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SIMATIC Controllers

The innovative solution for all automation tasks

Brochure · November 2011

SIMATIC

Answers for industry.

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SIMATIC Controllers

SIMATIC Modular Controllers

Our SIMATIC Controllers are based on different hardware and software architectures. You have a free choice among different designs and different CPU performance classes. You can run your user programs on the different but mutually compatible device types without costly adaptation.

The SIMATIC Modular Controllers have been optimized for control tasks and specially designed for ruggedness and long-term availability. They can be flexibly expanded at any time using plug-in I/O modules, function modules, and communication modules. The modular controllers can also be used as fault-tolerant or fail-safe systems.

LOGO!
Logic module for switching and control
from page 20

ET 200
Modular, distributed I/O system
from page 32

S7-1200
Modular, compact controller
from page 34

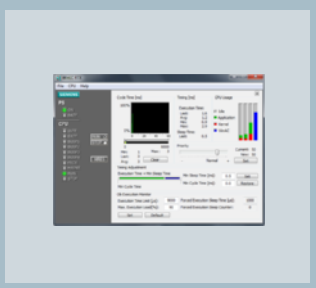
S7-300
The modular controller in the manufacturing industry
from page 36

SIMATIC PC-based Controllers

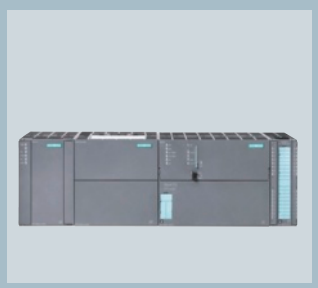
SIMATIC PC-based Controllers use a real-time-capable software controller based on Windows operating systems. They can be used to combine PC applications, HMI tasks and control tasks and technology functions into an automation solution (also fail-safe).

Through their rugged design and pre-installed, ready-to-use automation software, the SIMATIC Embedded Bundles allow the advantages of PC-based Automation to be used at the machine.

WinAC RTX
Software controller – open, flexible and reliable
from page 73

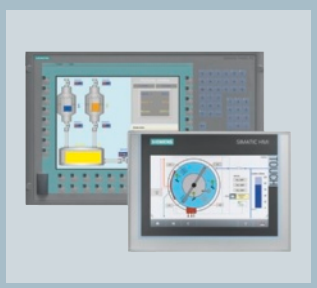


S7 Modular Embedded Controller
in S7-300 design
from page 82



Embedded Box PC bundles
Turnkey standard rail PC
from page 84

Embedded Panel PC bundles
Turnkey Panel PC
from page 87



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Contents

Highlights of SIMATIC Modular Controllers

- Ready to use
- Long-term compatibility and availability
- Can be used in harsh environments
- Modular expandability and scalability

S7-400
The powerful controller for the manufacturing and process industries
from page 50

Highlights of SIMATIC PC-based Controllers

- Flexible in use
- Open in hardware and software configuration
- Use of existing PC resources
- Benefiting from constant PC innovations

WinAC for Multi Panels
Software controller for Multi Panels
from page 90

Totally Integrated Automation 4
System characteristics 6
SIMATIC Controllers 16
Introduction 16
Product range 18
Shared functions 22
Selection guide 28
SIMATIC Modular Controllers 32
SIMATIC ET 200 32
SIMATIC S7-1200 34
SIMATIC S7-300 36
SIMATIC S7-400 50
SIMATIC S7-400H 62
SIMATIC PC-based Controllers 72
Introduction 72
SIMATIC WinAC RTX 73
SIMATIC S7 modular embedded controller 82
SIMATIC IPC227D bundles 84
SIMATIC IPC427C bundles 85
SIMATIC IPC277D bundles 87
SIMATIC HMI IPC477C bundles 88
Software controller for Multi Panels 90
SIMATIC WinAC MP for Multi Panels 90
Technical data 92
S7-300 signal modules 92
S7-400 signal modules 98
Environmental conditions SIMATIC / SIPLUS extreme 102
SIMATIC overview 103

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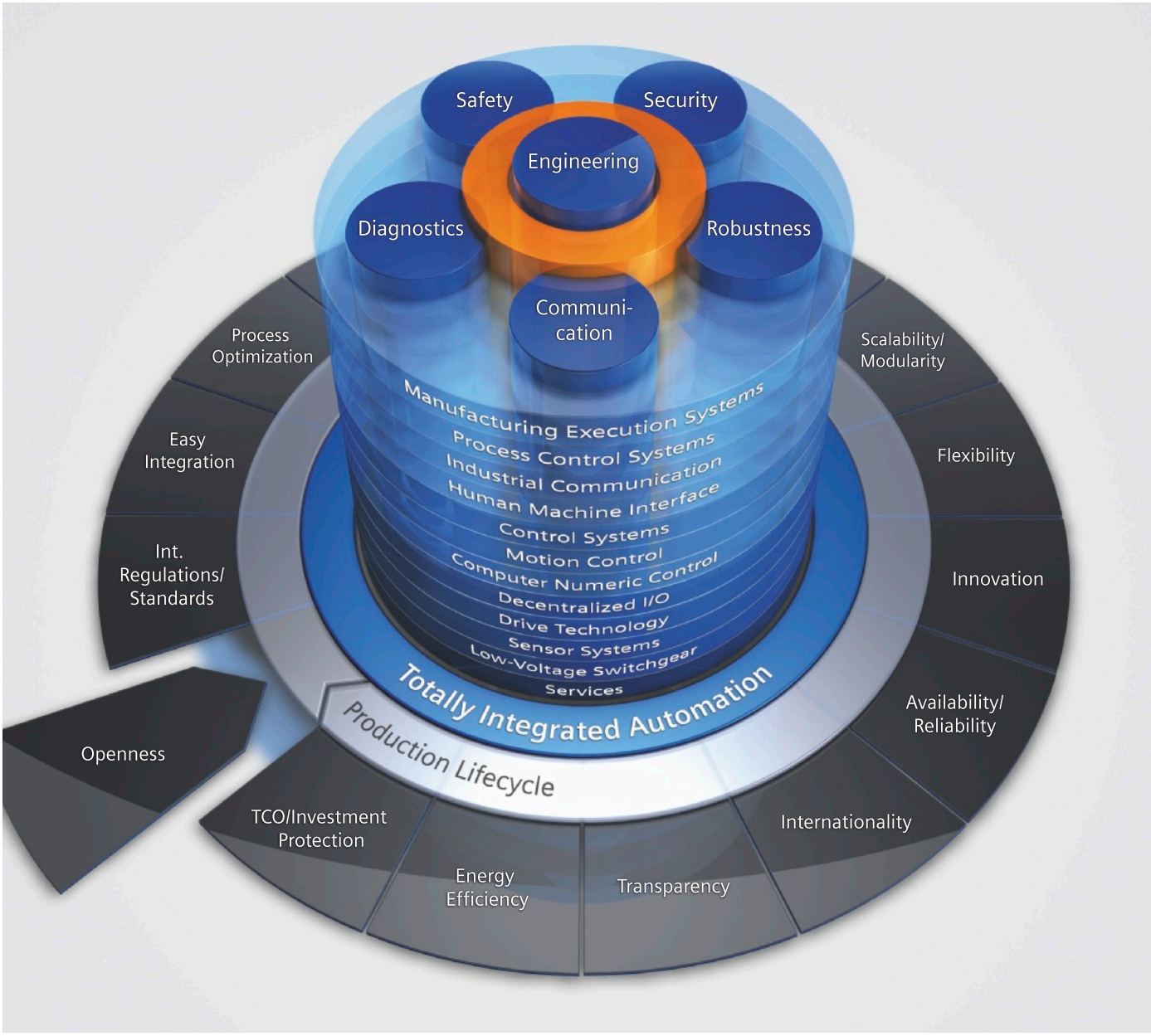
Totally Integrated Automation

Rely on new productivity standards for sustained competitive advantages



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To be able to respond to the increasing international competitive pressure, it is more important than ever to consistently make full use of the potential for optimization – over the complete lifecycle of a machine or plant.

Optimized processes reduce the total cost of ownership, shorten the time to market, and improve quality. This perfect balance between quality, time, and costs is now, more than ever, the decisive success factor in industry.

Totally Integrated Automation is optimally aligned to all requirements and open for international standards and third-party systems. With its six characteristic system features, Totally Integrated Automation supports the complete lifecycle of a machine or plant. The complete system architecture offers holistic solutions for every automation segment on the basis of a comprehensive range of products.

SIMATIC: more efficient and systematic automation

SIMATIC, a core component of Totally Integrated Automation, includes a variety of standardized, flexible, and scalable products – such as the devices of the SIMATIC Controllers portfolio presented in this brochure. Whether you prefer a conventional PLC, an embedded or a PC-based automation solution: Our complete range of SIMATIC Controllers covers solutions for all application areas – and offers the performance capability and flexibility you need.

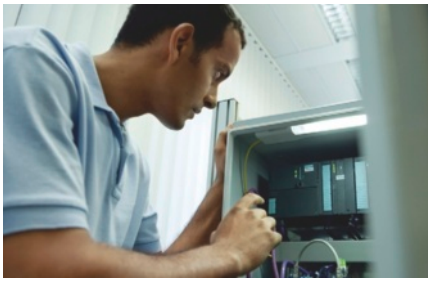
SIMATIC is currently considered to be the global number one in automation. One of the decisive reasons for this is that SIMATIC exhibits the six system features of Totally Integrated Automation:

- Engineering
- Communication
- Diagnostics
- Safety
- Security
- Robustness

In addition, SIMATIC features two additional system features:

- Technology
- High availability

You can find more about the system features and the resulting advantages in the following chapter “System features”.



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System features

The overview

Engineering

Maximum engineering efficiency –
in all phases of the lifecycle of the machine and plant
With SIMATIC you rely on an integrated engineering environment. Efficient software supports you over the complete lifecycle of your machine or plant – from the planning and design stages through configuring and programming as far as commissioning, operation and upgrading. With its integration capability and harmonized interfaces, SIMATIC software supports a high degree of data consistency – throughout the entire engineering process.
Siemens has redefined engineering with its Totally Integrated Automation Portal (TIA Portal). The new TIA Portal engineering framework combines the SIMATIC STEP 7, SIMATIC WinCC and SINAMICS StartDrive automation software tools in a unique development environment.

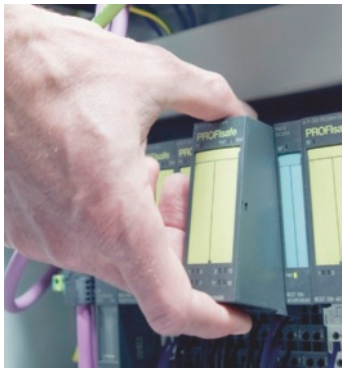
Communications

Maximum data transparency on all automation levels –
based on proven standards
SIMATIC creates the foundations for unlimited integration in communication – and thus for maximum transparency on all levels, from the field and control level to the operations management level all they way up to the corporate management level. SIMATIC relies on international, cross-vendor standards which can be combined flexibly: PROFINET, the leading Industrial Ethernet standard and PROFIBUS, the global No. 1 fieldbus.

Diagnostics

Minimization of downtimes –
through efficient diagnostic concepts
All SIMATIC products feature integrated diagnostic functions with which a fault can be identified and eliminated to provide increased system availability.
Even with larger plants, the Maintenance Station provides you with a uniform view of the maintenance-relevant information of all automation components.

Safety



Protection of personnel and machines –
within the framework of an integrated complete system
SIMATIC Safety Integrated offers TÜV-certified products, which facilitate compliance with relevant standards: IEC 62061 up to SIL 3, EN ISO 13849-1 up to PL e, as well as EN 954-1. Due to the integration of safety technology in standard technology, only one controller, one I/O, one engineering, and one bus system are required. Thus the system advantages and comprehensive functionality of SIMATIC are also available for fail-safe applications.

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Data security in the networked world – through harmonized, scalable security systems
Due to the increased use of Ethernet connections penetrating the field level, security issues are gaining in importance in industry. For comprehensive protection of a plant, a variety of suitable measures must be implemented. These range from the company organization and its guidelines regarding protective measures for PC and control systems through to protection of automation cells by segmenting the network. Siemens follows the cell protection concept and, with the modules of the SCALANCE series and the Security modules, offers components for building up protected cells.

www.siemens.com/industrialsecurity

Security

Maximum industrial suitability – through increased robustness
Each standard product from the SIMATIC range is characterized by the highest quality and robustness and is perfect for use in industrial environments. Specific system tests ensure the planned and required quality. SIMATIC components meet all relevant international standards and are certified accordingly. Temperature and shock resistance are defined in the SIMATIC quality guidelines, as are vibration resistance or electromagnetic compatibility.
For demanding to extreme rated conditions, special versions such as SIPLUS extreme or special versions of SIMATIC ET200 are available. These include an increased degree of protection, extended temperature ranges, and exceptional environmental stress.

Robustness

More possibilities, less complexity – through integrated technology functionality
Counting and measuring, cam control, closed-loop control, or motion control: You can integrate technological tasks in many different combinations and with various degrees of complexity without a system changeover into the world of SIMATIC – easily, conveniently, consistently. Parameter assignment and programming are implemented in the familiar STEP 7 environment.

Technology

Maximum availability – with integrated high availability concepts
Siemens offers a comprehensive high availability concept to ensure high availability for the entire plant: from the field level to the control level all the way up to the management level. For example, field-tested controllers ensure high availability through bumpless switching with automatic event synchronization.

High availability

www.siemens.com/simatic-system-features

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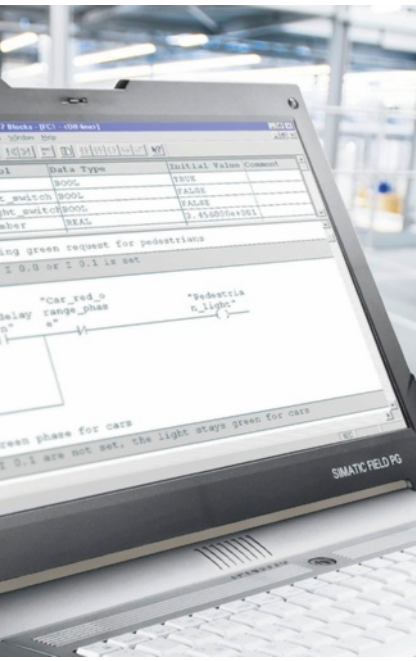
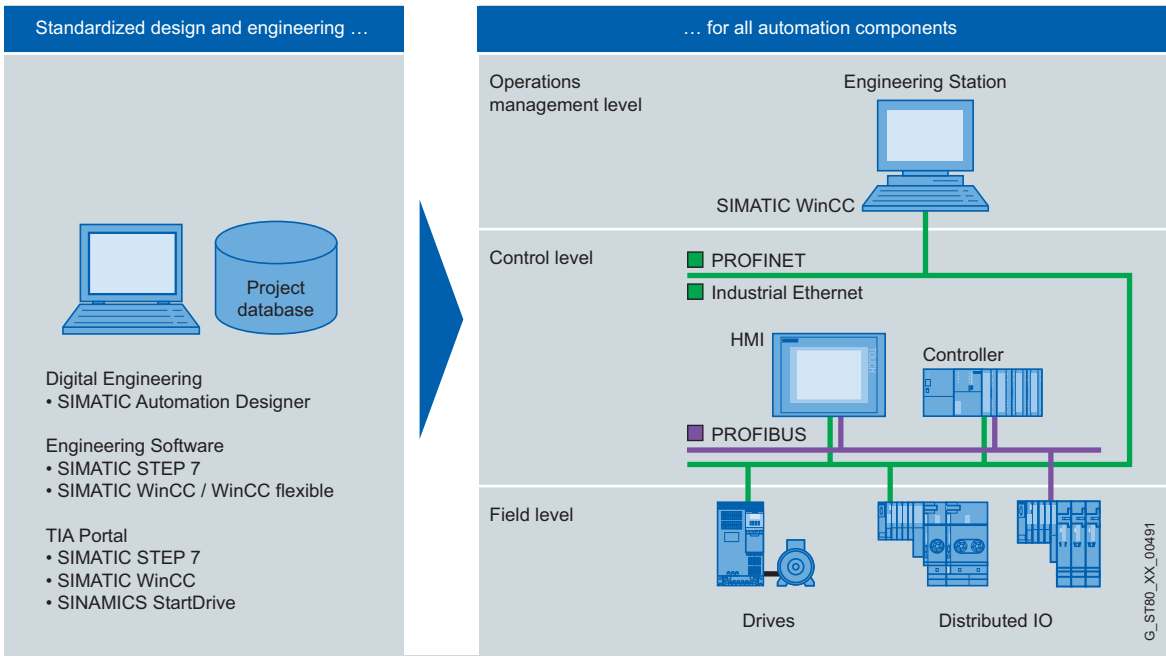
Engineering

Maximum engineering efficiency – in all phases of the lifecycle of the machine and plant





With SIMATIC you rely on an integrated engineering environment. Efficient software supports you over the complete lifecycle of your machine or plant – from the planning and design stages through configuring and programming as far as commissioning, operation and upgrading.
With its integration capability and harmonized interfaces, SIMATIC software permits a high degree of data consistency – throughout the entire engineering process.

Data consistency in the entire project
- Variables only have to be entered and configured in one editor
- Project-wide synchronization

Modularity through blocks
- Program sections and user interfaces can be created modularly as reusable blocks
- Program modules can be loaded into the automation system during operation
- In addition, expansions and changes to the hardware configuration are possible during operation

Shared configuration for the complete automation hardware
- Shared hardware configuration
- Shared network configuration

Open data interfaces
- Third-party components can be incorporated based on GSD/EDD
- Import/export interfaces permit data exchange with third-party software (MS Excel)

Data archiving
- All data, hardware configuration data, programs, user interfaces are saved and archived in one project

Multilingual/internationality
- The user interface of many software packages is available in six languages
- The interfaces of the HMI devices (operator panels) can be created in various languages, – as can the program comments within SIMATIC STEP 7

Standard programming languages
- PLCopen or IEC 61131-3-compliant programming languages
- PLCopen-certified motion control blocks

Siemens has redefined engineering with its Totally Integrated Automation Portal (TIA Portal). The new TIA Portal engineering framework combines the SIMATIC STEP 7, SIMATIC WinCC and SINAMICS StartDrive automation software tools in a unique development environment. With its intuitive user interface, effiient navigation and proven technology, the TIA Portal offers innovative highlights in many areas. It is a milestone in the software development of the future.

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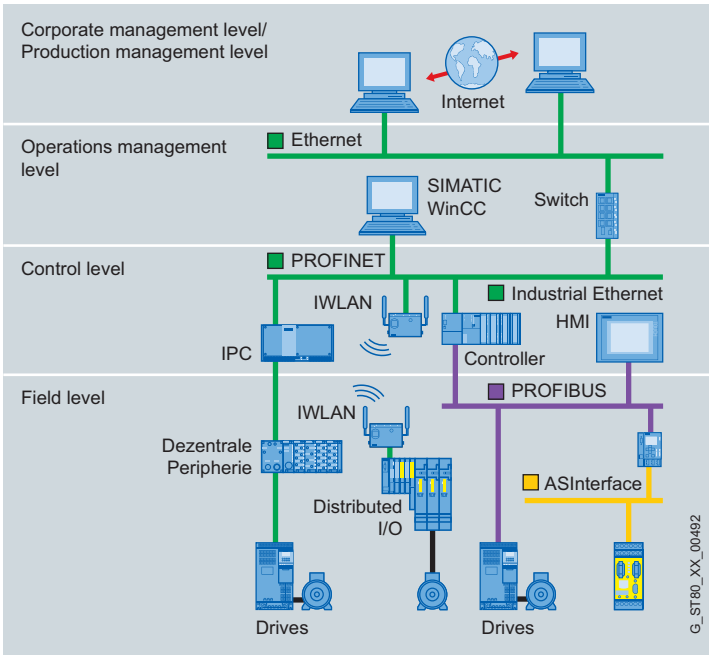
Communications

Maximum data transparency on all automation levels – based on proven standards



With SIMATIC you create the prerequisite for full integration of communication – and thus for maximum transparency from the field and control level via the operations management level all the way up to the corporate management level. SIMATIC relies on international, cross-vendor standards which can be combined flexibly: PROFIBUS, the global No. 1 fieldbus, and PROFINET, the leading Industrial Ethernet standard.
With SIMATIC, relevant information is thus available at any time throughout the plant. This enormously simplifies commissioning, diagnostics, and maintenance – even wirelessly or over the Internet. It is also possible to access the components from anywhere in order to intervene in the process if necessary.

Plant-wide or company-wide data access
- Integrated communications options via all automation levels
  - Management level
  - Operations management level
  - Control level
  - Field level

Flexibility and scalability
- Flexible combination options of the communication standard – without affecting the performance of a system (safety, diagnostics, etc.)
- Implementation of time-critical applications up to isochronous mode

Combinable bus systems
- Existing communications structures can be integrated and/or retained with the CP/Link communications processors (PROFINET, PROFIBUS, AS-Interface, etc.)

Wireless communication
- Support for wireless communication based on Industrial Wireless LAN – even safety functionality is implemented through IWLAN communication

Routing function
- System-wide access to all components – for facilitated commissioning, diagnostics, and remote maintenance

Integration in office applications
- OPC and OPC XML for the connection of office applications
- Web server functionality for access to device information (z. B. diagnostic buffer) from every Internet-ready PC

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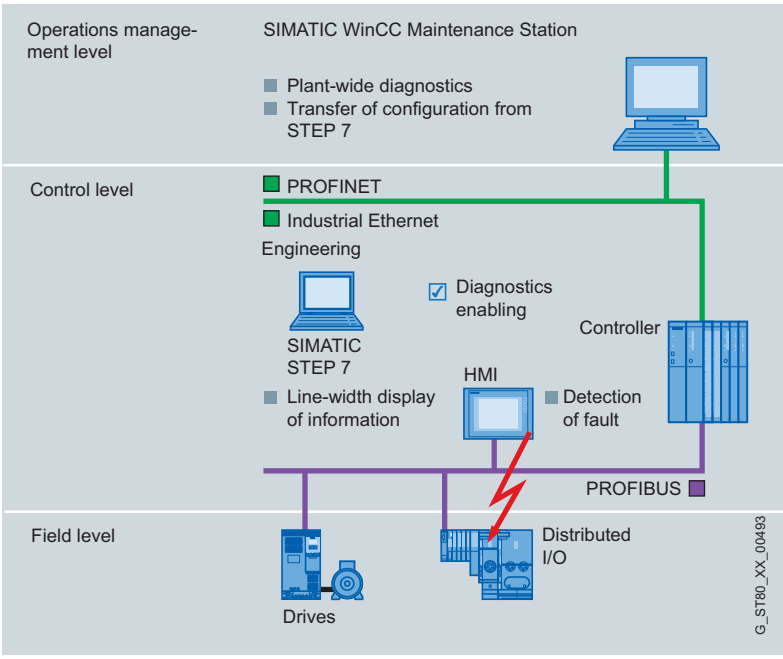
Diagnostics

Minimization of downtimes – through efficient diagnostic concepts



All SIMATIC products feature integrated diagnostic functions with which a fault can be detected and eliminated efficiently to provide increased system availability. Even with larger plants, the Maintenance Station provides you with a uniform view of the maintenance-relevant information of all automation components. This increases Overall Equipment Efficiency (OEE), minimizes downtimes, and saves costs.

Integrated diagnostics

- Totally Integrated Automation offers products and modules with integrated diagnostic function
- Plant-wide system diagnostics for detection and automatic signaling of faults
- Additional messages for monitoring the application/process (process diagnostics) are easy to configure and can be generated automatically

Diagnostics with display of relevant information

- Error text information
- Unique module identification (number)
- Address/slot information
- Chronological time stamp

Diagnostics can be activated, no programming is required

- The diagnostic function of the modules is easily activated in SIMATIC STEP 7
- Message texts are available in five languages
- Predefined message windows/views for visualization on the HMI device

Consistent diagnostics from the field level to the management level

- System states (module and network status, system error messages) are available plant-wide with consistent display.
- Diagnostics displays with different degrees of detail (hierarchy) are automatically generated from configuration data (HW Config)

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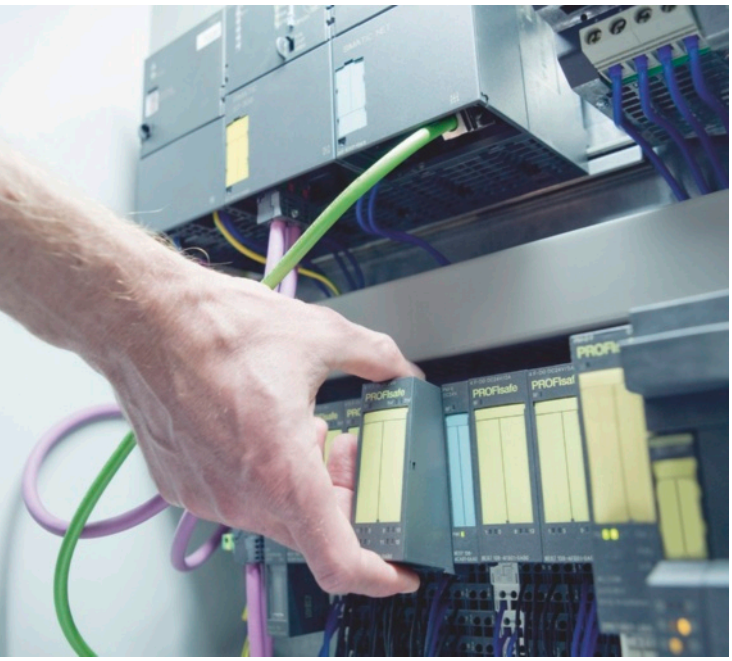
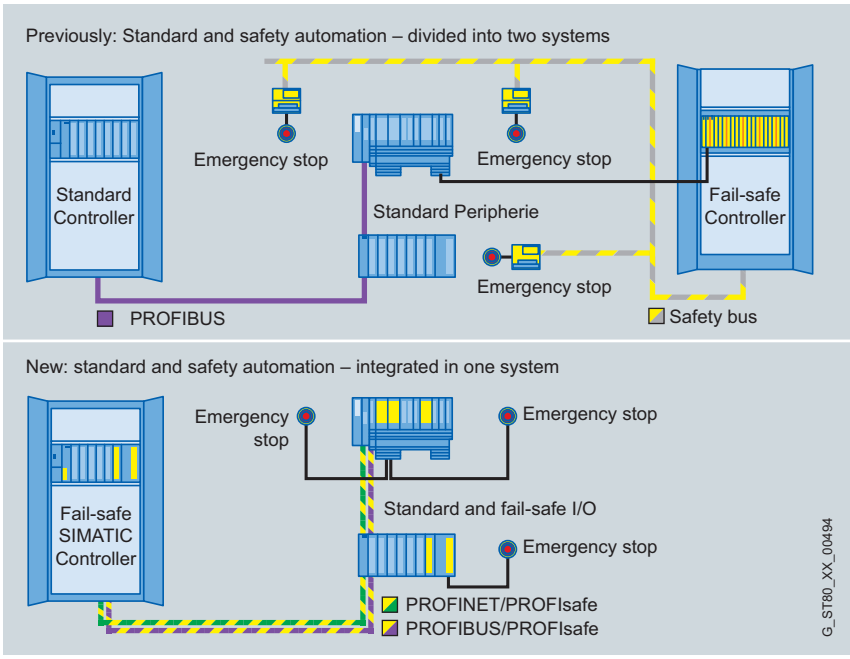
Safety

Protection of personnel and machines – within the framework of an integrated complete system





As a machine builder and plant constructor and operator, you are obliged by law to ensure the safety of personnel and the environment. With Safety Integrated, Siemens offers TÜV-certified products to meet these guidelines and that simplify compliance with relevant standards: IEC 62061 up to SIL 3, EN ISO 13849-1 up to PL e, as well as EN 954-1 up to Cat. 4.
In the spirit of Totally Integrated Automation, safety-related functions are integrated into standard automation with Safety Integrated. Thus Siemens offers a complete and integrated safety program – from detection to evaluation to reaction.
One of the cornerstones is SIMATIC Safety Integrated – the fail-safe control system. By integrating safety into standard technology, only one controller, one I/O, one engineering, and one bus system are required. Thus the system benefits and comprehensive functionality of SIMATIC are also available for fail-safe applications.

The result: A significant reduction in engineering overhead and the number of hardware components.

One controller for Standard and Safety
- Comprehensive self-tests and self-diagnostics of the fail-safe SIMATIC Controllers
- Simultaneous processing of the standard and safety program on one controller

Mixed configuration of I/O
- Space-saving setup thanks to the combination of fail-safe modules and standard modules in one station

Uniform engineering
- SIMATIC STEP 7 Safety Advanced is the seamless integration of safety into the TIA Portal. All configuration and programming tools required for generating a safety-oriented program are integrated into the STEP 7 user interface and use a common project structure.
- Programming as needed with ready-made, TÜV-certified, or user-created blocks

Fail-safe communication
- Fail-safe communication over the global proven communication standards PROFINET or PROFIBUS, with the PROFIsafe profile
- Innovative approaches such as wireless fail-safe communication over IWLAN (Industrial Wireless LAN) and PROFINET – e.g. using the SIMATIC Mobile Panel 277F IWLAN with integrated safety function

Diagnostic function
- Identical system diagnostics of safety modules and standard components: Uniform function, display, parameterization as well as easy activation of the diagnostic function without programming

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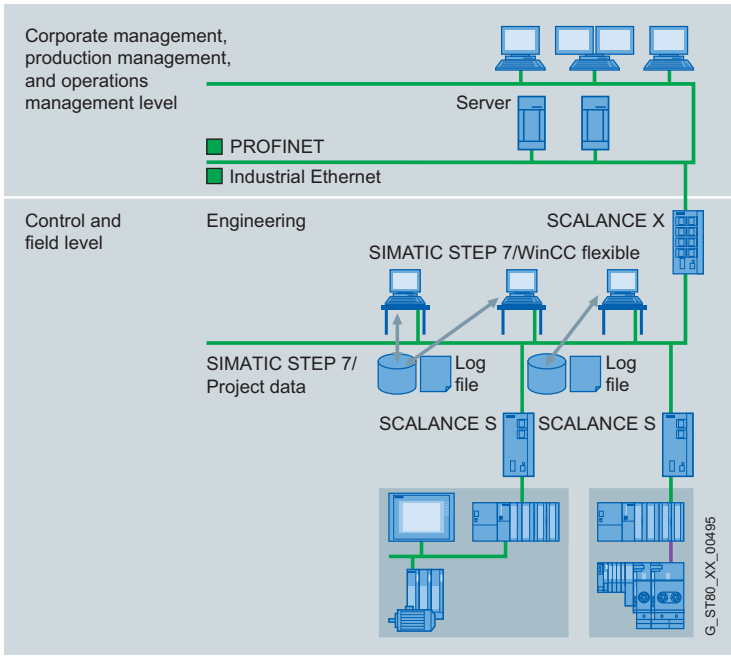
Security

Data security in the networked world – through matched, scalable security concepts



Due to the increased use of Ethernet connections penetrating the field level, security issues are gaining in importance in industry. For comprehensive protection of a plant, a variety of different measures must be implemented. These range from the company organization and its guidelines regarding protective measures for PC and control systems through to protection of automation cells by segmenting the network. Siemens follows the cell protection concept and, with the modules of the SCALANCE series and the Security modules, offers components for building up protected cells.

With the SCALANCE S device family or the SOFTNET Security Client, firewall functions, access protection, encryption, VPNs, etc. can be implemented very easily – to protect plants and machinery. With SIMATIC Logon, the engineering or control system is extended with a user administration function, with which plant personnel can be assigned role-based access rights to control machinery or plants.

Total protection of plants, machinery, and expertise:
- Low administrative effort without IT expertise
- Support for relevant IT security standards such as firewalls, VPN, WEP, WPA

Security architecture on every level:
Defense in Depth
- Physical separation and access protection
- Levels can function autonomously
- Clearly defined and monitored access points between levels

Uniform user administration (Single Logon)
- Uniform user management for secure authentication of the user

You find further information about the topic of Industrial Security on the Internet under **www.siemens.com/industrialsecurity**.

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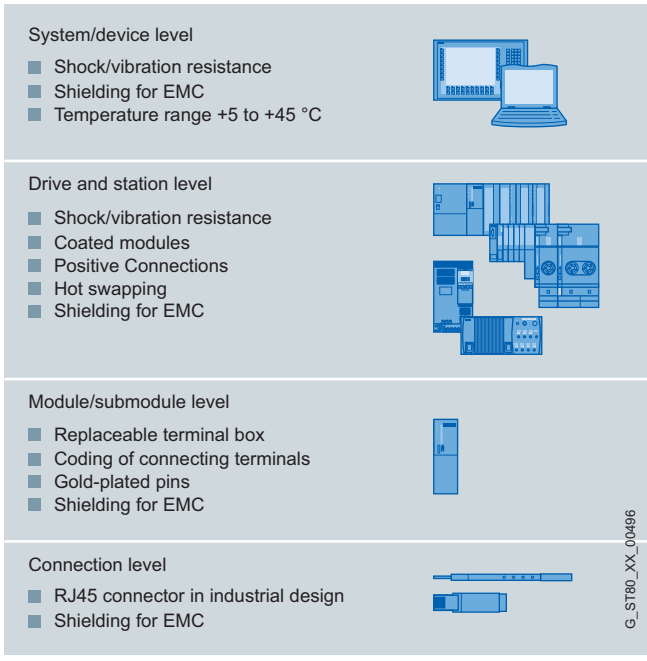
Robustness

Maximum industrial suitability – through increased robustness



With any standard product from the SIMATIC range, you rely on maximum quality and robustness – perfect for use in industrial environments. Specific system tests ensure the planned and required quality of each individual component. For example, SIMATIC IPCs undergo more than 50 tests to ensure industrial compatibility.

Of course, SIMATIC components meet all relevant international standards and are certified accordingly. Sensitivity to temperature, shock and vibration are defined in the SIMATIC Quality Guidelines as well as EMC resistance and versions for use in hazardous areas.
The SIMATIC ET 200 range also includes standard products with IP67 degree of protection which are dustproof and protected from temporary submersion.

For industrial applications with difficult to extreme conditions, specially designed SIPLUS extreme modules based on the SIMATIC spectrum, for example SIMATIC ET 200, are available. SIPLUS extreme components are suitable for use in expanded range of ambient temperature as well as in corrosive environmental conditions, salty ambient air, condensation and deposits of dust. This enables their use in harsh industrial environments or outdoors, without the need for additional precautions such as enclosures or air conditioning.

