

Industrial Ethernet Switches

Brochure · November 2011



SIMATIC NET

Answers for industry.

SIEMENS

Industrial Ethernet

Industrial Ethernet Networking

With Totally Integrated Automation, Siemens is the only manufacturer to offer an integrated range of products and systems for automation in all sectors – from incoming goods and the production process to outgoing goods, from the field level through the production control level, to connection with the corporate management level. SIMATIC NET offers all the components for industrial communication: from industrial communications processors right up to network components – even wireless if required.

The ever expanding spread of Ethernet in the industrial environment makes it increasingly important to structure the resulting Industrial Ethernet/PROFINET networks.

To achieve maximum uniformity of the networks and seamless integration of the industrial plants, SIMATIC NET offers different **Industrial Ethernet switches** – active network components for use direct at the SIMATIC system, as stand-alone devices, or as plug-in communications processors with integral switch for PCs and SIMATIC.

They are used for the structured networking of machines and plants as well as for integrating them into the overall corporate network. A graded portfolio of switches (SCALANCE X) and communications processors with integral switches enables optimum solutions for all types of switching tasks, not only in harsh industrial environments.

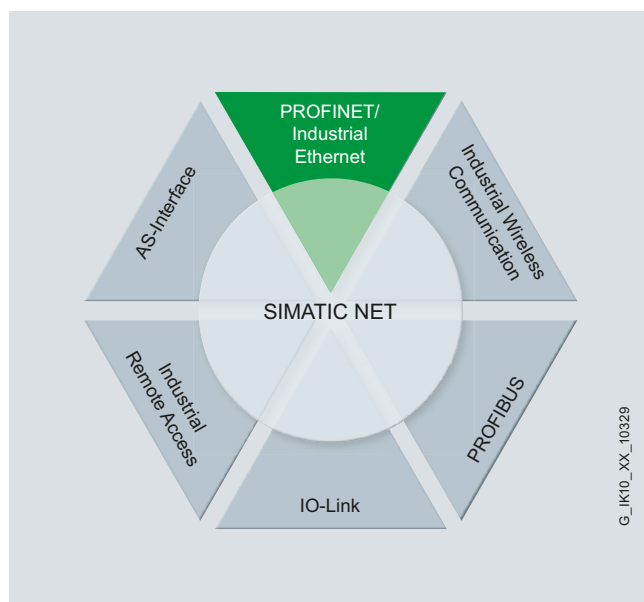
To assist in selecting the right Industrial Ethernet switches, cables and connectors as well as configuration of modular variants, the SIMATIC NET Selection Tool is available at:

Online version:

<http://www.siemens.com/snst>

Offline version:

<http://www.siemens.com/snst-download>



SIMATIC NET – Industrial Communication from Siemens

Industrial communication is of central importance for high-performance automation applications. Its diversity is mirrored in the broad range of industrial communication solutions from SIMATIC NET that extends beyond PROFINET/Industrial Ethernet: With Industrial Wireless Communication, Industrial Remote Communication, PROFIBUS, AS-Interface, and IO-Link, it covers all areas of industrial communication. The optimum solution is guaranteed for every application and every sector.

Communication in industrial environments

Industrial communication differs fundamentally from the communication that is used in the office environment. In the office environment, many clients communicate with one server; there are no cross-connections between clients. This type of data transmission can cause bottlenecks and delays when communication links are being established, when too many clients access a server simultaneously.

This cannot be used for automation because cyclically executing process programs require up-to-date input data in order to issue the appropriate control commands to components.

Furthermore, applications, communications relationships and network structures must be individually adapted to the harsh industrial conditions.

An industrial network must also be able to respond flexibly and at short notice to changing market requirements and re-tooling must be fast and efficient. It must always be ensured, however, that the capacity of the network and therefore the plant or machines is optimally utilized and any downtimes minimized. All the production and management processes must perfectly interact.



These requirements can only be satisfied when it is based on an open, company-wide communication system that permeates the entire company and extends beyond its boundaries. Island solutions are avoided in automation and information technology, so the following preconditions must apply:

- Continuous flow of information from the actuator/ sensor level through to the corporate management level
- Availability of information at every location
- Fast exchange of data between the plant sections
- Easy, plant-wide configuring and efficient diagnostics
- Integrated security functions that block unauthorized access

Totally Integrated Automation

The network and automation components of SIMATIC NET are part of Totally Integrated Automation (TIA), an integrated range of products and systems for automation in all areas – from incoming goods, through the production process to outgoing goods, and from the field level, through to the connection to the corporate management level. These components feature the highest possible degree of integration because they access a common database which, in turn, saves data entry costs and ensures consistency throughout the project.

Availability and performance

The demand for high network availability for powerful networks in the various automation applications is rising continuously. Different topologies such as line, ring or star offer wide-ranging possibilities, e.g. when implementing a production line or manufacturing cell.

Industrial Ethernet is a high-performance area and cell network designed to the IEEE 802.3 (Ethernet) standard that can be used to set up powerful communication networks extending over long distances. PROFINET, the open Industrial Ethernet Standard, uses Industrial Ethernet and facilitates real-time communication right down to the field level. If existing IT standards are fully utilized, PROFINET even permits isochronous motion control applications to be implemented via Industrial Ethernet.

Industrial Ethernet

Network performance and technologies

When combined, the current Industrial Ethernet technologies can significantly boost performance on the network in comparison with the original 10 Mbit/s technology.

These technologies are:

- **Fast Ethernet** at 100 Mbit/s:
Message frames are transported much faster than by Ethernet (10 Mbit/s) and therefore only occupy the bus for an extremely short time. For Fast Ethernet, a 4-wire Fast-Connect cabling system (Cat5e) is available with cable, plug and outlet.
- **Gigabit Ethernet** at 1 Gbit/s:
Gigabit Ethernet is faster than Fast Ethernet by a factor of 10, so the bus is occupied for only one tenth of the time. For Gigabit Ethernet, an 8-wire FastConnect cabling system (Cat6) is available with cable, plug and outlet.
- **Gigabit Ethernet** with 10 Gbit/s:
Compared to Ethernet with 1 Gbit/s, Ethernet with 10 Gbit/s is faster by a factor of 10.
- **Full Duplex** avoids collisions:
data throughput is increased hugely since the usual message frame repetitions are avoided. Data can be sent and received simultaneously between two nodes. The data throughput for a full duplex connection therefore rises to 200 Mbit/s with Fast Ethernet and to 2 Gbit/s with Gigabit Ethernet.
With full duplex, greater network expansion is also possible.
This means, for example, that when glass fiber-optic cables are used, distances of 120 km and more can be achieved between two nodes.

- **Switching** permits parallel communication:
When a network is subdivided into several segments using a switch, this results in load separation. Data communication is possible in each individual segment independently of the other segments. In the overall network, several message frames can therefore be en-route simultaneously. The performance gain is due to the simultaneity of several message frames.
- **Autocrossover** automatically crosses the send and receive cables on twisted-pair interfaces.
- **Autosensing** describes the characteristic of network nodes (data terminals and network components) that automatically detect the transmission rate of a signal (10 Mbit/s, 100 Mbit/s, or 1 Gbit/s) and support autonegotiation.
- **Autonegotiation** is a configuration protocol.
Before initiating the actual data transmission, network devices automatically negotiate a transmission mode that all devices can use (10/100/1000 Mbit/s, full duplex or half duplex).

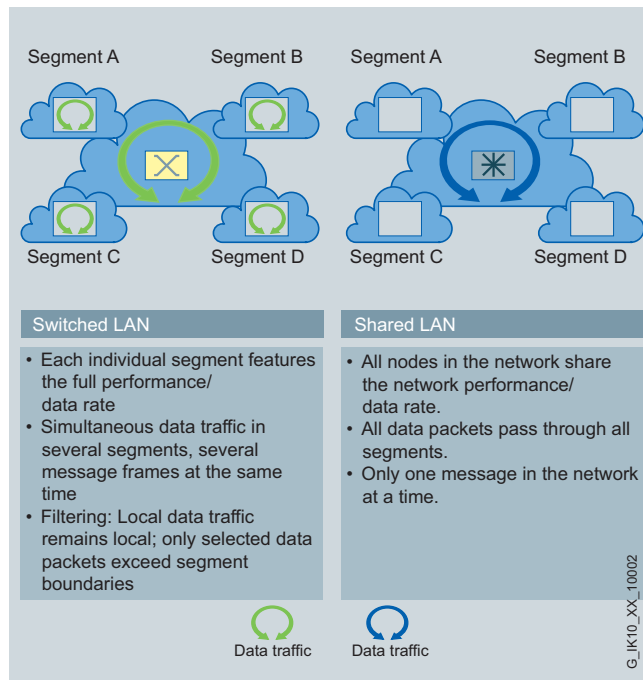


Advantages of the switching technology

Industrial Ethernet Switches are active network components that support the different network topologies: Networks can be constructed with switches in electrical or optical line, star and ring topologies. These active network components specifically distribute data to the relevant addressees.

SIMATIC NET offers the right Industrial Ethernet switch or a component with switch functionality for every application:

- **Compact Switch Modules (CSMs)** offer additional ports directly on the SIMATIC.
- **Unmanaged and managed switches** of the **SCALANCE X** product group, perfectly tuned to the respective automation and networking task for integration in PROFINET.
- **Communications processors (CPs)** for SIMATIC and the PC that support the CPU in communication tasks, and handle the switching of smaller network segments in addition to their actual task.



Switched LAN

Electrical or optical cabling systems are used as the transmission medium between the switches. Data terminals are connected electrically over twisted-pair cables.

The switching technology permits parallel communication, i.e. a network is divided into several segments, thereby resulting in load separation. Data communication is therefore possible in each individual segment independently of the other segments. This means that, throughout the network, multiple message frames can be in transit at the same time. The performance gain is due to the simultaneity of several message frames.

The switching technology offers definite advantages over shared LAN

- Switches can be used to construct subnets and network segments
- Data throughput and network performance are increased by structuring data communication.
- The rules for network configuration are simple
- Network topologies with 50 switches in a ring and an overall extension of up to 150 km can be implemented without the need to take signal propagation times into account.
- Unlimited expansion of the network by connecting individual collision domains/subnets (beyond 150 km, the signal propagation times must be taken into account)
- Easy, reaction-free extension of existing networks is possible

Industrial Ethernet

Reliable networks thanks to redundancy

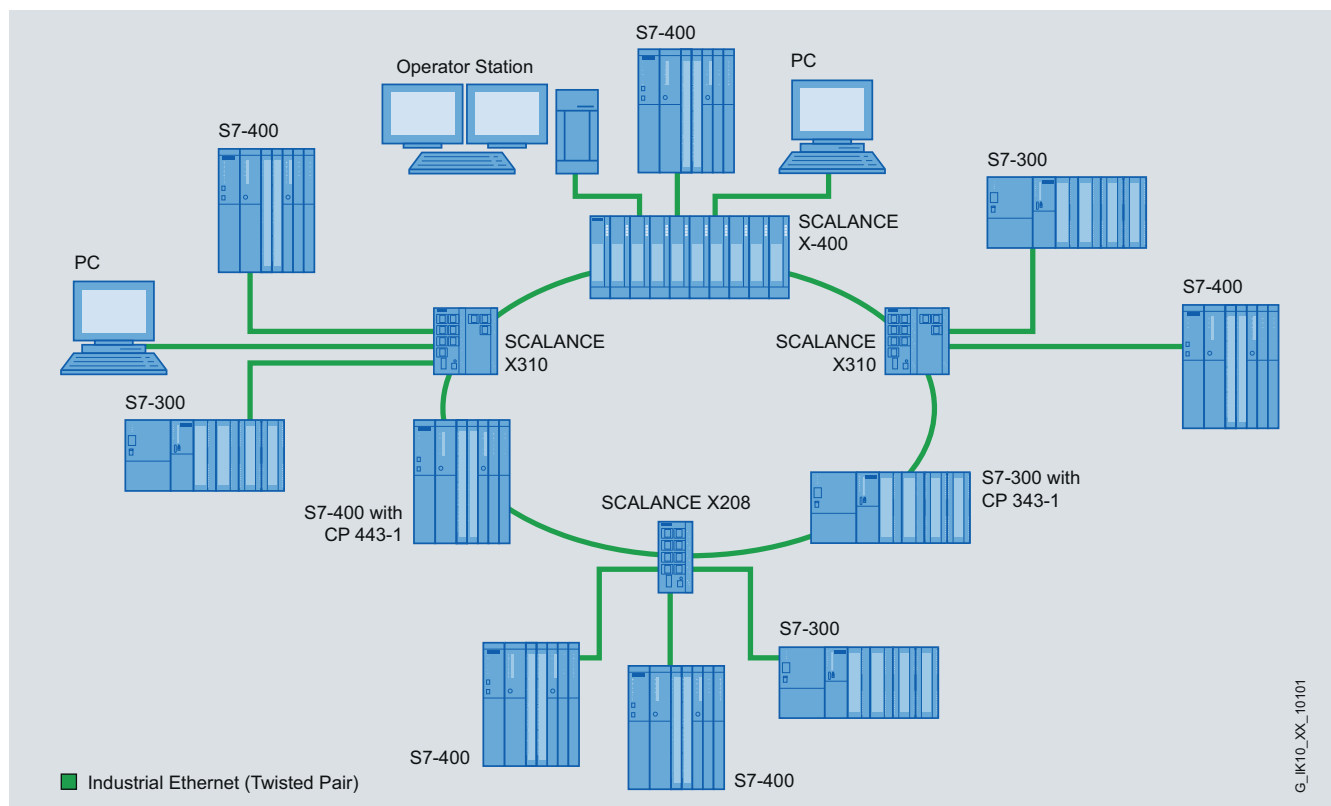
Fast redundancy

Extremely fast reconfiguration of the network in a ring following an error is indispensable for industrial applications, because the connected data terminals will otherwise disconnect logical communication links. This would result in a process running out of control or emergency shutdown of the plant.

In order to achieve the very fast reaction times required, various standardized procedures are used. The reconfiguration time in the network plays a crucial role here in avoiding breaks in connection and the associated plant standstills.

In the event of a fault (cable break or failure of a switch), the communication path is switched over bumplessly (e.g. PRP, MRPD) or with switchover times of a few milliseconds (e.g. MRP, max. 200 ms) depending on the redundancy procedure used. The connected data terminals remain unaffected by the changes in the network, and no logical connections are cleared down. Control over the process or application is assured at all times.

In addition to implementing high-speed media redundancy in the ring, SIMATIC NET switches also offer the functions required for high-speed redundant coupling of rings or network segments. Network segments in rings or any other topology can be coupled over two switches. (Standby redundancy)



Configuration with high-speed redundancy in the electrical ring

Media Redundancy Protocol (MRP)

Higher plant availability can be achieved by means of a redundant installation (ring topology).

The media redundancy can be created on the one hand by means of switches, and on the other hand direct via the PROFINET interfaces on SIMATIC controllers and distributed inputs/outputs.

Thanks to the MRP protocol (IEC 61158 Type 10), reconfiguration times of less than 200 ms can be achieved, depending on the number of stations.

If the ring is interrupted at one point, immediate reconfiguration takes place and all communication nodes continue to be accessible.

Redundancy with the standard Spanning Tree algorithm

The Spanning Tree algorithm is described in the IEEE 802.1d standard; it organizes any number of meshed Ethernet structures comprising bridges and switches.

To prevent data packages circulating in the network, in the case of closed meshes different connections are switched to standby so that an open tree structure results from the meshed structure.

The switches communicate for this purpose using the Spanning Tree protocol. This protocol is extremely complex because it has to handle any type of network structure.

The organization of network structures with the Spanning Tree protocol can take from 30 to 60 seconds. During this period, productive communication for reliable visualization or process control in the network is not possible.

In the time-optimized variant "Rapid Spanning Tree" according to IEEE 802.1, the time is shortened to a few seconds for up to 10 series-connected switches. For connecting to office networks, some SCALANCE X switches, e.g. SCALANCE X-300, support the Rapid Spanning Tree Protocol.

Optical cabling with POF/PCF or glass fiber-optic cable

Fiber-optic cables are always recommended as an alternative to copper cables in environments subject to strong electromagnetic interference (EMI), if reliable equipotential bonding cannot be guaranteed, if the system is in the open air, or if EMI is not desirable.

Glass fiber-optic cables are used to establish optical network topologies covering long distances, while for shorter distances, plastic fiber-optic cable made of light-conducting plastics like polymer optical fiber (POF), or plastic covered glass fibers such as polymer cladded fiber (PCF), are used. Simple fiber-optic cabling for machine-level use is implemented with the SC RJ connection system for POF and PCF.

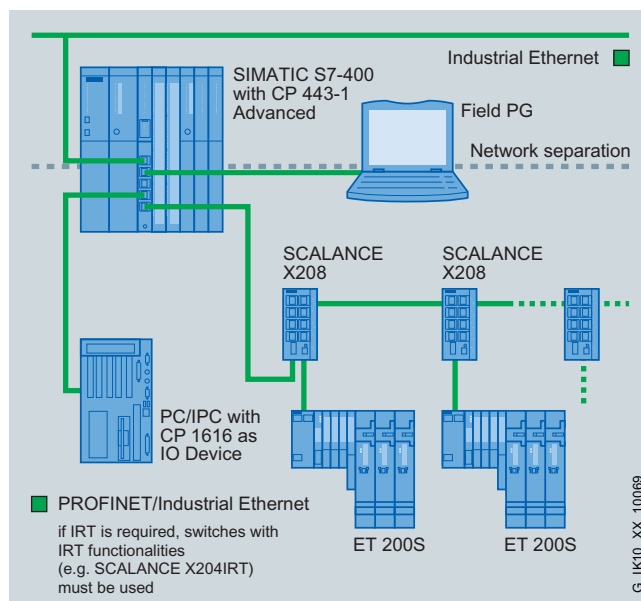
The SC RJ connectors can be assembled particularly quickly and easily on-site. The plastic fiber-optic cables designed for this purpose can be used universally or specifically in festoon cable systems.

