SIMATIC Safety Integrated for Factory Automation

Standard and safety technology in one system

Brochure · April 2011

Safety Integrated

Answers for industry.

SIEMENS

SIMATIC Safety Integrated
Standard and safety technology
in one system

SIMATIC Safety Integrated

comprises a scalable range of safety-related controllers of various designs based on different hardware and software architectures for all sectors of factory automation – from modular controllers and embedded automation products through to PC-based controllers.

Depending on your specific requirements, you can integrate the safety technology into the standard automation (integrated system) or implement it by means of two separate systems based on SIMATIC (one standard, one safety technology).

Competent lifecycle support

Siemens provides you with much more than a complete range of products and systems for safety technology. As your partner, we will provide you with competent support during all phases of the product life cycle – from consulting during planning and the corresponding training package to the acceptance of your machine.

Safety Evaluation Tool

The TÜV-approved online tool guides you step-by-step from definition of the safety system structure through selection of the components, all the way to determination of the achieved safety integrity level (SIL/PL). You receive the results as a standards-compliant report that can be integrated in the documentation as proof of safety.

www.siemens.com/safety-evaluation-tool
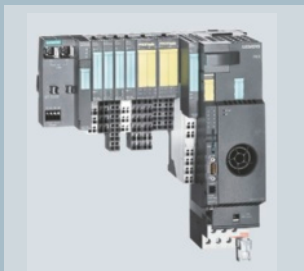
SIMATIC Controller

ET 200S	S7-300	S7-400	ET 200pro

SIMATIC ET 200

ET 200S	ET 200pro	ET 200M	ET 200iSP

Contents

Highlights

- Safety functions can be integrated into the standard automation
- State-of-the-art software technology with an intuitive operator interface
- Scalable range of products
- Hardware and software architecture for sectors of factory automation.
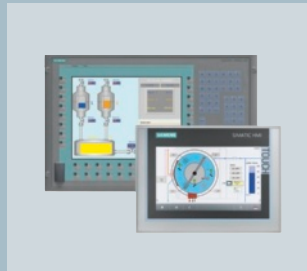
SIMATIC PC-based Automation

WinAC

S7-mEC

IPC227D/427C

HMI IPC277D/477C

Totally Integrated Automation

Rely on new productivity standards
for sustained competitive advantages

Safety

Security

Engineering

Diagnostics

Robustness

Communi-
cation

Process
Optimization

Scalability/
Modularity

Easy
Integration

Flexibility

Int.
Regulations/
Standards

Innovation

Openness

Availability/
Reliability

TCO/Investment
Protection

Internationality

Energy
Efficiency

Transparency

Manufacturing Execution Systems
Process Control Systems
Industrial Communication
Human Machine Interface
Control Systems
Motion Control
Computer Numeric Control
Decentralized I/O
Drive Technology
Sensor Systems
Low-Voltage Switchgear
Services

Totally Integrated Automation

Production Lifecycle

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 Safety Integrated portfolio presented in this brochure.

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

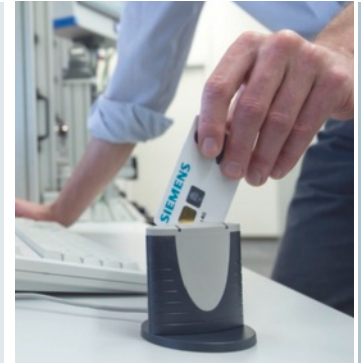You can find more about the system features and the resulting advantages in the following chapter "System features".

System features

**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.

**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.

**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.

**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.

Engineering

Communications

Diagnostics

Safety

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 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.

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

Safety Integrated for Factory Automation

The comprehensive range of products and services

Safety Integrated

Saving costs

Safety Integrated is the consistent implementation of safety technology for the purpose of Totally Integrated Automation. That means that Siemens integrates safety-related functions into standard automation on a consistent and user-friendly basis. This provides numerous advantages for machine manufacturers and plant operators. Especially from an economic point of view.

Machine manufacturers can achieve a decisive competitive advantage through Safety Integrated. The argument: engineering is facilitated considerably. The result: machines and plants can be implemented significantly faster and are easy to adapt to new requirements.

Plant operators also profit from this. They attain not only safer machines and plants but also more productive ones, and faster than previously. For a consistent complete system with safety engineering and standard automation reduces downtimes and increases availability thanks to improved diagnostics.

Compared to conventional safety engineering, Safety Integrated additionally facilitates conversion and modernization. Existing machines and plants can be upgraded to the latest state-of-the-art technology much more economically thanks to flexible concepts allowing modular expansion. An advantage that pays off throughout the complete lifecycle.

Competent lifecycle support

Siemens provides you with much more than a complete range of products and systems for safety technology. As your partner, we provide you with expert support **during all phases of the production lifecycle** – from consulting during planning and the corresponding training package, to the acceptance of your machine.

The advantages for you are obvious: Our consulting will help you explore new markets, reduce costs resulting from your mistakes, optimize your conformance to schedules and increase the product and process quality.

In other words: You can depend on our support one hundred percent – **around the clock**. Because our contacts are at your disposal worldwide, 24 hours a day:

Service & Support
www.siemens.com/automation/support
Contacts
www.siemens.com/automation/partner

Safety Evaluation Tool

The Safety Evaluation Tool is a free online calculation tool for the IEC 62061 and ISO 13849-1 standards, and offers valuable support for the implementation of safety functions on machines. The TÜV-approved online tool guides you step-by-step from definition of the safety system structure through selection of the components, all the way to determination of the achieved safety integrity level (SIL/PL). You receive the results as a standards-compliant report that can be integrated in the documentation as proof of safety.

The benefits to you:

- Less time to evaluate the safety functions
- Fast access to product data
- Calculation in accordance with current standards
- User-friendly archiving: Projects can be saved and called up again as required
- Fast and easy handling: comprehensive, predefined libraries of examples
- The online tool can be used free of charge

www.siemens.com/safety-evaluation-tool

SIMATIC Safety Integrated

Continuously increasing requirements...

Compared to past solutions, industrial automation is now considerably more flexible and open. Modern machines and systems also stand out due to their significantly increased productivity. This is due in no small part to the fact the relay technology has been replaced by the freely programmable controllers and distributed technology – at least for demanding applications.

In spite of this change in technology, very different products and systems were often used until now for safety-oriented functions and standard tasks. If more complex safety tasks are involved however, the efficiency of an automation solution can be significantly increased even if the safety technology consistently follows the trend toward intelligent PLCs.

A failsafe PLC serves to control processes and immediately switches to a safer state or remains in the current state if a fault occurs. It provides an integrated, efficient safety solution in systems with increased safety requirements.

... and our answer to this

The range of SIMATIC Safety Integrated products encompasses safety-related control systems for the process and manufacturing industry, based on SIMATIC Controllers and the SIMATIC ET 200 I/O systems.

SIMATIC Safety Integrated is presented in the following for the manufacturing industry. The *Safety Integrated for Process Automation (E86060-A4678-A181-A3)* brochure describes safety solutions for the process industry.

SIMATIC Safety Integrated comprises a scalable range of safety-related controllers of various designs based on different hardware and software architectures for all sectors of factory automation – from modular controllers and embedded automation products to PC-based controllers.

Depending on your specific requirements, you can integrate the safety technology into the standard automation (integrated system) or implement it by means of two separate systems based on SIMATIC (one standard, one safety technology).

With this, we are providing you with an integrated, safe and proven control system, which is extremely flexible, easy to expand and cost-effective. This results in the creation of the standard and safety program with its proven S7 environment, which reduces the engineering costs and the training and instruction overhead.

Programming is done using the STEP 7 languages LAD and FBD and TÜV-certified function blocks.

The connection to standard and safety-oriented modules can be optionally implemented using cables via PROFINET, the open Ethernet standard, or via PROFIBUS, the tried and tested fieldbus technology, or without cables via IWLAN. The bus system is expanded by the PROFIsafe profile for transmitting the safety-oriented data. Safety-related and standard communications are now possible via one connection (e.g. a bus).

Compliance with all major standards

The European guidelines apply today as those that reflect the highest safety standard and are accepted far beyond the boundaries of Europe.

In order to ensure the functional safety of a machine or system, the safety-relevant parts of the protective and control systems behave in such a manner in the event of a fault that the system remains in a safe state or is put into a safe state. To this end, special requirements that are defined in standards are placed on the products. Corresponding product certificates can document the compliance with these standards.

Any possible hazards to people and the environment cannot just be averted at the national level. They must always comply with the regulations and rules of the location where the machine or system is operated. Thus the free exchange of goods within the framework of global markets requires internationally agreed upon bodies of regulations.

The current standards and maximum safety requirements are fulfilled when you use SIMATIC Safety Integrated:
- IEC 61508: SIL 1 - 3
- EN 954: Cat. 2 - 4
- IEC 61511
- EN 60204-1
- EN 62061: SIL 1 - 3
- NFPA 79, NFPA 85
- UL 1998, UL 508 and UL 991
- EN ISO 13849 -1: PL a - e

Compliance with the standards is confirmed by the TÜV certificates: Z10 09 07 67803 003 and Z10 09 07 67803 004.

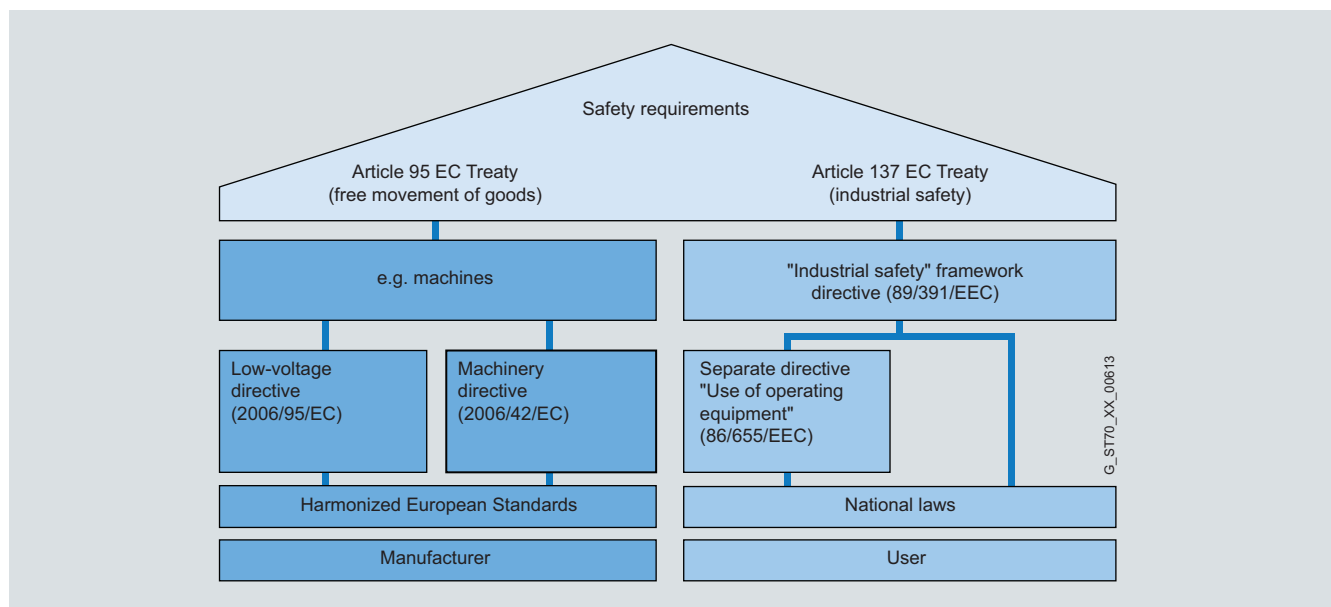

SIMATIC Safety Integrated controllers

Fundamental safety requirements in the manufacturing industry

With the introduction of the standardized internal European market, the national standards and directives concerning the technical implementation of machines were fully harmonized:

- At the same time, fundamental safety requirements were specified that, on the one hand – intended for the free traffic of goods (Article 95) – are geared toward the manufacturers and, on the other hand – for the protection of employment (Article 137) – toward the user (operator).
- The consequence of this was that the contents of the machine directive had to be implemented in national law as an internal market directive – on the basis of EU contracts – by the individual member states. In Germany, for example, this was anchored in the Equipment Safety Law (GSG).

To guarantee conformity with a directive, it is recommended that the correspondingly harmonized European standards be applied. This triggers the "assumption of conformity" and gives manufacturers and operators the legal security in terms of compliance with both national regulations and EU directives. The machine manufacturer uses the CE marking to document the compliance with all relevant directives and regulations in the free movement of goods.