Suitable for industry – even under difficult operating conditions

- An integrated range of products for all industrial application areas and extremely rough conditions
- Maximum robustness at all levels of automation and for all applications: from field devices to control units to operator panels
- Can be used direct on the machine or close to the process – even without a control cabinet, i.e. without requiring installation and wiring

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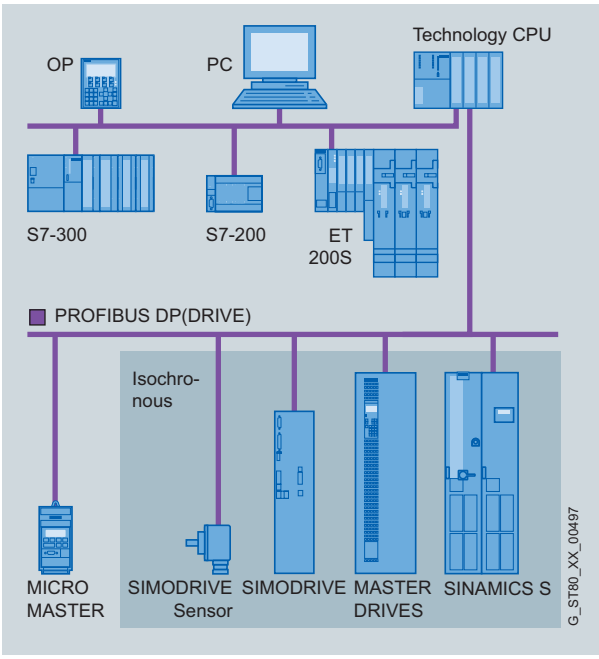
Technology

More possibilities, less complexity – through integrated technology functionality



Counting and measuring, cam control, closed-loop control, or motion control: You can integrate technological tasks in many different combinations and with various degrees of complexity without a system changeover into the world of SIMATIC – easily, conveniently, consistently.

Thanks to maximum freedom and scalability when choosing a software or hardware-based solution, SIMATIC Technology allows the effective implementation of technological functions at an excellent price-performance ratio. Parameter assignment and programming are implemented in the familiar STEP 7 environment.

For example, in technology controllers, the PLCopen-certified motion control modules are integrated in a standard S7-300 CPU. They are therefore especially suited for coupled motion sequences of multiple axes. The isochronous PROFIBUS ensures maximum precision of fast processing operations.

Integrated technology functions

- CPU/STEP 7-integrated functions – for compact machines with few axes and counter/control channels
- Loadable, software-based function blocks – for flexible implementation on almost all SIMATIC hardware platforms
- ET 200S modules – distributed solutions through intelligent I/O modules
- Parameterizable function modules – for high demands on accuracy and dynamic response
- Technology controllers – Solution to comprehensive motion control tasks with high performance
- Freely-configurable application modules and closed-loop control systems – for very complex technology tasks with highest performance

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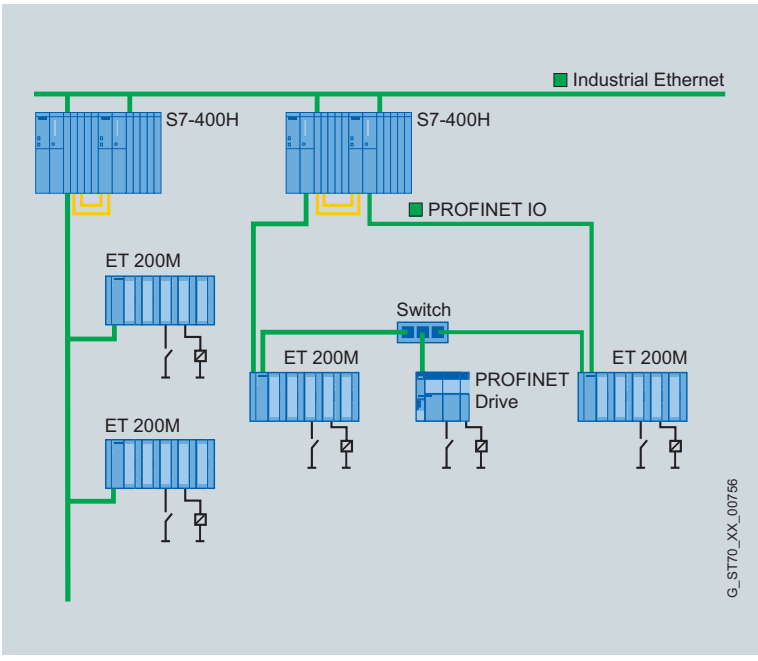
High availability

Maximum availability – with integrated high availability concepts



Downtimes in automation systems can lead to complicated re-start procedures, which cripple entire processes and production sequences and can result in very high costs – in any industry. Risk factors such as power outages, water damage, fire outbreaks, or lightning strikes, but also system failures or operator errors, can significantly affect the operation of a plant.
For high plant availability, Siemens offers a comprehensive high availability concept for the whole plant and on all levels of automation. This helps prevent the high cost of downtime. For example, field-tested controllers ensure high availability through bumpless switching with automatic event synchronization. Where necessary, the controllers can even be up to 10 km apart.

High availability options

- Interruption-free operation due to redundant controllers
- Redundant I/O – for a loss-free signal transfer from the field devices to the control system
- Redundant servers – for complete integrity of plant data; redundant archive servers can also be implemented
- Fault-tolerant fieldbuses – for reliable communication from the field devices to the controller via distributed I/O

Efficient programming and configuring of scalable solutions

- Highly efficient solutions – with scalable performance and flexibly adjustable degree of high availability
- Easy integration of safety functions
- Simple programming and configuration in the familiar STEP 7 engineering environment

Advantages in operation

- Problem-free exchange of all components during operation
- Changes to configuration during operation
- Highest system availability with early fault detection and integrated diagnostic capabilities
- No data loss in the event of failure – thanks to the event-driven synchronization of the controllers and redundant servers

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SIMATIC Controllers

Introduction

Automation with SIMATIC Controllers

You need optimal solutions for every application area to enable you to automate your machines and plants economically and flexibly This applies in plant construction and mechanical equipment manufacture as much as in the production or process industries and in one-off production or standard production.
The answer is: SIMATIC Controllers.

Your objective: Staying ahead of the competition

Markets are on the move more than ever and product life cycles are getting shorter all the time. You as a plant builder or mechanical equipment manufacturer are faced with continuously increasing demands, such as higher production performance,
compliance with safety guidelines, and optimization of diagnostics as well as service and maintenance friendliness - for all machine sizes and versions. You increase the productive power of your machines either by reducing the machine cycle times or by equipping your machine with new functions. In response to the competition, you must also minimize your development and production costs – as well as your development and delivery times.

Highlights

- More productive performance thanks to high-speed CPUs – even for complex computing and communication functions
- Problem-free implementation of additional functions such as technology functions for motion control, acquisition and intermediate archiving of quality data, or the connection of a higher-level MES system
- More flexibility through open automation on rugged industrial PCs
- More compact machines thanks to smaller controller dimensions, a host of integrated functions, and cabinet-free operation
- Reduction in time-to-market thanks to efficient engineering software, optimal integration with Totally Integrated Automation and user programs that are easy to reuse on all SIMATIC Controllers
- Time and cost savings during installation and at startup thanks to distributed automation
- Compliance with high safety requirements with only one system for standard and safety applications
- Higher machine and plant availability thanks to fault-tolerant configurations and powerful diagnostics functions
- Fit for global use thanks to comprehensive SIMATIC support and service in over 190 countries worldwide

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Our offer:
The power you need

SIMATIC Controllers are an essential component of Totally Integrated Automation. The extensive range of products makes it possible to find the right solutions for the most diverse application areas – in cost-sensitive standard production as well as in plant building and special mechanical equipment manufacture, where reduction of the engineering and startup costs plays a crucial role.

You benefit as a result of the
The best possible equipment for all requirements

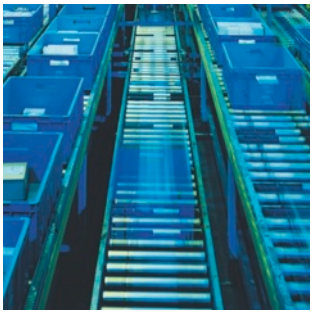
SIMATIC Controllers are a safe investment for the future: They enable you to respond promptly, flexibly and economically to new challenges.

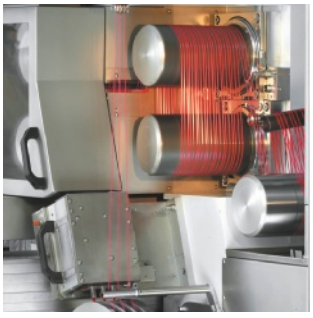
Innovative and compatible

Continuous innovation guarantees sustained market success for your machines and plants. And these innovation steps become easier if you can exploit previous investments for new machine generations too.

For this reason, we develop the SIMATIC Controllers continuously and compatibly – always keeping your current user requirements in view.

Siemens has been developing and manufacturing programmable controllers for 50 years. This long experience is reflected in the SIMATIC S7. Well over a million of the latest generation of innovative controllers are already in use around the world.





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Product range

The individual desires of your customers are your priority. To meet this priority, you must also be able to adapt the automation system quickly to the most varied requirements and machine versions. With SIMATIC
Controllers, you always achieve the necessary degree of flexibility.

Whether you want open-loop control "only", or you also want to cover other additional automation applications such as visualization, technology or data archiving – we always have the right solution for you! And with a unique level of integration in engineering, communication and diagnostics.

Our SIMATIC Controllers are based on different hardware and software architectures. You have a free choice among different designs and different CPU performance classes.

You can run your user programs on the different but mutually compatible device types without costly adaptation. This saves programming overhead and familiarization time. You thus secure your software investments, and at the same time, you can respond flexibly to the most varied market requirements.

SIMATIC Modular Controllers

Description

The SIMATIC Modular Controllers have been optimized for control tasks and specially designed for ruggedness and long-term availability. They can be flexibly expanded at any time using plug-in I/O modules, function modules, and communication modules. Depending on the size of the application, the right controller can be selected from a wide range according to performance, quantity frameworks, and communications interfaces. The modular controllers can also be used as fault-tolerant or fail-safe systems.

Advantages

- Ready to use
- Long-term compatibility and availability
- Can be used in harsh environments
- Modular expandability and scalability
- Vibration-resistant
- Maintenance-free

Fields of application

- Control with centralized and distributed I/O
- Technological tasks
- Fault-tolerant control
- Fail-safe control

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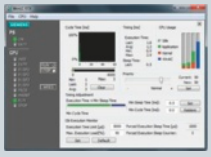
Application	SIMATIC Modular Controllers	SIMATIC PC-based controllers
Ruggedness	●	● (scalable from the office PC through to the rugged embedded IPC)
Spare parts availability (from date of discontinuation)	10 years	5 years
Faster restart after mains failure	●	
Faster program processing	Scalable	Limited by the PC platform only
Safety	●	●
Several automation disciplines on a single platform		●
Integration of high-level languages (C/C++/C#/Visual Basic)		●
Database		●

SIMATIC PC-based controllers



Description

SIMATIC PC-based controllers use the real-time-capable software controller WinAC RTX or its fail-safe version WinAC RTX F on the basis of Windows operating systems. Any PC applications, operator control and monitoring tasks, as well as technological functions can simply be combined here to form an overall automation solution. Thanks to their especially rugged design and pre-installed, ready-to-use automation software, the SIMATIC embedded bundles allow the advantages of PC-based Automation to be used at the machine.

Advantages

- Flexible in use
- Open in hardware and software configuration
- Use of existing PC resources
- Benefiting from constant PC innovations
- Multifunctional
- Customer-specific PC versions
- Embedded bundles
  - Ready to use
  - Rugged
  - Maintenance-free

Fields of application

- Control, operator control and monitoring
- Technological tasks
- Data acquisition and archiving
- Link to PC hardware and software
- Integration of C/C++ programs
- Data exchange via OPC
- Fail-safe control

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Product range

SIMATIC Modular Controllers		
LOGO! Logic module for switching and controlling	■ Simple automation in industry, trade and utility building as a replacement for mechanical switchgear ■ Simplest possible programming with LOGO! Soft Comfort More information about LOGO! at: **www.siemens.de/logo**	
SIMATIC S7-1200 Modular, compact controller for discrete and stand-alone automation solutions	■ Scalable and flexible design for compact solutions ■ Integrated Industrial Ethernet/PROFINET interface for programming, I/O and HMI connection and CPU-to-CPU communication ■ Integrated technology functions for counting, measuring, closed-loop control, and motion control ■ Simple and efficient programming with STEP 7 Basic	
SIMATIC ET 200 Bit-modular, distributed I/O system with local intelligence	■ Design with degree of protection IP20 (in the control cabinet) and IP65/67 (without control cabinet) ■ Module replacement during operation ■ Fail-safe version ■ Maintenance-free thanks to data retentivity on Micro Memory Card*)	
SIMATIC S7-300 The modular controller for system solutions in the manufacturing industry	■ Compact design, mounting on DIN rail ■ Many functions are integrated into the CPU (I/O, technology functions, PROFIBUS/PROFINET connection) ■ Maintenance-free thanks to data retentivity on Micro Memory Card*) ■ Isochronous mode on PROFIBUS and PROFINET ■ Fail-safe versions ■ Fail-safe technology controller	
SIMATIC S7-400 The powerful controller for system solutions in the manufacturing and process industries	■ Rack system with various rack types ■ Extremely high-speed processing and communications performance ■ Changes to the configuration during operation ■ Isochronous mode on PROFIBUS and PROFINET ■ Fail-safe and fault-tolerant versions (H-CPUs now also with PROFINET) **NEW** ■ Hot swapping	

*) without battery

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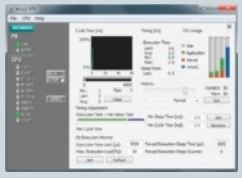
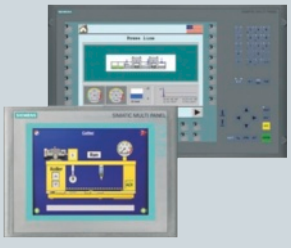
SIMATIC PC-based controllers		
SIMATIC WinAC RTX (F) Software controller – open, flexible and reliable	■ Software controller – real-time capable and deterministic ■ PC-based automation for high-performance applications ■ Flexibility through integration of customized, technological functions ■ Fail-safe version ■ Programming as for SIMATIC S7 with STEP 7 ■ Isochronous mode on PROFIBUS and PROFINET	
SIMATIC S7 modular embedded controller Embedded controller in S7-300 design with software controller and runtime visualization software	■ Fanless and diskless S7-300 design ■ Modular expansion with central S7-300 I/O modules, PC interface modules and PCI-104 module ■ Fail-safe version ■ Standard PC interfaces integrated ■ Data retentivity through non-volatile retentive memory	
SIMATIC Embedded Box PC bundles Turnkey, rail-mounted PC with software controller and runtime visualization software	■ Fanless and diskless Embedded Box PC ■ Available as Microbox PC or Nanobox PC ■ Fail-safe version ■ Standard PC interfaces integrated ■ Data retentivity through non-volatile retentive memory	
SIMATIC Embedded Panel PC bundles Turnkey Panel PC with software controller and runtime visualization software	■ Fanless and diskless Panel PC ■ Available as Panel PC or Nanopanel PC ■ Fail-safe version ■ All-round IP65 degree of protection for mounting directly onto a support arm ■ Operator input using touch screen or membrane keyboard ■ Standard PC interfaces integrated ■ Data retentivity through non-volatile retentive memory	
Software controller for Multi Panels		
SIMATIC WinAC MP for Multi Panels Software controller for Multi Panels	■ Control, operation and monitoring on a well-proven and extremely rugged Windows CE platform in real-time ■ Operation via touch screen, membrane keyboard or separate control units, e.g. Thin Client ■ Data retentivity through integrated MRAM	

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Shared functions – communication

Connection to all standard bus systems

Connection of field devices to the controllers is supported by AS-Interface, PROFIBUS DP, and PROFINET IO. For this purpose the controller can be connected either via the interface integrated on the CPU or using special communication processors (CPs). Transitions between bus systems are implemented by means of gateways, e.g. IE/PB Link PN IO.

Data exchange with other programmable controllers or intelligent partners (PCs, computers, etc.) is implemented via MPI interface, PROFIBUS or Industrial Ethernet. The MPI interface on each CPU allows on the one hand, simple cyclic data exchange (without acknowledgement) and on the other hand, programmed exchange of larger data volumes (with and without acknowledgement).

For simple communications functions such as connecting printers, scanners or third-party devices, point-to-point connections via CPs are used (not with WinAC MP).

Interfaces integrated direct into the CPUs enable you to set up a powerful communication landscape using common bus technology, for example HMI and PG functions. There are sufficient resources for connecting a large number of HMI devices. With the help of a routing function, a programming device connected to any point on the network can reach all nodes on that network.

CPUs with integral PROFINET interface on the S7-300/400 are predestined for Component Based Automation as well as for programming and HMI over Industrial Ethernet. They also allow the control of distributed field devices connected direct to Industrial Ethernet. Dispensing with the otherwise necessary communications processor results in lower procurement costs and other space benefits.

Communications interface modules can be used optionally in some S7-400 CPUs in order to adapt these to the requirements of the application in hand. By plugging such interface modules into the free slots of the CPU, additional DP lines can be established as master or slave.
Their functionality corresponds to that of the integral interface.

The distributed I/O is configured, like the centralized I/O, with STEP 7, thus saving engineering overhead. PROFIBUS and PROFINET also allow parameterization and optimization of field devices during operation, resulting in shorter machine retooling times. Detailed device diagnostics additionally reduce plant downtimes.

PROFINET/Industrial Ethernet	
Industrial Ethernet (IEEE 802.3)	– the industrial standard based on the international Ethernet standard
PROFINET (IEC 61158/61784)	– the open Industrial Ethernet standard for automation
Industrial Wireless LAN (IEEE 802.11)	– the industrial standard for wireless communication based on the international standard
PROFIBUS	
PROFIBUS (IEC 61158/61784)	– the international standard for the field level is the global market leader among fieldbus systems
AS-Interface	
AS-Interface (IEC 62026-2/EN 50295)	– the international standard which, as an economical alternative to the cable harness, links sensors and actuators by means of a two-wire line
IO-Link	
IO-Link	– the standard for intelligently connecting sensors and actuators from the field level to the MES level

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PROFINET – the open Industrial Ethernet standard

Integrated communication from the field level up to the control level is currently one of the most important demands placed on automation.

Standardized connection systems, uniform network management, IT access mechanisms and comprehensive diagnostics facilities mean that savings can be expected in all phases of planning, commissioning and operation.

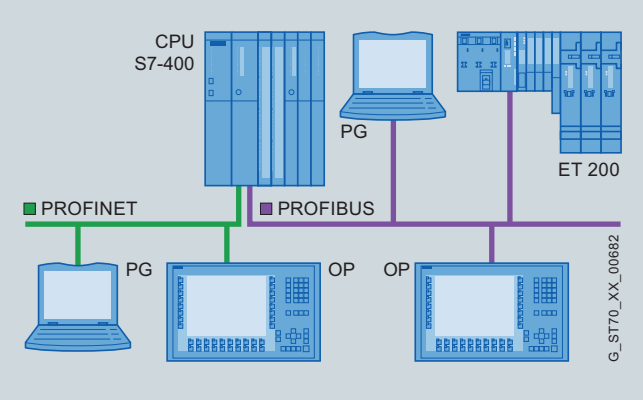
The advantages provided by rugged fieldbuses and by the standardized IT functionality of Industrial Ethernet should be utilized for uniform communication.

PROFIBUS International (PI) has defined PROFINET as a universal standard which opens up new facilities for the field level:
- IT integration
- Distributed automation
- Utilization of Industrial Wireless LAN
- Real-time
- Transfer of large volumes of data

PROFINET (in accordance with IEC 61158 / 61784) is the open Industrial Ethernet standard for industrial automation and uses the TCP/IP standards.

PROFINET enables the implementation of distributed automation structures, the integration of simple distributed field devices on Industrial Ethernet, and the operation of isochronous motion control applications. Applications based on PROFIBUS can be integrated via a proxy.

Apart from the time-critical input/output communication, PROFINET also allows standard TCP/IP communication on the same line. Both the CPUs with integrated PN interface and the communication processors support this functionality.



Integrated interfaces of the S7-400 CPUs for direct connection to PROFINET and PROFIBUS DP (PG = Programming device, OP = Operator panel)

A fast start-up (FSU) of PROFINET IO Devices within < 1 second at SIMATIC controllers permits swift changeover of machine tools, e.g. on robots in the automotive industry.

IO Devices can be replaced easily without programming devices or removable media thanks to centrally stored topology information (i.e. no memory card required for IO devices).

This default setting of a desired topology allows the automatic startup of IO configurations. This enables standard machines, for example, to be put into service faster and more easily.

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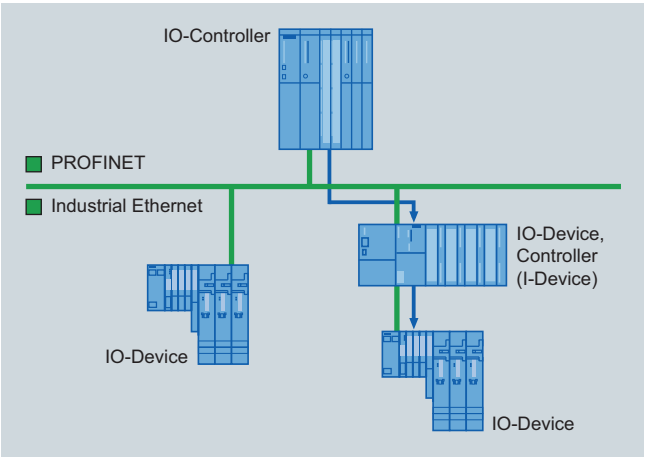
PROFINET innovations

PROFINET has been expanded with several innovative features. These simplify the system configuration, in fail-safe applications for example, and support a leaner and more flexible topology in many different scenarios.

The function **I-Device (Intelligent IO-Device)** supports quicker and easier controller-to-controller communication through direct access to the IO address image with PROFINET IO protocol. Local controllers, such as the ET 200S CPU, can for example be integrated into modular machines or safety applications more easily.

The function **Shared Device** enables two controllers to access the same PROFINET IO-Device, a distributed ET 200 station, for example. Fewer remote devices will have to be installed in the field, so the engineering, wiring and installation costs can be reduced. The modules can be flexibly assigned to one of the two CPUs.

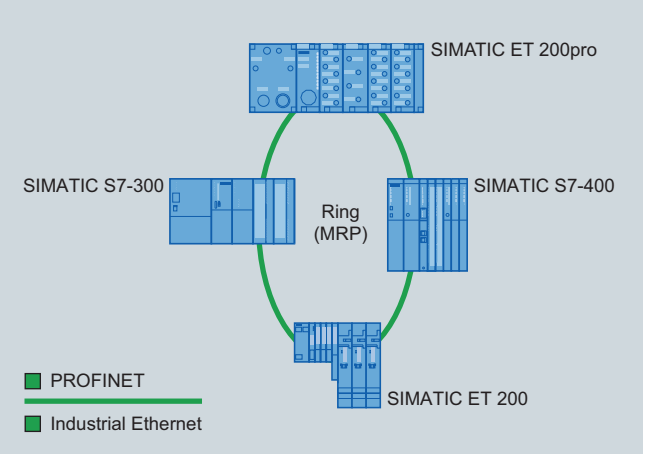


I-Device makes the modular controller and the topology leaner and more flexible.

A CPU operating as an I-Device also supports the Shared Device function, i.e. two transfer areas can be configured in the I-Device CPU for exchanging data with two controllers. One CPU can be an I-Device and IO-Controller at the same time.

PROFINET systems with the innovative profile **PROFIenergy** are able to control power consumption. They can be configured to switch off during production interruptions automatically and coordinated, and to switch on again when production is restarted, in the correct sequence, in the correct time intervals, reliably and plant-wide.

Higher plant availability can be achieved using a ring topology and the **Media Redundancy Protocol (MRP)**. This operates directly via the integrated PROFINET ports on SIMATIC controllers and ET 200 IO stations and can be used with or without Industrial Ethernet switches.



Ring topology with Media Redundancy Protocol (MRP)

PROFINET with IRT and isochronous mode supports high-speed, deterministic communication in which the different cycles of a system (input, remote station, network, CPU processing and output) are synchronized, even with TCP/IP communication operating in parallel. Highly accurate, dynamic applications can therefore be implemented using SIMATIC (also see page 27).

User-defined web pages

All PROFINET CPUs have a web server which enables the user to create application-specific web pages. These can enhance production start-up, because process values can be displayed and very easily changed. Special diagnostic parameters and machine parameters are managed on the web server of the CPU where they are accessible for service purposes quickly, easily and without the need for engineering tools.

Network topology as a web display

Apart from the system diagnostics, the automatically generated network topology is also displayed on the web server of the CPU online. Without the need for a special engineering tool, the physical connections and their status are displayed. The network topology is easy to access through this web display for service and maintenance purposes, which reduces downtime and increases productivity.

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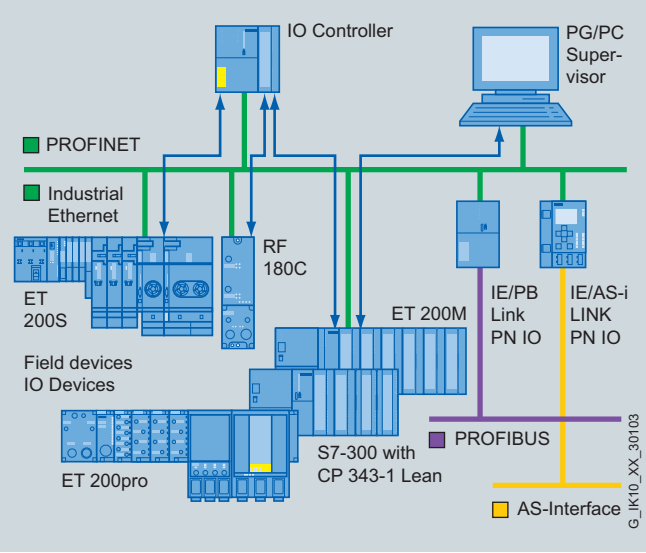
PROFINET IO

PROFINET IO is used to directly connect distributed field devices to Industrial Ethernet. Using the proven PROFIBUS configuration method with STEP 7, these field devices (IO devices) are assigned to a central controller (IO controller). Existing modules or devices can continue to be used with PROFINET-capable interfaces or links, thus safeguarding investments. An IO Supervisor serves HMI and diagnostics purposes (overview and detailed diagnostics). The following products, which can configured with STEP 7, are available for this:

- Interface module for connecting ET 200M, ET 200S, ET 200pro and ET200eco PN as IO-Device directly to PROFINET.
- CPU modules as IO Controllers, in order to edit process signals and connect field devices directly to PROFINET:
  - CPUs of the S7-1200
  - CPUs of the S7-300
  - CPUs of the S7-400
  - CPUs of ET 200S and ET 200pro
  - WinAC RTX
  - PC-based Automation bundles with WinAC RTX (S7-mEC, IPC227D/IPC427C, IPC277D/HMI IPC477C)



PROFINET IO: Distributed field devices to Industrial Ethernet

- Communications processors (CPs) expand S7-300/-400 with additional Industrial Ethernet/PROFINET interfaces, with a Gigabit Ethernet connection to higher-level networks, as well as with additional communication and safety functions (security functionality, e.g. access list, FW, VPN).
- IE/PB Link PN IO or IWLAN/PB Link PN IO as PROFINET proxy for connecting existing PROFIBUS devices transparently to PROFINET as IO Devices.

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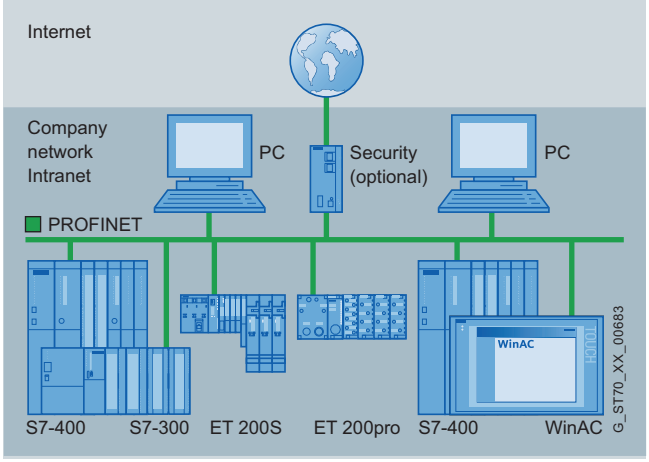
Shared functions –
Integrated web server for diagnostics from any location

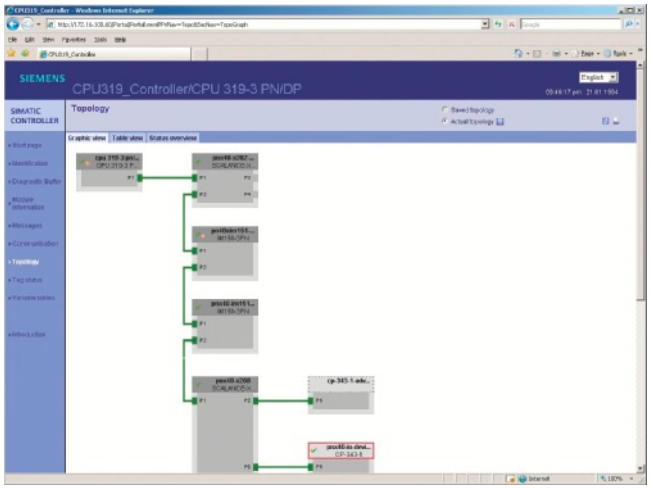
SIMATIC S7-300/-400 and WinAC RTX (F) controllers with an integrated PROFINET interface offer web server functionality and permit diagnostics from any location via the Industrial Ethernet network. Any web clients such as PCs, Multi Panels or PDAs can use a standard Internet browser and have read-access to the module data, program data and diagnostics data of a PN-CPU that functions as a server for the web pages. CPUs can then be accessed without STEP 7 installed. Diagnostics or remote servicing of a machine or plant can also be implemented via the Internet depending on the respective IT infrastructure of the company.



Access via Industrial Ethernet network to PN CPU with web server

The following diagnostic information, for example, can be called up via the network:

- Module identification of CPU
  (e.g. station name, module name, order number, firmware version)
- Operating status of the CPU
  (e.g. status of the mode selector switch)
- Diagnostics buffer of CPU with plain text entries
- Tag status and tag tables configured in STEP 7
- Module status
  (status of the station, e.g. modules in the rack and nodes connected via bus)
- Configured plain text messages
  (signaling of system error)
- Ethernet parameters and statistics
  (IP address, MAC address, sent packages)
- Display of the network topology



Graphical topology display in the Internet browser

The web server integrated in the CPU offers the following advantages:

- User-friendly access to diagnostics information of the CPU during start-up and operation from any location. This increases the plant availability and minimizes downtimes.
- No additional hardware or software is required:
  - The web pages are accessible via the integrated PROFINET interface of the CPU.
  - Each standard Internet browser, e.g. Internet Explorer, can display the web pages.
  - User generated pages can also be displayed.
- Optimized display even for Multi Panels and Personal Digital Assistants (PDA) with lower resolution

The web server features a login concept for controlled access via password. When a web-capable CPU is connected to the Internet, e.g. via the corporate network, it must be protected from unauthorized access through a firewall by means of an intermediately connected SCALANCE S6xx module. No programming work is required for using the web server integrated into the CPU: It is activated by a check box in STEP 7 HW Config.

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Isochronous mode

High-speed and precise processing operations

SIMATIC S7-400, S7-300, ET 200S and ET 200pro CPUs as well as WinAC RTX also enable decentralized automation solutions to access the important application area of high-speed processes and to achieve maximum precision.

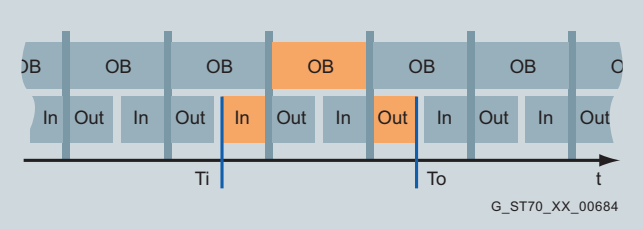
Applications subject to such requirements include:
- Motion Control
- Synchronous operation
- Closed-loop controls
- Software-based cam controllers
- Measuring at several measuring points
- Speed and
- Flow measurement

This makes faster production possible while simultaneously increasing quality. This is all possible thanks to the system function of isochronous mode.

The principle of isochronous mode

This refers to synchronization of signal acquisition and output by means of distributed I/Os, signal transmission over PROFINET or PROFIBUS and program processing with the cycle of the equidistant network. The result is a system which acquires and processes its input signals and outputs its output signals at constant intervals. The SIMATIC controllers thus ensure exact reproducibility and defined process response times, as well as equidistant and synchronous signal processing with distributed I/O devices.

The exact chronological reproducibility of all processes allows even fast processes to be handled safely. A comprehensive range of components which support the isochronous system function is available to solve many applications in the areas of motion control, measuring and controlling.



Distributed automation structure with isochronous, deterministic time characteristics (OB = Organization block)

Features

- The user program is *synchronized* with I/O processing. Synchronized means all processes are coordinated over time, and all input data are acquired at a defined point (Ti). The output data also become effective at a defined point (To). The input and output data are synchronized with the system cycle right up to the terminals. The data of one cycle are always processed in the next cycle.
- The input and output data are processed *equidistantly*. Equidistance means all input data are always read in at the same intervals and output data are always output at the same intervals.
- All input and output data are transferred *consistently*. Consistency means all the data of the process image belong together logically and chronologically.

Features and application of isochronous mode

Features	Application
Actual value acquisition and setpoint output ...	
...**take place synchronously**, that is, simultaneously for all inputs and outputs in order to generate consistent process images.	■ Synchronous applications become more **accurate** since the respective positions are measured simultaneously. ■ Time-linked signals can even be **spatially distributed** using distributed I/O devices, e.g. start signals on multiple assemblies where the time sequence is important. ■ The I/O image is **consistent in itself** thanks to simultaneous acquisition and synchronous transfer. This enables, for example, ratio generation of several analog values (e.g. several pressure values in a press).
...**are equidistant**, that is, always at the same intervals	■ Calculations from the difference of actual values, e.g. with speed measurement or flow measurement. ■ Proportioning operations. ■ Closed-loop control loops can also be connected via distributed I/O.

