

SIEMENS



Redundant networks for industry

SIMATIC NET

Brochure

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Answers for industry.

High availability thanks to redundant networks

High system availability resulting from redundancy

Production plants are designed and costed to ensure high availability. The consequences of a system failure are, therefore, costly downtimes, high restarting costs and the loss of valuable data or materials. Redundant control systems and redundantly configured networks protect plants from failures in their automation systems. In the event of a fault, the high-available communication can take over automatically without any consequences for the plant.

To achieve the extremely fast response times required by industrial companies, SIMATIC NET has for many years used standardized network redundancy protocols that support reconfiguration times of a few milliseconds in the event of a fault.

For critical applications with high-availability requirements that do not permit any additional delay in communication, Siemens offers various solutions for Industrial Ethernet networks.

In general, there are two types of redundancy:

- System redundancy: A high-availability automation system is implemented by deploying systems and communication components in duplicate
- Media redundancy: Systems are only implemented individually, but in the event of an interruption in the network, the plant will continue to operate along substitute communication paths

The different mechanisms of media redundancy are explained in this brochure.

Further information on system redundancy can be found at:

www.siemens.com/simatic-high-availability-systems



Redundancy protocol	Products	Topologies	Applications	Reconfiguration time
HSR High-availability Seamless Redundancy (IEC 62439-3)	SCALANCE X204RNA	Ring	Power generation and distribution	Seamless
	SCALANCE X204RNA EEC			
PRP Parallel Redundancy Protocol (IEC 62439-3)	SCALANCE X204RNA	Line, star, tree	Plant automation in ships, energy switchgear, tunnels, pipelines, power plants, process applications (PCS 7)	Seamless
	SCALANCE X204RNA EEC			
	SOFTNET-IE RNA			
MRPD Media Redundancy for Planned Duplication with real-time feature Isochronous Real-Time IRT – PROFINET standard (IEC 61158 Type 10)	SCALANCE X-200IRT, SIMATIC S7, ET 200SP, SINAMICS, SIMOTION, PROFINET devices with integrated 2-port switch	Ring	Specially for isochronous drive controls (e.g. print industry)	Seamless
MRP Media Redundancy Protocol – PROFINET standard (IEC 62439-2)	SCALANCE X-200, X-300, X-400, X-500, SIMATIC S7, ET200, SINAMICS, PROFINET devices with integrated 2-port switch	Ring	Industrial/ process automation	200 ms
High Speed Redundancy	SCALANCE X-200, X-300, X-400, X-500	Ring	Industrial/ process automation	300 ms
Standby coupling	SCALANCE X-200IRT, X-300, X-400, X-500	Standby coupling	Process automation	300 ms
STP/RSTP (Rapid) Spanning Tree Protocol	SCALANCE X-300, X-400, X-500	Ring, star, tree	Office-based automation	Depending on network size and topology
Router redundancy Virtual Router Redundancy Protocol (VRRP)	Layer 3 switches, e.g. SCALANCE X-400, X-500	Line, ring, star, tree	For interfacing or coupling to LAN over WAN, e.g. Internet	One to several seconds



Redundant PRP networks acc. to IEC 62439-3

High-availability system solution for seamless and undelayed data transmission in two networks

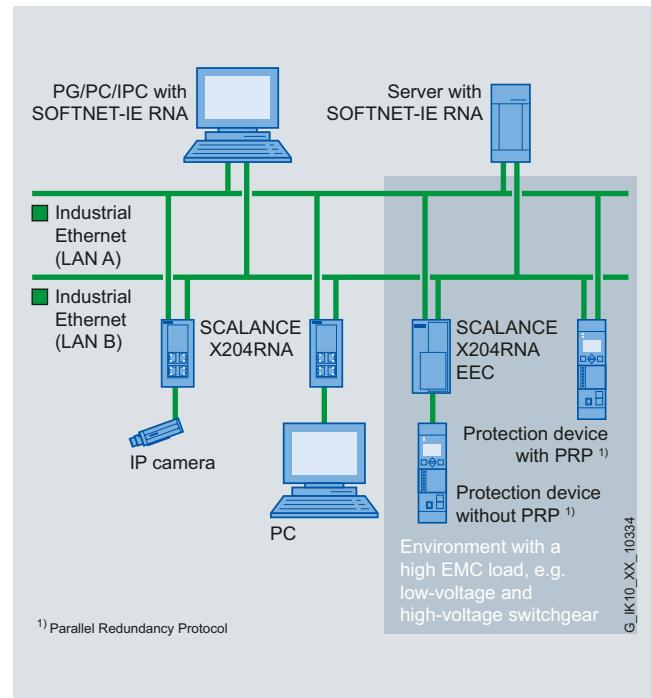
Parallel Redundancy Protocol (PRP)

The PRP redundancy protocol according to the IEC 62439-3 standard is based on double transmission of message frames over two separate networks. The access points SCALANCE X-200RNA for PRP networks connect up to two network segments or terminal devices without PRP functionality, without delay, over two parallel networks.

