Industrial Ethernet Switching

Brochure · November 2008
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 switching components - active network components for use directly at the SIMATIC system, as stand-alone devices or as plug-in communications processors with integral switch for PCs and SIMATIC.

Industrial Ethernet switching components

The communication network is of the utmost importance for automation solutions. With SIMATIC NET, Siemens offers Industrial Ethernet switching components for structuring networked machines and plants, and for integrating into the overall corporate network. A graded portfolio of switches (SCALANCE X) and communications processors with integral switch enables optimum solutions for all types of switching tasks, and not only in harsh industrial environments.

Industrial Wireless LAN (IWLAN)

Thanks to wireless communication with programmable controllers, even greater flexibility is achieved, maintenance work is simplified, and service and standstill times reduced. The IWLAN solution from Siemens Industry provides these benefits via a coordinated portfolio of WLAN devices for industrial use, even for fail-safe communication within the scope of safety for personnel and machinery. This includes IWLAN access points and client modules (SCALANCE W), wireless interfaces for PROFIBUS and distributed I/O, mobile operator panels, planning software, and extensive accessories.

Industrial Ethernet Security

By integrating into the corporate network, the increased wired and wireless networking of industrial plants enables a degree of integration and openness that provides many benefits such as remote access to plant sections over the Internet. However, this also results in certain risks with regard to data security. With its industrial security concept, SIMATIC NET offers a safety solution that is specially designed for industrial automation engineering and that satisfies the specific requirements of this application environment. The security modules (SCALANCE S) and software are easy to handle, and reaction-free integration into existing networking concepts is possible.
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 retooling must be fast and efficient. It must always be ensured, however, that the capacity of the network and therefore the plant or machines must be optimally utilized and any downtimes must be 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 a high-performance network 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 high-performance communication networks extending over long distances. PROFINET, the open Industrial Ethernet Standard uses Industrial Ethernet and 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

Throughput of the networks (values for 5 network nodes)

Ethernet becomes Industrial Ethernet by adapting all the components to provide the level of ruggedness and ease of use required in industrial applications. This is based fully on the Ethernet standard IEEE 802.3 that includes the following basic technologies:

• **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 FastConnect 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.

• **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 up to 70 km can be achieved.

• **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 on Fast Ethernet. Before initiating the actual data transmission, network devices automatically negotiate a transmission mode which is supported by any device (100 Mbit/s or 10 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 for every application.

Compact Switch Modules (CSMs) offer additional ports directly on the SIMATIC.

The product group SCALANCE X consists of several lines of unmanaged and managed switches that can be integrated into PROFINET and are matched to the relevant automation and networking task.

Communications processors (CPs) for SIMATIC and PC 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 facilitating a reduction of the 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 an optical ring comprising 50 switches, the network will be reconfigured after a fault (cable break or failure of a switch) in less than 200 ms. 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 any topology or rings can be coupled over two switches.

Configuration with high-speed redundancy in the electrical ring
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 SIMATIC NET switches, e.g. SCALANCE X-400, 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 no EMI is desired.

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.
**Industrial Ethernet**

Reliable networks thanks to redundancy

**Switching for future-oriented networks**

Whereas in the field level, short response times and small data message frames are in the forefront, the need for high data throughput is constantly increasing in the control level. The reason for this is the fast growing number of nodes and more data-intensive systems such as HMI, SCADA, image processing systems, Web applications or multimedia applications. As well as the gigabit-enabled network infrastructure, there are also gigabit-enabled system connections available for PC or SIMATIC S7-300/400. The CP 1623 communications processor for PCI Express supports a high-performance connection of the HMI/SCADA systems and simultaneously increases the reliability of the network by means of an optional external power supply.

For these requirements, the switches of the SCALANCE X-300 and SCALANCE X-400 families offer the relevant interfaces for electrical and optical Gigabit Ethernet, as well as the necessary switching performance.