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Selection guide

	SIMATIC Modular Controllers		
	S7-1200	ET 200 with CPU	
SIMATIC product range			
Brief description	Modular, compact controller for discrete and stand-alone automation solutions	Distributed, modular I/O system with local intelligence	
		With degree of protection IP20	With degree of protection IP65/67
Product range	• 3 compact CPUs	• 3 standard CPUs • 2 fail-safe CPUs	• 1 standard CPU • 1 fail-safe CPU
Spare parts guaranteed for	10 years	10 years	
Temperature range	0 ... 55 °C [1]	0 ... 60 °C [2]	0 ... 55 °C
Performance			
Execution time for bit operation, min.	0.1 µs	0.06 µs	0.05 µs
Memory			
Main memory, max.	50 KB (CPU 1214C)	192 KB [5]	384 KB [6]
Load memory/mass storage, max.	2 MB (CPU 1214C)	Micro Memory Card 8 MB	
Backup, max.	2 KB	Program and data on Micro Memory Card (maintenance-free)	
I/O			
I/O address area, max.	1 024/1 024 bytes	2 048 / 2 048 bytes	2 048 / 2 048 bytes
Centralized - I/O integrated in CPU	●		
- I/O modules on CPU	●	●	●
Distributed - I/O modules on PROFIBUS	●	●	●
- I/O modules on PROFINET	●	●	●
Technology functions			
Loadable function blocks	●	●	●
Basic functions integrated in CPU	●		
Special modules, plugged in centrally		●	●
Technology controllers			
Isochronous mode			●
Safety/availability			
Fail-safety		●	●
Fault tolerance			
Configuration changes during operation (CiR)			
Connection/disconnection of centralized I/O during operation (hot swapping)		●	
HMI functions			
integrated			
PC functions			
C/C++ link			
Data acquisition and archiving	●		
Expandable with PC standard hardware			
Integration of PC standard HW/SW			
Engineering			
Configuration / programming software	STEP 7 Basic V10.5/V11, STEP 7 Professional V11	STEP 7 / STEP 7 Professional	
Programming languages	LAD, FBD, SCL NEW	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	
Configuration of integral HMI functions			
Communications			
MPI		●	●
PtP	● (character-based serial communication)		
AS-Interface	● (via CP with STEP7 V11 SP2)		
PROFIBUS	●	●	●
PROFINET	●	● (PN-CPUs)	●
Others integrated			
Web server	●	● (PN-CPUs)	●

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	S7-300	S7-400
	Modular controllers for system solutions in manufacturing automation in the low to mid-performance ranges	Modular controllers for system solutions in manufacturing and process automation in the mid to upper performance ranges
	• 7 standard CPUs • 7 compact CPUs • 5 fail-safe CPUs • 2 technology CPUs • 1 fail-safe technology CPU	• 10 standard CPUs • 4 fail-safe CPUs • 4 fault-tolerant CPUs (also fail-safe)
	10 years	10 years
	0 ... 60 °C [2]	0 ... 60 °C [3]
	0.004 µs (CPU 319)	0.018 µs (CPU 417)
	2 MB (CPU 319), 2.5 MB (CPU 319F)	30 MB (CPU 417)
	Micro Memory Card 8 MB	Memory card 64 MB
	Program and data on Micro Memory Card (maintenance-free)	Program and data by means of backup battery or program by means of MC FEPROM
	8 192 / 8 192 bytes	16 384 / 16 384 bytes
	● (compact CPU)	
	●	●
	●	●
	●	●
	●	●
	● (compact CPUs)	
	●	●
	● (technology CPUs)	
	●	●
	● (F-CPUs)	● (F/FH CPUs)
		● (H/FH CPUs)
		●
		●
	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional
	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC
	●	●
	●(also via CP)	● (via CP)
	● (via CP)	
	● [4] (also via CP)	● (also via CP)
	● (also via CP)	●(also via CP)
	● (PN-CPUs)	● (PN-CPUs)

[1] As SIPLUS extreme component also for extended temperature range -25/0 ... +55/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or www.siemens.com/siplus-extreme)
[2] As for [1], except temperature range -40/-25 ... +60/+70 °C [3] As SIPLUS extreme component also for extended t temperature range -25/0 ... +60/+70 °C (for further details, see page 102 or www.siemens.com/siplus-extreme)
[4] With technology CPU, also PROFIdrive [5] 256 KB for fail-safe version [6] 512 KB for fail-safe version

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Selection guide

	SIMATIC PC-based controllers			
	WinAC RTX	**S7 modular embedded controllers**	**SIMATIC IPC227D bundles**	
SIMATIC product range				
Brief description	S7 controller as software controller for PC with Windows operating system (Windows XP, Windows Embedded Standard, Windows 7)	Embedded Controller in S7-300 design (fanless, diskless) with Windows Embedded Standard and software controller and HMI	Embedded rail-mounted PC (fanless, diskless) with Windows Embedded Standard, software controller and HMI	
Product range	Software Controller WinAC RTX, fail-safe version of WinAC RTX F (first safety-related real-time software controller worldwide for Windows-based automation solutions up to SIL3, PL e, Cat. 4)	PC-based controller in the following versions: - Pre-installed operating system - Also with WinAC RTX (F) - Also with HMI WinCC flexible/WinAC RTX - Fail-safe	1 hardware platform, fail-safe version, 3 device variants with different expansion possibilities, customized design/ OEM product on request	
Spare parts guaranteed for		5 years	5 years	
Temperature range	PC-dependent	0 ... 50 °C	0 ... 50 °C	
Performance				
Execution time for bit operation, min.	0.004 µs (P 4, 2.4 GHz), PC-dependent	0.004 µs (Intel Core Duo 1.2 GHz)		
Memory				
Main memory, max.	PC main memory [3]	1 GB RAM	1 GB RAM	
Load memory/mass storage, max.	PC mass storage	4 GB CF Card	4 or 8 GB CF Card or 50 GB SSD (SLC)	
Buff, max. (all data with UPS)	All data with UPS [4]	Control data (512 KB SRAM) without UPS, all data with UPS	Control data (128 KB MRAM) without UPS, all data with UPS	
I/O				
Address range for inputs, max.	16 384 bytes	16 348 bytes	16 384 bytes	
Address range for outputs, max.	16 384 bytes	16 348 bytes	16 384 bytes	
Centralized - I/O modules on CPU	● [2]	●	● (via PCIe, ODK)	
Distributed - I/O modules on PROFIBUS	●	● (via CP 5603)		
- I/O modules on PROFINET	●	●	●	
Technology functions				
Loadable function blocks	●	●	●	
Basic functions integrated in CPU				
Special modules, plugged in centrally				
Technology controllers				
Isochronous mode	●	●		
HMI functions				
integrated	● (can be installed on PC)	● (S7-mEC-HMI/RTX)	● (bundle with WinCC RT Advanced)	
PC functions				
Integration of C/C++/C#/Visual Basic	● (via ODK)	● (via ODK)	● (via ODK)	
Data acquisition and archiving	● (very large volumes of data)	● (large volumes of data)	● (large volumes of data)	
Expandable with PC standard hardware	● (PC-dependent)	● (max. 4 x 3 PCI-104 cards)	● (max. 1 PCIe card)	
Integration of PC standard HW/SW	● (via ODK, OPC)	● (via ODK, OPC)	● (via ODK, OPC)	
Engineering				
Configuration / programming software	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional	
Programming languages	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC [5]	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	
Configuration of integral HMI functions		WinCC flexible (optional)	WinCC RT Advanced	
Communications				
MPI				
PtP	● (via CP distributed)	● (via EM PC)	● (via CP distributed)	
PROFIBUS	● (via CP in PC)	● (via CP 5603)		
PROFINET	● (via CP in PC)	●	●	
Others integrated	PC interfaces	Industrial Ethernet, USB	Industrial Ethernet, USB, RS232, DVI-D	
Web server	● [6]	● [6]	● [6]	

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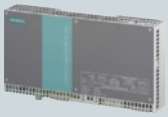
				Software controller for Multi Panels
	SIMATIC IPC427C bundles	**SIMATIC IPC277D bundles**	**SIMATIC HMI IPC477C bundles**	**WinAC MP for Multi Panels**
				
				MP 177/MP 277/MP 377
	Embedded rail-mounted PC (fanless, diskless) with Windows Embedded Standard, software controller and HMI	Embedded Panel PC (fanless, diskless) with Windows Embedded Standard, software controller and HMI	Embedded Panel PC (fanless, diskless) with Windows Embedded Standard, software controller and HMI	Software controller for Multi Panels
	2 hardware platforms (PROFINET, PROFIBUS), each with 3 software versions, fail-safe version, customized design/OEM product on request	Panel PC with 7", 9" and 12" Touch (15", 19" available soon), customized design/ OEM product on request.	Panel PC with 12", 15" and 19" Touch or 12", 15" Key, each with 3 software versions, customized design/OEM product available on request. Additional bundle with IPC477C PRO available with IP65 all-round protection. Also available as fail-safe version.	Standard product for Multi Panels with 6" ... 19" Customized design and OEM product on request
	5 years	5 years	5 years	10 years
	0 ... 50 °C	0 ... 50 °C	0 ... 50 °C	0 ... 50 °C [1]
	0.004 µs (Intel Core2 Solo 1.2 GHz)		0.004 µs (Intel Core2 Solo 1.2 GHz)	
	4 GB RAM	1 GB RAM	4 GB RAM	128 KB / 256 KB / 512 KB
	2, 4 or 8 GB CF Card or 32 GB SSD (SLC)	4 or 8 GB CF Card or 50 GB SSD (SLC)	2, 4 or 8 GB CF Card or 32 GB SSD (SLC)	
	Control data (128 KB SRAM) without UPS, all data with UPS	Control data (128 KB MRAM) without UPS, all data with UPS	Control data (128 KB SRAM) without UPS, all data with UPS	Control data (64 KB MRAM / 128 KB MRAM / 256 KB MRAM) without UPS
	16 384 bytes	16 384 bytes	16 384 bytes	2 048 / 4 096 / 8 192 bytes
	16 384 bytes	16 384 bytes	16 384 bytes	2 048 / 4 096 / 8 192 bytes
	● (via PCI-104, ODK)			
	●	●	●	●
	●	●	●	
	●	●	●	●
	●		●	
	● (bundle with WinCC flexible or WinCC (single-user station or client))	● (bundle with WinCC RT Advanced)	● (bundle with WinCC flexible or WinCC (single-user station or client))	● (Multi Panel)
	● (via ODK)	● (via ODK)	● (via ODK)	
	● (large volumes of data)	● (large volumes of data)	● (large volumes of data)	●
	● (max. 3 PCI-104 cards)			
	● (via ODK, OPC)	● (via ODK, OPC)	● (via ODK, OPC)	
	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional	STEP 7 / STEP 7 Professional
	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC	LAD, FBD, STL, S7-Graph (SFC), S7-SCL (ST), S7-HiGraph, CFC
	WinCC flexible, WinCC (optional)	WinCC RT Advanced	WinCC flexible, WinCC (optional)	WinCC flexible Standard, Advanced
				●
	● (via CP distributed)	● (via CP distributed)	● (via CP distributed)	
	●		●	●
	●	●	●	
	Industrial Ethernet, USB, RS232, DVI/VGA	Industrial Ethernet, USB	Industrial Ethernet, USB, DVI/VGA	Industrial Ethernet, USB, RS232
	● [6]	● [6]	● [6]	

[1] As SIPLUS extreme component also for corrosive atmosphere/condensation (**for further details, see page 102 or www.siemens.com/siplus-extreme**)
[2] Via PC cards and ODK
[3] Non-paged memory
[4] 128 KB with specific SIMATIC IPCs without UPS or WinAC NV 128
[5] With fail-safe version: S7 Distributed Safety, LAD, FBD for fail-safe program
[6] With WinAC RTX 2010

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SIMATIC Modular Controllers

SIMATIC ET 200

SIMATIC ET 200S – the all-rounder with the comprehensive range of products for distributed automation

SIMATIC ET 200S with PROFINET interface and I/O modules

SIMATIC ET 200S is the multifunctional, highly modular I/O system with IP20 degree of protection that can be exactly tailored to the automation task. Thanks to its rugged construction, it can also be used under conditions of high mechanical stress.

Various interface modules are available for interfacing to the PROFIBUS and/or PROFINET bus systems. Interface modules with an integral CPU transfer the computing power of an S7-300 CPU directly into the I/O device. They take the load off the central controller and the fieldbus and facilitate a rapid response to time-critical signals.

The interface modules with CPU functionality can be used in stand-alone mode as well as for distributed automation solutions with a medium-sized program. They correspond to a CPU 314 and enable distributed preprocessing of the production data locally – even in the fail-safe version. They communicate with the higher-level programmable controller over the coexistent MPI/PROFIBUS DP slave interface.

Highlights

- Discretely modular configuration with multi-wire connection
- Multifunctional thanks to a wide range of modules
- Also available as expandable block I/O with integral DI/DO: SIMATIC ET 200S COMPACT
- Use in areas subject to explosion hazard (Zone 2)
- Many of the ET200 components are also available in a SIPLUS extreme version for extreme environmental conditions, e.g. extended temperature range (-40/-25 ... +60/+70 °C) and for use where there is corrosive atmosphere/condensation.
  For further information, see page 102 or **www.siemens.com/siplus-extreme**

Distributed automation solutions frequently involve not just digital and analog signals, but also technological functions, motor starters, frequency converters or a pneumatic interface. The bit-modular ET 200S offers a comprehensive module range to implement the tasks:

- Technology modules
- Motor starter
- Frequency converter
- Pneumatic interface
- IQ-Link sensor modules
- Fail-safe modules (I/O, PM)
- DP master module

Technical data: ET 200S interface modules

Interface module	IM 151-7 CPU/CPU FO [1]	IM 151-7 F-CPU [1]	IM 151-8 PN/DP CPU [1]	IM 151-8F PN/DP CPU [1]
PROFIBUS	Copper/FO	Copper	● [2]	● [2]
PROFINET			Copper [3]	Copper [3]
Number of modules	63	63	63	63
Station width	2 m	2 m	2 m	2 m
CPU functionality	CPU 314	CPU 314	CPU 314	CPU 314
Fail-safety		●		●
Firmware update	Micro Memory Card	Micro Memory Card	Bus, Micro Memory Card	Bus, Micro Memory Card
Order No. group: 6ES7 151-	7AA. / 7AB.	7FA.	8AB.	8FB.

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] With master module

[3] 3-port switch

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SIMATIC ET 200pro – modular and multifunctional

SIMATIC ET 200pro is an extremely small, rugged and high-performance I/O system with IP65/67 degree of protection. It does not require a control cabinet and can be directly mounted on the machine. Its modular and time-saving design allows flexible, customized, distributed automation solutions to be implemented.

ET 200pro can be connected to well-proven fieldbuses such as PROFIBUS or to PROFINET, the open Industrial Ethernet standard for company-wide automation.

Highlights

- Modular design with an extremely compact housing
- Multifunctional thanks to a wide range of modules
- Easy installation

SIMATIC ET 200pro with PROFINET interface and I/O modules

The IM154-8 PN/DP interface module CPU with CPU functionality is based on the CPU 315-2 PN/DP and offers the same quantity frameworks and functions. The IM154-8 PN/DP CPU has two communication interfaces,

- one combined MPI/PROFIBUS DP interface, and
- one PROFINET interface with three ports.

ET 200pro CPU module

The IM 154-8 PN/DP CPU supports both PROFINET IO (up to 128 IO devices can be connected) and PROFINET CBA, as well as PROFIBUS DP (as master for up to 124 slaves).

The IM 154-8 PN/DP CPU is not only compatible with the programs of the S7-300 CPUs, it also offers a high degree of data retentivity (protection against voltage failure). A separate LED signals maintenance alarms. Modules can be replaced easily thanks to the Micro Memory Card. Firmware can be updated over the network.

Furthermore, a web server functionality for information, status (e.g. module status), topology, diagnostics, clock synchronization via the Ethernet (NTP) is available. User-specific web pages can also be created and displayed. The open Ethernet communication (TCP/IP, UDP, ISO-on-TCP) permits reliable and high-speed data exchange. Isochronous mode is possible on the PROFIBUS.

A fail-safe version IM 154-8F PN/DP CPU is also available.

Further information can be found in the brochure *SIMATIC ET 200* or on the Internet under **www.siemens.com/et200**

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SIMATIC S7-1200

SIMATIC S7-1200: Modular, compact controller for discrete and stand-alone automation solutions

The SIMATIC S7-1200 controller is modular and compact, versatile, a secure investment, and perfectly fits a wide variety of applications. A scalable and flexible design, a communication interface that fulfills the highest standards of industrial communication and a full range of powerful integrated technology functions make this controller an integral part of a complete and comprehensive automation solution.

SIMATIC S7-1200 for discrete and stand-alone automation solutions

Many of the S7-1200 components are also available in a SIPLUS extreme version for extreme environmental conditions, e.g. extended temperature range (-25/0 ... +55/+70 °C) and for use where there is corrosive atmosphere/condensation.

For further information, see page 102 or
www.siemens.com/siplus-extreme

A modular concept for automation in a scalable design

The SIMATIC S7-1200 features an integrated PROFINET interface, powerful integrated technology functions and a highly scalable and flexible design. This enables simple communication, efficient solutions for technological tasks, and perfectly fits individual automation requirements in a wide variety of applications.

Highlights

- Scalable and flexible design:
  The SIMATIC S7-1200 controller family has been designed with maximum flexibility to fit your individual machine requirements. This allows you to custom design your controller system to meet your needs; it also makes future system expansions quick and easy.
- Integrated Industrial Ethernet/PROFINET interface:
  The Industrial Ethernet/PROFINET interface integrated into SIMATIC S7-1200 offers seamless communication with distributed I/O with SIMATIC HMI Basic Panels for visualization and additional controllers for CPU-to-CPU communication. Also with devices from third parties for extended integration possibilities as well as the SIMATIC STEP 7 Basic engineering system for configuring and programming.
- Integrated technology functions:
  The name SIMATIC has been synonymous with reliability in the field of automation for many years. Based on long years of experience, we have integrated our proven and innovative technology functions into our new controller – ranging from counting and measuring, speed, position and duty cycle control to simple process control functionality. This wide variety of functionality enables you to solve a wide array of applications.
- Programming with SCL: NEW
  Like the other controllers, the S7-1200 can now also be programmed with the high-level language SCL (Structured Control Language).

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Scalable and flexible design

The SIMATIC S7-1200 system comprises three different CPU performance classes: CPU 1211C, CPU 1212C and CPU 1214C. They can all be extended in accordance with the requirements of the machine. One signal board can be added to any CPU to expand the digital or analog I/O without affecting the physical size of the controller. Signal modules can be connected to the right side of the CPU to further expand the digital or analog I/O capacity. CPU 1212C accepts two and CPU 1214C accepts eight signal modules. Finally, all SIMATIC S7-1200 CPUs can be equipped with up to three communication modules on the left side of the controller for performing seamless communication.

Integrated Industrial Ethernet/PROFINET interface

The SIMATIC S7-1200 is equipped with an integrated Industrial Ethernet/ PROFINET interface which provides seamless communication with the integrated SIMATIC STEP 7 Basic engineering system as well as with PROFINET IO Devices. It supports programming, as well as communication with SIMATIC HMI Basic Panels for visualization, additional controllers for CPU-to-CPU communication and third-party devices for advanced integration possibilities.

Simple networking

The SIMATIC S7-1200 communication interface consists of a noise-immune RJ45 connector with auto-crossover functionality supporting a number of Ethernet connections and providing data transmission rates up to 10/100 Mbit/s. To minimize cabling and provide maximum networking flexibility, the CSM 1277 Compact Switch Module can be used together with the SIMATIC S7-1200 to easily configure a uniform or mixed network consisting of line, tree or star topologies.
The CSM 1277 is a 4-port unmanaged switch which allows you to connect the SIMATIC S7-1200 with up to three additional devices. The new PROFIBUS master and PROFIBUS slave communication modules also permit integration in the standard automation solution.

Communication with third-party devices

Seamless integration of devices from other manufacturers is possible with the integrated interface on the SIMATIC S7-1200. It is possible to connect and communicate with multiple third-party devices utilizing the supported open Ethernet protocols TCP/IP native and ISO-on-TCP. Configured using the standard T-Send/T-Receive blocks provided by the integrated SIMATIC STEP 7 Basic engineering system, this communication capability offers you an even higher level of flexibility in designing your automation solution.

Integrated technology functions

High-speed inputs for counting and measuring

Up to six high-speed counters are integrated, three at 100 kHz and three at 30 kHz. This supports accurate monitoring of incremental encoders, frequency counting or high-speed counting of process events.

High-speed outputs for speed, position or duty cycle control

Two high-speed outputs are integrated into the SIMATIC S7-1200 controller, for use as either pulse train outputs (PTO) or pulse-width-modulated (PWM) outputs. When configured as a PTO, a 50 % duty cycle pulse train is provided at a rate of up to 100 kHz for the open-loop speed and position control of stepper motors and servo drives. Feedback for the pulse train outputs is provided internally using the two high-speed counters. When they are configured as PWM outputs, they offer a fixed cycle time with a variable operating point. The speed of a motor, the position of a valve and the operating point of a heating element can be controlled in this manner.

PLCopen motion control function blocks

The SIMATIC S7-1200 supports the open-loop speed and position control of stepper motors and servo drives. These functions can easily be mapped using the PLCopen-compliant motion control function blocks included in the SIMATIC STEP 7 Basic engineering system. Absolute and relative movements are supported in addition to home and jog functions.

PID functionality for closed-loop control

The SIMATIC S7-1200 supports system-integrated PID control loops for simple process control applications. These control loops are easily configured using a PID controller technology object provided as part of the SIMATIC STEP 7 Basic engineering system. Additionally, the SIMATIC S7-1200 supports PID auto-tuning to automatically compute the optimum tuning values for the proportional, integral and derivative components.

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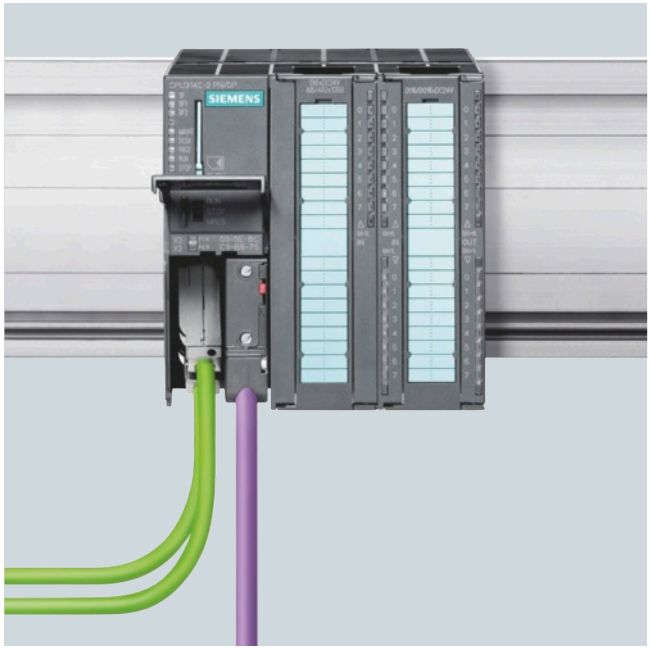
SIMATIC S7-300

SIMATIC S7-300: The modular controller for innovative system solutions in the manufacturing industry

SIMATIC S7-300 is the best-selling controller of the *Totally Integrated Automation* spectrum with a host of successful reference applications worldwide from the most varied industrial sectors, such as:

- Manufacturing engineering
- Automotive industry
- General machine construction
- Special-purpose machine manufacturing
- Standard mechanical equipment manufacture, OEMs
- Plastics processing
- Packaging industry
- Food, beverages and tobacco industries
- Process engineering



SIMATIC CPU 314C-2 PN/DP - the new PROFINET-capable compact CPU for the manufacturing industry with PROFINET and PROFIBUS interfaces

New for SIMATIC S7-300

The SIMATIC S7-300 is subject to a continuous development process – especially in the area of CPUs. The PROFINET-capable, compact CPU 314C-2 PN/DP with 192 KB memory and 0.06 µs per bit operation is completely new, as well as the familiar technology functions and onboard IOs. From firmware version V3.2, the PN CPUs are capable of processing all the new PROFINET functions, e.g. I-Device, Shared Device, MRP (Media Redundant Protocol), IRT (Isochronous Real-Time) and user-defined web pages. All the compact CPUs as well as the CPU 317F-2DP have been redesigned: with a new firmware version, more work memory and shorter execution times.

Highlights

The SIMATIC S7-300 has been designed for innovative system solutions with the focus on manufacturing engineering, and as a universal automation system, it represents an optimal solution for applications in centralized and distributed configurations:

- The ability to integrate powerful CPUs with Industrial Ethernet/PROFINET interface, integrated technological functions, or fail-safe designs make additional investments unnecessary.
- The S7-300 can be set up in a modular configuration without the need for slot rules for I/O modules. There is a wide range of modules available both for the centralized and the distributed configuration with ET 200M.
- The Micro Memory Card as a data and program memory makes a backup battery superfluous and saves maintenance costs. In addition, an associated project, including symbols and comments, can be stored on this memory card to facilitate service calls.
- The Micro Memory Card also enables simple program or firmware updates without a programming device. The Micro Memory Card can also be used during operation for storing and accessing data, e.g. for measured value archiving or recipe processing.
- In addition to standard automation, safety technology and motion control can also be integrated in an S7-300.
- Many of the S7-300 components are also available in a SIPLUS extreme version for extreme environmental conditions, e.g. extended temperature range (-40/-25 ... +60/+70 °C) and for use where there is corrosive atmosphere/condensation.
  For further information, see page 102 or **www.siemens.com/siplus-extreme**

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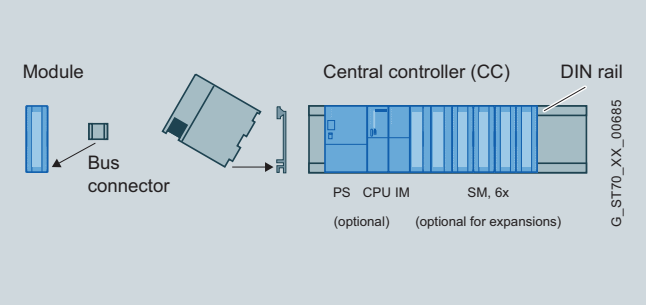
Design

The S7-300 enables space-saving and modular configurations. In addition to the modules, only a DIN rail is required for hooking in the modules and screwing them into place. This results in a rugged and EMC-compatible design. The build-as-you-go backplane bus can be expanded by simply plugging in additional modules and bus connectors.

The varied range of the S7-300 can also be used for central expansions or the construction of distributed structures with ET 200M; thereby producing very cost-effective spare parts handling.



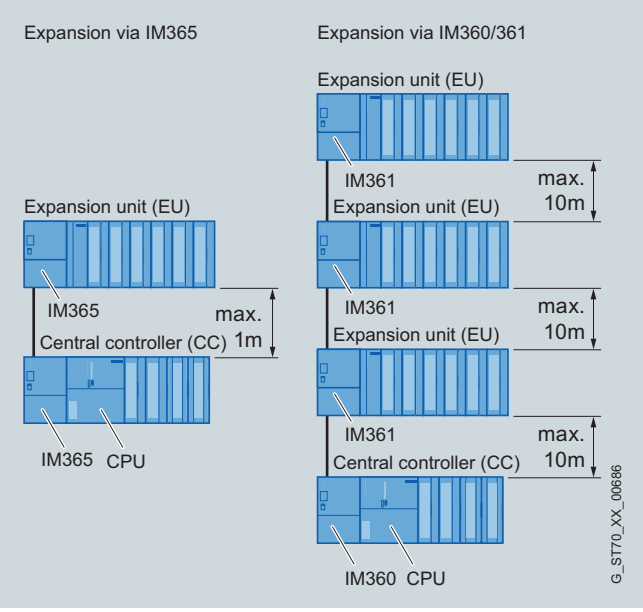
Structure of the S7-300: space-saving, modular and simple

Expansion options

If the automation task requires more than 8 modules, the central controller (CC) of the S7-300 can be expanded using expansion units (EUs) Up to 32 modules can be used in the central rack and up to 8 per expansion unit. Interface modules (IMs) handle communication between the individual racks autonomously. In the case of plants covering wide areas, CCs/EUs can also be installed at greater distances from each other (up to 10 m).

In a single-tiered configuration, this results in a maximum configuration of 256 I/O, and in multi-tiered configurations up to 1024 I/O. In distributed configurations with PROFIBUS DP, 65 536 I/O connections are possible (up to 125 stations, such as ET 200M via IM 153). The slots are freely addressable, that is, there are no slot rules.

The extensive range of S7-300 modules is also used in distributed automation solutions. The ET 200M I/O system that has the same construction as the S7-300 can be connected via Interface modules not only to PROFIBUS but also to PROFINET.



Centralized expansion of the S7-300 with up to 32 modules

Components for SIMATIC S7-300			
	Component	**Special feature**	**Order No. group**
Racks	Mounting rail	160 to 2 000 mm	6ES7 390-1....
Interface	IM 360	Send IM for CC, for up to 3 EUs	6ES7 360-3A...
	IM 361	Receiver IM for EU, for connecting to IM 360	6ES7 360-3C...
	IM 365	Expansion with 1 EU	6ES7 365-0B...
Power supply	PS 307 (2 A)	120/230 V AC	6ES7 307-1BA..
	PS 305 (2 A) [1]	24-110 V DC	6ES7 305-1BA..
	PS 307 (5 A) [1]	120/230 V AC	6ES7 307-1EA..
	PS 307 (10 A) [1]	120/230 V AC	6ES7 307-1KA..

[1] As SIPLUS extreme component also for extended temperature range -25 ... +70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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CPU range

Standard CPUs

A graded CPU range with a wide performance range is available for configuring the controller. Thanks to their high processing speed, the CPUs enable short machine cycle times. The narrow module width results in a compact controller design or a small control cabinet.

Portfolio of standard CPUs from 312 to 319-3 PN/DP

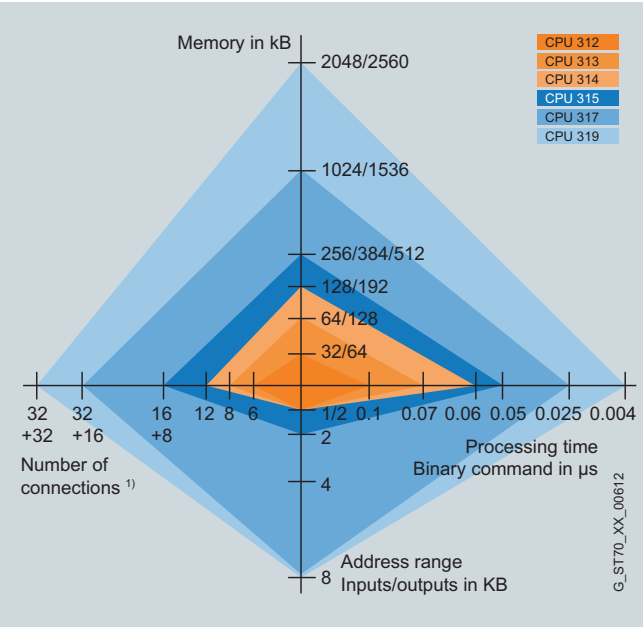
The CPUs are available from a width of only 40 mm. Fail-safe CPUs are available for safety-oriented applications. The PROFIsafe profile for safe communication via PROFIBUS and PROFINET allows the integration of safety-related functions into standard automation environments.

Compact CPUs

Compact CPUs with widths of 80 or 120 mm also offer integral I/O and integral technological functions. This onboard I/O (digital/analog) and the technological functions save additional investments in other modules.

The PROFINET-capable, compact CPU 314C-2 PN/DP is the PROFINET-capable controller in the performance class below the CPU 315.

Portfolio of compact CPUs from 312C to 314C-2 PN/DP



Six performance classes of the S7-300 CPUs (firmware V3.x and higher)

1) Connections stand for internal resources of the CPU for the communication with PGs/OPs and over blocks. The standard bus communication and the PtP coupling do not require connections. The PN CPUs offer 8, 16 or 32 (CPU 319) additional connections for TCP/IP, UDP, and ISO-on-TCP.

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Application cases for compact controllers

- High-speed counting/measuring with direct access to the hardware counter
- Simple positioning with direct control of the MICROMASTER frequency inverter
- PID control with integral function block

This range is rounded off by a special technology CPU with powerful technological functions, especially for motion control.

Together with the integral digital I/O and equidistant and isochronous mode on PROFIBUS DP, off-the-shelf, PLCopen-compliant motion control functions enable the flexible motion control of several (even linked) axes.

Micro Memory Card

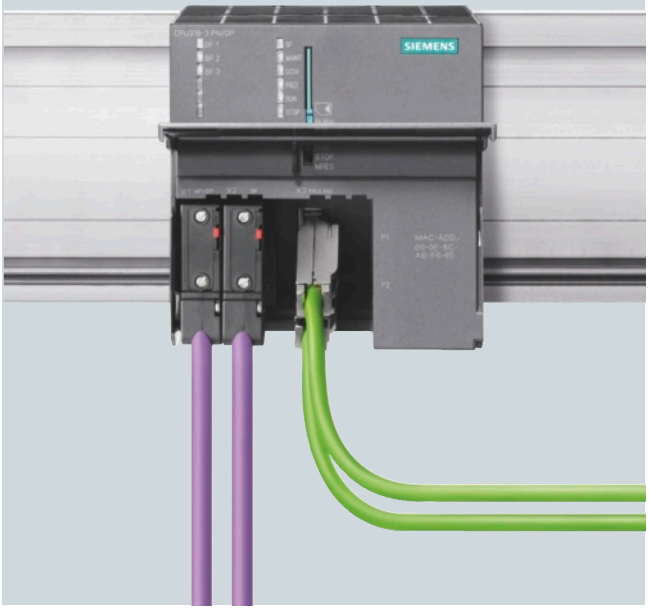
The Micro Memory Card is a compact medium that meets the highest industrial requirements, especially ESD protection and mechanical ruggedness.

The system-tested Micro Memory Card allows more write cycles than conventional memory cards and offers know-how protection because the serial number can be read out by the program.