For optical PROFINET networking, products with POF or PCF connection are used, e.g. the Industrial Ethernet Switch SCALANCE X200-4P IRT, ET 200S distributed I/O or the SCALANCE X101-1POF media converter.

Network separation between corporate levels

The subdivision of the overall corporate network into different network levels is referred to as network separation. Reasons for network separation are deliberate load decoupling or different responsibilities within an enterprise (e.g. office and production network).

To nevertheless enable company-wide communication, either SCALANCE X-400/SCALANCE X-500 with layer 3 functionality or CP 343-1 Advanced or CP 443-1 Advanced communications processors with IP routing functionality can be used at the interfaces between the individual levels. A configurable IP access list ensures additional network security at the transition points between the network levels.



CP 443-1 Advanced – connection to higher-level network

SCALANCE X Industrial Ethernet switches

Overview

Industrial Ethernet switching components comprise:

- Compact Switch Modules (CSMs)
- SCALANCE X Industrial Ethernet switches
- Communications processors (CP) with integral switch

Compact Switch Modules (CSMs)

Unmanaged switches for use directly on the SIMATIC or LOGO! for interface expansion and integration of machines into existing plant networks.

SCALANCE X-000/XB-000 unmanaged

Unmanaged switches with electrical and optical ports for establishing small networks for machine and process cells with 10/100/1000 Mbit/s.

SCALANCE X-100 unmanaged

Switches with electrical and/or optical ports, redundant power supply, and signaling contact for use in machine-level applications (also available as media converters with two ports for converting between different media).

SCALANCE X-200 managed

Universally applicable, from machine-level applications to networked plant sections. Configuration and remote diagnostics are integrated in the STEP 7 engineering tool. This increases the level of plant availability. Devices with a high degree of protection permit a cabinet-free construction.

Appropriate switches (SCALANCE X-200IRT) are also available for use in subsystem networks requiring strict real-time and maximum availability.

SCALANCE XF-200 managed

SCALANCE XF-200 Industrial Ethernet switches have the same functions as SCALANCE X-200 switches. Their type of construction in the slim design of the ET 200S distributed I/O (degree of protection IP20) makes them ideal for space-saving use in small control boxes.

SCALANCE X-300 managed

Networking of subsystems/plant areas, as well as interfacing to the enterprise network. The SCALANCE X-300 managed product line combines the firmware functionality of the SCALANCE X-400 line with the compact design of the SCALANCE X-200 line. As a result, SCALANCE X-300 switches feature expanded management functions and enhanced firmware functionality compared to SCALANCE X-200 switches. Electrical and optical Gigabit Ethernet ports are also available.

SCALANCE XR-300 managed

The SCALANCE XR-300 Industrial Ethernet switches correspond functionally to the SCALANCE X-300 switches. As rack switches, they are especially suited for use in 19" control cabinets. They are also fully modular, and due to their 2-port media modules (electrical and optical) they can be adapted to the respective task.

For use in power plants and under difficult environmental conditions, ECC (Enhanced Environmental Conditions) versions may be used in compact and rack designs.

SCALANCE X-400 managed (layer 3)

For use in high-performance plant networks (e.g. with high-speed redundancy). Due to the modular structure, the switches can be adapted to the task in question. Due to the support of IT standards (e.g. VLAN, IGMP, RSTP), seamless integration of automation networks into existing office networks is possible. Routing functions on layer 3 permit communication between different IP subnets.

SCALANCE X-500 managed (layer 3)

For networking and structuring high-performance industrial networks and for connecting office networks to automation networks. As a layer 3 switch, SCALANCE X-500 can be used as a central component in backbone networks, e.g. when a high number of slots is required, at extremely high transmission rates (10 Gigabit Ethernet), or for redundant connection to an office infrastructure.

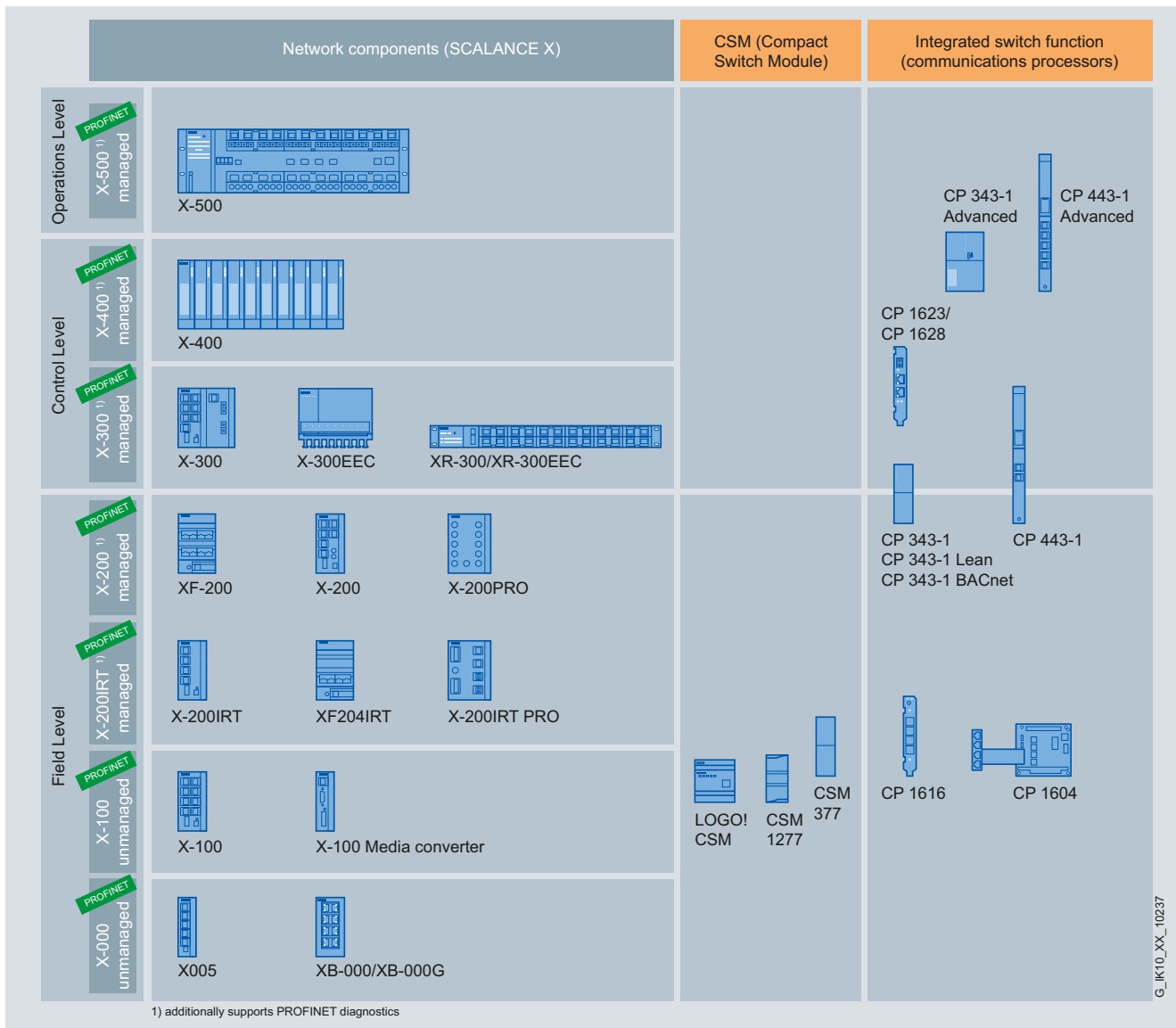
The rack switch (19" design) can be used flexibly to suit requirements thanks to its modular design and the plug-in 4-port media modules (electrical and optical). Routing functions on layer 3 permit communication between different IP subnetworks.

Communications processors for SIMATIC with integral switch

Managed switches for adding Industrial Ethernet/PROFINET interfaces to the SIMATIC and for integrating the controllers into existing line or ring topologies. Thanks to integral Layer 3 functionality, the Advanced-CPs can also be used as routers between IP subnets.

Communications processors for PCs with integral switch

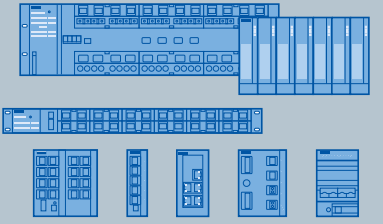

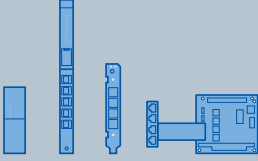
Managed switches for adding Industrial Ethernet/PROFINET interfaces to industrial PCs and for integrating PCs into existing line topologies.



Overview of SCALANCE X Industrial Ethernet switches and components with switch functionality

SCALANCE X Industrial Ethernet switches

Overview

Network component	CSM	Integral switch function
		
<ul style="list-style-type: none"> • Basis for integrated networking in industrial automation - from the field to the management level • Network components optimized for various applications: <ul style="list-style-type: none"> - Small and large-scale networks - Management functions for network structuring - Connection to IT networks - Configuring of redundant networks - Use with PROFINET and Industrial Ethernet • Robust housing for harsh environments • Graded diagnostics concept 	<ul style="list-style-type: none"> • Configuration of small networks • Easy expansion of the number of ports for: <ul style="list-style-type: none"> - Connection of local HMI systems - Connection to higher-level networks • Space-saving design of SIMATIC • Unmanaged Switch with local diagnostics 	<ul style="list-style-type: none"> • Communications processor for interfacing with PROFINET/Industrial Ethernet including integral switch for: <ul style="list-style-type: none"> - For interfacing with distributed I/O. - Connection to higher-level networks - IP routing - Service/maintenance • SIMATIC or PC module design • Functions for network diagnostics

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Criteria for selecting Industrial Ethernet switching components

		Application areas / type of network / requirements	Office incorporation	Plant networking	Industry-related applications	Energy generation and distribution	Wind energy plants	Machine building and plant engineering	Plant subnetworking	High-volume machine building	Internal machine networking	Network setup using SIMATIC S7	PC-based applications
X-500		High-performance backbone networks with very high emphasis on functionality / port density / availability and interface to IT network	•	•	•								
X-400		High-performance plant network with high emphasis on functionality and availability	•	•	•								
X-300	X-300EEC/ XR-300EEC	Large networks with high emphasis on functionality and availability		•		•	•						
X-200		Networks with higher emphasis on functionality and availability						•	•				
X-100		Networks with low emphasis on functionality						•		•			
X-000		Networks with low emphasis on functionality and robustness								•	•		
CSM		Very small networks or interface expansion for SIMATIC S7										•	
CPs		Very small networks through integrated switch in CP										•	•

• applies

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SCALANCE X Industrial Ethernet switches: Areas of application

Features		Modular through media modules	19" design	Support of Gigabit Ethernet	Additional interface for SIMATIC S7	Power-over-Ethernet	Can be used under Enhanced Environmental Conditions (EEC)	Isochronous Real-Time (IRT)	Layer 3	Office features (VLAN)	Diagnosis	PROFINET IO Device	Time synchronization according to IEEE 1588
X-500		•	•	•		•			•	•	•	•	
X-400		•		•					•	•	•	•	
X-300		•	•	•		•				•	•	•	
	X-300EEC/ XR-300EEC	•	•	•			•				•	•	•
X-200		•						• ²⁾			•	•	
X-100						•							
X-000				• ¹⁾									
CSM					•								
CPs					•				•		•		

• applies

1) with Gigabit version

2) with IRT version

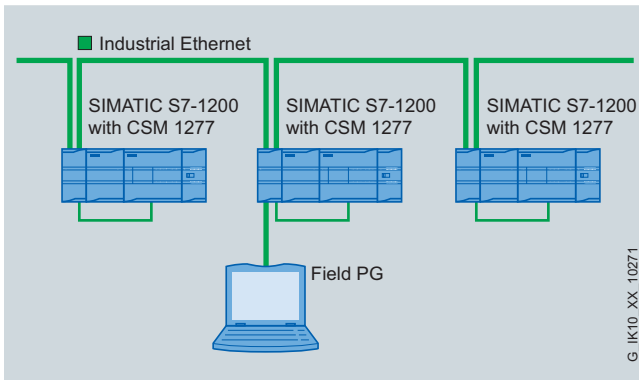
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SCALANCE X Industrial Ethernet switches: Function overview

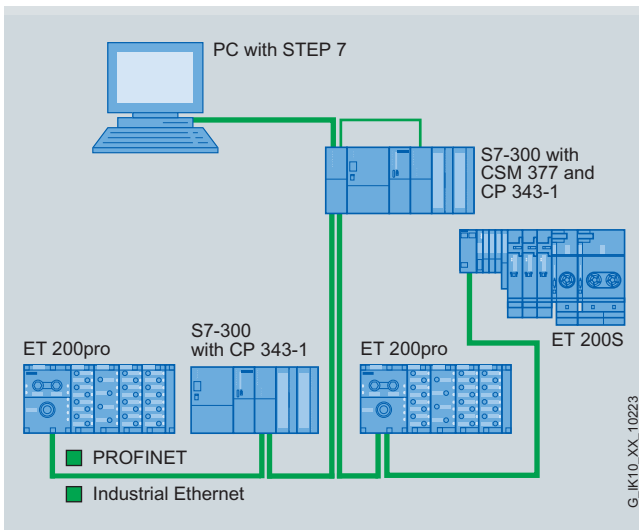
SCALANCE X Industrial Ethernet switches

Compact Switch Modules LOGO! CSM, CSM 1277 and CSM 377

The Compact Switch Modules LOGO! CSM, CSM 1277 and CSM 377 are unmanaged switches for simple and rapid connection of a LOGO!, SIMATIC S7-1200, S7-300, or ET 200M to an electrical Industrial Ethernet network. The low-cost switches are thus suitable for the integration of small machines into existing automation networks, for stand-alone operation of machines, or to set up small, local Ethernet networks.



Connection of SIMATIC S7-1200 with CSM 1277 to Industrial Ethernet with line topology



Connection of SIMATIC S7-300 with CSM 377 to Industrial Ethernet with linear structure

Properties at a glance

LOGO! CSM unmanaged

- Multiplication of the Ethernet interfaces of a LOGO! logic module. One port is on the front for easy diagnostics access
- Two versions for the voltage ranges 12/24 V DC or 230 V AC/DC
- Low-cost solution for implementing small, local Ethernet networks

CSM 1277 unmanaged

- Saving on installation costs and installation space compared to the use of an external network component
- Multiplication of the Ethernet interfaces on a SIMATIC S7-1200 for additional connection of programming devices, operator controls, and other Ethernet nodes
- Lowest-cost solution for implementing small, local Ethernet networks with a SIMATIC S7-1200

CSM 377 unmanaged

- Integration into SIMATIC S7-300 and ET200 M for implementing small, local Ethernet networks
- Diagnostics on the device by means of LEDs (power, link status, data communication)
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug



SCALANCE X-000 unmanaged

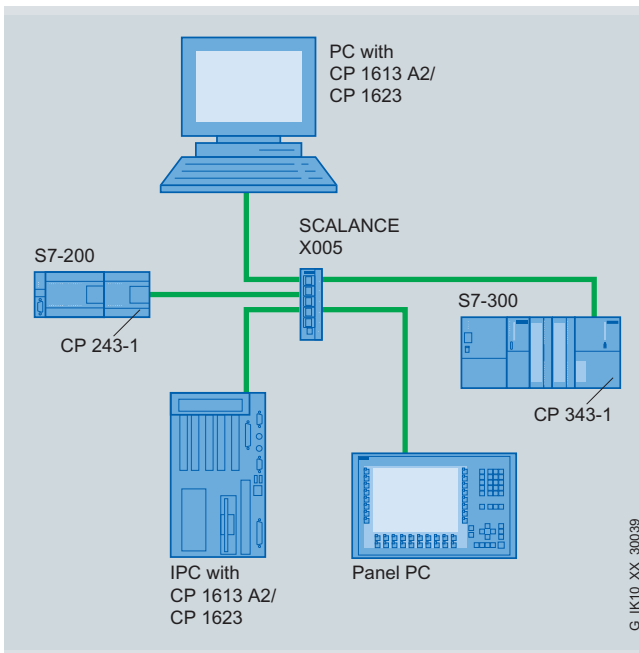
The Industrial Ethernet switch SCALANCE X005 is an unmanaged switch with five RJ45 ports, 10/100 Mbit/s. The product is a low-cost solution for establishing small star or line topologies with switching functionality in machines islands or process cells. SCALANCE X005 has a rugged metal housing (IP30) for space-saving installation in the control cabinet, on standard rails or S7-300 rails, or for direct wall mounting.

