components such as CPU, power supply and hardware for coupling the two CPUs are present in pairs (mirrored). Additional component pairs, such as power supplies or communication processors, can be added to further increase fault tolerance and availability based on the user's automation system requirements.

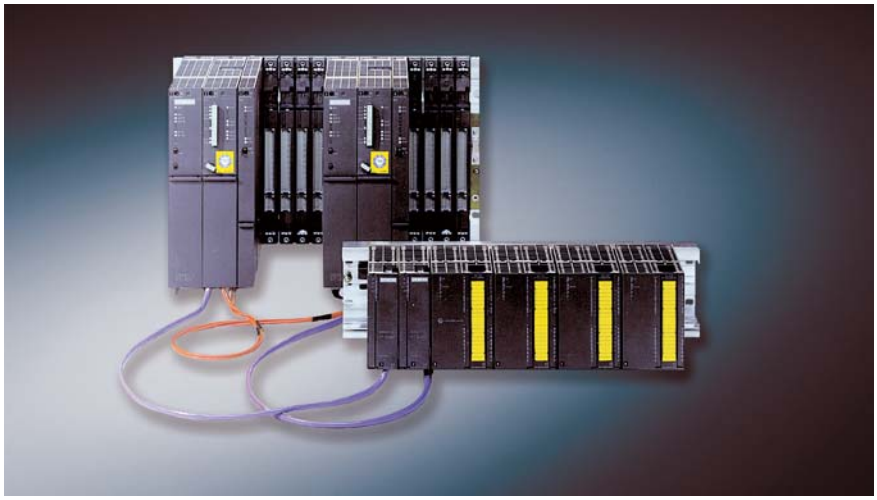
The two fully independent systems of a redundant automation system are electrically isolated from one another. This increases the system stability with respect to EMC interference.
A redundant automation system can be installed mechanically in a one- or two-rack architecture. Automation systems can be installed in two standalone racks for example, if both sides of the redundant system have to be physically separated from one another by a fire-resistant wall. Redundant systems can be completely separated by up to 500 m (1640 ft) to reduce the chance of common-cause failures. Appropriate complete units are available for every type of application. Mixed operation of redundant and non-redundant systems is also possible.

Typical system capacity for SIMATIC PCS 7 automation systems

	AS 416-3	AS 417-4/ AS 417H
Analog-value measurements	125	150
Digital-value measurements	300	400
Dosing	10	15
Motors	125	150
PID controllers	100	130
Valves	125	150
SFC	30	50
Steps	300	500
or:		
Digital inputs DI Digital outputs DO	675 260	850 315
Analog inputs AI Analog outputs AO	210 100	275 130

Note:
The values listed here are not maximum AS-specific values for their respective model, they represent one typical distribution of the totally available capacity available for a representative mixture of I/O. Individual calculation of system capacity and performance is possible for actual systems using the configurator software present on the current CD-ROM of the interactive catalog CA 01.

Automation
Fail-safe automation systems



Fail-safe automation systems (F/FH systems) are used for critical applications where a fault can result in danger to persons, plant damage or environmental pollution. These systems detect process faults as well as their own internal faults, and automatically set the plant to a safe state in the event of a fault.

The fail-safe automation systems (F/FH systems) based on the AS 414H and AS 417H automation systems utilize standard process automation equipment with safety technology in one single system. They are TÜV-certified, and comply with the safety requirement classes SIL 1 to SIL 3 according to IEC 61508, requirement classes AK 1 to AK 6 according to DIN V 19250/ DIN V VDE 0801, and categories 2 to 4 according to EN 954-1.

Using redundant, diverse command processing, the safety function configured by the user in the CFC is processed twice in different parts of the CPU. Faults are detected when the results are subsequently compared.

Fail-safe automation systems can have a single-channel design (F systems with one CPU) or a redundant design (FH systems).

The redundancy of the FH systems is not relevant to safety. It is not used for fault detection, it only serves to increase the availability of the fail-safe automation systems.