In addition to these infrastructure components, there are also gigabit-enabled communications processors available for PC and SIMATIC S7. This enables direct, high-performance connection of SCADA systems like WinCC to a Gigabit Ethernet. S7 controllers can also communicate with lower-level I/O devices while simultaneously connected to higher-level gigabit structures.

Network separation between field level, control level and enterprise level including gigabit communication
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 X414-3E or CP 343-1 Advanced/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
Industrial Ethernet Switching
Components with switch functionality

Industrial Ethernet switching components encompass Compact Switch Modules (CSMs), SCALANCE X Industrial Ethernet Switches, and communications processors (CPs) with integral switch.

**Compact Switch Modules (CSMs)**
Unmanaged switches for use directly in the SIMATIC to expand interfaces and integrate machines into existing plant networks.

**SCALANCE X-000/XB-000 unmanaged**
Unmanaged switches with electrical and optical ports for establishing small networks for machines and process cells.

**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 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 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.

**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 linear bus 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 the industrial PCs and for integrating the PCs into existing linear bus topologies.
Overview of SCALANCE X Industrial Ethernet switches and components with switch functionality

Criteria for selecting Industrial Ethernet switching components

- Basis for integrated networking in industrial automation - from the field to the management level
- Network components optimized for various applications:
  - Small and large-scale networks
  - Management functions for network structuring
  - Configuring of redundant networks
  - Use with PROFINET and Industrial Ethernet
- Robust housing for harsh environments
- Graded diagnostics concept

- Configuration of small networks
- Easy expansion of the number of ports for:
  - Connection of local HMI systems
  - Connection to higher-level networks
  - Service/maintenance

- Space-saving design of SIMATIC
- Unmanaged Switch with local diagnostics

- Communications processor for interfacing with PROFINET/Industrial Ethernet including integral switch for:
  - For interfacing with distributed I/O
  - Connection to higher-level networks
  - IP routing
  - Service/maintenance

- SIMATIC or PC module design
- Functions for network diagnostics
SCALANCE X Industrial Ethernet switches

Compact Switch Module CSM 377

The Compact Switch Module CSM 377 is an unmanaged switch for simple and fast connection of a SIMATIC S7-300 or ET 200M to an electrical Industrial Ethernet network. This makes the low-cost switch suitable for integrating small machines into existing automation networks, for operating the machines in stand-alone mode, or for establishing small, local Ethernet networks. Its single-width design enables space-saving installation on the S7-300 mounting rail.

Integration into SIMATIC S7-300 and ET200M for implementing small, local Ethernet networks

Diagnostics on the device by means of LEDs (power, link status, data communication)

RJ45 sockets with 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 auto-negotiation function

Connection of SIMATIC S7-300 with CSM 377 to Industrial Ethernet with linear topology
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 linear bus 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.

- Diagnostics on the device by means of LEDs (power, link status, data communication)
- RJ45 sockets with 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
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 linear bus and star topologies. They have a rugged plastic housing (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)

- 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

Star topology with SCALANCE XB005
SCALANCE X-100 unmanaged

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

- 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 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 auto-negotiation 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 fiber-optic 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 connections)
- 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 connections)
- SCALANCE X101-1AUI with one 10 Mbit/s AUI interface (SUB-D connections)
- SCALANCE X101-1FL with one 10 Mbit/s multimode interface (BFOC connections)

<table>
<thead>
<tr>
<th>Type and number of ports</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Twisted Pair</strong></td>
<td><strong>Fiber Optic</strong></td>
</tr>
<tr>
<td>10 / 100 Mbit/s</td>
<td>100 Mbit/s</td>
</tr>
<tr>
<td>RJ45</td>
<td>POF / PCF</td>
</tr>
<tr>
<td>SCALANCE X101-1</td>
<td>1</td>
</tr>
<tr>
<td>SCALANCE X101-1LD</td>
<td>1</td>
</tr>
<tr>
<td>SCALANCE X101-1POF</td>
<td>1</td>
</tr>
<tr>
<td>SCALANCE X101-1AUI</td>
<td>1</td>
</tr>
<tr>
<td>SCALANCE X101-1FL</td>
<td>1</td>
</tr>
<tr>
<td>OMC TP11</td>
<td>1</td>
</tr>
<tr>
<td>OMC TP11LD</td>
<td>1</td>
</tr>
</tbody>
</table>

