SIEMENS

SIMATIC

Communication with SIMATIC

System Manual

The following supplement is part of this documentation:

No.	Designation
1	Brochure Industrial Communication for Automation

Preface

Introduction 1

PROFINET / Industrial Ethernet 2

Industrial Wireless LAN 3

PROFIBUS 4

AS-Interface 5

Wide Area Network (WAN) 6

Multi-Point Interface (MPI) 7

Point-to-Point Interface (PPI) 8

Point-to-Point 9

KNX/EIB (KONNEX) 10

Configuration and Parameter Assignment Tools 11

09/2006
EWA 4NEB 710 6075-02 04

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

Order No.: EWA 4NEB 710 6075-02 04
09/2006

Preface

Preface

SIMATIC products allow control solutions for a variety of industries and requirements. A key element in the success of the SIMATIC products is the ability of the different hardware platforms to communicate seamlessly over different networks--sharing information quickly and efficiently.

Purpose of this manual

The *Communication with SIMATIC System Manual* provides a general overview of the communication networks and communication technologies that are used in the automation field. The emphasis is on the SIMATIC product line and the network protocols it supports.

This manual is based on the brochure "Industrial Communication for Automation" and extends the technical facts. The manual also specifies the available configuration tools and refers to further information.

The manual offers the following opportunities:

- Introduction into the communication technologies
- Basis for decision-taking and planning for the various networks
- Navigation aid within the documentation structure in the SIMATIC environment

However, more detailed descriptions of the SIMATIC products and instructions on the concrete structuring of communication networks are not contained. This information is provided in the corresponding product-oriented manuals.

Required Background

It is advantageous if you already have a general knowledge of networks and automation technology and are familiar with the brochure "Industrial Communication for Automation".

No specific knowledge of communication theory is required. Basic knowledge about communication, for example about network topology and the 7-layer ISO/OSI reference model, is recommended

Scope of This Manual

This manual applies for the SIMATIC product line.

Changes compared to the previous version

The decisive change compared to the previous version is the improved structuring of the contents. In this new manual the contents are provided classified by the networks. The chapters for the respective networks have a uniform substructure.

Audience

This manual is intended for the following target groups who plan and design networked automation solutions with SIMATIC products:

- Decision makers
- Planner
- Designers

Commissioning engineers and the service personnel will also profit from the manual.

Further Support

Please talk to your Siemens contact at one of our agencies or local offices if you have any questions about the products described here and do not find the answers in this manual.

- You will find your contact partner at:
  http://www.siemens.com/automation/partner
- You will find the pointer to the offering of technical documentation for the individual SIMATIC products and systems at:
  http://www.siemens.de/simatic-doku
- You will find the online catalog and the online ordering system at:
  http://mall.automation.siemens.com/

Training Center

We offer various courses for newcomers to the SIMATIC S7 automation system. Please contact your regional Training Center, or the central Training Center in D90327 Nuremberg.

- Phone: +49 (911) 895-3200
- Internet: http://www.sitrain.com

Technical Support

You can contact the Technical Support for all the A&D products by means of the Web form for the support request:

- Internet: http://www.siemens.de/automation/support-request
- Phone: + 49 180 5050 222
- Fax: + 49 180 5050 223

For further information on our Technical Support can be found on the Internet under http://www.siemens.de/automation/service

Service & Support on the Internet

In addition to our range of documentation, you also have access to our know-how on the Internet.

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

There you can find:

- The Newsletter, which provides the latest information on your products
- The right documents via our Search function in Service & Support.
- A forum where users and experts from all over the world exchange ideas
- Your local representative for Automation & Drives.
- Information about on-site services, repairs, spare parts. You will find much more under "Services".

Table of contents

Preface iii

1 Introduction 1-1

1.1 Introduction 1-1

2 PROFINET / Industrial Ethernet 2-1

2.1 Introduction 2-1

2.2 Properties 2-3
2.2.1 Basic principles 2-3
2.2.2 Network Architectures 2-4
2.2.3 Network Components 2-5
2.2.4 Connection Systems 2-5
2.2.5 High-Availability 2-7

2.3 Technology 2-8
2.3.1 Transmission 2-8
2.3.2 Access Methods 2-9

2.4 Information Security in the Automation 2-11

2.5 Services 2-14
2.5.1 Standard Communication Services - Overview 2-14
2.5.2 FTP Services 2-15
2.5.3 E-Mail Services 2-16
2.5.4 SNMP Services 2-17
2.5.5 OPC Services 2-19
2.5.6 PROFINET IO Services 2-20
2.5.7 PROFINET CBA Services 2-21
2.5.8 PROFIdrive 2-23
2.5.9 PROFIsafe 2-24
2.5.10 TCP Services 2-26
2.5.11 ISO Transport Services 2-27
2.5.12 UDP Services 2-28
2.5.13 PG/OP Communication Services 2-29
2.5.14 S7 Communication Services 2-30

2.6 Configurations 2-31
2.6.1 Device Family 2-31
2.6.2 Gateways 2-34

3 Industrial Wireless LAN 3-1

3.1 Introduction 3-1

3.2 Properties 3-4
3.2.1 Basics 3-4
3.2.2 Network Architectures 3-5
3.2.3 Network Components 3-6
3.2.4 Connection Systems 3-6
3.2.5 Fault Tolerance 3-7

3.3 Technologies ... 3-7
3.3.1 Transmission ... 3-7
3.3.2 Access Methods ... 3-8
3.4 Information Security in the IWLAN ... 3-9
3.5 Configurations ... 3-10
3.5.1 Planning and Engineering ... 3-10
3.5.2 Device Family ... 3-11
3.5.3 Gateways ... 3-14
4 PROFIBUS ... 4-1
4.1 Introduction ... 4-1
4.2 Features ... 4-4
4.2.1 Basics ... 4-4
4.2.2 Network Architectures ... 4-4
4.2.3 Network Components ... 4-5
4.2.4 Connection Systems ... 4-5
4.2.5 High-Availability ... 4-6
4.3 Technologies ... 4-7
4.3.1 Transmission Methods ... 4-7
4.3.2 Access Methods ... 4-7
4.4 Services ... 4-8
4.4.1 PROFIBUS DP services ... 4-8
4.4.2 PROFIBUS PA Communication Services ... 4-9
4.4.3 PROFIdrive ... 4-11
4.4.4 PROFIsafe ... 4-12
4.4.5 PG/OP Communication Services ... 4-14
4.4.6 S7 Communication Services ... 4-14
4.4.7 PROFIBUS FMS Communication Services ... 4-15
4.4.8 PROFIBUS FDL Communication Services ... 4-15
4.5 Configurations ... 4-16
4.5.1 Device Family ... 4-16
4.5.2 Gateways ... 4-17
5 AS-Interface ... 5-1
5.1 Introduction ... 5-1
5.2 Properties ... 5-2
5.2.1 Basic Principles ... 5-2
5.2.2 Network Architectures ... 5-3
5.2.3 Network Components ... 5-3
5.2.4 Connection Systems ... 5-3
5.3 Technologies ... 5-4
5.3.1 Transmission Modes ... 5-4
5.3.2 Access Methods ... 5-4
5.4 Services ... 5-5
5.4.1 AS-Interface Services ... 5-5
5.4.2 ASIsafe ... 5-6
5.5 Configurations ... 5-7
5.5.1 Device Family ... 5-7
5.5.2 Gateways ... 5-8

6 Wide Area Network (WAN) 6-1

6.1 Introduction 6-1

6.2 Features 6-1
6.2.1 Terminal 6-1
6.2.2 Control Center 6-3
6.2.3 Classical WAN 6-3
6.2.4 Ethernet-based WAN 6-4
6.2.5 Transmssion on the Store-and-Forward Principle 6-4
6.2.6 Change-Driven Data Transmission 6-5
6.2.7 Date and Time 6-5
6.2.8 Local Data Storage 6-5
6.2.9 SINAUT Remote Programming and Remote Diagnostics 6-5
6.2.10 Alarm Messaging via Text Message 6-6
6.2.11 Network Forms 6-6
6.2.12 Connection to Classical WAN 6-6
6.2.13 Connection to Ethernet-Based WAN 6-6

6.3 Protocols 6-7
6.3.1 SINAUT ST1 Protocol 6-7
6.3.2 SINAUT ST7 Protocol 6-7
6.3.3 Operating Modes 6-8
6.3.4 Function of the TIM 6-10

6.4 Topologies 6-12
6.4.1 Introduction 6-12
6.4.2 Configuration Examples 6-13

6.5 Device Family 6-17
6.5.1 Overview of All TIM Variants 6-17

7 Multi-Point Interface (MPI) 7-1

7.1 Introduction 7-1

7.2 Properties 7-1
7.2.1 Basic Principles 7-1
7.2.2 Network Architectures 7-2
7.2.3 Network Components 7-2
7.2.4 Connection Systems 7-2

7.3 Technologies 7-2
7.3.1 Transmission M 7-2
7.3.2 Access Methods 7-2

7.4 Services 7-3
7.4.1 PG/OP Communication Services 7-3
7.4.2 S7 Communication Services 7-3
7.4.3 S7 Basic Communication Services 7-3
7.4.4 Global Communication Services 7-4

7.5 Configurations 7-5

8 Point-to-Point Interface (PPI) 8-1

8.1 Introduction 8-1

8.2 Features 8-1
8.2.1 Basic Principles 8-1
8.2.2 Network Architectures 8-2
8.2.3 Network Components 8-2
8.2.4 Connection Systems 8-2

8.3 Technologies ... 8-2
8.3.1 Transmission M ... 8-2
8.3.2 Access Methods ... 8-2
8.4 Services ... 8-3
8.5 Configurations ... 8-3
9 Point-to-Point ... 9-1
9.1 Introduction ... 9-1
9.2 Features ... 9-1
9.2.1 Basic Principles ... 9-1
9.2.2 Network Architectures ... 9-2
9.2.3 Network Components ... 9-2
9.2.4 Connection Systems ... 9-2
9.3 Technologies ... 9-2
9.3.1 Transmission Modes ... 9-2
9.3.2 Access Methods ... 9-2
10 KNX/EIB (KONNEX) ... 10-1
10.1 Introduction ... 10-1
10.2 Features ... 10-2
10.2.1 Basic Principles ... 10-2
10.2.2 Network Architectures ... 10-5
10.2.3 Network Components ... 10-6
10.2.4 Connection Systems ... 10-6
10.3 Technologies ... 10-6
10.3.1 Transmission M ... 10-6
10.3.2 Access Methods ... 10-7
10.4 Configurations ... 10-8
10.4.1 Device Family ... 10-8
10.4.2 Gateways ... 10-8
10.4.3 Connection of Other Systems ... 10-9
11 Configuration and Parameter Assignment Tools ... 11-1
11.1 Tools and their Use ... 11-1
11.2 Tools for your task ... 11-8
Glossary ... Glossary-1
Index ... Index-1

Tables

Table 2-1 Media and Topologies at PROFINET / Industrial Ethernet ... 2-4
Table 2-2 Network Components at PROFINET / Industrial Ethernet ... 2-5
Table 2-3 Technical Specification PROFINET / Industrial Ethernet Interface ... 2-6
Table 2-4 PROFINET Connection for SIMATIC Controllers and CPs ... 2-32
Table 2-5 PROFINET connection for IO Devices ... 2-33
Table 2-6 PROFINET connection for IO Devices ... 2-33

Table 2-7 PROFINET connection for PC-based automation 2-33
Table 3-1 Network Components for IWLAN 3-6
Table 3-2 Connection System at the SCALANCE W Product Family 3-6
Table 3-3 Properties of the variants of the IEEE 802.11 standard 3-7
Table 3-4 Overview of the SCLANCE W700 Product Range 3-13
Table 4-1 Media and Topologies at PROFIBUS: 4-4
Table 4-2 Active Network Components at PROFIBUS: 4-5
Table 4-3 Transmission Modes at PROFIBUS: 4-7
Table 4-4 PROFIBUS Connection for SIMATIC Components 4-16
Table 4-5 Gateways at PROFIBUS: 4-17
Table 5-1 SIMATIC AS-i Masters: 5-7
Table 5-2 Gateways at AS-Interface 5-8
Table 6-1 TIM Variants and Their Properties 6-17
Table 11-1 Tools and their Use 11-1
Table 11-2 Tasks and Available Tools 11-8

Introduction

1

1.1 Introduction

Overview

Communication networks are a central component of modern automation solutions. Industrial networks have to fulfill special requirements, for example:

- Coupling of automation systems as well as simple sensors and actuators and computers
- The information has to be correct and has to be transferred at the right moment.
- Robust against electromagnetic disturbances, mechanical stresses and soiling
- Flexible adaptation to the production requirements

Industrial networks belong to the LANs (Local Area Networks) and allow communication within a limited area.

Industrial networks fulfil the following communication functions:

- Process and field communication of the automation systems including sensors and actuators
- Data communication between automation systems
- IT communication for integrating the modern information technology

SIMATIC NET

The network solutions of SIMATIC NET are an integral component of Totally Integrated Automation (TIA). With Totally Integrated Automation (TIA) Siemens provides an integrated basis for implementing customer-specific automation solutions as the only manufacturer.

SIMATIC NET is characterized by the following features:

- Complete integration from the field level to the management level
- Coverage of the field area with Industrial Ethernet
- Promotion of mobile communication
- Integration of the IT technologies

These communication network options allow you to combine SIMATIC products and intelligent devices locally according to your requirements. Flexibility and openness of the standards of SIMATIC communication networks make it possible to link different systems and to implement extensions.

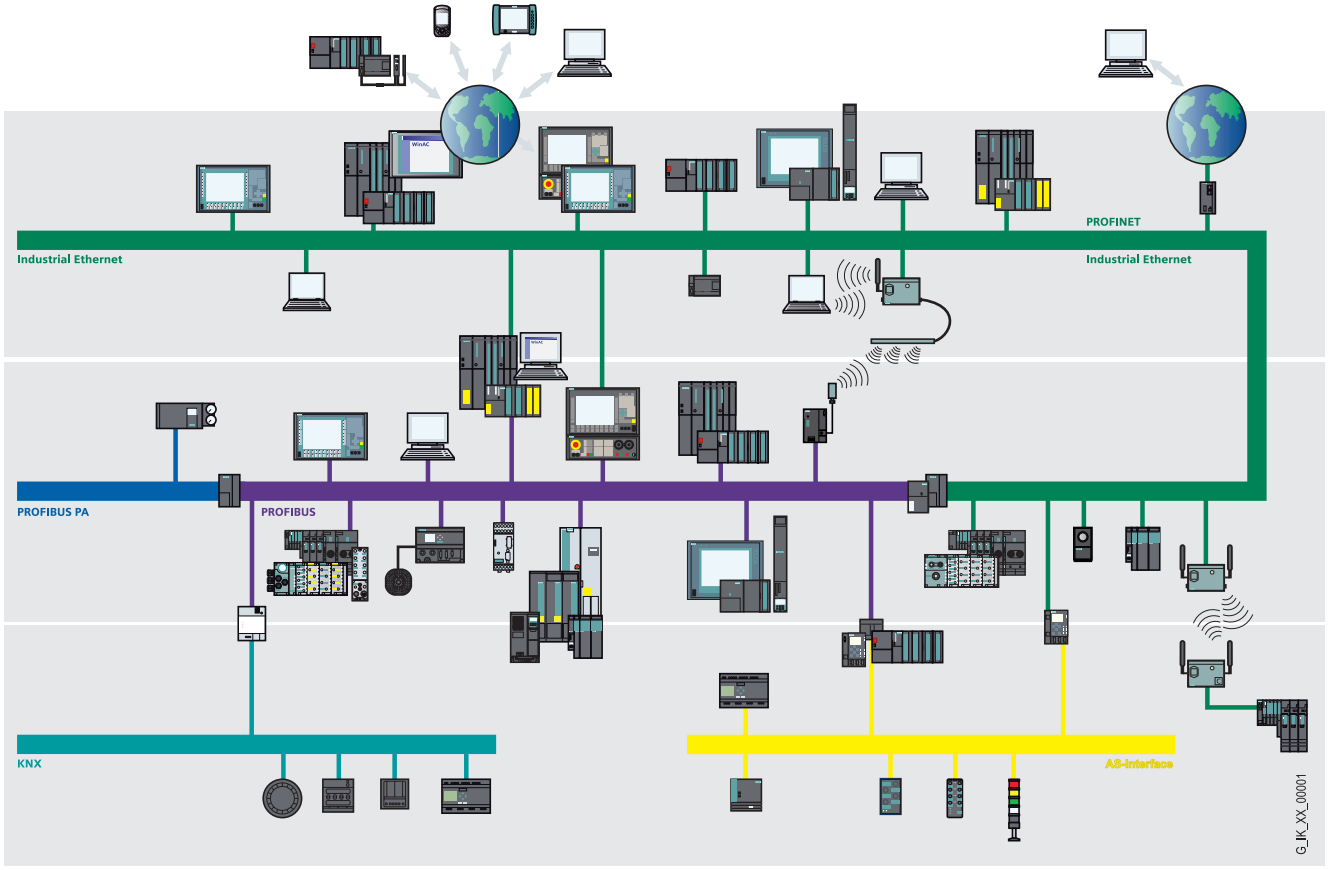


Figure 1-1 Overview of Bus Systems

Overview of the Networks

This manual deals with the following networks:

- **Industrial Ethernet**

  The industrial network standard for all levels

- **PROFINET**

  The open Industrial Ethernet standard for automation

- **PROFIBUS**

  The international standard for the field area and market leader at the field busses

- **AS-Interface**

  The inexpensive system for linking sensors and actuators as an alternative to cable harnesses

- **MPI**

  The integrated interface of the SIMATIC products

- **PPI**

  The integrated interface specially for the S7-200

- **Point-to-point Communication**

  The serial coupling of two communication partners

- **KONNEX (KNX/EIB)**

  The universal bus system for the complete home and building technology

PROFINET / Industrial Ethernet 2

2.1 Introduction

Industrial Ethernet, which is based on the IEEE 802.3, allows you to connect your automation system to your office networks. Industrial Ethernet provides IT services that allow you to access production data from the office environment.

PROFINET is an open standard conforming to the IEEE 61158 for industrial automation based on Industrial Ethernet. PROFINET uses the IT standards right down to the field level and supports plant-wide engineering.

With PROFINET you can implement automation solutions with a higher performance that require hard realtime, for example in the field of motion control.

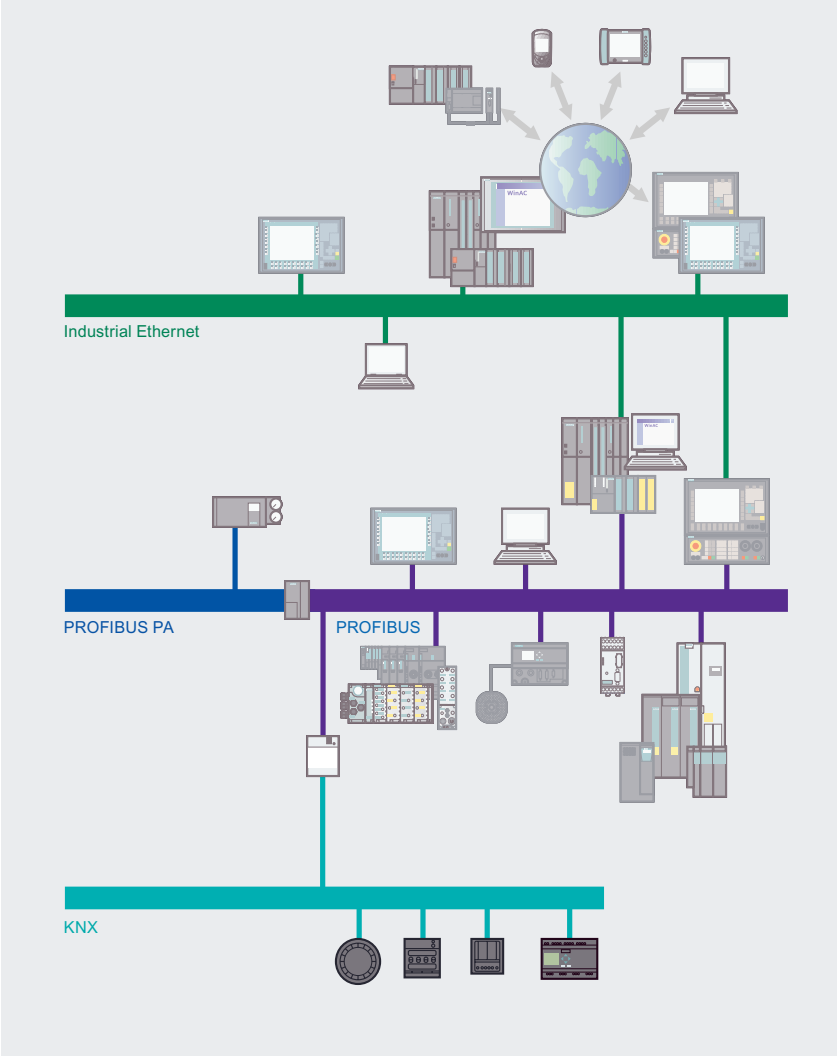


Figure 2-1 PROFINET via Industrial Ethernet

Further Information

Brochure "Industrial communication for automation".

- Introductory information about industrial communication
- http://www.automation.siemens.com/net/html_76/ftp/presales/k-schrift_e.pdf

Catalog IK PI 2007 "Industrial Communication for Automation and Drives",

- Device overview and ordering data for industrial communication
- http://www.automation.siemens.com/net/html_76/support/printkatalog.htm

Isochronous Mode function manual:

- Complete overview of the isochronous mode system function
- http://support.automation.siemens.com/WW/view/en/15218045

PROFINET system description:

- http://www.profibus.com/pall/meta/downloads/

PROFIBUS international homepage:

- http://www.profibus.com/

2.2 Properties

2.2.1 Basic principles

Industrial Ethernet

Industrial Ethernet is tailored to the requirements in industrial environments, on the basis of Ethernet.

Industrial Ethernet is particularly characterized by the following features:

- Networking of different application areas such the office and production areas
- Robust design and electromagnetic interference immunity
- High transmission performance even at a large number of nodes due to the continuous availability of components with 100 Mbps transmission rates to Fast Ethernet at all the network components.
- Various transmission media (for example Industrial Twisted Pair, fiber-optic conductors)
- Scalable performance with switching technology
- High availability thanks to redundant network topologies

Fast Ethernet

Fast Ethernet is the further development of the Ethernet technology. The Fast Ethernet standard IEEE 802.3 u is essentially based on the classical Ethernet standard.

Ethernet and Fast Ethernet have the following common properties:

- Data format
- CSMA/CD access method

They differ in the following properties:

- Length of the network
- Rules for network structure
- Autosensing, meaning the automatic recognition of the transmission rate
- Support of duplex mode

PROFINET

PROFINET supports the communication services PROFINET IO, PROFINET CBA and various profiles such as PROFIsafe and PROFIdrive.

The PROFINET IO and PROFINET CBA communication services ensure the functionality required for automation systems:

- PROFINET IO enables distributed field devices (IO devices such as signal modules) to be connected directly to Industrial Ethernet. For additional support of fail-safe applications, devices communicate over PROFINET IO with the PROFIsafe profile.
- You use the standard SIMATIC software tools with PROFINET IO, such as STEP 7 for the engineering and diagnostics at the field level and SIMOTION Scout for the configuration of motion control applications.
- At IRT communication (IRT: Isochronous Real Time) a part of the transfer time is reserved for cyclic (deterministic) data traffic. This means that the communication cycle is split into a deterministic section and an open section.

- You can route both the IRT and TCP/IP communications over the same network at the same time without their affecting each other.
- By supporting isochronous real-time communications, PROFINET provides the short and deterministic send cycles that are critical for motion control applications.
- PROFINET CBA (Component Based Automation) allows you to implement a modular solution for your distributed automation system. Using the component-based functionality of PROFINET CBA, you structure the automation system into independent modules. The connections between the modules are implemented with the graphics engineering tool SIMATIC iMap. This tool supports you in interconnecting modules up to complete plant and complete systems.
- PROFINET CBA supports cyclic and acyclic communication and is particularly suitable for data transfer between controllers thanks to its send cycles of up to 10 ms.
- PROFIdrive is the functional interface between control systems and drives at PROFINET and at PROFIBUS. PROFIdrive is defined by the PROFIdrive drive profile of the PROFIBUS User Organization (PNO). The PROFIdrive drive profile defines the device behavior and the access procedure to drive data for electrical drives, from simple frequency converters up to high performance servo controllers.
- PROFIsafe is the profile of PROFINET and PROFIBUS for safety-oriented communication. PROFIsafe uses the conventional standard automation of PROFINET and PROFIBUS and is certified for the safety levels up to SIL 3 (Safety Integrated Level) of IEC 61508 as well as Category 4 of EN954-1.
- PROFINET defines requirements on the information security for automation systems and supports the users with possible security solutions specially in the industrial environment.

Further Information

Further information about the PROFINET standards and the participating companies can be found on the homepage of the PROFINET User Organization (PNO), under the Internet address http://profibus.de.

The PROFINET Security Guideline is available on the PNO homepage, under the Internet address http://profibus.de, in Version 1.0 of March 2005.

2.2.2 Network Architectures

PROFINET / Industrial Ethernet supports the media and topologies that are listed in the following table.

Table 2-1 Media and Topologies at PROFINET / Industrial Ethernet

Medium	Topology	Number of nodes	Length of the network
Copper	Star Line Tree	Max. 126	Up to 5 km
Fiber-optic conductor	Star Ring Line	More than 1000	Up to 150 km
Radio	Star	Max. 8	Up to 1000 m per segment

PROFINET / Industrial Ethernet allows you to integrate existing subnets (for example PROFIBUS, ASi) into the Industrial Ethernet architecture.

2.2.3 Network Components

In PROFINET / Industrial Ethernet there are passive and active network components:

- Passive network components are for example power cables and plug connectors.
- Active network components are for example Switch, Access Point, Client Modules, media converters and Link Modules.

The following table lists the various network components for PROFINET / Industrial Ethernet.

Table 2-2 Network Components at PROFINET / Industrial Ethernet

Medium	Components	Comment
Copper (electrical)	Switch	Used to interconnect nodes at Industrial Ethernet Used to couple two segments
	Repeater	Used to couple PROFINET to PROFIBUS
	PN/DP Link	Used to couple two PROFINET subnets
	PN/PN Link	Used to couple networks with different media
	Media converter SCALANCE X	Used to connect nodes and establish electrical networks
Fiber-optic conductor (optical)	SCALANCE X	Used to connect nodes and establish optical networks Used to connect nodes without integrated fiber-optic conductor interface
Radio (wireless)	Access Point IWLAN/PB Link PN IO	For close-range wireless transfer For wireless coupling of Industrial Ethernet to PROFIBUS DP

2.2.4 Connection Systems

The specifications of the plug-in connections at PROFINET / Industrial Ethernet depending on the respective medium used are listed in the following table.

Table 2-3 Technical Specification PROFINET / Industrial Ethernet Interface

Physical properties	Connection technology	Cable type / transmission medium Standard
Copper (electrical)	RJ 45 plug-in connector ISO/IEC 61754-24 IE FC RJ45 plug 90/145/ 180 M12- connector D-coded	100 Base TX Twisted pair, symmetrical and shielded copper cable IEC 61158 E FC TP standard cable GP 2x2 IE FC TP flexible cable GP 2x2 IE FC TP trailing cable GP 2x2 IE TP torsion cable GP 2x2 IE FC TP trailing cable 2x2 IE FC TP marine cable 2x2
Fiber-optic cable (optical)	SC RJ 45 ISO/IEC 61754-24	Plastic Fiber-optic cable (polymer optical fiber, POF) ISO/IEC Plastic-LWL 60793-2
		Plastic-covered glass fiber (Polymer Cladded Fiber, PCF) ISO/IEC 60793-2 PCF standard cable GP PCF trailing cable PCF trailing cable GP (for SC RJ45 connector)
	BFOC (Bayonet Fiber Optic Connector) ISO/IEC 60874-10 SC connector	Glass fiber - Fiber-optic cable - monomode fiber ISO/IEC 9314-4 Fiber-optic standard cable INDOOR-Fiber-optic indoor cable Flexible fiber-optic trailing cable SIENOPYR shipboard-duplex fiber-optic conductor (for BFOC connector)
		Glass fiber - Fiber-optic cable - multimode fiber ISO/IEC 9314-4 FO Standard Cable GP FO Trailing Cable FO Trailing Cable GP FO ground cable (for BFOC and SC connectors)
Radio (wireless)	IWLAN RCoax N-Connector	IEEE 802.11 IWLAN RCoax Cable 2,4 GHz, 5 GHz

Note

Cable installation

FastConnect cables can also be assembled extremely quickly and easily on site. This means that the RJ45 cabling technology as an existing standard is also available for industrial applications.