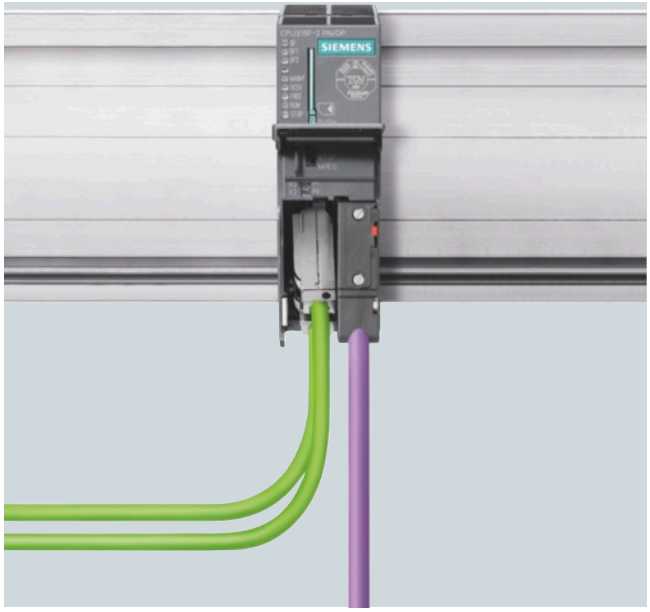
Useful additional functions of the Micro Memory Card:

- Simpler and faster upgrade due to firmware update via network.
- Resetting of all settings to the factory settings using the hardware switch (Reset to Factory)
- Online view of two blocks
  - Status of two blocks simultaneously on one PG
  - Status of one block on two PGs simultaneously

Standard-CPU 315-2 DP



High performance CPU 319-3 PN/DP with integrated PROFINET and PROFIBUS interface



Fail-safe CPU 315F-2 PN/DP with integrated PROFINET and PROFIBUS interface

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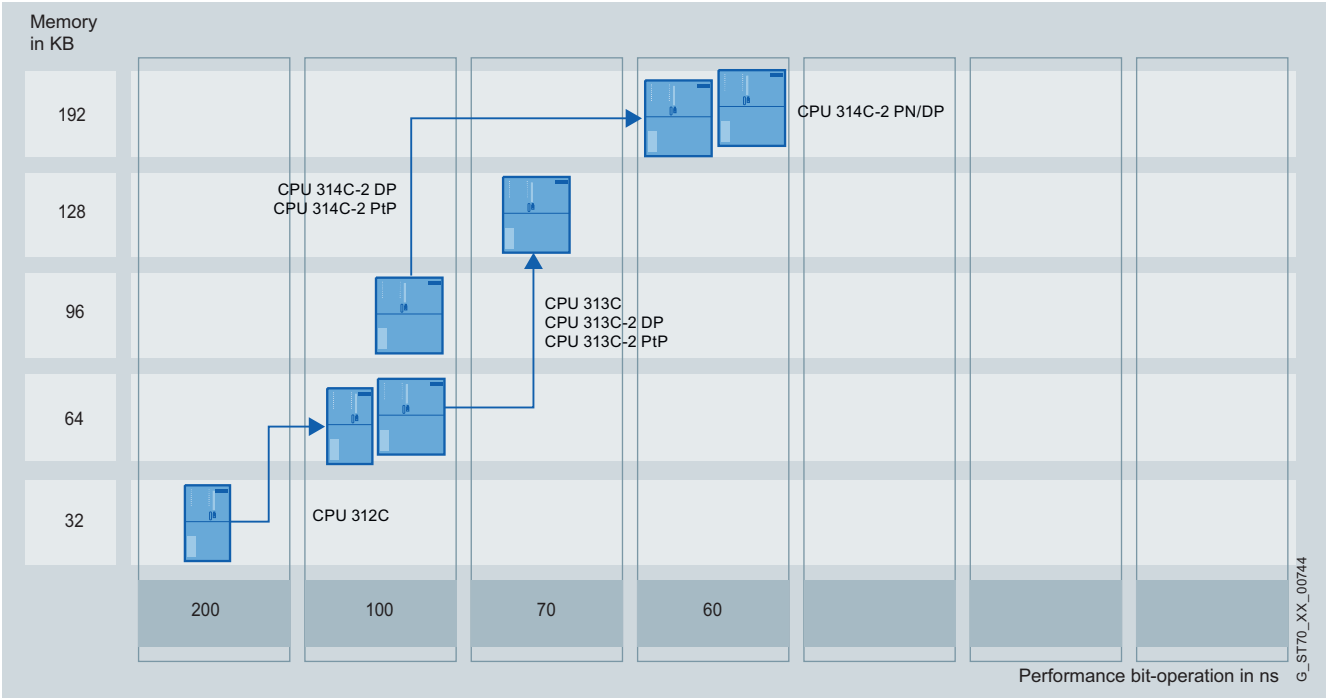
CPU range

Version	CPU	Isochronous mode on PROFIBUS/ PROFINET	Integrated interfaces	Integrated I/O	Integrated technological functions
Standard CPUs					
	CPU 312, 314 [1]		MPI		
	CPU 315-2 DP [1]	● / –	MPI, DP		
	CPU 315-2 PN/DP [1]	● / ●	DP/MPI, PROFINET		
	CPU 317-2 DP	● / –	DP/MPI, DP		
	CPU 317-2 PN/DP [1]	● / ●	DP/MPI, PROFINET		
	CPU 319-3 PN/DP	● / ●	DP/MPI, DP, PROFINET [2]		
Compact CPUs					
	CPU 312C [1]		MPI	Digital	• Counting • Rules • Frequency measurement • Pulse width modulation • Pulse generator
	CPU 313C [1]		MPI	Digital, analog	
	CPU 313C-2 PtP		MPI, PtP	Digital	
	CPU 313C-2 DP [1]		MPI, DP	Digital	
	CPU 314C-2 PtP[1]		MPI, PtP	Digital, analog	As above, and additionally • Positioning
	CPU 314C-2 DP [1]		MPI, DP	Digital, analog	
	CPU 314C-2 PN/DP	● / ●	DP/MPI, PROFINET	Digital, analog	
Fail-safe CPUs					
	CPU 315F-2 DP [1]	● / –	MPI, DP		Fail safety with PROFIsafe profile
	CPU 315F-2 PN/DP [1]	● / ●	DP/MPI, PROFINET		
	CPU 317F-2 DP [1]	● / –	DP/MPI, DP		
	CPU 317F-2 PN/DP [1]	● / ●	DP/MPI, PROFINET		
	CPU 319F-3 PN/DP	● / ●	DP/MPI, DP, PROFINET [2]		
Technology CPUs					
	CPU 315T-2 DP	● / –	DP/MPI, DP(DRIVE)	Digital	• Synchronous operation • Traversing to fixed stop • Pressure mark correction • Cam control • Controlled positioning
	CPU 317T-2 DP	● / –	DP/MPI, DP(DRIVE)	Digital	
	CPU 317TF-2 DP	● / –	DP/MPI, DP(DRIVE)	Digital	

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] Two PN ports (switch)



The graphic shows the innovations of the compact CPUs. They have twice as much memory capacity and shorter processing times. The CPUs with point-to-point or PROFIBUS communication in the 313C series are no longer 120 mm but only 80 mm wide.

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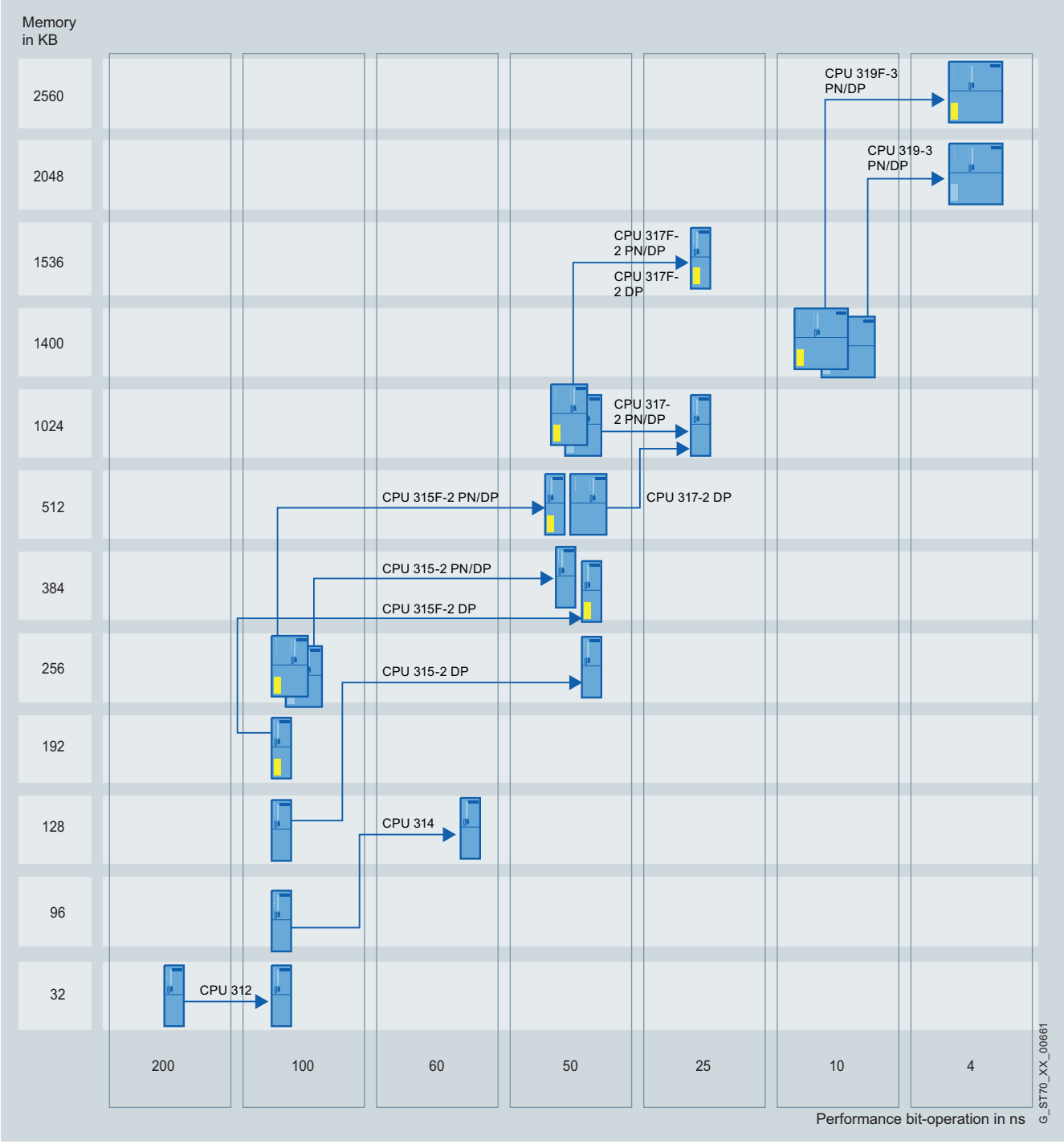
Memory and performance innovations of the S7-300 CPUs

The following graphic shows the standard and fail-safe CPU innovations. They have an increased memory capacity and/or shorter processing times.

The CPUs 315-2 PN/DP, 317-2 DP, 317-2 PN/DP and the corresponding fail-safe versions are only 40 mm wide. Furthermore, all PROFINET CPUs feature two PN ports.



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Technical data: Standard CPUs

CPU	CPU 312	CPU 314 [1]	CPU 315-2 DP [1]	CPU 315-2 PN/DP [1]	CPU 317-2 DP	CPU 317-2 PN/DP [1]	CPU 319-3 PN/DP
Dimensions (mm)	40 x 125 x 130	40 x 125 x 130	40 x 125 x 130	40 x 125 x 130	40 x 125 x 130	40 x 125 x 130	120 x 125 x 130
Order No. group: 6ES7	312-1AE.	314-1AG.	315-2AH.	315-2EH.	317-2AK.	317-2EK.	318-3EL.
Firmware	V3.3			V3.2	V3.3	V3.2	V3.2
Memory							
Work memory	32 KB	128 KB	256 KB	384 KB	1 MB	1 MB	2 MB
Instructions	10 K	42 K	85 K	128 K	340 K	340 K	680 K
Processing times							
Bit operation	0.1 µs	0.06 µs	0.05 µs		0.025 µs	0.025 µs	0.004 µs
Word operation	0.24 µs	0.12 µs	0.09 µs		0.03 µs	0.03 µs	0.01 µs
Fixed-point operation	0.32 µs	0.16 µs	0.12 µs		0.04 µs	0.04 µs	0.01 µs
Floating-point operation	1.1 µs	0.59 µs	0.45 µs		0.16 µs	0.16 µs	0.04 µs
Bit memories/timers/counters							
Bit memory	256 bytes		2 048 bytes		4 096 bytes		8 192 bytes
S7 timers/counters	256 / 256				512 / 512		2 048 / 2 048
IEC timers/counters	● *)						
Address ranges							
Number of I/Os (bytes)	1 024 / 1 024		2 048 / 2 048		8 192 / 8 192		
Process image I/O (bytes), max.	1 024 / 1 024		2 048 / 2 048		8 192 / 8 192		
Digital channels (central)	256	1 024					
Analog channels (central)	64	256					
DP interfaces							
DP master systems internal / CP 342-5	○ / ●		● / ●				
DP slaves			●				
Data set gateway [2]			●	●	●	●	
PROFINET interface							
PROFINET CBA				●		●	
PROFINET IO				●		●	
PROFINET with IRT				● [3]		● [3]	
Open User Communication (OUC)							
• TCP/IP				●		●	
• UDP				●		●	
• ISO-on-TCP (RFC 1006)				●		●	
Web server				●		●	

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] For explanation, see page 56 bottom right

*) Via SFB, number unlimited or limited by main memory

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Technical data: Compact CPUs

CPU	CPU 312C [1]	CPU 313C [1]	CPU 313C-2 PtP	CPU 313C-2 DP [1]	CPU 314C-2 PtP [1]	CPU 314C-2 DP [1]	CPU 314C-2 PN/DP
Dimensions (mm)	80 x 125 x 130	120 x 125 x 130	80 x 125 x 130	80 x 125 x 130	120 x 125 x 130		
Required front connector	1 x 40-pin	2 x 40-pin	1 x 40-pin		2 x 40-pin		
Order No. group: 6ES7	312-5BF.	313-5BG.	313-6BG.	313-6CG.	314-6BH.	314-6CH.	314-6EH.
Firmware	V3.3	V3.3	V3.3	V3.3	V3.3	V3.3	V3.3
Memory							
Work memory	64 KB	128 KB			192 KB		
Instructions	21 K	42 K			64 K		
Processing times							
Bit operation	0.1 µs	0.07 µs			0.06 µs		
Word operations	0.24 µs	0,15 µs			0.12 µs		
Fixed-point operations	0.32 µs	0.2 µs			0.16 µs		
Floating-point operations	1.1 µs	0.72 µs			0.59 µs		
Bit memories/timers/counters							
Bit memory	256 bytes						
S7 timers/counters	256 / 256						
IEC timers/counters	● *)						
Address ranges							
Number of I/Os (bytes)	1 024 / 1 024			2 048 / 2 048	1 024 / 1 024	2 048 / 2 048	
I/O process image	1 024 / 1 024			2 048 / 2 048	1 024 / 1 024	2 048 / 2 048	
Digital channels (central)	266	1 016	1 008		1 016		
Analog channels (central)	64	253	248		253		
Integrated functions							
Counter (incremental enc.)	2, 24 V/10 kHz	3, 24 V/30 kHz			4, 24 V/60 kHz		
Pulse outputs (PCM)	2 channels, max. 2.5 kHz	3 channels, max. 2.5 kHz			4 channels, max. 2.5 kHz		
Frequency measurement	2 channels max. 10 kHz	3 channels, max. 30 kHz			4 channels max. 60 kHz		
Controlled positioning					SFB for positioning, 1 axis via 2 DO, AO		
Integrated "Control" FB		PID controllers					
Integrated inputs/outputs							
Digital inputs	10 x 24 V DC; all channels can be used for process interrupts	24 x 24 V DC; all channels can be used for process interrupts	16 x 24 V DC; all channels can be used for process interrupts		24 x 24 V DC; all channels can be used for process interrupts		
Digital outputs	6 x 24 V DC, 0.5 A	16 x 24 V DC, 0.5 A					
Analog inputs		4 : ± 10 V, 0 ... 10 V, ± 20 mA, 0 / 4 ... 20 mA; 1 : 0 ... 600 Ω, PT100			4 : ± 10 V, 0 ... 10 V, ± 20 mA, 0 / 4 ... 20 mA; 1 : 0 ... 600 Ω, PT100		
Analog outputs		2 : ± 10 V, 0 ... 10 V, ± 20 mA, 0 / 4 ... 20 mA			2 : ± 10 V, 0 ... 10 V, ± 20 mA, 0 / 4 ... 20 mA		
DP interface							
DP master systems int./ CP 342-5	○ / ●			● / ●	○ / ●	● / ●	● / ●
DP slave				●		●	●
Data set gateway [2]				●		●	●
PROFINET interface							
PROFINET CBA							●
PROFINET IO							●
PROFINET with IRT							●
Open User Communication (OUC)							
• TCP/IP							●
• UDP							●
• ISO-on-TCP (RFC 1006)							●
Web server							●
PtP interface							
Physics			RS485/422		RS485/422		
Protocol driver			3964 (R), RK512, ASCII		3964 (R), RK512, ASCII		

[1] As SIPLUS extreme component also for extended temperature range -25 ...+60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or www.siemens.com/siplus-extreme)
[2] For explanation, see page 56 bottom right *) Via SFB, number unlimited or limited by main memory

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Technical data: Fail-safe CPUs

Fail-safe CPU	CPU 315F-2 DP [1]	CPU 315F-2 [1] PN/DP	CPU 317F-2 DP [1]	CPU 317F-2 [1] PN/DP	CPU 319F-3 PN/DP
Dimensions (mm)	40 x 125 x 130		40 x 125 x 130	40 x 125 x 130	120 x125 x130
Order No. group: 6ES7	315-6FF.	315-2FJ.	317-6FF.	317-2FK.	318-3FL.
Firmware	V3.3	V3.2 [3]	V3.3	V3.2 [3]	V3.2 [3]
Memory					
Work memory	384 KB	512 KB	1.5 MB	1.5 MB	2.5 MB
Processing times					
Bit operation	0.05 µs		0.025 µs	0.025 µs	0.004 µs
Word operation	0.09 µs		0.03 µs	0.03 µs	0.01 µs
Fixed-point operation	0.12 µs		0.04 µs	0.04 µs	0.01 µs
Floating-point operation	0.45 µs		0.16 µs	0.16 µs	0.04 µs
Bit memories/timers/counters					
Bit memory	2 048 bytes		4 096 bytes		8 182 bytes
S7 timers/S7 counters	256 / 256		512 / 512		2 048 / 2 048
IEC timers/IEC counters	● *)				
Address ranges					
Number of I/Os (bytes)	2 048 / 2 048		8 192 / 8 192		
Process image I/O (bytes), max.	2 048 / 2 048		8 192 / 8 192		
Digital channels (central)	1 024				
Analog channels (central)	256				
DP interfaces					
DP master systems (int./CP)	● / ●				
DP slave	●				
Data set gateway [2]		●	●	●	
PROFINET interface					
PROFINET CBA		●		●	
PROFINET IO		●		●	
PROFINET with IRT		●		●	
Open User Communication (OUC)					
• TCP/IP		●		●	
• UDP		●		●	
• ISO-on-TCP (RFC 1006)		●		●	
Web server		●		●	

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] Explanation, see page 56 bottom right

[3] Available soon

*) Via SFB, number unlimited or limited only by main memory

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Technical data: Technology CPUs

Technology CPU	CPU 315T-2 DP	CPU 317T-2 DP	CPU 317TF-2 DP
Dimensions	160 x 125 x 130		
Required front connector	1 x 40-pin		
Order No. group:			
- CPU 6ES7	315-6TH.	317-6TK.	317-6TF.
- S7-Technology 6ES7	864-1CC.		
Memory			
Work memory	256 KB	1 MB	1.5 MB
Instructions	84 K	333 K	400 K
Processing times			
Bit operation	0.1 µs	0.05 µs	
Word operation	0.2 µs		
Fixed-point operation	2 µs	0.2 µs	
Floating-point operation	3 µs	1 µs	
Bit memories/timers/counters			
Bit memory	4 096 bytes		
S7 timers/S7 counters	256 / 256	512 / 512	
IEC timers/IEC counters	● *)		
Address ranges			
I/O address area	2 048 / 2 048 bytes	8 192 / 8 192 bytes	
I/O process image	2 048 / 2 048 bytes		
Digital channels (central)	512		
Analog channels (central)	64		
DP interfaces			
DP master systems internal / CP 342-5	● / ●		
DP slave	●		
Integrated inputs/outputs			
Digital inputs	4 x 24 V DC; for BERO evaluation, for example		
Digital outputs	8 x 24 V DC, 0.5 A: for high-speed cam switching functions		
Integrated functions	Gearbox synchronism and curve synchronism Traversing to fixed stop Registration mark correction via measuring probe Path- or time-dependent cam switching Controlled positioning		
Fail-safety			●
Maximum quantity structure for technology			
Axes	8	32	
Cam disks	16	32	
Cams	16	32	
Measuring probes	8	16	
External encoders	8	16	
Used simultaneously	32	64	

*) Via SFB, number unlimited or limited only by main memory

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Module range

The multi-facetted module range of S7-300 allows modular customization to suit the most varied tasks. S7-300 supports multi-facetted technological tasks and offers exhaustive communication options. Apart from the CPUs with integrated functions and interfaces, there is a wide range of special modules in S7-300 design for technology and communication.

Technology

Function modules are intelligent modules that independently execute the technological tasks and thus reduce the load on the CPU. They are used when a high level of accuracy and dynamic response is required.

Controller module FM 355-2

Communications

Communication processors are used for connecting S7-300 to the different bus systems/communication networks as well for point-to-point connection.

CP 343-1 Advanced communications processor with Gigabit interface

Function modules

Technological function	Channels / Axes	Module
Counting, measuring, proportioning, position detection (incremental)	1	FM 350-1 [3]
Counting, measuring, proportioning	8	FM 350-2 [2]
Cam controls	1	FM 352
High-speed binary logic operations	1	FM 352-2
PID control (continuous)	4	FM 355C
PID control (step/impulse)	4	FM 355S
Temperature control (continuous)	4	FM 355-2C
Temperature control (step/impulse)	4	FM 355-2S
Positioning (rapid traverse/creep feed)	2	FM 351
Position detection (SSI)	3	SM 338
Positioning (with stepper drives)	1	FM 353
Positioning (with servo drives)	1	FM 354
Positioning, path control, interpolation, synchronization	4	FM 357-2
Isochronous connection of drives via PROFIBUS	4	IM 174

[1] Further information can be found in the Industrial Communications brochure and on the Internet at **www.siemens.com/automation/simatic-net**

[2] As SIPLUS extreme component also for corrosive atmosphere/ condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[3] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

Communications processors

Bus system / communication network	Module
AS-Interface (master) [1]	CP 343-2 CP 343-2 P
PROFIBUS DP [1]	CP 342-5 [2] [3] CP 342-5 FO (for fiber-optic conductors)
PROFIBUS FMS [1]	CP 343-5
PROFINET/Industrial Ethernet [1]	CP 343-1 Lean [2] [3] CP 343-1 [2] [3] CP 343-1 Advanced [2]
Point-to-point connection	CP 340 [3] CP 341 [3]
Wide Area Networks (WAN) for telecontrol	TIM 3V-IE [3] TIM 3V-IE Advanced

The CP 343-1 Advanced provides the following additional functions:

- HTTP communication for access to process data via user-configured web pages
- E-mail client function for sending of e-mails direct from the user program
- FTP communication for program-controlled FTP client communication as well as access to blocks via an FTP server
- Gigabit connection including IP routing functionality for network separation
- Access protection by means of IP access list

You can find further information in the SIMATIC Technology brochure and on the Internet at **www.siemens.com/simatic-technology**

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Point-to-point connection

Point-to-point link via communications processors (CPs) is an extremely powerful and low-cost alternative to bus systems. The advantage of point-to-point links over bus systems is especially pronounced when only a few (RS 485) devices are to be connected to the SIMATIC S7.

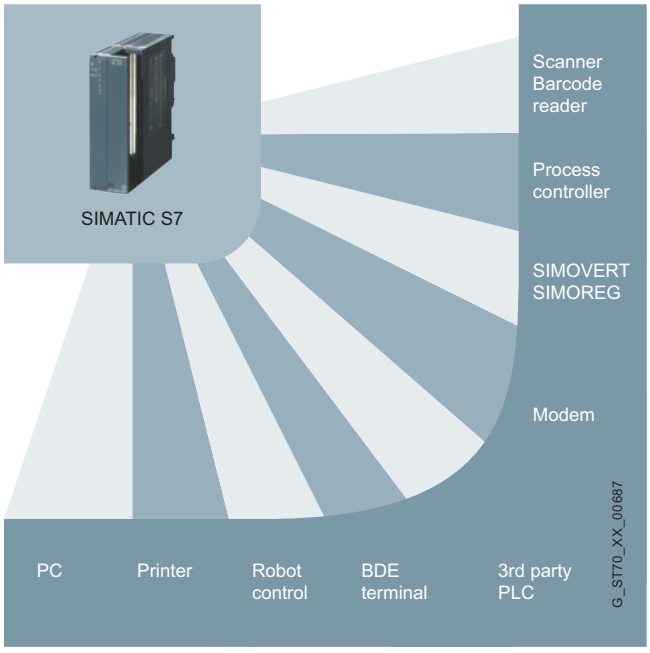
The CPs can also economically connect third-party systems to the SIMATIC S7. Thanks to the great flexibility of the CPs different physical transmission media, speeds or even customized transmission protocols can be implemented.

The CPs have a rugged plastic housing with LEDs for displaying operating states and faults.

For each CP there is a configuring package on CD with electronic manual, parameterization screen forms and standard function blocks for communication between the CPU and the CP.

The configuration data are stored in a system block and backed up in the CPU. When modules are replaced, the new module is therefore immediately ready for use.

The interface modules for the S7-300 are available in three versions, each with one interface for the different physical transmission media.



Point-to-point links for SIMATIC S7-300

Technical data: Point-to-point connection		
Application	**Low-cost entry version**	**Powerful computer connection, loadable protocols**
Transmission rate	Low (19 200 bit/s)	High (76 800 bit/s)
Loadable protocols		MODBUS master (6ES7 340-1AA.), MODBUS slave (6ES7 340-1AB.), Data highway (6ES7 340-1AE.)
Module	**CP 340**	**CP 341**
Order No. group: 6ES7	340-1.	341-1.
Physical transmission media		
RS 232C (V.24)	CP 340-1A	CP 341-1A
20 mA (TTY)	CP 340-1B	CP 341-1B
RS 422/485 (X.27)	CP 340-1C [1]	CP 341-1C [1]
Integrated transmission protocols		
ASCII	●	
Printer driver	●	
3964 (R)	●	
RK 512		●

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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Signal modules

Signal modules are the interface of the SIMATIC S7-300 to the process. A host of different digital and analog modules provide exactly the inputs/outputs required for each task.

Digital and analog modules differ as regards the number of channels, voltage and current ranges, electrical isolation, diagnostics and alarm functions, etc.

In all the module ranges listed here, SIPLUS extreme components are also available for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation ((for further details, see page 102 or **www.siemens.com/siplus-extreme**). In addition, there are fail-safe modules for safety-oriented applications.

Easy installation

The sensors/actuators are connected through front connectors. These are available for the following connection methods:

- Screw-type terminals
- Spring loaded
- Fast Connect (insulation displacement)

When a module is replaced, the connector is simply plugged into the new module of the same type; the wiring is retained. The coding of the front connector avoids mistakes.

Fast connection

Connection with SIMATIC TOP connect is even simpler and faster (not for the onboard I/O of the compact CPUs). Preassembled front connectors with single cores and a complete plug-in modular system comprising a front connector module, connecting cable and terminal block are available.

High packing density

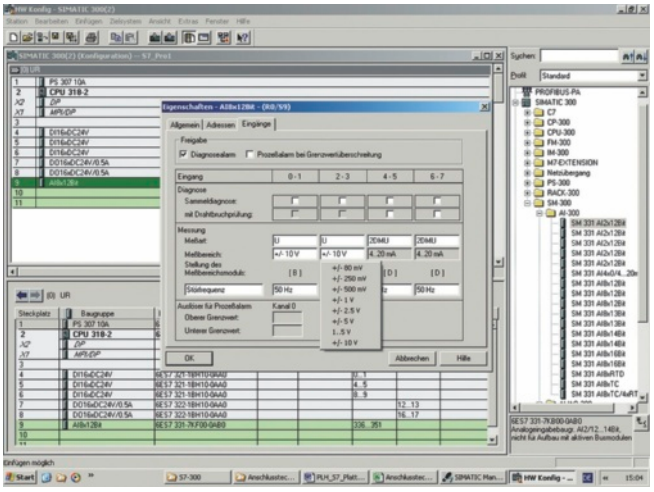
The high number of channels on the modules provides for the space-saving design of the S7-300. Modules are available with 8 to 64 channels (digital) or 2 to 8 channels (analog) per module.

Simple parameterization

The modules are configured and parameterized using STEP 7, and there are no inconvenient switch settings to be made. The data are stored centrally and, following module replacement, they are automatically transferred to the new module so that no setting errors can occur. No software upgrade is required when using new modules. A configuration can be copied as often as required, e.g. for series machines.

Diagnostics, interrupts

Many modules additionally monitor signal acquisition (diagnostics) and the signals from the process (process interrupt). This makes it possible to react immediately to process errors, e.g. wire breaks or short circuits, and any process event, e.g. rising or falling edge at a digital input. The response of the controller can easily be programmed with STEP 7.



Parameterization of an analog input module

Special modules

For test and simulation, the simulation module can be plugged into the S7-300. It enables simulation of encoder signals via switches and indicates output signals via LEDs.

The module can be plugged in anywhere regardless of slot rules. The dummy module reserves a slot for an unconfigured signal module. When the module is installed later, the mechanical configuration and address assignment of the overall configuration remain unchanged.

On the following page you will find criteria for selecting the appropriate signal module for each application.

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Digital inputs *)

Module	Voltage range	Number of channels
SM 321 1)	24 V DC	16, 32, 64
SM 321 3)	48 ... 125 V DC	16
SM 321	24/48 V UC	16
SM 321 2)	120/230 V AC	8, 16, 32

Digital inputs/outputs

Module	Voltage range	Number of channels
SM 323 2)	24 V DC	8 or 16 DI and DO
SM 327	24 V DC	8 DI and 8 DX (parameterized as input or output)

Digital outputs *)

Module	Voltage range	Current range	Number of channels
SM 322 5)	24 V DC	0.5 A	8, 16, 32, 64
SM 322 3)	24 V DC	2 A	8
SM 322 3)	48 ... 125 V DC	1.5 A	8
SM 322 3)	120/230 V AC	1 A	8, 16, 32
SM 322	120/230 V AC	2 A	8
SM 322	UC (relay)	0.5 A ... 5 A	8, 16

*) Fail-safe digital inputs, digital outputs and analog inputs available.

1) Available with 16 and 32 channels as SIPLUS extreme
2) Available with 8 channels as SIPLUS extreme
3) Available as SIPLUS extreme
4) Available with 2 and 4 channels as SIPLUS extreme
5) Available with 8, 16 and 32 channels as SIPLUS extreme
6) Available with 4 and 8 channels as SIPLUS extreme.
(For further details, see page 102 or **www.siemens.com/siplus-extreme**)

Analog inputs *)

Module	Measuring range	Resolution	Number of channels
SM 331 2)	Power	Up to 16 bit	2, 8
SM 331 2)	Current (also HART)	Up to 16 bit	2, 8
SM 331 2)	Resistance	Up to 16 bit	1, 4, 8
SM 331 2)	Thermocouples	Up to 16 bit	2, 6, 8
SM 331	Resistance thermometer	Up to 15 bits	1, 4, 8

Analog inputs/outputs

Module	Measuring range	Resolution	Number of channels
SM 334 4)	Power	Up to 13 bit	2, 4
SM 334 3)	Current	8 bit	4
SM 334 3)	Resistance	13 bit	4
SM 334 3)	Resistance thermometer	15 bit	4
SM 335 3)	Power	14 bit	4
SM 335 3)	Current	14 bit	4

Analog outputs

Module	Measuring range	Resolution	Number of channels
SM 332 6)	Power	Up to 16 bit	2, 4, 8
SM 332 2)	Current (also HART)	Up to 16 bit	2, 4, 8

You can find detailed information on S7-300 signal modules in the appendix.

Signal module SM 332-1

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SIMATIC S7-400

SIMATIC S7-400: The Power Controller for system solutions in the manufacturing and process industries

Within the Controller family, the SIMATIC S7-400 is designed for system solutions in the manufacturing and process automation.

Typical applications:
- Automotive industry
- Standard mechanical equipment manufacture, including custom mechanical equipment manufacture
- Warehousing systems
- Building engineering
- Steel industry
- Power generation and distribution
- Paper and printing industries
- Woodworking
- Textile manufacture
- Pharmaceuticals
- Food, beverages and tobacco industries
- Process engineering, e.g. water and wastewater utilities
- Chemical industry and petrochemicals

New for SIMATIC S7-400

The SIMATIC S7-400 is subject to a continuous development process – especially in the area of CPUs.

In firmware version V6, the CPUs are capable of processing all the new PROFINET functions, e.g. I-Device, Shared Device, MRP (Media Redundant Protocol), IRT (Isochronous Real-Time) and user-defined web pages.

Use in a brewery ...

Highlights

The following features make the SIMATIC S7-400 the most powerful controller:

- The S7-400 is especially suitable for data-intensive tasks in the process industry. High processing speeds and deterministic response times guarantee short machine cycle times on high-speed machines in the manufacturing industry. The high-speed backplane bus of S7-400 ensures efficient linking of central I/O modules.
- The S7-400 is used preferably to coordinate overall plants and to control lower-level communications lines with slave stations; this is guaranteed by the high communication power and the integral interfaces.
- The power of the S7-400 is scalable thanks to a graded range of CPUs; the capacity for I/O is almost unlimited.
- The power reserves of the CPUs enable new functions to be integrated without further hardware investment, e.g. processing of quality data, user-friendly diagnostics, integration into higher-level MES solutions or high-speed communication via bus systems.
- The S7-400 can be structured in a modular way without any slot rules; there is a wide range of modules available both for centralized configurations and distributed structures.
- The configuration of the distributed I/O of the S7-400 can be modified during operation. In addition, signal modules can be removed and inserted while live (hot swapping). This makes it very easy to expand the system or replace modules in the event of a fault.
- The storage of the complete project data including symbols and comments on the CPU simplifies service and maintenance calls.
- Safety engineering and standard automation can be integrated into a single S7-400 controller; plant availability can be increased through the redundant structure of the S7-400.
- Many S7-400 components are also available in a SIPLUS extreme version for extreme environmental conditions, e.g. for use where there is a corrosive atmosphere/condensation. For further information, see page 102 or **www.siemens.com/siplus-extreme**

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Modularity

An important feature of the S7-400 is its modularity. The powerful backplane bus of the S7-400 and the DP communication interfaces that can be plugged directly onto the CPU allow the high-performance operation of multiple communication lines.

... or in the textile industry

This permits, for example, the division into one communications line for HMI and programming tasks, one line for high-performance and equidistant motion control components, and one "normal" I/O fieldbus. Additionally required connections to MES/ERP systems or the Internet via SIMATIC IT can also be implemented.

The S7-400 can be expanded centrally or in a distributed configuration depending on the task. Add-on devices and interface modules are available centrally for this purpose. Distributed expansion is possible over the PROFIBUS or PROFINET interfaces integrated in the CPUs. If required, communication processors (CPs) can also be used.

Design

An S7-400 system basically comprises a rack, power supply, and central processing unit. It can be installed and expanded in a modular way. All modules can be positioned freely next to the power supply plugged in on the left. The S7-400 has a rugged design without a fan. Signal modules can be hot-swapped.

A multi-faceted module range can be used for central expansions as well as for simple configuration of distributed topologies with ET 200. This results in very cost-effective spare parts handling.

Simple installation of the SIMATIC S7-400 through hooking in the modules

In addition to the standard mounting racks, aluminum mounting racks with 9 and 18 slots are also available. These aluminum racks are highly resistant to unfavorable environmental conditions, and they are more rigid and around 25 % lighter.

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Design

Enhancements

Centralized expansion

In a centralized expansion, additional mounting racks are connected direct to the central controller. Distances of up to 100 m can be bridged while still providing the full performance of the backplane bus. Over shorter distances, the power supply can also be looped through. Mounting racks with 4, 9 or 18 slots are available as central rack. Up to 21 expansion units, also with 18 or 9 slots for S7-400 modules, can be connected via interface modules.

Distributed expansion

PROFIBUS or PROFINET are used for distributed expansion. For this purpose, the S7-400 permits the connection to the bus systems via the interfaces integrated in the CPU. There is a host of I/O modules in different degrees of protection (e.g. IP20, IP65/67) available for this. They can be used to adapt the S7-400 to the most varied tasks.