At the sender, the software SOFTNET-IE RNA or the network access point SCALANCE X-200RNA duplicates the message frame arriving from the sender (e.g. a PC); one message frame is fed into each of the two networks. The message frame will always be transmitted without delay, even in the event of a fault, because there is no need for reconfiguration of the network.

The protocol is transparent for the application (e.g. PCS 7, T3000) in the PC. SCALANCE X204RNA EEC can also be used under adverse EMC conditions.

This seamless data transmission offers extreme reliability and high availability in parallel networks and can be used for numerous applications, for example, in ships, energy switchgear or along pipelines.



Seamless, parallel networks with PRP redundancy protocol



SOFTNET-IE RNA software

Redundant HSR networks acc. to IEC 62439-3

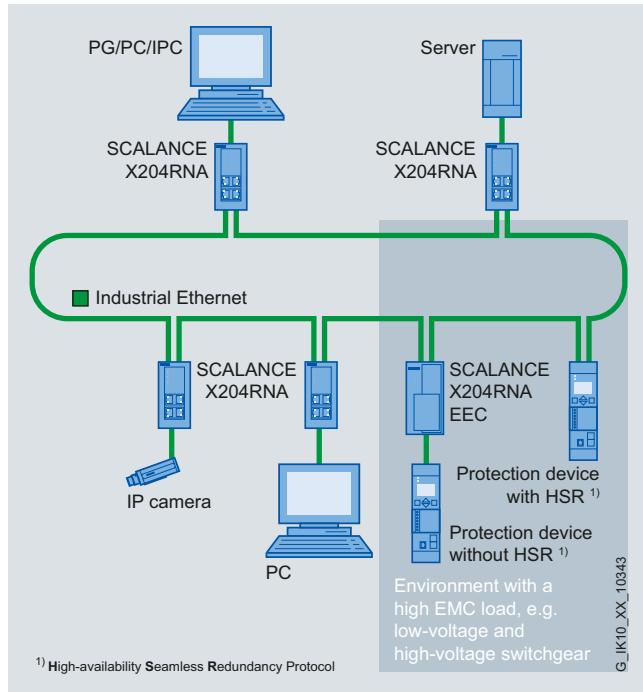
High-availability system solution for seamless and undelayed data transmission in ring topology

High-availability Seamless Redundancy Protocol (HSR)

The HSR redundancy protocol according to the IEC 62439-3 standard is based on double transmission of message frames over ring-topology networks in both directions. In the case of an error, the message frame will be transmitted without any delay. No reconfiguration time (relearning of the communication paths) is necessary for the network, as is the case for most other redundancy protocols.

In ring-topology networks, seamless data transmission is implemented for high-availability plants using the HSR protocol. The SCALANCE X204RNA devices with HSR functionality can also be used for redundant transition from HSR to PRP network structures.

SCALANCE X204RNA EEC can also be used under adverse EMC conditions. This seamless data transmission offers extreme reliability and high availability in ring topologies and can be used for numerous applications, for example, in drilling rigs, refineries and energy distribution.



Seamless, ring-shaped network with HSR redundancy protocol



SCALANCE X204RNA EEC and X204RNA

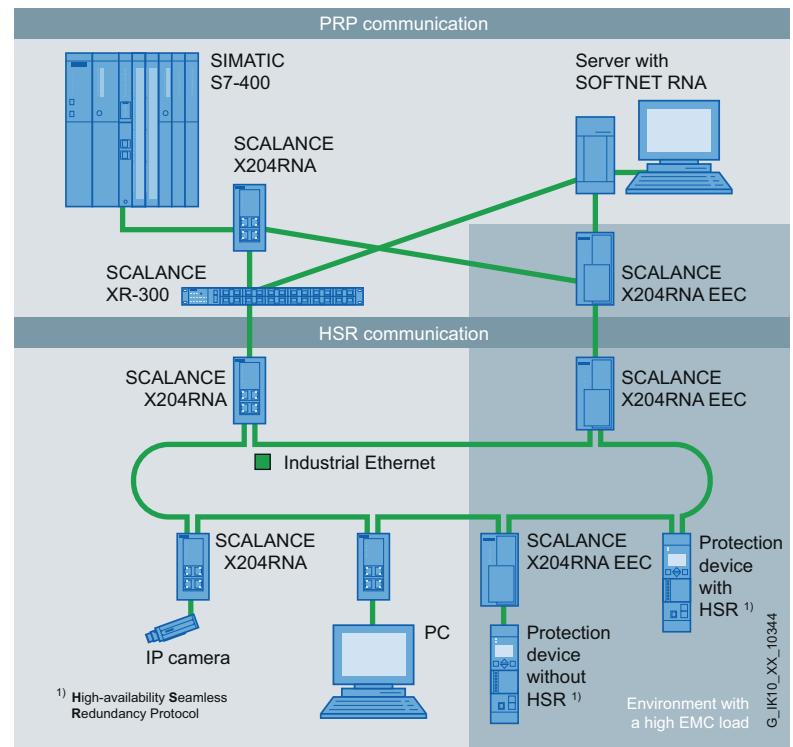
Redundant PRP/HSR networks acc. to IEC 62439-3