The following versions are available:

- SCALANCE X005 with five electrical ports (RJ45)
- SCALANCE X005TS (Transportation Systems) with five electrical ports (RJ45); suitable for use in railroad and traffic applications with extended temperature range in accordance with EN 50155 and e1/E1

Properties at a glance

- Diagnostics on the device by means of LEDs (power, link status, data communication)
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Use in railway and traffic applications



SCALANCE X Industrial Ethernet switches

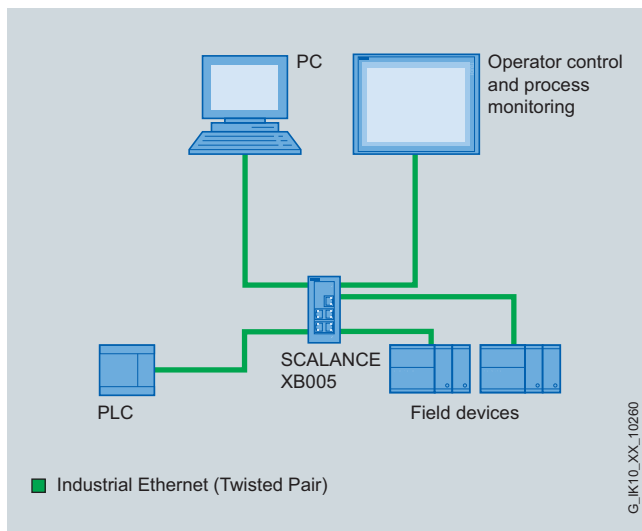
SCALANCE XB-000 unmanaged

The SCALANCE XB-000 Industrial Ethernet switches are compact, unmanaged switches with up to eight ports that enable low-cost establishment of Industrial Ethernet line and star topologies. They have a rugged plastic enclosure (IP20) and save space when installed on standard mounting rails in the control cabinet or control box. The SCALANCE XB-000 switches are available in electrical and electrical/optical versions:

- SCALANCE XB005 with five electrical ports
- SCALANCE XB008 with eight electrical ports
- SCALANCE XB004-1/XB004-1LD with four electrical and one optical port (SC)

For Gigabit cabling (10/100/1000 Mbit/s), the following versions are available:

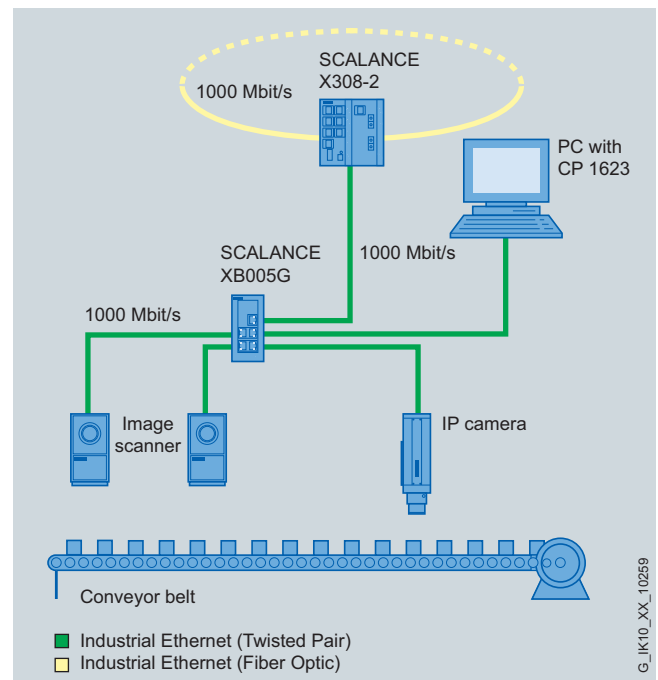
- SCALANCE XB005G with five electrical ports
- SCALANCE XB008G with eight electrical ports
- SCALANCE XB004-1G/XB004-1LDG with four electrical ports and one multimode glass FOC port (SC)



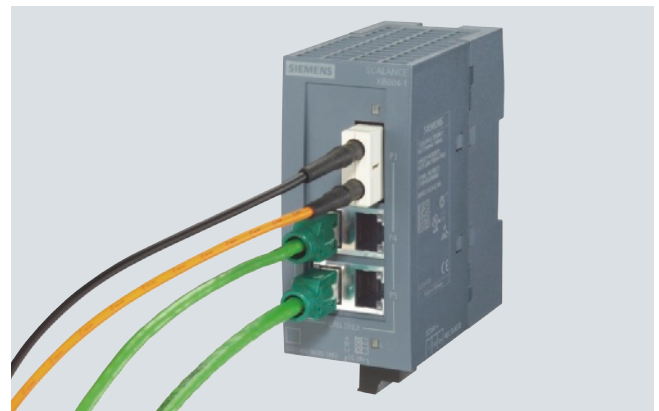
Star topology with SCALANCE XB005

Properties at a glance

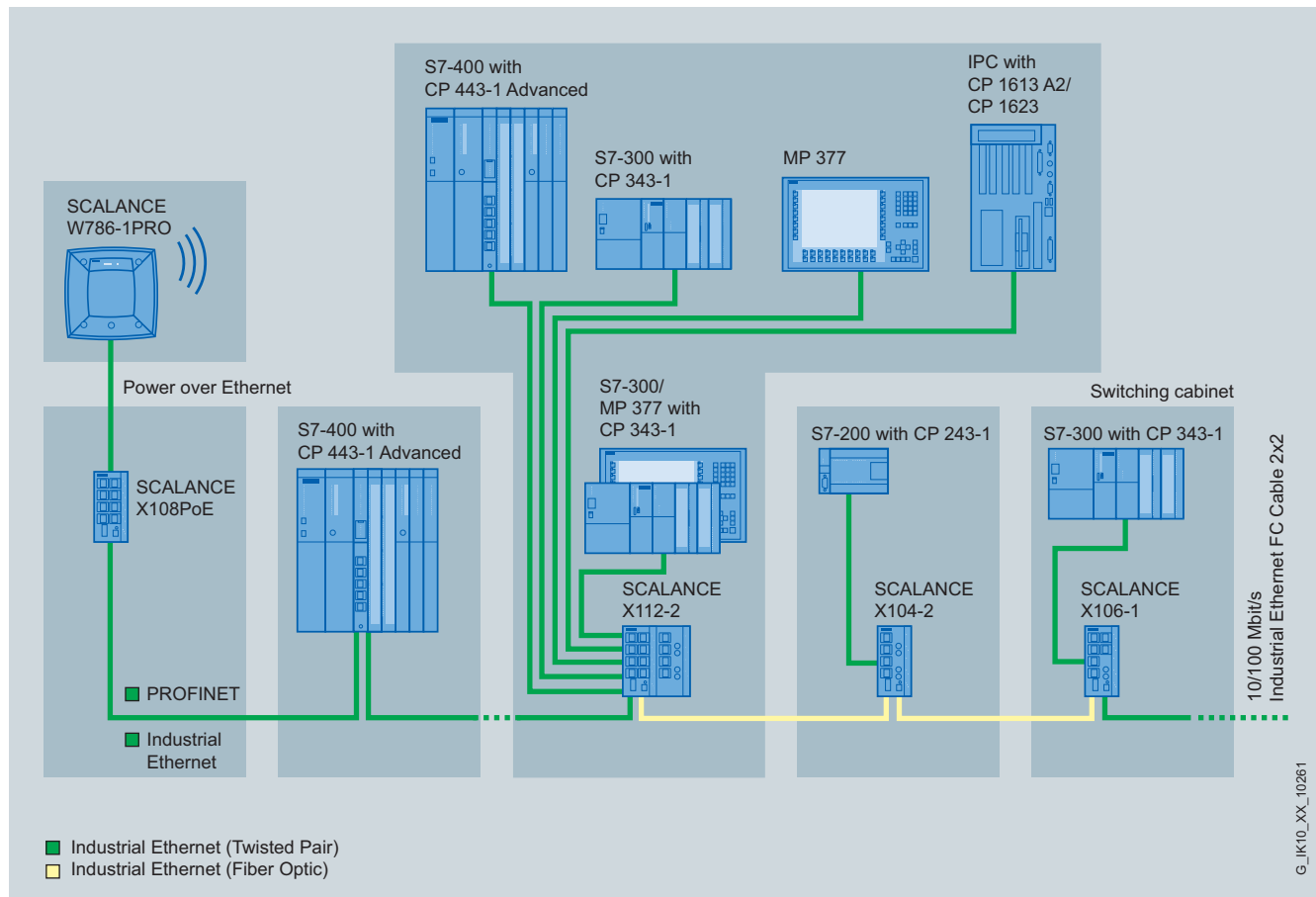
- Diagnostics on the device by means of LEDs (power, link status, data communication)
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function



Electrical and optical subnet with SCALANCE XB005G and SCALANCE X308-2



SCALANCE X-100 unmanaged



Electrical and optical line topology with SCALANCE X-100 and Power-over-Ethernet

The unmanaged switches of the SCALANCE X-100 product range with up to 24 ports are very suitable for setting up line and star structures (10/100 Mbit/s) and perfect for the on-site diagnosis in machine-level applications.

They are suitable for industry and save room in the control cabinet with their compact housing.

The SCALANCE X-100 switches are available in electrical and electrical/optical versions:

- SCALANCE X108/X108PoE with eight electrical ports
- SCALANCE X116 with 16 electrical ports
- SCALANCE X124 with 24 electrical ports
- SCALANCE X104-2 with four electrical and two optical ports (BFOC)
- SCALANCE X106-1 with six electrical and one optical port (BFOC)
- SCALANCE X112-2 with twelve electrical and two optical ports (BFOC)

Properties at a glance

- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- Redundant power supply
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Power supply of up to two Power-over-Ethernet-enabled terminals via four-core data line (SCALANCE X108PoE only)

SCALANCE X Industrial Ethernet switches

SCALANCE X-100 media converter

Media converter for converting electrical signals to optical signals and for connecting existing networks, e.g. AUI networks. The SCALANCE X101-1POF media converter is ideally suitable for integrating devices with POF interfaces into existing network structures.

The unmanaged Industrial Ethernet media converters of the SCALANCE X-100 product line are ideally suited to the conversion of different transmission media in Industrial Ethernet networks at 10/100 Mbit/s in line, star and ring topologies. They are suitable for industry and save room in the control cabinet with their compact housing.

Die SCALANCE X-100 media converters are available in the following versions depending on whether ports are electrical or optical, and they are used to connect existing 10 Mbit/s fiberoptic networks or existing 10Base5 networks (e.g. SINEC H1):

- SCALANCE X101-1 with one electrical 10/100 Mbit/s RJ45 port and one 100 Mbit/s multimode interface (BFOC connection system)
- SCALANCE X101-1LD with one electrical 10/100 Mbit/s RJ45 port and one 100 Mbit/s singlemode interface (BFOC connection system)
- SCALANCE X101-1POF with one 100 Mbit/s plastic optical fiber (POF) interface (SC RJ connection system)
- SCALANCE X101-1AUI with one 10 Mbit/s AUI interface (SUB-D connection system)
- SCALANCE X101-1FL with one 10 Mbit/s multimode interface (BFOC connection system)



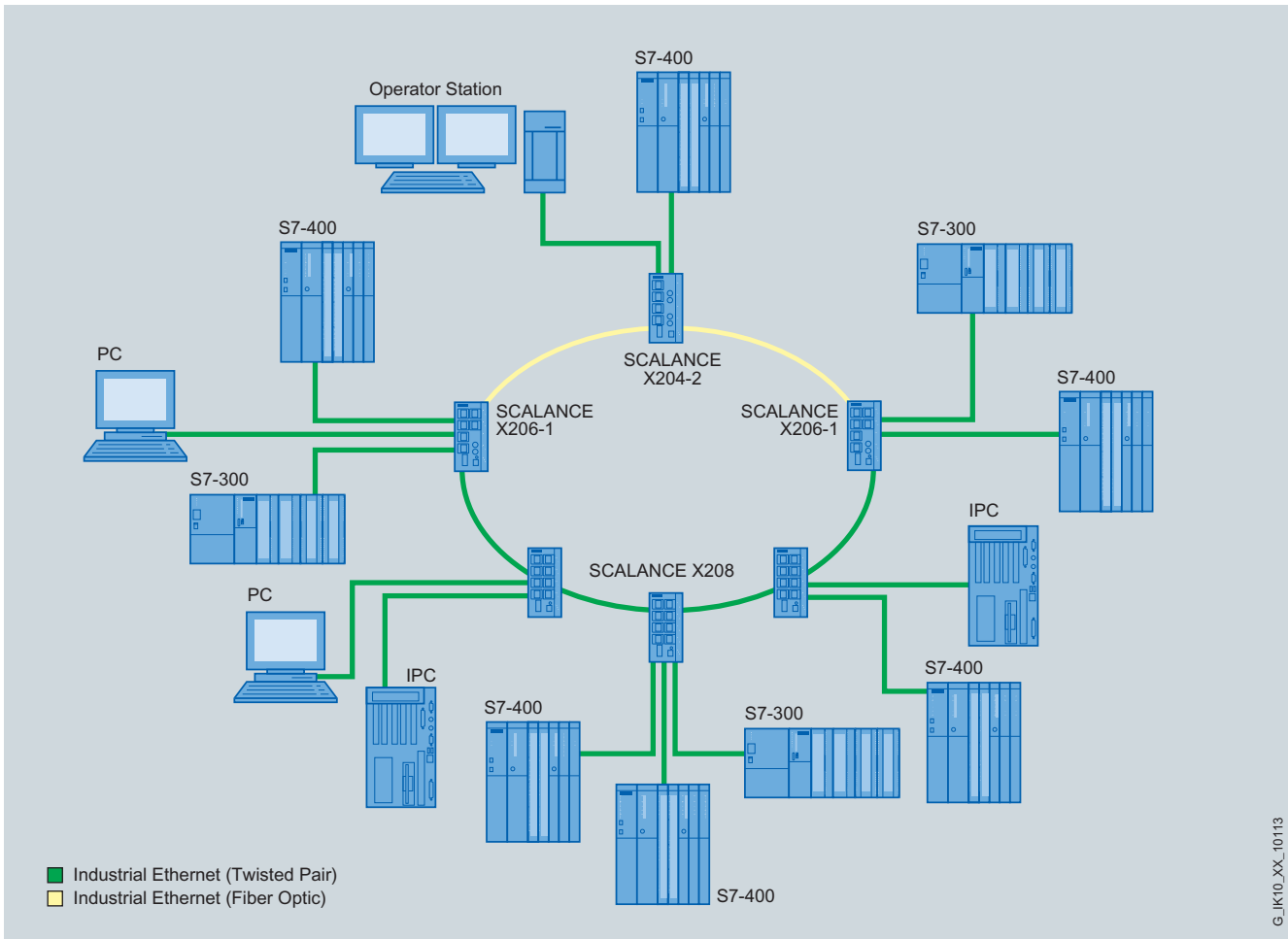
Properties at a glance

- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- RJ45 sockets with a sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Redundant power supply

	Type and number of ports						Characteristics							
	Twisted Pair	Fiber Optic				10 / 100 Mbit/s	AUI	Compact enclosure	LED diagnostics	SIMATIC environment	2 x 24 V DC	Signaling contact	On-site display (SET button)	Ring redundancy without RM
	RJ45	Fast Ethernet		10 Mbit/s										
		POF / PCF	Multimode BFOC	Singlemode BFOC	Multimode BFOC									
SCALANCE X101-1	1		1				•	•	•	•	•	•	•	
SCALANCE X101-1LD	1			1			•	•	•	•	•	•	•	
SCALANCE X101-1POF	1	1					•	•	•	•	•	•	•	
SCALANCE X101-1AUI	1				1		•	•	•	•	•	•	•	
SCALANCE X101-1FL	1					1	•	•	•	•	•	•	•	

Function overview of Industrial Ethernet media converters

SCALANCE X-200 managed



High speed redundancy in the ring with electrical and optical paths

The managed switches of the SCALANCE X-200 product range are very well suited for the setup of line, star, and ring structures (10/100 Mbit/s).

Redundant ring topologies can be established via the SCALANCE X-200 switches.

On the failure of a transmission link or a SCALANCE X-200 switch in the ring, the transmission path is reconfigured within 200 ms.

With the C-PLUG swap medium, devices can be exchanged without a programming device; the configuration or application data are secured on the C-PLUG and can be implemented in another SCALANCE X-200 switch without special know-how.

Based on PROFINET, the switches of the SCALANCE X-200 product line can be easily integrated into the process and system diagnostics.

The SCALANCE X-200 switches are available in electrical and electrical/optical versions:

- SCALANCE X208 with eight electrical ports
- SCALANCE X204-2/X204-2LD with four electrical and two optical ports (BFOC)
- SCALANCE X206-1/X206-1LD with six electrical and one optical port (BFOC)
- SCALANCE X212-2/X212-2LD with 12 electrical and two optical ports (BFOC)
- SCALANCE X216 with 16 electrical ports
- SCALANCE X224 with 24 electrical ports

SCALANCE X Industrial Ethernet switches

SCALANCE X-200 managed/SCALANCE XF-200 managed

SCALANCE XF-200 managed

The SCALANCE XF-200 switches have an extra-flat design. These industry-standard units with IP20 degree of protection and special port arrangement with angled cable outlet allows easy installation of the switches in the control cabinet or control box. In addition, they offer an integrated redundancy manager function, which allows the network to be reestablished within milliseconds following an error.