- 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 sleeve for additional strain relief, designed for PROFINET-compliant IE FC RJ45 plug
- Redundant power supply

Function overview of Industrial Ethernet media converters
SCALANCE X-200 managed

The managed switches of the SCALANCE X-200 product range are very well suited for the setup of linear, 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 X208PRO with eight electrical ports; version in degree of protection IP65 which enables the setup of a star-shaped topology outside the control cabinet and can be operated with 24 V DC or, if required, via the PS791-1PRO power supply with 230 V AC.
- 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

Example for the use of power supply PS791-1PRO with SCALANCE X and SCALANCE W

SCALANCE X-200IRT managed

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 heavy 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.

Configuration example for SCALANCE X204IRT

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

- SCALANCE X204IRT with four electrical ports
- SCALANCE X201-3P IRT with one electrical and three optical ports (POF/PCF)
- SCALANCE X200-4P IRT with four optical ports (POF/PCF)
- SCALANCE X202-2IRT/X202-2P IRT with two electrical and two optical ports (BFOC or POF/PCF)
- SCALANCE XF204IRT with four electrical ports in ET 200S design with angled cable outlet (degree of protection IP20)
Redundant coupling of two subnets with SCALANCE X-200IRT

- 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 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 auto-negotiation 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
The compact gigabit switches of the SCALANCE X-300 product range are Industrial Ethernet switches for setting up linear bus, 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 a 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 know-how. The gigabit ports are typically used for connecting the switches to each other and for a possible connection to higher network levels. The SCALANCE X-400 switches are ideally 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 SCALANCE X-300 switches cascaded in line can be connected into a ring with a total length of up to 150 km with multi-mode, or 1,300 km with single mode. 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 (redundancy manager, standby function, and RSTP are integrated)
SCALANCE X-300 managed

SCALANCE X-300 is available in the following versions:

- SCALANCE X310: Three gigabit ports and seven Fast Ethernet ports
- SCALANCE X310FE: Ten Fast Ethernet ports
- SCALANCE X308-2: Two optical gigabit ports (SC Multi-mode, up to 750 m), one electrical gigabit port (RJ45) and seven Fast Ethernet ports
- SCALANCE X308-2LD: Two optical gigabit ports (SC Singlemode, up to 10 km), one electrical gigabit port (RJ45) and seven Fast Ethernet ports
- SCALANCE X308-2LH: Two optical gigabit ports (SC Singlemode, up to 70 km), one electrical gigabit port (RJ45) and seven Fast Ethernet ports
- SCALANCE X307-3: Three optical gigabit ports (SC Multi-mode, up to 750 m), and seven Fast Ethernet ports
- SCALANCE X307-3LD: Three optical gigabit ports (SC Singlemode, up to 10 km), and seven Fast Ethernet ports

Configurations for integrating existing networks

Existing network configurations that were constructed, for example, using Industrial Ethernet switches OSMs (Optical Switch Modules) and ESMs (Electrical Switch Modules), can be easily expanded using SCALANCE X components.

Existing 100 Mbit/s data terminals or subnets with Fast Ethernet up to 100 Mbit/s can be easily integrated into new network structures.

- 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 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
- Investment protection due to compatibility of SCALANCE X with OSM, ESM
The modular switches of the SCALANCE X-400 product range are Industrial Ethernet switches for setting up linear, 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 SCALANCE X-400 switches cascaded in line can be connected into a ring with a total length of up to 150 km with multi-mode, or 1,300 km with single mode. 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 (redundancy manager, standby function, RSTP and VRRP are integrated)
  - 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.
- Different media modules enable Fast Ethernet and gigabit connections with ranges of up to 70 km.
Configurations for integrating existing networks

Existing network configurations that were constructed, for example, using Industrial Ethernet switches OSMs (Optical Switch Modules) and ESMs (Electrical Switch Modules), can be easily expanded using SCALANCE X components. Existing 100 Mbit/s data terminals or subnets with Fast Ethernet up to 100 Mbit/s can be easily integrated into new network structures.

