Industrial Communication
for Automation and Drives

Overview

automation
AND DRIVES

SIEMENS

Contents

Introduction

The configurations shown in this brochure should be regarded as example configurations for information purposes only.

Your requirements

Do you want to bring new products quickly onto the market and at the same time be flexible and in a position to change your product range at short notice and shorten your time-to-market? Do you want to be able to manufacture efficiently at low costs? Do you want to optimize the capacity of your machines/plant and reduce plant shutdown times?

The possibilities

These demands can only be fulfilled when all the machines in your plant work perfectly together. This can be achieved by using open, transparent automation communication not just within the whole company but also for external communication, thereby helping avoid isolated automation and information technology solutions. This requires

- A seamless information flow from the actuator/sensor level right through to the management level.
- Availability of information at any location
- Quick data exchange between the different plant sections
- Simple and transparent configuration and efficient diagnostics
- Integrated security functions to avoid unauthorised access

Worldwide trends

Decentralization has been gaining worldwide importance for a number of years now. A distributed plant structure can reduce installation, maintenance and diagnostics costs. This involves intelligent devices working locally and being connected together across networks. Openness and flexibility are important in order to expand existing setups and to connect up third party systems. For this reason international boards/committees are defining and standardising the rules for bus systems.

Our offer

One area of utmost importance for automation solutions is that of communication networks. SIMATIC NET - networking for industry - offers a wide selection of modular blocks designed for industry, to efficiently solve your communication tasks:

- In the different automation areas
- Across the complete workflow
- For the complete plant lifecycle

SIMATIC NET offers solutions for all branches which both maximise the benefits of Ethernet and simply integrate field bus systems. Noticeable examples are:

- The penetration of the field level for the use of Industrial Ethernet
- Transparency from the field level through to the management level
- The promotion of mobile communication
- The integration of IT-technologies

An overview of the bus systems

Industrial Ethernet

Industrial Ethernet (IEEE 802.3 and 802.3u) – the international network standard for all levels

PROFINET – the open Industrial Ethernet standard for automation

PROFIBUS

PROFIBUS (IEC 61158/EN 50170) – the international standard for the field level is the worldwide market leader for field busses

AS-Interface

AS-Interface links sensors and actuators using a two-wire cable, as a low-priced alternative to a wiring harness

KNX

KNX (EN 50090, ANSI EIA 776)) is the universal bus system for the complete house and building technology. KNX was developed by the Konnex Association on the basis of EIB (European Installation Bus)

Industrial Communication

Totally Integrated Automation

With Totally Integrated Automation Siemens is the only vendor of a transparent, uniform product and system range for automation in all branches - from arrival of the raw materials through the production process to the output of the finished goods, from the field level through the production level right up to the management level.

The advantages of Totally Integrated Automation can be seen not just at the design and engineering stage but also during installation, commissioning, operation and maintenance: Automation solutions can be developed at a minimum of effort allowing a more flexible and quicker adaptation to market demands. Plants can be extended or altered without having to interrupt production.

Through the increasing use of Industrial Ethernet in automation, two topics within Totally Integrated Automation are becoming more and more important - PROFINET and SCALANCE

PROFINET .. for increasing productivity in your plant

You need a seamless information flow for your strategic decisions within your company - for the first manufacturing step through operation up to the management level. In order to achieve this you already rely on efficiency and transparency in your engineering. **PROFINET** the open, manufacturer independent standard based on Industrial Ethernet fulfils all the demands of industrial automation and guarantees a uniform company-wide communication.
PROFINET enables distributed field devices to be connected directly to Industrial Ethernet and can be used for the solution of synchronous Motion Control applications. In addition PROFINET supports distributed automation with the help of component technology (see pages 12 and 13).

SCALANCE .. for the security, flexibility and performance of your industrial communication network

Totally Integrated Automation from Siemens has proved in successful applications across the globe the dimensions in which transparent solutions can be reached with common tools and uniform mechanisms. A key role in this has been played by the development of SIMATIC NET industrial communication.

A new milestone in this development is SCALANCE, the new generation of components for the creation of transparent networks - wired or Industrial Wireless LAN (IWLAN) - in industry and similar environments. And this in three forms:

- The security modules from SCALANCE S are the core of the Siemens security concept that protects data and networks
- Based on Industrial Wireless LAN, SCALANCE W ensures transparent communication in areas that are difficult to access with wired technology
- The modular switches (active network components) from SCALANCE X ensure a future oriented network with the right switch for the required task

A complete solution consists of:

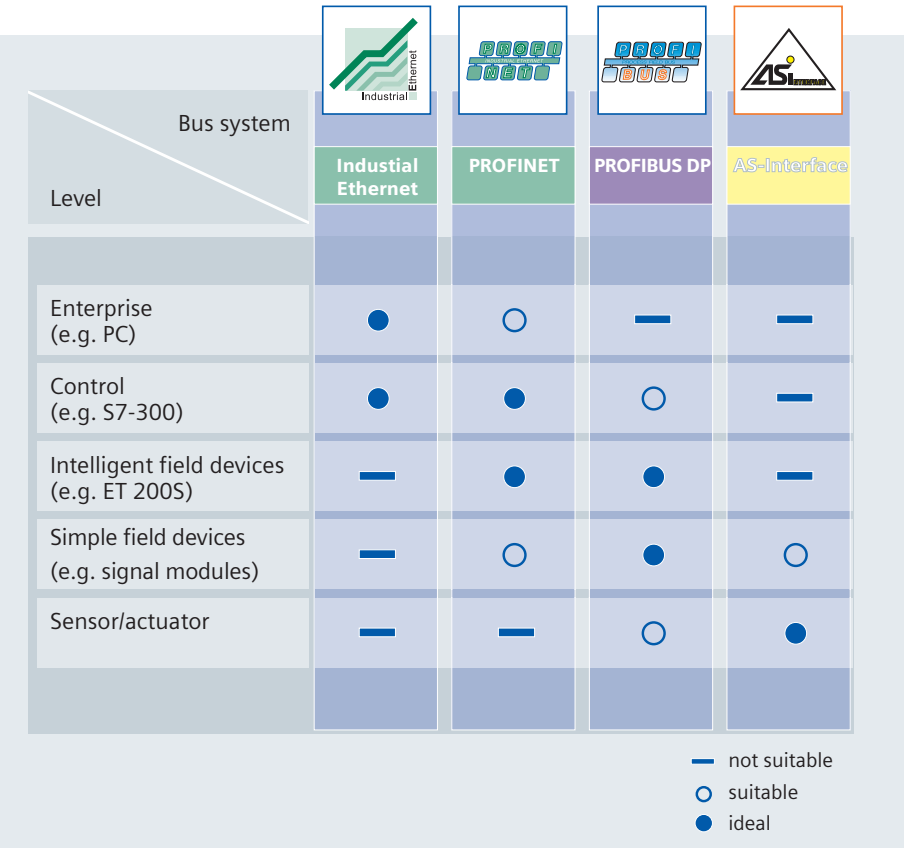
- Bus systems
  - active network components e.g. repeater
  - passive network components e.g. cables
- Interfaces to connect the automation devices to the bus system
  - Integrated interfaces
  - Communications processors
- Network transitions e.g. links
- Software for the configuration of networks
- Tools for maintenance and diagnostics

SIMATIC NET offers all necessary components to create a complete system solution.

SIMATIC NET supports the following bus systems:

Industrial Ethernet (IEEE 802.3 and 802.3u) –

is the international standard for area networks. At present Industrial Ethernet is the number one network in the LAN landscape, with a market share of over 80%. Industrial Ethernet is ideal for the creation of powerful long distance communication networks.



PROFINET –
The international standard uses Industrial Ethernet and makes real-time communication in the field level a reality. PROFINET uses existing IT-standards to realise synchronous Motion Control applications on Industrial Ethernet.

PROFIBUS (IEC 61158/EN 50170) – is the international standard for the field level and the worldwide market leader among field busses. It is the only field bus system that can be used for both manufacturing and process industry applications.

As a low-cost alternative to a cable harness the **AS-Interface** connects actuators and sensors using a two-wire cable.

The basis for building automation is the worldwide **KNX** (EN 50090, ANSI EIA 776).

Gateways are implemented using PLCs or links

Typical practice-related data

The table below contains values gained form our experiences on different sites and is intended to serve as a recommendation for the selection of the optimum network.

Criterion	AS-Interface	PROFIBUS DP	Industial Ethernet
Data transmission	Updating time of ≤ 5 ms	9.6 Kbit/s – 12 Mbit/s selectable 31.25 Kbit/s [1]	10/100 Mbit/s 1 Gbit/s
Maximum number of nodes	62	125 125 DP/PA Links [1] 31 field devices per [1] DP/PA Link	more than 1000
Netzwork size • LAN (Local Area Network)	- electrical up to 100 m wihout Repeater 100 m with Repeater 500 m	- electrical up to 9.6 km - optical up to 90 km Intric. safe: max 1 km [1] non int-safe: 1.9 km [1]	- electrical up to 1.5 km - optical up to 200 km
• WAN (Wide Area Network)			- worldwide using TCP/IP - wireless LAN
Topology	Line Tree Star	Line[1] Tree[1] Ring Star[1]	Line Tree Ring Star

[1] with PROFIBUS PA

Industrial Ethernet Devices and Services

Product	PG/OP Communication	S7 Communication	S5-compatible communication	PROFINET CBA	PROFINET IO
SIMATIC S7-200					
CP 243-1	–	●	–	–	–
CP 243-1 IT	–	●	–	–	–
SIMATIC S7-300 / SIMATIC C7					
CPU 317-2 PN/DP	●	●	–	●	●
CP 343-1	●	●	●	●	●
CP 343-1 PN	●	●	●	●	–
CP 343-1 IT	●	●	●	–	–
SIMATIC S7-400					
CP 443-1	●	●	●	–	–
CP 443-1 IT	●	●	●	–	–
CP 443-1 Advanced	●	●	●	●	●
SIMATIC TDC					
CP 5100	–	–	●	–	–
SIMOTION C/P/D					
integrated interface	●	●	●	–	–
SIMATIC PC Field PG Power PG / PC/Notebook					
integrated interface	●	●	●	–	● 5)
CP 1613	●	●	●	–	–
CP 1612/1512	●	●	●	–	● 5)
CP 7515	●	●	●	–	–
PC-based Automation					
WinAC Basis, WinAC RTX: CP 1613/1512/1612 4)	●	●	● 1)	● 3)	–
WinAC Slot 412/416: CP 1613/1612/1512 4)	●	●	–	–	–
WinAC MP: integrated interface	●	●	–	–	–
PC					
ProTool/Pro, WinCC flex.	●	●	–	–	–
WinCC	●	●	–	–	–
WinAC	●	●	–	● 3)	–
MOBIC					
integrated interface or Wireless with CP 1515	–	–	–	–	–
SIMATIC PCS 7 / PC					
CP 1613	● 2)	●	–	–	–
CP 443-1	● 2)	●	–	–	–
Vision Sensor VS 130-2					
integrated interface	–	–	–	–	●
ET 200S					
IM 151-3 PN	–	–	–	–	●

1) With industrial data bridge
2) PG communication only
3) WinAC basis plus optional package
4) Also with the integrated Ethernet PC-interface
5) With the optional package SOFTNET PN IO

Diagnostics

Network and device diagnostics ease the commissioning and operation of a plant. They reduce the number of network failures and increase the safety and availability of the plant.

Industrial Ethernet diagnostics

The data exchange of process and control data in a modern manufacturing plant nearly always takes place over Industrial Ethernet. In order to keep the number of network failures to a minimum you cannot do without diagnostics. However most analysis and management systems are too complex and expensive. The Siemens Industrial Ethernet components have the following diagnostic possibilities:

Diagnostics with STEP 7

STEP 7 offers:

- Connection diagnostics
- Diagnostics of the assigned PROFINET field devices even in the user program; module status as with PROFIBUS
- Information about every switch port

Diagnostics using IT functions

Standard diagnostic pages can be used for a quick diagnosis without the need for additional tools.
The following communications processors support diagnostics using IT-functions:

- CP 243-1 IT
- CP 343-1 IT
- CP 443-1 IT
- CP 443-1 Advanced

SNMP diagnostics

SNMP (Simple Network Management Protocol) is a special protocol for the administration of TCP/IP networks. PROFINET also supports diagnostics via SNMP. The following Industrial Ethernet components offer diagnostic possibilities via SNMP:

- SNMP OPC server
- Industrial Ethernet switches (SCALANCE X, OSM, ESM, ELS)

The use of SNMP OPC Server enables access to device information from SNMP capable Ethernet components via the OPC interface. In addition simple diagnostics and detailed information about network load or redundant network structures can also be displayed. With the help of Industrial Ethernet switches it is possible to obtain information about the status of the network or to diagnose the data traffic.