Seamless, redundant coupling between PRP and HSR networks



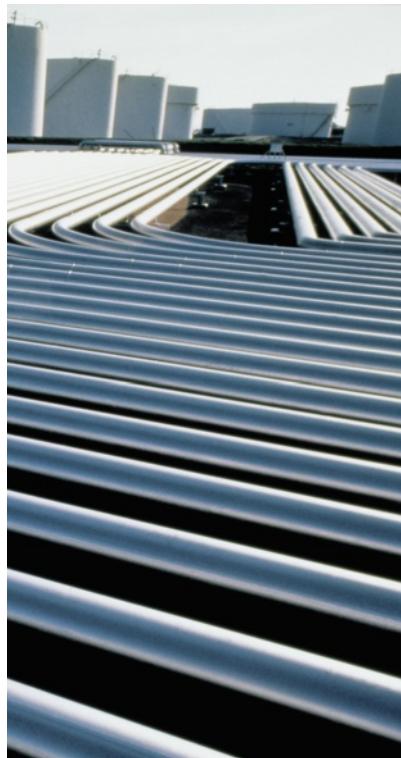
Coupling of PRP and HSR networks

One PRP network and one HSR network are coupled redundantly over SCALANCE X204RNA or SCALANCE X204RNA EEC. These redundancy techniques are used, in particular, in energy switchgear.