The SCALANCE XF-200 switches are available in electrical and electrical/optical versions:

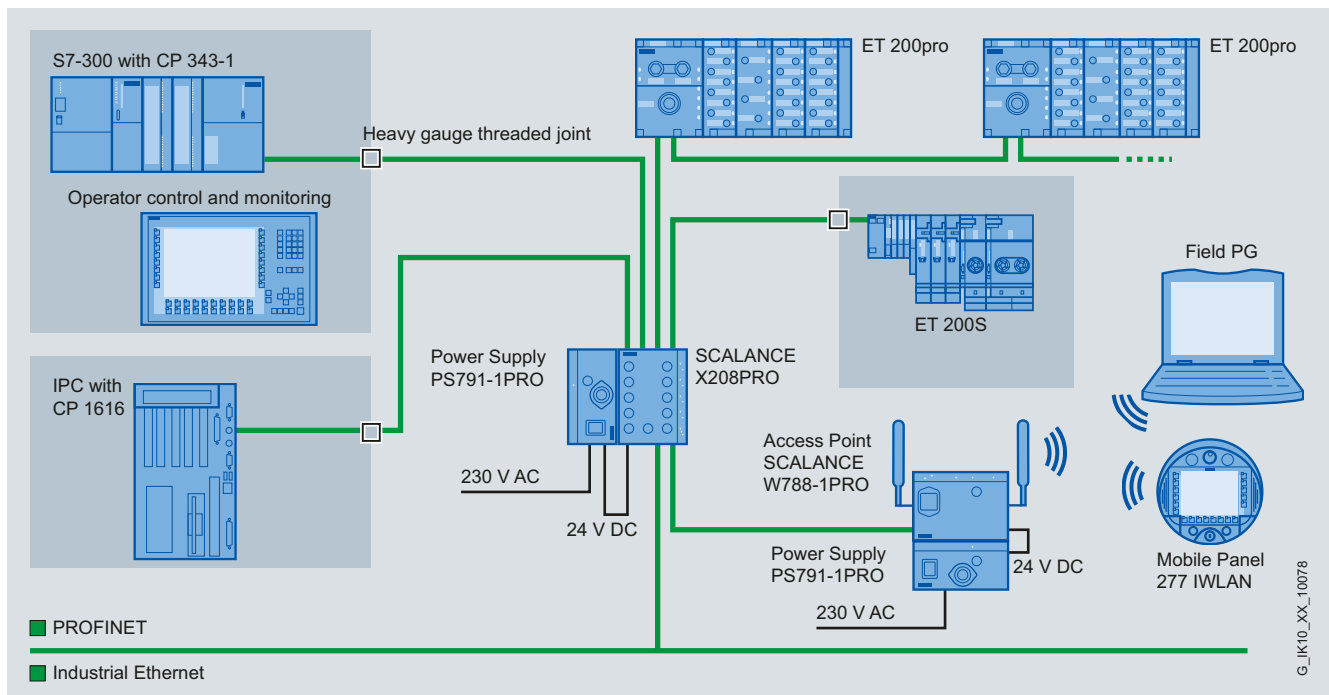
- SCALANCE XF204 with four electrical ports
- SCALANCE XF208 with eight electrical ports
- SCALANCE XF204-2 with four electrical and two optical ports (BFOC)
- SCALANCE XF206-1 with six electrical ports and one optical port (BFOC)

SCALANCE X-200PRO managed



Thanks to its rugged design, the SCALANCE X-200PRO Industrial Ethernet switch with IP65 degree of protection allows the setup of a star network topology outside the control cabinet. If needed, the network can be powered by 24 V DC, or with 230 V AC using the PS791-1PRO power supply.

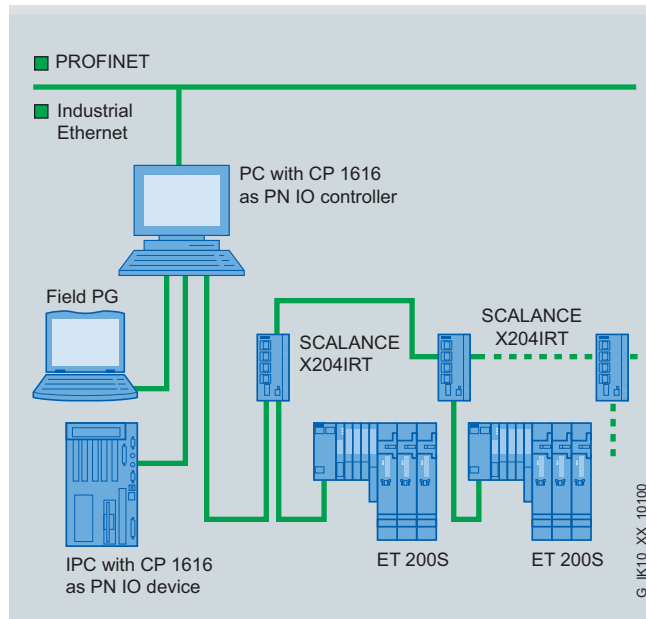
- SCALANCE X208PRO with eight electrical ports



Configuration for cabinet-free setup with SCALANCE X208PRO with IP65 degree of protection

SCALANCE X-200IRT managed/SCALANCE XF-200IRT managed

SCALANCE X-200IRT managed



Configuration example for SCALANCE X204IRT

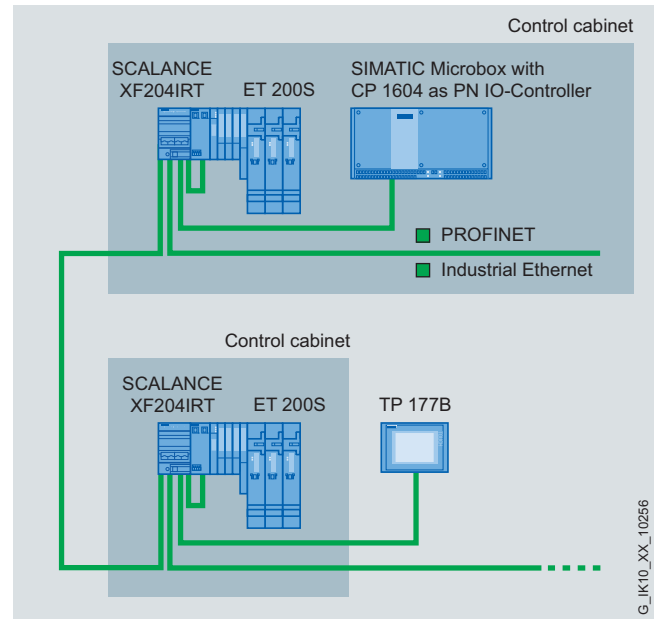
With the versions SCALANCE X-200IRT, real time and isochronous real time networks can be set up. As a result, one network is available for hard real-time and standard data transmission (TCP/IP), preventing the need for a double infrastructure.

Redundant ring structures can be set up and two sub-networks, e.g. rings, can be connected redundantly via the SCALANCE X-200IRT switches (standby function).

On the failure of a transmission link or a SCALANCE X-200 switch in the ring, the transmission path is reconfigured within 200 ms.

The SCALANCE X-200IRT switches are available as electrical and electrical/optical versions with degrees of protection IP30 and IP65:

- SCALANCE X204IRT/X204IRT PRO with four electrical ports
- SCALANCE X201-3P IRT/X201-3P IRT PRO with one electrical port and three optical ports (POF/PCF)
- SCALANCE X200-4P IRT with four optical ports (POF/PCF)
- SCALANCE X202-2IRT/X202-2P IRT/X202-2P IRT PRO with two electrical and two optical ports (BFOC or POF/PCF)



Use of SCALANCE XF-200/XF-200IRT in slim control boxes

SCALANCE XF-200IRT managed

Thanks to the advantages of its slim design, the SCALANCE XF-204IRT switch allows the setup of real-time and isochronous real-time networks. As a result, one network is available for hard real-time and standard data transmission (TCP/IP), preventing the need for a double infrastructure.

Redundant ring structures can be set up and two subnets, e.g. rings, can be connected redundantly (standby function).

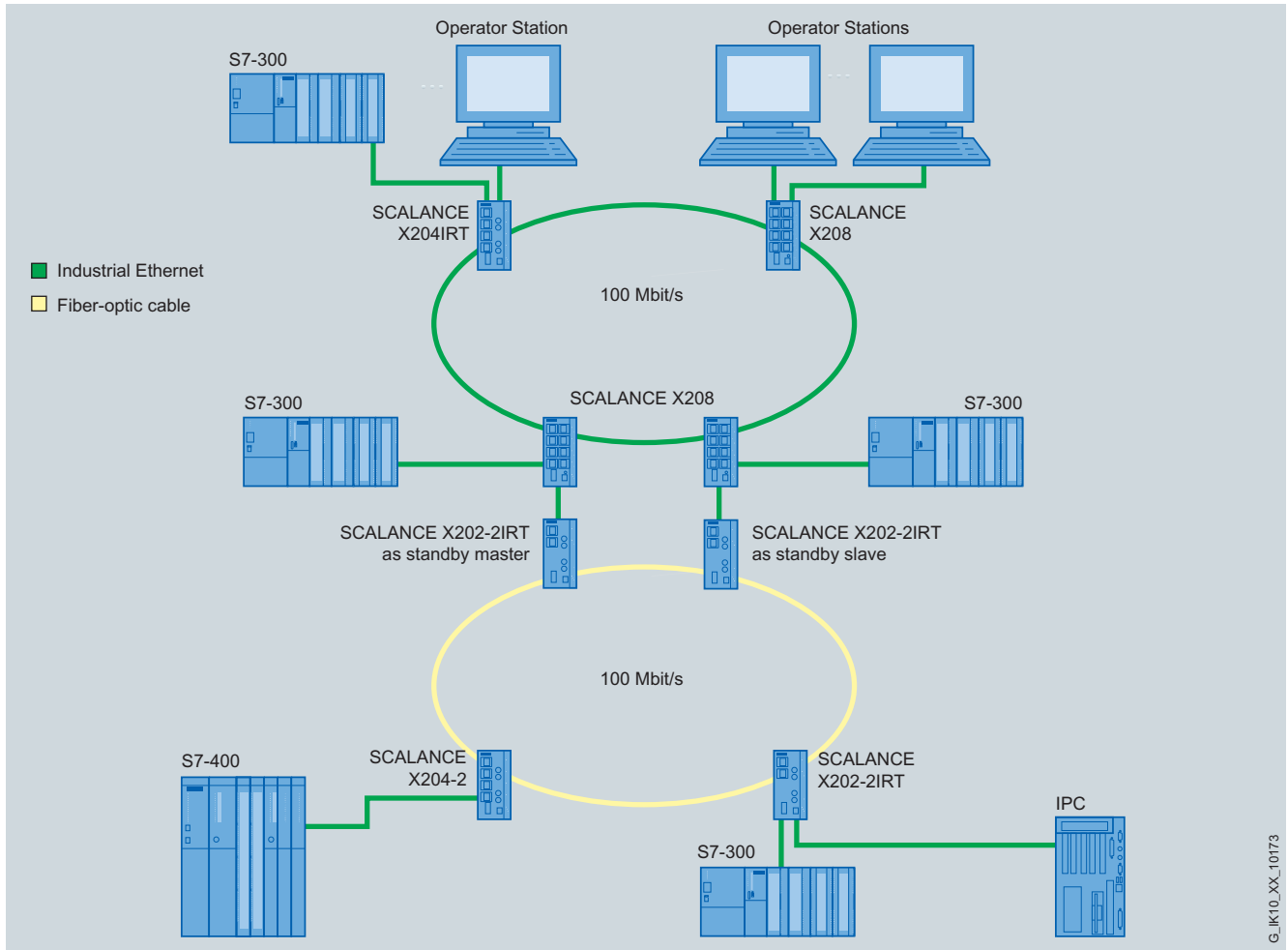
Fast Start-Up

In modern manufacturing applications, the installed robots use different tools depending on the task. For this, a fast power-up of the components on the robot tools is necessary. The power-up behavior (link building, data forwarding) of PROFINET network components and I/O devices has been optimized with the new Fast Start-Up (FSU) functionality. Depending on the peripheral devices used, the start-up can occur within 500 ms after power is applied and the components are included in the data exchange.

The demand for very short cycle times in production is met not only by PROFINET IO controllers and I/O devices, but also by SCALANCE X switches with integrated ERTEC and IRT functionality.

SCALANCE X Industrial Ethernet switches

SCALANCE X-200 managed/SCALANCE XF-200 managed

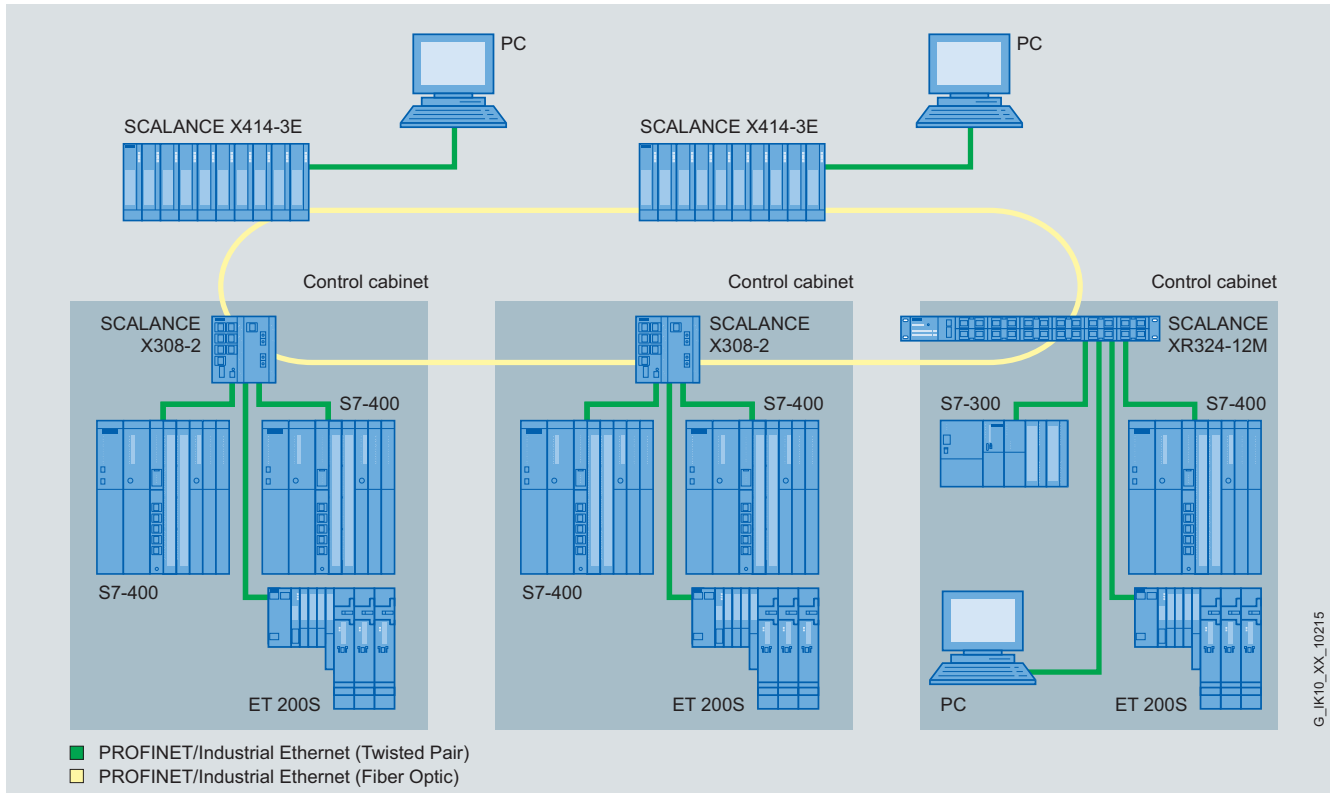


Redundant coupling of two subnets with SCALANCE X-200IRT

Properties at a glance

- Fast Start-Up for optimized start-up behavior (link building, data forwarding) of PROFINET network components and I/O devices
- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- Redundant power supply
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Integrated redundancy manager for constructing Fast Ethernet ring topologies with high-speed media redundancy.
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Remote diagnosis is performed by means of SNMP, web browser and PROFINET IO diagnostics
- Integrated configuration and diagnostics in STEP 7
- Integration of the switches in existing network management infrastructure by means of SNMP access
- Automatic e-mail sending function
- C-PLUG swap medium for rapid replacement of devices

SCALANCE X-300 managed



Integration of control cabinets with SCALANCE X-300 in an optical Gigabit ring

The compact Gigabit switches of the SCALANCE X-300 product range are Industrial Ethernet switches for setting up line, star, and ring topologies (10/100/1000 Mbit/s) for high-performance networks. They enable the construction of optical and/or electrical networks with high network availability, since, for example, they enable ring redundancy in combination with a redundancy manager function and have a redundant power supply.

With the C-PLUG swap medium, devices can be exchanged without programming device; the configuration or application data are secured on the C-PLUG and can be implemented in another SCALANCE X-300 switch without special expertise.

The gigabit ports are typically used for connecting the switches to each other and for a possible connection to higher network levels.

The following network topologies and combinations of topologies are possible:

- Fast Ethernet and Gigabit Ethernet rings with fast media redundancy. To protect against failure of a transmission link or a switch, as many as 50 SCALANCE X-300 switches cascaded in line can be connected into a ring. On the failure of a transmission link or a SCALANCE X-300 switch in the ring, the transmission path is reconfigured within 200 ms.
- Redundant connection of the ring topology to the corporate network using Rapid Spanning Tree Protocol (RSTP)
- Redundant linking of subnets, e.g. ring topologies (standby redundancy)
- Star topology with SCALANCE X-300 switches: Each SCALANCE X-300 switch represents a star point which can interconnect nodes or subnets electrically or optically.
- Problem-free connection of existing twisted-pair data terminals or existing network segments at 10/100/1000 Mbit/s
- High availability of the network thanks to
 - Redundant power supply
 - Redundant network structures based on fiber-optic or twisted pair cables

SCALANCE X Industrial Ethernet switches

SCALANCE X-300 managed

Switches with Fast Ethernet and Gigabit Ethernet ports

SCALANCE X310

- Three Gigabit ports
- Seven Fast Ethernet ports

SCALANCE X308-2

- Two optical Gigabit ports (SC multimode, up to 750 m)
- One electrical Gigabit port (RJ45)
- Seven Fast Ethernet ports

SCALANCE X308-2LD

- Two optical Gigabit ports (SC singlemode, up to 10 km)
- One electrical Gigabit port (RJ45)
- Seven Fast Ethernet ports

SCALANCE X308-2LH

- Two optical Gigabit ports (SC singlemode, up to 40 km)
- One electrical Gigabit port (RJ45)
- Seven Fast Ethernet ports

SCALANCE X308-2LH+

- Two optical Gigabit ports (SC singlemode, up to 70 km)
- One electrical Gigabit port (RJ45)
- Seven Fast Ethernet ports

SCALANCE X307-3

- Three optical Gigabit ports (SC multimode, up to 750 m)
- Seven Fast Ethernet ports

SCALANCE X307-3LD

- Three optical Gigabit ports (SC singlemode, up to 10 km)
- Seven Fast Ethernet ports

Fast Ethernet switches

SCALANCE X310FE

- Ten electrical Fast Ethernet ports

SCALANCE X306-1LD FE

- Six electrical Fast Ethernet ports
- One optical port (SC, singlemode, up to 26 km)

SCALANCE X320-1FE

- Twenty electrical Fast Ethernet ports
- One optical port (SC, multimode, up to 5 km)

SCALANCE X320-3LD FE

- Twenty electrical Fast Ethernet ports
- Three optical ports (SC, multimode, up to 5 km)

Full Gigabit Ethernet switches

SCALANCE X308-2M

- Four electrical Gigabit ports
- Two free module slots for 4 x 10/100/1000 Mbit/s media modules (electrical or optical)

SCALANCE X308-2M TS (Transportation Systems)

- Four electrical Gigabit ports
- Two free module slots for 4 x 10/100/1000 Mbit/s media modules (electrical or optical)
- Suitable for use in railroad applications in accordance with EN 50155



SCALANCE XR-300 managed

The SCALANCE XR-300 is an industry-standard Industrial Ethernet 19" rack switch with IP20 degree of protection that features IT functions such as VLAN, IGMP Snooping/Querier, or STP/RSTP.