Components for SIMATIC S7-400

	Component	Special feature	Order No. group
Racks	UR1	For CCs and EUs, 18 slots	6ES7 400-1TA0.
	UR1 (Alu) [1]	For CCs and EUs, 18 slots	6ES7 400-1TA1.
	UR2	For CCs and EUs, 9 slots	6ES7 400-1JA0.
	UR2 (Alu) [1]	For CCs and EUs, 9 slots	6ES7 400-1JA1.
	UR2-H	For split CCs, 9 slots	6ES7 400-2JA0.
	UR2-H (Alu) [1]	For split CCs, 9 slots	6ES7 400-2JA1.
	CR1	For segmented CCs, 18 slots	6ES7 401-2TA.
	CR3	For CC, 4 slots	6ES7 401-1DA.
	ER1	For EUs, 18 slots	6ES7 403-1TA0.
	ER1 (Alu)	For EUs, 18 slots	6ES7 403-1TA1.
	ER2	For EUs, 9 slots	6ES7 403-1JA0.
	ER2 (Alu)	For EUs, 9 slots	6ES7 403-1JA1.
Connection (interface module)	IM 460-0 [1]	Send interface module for centralized expansion, 5 m	6ES7 460-0A.
	IM 461-0 [1]	Receive interface module for centralized expansion, 5 m	6ES7 461-0A.
	IM 460-1	Send interface module for centralized expansion, 1.5 m	6ES7 460-1B.
	IM 461-1	Receive interface module for centralized expansion, 1.5 m	6ES7 461-1B.
	IM 460-3	Send interface module for distributed expansion, 102 m	6ES7 460-3A.
	IM 461-3	Receive interface module for centralized expansion, 102 m	6ES7 461-3A.
Power supply	PS 405 (4 A)	24 V DC	6ES7 405-0D.
	PS 405 (10 A) [1]	24 V DC	6ES7 405-0KA.
	PS 405 (10 A)	24 V DC, redundant	6ES7 405-0KR.
	PS 405 (20 A)	24 V DC	6ES7 405-0R.
	PS 407 (4 A)	120/230 V AC	6ES7 407-0D.
	PS 407 (10 A) [1]	120/230 V AC	6ES7 407-0KA.
	PS 407 (10 A) [1]	120/230 V AC, redundant	6ES7 407-0KR.
	PS 407 (20 A)	120/230 V AC	6ES7 407-0R.

[1] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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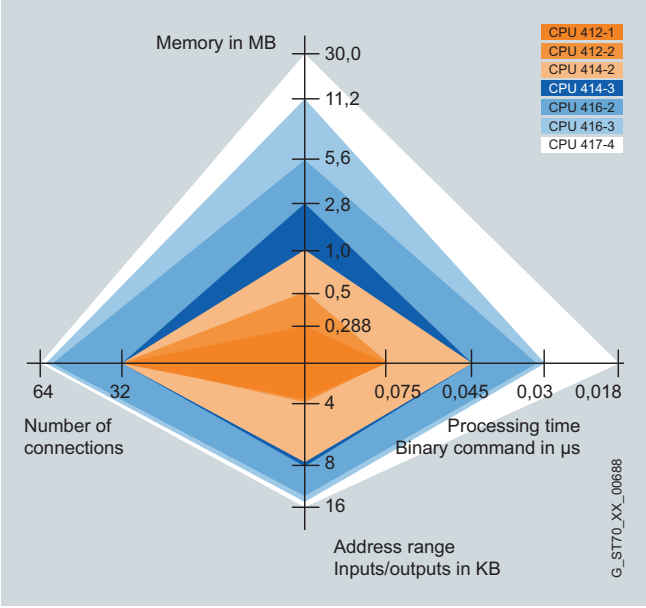
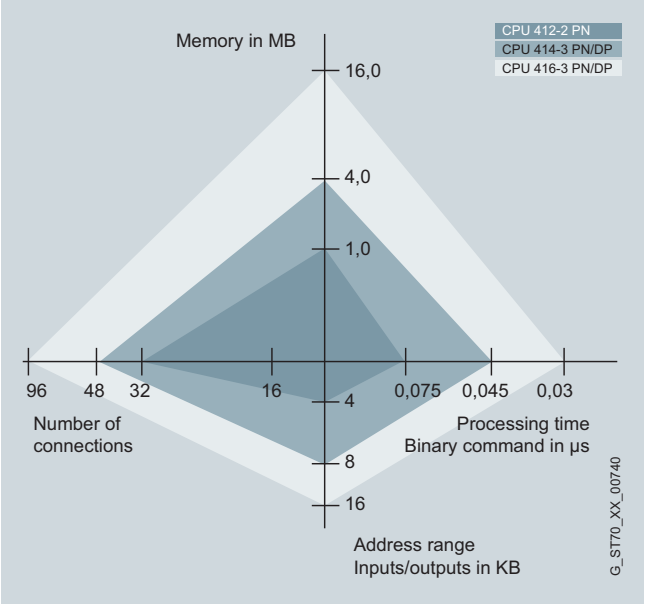
CPU range

There is a graded range of CPUs from the entry-level CPU right up to the high-performance CPU for configuring the controller. All CPUs control large quantity structures; several CPUs can work together in a multicomputing configuration to boost performance. Thanks to their high processing speed and deterministic response times, the CPUs enable short machine cycle times.

The different CPUs are distinguished by, for example, main memory, address range, number of connections and execution time. As well as the standard CPUs, there are also two fail-safe and three fault-tolerant CPUs available.



Seven performance classes of the S7-400 standard CPUs



Three performance classes of the S7-400 PN CPUs

Multicomputing
Multicomputing, that is, the simultaneous operation of several CPUs in one S7-400 central controller, offers users different benefits:

- The overall performance of an S7-400 can be shared by means of multicomputing, for example, complex tasks in technologies such as open-loop control, computing or communication can be split and assigned to different CPUs. Each CPU is assigned its own, local I/O for this purpose.
- Some tasks can also be disconnected from each other in multicomputing, that is, one CPU processes the time-critical process tasks and another CPU handles the non-time-critical tasks.

In multicomputing operation, all CPUs behave like a single CPU, that is, when one CPU goes to STOP, the others are also halted. The actions of several CPUs can be coordinated selectively by instruction via synchronization calls. In addition, data exchange between the CPUs takes place at an extremely high speed via the "global data" mechanism.

Performance
The S7-400 is characterized not only by short response times, but also by large performance reserves. Extremely short response times can be achieved in this way even when simultaneous communication is required or other unforeseen loads occur. This makes specified response times possible, for example the response time of an output signal to a change in an input signal.

Additional functions can also be integrated without any further hardware investment. Examples of new functions include the saving and processing of quality data, user-friendly diagnostics or vertical integration into higher-level MES solutions. The improved communication performance enables high-speed communication over Industrial Ethernet as well as efficient connection of the field level via PROFIBUS, for example with isochronous tasks.

Diagnostics
The intelligent diagnostics system of the CPUs continuously monitors the functional capability of the system and the process, and registers faults and specific system events; the user's own diagnostics messages can also be added.

The diagnostics can be used to determine whether the module's signal acquisition (in the case of digital modules) or analog processing (analog modules) is fault-free. When a diagnostics message is pending (e.g. "No encoder supply"), the module triggers a diagnostics interrupt.

The CPU then interrupts execution of the user program and runs the relevant diagnostics interrupt block. Process signals can be monitored, and responses to signal changes can be triggered via process interrupts.

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Technical data: S7-400 CPUs

CPU	CPU 412-1	CPU 412-2	CPU 412-2 PN [1]	CPU 414-2	CPU 414-3	CPU 414-3 PN/DP [1]	CPU 414F-3 PN/DP
Dimensions (mm)	25 x 290 x 219				50 x 290 x 219		
Slots	1				2		
Order No. group: 6ES7	412-1XJ.	412-2XJ.	412-2EK.	414-2XK.	414-3XM.	414-3EM.	414-3FM.
Firmware	V5	V5	V6	V5	V5	V6	V6
Work memory							
Integrated	288 KB	512 KB	1 MB	1 MB	2.8 MB	4 MB	
Instructions	48 K	84 K	170 K	170 K	460 K	680 K	
For program	144 KB	256 KB	512 KB	512 KB	1.4 MB	2 MB	
For data	144 KB	256 KB	512 KB	512 KB	1.4 MB	2 MB	
Processing times							
Bit operation	0.075 µs			0.045 µs			
Word operation	0.075 µs			0.045 µs			
Fixed-point operation	0.075 µs			0.045 µs			
Floating-point operation	0.225 µs			0.135 µs			
Bit memories, timers, counters							
Bit memory	4 KB			8 KB			
S7 timers/counters	2 048 / 2 048			2 048 / 2 048			
IEC timers/counters	● *)			● *)			
Address ranges							
I/O	4 KB / 4 KB			8 KB / 8 KB			
I/O process image	4 KB / 4 KB			8 KB / 8 KB			
Digital channels	32 768 / 32 768			65 536 / 65 536			
Analog channels	2 048 / 2 048			4 096 / 4 096			
DP interfaces							
Number of DP interfaces	1 (MPI/DP)	1	1 (MPI/DP)	1	2	1	
Number of DP slaves	32	64	32	96	96 each	125 each	
Plug-in interface modules					1 x DP	1 x DP	
PN interfaces							
Number of PN interfaces			1 (2 ports)			1 (2 ports)	
PROFINET IO			●			●	
PROFINET with IRT			●			●	
PROFINET CBA			●			●	
TCP/IP			●			●	
UDP			●			●	
ISO-on-TCP (RFC 1006)			●			●	
Web server			●			●	
Data set gateway	●			●			

[1] As SIPLUS extreme component also for extended temperature range -25 °C ... +70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

*) Via SFB, number unlimited or limited only by main memory

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CPU	CPU 416-2	CPU 416F-2	CPU 416-3 [1]	CPU 416-3 PN/DP [1]	CPU 416F-3 PN/DP	CPU 417-4 [1]
Dimensions (mm)	25 x 290 x 219		50 x 290 x 219			50 x 290 x 219
Slots	1		2			2
Order No. group: 6ES7	416-2XN.	416-2FN.	416-3XR.	416-3ES.	416-3FS.	417-4XT.
Firmware	V5	V5	V5	V6	V6	V5
Work memory						
Integrated	5.6 MB		11.2 MB	16 MB		30 MB
Instructions	920 K		1840 K	2 680 K		5 M
For program	2.8 MB		5.6 MB	8 MB		15 MB
For data	2.8 MB		5.6 MB	8 MB		15 MB
Processing times						
Bit operation	0.03 µs					0.018 µs
Word operation	0.03 µs					0.018 µs
Fixed-point operation	0.03 µs					0.018 µs
Floating-point operation	0.09 µs					0.054 µs
Bit memories, timers, counters						
Bit memory	16 KB					16 KB
S7 timers/counters	2 048 / 2 048					2 048 / 2 048
IEC timers/counters	● *)					● *)
Address ranges						
I/O	16 KB / 16 KB					16 KB / 16 KB
I/O process image	16 KB / 16 KB					16 KB / 16 KB
Digital channels	131 072 / 131 072					131 072 / 131 072
Analog channels	8 192 / 8 192					8 192 / 8 192
DP interfaces						
Number of DP interfaces	1		2	1		3
Number of DP slaves	125		125 each			125 each
plug-in interfaces			1 x DP			2 x DP
PN interfaces						
Number of PN interfaces				1 (2 ports)		
PROFINET IO				●		
PROFINET with IRT				●		
PROFINET CBA				●		
TCP/IP				●		
UDP				●		
ISO-on-TCP (RFC 1006)				●		
Web server				●		
Data set gateway	●					●

[1] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

*) Via SFB, number unlimited or limited by main memory

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Memory concept, buffering, special functions

Data/program memory

All CPUs of the S7-400 have a separation between data memory and program memory. This division of the main memory provides a performance boost of 100 % in some constellations. Whereas a standard processor has to access its RAM at least twice, the S7-400 special processor accesses the code memory and data memory simultaneously in the same cycle. There are also separate code and data buses for this purpose. This provides the user with additional performance power!

The size of the main memory is determined CPU that can be selected from a finely graded range of CPUs.

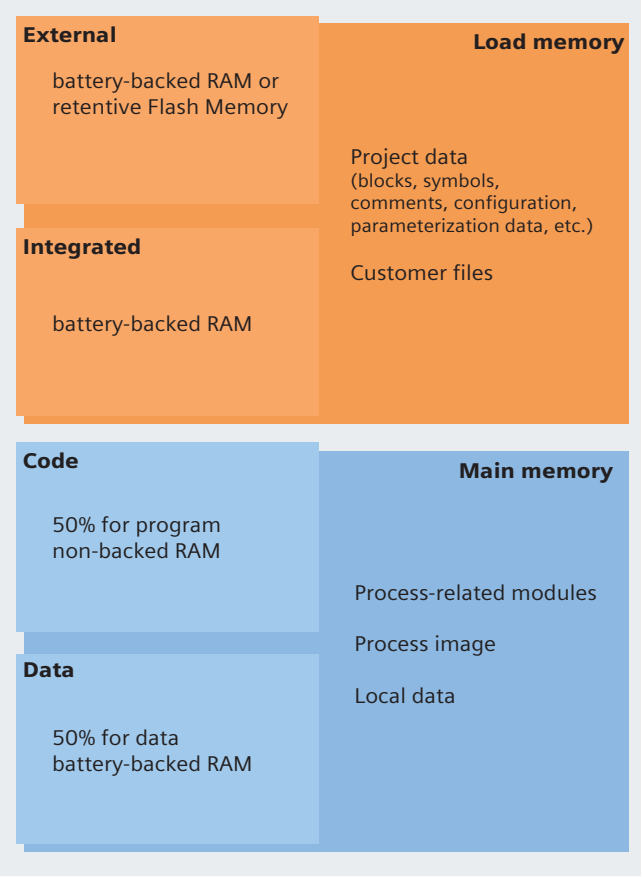
The integral load memory (RAM) is sufficient for small to medium-sized programs. For larger programs, the load memory is enlarged by plugging in RAM or FEPROM memory cards (64 KB to 64 MB).

With the 64 MB RAM memory card, it is possible to store the contents of the entire main memory of even the largest CPU. This RAM memory is backed up using a battery of the power supply. RAM memory cards are used especially in cases where, for example, the user program has to be modified frequently during the startup phase. RAM memory cards enable faster saving than FEPROM memory cards, and any number of write cycles.

For retentive storage without backup battery, there are plug-in FEPROM memory cards available whose data are retained even after the card has been disconnected.

Backup battery

The power supply modules of the S7-400 have a battery compartment for one or two backup batteries, depending on the type. If the supply voltage via the backplane bus fails, this battery backs up the set parameters and the memory contents (RAM) in CPUs and parameterizable modules and thus permits a restart of the CPU after a voltage failure using the saved parameters. Both the power supply module and the backed-up modules monitor the operating voltage and indicate when the battery is empty.



Memory types of the SIMATIC S7-400

Special functions

The S7-400 CPUs have some highly useful special functions:

- Simpler and faster upgrade due to firmware update via network
- Resetting of all settings to the factory settings using the hardware switch (Reset to Factory)
- Additional write-protection (for e.g. no component download from PC to CPU) via a system function
- Optional know-how protection by reading the serial number of the memory card, so that it is ensured that the program runs only with the particular memory card

An integrated data record gateway permits integrated access to data records across different bus systems and network boundaries, e.g. a control-level PC can communicate via PROFINET with a lower-level S7-400 controller and the field devices connected to it via PROFIBUS.

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Configuration in RUN

Changes to the configuration during operation

Modifications or expansions are also required during operation of a plant (section), such as implementation of additional sensors or actuators, reparameterization of I/O modules (e.g. selection of other interrupt limits). Possible applications are non-stop requirements, that is, in continuous processes that cannot be shut down or whose production cannot be interrupted: process plants or manufacturing plants with high restart costs.

With SIMATIC S7-400, hardware configuration changes can be carried out during operation of a plant without any adverse effects. CiR (Configuration in RUN) enables plant expansions and conversions during the operational phase.

Advantages

- CiR enables plant expansions and optimizations. Expansion and conversion of a plant can be made during operation of the process. These changes to the plant are reaction-free. This means expansions and conversions can be carried out faster and at lower cost.
- In addition, modifications in RUN enable an extremely flexible response to process changes and process optimizations.
- The time needed for the conversion of plants with no non-stop requirements can also be reduced through changing and reconfiguring during RUN because the plant does not have to be re-initialized or synchronized due to hardware configuration changes.

Application

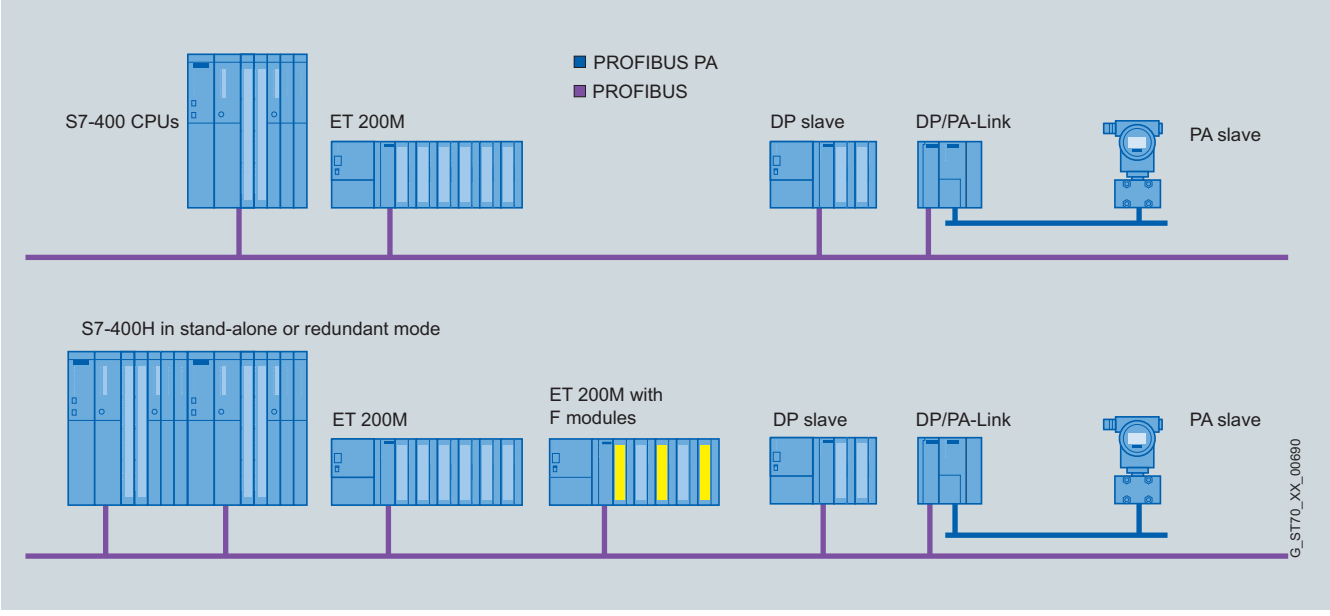
Changes to the hardware configuration in RUN are possible with distributed I/O. All standard CPUs of the S7-400 can be used, as well as the S7-400H fault-tolerant CPUs in stand-alone operation.

CiR processes can be carried out with the following DP masters:
- CPU via integrated interfaces
- CP 443-5 ext (from V5.0)

S7-400H CPUs in redundant configurations can be modified during operation using the H-CiR function.

Functions

The following hardware configuration changes can be carried out during plant operation:
- Addition of distributed I/O nodes (PROFIBUS DP and PROFIBUS PA slaves), e.g. for establishing an additional process line
- Adding of I/O modules in the ET200M distributed I/O system, e.g. for implementing additional sensor technology
- Undoing changes, that is, field devices (DP/PA slaves) and modules that have been added can be removed again
- Reparameterization of I/O modules in the ET 200M I/O system, e.g. replacing parts when using a sensor with another specification, or for selecting other interrupt limits



Range of modules that can be added to or removed from a plant during operation with an S7-400 as master

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Module range

The multi-facetted module range of S7-400 allows modular customization to suit the most varied tasks. S7-400 supports multi-facetted technological tasks and offers exhaustive communication options. There is a wide range of special modules in S7-400 design technology and communication.

Function module FM 452

Communications processor CP 443-1 A dvanced with Gigabit interface

Technology

Function modules are intelligent modules that independently execute the technological tasks and thus reduce the load on the CPU. They are used when a high level of accuracy and dynamic response is required.

Function modules		
Technological function	**Channels / Axes**	**Module**
Counting, measuring, proportioning, position detection (incremental)	2	FM 450 [2]
Cam controls	1	FM 452
PID control (continuous)	16	FM 455C
PID control (step/impulse)	16	FM 455S
Positioning (rapid traverse/creep feed)	3	FM 451
Positioning (with stepper and servo drives)	3	FM 453
Freely configurable logic, closed-loop control, motion control and technology tasks	Any	FM 458-1 DP

You can find further information in the SIMATIC Technology brochure and on the Internet at
www.siemens.com/simatic-technology

Communications

Communication processors are used for connecting S7-400 to the different bus systems / communication networks as well for point-to-point coupling.

Communications processors	
Bus system / communication network	**Module**
PROFIBUS DP [1]	CP 443-5 Extended
PROFIBUS FMS [1]	CP 443-5 Basic [2]
PROFINET/ Industrial Ethernet [1]	CP 443-1 [2] CP 443-1 Advanced [2]
Point-to-point connection	CP 440 CP 441-1, CP 441-2

[1] Further information can be found in the brochure Industrial Communications and on the Internet at
www.siemens.com/automation/simatic-net

[2] As SIPLUS extreme component also for corrosive atmosphere/ condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

The CP 443-1 Advanced provides the following additional functions:

- HTTP communication for access to process data via user-configured web pages
- E-mail client function for sending of e-mails direct from the user program
- FTP communication for program-controlled FTP client communication as well as access to blocks via an FTP server
- Gigabit connection including IP routing functionality for network separation
- Access protection by means of IP access list

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Point-to-point connection

Point-to-point link via communications processors (CPs) is an extremely powerful and low-cost alternative to bus systems. The advantage of point-to-point links over bus systems is especially pronounced when only a few (RS 485) devices are to be connected to the SIMATIC S7.

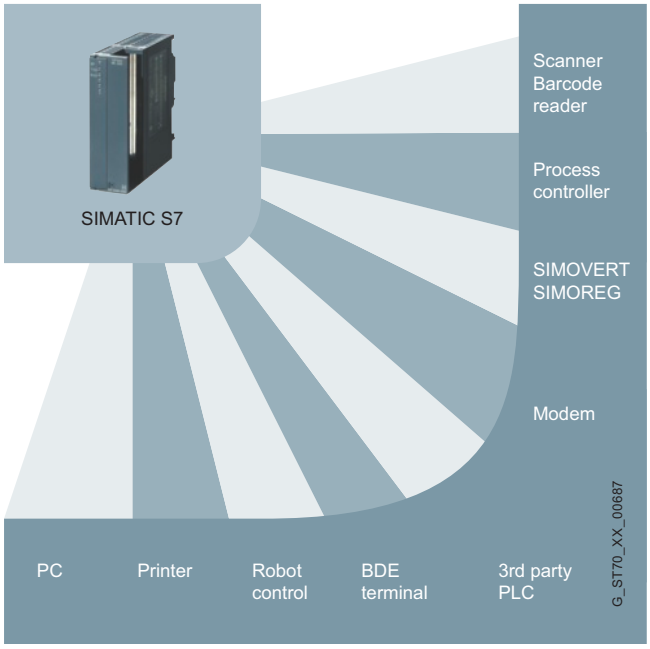
The CPs can also easily link third-party systems to the SIMATIC S7. Thanks to the great flexibility of the CPs, different physical transmission media, transmission rates or even customized transmission protocols can be implemented.

The CPs have a rugged plastic housing with LEDs for displaying operating states and faults.

For each CP there is a configuring package on CD with electronic manual, parameterization screen forms and standard function blocks for communication between the CPU and the CP.

The configuration data are stored in a system block and backed up in the CPU. When modules are replaced, the new module is therefore immediately ready for use.

With the S7-400 point-to-point link modules, adaptation to the physical transmission media is achieved by plugging in the relevant interface submodules, without the need for external converters.



Point-to-point links for SIMATIC S7-400

Technical data: Point-to-point connection

Application	*High-speed* response with low data volumes	Interconnection	
		Low-cost With one variable interface	*High-speed*: With two variable interfaces
Transmission rate	High (115 200 bit/s)	Low (38 400 bit/s)	High (115 200 bit/s)
Loadable protocols (Order No. group: 6ES7 340-)			MODBUS Master (-1AA.), MODBUS Slave (-1AB.), Data Highway (-1AE.)
Module	**CP 440**	**CP 441-1**	**CP 441-2**
Order No. group: 6ES7	440-1.	441-1.	441-2.
Physical transmission media			
RS 232C (V.24)		All transmission methods, all interface modules, plug-in, serial	
20 mA (TTY)			
RS 422/485 (X.27)	● (up to 32 nodes)		
Integrated transmission protocols			
ASCII	●		
Printer driver		●	
3964 (R)	●		
RK 512			●

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Signal modules

Signal modules are the interface of the controller to the process. A host of different digital and analog modules provide exactly the inputs/outputs required for each task.

Digital and analog modules differ as regards the number of channels, voltage and current ranges, electrical isolation, diagnostics and alarm functions, etc.

However, the S7-400 signal modules are only a subset of the modules that can be connected to the S7-400 via PROFIBUS DP. Centrally connected signal modules can be connected and disconnected during operation. This makes module replacement extremely easy.

In all the module ranges listed here, SIPLUS extreme components are also available for corrosive atmosphere/ condensation. (For further details, see page 102 or **www.siemens.com/siplus-extreme**)

Easy installation

The sensors/actuators are connected through front connectors. When a module is replaced, the connector is simply plugged into the new module of the same type; the wiring is retained. The coding of the front connector avoids mistakes. The S7-400 is also able to detect whether the front connector is plugged in.

Fast connection

SIMATIC TOP connect makes connection even simpler and faster. Preassembled front connectors with single cores and a complete plug-in modular system comprising a front connector module, connecting cable and terminal block are available.

High packing density

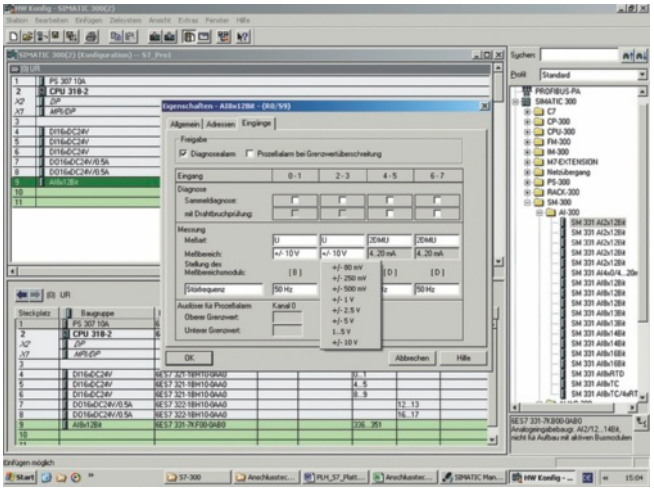
The high number of channels on the modules is a reason for the space-saving design. For example, modules with 8 to 32 digital channels or 8 to 16 analog channels are available.

Simple parameterization

The modules are configured and parameterized using STEP 7, and there are no inconvenient switch settings to be made. The data are stored centrally and, following module replacement, they are automatically transferred to the new module so that no setting errors can occur. No software upgrade is required when using new modules. A configuration can be copied as often as required, e.g. for series machines.

Diagnostics, interrupts

Many modules additionally monitor signal acquisition (diagnostics) and the signals from the process (process interrupt. e.g. edge evaluation). This makes it possible to react immediately to every process error, e.g. wire break or short circuit, and any process event, e.g. rising or falling edge at a digital input. The response of the controller can easily be programmed with STEP 7. On the digital input modules, several interrupts per module are possible.



Parameterization of an analog input module

On the following page you will find criteria for selecting the appropriate signal module for each application.

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Digital inputs

Module	Voltage range	Number of channels
SM 421 [1]	24 V DC	16, 32
SM 421	24 ... 60 V UC	16
SM 421	120/230 V UC	16, 32

Digital outputs

Module	Voltage range	Current range	Number of channels
SM 422 [2]	24 V DC	0.5 A	32
SM 422	24 V DC	2 A	16
SM 422	120/230 V AC	2 A	16
SM 422	UC (relay)	5 A	16

1) Available with 32 channels as SIPLUS extreme

2) Available as SIPLUS extreme (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

Analog inputs

Module	Measuring range	Resolution	Number of channels
SM 431	Power	Up to 16 bit	8, 16
SM 431	Current	Up to 16 bit	8, 16
SM 431	Resistance	Up to 16 bit	4, 8
SM 431	Thermocouples	Up to 16 bit	8, 16
SM 431	Resistance thermometer	Up to 16 bit	4, 8

Analog outputs

Module	Measuring range	Resolution	Number of channels
SM 432 [2]	Voltage, current	13 bit	8

You can find detailed information on S7-400 signal modules in the appendix.

SM 421 signal module

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SIMATIC S7-400H

Regardless of sector, cost pressures and the demand for maximum productivity are ratcheting up automation levels in production plants. This means that economic effectiveness depends directly on the availability of the systems, that is, the automation components.

The following requirements result:

- Prevention of expensive downtimes caused by controller failures, e.g. in production systems and power and water supplies, but also for runway lighting, shunting systems, etc.
- Avoidance of high restart costs following plant failure due to data loss, for example, with baggage transport, in high-bay warehouses, with tracking & tracing, etc.
- Protection of the plant and workpieces/materials in the event of plant or machine standstill, e.g. in smelting furnaces, the semiconductor industry, or with ship rudders, etc.
- Ensuring plant operation without supervisory or maintenance personnel, e.g. in wastewater treatment plants, tunnels, locks, and in building technology, etc.

All automation components – whether mechanical, electromechanical or electronic – are statistically subject to failure. This necessitates maintenance and modernization work. This factor alone means that the ideal availability of 100% cannot be achieved in practice.

SIMATIC S7-400H is a fault-tolerant controller that minimizes the probability of production failure – and thus contributes decisively towards maximum productivity.

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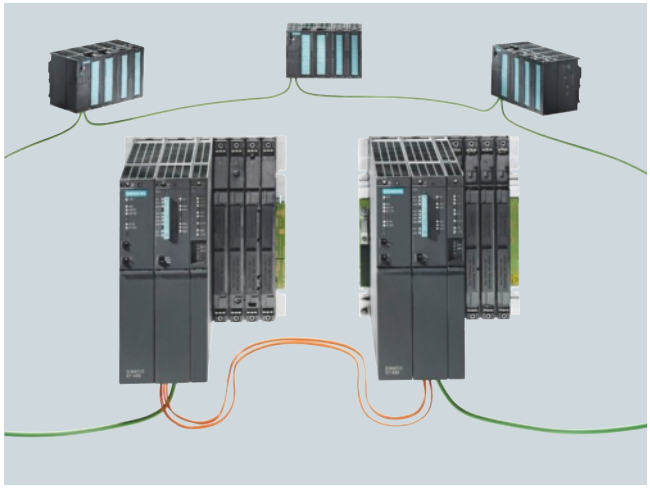
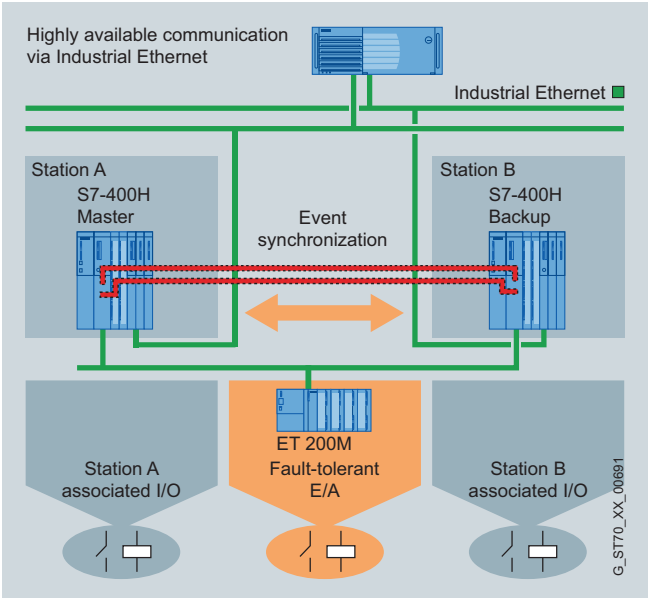
Hot standby with SIMATIC S7-400H

The SIMATIC S7-400H is a controller with two H CPUs of the same type; in the event of a fault, changeover takes place from the master system to the standby station. It is suitable for fault-tolerant processes with hot standby requirements (processes with changeover times shorter than 100 ms).



Highlights

- Flexible and scalable hardware solution with redundant controllers, in order to minimize downtimes
- Different redundancy options:
  - Redundant I/O
  - Redundant fieldbuses
- Bumpless changeover without loss of data
- Changes to the configuration and replacement of components during operation
- Simple integration of safety functionality
- Synchronization of the systems up to distances of 10 km are possible
- Many S7-400H components are also available in a SIPLUS extreme version for extreme environmental conditions, e.g. for use where there is a corrosive atmosphere/condensation. For further information, see page 102 or **www.siemens.com/siplus-extreme**



Topology of the S7-400H with two controllers and the associated I/O (standard and fault-tolerant)

Flexible modular redundancy (FMR)

The design of the S7-400H system is unique thanks to its flexibility, modularity and redundancy. The configuration of controller, I/Os and fieldbus can be tailored to requirements. Single and double redundancies can be mixed in one and the same system and coordinated with each other. Thanks to this flexibility, redundancy only has to be provided where it is actually needed. This enables more attractive and cost-effective solutions than conventional architectures with uniform design.

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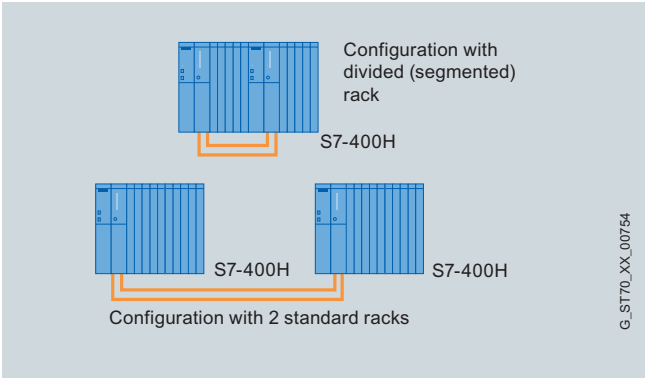
Design

The central devices can be configured in two different ways:

When the subunits have to be completely separated from each other for availability reasons, it is appropriate to use two standard racks (UR1 and UR2). Each rack accommodates one CPU and one power supply (PS). If extremely high availability is required, two redundant power supply modules can be used. The distance between the two racks can be up to 10 km.