Seamless, redundant coupling
between PRP and HSR networks

Use of the redundancy protocols in different sectors



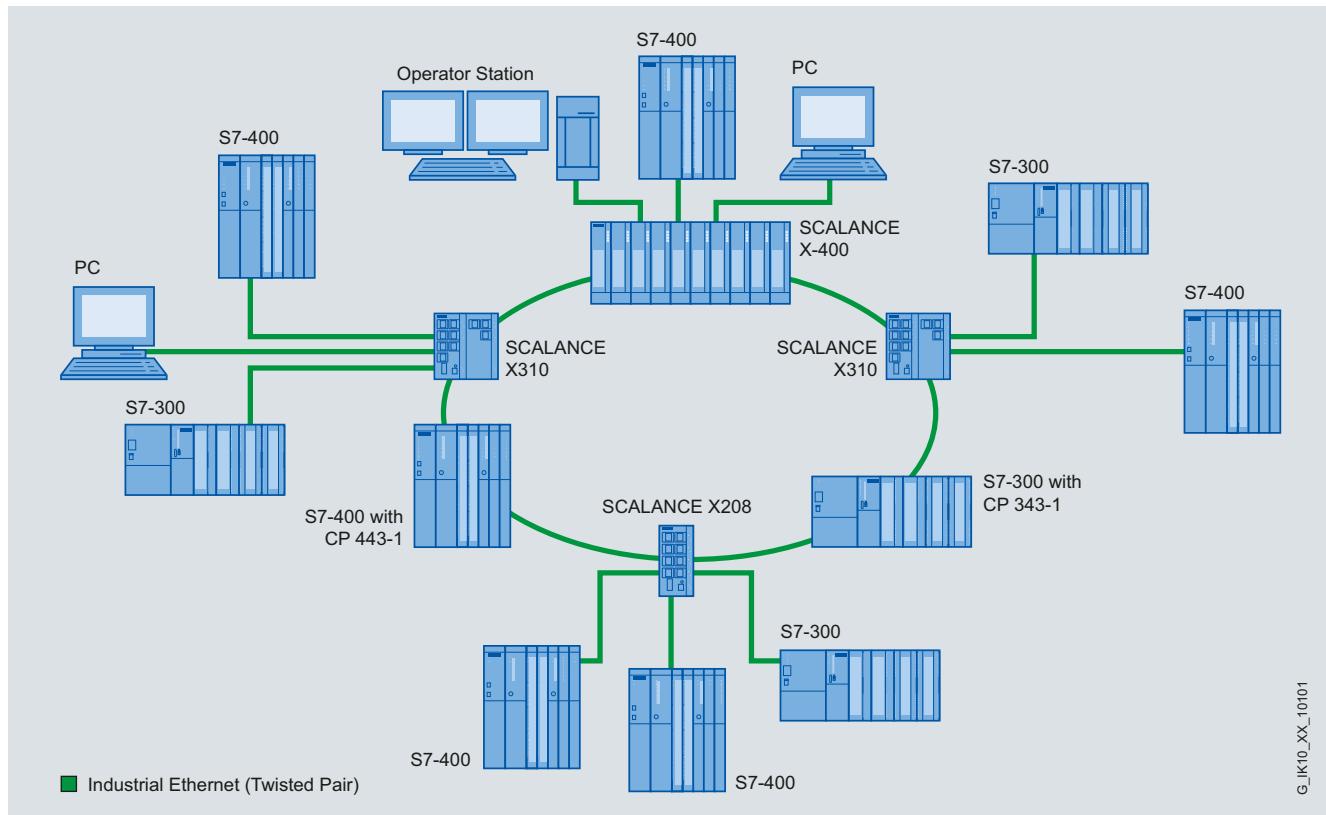
Your benefits at a glance

- The control level is designed with a PRP network, because it is essential that it features high availability. Subprocesses that are non-critical and that are distributed over a wide area can be networked cost-effectively using the HSR ring structure. The seamless functionality is assured in both protocols.
- Sending of the message frames twice ensures that there are no time delays in the event of a fault.
- A hardware solution (SCALANCE X204RNA) and a software solution (SOFTNET-IE RNA) are available for implementing PRP networks.

- Easy coupling of PRP and HSR networks using one device that can be configured for the transition.
- Easy coupling of networks with maximum availability (duplicated network structure using PRP) and cost-optimized, ring-shaped networks (HSR network structure).
- Comprehensive product range for network coupling of PRP and HSR networks comprising IP20 devices for industrial environments and also for extended ambient conditions (EEC variant) for use in power plants and energy switchgear.

Redundant networks according to the PROFINET standard

Media redundancy



Media redundancy for networking controllers (Control Level) with high-speed redundancy in the electrical ring

The MRP redundancy protocol in accordance with the PROFINET standard is ideally suited to the networking of controllers and control systems at the Control Level.

Media redundancy in the Field Level: MRP and MRPD

MRP

Higher plant availability can be achieved by means of a ring topology. This 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 I/Os. Thanks to the MRP protocol, reconfiguration times of 200 ms can be achieved with up to 50 participants in the ring. When communication is interrupted in one section of the ring installation only, plant shutdown can be prevented (depending on the response time).

A diagnosis is always offered so that faults can be rectified quickly and downtimes reduced.



*Particularly suitable for...
Industrial and process automation*



MRPD

High network availability can be achieved without reconfiguration time using the PROFINET-compatible MRPD protocol (Media Redundancy for Planned Duplication).

The MRPD protocol is an extension to the MRP protocol for sending message frames in duplicate within a ring structure. Networks can only be constructed with SCALANCE X-200IRT switches and additional components with the real-time feature Isochronous Real-Time IRT (PROFINET standard), such as SIMATIC controllers, ET 200, SIMOTION and SINAMICS drives.

*Particularly suitable for...
**Isochronous drive controls, e.g. in
the printing industry***

Redundant couplings

High Speed Redundancy

For use in high-availability plant networks, fast redundancy in the ring can be implemented with High Speed Redundancy. The reconfiguration time for 50 switches in the ring is up to 300 ms.

*Particularly suitable for...
Industrial and process automation*

Standby coupling

Industrial Ethernet switches of the SCALANCE X-300 and X-400 product lines are equipped with this function for the redundant coupling of network segments, such as coupling of redundant ring structures. This is particularly necessary in process automation to meet the demanding requirements of network availability.

*Particularly suitable for...
integration of automation networks in
existing office networks*

(Rapid) Spanning Tree Protocol STP/RSTP

(Rapid) Spanning Tree is a redundancy protocol with a minimal response time that has been standardized in IEEE-802.1D (2004). The reconfiguration times depend on the topology and start at around 50 ms.