As the European directives are recognized worldwide, their use is of great help when exporting to countries in the European Economic Area. All explanations below are oriented toward the manufacturer of a machine or its operator, provided the latter performs or authorizes safety-related modifications to the machine.
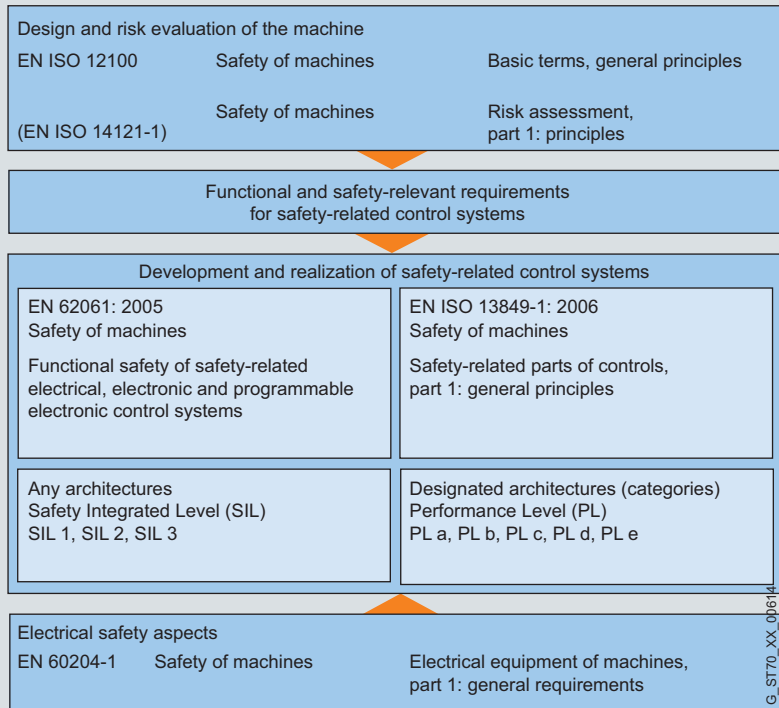

Safety requirements in the manufacturing industry

Fundamental standards in the drafting of control functions

Objective:

Compliance with all relevant safety require-
ments by means of adequate reduction of risk
– with the aim of being secure against liability
and "export-ready".

Result:

Implementation of risk-reducing protective
measures by applying harmonized standards –
resulting in conformity with the safety require-
ments of the machine directive on the basis of
the "presumption of conformity".

Design and risk evaluation of the machine

EN ISO 12100 — Safety of machines — Basic terms, general principles

Safety of machines — Risk assessment, part 1: principles
(EN ISO 14121-1)

Functional and safety-relevant requirements
for safety-related control systems

Development and realization of safety-related control systems

EN 62061: 2005
Safety of machines

Functional safety of safety-related
electrical, electronic and programmable
electronic control systems

EN ISO 13849-1: 2006
Safety of machines

Safety-related parts of controls,
part 1: general principles

Any architectures
Safety Integrated Level (SIL)
SIL 1, SIL 2, SIL 3

Designated architectures (categories)
Performance Level (PL)
PL a, PL b, PL c, PL d, PL e

Electrical safety aspects

EN 60204-1 — Safety of machines — Electrical equipment of machines,
part 1: general requirements

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Standards for the design of controllers

Safety requires protection against a variety of risks. These can
be managed as follows:

- Design in accordance with risk-reducing design principles
  and risk assessment of the machine (EN ISO 12100-1,
  EN ISO 14121-1)
- Technical protection measures, if necessary through the
  use of safety-related controllers (functional safety in accor-
  dance with EN 62061 or EN ISO 13849-1)
- Electrical safety (EN 60204-1)

Functional safety involves the part of the safety of a machine
or plant that depends on the correct function of its control or
protection equipment. Two standards are available to the us-
er:

- EN 62061: 2005 – as European sector standard of the basic
  standard IEC 61508.
- EN ISO 13849 -1: 2006

Clear added value –
throughout the entire product lifecycle

Support from design to upgrade

Safety Integrated enables you to integrate safety into the standard functions. With our specialized support we offer you clear advantages during all phases of the product life cycle.

Phase	Requirement
Design and engineering	Before creating a machine, the machine manufacturer carries out a risk analysis while observing all of the relevant standards. This shows what risks the machine poses and how they must be countered.
Installation and startup	The risk analysis reveals which components are needed for making the hazardous zones safe. The safety must be verified so that the machine receives its CE marking.
Operation and maintenance	The operator must observe the occupational safety framework guidelines – as well as the documentation for following the machine directive that the machine manufacturer has to produce.
Maintenance	If maintenance is required, it must be performed quickly in order to keep downtimes and standstills as short as possible. If a fault does occur, it must be eliminated as quickly as possible. Because, for competitive reasons it is essential to keep production up and running continuously – or with only the shortest possible interruptions.
Modernization and upgrade	In order to bring existing plants up to the state of the art of safety engineering, expansion or modernization measures are necessary. Through inspections, documentation, consulting and defining remedial measures, we assist you in meeting the current safety requirements most effectively.

Safety Plan – the guideline for implementing a safe machine

The Safety Plan, whose structure and obligatory implementation are defined in standard EN 62061, supports you in determining and implementing all safety-related aspects and regulations for the design and operation of a safe machine – through every phase of the product lifecycle.

Due to the systematic procedure presented by the Safety Plan you not only achieve the highest level of safety, but save considerable time at every stage – even in the CE marking of the machines.

Services	System advantages
■ Comprehensive training package ■ Support in planning and design ■ Advice for the application/design of safety-relevant directives and standards ■ Safety Evaluation Tool helps in the calculation of the safety integrity level ■ All system components and a comprehensive range of services from one source	■ Modular solutions tailored for different machines and plants through innovative technologies ■ Products and systems for worldwide use with the required approvals and conformity with the EU directives
■ Installation and startup ■ Preparation up to acceptance and handing over of machine ■ Safety Evaluation Tool for generation of the standards-compliant report	■ The setup saves space, time and costs through the integration of safety automation into the standard automation ■ Quick commissioning through comprehensive diagnostics and pre-wired and certified components –expertise in product liability
■ Global presence due to on-site service ■ Fast delivery of spare parts for a small capital commitment ■ TÜV-compliant user manuals	■ Quick troubleshooting and fault clearance thanks to full integration raises productivity ■ Standardized operating philosophy simplifies handling ■ High production quality and availability reduces downtimes
■ Overtravel measurement for contactless sensors ■ Regular renewal of safety-relevant components ■ Global presence due to on-site service ■ Fast delivery of spare parts for a small capital commitment	■ Quick fault diagnostics and fault clearing thanks to universality of Safety Integrated ■ Long-term availability of the components
■ Concepts and implementation of modernization, conforming to your requirements and the latest status of safety technology ■ Projects and services from a single source ■ Efficient plant concepts ■ Comprehensive training package	■ Simple expansion through integration into the world of Totally Integrated Automation ■ Long-term product availability

Security of investment with SIMATIC Safety Integrated

Design and engineering

Services
As early as the planning phase, we take the concrete requirements of the EU directives and the requirements for worldwide approval into consideration.

We offer a specific training package – for example including the following topics: The use of various standards, programming the devices for standardization and safety or the use of user-friendly functions such as connecting safety-oriented drives.

System advantages
The tried and tested system environment of SIMATIC really pays off: Users profit from significant savings in both time and costs. Existing expertise in standard engineering carries over into safety engineering. The integrated engineering in STEP 7 makes it possible to work in a traditional developmental environment. Thanks to the certified program module library, safety functions can be quickly implemented.

A shared database for failsafe and standard applications provides integrated data and project management.

The system is open due to the use of standards such as PROFIBUS and PROFINET with PROFIsafe. Siemens also offers fail-safe, wireless communication (IWLAN).

Installation and startup

Services
We provide support during the machine acceptance or hand-over by providing proof of conformity. Thanks to our contacts with worldwide certification centers such as UL, SA, etc., we are in a position to obtain international certificates for your machine or plant.

System advantages
You will save time during set up through the use of only one bus system for standard and safety applications. In addition, the number of hardware components needed is reduced thanks to the integration of safety technology into the standard technology. The result: More space in the control cabinet. And last but not least, you will profit from the increased flexibility of the automation solution.

Comprehensive diagnostic capabilities and pre-wired and certified components accelerate the commissioning. Pre-calculated safety distances (e.g. the distance of light barriers to the part presenting the hazard) in the engineering phase minimize the risk of reworking in the construction phase.

Operation and maintenance

Services

We will assist you in creating equipment operating instructions that correspond to all of the requirements of the machine directive.

System advantages

Any possible faults are reduced to a minimum through the use of a uniform operator interface. This pays off – in the form of increased productivity, fewer downtimes, and increased product quality and availability.

Maintenance

Services

As a global player, we are always in position right where we are needed. Our on-site experts will quickly and competently clear any faults or malfunctions in your system. With us as a partner, you will also profit from the low capital commitment. Because we provide you with smooth spare parts logistics in every respect.

System advantages

Because the numerous components can be used for standard and safety applications, the spare parts inventory - and thus capital commitment – is clearly reduced. The quick fault diagnostics and clearing increases productivity and minimizes downtimes.

Within the scope of clearing faults, defective modules can be swapped using the existing wiring while the system is in operation (hot swapping). Thanks to the long-term availability of the Siemens components, long-term maintenance of the system is possible – and you will profit from the increased security of your investment.
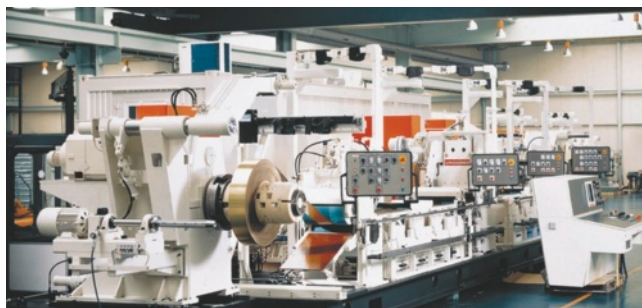
Modernization and upgrade

Services

The same service package that we offer you for the design and engineering comes to bear during the modernization of your machine.

System advantages

In combination with the uniform engineering and the flexible distributed architecture, the integrated system offers you clear advantages: Changes necessary for modernizing can be carried out more quickly and with less outlay. This means that the machine can be integrated more quickly into the production process. The long-term availability of the SIMATIC components provides high investment security for these machines as well.

SIMATIC –
the integrated automation system for standard and fail-safe applications

SIMATIC Controller

For more than 30 years, the name SIMATIC stands for first-class automation technology. Today, SIMATIC is established worldwide and is rightly regarded as the number one.

SIMATIC Controller

As the core of Totally Integrated Automation, SIMATIC comprises a wide range of standardized products and systems – such as the SIMATIC Controllers. 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 Modular Controllers

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 communications 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 technology controllers are available for typical motion control applications, e.g. flying shears, palettizer or feeder.

SIMATIC ET 200

Bit-modular, distributed I/O system with local intelligence
• Versions with degree of protection IP20 (in the control cabinet) and IP65/67 (without control cabinet) and for Hazardous area, Zone 1
• Module replacement during operation
• Fail-safe version
• Maintenance-free thanks to data retentivity on Micro Memory Card

SIMATIC S7-300

The S7-300 is the modular controller for system solutions in the manufacturing industry:
• Compact design, mounting on DIN rail
• Many functions are integrated into the CPU (I/Os, technology functions, PROFIBUS/PROFINET connection)
• Maintenance-free thanks to data retentivity on Micro Memory Card
• Isochronous mode on PROFIBUS
• Failsafe versions
• Fail-safe technology CPU

SIMATIC S7-400

The S7-400 is the power controller for system solutions in the manufacturing and processing industry:
• Rack system with various rack types
• Extremely high-speed processing and communication performance
• Changes to the configuration during operation
• Isochronous mode on PROFIBUS
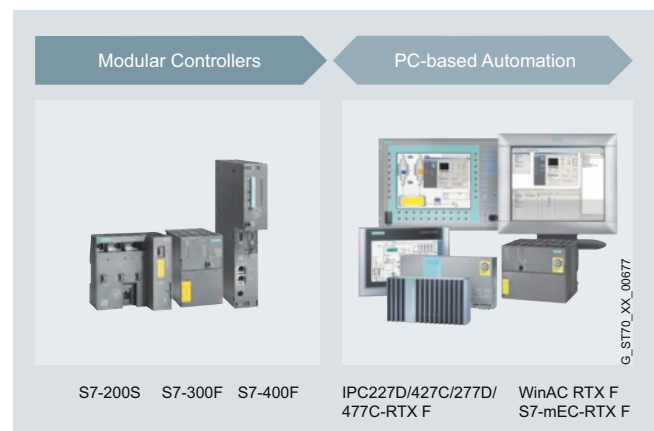• Failsafe and fault-tolerant versions
• Hot swapping

SIMATIC PC-based Automation

SIMATIC PC-based controllers
The SIMATIC PC-based Controllers can run on standard PC systems as software controllers. Any PC applications, operator control and monitoring tasks, as well as technological functions can simply be combined here to form an overall automation solution. The extensive resources of an industrial PC, such as its work memory, are exploited here.

SIMATIC Embedded Bundles
SIMATIC Embedded Bundles utilize the openness of HMI and PC-based systems and offer an increased level of ruggedness. Control, applications and operator control and monitoring all run on the same device – without the use of rotating parts such as hard disks or fans. The operating system used is tailored and optimized to the relevant hardware architecture. They are ready to use and can be installed directly on a DIN rail (IPC227D/IPC427C) or on site as HMI IPC277D/IPC477C.