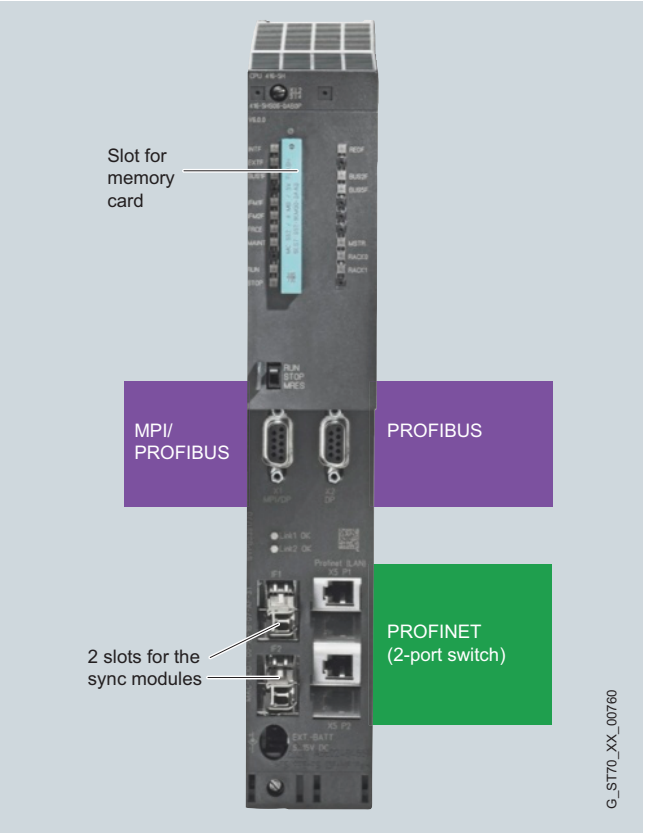
Two CPUs, each with either a single or a redundant power supply, are plugged into the UR2-H rack with a segmented backplane bus. This supports an extremely compact configuration.



Configuration of the central controllers

All CPUs have 5 interfaces:

- 1 PROFIBUS DP interface
- 1 MPI/PROFIBUS DP interface
- 2 interfaces for accommodating the Sync modules
- 1 PROFINET interface with 2-port switch



Interfaces of the CPU

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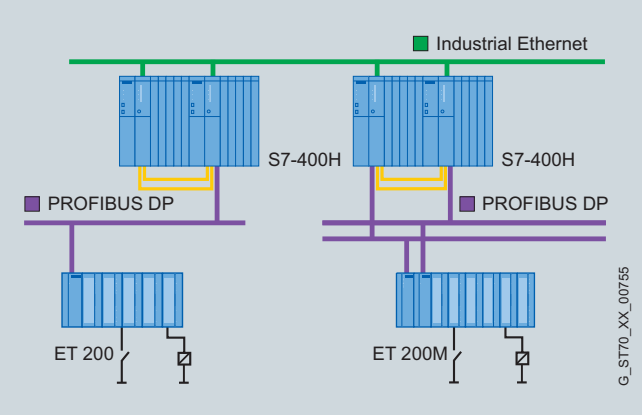
I/O NEW

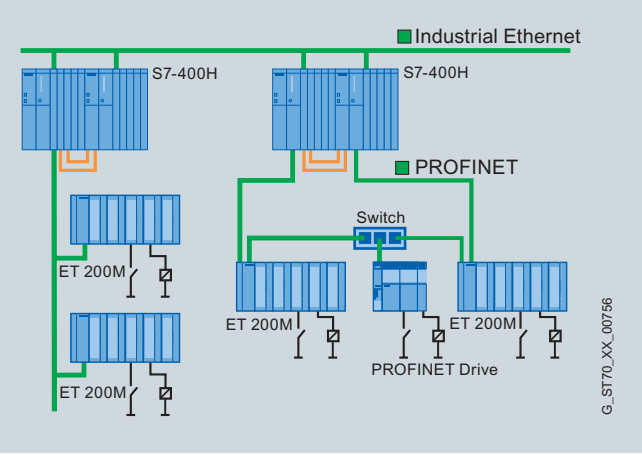
The I/O can be connected flexibly via PROFIBUS and PROFINET. PROFIBUS and PROFINET configurations can be combined with one another.

PROFIBUS can provide a one-way interface (normal availability) or a switched interface (increased availability).



One-way (left) or switched (right) I/O interface via PROFIBUS

PROFINET provides a one-way interface (normal availability) or a system-redundant interface via open ring. Availability in the open ring increases when devices that support PROFINET IO system redundancy are connected, such as the SIMATIC ET 200M distributed I/O device.

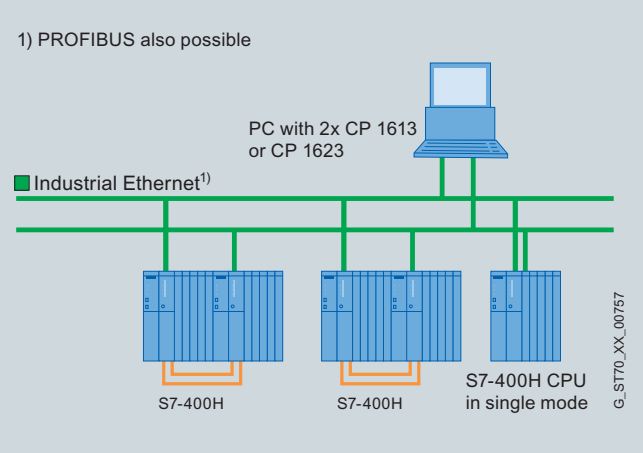


One-way (left) or system-redundant (right) I/O interface via PROFINET

Communications

Fault-tolerant communication for redundant connections is already integrated into the SIMATIC S7-400H.
In the event of a fault, the fault-tolerant communication link can take over automatically, and invisibly to the user.

When connecting the I/O via PROFIBUS, the internal PROFINET interface can be used for communication.



Fault-tolerant communication

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Redundant I/O

Redundant I/Os are input and output modules that are redundantly configured and operated. Maximum availability is offered by the implementation of redundant I/O because in this manner, failure of a CPU, a PROFIBUS line and a signal module is compensated for. During fault-free operation, both modules are active: For example, in the case of redundant inputs, the values of the shared sensor are read in by two modules, and the result is compared and made available to the user as a unified value for further processing.

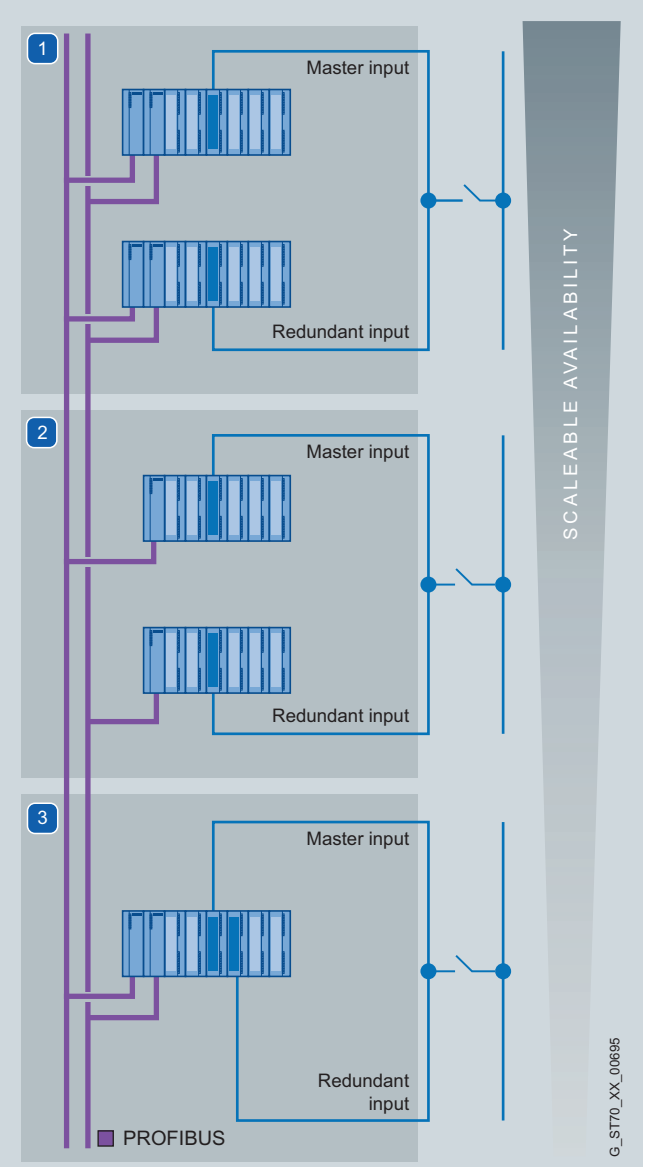
In the case of redundant outputs, the value calculated by the user program is output by both modules. In the event of a fault, e.g. if one of the two input modules fails, the defective module is no longer addressed, the fault is signaled and processing continues with the intact module only. Following repair, which may be carried out during operation, both modules can be addressed again.

Numerous signal modules of the S7-300 (for distributed configurations with ET 200M) are available for redundant operation.

Scalable availability

The availability is scalable in accordance with the redundant I/O configuration:

1. Each module in a separate rack with redundant connection to PROFIBUS
   or
2. Each module in a separate rack with single connection to PROFIBUS
   or
3. Both modules in one rack



Scalable availability of the redundant I/O

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User-friendly engineering

Programming is possible, as in the case of a standard system, in all STEP 7 programming languages. The programs can easily be ported from standard systems to a redundant system and vice-versa. When the program is loaded, it is automatically transferred to the two redundant CPUs. The redundancy-specific functions and configurations are parameterized with STEP 7.

Integrated diagnostics

In addition to the standard diagnostics functions, there are also integrated self-diagnostic functions. With these, the system detects and signals faults before they can affect the process. They enable the faulty components to be identified and replaced quickly which speeds up repairs.

Replacement of components and changes to the configuration

All components can be replaced during operation. When a CPU is replaced, all the current programs and data are automatically reloaded. Program changes such as changing/reloading blocks, configuration changes such as adding or removing DP slaves or modules, and also changing the memory configuration of the CPU can also be carried out during operation.

High-availability and safety in one system

The fail-safe and fault-tolerant S7-400FH is based on the S7-400H CPUs, the engineering tool F-Systems, the fail-safe I/O modules of the ET 200, and fail-safe communication via PROFIsafe. The S7-400FH immediately assumes a safe state or remains in a safe state when a fault occurs, and thus guarantees maximum safety for personnel, machinery, the environment, and the process. The S7-400FH is certified by the German Technical Inspectorate (TÜV) and complies with all the relevant standards. The architecture of the S7-400FH tolerates faults while maintaining safety.

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H-CPUs

Fault-tolerant CPUs NEW

Four new CPUs are available for the SIMATIC S7-400H to suit different performance requirements. Apart from high volumes, the H-CPUs are also characterized by high performance. This is not only visible in a high processing speed, but also in a large communication output.

Furthermore, an integrated memory type that detects and automatically corrects memory cells corrupted through external influences is also used. The H-CPUs also permit a firmware update via the network.

Synchronization

The method of event-driven synchronization supports fast and bumpless changeover to the redundant CPU in the event of a fault. It resumes processing at the point of interruption without any loss of information or interrupts. The operating system ensures that all commands, which if executed independently would produce different states in the two systems, operate in synchronism. No programming or parameterization has to be performed by the user for this purpose.

Sync modules

The H-CPUs are connected by means of fiber-optic cables and Sync modules that can be plugged directly into the CPU. This means that no slot in the rack is lost and that communication is extremely fast. The Sync modules can be replaced with the voltage applied.

There are two types of Sync modules:
- For Sync cables up to 10 m in length
- For Sync cables up to 10 km in length for applications in which the subunits have to be set up at some distance

Features of H-CPUs

	CPU 412-5H	CPU 414-5H	CPU 416-5H	CPU 417-5H
Work memory (program/data)	1 MB (512 KB/512 KB)	2 MB (2 MB/2 MB)	16 MB (6 MB/10 MB)	32 MB (16 MB/16 MB)
MPI/PROFIBUS	1	1	1	1
PROFIBUS	1	1	1	1
PROFINET	1 with 2-port switch	1 with 2-port switch	1 with 2-port switch	1 with 2-port switch
Safety (optional)	Yes	Yes	Yes	Yes
Max. distance between 2 CPUs	10 km	10 km	10 km	10 km

The most important features of the new CPUs. Innovations compared to the predecessor CPUs are set against a blue background.

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Technical data: H-CPUs				
CPU	**CPU 412-5H**	**CPU 414-5H**	**CPU 416-5H**	**CPU 417-5H**
Dimensions (mm)	50x290x219			
Slots	2			
Order No. group: 6ES7	412-5HK.	414-5HM.	416-5HS.	417-5HT.
Firmware	V6.0			
Work memory				
Integrated	1 MB	4 MB	16 MB	32 MB
For program	0.5 MB	2 MB	6 MB	16 MB
For data	0.5 MB	2 MB	10 MB	16 MB
Processing times				
Bit operation	31.25 ns	18.75 ns	12.5 ns	7.5 ns
Word operation	31.25 ns	18.75 ns	12.5 ns	7.5 ns
Fixed-point operation	31.25 ns	18.75 ns	12.5 ns	7.5 ns
Floating-point operation	62.5 ns	37.5 ns	25 ns	15 ns
Bit memories, timers, counters				
Bit memory	8192			
S7 timers/counters	2048/2048			
IEC timers/counters	Unlimited (limited only by the work memory)			
Address ranges				
I/O	8192 bytes			
I/O process image	256 bytes		1 024 bytes	
DP interfaces				
Number of MPI/DP interfaces	1			
Number of DP interfaces	1			
Plug-in interfaces	–			
PN interfaces				
Number of PN interfaces	1			
PROFINET IO	Yes			
PROFINET with IRT	No			
PROFINET CBA	No			
TCP/IP	Yes			
UDP	Yes			
ISO-on-TCP (RFC 1006)	Yes			
Web server	No			
Data set gateway	Yes			

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Application examples NEW

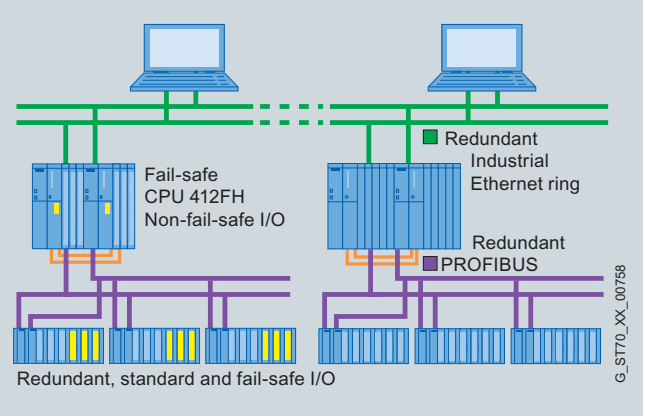
Infrastructure – Maximum availability round the clock

Requirements

Whether it is a matter of supplying water or electricity, or keeping traffic moving on streets, rails or water: in the field of infrastructure, 24/7 availability is absolutely essential. Without it, life as we know it would be unimaginable. For both rail and road transport, tunnels are particularly critical spots. For this reason, programmable controllers play a key role here. They are used for monitoring and controlling all plant sections around the clock and with maximum reliability. These include: traffic control systems, medium-voltage and emergency power supplies, low-voltage energy distribution, air measuring devices and video monitoring – as well as lighting, ventilation, fire alarm, loud speaker, emergency call and radio systems.

Solution

The high demands for availability and safety in tunnel systems can be met easily and efficiently using a redundant configuration of the SIMATIC S7-400H in connection with Safety Integrated. For this purpose, the entire I/O and all sensor systems are connected to an Ethernet network by means of a redundant PROFIBUS and the likewise redundant SCADA system – via the internal interfaces of the S7-400 H CPUs. Safe operation is even ensured when SCADA systems or cable connections fail. The fire program, for example, operates extremely reliably even after the outbreak of a fire. In addition, the maintenance or service personnel can intervene in the event of a fault, which in turn helps to optimize the availability of the plant.



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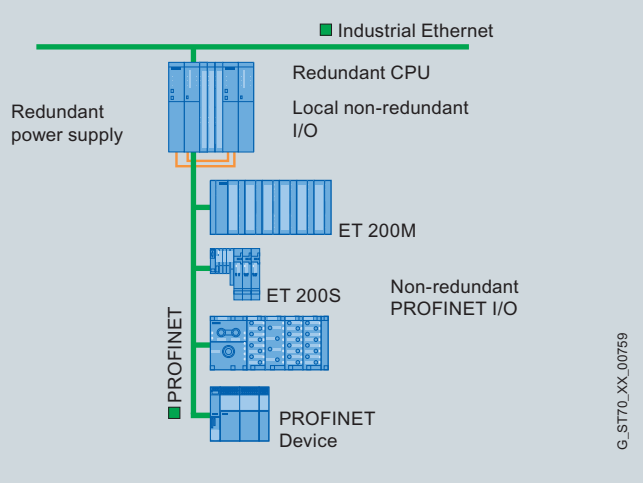
Warehouse - avoiding loss of data and the resulting high restart costs

Requirements

In a typical warehouse, several thousand movements must be performed every day in three shifts. The corresponding orders come from the higher-level central controller. As long as this continues to function perfectly, everything runs to plan. The total failure of a single-design central controller would cause partial loss of data with far-reaching consequences. After restart, the stackers must be repositioned and the content of the transport containers re-recorded – and production would be at a standstill for all this time.

Solution

The SIMATIC S7-400H fault-tolerant controller is available in redundant form. Automatic comparison between controllers ensures a consistent program and consistent data. If one controller fails, at least one CPU is always at the latest (warehouse) status. After replacing the defective CPU, a comparison of data is performed automatically. If changes are required during operation, the same procedure is executed. In this case, CPU 1 is stopped, the modified program transferred, and the CPU then restarted. The automatic comparison ensures a consistent program.



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SIMATIC PC-based controllers

Introduction

Why PC-based automation?

The PC is an incomparable success story and has become indispensable in many areas of everyday life. PC know-how is taken for granted today and standards (hardware components, operating system, user interfaces, communication, etc.) have developed with the PC that can be implemented in an ever-widening range of applications thanks to constantly increasing performance combined with falling prices.

In automation too, where PCs were only deployed rarely (mainly for visualization tasks), extensive applications for complex tasks are now commonplace.

This has been mainly due to two reasons:

- The PC offers new possibilities with regard to flexibility, cost reductions and reduced time-to-market in combination with considerable increases in performance.
- PC technology provides on the one hand new application possibilities in a standardized environment, and on the other hand easy integration of such PC-based solutions in the office world.

Automation solutions based on this technology naturally result in total integration of all the main components (logic control, safety, visualization, high-level languages, distributed I/O, IT integration, etc.).

Rugged, turnkey, embedded bundles

In recent years, thanks to the rapid advances in PC technology, a new class of embedded PC has been created.

The technology used here raises the ruggedness of such devices to new levels. The modern embedded PC is fan free due to appropriate selection of the new energy-saving processors and a suitable housing design.

By replacing the classical hard disk with a Flash memory card or solid-state drive (SSD), the disadvantages of rotating mass storage can also be avoided. Building on a compact, embedded operating system (Windows Embedded), in combination with software controllers, visualization software, technology functions and motion control functions, extremely compact, powerful and rugged embedded systems are created for implementation at the machine. Embedded systems in the form of embedded bundles offer additional customer benefits, because logic control functions (also fail-safe) and/or visualization functions are preinstalled and ready for switch-on. This can save time in the engineering and commissioning phases of many applications.

The benefits of SIMATIC PC-based Automation

- Optimum integration with logic control, visualization, industrial PC, high-level languages, distributed I/O, communication and the IT world supports compact automation solutions
- Turnkey, embedded bundles – rugged and maintenance-free
- High-performance through participation in the relentless PC innovation process
- Easy integration of high-level languages (C/C++/VB/...) in the controller program to support the implementation of technology functions and know-how protection through the encapsulation of functions
- Scalable, integrated safety solution – also on the PC – with system-wide advantages, such as uniform engineering and communication
- Open solutions through, for example, interfacing to software (databases, business SW) or through integrating special hardware
- Easy communication through integrated network interfaces
- High degree of system availability
- Use of familiar engineering tools (SIMATIC STEP 7)
- Integral diagnostic/alarm functions
- High degree of flexibility and openness

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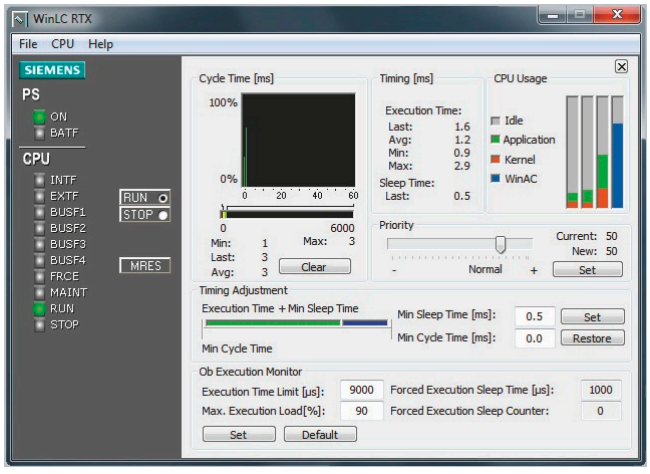
SIMATIC WinAC RTX

SIMATIC WinAC (Windows Automation Center) is the PC-based control system from Siemens with a real-time response.

A SIMATIC S7 is integrated into the PC to produce a cost-optimized total solution in which all the components are available from a single source, if desired. Developers and users profit here from the experience and the global service network of the market leader Siemens and from the high quality of the SIMATIC products and systems. PC-based controllers are configured and programmed with the STEP 7 standard software, in exactly the same way as S7 Controllers. User programs can run on a SIMATIC CPU or a PC according to customer wishes, and finished S7 programs can be adopted for PC-based solutions.



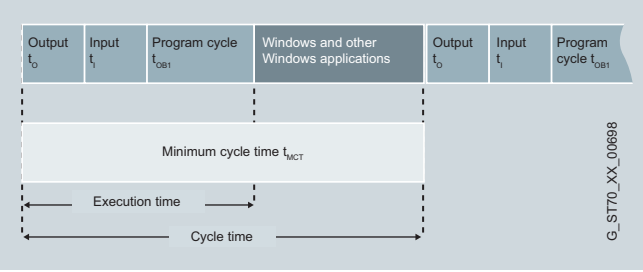
Operator interface of SIMATIC WinAC RTX

Increased flexibility and openness

The WinAC RTX software controller is used when high performance, high data volumes and at the same time hard real time are required for the automation task. The optimized runtime system supports the processing of extensive and demanding PC applications in parallel with the control task. It executes on the operating systems Windows XP Professional, Windows 7 or Windows Embedded Standard and uses the real-time core Interval Zero RTX to ensure real time and deterministic behavior.

Real-time behavior means the response to process events takes place within a specific time. The priority of the control program compared to the Windows applications running in parallel can also be specified.

Deterministic behavior means the control program is executed in a fixed cycle and any Windows applications running in parallel will be interrupted if required – such as in drive controls, for example. The time remaining after execution of the control program at the end of the cycle time is available to Windows.



Deterministic behavior of WinAC RTX through a constant cycle time with reserve for Windows after execution of the control program

Open, PC-based Control based on Windows

WinAC RTX enables control on the PC. WinAC RTX – the SIMATIC S7 in the PC – is eminently suitable when, in addition to control and visualization functions, tasks with high data volumes and high-speed technological functions have to be solved on a PC platform.

The SIMATIC HMI software is ideal for visualizing an integrated total solution within the scope of Totally Integrated Automation (TIA):

- SIMATIC WinCC – the multi-user SCADA system with Plant Intelligence
- SIMATIC WinCC flexible – the HMI software for machine and process-level applications

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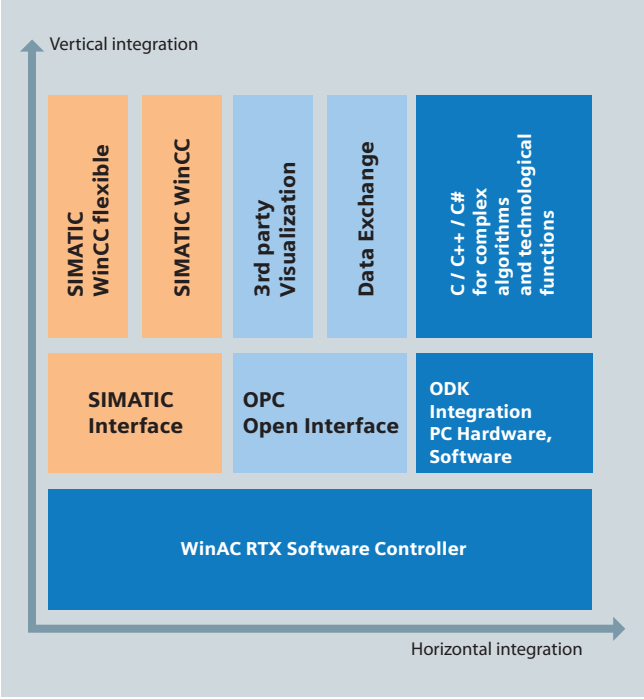
WinCC and WinCC flexible can be connected via a SIMATIC interface in order to exploit the advantages of the shared database, such as convenient configuration and simple alarm handling. PG/OP communication allows connection of SIMATIC programming devices and operator panels.



WinAC RTX offers open data interfaces for vertical and horizontal integration of other applications

WinAC RTX offers an open data interface to the standard software of the office world for vertical integration on the basis of OPC. In the case of visualization and data processing, simple and symbolic access to the process data can be made via this open interface. The integral SIMATIC NET OPC server enables vendor-independent communication with all OPC client applications, such as visualization systems from other manufacturers.

WinAC RTX is open to integration of technological applications, such as barcode readers, image processing, measured value acquisition and numerical controls. C/C++ programs can also be integrated into the WinAC RTX control program. Extremely flexible solutions can therefore be generated with access to all the hardware and software components of the PC.

C/C++ is frequently used to program complex technology functions. These often contain valuable know-how. C/C++ encapsulates these programs. The openness of WinAC RTX can therefore also be used to protect the know-how in customized functions.

The performance of WinAC RTX can be scaled across the PC platform. Applications range from machine-level control tasks with rugged embedded PCs to high-end applications on PCs with the latest technology.

Implementation on embedded platforms and Windows XP Embedded or Windows Embedded Standard results in cost-effective and rugged automation solutions at the machine.

The following devices are offered as turnkey embedded bundles:

- SIMATIC S7 modular embedded controller
- Nanobox PC IPC227D and Microbox PC IPC427C
- Nanopanel PC IPC277D and Panel PC HMI IPC477C

Fail-safe version

With WinAC RTX F, a TÜV-certified (German Technical Inspectorate), fail-safe software controller for safety-oriented applications is available. The S7 Distributed Safety software (a STEP 7 option) is required for programming the fail-safe program. The PROFIsafe profile permits fail-safe communication via PROFIBUS DP and PROFINET IO.

Use of SIMATIC know-how

WinAC RTX is programmed with the usual SIMATIC programming tools – with STEP 7 or, if required, also with the field-proven engineering tools, such as the IEC 61131-3-compliant languages S7-SCL or S7-GRAPH.
WinAC RTX is code-compatible with SIMATIC S7, i.e. program sections created for SIMATIC S7-300 and S7-400 can continue to be used in WinAC RTX and vice versa. Existing investments in software are thus protected. In conjunction with the familiar and field-proven configuring using STEP 7, accumulated SIMATIC know-how can be used extremely well with WinAC RTX.

Simple integration of technological functions

SIMATIC WinAC RTX enables simple integration of technological functions for, say, counting, positioning and closed-loop control tasks.
On the one hand, there are intelligent function modules of the SIMATIC ET 200 distributed I/O devices available for this that are connected via PROFIBUS DP or PROFINET IO.

On the other hand, different SIMATIC software packages enable the solution of simple technological tasks. Examples include Standard PID Control for general closed-loop control purposes, and Easy Motion Control with its block library in accordance with the PLCopen Motion Control standard for traversing linear or rotary axes.

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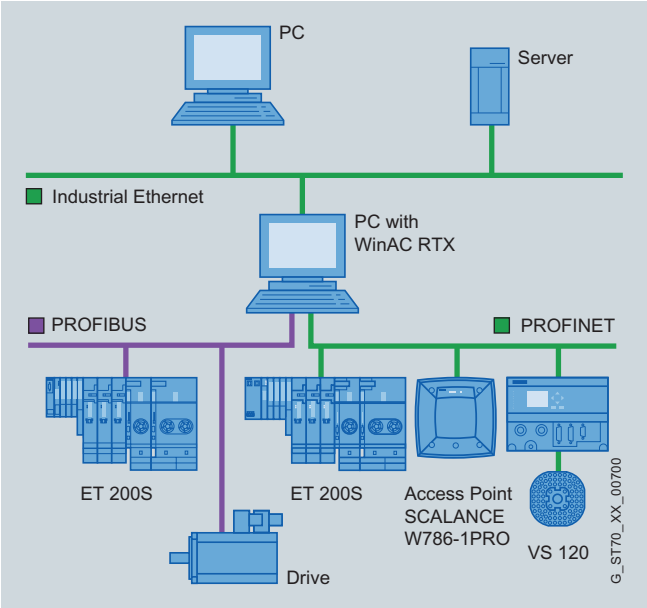


Example of a controller configuration with WinAC RTX on PROFINET and PROFIBUS

Use of the PC resources and retentivity behavior

With WinAC RTX software controllers, your PC-based automation solution benefits from the high performance of modern PCs. High processor clock rates result directly in a high-performance solution. Using the PC work memory effectively removes any size restrictions on your user programs.

WinAC RTX uses the main memory of the PCs and offers program backup on the hard disk. Non-cyclic data such as production parameters or recipe data can be stored permanently on the PC's hard disk with the help of system functions (SFC 82 – 84).

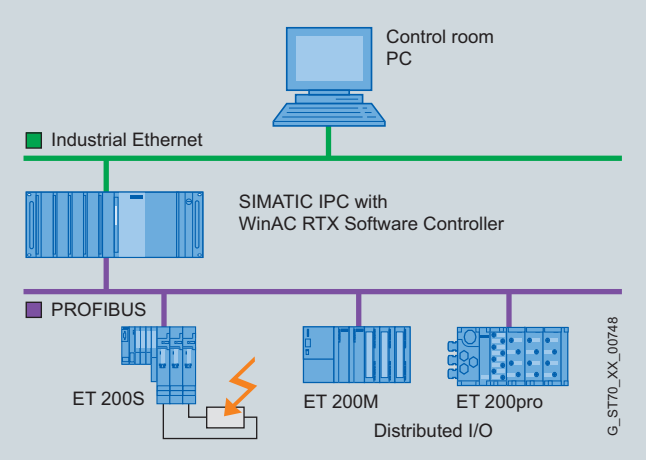
On exiting, WinAC RTX saves all the data declared as retentive to the hard disk. In order to ensure a defined shutdown of the software controller in the event of an unexpected failure of the PC voltage supply, an uninterruptible power supply (UPS, e.g. SITOP DC UPS) can be used.

SIMATIC IPC with integrated, non-volatile memory enable up to 128 KB of retentive data to be stored in the event of a voltage dip, regardless of the file system.

Communication and diagnostics across all levels

WinAC RTX offers the full scope of performance of S7 communication with S7 controllers and other WinAC stations over the PROFIBUS and Industrial Ethernet / PROFINET networks. Any data areas can be sent and received with S7 Communication. WinAC stations are handled identically to other S7-CPUs here. WinAC RTX supports several independent PROFIBUS interfaces (e.g. CP 5613) and a PROFINET line. Thanks to this and to the activation / deactivation of PROFIBUS slaves, networks can be constructed with great flexibility. Intelligent field devices with complex functions can be integrated via PROFIBUS DP V1.

Direct access can be made to all IO devices and their components from a central control desk across network boundaries using WinAC RTX, especially for diagnostics purposes – even for remote diagnostics via Teleservice. This powerful routing function indicates the status of the individual (sub)modules of the slaves distributed on-site, that is, faults can be diagnosed precisely in the control room.



For diagnostics purposes, direct access to the I/O level of the I/O devices is possible from the control room using WinAC RTX

Highlights

- Cost savings through integration of all automation components on the industrial PC (IPC)
- Utilization of the continuous level of innovation and performance improvement of PCs
- Easy communication through low-cost, integrated network interfaces
- Simple use of business software (e.g. MS Office) and creation of proprietary user software with powerful software tools (C++, VB, etc.)
- Wide, standardized range of hardware
- Large choice of products
- Investment security in the use of IPCs with long-term availability

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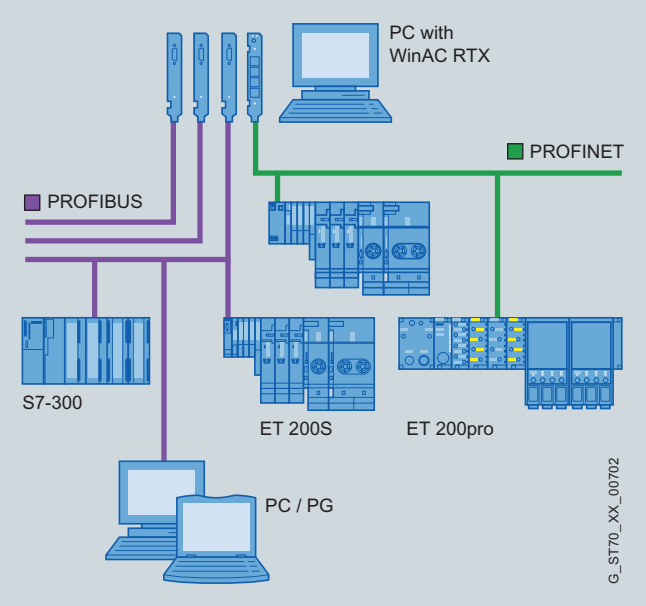
Connection of the I/O

WinAC RTX can control the distributed I/O not only via PROFIBUS, but also via PROFINET.

The I/O is connected via PROFIBUS DP at up to 12 Mbit/s via the integral DP interface of the SIMATIC IPCs or via communication processors (CP 5611 A2/5613 A2). Up to four PROFIBUS lines can be operated with up to max. 500 slaves.
It is also possible to connect the I/O over PROFINET. Either the integral Ethernet interface or the integral PROFINET interface is used for this purpose with the 3-port switch integrated into the SIMATIC IPC.

In addition, WinAC RTX also supports the system function isochronous mode with PROFIBUS or PROFINET. With isochronous mode, high-speed, time-dependent applications such as closed-loop controls can also be implemented with distributed I/O. This means that in addition to the control job other functions can be integrated into a PC or smaller, more economical IPCs can be used for the same job.