The main application areas for the SCALANCE XR-300 switches are high-performance plant networks with a connection to the enterprise network, as well as power distribution centers. Thanks to the compact, space-saving 19" design, the SCALANCE XR-300 can be installed in 19" control cabinets.

SCALANCE XR-300 switches permit the configuration of switched networks at the field level and control level, which not only demand high availability of the network and extensive diagnostic options, but also high transmission rates.

The use of media modules supports unlimited flexibility in expansion (e.g. more data terminals) or conversion of the network (e.g. conversion from copper to fiber-optic conductors).

SCALANCE XR324-12M (12 media modules)

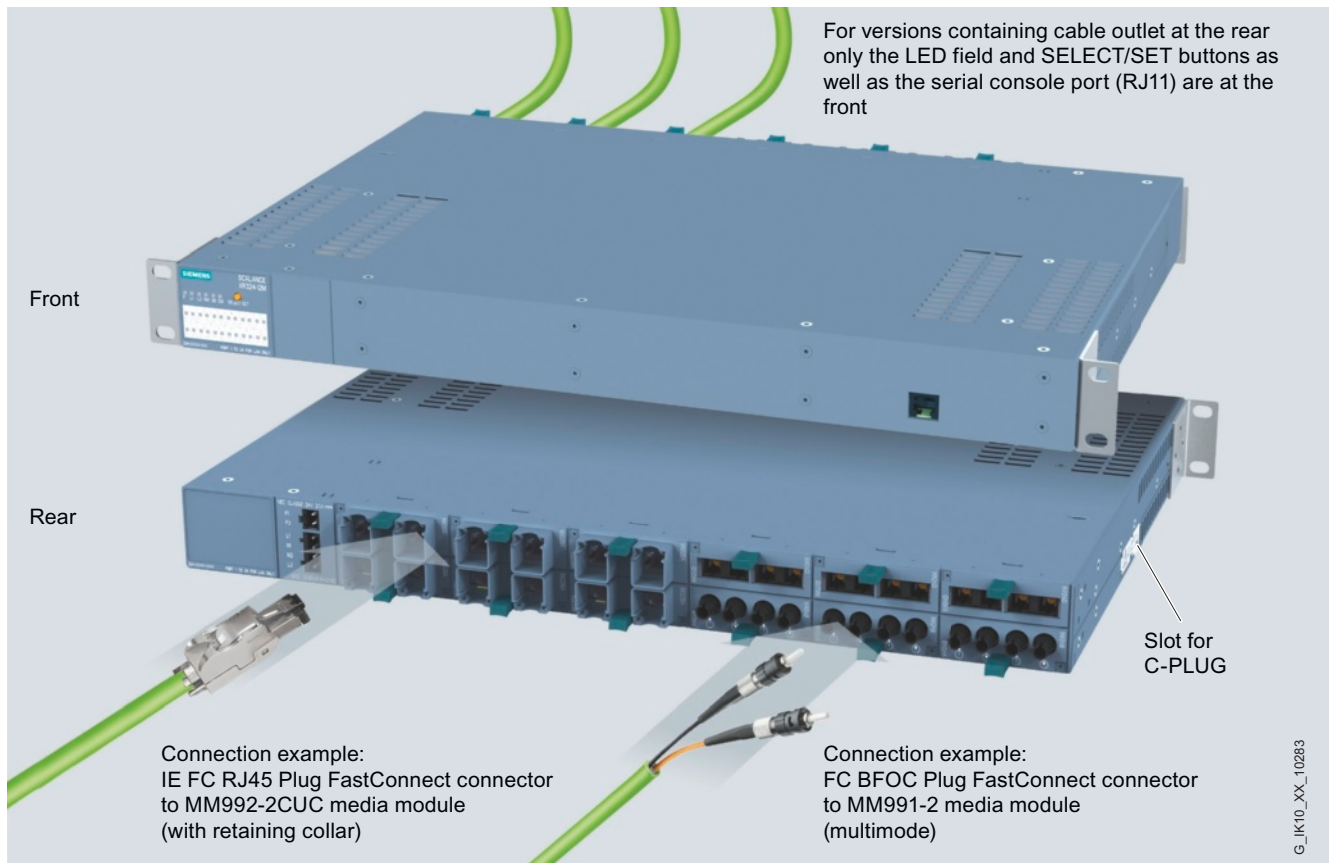
Optical Industrial Ethernet line, ring or star topologies are constructed using the SCALANCE XR324-12M switches with 24 ports, of which 12 are media module slots. The switches can be equipped with electrical and/or optical 2-port media modules.

Space is also saved in the control cabinet due to the flexible cable outlet on the front or rear of the device.

LEDs, connections for the power supply and data cable outlet are installed – depending on the device variant – on the front or rear.

The power supply is alternatively from

- 1 x 24 V DC power supply unit
- 1 x 110 to 230 V AC power supply unit



SCALANCE XR-300 with data cable outlet at rear

SCALANCE X Industrial Ethernet switches

SCALANCE X-300 managed

SCALANCE X-300PoE / XR-300PoE managed

The SCALANCE X-300PoE product line for constructing electrical and/or optical line, star and ring topologies operating at 10/100/1000 Mbit/s has the functionality of SCALANCE X-300.

SCALANCE X308-2M PoE

Compact Industrial Ethernet switch with

- Four RJ45 ports incl. Power-over-Ethernet functionality (according to IEEE 802.3at Type 1, corresponding to IEEE 802.3af) for the supply of power to data terminals (up to 15 W each)
- Two slots for any type of 2-port media module

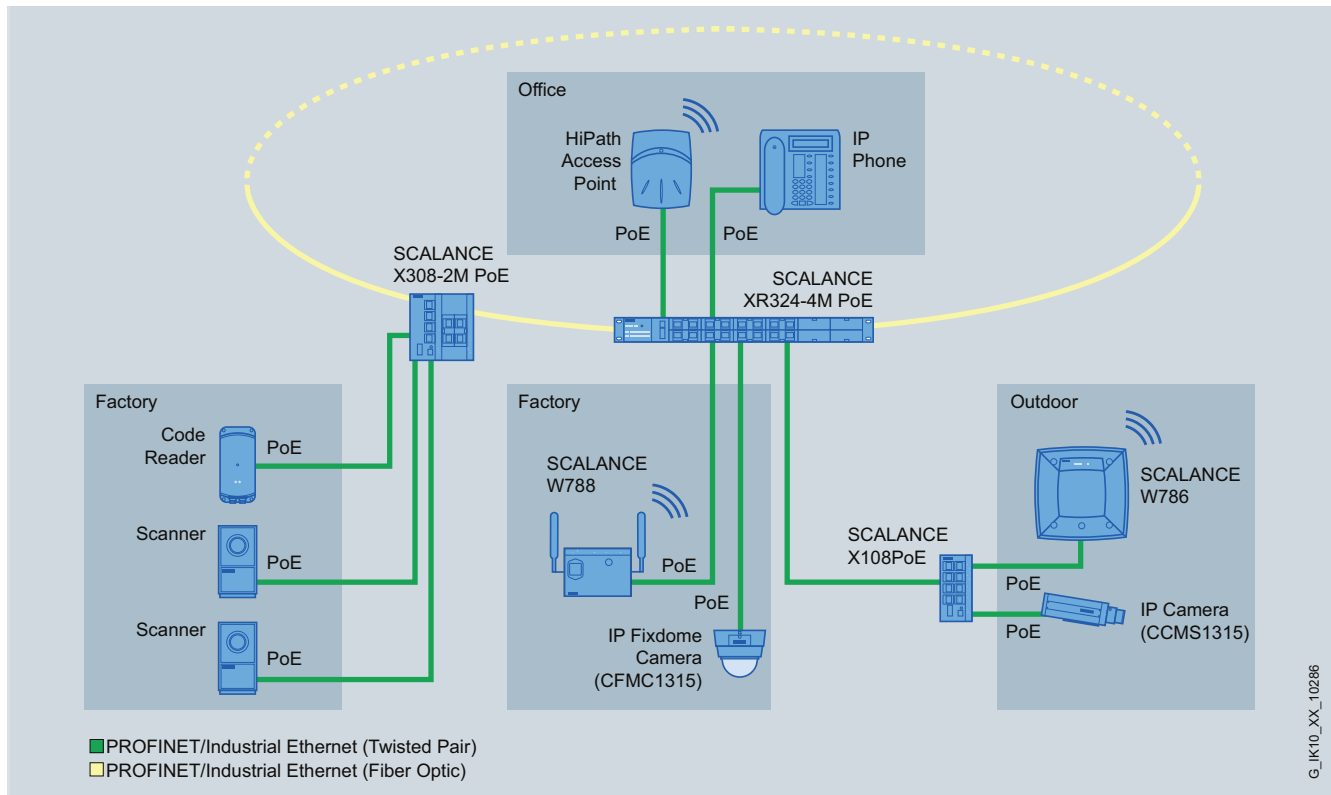
SCALANCE XR324-4M PoE

19" Industrial Ethernet switches with

- Eight permanently integrated RJ45 ports incl. Power-over-Ethernet functionality (according to IEEE 802.3at Type 1, corresponding to IEEE 802.3af) for the supply of power to data terminals (up to 15 W each)
- Eight permanently integrated RJ45 ports without Power-over-Ethernet functionality
- Four slots for any type of 2-port media module

The modularity offered by the use of media modules enables the network to be perfectly adapted to the application. This means that a network can be easily expanded or converted, e.g. to Gigabit Ethernet or from multimode to singlemode fiber-optic cables.

The SCALANCE X308-2M PoE and XR-300PoE switches supply PoE-compatible devices, such as IWLAN access points SCALANCE W, IP cameras or IP telephones, with energy over the data cable and are suitable for constructing electrical and/or optical Industrial Ethernet line, star or ring structures.



Supply of terminal devices with Power-over-Ethernet by means of PoE-compatible switches

SCALANCE X-300EEC/XR-300EEC managed

The switches of the product line SCALANCE X-300EEC/XR-300EEC (Enhanced Environmental Conditions) are managed Industrial Ethernet switches with degree of protection IP30 or IP20. They are designed for use in harsh industrial environments as well as in power switchgear. They permit the communication of switching and protection devices in low-voltage and high-voltage switchgear. The switches meet all the necessary EMC approvals for this field of application (IEC standard 61850-3). The devices for increased availability requirements are offered with redundant wide-range power supplies (for 60 V to 250 V DC / 100 V to 240 V AC). SCALANCE X-300EEC switches with conformal coating can also be used in harsh environments.

SCALANCE X-300EEC/XR-300EEC are available in the following versions:

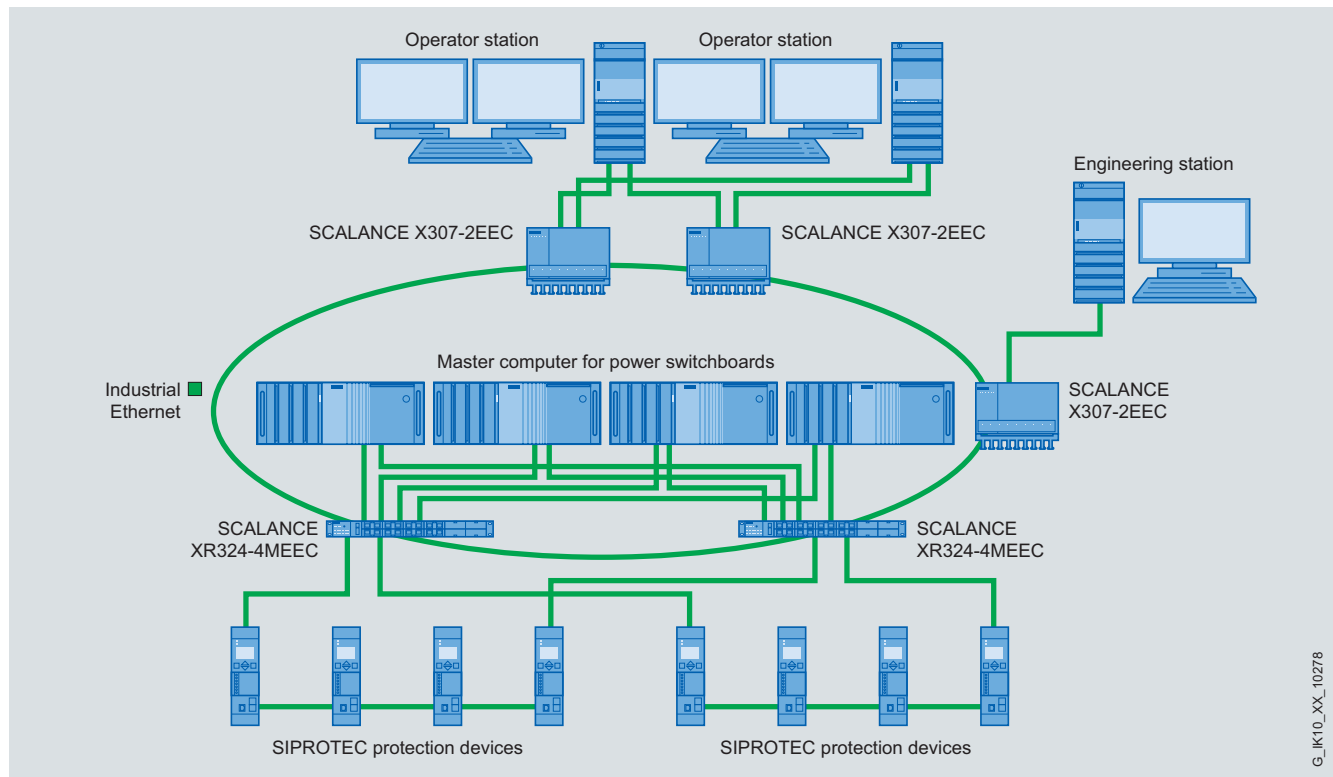
SCALANCE X307-2EEC and SCALANCE X302-7EEC compact devices

- Seven electrical (RJ45) and two optical (SC) ports
- Seven optical and two electrical ports

Modular 19" rack device SCALANCE XR324-4M EEC (four media module slots)

- 16 electrical (RJ45) ports
- Eight modular ports which can be equipped with 2-port media modules.

The SCALANCE XR324-4M EEC is available with front or rear cable outlet. In the version with rear cable outlet, the cables are located in the back of the control cabinet and the devices can be diagnosed by means of LEDs on the front. As a star coupler in the plant bus (redundant connection possible), it is designed specifically for use in power distribution plants.