Modular Controllers	PC-based Automation
S7-200S S7-300F S7-400F	IPC227D/427C/277D/ 477C-RTX F WinAC RTX F S7-mEC-RTX F

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SIMATIC ET 200

With SIMATIC ET 200 a wide range of distributed I/O systems is available – for solutions in the control cabinet, without a control cabinet, directly at the machine, and for applications in hazardous areas (Zone 2).

The ET 200 I/O systems permit a space-saving setup for fail-safe applications, since standard and fail-safe modules can be combined.

This is possible with the following ET 200 systems:
- SIMATIC ET 200S - The all-rounder with a comprehensive range of functions
- SIMATIC ET 200M – the multi-channel S7-300
- SIMATIC ET 200pro – modular and multifunctional
- SIMATIC ET 200eco – digital block I/O
- SIMATIC ET200iSP – the intrinsically safe version for hazardous areas

ET 200M / S7-300

The failsafe modules of the S7-300 can be used either centrally in the S7-300 or distributed in the ET 200M. The ET 200M distributed I/O station is a modular DP slave with IP20 degree of protection. Up to 8 multi-channel signal modules (e.g. 32 digital inputs) and function modules as well as communications processors of the S7-300 can be used as I/O modules – the interface to the process. There are no slot rules. Hot swapping and expansion of modules is permissible when using active bus modules.

ET 200pro

SIMATIC ET 200pro is a very compact, extremely rugged and high-performance I/O unit 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 and customer-specific distributed automation solutions to be implemented.
ET 200pro can be connected to the tried and tested fieldbus

PROFIBUS or to PROFINET, the open Industrial Ethernet standard for company-wide automation. Interface modules with an integral CPU transfer the computing power of an S7-300 CPU directly into the I/O device. This reduces the load on the central controller and enables fast response to time-critical signals.

ET 200S

SIMATIC ET 200S, the multifunctional and bit-modular I/O system with IP20 degree of protection, can be exactly tailored to the
automation task. 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. This reduces the load on the central controller and enables fast response to time-critical signals.
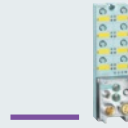
ET 200iSP

SIMATIC ET 200iSP can be used in hazardous areas with a gas or dust atmosphere:
- The ET 200iSP station can be installed in Zones 1, 21 and 2, 22.
- The connected sensors and actuators can also be located in Zones 0 and 20.

Communication between the field devices and the process control system or automation system is performed over PROFIBUS DP. The terminal blocks commonly used today, as well as the necessary distribution boards and Ex isolating transformers for the signals, can be omitted.

ET 200eco

SIMATIC ET 200eco is the digital block I/O with IP65/67 degree of protection. It consists of a basic module and two different connection blocks. Selection is possible between M12, 7/8" and ECOFAST. A matched module range for digital I/Os as well as a failsafe module with 8 failsafe inputs is available.

For the control cabinet (IP20)				Without control cabinet (IP65/67)
GAS FM/UL	Class I Zone 2	Class I Zone 1	Class I Zone 0	
GAS ATEX	Zone 2 ⬡Ex	Zone 1 ⬡Ex	Zone 0 ⬡Ex	
DUST FM/UL	Class II Zone 2	Class II Zone 1	Class II Zone 0	
DUST ATEX	Zone 22 ⬡Ex	Zone 21 ⬡Ex	Zone 20 ⬡Ex	

ET 200S
- The all-rounder with a comprehensive range of modules

ET 200M
- The multi-channel S7-300 I/O

ET 200iSP
- The intrinsically safe version for hazardous areas

ET 200pro
- Modular and multifunctional

ET 200eco
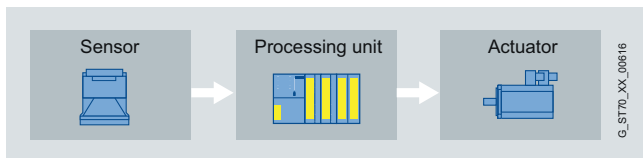- The digital block I/O in IP65/67

G_ST70_XX_00615

SIMATIC –
Safety Integrated for Factory Automation

Functional safety

Ensuring functional safety

A safety-oriented function of a machine/plant encompasses sensors for signal acquisition, a processing unit for processing the signals and actuators for signal output.

Processing chain: Sensing, evaluating, reacting

All of the components contribute to the functional safety of the system in order to put the system into a safe state in the event of a dangerous situation or to keep it in a safe state.

Safety using SIMATIC Safety Integrated

For SIMATIC Safety Integrated systems, the processing unit consists of fail-safe single-channel controllers and fail-safe dual-channel I/O modules. Fail-safe communication takes place via the safety-oriented PROFIsafe profile. SIMATIC Safety Integrated is certified and suitable for use in accordance with

• IEC 61508: SIL 1 - 3
• EN 954: Cat. 2 - 4
• IEC 61511
• EN 60204-1
• EN 62061
• NFPA 79, NFPA 85
• EN ISO 13849 -1: PL a - e

SIMATIC Safety Integrated thus fulfills the highest requirements for the manufacturing and processing industry.

Fail-safe controllers

The fail-safe controllers have the following functions:
• Comprehensive self-tests and self-diagnostics check the fail-safe state of the controller.
• Simultaneous execution of standard and safety programs on one controller – also on one fail-safe software controller.

Failsafe I/O modules (F modules)

The major difference between failsafe modules and standard ET 200 modules is that failsafe modules have a two-channel internal design. Both integrated processors monitor each other and automatically test the input and output wiring, and place the F-module in a safe state in the event of a fault.

The fail-safe controller communicates with the fail-safe module via the PROFIsafe safety-related bus profile.
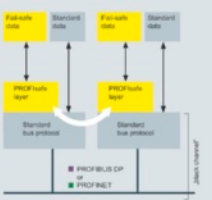
Failsafe power modules supply load voltage to the potential group and safely shut down the load voltage for standard output modules.

Fail-safe digital input modules record the signal states of safety-related sensors (e.g. EMERGENCY-STOP pushbutton) and send corresponding safety message frames to the fail-safe controller. Failsafe digital output modules are suitable for switching processes with short-circuit monitoring up to the actuator.

SIMATIC Safety Integrated - System Overview

SIMATIC Safety Integrated from Siemens is a comprehensive fail-safe automation system which is TÜV-certified in accordance with IEC 61508 and meets maximum safety require ments; therefore it complies with relevant standards: EN 954-1 up to Cat. 4, IEC 62061 up to SIL 3, and EN ISO 13849 up to PL e.

System features		
	Communication	Safety-related communication is possible by means of the PROFIsafe profile. Standard and safety-related communication can take place over one bus cable – be it PROFIBUS, PROFINET, or IWLAN.
	Diagnostics	All SIMATIC products have integral diagnostics functions for increased system availability with which a possible fault can be identified in advance and eliminated.
	Engineering	Failsafe systems are configured using STEP 7 and S7 Distributed Safety. The languages F-LAD and F-FBD (based on the standard languages LAD and FBD), as well as pre-configured, certified blocks are used for programming the safety program. Fail-safe systems are configured in the TIA Portal using STEP 7 Safety Advanced or with STEP 7 and S7 Distributed Safety as before. The languages LAD and FBD, as well ready-made certified blocks are used for programming the safety programs.

Product portfolio		
	Controllers	Fail-safe SIMATIC Controllers allow simultaneous processing of standard and safety programs on the same controller. They are based on different hardware and software architectures. You can choose between various designs and CPU classes: **SIMATIC Modular Controllers** ■ ET 200 F-CPUs: Fail-safe, intelligent interface modules for use on site in the lower performance range ■ S7-300F: Fail-safe CPUs for the mid to upper performance range, optionally with integral motion control functionality ■ S7-400F: fail-safe CPUs for the highest possible performance range **SIMATIC PC-based controllers** ■ WinAC RTX F: Fail-safe S7 software controller for PCs with Windows XP **SIMATIC Embedded Bundles** ■ S7-mEC-RTX F: fail-safe embedded controller in S7-300 design, with Windows XP Embedded and S7 software controller WinAC RTX F pre-installed ■ IPC227D/IPC427C bundle with WinAC RTX F: Fail-safe embedded DIN rail PC, pre-installed with Windows Embedded Standard 2009 and S7 software controller WinAC RTX F ■ HMI IPC277D/IPC477C bundle with WinAC RTX F: Embedded Panel PC, pre-installed with Windows Embedded Standard 2009 and fail-safe S7 software controller WinAC RTX F
	I/O	Distributed field devices from the ET 200 range are used as fail-safe I/O. There are versions for the control cabinet or, with a high degree of protection, for cabinet-less use – in modular and in block design: ■ ET 200S ■ ET 200M ■ ET 200pro ■ ET 200eco ■ ET 200iSP Within an ET 200 station, both standard and fail-safe modules can be operated.

Engineering

The TIA Portal offers the latest software technology that reveals its true potential by means of an intuitive user interface. This enables you to concentrate on your engineering task. Thanks to the intuitive layout and the easy navigation, you will quickly grasp the programming and editing functions that are important for you. At the start of a project, you can choose between the task-oriented portal view with simplified user guidance or the project view that offers you quick access to the relevant tools.

The portal view guides you intuitively through each engineering step. The modules are clearly and thematically arranged in the hardware catalog on the right and can be selected by their order number and dragged directly to the photorealistic representation of the rack and "inserted". The structured tree offers all parameters directly in the program editor. All device settings can be made immediately in the device properties, e.g. the operating mode. Whether a controller is to be programmed, an HMI display or network connections are to be configured – the TIA Portal helps both new and experienced users work as productively as possible.

STEP 7 Safety Advanced is the seamless integration of safety into the TIA Portal. Safety-oriented programs can, however, still be generated using STEP 7 and Distributed Safety. Programs created with **STEP 7 Distributed Safety** can be migrated into the TIA Portal at any time.

Both engineering tools offer commands, operations and blocks for safety-related programs in the LAD and FBD languages. To this end, there is a library with pre-prepared, TÜV-accepted blocks for safety-related functions. You do not need additional engineering expertise, because the programming is done in the traditional STEP 7 environment. Error detection functions and safety checks when generating the safety program are also supported, as is the comparison of safety programs. Apart from the safety program, a standard program can also be run on the same CPU.

Engineering with STEP 7 Safety Advanced

SIMATIC Safety Integrated is the seamless and easy to use integration of safety-related functions into the standard automation. This also applies to the engineering in the TIA Portal with STEP 7 Safety Advanced. All configuration and programming tools required for creating a safety-oriented program are integrated into the STEP 7 user interface and use a common project structure. With STEP 7 Safety V11 you can exploit all the advantages of the TIA Portal for your fail-safe automation as well.

Safety engineering in the TIA Portal

- Intuitive operation and and same operating concept as for the creation of standard programs allow you to quickly create fail-safe programs
- Same configuration of the F-system as for the standard automation system
- Ready-to-start: The F-runtime group is set up automatically on insertion of the F-CPU
- Using its own signatures, the library concept supports in-house standardization and simplifies the validation of safety-related applications
- The Safety Administration Editor provides central support in the management, display and modification of safety-relevant parameters
- Uniform and integrated identification of all safety-related objects provides you with an instant overview
- Another new feature is the support of 32-bit integer data types

Engineering with STEP 7 V5.5 and S7 Distributed Safety

Using the Distributed Safety engineering tool, safety-oriented automation applications can be created with STEP 7 Version 5.5 in LAD or FBD.
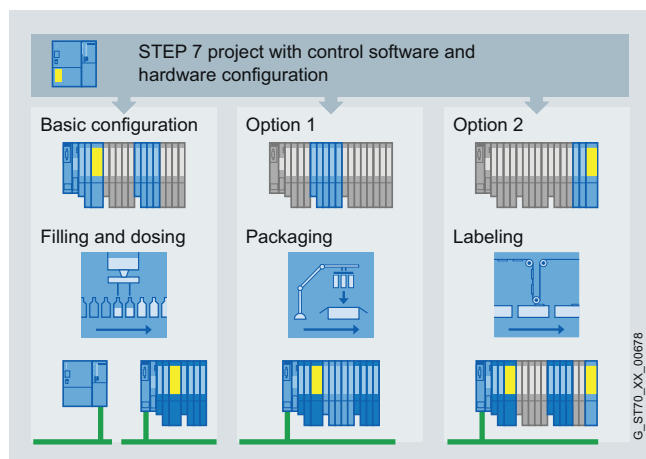
The safety program from the standard user program is called up via the so-called F-call (e.g. from a time interrupt OB such as OB 35).

Option handling without RESERVE modules

Option handling without RESERVE modules enables finely modular I/O systems to be implemented, in which the number and type of the input and output channels can be exactly adapted to the requirements of the plant or machine supplied. Option handling without RESERVE modules enables the entire SIMATIC ET 200S station to be configured, including all options. Modules for unnecessary options are not required. Optional functions are activated during operation without new configuration.

Advantages:
- Retrofitting of options without changing the configuration while the plant is operating
- Enabling of options by the S7 program
- Tool changing during operation
- Simple diagnostics, regardless of the configuration version

Function examples

On the Internet you will find practical function examples that cover the typical requirements of industrial safety technology. They describe how certain safety functions can be implemented using S7 Distributed Safety and which components are required for the same. The examples contain function descriptions, component lists and circuit plans as well as one STEP 7 project that can be loaded. They will thus help you in speedy and simple implementation of the described tasks.