WinAC RTX can operate one PROFINET and up to three PROFIBUS subnets for connecting the I/O

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	WinAC RTX 2010	WinAC RTX F 2010
Order No. group	6ES7 671-0RC.	6ES7 671-1RC.
Basic features		
Work memory (integral) (code/data)	PC memory (non-paged memory)	
Number of inputs/outputs in total	16/16 KB	
Bit memory	16 KB	
S7 counters/timers	2 048 / 2 048	
Number of blocks (FBs, FCs, DBs)	Limited only by available PC work memory	
Programming software	STEP 7, V5.4 SP4 or higher, Engineering Tools (optional)	STEP 7 V5.4 SP4 or higher, S7 Distributed Safety
Retentivity		
with UPS	All data[1)]	
Instruction execution times		
Bit / integer operation	0.004 µs / 0.003 µs	
Floating-point operation (reference platform)	0.004 µs (Pentium 4, 2.4 GHz)	
Deterministic	●	
DP connections		
Total	4	
CP5613-A2 / 5603 / 5623	4	
CP5611 / 5621 / integrated interface of SIMATIC IPC, max.	1	
PN terminals		
CP1616 / 1604 / integrated interface of SIMATIC IPC, max.	1	
PROFINET interface	1 (also real-time)	
Communications functions		
PG/OP communication	●	
S7 Communication	●	
Open User Communication (OUC)	●	
Process data access via OPC	●	
Technology		
Isochronous mode	● (PN and DP)	
SIMATIC FM	FM 350/351/352/ 353/354/355	
Easy Motion Control	●	
C/C++ link, VB, C#	● with ODK	● read only in the fail-safe part
HMI over SIMATIC interface		
SIMATIC WinCC/WinCC flexible	●	
Operating system		
Windows XP Professional	● (SP2, SP3)	
Windows Embedded Standard	● (on XPe images of the SIMATIC IPC)	
Windows 7	● (on images of the embedded IPC)	

1) 128 KB with specific SIMATIC IPC without UPS

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Open Development Kit (ODK)

Integrating special tasks

PC-based solutions typically include technological tasks such as image processing, measured value acquisition and numerical controls. The new WinAC option Open Development Kit (ODK) allows flexible use of all PC resources from the control program via three different interfaces in order to provide high-performance expansion of the functionality. All the operating system functions and system resources of Windows are available to the programmer for this purpose, also providing access to external hardware and software components.

An ODK application is developed with a standard development environment for C-/C++/C# programming, such as Microsoft Visual Developer's Studio. This provides the application developer with the familiar environment tailored to Windows applications.

C++ programming knowledge is not required for integrating such applications into the WinAC control program. The ODK applications can be used like normal system functions in the STEP 7 program.

Developers of high-level language applications can get support from the WinAC Competence Centers:
www.siemens.com/pcbasedautomation/cc

WinAC ODK offers three interfaces for the following applications:

- Custom Code Extension Interface (CCX) for calling your own high-level language programs from the WinAC control program
- Shared Memory Extension Interface (SMX) for high-speed WinAC data exchange with Windows applications
- Controller Management Interface (CMI) for integrating the WinAC Panel functionality into a Windows application

Custom Code Extension Interface (CCX)

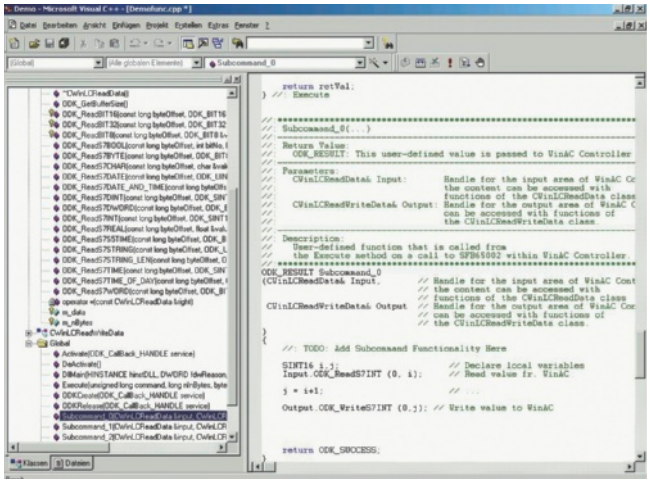
ODK includes an application wizard and a class library for simple programming in Microsoft Visual Studio. The program, which executes outside WinAC, is created using Visual C# – or Visual Basic or Visual C# in the case of Windows applications – and generated as a DLL or real-time DLL. The DLL is called by means of three system functions (SFC 65001, 65002, 65003).
The C program can be executed in three different ways:

- Synchronously, that is, processed as part of the cyclic program
- Asynchronously, that is, started by the cyclic program and terminated in the background
- Continuously, that is, processed in parallel with the cyclic program

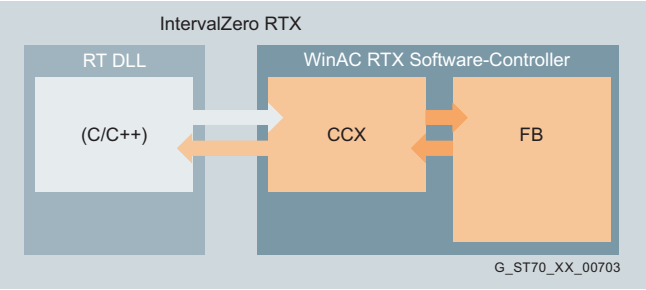
CCX and SMX applications can be executed both under Windows as well as in the real-time core used by WinAC RTX. An additional tool from the manufacturer of the real-time core is required for developing real-time CCX applications. This allows diverse applications to be implemented.

Some examples include:

- Connection of fieldbus cards to WinAC
- Integration of robot control software into WinAC
- Direct access to Windows file system
- Implementation of special communications protocols
- Complex calculations for control of the quality of packaging film



Operator interface of the application wizard with class libraries and C++ program



The Custom Code Extension Interface (CCX) offers the facility of calling high-level language programs from the control program of the WinAC software controller

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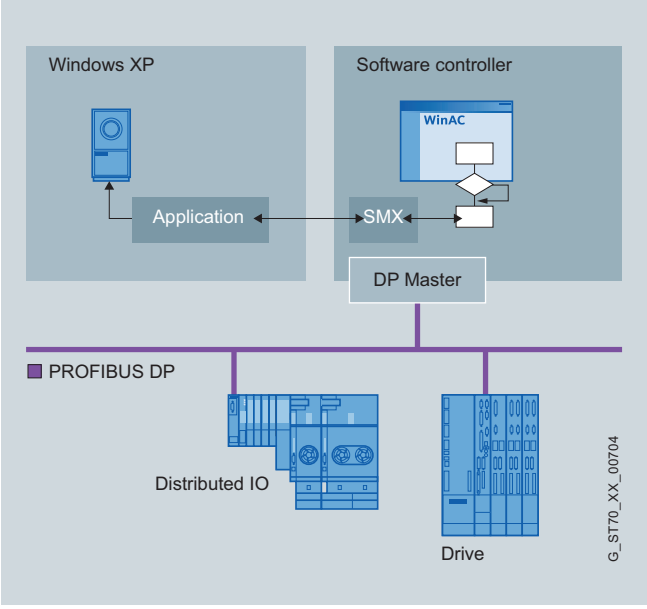
Shared Memory Extension Interface (SMX)

ODK supports the development of applications requiring data exchange between Windows applications such as Visual C++ and WinAC, as is the case, for example, in closed-loop control or image processing tasks. This data exchange is especially fast via the a dual-port RAM (DPR) or shared memory, accessed by both the external C++ program and the cyclic program. ODK includes libraries for reading and writing to this DPR according to the polling method. From the viewpoint of WinAC, the DPR represents a 4 KB I/O area that can be accessed with load/transfer commands.

Typical applications of the SMX:
- Connection of motion control systems
- Connection of systems for measured data acquisition and analysis
- Transfer and backup of large volumes of production and quality data
- Direct and high-performance integration of an order database

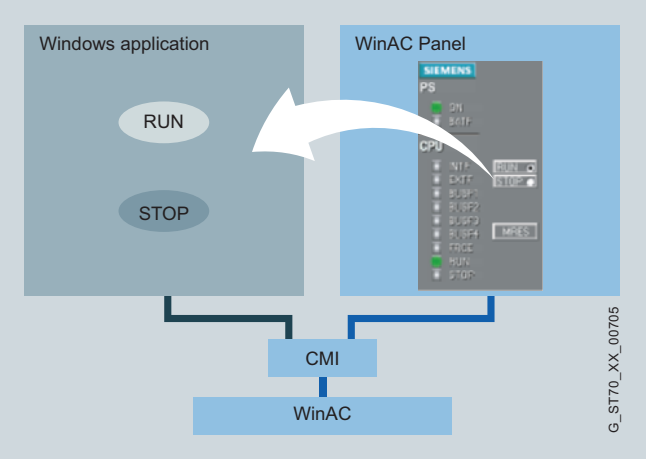


The Shared Memory Extension Interface (SMX) enables data exchange between software controllers and Microsoft applications

Controller Management Interface (CMI)

With ODK, the function of the WinAC Panels can be integrated into a Windows application (see figure). For this purpose, the CMI provides the application with the following functions of the WinAC Panel:
- LED status
- Start and stop of WinAC
- Subsequent loading of programs

Application examples:
- Integration of the WinAC Panel into an HMI application
- Remote operation of WinAC
- Implementation of specific user rights



The Controller Management Interface (CMI) integrates the WinAC Panel functionality into a Windows application

ODK programming languages	
Real-time application CCX or SMX	C/C++
Windows application CCX, SMX or CMI	C/C++ Visual Basic C#

Technical data	
Features	**WinAC ODK V4.2**
Order No. group	6ES7 806-1CC.
Operating system	Windows XP Professional SP2 and SP3
Software required	MS Visual Developer Studio V6.0, .net 2003, 2005, 2008; IntervalZero SDK (suitable for the real-time core version of WinAC RTX for real-time CCX and SMX applications)

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Turnkey SIMATIC embedded bundles

SIMATIC embedded bundles combine different tasks

- Control
- Operator control and monitoring
- Data processing
- Communications

on one shared, compact and rugged embedded platform. Strict real-time requirements are also met.

In addition, this platform is flexible and can be effectively integrated into an overall solution. Including close links with data processing or logistics systems, as well as connection to vision systems.

Thanks to their fan-free and disk-free design, the SIMATIC embedded bundles can be used direct at the machine in harsh environments.

Customized versions increase flexibility and openness even further, and tap into additional application areas.

SIMATIC embedded bundles support automation solutions based on an embedded box PC, an embedded Panel PC or a modular embedded controller in S7-300 design.

SIMATIC Embedded Bundles are combinations of hardware and software that have been configured as turnkey solutions for specific automation tasks. They combine the openness of PC-based controllers with the ruggedness of conventional controllers. In addition, they boast flexible software installed on powerful, scalable hardware in an open, compact combination.

The devices do not require fans, and standard memory cards, e.g. CompactFlash, SD or Multi Media Cards, are used instead of a hard disk. Microsoft Windows Embedded Standard is used as the operating system.

The products can be supplied with display, operator controls, and HMI software already integrated, along with interfaces to fieldbuses and Industrial Ethernet. This provides a rugged, compact and low-cost device for data-intensive tasks.

Spare parts are available for five years due to the short service life of the chip sets, operating systems, and service packs used. This is significantly more than for standard PCs, but not as long as for classic SIMATIC products.

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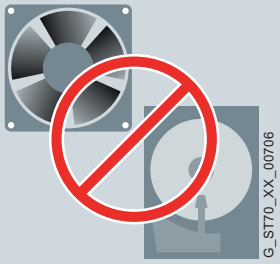
The SIMATIC embedded bundles are configured turnkey systems. Like all other SIMATIC Controllers, they are configured and programmed with STEP 7 – both via PROFIBUS and PROFINET/Industrial Ethernet.

These are the advantages of the embedded bundles:

Rugged and maintenance-free

SIMATIC embedded bundles are rugged and maintenance-free. They thus enhance system availability and reduce standstill times.

- Fan-free and diskless, that is, no rotating parts. Instead, an industry-standard CompactFlash (CF) Card or innovative solid-state drive (SSD) is used as the memory medium
- Retentivity of certain data areas without uninterruptible power supply (UPS)
- Preinstalled software that is impervious to operator errors and viruses



Compact and space-saving

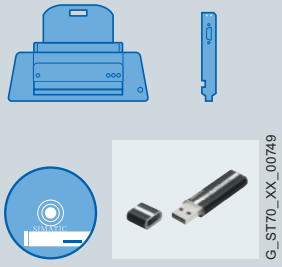
SIMATIC embedded bundles are extremely compact. Enabling space-saving installation.

- Mounting depths start from 61 mm with IPC477C
- The pre-configured Windows XP Embedded or Windows Embedded Standard operating system offers the familiar PC user interface and has been optimized for automation tasks

Open and flexible

SIMATIC embedded bundles are open and flexible. Making it easy to integrate other applications and connect external hardware.

- Integration of C/C++/C# or VB programs (Visual Basic)
- Integration of typical standard Windows applications, e.g. for further processing of data via OPC server
- Connection of third-party systems via OPC server
- Installation of embedded PC hardware, e.g. PCI-104 or PCIe expansion cards
- Connection of USB devices, e.g. printers, monitors
- Easy integration into existing automation landscape or IT environments via integral PROFINET and PROFIBUS interface



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SIMATIC S7 modular embedded controller

Modular embedded controller in S7-300 design with EM PC, EM PCI-104 expansion module, EC31 modular embedded controller and SM3XX signal module (from the left)

SIMATIC S7-mEC is a modular embedded controller in S7-300 design with the latest embedded PC technology. This embedded controller combines the advantages of the tried and tested modular S7 controller and the PC technology in one new device.

Highlights

- Combination of modular S7-300 controller design concept and embedded PC technology
- Fanless and diskless S7-300 design
- Modular expansion with central S7-300 I/O modules and PC interface modules
- Configuration and programming as for an S7 Controller with STEP 7
- Simple integration of HMI and PC applications into the controller
- Retentive data memory

On the one hand, SIMATIC S7-mEC stands out due to:

- Maximum ruggedness without fan or hard disk
- Modularity and scalability, e.g. central expansion with S7-300 I/O and additional PC interfaces
- Commissioning by specialist automation personnel as with the S7-300

On the other hand, S7-mEC offers:

- Standard PC operating system Windows Embedded Standard and standard PC interfaces
- Latest embedded PC technology
- Openness in software and hardware (integration of standard Windows XP applications and standard PCI-104 cards)

The modular embedded controller is particularly suitable for applications in which control, visualization and data processing are of equal importance. The most important applications of the S7-mEC are in special and series machine building, which apart from the control task also integrate additional automation tasks, e.g. HMI on one hardware platform. This means that centralized expandability with the standard SIMATIC I/O is still possible. In addition, the performance and openness of current PC technology can be fully exploited.

S7-mEC consists of one Embedded Controller (EC 31) which can be

- constructed on the one hand with S7-300 SM modules
- and on the other hand with expansion modules (EM).

EC31 is available in the following functional versions:

- EC31 with Windows Embedded Standard operating system and Software Development Kit (SDK) for Windows programs
- EC31-RTX with software controller WinAC RTX
- EC31-HMI/RTX with HMI Runtime software WinCC flexible and software controller WinAC RTX
- EC31-RTX F
  As TÜV-certified (German Technical Inspectorate), fail-safe version for safety-oriented applications with the fail-safe software controller WinAC RTX F (SIL3, PLe, Cat. 4).

In addition to Windows Embedded Standard, EC31 has an integrated controller process level system. Programming and diagnostics – as with all other SIMATIC Controllers – are performed with STEP 7. The I/O bus interface enables signal modules (SM) and interface modules (IM) to be operated centrally for the multi-tier rack configuration.

WinCC flexible Runtime is already preinstalled on the EC31-HMI/RTX version in order to perform machine-level visualization tasks on a ready-to-run basis.

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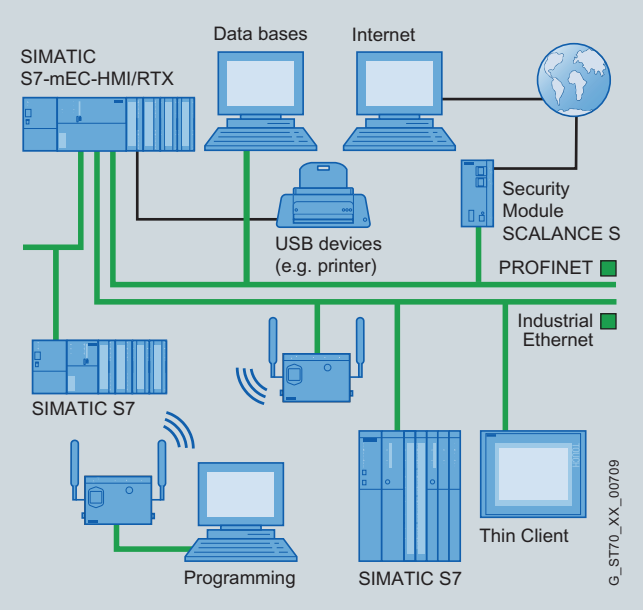
Modular Embedded Controller with Multi Media Memory Card MMC

Operator control and monitoring can also be performed with installed HMI Runtime on a SIMATIC Thin Client which has access to S7-mEC data by means of standard TCP/IP mechanisms . Distances of 100 m or more can be spanned without difficulty.

EC31 can be expanded with a wide range of different standard PC modules:

- The expansion module PC (EM PC) offers several interfaces, including a Gigabit Ethernet interface with separate IP address and two slots for memory cards.
- The expansion module PCI-104 (EM PCI-104) has three slots for any PC modules (PCI-104 and PCI-104+), e.g. bus interface modules, instrumentation modules, video modules, memory cards or sound cards.
- The following can be used:
  - One or two EM PCI-104 modules or
  - One EM PC or
  - One EM PC and one EM PCI-104



S7-mEC RTX connection options via PROFINET and USB

Technical data: S7-mEC

Feature	EC31-RTX, EC31-HMI/RTX	EC31-RTX F
Design	Modular, fanless, expandable controller in S7-300 design	
Processor	Intel CoreDuo 1.2 GHz	
Work memory	1 GB	
Retentive memory	512 KB	
Operating system	Windows Embedded Standard	
Software controller	WinAC RTX	WinAC RTX F
HMI Runtime software	WinCC flexible with 128, 512 or 2 048 PowerTags including archives, recipes and SmartAccess	
CompactFlash	4 GB	
Additional memory	Multi Media Card MMC	
Interfaces	1 x PROFINET (2 ports),[1] 1 x Ethernet, 2 x USB 2.0, Mouse, keyboard	
Order No. group	6ES7 677-1DD.	6ES7 677-1FD.
EM PC (optional)		
Interfaces	2 x USB 2.0, 1 x Gigabit Ethernet (separate IP address), 1 x serial, 1 x DVI-I, 1 slot for CompactFlash card, 1 slot for SD / Multi Media Card	
Order No. group	6ES7 677-1DD5.	
EM PCI-104 (optional)		
Slots	3 x PCI-104	
Order No. group	6ES7 677-1DD4.	

[1] PROFIBUS optionally via CP 5603

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SIMATIC IPC227D bundles

**Nanobox PC with maximum flexibility –
absolutely maintenance-free – power-optimized with Intel Atom**

The Nanobox PC SIMATIC IPC227D is an extremely compact and flexible embedded industry PC.
It is power-optimized due to Intel Atom processors of the latest generation E6xx, and is suitable for implementing simple control, data collection or communication tasks.
The innovative Nanobox PC SIMATIC IPC227D received the coveted iF product design award.

With its compact dimensions of 191 x 100 x 60 mm (W x H x D), the Nanobox PC fits in small control boxes, as well as directly in a machine or the machine stand. All its interfaces are on one side, so the device can be cabled up easily.
It can be installed with considerable versatility in four different mounting variants: standard rail, wall, book and side mounting.

The SIMATIC IPC227D is also available as a compact Nanopanel PC SIMATIC IPC277D with brilliant widescreen displays of 7" upwards.

The Nanobox PC with long-term availability is configurable online and is supplied with a preinstalled and activated operating system.

Highlights:

- Low power consumption:
  - Intel Atom processors E6x0 (power-optimized)
  - Integrated 24 V industrial power supply
  - Wake-on-LAN functionality for timed start-up from a central point, over the network
- Extremely high system availability and data security
  - Solid-state drive (SSD) with SLC technology (SATA) or CompactFlash drive
  - 512 KB non-volatile, retentive memory also for battery-free operation (optional)
  - Front LED display for efficient self-diagnostics
  - Pre-installed local diagnostics software
- High data transfer rates and redundancy thanks to two teaming-capable Gigabit Ethernet connections, one of which can optionally be used as a PROFINET interface with real-time functionality
- High degree of flexibility for interfaces and expansions
  - 4 x high-speed USB 2.0 ports
  - 1 x RS232 optionally also as RS485 or CAN
  - 1 x PCI slot (optional)
  - or 3 x additional serial interfaces (opt.)
  - or 4 x digital inputs and outputs, 24 V DC (opt.)
- High-quality industrial design for continuous use round-the-clock at ambient temperatures up to 50 °C:
  - Absolutely maintenance-free – no fan, hard disk or battery
  - Full-metal enclosure with high electromagnetic compatibility
  - High resistance to vibration and shock
  - Dust-tight
  - CE, UL, shipbuilding approvals [1)]

[1)] Available soon

For fast commissioning, turnkey bundles are offered complete with visualization and/or control software.

Technical data: IPC227D	
	IPC227D with WinAC RTX (F) and WinCC Advanced V11
Intel processors	Intel Atom (E6x0)
Work memory	Up to 1 GB
CompactFlash	2, 4 or 8 GB or 50 GB SSD (SLC)
Retentivity	128 KB without UPS
Interfaces	PROFINET via standard Ethernet interface
PC cards	Max. 1 x PCIe
Operating system	Windows Embedded Standard
Software controller	WinAC RTX (F)
HMI software	WinCC RT Advanced with 128, 512, 2048, or 4096 PowerTags incl. archives and recipes
Additional software in scope of delivery	SOFTNET-S7 Lean including OPC server
Order No. group	6ES7 647-8A...

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SIMATIC IPC427C bundles

Turnkey IPC427C bundle

SIMATIC IPC427C complete units are turnkey rail-mounted PCs with high industrial capability (degree of protection IP20) and are available with preinstalled automation software in four versions:

- With WinAC RTX
- With WinAC RTX F
- With WinAC RTX and WinCC flexible
- With WinAC RTX F and WinCC flexible
- With WinCC flexible
- with WinCC

The IPC427C bundle is recommended when the following demands are made on the automation solution:

- Compact use without operator input
- Use with remote screen
- Machine-level installation
- User-specific hardware and software
- Integration of different tasks (control, technology, data processing) on one hardware

The WinAC RTX software controller and the WinCC flexible HMI software are already installed and configured:

- The WinAC RTX software controller handles the actual control task and execution of the user program.
- WinCC flexible Runtime allows machine-level visualization of up to 2 048 PowerTags including archives and recipes.

Highlights

- Fanless and diskless design
- Deterministic software controller with real-time capability
- Data retentivity through integrated SRAM
- A fail-safe version is available

The fail-safe version with WinAC RTX F offers the following additional advantages:

- Programmable with S7 Distributed Safety V5.4
- Fail-safe communication using PROFIsafe via PROFIBUS and PROFINET

Up to 128 KB of retentive data are stored on an integral, non-volatile memory without an uninterruptible power supply (UPS). Full retentivity of all process values can be achieved with a commercially available UPS.

The integral OPC server allows open access to all process values. Any visualization or data processing systems can be connected to WinAC RTX via this interface.

C/C++ programs can be integrated into the control cycle via ODK – under real-time conditions as well. The software controller is programmed with STEP 7 via the integral PROFINET or PROFIBUS interface. The SOFTNET-S7 Lean communications package is installed for this purpose.

Three status LEDs for RUN, STOP and group error indicate the operating status of WinAC RTX.

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SIMATIC IPC427C bundles

Technical data: IPC427C	
	IPC427C bundle with WinAC RTX (F) and WinCC flexible
Intel processors	Intel Celeron (1.2 GHz) up to Intel Core2 Duo (2 x 1.2 GHz)
Work memory	Up to 4 GB
CompactFlash	2, 4 or 8 GB or 32 GB SSD (SLC)
Retentivity	128 KB without UPS
Interfaces [1)]	PROFIBUS PROFINET via standard Ethernet interface PROFINET via integrated CP 1616 interface
PC cards	Max. 3 x PCI-104
Operating system	Windows Embedded Standard
Software controller	WinAC RTX (F)
HMI software	WinCC flexible with 128, 512, 2 048 or 4 096 PowerTags including archives and recipes
Additional software in scope of delivery	SOFTNET-S7 Lean including OPC server
Order No. group	6ES7 675-1D.

[1)] Additional PROFIBUS interfaces with CP 5603

SIMATIC IPC427C with WinCC V7.0 Embedded as a client or single-user station

Turnkey bundles based on SIMATIC HMI IPC427C are supplied with WinCC V7.0. These are designed for direct plant operation on site in combination with flat panel monitors (as a client or single-user station). In combination with a WinCC server, multi-user systems can be built up containing up to 32 clients (on one server).

WinCC V7.0 is preinstalled on SIMATIC IPC427C and is supplied ready to use. The installed software is identical for client and single-user applications and includes Microsoft SQL-Server Express.

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SIMATIC IPC277D bundles

Nanopanel PC – absolutely maintenance-free – power-optimized with Intel Atom

The SIMATIC IPC277D is equipped with brilliant touch displays from 7". Its rugged widescreen fronts offer more freely-configurable display area, high resolution and a large viewing angle. With backlighting that can be dimmed by 100%, it is suitable for high-luminescence display with low power consumption.

The IPC277D is also available as a compact Nanobox PC SIMATIC IPC227D with maximum flexibility for interfaces, expansions and mounting possibilities.

The Nanopanel PC with long-term availability is configurable online and is supplied with a preinstalled and activated operating system. For fast commissioning, turnkey bundles are offered complete with visualization or control software.

Highlights:

- Power-optimized:
  - Intel Atom processors E6x0 (power-optimized)
  - Integrated 24 V industrial power supply
  - Wake-on-LAN functionality for timed start-up from a central point, over the network
- Extremely high system availability and data security
  - Solid-state drive (SSD) with SLC technology (SATA) or CompactFlash drive
  - 512 KB non-volatile, retentive memory also for battery-free operation (optional)
  - Preinstalled diagnostics software
- High data transfer rates and redundancy thanks to two teaming-capable Gigabit Ethernet connections, one of which can optionally be used as a PROFINET interface with real-time functionality
- High flexibility in terms of interfaces
  - 3 x high-speed USB 2.0 ports
  - 1 x RS232
- High-quality industrial design for continuous use round-the-clock at ambient temperatures up to 50 °C:
  - Absolutely maintenance-free – no fan, hard disk or battery
  - High electromagnetic compatibility
  - High resistance to vibration and shock
  - CE, UL, shipbuilding approvals [1)]

[1)] Available soon

Technical data: IPC277D bundle	
Feature	**IPC277D with WinAC RTX (F) and WinCC Advanced V11**
Processor	Intel Atom (E6x0)
Work memory	1 GB
CompactFlash	2, 4 or 8 GB or 50 GB SSD (SLC)
Displays	7" color display (800 x 480) Touch 9" color display (800 x 480) Touch 12" color display (1200 x 800) Touch 15", 19" available soon
Retentivity	128 KB without UPS
Interfaces	PROFINET via standard Ethernet interface
Operating system	Windows Embedded Standard
Software controller	WinAC RTX (F)
HMI software	WinCC RT Advanced with 128, 512, 2 048 or 4 096 PowerTags including archives and recipes
Software packages included in the scope of supply	SOFTNET-S7 Lean including OPC server
Order No. group	6AV7 881-...

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SIMATIC HMI IPC477C bundles

The SIMATIC HMI IPC477C is a compact device and combines ruggedness and high reliability with the openness of a PC. With an IPC477C bundle, the following software is already pre-configured and ready to run:

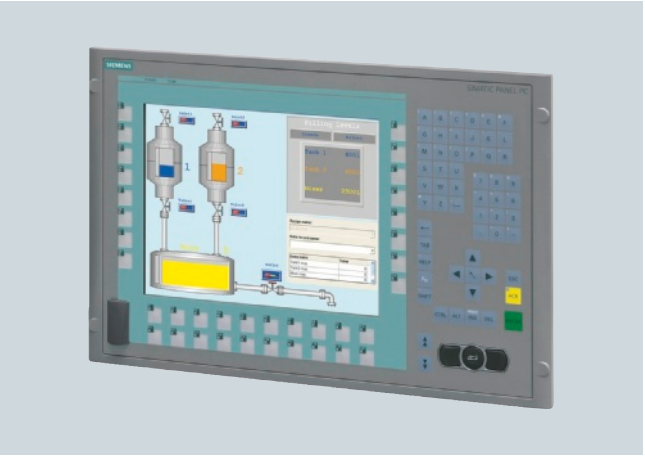
- The software controller WinAC RTX or the fail-safe software controller WinAC RTX F
- Runtime of the HMI software WinCC flexible
- SOFTNET S7-LEAN communications package

The SIMATIC HMI IPC477C bundle is the perfect, turnkey solution for applications where operation, visualization and control tasks have to be performed on just one compact device. As a scalable and expandable device, it is suitable where

- use directly at the machine and
- flexible adaptation of the application are necessary.

The HMI IPC477C is available with brilliant 12", 15" and 19" displays with touch operation or 12" and 15" displays with key operation. All device versions are available from stock. The low mounting depth of 61 mm (100 mm for the 19" Touch) allows the HMI IPC477C to be operated even where space is restricted.

A variant is also available with all-round protection to IP65, the HMI IPC477C PRO, which is suitable for mounting on a support arm or base.



SIMATIC HMI IPC477C bundle with key operation

Technical data: HMI IPC477C	
Feature	**HMI IPC477C bundle**
Processor	Intel Celeron (1.2 GHz) up to Intel Core 2 Duo (2 x 1.2 GHz)
Work memory	Up to 4 GB
CompactFlash	2 GB, 4 GB, 8 GB or 32 GB SSD (SLC)
Displays	12" TFT color display 800 x 600 (Key or Touch) 15" TFT color display 1 024 x 768 (Key or Touch) 19" TFT color display 1 280 x 1 024 (Touch)
Retentivity	128 KB without UPS
Interfaces	PROFIBUS (optional) PROFINET
Operating system	Windows Embedded Standard
Software controller	WinAC RTX (F)
HMI software	WinCC flexible with 128, 512, 2 048 or 4 096 PowerTags including archives and recipes
Software packages included in the scope of supply	SOFTNET-S7 Lean including OPC server
Order No. group	6AV7 884-. (standard variant) 6AV7 883-. (PRO variant)

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The WinAC RTX or WinAC RTX software controller and the WinCC flexible HMI software are already installed and configured:

- The WinAC RTX (F) software controller handles the actual control task (also fail-safe) and execution of the user program.
- WinCC flexible Runtime allows machine-level visualization of up to 2 048 PowerTags including archives and recipes.

As in the case of the IPC427C bundle, process values are accessed via the integrated OPC server and C/C++/C# programs can also be integrated – even under real-time conditions. For further details, see IPC427C bundle.

Up to 128 KB of retentive data are stored on an integral, non-volatile memory without an uninterruptible power supply (UPS). Full retentivity of all process values can be achieved with a commercially available UPS.

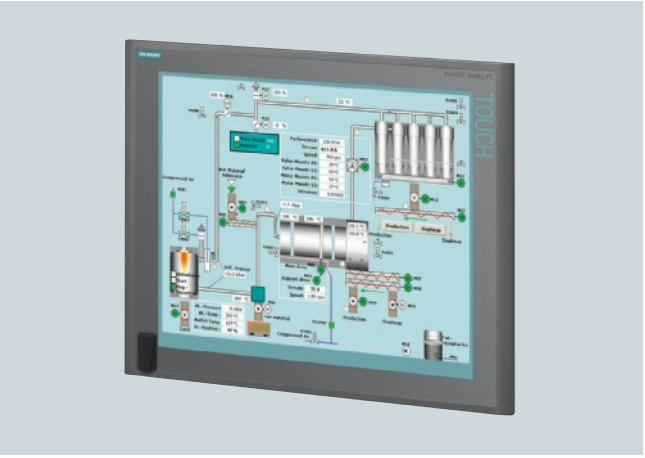
Configuring is carried out using the engineering software WinCC flexible. The simple user interface of WinCC flexible permits extremely efficient operation:

- Libraries offer preconfigured objects and reusable faceplates
- Intelligent tools permit project management and graphical configuration
- Extensive support of multilingual configurations

SIMATIC HMI IPC477C with WinCC V7.0 Embedded as a client or single-user station

Turnkey bundles based on SIMATIC HMI IPC477C are supplied with WinCC V7.0 that are designed for direct plant operation on site. The SIMATIC HMI IPC477C and WinCC Embedded bundles represent rugged, powerful Panel PCs that can be implemented as standard client or single-user systems, depending on the hardware ordered. In combination with a WinCC server, multi-user systems can be built up containing up to 32 clients (on one server).

WinCC V7.0 is preinstalled on SIMATIC HMI IPC477C and is supplied ready to use. The installed software is identical for client and single-user applications and includes Microsoft SQL-Server Express.



SIMATIC HMI IPC477C bundle with 19" touch display

Highlights

- Fanless and diskless design
- Deterministic software controller with real-time capability
- HMI runtime software with archives and recipes
- Controlling and visualizing via touch screen or membrane keyboard
- Data retentivity through integrated SRAM

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Software controller for Multi Panels

SIMATIC WinAC MP for Multi Panels

SIMATIC WinAC MP is the software controller running under Windows CE for all SIMATIC Multi Panels. WinAC MP is ideally suited to small and medium-size applications in which maximum performance is not essential. WinAC MP is a good alternative for price-sensitive applications, in which the stability and ruggedness of a hardware solution are still essential.

WinAC MP is very closely aligned with a hardware CPU and is installed on the rugged and fanless Multi Panels.

- The smaller version is optimized for MP 177.
- The medium version is optimized for MP 277.
- The larger version is optimized for MP 377.

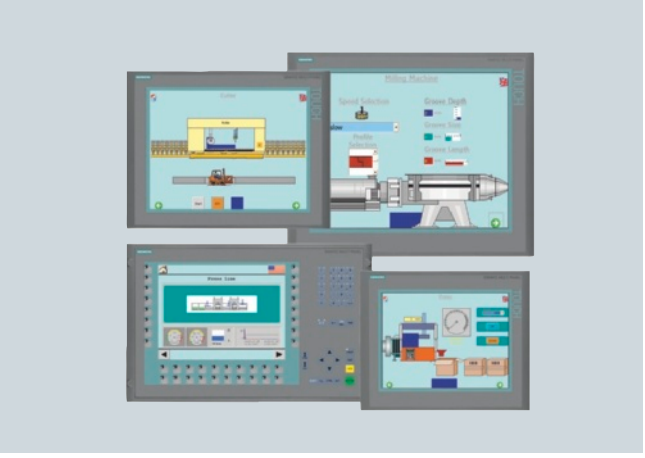
The Multi Panels with touch or key functionality are available with display sizes between 6" and 19" and offer both real-time and deterministic behavior via Windows CE.

WinAC MP uses standard tools such as STEP 7 (V5.4/SP4 or higher) and WinCC flexible (Standard or higher from Version 2008 SP1). This means that a switch is possible at any time without any training overhead for new tools. The operator interface of WinAC MP is available in the WinCC flexible library. Standard and High Feature ET 200 modules (from I/O modules to technology modules) are connected as I/O via PROFIBUS.