2.2.5 High-Availability

Overview

Fault-tolerant systems are designed to reduce production downtime. Availability can be enhanced, for example, by means of component redundancy. Communication systems are thus extended to automation systems.

Redundant systems in industrial Ethernet are characterized by the multiple (redundant) presence of important automation components. When a redundant component fails, processing of the program is not interrupted.

Redundancy is achieved by duplicating the part components such as CPU, network, CP, etc..

Monitoring and synchronization mechanisms ensure that if the active redundant connection path fails, the previously passive (redundant) connection path takes over the communication automatically. The connection itself remains established.

Ring Redundancy

The following graphic illustrates the principle of high-availability using a ring with twisted-pair cabling as an example. The network in the ring structure is structured redundantly.

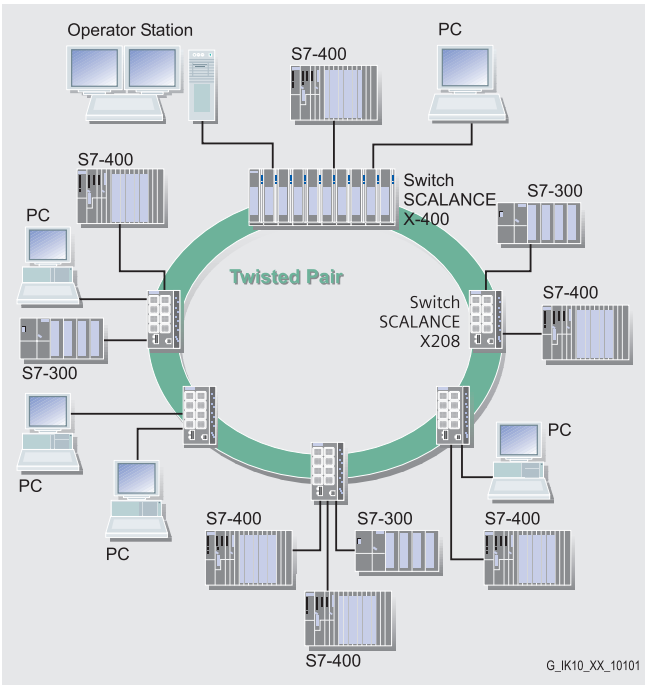


Figure 2-2 Redundancy at Industrial Ethernet in an Electrical Ring

In this redundant ring the SCALANCE X414 -3E switch assumes the task of the redundancy manager. If a part component of the network, in this case the cable, fails, the switch reroutes the data packages to the intact transmission path.

2.3 Technology

2.3.1 Transmission Methods

Overview

Industrial Ethernet uses the protocol family TCP/IP or UDP/IP for data transfer. These are essentially defined in the following RFCs (RFC: Request For Comment):

- RFC 768: UDP (User Datagram Protocol)
- RFC 791: IP (Internet Protocol)
- RFC 792: ICMP (Internet Control Message Protocol)
- RFC 793: TCP (Transmission Control Protocol)

However, Industrial Ethernet is unsuitable for cyclic data exchange due to its telegram overhead. An optimized Layer-2 protocol conforming to IEEE 802.3 that makes real-time communication on the basis of Industrial Ethernet possible is therefore used.

Data transfer by means of PROFINET takes place through Industrial Ethernet. The following transmission types are supported:

- Cyclic transfer of user data (for example process values, etc.).
- Acyclic transfer of engineering data and time-critical data.
- PROFINET CBA uses automatic retransmission and additional checking mechanisms (parity bit per character and checksum) to provide a high degree of data integrity and accuracy.

Real-time communication (Real-Time, RT)

Real-time means that a system processes external events within a defined time.

Determinism means that a system responds in a predictable (deterministic) manner.

Both requirements are important for industrial networks. PROFINET fulfills these requirements with the following transfer characteristics:

- Transfer of time-critical data takes place at guaranteed time intervals.

  To achieve this, PROFINET provides an optimized communication channel for real-time communication.
- The time of transfer can be accurately determined.(forecast).
- Problem-free communication using other standard protocols is guaranteed within the same network.

Isochronous Real-Time Communication, IRT

At PROFINET with IRT the communication cycle is subdivided into different, time-specific channels for this purpose. The first channel is used for isochronous real-time communication (IRT), followed by real-time communication (RT) and standard TCP/IP communication. In this way, both types of data data transfer exist together without interfering with each other.

When this transmission method is implemented in ERTEC-ASICs (Enhanced Real-Time Ethernet Controller), cycle times of 0.25 ms and jitter accuracy below 1 µs are achieved.

Applications for IRT

IRT is used in areas with particularly stringent requirements for response times that cannot be exceeded. This is the case, for example, for motion control applications, which require response and update times in the range of a few milliseconds.

IRT Communication / Real-Time and TCP/IP Communication

Alongside IRT communication for which a bandwidth is reserved within the update time, RT and TCP / IP communications are also permitted within the update time.

In RT communication the cyclic data are transferred between the IO controller and IO device, however, without the "best possible synchronicity".

Unsynchronized IO devices automatically exchange data using RT communication.

2.3.2 Access Methods

Collision Recognition with CSMA/CD

Ethernet uses the bus access method CSMA/CD. This abbreviation stands for Carrier Sense Multiple Access with Collision Detection. In this method a node that wants to send listens to the common bus line (Carrier Sense) and sends if it is not occupied. If the bus line is occupied by another node, the node that wants to send postpones its wish to send and tries to transfer again later on (Multiple Access).

In order to recognize collisions, the nodes receive the signals while they are sending. If the sent and received data differ, a collision has occurred, and the transfer is stopped and restarted later at a moment that is randomly controlled.

In order to implement networks with a larger extension, switches with full duplex function can be used. If switching technology and full duplex mode are used throughout, collisions cannot occur.

Switching Mechanisms

PROFINET uses switched Ethernet as the access method. This consists of a point-to-point connection where every device is connected directly with one (and only one) other device. A switch enables communication to take place simultaneously in both directions (sending and receiving). This provides a network capacity of 200 Mbps, or twice the bandwidth of Fast Ethernet (100 Mbps). Due to the use of switching technology that is stipulated for PROFINET, data transfer is collision-free at PROFINET.

Switches in SIMATIC fulfill the real-time properties by means of two mechanisms at PROFINET: "Cut through" and "Store and Forward".

The advantage of the switching mechanisms: Nodes or networks that do not need the telegram are not stressed with data that are not relevant to them. The resulting free network capacities can be used by further devices. With switching technology it is possible, in contrast to a conventional solution, to communicate in parallel in different network sections, thus increasing the effective bandwidth.

Store and Forward

In the Store and Forward process the switch stores the telegrams and rows them into a queue. The telegrams are then forwarded selectively to the specific port that can access the addressed node (Store and Forward).

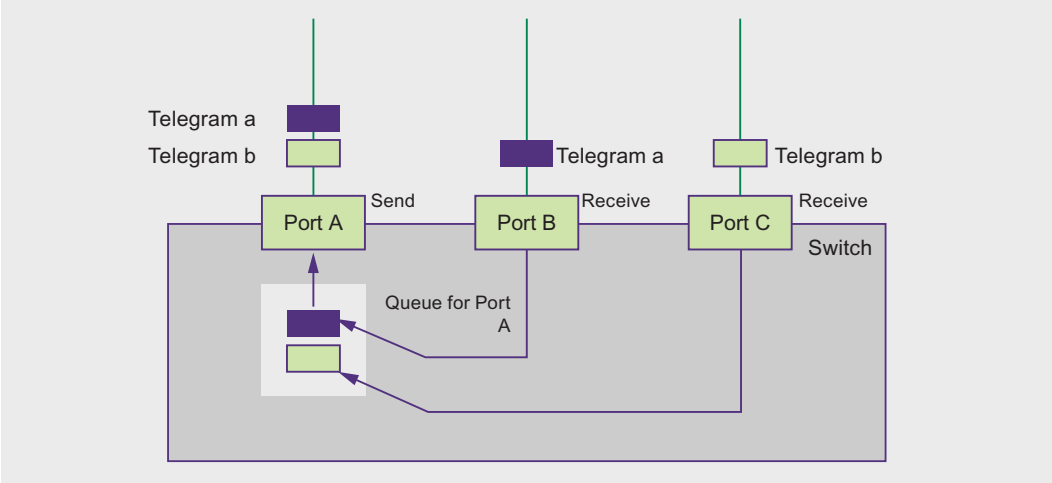


Figure 2-3 Store and Forward at Industrial Ethernet

Cut Through

In the Cut Through process not the entire data package is stored temporarily in a buffer, but is passed directly onto the target port as soon as the first 6 bytes (target address) have been read. The times required by the data package to pass the switch are then minimal. The data are only stored temporarily in accordance with the Store and Forward process when the section between the target part and the port of the next switch is occupied.

2.4 Information Security in the Automation

Overview

Modern automation technology is based on communication and the trend toward increased networking of individual manufacturing cells. It is becoming more and more important to integrate all the manufacturing components into a uniform network that merges with the office network and the corporate Intranet. There is also a requirement for remote access for servicing, the increasing use of IT mechanisms such as Web servers and e-mail with programmable controllers as well as the use of wireless LANs. In this manner, industrial communication interacts more and more with the IT environment and is now subjected to the same dangers that are well-known from the office and IT environment, such as hackers, viruses, worms and Trojans.

The current security concepts are tailored to the office world and require constant administration and specialist knowledge. They are not usually conversant with the special protocol landscape of industrial communication and are not designed to withstand the harsh environmental conditions.

With its security concept, Siemens offers a safety solution specially designed for industrial automation engineering that satisfies the specific requirements of this application environment.

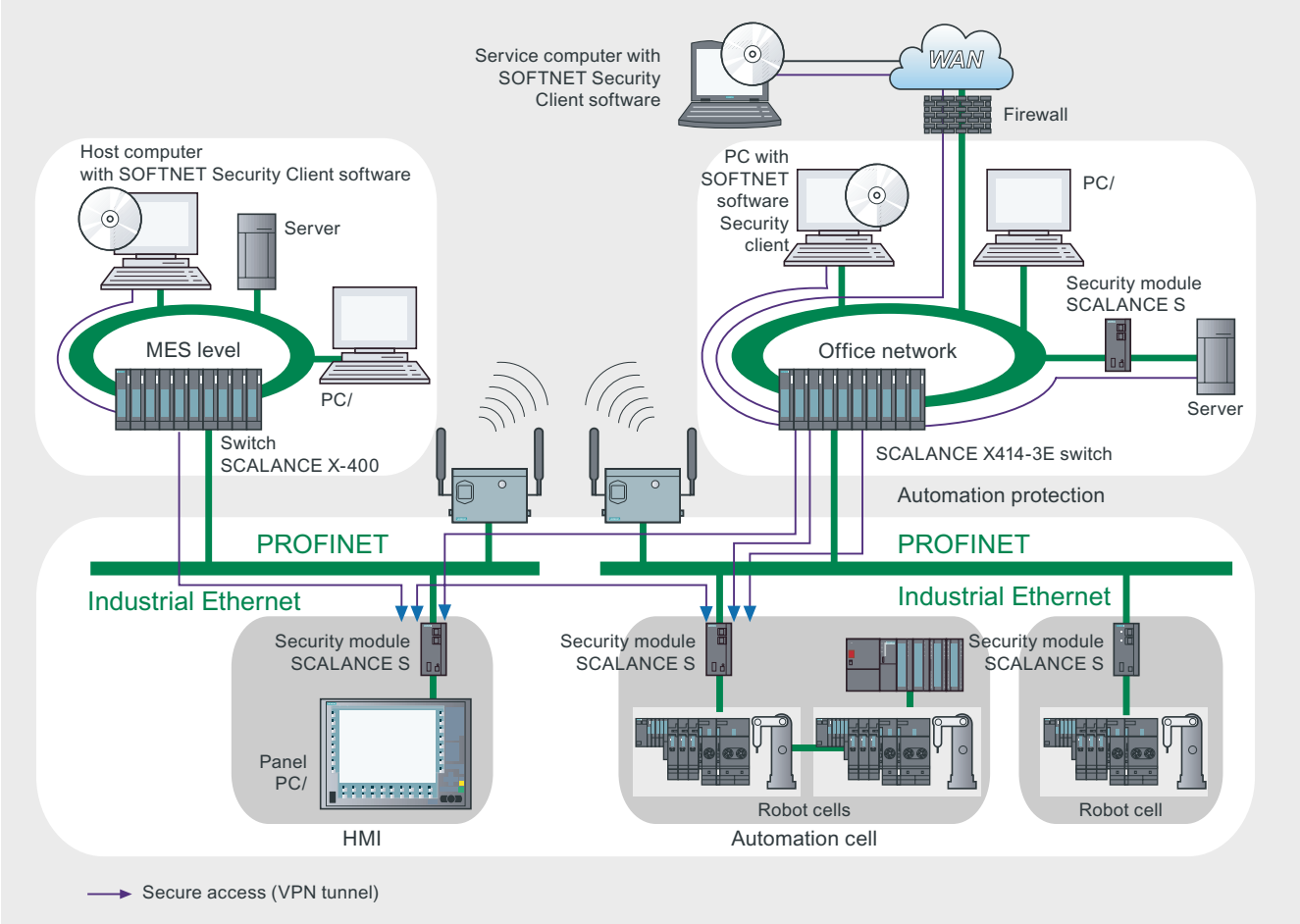


Figure 2-4 Secure Communication - Overview

Advantages of industrial security concept

- Protection from espionage and data manipulation
- Protection against overloading of the communication system
- Protection against mutual interference
- Protection against addressing mistakes
- User-friendly and simple configuration and administration without specialist knowledge of IT security
- No changes or modification of the existing network structure are necessary
- No changes or modification of the existing applications or network stations are necessary
- Rugged, industry-compatible design

Features

From the particular requirements on the communication in the industrial environment (e.g. communication in real-time) there brings about additional requirements on the security for the industrial application:

- Repercussion protection for the automated cells, meaning that network topologies do not have to be changed and network nodes do not have to be reconfigured.
- Protection of network segments
- Protection against faulty access
- Scalability of the security functionality
- No influence on the network structure

Definition of IT Security

Generic term for all measures that protect against

- The loss of confidentiality through unauthorized access to data
- The loss of integrity through manipulation of data
- The loss of availability through the destruction of data

Aims of Industrial Security

- Trouble-free operation and ensured availability of industrial plants and production processes
- Protection of industrial communication against espionage and manipulation
- Protection of industrial automation systems and components against unauthorized access and data loss
- Practicable and cost-effective concept for securing existing systems and devices without own security functions
- Utilization of existing, open, tried and tested IT security standards
- Security concept optimized and adapted for automation technology

Precautions

The most significant precautions against manipulation and loss of data security in the industrial environment are:

- Filtering and inspection of the data traffic by means of Virtual Private Networks (VPN)

  A virtual private network is used to exchange private data in an official network (e.g. Internet). The most common VPN technology is IPsec. IPsec is a collection of protocols for ensuring information security that use the IP protocol on the network layer.

- Segmenting in the protected automation cells

  This concept has the aim of protecting the network nodes by means of security modules. A group of protected devices forms a protected automation cell. Only security modules of the same type or devices they are protecting can exchange data amongst each other.

- Authentication (identification) of the nodes

  By means of authentication procedures the security modules identify each other via a safe (encrypted) channel. It is therefore impossible for unauthorized parties to access a protected segment.

- Encrypting the data traffic

  The confidentiality of data is ensured by means of encrypting the data traffic. For this purpose each security module obtains a VPN certificate in which, among others, includes the code.

SCALANCE S Security Modules

SCALANCE S security modules offer a scaleable security functionality.

- Firewall for protecting the programmable controllers from unauthorized access regardless of the size of the network to be protected.

  The firewall can be used as an alternative or to supplement VPN with flexible access control. The firewall filters data packets and disables or enables communication links in accordance with the filter list (packet filter firewall). Both incoming and outgoing communication can be filtered, IP and MAC addresses, as well as communication protocols (ports).

- Supplementary or alternative VPN (Virtual Private Network) for reliable authentication of the communication partners and encryption of the transmitted data

Configuration

Configuring is simple to carry out even without special IT knowledge. Only the Security Modules or SOFTNET Security Clients that have to communicate with each other securely have to be created and configured. The entire configuration can be stored on the optional removable medium C-PLUG (not included in the scope of delivery). In case of a fault the Security Module can then be replaced rapidly and without a programming device.

2.5 Services

2.5.1 Standard Communication Services - Overview

SIMATIC integrates IT functions such as e-mail and Web technology into the information technology through Industrial Ethernet.

In the office environment, e-mail and Web browsers are widely used communication techniques. Ethernet is used as the main communication path, in addition to telephone cables and the Internet. These communication media and paths are also available to SIMATIC as a result of the TCP/IP protocol.

The following IT services are supported by the SIMATIC device family:

- FTP communication (File Transfer Protocol) for program-driven data exchange between computers having different operating systems
- E-mail via SMTP (Simple Mail Transfer Protocol)
- HTML process control / access to Web browsers via HTTP (Hyper Text Transfer Protocol)
  In the case of CPs with IT function, you use the supplied functions and HTML pages to query important system data over a Web browser.
  The HTML process control can be used for communication between a PC station and an S7-300 or S7-400.

2.5.2 FTP Services

Overview

File transfer protocol functions (FTP) enable an IT-CP or Advanced CP to provide a powerful means of transmitting files to and from the following S7 devices:

- Programming device/PC and S7-300/400
- Between several S7-200/300/400 devices
- Between S7 and process control computers or MES level

Properties

The IT-CP or Advance CP can be operated both as an FTP server and an FTP client.

- FTP server
  This function enables you to use FTP commands to transfer data in the form of files to or from data blocks of an S7 station.
  For transmission of data via FTP, you create data blocks (File DBs) in the CPU of your S7 station.
  When an FTP command is issued, the IT-CP/Adv-CP as FTP server uses a file assignment table (file_db.txt) to determine how the data blocks used for the file transfer in the S7 station are to be mapped to files.
  The information in the file assignment table enables you to reference data blocks in one or more (up to 4) CPUs in an S7 station.
- FTP client
  You create data blocks (file DBs) in the CPU of your S7 station for purposes of transferring data via FTP.
  Using special FCs, the user program issues FTP requests, which are then executed by the IT-CP or Advanced CP as an FTP client.
  The transmission takes place over FTP connections. FTP connections are special TCP connections that you have to configure in STEP 7 / NetPro.
  The request contains an additional target parameter specifying the IP address of the FTP server, the file storage location on the FTP server, and the file name, as well as access information.

Integration in STEP 7

To manage an FTP request sequence between the S7 station as FTP client and an FTP server, the IT-CP or Advanced CP must set up a connection to the S7-CPU.

An FTP connection is set up as follows:

- Using the connection configuration in STEP 7 (standard application)
- Using the user program with FB CP_CONFIG and configuration data block.
  In some applications it is advantageous to program the setup of the communication connections using special applications and not using the STEP 7 configuration interface.

Further Information

For more information on IT services, refer to the manual *Information Technology with CP 343–IT and CP 443–IT* and *CP 243-IT* and *Information Technology at SIMATIC S7 with CPs for S7-300 and S7-400*.

2.5.3 E-Mail Services

Overview

The automation system can use the e-mail function of the IT-CP or Advanced CP to send process- or time-dependent communications containing process information.

Features

Based on the usual features of e-mail, it is possible to send messages with or without attachments. The form of delivery is selected depending on the amount of data and the properties of the receiving device. E-mail with attachments may be necessary, for example, for conveying binary-coded information from a controller for evaluation purposes.

- The IT-CP or Advanced-CP works as an e-mail client. It supports the SMTP service (Simple Mail Transfer Protocol).
- E-mails can be sent from the automation system, but not received. To send e-mail in the user program of the S7-300 or S7-400 CPU, you poll the SEND/RECEIVE interface (FC AG_SEND / AG_LSEND).

E-mails are sent via the SMTP service. Encoding e-mails to increase transmission reliability is not possible.

Integration in STEP 7

To send e-mails, an e-mail connection must always be set up for each IT-CP or Advanced-CP. The e-mail connection defines the mail sever to be used for delivering all e-mails sent by the IT-CP or Advanced-CP.

The complete e-mail, including the address information and the message itself, is generated in a random data block.

As soon as you have configured the IT-CP or Advanced-CP with HW Config in the station, there are two options for establishing an e-mail connection.

- Using the connection configuration in STEP 7 (standard application)
- Using the user program with FB CP_CONFIG and configuration data block.

Further Information

For more information on IT services, refer to the *Information Technology with CP 343-1 IT and CP 443-1 IT* and *CP243-1 IT* manual.

2.5.4 SNMP Services

Overview

SNMP (Simple Network Management Protocol) is a standardized open protocol for network management in Ethernet networks. Network management includes all functions that are suitable for monitoring, controlling, and parameterizing network nodes.

Network management (e.g., error logging) protects a network with SNMP-capable network nodes from failure and ensures high network quality and efficiency.

The network management products such as SINEMA E and the SNMP-OPC Server of Siemens support you in essential tasks related to the planning, control and monitoring of networks in an industrial environment.

Features

SNMP is defined in RFC 1065, RFC 1066, and RFC 1067. An expansion of the protocol to include safety functions for read/write access is described in RFC 2571 (Request for Comments).

The SNMP network management protocol makes use of the wireless UDP transport protocol. The SNMP Manager monitors the network nodes, and the SNMP agents collect the various network-specific information in the individual network nodes and places it in a structured form in the MIB - **M**anagement **I**nformation **B**ase.

The MIB information is polled by the management station and, if appropriate, visualized. The nodes, however, are also able to report certain statuses to the network management stations via so-called traps. With SNMP it is not only possible to monitor the nodes, but operations and instructions for controlling the devices are also possible. This includes, for example, for the activation or deactivation of a port at a network component.

The communication between the agent and the network management station is executed in the background and only places a minor load on the network.

To integrate additional SNMP devices that have files in the MIB, you can use STEP 7 or NCM PC.

Configuration of the OPC server is integrated in the STEP 7 Hardware Configuration application. Already configured S7 modules from the STEP 7 project can be transferred directly. As an alternative to STEP 7, the NCM PC (included on the SIMATIC NET CD) can also be used to perform the configuration. Fast Online Configuration using "Autodiscovery" In STEP 7 V5.3 SP3 and higher, all Ethernet devices can be detected by means of their IP address and/or the SNMP protocol (SNMP V1) and transferred to the configuration. The SIMATIC NET SNMP OPC server also provides detection of PROFINET devices using the DCP protocol.

Integration in STEP 7

The SNMP OPC Server is configured with STEP 7/NCM PC.

STEP 7/NCM PC is used to specify to the SNMP OPC Server which stations (entry of the station IP address) it is to monitor. In addition, STEP 7/NCM PC supports you in selecting a profile when monitoring the data. The profile describes a readable/writeable object in an SNMP node and is a subset of an MIB. The term MIB II describes the minimum scope of such objects that is understood by every SNMP device. If device-specific data have to be read/written, a "private" MIB of the manufacturer has to be read in and a new profile (function of the MIB compiler in STEP 7/NCM PC) created. SIEMENS AG makes its MIBs as well as ready-to-use profiles for the SNMP OPC Server available on the Support pages (see Additional Information).

Use of SNMP in SIMATIC NET

SNMP-capable devices of the SIMATIC NET family can be monitored and operated via a conventional standard Internet browser.

For Industrial Ethernet applications, the SIMATIC NET switches also provide information on the network load based on SNMP.

Diagnostics with SNMP OPC Server in SIMATIC NET

The SNMP OPC server software provides diagnostic and parameter assignment functions for all SNMP devices. The OPC server uses the SNMP protocol to perform data exchange with SNMP devices.

All information can be integrated in OPC-compatible systems, such as the WinCC HMI system. This is a possibility of including SNMP data (for example of a switch) in an OPC-capable application (for example WinCC, PCS7 or other HMI/SCADA systems) . This enables process and network diagnostics to be combined in the HMI system.

Further Information

For additional information on the SNMP OPC server, refer to the *PCS 7 Network Diagnostics with the SNMP OPC Server* function manual.

The RFCs described in this manual can be found at: http://www.ietf.org/rfc or http://www.rfc-editor.org

MIB files can be found at the Internet address:

http://support.automation.siemens.com/WW/view/en/22015045

Further Information about the MIBs and SNMP OPC Server is available at the Internet address:

http://www.siemens.com/snmp-opc-server

2.5.5 OPC Services

Overview

OPC (OLE for Process Control) allows Windows applications to access process data, making it easy to combine devices and applications produced by different manufacturers.

Features

Not only does OPC provide an open, vendor-independent interface, but the easy-to-use client-server configuration provides standardized data exchange between the components of an automation solution (such as a PLC), field devices, and PC-based applications (such as HMI or office applications).

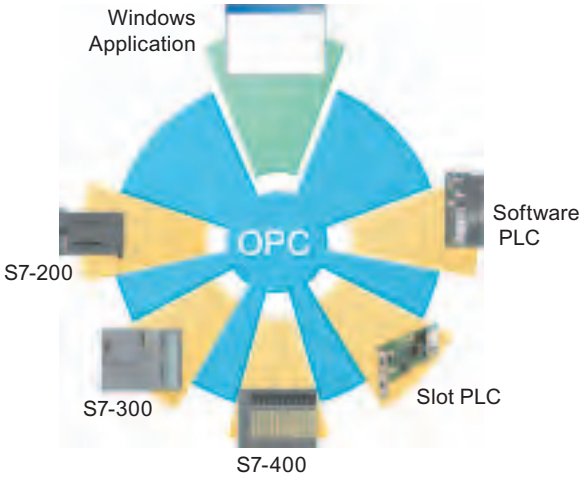


Figure 2-5 OPC Connections for SIMATIC

The OPC server provides interfaces for connecting the OPC client applications. Access to data sources, such as memory locations in a PLC, is performed by client applications. Because several different OPC clients can access the same OPC server at the same time, the same data source can be used for any OPC-compliant application.

For networks that use only S7-200 products, the PC Access application also provides an OPC server and configuration tool. The SIMATIC NET OPC servers support the following communication services:

- PROFINET IO
- PROFINET CBA
- PROFIBUS DP
- S7 communication (using PROFIBUS DP or Industrial Ethernet)
- Open IE- / S5-compatible communication (using PROFIBUS DP or Industrial Ethernet)
- SNMP (using Industrial Ethernet)

Integration in STEP 7

In addition to providing OPC servers, SIMATIC NET also provides the following applications for configuring and testing OPC connections:

- Advanced PC Configuration (APC)
- OPC Scout

You use these tools to connect SIMATIC S7 products to other OPC-compliant applications.

2.5.6 PROFINET IO Services

Overview

PROFINET IO is a communication standard for the implementation of modular, distributed applications. With PROFINET IO, distributed field devices (IO-Devices) can be directly connected to Industrial Ethernet.

Features

PROFINET IO communication provides three performance levels:

- Non-Real-Time (NRT) uses the TCP/UDP/IP channel to transfer parameterization and non-time-critical data with a typical cycle time of approximately 100 ms.
- Real-Time (RT) provides the transfer of time-critical process data by prioritizing and optimizing the communication stacks with a typical update cycle time of 1 ms to 10 ms.
- Isochronous Real-Time (IRT) provides isochronous execution cycles to ensure that the information is transmitted at consistently equidistant time intervals. IRT delivers isochronous data transmission with very short update cycles (from 250 microseconds to 1 ms) and very little jitter.

PROFINET offers the following further advantages:

- PROFINET IO provides the same device model as PROFIBUS.
- In PROFINET IO, you configure the devices with the same engineering system (for example STEP 7). The properties of a PROFINET device are described in a GSD file (General Station Description) that contains all the information required for configuration and communication.
- During configuration with STEP 7, these field devices are assigned to an IO-Controller. Existing PROFIBUS modules or devices can continue to be used with PROFINET-capable interfaces or links.
- A proxy is the connecting element between PROFINET and any lower-level fieldbus. For example, the PROFINET IO IE/PB Link allows a PROFINET IO controller to communicate with a PROFIBUS DP slave device.

2.5.7 PROFINET CBA Services

Overview

PROFINET CBA supports distributed automation through the modularization. You can structure a complete automation plant into subsystems that operate autonomously, so-called technological modules.

PROFINET components are, in turn, the representatives of a technological module with its inputs and outputs. The technology module includes not only the mechanical, electrical and electronic parts of an control system, but also includes the associated control program.