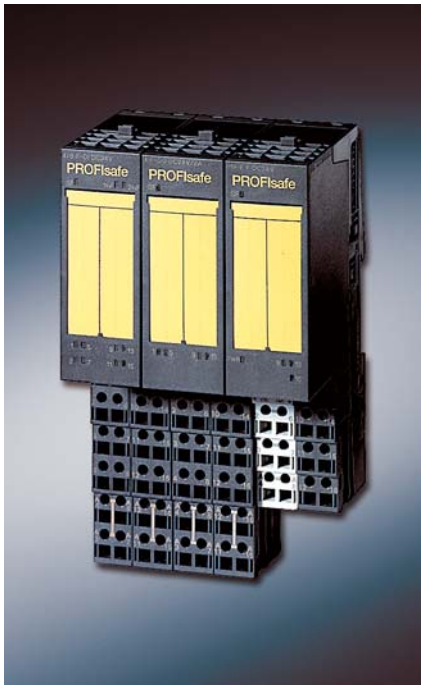
Safety functions

The safety functions of the F/FH systems are present in the F program of the CPU and in the fail-safe ET 200 I/O modules. The PROFIsafe profile is used for the safety-oriented PROFIBUS DP communication between CPU and process I/Os. Using this additional safety message, F/FH systems and F I/O modules can recognize corrupt data and can initiate appropriate responses.

For non-critical I/O, standard modules can be used in F/FH systems along with the fail-safe I/O modules for safety critical I/O. This truly integrated system is very beneficial for plants containing safety and standard applications, and which want to reduce their inventory, engineering and operation costs using common configuration tools and hardware.

Integrated in the SIMATIC Manager for PCS 7 F/FH systems is the F-Tool (S7 F systems). This engineering tool enables parameterization of the CPU and the F signal modules as well as generation of fail-safe applications in the CFC based on predefined, TÜV-approved blocks. The fail-safe blocks are extremely versatile and detect programming errors such as division by zero or out-of-range values. Functions such as the comparison of F programs, the detection of changes in F program using a checksum, or access privileges using passwords provide further support and guarantee simple, safe operation.

The application program may contain fail-safe programs (F) and non-fail-safe standard programs (S), where strict separation of F and S program components together with data exchange via special conversion blocks prevent conflicts. An error detected in the F program does not result in stopping of the CPU, it leads to triggering of configurable shutdown logic which sets either the associated F sequence group or the complete F program to a safe state. The standard program is not influenced, and continues to run as normal. Following elimination of the fault, the F program can be started again with the CPU still running.



Fail-safe I/O modules

The special safety functions of the F systems are matched to the fail-safe modules of the ET 200M and ET 200S distributed I/O systems which also support plant safety in the event of a CPU failure. The F signal I/O modules offer extensive diagnostics for both internal and external faults, have a redundant design for maximizing safety, and comply with the requirements up to SIL 3 (IEC 61508) or AK 6 (VDE 0801).

Highlights

- Use of standard SIMATIC S7 components for fail-safe applications
- Safety levels SIL 3, AK 6 can be achieved with just *one* CPU
- Safety-certified communication via PROFIBUS with PROFIsafe
- Safe communication via Industrial Ethernet plant bus
- Standard and fail-safe functions can be mixed in the same automation system
- Standard and fail-safe I/O can be operated on the same PROFIBUS DP line
- Common hardware components for process and fail-safe applications minimizes spare parts inventory
- Configuration of standard process control and fail-safe functions using common engineering tool
- F-Tool (S7 F systems) provides support for TÜV acceptance:
  – Separation of standard and fail-safe functions
  – Checksum by means of application program
  – Comparison function
  – Access protection to fail-safe functions through password

  → Reduction of engineering costs through simple data exchange between standard and fail-safe systems
  → Minimum training requirements since same tools used for standard and fail-safe systems
  → Simple fault analysis since same operation and monitoring for standard and fail-safe systems (message sequence)
  → Low hardware costs through mixed configurations: optimum for small applications
  → Minimization of life cycle costs

The input modules can operate in either a simplex or dual mode. A safety reaction is triggered immediately if critical input errors are detected. Dual output switches, on the digital output module guarantee a safe shutdown even in the event of a failed output channel.

The PM-E F power module of the ET 200S serves to transfer to a safe state, any standard ET 200S modules that are located in the same subrack.