Timers, counters, flags and data blocks are retentive as in the case of a hardware CPU . This is ensured by the multi panel hardware without uninterruptible power supply (UPS). All data (operating system, HMI data, control data, archive, recipes, licenses, etc.) can be transferred with one keystroke to a standard memory medium (SD card, Multi Media Card, USB stick).

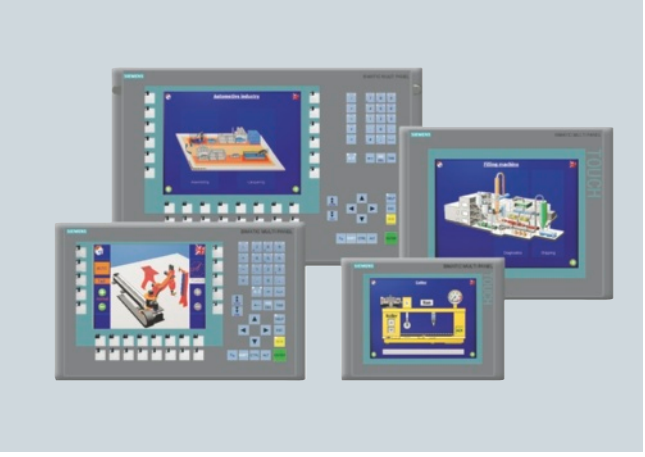
Highlights

- Software controller on Windows CE basis
- Versions optimized for all SIMATIC Multi Panels
- Rugged and economical solution for all applications in combination with a rugged hardware platform
- Ideal for machine-level tasks, saving space and money
- Simple service concept by means of backup/restore of all PLC and HMI data on standard storage media



SIMATIC Multi Panels MP 377 with 12", 15" and 19" displays

SIMATIC Multi Panel MP 177 6" Touch



SIMATIC Multi Panels MP 277 with 8" and 10" displays

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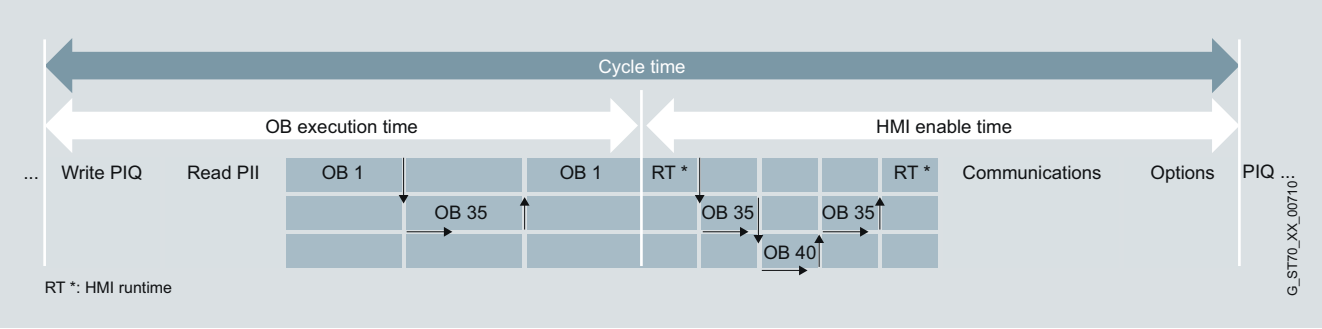

Cycle diagram for SIMATIC WinAC MP with control and HMI segments

Technical data: WinAC MP			
Features	**WinAC MP for MP 177**	**WinAC MP for MP 277**	**WinAC MP for MP 377**
Hardware platform			
Order No. group	6ES7 671-4EE.	6ES7 671-5EF.	6ES7 671-7EG.
Panel	MP 177 6" (Touch)	MP 277 8" (Touch, Key), MP 277 10" (Touch, Key)	MP 377 12" (Touch, Key), MP 377 15" (Touch), MP 377 19" (Touch)
Integrated work memory	128 KB	256 KB	512 KB
Operating system	Windows CE 5.0		
Programming software	STEP 7 V5.4 SP4 or higher		
Visualization software	WinCC flexible 2008 (SP1 required) Standard, Advanced		
I/O			
Inputs/outputs	2 KB each	4 KB each	8 KB each
Bit memory	1 KB	2 KB	4 KB
Timers	128	256	512
Counters	128	256	512
Retentive data	64 KB	128 KB	256 KB
Interfaces			
PROFIBUS master	integrated, up to 12 Mbit/s		
PROFIBUS slaves	max. 32		
Industrial Ethernet	Integrated		
Other interfaces	USB, SD, MMC		PC/CF card, USB

To make ordering easier, various different price-optimized complete packages are available:

	WinAC MP 177 package	WinAC MP 277 package	WinAC MP 377 package
Order No. group	6AV6 652-2.	6AV6 652-3.	6AV6 652-4.

Migration packages are also available for changeover from SIMATIC C7 to SIMATIC WinAC MP.

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Technical data

S7-300 digital inputs

Module type	Digital inputs SM 32x					
Special features of this module	Module with programmable input delay and comprehensive diagnostics; suitable for isochronous mode.	Simple, economically priced module for recording frequently required signals	Simple, economically priced module for the acquisition of frequently required signals with high channel density	Simple, economically priced module for recording frequently required signals	Simple, economically priced module for the acquisition of frequently required signals with high channel density	Universal, scalable I/O module; 8-bit channel-specific, programmable as input or output
Type of voltage	Direct voltage DC					
Suitable for	Switches and 2, 3 or 4-wire proximity switches (BEROs)					
Input voltage	24 V					
Diagnostics capability	●					
Interrupt capability	●					
Input delay	0.1 ... 20 ms [1]	Typ. 3 ms (fixed)				
Number of channels	16		32 / 64	8 DI / 8 DO	16 DI / 16 DO	8 DI / 8 DX
Galvanic isolation: Number of groups	1		2 / 4	1		
Order No. group: 6ES7	321-7BH0. [3]	321-1BH0. [3]	321-1BL0. [3] 321-1BP0. [2]	323-1BH0. [3]	323-1BL0.	327-1BH0.

Module type	Digital inputs SM 32x				
Special features of this module	Source input module	Very fast module, especially for isochronous applications	NAMUR inputs and other comprehensive control functions, in particular for use in a process-oriented environment	Recording high direct voltages, e.g. as they occur in power plants or engine test stands	16 single-channel isolated channels; possible for recording both direct and alternating voltages
Type of voltage	Direct voltage DC				Universal voltage UC
Suitable for	Switches and 2, 3 or 4-wire proximity switches (BEROs)		NAMUR sensor	Switches and 2, 3 or 4-wire proximity switches (BEROs)	
Input voltage	24 V			48 ... 125 V	24/48 V UC
Diagnostics capability			●		
Interrupt capability			●		
Input delay	Typ. 3 ms fixed	0.05 ms fixed	3 ms fixed	10 ms fixed	<6 ms fixed
Number of channels	16				
Galvanic isolation: Number of groups	1		2	8	16
Order No. group: 6ES7	321-1BH5.	321-1BH10-.	321-7TH00-. [3]	321-1CH20-. [3]	321-1CH00-.

Module type	Digital inputs SM 32x			
Special features of this module	Direct detection of AC voltages up to 230 V AC; 4-grouping	Direct detection of AC voltages up to 120 V AC at a high channel density	Direct detection of AC voltages up to 230 V AC; 2-grouping	Direct detection of AC voltages up to 230 V AC; isolated single channels
Type of voltage	Alternating voltage AC			
Suitable for	Switches and 2, 3 or 4-wire AC proximity switches			
Input voltage	120 / 230 V	120 V	120 / 230 V	
Diagnostics capability				
Interrupt capability				
Number of channels	16	32	8	
Galvanic isolation: Number of groups	4			8
Order No. group: 6ES7	321-1FH0. [3]	321-1EL0.	321-1FF0. [3]	321-1FF1. [3]

[1] Parameterizable

[2] Connection with detached terminal block

[3] As SIPLUS extreme component also for extended temperature range -40/-25. .. +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-300 digital outputs

Module type	Digital inputs SM 32x					
Special features of this module	Simple, economically priced module for standard applications	Very fast module, especially for isochronous applications	Simple, economically priced module for standard applications with high packing density	Simple, economically priced module for recording frequently required signals	Simple, economically priced module for the acquisition of frequently required signals with high channel density	Universal, scalable I/O module; 8-bit channel-specific, programmable as input or output
Type of voltage	Direct voltage DC					
Suitable for	Solenoid valves, DC contactors and signal lamps					
Output voltage	24 V					
Output current	0.5 A		0.5 A / 0.3 A	0.5 A		
Diagnostics capability						
Interrupt capability						
Number of channels	16		32 / 64	8 DI / 8 DO	16 DI / 16 DO	8 DI / 8 DX
Galvanic isolation: Number of groups	2		4	1	2	1
Order No. group: 6ES7	322-1BH0. [2]	322-1BH1.	322-1BL0. [2] 322-1BP. [1]	323-1BH0. [2]	323-1BL0. [2]	327-1BH0. [2]

Module type	Digital inputs SM 32x				
Special features of this module	Comprehensive diagnostics functions; integrated diode for redundant interconnection of the outputs	Comprehensive control functions, in particular for use in a process-oriented environment; integrated diode for redundant interconnection of the outputs	8-channel output module for the switching of high currents (2 A)	Switching of high direct voltages (125 V DC; 1.5 A), as they occur in power plants or engine test stands	
Type of voltage	Direct voltage DC				
Suitable for	Solenoid valves, DC contactors and signal lamps				
Output voltage	24 V			48 ... 125 V	
Output current	0.5 A		2 A	1.5 A	
Diagnostics capability	●				
Interrupt capability	●				
Number of channels	8	16	8		
Galvanic isolation: Number of groups	1	4	2	2	
Order No. group: 6ES7	322-8BF0. [2]	322-8BH0. [2]	322-1BF0. [2]	322-1CF0. [2]	

Module type	Digital inputs SM 32x								
Special features of this module	TRIAC module for the electronic switching of high currents and voltages; wear-free compared to relay	8-channel TRIAC module with single-channel isolated outputs; wear-free compared to relay module; diagnostics and substitute values are parameterizable	Switching of high voltages and currents with high channel density	Universal relay output module that covers a broad range of applications	Universal relay output module with up to 2 A at 230 V AC	Universal relay output module with up to 5 A at 230 V AC; switching of higher outputs is thus possible	Relay module with integrated RC quenching circuit; diagnostics and substitute values are parameterizable	16 channels single-channel, electrically isolated; diagnostics and substitute values are parameterizable
Type of voltage	Alternating voltage AC			UC (relay)				
Suitable for	AC/DC magnetic coils, contactors, motor starters, miniature motors and indicator lights							
Output voltage	120 / 230 V			DC: 24 ... 120 V AC: 24 ... 230 V	24 ... 120 V DC 48 ... 230 V AC			24 V/ 48 V
Output current	1 A	2 A	1 A	2 A		5 A		0.5 A
Diagnostics capability		●					●	
Interrupt capability								●
Number of channels	16	8	32	16	8			16
Galvanic isolation: Number of groups	2	8	4	2	4	8		16
Order No. group: 6ES7	322-1FH0. [2]	322-1FF0. [2]	322-5FF0. [2]	322-1FL0.	322-1HH0. [2]	322-1HF0.	322-1HF1. [2]	322-5HF0. [2]	322-5GH0.

[1] Connected with separate terminal block

[2] As SIPLUS extreme component also for extended temperature range -40/-25 ...+60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-300 analog inputs

Module type	Analog inputs SM 33x									
Special features of this module	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling		High-resolution and high-precision module for detecting currents and voltages		Low-cost, universal hybrid module for the acquisition and output of currents and voltages	Universal hybrid module for measuring voltages, resistances and temperatures by means of resistance-type transmitters (RTD) and for the output of voltages	Hybrid module for high-speed applications, such as plastics machines; integrated comparator	Universal module that covers all prevalent measurement ranges (no TC measurement) and thus simplifies spare parts handling	Very fast module that operates according to the principle of current value encryption; suitable for isochronous applications	High-resolution, individually floating module for voltage measurement and thermocouples, two-channel redundancy for the increased demands of process engineering
Voltage measuring range Sensors	± 80 mV ± 250 mV ± 500 mV ± 1 V ± 2.5 V		± 5 V ± 10 V 1 ... 5 V		0 ... 10 V		± 1 V ± 2.5 V ± 10 V 0 ... 2 V 0 ... 10 V	± 10 V ± 50 mV ± 500 mV 1 ... 5 V ± 1 V ± 5 V 0 ... 10 V	± 1 V ± 5 mV ± 10 V 1 ... 5 V	± 25 mV, ± 50 mV, ± 80 mV, ± 250 mV, ± 500 mV, ± 1 V
Diagnostics capability	●			●			●		●	●
Interrupt capability	●			●			●		●	●
Operating error	± 1 %		± 0.1 %	± 0.1 %	± 0.9 %	± 0.7 %	± 0.15 %	± 0.6 %	± 0.4 %	± 0.12 %
Number of channels	8	2	8	8	4	2	4	8	8	6
Galvanic isolation: Number of groups	4	1	4	4	1	1	4	1	1	6
Resolution	max. 14 bits + sign	max. 14 bits + sign	15 bits + sign	15 bits + sign	8 bit	12 bits + sign	13 bits + sign	12 bits + sign	13 bits + sign	15 bits + sign
Conversion time per channel (at 50 Hz)	22 ms	22 ms	65 ms	83 ms [2]	100 µs	85 ms	200 µs	60 ms	52 µs [1]	20 ms
Order No. group: 6ES7	331-7KF0. [3]	331-7KB0. [3]	331-7NF0. [3]	331-7NF1. [3]	334-0CE0.	334-0KE0. [3]	335-7HG0.	331-1KF0. [3]	331-7HF0.	337-7PF1.

Module type	Analog inputs SM 33x								
Special features of this module	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling		High-resolution and high-precision module for detecting currents and voltages		Low-cost, universal hybrid module for the acquisition and output of currents and voltages	Hybrid module for high-speed applications, such as plastics machines; integrated comparator	Universal module that covers all prevalent measurement ranges (no TC measurement) and thus simplifies spare parts handling	Very fast module that operates according to the principle of current value encryption; suitable for isochronous applications	Supports communications with HART-capable field devices; high channel density and thus a low price
Current measuring range Sensors	± 3.2 mA, ± 10 mA, ± 20 mA, 0 ... 20 mA, 4 ... 40 mA		0 ... 20 mA 4 ... 20 mA ± 20 mA		0 ... 20 mA	± 10 mA 0 ... 20 mA 4 ... 40 mA	± 20 mA 0 ... 20 mA 4 ... 20 mA		± 20 mA 0 ... 20 mA 4 ... 20 mA HART
Type of connection	2-wire and 4-wire transducers				4-wire transducers		2-wire and 4-wire transducers		
Diagnostics capability	●			●		●		●	●
Interrupt capability	●			●		●		●	●
Operating error	± 1 %		± 0.3 %	± 0.1 %	± 0.8 %	± 0.25 %	± 0.5 %	± 0.3 %	± 0.15 %
Number of channels	8	2	8	8	4	4	8	8	8
Galvanic isolation: Number of groups	4	1	4 (8)	4	1	1	1	1	1
Resolution	max. 14 bits + sign	max. 14 bits + sign	15 bits + sign	15 bits + sign	8 bit	13 bits + sign	12 bits + sign	13 bits + sign	15 bits + sign
Conversion time per channel (at 50 Hz)	22 ms	22 ms	65 ms	83 ms [2]	100 µs	200 µs	60 ms	52 µs [1]	65 ms
Order No. group: 6ES7	331-7KF0. [3]	331-7KB0. [3]	331-7NF0. [3]	331-7NF1. [3]	334-0CE0.	335-7HG0.	331-1KF0. [3]	331-7HF0.	331-7TF0. [3]

[1] Independently of the set interference frequency suppression

[2] in 4-channel mode 10 ms

[3] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-300 analog inputs

Module type	Analog inputs SM 33x				
Special features of this module	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling		High-resolution and high-precision module for recording temperatures via resistance-type transmitters (RTD) including characteristic-curve linearization based on the Russian GOST standard	Universal hybrid module for measuring voltages, resistances and temperatures by means of resistance-type transmitters (RTD) and for the output of voltages	Universal module that covers all prevalent measurement ranges (no TC measurement) and thus considerably simplifies spare parts handling
Resistance measuring range Sensors	150 Ω, 300 Ω, 600 Ω			10 kΩ	600 Ω, 6 kΩ
Type of connection	2-/3-/4-wire connection				
Diagnostics capability	●				
Interrupt capability	●				
Operating error	± 1 %		± 0.1 %	± 3.5 %	± 0.5 %
Number of channels	4	1	8	4	8
Galvanic isolation: Number of groups	4	1	4	2	1
Resolution	max. 14 bits + sign	max. 14 bits + sign	max. 15 bits + sign	12 bits + sign	12 bits + sign
Conversion time per channel (at 50 Hz)	23 ms	23 ms	80 ms	170 ms	132 ms
Order No. group: 6ES7	331-7KF0. [3]	331-7KB0. [3]	331-7PF0. [3]	334-0KE0. [3]	331-1KF0. [3]

Module type	Analog inputs SM 33x								
Special features of this module	Universal hybrid module for measuring voltages, resistances and temperatures by means of resistance-type transmitters (RTD) and for the output of voltages	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling		High-resolution and high-precision module for recording temperatures via resistance-type transmitters (RTD) including characteristic-curve linearization based on the Russian GOST standard	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling		High-resolution and high-precision module for recording temperatures via thermocouples (TC) including characteristic-curve linearization based on the Russian GOST standard	Universal module that covers all prevalent measurement ranges (no TC measurement) and thus considerably simplifies spare parts handling	High-resolution, individually floating module for voltage measurement and thermocouples, two-channel redundancy for the increased demands of process engineering
Temperature measuring range Sensors	Pt 100 (-120... +130 °C)	Pt 100 Ni 100 (-200...+385 °C) standard or climate		Pt: 100; 200; 500; 1 000; Ni: 100; 120; 200; 500; 1 000; Cu 10 (-200 ... +850 °C and -120 ... +130 °C) [1]	Thermocouples types E, N, J, K, L		Thermocouples type B, C, E, N, J, K, L, R, S, T, U [2]	Pt 100 (-120... +130 °C); Ni 100; Ni 1 000; LG-Ni 1 000; (standard or depending on climate)	Thermocouples type T, U, E, J, L, K, N, R, S, B, C, TxK, XK (L) [2]
Diagnostics capability		●							
Interrupt capability		●							
Operating error	± 1 %			± 0.1 %	± 1 %		± 0.1 %	± 1 %	± 0.15 %
Number of channels	4	4	1	8	8	2	8	8	6
Galvanic isolation: Number of groups	2	1	1	4	4	1	4	1	6
Resolution	max. 14 bits + sign			15 bits + sign	max. 14 bits + sign		15 bits + sign	12 bits + sign	15 bits + sign
Conversion time per channel (at 50 Hz)	170 ms	23 ms		80 ms	22 ms	44 ms	95 ms	110 ms	20 ms
Order No. group: 6ES7	334-0KE0. [3]	331-7KF0. [3]	331-7KB0. [3]	331-7PF0. [3]	331-7KF0. [3]	331-7KB0. [3]	331-7PF1. [4]	331-1KF0. [3]	331-7PF1.

[1] Characteristics according to GOST 6651-94

[2] Characteristics according to GOST P8.585.2001

[3] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[4] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-300 analog outputs

Module type	Analog outputs SM 33x						
Special features of this module	Universal analog output module		Universal analog output module; economical thanks to high channel density	High-speed module with high resolution and accuracy; suitable for isochronous mode	Low-cost, universal hybrid module for the acquisition and output of currents and voltages	Universal hybrid module for measuring voltages, resistances and temperatures by means of resistance-type transmitters (RTD) and for the output of voltages	Hybrid module for high-speed applications, such as plastics machines; integrated comparator
Output range	0 ... 10 V, 1 ... 5 V, ± 10 V				0 ... 10 V		0 ... 10 V ± 10 V
Diagnostics capability	●						●
Interrupt capability	●						●
Operating error	± 0.5 %			± 0.12 %	± 0.6 %	± 1 %	± 0.5 %
Number of channels	2	4	8	4	2		4
Galvanic isolation: Number of groups	1	1	1	4	1		1
Resolution	11 bits + sign			max. 15 bits + sign	8 bit	12 bit	max. 13 bits + sign
Conversion time per channel	< 0.8 ms			> 1.6 ms	0.5 ms	0.5 ms	> 0.8 ms
Order No. group: 6ES7	332-5HB0 [2]	332-5HD0. [1]	332-5HF0. [2]	332-7ND0. [1]	334-0CE0.	334-0KE0. [2]	335-7HG0.

Module type	Analog outputs SM 33x					
Special features of this module	Universal analog output module		Universal analog output module; economical thanks to high channel density	High-speed module with high resolution and accuracy; suitable for isochronous mode	Low-cost, universal hybrid module for the acquisition and output of currents and voltages	Supports communications with HART-capable field devices; low price per channel thanks to high channel density
Output range	± 20 mA, 0 ... 20 mA, 4 ... 20 mA				0 ... 20 mA	0 ... 20 mA HART 4 ... 20 mA HART
Diagnostics capability	●					●
Interrupt capability	●					●
Operating error	± 0.6 %			± 0.18 %	± 1 %	± 0.2 %
Number of channels	2	4	8	4	2	8
Galvanic isolation: Number of groups	1	1	1	4	1	1
Resolution	11 bits + sign			max. 15 bits + sign	8 bit	15 bits + sign
Conversion time per channel	< 0.8 ms			1.6 ms	0.5 ms	50 ms
Order No. group: 6ES7	332-5HB0. [2]	332-5HD0. [1]	332-5HF0. [2]	332-7ND0. [1]	334-0CE0.	332-8TF0. [2]

[1] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] As SIPLUS extreme component also for extended temperature range -25 ... +60/+70 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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Fail-safe S7-300 digital modules, standards and approvals

Failsafe digital modules	Digital input SM 326 F	Digital input SM 326 F (NAMUR)	Digital output SM 326 F	Digital output SM 326 F (PM)	Analog input module SM 336 F
Number of inputs or outputs	up to 24 (1-channel for SIL 2 sensors); up to 12 (2-channel for SIL 3 sensors)	8 (1-channel) 4 (2-channel)	10	8 x current sinking/ sourcing	6 (15 bit)
Input or output voltage	24 V DC	NAMUR	24 V DC	24 V DC	
Interrupts	Diagnostic interrupt	Diagnostic interrupt	Diagnostic interrupt	Diagnostic interrupt	Diagnostic interrupt
Input current/ output current			2 A per channel at signal "1"	2 A per channel at signal "1"	0/4 ... 20 mA, HART
Order No. group: 6ES7	326-1BK. [1]	326-1RF. [2]	326-2BF. [1]	326-2BF [1]	336-4GE. [2]

[1] As SIPLUS extreme component also for extended temperature range -25 ... +60 °C and corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

[2] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

SIMATIC S7-300 complies with the following national and international standards *)	The failsafe CPUs comply *additionally* with the following standards
DIN, EN, IEC	IEC 61508 (SIL 3)
CE	EN 954 (Category 4)
UL certificate	NFPA 79-2002, NFPA 85
cULus certificate	UL 1998, UL 508 and UL 991
FM class 1 div. 2; group A, B, C and D temperature group T4 (≤ 135 °C)	PL e as per ISO 13849
GOST	
C-Tick	
EU Directive 94/9/EC (ATEX 100a)	
ISA-S71.04 severity level G1, G2, G3	
Marine certification from • American Bureau of Shipping • Bureau Veritas • Det Norske Veritas • Germanischer Lloyd • Lloyds Register of Shipping	
Max. permissible environmental temperature: 60 °C for all components	
Earthquake resistance	

*) The SIPLUS extreme S7-300 also complies, in part, with Standard EN50155 (Railroad Standard) and is designed for the extended temperature range down to -25 °C (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-400 digital inputs/outputs

Module type	Digital inputs SM 421				
Special features of this module	Module for the acquisition of very fast signals with parameterizable input delay and process alarms; diagnostics	Simple, economically priced module for the acquisition of frequently required signals with high channel density	Direct acquisition of DC and AC voltages at high channel density		Suitable for DC and AC voltage; can be implemented as active high and active low module
Type of voltage	DC		UC		
Input voltage	24 V		120 V	120 / 230 V	24 ... 60 V
Diagnostics capability	●				●
Interrupt capability	●				●
Input delay	0.05 ... 3 ms [1]	3 ms fixed	<25 ms fixed		0.5 ... 20 ms [1]
Number of channels	16	32	32	16	16
Galvanic isolation: Number of groups	2	1	4	4	16
Order No. group: 6ES7	421-7BH.	421-1BL. [2]	421-1EL.	421-1FH.	421-7DH.

Module type	Digital inputs SM 422				
Special features of this module	Simple, economically priced module for standard applications	Simple, economically priced module for standard applications with high channel density	Extensive diagnostics functions; parameterizable substitute values	Electronic switching of high currents and voltages; no wear compared to relay output	Universal relay output group
Type of voltage	DC			AC	Relays
Output voltage	24 V			120 / 230 V	5 ... 125 V DC
Output current	2 A	0.5 A		2 A	5 A
Diagnostics capability			●	●	
Interrupt capability			●		
Number of channels	16	32	32	16	16
Galvanic isolation: Number of groups	2	1	4	4	8
Order No. group: 6ES7	422-1BH.	422-1BL. [2]	422-7BL.	422-1FH.	422-1HH.

[1] Parameterizable

[2] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-400 analog inputs

Module type	Analog inputs SM 431					
Special features of this module	Simple module for current and voltage measurement; high channel density	Universal module for current, voltage and resistance measurement	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling	Very fast analog value conversion with current value encryption; therefore suitable for acquisition of fast signals	Universal module, covering the most common measurement ranges; high resolution and precision; high channel density	High resolution and highly precise measurement of temperatures with thermocouples (TC); available as an option: Plug with integrated temperature compensation; single-channel, electrically isolated
Voltage measuring range Sensors	±1 V 1 ... 5 V	±1 V ±10 V 1 ... 5 V	±80 mV ±250 mV ±500 mV ±1 V ±2.5 V ± 5 V ±10 V 1 ... 5 V	±1 V 1 ... 5 V ±10 V	±25 mV, ±50 mV, ±80 mV, ±250 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V, 1 ... 5 V	
Diagnostics capability					●	
Interrupt capability					●	
Operating error	≤ ± 1 %	< ± 1 %	< ± 0.38 %	< ± 0.9 %	< ± 0.35 %	< ± 0.3 %
Number of channels	16	8			16	8
Galvanic isolation: Number of groups	1	1			1	8
Resolution	12 bits + sign		13 bits + sign		15 bits + sign	
Conversion time per channel (50 Hz)	65 ms	25 ms	23 ms	52 µs [1]	23 ms	20 ms
Order No. group: 6ES7	431-0HH. [2]	431-1KF0.	431-1KF1.	431-1KF2. [2]	431-7QH.	431-7KF0.

Module type	Analog inputs SM 431					
Special features of this module	Simple module for current and voltage measurement; high channel density	Universal module for current, voltage and resistance measurement	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling	Very fast analog value conversion with current value encryption; therefore suitable for acquisition of faster signals	Universal module, covering the most common measurement ranges; high resolution and precision; high channel density	High resolution and highly precise measurement of temperatures with thermocouples (TC); available as an option: Plug with integrated temperature compensation; single-channel, electrically isolated
Current measuring range Sensors	4 ... 20 mA ±20 mA		4 ... 20 mA 0 ... 20 mA ±20 mA	4 ... 20 mA ±20 mA	4 ... 20 mA 0 ... 20 mA ±5 mA ±10 mA ±20 mA	4 ... 20 mA 0 ... 20 mA ±5 mA ±10 mA ±20 mA ± 3.2 mA
Diagnostics capability					●	
Interrupt capability					●	
Operating error	≤ ± 0.65 %	≤ ± 1 %	≤ ± 0.35 %	≤ ± 0.8 %	≤ ± 0.3 %	≤ ± 0.5 %
Number of channels	16	8			16	8
Galvanic isolation: Number of groups	1	1			1	8
Resolution	12 bits + sign		13 bits + sign		15 bits + sign	
Conversion time per channel (50 Hz)	65 ms	25 ms	23 ms	52 µs [1]	23 ms	20 ms
Order No. group: 6ES7	431-0HH. [2]	431-1KF0.	431-1KF1.	431-1KF2. [2]	431-7QH.	431-7KF0.

[1] Independent of the set interference frequency suppression

[2] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-400 analog inputs

Module type	Analog inputs SM 431			
Special features of this module	Universal module for current, voltage and resistance measurement	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling	Very fast analog conversion with current value encryption; therefore suitable for acquisition of fast signals	Universal module, covering the most common measurement ranges; high resolution and precision; high channel density
Resistance measuring range Sensors	0 ... 600 Ω	0 ... 48 Ω, 0 ... 150 Ω, 0 ... 300 Ω, 0 ... 600 Ω 0 ... 6 000 Ω	0 ... 600 Ω	0 ... 48 Ω, 0 ... 150 Ω 0 ... 300 Ω, 0 ... 600 Ω, 0 ... 6 000 Ω
Diagnostics capability				●
Interrupt capability				●
Operating error	≤ ± 1.25 %	≤ ± 0.5 %	≤ ± 1 %	≤ ± 0.4 %
Number of channels	4			8
Galvanic isolation: Number of groups	1			1
Resolution	13 bit	14 bit		16 bit
Conversion time per channel (50 Hz)	25 ms	23 ms	52 µs [1]	23 ms
Order No. group: 6ES7	431-1KF0.	431-1KF1.	431-1KF2. [3]	431-7QH.

Module type	Analog inputs SM 431		
Special features of this module	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling	Universal module, covering the most common measurement ranges; high resolution and precision; high channel density	High resolution and highly precise measurement of temperatures with thermocouples (TC); available as an option: Plug with integrated temperature compensation; single-channel, electrically isolated
Thermocouple types	B, E, N, J, K, L, R, S, T, U		
Diagnostics capability		●	
Interrupt capability		●	
Operating error	≤ ± 14.8 K	≤ ± 11.5 K	≤ ± 3.5 K
Number of channels	8	16	8
Galvanic isolation: Number of groups	1		8
Resolution	14 bit	16 bit	
Conversion time per channel (50 Hz)	20/23 ms	6/21/23 ms	–
Order No. group: 6ES7	431-1KF1.	431-7QH.	431-7KF0.

Module type	Analog inputs SM 431		
Special features of this module	Universal module covering the most common measurement ranges and therefore greatly simplifying spare parts handling	Universal module, covering the most common measurement ranges; high resolution and precision; high channel density	High resolution and highly precise measurement of temperatures with the resistance temperature detector (RTD); single-channel, electrically isolated
Resistance thermometer types	Pt 100; 200; 500; 1 000 Ni 100; 1 000 [2]	Pt 100; 200; 500; 1 000 Ni 100; 1 000 [2]	
Diagnostics capability		●	
Interrupt capability		●	
Operating error	≤ ± 5.7 K	≤ ± 4.9 K	≤ ± 1 K
Number of channels	4	8	
Galvanic isolation: Number of groups	1		8
Resolution	14 bit	16 bit	
Conversion time per channel (50 Hz)	20/23 ms	6/21/23 ms	--
Order No. group: 6ES7	431-1KF1.	431-7QH.	431-7KF1.

[1] Independent of the set interference frequency suppression

[2] Both standard and climate

[3] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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S7-400 analog output modules, standards and approvals

Module type	Analog outputs SM 432
Special features of this module	Universal analog output module
Power	±10 V, 0 ... 10 V, 1 ... 5 V
Current	±20 mA, 0 ... 20 mA, 4 ... 20 mA
Diagnostics capability	
Interrupt capability	
Operating error	A: ± 0.5 % I: ± 1 %
Number of channels	8
Galvanic isolation: Number of groups	1
Resolution	12 bits + sign
Conversion time per channel	< 420 µs
Order No. group: 6ES7	432-1HF. [1]

The SIMATIC S7-400 complies with the following national and international standards	The failsafe CPUs comply *additionally* with the following standards
DIN, EN, IEC	IEC G1508 (SIL3)
CE	EN 954 (Category 4)
UL certificate	NFPA 79-2002, NFPA 85
CSA certificate	UL 1998, UL 508 and UL 991
FM class 1 div. 2; group A, B, C and D, temperature group T4 (<=135 °C)	
GOST	
C-Tick	
EU Directive 94/9/EC (ATEX 100a)	
ISA-S71.04 severity level G1, G2, G3	
Marine certification from • American Bureau of Shipping • Bureau Veritas • Det Norske Veritas • Germanischer Lloyd • Lloyds Register of Shipping	
Max. permissible environmental temperature: 60 °C for all components	
Earthquake resistance	

[1] As SIPLUS extreme component also for corrosive atmosphere/condensation (for further details, see page 102 or **www.siemens.com/siplus-extreme**)

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Environmental conditions SIMATIC / SIPLUS extreme

SIPLUS CPU 317-2 PN/DP

Environmental conditions	SIMATIC	SIPLUS extreme	
Ambient temperature	From 0 °C ... 60 °C [1]	From -40/-25 °C ... +60/+70 °C [1]	
Relative humidity	From 10 ... 95 % No condensation	100 % Dewing, condensation and ice formation permitted	
Chemically active substances	ISA S71.04 G3	EN 60721-3-3 3C4 and ISA S71.04 G1, G2, G3, GX [3]	
		Permanent load	**Limit value[2]**
SO_2	0.5 ppm	4.8 ppm	14.8 ppm
H_2S	0.1 ppm	9.9 ppm	49.7 ppm
Cl		0.2 ppm	1.0 ppm
HCl		0.66 ppm	3.3 ppm
HF		0.12 ppm	2.4 ppm
NH		49 ppm	247 ppm
O_3		0.1 ppm	1.0 ppm
NO_x		5.2 ppm	10.4 ppm
	With RH < 60 %, no condensation	With RH < 75 %, condensation permitted	
Salt spray	Not permitted	Salt spray test (EN 60068-2-52)	
Mechanically active substances	EN 60721-3-3 3S2	EN 60721-3-3 3S4	
Dust (suspended solids)	0.2 mg/m[3] [3]	4.0 mg/m[3] [3]	
Dust (falling deposits)	1.5 mg/m[3] [3] except for sand	40 mg/m[3] [3] Incl. sand/dust	
Biologically active substances	Not tested	EN 60721-3-3 3B2 Mold growth, fungus, excluding fauna	

Other certifications/approvals such as railroad standard EN 50155 or marine approvals possible

[1] For certain product families

[2] 30 min/day

[3] The SIPLUS product families are resistant according to EN 60721 to chemical (3C4/salt), mechanical (-3S4/sand), biological (-3B2) active substances and according to ISA S71.04 G1, G2, G3. GX applies to products with serial number LBB0... onwards (product date October 2010). The supplied plug covers must remain in place over unused interfaces during operation!

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This brochure has given you an initial overview of the extensive SIMATIC portfolio for factory and process automation – and of the advantages for you as a machine builder and plant operator. Further information on the individual families of systems can be found in the Internet sites listed below.

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