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)

- 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 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 autonegotiation 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 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
- Investment protection due to compatibility of SCALANCE X with OSM and ESM
- Layer-3 functionality (IP routing)
Industrial Ethernet Switching
Communications processors for SIMATIC S7 and PCs

Generally, communications processors are used to connect SIMATIC S7 or PCs to PROFIBUS or Industrial Ethernet. They offload the controller significantly of communication tasks and use fewer resources in the controller. Some communications processors also have an integral switch and consequently offer 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) with CP 343-1 Advanced and CP 443-1 Advanced.
- Functions for network diagnostics

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

Connection to higher-level network

CP 1616 as PROFINET IO-Controller and PROFINET IO-Device
Industrial Ethernet Switching
Communications processors for SIMATIC S7 and PCs

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 have shipbuilding certification enabling their use onboard ship or on offshore facilities.

The CPs are integrated into the industrial cabling system of SIMATIC NET via the RJ45 interface.

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

**CPs for PCs:**
- CP 1623, CP 1616, CP 1604

- Connection to SIMATIC S7 via backplane bus
- Diagnostics on the device by means of LEDs (link status, bus fault, data communication)
- RJ45 sockets with 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 auto-negotiation 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 and 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)
- C-PLUG swap medium for module replacement without programming device
- 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 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 auto-negotiation 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)
### Type and number of ports

<table>
<thead>
<tr>
<th>Type and number of ports</th>
<th>Gigabit Ethernet</th>
<th>Fast Ethernet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 / 100 / 1000 Mbit/s</td>
<td>10 / 100 Mbit/s</td>
</tr>
<tr>
<td>TP</td>
<td>Fiber Optic</td>
<td>TP</td>
</tr>
<tr>
<td>RJ45</td>
<td>M12 with PoE</td>
<td>RJ45</td>
</tr>
<tr>
<td></td>
<td>POF/PCF (50m/100m)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multi-mode BFOC (3km)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long-haul SC (70km)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of module</th>
<th>RJ45 Multi-mode SC (750m)</th>
<th>Single-mode SC (10km)</th>
<th>Long-haul SC (60km)</th>
<th>Long-haul+ SC (70km)</th>
<th>RJ45 with PoE</th>
<th>M12</th>
<th>POF/PCF (50m/100m)</th>
<th>Multi-mode BFOC (3km)</th>
<th>Single-mode BFOC (28km)</th>
<th>Long-haul SC (70km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALANCE X-400</td>
<td>X414-3E</td>
<td>2 2(i)</td>
<td>2(i)</td>
<td>2(i)</td>
<td>2(i)</td>
<td>20(i)</td>
<td>12(i)</td>
<td>12(i)</td>
<td>12(i)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X408-2</td>
<td>4 4(i)</td>
<td>4(i)</td>
<td>4(i)</td>
<td>4(i)</td>
<td>4</td>
<td>4(i)</td>
<td>4(i)</td>
<td>4(i)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X310</td>
<td>3</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-300</td>
<td>X310FE</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X307-3</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X307-3L</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X308-2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X308-2L</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-200</td>
<td>X204IRT/ XF204IRT</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X202-2IRT</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X202-2P IRT</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X201-3P IRT</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td>1 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X200-4P IRT</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X204IRT PRO(i)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X204-2P IRT PRO(i)</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X224</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X216</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X212-2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X212-2LD</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X208</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X208PRO</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X208-1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X206-1LD</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X204-2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X204-2LD</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-100</td>
<td>X124</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X116</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X112-2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X112-2LD</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td>12 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X108</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X108PoE</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td>8 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X106-1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td>6 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X104-2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X104-2LD</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td>4 2</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-000</td>
<td>XB004-1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td>4 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>XB004-1LD</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X005XBO05</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X008</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