Fail-safe ET 200M I/O modules:

- Digital input DI 24 x DC 24 V
- Digital input DI 8 x NAMUR [EEx ib]
- Digital output DO10 x DC 24 V/2 A
- Analog input AI 6 x 13 bit

Fail-safe ET 200S I/O modules:

- Digital input F-DI 4/8 channels PROFIsafe DC 24 V
- Digital output F-DO 4 channels PROFIsafe DC 24 V/2 A
- Power module PM-E F DC 24 V PROFIsafe; with diagnostics

Process I/Os
Central and distributed process I/Os

The SIMATIC PCS 7 process control system offers many choices for interfacing with field I/O devices such as transmitters and control valves:

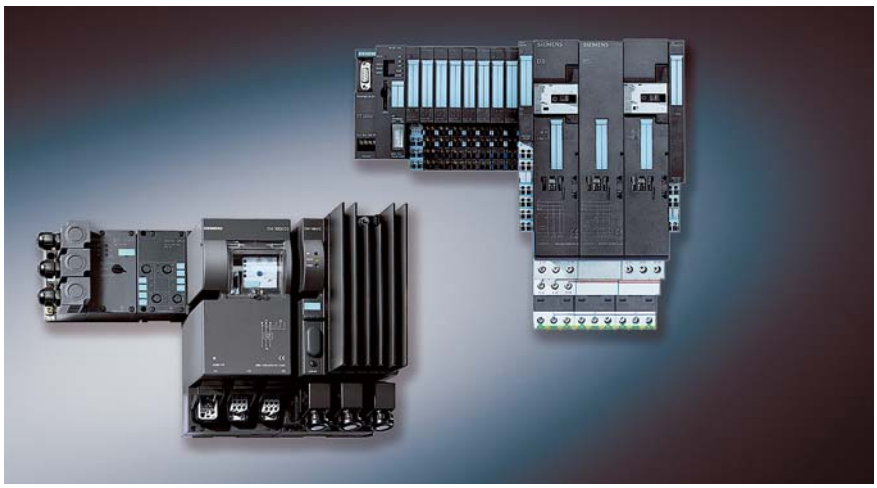
- Analog and discrete input/output modules of the SIMATIC S7-400 family used in the same rack as the automation system (central I/O)
- ET 200M, ET 200S, ET 200iS, ET 200X distributed I/O systems (remote I/O) connected to the automation system via PROFIBUS DP with a comprehensive range of cost-effective I/O modules
- Connecting intelligent, distributed field devices and operator terminals via PROFIBUS DP/PA (including redundant architectures and applications in potentially explosive atmospheres of zone 0, 1 or 2)

SIMATIC S7-400 signal modules used centrally in the automation system are primarily used for small applications or plants with a relatively small distributed structure.

Features such as

- modularity and uniformity,
- flexible adaptation to the plant structure,
- reduced cabling and engineering effort,
- quick commissioning, lower life cycle maintenance costs, as well as
- the comprehensive choice of I/O modules for all applications

support the wide acceptance and popularity of remote I/Os.



Possible online modifications for I/Os	
ET 200M	• Add/remove ET 200M stations • Add/remove new input/output modules • Parameterization of input/output modules as well as HART field devices connected to HART modules via SIMATIC PDM
ET 200S, ET 200iS, ET 200X	• Add/remove ET 200S/iS/X stations • ET 200iS: parameterization of input/output modules as well as HART field devices connected to HART modules via SIMATIC PDM
PROFIBUS DP, PROFIBUS PA	• Add/remove PROFIBUS DP stations • Add/remove DP/PA links and field devices • Parameterization of field devices using SIMATIC PDM

SIMATIC ET 200M

Within the ET 200 family of I/O, the ET 200M is the most popular distributed I/O system for process industry applications with SIMATIC PCS 7. It supports online modifications and supports a wide range of S7-300 I/O modules, some with special process control functions:

- Standard S7-300 signal modules
- Redundant S7-300 signal modules (DI 16 x DC 24 V, with diagnostics; DO 32 x DC 24 V/0.5 A; AI 8 x 12 bit)
- process control I/O modules with increased diagnostics capability
- Input/output modules for field devices in electrically hazardous areas
- Closed-loop control and counter modules
- HART modules
- Fail-safe modules

Up to 8 I/O modules can be connected to one interface module (IM). The I/O modules with diagnostics capability also offer channel-based fault display, internal module monitoring, monitoring of unsteady sensor signals, pulse stretching, diagnostics alarm, holding of last value or application of substitute value on failure of CPU or load power supply. They detect open-circuits, short-circuits, load voltage failures as well as internal module faults, and display these events to the operator station without any engineering effort.