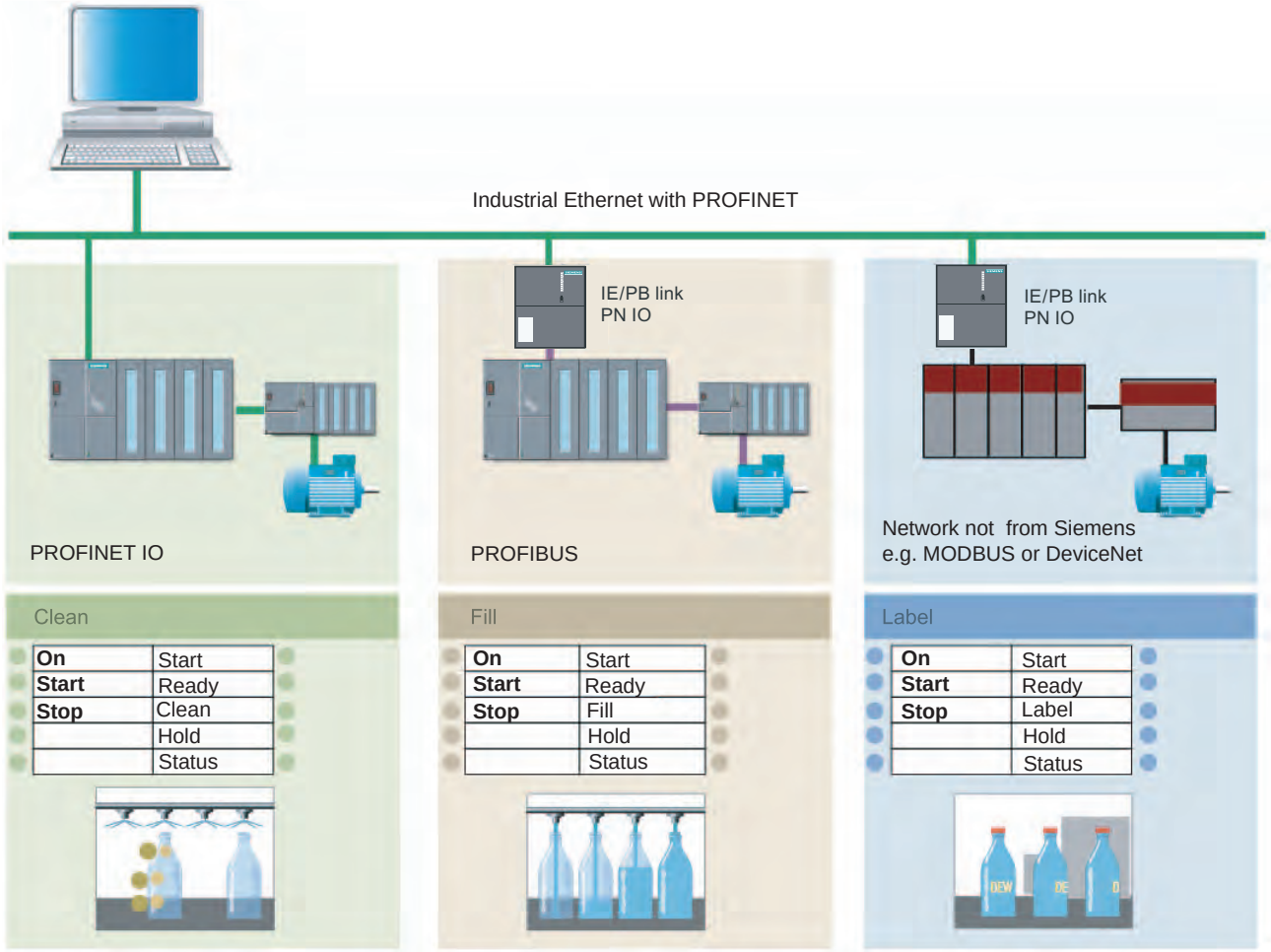


Figure 2-6 PROFINET CBA

Features

PROFINET CBA defines the engineering model (design and construction of the PROFINET components) and the communication between components.

A PROFINET component incorporates all the hardware configuration data, the module parameters, and the associated user program.

You can use PROFINET IO to integrate field devices within a PROFINET CBA component. By using proxy devices on PROFIBUS, you can also use PROFINET CBA to interconnect all the existing subnets with their controllers and field devices (such as PROFIBUS DP) to form a larger automation system.

- The PROFINET components are accessible by means of uniformly defined interfaces. These components can be interconnected in any way to allow configuration of the process.
- The open-engineering interface enables graphical configuration of PROFINET components from different manufacturers.

Integration in STEP 7 and SIMATIC iMap

- You use STEP 7 to create reusable modules, which include the definition of the interfaces for exchanging data with other modules.
- The components are created in the PROFINET Component Description (PCD) and stored in XML format in the general station description (GSD).
- You use SIMATIC iMap to configure the complete system by graphically linking the individual components. SIMATIC iMap also allows you to configure simple diagnostics for the system.

2.5.8 PROFIdrive

Overview

PROFIdrive is used to include drives in automation solutions - from simple frequency converters to highly dynamic servo controller. To this purpose PROFIdrive defines the device behavior and the methods for accessing drive data at PROFINET.

Features

In order to accomplish the various tasks that modern drives must perform, PROFIdrive defines six application classes:

- Class 1 defines a standard drive that is controlled via a main setpoint, e.g., the speed setpoint.
- Class 2 defines a standard drive with technology function. The process is divided into subprocesses for this class. Drive tasks are issued to the drive device, requiring direct data exchange between the individual drives.
- Class 3 defines a positioning drive that includes a position controller. The positioning requests are started and transferred via PROFINET.
- Classes 4 and 5 define the central motion control that enables coordinated motion sequences among multiple drives. PROFINET is used to close the position control loop and to synchronize the clock cycles.
- Class 6 includes distributed automation in clocked processes and with electronic shafts. This allows applications such as "electrical gearing" or "cam disk" to be implemented.

PROFIdrive defines the mechanism of accessing parameters and a subset of manufacturer-specific profile parameters. Access to the other parameters is carried out acyclically through a special channel.

PROFIdrive is specified in "PROFIdrive Profile – Drive Technology V3".

Integration in STEP 7

Drives are configured with the STEP 7 Hardware Configuration application.

Further Information

Further information about the topic of PROFIdrive technology is available at the Internet address http://www.profibus.com/pall/meta/downloads/article/00352/

2.5.9 PROFIsafe

Overview

PROFIsafe is used for all fail-safe communications via PROFINET and PROFIBUS. PROFIsafe can be used to simply implement safety-oriented distributed solutions in various branches:

- Automobile bodyshell work with presses and robots
- Passenger transportation, for example cableways, lifting platforms, fun rides
- Burner management
- Chemical, petrochemical

PROFIsafe defines how safety-oriented devices communicate fail-safe so that they can be used for safety-oriented applications.

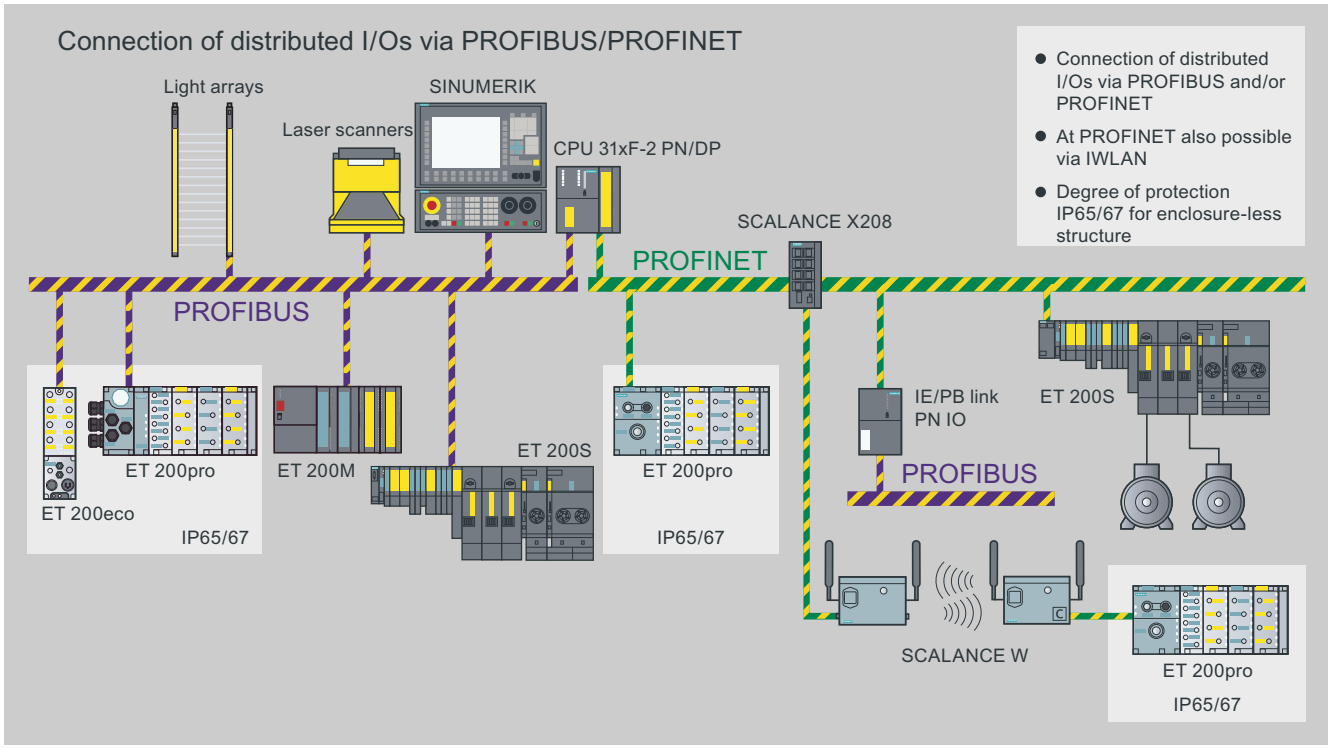


Figure 2-7 PROFIsafe Configuration with PROFINET and PROFIBUS

Features

PROFIsafe is suitable for applications up to SIL3 (Safety Integrity Level in accordance with IEC 61508) or Category 4 (in accordance with EN 954-1). The Safety Integrated Level is used to asses the reliability of safety functions in electrical systems.

PROFIsafe allows the transfer of standard data and fail-safe data across the same bus - additional hardware components are not required.

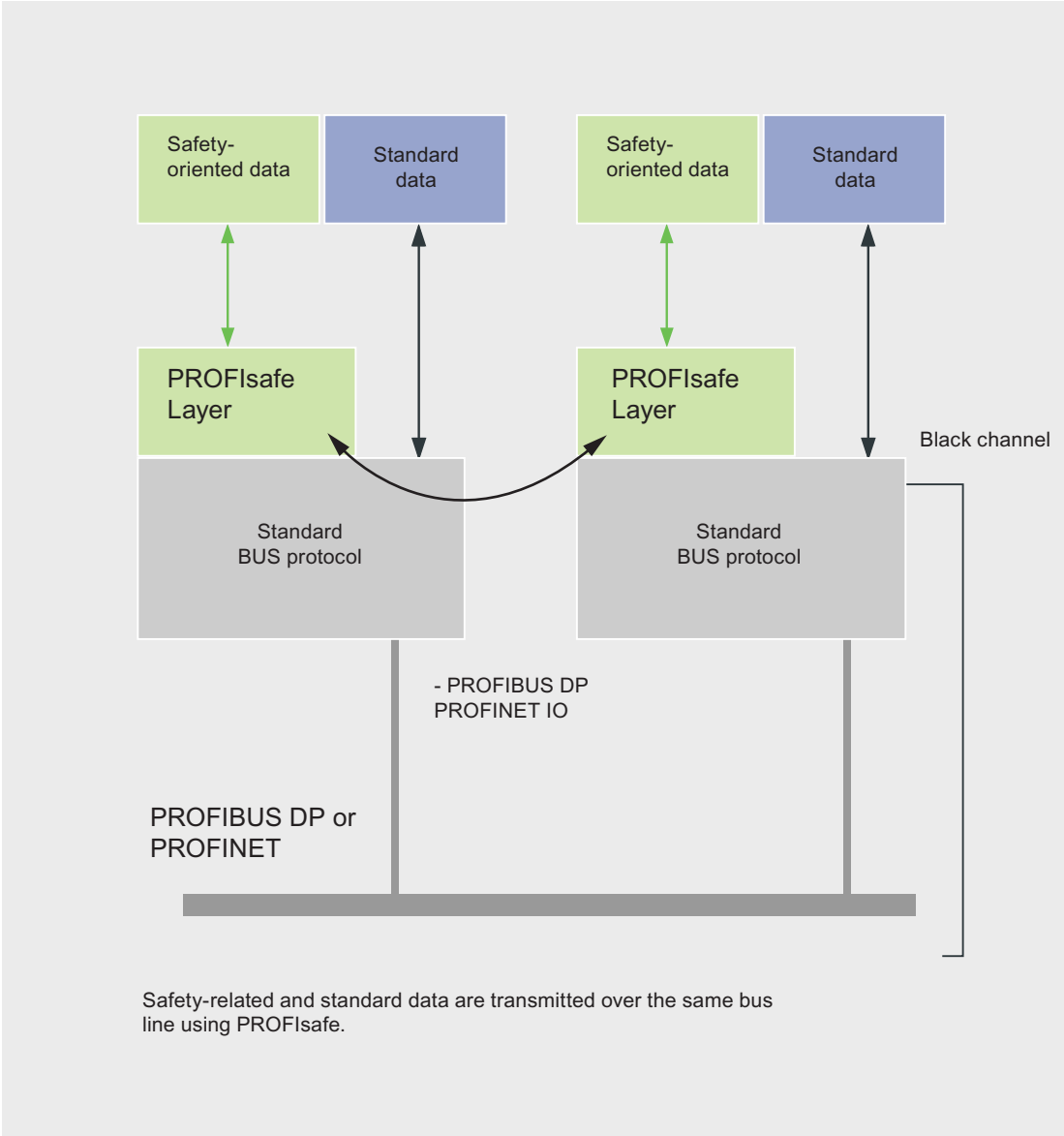


Figure 2-8 PROFIsafe as a Layer Model

PROFIsafe is a software solution that is implemented as an additional layer (PROFIsafe Layer) in the devices (for example CPU operating system). The safety data are packed in the telegram as a supplement to the standard data, thus forming the PROFIsafe telegram.

PROFIsafe presents two alternative implementations:

- Solution with a bus line and a combined standard and safety-related controller
- Solution with separate transmission lines and separate controllers for standard and safety-oriented automation

PROFIsafe uses the following measures to ensure the data integrity of fail-safe transmissions:

- Sequential numbering of the safety telegrams.
- Time monitoring for telegrams and acknowledgement
- Identification between transmitter and receiver using a password
- Additional data security (Cyclic Redundancy Check)

PROFIsafe is specified in "PROFIsafe, Profile for Safety Technology".

Integration in STEP 7

With PROFIsafe, the fail-safe blocks in your user program are marked in yellow to correspond with the yellow that designates the physical fail-safe I/O modules.

Further Information

Further information about the topic of fail-safety is available at the Internet address http://www.profibus.com/pb/profibus/safety/

2.5.10 TCP Services

Overview

The TCP/IP service facilitates communication to any communication partner (for example, PC or non-Siemens system) that supports sending and receiving data in accordance with RFC 793 and RFC 1323 for TCP and RFC 791 for IP.

Features

Contiguous data blocks (maximum of 8 Kbytes) can be transmitted from one Ethernet node to another. Receipt of data is acknowledged by the communication partner. This is indicated in the appropriate block.

The TCP service ensures data transfer and thus data integrity by means of two mechanisms:

- Repeated sending of the data in case of transmission errors
- The receiver checks the integrity of the transferred data by means of a cyclic algorithm (CRC) and acknowledges receipt of the data.

Integration in STEP 7

The PROFINET IO CPUs with integrated PROFINET interface provide integrated function blocks (FBs) for TCP/IP communication:

- FB63 (TSEND)
- FB64 (TRCV)
- FB65 (TCON)
- UDT65 (TCON_PAR)
- FB66 (TDISCON)

In SIMATIC S7, the ISO-on-TCP services are used for communication with the blocks AG_SEND/AG_RECV via Industrial Ethernet.

In addition, the FETCH/WRITE services constitute an interface through which a SIMATIC S5 or non-Siemens device can have direct access to the system memory of the SIMATIC S7 controller.

The AG_LOCK and AG_UNLOCK blocks can be used to coordinate FETCH/WRITE access by the user program of the SIMATIC S7.

The TCP services are implemented on the PC as C functions within the framework of the software socket interface.

2.5.11 ISO Transport Services

Overview

ISO Transport facilitates communication to any communication partner (for example, SIMATIC S5 or PC) that supports sending and receiving data in accordance with the ISO reference model on Layer 4.

Features

Larger amounts of data are transferred using the ISO transport service by segmenting them into smaller data telegrams.

You must use a SIMATIC NET CP card for ISO Transport.

The ISO transport service ensures data transfer and thus data integrity by means of two mechanisms:

- Repeated sending of the data in case of transmission errors
- The receiver checks the integrity of the transferred data by means of a cyclic algorithm (CRC) and acknowledges receipt of the data.

Integration in STEP 7

With ISO Transport, SIMATIC S7 family provides communication functions for sending and receiving data by means of static links. The corresponding ISO Transport connections are configured with STEP 7. They are configured when the station starts up.

The STEP 7 option package "NCM S7 for Industrial Ethernet" supplements the STEP 7 link configuration with the ISO Transport link type.

- The IO Controllers with integrated PROFINET interface provide integrated function blocks (FBs) for communication by means of ISO transport:
- FB63 (TSEND)
- FB64 (TRCV)
- FB65 (TCON)
- UDT65 (TCON_PAR)
- FB66 (TDISCON)

In SIMATIC S7, the ISO transport services are used for communication with the blocks AG_SEND/AG_RECV by means of Industrial Ethernet.

2.5.12 UDP Services

Overview

The UDP service (User Datagram Protocol) facilitates communication to any communication partner (for example, PC or non-Siemens system) that supports sending and receiving data in accordance with RFC 768.

Features

UDP offers communication services for simple, cross-network data transmission without acknowledgment (datagram service). UDP is used as a simple datagram or transport service in situations in which it is not necessary to guarantee that the data blocks are transferred correctly.

Contiguous data blocks (maximum of 2 Kbytes) can be transmitted from one Ethernet node to another on IP.

No acknowledgment of received data is sent, so UDP frames are not reliable.

Integration in STEP 7

With ISO Transport, SIMATIC S7 family provides communication functions for sending and receiving data by means of static links. The corresponding ISO Transport connections are configured with STEP 7. They are configured when the station starts up.

The IO CPUs with integrated PROFINET interface provide integrated function blocks (FBs) for UDP communication:

- FB63 (TSEND)
- FB64 (TRCV)
- FB65 (TCON)
- UDT65 (TCON_PAR)
- FB66 (TDISCON)

2.5.13 PG/OP Communication Services

Overview

The PG/OP communication services support the protocol that the S7 controllers use to communicate with the various HMI devices or programming devices (programming device/PC). The following are typical HMI devices:

- Operator Panels (OPs)
- Touch Panels (TPs)
- Multifunction Panels (MPs)
- Text Displays (TDs)

Because the S7 communication functions are built into the operating system of the SIMATIC controller, you are able to access data in the controller with your HMI device, programming device (PG), or PC.

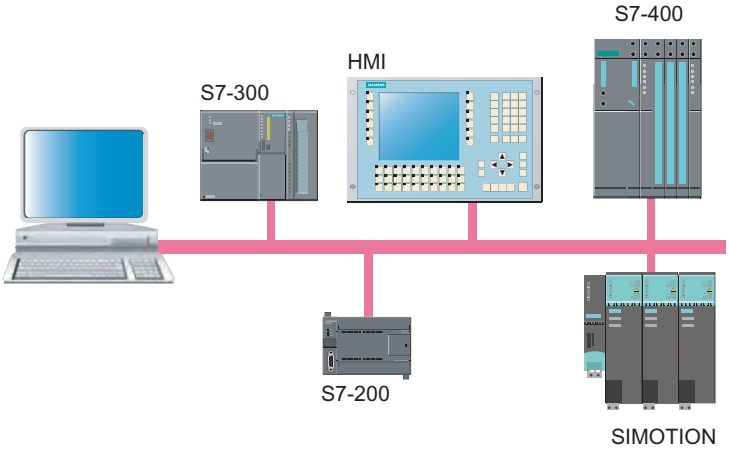


Figure 2-9 PG/OP Communication Services (for an MPI Network)

Features

The PG/OP Communication services provide the following functions:

- Programming device / PC functions

  STEP 7 uses these functions for programming the communication partner (S7 station). Programming device / PC functions are the following functions:

  – Downloading the hardware configuration

  – Downloading the user program

  – Online monitoring of the S7 station for testing and diagnostics

- OP functions

  The HMI devices and the programming device / PC use these functions for automatically reading and writing variables without requiring special programming in the user program of the communications partner (S7 station).

2.5.14 S7 Communication Services

Overview

S7 communication services provide data exchange using communication system function blocks (SFBs) and function blocks (FBs) for configured S7 connections.

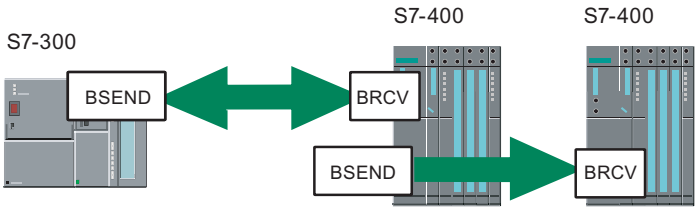


Figure 2-10 S7 Communication Services

Features

All SIMATIC S7 and C7 controllers integrate the S7 communication services that allow the user program to read or write data. The S7-400 controllers use SFBs, and S7-300 or C7 controllers use FBs. These functions are are available independent of the communication service used, allowing you to use S7 communication over PROFINET, Industrial Ethernet, PROFIBUS, or MPI.

S7 communication services provide the following features:

- During system configuration, you configure the connections to be used by the S7 communication. These connections remain configured until you download a new configuration.
- You can establish several connections to the same partner. The number of communication partners accessible at any time is restricted to the number of connection resources on the CPU or on the CP available.
- S7 communication allows you to transfer a block of up to 64 Kbytes per call of the SFB or FB. An S7-400 transfers a maximum of four variables per block call. An S7-300 transfers a maximum of one variable per block call.

Integration in STEP 7

For S7-300, S7-400, and C7 systems, the following communication blocks provide for S7 communication over configured S7 connections:

- BSEND (SFB12 / FB12) and BRCV (SFB13 / FB13)
- USEND (SFB8 / FB8) and URCV (SFB9 / FB9)
- GET (SFB14 / FB14) and PUT (SFB15 / FB15)
- Alarm SFBs and SFCs (ALARM_R and ALARM_S)

2.6 Configurations

2.6.1 Device Family

Overview - SIMATIC components

The following graphic provides an overview of the systems for solving complex automation tasks with SIMATIC components.

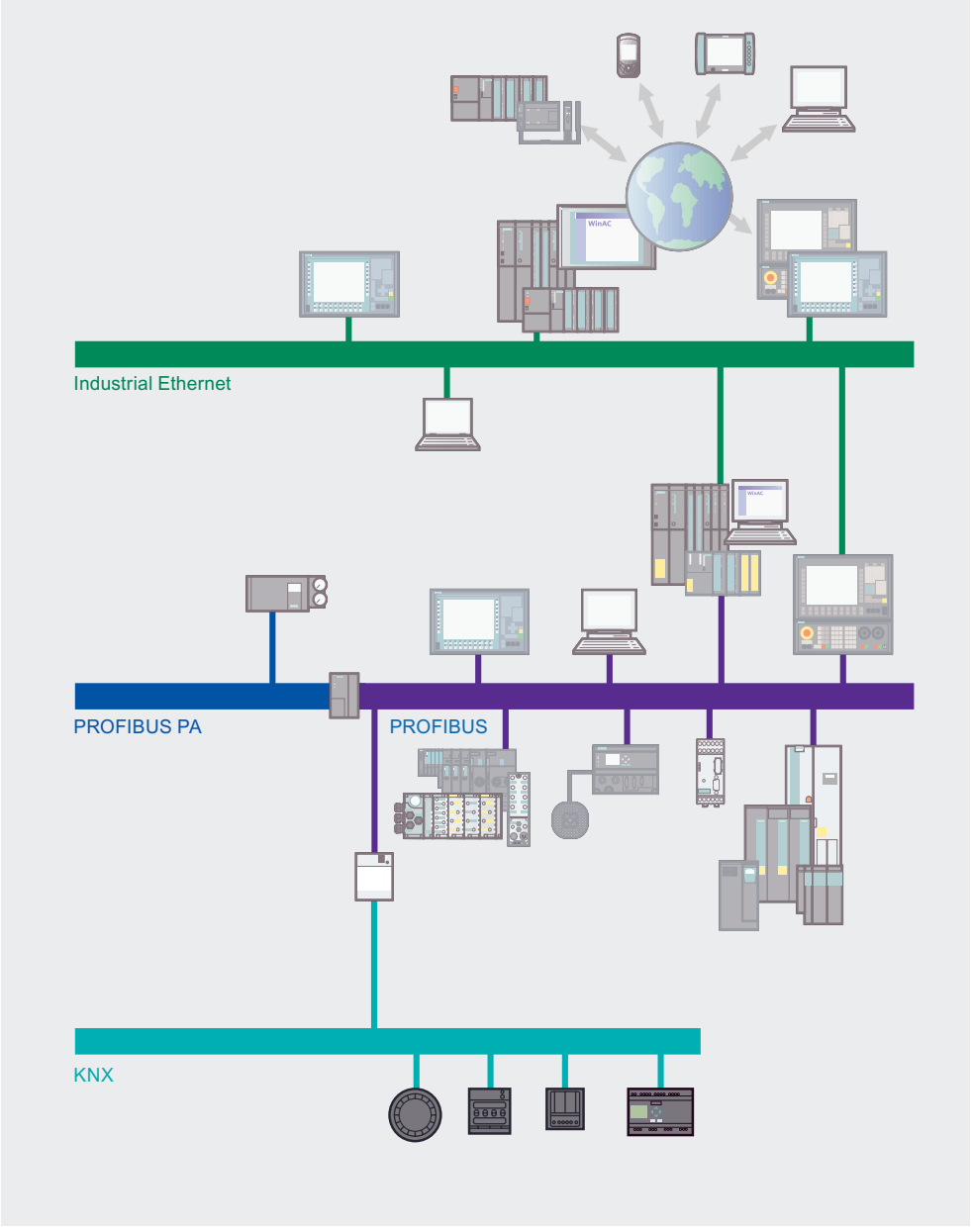


Figure 2-11 Overview of Industrial Ethernet

PROFINET Controllers

The SIMATIC Controller family with PROFINET interface provides you with a graded performance for control tasks in various branches.

S7-300/S7-400 CPUs with integrated PROFINET interface are ideal for PROFINET CBA applications.

There are two alternatives for connecting SIMATIC components to PROFINET:

- Integrated interfaces, for example on the CPU
- Auxiliary modules, for example communications processors (CP)

The following table lists the SIMATIC components that support PROFINET IO and PROFINET CBA.

Table 2-4 PROFINET Connection for SIMATIC Controllers and CPs

SIMATIC component	Integrated interface	Module
Standard CPUs/CPs		
CPU 315-2 PN/DP; CPU 317-2 PN/DP; CPU 319-3 PN/DP	Yes (on CPU)	--
CPU 414-3 PN/DP; CPU 416-3 PN/DP	Yes (on CPU)	--
S7-300 and AS7-400 CPUs without PROFINET interface	--	CP 343-1; CP 343-1 Advanced CP 443-1; CP 443-1 Advanced
Fail-safe CPUs		
CPU 315F-2 PN/DP; CPU 317F-2 PN/DP	Yes (on CPU)	--
CPU 416-3 PN/DP	Yes (on CPU)	--
C7-compact devices		
C7-613; C7-635 Touch; C7-635 Key C7-636 Touch; C7-636 Key	--	CP 343-1; CP 343-1 Adv
Embedded Automation		
Microbox	Yes	--
WinAC MP	Yes	
PC		CP 1616; CP 1604
WinAC Basis	--	CBA with Win AC PN optional package for Component Based Automation
Network components		
SCALANCE X-200; SCALANCE X-200 IRT, SCALANCE X-200P IRT	Yes	--

PROFINET IO Device

With the ET 200 S I/O device you can structure distributed automation solutions with an integrated PROFINET interface.

The following table lists distributed I/O devices with an integrated PROFINET interface.

Table 2-5 PROFINET connection for IO Devices

SIMATIC component	Integrated interface	Module
ET 200 S: IM 151-3 PN; IM IM 151-3 PN HF; IM 151-3 PN FO	Yes (on IM)	--
ET 200 pro: IM 154-4 PN HF	Yes (on IM)	--
S7-300	--	CP 343-1 LEAN

HMI

The SIMATIC Panel PC is a compact device and is ideally used directly on site at the machine and when flexible adaptation at the application is required.

The following table lists distributed HMI devices with an integrated PROFINET interface.