PROFIBUS diagnostics

Commissioning with the bus tester

The bus tester BT200 can determine the status of bus segments in offline-mode i.e. without a connected master. The bus tester offers the following functions:

- Bus cable diagnostics e.g. wire-break, short circuit
- Test the PROFIBUS interface of masters and slaves
- Test the accessibility of all slaves (Life-list)

Operation with the Diagnostics-repeater

The diagnostics repeater is capable of diagnosing the cable during operation. It recognizes the following cable errors:

- Wire-break
- Short circuit of signal cables,
- missing terminating resistor

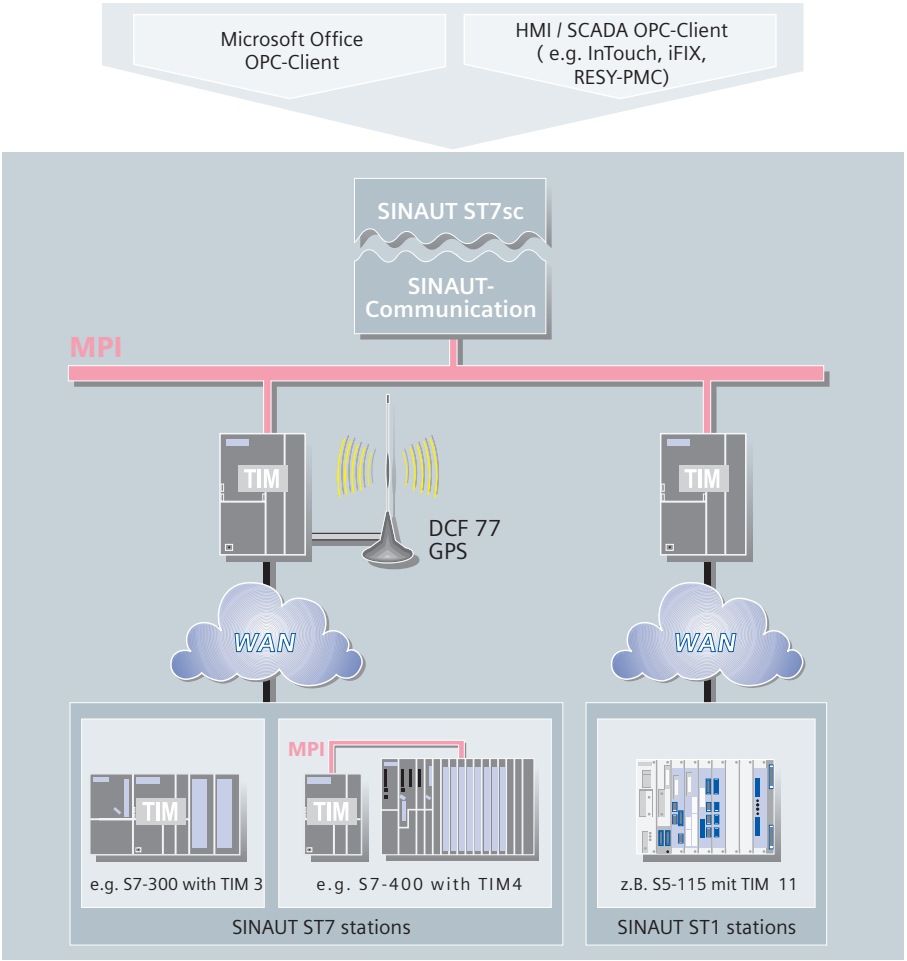
Diagnostics in STEP 7

In STEP 7 the automation system topology is displayed graphically (overview diagnostics). Diagnostics symbols indicate diagnostics information about the monitored devices (e.g. PROFIBUS slave failed).

A detailed window gives more detailed information about the individual modules (module status), for example:

- Module slot
- Channel number
- Cause of error (in text)

Telecontrol and monitoring



SINAUT

SINAUT ST7 is a SIMATIC S7 based system for a fully automatic control and monitoring of process stations, which exchange data with one or more central control stations or among each other via a WAN.

Control center

As the central control station you can have:

- SIMATIC PLCs S7-300 or S7-400
- SINAUT ST7cc, the PC control station (simple or redundant) based on WinCC. It is a control system for SINAUT ST7 and SINAUT ST1 specially designed to handle event triggered and time stamped data transmission from SINAUT systems.
- SINAUT ST7sc enables the link of control centres from other manufacturers via OPC. SINAUT telecontrol can be linked to the control centres of other manufacturers by means of the "Data Access Interface". SINAUT ST7sc has a comprehensive buffering mechanism which ensures there is no data loss, even if the clients fail.

SINAUT WAN networks

- Dedicated lines (copper and fiber optic)
- Private radio networks (optional with time-slot procedure)
- Analog telephone network
- Digital ISDN network
- Mobile network (GSM)

All networks can be combined in any manner, even redundant paths are possible. Star, line and node structures are possible.

Event triggered data transmission

The SINAUT software in the stations provide an event triggered process data transmission with the control center and between the individual CPUs.

Local data storage

A special feature of the SINAUT ST7 system transmission module TIM is the local storage of the data frames (incl. time stamp) if the communication path is down, if a partner fails or if costs are to be minimized in a dial-up network.

Date and time are always up-to-date

The DCF77 radio clock is used to supply the control center e.g. ST7cc and the CPUs with the date and time. The system always has the exact date and time including the summer/winter switchover. Instead of DCF77 it is also possible to use GPS (Global Positioning System) as the time source.

SINAUT remote programming and diagnostics

All diagnostic and programming functions which are available from SINAUT and SIMATIC can be used remotely through the communication path even while process data is being transmitted.

The data transfer for telecontrol and monitoring takes place via Multi-Point-Interface (MPI).

SIMATIC TeleService

The MPI interface of the SIMATIC S7/C7, SIMATIC TDC and SIMTION automation systems and OPs is extended via the telephone network. This is simply done by using a TS-adapter plus a modem. The engineering tool Teleservice set ups a connection to the machine/plant and supports the known functions STEP 7, Drives ES and SIMOTION SCOUT and other diagnostic tools. The remote operations are done as if one was sitting in front of the machine. An additional PG/PC on the plant is not required.

High-availability communication and redundancy

Process or field communication

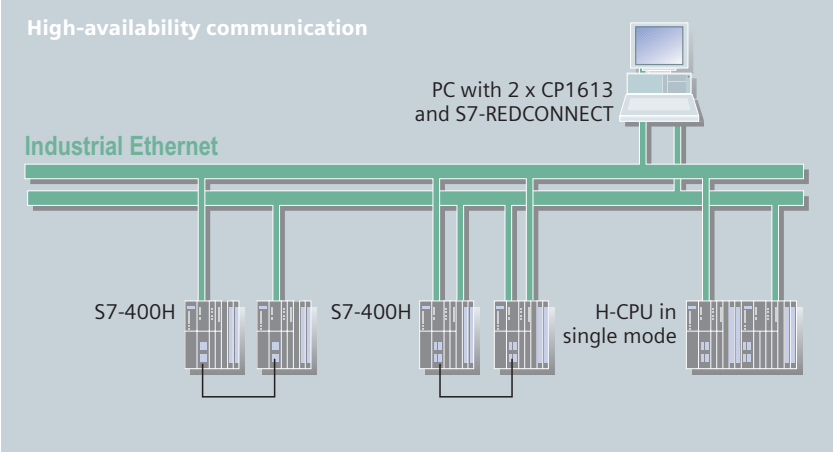
Manufacturing plants are designed and devised for around-the-clock operation. When a plant fails the results are often cost-intensive downtimes, high re-start costs and the loss of valuable materials. Redundant control systems such as the SIMATIC S7-400H system protect against automation system failures.

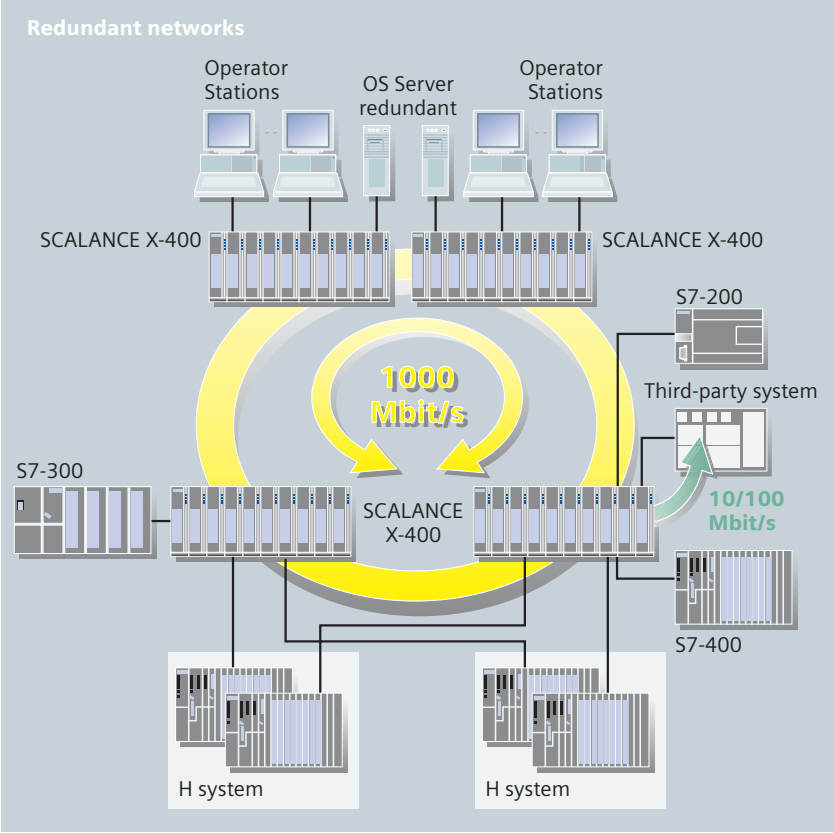
High-availability systems

The S7-400H is a high-availability programmable controller. Handling, programming, configuring and communication are the same as for standard systems. Depending on the network topology, redundant communication links can be so created that in the event of an error the system automatically switches over without any loss of data.

Redundant networks

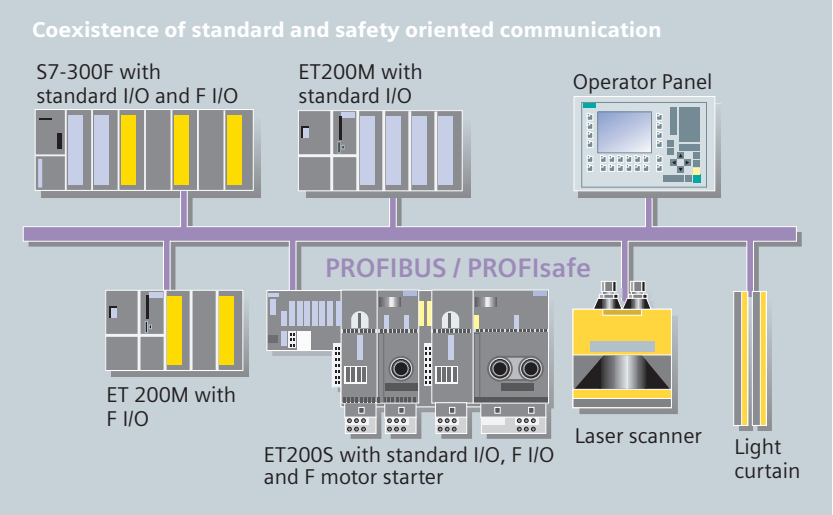
S7-REDCONNECT ensures problem-free communication between PC-applications (such as WinCC®) and the S7-400H via redundant networks. PC-applications which already use S7 communication (e.g. via the OPC interface) may continue to be used without any modifications. Industrial Ethernet and PROFIBUS networks can be sep up as redundant networks with switches from the SCALANCE™ X product range and with OSM®, ESM® and OLM®. Thanks to a ring topology the network continues to work when one transmission path fails; failure of a network components effects only nodes in that segment.

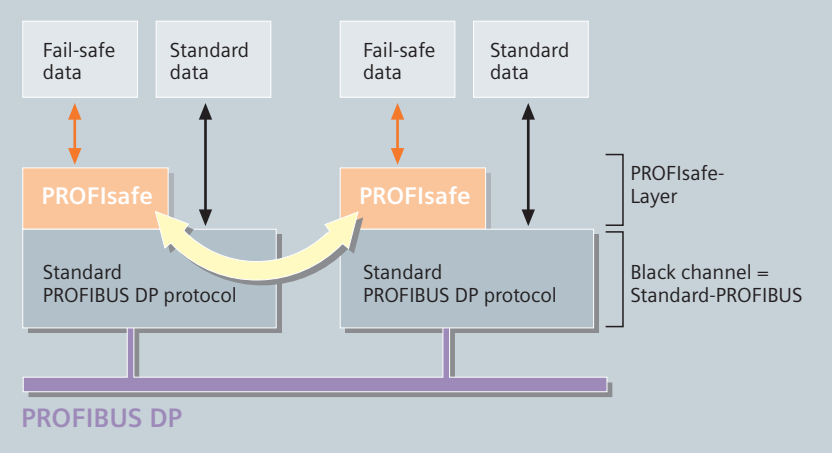




Fail-safe communication

The fail-safe SIMATIC components are part of **Safety Integrated**, the Siemens safety program based on SIGUARD®, SIMATIC® and SINUMERIC®/SIMODRIVE® products. The PROFIsafe protocol profile is used for all fail-safe communication on PROFIBUS.





AS-Interface Safety at Work

The "safety at work" concept enables the integration of fails-safe components such as emergency stop switches, safety door switches or a fail-safe light grid directly onto an AS-Interface network. These components which are fully compatible to familiar AS-Interface components (such as master, slaves, power supply, repeater etc.) are compliant with IEC 62026-2 and are jointly operated on the yellow AS-Interface cable. This means that AS-Interface safety at work enables the connection of devices up to Category 4 (EN954-1) and/or SIL 3 (IEC 61508) without losing the advantage of a simple and low-cost cabling.

PROFIsafe

The "PROFIsafe" protocol profile, developed for PROFIBUS DP, is used for communication between a fail-safe CPU and fail-safe signal modules.

PROFIsafe features

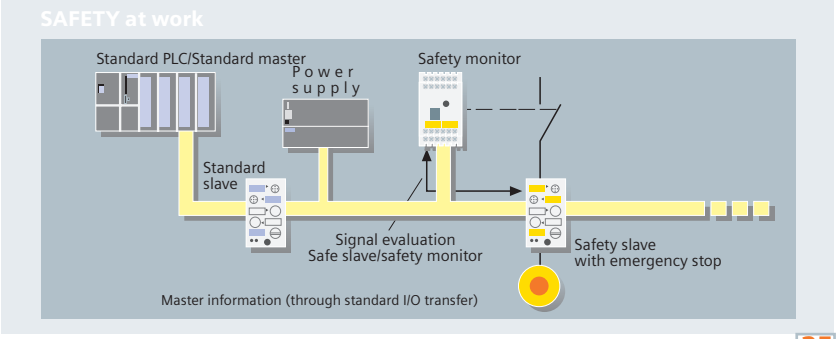
PROFIsafe was the first communication standard based on IEC 61508 to allow standard communication and fail-safe communication on the same bus. With SIL3 (Safety Integrity Level 3), Category 4 (EN 954-1) it fulfils the highest demands for the manufacturing and process industries and with the PA version (IEC 61158-2) PROFIBUS DP expands the integrated distributed automation into the process world. PROFIsafe thus supports the different communication requirements of both the manufacturing and process industries.