The ET 200M can be used on a redundant architecture and permits transmission rates up to 12 Mbit/s. It can be used in general purpose areas or in Ex zone 2. The actuators/sensors can be located in Ex zone 1 when using appropriate Ex input/output modules. Hot swapping of I/O modules is possible in Ex zone 2 with appropriate safety practices (e.g. Hot Work Permits).

SIMATIC ET 200iS

The intrinsically-safe ET 200iS distributed I/O system rated for IP 30 can be installed directly in Ex zone 1 or 2 (EEx de ib [ia/ib] IIC T4), with the sensors/actuators in zone 0 if required. The ET 200iS connects with the control system using PROFIBUS DP. Using an isolating transformer, the energy on this PROFIBUS-DP is sufficiently reduced such that it can be safely used as an intrinsically-safe bus in Ex zone 1.

The ET 200iS has a bit-modular design: flameproof power supply, interface module for PROFIBUS DP, and supports up to 32 different I/O module types including HART. The I/O modules are designed such that they can be swapped safely in an electrically classified area without a hot work permit. Transmission rates up to 1.5 Mbit/s are possible.

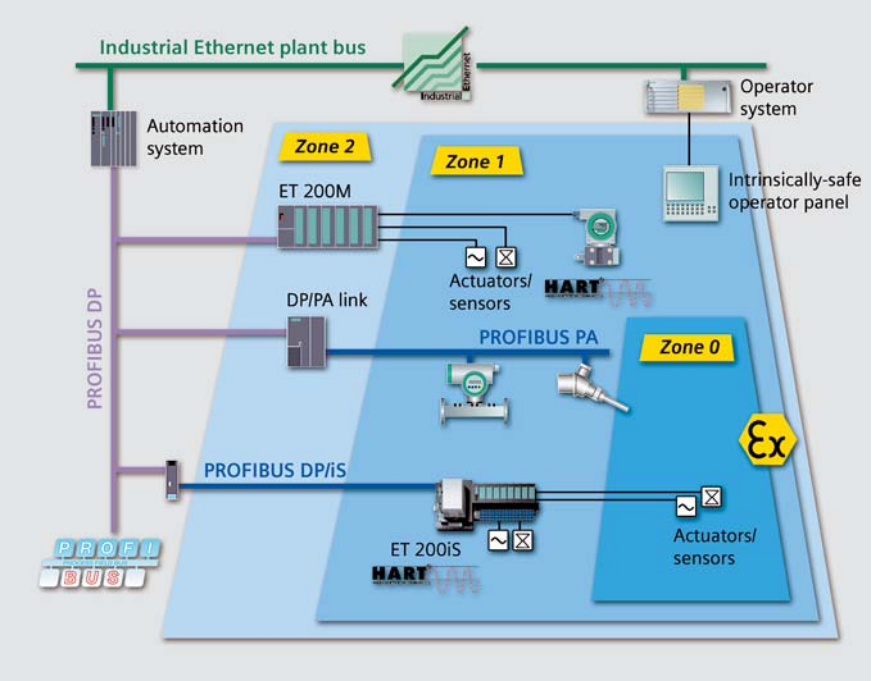
Incorporation into SIMATIC PCS 7 comprises CFC driver blocks, system diagnostics and time stamping. The ET 200iS is easy to configure and commission. Configuration of the electronics modules and parameterization of the field devices are carried out in the engineering system using SIMATIC PDM.

The range of electronics modules includes a NAMUR discrete input module, a discrete output module, and analog input/output modules with and without HART.