Table 2-6 PROFINET connection for IO Devices

SIMATIC component	Integrated interface	Module
Panels		
TP/OP 170; TP/OP 270; MP 270; MP 370	Yes	--
Panel PC		
PC 477-HMI/RTX	Yes (additionally 2 Industrial Ethernet interfaces)	--

PC-based Automation

SIMATIC Embedded PC Automation enables automation solutions based on rugged embedded SIMATIC PCs. SIMATIC Embedded Automation products are combinations of hardware and software that have been pre-configured for specific automation tasks.

SIMATIC WinAC MP is the software PLC for Windows CE and is particularly suitable for visualization tasks and data-intensive control tasks with deterministic requirements.

The following table lists the PC-based devices and the Embedded PC with an integrated PROFINET interface.

Table 2-7 PROFINET connection for PC-based automation

SIMATIC component	Integrated interface	Extension
Embedded Automation		
Microbox	Yes	--
PC-based Control		
WinAC MP	Yes	
WinAC Basis	No	CBA with Win AC PN optional package for Component Based Automation

2.6.2 Gateways

Integrating other fieldbuses

PROFINET IO provides the real-time communication required for automation systems. In addition, you can use PROFINET IO to interconnect existing bus systems with their associated devices, such as a PROFIBUS subnet with field devices.

PROFINET allows you to integrate existing field bus systems (such as PROFIBUS or ASI) into PROFINET via a proxy. This allows you to set up mixed systems consisting of fieldbus and Ethernet-based subsystems. This makes a continuous technological transition to PROFINET possible. The proxy functionality allows a PROFIBUS device to communicate not only with its master but also with all nodes on PROFINET. You can integrate existing PROFIBUS subnet in PROFINET communication, for example with the help of an IE/PB Link or a CPU 31x-2 PN/DP. The IE/PB Link then handles communication over PROFINET as a substitute for the PROFIBUS components. In this way, you can connect both DPV0 and DPV1 slaves to PROFINET. The following graphic shows the possibilities of integrating other fieldbus systems in PROFINET / Industrial Ethernet.

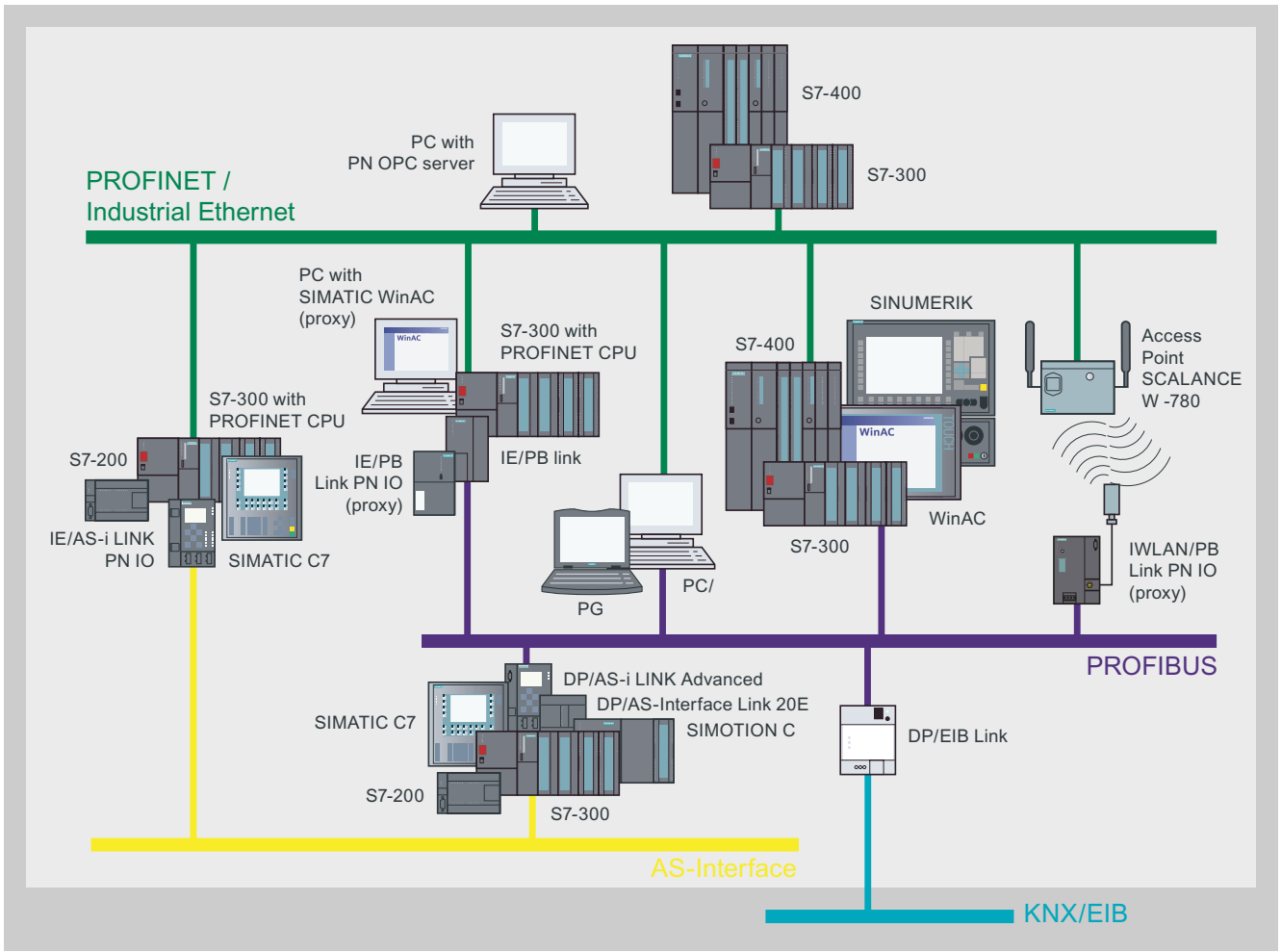


Figure 2-12 Gateways for Industrial Ethernet / PROFINET - Overview

You configure PROFINET IO devices and the network components in STEP 7. Here, PROFINET IO also provides a diagnostic tool for troubleshooting.

The IE/PB Link PN IO is a gateway that links the Industrial Ethernet (management level) and PROFIBUS (cell level / field level) network types. The IE/PB Link PN IO supports access to all PROFIBUS DP slaves connected to the lower-level PROFIBUS.

The IE/PB Link PN IO is an essential component of PROFINET IO. In this case, it provides the connection between the PROFINET IO controllers on Industrial Ethernet and the PROFINET IO devices (DP slaves on PROFIBUS). From the perspective of the PROFINET IO controller on Industrial Ethernet, there is no difference between accessing PROFINET IO devices connected to Industrial Ethernet and accessing PROFIBUS DP slaves connected to PROFIBUS DP. IE/PB Link PN IO serves as a proxy for the DP slaves that are connected to PROFIBUS DP and have the following tasks:

- Parameterization for field devices (data record routing)

  You can use the IE/PB Link PN IO as a router for data records that are forwarded to field devices (DP slaves).

  This enables devices that are not directly connected to PROFIBUS and, thus, have no direct access to the field devices (DP slaves) to transfer data records to the field devices via IE/PB Link PN IO> For example, the SIMATIC Process Device Manager (PDM) tool generates these types of data records for parameter assignment of field devices.

- Subnet-overlapping S7 connections for HMI operation

  The IE/PB Link PN IO transmits the communication over S7 connections. This service is used for HMI applications (PC stations), for example. In addition, the following functions are supported:

- PG/OP communication

  PG/OP communication is used for loading programs and configuration data, testing and diagnostic functions, and operator control and monitoring (HMI systems) of a plant.

Further Information

Further information about the topic of coupling various networks is available in the *Industrial Communication for Automation and Drives* catalog in Chapter 8.

The catalog can be found on the Homepage of the A&D under the address: http://www.automation.siemens.com/net/html_76/support/printkatalog.htm.

An overview of all the catalogs with the possibility of ordering them is provided under the address: http://www.automation.siemens.com/infocenter/order_form.aspx?lang=en.

Industrial Wireless LAN

3

3.1 Introduction

Overview

The SIMATIC NET device family provides communications products for mobile data data transfer in accordance with the open wireless LAN standard IEEE 802.11. The SCALANCE W device family in which the extension of the wireless LAN standard "Industrial Wireless LAN" is implemented is available to this purpose.

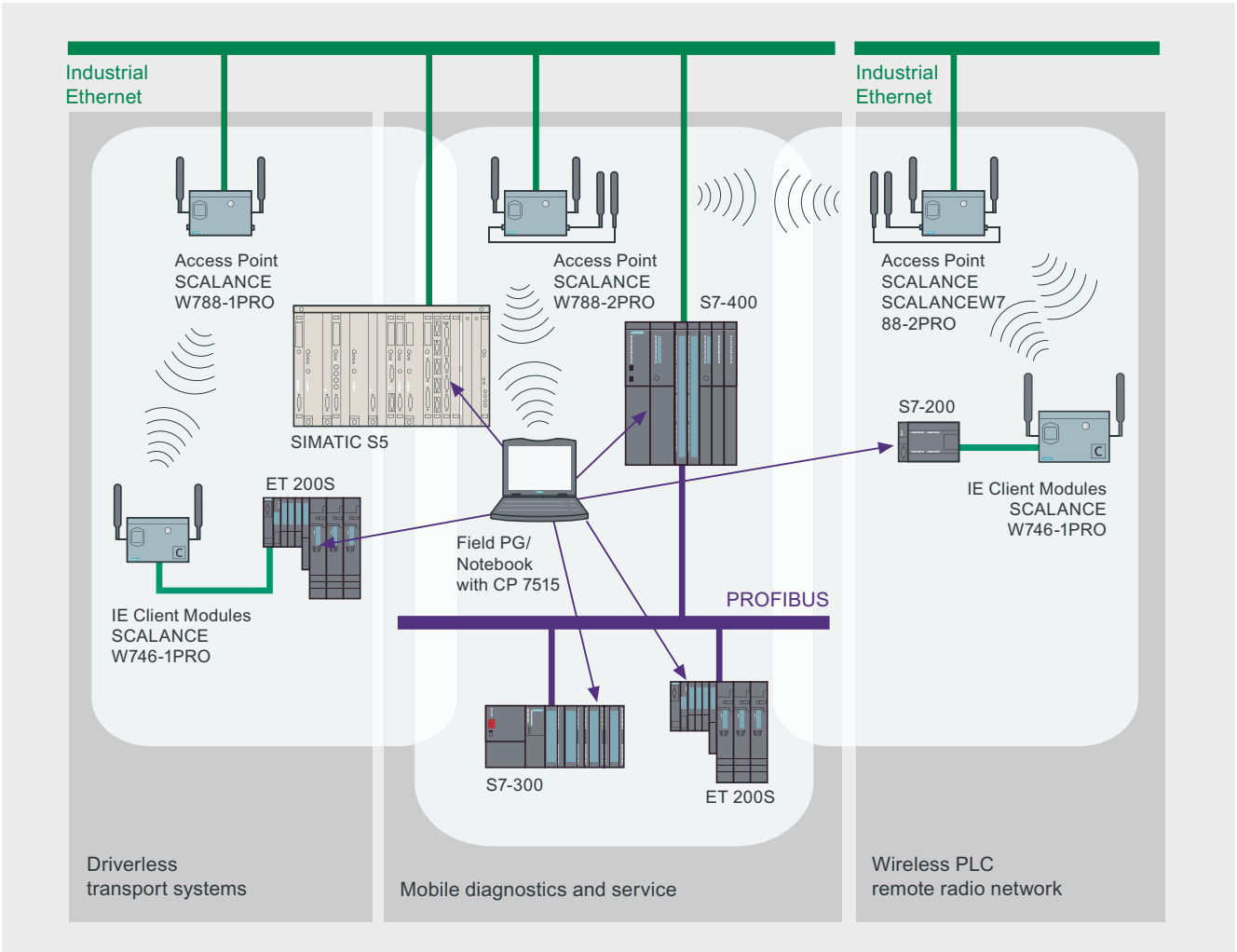


Figure 3-1 Industrial Wireless LAN - Overview

The extended standard Industrial WLAN requires minimum updating times for high-performance applications. This allows the data transfer of process-critical data, such as alarm messages, in addition to the non-time-critical communication (WLAN) for service and diagnostics.

The products of the SCALANCE W device family are designed for the particular requirements of an industrial environment with IP 65 degree of protection.

In addition to the standard wired network media supported by Ethernet, PROFINET IO also supports wireless communication with Industrial Wireless LAN (IWLAN). Implementing a wireless solution allows you to replace electrical connections that are naturally subject to wear (for example, contact conductors). A wireless solution also allows you to use automated guided vehicles or customized operator and maintenance devices.

Advantages of a wireless communication network

- Increase in the competitiveness since the mobility and flexibility simplify maintenance work, reduce service costs and stoppage times and allow the personnel to be deployed optimally.
- Work orders can be received and acknowledged online.
- The system solution is tested and well-proven because the network components, communications processors, and software are perfectly matched to each other.
- Remote diagnostics for different production machines from a central service location reduces service costs.
- Inaccessible installation locations can be easily reached without labor-intensive cabling.
- Fast commissioning of new system parts due to reduced effort for installing the communication network.
- No wear and tear of rotating and moving equipment or system components.
- Cost-effective connection to devices in corrosive environments.

Primary Advantages

- Communication with moving nodes
  In the case of electrical telpher lines, the wireless connection saves the entire busbar layout for data. Furthermore, the travel paths can be easily changed.
  If rotating equipment is incorporated in a data network, wear on the slip rings is avoided. The same advantage applies to substitution of cable carriers.
- Communication with mobile nodes and mobile data acquisition
  The user can acquire data and supply it to central data processing using mobile industrial-rated Internet PADs such as MOBIC (Mobile Industrial Communicator). In this case, the mobile handhelds are no longer assigned to a machine or a process but, instead, to a user (fewer devices required).
  IWLAN enables the radio connection between nodes and the radio network to be monitored. If a node exits the radio field or the radio connection is suddenly broken, a warning is automatically sent to the management or control level.
- Mobile service and diagnostics
  When an error occurs, the problem can be analyzed on the spot, and targeted information for fast remedial action can be provided via the wireless MOBIC Internet PAD. The spare parts inventory in the warehouse can be checked directly, and spare parts can be ordered online, if necessary.
  An IWLAN radio network enables transmission of both "noncritical" service and diagnostic data as well as process-critical data requiring a high level of performance.
- Flexible production in time-limited configurations and communication with remote units
  Automobile manufacturing plants, in particular, are subject to fast layout changes. Flexible production enables customer demands to be implemented quickly without significant retrofit times. Production units can be quickly integrated into the data network without significant effort required for connections using wireless data networking. Moreover, test configurations can be implemented quickly.

Further Information

Brochure "Industrial communication for automation".

- Introductory information about industrial communication
- http://www.automation.siemens.com/net/html_76/ftp/presales/k-schrift_e.pdf

Catalog IK PI 2007 "Industrial Communication for Automation and Drives",

- Device overview and ordering data for industrial communication
- http://www.automation.siemens.com/net/html_76/support/printkatalog.htm

"Fundamentals of Industrial Wireless LAN": System Manual

- http://support.automation.siemens.com/WW/view/en/9975764

SIEMENS information about Industrial Mobile Communication :

- http://www.automation.siemens.com/net/html_76/produkte/050_produkte.htm

3.2 Properties

3.2.1 Basics

Overview

The Industrial Wireless LAN products (SCALANCE W) are based on the WLAN standards. They stand out thanks to their rugged design and high IP65 rating as well as integrated security functions. In addition, SCALANCE W offers functions with which field devices can be linked to controllers at high performance levels:

Radio Transmission in Free Space

Unlike LAN cabling which uses copper or fiber optic cables, a wireless local network uses free space as the transmission medium (WLAN network in accordance with IEEE 802.11). Information is transmitted through space in the form of electromagnetic waves.

Due to physical factors, the available frequency spectrum for transmission is limited to electromagnetic waves on earth. Each frequency can, depending on the transmitter power, be assigned only once in a certain radius around the transmitter (Shared Medium).

Features

There are many unfavorable influences that can impair a radio connection in the industrial field. Consequently, constant boundary conditions for radio transmission cannot be guaranteed. Automation systems, in particular, require that throughput times be predictable and that a defined portion of the available data rate be allocated to devices (e.g., PLC) that have stringent requirements for radio communication. Industrial Wireless LAN (IWLAN) satisfies the stringent reliability and performance requirements for radio communication by defining predictable throughput times and data rates. Only IWLAN of SIMATIC NET offers this function.

To overcome the multipath propagation that occurs intensively in assembly shops and the associated attenuating and extinguishing effects on radio waves, the radio modules are equipped with two antennas (Antenna Diversity). Consequently, the receiver has the option of selecting the strongest of the two signals received.

The modules are able to switch from the maximum data rate to a lower data rate if the quality of the transmission link changes permanently (number of nodes, variable distance between nodes and access point) in order to ensure reliable transmission of data at all times.

The design of products also satisfies the requirements for harsh industrial environments and provides for easy installation. In addition, the modules also provide the convenience of an IT component, including features such as Web-based management with SNMP or sending of e-mails or SMS messages.

3.2.2 Network Architectures

Overview

There are two different Wireless LAN network types:

- Infrastructure mode
  Connection of nodes over a common access point
- Ad hoc network
  Direct connection between nodes

Infrastructure Mode

In infrastructure mode, communication takes place over an access point. The nodes have to log on to the access point and transmit on the channel specified there. In the simplest case, a group of IEE 802.11 nodes are located in the radio area of this access point. A network of this type is referred to as a Basic Service Set (BSS).

If the radio area does not reach an access point because either the sensing range is too small or too few nodes can be operated, two or more overlapping BSSs can be operated in a common network (Extended Service Set, ESS).

The infrastructure mode enables large networks to be configured and, in particular, supports operation within an Ethernet network. Wireless LAN in accordance with IEEE 802.11 is also referred to as Wireless Ethernet.

Ad hoc Network

The simplest form of Wireless LAN network in accordance IEEE 802.11 is referred to as an ad-hoc network. In this type of spontaneous network (Independent Basic Service Set, IBSS), the radio cards of individual devices can establish fast, simple networks without a large network structure and without user intervention. These networks are used for temporary data exchange over short distances.

3.2.3 Network Components

Overview

In IWLAN there are passive and active network components:

- Passive network components are for example antenna cables, antennas and hybrid plug connectors.
- Active network components are for example Access Point and Client Module.

The following table lists the various network components for IWLAN

Table 3-1 Network Components for IWLAN

Medium	Components	Remark
Radio (wireless)	Access Point	For close-range wireless transfer
	Leaky ware cable	Used to establish a defined conical radio field in demanding radio areas
	IWLAN/PB Link PN IO	For wireless coupling of PROFIBUS DP to Industrial Wireless LAN
	Client Module	For administering the radio connection of up to 8 connected nodes with IE / PN IO interface.
	Dual Access Point	For operation in redundancy mode. Two coupled radio cards transfer the data parallel to the increase in availability

3.2.4 Connection Systems

Overview

Hybrid connectors and standard connectors with a degree of protection of IP67 is used to connect the network components of the SCALANCE W family. Depending on the application, the power supply is realized by means of the same cable.

The following table lists the specifications of the connections.

Table 3-2 Connection System at the SCALANCE W Product Family

	24 VDC and data transfer via one cable (8-wire)	24 VDC and data transfer via two separate cables (4-wire and 2-wire)	Redundant 24 VDC and data transfer via one cable (8-wire and 2-wire)	90 VDC - 265 VDC and data transfer via two separate cables (4-wire and 3-wire)
IP 67 Hyprid connector with IE Hybrid Cable	X		X	
IP 67 Hyprid connector with FC Standard Cable		X		X

3.2.5 Fault Tolerance

Overview

For highly reliable radio connections, redundancy is achieved by transmitting data over two separate radio cards and two different channels (redundancy mode).

Redundant Wireless LANs

In redundancy mode Access Points have to be used that dispose of two radio interfaces and can thus send on two frequencies.

In its main aspects the structure corresponds to that of the Wireless Distribution System, but the Access Points do not communicate with each other only on the primary frequency but also on the second channel with a second set of antennas.

By this means a high connection security is attained in combination with high data rates: Even if a frequency range is disturbed temporarily by interfering nodes or interferences, a connection by means of the other channel may still be possible with a high probability.

3.3 Technologies

3.3.1 Transmission Method

Overview

IWLAN is based on the IEEE 802.11 standard and defines the connection of the network stations by means of radio in the frequency band at 2.4 GHz. Extensions of the IEEE 802.11 standards are the variants "b" (i.e. IEEE 802.11 b), "a", "g" and "h". The properties such as transmit frequency, transmit capacity and modulation method are listed in the following table.

Table 3-3 Properties of the variants of the IEEE 802.11 standard

	802.11 "a"/"h"	802.11 "b"	802.11 "g"
Frequency band	5 GHz	2.4 GHz	2.4 GHz
Gross baud rate	54 Mbps	11 Mbps	54 Mbps
Modulation method	OFDM	DSSS	OFDM

Modulation Method

A modulation in the sense of communications engineering is when the signal is "modulated onto" a carrier wave. The "sum" of carrier wave and Signal is transferred to the receiver that deducts the carrier wave from the received oscillation and thus obtains the pure signal again.

More complex procedures described below are used to transfer digital data

OFDM (Orthogonal Frequency Division Multiplexing)

OFDM does not use only one frequency to transfer a signal, but rather transmits on several hundred to several thousand ones. The channels lie near each other in a narrow frequency band

The massive parallel data transfer means that the data rate passing on the each individual channel is reduced drastically. Much more time is thus available to transfer the individual bits.

The advantage in this process is the relatively high resistance to disturbances such as echoes or brief noise.

Sequence Spread Spectrum (DSSS)

A further method of transferring digital data is the adding of randomly generated bits. These random bits are added to the data flow by means of an XOR logic operation in such a manner that the random bits change much faster then the values of the data flow.

The receiver subtracts this random bit from the received data flow and receives the unfalsified signal. To this purpose the receiver has to know the sequence of the random bit. These are generated on both ends of the transfer path by means of a key algorithm. To this purpose the key has to be exchanged beforehand and has to be known to the transmitter and receiver.

3.3.2 Access Methods

CSMA/CA

A wired Ethernet network operates according to the CSMA/CD access method (Carrier Sense Multiple Access with Collision Detection). Once the ready-to-send node has listened in on the cable and identifies it to be free (Carrier Sense, CS), the data are transmitted. During transmission, the transmitting node can detect a collision (Collision Detection, CD) between itself and other simultaneously transmitting nodes (Multiple Access, MA) based on a faulted signal level, and thereby terminate the transmission.

In a wireless network, this mechanism is applied in the same way except that collisions are deliberately avoided (Collision Avoidance, CA) to keep from reducing the net data throughput unnecessarily. For this reason, wireless LANs do not use the CSMA/CD method, in which permitted collisions are detected. Rather, wireless LANs use the CSMA/CA method (Carrier Sense Multiple Access with Collision Avoidance).

Instead of physically listening in on the channel, wireless LANs use a communication protocol that reserves the channel for a certain amount of time. In this method, the node checks to see if the medium is free before starting transmission.

The following access mechanisms are available at IWLAN::

- Data Reservation: The bandwidth between an access point and a defined client is reserved. This safeguards high, reliable performance for this client regardless of how many additional clients are operated at the access point.
- Rapid Roaming: This function enables movable stations to be rapidly passed on between various access points. These expansions to the standard allow high-performance wireless applications with PROFINET IO down to the field level.

3.4 Information Security in the IWLAN

Overview

Intrusion into IWLANs is possible because radio waves are not tied to a fixed medium, i.e., a wire, and because effects such as reflections and diffractions overlap. In addition, IWLAN is a "Shared Medium" meaning that all nodes endeavor to access the same network infrastructure. This is not the case in wired "Switched Ethernet." There, each node has an exclusive cable up to the switch that it does not have to share with any other node. Unless additional measures are taken, it is thus impossible to be certain which node is "tying up" the radio network and accessing the medium.

IEEE 802.11i

The working committee 802.11i of the IEEE is handling the security of data transfer via WLANs. One focus of the working committee is the definition of encryption algorithms and authentication procedures for wireless data transfer.

Wired Equivalent Privacy (WEP)

In this encryption procedure a password is used in order to generate the random sequences (see Section 3.3.1 - Transmission Modes). Each character of the telegram to be transferred is then encrypted or decoded with the next number from this sequence. This procedure is regarded as relatively insecure, since conclusions can be drawn from the encoded data flow about the key that is used.

An improved procedure us Wi-Fi Protected Access (WPA)

WPA

WPA represents the further development of WEP and is still regarded as the standard despite some weaknesses. In addition to technical modifications to the actual encryption algorithm, the course of the protocol was also changed.

- Passwords for the network access (authentication) are stored on a central server (RADIUS)
- The key for the telegram transfer changes dynamically, thus making static attacks more difficult.
- The key also includes the MAC address (the unique hardware identification) of the transmitter, making faking of the transmitter address at messages more difficult.

WPA2 und Advanced Encryption Standard (AES)

WPA2 differs from WPA mainly in the encryption procedure that is used: The weaknesses that have been identified at WPA no longer exist in the AES procedure that is used at WPA2.

The "Advanced Encryption Standard" also "adds a key onto" the message, as at WEP. On the one hand one block of raw data at a time is processed with the same key respectively, on the other hand several processing passes are carried with respectively varying block limits.

Extensible Authentication Protocol (EAP)

EAP is a protocol that specifies the authentication method on which a client and server agree for the communication process.

MAC Filters

MAC addresses (Media Access Control) are codes through which hardware elements (such as network cards, modules, motherboards) can be identified uniquely worldwide.

The addresses usually encompass 6 bytes (48 bits) and are "wired fixed" in the corresponding components. When requested, the components identify themselves by returning their MAC address.

In the network administration function filter tables with MAC addresses can be set up that allow or prohibit access for certain addresses. By this means a simple, even if comparatively insecure access protection can be implemented for the network.

It is not impossible for MAC addresses to be manipulated (so-called "spoofing") so that MAC filters only offer sufficient security for a network in combination with other measures.

3.5 Configurations

3.5.1 Planning and Engineering

SINEMA E Lean

The planning, simulation and configuration software SINEMA E Lean is used to plan and configure IWLAN applications. It can be used to visualize IWLAN networks for example according to coverage, data transfer rate, signal/noise ratio and overlapping with consideration of environmental and device characteristics

3.5.2 Device Family

SIMATIC Components at IWLAN - Overview

The following graphic provides an overview of the systems with mobile access for solving complex automation tasks that are provided in SIMATIC.