Use of SCALANCE X-300EEC and XR-300EEC in power switchgear

To assist in selecting the right Industrial Ethernet switches, cables and connectors as well as configuration of modular variants, the SIMATIC NET Selection Tool is available at:

Online version:

www.siemens.com/snst

Offline version:

www.siemens.com/snst-download

SCALANCE X Industrial Ethernet switches

SCALANCE X-300 managed

Properties at a glance

- Simple adaptation to the structure of a plant thanks to the modularity offered by 2-port media modules
- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- Redundant power supply
- Reduction of the network installation costs due to savings in power cables and additional network components when Power-over-Ethernet is used
- High flexibility thanks to variable mounting options of the power supply unit, and choice between front or rear cable outlet on the device (depending on the device variant)
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Remote diagnosis is performed by means of SNMP, web browser and PROFINET IO diagnostics
- Integrated configuration and diagnostics in STEP 7
- Integrated redundancy manager for constructing Fast Ethernet and Gigabit Ethernet ring topologies with high-speed media redundancy
- Integration of the switches in existing network management infrastructure by means of SNMP access
- Automatic e-mail sending function
- C-PLUG swap medium for rapid replacement of devices
- Multicast and broadcast limitation
- Support of VLAN permits integration into enterprise security policies
- IGMP Snooping and IGMP Query support Multicast filtering and limiting



Media modules for modular SCALANCE X-300 managed switches

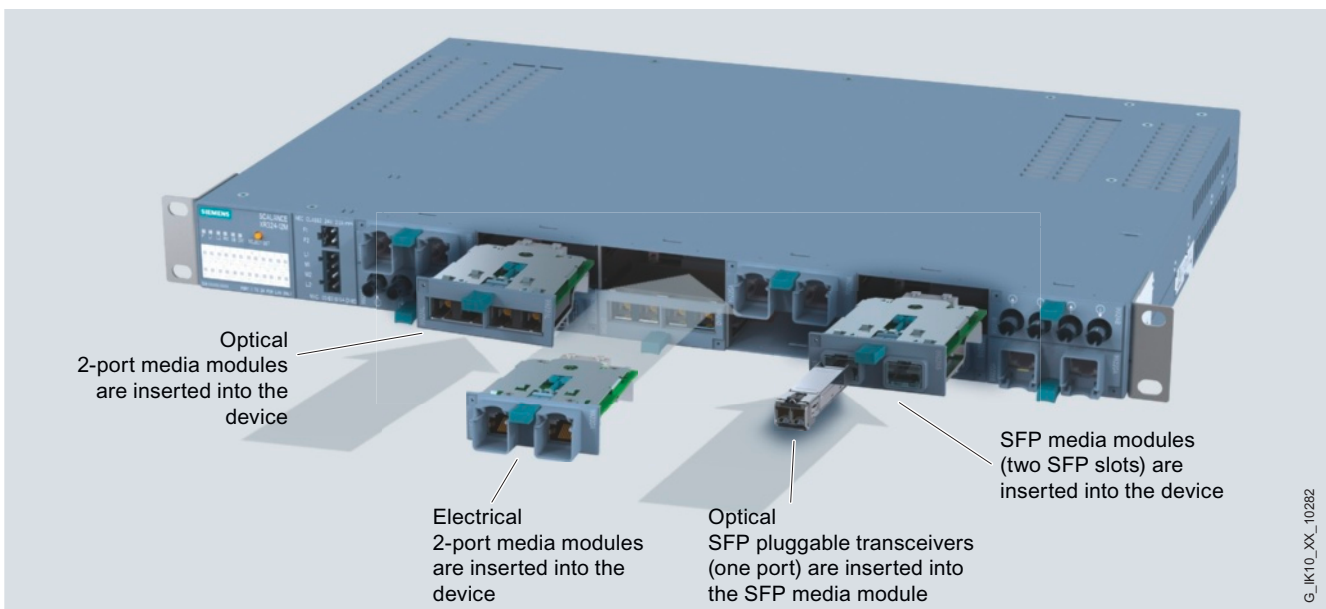
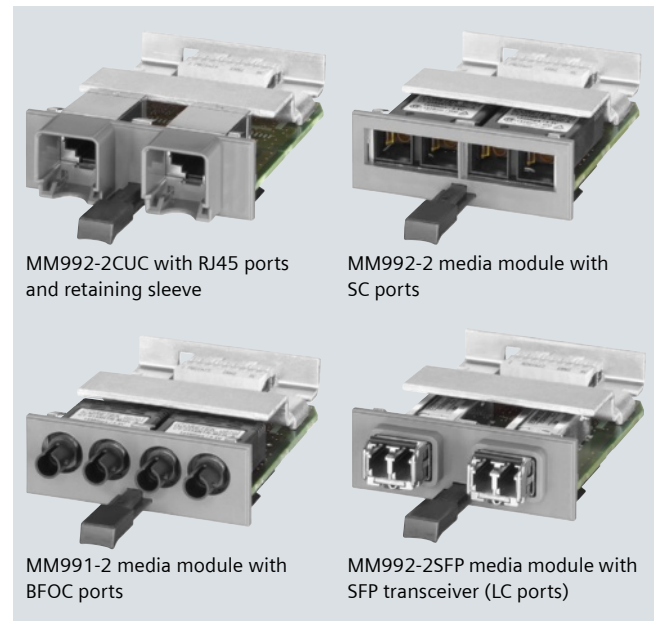
Different 2-port media modules support versatile configuration of the partly and fully modular switches

- SCALANCE X308-2M/X308-2M TS/X308-2M PoE and
- SCALANCE XR-300/XR-300PoE/XR-300EEC

The media modules are available both as electrical versions with RJ45 ports and as optical versions with BFOC, SC and LC ports for the use of multimode and singlemode fiber-optic cables.

Using a 2-port SFP media module (Small Form-Factor Pluggable) the optional use of fiber optic SFP plug-in transceivers with LC connection technology is possible.

Their versatility (electrical/optical, multimode/singlemode, Fast Ethernet, Gigabit Ethernet) with media modules which can be differently equipped allows significantly reduced stocking of device variants.



Insertion of 2-port media modules in media module slot

Properties at a glance

- Flexibility on network expansion or conversion
- Reductions in stock-keeping costs and upkeep

- Different variants: electrical or optical, multimode or singlemode

SCALANCE X Industrial Ethernet switches

SCALANCE X-400 managed (layer 3)

The modular switches of the SCALANCE X-400 product range are Industrial Ethernet switches for setting up line, star, and ring structures (10/100/1000 Mbit/s) for high-performance networks.

They allow flexible setup of optical or electrical networks, which can be adapted in their topology, port number, and port type to the respective network structures. They allow high network availability, since, for example, they enable ring redundancy in combination with a redundancy manager function, have redundant power supply or permit exchange and extension of media modules during operation.

With the C-PLUG swap medium, devices can be exchanged without programming device; the configuration or application data are secured on the C-PLUG and can be implemented in another SCALANCE X-400 switch without special know-how.

- SCALANCE X-400 switches have a modular structure, in which media modules and/or extender modules can be connected to the switch as required. Thanks to these expansions, up to eight electrical and eight optical ports are additionally available.
The gigabit ports are typically used for connecting the switches to each other and for a possible connection to higher network levels. Optical connections are available by means of media modules.
The SCALANCE X-400 switches are well suited, for example, to process control systems such as PCS7.

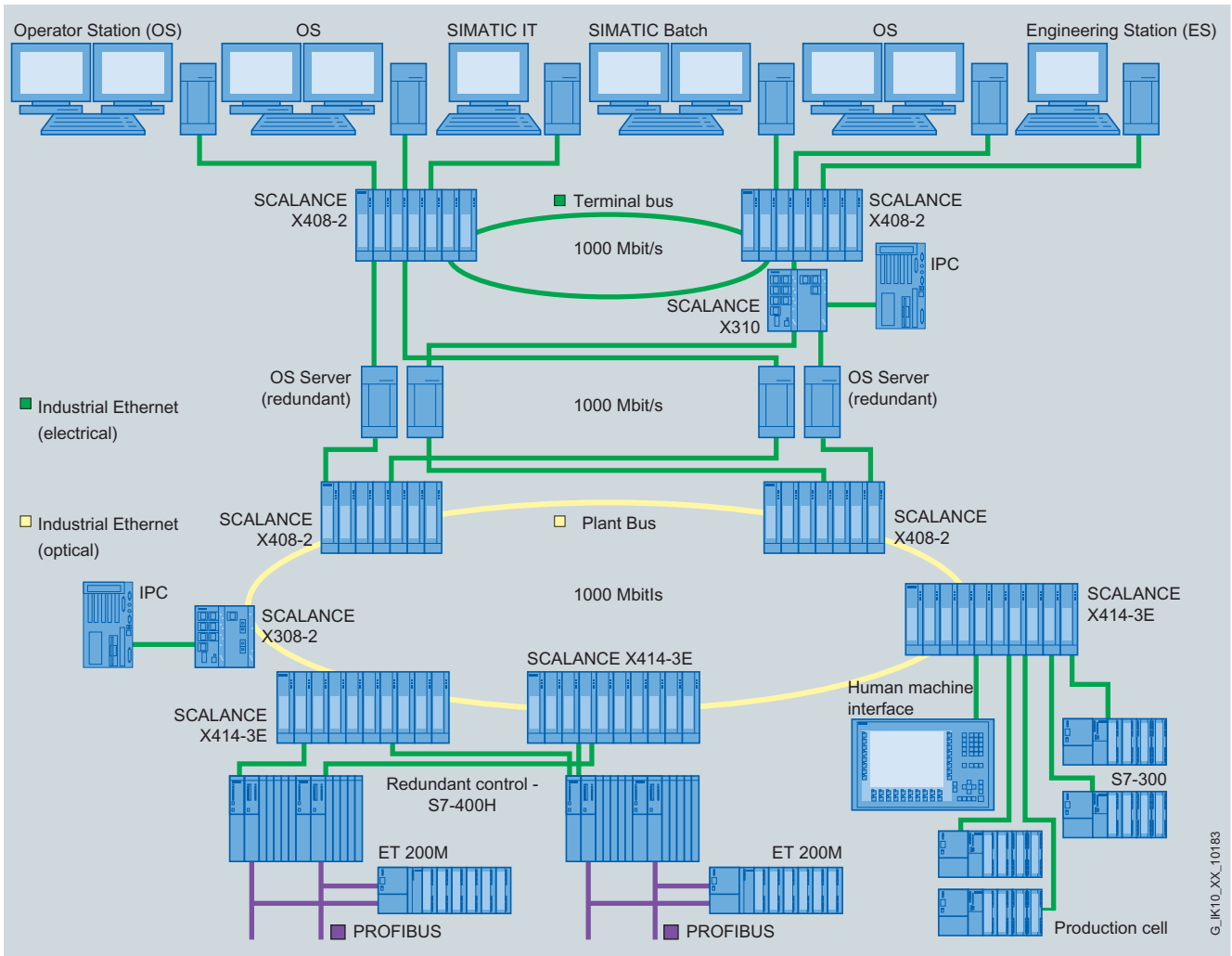


The following network topologies and combinations of topologies are possible:

- Fast Ethernet and Gigabit Ethernet rings with fast media redundancy. To protect against failure of a transmission link or a switch, as many as 50 X-400 switches cascaded in line can be connected into a ring. On the failure of a transmission link or a SCALANCE X-400 switch in the ring, the transmission path is reconfigured within 200 ms.
- Redundant connection of the ring topology to the corporate network using Rapid Spanning Tree Protocol (RSTP).
- Redundant linking of subnets, e.g. ring topologies (standby redundancy)
- Star topology with SCALANCE X-400 switches: Each SCALANCE X-400 switch represents a star point which can interconnect up to 26 nodes or subnets electrically or optically.
- Problem-free connection of existing twisted-pair data terminals or existing network segments up to 10/100/1000 Mbit/s
- High availability of the network thanks to
 - Redundant power supply
 - Redundant network structures based on fiber-optic or twisted pair cables
 - Replacement and extension of media and expansion modules during operation
 - Layer-3 functionality and Virtual Router Redundancy Protocol (VRRP) enable use as routers between different IP subnets, also redundantly (only SCALANCE X414-3E)

SCALANCE X-400 modular is available in the following versions:

- **SCALANCE X408-2**: choice of four electrical or optical (SC) gigabit ports and four electrical Fast Ethernet ports
- **SCALANCE X414-3**: choice of two electrical or optical (SC) gigabit ports, twelve electrical Fast Ethernet ports and optionally four optical Fast Ethernet ports (BFOC). It can be extended with extender modules with either eight electrical or eight optical (BFOC) Fast Ethernet ports.



Use of the SCALANCE X-400 switches in a process control system, e.g. PCS7

SCALANCE X Industrial Ethernet switches

SCALANCE X-400 managed (layer 3)

Properties at a glance

- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- Redundant power supply
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Flexible, modular design
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and auto-negotiation function
- Remote diagnosis is performed by means of SNMP, web browser and PROFINET IO diagnostics
- Integrated redundancy manager for constructing Fast Ethernet and Gigabit Ethernet ring topologies with high-speed media redundancy
- Integrated configuration and diagnostics in STEP 7
- Integration of the switches in existing network management infrastructure by means of SNMP access
- Automatic e-mail sending function
- C-PLUG swap medium for rapid replacement of devices
- Multicast and broadcast limitation
- Support of VLAN permits integration into enterprise security policies
- IGMP Snooping and IGMP Query support Multicast filtering and limiting
- Layer 3 functionality (IP Routing; SCALANCE X414-3E)

SCALANCE X-500 managed (layer 3)

SCALANCE X-500 switches are fully modular, high-performance, and industry-standard switches for the construction of electrical and optical line, ring and star topologies with transfer rates of up to 10 Gbit/s, designed for installation in 19" control cabinets.

The SCALANCE X-500 switches are ideal for use in industrial networks and for integrating the industrial network into an existing corporate network. From the control level to the management level, the switch handles the networking of plant sections as well as distributed field devices and ensures high plant availability with extensive diagnostics options and high transmission speeds.

Thanks to the scalability of the basic unit and the optionally available layer 3 switching function, the network can be established specially for the relevant application. Additional functions of the switch are activated by means of a KEY-PLUG.

The SCALANCE X-500 switches are suitable for setting up electrical and optical Industrial Ethernet line, star and ring structures, and they are available with the following port types for multimode or singlemode connections:

- Four SFP+ slots for optical SFP+ or SFP plug-in transceivers
 - The SFP+ plug-in transceivers support 10 Gbit/s
 - The SFP plug-in transceivers support 1000 Mbit/s
- Up to 12 slots for electrical 4-port media modules, electrical PoE 4-port media modules and optical 4-port media modules (with different connection methods);
 - For industrial applications, the RJ45 sockets are also available with additional retaining sleeve for connection of the Industrial Ethernet FC RJ45 Plug 180
 - All electrical Ethernet interfaces support 10/100/1000 Mbit/s, all optical Ethernet interfaces support 100 or 1000 Mbit/s.

The use of media modules or SFP+/SFP enables the following:

- Extension of networks by subsequent insertion of additional media modules in unused media module slots
- Changing of cabling technology, such as conversion from copper to fiber-optic cables, or from multimode to single-mode FOC
- Changing of the transfer rate, e.g. from 1000 Mbit/s to 10 Gbit/s

Product versions

SCALANCE XR552-12M

- LEDs and data cable outlet on the front
- Alternatively: LEDs on the front and data cable outlet at the rear
- Connection of power supply unit at rear or above/below the switch
- Four SFP+ slots for equipping with 10 Gigabit Ethernet SFP+ plug-in transceivers or Gigabit SFP plug-in transceivers
- 12x 4-port media module slots

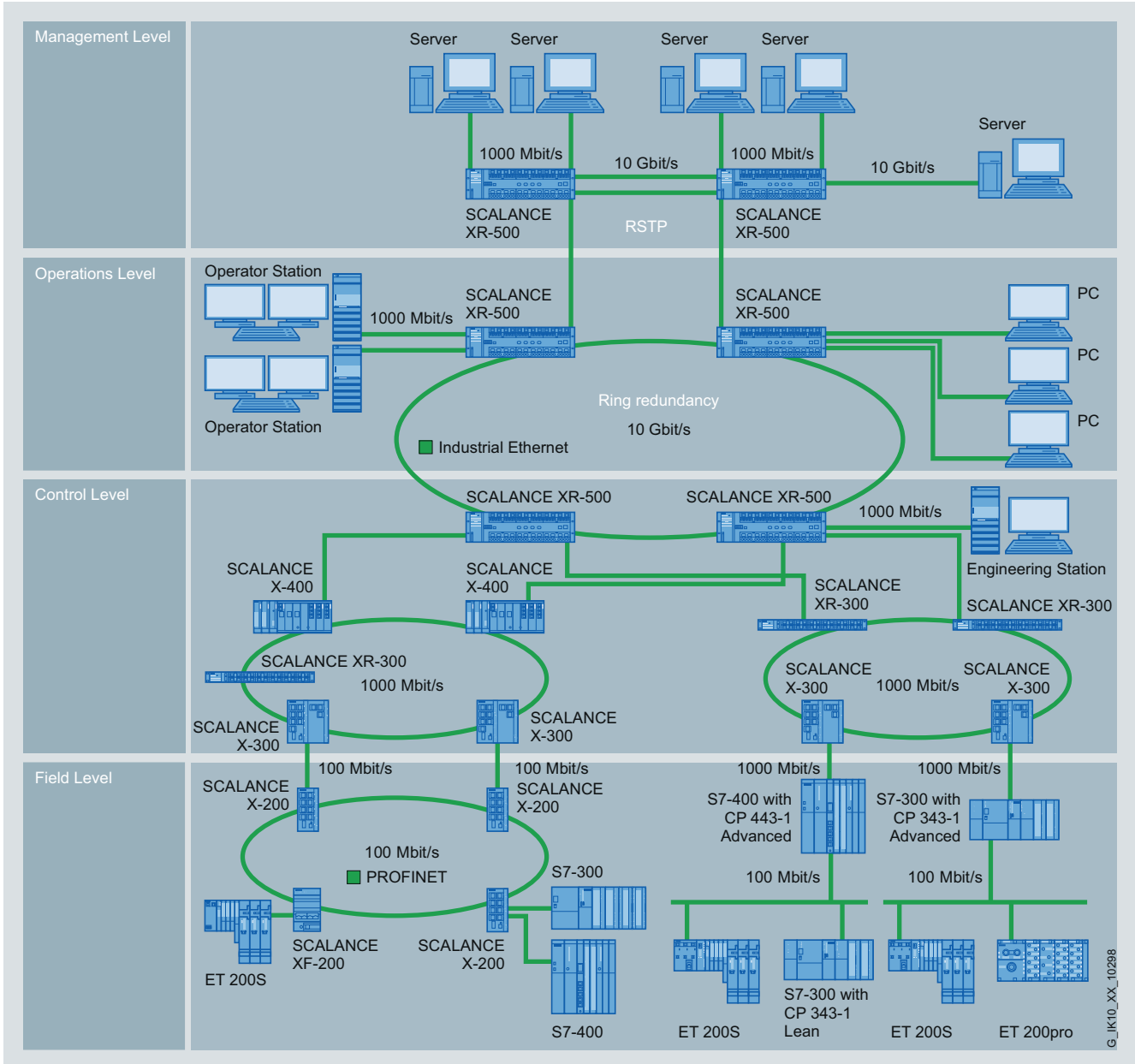
SCALANCE XR528-6M

- LEDs and data cable outlet on the front
- Alternatively: LEDs on the front and data cable outlet at the rear
- Connection of power supply unit at rear or above/below the switch
- Four SFP+ slots for equipping with 10 Gigabit Ethernet SFP+ plug-in transceivers or Gigabit SFP plug-in transceivers
- 6x 4-port media module slots