Some examples include:
- Protective door with spring-actuated tumbler
- EMERGENCY-STOP with acknowledgment
- Light curtain with muting function
- Safe standstill recording and safely reduced speed with F-CPU and MASTERDRIVES

You will find these and other examples on the Internet at **www.siemens.com/safety-functional-examples**

Web-based Training

In the new Web-based Training you learn more about the fail-safe SIMATIC and its advantages and options. You learn how to configure the hardware correctly, how fail-safe programs are structured, and how data exchange between standard and fail-safe programs is implemented.

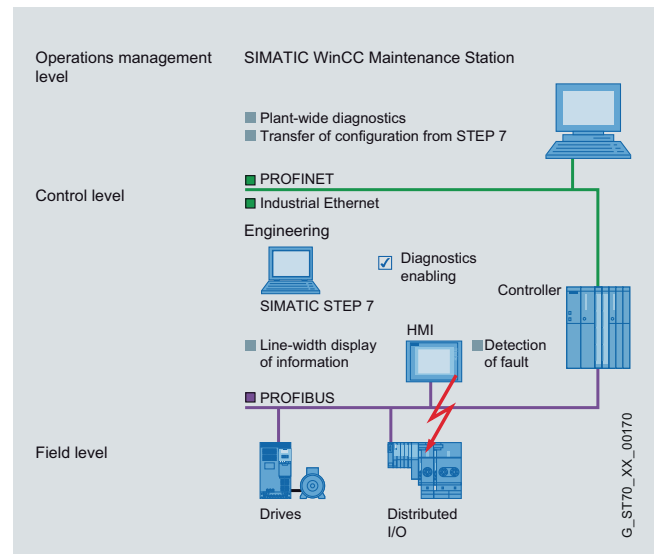**www.siemens.com/simatic-safety-integrated/e-learning**

Industry-specific F software packages

The optional *burner package* contains an F-library with blocks for industrial gas and oil burners. The blocks are certified by TÜV for heating vessels and boilers (see Table).

The other optional *press package* contains finished function blocks in order to implement press safety functions in accordance with EN 954-1, Cat.4 and EN 61508 - for example, for mechanical, hydraulic or pneumatic presses.

Software for fail-safe applications			
Package	STEP 7 Safety Advanced STEP 7 Distributed Safety	Burner option package	Press option package
Library	Certified modules, e.g. EMERGENCY-STOP, two-hand control, muting, door monitoring	Certified burner modules	Certified modules
Certificates	IEC 61508: SIL 1 - 3 EN 954: Cat. 2 - 4 IEC 61511 EN 60204-1 EN 62061 NFPA 79, NFPA 85 ISO 13849: PL a - e	IEC 61508: 2000, Part 3, SIL3 DIN EN 676: 2003 DIN EN 267: 2009 DIN EN 12952-8: 2002 DIN EN 12953-7: 2002 DIN EN 746-2: 2010	EN 954-1, Cat. 4 EN 61508
Requirement	STEP 7	S7 Distributed Safety	S7 Distributed Safety
Engineering package	1 license per engineering location		
Runtime package		1 license per CPU	
Order No. group	6ES7 833-1FC.	9AL3 100-1AD5.	6AU1 837-0EA.

Diagnostics

Minimization of downtimes through efficient diagnostics concepts

All SIMATIC products have integral diagnostics functions with which a possible fault can be identified in advance 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. This increases the Overall Equipment Efficiency (OEE), minimizes downtimes, and saves costs.

Integrated diagnostics

- Totally Integrated Automation offers products and modules with integrated diagnostics 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

- Fault text information
- Unambiguous module identification (number)
- Address/slot information
- Chronological time stamp

Diagnostics can be activated, no programming is required

- The diagnostics function of the modules is conveniently accessible 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 statuses (module and network statuses, signaling of system faults) are represented uniformly throughout the plant
- The diagnostics displays with different degrees of detail (hierarchy) are generated automatically from configuration data (HW Config).
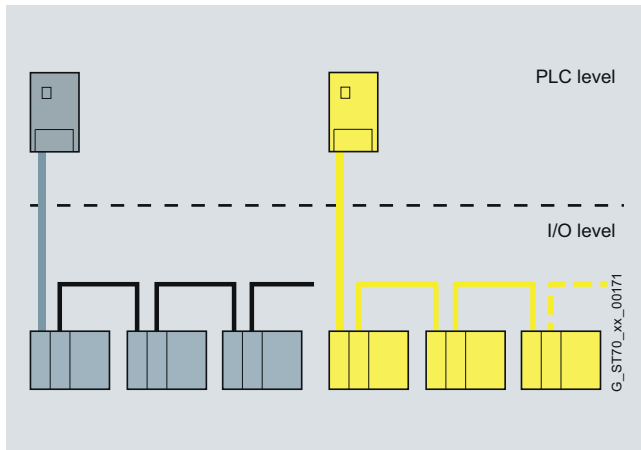
Architectures

Failsafe applications can be implemented in various forms.
A distinction is made between four different options.
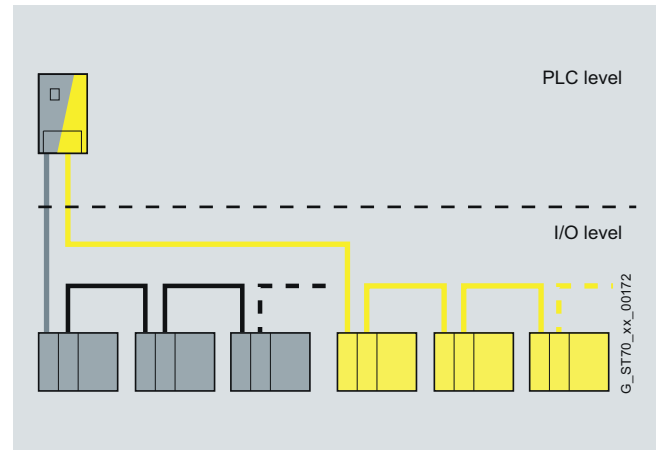
Separation of PLC, I/O and bus

In this configuration, completely separated systems are available for the standard section and the safety section (a very widespread solution today).

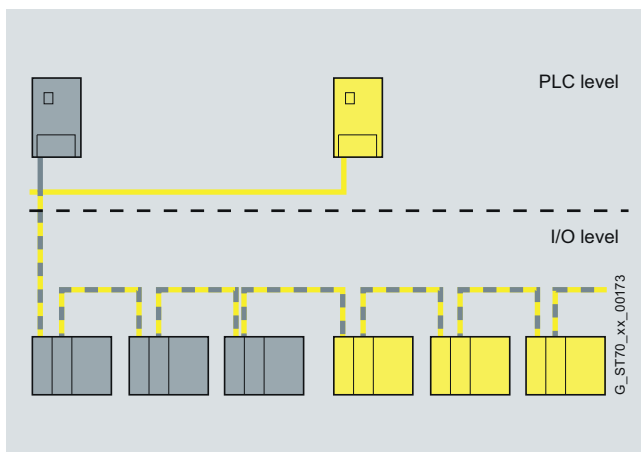Separation of PLC, I/O and bus
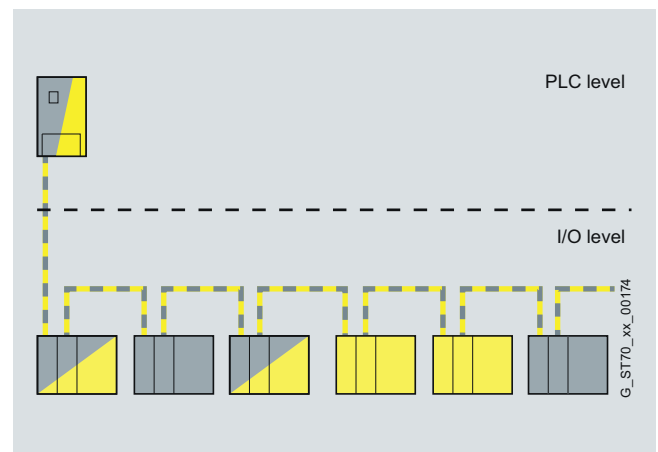
One bus, but separation of PLC and I/Os

In this configuration, separate controllers and separate I/Os are available for the standard section and safety section. Communications are carried out via a shared bus system.

One bus, but separation of PLC and I/Os

One PLC, but separation of I/Os and bus

In this configuration, there is a shared controller, but separate bus systems and separate I/Os for the standard section and safety section.

One PLC, but separation of I/Os and bus

One PLC, one bus and hybrid I/Os

In this configuration, a shared controller, a shared bus system and shared I/Os serve both the standard section and the safety section.
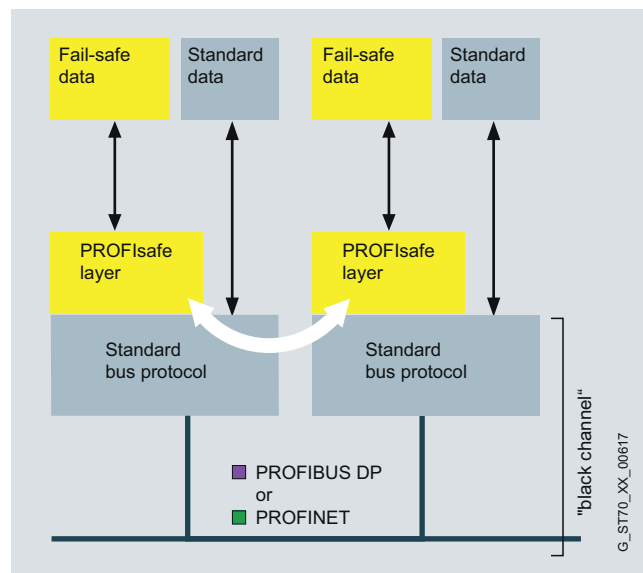

One PLC, one bus and hybrid I/Os

Communication – PROFIsafe

PROFIsafe was the first communications **standard conforming to the safety standard IEC 61508 that permits both standard and safety-related communications on one bus line.** This not only results in an enormous savings potential with regard to cabling and the required number of parts, but also the advantage of retrofitting.

PROFIsafe is one of the open solutions for safety-related communication over standard field buses, and is defined in IEC 61784-3-3 as an international standard. Numerous manufacturers of safety components and end users of safety technology have helped develop this vendor-independent and open standard for PROFIBUS International (PI).

PROFIsafe profile allow safe communication for the open standard buses PROFIBUS and PROFINET on the basis of standard network components. In connection with PROFINET, PROFIsafe also supports failsafe wireless communication via IWLAN.

The table below shows how PROFIsafe deals with the various potential sources of errors when transmitting messages.

Safety-related and standard data is transferred using PROFIsafe via the same bus line. The black channel indicates that safety-related communication is independent of the bus system and the underlying network components.

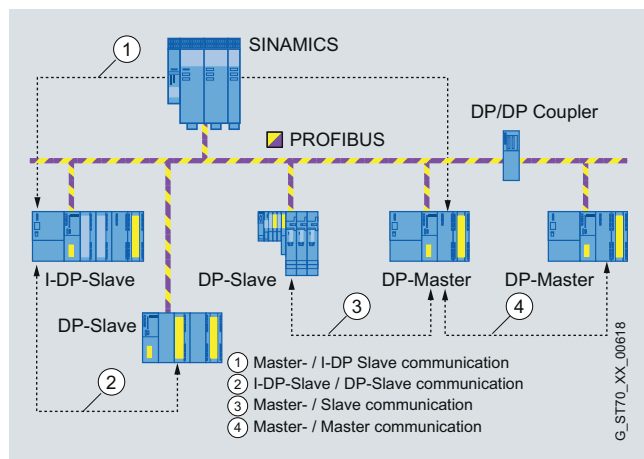| PROFIsafe – Measures against transmission errors				
Measure / Fault	Consecutive number	Time expectation with acknowledgment	Identification for transmitter and receiver	Data security CRC
Repeat	●			
Loss	●	●		
Insertion	●	●	●	
Incorrect sequence	●			
Data corruption				●
Delay		●		
Coupling of safety-related messages and standard messages (masquerade)		●	●	●
FIFO errors (First In First Out data register for maintaining the sequence)		●		

Communication – PROFIBUS, PROFINET and IWLAN

The following graphics show which communications options are available with the PROFIsafe profile over PROFIBUS, PROFINET, and IWLAN.