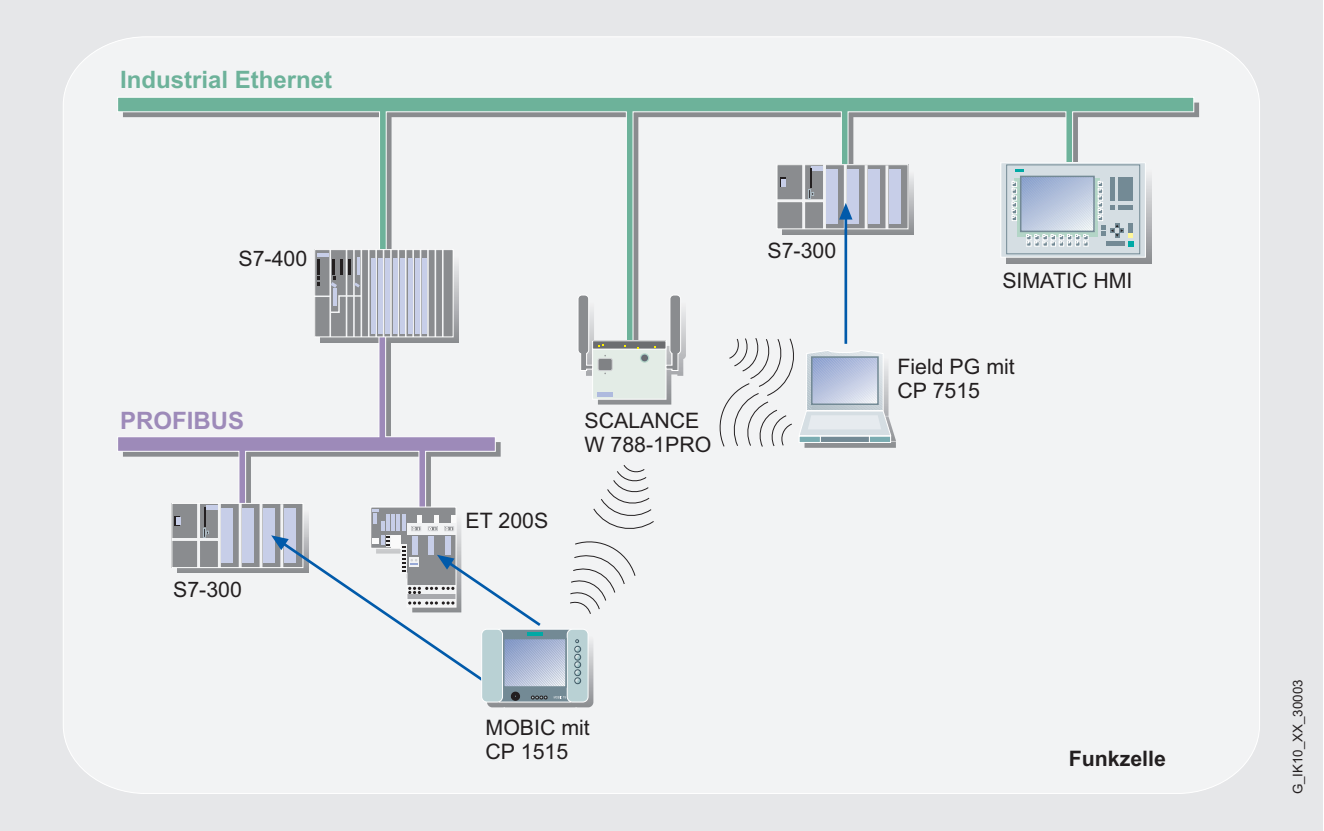


Figure 3-2 Access of Mobile Devices in Industrial Wireless LAN

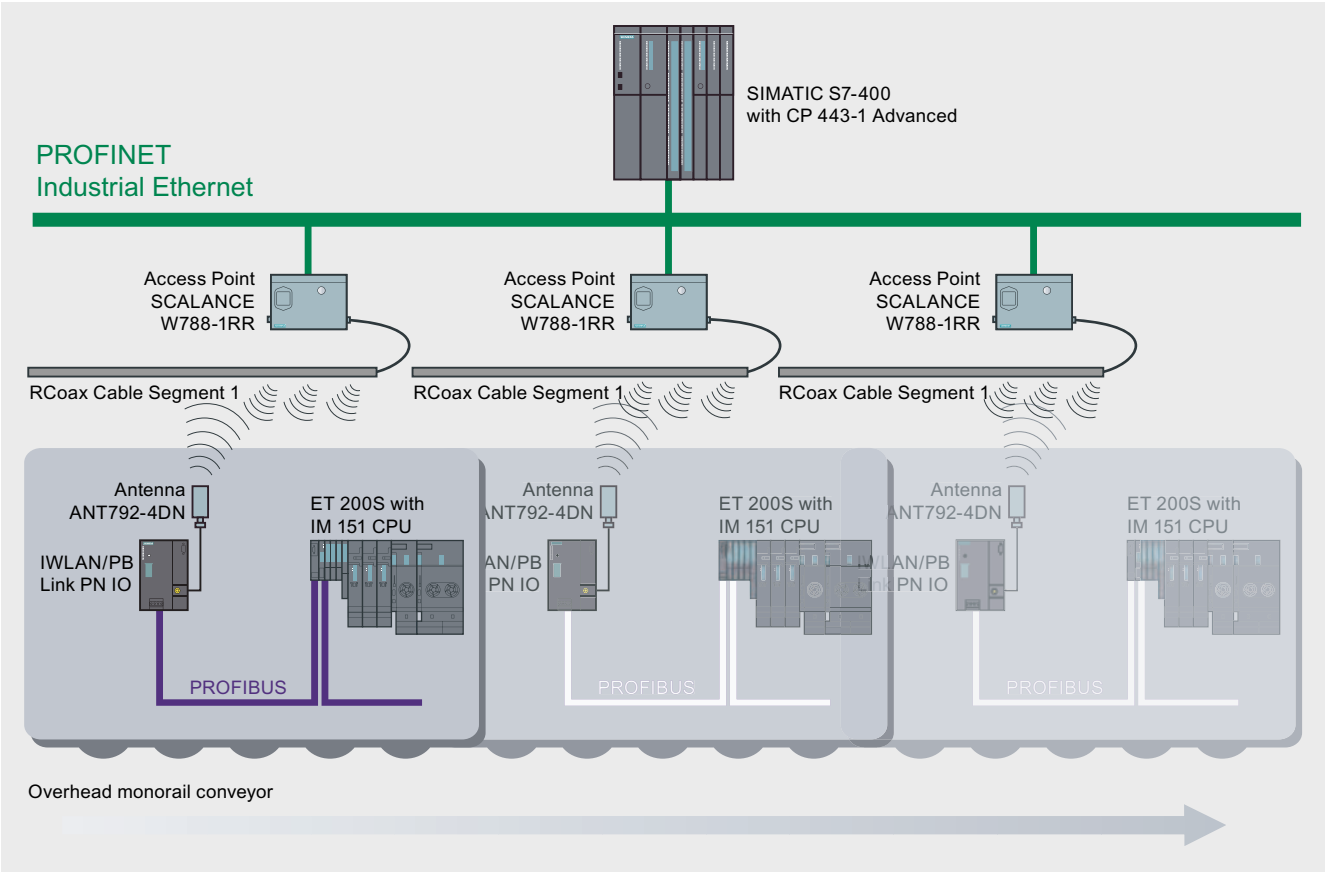


Figure 3-3 IWLAN in Automation Systems Using an Electrical Telpher Line as an Example

The SCALANCE W ("Wireless") family consists of components for connecting Industrial Ethernet and WLAN in industrial environments.

Access Points

"Access points" have to be used in order to combine several radio cells. Within the WLAN these have a position similar to switches.

On the one hand each of the access points communicates with all the regular nodes in its cell, the so-called "clients" – irrespective of whether they are stationary or mobile. On the other hand the access points of a WLAN maintain the connection amongst each other, wether by means of cables or by means of a second independent radio network and thus make communication beyond the limits of the radio cells possible.

The "W780" modules are access points that serve as network switches of the individual radio cells, as well as as transitions between Industrial Ethernet and WLAN networks.

Client Modules

The client modules have the designation "W740". They are connected via Ethernet to mobile end nodes and communicate with each other via the access points.

The range of the mobile IWLAN devices in the SIMATIC is listed in the following table.

Table 3-4 Overview of the SCLANCE W700 Product Range

SCALANCE W-700	
SCALANCE W-780 Access points	**SCALANCE W-740** Clients
SCALANCE W788-1PRO	SCALANCE W744-1PRO
SCALANCE W788-2PRO	SCALANCE W746-1PRO
SCALANCE W788-1RR	SCALANCE W747-1RR
SCALANCE W788-2PR	

3.5.3 Gateways

LAN/Wireless LAN

Two devices are needed for the transition from a wired LAN to an end device (e.g., PC) over a Wireless LAN.

- One Access Point (LAN -> Wireless LAN)
- One communications processor (Wireless LAN -> End device)

The radio path is located between the two devices.

IWLAN/PB Link PN IO

The IWLAN/PB Link PN IO is a gateway that connects the two network types: Industrial Ethernet LAN and PROFIBUS.

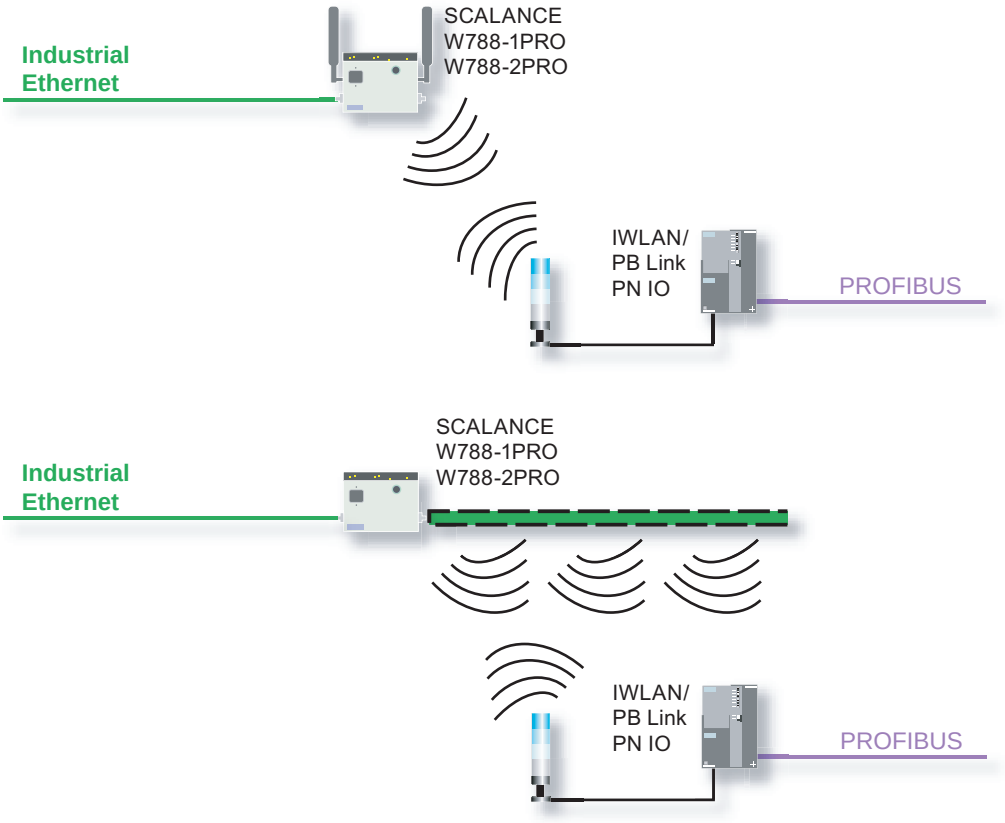


Figure 3-4 Gateway IWLAN - PROFIBUS (standard antenna (top), RCoax (leaky ware cable; bottom))

The IWLAN/PB Link PN IO supports access to all PROFIBUS DP slaves connected to the subordinate PROFIBUS.

In addition, the use of Industrial Wireless LAN (IWLAN) with the leaky ware cable RCoax and WLAN antennas for wireless or contact-less data transmission (for example EHB or high-bay storage and retrieval systems) opens up a wide range of possibilities for mobile applications.

IWLAN/PB Link PN IO can be used in the following operating modes:

- Gateway as PROFINET IO proxy
- Gateway in standard operation

Further Information

For additional information on the S7-CPs for Industrial Ethernet, refer to the SIMATIC NET Manual Part BL 2 *SIMATIC S7-CPs for Industrial Ethernet*

For basic information on the Industrial Wireless LAN, refer to the SIMATIC NET System Manual *Basics of Industrial Wireless LAN*

PROFIBUS

4

4.1 Introduction

Overview

PROFIBUS is used to connect field devices, such as distributed I/O devices, valves or drives, to automation systems, such as SIMATIC S7, SIMOTION, SINUMERIK or PCs.

PROFIBUS that is standardized in accordance with IEC 61158 and EN 50170 is a powerful, open and robust with fieldbus system with short reaction times. This open fieldbus standard is supported by the most important companies in the automation industry.

PROFIBUS provides a fieldbus solution for the complete production and process automation with rapid and reliable data exchange as well as integrated diagnostics capabilities. PROFIBUS can also be used in hazardous areas as well as for fail-safe applications and HART devices.

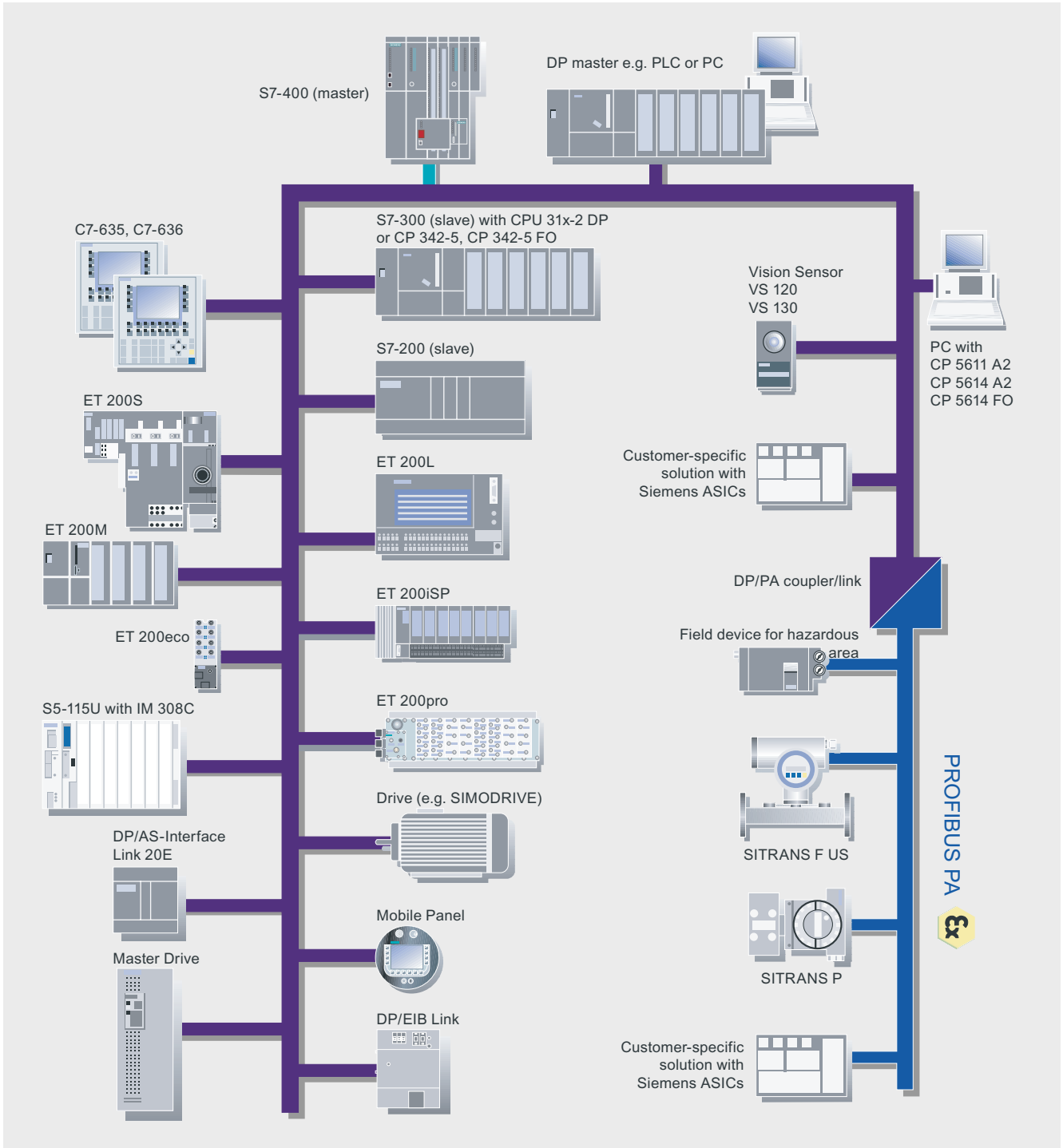


Figure 4-1 Device Diversity at PROFIBUS

Advantages

In comparison to conventional operation of process I/O, PROFIBUS provides many advantages:

- Reduced planning and engineering costs and time
- Reduced installation and start-up costs through
  - Reduced effort required for wiring,
  - Abolition of termination modules,
  - Mounting in the field and
- Rationalization of connection and power distribution
- Reduced operating and maintenance costs due to embedded diagnostics in devices

Further Information

Brochure "Industrial communication for automation".

- Introductory information about industrial communication
- http://www.automation.siemens.com/net/html_76/ftp/presales/k-schrift_e.pdf

Catalog IK PI 2007 "Industrial Communication for Automation and Drives",

- Device overview and ordering data for industrial communication
- http://www.automation.siemens.com/net/html_76/support/printkatalog.htm

Isochronous Mode function manual:

- Complete overview of the isochronous mode system function
- http://support.automation.siemens.com/WW/view/en/15218045

"PROFIBUS - Technology and Application" System Description

- Comprehensive overview of the PROFIBUS technology
- http://www.profibus.com/pall/meta/downloads/article/00454/

PROFIBUS international homepage:

- http://www.profibus.com/

4.2 Features

4.2.1 Basics

PROFIBUS supports the data exchange between the field devices on the cell and field levels and systems on a higher level. PROFIBUS is available in different forms for various applications, for example:

- PROFIBUS DP provides rapid communication with intelligent devices of the distributed I/Os.
- PROFIBUS PA supplies signals and power for sensors and actuators by means of the same line.

Thanks to the modular concept, the uniform communications protocol as well as a wide range of applications-specific branch-specific profiles, such as PROFIdrive or PROFIsafe, PROFIBUS is the fieldbus for both factory automation and the process industries.

PROFIBUS is furthermore characterized by the following features:

- User-selectable redundancy for host systems, media and slave devices
- Time synchronization
- Time stamp

4.2.2 Network Architectures

Media and topologies at PROFIBUS are listed in the following table.

Table 4-1 Media and Topologies at PROFIBUS:

Medium	Topology	Number of nodes	Length of the network
Copper (electrical)	Line Tree	Max. 125 1)	Up to 9.6 km 2)
Fiber-optic conductor (optical)	Star Ring Line	Max. 125 1)	Up to 90 km 2)
Infrared (wireless)	Point-to-point; Point-to-multipoint	2 Max. 32	Up to 15 m

1) 31 field devices per DP/PA Link at PROFIBUS PA

2) Up to 1.0 km in hazardous area, up to 1.9 km in non-hazardous area at PROFIBUS PA

- Copper cable, that is used very often, is terminated at the ends with one surge impedance each. This gives rise to a network segment to which a maximum of 32 nodes can be connected. Several segments are connected by repeaters to a complete network..
- Fiber-optic conductors are suitable for data exchange across large distances or through areas with strong electromagnetic interferences.
- Infrared communication is supported for line-of-sight applications over short distances.

4.2.3 Network Components

In PROFIBUS there are passive and active network components:

- Passive network components are for example power cables and plug connectors.
- Active network components are for example repeaters and Link Modules.

The active network components that can be used at PROFIBUS are listed in the following table.

Table 4-2 Active Network Components at PROFIBUS:

Medium	Components	Remark
Copper (electrical)	Repeaters	Used to couple two segments
	DP/DP coupler	Used to couple two DP networks
	DP/PA coupler, DP/PA link	For transition from PROFIBUS PA to DP
Fiber-optic conductor (optical)	Optical Link Module (OLM)	For connecting nodes and establishing optical networks
	Optical Bus Terminal (OBT)	For connecting nodes without integrated fiber-optical bale
Infrared (wireless)	Infrared Link Module ILM	For close-range wireless transfer

4.2.4 Connection Systems

Bus connectors are used to connect nodes to the bus line. The bus connector RS 485 (degree of protection IP20) for electrical power systems is available in various designs with the cable outlet at various angles.

The FastConnect system allows rapid mounting with insulation piercing technique.

Connecting cables are used to connect nodes to network components or automation systems.

4.2.5 High-Availability

PROFIBUS can optionally also be used in redundant architectures.

- ET 200 I/O devices are connected with two interface modules to the two PROFIBUS subnets of a high-availability automation system.
- A PROFIBUS PA line is coupled by means of a redundant DP/PA Link and two interface modules.
- Non-redundant devices can also be operated at a redundant PROFIBUS by means of a so-called Y link.

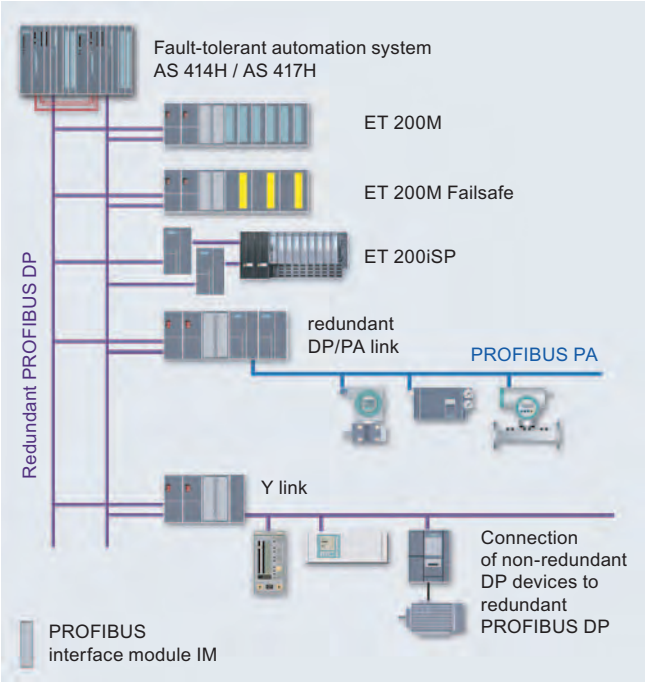


Figure 4-2 Redundancy at PROFIBUS

4.3 Technologies

4.3.1 Transmission Methods

PROFIBUS DP allows serial process and field communication between PROFIBUS DP masters and PROFIBUS DP slaves:

- Cyclic data exchange
- Acyclic data exchange

The transmission modes and media that can be used at PROFIBUS are listed in the following table.

Table 4-3 Transmission Modes at PROFIBUS:

Procedure	MBP	RS 485	RS 485-iS	Fiber-optic
Data transmission	Synchronized	Voltage differential signals	Voltage differential signals	optical
Transfer rate	Fixed 31.25 kbps	9.6 kbps to 12 Mbps	9.6 kbps to 1.5 Mbps	9.6 kbps to 12 Mbps
Cables	Twisted-pair shielded 2-wire cable (copper)	Twisted-pair shielded 2-wire cable (copper)	Twisted-pair shielded 4-wire cable (copper)	Fiber-glass, plastic, PDF
Topology	Line, tree	Line, tree	Line	Star, ring, line
Intrinsic safety	EEx ia/ib		EEx ib	

MBP (**M**anchester Coding and **B**us **P**owering) is suitable in particular for the process industry, since the bus power is carried out in 2-wire technique. The intrinsic safety allows laying also in Zone 1 and 0 hazardous areas.

With RS 485-iS a high data transfer rate is also available in the process industry. Data and power are passed over a 4-wire cable. The intrinsic safety allows usage in Zone 1 hazardous areas. Isolating transformers (RS 485-iS couplers) isolate the RS 485 and the RS 485-iS sections from each other.

4.3.2 Access Methods

Bus access (Medium Access Control, MAC) is effected at PROFIBUS via the master-slave access method together with token passing.

In master/slave mode, the master that currently has permission to transmit (token) is allowed to address the slaves assigned to it. Subsequently the token is passed on to the next master.

4.4 Services

4.4.1 PROFIBUS DP services

Overview

PROFIBUS DP (distributed I/Os) is used to connect the following devices:

- Controllers, PCs, HMI devices
- Distributed field devices, for example SIMATIC ET 200
- Valves
- Drives

Thanks to its rapid response times PROFIBUS DP is particularly suitable for the manufacturing industry.

Features

As at a centralized I/O devices access to the distributed I/Os is carried out by means of the configured device address. The STEP 7 user program can read and write data to these addresses in the same manner as to the central I/O devices. This means that the distributed I/Os can be addresses through direct I/O access or through the process image exchange.

PROFIBUS offers various performance levels:

- The basic functionality (DPV0) includes the cyclic data exchange of process data between the master and PROFIBUS DP slaves as well as workstation- module- and channel-specific diagnostics.
- The extensions in accordance with DPV1 encompass acyclic data traffic during operation for:
  - Parameterization as well as operator control & monitoring (non-time-critical)
  - Handling of interrupts (time-critical)
- Isochronous mode and data exchange broadcast (DPV2):
  - Isochronous mode is characterized by a deterministic and clock-synchronized behavior. The synchronized execution cycles ensure that the data are transmitted at consistently equidistant time intervals. This ensures that demanding control systems, high-precision position processes and rapid motion control applications can be realized.
  - Data exchange broadcast means that PROFIBUS DP slaves communicate with each other using broadcasting without going through the master, thus reducing the bus response times notably.

The additional "HART on PROFIBUS DP" profile also allows communication with HART devices.

Integration in STEP 7

You use STEP 7 to configure the distributed I/O (such as ET 200 stations) as part of the hardware configuration for the controller. With the vendor-supplied GSD file, you can also use STEP 7 to configure the addresses for slave devices from other (non-SIMATIC) manufacturers.

4.4.2 PROFIBUS PA Communication Services

Overview

PROFIBUS PA (Process Automation) is based on the MBP transmission technology and the DPV1 functions. PROFIBUS PA allows intrinsically safe data transfer and power supply by means of a 2-wire cable.

PROFIBUS PA with the PA Devices profile is suitable in particular for the process industry. It is used to integrate, for example, pneumatic actuators, solenoid valves and measuring transducers.

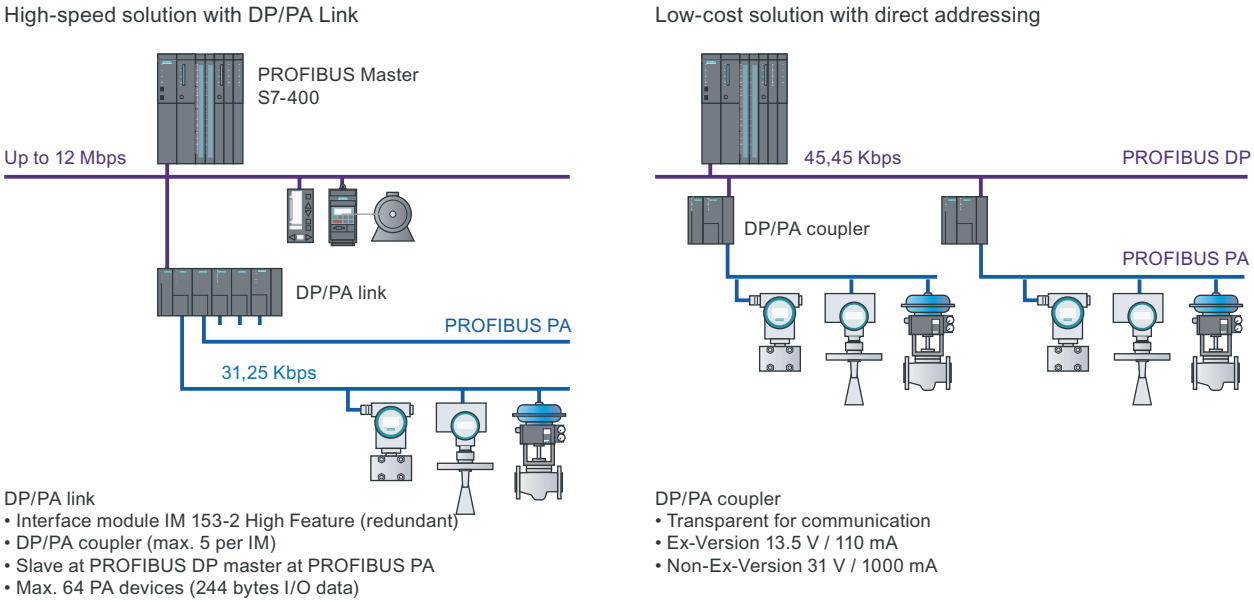


Figure 4-3 PROFIBUS PA Configuration

Features

The PA Devices profile defines the parameters and functions for various classes of process devices. PA Devices is available as Version 3.0 in "Profile for Process Control Devices".

The PA instruments are connected to the current-limited PA bus and, with few exceptions, are supplied with power and data over the bus. These instruments are low-voltage devices that can be installed in hazardous areas up to Zone 0.

The communication encompasses cyclic and acyclic access:

- Cyclic access to the inputs/outputs is typically carried out using a SIMATIC Controller.
- Acyclic access to the potentially extensive set of device operating parameters is typically carried out using an engineering tool such as Process Device Manager (PDM).

The inputs/outputs of a PROFIBUS PA slave are addressed through process image exchange, exactly like the central I/O devices.

All the bus components used as PROFIBUS PA differ from those used at PROFIBUS DP, for example:

- Cables
- Plug connectors
- Repeaters
- Terminations

These differences are due to the differing electrical properties of the bus.

PROFIBUS PA allows a transfer rate of 31.25 kbps and can have a line or tree structure.

PROFIBUS PA is connected to PROFIBUS DP by means of the following active network components:

- DP/PA couplers for small volumes of data
- DP/PA links for large volumes of data

DP/PA couplers allow the following segment lengths:

- Up to 1 km in an Ex area
- Up to 1.9 km in a non-Ex area

Integration in STEP 7

As with PROFIBUS DP devices, PROFIBUS PA devices are also described by GSD files by the manufacturer. These GSD files are installed in the STEP 7 hardware configuration. Afterwards the PA devices are displayed in the device catalog.

4.4.3 PROFIdrive

Overview

PROFIdrive is used to include drives in automation solutions from simple frequency converters to highly dynamic servo controller. To this purpose PROFIdrive defines the device behavior and the methods for accessing drive data at PROFIBUS.