SIMATIC ET 200S

The ET 200S is a bit-modular distributed I/O system rated for IP 20. It is approved for operation in Ex zone 2. Field device wires are connected to integrated terminal blocks thus allowing point-to-point wiring checkout prior to installation of the I/O modules. The I/O modules are simply plugged in at a later time. The design supports hot swapping of modules during runtime with safety precautions such as hot work permits.

The range of I/O includes analog and discrete I/O modules, function modules, motor starters up to 7.5 kW, fail-safe discrete input/output modules and the fail-safe PM-E F power module.



Connection of I/O modules in hazardous area

SIMATIC ET 200X

The modular design rated for IP 65/67 makes the ET 200X appropriate for use in extreme environmental conditions where it may be exposed to harsh elements. The ET 200X consists of a basic module for connection to the PROFIBUS DP and a maximum of 7 expansion modules. The expansion modules are mounted side by side using integral connectors. All signal cables and supply voltages required for the inputs/outputs are looped through. The modules can be replaced online without having to power down the complete station.

When used with SIMATIC PCS 7, discrete and analog input/output modules, pneumatic interfaces for FESTO valve manifolds CPV-10/-14 and an optional power module are popularly used as expansion modules.

Connection of intelligent field devices

Communication between SIMATIC PCS 7 and the intelligent field devices is based on international standards such as IEC 61158. Intelligent field devices are connected to the control system via PROFIBUS or the HART interface modules in the remote I/O racks. The I/O modules in a remote I/O rack supports connection with field devices in the Ex zones 1 or 2, sensors/actuators also in zone 0.

PROFIBUS or HART devices can be parameterized, commissioned, diagnosed and maintained using SIMATIC PDM.

Intrinsically-safe operator panel

If required, an intrinsically-safe PC operator panel is available for use in potentially explosive atmospheres (Ex zone 1 or 2). The panel is connected to a PCS 7 operator system and can be in a remote location up to a distance of 750 m.

Process I/Os
Intelligent devices for automation in the field

Siemens offers a complete range of intelligent field devices for use with the SIMATIC PCS 7 process control system that allow automation and control at the field level:

- Field devices
- Analyzers
- Weighing systems
- Drives

PDM *The process devices identified by this symbol can be parameterized using SIMATIC PDM.*

Field devices

The field devices are available as either PROFIBUS or HART compliant versions.

Further technical data and ordering information on these field devices are available at:

www.siemens.com/fielddevices

Pressure measurements PDM

The SITRANS P transmitters are suitable for flow, pressure and level measurements of corrosive and non-corrosive gases, vapors and liquids. With a completely welded measuring cell, the SITRANS P is vacuum-tight, has an exceptional over-pressure tolerance capability, resulting in a long service life with unmatched operating performance. These transmitters are designed for absolute and differential pressures from 1 mbar to 400 bar.

Flow measurements PDM

The SITRANS F US ultrasonic flowmeter with the patented helical passage of sound is used to measure flow of conductive and non-conductive liquids, e.g. solvents, organic liquids and condensates.

The SITRANS F M electromagnetic flowmeter measures the flow of electrically conductive media above 0.008 µS/cm. Homogeneous liquids can be measured, including flowing media with solid particles such as slurries, pastes and sludges. Flow velocities up to 12 m/s are permissible.

Temperature measurements PDM

SITRANS T is used to measure temperatures. Its universal input stage provides flexibility such that all common temperature sensors and DC voltage sources can be connected: Pt 100 resistance thermometers, thermocouples, resistance-based sensors/ potentiometers from 24 to 6000 Ω and DC voltage sources from 17 to 1120 mV.

Level measurements PDM

SITRANS LR 400 is a high-frequency radar level meter for the process industry, featuring high accuracy and wide measuring ranges.

SITRANS LR 300 is a level meter that operates per the Siemens patented microwave pulse technology, and provides exceptional measurement reliability even under difficult operating conditions. The device can be used on pressurized vessels, in explosive or non-explosive media, in applications where large amounts of steam or dust are present, and in high temperature applications.

Besides these two level instruments, Siemens portfolio also includes various ultrasonic level meters for a variety of applications. These include compact devices for measuring liquid, solid or sludge levels, and a system for monitoring and controlling pump stations.