PROFIsafe functionality

PROFIsafe counters the possibility of transmission errors due to problems such as incorrect addressing, loss, delay etc. with 4 different measures:

- Sequential numbering of the PROFIsafe data
- Time monitoring
- "Password" based authenticity monitoring and
- An optimized version of CRC.

Using slave nodes, fail-safe encoder signals from a PROFIBUS station are transmitted to the fail-safe CPU. When these encoder signals have been logically linked an appropriate output signal is transmitted to a fail-safe PROFIBUS slave. Single channel transmission is used and there is no redundancy transmission path.



Network transitions (gateways)

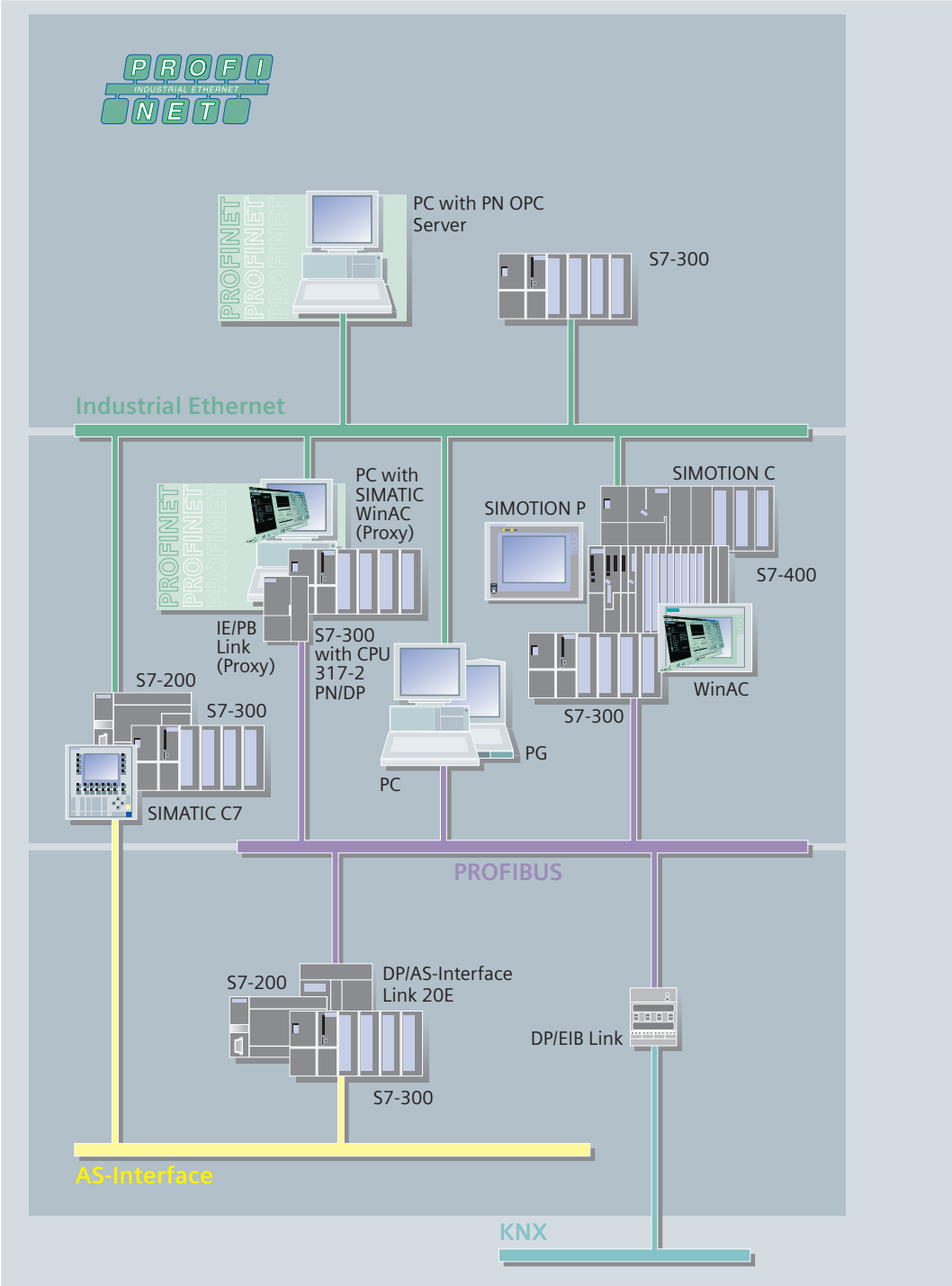
Network transitions between Industrial Ethernet, PROFIBUS, AS-Interface and EIB are implemented through links, PLCs or PCs. In the latter 2 cases integrated interfaces and communications processors (CPs) can be used to link networks. When a link is used to implement a network transition the data is forwarded without any kind of changes from one network to another. The DP/EIB Link, the DP/AS-Interface Link or the IE/PB Link can be used as gateways between KNX, AS-Interface, PROFIBUS and Industrial Ethernet networks. When PLCs such as S7-200, S7-300 and S7-400 are used, data is exchanged between the networks via communications processors (CPs) or integrated interfaces.
The data is pre-processed using a controller (PLC or PC-based) before being forwarded to the next network.

PROFINET link with proxy functionality

PROFIBUS segments can be linked to Industrial Ethernet by means of devices with a representative function, so-called PROFINET proxies.

This can be done using a solution involving SIMATIC WinAC PN, SIMATIC S7-300 (CPU 317-2 PN/DP) or via a IE/PB Link.

This means that all standard PROFIBUS slaves can be used without any modification in PROFINET.



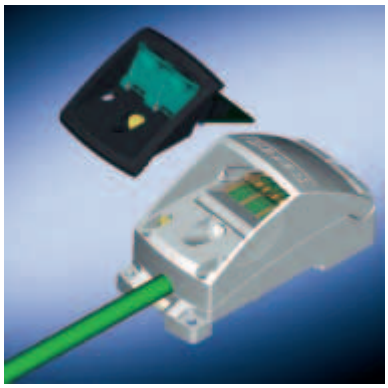
Connection technology and transmission media

Structured cabling compliant with ISO IEC 11801/EN 50173

FastConnect (FC) from SIMATIC NET is a quick assembly system for assembling copper cables for Industrial Ethernet and PROFIBUS. FastConnect cables can be assembled easily and quickly on-site.

This means that the existing RJ45 standard cabling technology can be used in an industrial environment thereby enabling structured cabling by means of patch cables, patch fields, installation cables and connection plugs and sockets.

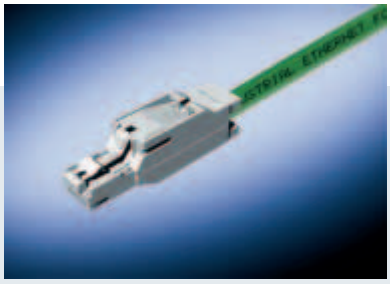
Significant cost-savings can be reached thanks to the quick and secure assembly system.



FastConnect - the quick assembly system for PROFIBUS and Industrial Ethernet

The FastConnect system comprises special cables, a stripping tool and connectors

- Industrial Ethernet FastConnect cables
  with special construction for fast assembly as FC standard, FC Trailing and FC Marine cable (PROFINET compliant).
- Convenient insulation displacement system with the FastConnect Stripping Tool, which strips the outer shield and the braided shield with a precise measurement in one operation. The cables prepared in this way are connected to the FastConnect products using the insulation piercing method.
- FastConnect RJ 45 Plug (90° and 180°)
  are resistant to interference thanks to their rugged metal housing and are the ideal solution for the installation of RJ45 connectors in the field (PROFINET compliant)
- IE FC RJ45 Modular Outlet
  also for Gigabit cabling.
- PROFIBUS FastConnect cables
  are shielded, 2-wire cables and come in different versions: a standard type, one with a PE sheathing, one with PUR sheathing and a halogen free variation. There are also cables for underground installation, trailing cables and for used in intrinsically safe areas.
- PROFIBUS bus connector
  with 30°, 35°, 60°, 90° and 180°



Data transmission with movable communication nodes

Electrical transmission of the PROFIBUS DP signals are also possible via slip rings and telephone/standard cable using the SIMATIC Power Rail Booster (e.g. mono-rail).

Optical data transmission

Optical data transmission can be done via either glass or plastic fibre optic cables. There are a number of different types of cables for indoor and outdoor use as well as a trailing cable and halogen free cables. The fibre optic cables are completely resistant to any electromagnetic interferences and are ideally suited for any future cabling developments.

Wireless data transmission

A local radio network for wireless communication can be set up creating an Industrial Wireless LAN using access points such as the SCALANCE W 788-1PRO and a wireless card such as the CP7515.

AS-Interface

Valves, actuators, drives - many different components are used in the field level.

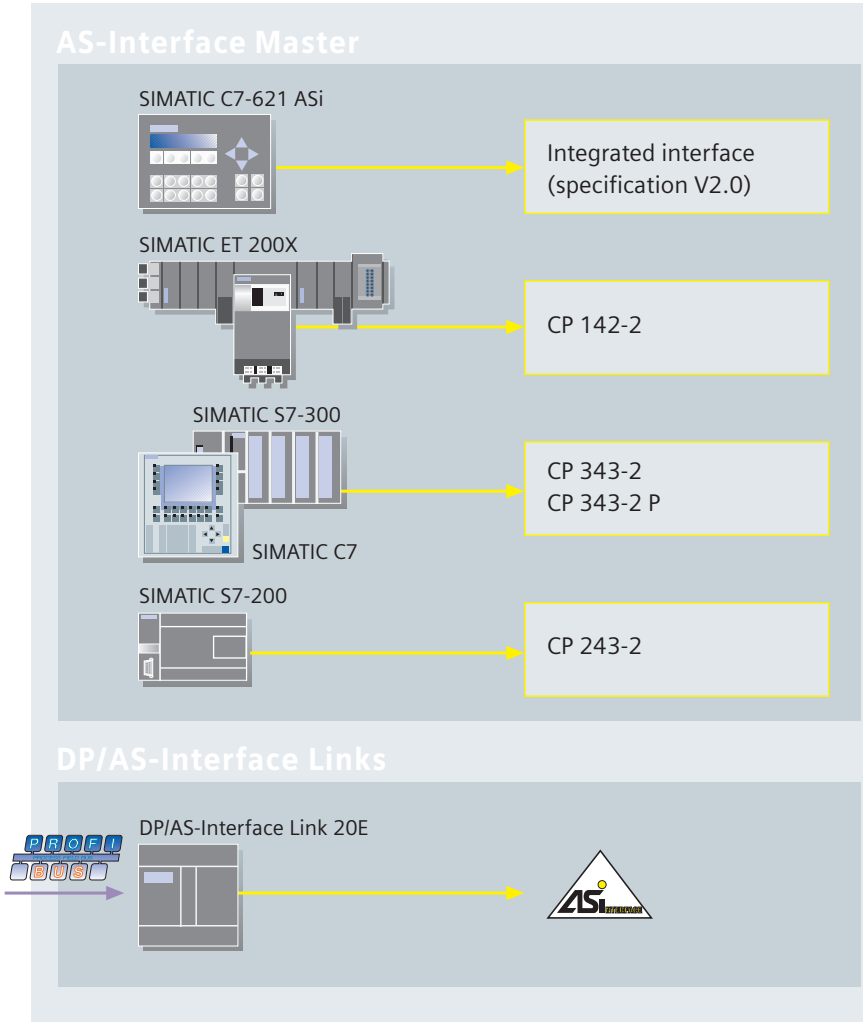
All of these actuators/sensors must be interfaced to an automation system.

Today distributed I/Os are being used in the field level as intelligent on-site outposts, so to speak.

As a price efficient alternative to a cable harness, AS-Interface connects the components using a two-wire cable.

AS-Interface is used where individual actuators/sensors are spatially distributed throughout the machine (e.g., in a bottling plant).

The AS-Interface is an open international standard IEC 62026-2/ EN 50295 and is supported worldwide by leading manufacturers of actuators and sensors. Interested companies have full access to electrical and mechanical specifications for this interface.



AS-Interface is a single master system. There are communications processors available from the SIMATIC range which operate as masters for controlling process or field communication.The extended AS-Interface specification V2.1 permits interfacing of up to 62 slaves.