Features

In order to accomplish the various tasks that modern drives must perform, PROFIdrive defines six application classes:

- Class 1 defines a standard drive that is controlled via a main setpoint, e.g., the speed setpoint.
- Class 2 defines a standard drive with technology function. The process is divided into subprocesses for this class. Drive tasks are issued to the drive device, requiring direct data exchange between the individual drives.
- Class 3 defines a positioning drive that includes a position controller. The positioning requests are started and transferred via PROFIBUS.
- Classes 4 and 5 define the central motion control that enables coordinated motion sequences among multiple drives. PROFIBUS is used to close the position control loop and to synchronize the clock cycles.
- Class 6 includes distributed automation in clocked processes and with electronic shafts. This allows for example "electrical gearing" or "cam disk" to be implemented.

PROFIdrive defines the mechanism of accessing parameters and a subset of manufacturer-specific profile parameters. Access to the other parameters is carried out acyclically through a special channel in accordance with DPV1.

PROFIdrive uses the DPV2 functions isochronous mode and data exchange broadcast as the communication protocol.

Further Information

PROFIdrive is specified in "PROFIdrive Profile – Drive Technology V3":

- http://www.profibus.com/pall/meta/downloads/article/00352/

Integration in STEP 7

Configuration of the drives is carried out using STEP 7.

4.4.4 PROFIsafe

Overview

PROFIsafe is used for all fail-safe communications via PROFIBUS and PROFINET. PROFIsafe can be used to simply implement safety-oriented distributed solutions, for example in the following branches and applications:

- Automobile bodyshell work with presses and robots
- Passenger transportation, for example cableways, lifting platforms, fun rides
- Chemical, petrochemical
- Burner management

PROFIsafe defines how safety-oriented devices communicate fail-safe so that they can be used for safety-oriented applications.

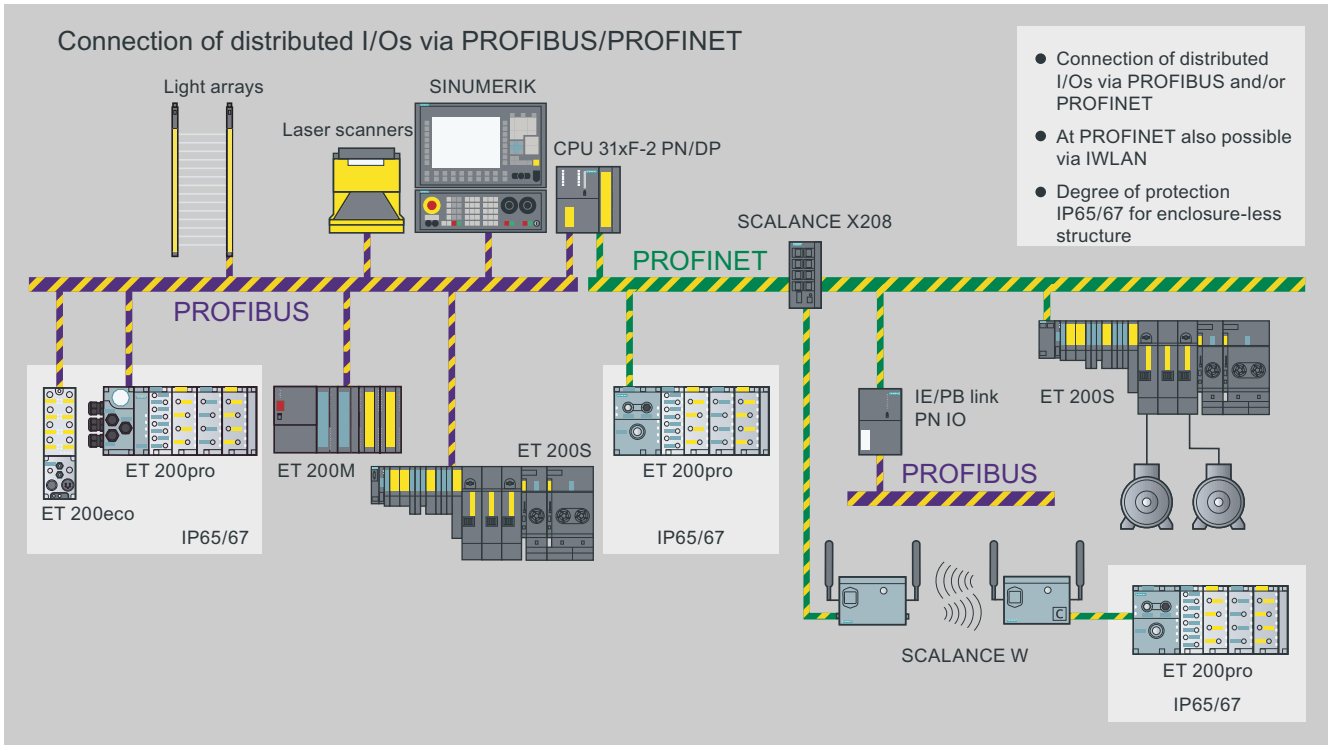


Figure 4-4 PROFIsafe Configuration with PROFIBUS and PROFINET

Features

PROFIsafe is suitable for applications up to SIL 3 (Safety Integrity Level in accordance with IEC 61508) or Category 4 (in accordance with EN 954-1). The Safety Integrated Level is used to asses the reliability of safety functions in electrical systems.

PROFIsafe allows the transfer of standard data and fail-safe data across the same bus - additional hardware components are not required.

PROFIsafe is a software solution that is implemented as an additional layer (PROFIsafe Layer) in the devices (for example CPU operating system). The safety data are packed in the telegram as a supplement to the standard data, thus forming the PROFIsafe telegram.

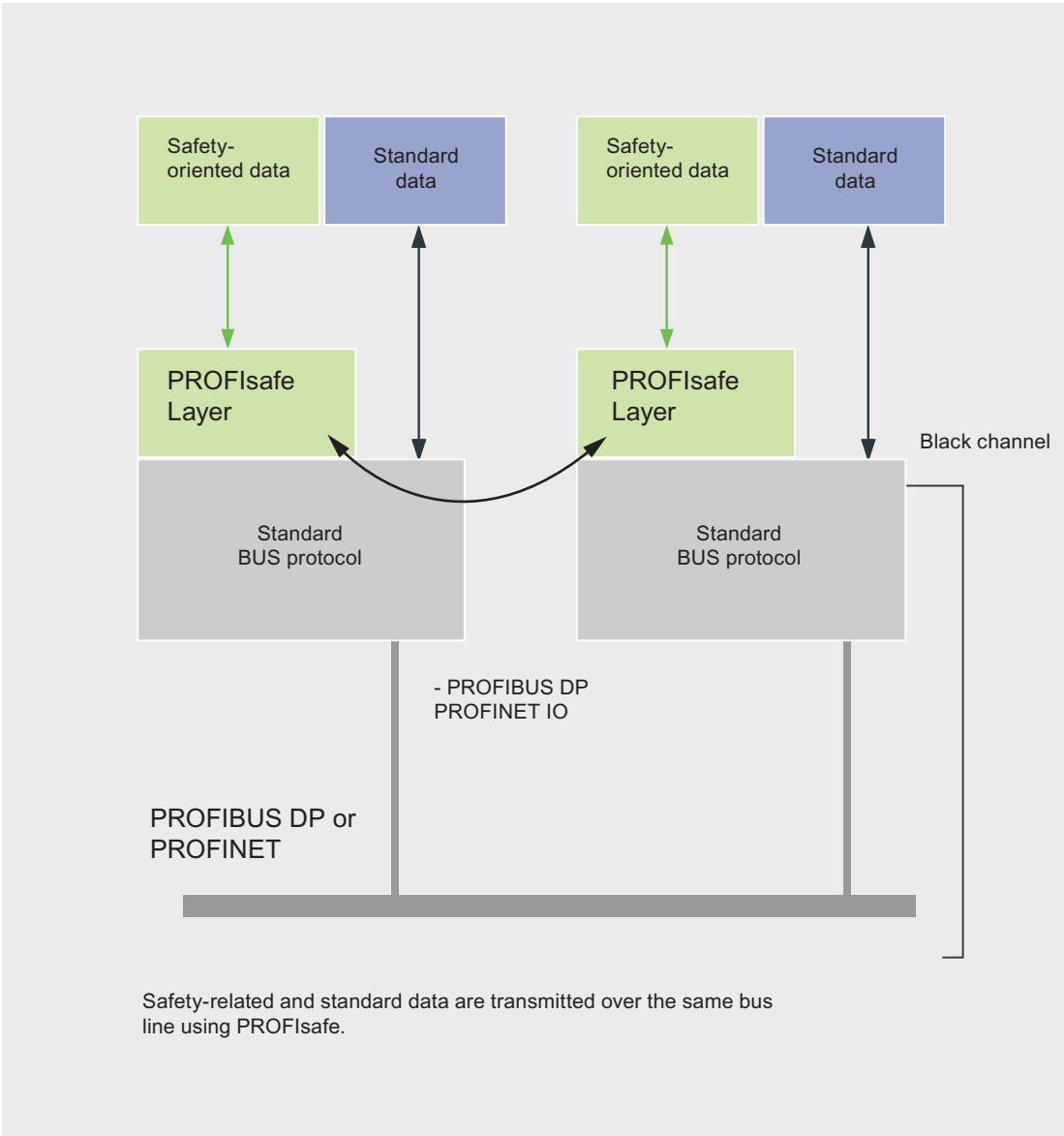


Figure 4-5 PROFIsafe Layer

PROFIsafe presents two alternative implementations:

- Solution with a bus line and a combined standard and safety-related controller
- Solution with separate transmission lines and separate controllers for standard and safety-oriented automation

PROFIsafe uses the following measures to ensure the data integrity for fail-safe transmissions:

- Sequential numbering of the safety telegrams.
- Time monitoring for telegrams and acknowledgement
- Identification between transmitter and receiver using a password
- Additional data security (Cyclic Redundancy Check)

Further Information

PROFIsafe is specified in "PROFIsafe, Profile for Safety Technology".

- http://www.profibus.com/pb/profibus/safety/

Integration in STEP 7

With PROFIsafe, the fail-safe blocks in your user program are marked in yellow to correspond with the yellow that designates the physical fail-safe I/O modules.

4.4.5 PG/OP Communication Services

See also

PG/OP Communication Services (Page 2-29)

4.4.6 S7 Communication Services

See also

S7 Communication Services (Page 2-30)

4.4.7 PROFIBUS FMS Communication Services

Overview

PROFIBUS FMS (Fieldbus Message Specification) allows the transfer of structured data (FMS variables) in order to facilitate open communication with field devices of various manufacturers. It is thus possible to implement not only motion control tasks, but also general control and measuring tasks.

Features

PROFIBUS FMS is used to exchange data between programmable controllers of various manufacturers on one PROFIBUS subnet.

The following FMS services are available to this purpose:

- READ
- WRITE
- INFORMATION REPORT

With these FMS services the user program has read- and write-access to variables of the communication partner.

Receipt of data is acknowledged by the partner, meaning that the application running on the distant communication partner has received the data correctly.

Integration in STEP 7

At SIMATIC S7 systems communication FBs are used for the FMS services. Data transmission and receipt is carried out by means of static connections. The corresponding FMS connections are configured with STEP 7 and are established when the S7 is started up.

For PCs C functions within the framework of the SAPI-S7 interface and in OPC provide the FMS services.

4.4.8 PROFIBUS FDL Communication Services

Overview

Fieldbus Data Link (FDL) offers services for the transferring data with acknowledgement on the PROFIBUS subnet.

Features

The FDL service facilitates communication to any communication partner (for example, SIMATIC S5 or PC) that supports sending and receiving data in accordance with the SDA function. SDA means Send Data with Acknowledgement, meaning that the receipt of data is acknowledged by the FDL service of the communication partner.

A SIMATIC NET CP card must be used for FDL.

Integration in STEP 7

At SIMATIC S7 systems the communication FBs AG_SEND and AG_REC are used for the FMS services. The corresponding FDL connections are configured with STEP 7 and are established when the PROFIBUS CP is started up.

On PCs the FDL services are provided in the form of C functions.

4.5 Configurations

4.5.1 Device Family

There are two alternatives for connecting SIMATIC components to PROFIBUS:

- Integrated interfaces, for example on the CPU
- Auxiliary modules, for example communications processors (CP)

The following table provides an overview of the components that can be connected to PROFIBUS.

Table 4-4 PROFIBUS Connection for SIMATIC Components

SIMATIC component	Integrated interface	Module
S7-200	--	EM277
S7-300, C7	Yes (on CPU)	CP 342-5, CP 343-5
S7-400	Yes (on CPU)	CP 443-5, IM 467
TDC	--	CP 50M0
ET 200	Yes (with IM)	--
Box PC, Rack PC, Panel PC, Field PG	Yes	CP 5512, CP 5611 A2, CP 5613 A2, CP 5613 FO, CP 5614 A2
WinAC Slot	Yes	--
WinAC MP	Yes	--
WinAC RTX	--	CP 5613 A2, CP 5613 FO
WinAC Basis	--	CP 5611 A2, CP 5613 A2, CP 5613 FO
Panels (OP, TP, MP)	Yes	--

4.5.2 Gateways

Overview

Gateways are used to connect two networks to each other. Gateways are realized by using different devices:

- Couplers connect two PROFIBUS networks.
- Links connect different networks.
- Controllers with corresponding CPUs or CPs connect different networks.

Gateways

The following table lists the gateways possible at PROFIBUS.

Table 4-5 Gateways at PROFIBUS:

Network 1	Network 2	Coupler / Link	Controllers etc.
PROFIBUS	PROFIBUS	DP/DP coupler	--
PROFIBUS DP	PROFIBUS PA	DP/PA coupler	--
PROFIBUS	Industrial Ethernet / PROFINET	IE/PB Link, IE/PB Link PN IO	S7-200, S7-300, S7-400, PC, Microbox
PROFIBUS	Industrial Wireless LAN	IWLAN/PB Link PN IO	--
PROFIBUS	AS-Interface	DP/AS-I link	S7-200, S7-300, ET 200M
PROFIBUS	EIB/KONNEX	DP/EIB link	--

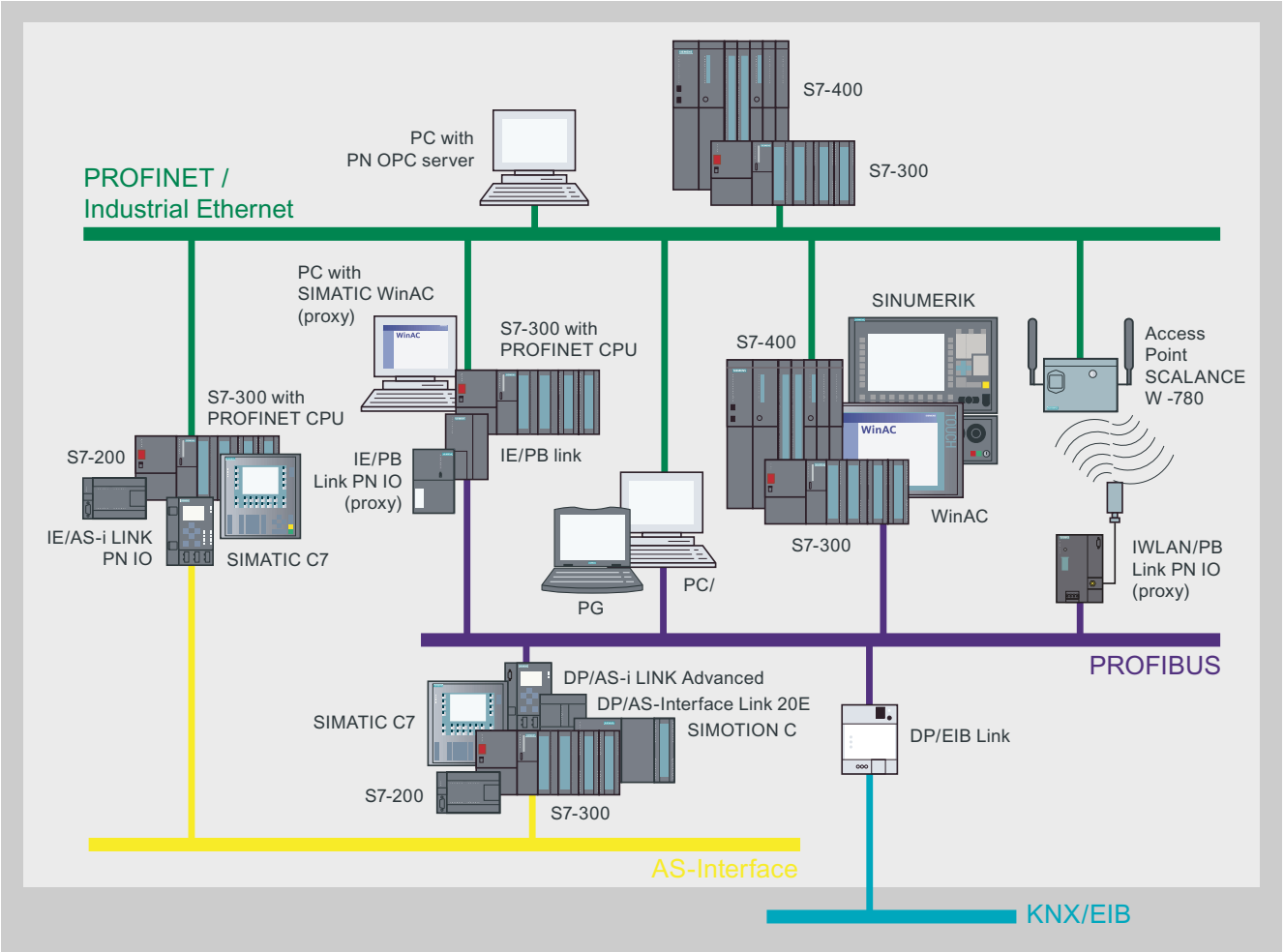


Figure 4-6 Gateways at PROFIBUS

Routing

Routing means that you can access devices across subnet boundaries. Controllers that serve as a router between two networks provide this function. For example an S7-300 CPU with an integrated DP and PN interface can connect two PROFIBUS and PROFINET subnets. With a programming device you can access all modules on local and remote networks. To this purpose all the devices must be part of the same STEP 7 project.

AS-Interface

5

5.1 Introduction

Overview

The AS-Interface (actuator sensor interface, AS-i) is an open international standard for fieldbus communication between ditributed actuators and sensors on the lowest control level.

Complying with the IEC 61158 and EN 50295 standards, AS-i was specifically designed for the interconnection of binary sensors and actuators that fulfil these standards. AS-i makes it possible to replace point-to-point cabling of the sensors and actuators by a bus line.

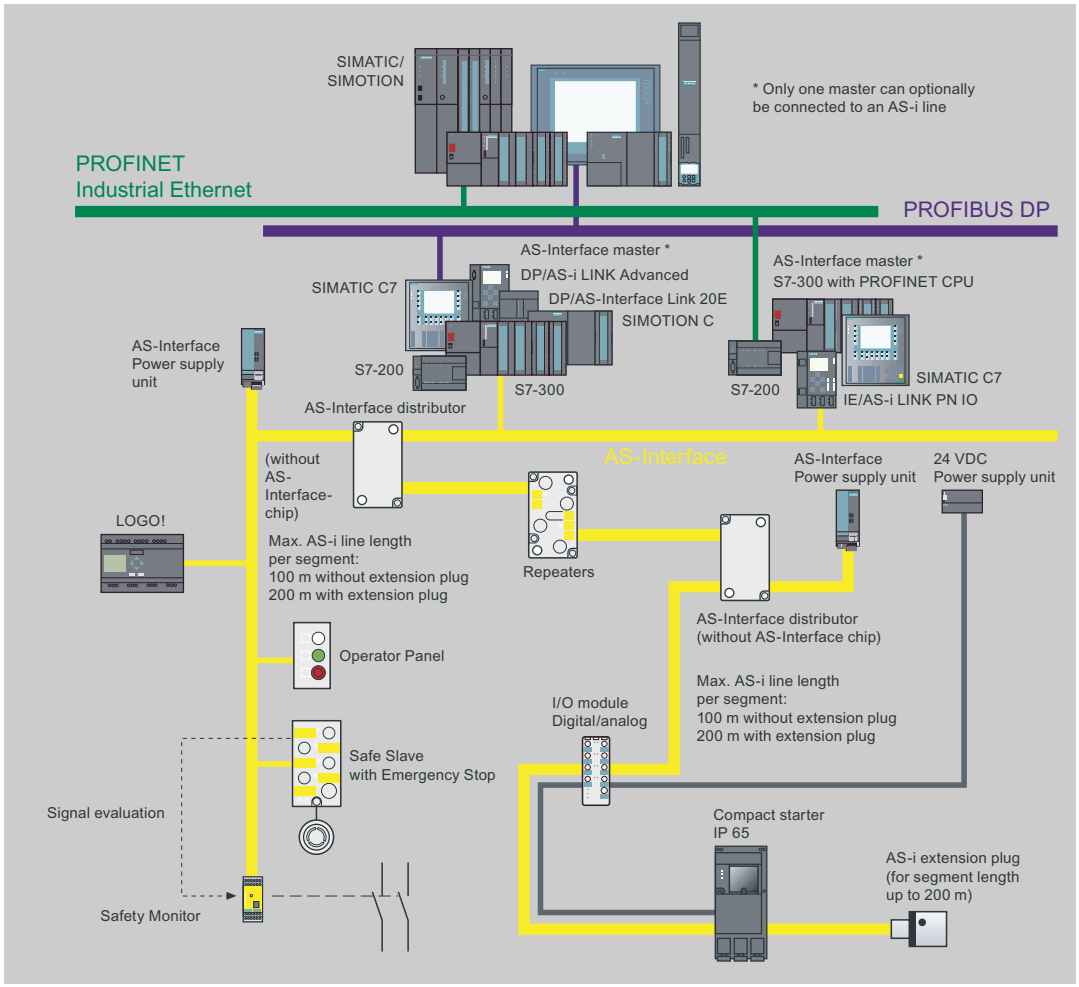


Figure 5-1 AS-Interface Configuration

The AS-Interface has the following advantages:

- Flexibility
- Cost effectiveness
- Simple and rapid installation with a minimum of errors
- A common line for transferring data and power

Further Information

Brochure "Industrial communication for automation".

- Introductory information about industrial communication
- http://www.automation.siemens.com/net/html_76/ftp/presales/k-schrift_e.pdf

Catalog IK PI "!ndustrial Communication for Automation and Drives",

- Device overview and ordering data for industrial communication
- http://www.automation.siemens.com/net/html_76/support/printkatalog.htm

"AS-Interface - The Solution for Automation" Compendium.

- Compendium about technology, function and applications
- http://www.as-interface.net/System/Publications

AS-Interface homepage:

- http://www.as-interface.net

5.2 Properties

5.2.1 Basic Principles

The cable for an AS-i subnet handles both the data transmission and the distribution of auxiliary power to the sensors and actuators. AS-i subnets use an electrical bus. AS-i does not support optical or wireless networks.

The AS-i master cyclically polls the AS-i slave devices to guarantee a pre-defined response time. All slaves have a unique address that is set by means of a specified address programming device.

For fail-safe applications, ASIsafe supports the use of fail-safe devices on an AS-i subnet.

The AS International Association certifies AS-i products. Tests ensure that devices of different manufacturers can communicate with each other at an AS-i subnet. The current AS-Interface standard is Specification 3.0.

5.2.2 Network Architectures

AS-Interface allows the topologies line, tree and star. The length of the line may not exceed 100 m.

You can connect the following to AS-i:

- Max. of 31 standard AS-i slaves or
- Max. of 62 AS-i slaves with extended addressing area

A cycle time of 5 or 10 ms is reached.

Analog slaves are special standard AS-i slaves that exchange analog data with the master by means of special profiles.

AS-i slaves can be:

- Either sensors/actuators with an integrated AS- i connection
- Or AS- i modules

Up to eight conventional binary sensors / actuators can be connected to each AS-i module.

5.2.3 Network Components

An AS-i network consists of the following network components:

- Copper cable (usually yellow profiled flat cable)
- Repeaters and extenders for extending the AS-i line.
  In addition repeaters isolate the two segments electrically from each other.
- AS-i power supply unit for supplying power to the sensors and actuators

5.2.4 Connection Systems

Many sensors and actuators are connected to the AS-i line by means of the so-called penetration technique in which the contact mandrels of the device penetrate the insulation of the cable and establish a reliable contact.

Sensors and actuators that do not have any AS-Interface connection can be connected to the bus via AS-i modules.

5.3 Technologies

5.3.1 Transmission Modes

An unshielded 2-wire copper cable is used as the transmission medium at AS-i. At the same time it serves as the power supply (30 VDC) for the communication electronic equipment and for nodes with low power requirements such as light barriers. Loads with a high power requirement, such as valves, have a separate cable for the power supply (24 VDC).

A special modulation procedure has been developed for the AS-Interface. The data that are to be transferred serially are modulated onto the power supply at a high frequency and insensitive to interefrence.

Layers 1, 2 and 7 of the ISO-OSI reference model are implemented at AS-Interface.

5.3.2 Access Methods

AS-Interface is designed as a single-master system with cyclic polling and serial tranmission protocol.

The master of the AS-i network polls all the configured slaves at intervals that have been specified exactly. During this cyclic data transfer the master reads the inputs and writes the outputs of the slaves.

5.4 Services

5.4.1 AS-Interface Services

Overview

AS-i services support direct communication with distributed actuators and sensors through cyclic data transfer. The control program accesses these distributed devices just like does the centralized I/O devices.

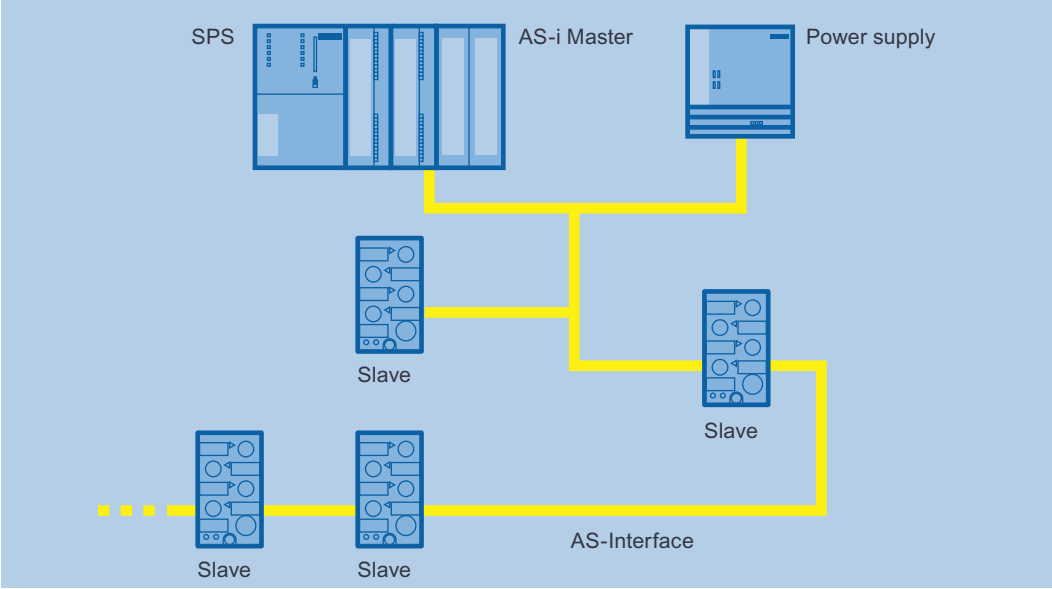


Figure 5-2 AS-i Communication Services

Features

The sensors and actuators are addressed like the centralized I/O devices, meaning through direct I/O access or by means of process image exchange. The master cyclically reads the input data and writes the output data.

Furthermore, parameters and diagnostics data can be exchanged acyclically. In addition the master can change the address of the slave (if supported by the slave).

AS-i utilizes automatic repetition of data transfer and additional test methods (parity bit per character and special signal shape) in order to provide a high degree of data integrity and accuracy.

Integration in STEP 7

Configuration of the AS-i subnet is carried out during the hardware configuration of the CP in STEP 7 or STEP 7-Micro/WIN.

Slaves are not configured since they are recognized automatically by the master when the network starts up.

5.4.2 ASIsafe

Overview

ASIsafe (AS-Interface *Safety at Work*) is the safety-related version of AS-Interface. In this version, both standard data and safety-related data are transmitted on the same bus system.

Features

ASIsafe allows the direct integration of safety-oriented components into an AS-i network, for example:

- EMERGENCY STOP switch
- Protection door switches
- Safety light grids

These safety-oriented components are fully compatible with the familiar AS-Interface components in accordance with EN 62026-2 and are operated in conjunction with them on the yellow AS-Interface cable. This means that ASIsafe can be used to carry out safety-oriented cut-offs up to Category 4 (EN 954-1) or SIL 3 (IEC 61508). All the advantages of simple and inexpensive wiring are not lost in the process.

Two additional components are needed to upgrade AS-Interface to a safety bus:

- Safe slaves
- Safety monitor

Safety-related inputs can be acquired with the safe AS-i slaves.