1(i) additionally connectable by means of multimode media modules
2(i) additionally connectable by means of singlemode media modules
3(i) and 4(i) no more than two 100 Mbit/s media modules can be connected
5(i) with extender module
6(i) additionally connectable by means of single or multimode media modules with SC connection
7(i) with Push/Pull connector technology
Industrial Ethernet Switching

Diagnostics and network management

Industrial Ethernet switching components SCALANCE X, CSM and CPs with integral switch function have different diagnostics functions depending on the device:

- **LED displays;**
  LEDs display information locally about power, port status and data communication.

- **Fault signaling contact/signaling mask;**
  the signaling mask is set to the current status (setpoint) using the SET pushbutton.
  The signal mask defines which ports and which power supplies are to be monitored. The signaling contact only reports an error when a monitored port or a monitored feeder fails (deviation of setpoint/actual status). This enables, for example, the module to be monitored via an input module from a controller.

- **PROFINET diagnostics;**
  PROFINET diagnostics alarms can be displayed with the appropriate SIMATIC Engineering Tools and processed in the controller.
  By means of complete integration into the SIMATIC concept for system error messages, the engineering overhead for PLC and HMI is reduced.

- **Web-based management;**
  The integral Web server enables configuration and diagnosis settings to be made using a standard browser. Statistical information can also be read out over the Web server.

- **Standard diagnostics via SNMP (Simple Network Management Protocol);**
  the switching components can be monitored with SNMP on a central network management system such as SNMP OPC Server. If faults occur on the device, error messages (SNMP traps) are sent to a network management system or as e-mail to a specified network administrator.

Network monitoring of a pumping station with SNMP OPC Server
<table>
<thead>
<tr>
<th>Module type</th>
<th>LED</th>
<th>Fault signaling contact</th>
<th>Message screen</th>
<th>PROFINET diagnostics</th>
<th>Web-based management</th>
<th>Diagnostics via SNMP</th>
<th>VLAN</th>
<th>IGMP-Snooping/Querier</th>
<th>RSTP</th>
<th>Multicast/broadcast limiting</th>
<th>Layer 3 (IP-Routing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALANCE X-400</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-300</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-200/X-200IRT</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-100</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SCALANCE X-000/XB-000</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>OSM</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ESM</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CSM</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 343-1 Lean</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 443-1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 343-1 Advanced</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 443-1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 443-1 Advanced</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 1604</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 1616</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CP 1623</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

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

Industrial Ethernet switches and components with switch functionality: Diagnostic features
Industrial Ethernet
Networking with FastConnect

The FastConnect system

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** by means of the insulation displacement method.
- **IE FC RJ45 Plug and IE FC M12 Plug PRO** are insensitive to interference due to the rugged metal housing, and are the ideal solution for installing RJ45 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

- 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
- Easy connection method (insulation-piercing contacts) for 4-core (Cat5) and 8-core (Cat6) Industrial Ethernet FC twisted-pair installation cables
- Easy assembly of both cable types with the pre-adjusted FC stripping tool
- Reliable shield contact and strain relief thanks to bolt-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
Industrial Ethernet Switching

Advantages at a glance

- Rugged industry-compatible design
- Low-cost versions
- 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
- One network for strict real time and standard TCP/IP, saving on duplicated infrastructure
- High network and machine availability

- 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

Order or download additional informative material:
http://www.siemens.com/simatic/printmaterial

SIMATIC Guide Manuals:
http://www.siemens.com/simatic-docu

Service & Support:
http://www.siemens.com/automation/service&support

SIMATIC NET partners:
http://www.siemens.com/automation/partner

A&D Mall internet ordering system:
http://www.siemens.com/automation/mall

The information provided in this brochure contains descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract. Availability and technical specifications are subject to change without notice. All product designations may be trademarks or product names of Siemens AG or their supplier companies whose use by third parties for their own purposes could violate the rights of their owners.