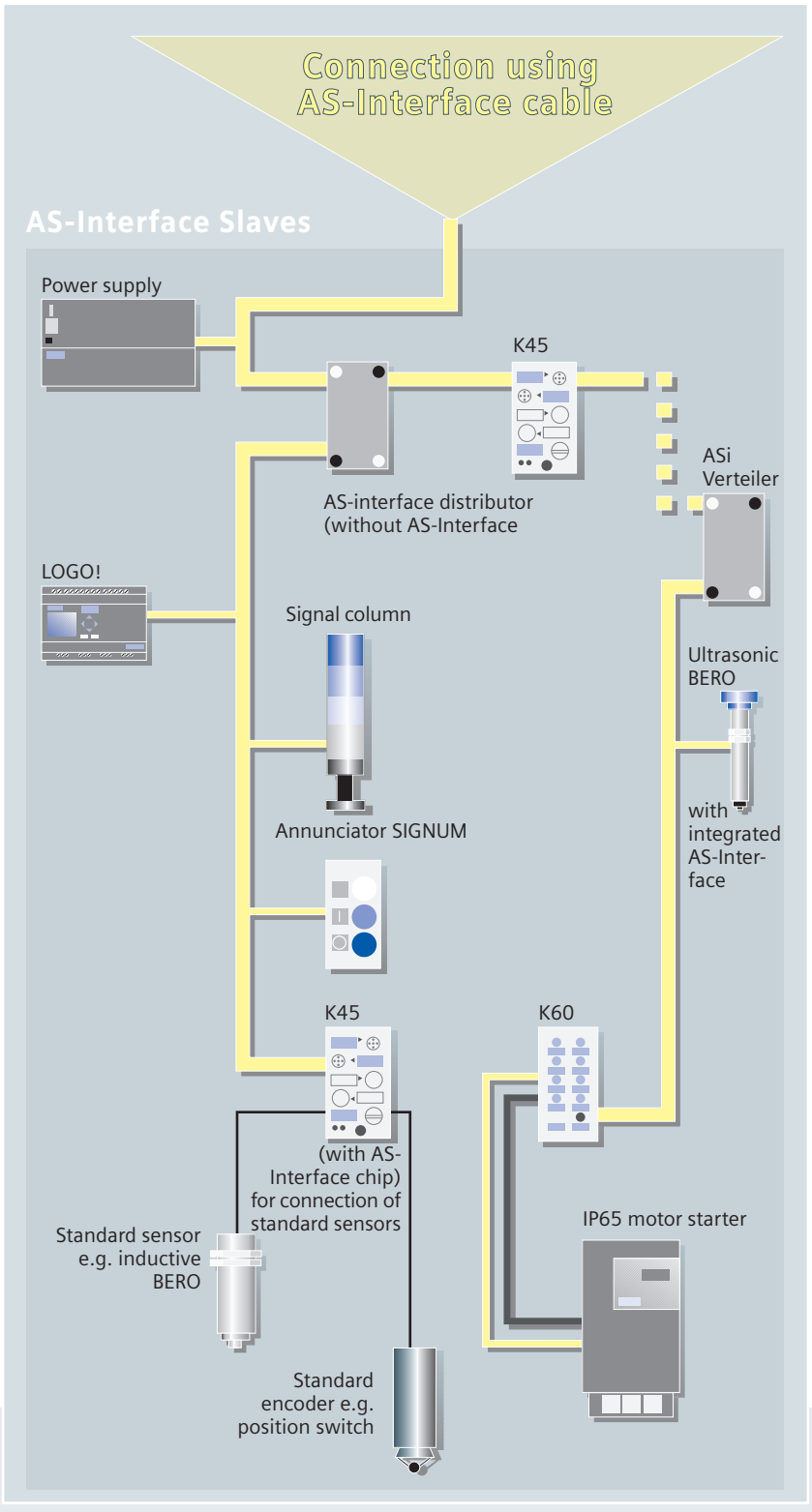
Thanks to the integration of analog value processing in the masters, accessing analog values is just as easy as accessing digital values. A DP/AS-Interface is used to link the S7-400 PLC range to the AS-Interface network. The DP/AS-Interface Link 20E (IP20) is available for connecting the AS-Interface directly to PROFIBUS DP, making it possible to use AS-Interface as a PROFIBUS DP sub-network.

This is how you save money

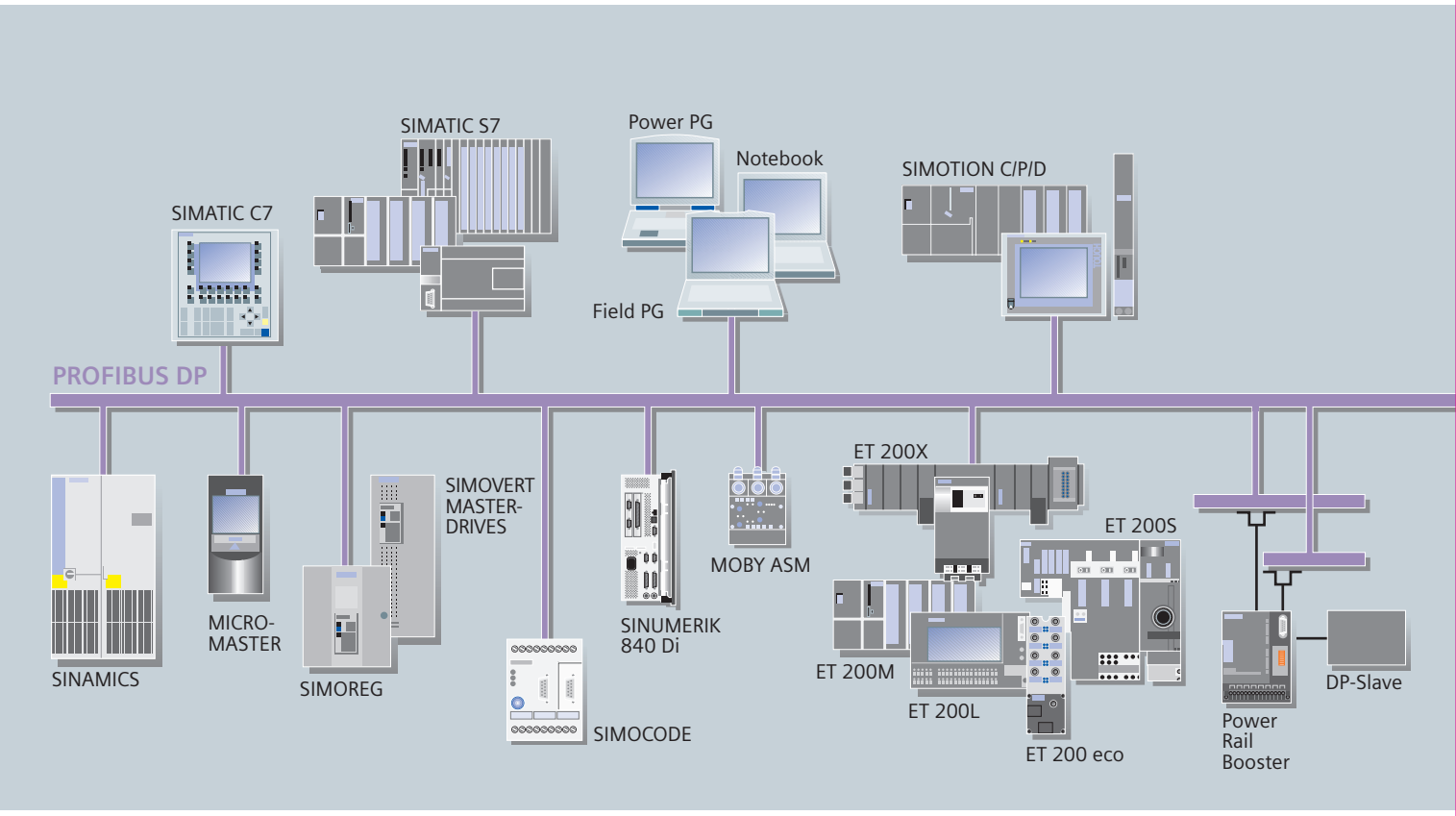
AS-Interface replaces costly and expensive cable harnesses and connects binary actuators and sensors such as proximity switches, valves and indicator lights to a PLC, for example, SIMATIC. In practice this results in simple installation procedure as data and power are transmitted over **one** cable.

Thanks to a specially developed cable and cable-piercing technology, the AS-Interface cable can be tapped at any point. This concept gives you enormous flexibility and is exceptionally cost-saving.

Special installation and commissioning knowledge are unnecessary. In addition, easy cable installation, a clear cable structure and the special design of the AS-Interface cable reduce the risk of errors as well as service and maintenance costs.



PROFIBUS



PROFIBUS is used for the connection of field devices such as, say, distributed peripheries or drives with automation systems such as SIMATIC S7, SIMOTION or PCs.

PROFIBUS is an open, high performance, robust field bus system with short reaction times and compliant with IEC 61158.

There are different PROFIBUS protocols for various applications

PROFIBUS DP
(Distributed Periphery)

is used for the connection of distributed field devices e.g. SIMATIC ET200S or drives with very quick reaction times.

PROFIBUS DP/PA is used when actuators/sensors in the machine or plant (e.g. at the field level) are widely distributed and can be spatially combined in a single station (such as the ET200S). In this case the actuators/sensors are connected to the field devices, which are supplied with output data as per the master/slave principle and provide the PLC or PC with input data.

Openness on the whole range

Thanks to the openness of PROFIBUS DP it is of course possible to connect standardized components from various manufacturers together on the network.

The IEC 61158/EN 50170 standard protects the customers investments. More than 2000 products with a PROFIBUS DP interface and services from more than 1200 companies offer varyingly different products on a worldwide basis. Siemens has a wide product range varying from CPUs, network components, communication software up to different field devices.

If you are a field device manufacturer, then we can offer you a wide range of products such as ASICs, training, certifications and a lot more.

Fail-safe PROFIBUS communication
with PROFIsafe,
page 25
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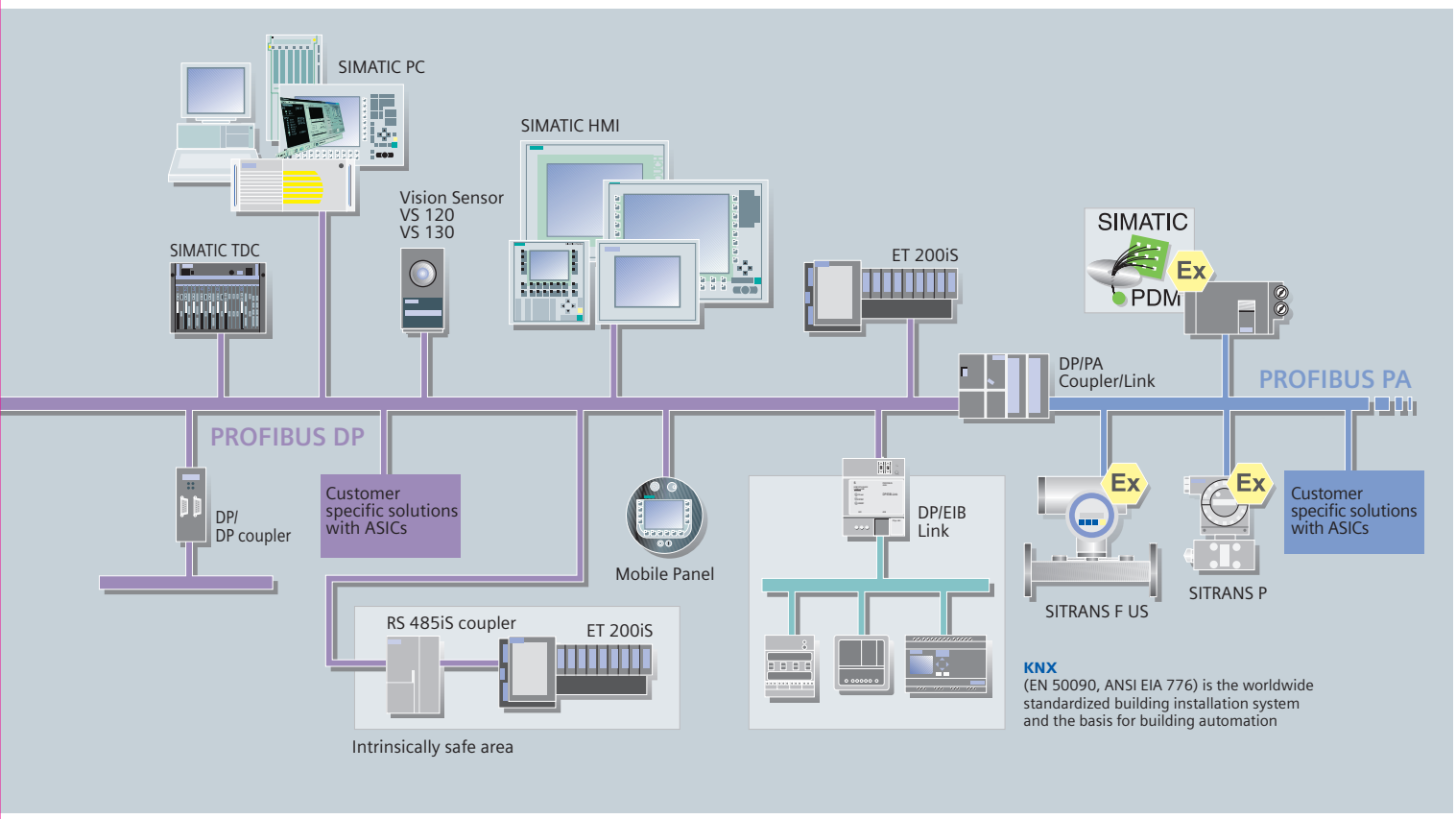
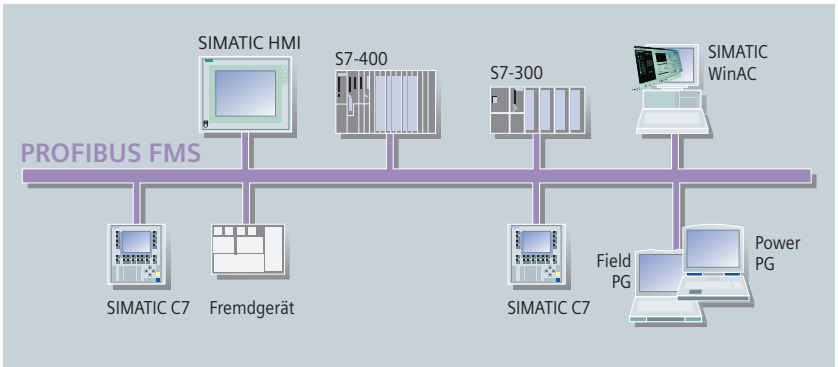


Synchronization

Synchronous PROFIBUS using the PROFIdrive profile "drives technology" is supported on the SIMOTION drives ports. CPU, I/O and user program are synchronized to the PROFIBUS clock.

PROFIBUS PA
(Process Automation)

is an expanded version of PROFIBUS DP which offers intrinsically safe data and power transmission (e.g. measuring transducers in the food industry) according to the international standard IEC 6158-2.