The safety monitor carries out the following tasks:

- Monitoring of the safe inputs
- Linking of the safe inputs by means of a configurable logic
- Safe cut-offs through built-in safety relays

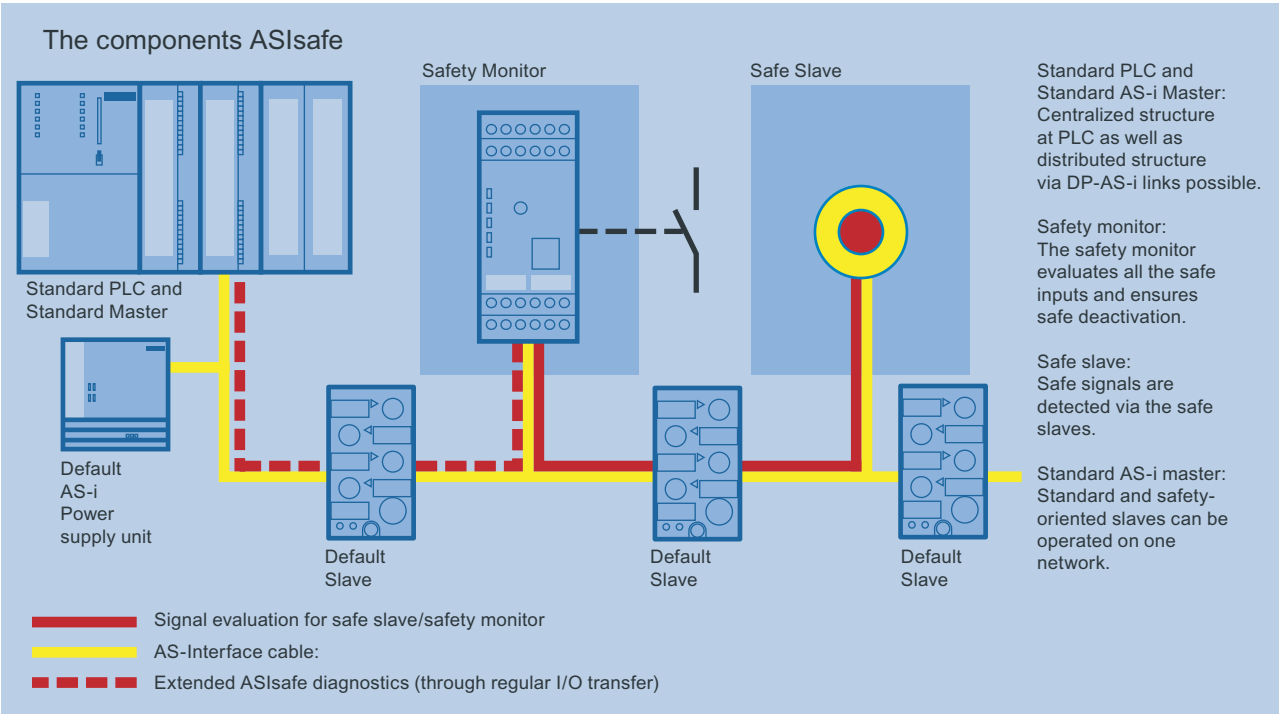


Figure 5-3 Components of ASisafe

ASIsafe provides the following advantages:

- Low-cost configuration option available without a fail-safe SIMATIC station or special master
- Simple integration of safety-oriented components
- Increased flexibility due to programming instead of wiring the safety logic
- Ability to easily duplicate a solution on multiple machines/systems by copying the safety program
- Fast overview of safety functionality of the system available using a simple graphics tool
- Minimum maintenance and down times due to integrated diagnostics

5.5 Configurations

5.5.1 Device Family

The following table lists the SIMATIC components that can operate as the master on an AS-i network.

Table 5-1 SIMATIC AS-i Masters:

SIMATIC component	AS-i coupling
ET 200X	CP 142-2
S7-200	CP 243-2
S7-300, C7, ET 200M	CP 343-2, CP 343-2 P
C7-621 ASi	Integrated interface

A wide spectrum of AS-i slaves is available, for example::

- Digital and analog I/O modules in IP67 for field usage and IP20 for the cabinet
- Motor starters and load branches in IP67 and IP20
- Contactors, pushbuttons, indicator lights

5.5.2 Gateways

Overview

AS-Interface can be connected as a subnet to higher-level bus systems, for example PROFIBUS or PROFINET. Gateways are used to connect two networks to each other. Gateways are implemented either via controllers or links.

Gateways

The following table lists the gateways possible at the AS-Interface.

Table 5-2 Gateways at AS-Interface

Network 1	Network 2	Link	Controller
AS-i	Industrial Ethernet / PROFINET	IE/AS-i Link PN IO	S7-200, S7-300, C7
AS-i	PROFIBUS	DP/AS-I link	S7-200, S7-300, C7, ET 200X/M

There are two DP/AS-i links with different degrees of protection (IP20 or IP65).
Connection to the S7-400 is also carried out by means of a link

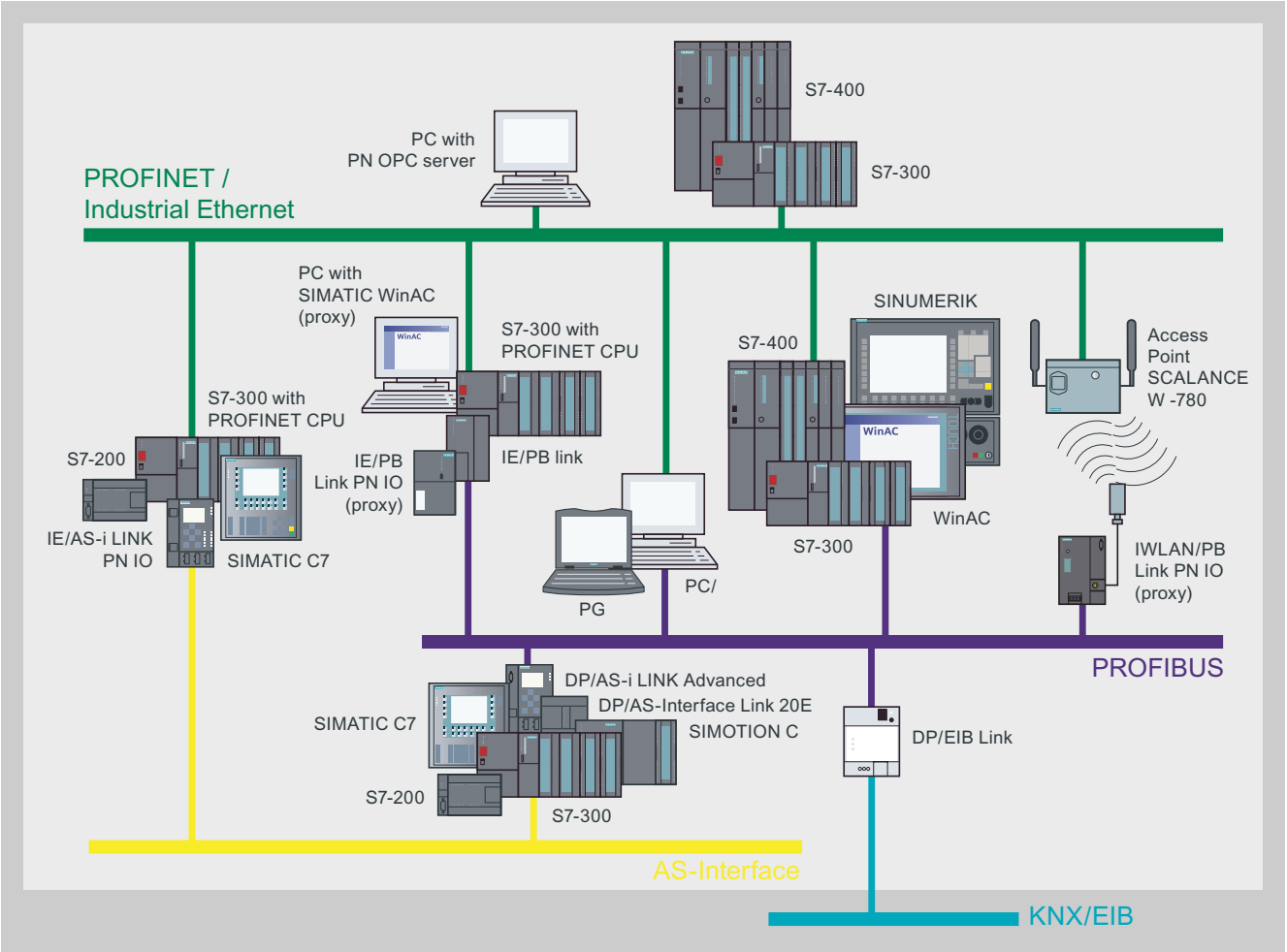


Figure 5-4 Gateways at AS-Interface

Wide Area Network (WAN)

6

6.1 Introduction

A SINAUT system is typically a geographically widely distributed system. It consists of stations, possible node terminals as well as one or more control centers. The system parts are connected by means of suitable data transfer media. Communications processors specially developed for SINAUT (TIM) ensure secure data transfer with a protocol adapted to the communication network. Data that may not be lost in case of faults on the transmission path or the failure of a partner are stored on the TIM and are transferred after the fault has been eliminated.

6.2 Features

6.2.1 Terminal

S7-300 and S7-400 Control System

Every SIMATIC S7-300 or S7-400 control system can extended to a SINAUT station (also node terminal) by adding a suitable TIM module to it. C/ devices are suitable for compact workstation systems that require an operator panel.

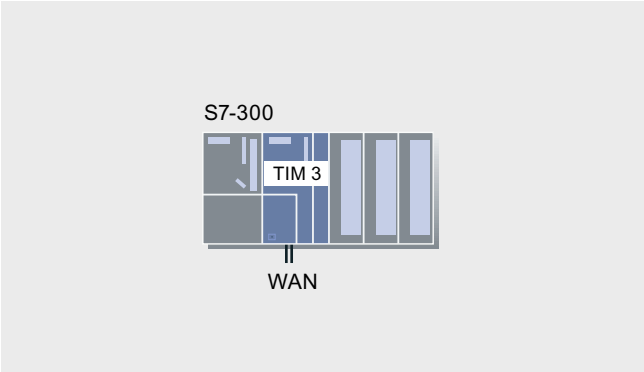


Figure 6-1 TIM 3 as CP in S7-300 rack

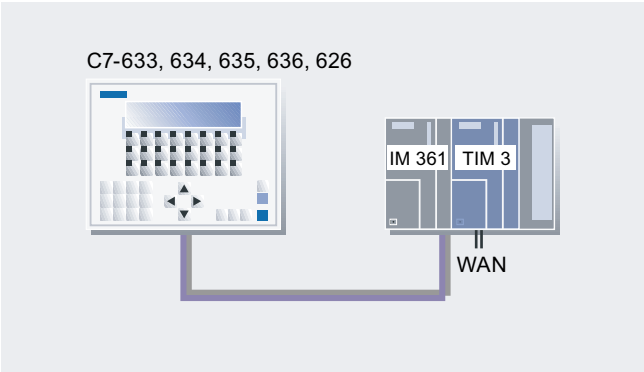


Figure 6-2 TIM 3 as CP in S7-300 expansion rack combined with C7 complete unit

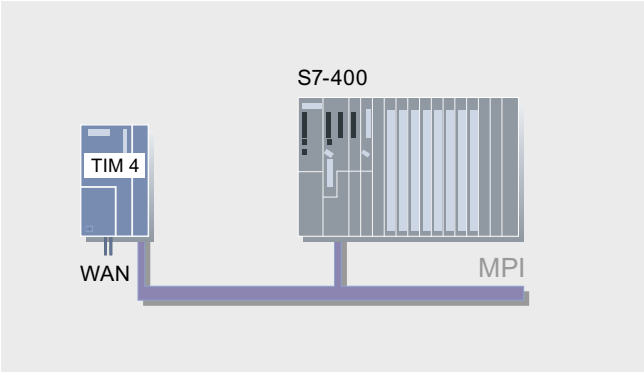


Figure 6-3 TIM 4 connected to S7-400 via MPI as a standalone device

6.2.2 Control Center

Design of the Control Center

A number of different variants can be selected as components of the central control center:

- Like the stations, a control center consists of an S7-300 or an S7-400 control system.

  This solution is suitable for simpler control centers at which only a current process image of the process data existing on the stations is required. The station process control can be influenced by entering commands, setpoints or parameters. This S7-300 or S7-400 control center can also be used to extend a PC control center (SINAUT ST7cc or ST7sc), for example for data output on a panel and/or as an emergency operating system.

- SINAUT ST7cc; the PC control center based on WinCC.
  This is the ideal control center system for both SINAUT ST7 and the predecessor system SINAUT ST1. It has been designed specifically for event-driven and time-stamped data transmission on the SINAUT system and can be set up as a non-redundant or redundant system (to supplement the WinCC redundancy package).

- SINAUT ST7sc, for interfacing control centers from other vendors via OPC.
  The SINAUT telecontrol technology (ST7 and ST1) can also be interfaced with control center systems from other manufacturers via the "Data Access Interface". ST7sc features extensive buffer mechanisms which prevent data from being lost even if the OPC client fails. It can be connected to non-redundant or redundant clients.

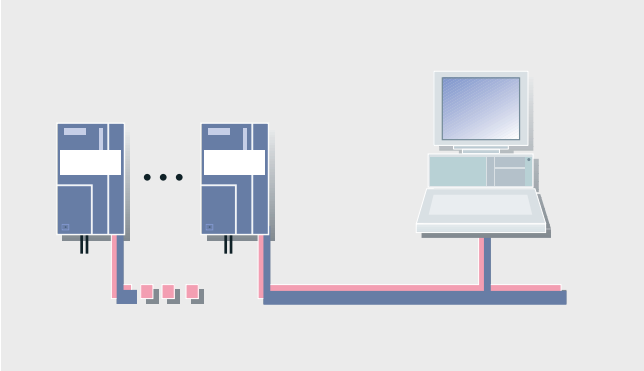


Figure 6-4 SINAUT ST7cc/ST7sc with Several TIMs on the MPI Bus

6.2.3 Classical WAN

The following classical WANs can be used for data transmission:

- Dedicated lines, private or leased;
  copper or fiber-optic cable (also in conjunction with transmission systems such as PCM30 or OTN)
- Private radio networks (optionally with time slot procedure)
- Analog telephone network
- Digital ISDN network
- Mobile radio network GSM

6.2.4 Ethernet-based WAN

SINAUT communication via the Ethernet-based networks is possible between station and control center and also between individual stations:

- Via radio through use of special radio devices optimized for Ethernet, for example SCALANCE W
- Via fiber-optic conductors, e.g. through use of SCALANCE X switches with optical ports; distances of up to 26 km can then be covered
- Via public networks and the Internet using DSL or GPRS.

6.2.5 Transmssion on the Store-and-Forward Principle

A simple connection between a station and the control center is not, as is common in SIMATIC communication, a direct connection between two partners in whichn one partner transmits and receives an acknowledgement of the proper receipt directly from the partner. This would not function at most WAN types as well as at the complex networks that are possible at SINAUT.

At SINAUT a connection consists of several connection sections, whereby one TIM module takes over the role of a switching partner, meaning that it represents the respective end point of a section.

A simple connection between the station and control center consists of three independent connections at SINAUT:

- From the station CPU to the station TIM
- From the station TIM to the central TIM
- From the central TIM to the control center PC

SINAUT data transfer is carried out in accordance with the Store-and-Forward principle as follows:

1. The station CPU transfers the data to be sent to its station TIM and receives an acknowledgement. The CPU then deletes the acknowledged data from its send buffer.
2. The station TIM saves these data temporarily and transfers them as soon as possible to the central TIM. This acknowledges the receipt to the station TIM that then deletes the acknowledged data from its send buffer.
3. The central TIM also stores the data until these can be transferred to the control center PC and it has received a receipt acknowledgement from it. The central TIM then deletes the acknowledged data from its buffer memory.

The data storage duration at a TIM depends on the classification of the data to be transferred:

- Data that are recorded locally from the process in the station, typically status messages, interrupts, analog process values, counter values, etc., are stored on the TIM until it was possible to send the data to the next instance in the SINAUT connection chain.
- Data that are to be transferred from the control, center to the process, typically commands, setpoint values, paramneters, etc., are only stored temporarily on the TIM until they could be transferred to the next instance in the network or until it is established that the end partner to whom the data are addressed cannot be reached.

6.2.6 Change-Driven Data Transmission

In the terminals, the SINAUT software ensures that process data is transmitted between the individual CPUs and the control center, e.g. ST7cc, in the event of changes. Connection, CPU or control center failures are displayed. A data update is performed automatically following debugging or after CPU or control center startup.

6.2.7 Date and Time

An (optional) DCF77 radio clock can be used to supply the CPUs and the control center, e.g. ST7cc, with the date and time across the network. The systems therefore always have the exact time; switching over between summer (daylight saving) and winter (standard) times is carried out automatically. The GPS (Global Positioning System) can also be used as the time source instead of DCF77. This allows data telegrams to be sent with the original event moment. The user program can access the time, for example in order to start the programs depending on the time of day.

6.2.8 Local Data Storage

A special property of the TIM communications module used in the SINAUT ST7 system is the capability for saving data which must not be lost in the event of a connection fault or if the partner fails. A memory capacity is provided for up to 32,000 telegrams.

The memory capacity helps to save money on dial-up networks. Various priorities can be assigned to the data to be transmitted. At high priority, a dial-up connection is established immediately. At low priority, data are initially saved in the TIM. The data are transmitted the next time a connection is established with the partner for any reason. For example, if higher-priority information is to be transferred, or if a connection is established by the partner in order to exchange data.

It is precisely because the TIM module can save data and transmit them at a later point in time with a time stamp that the use of a suitable control center system must be ensured. It must also be possible to continue to process these data, specifically as regards subsequent archiving, if the data are received in the control center delayed by a number of hours or even days. The SINAUT ST7cc control center system has been developed specially for these tasks.

6.2.9 SINAUT Remote Programming and Remote Diagnostics

In industries in which SINAUT is used, the terminals are distributed across wide areas and are often situated in locations that are difficult to access. Faults which require a visit to be made to a terminal of this type are associated with long journeys. SINAUT ST7 therefore offers the possibility of remote programming and remote diagnostics through the WAN networkd configured in the SINAUT project.

All diagnostics and programming functions provided by SIMATIC and SINAUT for station automation and WAN communication can be used via the WAN without interrupting the SINAUT data traffic. Programming device routing and data traffic share the available bandwidth on the transmission path. Programming device routing is simply allocated a higher priority.

6.2.10 Alarm Messaging via Text Message

In order to alert standby service personnel, event-driven text messages can be sent to mobile phones from the CPUs. An acknowledgment that a message of this type has been received can be sent back to the sender CPU from the mobile phone. An SMS message can also be output as e-mail, fax or voice mail if the SMS provider offers these options.

6.2.11 Network Forms

SINAUT ST7 supports the set-up of complete hierarchical control networks comprising terminals, node terminals and control center. Classical WANs as well as Ethernet-based networks can be used for information exchange between the individual devices.

There are no restrictions in terms of network combinations in a project. Star, line and node structures can be set up, or even mixed configurations of these basic structures.

A station can be linked using two transmission paths to permit redundant data transmission. The two paths can be of the same type or different, for example dedicated line, telephone network, ISDN or DSL

(Also refer to the "Topologies" section below.)

6.2.12 Connection to Classical WAN

The connection to a classicalWAN is made via the RS232 interface or the combined RS232/485 interface of the TIM through which various modems can be connected depending on the application:

- Dedicated line modems (for example MD2) for point-to-point, point-to-multipoint or linear connections
- Radio sets from various manufacturers, also for company radiotelephone with time slot procedure
- Analog dialing modems (for example MD3) for the analog telephone network or point-to-point dedicated lines
- ISDN modems (for example MD4) as connection to the ISDN network
- GSM modems (for example GSM Kit MC45) as access to the mobile radio network

Some TIM types already have a modem for a dedicated line, analog telephone network or ISDN on board. Connection of these compact units to the corresponding WAN is then carried out directly by means of the RJ12 port of the built-in modem.

6.2.13 Connection to Ethernet-Based WAN

Some TIM types dispose of an RJ45 socket. These are suitable for connection to Ethernet-based networks with dedicated-line behavior.

Depending on the application, different data communication equipment can be connected, such as:

- SCALANCE X switches for twisted pair cables or fiber-optic cables
- SCALANCE W (IWLAN) and Ethernet radio devices from various manufacturers
- DSL routers
- GPRS routers

6.3 Protocols

6.3.1 SINAUT ST1 Protocol

This protocol is used in the SINAUT ST1 system, which is based on the SIMATIC S5 system and is suitable for data transfer through a classical WAN. However, the SINAUT ST7 system also supports this protocol. The protocol can be used to further extend existing SINAUT ST1 systems or replace existing system parts with ST7 devices.

Note: In SINAUT ST1 systems with SAMSY PC, LSC or CS7 control center systems, as well as in redundant ST1 configurations, the use of ST7 devices is only possible under certain conditions.

Possible operating modes:

- Polling
- Polling with time-slot procedure
- Spontaneous mode (in dial-up networks)

Please note that only modems suitable for 11-bit asynchronous characters may be used in both polling modes. However, "spontaneous" mode supports transmission with both 11-bit and 10-bit asynchronous characters.

6.3.2 SINAUT ST7 Protocol

This protocol is a more advanced version of the ST1 protocol. It enables SINAUT communication via classical and Ethernet-based WAN. In addition, the addressing options have been extended:

- Up to 32000 stations can be addressed (as compared to a maximum of 254 with ST1)
- Telegrams contain a source and a target address, (ST1 telegrams only contain a source or a target address).

The ST7 protocol also supports "PG routing", i.e. remote programming and remote diagnostics via the WAN without the SINAUT data traffic being stopped. Programming device routing and data traffic share the available bandwidth on the transmission path. Programming device routing is simply allocated a higher priority.

Possible operating modes in classical WAN:

- Polling,
- Polling with time-slot procedure,
- Multi-master polling with time-slot procedure
- Spontaneous mode (in dial-up networks)

Please note that only modems suitable for 10-bit asynchronous characters may be used in "multi-master polling with time-slot procedure" mode. However, the other modes support transmission with both 11-bit and 10-bit asynchronous characters.

Operating mode for Ethernet

- Spontaneous mode

6.3.3 Operating Modes

The following description of the operating modes the terms "terminal", "node terminal" and "master (controller)" are used. In all these cases these refer to the TIM module that is operating in the respective function "terminal", "node terminal" or " master (controller)".

Polling

In polling mode, data exchange is controlled from the controller. It calls the connected terminals (including node terminals) in sequence. Terminals with modified data send these data as soon as they are called. Terminals with no modified data at the present time simply acknowledge the call. Data from the master (controller) to the terminals can be transferred at any time between the individual calls.

The ST7 protocol supports data exchange broadcast between the terminals. During this type of communication, data is always exchanged via the polling controller.

Polling with time-slot procedure

Polling with time-slot procedure mode is used on a radio network on which the use of the radio frequency assigned by the registration authorities has to be shared with other operators. Typically, each operator has 6 seconds per minute to exchange data with its terminals. Once this time has elapsed, the frequency must be enabled for the next operator. During the assigned time slot this polling variant functions like normal polling.

The ST7 protocol supports data exchange broadcast between the terminals. During this type of communication, data are always exchanged via the polling controller TIM..

In order that the time slot is observed exactly, the controller must be equipped with a DCF77 or GPS radio clock.

Multi-master polling with time-slot procedure

If terminals on the dedicated-line or radio network have to communicate with more than one control center, multi-master polling with time-slot procedure mode is used. Every minute, each of the connected controllers is allocated one or even a number of time slots for polling. During polling, the controllers take turns within one minute.

This type of polling is similar to polling with time-slot procedure operating mode. However, in this mode, each station (including node stations) has a separate data buffer for each controller.

Direct data transmission between the terminals is possible. During this type of communication, data is always exchanged via the polling controller. As a number of controllers are present, data exchange broadcast between substations can be set up with redundancy: If the priority controller fails, the alternative controller will take over data exchange broadcast.

In this operating mode every controller also must be equipped with a DCF77 or GPS radio clock in order that the time slot is observed exactly.

Spontaneous mode for data exchange on dial-up networks

Different priorities (high, normal or alarm) can be assigned to the data of the station or node station for transmission in the dial-up network. Data to be sent by the control center always have the high priority.

If data with a high or alarm priority are pending for transmission, a dial-up connection is established immediately. At normal priority, data are initially saved in the terminals. They are transmitted the next time a connection is established with the partner for any reason. For example, if information with a high or alarm priority is to be transferred, or if a connection is established by the partner in order to exchange data.

The telegrams saved in the TIM are transmitted according to the FIFO principle, i.e. in the original chronological sequence, providing they are telegrams with high or normal priority. If alarm telegrams are present in the TIM buffer, these are always transmitted before the other telegrams.

Data exchange broadcast between terminals is possible with the ST7 protocol.

Spontaneous mode for free-of-charge Ethernet

When sending data through a free-of-charge Ethernet, these are immediately transferred to the respective partner irrespective of priority.

The transmission sequence is according to the FIFO principle. This does not apply to telegrams with maximum priority. These are transmitted prior to any other telegrams still present in the buffer.

Transmission is carried out using the S7 communications functions. A permanent S7 connection is established in each case for transmission between two Ethernet TIMs or between an Ethernet TIM and ST7cc/ST7sc. The two TIMs or the TIM and ST7cc/ST7sc exchange the data packages specific to SINAUT ST7 with application of the TCP/IP transport protocol.

Data exchange broadcast between the terminals directly from terminal to terminal is possible, as usual with Ethernet.

Spontaneous mode for charged Ethernet

Different priorities (high, normal or alarm) can be assigned to the data of the terminal or node terminal for charged Ethernet, for example GPRS, as in a dial-up network. If data with a high or alarm priority are pending for transmission, these are transmitted immediately. At normal priority, data are initially saved in the TIM.

The data are transmitted under the following conditions:

- If data with a high or alarm priority arrive
- If the amount of stored data reaches or exceeds a specific limit
- If a configurable period expires without one of the previous criteria having caused transmission of the stored data.

Transmission is carried out using the S7 communications functions here as well.

Direct data transmission between the terminals is possible. However, it depends on the network whether this is possible directly from terminal to terminals or whether such connections have to be routed through the controller TIM. The latter is the case, for example, for GPRS connections.

6.3.4 Function of the TIM

The TIM can operate in "terminal", "node terminal" and "master (controller)" mode in classical WAN. In the case of Ethernet-based networks this depends on the type. This classification normally does not exist, meaning that all the partners are equal. However, in a GPRS network the classification by "terminal", "node terminal" and "master (controller)" have to be used.

The TIM manages data traffic via the connected WAN independently. For this purpose, the module has its own processor and a RAM to buffer up to 32.000 data messages when the communication link is faulty or a partner fails and to reduce connection costs in the dial-up network.

Two alternatives are available for the CPU and TIM for reading and writing the data to be sent or received:

- Use of the SINAUT TD7 software for the CPU (TD7onCPU):
  The SINAUT program in the CPU, configured with blocks from the SINAUT TD7 library, acquires the process data to be transferred, checks them for changes and then forwards them to the TIM for transmission via the WAN. Telegrams received without faults by the TIM via the WAN are forwarded to the local CPU. A block integrated in the CPU responsible for evaluating the telegrams concerned outputs the information received to the outputs or data areas configured on the block.
- Use of the Software SINAUT TD7 integrated in the TIM (TD7 on TIM):
  The TD7onTIM program configured by the user directly reads the process data to be transferred from the memory areas of the CPU located in the S7-300 rack (inputs, bit memories, DBs), checks them for changes, and then forwards them to the TIM's send buffer for transmission via the WAN or Ethernet. Data from telegrams received without fault by the TIM via the WAN are directly written by the TIM into the configured memory areas of the CPU.

The data acquired by "TD7onCPU" or "TD7onTIM" can be optionally assigned a time stamp, and also a "normal" or "high" priority ID for transmission via a dial-up network. "TD7onTIM" additionally permits identification of very important data as "maximum priority". These data have priority over all other data present in the send buffer, i.e. they are transferred first.

The TIM stores the data to be transferred in its RAM buffer. The manner in which the TIM subsequently sends these data depends on the respective transmission network:

Transfer via a classical WAN

The manner in which the TIM sends these data depends on the type of WAN and the TIM function selected:

- Dedicated line, radio network
  In "terminal" or "node terminal" mode, the TIM waits to be polled by the controller. The stored data telegrams are then transferred. If no telegrams are available, the poll is only acknowledged.
  In "controller" mode, after each poll + reply has been completed, the TIM sends one of the messages stored in its buffer (default setting). If a larger number of telegrams is to be exchanged between two polls, this can be defined when configuring the TIM.
- Dial-up network
  For data with "normal" priority, the TIM is not active initially in "terminal" or "node terminal" mode. However, for data with "high" or "maximum" priority, the TIM will immediately attempt to establish a connection with the addressed partner in order to start data transmission. If the TIM buffer contains data with "normal" priority at this point, they are also transferred. Data with "maximum" priority are always transferred first. Subsequently the data with the priority "high" and "normal" are transferred in accordance with the FIFO principle, meaning irrespective of the respective priority.
  In the "master (controller)" function the TIM will always try to establish a connection with the addressed partner and to transfer the data, irrespective of any priority.