SCALANCE X Industrial Ethernet switches

SCALANCE X-500 managed (layer 3)



Use of SCALANCE XR-500 in redundant network topologies, e.g. with Rapid Spanning Tree Protocol (RSTP) and ring redundancy

Properties at a glance

- Simple adaptation to the structure of a plant thanks to the modularity offered by 4-port media modules
- Diagnostics on the device by means of LEDs (power, link status, data communication) and signaling contact (signaling mask can be set on site using buttons)
- High availability of the network thanks to
 - Redundant power supply
 - Integrated redundancy manager for constructing Fast Ethernet and Gigabit Ethernet ring topologies with high-speed media redundancy
 - Easy device replacement by means of plug-in C-PLUG/KEY-PLUG swap medium
 - Very fast reconfiguration of the network in event of a fault
- KEY-PLUG swap medium for layer 3 functionality during operation
- Thanks to support for the Dual Stack Routing function, both IPv4 and IPv6 addressing can be operated in one network
- High flexibility thanks to variable mounting options of the power supply unit, and choice between front or rear cable outlet on the device (depending on the device variant)
- Reduction of the network installation costs due to savings in power cables and additional network components when Power-over-Ethernet is used
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Remote diagnosis is performed by means of SNMP, web browser and PROFINET IO diagnostics
- Integrated configuration and diagnostics in STEP 7
- Integration of the switches in existing network management infrastructure by means of SNMP access
- Automatic e-mail sending function
- Multicast and broadcast limitation
- Support of VLAN permits integration into enterprise security policies
- IGMP Snooping and IGMP Query support Multicast filtering and limiting

SCALANCE X Industrial Ethernet switches

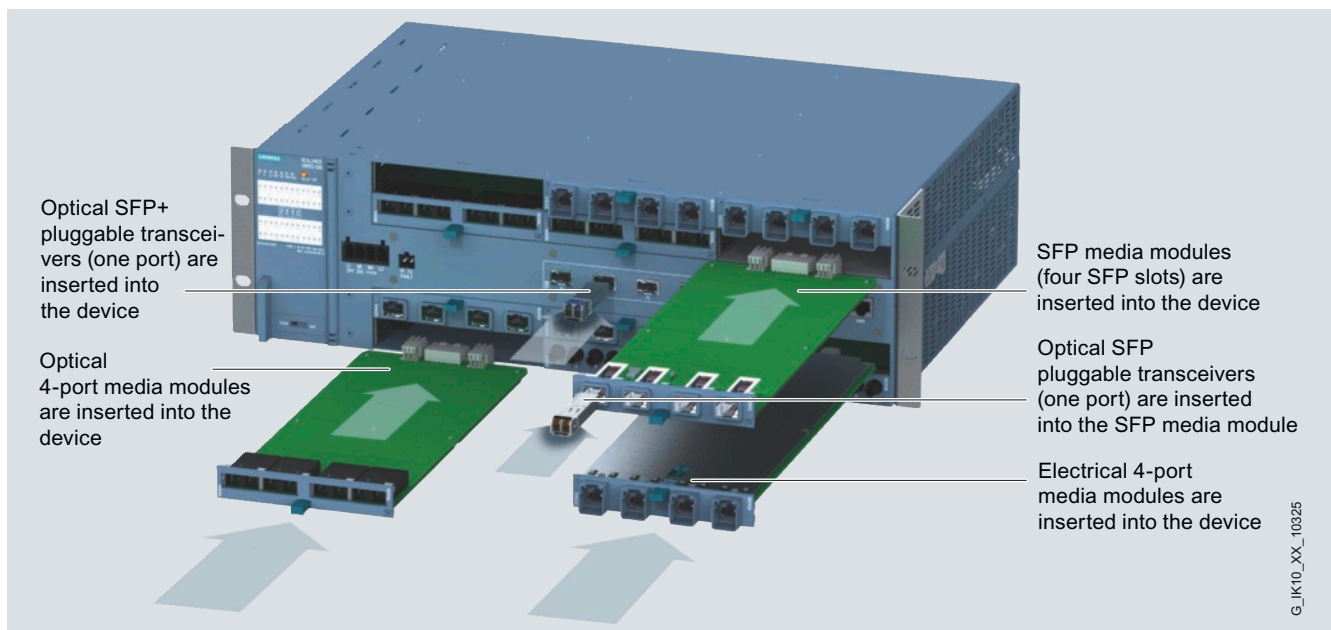
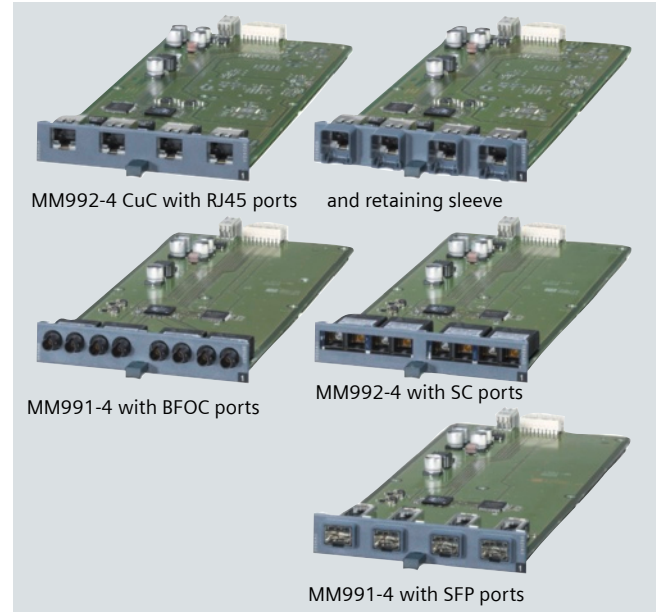
Media modules for modular SCALANCE X-500 managed switches

Different 4-port media modules support versatile configuration of SCALANCE X-500 switches.

Electrical versions with RJ45 ports are available as well as optical versions with BFOC and SC ports for the use of multimode and singlemode fiber-optic cables.

- Using a 4-port SFP media module, the optional use of fiber-optic SFP plug-in transceivers (Small Form-Factor Pluggable) with LC connection technology is possible
- SFP+ and SFP plug-in transceivers for flexible equipping of the four integral SFP+ slots in SCALANCE X-500

Their versatility (electrical/optical, multimode/singlemode, Fast Ethernet, Gigabit Ethernet) with media modules which can be differently equipped allows significantly reduced stocking of device variants.



4-port media modules plugged into media module slot and SFP/SFP+ plug-in transceivers in SFP+ slots

Properties at a glance

- Unlimited flexibility for network expansions, conversion, or increasing the performance
- Reductions in stock-keeping costs and upkeep

- Different variants: electrical or optical, multimode or singlemode

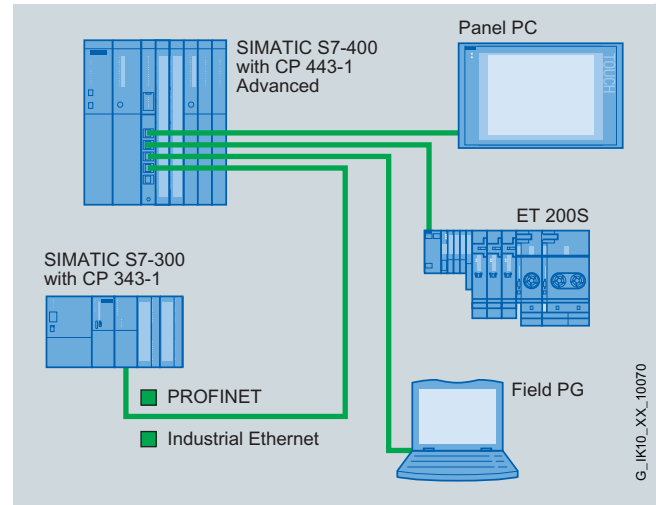
Industrial Ethernet Switching

Communications processors with switch functionality

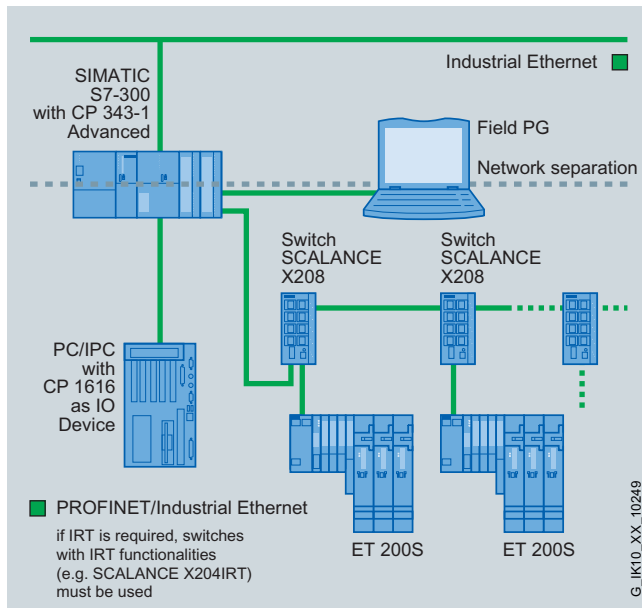
Generally, communications processors are used to connect SIMATIC S7 or PCs to PROFIBUS or Industrial Ethernet. The CPs perform communication tasks for the controllers and take up few of their resources. Some communications processors also have an integral switch, which offers additional benefits.

- Establishment of small networks without additional switch
- Connection of machines or process cells to higher-level networks
- Network separation by means of layer 3 functionality (IP routing) and Security Integrated (firewall, VPN) with CP 343-1 Advanced and CP 443-1 Advanced.
- Functions for network diagnostics

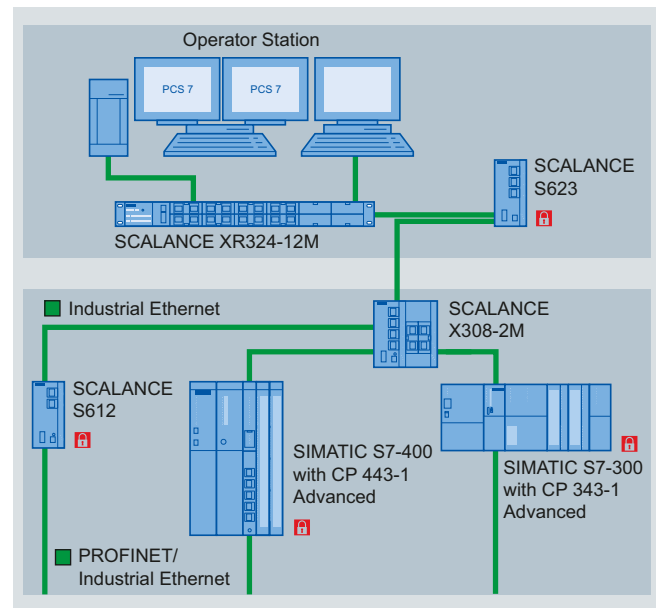
In this case, suitable protective measures (including IT security such as network segmentation) should be taken in order to ensure safe operation of the plant. For more information on the topic of industrial security, go to www.siemens.com/industrialsecurity.



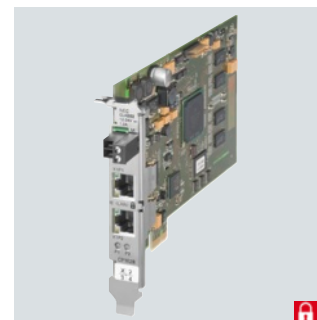
Independent local networks (e.g. within a machine or cell)



Connection to higher-level network



Protection of controls by means of CPs with Security Integrated



Industrial Ethernet Switching

Communications processors with switch functionality

The SIMATIC NET communications processors can be used for applications in factory and process automation. With their protocol pre-processing, they offer constant data throughput, enable consistently fast response times, and prevent fluctuations in communication performance.

The communication processors are all designed for use in tough industrial environments with a wide range of temperatures. They are certified for marine use, enabling them to be used in ships or offshore installations.

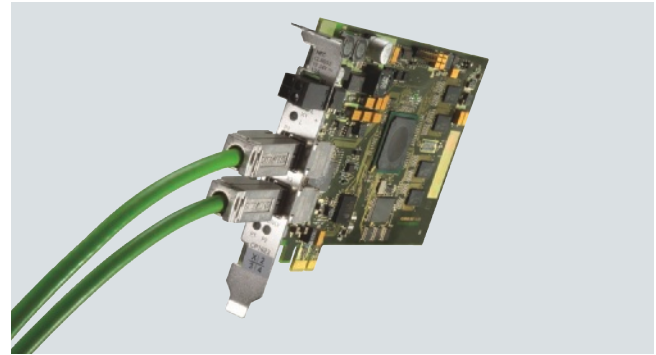
The following communications processors are available with integral switch:

CPs for SIMATIC S7

CP 343-1 Lean, CP 343-1, CP 343-1 Advanced,
CP 443-1, CP 443-1 Advanced

Properties at a glance

- Connection to SIMATIC S7 via backplane bus
- Diagnostics on the device by means of LEDs (link status, bus fault, data communication)
- RJ45 sockets with retaining sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Remote diagnostics is performed by means of SNMP, Web browser and PROFINET IO diagnostics
- Support of PROFINET IRT for time-critical applications, also with isochronous closed-loop control in the motion control area (except CP 343-1 Lean/CP 343-1)
- Integrated configuration and diagnostics in STEP 7
- Integration of the CPs into existing network management infrastructure by means of SNMP access
- Automatic e-mail sending function (Advanced CPs only)
- IP routing between gigabit and PROFINET interface (Advanced CPs only)



CPs for PCs

CP 1604, CP 1616, CP 1623, CP 1628

Properties at a glance

- Connection in the PC via PCI, PCIe or PC/104-Plus interface
- Redundant voltage supply via PCIe interface and external power supply 12 to 24 V DC for operating the switch when the PC is turned off (CP 1623 and CP 1628 only)
- Integrated autocrossover function makes the use of uncrossed connection cables possible
- Automatic detection and negotiation of the data transmission rate by means of autosensing and autonegotiation function
- Remote diagnostics is performed by means of SNMP and PROFINET IO diagnostics
- Support of PROFINET IRT for time-critical applications also with isochronous closed-loop control in the motion control area (except CP 1623)
- Integrated configuration and diagnostics in STEP 7
- Integration of the CPs into existing network management infrastructure by means of SNMP access
- Support for Gigabit Ethernet (CP 1623 only)
- Security Integrated (Firewall, VPN) with CP 343-1 Advanced, CP 443-1 Advanced, and CP 1628

Port configuration for SCALANCE X Industrial Ethernet switches and components with switch functionality

Type of module	Gigabit Ethernet				Fast Ethernet				Managed Switches
	10 / 100 / 1000 Mbit/s	1 Gbit/s		10 Gbit/s	10 / 100 Mbit/s	100 Mbit/s			
	Electrical	Optical			Electrical	Optical			
	Twisted Pair	Multimode	Singlemode		POF/PCF	Multimode	Singlemode		
XR552-12M ¹⁾	48x RJ45	48x SC/LC	48x SC/LC	4x LC			48x SC/LC/BFOC	48x SC/LC/BFOC	SCALANCE X-500
XR528-6M ¹⁾	24x RJ45	24x SC/LC	24x SC/LC	4x LC			24x SC/LC/BFOC	24x SC/LC/BFOC	
X414-3E ¹⁾	2x RJ45	2x SC	2x SC		20x RJ45		12x BFOC	12x SC/BFOC	SCALANCE X-400
X408-2 ¹⁾	4x RJ45	4x SC	4x SC		4x RJ45		4x BFOC	4x BFOC	
X302-7EEC ¹⁾	2x RJ45						7x LC		SCALANCE X-300
X304-2LD					4x RJ45			2x SC	
X306-1LD FE					6x RJ45			1x SC	
X307-2EEC ¹⁾	2x RJ45				5x RJ45		2x LC		
X307-3		3x SC			7x RJ45				
X307-3LD			3x SC		7x RJ45				
X308-2	1x RJ45	2x SC			7x RJ45				
X308-2LD	1x RJ45		2x SC		7x RJ45				
X308-2LH	1x RJ45		2x SC		7x RJ45				
X308-2LH+	1x RJ45		2x SC		7x RJ45				
X308-2M ¹⁾	8x RJ45	4x SC/LC	4x SC/LC						
X308-2M TS ¹⁾	8x RJ45	4x SC/LC	4x SC/LC						
X308-2M PoE ¹⁾	8x RJ45	4x SC/LC	4x SC/LC						
X310	3x RJ45				7x RJ45				
X310FE					10x RJ45				
XR324-12M ¹⁾	24x RJ45	24x SC/LC	24x SC/LC				24x SC/LC/BFOC	24x SC/LC/BFOC	
XR324-4M EEC/ XR324-4M PoE ¹⁾	24x RJ45	8x SC/LC	8x SC/LC				8x SC/LC/BFOC	8x SC/LC/BFOC	
XF204/X204IRT/ XF204IRT					4x RJ45				
X202-2IRT					2x RJ45		2x BFOC		
X202-2P IRT					2x RJ45	2x SCRJ			
X201-3P IRT					1x RJ45	3x SCRJ			
X200-4P IRT						4x SCRJ			
X204IRT PRO					4x RJ45 (Push Pull)				
X202-2P IRT PRO					2x RJ45 (Push Pull)	2x SCRJ			
X224					24x RJ45				
X216					16x RJ45				
X212-2					12x RJ45		2x BFOC		
X212-2LD					12x RJ45			2x BFOC	
X208/XF208					8x RJ45				
X208PRO					8x M12				
X206-1/XF206-1					6x RJ45		1x BFOC		
X206-1LD					6x RJ45			1x BFOC	
X204-2/XF204-2					4x RJ45		2x BFOC		
X204-2TS					4x RJ45		2x BFOC		
X204-2LD					4x RJ45			2x BFOC	

1) The specified number of ports pertains to the max. possible number of devices per interface type. The combined number of ports per device is provided in the specific technical data.