PROFIBUS FMS
(Fieldbus Message Specification)

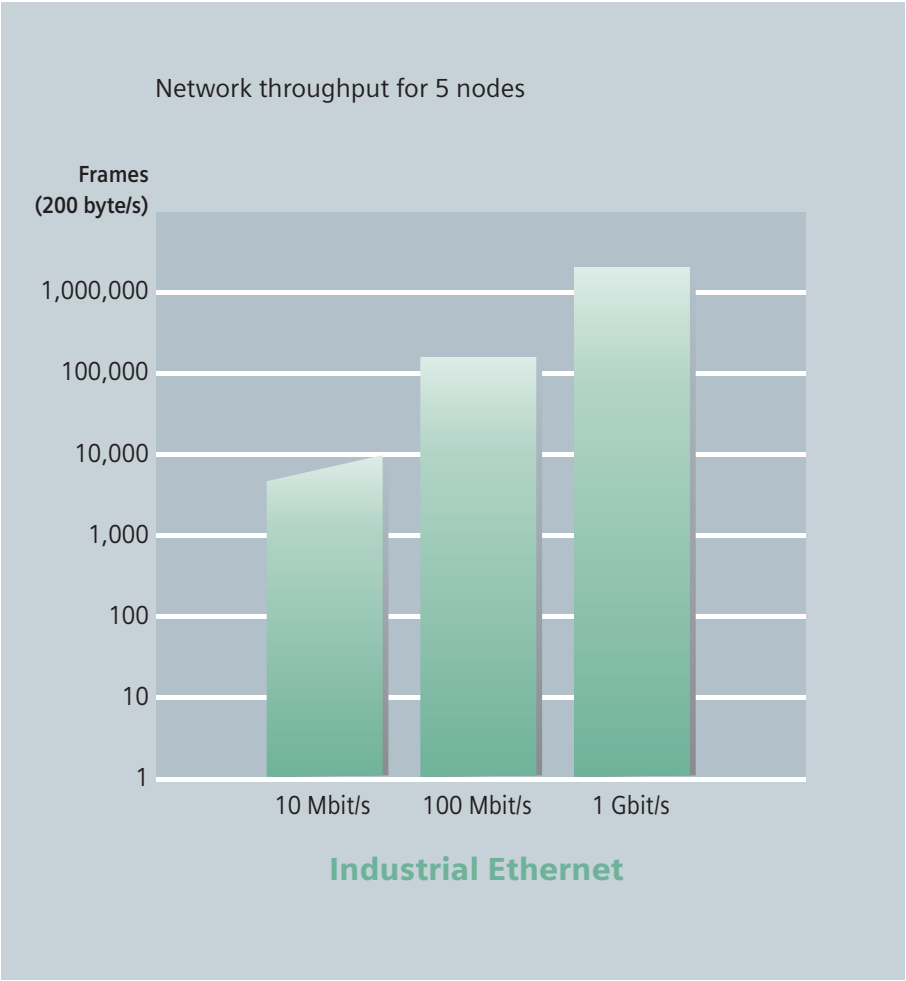
For data communication between automation systems from different manufacturers.

This means that not only Motion Control tasks but also distributed general control and measuring tasks can be accurately processed.

Industrial Ethernet network performance and technologies

New technologies, when optimally used on Industrial Ethernet, can produce performance improvements of up to a factor of 50 or more. These technologies are:

- Fast Ethernet with 100 Mbit/s: Telegrams are transported much faster than with 10Mbit/s and therefore reserve the bus for a much shorter time.
- Gigabit Ethernet with 1 Gbit/s: Compared to Fast Ethernet Gigabit is a factor of 10 times faster and transport time on the bus is reduced to a tenth of the time.
- Full Duplex excludes collisions: The data throughput increases enormously since common retries are unnecessary. Data can be sent and received simultaneously between 2 stations. The data throughput over a Full Duplex Fast Ethernet connection thus increases to 200Mbit/s.



- Switching enables parallel communication:
  Dividing the network into segments using a switch reduces the network load. Local data traffic in each network segment is independent of the traffic on the rest of the network, thereby making it possible for several frames to be in transport at the same time. The performance improvements stem from the fact that multiple frames are underway at the same time.
- Autosensing is the term used for network nodes (end devices and network components) which automatically detect the transmission rate of a signal (10Mbit/s, 100 Mbit/s or 1 Gbit/s) and support autonegotiation.
- Gigabit cabling system
  The 8-wire FastConnect cabling system from SIMATIC NET ensures that transmission rates of up to 1 Gbit/s are possible.

Active network components for Industrial Ethernet

SCALANCE X is the new product range of industrial switches for Industrial Ethernet from SIMATIC NET. Switches are active network components aimed at distributing data to specified addressees. The SCALANCE X product range presently comprises of 3 product lines, each one building on the previous one and optimally developed for the task in hand.

SCALANCE X-100

Switches with up to eight ports and local diagnostics on the device (LEDs) for use in "local-machine" applications.

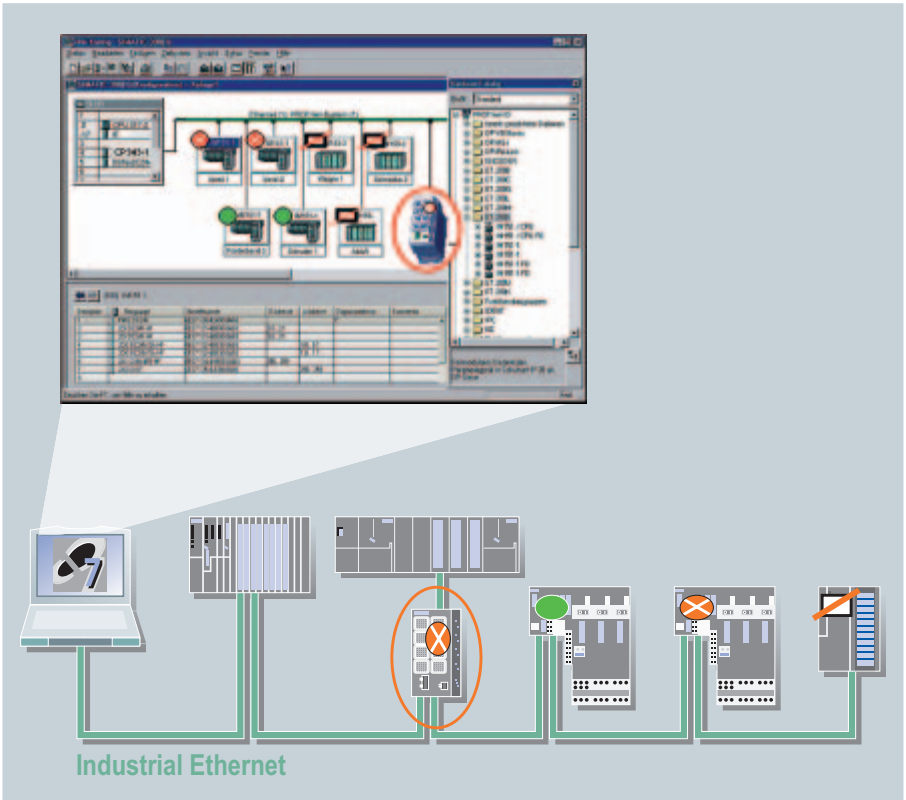
SCALANCE X-200

Can be universally used from local machine applications up to subplant networks. Configuration and remote diagnostics are integrated in the engineering tool STEP 7 giving the customer advantages in engineering, commissioning and operation. Devices with degree of protection IP65 level allow mounting outside the switching cabinet.

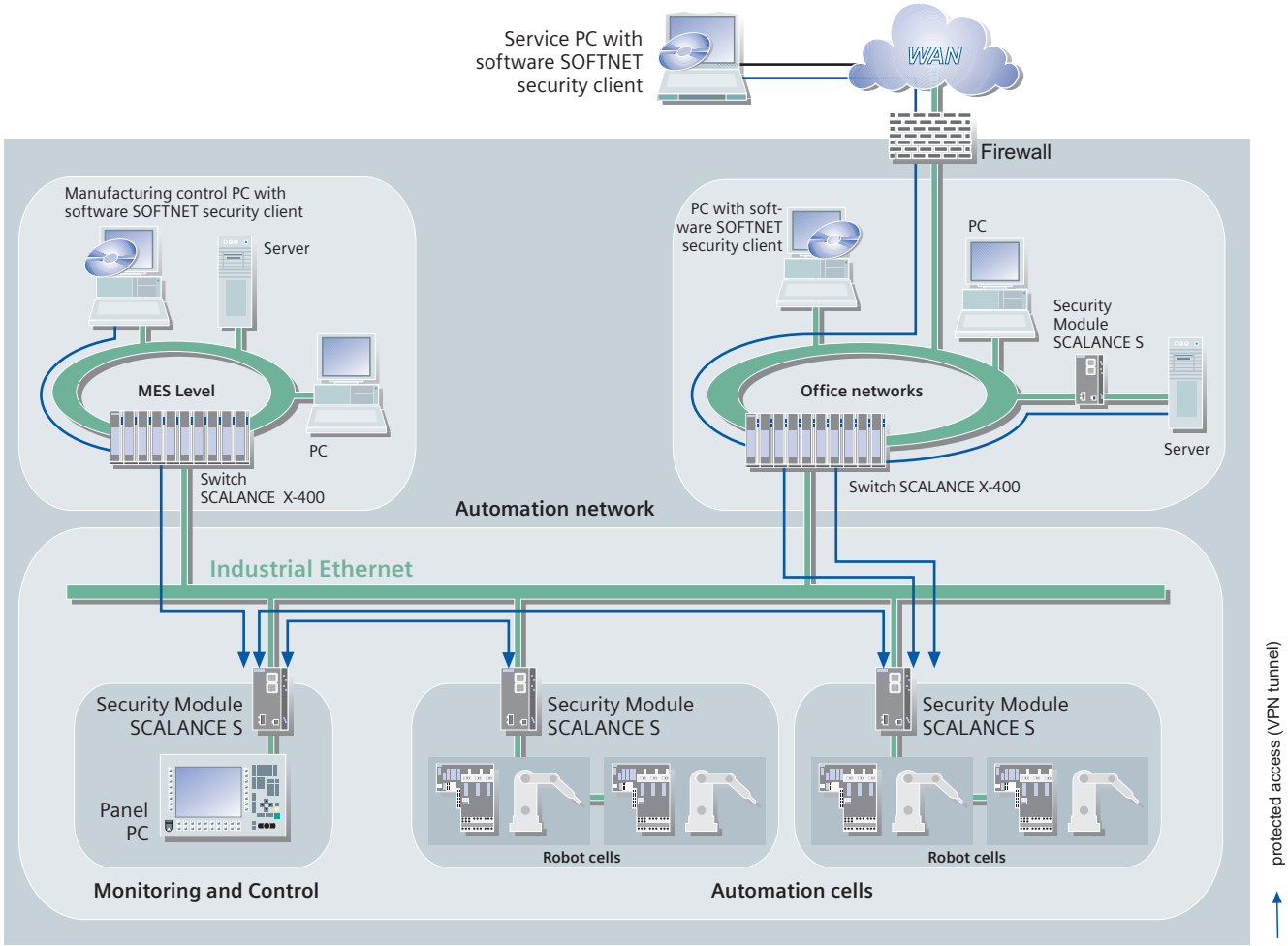
These switches can also be used in plant sub sections where there are demands for hard real-time communication and high availability. Standard data traffic (no real-time requirements) can also take place on the same cable thus eliminating the need for two separate networks.

SCALANCE X-400

for use in high performance plant networks, which also have to meet the challenge of future developments e.g. high speed redundancy. Thanks to the modular concept these can easily be adapted to the task at hand. In addition a seamless integration of automation networks into existing office networks is possible thanks to the support of office standards.



Industrial security for automation networks



Modern automation technology is built on communication and the networking of individual production islands. This means that the integration of automation components into office networks and company Intranets is becoming more important. The same can be said about remote access for service purposes; the increasing use of IT mechanisms such as Web servers and email in automation devices as well as the use of wireless LANs.

All this means that with industrial communication growing together with the IT world, automation devices are susceptible to the same dangers as we know in the office environment, namely hackers, viruses, worms etc.

The Siemens industrial security concept offers a security solution specifically designed for use in automation technology and fulfilling all the requirements of an industrial environment.

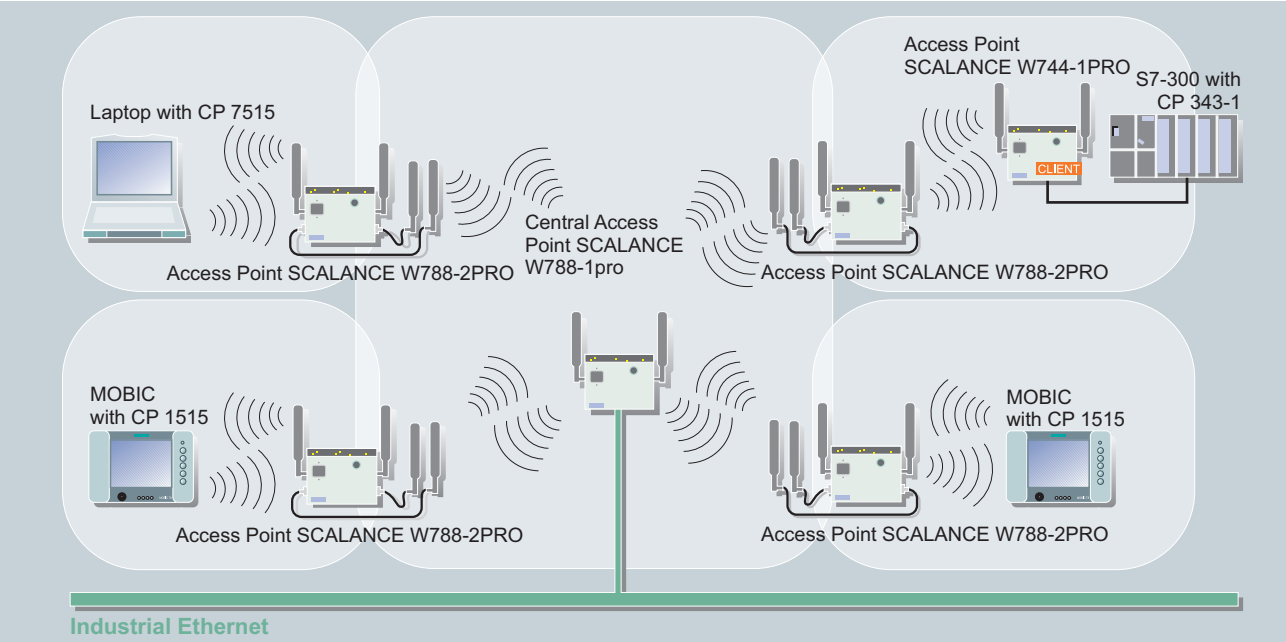
Advantages of the SCALANCE S security concept:

- Protects against spying and data manipulation
- Protects against communication overload
- Protects against mutual influences
- Protects against incorrect addressing
- User friendly and simple configuration and administration without special knowledge about IT security.
- No changes or adjustments of the existing network are necessary.
- No changes or adjustments of the existing application or network nodes are necessary
- Robust and designed for industry

SCALANCE S security module offers scaleable security functionality:

- Firewall to protect automation devices from unauthorised access, independent of the size of the network to be secured.
- Alternative or additional VPN (Virtual Private network) for secure authentication of the network nodes and encryption of data transmission.
- Software security module for client access from PCs/laptops to SCALANCE S protected automation devices.