Meters for capacitive level measurements

SITRANS LC 500 is an ideal capacitive level meter for use under extreme temperature and pressure conditions. The Siemens patented active shield technology protects it from dirt, deposits, steam and condensation.

SITRANS LS level switch is used to determine predefined levels of bulk materials, sludges and interfaces.

Intelligent positioner for pneumatic control valves PDM

The SIPART® PS2 electropneumatic positioner is used with linear or quarter-turn control valves and air-operated dampers. The positioner ensures that the control valve performs as commanded by the control system and also provides feedback to the control system regarding the actual valve position at all times. The SIPART PS2 positioner is available in PROFIBUS and HART compliant versions. The user is able to configure many advanced functionalities such as a min-stop position, a fail-safe position, etc. via a comprehensive choice of configurable parameters in the positioner.

Compact controllers PDM

The SIPART DR19 and DR21 compact controllers designed for general process control provide a single-loop control solution at an affordable price. These offer a wide range of preconfigured functions for process control which can be deployed by users without any programming knowledge or engineering effort. The built-in self-tuning algorithms in the SIPART DR19 and DR21 makes the task of commissioning these controllers even easier.

These two compact controllers are connected to the SIMATIC PCS 7 automation systems via PROFIBUS DP. The SIPART DR19/21 function blocks are available as add-on products for SIMATIC PCS 7. Each function block has its associated OS faceplate which shows the control and display elements of the corresponding compact controller.

Analyzers

Liquid analysis PDM

Siemens liquid analyzers under the brand SIPAN® are available for measurement of pH, conductivity and dissolved oxygen. These analyzers are PROFIBUS PA compliant and are powered over the bus. Intrinsically-safe versions are available for applications in electrically hazardous areas.

Gas analyzers PDM

ULTRAMAT® 6 operates on the dual beam NDIR principle, and continuously and selectively measures IR-active gases such as CO/NO/SO_2, CO_2, N_2O and CH_4.

CALOMAT® 6 has been developed for exact determination of composition and concentration of process gases using thermal conductivity.

OXYMAT® 6 operates according to the paramagnetic alternating pressure principle, and is used to measure oxygen in gases.

Weighing systems

Weighing modules

Net weight and proportioning scales for industrial processes can be configured quickly and efficiently using predefined scales blocks.

For SIMATIC PCS 7, Siemens offers configuration packages with blocks for the SIWAREX M and SIWAREX U weighing modules as add-on products. These blocks permit simple linking of the weighing modules into the engineering system, and also easy operation of the scales from the operator system. The scale's faceplate in the operator system also provides important diagnostics information for the operating personnel.

Integral message response and maintenance functions such as the reading or writing of all weighing parameters provide a high level of system availability, and thus short down times.

Siemens-Milltronics weighing systems

The range comprises:

- Precision and torque scales for reliable and continuous weighing of bulk materials
- High-performance conveyor scales for measuring ranges from 45 kg/h up to 725 t/h
- Low-maintenance bulk flow meter with high reliability and repeatability (even for difficult mixing and batch functions)

Drives

Motor management PDM

The SIMOCODE-DP motor protection and control device is primary used in the motor control centers (MCC) of process industry plants. It offers the following functions:

- Comprehensive motor protection and motor feeder monitoring
- Integral, software-based control programs for all typical, switched motor applications
- Detailed motor and plant diagnostics
- Integral PROFIBUS DP interface

In particular for applications in the chemical industry, SIMOCODE-DP provides safe isolation and complies with the NAMUR regulations.