PROFIBUS

PROFIBUS provides the following options for failsafe communication:
- Master to master communications between DP masters across subnet boundaries – for example, between fail-safe CPUs via DP to DP coupler
- Master to I-DP slave communications between DP master and I-DP slave in the same subnet – for example, between fail-safe CPU and ET 200S CPU
- Master to slave communications between DP master and DP slave in the same subnet – for example, between fail-safe CPU and ET 200 system with fail-safe modules
- Direct communications between I-DP slave and DP slave without incorporating a DP master – e.g. between intelligent slave (fail-safe CPU) and slave (ET 200 with fail-safe modules). No fail-safe DP master is needed for this (fail-safe CPU), a standard DP master is sufficient.
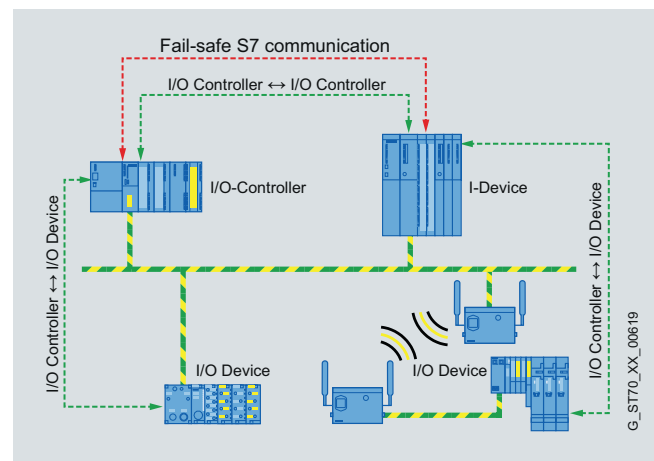

Failsafe communication via PROFIBUS

PROFINET

PROFINET provides the following options for failsafe communication:
- Master to master communications between DP masters across subnet limits – for example, between fail-safe CPUs via DP/DP coupler
- Master to I-DP slave communication between DP master and I-DP slave in the same subnet – for example, between fail-safe CPU and ET 200S-CPU
- Master to slave communications between DP master and DP slave in the same subnet – for example, between fail-safe CPU and ET 200 system with fail-safe modules
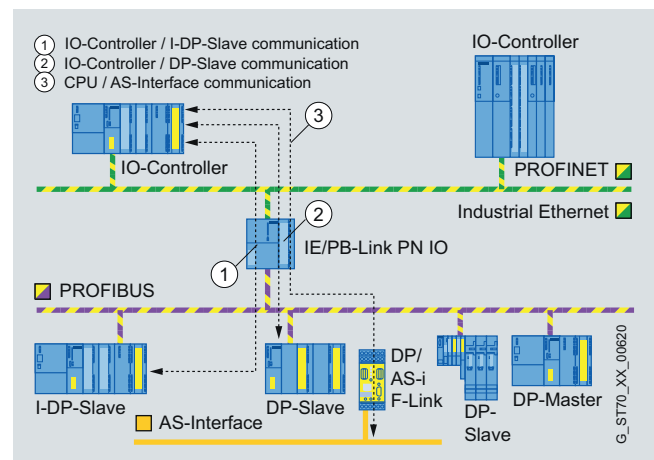

Failsafe communication via PROFINET

Network transitions

Gateways permit fail-safe communication between different bus systems:
- Communications between IO controller and DP slave – for example, via IE/PB link
- Master/slave communications between IO controller and intelligent DP slave – for example, via IE/PB link
- Communications between CPU and AS-interface: with the DP/ASi F link fail-safe signals can be read in at the AS-Interface and the fail-safe CPU made available via PROFIsafe
- All SIMATIC components also can be accessed throughout the system via bus systems. You can access all devices from any access point in the plant.
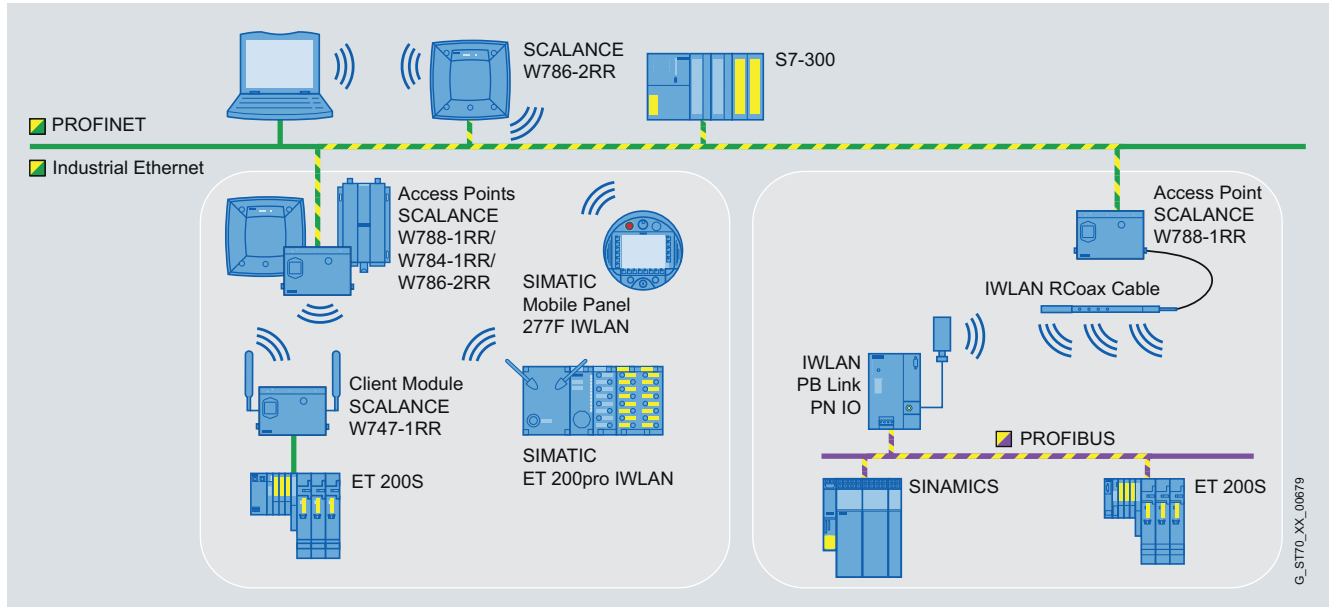

Failsafe communication between PROFIBUS and PROFINET

Additional functions for PROFINET

Wireless

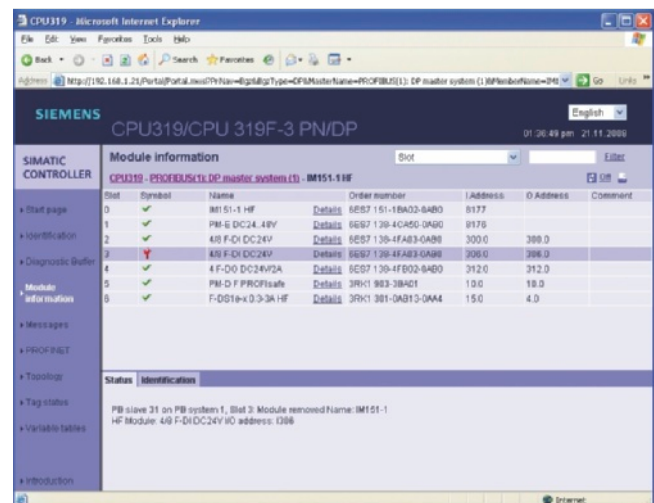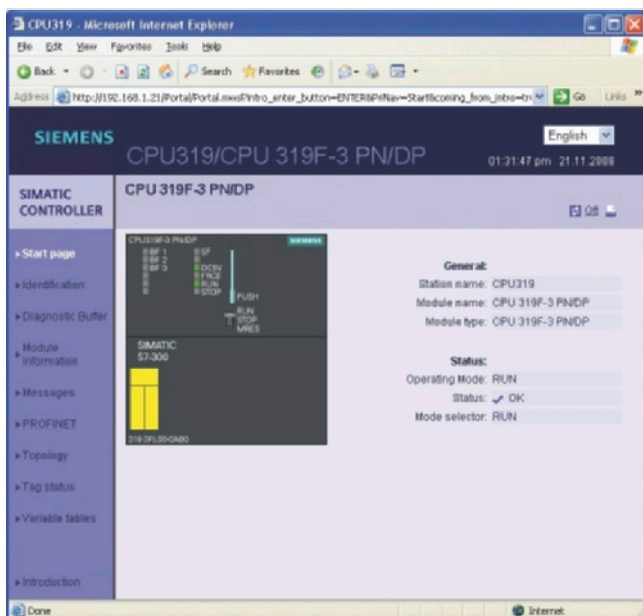Wireless failsafe communication is also possible using
PROFINET via access points.

Various application options for wireless, fail-safe communication
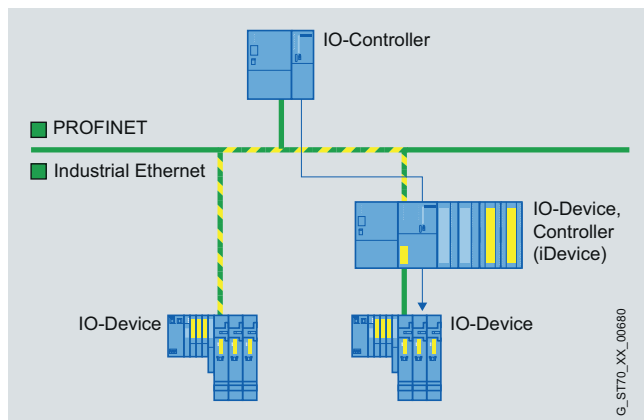
Web server functionality

- The SIMATIC Controllers, Panels and Switches have an integral web server functionality for online access to setting options and device information (e.g. diagnostics buffer).

- The display is directly in the web browser without the need for additional software tools. Access is possible from any PC with Internet capability.

Intelligent and shared device

Intelligent device (I-Device)

With this functionality, PROFINET in a typical automation system with several networked controllers not only permits communication with lower-level devices as an IO controller, but also permits IO communication with other higher-level or central controllers as IO devices. This communication takes place at the same time on the same bus. I-Device makes the topology leaner and more flexible. It facilitates the simple connection of controllers from different projects in exactly the same way as the integration of Siemens and third-party controllers within one communication network.
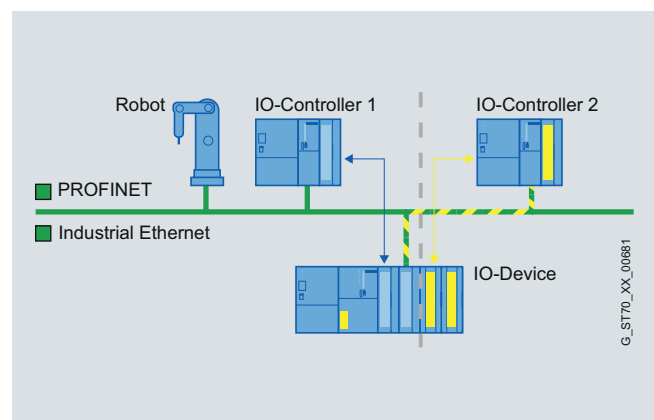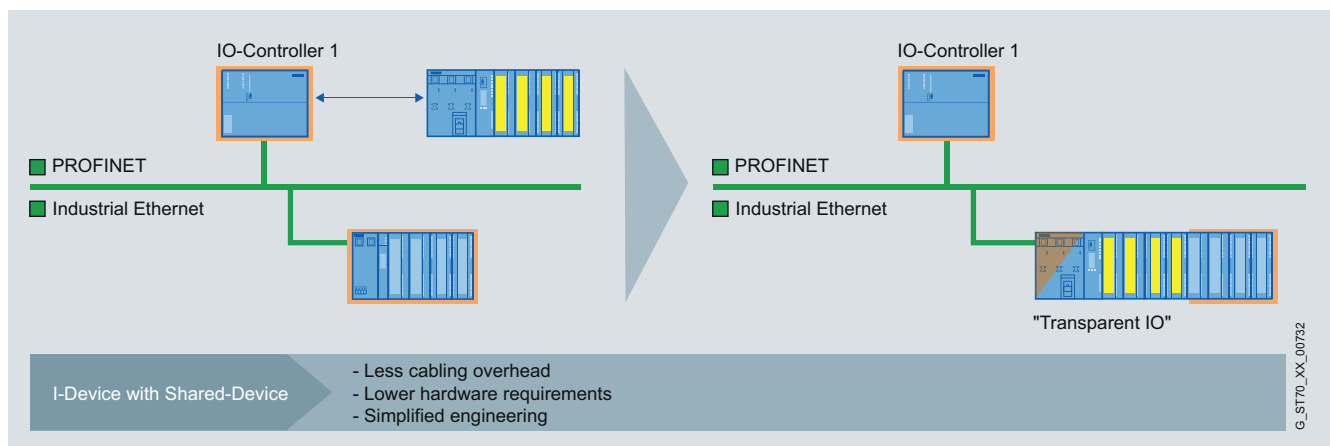
Shared device

With this functionality, several SIMATIC controllers can use the same PROFINET IO device. This makes system configuration easy and economical. This applies, for example, to applications in which the standard CPU operates separately from the fail-safe CPU. Fewer remote devices have to be installed in the field, as a complete "remote head" of different CPUs can be addressed. In addition, channels and modules can be assigned flexibly.