*Particularly suitable for...
process automation*

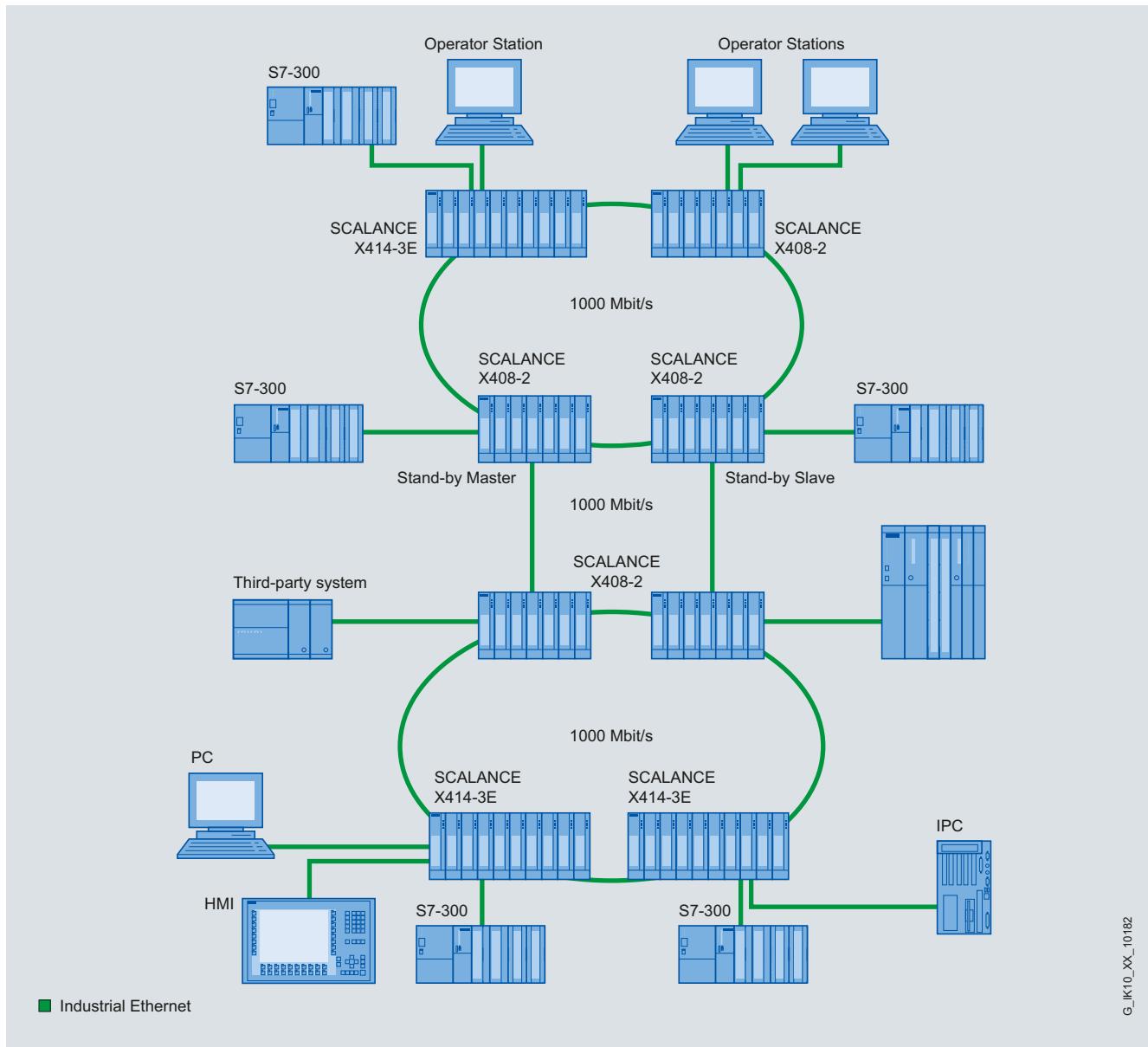
Router redundancy VRRP (Virtual Router Redundancy Protocol)

Layer 3 switches, such as SCALANCE X-500, support router redundancy as well as parallel routing over several paths which increase the availability of the network significantly. They are therefore suitable for use in high-performance plant networks (e.g. with high-speed redundancy). Since IT standards are also supported (e.g. VLAN, IGMP, RSTP), the seamless integration of automation networks into existing office networks is possible. Routing functions on Layer 3 permit communication between different IP subnets.

*Particularly suitable for...
Office-based automation*



Layer 3 Industrial Ethernet switch SCALANCE X-500



G_IK10_XX_10182

Redundant connection of two optical Gigabit subnets with SCALANCE X-400 on Layer 2 and Layer 3

Get more information

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