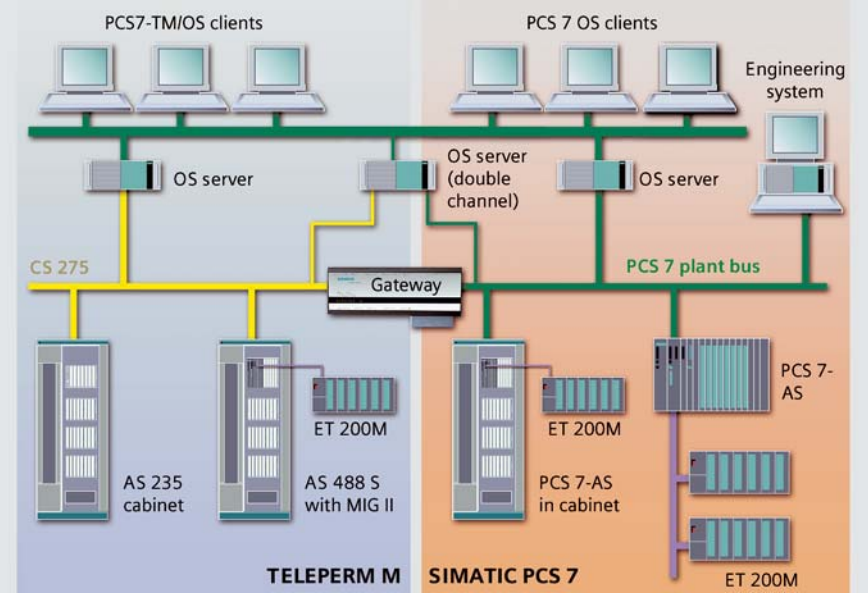
Variable Frequency Drives

The MASTERDRIVES range is universal and modular. The power range extends from 0.55 up to 2300 kW. All common international power supplies from 200 to 690 V are covered.

The MICROMASTER drive is a standard frequency converter in the power range from 0.12 up to 90 kW, and can be used for numerous drive applications with variable speeds. The converter is particularly suitable for applications with pumps, fans and conveying equipment.

The add-on product "Drive ES PCS 7" can be used to control, operate and monitor the drives using the SIMATIC PCS 7 process control system. Parameterization, commissioning and diagnostics of the drives can be carried out with the add-on product "Drive ES Basic" which can be integrated in the SIMATIC Manager.

Migration solutions
TELEPERM M process control system to SIMATIC PCS 7



The TELEPERM® M process control system from Siemens has proven itself worldwide in many different industry sectors in the past 20 years. More than 15,000 installed systems have proven their performance, reliability and user-friendliness, even under extreme operating conditions.

Many users are faced with the need to expand or modernize their plants.

SIMATIC PCS 7, the successor generation for the process control system, was introduced by Siemens in 1997 for new plants and plant expansions, and offers an open platform for modern, forward-looking and economical automation solutions in all industries.

The objective of migration is to modernize the existing platform step-by-step without changing the system, simultaneously guaranteeing past investments for as long as possible.

For this purpose, Siemens has been offering optimized migration solutions for the transition from TELEPERM M to SIMATIC PCS 7 since 1996.

The range of migration products covers hardware and software components as well as services for converting application software, on site conversions, and migrating complete systems.

At the beginning, the main migration requirement of customers was the step-by-step modernization and functional expansion of individual components of the existing TELEPERM M system:

- Replacement of existing automation systems by future-compatible automation systems under the premise of importing existing application software and TELEPERM M I/O.
- Replacement of operation and monitoring systems by operator systems on the basis of SIMATIC PCS 7
- Integration of the distributed SIMATIC process I/O
- Introduction of PROFIBUS as additional plant bus with a bridge as the link to the TELEPERM M CS 275 plant bus

Customers are increasingly choosing a more direct migration of TELEPERM M to SIMATIC PCS 7. They are completely selecting the proven system components of SIMATIC. They therefore benefit from the properties of a modern process control system and the synergies of TIA, while simultaneously have the ability to continue using their existing TELEPERM M I/Os. Siemens supports this trend by means of new migration products as well as optimized services and in-house tools for hardware and software conversion.

With the modern, pioneering SIMATIC PCS 7 process control system, innovative migration solutions and services, many years of know-how in process control engineering and migration, as well as worldwide servicing, Siemens demonstrates its competence in the process control engineering industry and offers the security of a reliable partner.