Thanks to I-Device, the modular controller and the topology architecture become leaner and more flexible

With Shared Device, several controllers can use the same IO device

Transparent I/O

The combination of Shared-Device and I-Devices permits the implementation of additional innovative plant concepts that have not yet been possible without any accessories. Small, local F-CPUs with centralized F I/O are frequently used on-site in machine tools. I/O stations that concentrate inputs/outputs for the higher-level controller are installed at the same locations. The small F-CPU also has a communications link with the higher-level controller as the latter requires the status and diagnostics information. Transfer of the I/O of the higher-level controller to the local F station and transparent access to the I/O by means of the shared-devices mechanism save the user the overhead for an additional header station, additional cabinet space, additional cabling and engineering.

Combination I-Device with Shared Device

Technical data: SIMATIC Modular Controllers

	SIMATIC Modular Controllers				
	ET 200pro	ET 200S		S7-300	
	IM 154-8F PN/DP CPU	IM 151-7 F-CPU [1]	IM 151-8F PN/DP CPU [1]	CPU 315F-2 DP [1]	CPU 315F-2 PN/DP [1]
Dimensions (mm)	135 x 130 x 51	60 x 120 x 75	120 x 120 x 75	40 x 125 x 130	
Order No. group: 6ES7	154-8FB.	151-7FA.	151-8FB.	315-6FF.	315-2FJ.
Memory					
Working memory	512 KB	128 KB	256 KB	384 KB	512 KB
Processing times					
Bit operation	0.1 μs	0.06 μs		0.05 μs	
Word operation	0.2 μs	0.2 μs		0.09 μs	
Fixed-point operation	2 μs	2 μs		0.12 μs	
Floating-point operation	3 μs	3 μs		0.45 μs	
Bit memories/timers/counters					
Bit memory	2 048 bytes	256 bytes		2 048 bytes	
S7 times/S7 counters	256 / 256	256 / 256		256 / 256	
IEC times/IEC counters	●	●		●	
Address ranges					
Distributed I/O (bytes)	2 048 / 2 048	2 048 / 2 048		2 048 / 2 048	
I/O process image (bytes)	2 048 / 2 048	128 / 128	2 048 / 2 048	2 048 / 2 048	
Digital channels (central)	16 384	248	496	1 024	
Analog channels (central)	1 024	124		256	
DP interfaces					
DP master systems (int./CP)	● / ●	– / ●		● / ●	
DP slave	●	●		●	
Plug-in interfaces					
Isochronous mode	●			●	
PROFINET interfaces					
PROFINET IO (also with IRT)	●		●		●
TCP/IP	●		●		●
UDP	●		●		●
ISO-on-TCP (RFC 1006)	●		●		●
Web Server	●		●		●
Open user communication	●				●
Isochronous mode	●				●

[1] As SIPLUS extreme version, also for extended temperature range (-25...+60/+70°C) and corrosive atmosphere/condensation, for precise details, visit **www.siemens.com/siplus-extreme**

[2] Operation possible on PROFINET with CP 443-1 Advanced.

				S7-400		
CPU 317TF-2 DP	CPU 317F-2 DP [1]	CPU 317F-2 PN/DP [1]	CPU 319F-3 PN/DP	CPU 414F-3 PN/DP	CPU 416F-2 DP [2]	CPU 416F-3 PN/DP
160 x 125 x 130	40 x 125 x 130	40 x 125 x 130	120 x 125 x130	50 x 290 x 219	25 x 290 x 219	50 x 290 x 219
317-6TF.	317-6FF.	317-2FK.	318-3FL.	414-3FM.	416-2FN.	416-3FS.
1.5 MB	1 MB	1.5 MB	2.5 MB	4 MB	5.6 MB	16 MB
0.05 µs		0.025 µs	0.004 µs	0.045 µs	0.03 µs	
0.2 µs		0.03 µs	0.01 µs	0.045 µs	0.03 µs	
0.2 µs		0.04 µs	0.01 µs	0.045 µs	0.03 µs	
1 µs		0.16 µs	0.04 µs	0.135 µs	0.09 µs	
4 096 bytes			8 192 bytes	8 192 bytes	16 KB	
512 / 512			2 048 / 2 048	2 048 / 2 048	2 048 / 2 048	
●			●	●	●	
8 192 / 8 192			8 192 / 8 192	8 192 / 8 192	16 KB / 16 KB	
2 048 / 2 048	2 048 / 2 048	8 192 / 8 192	8 192 / 8 192	8 192 / 8 192	16 KB / 16 KB	
512	1 024		1 024	65 536 / 65 536	131 072 / 131 072	
64	256		256	4 096 / 4 096	8 192 / 8 192	
● / ●			● / ●	● / ●	● / ●	
●			●	●	●	
				1 x DP		1 x DP
●			●	●	●	
		●	●	●		●
		●	●	●		●
		●	●	●		●
		●	●	●		●
		●	●	●		●
		●	●	●		●
		●	●	●		●

Technical data: SIMATIC PC-based Automation

	SIMATIC PC-based Automation			
	PC-based controllers	**Embedded bundles**		
	WinAC	S7-mEC	IPC227D / IPC427C	HMI IPC277D / HMI IPC477C
	WinAC RTX F	EC31-RTX F	IPC227D / IPC427C bundles with WinAC RTX F	HMI IPC277D / HMI IPC477C bundles with WinAC RTX F
Dimensions (mm)		160 x 125 x 115 mm	IPC227D: 191 x 100 x 60 mm IPC427C: 262 x 134 x 47 mm	depending on operator panel 7" to 19"
Order No. group: 6ES7	671-1RC.	677-1FD.	IPC227D: 6ES7 647-8A. IPC427C: 6ES7 675-1D.	HMI IPC277D: 6AV7 881-. HMI IPC477C: 6AV7 884-. HMI IPC477C PRO: 6AV7 883-.
Memory				
Working memory	depending on the PC	1 GB	IPC227D: up to 1 GB IPC427C: up to 4 GB	HMI IPC277D: up to 1 GB HMI IPC477C: up to 4 GB
Processing times				
Bit operation	0.004 µs [3]	0.004 µs	0.004 µs [5]	
Word operation	0.003 µs [3]	0.003 µs	0.003 µs [5]	
Fixed-point operation	0.003 µs [3]	0.003 µs	0.003 µs [5]	
Floating-point operation	0.004 µs [3]	0.004 µs	0.003 µs [5]	
Bit memories/timers/counters				
Bit memory	16 KB	16 KB		
S7 times/S7 counters	2 048 / 2 048	2 048 / 2 048		
IEC times/IEC counters	●	●		
Address ranges				
Distributed I/O (bytes)	16 348 / 16 348 bytes	16 348 / 16 348 bytes		
I/O process image (bytes)	8 192 / 8 192 bytes	8 192 / 8 192 bytes		
Digital channels (central)		1 024		
Analog channels (central)		256		
DP interfaces				
DP master systems (int./CP)	depending on the PC	– / ●	● / ● (IPC427C only)	● / –
DP slave	●	●	● (IPC427C only)	●
Plug-in interfaces		●		
Isochronous mode	●	●	● (IPC427C only)	● (HMI IPC477C only)
PROFINET interfaces				
PROFINET IO	●	●	●	●
TCP/IP	●	●	●	●
UDP	●	●	●	●
ISO-on-TCP (RFC 1006)	●	●	●	●
Web Server	● [4]	●	● [4]	●
Open user communication	●	●	●	●
Isochronous mode (IRT)	●	●	● (IPC427C only)	● (HMI IPC477C only)

[3]   Depends on PC hardware used
      Reference platform: Pentium IV, 2.4 GHz
[4]   Available soon

[5]   (Intel Core2 Solo 1.2 GHz) for IPC427C and HMI IPC477C

ET 200 failsafe I/Os

For connecting actuators and sensors, there is a series of failsafe distributed ET 200 I/O devices and systems that can be directly connected to PROFIBUS or PROFINET.

The failsafe I/O ET 200M can also be operated centrally in S7-300.

SIMATIC ET 200 – Fail-safe I/Os	ET 200S	ET 200M	ET 200pro	ET 200eco	ET 200iSP
Feature	Bit-modular I/O with up to 8 channels per module	Modular I/O for multi-channel applications with up to 24 channels per module	Modular, multifunctional I/O module with high level of protection IP65/67	The cost-effective block I/O with a high degree of protection IP65/67	Intrinsically-safe version with IP 30 degree of protection for hazardous areas
Number of modules	63	8	16	1	32
DI (digital inputs)	●				
DO (digital outputs)	●				●
Relays	●				
DI/DO (digital inputs/outputs)	●		●		
AI (analog inputs)		●			●
Motor starter	●		●		
Frequency converter	●		●		
For use in hazardous areas	Zones 2, 22				1, 21
PROFIBUS [4]	●	●	●	●	●
Interface module	IM 151-1 HF [8]	IM 153-2 HF [8] IM 153-2 HF FO	IM 154-2 DP HF With connection modules for direct connection [1], ECOFAST [2] and M12 or 7/8" [3]	Via connection block for ECOFAST or M12, 7/8"	IM 152 [9]
Product selection code 6ES7...	151-1BA.	153-2BA. 153-2BB.	154-2AA.	194-3AA.	152-1AA.
PROFINET [5]	●	●	●		
Interface module	IM 151-3 PN HF [6] IM 151-3 PN FO [7]	IM 153-4 HF	IM 154-4 PN HF [6] IM 154-6 PN IWLAN With connection modules for M12 or 7/8"		
Product selection code 6ES7...	151-3BA. 151-3BB.	153-4.	154-4AB. 154-6AB.		

[1] Direct connection with cable gland
[2] ECOFAST: Standardized connecting cable with hybrid cables
[3] M12, M 7/8": Connection method with widespread connector standard
[4] Transfer rate PROFIBUS 12 Mbit/s
[5] Transfer rate PROFINET 100 Mbit/s
[6] With integrated 2-port switch, e.g. for simple setup of linear structures

[7] For setting up optical networks with easy to configure plastic fiber-optic cables
[8] As SIPLUS extreme version also for extended temperature range (-25...+60/+70°C) and corrosive atmosphere/condensation; for precise details, visit **www.siemens.com/siplus-extreme**
[9] Transfer rate RS485iS 1.5 Mbit/s

Technical data ET 200

SIMATIC ET 200S – Fail-safe modules							
	Digital input 4/8 F-DI [1]	Digital input module 4 F-DI/3 F-DO	Digital output module 4 F-DO [1]	Relay module 1F-RO	Power module PM-D F 24 VDC	Power module PM-E F pp 24 VDC	Power module PM-E F pm 24 VDC
Number of I/Os	4 (2-channel for SIL 3 sensors) 8 (1-channel for SIL 2 sensors)	4 inputs (SIL 2) 3 outputs 2A (SIL 2)	4 at 24 V/2 A (current-sinking)	1 relay output 24 V DC, 24 ... 230 V AC, 5 A	6 switch-off groups, each 3 A (aggregate current 5 A)	1 relay output 24 V DC (aggregate current 10 A) (source/source output)	up to 2 SIL 3 outputs for 24 V/2 A, 1 relay output 24 V DC (aggregate current 10 A) (source/sink output)
Input or output voltage	24 V DC						
Order No. group	6ES7 138-4FA.	6ES7 138-4FC.	6ES7 138-4FB.	6ES7 138-4FR.	3RK1 903-3BA.	6ES7 138-4CF4.	6ES7 138-4CF.

SIMATIC ET 200S – Fail-safe motor starter

In addition to a circuit breaker/contactor combination, the fail-safe motor starters have a safe electronic evaluation circuit for fault detection.
If the contactor to be switched in the case of an EMERGENCY STOP fails, the analyzing electronics detect a fault and deactivate the circuit-breaker in the motor starter in a failsafe manner.

Performance at 500 V	7.5 KW
Rated operational current IE	16 A
Short-circuit break-ing capacity	50 kA at 400 V
Coding	Allocate one of 6 disconnect groups
Order No. group motor starter	3RK1 301-0.B13-.AA2
Order No. group terminal module	3RK1 903-3A.

SIMATIC ET 200S – Power Module PM-D F

Number of int. dis-connection groups	6
Aggregate current of outputs	5 A
Diagnostics	Can be read out
Order No. group	3RK1 903-3BA.

SIMATIC ET 200S – Fail-safe contact multiplier F-CM

Contacts	4 NO
Diagnostics	Power failure, equipment failure
Switching capacity	1.5 A/24 V
Order No. group	3RK1 903-3CA.

SIMATIC ET 200S – Fail-safe power module PM-D F X1 Infeed terminal module

Operation	Standalone with external safety technology
Double terminals for switch-off groups	6
Diagnostics	Voltage failure
Order No. group	3RK1 903-3DA.

SIMATIC ET 200S – Fail-safe frequency converter

The fail-safe frequency converters allow safety functions for encoderless speed-controlled asynchronous motors:
- Safely shutdown torque
- Safe stop 1
- Safely limited speed

Power	Up to 4 kW
Order No. group	6SL3 244-0S.