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SCALANCE X managed Industrial Ethernet switches

Industrial Ethernet Switching

Port configuration for SCALANCE X Industrial Ethernet switches and components with switch functionality

	Gigabit Ethernet			Fast Ethernet				Unmanaged Switches
	10 / 100 / 1000 Mbit/s	1000 Mbit/s		10 / 100 Mbit/s	100 Mbit/s			
	Electrical	Optical		Electrical	Optical			
Type of module	Twisted Pair	Multimode	Singlemode	Twisted Pair	POF/PCF	Multimode	Singlemode	
X124				24x RJ45				SCALANCE X-100
X116				16x RJ45				
X112-2				12x RJ45		2x BFOC		
X108/X108PoE				8x RJ45				
X106-1				6x RJ45		1x BFOC		
X104-2				4x RJ45		2x BFOC		
XB008G	8x RJ45							SCALANCE X-000
XB008				8x RJ45				
XB005G	5x RJ45							
XB005				5x RJ45				
XB004-1LDG	4x RJ45		1x SC					
XB004-1LD				4x RJ45			1x SC	
XB004-1G	4x RJ45	1x SC						
XB004-1				4x RJ45		1x SC		
X005/XB005				5x RJ45				

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SCALANCE X unmanaged Industrial Ethernet switches

	Gigabit Ethernet			Fast Ethernet				
	10 / 100 / 1000 Mbit/s	1000 Mbit/s		10 / 100 Mbit/s	100 Mbit/s			
	Electrical	Optical		Electrical	Optical			
Type of module	Twisted Pair	Multimode	Singlemode	Twisted Pair	POF/PCF	Multimode	Singlemode	
LOGO! CSM 12/24				4x RJ45				Module for Logic module LOGO!
LOGO! CSM 230				4x RJ45				Module for SIMATIC S7-1200
CSM 1277				4x RJ45				Module/CPs for SIMATIC S7-300
CP 343-1 Lean				2x RJ45				CPs for SIMATIC S7-400
CP 343-1				2x RJ45				
CP 343-1 Advanced	1x RJ45			2x RJ45				CPs for PG/PC
CP 443-1				2x RJ45				
CP 443-1 Advanced	1x RJ45			4x RJ45				
CP 1604				4x RJ45				
CP 1616				4x RJ45				
CP 1623	2x RJ45							

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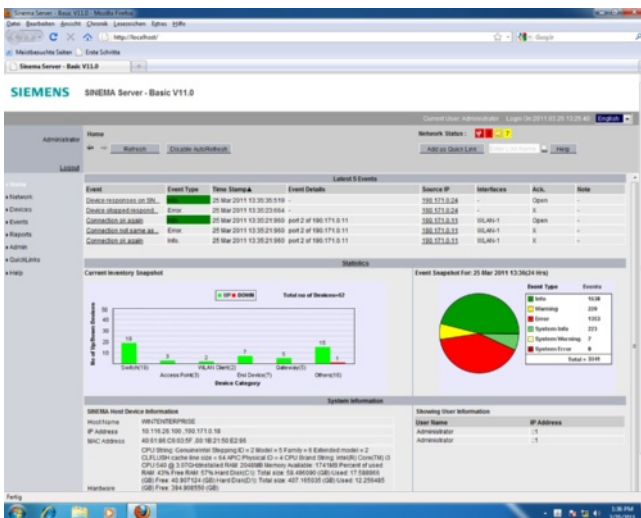
Industrial Ethernet communications processors with switch functionality

Network management

The network management products SINEMA Server (SIMATIC Network Manager) and SNMP/OPC Server support in monitoring and diagnosing wireless and wired networks in industrial environments.

SINEMA Server network management

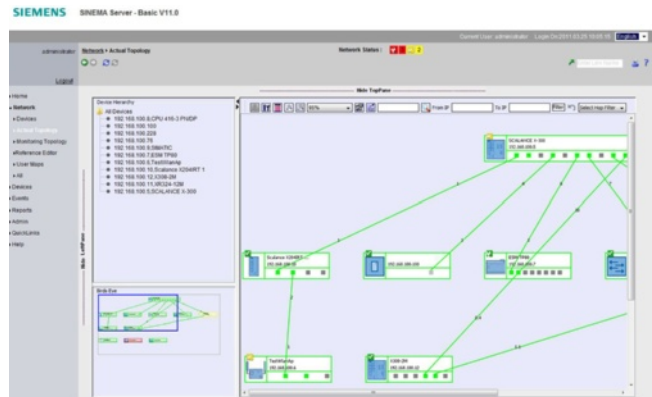
SINEMA Server network management software diagnoses and visualizes Ethernet networks. It continuously logs network activities using various protocols such as SNMP, DCP, and LLDP, makes them available to users and other systems on the network, e.g. HMI software such as WinCC, for evaluation and further processing.



Clear analysis of network activities with SINEMA Server

Using autodiscovery, devices, their properties, and their topology are recognized and network statistics are compiled. These can be displayed graphically and, if desired, also enhanced using individual diagnostics screens. In addition, cyclic data from Ethernet participants is queried and network alarms are signaled during runtime.

The information can be called up simultaneously by several users in the network by means of a Web browser.



Depiction of network topology with SINEMA Server

Furthermore, the software offers an e-mail client function and OPC server in order to forward network data and alarms to other systems. SINEMA Server can be easily integrated in HMI and visualization systems such as SIMATIC WinCC.

Changes in the network, such as the addition of new devices, are reported to the user through the alarm console and saved in a database. For the analysis of past network failures or as evidence of network availability, the database information can be prepared and documented as reports for a configurable period of time. The SINEMA user interface and the available features are accessible via the browser from any computers on the network.

SNMP OPC Server

Through the SNMP OPC server the diagnostic and configuration data of SNMP-capable devices, such as network components, can be displayed in HMI systems such as WinCC or in the SIMATIC Maintenance Station. Using this software, standard maintenance data can be read and plant network problems, such as failure of a line, can be quickly and easily detected.

Configuration of SNMP diagnostics is integrated into STEP 7. Ethernet devices can be read from a STEP 7 project or, using the autodiscovery function, directly from the live network. The user can easily add all devices detected there to the device list for monitoring on the OPC Server.

Industrial Ethernet Switching

Diagnostics and network management

Module type	Diagnostics options for components with switching functionality										
	LED	Fault signaling contact	Message screen	PROFINET diagnostics	Web-based management	Diagnostics via SNMP	VLAN	IGMP-Snooping/-Querier	RSTP	Multicast / broadcast limiting	Layer 3 (IP-Routing)
SCALANCE X-500	•	•	•	•	•	•	•	•	•	•	•
SCALANCE X-400	•	•	•	•	•	•	•	•	•	•	• ¹⁾
SCALANCE X-300	•	•	•	•	•	•	•	•	•	•	
SCALANCE X-200	•	•	•	•	•	•					
SCALANCE X-100	•	•	•								
SCALANCE X-000	•										
CSM	•										
CP for S7-300	•			•	• ²⁾	•					
CP for S7-400	•			•	• ²⁾	•					
CP 1604	•			•	• ²⁾	•					
CP 1616	•			•	• ²⁾	•					
CP 1623	•					•					

1) only SCALANCE X414-3E
2) Port diagnostics possible via integral web server

Industrial Ethernet switches and components with switch functionality: Network structure diagnostic options and logs

Industrial Ethernet

Networking with FastConnect

FastConnect for electrical cables

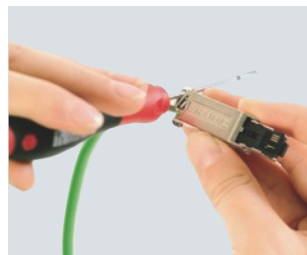
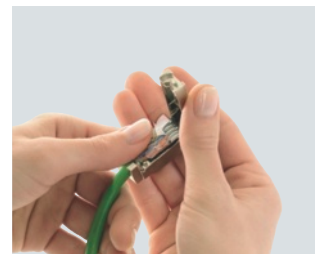
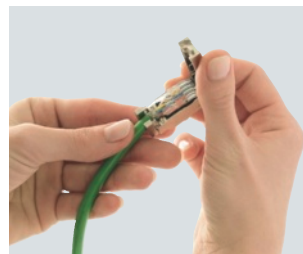
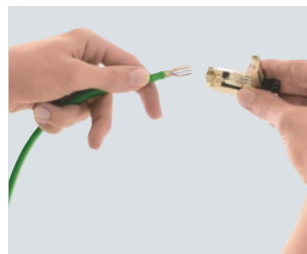
The rapid connection system FastConnect (FC) for Industrial Ethernet enables industry-compatible network structures to be set up within a short time using optimally matched components. It comprises:

- **Industrial Ethernet FastConnect cables** specially designed for fast connection (UL and CAT5e certified) as FC TP Standard, FC TP Flexible, FC TP Trailing and FC TP Marine Cable
- User-friendly stripping technology with the **FastConnect stripping tool**, enabling the outer sheath and braided shield to be removed accurately in a single operation.
- Cables prepared in this way are connected to the FastConnect products using the insulation displacement technique.
- **IE FC RJ45 Plug and IE FC M12 Plug PRO** are insensitive to interference due to the rugged metal enclosure, and are the ideal solution for installing RJ45 or M12 connectors even at the field level (PROFINET-compliant).
- **Industrial Ethernet FC Modular Outlets** are connection sockets for structured cabling with Fast and Gigabit Ethernet

Advantages of the FastConnect system for electrical cables

- Comprehensive product range for flexible wiring in industry in accordance with the innovative PROFINET Industrial Ethernet standard
- Minimized time taken to connect data terminals thanks to safe stripping of the outer sheath and braided shield in one step
- Simple connection system
 - Insulation-displacement contacts for 4-core (Cat5) and 8-core (Cat6) Industrial Ethernet FC twisted-pair installation cables
 - SC or BFOC connection system for FC glass fiber-optic cable
- Easy assembly for both TP cable types with the preadjusted FC stripping tool or FC FO termination kit for FC glass FOC
- Reliable shield contact and strain relief thanks to screw-on cover
- Good EMC shielding and conduction (metal casing); mistakes are prevented thanks to color coding and the transparent terminal cover
- RJ45 cabling technology is used as the existing standard

Assembly with FastConnect for RJ45 and M12 connectors



Industrial Ethernet

Networking with FastConnect

FastConnect for glass fiber-optic cables

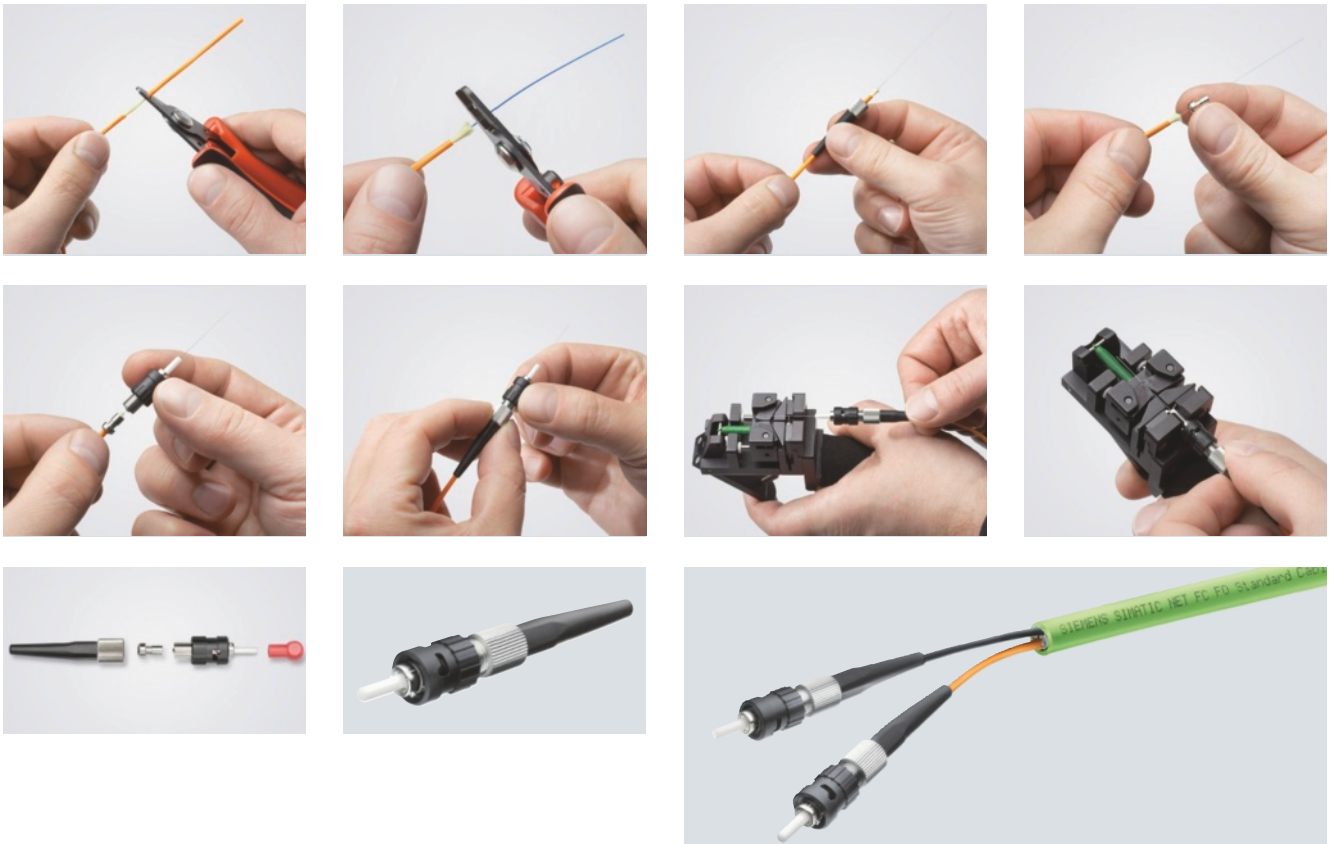
For the FastConnect FOC system, fiber-optic cables with glass core (62.5/200/230) are offered. They are suitable for easy assembly in the field:

- **FC FO Standard Cable GP;** 62.5/200/230 with PVC casing for permanent indoor installation
- **FC FO trailing cable;** for use in tow chains and moving applications
- FastConnect glass fiber-optic cables are assembled on-site using the **FC FO termination kit**. The termination kit permits the stripping and the "cleaving" of the fiber in the assembled connector.
- **FastConnect SC** and **FastConnect BFOC connectors** are available for the assembly of FC glass fiber-optic cables

Advantages of the FastConnect system for glass fiber-optic cables

- Simple installation of the unassembled cable
- Flexible connector assembly on site (SC/BFOC connectors) without skilled personnel
- Prevention of faults by simply checking the assembled connectors on site using a microscope
- Simple repair of FC glass fiber-optic cables in the field

Assembly with FastConnect for glass fiber-optic cables

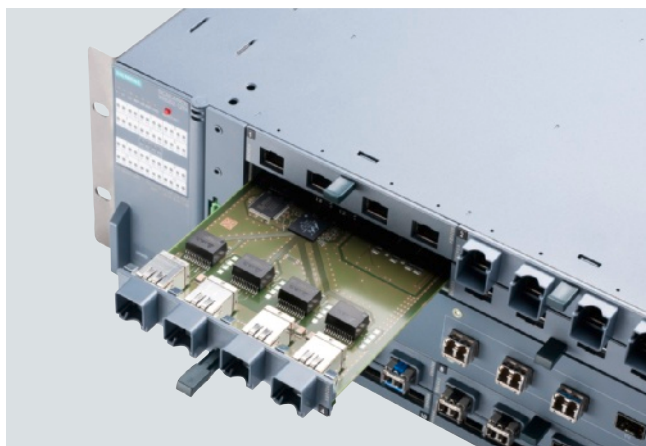
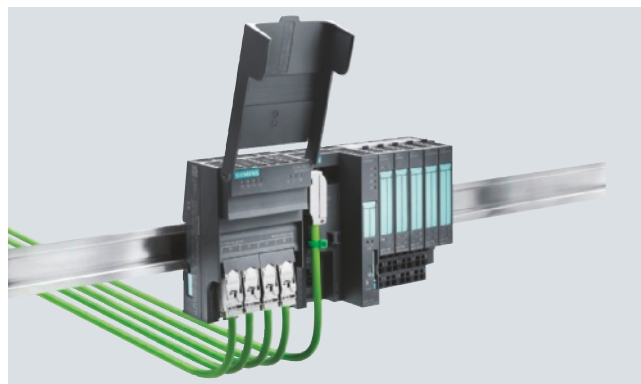


Industrial Ethernet Switching

Advantages at a glance

- Rugged industry-compatible design
- The right construction type for any application
- Protection of investments: Existing networks can be expanded with new products
- Integration into existing concepts for network security thanks to integral security functions
- Broad-based use in small or large networks even outside the control cabinet
- Avoidance of additional training and familiarization costs thanks to the use of standardized Ethernet technology
- High network and machine availability

- One network for strict real time and standard TCP/IP, saving on duplicated infrastructure
- Reduction of downtimes due to saving of engineering and configuration data
- Quick, easy and reliable cabling and the option of self-assembly
- On-site or remote parameterization and diagnostics
- Support from SIMATIC Engineering Tools
- Embedding in the SIMATIC error message concept (system fault signaling, SFM) and PROFINET
- Networking without the need for additional gateways



Get more information

SIMATIC NET:

<http://www.siemens.com/automation/simatic-net>

Info material for downloading:

<http://www.siemens.com/automation/infocenter>

SIMATIC Manuals Guide:

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