Industrial Mobile Communication



The key to future marketing successes lies in the ability to access data independent of time and place. Processes can be considerably improved by using mobile devices networked across wireless LANs. The great advantage of a wireless solution lies in the simple and flexible accessibility of mobile devices.

These advantages can be used by implementing mobile solutions using Industrial Mobile Communication (IMC) products from SIMATIC NET. These products are developed on the basis of international standards e.g. according to IEEE 802.11, GSM, GPRS or UTMS.

Advantages of wireless communication networks

- Increase competitiveness by reaching a higher level of flexibility and mobility
- Simplify maintenance work and service costs and reduce plant shut down times while at the same time optimizing the use of staff
- Spare parts lists and manuals can be accessed independent of location
- Business orders can be received and acknowledged online
- System solutions have been tried and tested as network components, communications processors and software are fully coordinated with wireless devices
- Remote diagnostics from any location helps to reduce service costs
- Hard-to-reach locations can be easily accessed and cabling cost reduced
- Quick commissioning of new installations by reducing the costs of installing the communication network
- There is no wear and tear or abrasion of rotating and mobile parts and plants
- Low-cost connection of devices which are hard to reach or in aggressive environments

SCALANCE W - wireless communication

The SCALANCE W products offer a unique combination of reliability, robustness and security in one product.
An expansion of the IEEE 802.11 Standard is made available with Industrial Wireless LAN (IWLAN), which is especially significant for industrial customers requiring a deterministic, redundant wireless solution. This is the first time that customers can have a wireless network that can be used for both critical process data (e.g. alarm signal), as well as for standard wireless communication (WLAN) such as service and diagnostics. The reliability of the wireless network can also be seen in the dustproof, spray water resistant metal housing of the devices(IP65), fulfilling the typically high SIMATIC demands on mechanical stability. The devices are fitted with modern mechanisms to recognize the user (authentication) and to encrypt the data and can be easily integrated into existing security policies.

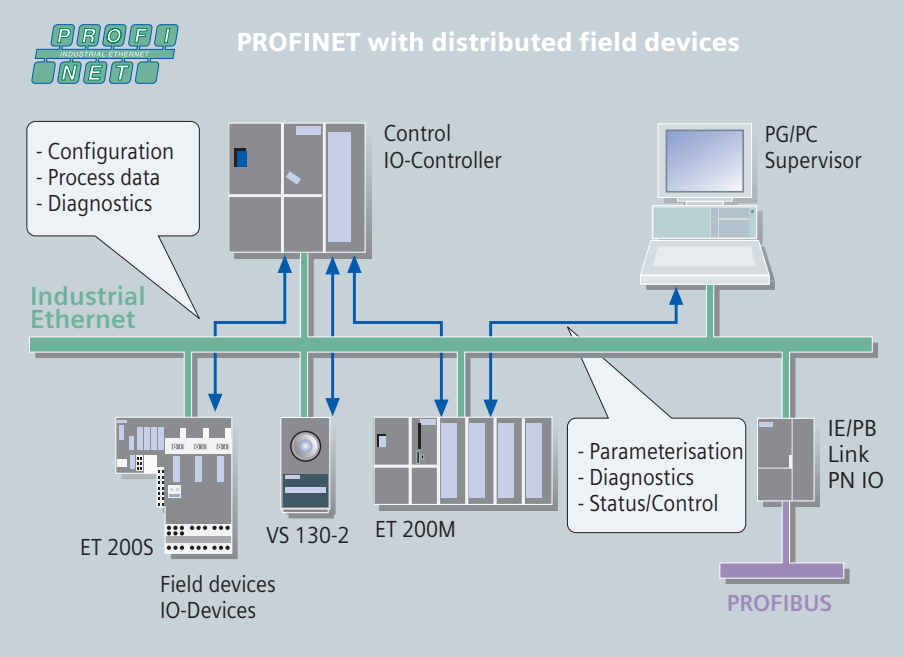
PROFINET products on Industrial Ethernet

PROFINET with distributed field devices

With PROFINET distributed field devices (so-called IO-Devices e.g. I/O modules) can be connected directly to Industrial Ethernet. Using STEP 7 these field devices can be assigned to a central controller (so-called IO-Controller). Existing modules and devices can still be used thanks to PROFINET proxies, thus ensuring investment protection. An IO-Supervisor can be used in HMI or other diagnostic programs - similar to PROFIBUS - to provide detailed plant diagnostics.

The following PROFINET devices are available:

- IM 151-3 PN;
  Interface module for the direct connection of ET200S as an IO-Device
- CPU 317-2 PN/DP
  CPU as IO-Controller for handling process signals and directly connecting field devices to Industrial Ethernet.
- IE/PB Link PN IO;
  PROFINET proxy for the transparent connection of existing PROFIBUS devices as IO-Devices.

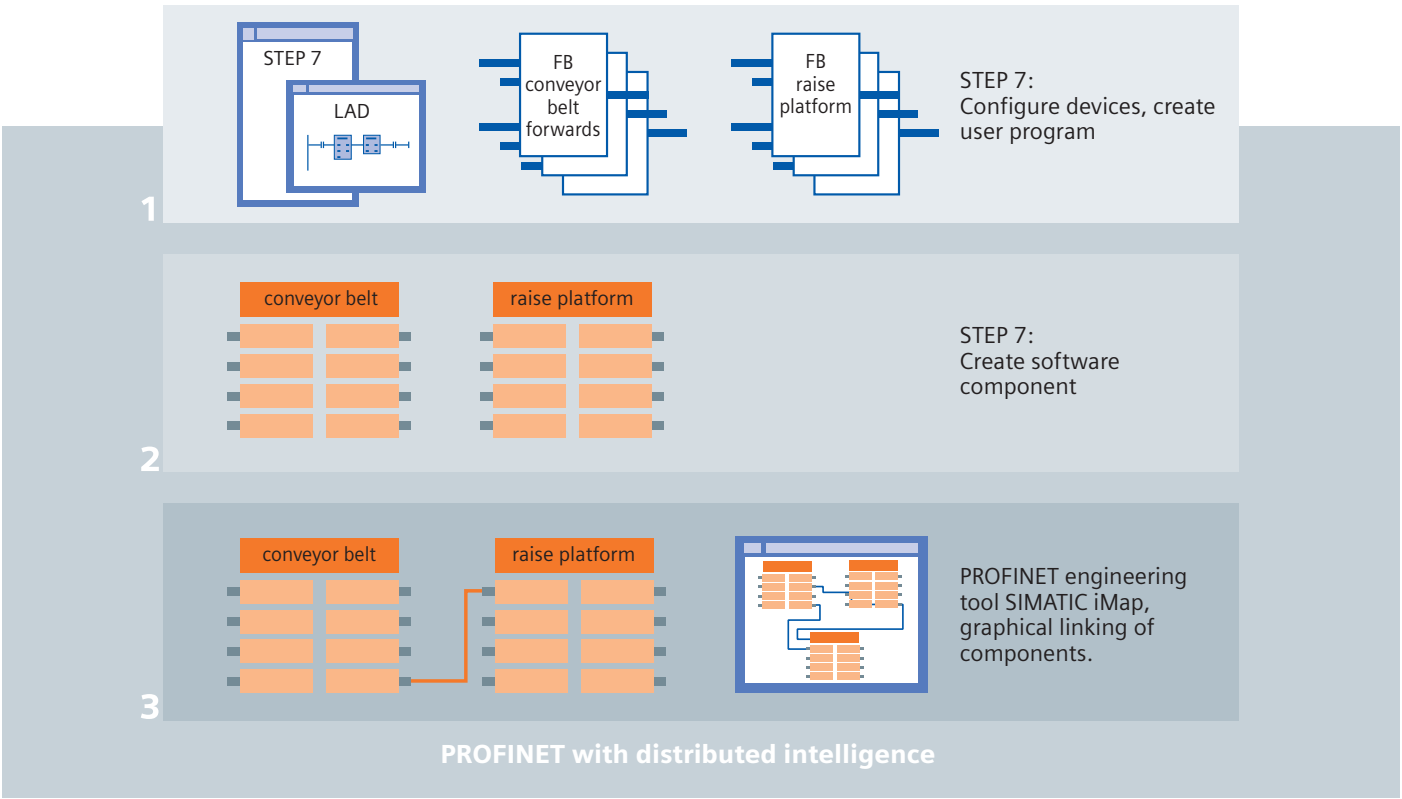


- CP 343-1;
  Communications processor for linking an S7-300 PLC to Industrial Ethernet in order to connect field devices as IO-Devices to Industrial Ethernet.
- CP 443-1 Advanced;
  Communications processor with integrated switch for the system connection of field devices to an S7-400 PLC.
- VS 130-2;
  Vision sensor as IO-Device for 2-d code reader
- SOFTNET PN IO;
  Communication software which enables a PC/workstation to operate as an IO-Controller.
- PN OPC server;
  Enable access from PC applications to data from PROFINET devices
- STEP 7;
  For configuration in the manner used with PROFIBUS

PROFINET and distributed intelligence

PROFINET supports distributed automation by means of Component Based Automation - the modular solution for machine builders and OEMs within Totally Integrated Automation. The solution involves not just PROFINET but also PROFIBUS. PROFINET defines the engineering model (design and setup of PROFINET components) and the communication between components.

Re-usable, intelligent technological modules - together with clearly defined interfaces for data exchange with other modules - are created in STEP 7. SIMATIC iMap is used for both the configuration of the complete plant by means of graphical linking of the individual modules and for simple diagnostics.



The following SIMATIC products support PROFINET with distributed intelligence:

- IE/PB Link;
  CBA proxy for the integration of existing PROFIBUS devices into a Component Based Automation application. The IE/PB link supports S7 routing.
- CPU 317-2 PN/DP;
  Central processing unit within a CBA component, which enables the data exchange with other components via PROFINET and via PROFIBUS (with a proxy).
- CP 343-1;
  Communications processor which enables an S7-300 PLC to be integrated into a Component based Automation application.
- CP 443-1 Advanced
  Communications processor with integrated switch which enables an S7-400 PLC to be integrated into a Component based Automation application.
- WinAC PN;
  The software PLC based on WinAC. WinAC PN operates as a proxy for PROFIBUS devices.
- PN OPC server;
  Enable access from PC applications to data from PROFINET devices

Network components for Industrial Ethernet - optimized for use with PROFINET

Active network components

The industrial switches from the SCALANCE X product family are optimized for use in the field level.

- Cost optimized number of optical and electrical ports.
- Optimal integration in the PROFINET diagnostics concept.
- Ideal support for the real-time (RT) technology thanks to priorisation.

Passive network components

The quick assembly system for SIMATIC NET Industrial Ethernet - FastConnect (FC) - means that the structured cabling known in the office-world can be used in a rugged industrial environment. FastConnect cables can be assembled quickly and easily on-site. In addition to the range of copper based FastConnect products including industrial installation cables, sockets, plugs and patch cables there is also a wide range of optical transmission media available.

Industrial Security

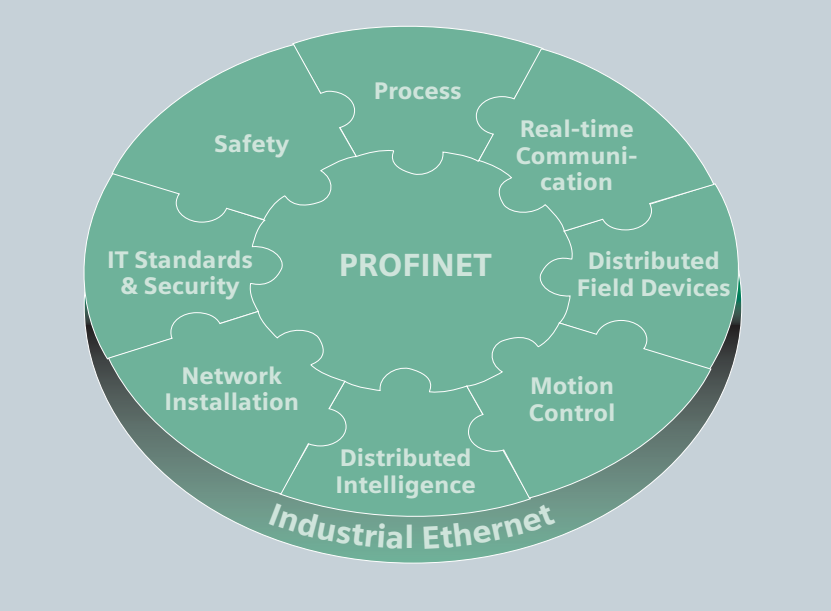
SCALANCE S, the product family - whether we are talking about the software or hardware modules - form the security solution specially developed for industrial automation.

PROFINET - the open standard for automation

PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation based on Industrial Ethernet that links devices from the field level right through to the management level.

Through it's transparency PROFINET supports plant-wide engineering and uses IT standards, even in the field level.

Existing field bus systems e.g. PROFIBUS can be simply integrated without changes in the existing devices. PROFINET takes account of:



Real-time communication

PROFINET is based on Industrial Ethernet and uses TCP/IP (Transport Control Protocol/Internet Protocol) for parameterisation, configuration and diagnostics.
Real-time communication for the transmission of user/process data can take place on the same cable. PROFINET devices support the following real-time features:

- Real-Time (RT) makes use of different priorities and optimises the communication stack of the bus nodes. This ensures a high performance data transfer in the area of industrial automation using standard network components.
- Isochronous Real-Time (IRT)
  The hardware supported real-time communication supports synchronous data transfer with very short updating times with a minimum of jitter and is ideally suited for dynamic Motion Control applications.