[1] As SIPLUS extreme version, also for extended temperature range (-25...+60/+70°C) and corrosive atmosphere/condensation, for precise details, visit **www.siemens.com/siplus-extreme**

SIMATIC ET 200M – Fail-safe modules

	Digital input module SM 326 F DI 24 [2]	Digital input SM 326 F DI 8 NAMUR	Digital output module SM 326 F DO 10 PP [2]	Digital output module SM 326 F DO 8 PM [2]	Analog input module SM 336 F AI 6 [1]
Number of I/Os up to	12 (2-channel for SIL 3 sensors) 24 (1-channel for SIL 2 sensors)	4 (2-channel) 8 (1-channel)	10 (source/source output)	8 (source/sink output)	6 (15 bit)
Input or output voltage	24 V DC	NAMUR	24 V DC		
Interrupts	Diagnostic interrupt				
Input or output current			2 A per channel at signal "1"		0/4 ... 20 mA, HART
Order No. group	6ES7 326-1BK.	6ES7 326-1RF.	6ES7 326-2BF.	6ES7 326-2BF.	6ES7 336-4GE.

SIMATIC ET 200eco – Fail-safe modules

	4/8 F-DI
Number of inputs	4 (2-channel for SIL 3 sensors) 8 (1-channel for SIL 2 sensors)
Input voltage	24 V DC
Order No. group	6ES7 148-3FA.

SIMATIC ET 200pro – Fail-safe modules

	EM 8/16 F-DI	EM 4/8 F-DI/F-DO
Number of inputs	8 (2-channel for SIL 3 sensors) 16 (1-channel for SIL 2 sensors)	4 (2-channel for SIL 3 sensors) 8 (1-channel for SIL 2 sensors)
Input voltage	24 V DC	
Number of outputs		4 (source/sink output), SIL 3
Output current		24 V DC / 2 A
Order No. group	6ES7 148-4FA.	6ES7 148-4FC.

[1] As SIPLUS extreme version also for corrosive atmosphere/condensation, for precise details, visit **www.siemens.com/siplus-extreme**

[2] As SIPLUS extreme version also for extended temperature range (-25...+60/+70°C) and corrosive atmosphere/condensation, for precise details, visit www.siemens.com/siplus

SIMATIC ET200 pro – Fail-safe frequency converter

The fail-safe frequency converters allow safety functions for encoderless standard asynchronous motors:
- Safely shutdown torque
- Safe stop 1
- Safely limited speed

Power	1.1 kW (0 ... 55°C); 1.5 kW (0 ... 45°C)
Order No. group	6SL3 235-OTE.

SIMATIC ET 200pro – F-Switch PROFIsafe

- Safe shutdown of standard I/O modules, SIL 2/ Cat. 3/PL d
- Safe control of ET 200pro motor starters in connection with the ASM 400 V module, SIL 3/Cat. 4/PL e
- Activation of parameterized safety functions of ET 200pro frequency converters

Number of inputs	2 (2-channel, digital), SIL 3/Cat. 4/PL e
Number of outputs	3 (source/source output)
Order No. group	6ES7 148-4FS.

SIMATIC ET 200iSP NEW

	Digital input 8F-DI Ex NAMUR	Digital output 4F-DO Ex	Analog input 4F-AI Ex HART
Number of input channels	8x 1-channel 4x 2-channel	4x 17.4 V DC/ 40 mA, or 2x 17.4 V DC/ 80 mA	4x 0...20 mA/ 4...20 mA or 4x 4...20 mA with HART
Monitoring	Overflow and underflow		Overflow and underflow
Diagnostics	System diagnostics	Energized-to-trip diagnostics	System-diagnostics
Suitable for	NAMUR-sensor, mechanical contact	Ex(i) solenoid valves, relays	2-wire transducer with/without HART
Order No. group 6ES7 138	-7FN.	-7FD.	-7FA.

References and portfolio

SIPA Berchi opts for an integrated PC-based safety solution

Requirements

With the launch of its SINCRO TRIBLOC isotronic, the Italian SIPA Berchi company has implemented an extremely compact filling machine for PET bottles that, for the first time, applies labels to the bottles before filling. As the labeling is the processing stage most prone to faults, incorrectly labeled bottles can now be rejected before the filling stage – a significant saving for the end customers. Additional requirements: a PC-based safety solution that offers their customers genuine added value.

Solution

The new failsafe software controller SIMATIC WinAC RTX F and the modular embedded controller SIMATIC S7-mEC have been used together as the automation system. SIMATIC WinAC RTX F enables the straightforward implementation of both standard and failsafe tasks on PC-based solutions. It meets the highest safety requirements as well as conformity with the relevant standards: EN 954-1 up to Cat. 4, IEC 62061 up to SIL 3, and EN ISO 13849-1 up to PL e. SIMATIC S7-mEC is the modular controller system in S7-300 technology with the latest embedded PC technology – and therefore combines the advantages of the proven modular S7 controller and PC technology in one new device.

Advantages

- Significant saving of time and money due to standardized engineering for standard and failsafe control systems in SIMATIC STEP 7
- Simple modernization of existing machines with failsafe components by connecting safety sensors via PROFINET and reducing cabling costs
- TÜV certification
- Raising the performance for the PLC and HMI application on a PC-based platform
- Simple integration of failsafe IOs on PROFINET into the SIMATIC ET 200S
- Significant saving of engineering time and costs

ZF Lenksysteme GmbH –
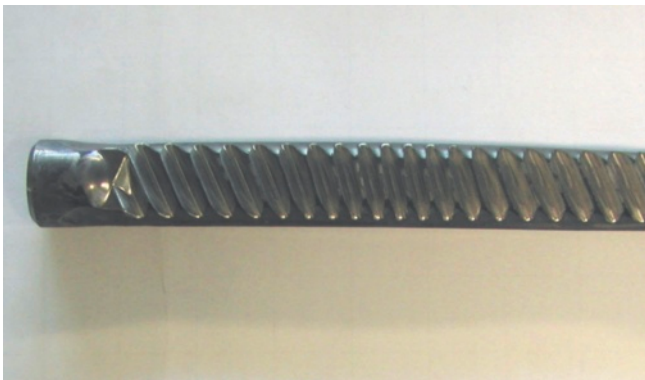## Manufacturer of vehicle guidance systems, Germany

Requirements

ZF Lenksysteme GmbH (ZFLS), which is headquartered in Schwäbisch Gmünd, is a leading manufacturer of vehicle guidance systems in the field of safety technology. In order to be state-of-the-art, the company decided to replace the conventional, hard-wired safety technology with modern, freely programmable PLC systems from Siemens. ZFLS believed that this change would bring about an increased level of flexibility and considerable cost savings for engineering and maintenance. One of the first applications to be implemented on this basis: a hydraulic press for preforming gear racks in an automated manufacturing unit.

Solution

ZFLS, the leader in steering technology, has decided on the fail-safe SIMATIC S7-300F controller with the 317F-2 DP CPU in the medium performance range and for the fail-safe ET 200S I/O modules optimized for use with it. Both the controller and the peripherals are approved by the TÜV. They guarantee functional safety up to SIL 3 as per IEC 61508. Safety-related and standard program parts run side-by-side on the failsafe CPU. This significantly simplifies the implementation of complex applications. No stand-alone safety controller is required. This architecture also permits in the I/O a hybrid, fine-modular setup, which is tailored exactly to the requirements. Controllers and I/O communicate via PROFIBUS. The fieldbus allows safe and standard data traffic on one and the same line via the PROFIsafe profile. This makes a separate safety bus superfluous, which reduces the installation outlay even in comparison to other PLC-based safety concepts.

Advantages

The responsible contacts at ZF Lenksysteme are sure they have found a suitable basis for more flexible failsafe automation solutions with the failsafe SIMATIC controllers. Even during its first use, it was possible to reduce the total costs by around 10%, due in no small part to the use of fail-safe PLC and bus technology. For the future, the company is planning to integrate several plant sections via PROFIBUS or PROFINET into a fail-safe control unit in order to be able to profit from even greater savings.

**CAMotion Inc. –
Mechanical engineering, Atlanta, USA**

Requirements

The American system integrator CAMotion, based in Atlanta, Georgia, implemented an innovative safety control network for one of its customers for use with large-scale overhead crane robotic systems – an innovative solution which allows standard and fail-safe communications to be conducted wirelessly. Additional requirements: Cost savings compared to conventional approaches, a high degree of ruggedness and reliability and minimized risk. In addition, CAMotion's solution should stand out due to its future-oriented design: It should be possible to flexibly expand it and adapt it to current requirements.
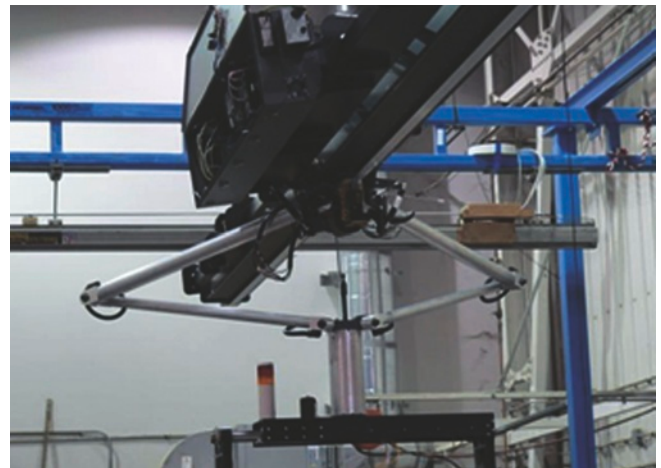
Solution

CAMotion decided on what they themselves described as the only solution that met the high requirements: a combination of fail-safe Siemens controllers, that are connected via PROFIBUS with PROFIsafe profile to the safety components that are in use.

The following are used: SIMATIC CPU 315F-2 PN/DP (on the floor) and the failsafe I/O SIMATIC ET200S with safety modules (on the moving crane). The basis for the wireless communication is created by the industrial Wireless LAN Access Points SCALANCE W788 and industrial Ethernet switches SCALANCE X208.

Advantages

CAMotion's solution is a real milestone in automation: For the first time, safety and wireless technology have been combined in one application – worldwide. The solution wins over the customer in every respect. Clear cost savings result from the fact that only one network is needed for all of the tasks.

And the customer sees his high requirements met without exception: The flexible, expandable and modular solution has been working extremely reliably since it was commissioned and it can be easily maintained. This is due to both the convenient diagnostics capabilities and the efficient fault clearing capabilities.

Volkswagen –
Radiator manufacturing in the Hannover plant in Germany

Requirements

In the future, the automation initiative of German automobile manufacturers (AIDA) will increasingly use PROFINET with integrated personnel safety as a standard process of the industrial Ethernet. The goal of AIDA, whose members include Audi, BMW, Daimler-Chrysler and VW, is the simple and uniform connection of the automation components that are used.
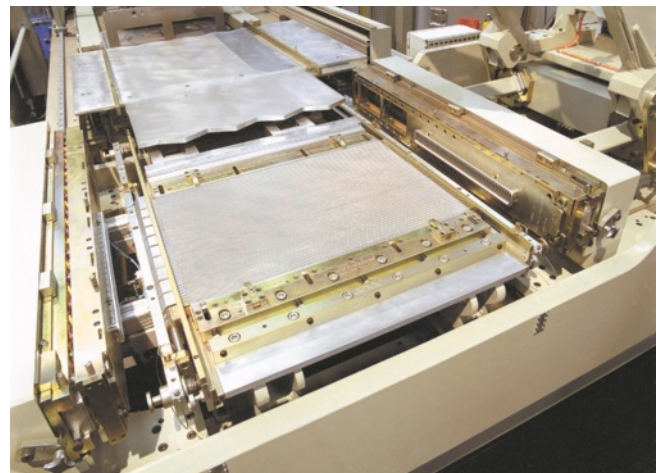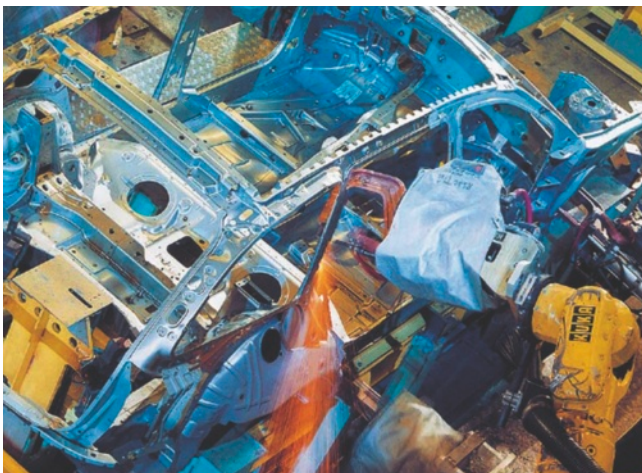
In their plant in Hanover, Volkswagen AG operates a fully automatic production plant for water coolers. It proves that distributed plant configurations with integrated safety on the basis of PROFINET I/O can be implemented – with a maximum degree of product quality and process safety.

Solution

The communication with the distributed I/O is conducted via PROFINET with integrated safety technology. The individual failsafe modules of the ET 200S communicate via PROFINET I/O with the central system controller CPU 416F-2DP with CP 443-1 Advanced of the SIMATIC S7-400F family via PROFIsafe. Also connected to it via PROFINET: the SIMATIC Panel PC670 for operator control and monitoring.

Advantages

The solution with PROFINET proves its worth through considerable increase in transfer performance. As PROFINET supports IRT (Isochronous Real Time) technology, the latter offers automation solutions as well as real-time capability along with isochronous mode - a very important aspect of highly dynamic processes. Furthermore, data archiving is also much more effective.