You can find further information on migration solutions on the Internet at

www.siemens.com/teleperm

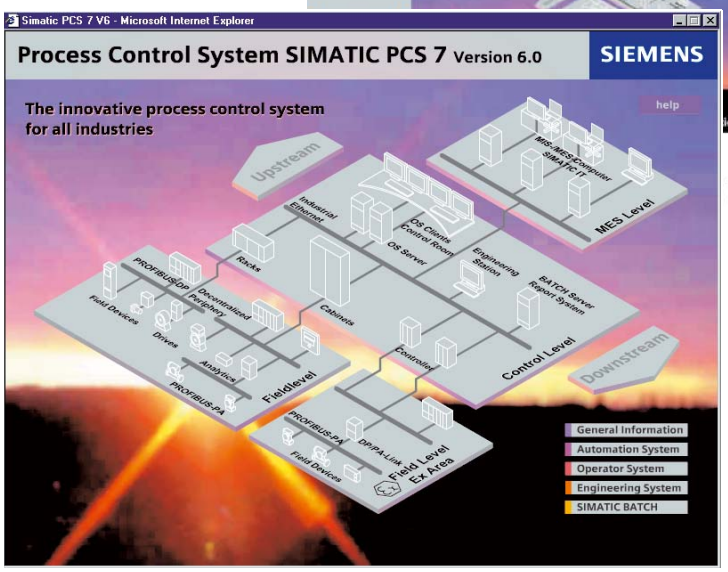
SIMATIC PCS 7 on the Internet

We offer extensive information on the SIMATIC PCS 7 process control system at:

www.siemens.com/simatic-pcs7

In addition to SIMATIC PCS 7 products and add-on products from Siemens and external partners, you will also find:

- Access to the catalog and online ordering system (mall)
- Catalogs for SIMATIC PCS 7 and add-on products
- System descriptions, product briefs, presentations and references
- Technical documentation such as manuals and Update Procedures
- FAQ sites with tips and tricks
- Access to tools & downloads as well as servicing facilities
- Training information
- Newsletter for the complete range of process automation
- Range of services for process automation
- Info Center for the process industry



- Access to the process automation portal with information on TELEPERM M migration, process instrumentation, process analysis and industry-specific solutions

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

Siemens offers comprehensive service and support for automation and drives in all phases of a project: planning, commissioning, maintenance and modernization.

Online support

An information system accessible at all times via the Internet, and covering product support, Service & Support facilities and support tools:

www.siemens.com/automation/service&support

Technical support

Expert support for technical questions together with a wide range of specific services for our products and systems.

Tel.: +49 (0)180 50 50 222 (worldwide)
Tel.: +1 (0) 800 333 7421 (USA)
Tel.: +86 10 64 75 75 75 (Asia/Australia)

E-mail: adsupport@siemens.com

Technical consulting

Support during the planning and design of your project: from detailed analysis of current situation, definition of targets, advice concerning products and systems, up to elaboration of the automation solution.

Field service

Commissioning, repairs and maintenance to guarantee the availability of automation plants and systems.

Optimization and modernization

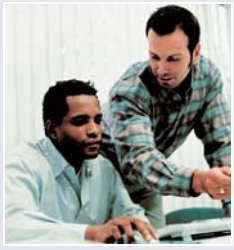
High-quality optimization and modernization facilities with the objective of increasing productivity or reducing costs.

Configuration and software engineering

Support during configuration and development with specific services ranging from the configuration of an automation project up to its implementation.

Repairs and spare parts

Comprehensive repair and spare parts service during the operating phase of a plant's lifecycle offers a high degree of operational safety and assurance.



Further information

Complete SIMATIC information

On the Internet at

www.siemens.com/simatic

The SIMATIC portal provides access to all information concerning the SIMATIC range of products.

You can find further information documents in the online ordering form in the support area of the portal under "Info material". From there you can download

- all SIMATIC catalogs
- customer periodicals such as advance (products, systems, solutions for Totally Integrated Automation) or ProcessNews (info, news and trends for process automation)
- information documents
- technical descriptions

or you can order a printed copy.

Siemens worldwide partners

At

www.siemens.com/automation/partner

you can find information on Siemens partners worldwide for particular technologies, also for process automation and SIMATIC PCS 7.

As far as possible, each location includes partners for:

- technical support
- spare parts/repairs
- service
- training
- sales
- special consulting/engineering

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