Distributed field devices

PROFINET enables the connection of distributed field devices directly onto Industrial Ethernet. Existing modules can be used without modification by simply adding a PROFINET interface module. Data transmission takes place using real-time communication. Configuration and diagnostics use TCP/IP or Web services.

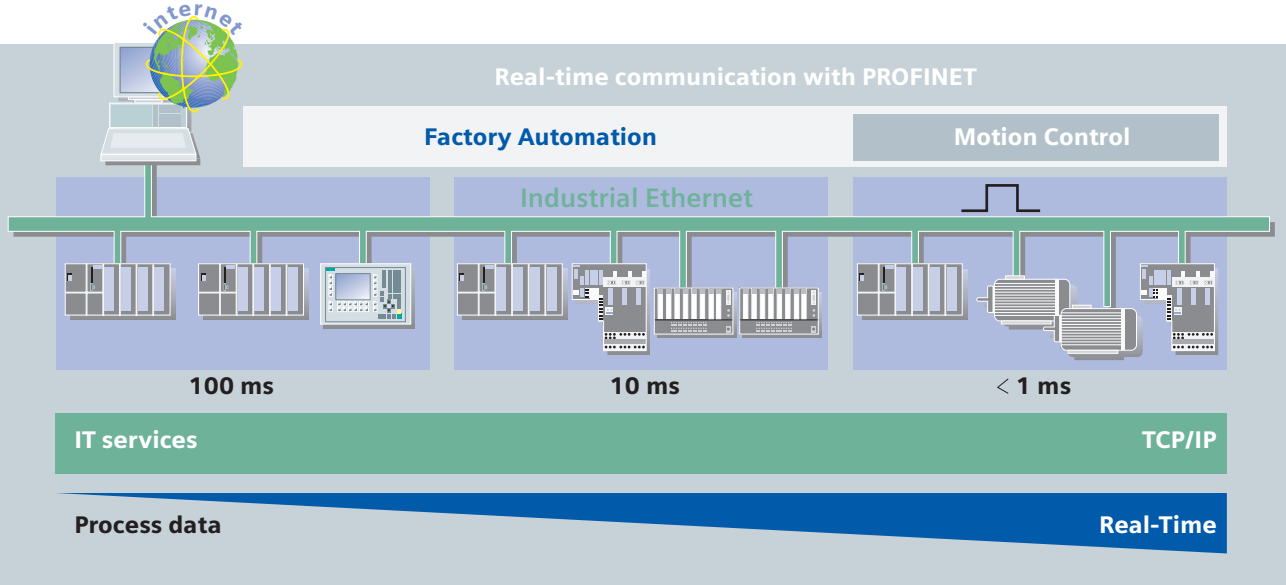
Motion Control

Isochronous real-time (IRT) PROFINET enables the realisation of quick, synchronous drive controls for high performance Motion Control applications with a minimum of time and effort. The standard drives profile PROFIdrive ensures a manufacturer independent communication between motion controllers and drives independent of the bus system - whether Industrial Ethernet or PROFIBUS.

Distributed intelligence

Machines and plants can be broken up into re-useable technological modules. Such modules comprise of the mechanical, electronic and user software parts of a plant or section of a plant. The first step involves the creation, testing and encapsulation of the individual modules, while in the second stage the communication of the complete plant can be graphically linked. This process leads to efficient configuration and shorter commissioning times.

- **PROFINET is the open Industrial Ethernet standard for automation**
- **PROFINET is based on Industrial Ethernet**
- **PROFINET uses TCP/IP and IT standards**
- **PROFINET is real-time Ethernet**
- **PROFINET support seamless integration of field bus systems**



Network installation
Although PROFINET fulfils all the requirements for Industrial Ethernet in automation, no expert knowledge is required to install a PROFINET network. Network topologies in line, ring, tree or star structures can be simply realised using rugged cabling and connectors.

The "PROFINET installation guide" gives a detailed description of all the necessary steps required for a successful network installation. Depending on the requirements either copper of fibre optic cables can be selected and devices from various manufacturers can be connected using standardised rugged connectors (IP65).

For address allocation and network diagnostics PROFINET uses the IT standards DCP (Discover Configuration Protocol), DHCP (Dynamic Host Configuration protocol) and SNMP (Simple Network Management Protocol).

IT standards & security
Within the concept of Web integration, data from PROFINET components can be displayed in HTML and XML format. This means that the data from the automation level can be accessed from any PC using a standard Web browser thereby significantly simplifying commissioning and diagnostics.

PROFINET also provides a scaleable security concept which prohibits data manipulation, unauthorised data access and operator errors without the necessity of expect IT knowledge.

Safety
The well-proven PROFIBUS safety profile, which enables the transmission of both standard and safety data on one bus cable is independent of the bus medium used. This means that PROFINET also supports fail-safe applications with a uniform configuration across the complete network, both for new plants or for the extension of existing plants.

Process
PROFINET is the standard for all automation applications. The simple PROFIBUS integration in PROFINET means that even the process industry (including intrinsically safe areas) can be accessed.

Field bus integration
Proxies can be used to integrate existing field bus systems into new networks. This means that, for example, a PROFIBUS or AS-Interface master can access devices connected to Industrial Ethernet via a proxy that supports PROFINET. This means that investments and devices already made by plant and machine builders can be used in future networks and systems.

Industrial Ethernet

Industrial Ethernet is a powerful area and cell network based on the IEE 802.3 (ETHERNET) standard.

Ethernet is also the technology on which the Internet is based and offers many possibilities for worldwide networking.

The many possibilities provided by the Intranet, Extranet and Internet already available in today's office environments can also be utilized in production and process automation.

Ethernet technology, which has been used successfully over many years in combination with switching, full-duplex mode and autosensing, allows you to match your network's performance to your requirements.

You can choose your data throughput rate to suit your particular needs, as integrated compatibility makes it possible to introduce new technology in stages.

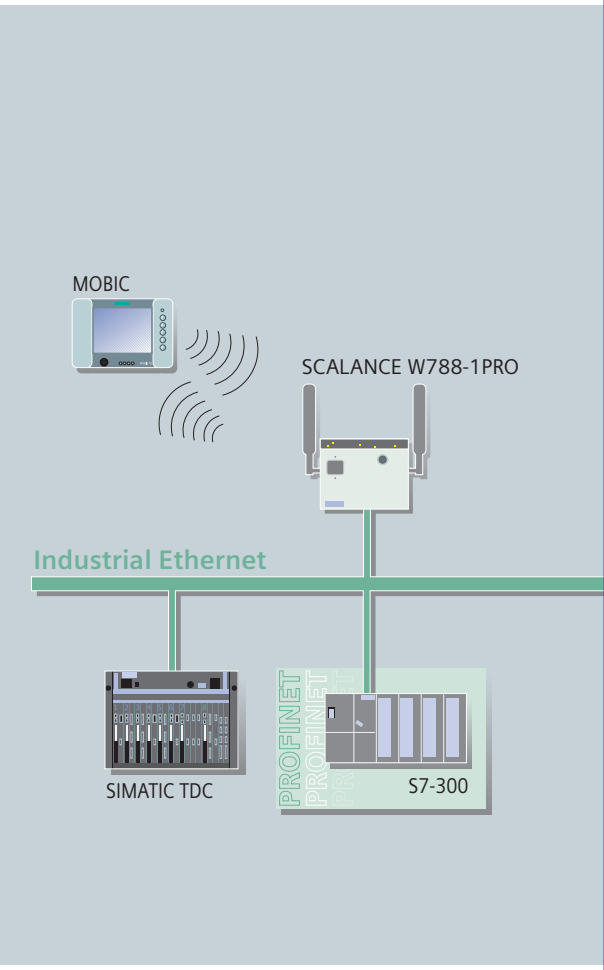
With a market share of over 80% Ethernet is number one worldwide in today's LAN landscape. Ethernet provides important features and performance characteristics which can provide many important benefits for your application:

- Fast commissioning thanks to a simple connection technology.
- High availability, as existing plants can be expanded without any side effects.
- Virtually unlimited communication capabilities due to scaleable performance using switching technology.
- Networking of widely varied types of applications such as office and production applications.
- Company-wide communication thanks to WAN (Wide Area Network) link-ups such as ISDN and Internet
- Investment protection thanks to continual compatibility developments

SIMATIC NET uses this well-proven, reliable technology. Siemens has already supplied more than 500,000 components and connections for rough and noise prone industrial sites worldwide.

SIMATIC NET provides important extras to traditional Ethernet technology for use in industrial environments:

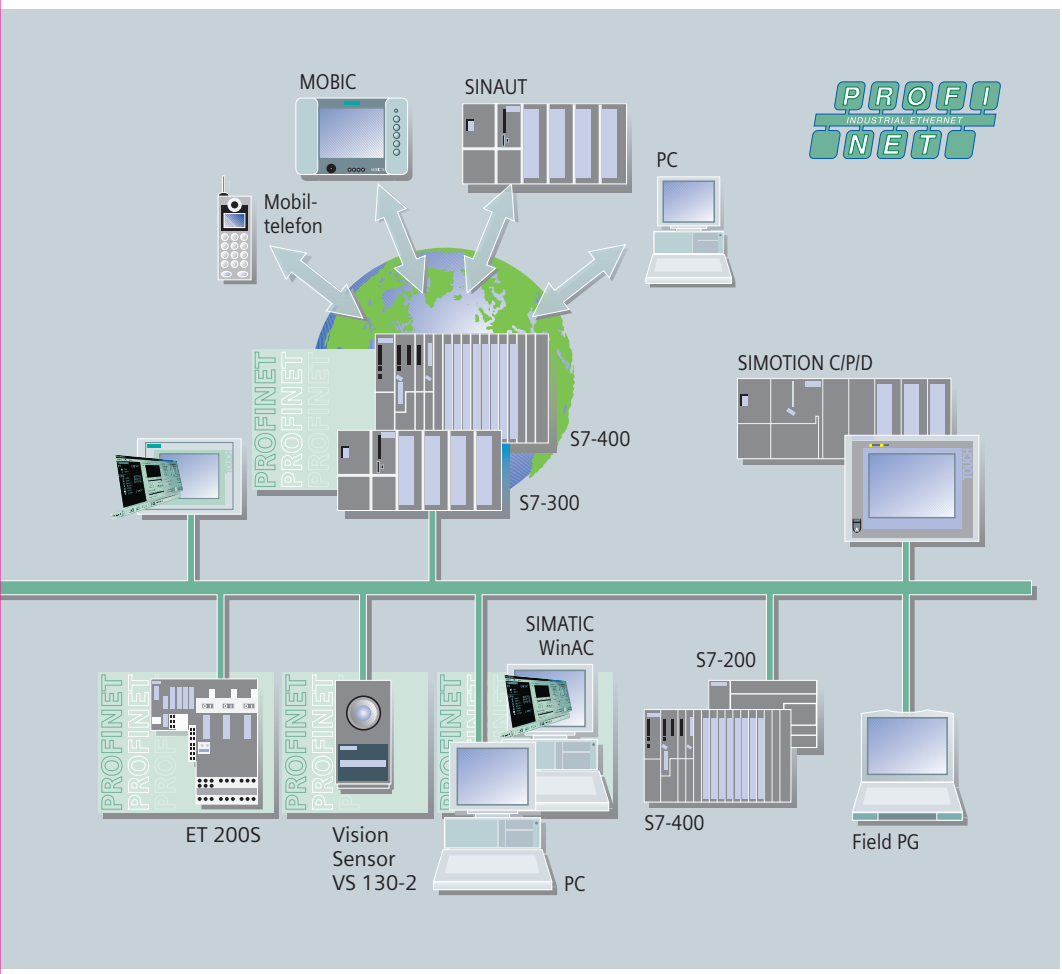
- Network components for use in rugged industrial environments
- Fast on-site cable assembly using the FastConnect cabling system with RJ45 technology
- High availability networks thanks to quick redundancy
- Constant monitoring of network components thanks to a simple but effective signalling concept
- Future oriented network components with the new SCALANCE X generation



The following communication functions/service are supported by Industrial Ethernet:

PG/OP communication

are integrated communication functions which allow SIMATIC and SIMOTION automation systems to communicate with every HMI device (TD/OP) and SIMATIC PG (STEP 7). PG/OP communication is supported by all networks.



S7 communication

S7 communication is the integrated communication function (System Function Block) for S7-300 (where there are loadable FBs) and for S7-400 which has been optimised for SIMOTION and SIMATIC S7/C7/WinAC systems. It also makes it possible to link PCs and workstations to SIMATIC. The amount of useful data per request may not exceed 64 Kbyte. S7 communication provides simple, powerful communication services as well as a network independent software interface.

S5-compatible communication (SEND/RECEIVE)

S5 compatible communication (SEND/RECEIVE) enables SIMATIC S7/C7 to communicate to existing systems, particularly SIMATIC S5 as well as to PCs via PROFIBUS and Industrial Ethernet.

Fetch and Write are also available on Industrial Ethernet ensuring that software created for SIMATIC S5 can continue to be used without any modification.

Standard communication

Standard communication consists of standardized data communication protocols such as FTP.

OPC

(OLE for Process Control) is a standardised, open, vendor-independent interface and is used to interface OPC-capable Windows applications to S7 and to S5 (S/R) communication.