ContiTech –
Manufacturer of quality hoses in Germany

Requirements

ContiTech specializes in rubber and plastic technology and is a leading manufacturer of quality hoses. As a partner in development and an initial supplier, the company enjoys an outstanding reputation in the automobile industry and in many other sectors around the world. In order to always be able to deliver "just in time" and to be able to meet the customer's demands 100% in the future, ContiTech wants to reduce the risk of unscheduled system downtimes to an absolute minimum. For this reason, it has modernized its hose manufacturing machines. The new solution should also provide a higher degree of flexibility in production.

Solution

Over the course of modernizing the system, ContiTech carried out two essential, innovative steps at the same time: the switch-over from the previous contactor control to systematic decentralization and the use of a single bus system for standard and failsafe signals. The ET 200S distributed I/O in connection with PROFIsafe allowed the simple and efficient combination of standard control technology and safety technology.

Also in use: the failsafe SIMATIC 315F-2 DP controller, which can process standard and failsafe signals. The ET 200 configurator allowed both safety-related and standard components to be quickly and easily selected. This meant that the quasi "built-in" plausibility test made mistakes in the selection of the components nearly impossible.

Advantages

ContiTech is excited about the new solution: It provides the flexibility needed in production. And the design of the safety circuits was extremely easy. This innovative concept also opens up new diagnostic possibilities, because the individual system sections can be taken into consideration completely separately at any time.

Also an advantage: the central data storage with one CPU for a project – also against the backdrop of future system optimizations or modifications. And since there were no interface-related problems, the commissioning of the new system only took one week.

Detecting

Products Approval (max.)	SIRIUS position switches with separate actuator, without and with tumbler, hinge switches, magnetically operated switches (contact-free)	SIRIUS commanding and signaling devices, EMERGENCY-STOP, cable-operated switches, two-hand operation consoles, foot-operated switches, signaling columns and integrated signal lamps	DP/AS-i F-Link (ASIsafe solution PROFIsafe)	SIMATIC mobile panel 277F IWLAN	SIRIUS 3TK28 safety relays 1) Safety relays 2) Standstill monitors 3) Speed monitors
IEC 62061 (IEC 61508)	Up to SIL 3	Up to SIL 3	Up to SIL 3	Up to SIL 3	Up to SIL 3
ISO 13849-1	Up to PL e	Up to PL e	Up to PL e	Up to PL e	Up to PL e
EN 954-1 or IEC/EN 61496	Up to Cat. 4	Up to Cat. 4	Up to Cat. 4	Up to Cat. 4	Up to Cat. 4
Others			NFPA 79, NRTL-listed		NFPA 79, NRTL-listed
Application/ safety function	For the mechanical monitoring of protective equipment, protective doors or protective flaps. For accurate position sensing.	EMERGENCY-STOP applications in the production and process industry; state signaling on machines and systems	Safe gateway for transfer of ASIsafe signals to the PROFIsafe telegram for safety applications in production automation	Machine-level operation and monitoring of production systems with safety-critical applications, realization of safety-relevant tasks, e.g. troubleshooting in running systems Safety functions: • EMERGENCY-STOP button • two acknowledgement buttons (right/left) • transponder identification and distance measuring for safe registration and operation Engineering: – Safety Advanced for STEP 7 V11 in the TIA Portal – Distributed Safety for STEP 7 V5.5	1) Monitoring of protective equipment, e.g. EMERGENCY-STOP commanding devices, position switches and contact-free sensors 2) Safe standstill monitoring: Standstill monitoring of motors without sensors 3) Safe speed monitoring: – three parameterizable limit values for standstill, setup speed and automatic speed – connection option for various sensors and encoders – integrated protective door monitoring
Fail-safe communication options	AS-Interface (ASIsafe)	AS-Interface (ASIsafe)	AS-Interface (ASIsafe) and PROFIBUS with PROFIsafe profile	PROFINET with PROFIsafe profile, IWLAN with PROFIsafe	

Evaluating

SIMOCODE pro 3UF7 motor management system with fail-safe expansion modules DM-F	ASIsafe 1) Safe input modules 2) Safety monitor (ASIsafe Solution local) 3) Safe AS-i outputs	SIRIUS 3RK3 modular safety system	SIMATIC controllers	SIMATIC I/O
Up to SIL 3	Up to SIL 3	Up to SIL 3	Up to SIL 3	Up to SIL 3
Up to PL e	Up to PL e	Up to PL e	Up to PL e	Up to PL e
Up to Cat. 4	Up to Cat. 4	Up to Cat. 4	Up to Cat. 4	Up to Cat. 4
NFPA 79, NRTL-listed	NFPA 79, NRTL-listed	NFPA 79, NRTL-listed	NFPA 79, NFPA 85, NRTL-listed, IEC 61511	NFPA 79, NFPA 85, NRTL-listed, IEC 61511
Motor management with integrated safety functions for process automation • Safe motor disconnection • **Fail-safe digital module DM-F Local:** For safe disconnection via hardware signal; 2 relay enabling circuits, jointly switching; 2 relay outputs, fail-safely disconnected common potential; inputs for sensor circuit, start signal, cascading and feedback circuit • **Fail-safe digital module DM-F PROFIsafe:** For safe disconnection via PROFIBUS/PROFIsafe; 2 relay enabling circuits, jointly switching; 2 relay outputs, fail-safely disconnected common potential; 1 input for feedback circuit; 3 binary standard inputs • Setting of the safety functions directly on DM-F Local or in STEP 7 (DM-F PROFIsafe) Engineering: – via TIA Portal – via SIMOCODE ES	1) Safe connection and networking of safety switches and electronic safety sensors 2) All safety applications in production automation: • Monitoring and evaluation of safe signals via AS-Interface, incl. disconnection on 1 to 2 enabling circuits • Optional control of safe AS-i outputs for the disconnection of motors or for the control of e.g. safe valves • Safe coupling of ASIsafe networks 3) Safe distributed disconnection of motors and drives via AS-i • Engineering via TIA Portal	Modular, parameterizable safety system for all safety applications in production automation: • Safe evaluation of mechanical and contactless protective equipment • Integrated diagnostic function • Integrated signal test and discrepancy time monitoring • Easy realization of safety functions via prefabricated function blocks Engineering: – Parameterization via MSS ES – Integration in the TIA Portal	Scalable, fail-safe controllers • Modular controllers: CPU315F/317F/319F CPU 414F/416F ET 200F-CPU for ET 200S and ET 200pro • Technology controllers with motion control: CPU 317TF-2DP • PC-based automation: Software controllers, embedded controllers, IPC Safety functions: • Integrated diagnostics function • Coexistence of standard and fail-safe programs on a CPU Engineering: – Safety Advanced for STEP 7 V11 in the TIA Portal – Distributed Safety for STEP 7 V5.5 with F-FBD and F-LAD as well as integrated library with TÜV-certified safety blocks – Optional: Library with function blocks for presses and burners	Scalable and redundant I/O systems • ET 200eco • ET 200M • ET 200iSP • ET 200S • ET 200pro Safety functions: • Integrated signal test and discrepancy time monitoring • One distributed I/O system with standard and fail-safe input and output modules • Configuration of signal test and discrepancy time visualization with STEP 7 Engineering: – Safety Advanced for STEP 7 V11 in the TIA Portal – Distributed Safety for STEP 7 V5.5
PROFIBUS with PROFIsafe profile	AS-Interface (ASIsafe)	Diagnostics via PROFIBUS	• PROFINET with PROFIsafe, IWLAN with PROFIsafe	• PROFIBUS with PROFIsafe profile: all systems • PROFINET with PROFIsafe profile: ET 200S, ET 200M, ET 200pro (IWLAN interface module available)

Reacting

Products	Motor starters for • ET 200S (IP20) • ET 200pro (IP65)	Frequency converters for: • ET 200S • ET 200pro FC	Frequency converters 1) SINAMICS G120C (IP20) 2) SINAMICS G120 (IP20) 3) SINAMICS G120D (IP65)	Frequency converters SINAMICS G130 SINAMICS G150
Approval (max.)				
IEC 62061 (IEC 61508)	Up to SIL 3	Up to SIL 2	Up to SIL 2	Up to SIL 2
ISO 13849-1	Up to PL e	Up to PL d	Up to PL d	Up to PL d
EN 954-1 or IEC/EN 61496	Up to Cat. 4	Up to Cat. 3	Up to Cat. 3	Up to Cat. 3
Others	NFPA 79, NRTL-listed			
Application/ safety function	All safety applications in production automation and distributed drive tasks as in conveyor technology or lifting drives • Starting and safe disconnection with conventional and electronic switching technology • Integrated motor protection • Safe selective disconnection (ET 200S) • All advantages of the SIMATIC ET 200S and SIMATIC ET 200pro systems Integrated, autonomous safety functions: • Safe torque off Engineering: – Safety Advanced for STEP 7 V11 in the TIA Portal – Distributed Safety for STEP 7 V5.5	System-integrated, central drive (frequency converter) on standard asynchronous motors without encoders Integrated, autonomous safety functions: • Safe torque off • Safe stop 1 • Safely limited speed	1) Compact frequency converter for applications from 0.37 to 18.5 kW 2) Modular frequency converter for applications from 0.37 to 250 kW 3) Distributed frequency converter in high degree of protection (IP65) for applications from 0.75 to 7.5 kW The SINAMICS G120 devices are employed for the speed-variable application of asynchronous motors in applications involving conveyor technology, pumps, fans and compressors as well as other equipment such as extruders Integrated safety functions[1]: • Safe torque off (STO) • Safe stop 1 • Safely limited speed • G120: Safe direction of rotation • G120: Safe brake control • G120: Safe speed monitoring	Frequency converters for speed-variable individual drives from 75 to 2700 kW, e.g. pumps, fans, compressors, conveyor belts, extruders, agitators, mills Integrated safety functions: • Safe torque off • Safe stop 1
Fail-safe communication options	• Solution PROFIsafe: PROFIBUS/PROFINET with PROFIsafe profile • Solution local: on-site safety application	PROFIBUS/PROFINET with PROFIsafe profile	PROFIBUS with PROFIsafe profile, G120 and G120D also PROFINET 1) the integrated safety functions can be utilized without sensors; SINAMICS G120C does not support any further safety functions besides STO	PROFIBUS/PROFINET with PROFIsafe profile

Reacting

SINAMICS S110 positioning drive	1) Drive system SINAMICS S120 2) Cabinet device SINAMICS S150	SINUMERIK 840D sl CNC control for machine tools	SINUMERIK 828D CNC control for machine tools
Up to SIL 2	Up to SIL 2	Up to SIL 2	Up to SIL 2
Up to PL d	Up to PL d	Up to PL d	Up to PL d
Up to Cat. 3	Up to Cat. 3	Up to Cat. 3	Up to Cat. 3
	NFPA 79, NRTL-listed*	NFPA 79, NRTL-listed	NFPA 79, NRTL-listed
Single-axis servo drive for simple positioning applications with synchronous/induction motors with power ratings from 0.12 to 90 kW Integrated safety functions, partially also possible without sensors: • Safe torque off • Safe stop 1 and 2 • Safe operating stop • Safely limited speed • Safe direction of rotation • Safe speed monitoring • Safe brake control	1) Drive system for high-performance control tasks from 0.12 to 4500 kW in machine and system production, e.g. for packing or plastic machines, handling devices, roller mills or paper machines 2) Demanding, speed-adjustable individual drives with high power ratings (75 to 1200 kW) such as test beds, sugar centrifuges, cross-cutters, cable winches, conveyor belts Integrated safety functions, partially also possible without sensors: • Safe torque off • Safe stop 1 and 2 • Safe operating stop • Safely limited speed S120: Booksize/blocksize: • Safe direction of rotation • Safe speed monitoring • Safe brake control	Numeric control with integrated safety technology in the control and drive for machine tools (rotating, milling, grinding, nibbling, ...) Integrated safety functions: • Safe torque off • Safe stop 1 and 2 • Safe acceleration monitoring • Safe operating stop • Safely limited speed • Safely limited position • Safe brake management • Safe brake control • Safe brake test • Safe software cams • Safety-related inputs/outputs • Safe programmable logics • Integrated acceptance test	Numeric control for turning and milling machines with integrated safety technology in the drive The SINUMERIK 828D is a panel-based CNC control for demanding applications on turning and milling machines, which are typically employed in workshops. Integrated safety functions: • Safe torque off • Safe stop 1 and 2 • Safe operating stop • Safely limited speed • Safe direction of rotation (in preparation) • Safe speed monitoring • Safe brake control
PROFIBUS/PROFINET with PROFIsafe profile	PROFIBUS/PROFINET with PROFIsafe profile	PROFIBUS with PROFIsafe profile	PROFIBUS with PROFIsafe Profil

* Only applicable to SINAMICS S120 booksize   ** Not applicable to S150 and S120 chassis devices

Step into the world of SIMATIC

This brochure has given you an initial overview of the extensive SIMATIC portfolio for factory 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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the comprehensive and integrated range of products and systems for automation:
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Training courses and e-learning on Safety Integrated:
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SIMATIC Guide Manuals:
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