Informationstechnologie (IT) with email und Web technology

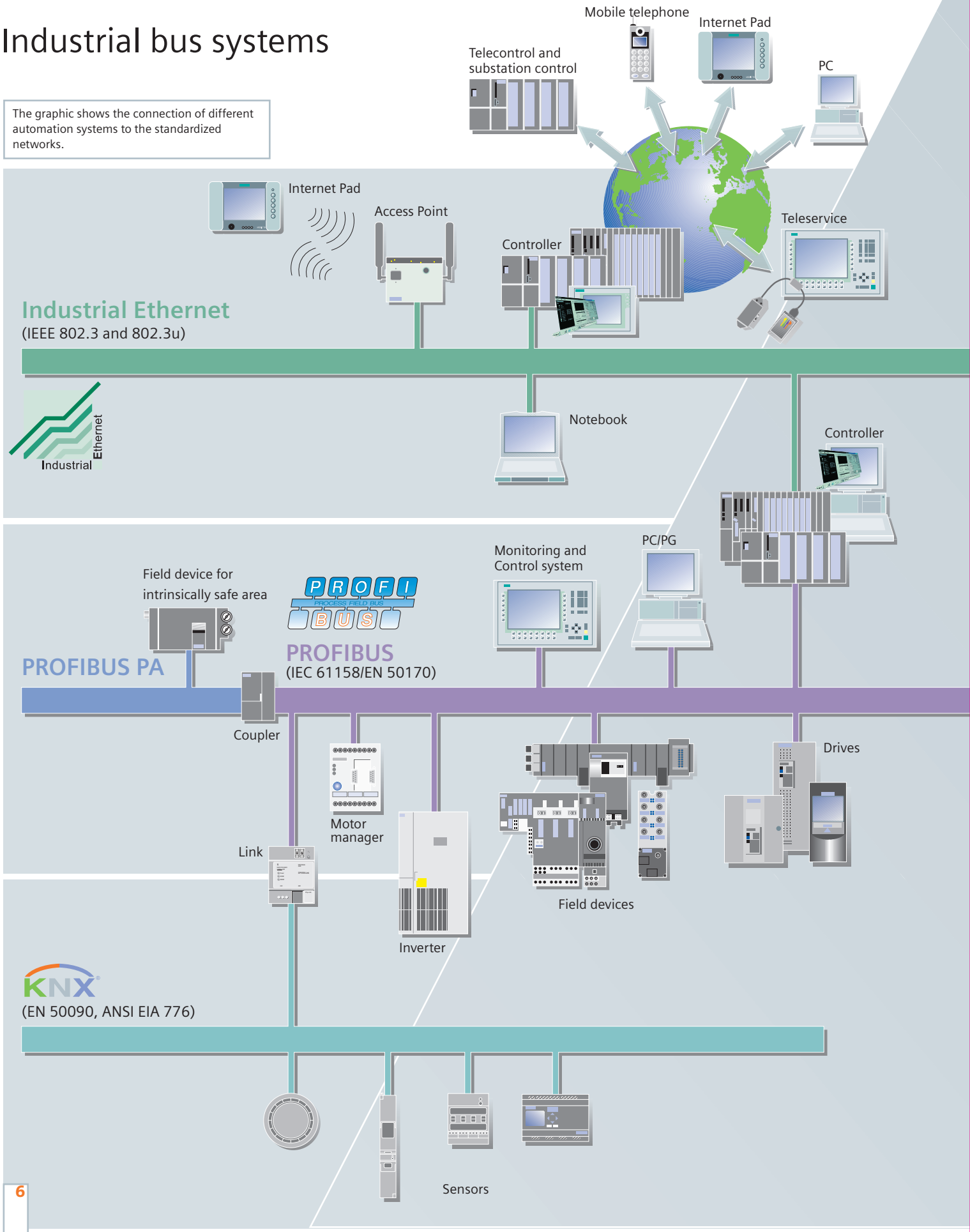
This form of standard communication links SIMATIC to IT via Industrial Ethernet. In office environments email and Web browsers have become widely used communication resources. The most widely accepted communication path is Ethernet, although telephone lines and Internet are also popular.

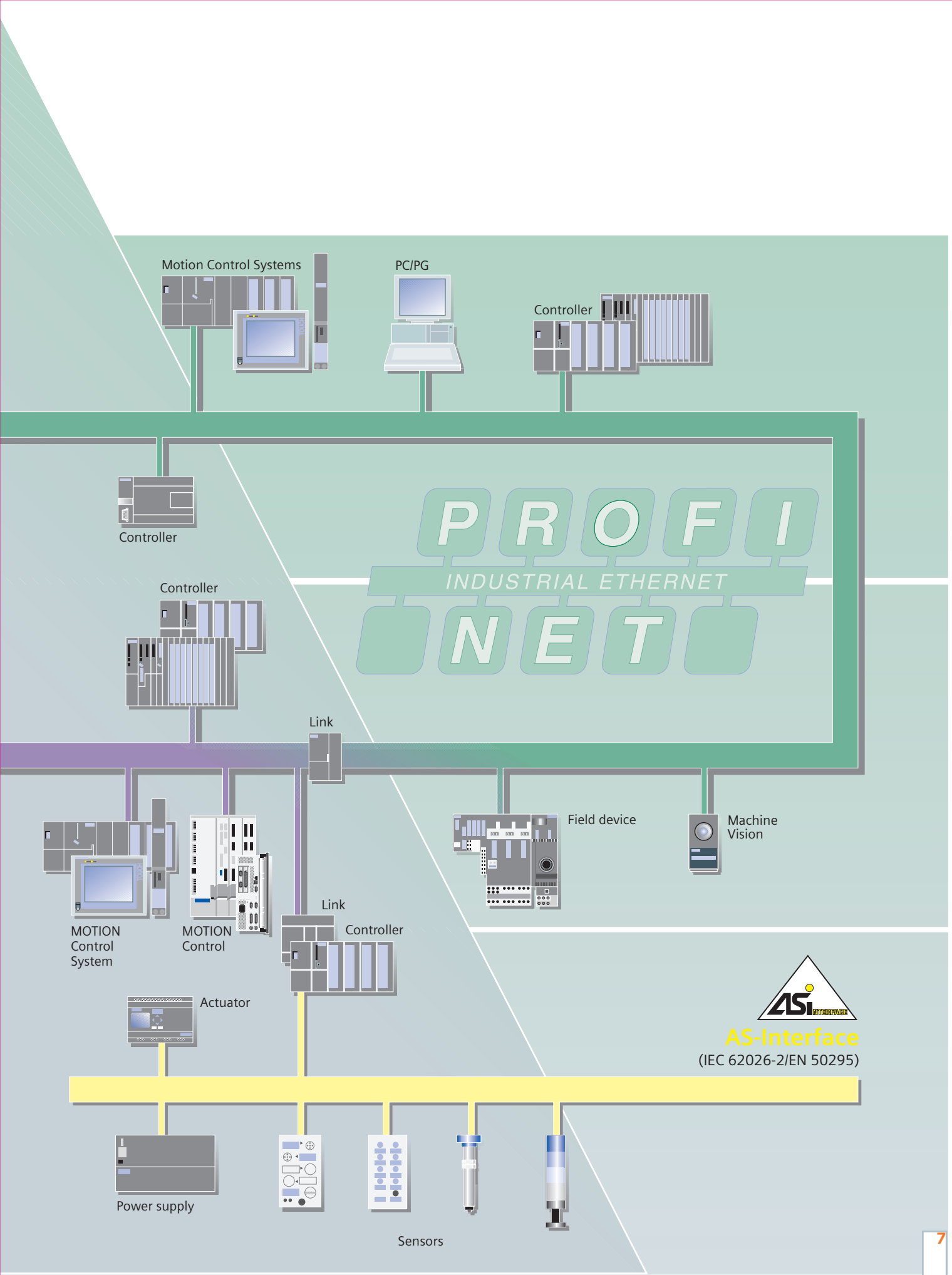
Socket interface for Industrial Ethernet

This interface enables data communication with computers via TCP/IP. Users can freely program the data exchange for this PC- and Unix-world interface. In the SIMATIC S7, the SEND/RECEIVE (S/R) blocks are used to access to TCP/IP.

Industrial bus systems

The graphic shows the connection of different automation systems to the standardized networks.




Motion Control Systems
PC/PG
Controller
Controller
PROFI
INDUSTRIAL ETHERNET
NET
Controller
Link
Field device
Machine
Vision
MOTION
Control
System
MOTION
Control
Link
Controller
Actuator
AS-Interface
(IEC 62026-2/EN 50295)
Power supply
Sensors

PROFIBUS Devices and Services

The table contain the supported functions of the integrated interfaces, communications processors (CPs) and communication software.

		PG/OP	S7-comm.	S5-comp.-comm.	DP/PA	FMS	OPC
SIMATIC							
Integrated interfaces	S7-300 / S7-400						
	CPU 41x -2/3 FM 458-1 DP (synchronous)	●	●	–	●	–	–
	CPUs with DP interface	●	●	–	●	–	–
	SIMATIC C7 / ET 200S / ET 200M						
	C7-635/636	●	●	–	●	–	–
	IM 151-7 CPU	●	●	–	●	–	–
	BM 147 CPU	●	●	–	●	–	–
Communications Processors (CPs)	S7-300 / S7-400						
	CP 443-5 Basic	●	●	●	–	●	–
	CP 443-5 Extended	●	●	●	●	–	–
	IM 467/467 FO	–	–	–	●	–	–
	CP 342-5/CP 342-5 FO	●	●	●	●	–	–
	CP 343-5	●	●	●	–	●	–
	SIMATIC TDC						
	CP 50M0	–	–	–	●	–	–
	SIMATIC C7						
	CP 342-5/CP 342-5 FO	●	●	●	●	–	–
	CP 343-5	●	●	●	–	●	–
SIMOTION							
	SIMOTION C/P/D						
	integrated interface	●	●	–	●	–	●

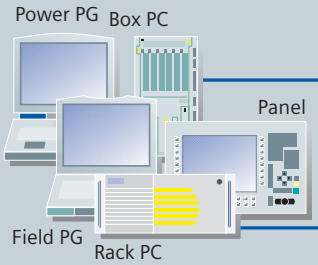
Powerful tools such as STEP 7, COM PROFIBUS and PDM are used to configure and parameterize I/O devices. In STEP 7 the central and distributed peripheries are configured identically.

PDM (Process Device manager) is the parameterisation tool to parameterize and diagnose intelligent field devices and is called from within STEP 7. STEP 7 is used to make changes to the user program as well as for testing and commissioning purposes from any point of the plant which is connected to PROFIBUS.

Drives ES is the engineering tool for the drives on PROFIBUS. There are also diagnostic tools such as S7-DIAG, S7-GRAPH and ProAgent which can diagnose the process data without the need for additional instruments.

SIMATIC PC/PG

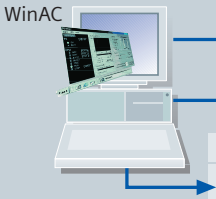
			PG/OP	S7-comm.	S5-comp.-comm.	DP/PA	FMS	OPC
Integrated interface	Box PC 620/840 Rack PC 840/IL40 Panel PC IL70/670/870 Field PG Power PG FI 45 V2	SOFTNET for PROFIBUS	●	●	●	●	–	●
CP	CP 5511/CP 5512 CP 5611 CP 5613 A2/CP 5613 FO CP 5614 A2/CP 5614 FO	SOFTNET for PROFIBUS SOFTNET for PROFIBUS DP-5613/ FMS-5613 DP-5613/ FMS-5613	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●



Device basis for WinAC

PC-based Automation

			PG/OP	S7-comm.	S5-comp.-comm.	DP/PA	FMS	OPC
Integrated interface	WinAC Slot 412/416 (with integrated interface)		●	●	–	●	–	●
	WinAC MP (with integrated interface)		●	–	–	●	–	–
CP	WinAC RTX: CP 5613 A2	DP-5613/FMS-5613	●	●	–	●	●	●
	WinAC Basis: CP 5611	SOFTNET for PROFIBUS	●	●	–	●	●	●
	WinAC Basis: CP 5613 A2	SOFTNET for PROFIBUS	●	●	–	●	●	●
	WinAC Basis: integrated interface PC/PG	DP-5613/FMS-5613	●	●	–	●	–	●



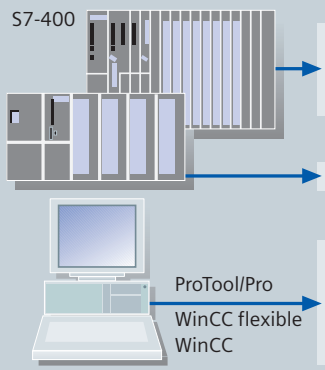
Device basis for WinAC

PC/Notebook

			PG/OP	S7-comm.	S5-comp.-comm.	DP/PA	FMS	OPC
CP	CP 5511/CP 5512 CP 5611 CP 5613 A2/CP 5613 FO CP 5614 A3/CP 5614 FO	SOFTNET for PROFIBUS SOFTNET for PROFIBUS DP-5613/ FMS-5613 DP-5613/ FMS-5613	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●

Visualization

			PG/OP	S7-comm.	S5-comp.-comm.	DP/PA	FMS	OPC
CP	S7-400: CP 443-5 Basic		●	●	●	–	●	–
	S7-400: CP 443-5 Extended		●	●	●	●	–	–
	S7-400: IM 467/467 FO		●	–	–	●	–	–
	S7-400: CP 342-5/CP 342-5 FO		●	●	●	●	–	–
	ProTool/Pro, WinCC flexible, WinCC: CP 5511/CP 5512 CP 5611 CP 5613 A2/CP 5613 FO CP 5614 A2/CP 5614 FO	SOFTNET for PROFIBUS SOFTNET for PROFIBUS	● ● ● ●	● ● ● ●	– – – –	● ● ● ●	– ● ● ●	● ● ● ●
Integrated interface	PC: ProTool/Pro/WinCC flexible, WinCC		●	●	–	●	–	●
			●	●	–	●	●	●



Further information

In various SIMATIC NET components (e.g. OSM/ESM, CPs with IT functions) comprehensive parameter and diagnostic functions (e.g. Web Server, network management) are available via open protocols and interfaces.

The open interfaces create an access to components which can however result in misuse though illegal activities.

By using these functions and the open interfaces and protocols (e.g. SNMP, HTTP, Telnet) suitable security measurements should be taken to ensure there is no unauthorized access to components and networks, particularly those connected to the WAN/Internet.

Automation networks should be separated from the company network by means of suitable gateways (e.g. Firewalls).

- **More detailed information can be found in the SIMATIC Guide technical documentation**

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