Either the SINAUT ST7 or the SINAUT ST1 protocol can be used for data traffic on a classical WAN. The operating mode used depends on the type of WAN:

- In the case of a dedicated line and a radio network, data exchange is usually carried out in the "Polling operating mode. In the case of several controllers in the mode "Multi-master polling with time-slot procedure" (not possible for SINAUT ST1).
  In the case of a radio network the operating mode "Polling with time-slot procedure" can be selected.
  In both operating modes with time-slot procedure a TIM can always be used in the function "terminal" or "node terminal". In order to function as a "master (controller)" the TIM must have a DCF77 radio clock receiver on board.
- On dial-up networks, data exchange always takes place in "Spontaneous" mode.

Transfer via an Ethernet-Based WAN

The transmission behavior depends on which the network is a charged network (for example GPRS) or not.

The correspondingly required spontaneous operating mode (immediate or cost-optimized transmission) can be set for the corresponding WAN port of the TIM.

6.4 Topologies

6.4.1 Introduction

The overview below outlines the network configurations which can be implemented with SINAUT in the WAN. The protocols and operating modes which can be used by SINAUT for communication via each network are indicated for each network configuration.

The symbols used describe the function of the WAN port on a TIM module. A TIM 3 module has one or two WAN ports, depending on its type. A TIM 4 has two WAN ports. The two ports on a TIME 3 or TIM 4 can exercise the same functions (e.g. 2 x controller) or different functions (e.g. node + controller).

On redundant WAN connections, a TIM with two ports must always be used, as redundant paths always start and end on a TIM module.

6.4.2 Configuration Examples

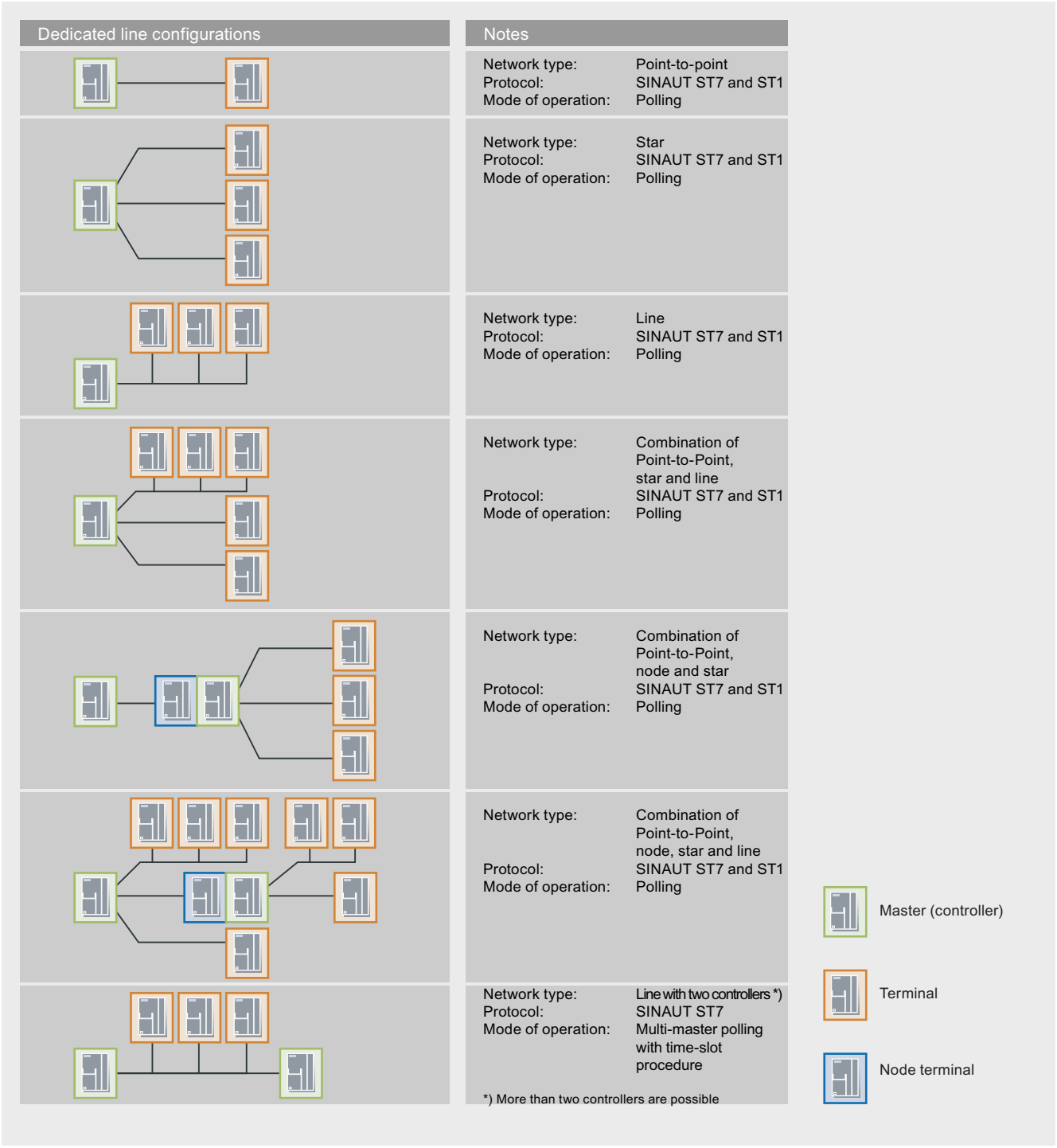


Figure 6-5 Dedicated Line Configurations

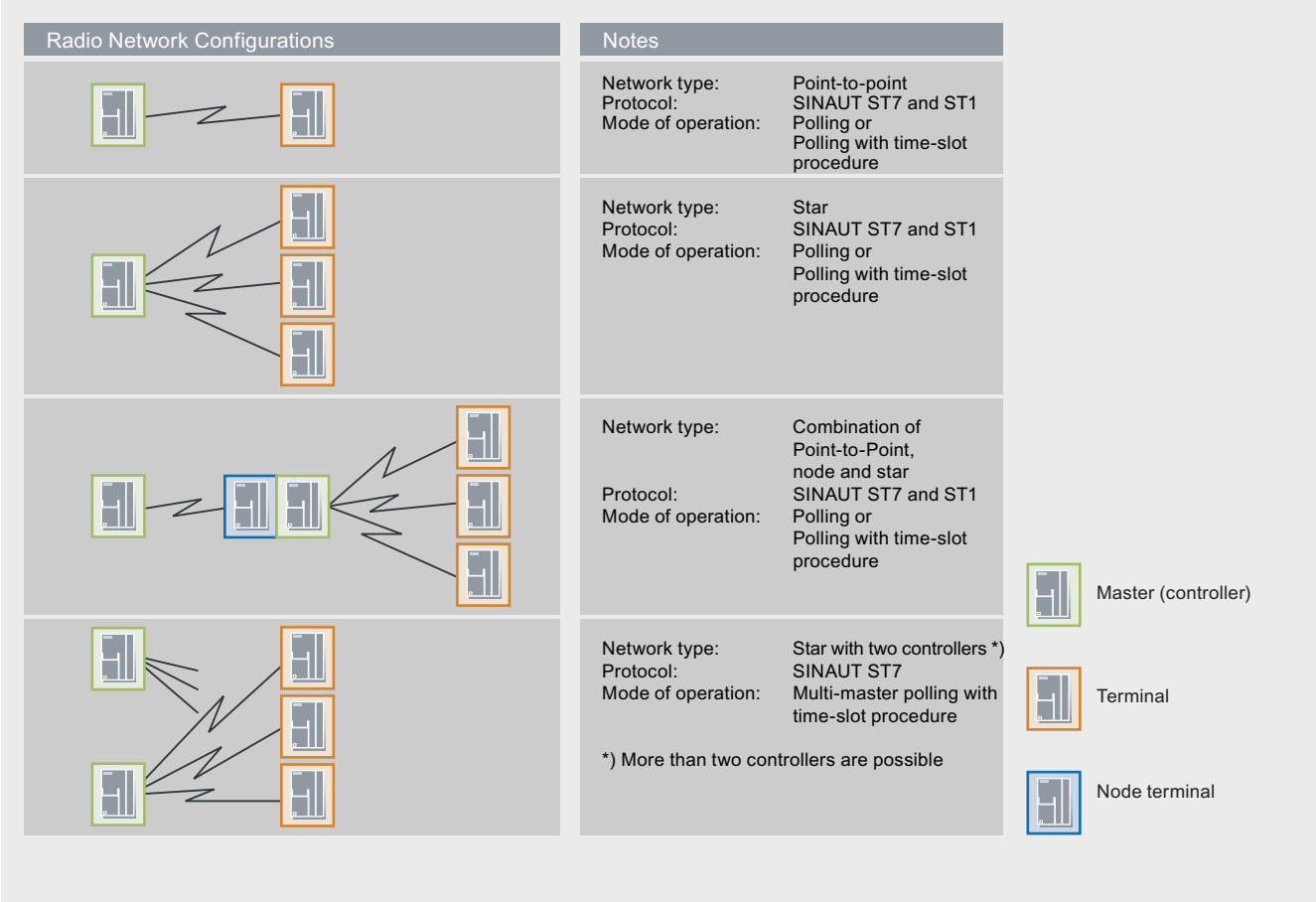


Figure 6-6 Radio Network Configurations

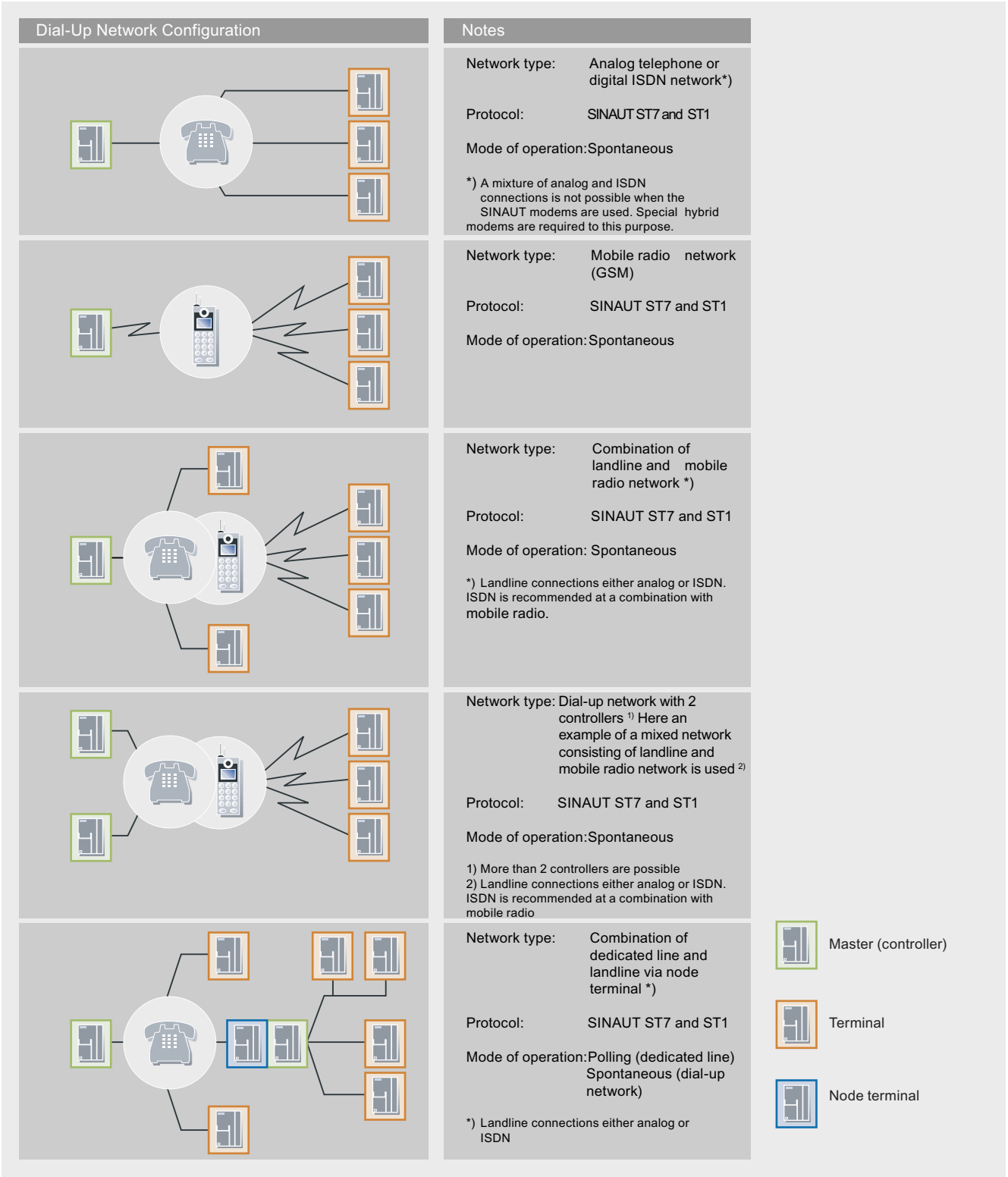


Figure 6-7 Dial-Up Network Configuration

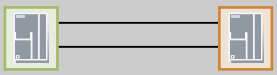
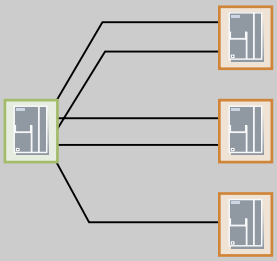
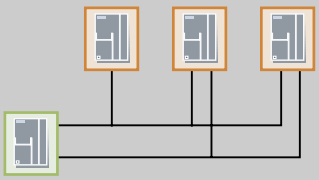
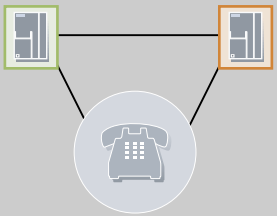
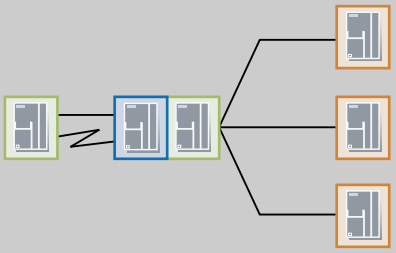
Redundant network configuration (examples)	Notes
	Network type: Redundant Point-to-Point connection via two dedicated lines Protocol: SINAUT ST7 and ST1 Mode of operation: Polling
	Network type: Redundant star network via 2 dedicated lines each, mixed with non-redundantly connected nodes Protocol: SINAUT ST7 and ST1 Mode of operation: Polling
	Network type: Redundant line network via 2 dedicated lines each, mixed with non-redundantly connected nodes Protocol: SINAUT ST7 and ST1 Mode of operation: Polling
	Network type: Redundant Point-to-Point connection via dedicated line and dial-up network Protocol: SINAUT ST7 and ST1 Mode of operation: Polling (dedicated line)Spontaneous (dial-up network)
	Network type: Redundant Point-to-Point connection via dedicated line and radio between controller and node terminal, subordinate nodes connected via a non- redundant star network Protocol: SINAUT ST7 and ST1 Mode of operation: Polling or Polling with time-slot procedure (radio)

Figure 6-8 Redundant Network Configurations

6.5 Device Family

6.5.1 Overview of All TIM Variants

All TIMs are supplied with a bus connector for integrating the TIM into an S7-300 as a CP. TIM modules with built-in modem also feature the WAN connecting cable required in each case. TIMs with DCF77 radio clock receiver are supplied with the DCF77 adapter cable and TIM4R-V modules with the adapter cable for the second RS232/485 interface.

Table 6-1 TIM Variants and Their Properties

	Can be used in conjunction with		MPI connection	Ethernet connection	Number of WAN accesses	RS232/RS485 For external modem
	S7-300	S7-400 3)				
TIM 32	■ 2)			1		
TIM 33	■ 2)				1	
TIM 34	■ 2)				1	
TIM 3V-IE	■			■	1	1 (RS232)
TIM 3V-IE Advanced	■			■	2	1 (RS232)
TIM 42	■	■	■		2	1
TIM 42D	■	■	■		2	1
TIM 43	■	■	■		2	1
TIM 43D	■	■	■		2	1
TIM 44	■	■	■		2	1
TIM 44D	■	■	■		2	1
TIM 4V	■	■	■		2	1
TIM 4VD	■	■	■		2	1
TIM 4R 1)	■	■	■		2	1
TIM 4RD 1)	■	■	■		2	1

1) Including adapter cable 6NH7700-0AS05 for the 2nd serial RS232/485 interface
2) The specified TIM 3 cannot be combined with a CPU 317, CPU 318, CPU 319 or with the CPU 315-2 PN/DP! A TIM 3V- IE or a TIM 4 that is linked by means of MPI is to be used for these CPUs.
3) All the TIMs suitable for S7-400 can also be connected by means of an MPI bus to the ST7cc or ST7sc PC.
TIM Variants and Their Properties

	Ded. line modem MD2 [2)]	MD3 analog dial-up modem [3)]	MD4 ISDN modem [4)]	DCF77 radio clock [5)]	Order no.
TIM 32	■				6NH7800-3AA20
TIM 33		■			6NH7800-3AA30
TIM 34			■		6NH7800-3AA40
TIM 3V-IE					6NH7800-3BA00
TIM 3V-IE Advanced					6NH7800-3CA20
TIM 42	■				6NH7800-3AA20
TIM 42D	■			■	6NH7800-4AD20
TIM 43		■			6NH7800-4AA30
TIM 43D		■		■	6NH7800-4AD30
TIM 44			■		6NH7800-4AA40
TIM 44D			■	■	6NH7800-4AD40
TIM 4V					6NH7800-4AA00
TIM 4VD				■	6NH7800-4AD00
TIM 4R [1)]					6NH7800-4AA90
TIM 4RD [1)]				■	6NH7800-4AD90

1) Including adapter cable 6NH7700-0AS05 for the 2nd serial RS232/485 interface
2) Including WAN connecting cable 6NH7700-2AR60 (RJ12 – RJ12)
3) Including WAN connecting cable 6NH7700-3BR60 (RJ12 – RJ12 / TAE6)
4) Including WAN connecting cable 6NH7700-4AR60 (RJ12 – RJ45)
5) Including DCF77 adapter cable 6NH7700-0AD15

Multi-Point Interface (MPI) 7

7.1 Introduction

MPI (Multi-Point Interface) is the integrated interface for SIMATIC products:

- Controllers
- Panels
- Programming devices/PCs

With MPI shall subnets with the following properties are established:

- Small scope
- Few nodes
- Small amounts of data

7.2 Properties

7.2.1 Basic Principles

MPI provides a simple network capability with the following services:

- PG/OP communication
- S7 communication
- S7 basic communication
- Global Data Communication (GD)

MPI supports baud rates of 187.5 kbps to 12 Mbps. The addresses of the MPI nodes must be unique and are set with the programming device PC.

7.2.2 Network Architectures

MPI is based on the PROFIBUS standard (IEC 61158 and EN 50170) and supports the following bus topologies:

- Line
- Star
- Tree

An MPI subnet encompasses 127 nodes and consists of several segments. A segment encompasses a maximum of 32 nodes and is limited by terminating resistors. Segments are coupled by repeaters. The max. line length without repeaters amounts to 50 m.

7.2.3 Network Components

The following network components are used at MPI:

- PROFIBUS bus line for bulding up the network
- Repeater RS 485 for coupling segments

7.2.4 Connection Systems

The nodes are connected to the MPI network as follows:

- Programming devices/PCs and panels are coupled by means of connecting cables.
- The PROFIBUS bus line is connected by means of a bus connector to the MPI interface of the CPUs of the controllers.

7.3 Technologies

7.3.1 Transmission Methods

MPI uses the electrical standard transmission medium RS 485 that is also used by PROFIBUS.

However, an MPI network can also be connected to optical PROFIBUS networks by means of the PROFIBUS OLM (Optical Link Module).

7.3.2 Access Methods

The access method used at MPI depends on the service used, for example PROFIBUS DP.

7.4 Services

7.4.1 PG/OP Communication Services

See also

PG/OP Communication Services (Page 2-29)

7.4.2 S7 Communication Services

See also

S7 Communication Services (Page 2-30)

7.4.3 S7 Basic Communication Services

Overview

S7 basic communication allow the exchange of data for non-configured S7 connections in an MPI subnet. System functions (SFCs) are used to this purpose.

Features

These SFCs perform the following tasks:

- Reading and writing access to data in the SIMATIC S7 and C7 controllers
- Transferring small amounts of data through an MPI subnet to another S7 station (S7 controller, panel or PC)

The maximum amount of data that can be transferred is 76 bytes.

Communication with stations in other subnets is not possible with the SFCs for S7 basic communication.

Modules can be addressed in the local station or in the MPI subnet:

- SFCs for exchanging data between an S7 CPU and other modules with communication functionality, if the communication partners belong to the same S7 station. These SFCs are identified by a preceding "I" for internal.
  - I_GET (SFC 72)
  - I_PUT (SFC 73)
- SFCs for echanging data between an S7 CPU and other modules with communication functionality, if the communication partners are connected to a common MPI subnet. These SFCs are identified by a preceding "X" for external.
  - X_SEND (SFC 65)
  - X_RCV (SFC 66)
  - X_GET (SFC 67)
  - X_PUT (SFC 68)

The connection is not configured, but is rather established explicitly when the SFC is called up by the user program. After the SFC has finished transferring the data, the connection either remains established or is terminated, depending on the parameterization. If a connection cannot be established, the corresponding job is not sent.

At any one time, a maximum of one connection is possible to a communication partner.

The number of communication partners that can be reached one after the other is not restricted by the connection resources available.

Integration in STEP 7

The SFCs are integrated in the operating system and form the software interfaces to the user program. SFCs do not require user memory and do not require an instance data block.

All S7-300 and S7-400 CPUs can execute the SFCs for S7 basic communication. S7-300 or S7-400 CPUs also use these SFCs for reading or writing data in an S7-200 CPU. Because an S7-200 can only function as a server in S7 basic communication, no configuration is required in STEP 7 Micro/WIN.

7.4.4 Global Communication Services

Overview

Global communication is a communication service for cyclic data transfer that is easy to set up. Global communication is carried out between SIMATIC controllers (S7-300, S7-400, C7) that have to be located in the same MPI subnet.

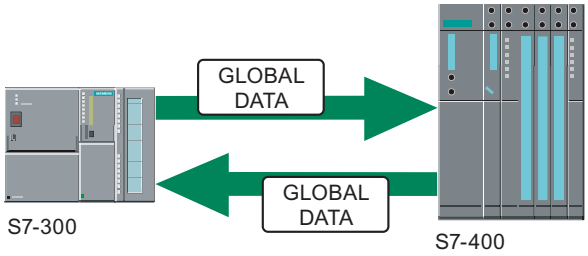


Figure 7-1 Global communication

Features

The support of the global communication is integrated into the operating system of the SIMATIC controller. Global communication does not require any special programming or blocks in your STEP 7 user program. The operating systems of the SIMATIC controllers handle the exchange of global data between the source and the target.

Because global communication is a broadcast method for transferring data, the receipt of the global data is not acknowledged. Global communication does not have amechanism for guaranteeing data integrity and precision.

Integration in STEP 7

You use STEP 7 to configure a global data table that contains the source and the target for the data exchange. In order to configure global communication, you must include all the controllers in the same STEP 7 project and in one MPI subnet.

7.5 Configurations

An MPI subnet connects any combination of SIMATIC devices:

- S7 controllers (S7-300, S7-400, C7)
- HMI devices (operator panels, touch panels)
- Programming devices , PCs

Every SIMATIC CPU supports the MPI protocol. You do not have to add a CP (communications processor) to connect an S7 device to an MPI network. The S7-200 is only slave at the MPI.

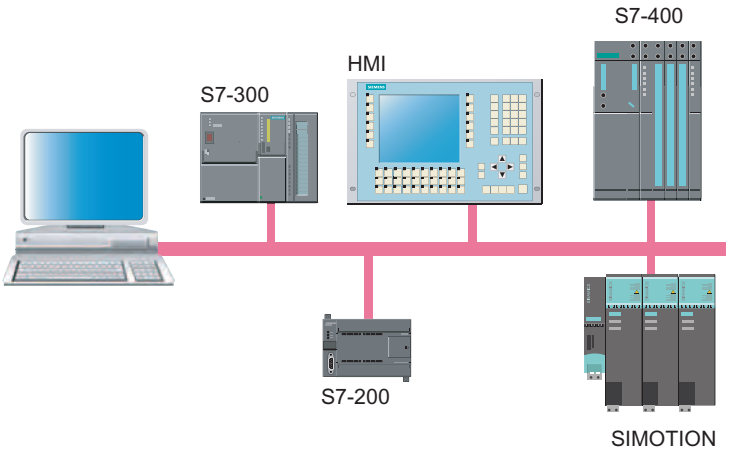


Figure 7-2 MPI Network

Point-to-Point Interface (PPI)

8

8.1 Introduction

PPI (Point-to-Point Interface) is an integrated interface that was developed specially for the SIMATIC S7-200.

A PPI network typically connects S7-200 devices. However, other SIMATIC S7 controllers (such as S7-300 and S7-400) or operator panels can communicate with an S7-200 in the PPI network.

8.2 Features

8.2.1 Basic Principles

PPI is a master-slave protocol in which the master devices send requests to slave devices. Slave devices do not initiate messages, but wait until a master device sends a request or polls for a response. Communication is carried out by means of a commonly used PPI connection.

Master devices are, for example:

- Programming device with STEP 7 Micro/WIN
- HMI devices (touch panels, text displays or operator panels)

Slave devices are, for example:

- S7-200 CPUs
- Expansion racks (for example EM 277)

S7-200 CPUs can also be activated as PPI masters through programming.

8.2.2 Network Architectures

PPI is based on the PROFIBUS standard (IEC 61158 and EN 50170) and supports the following bus topologies:

- Line
- Star

With PPI multi-master networks with a maximum of 32 masters are built up:

- The number of masters that can communicate with any slave is not limited.
- An slave can be assigned to masters.

The PPI network can be extended by using the RS-485 repeater. Modems can also be connected to the PPI network.

8.2.3 Network Components

The PPI multi-master cable.is used to build up the PPI network.

8.2.4 Connection Systems

The PPI multi-master cable is connected to the devices by means of plug connectors.

8.3 Technologies

8.3.1 Transmission Methods

PPI is an asynchronous character-based protocol. Data transfer is carried out through the RS 232 or USB interface. The data transfer rate lies between 1.2 kbps and 115.2 kbps.

8.3.2 Access Methods

Like PROFIBUS PPI also uses the Token passing procedure for the bus access.

8.4 Services

PPI supports the following network services:

- PG/OP Communication:
  S7-200 is the slave device for all the HMI devices that can communicate with S7-300 or S7-400.
- S7 communication:
  S7-200 is a slave device for the X_PUT and X_GET instructions of an S7-300 or S7-400.
- PPI supports OPC, allowing any other OPC client to access data in the S7-200.

8.5 Configurations

Overview

Various configurations can be built up with PPI:

- Single-Master PPI Network
- Multi-Master PPI Network
- Complex PPI Network
- PPI Network with S7-300 or S7-400

Single-Master PPI Network

A typical single-master PPI network consists of the following components:

- A programming device/PC with STEP 7-Micro/WIN or an HMI device (panel) as the master device
- One or more S7-200s as slave devices

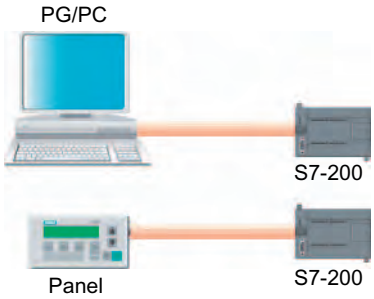


Figure 8-1 Single-Master PPI Networks Principle

Multi-Master PPI Network

You can configure a PPI network with several master devices that communicate with one or more S7-200 as slave devices. Every master (programming device/PC or panel) can exchange data with every slave in the network.

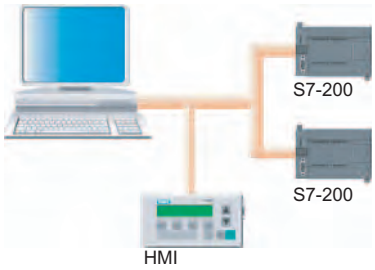


Figure 8-2 Multi-Master PPI Network Principle

Complex PPI Network

In a complex PPI network you can also program the S7-200 for peer-to-peer communication. Peer-to-peer means that the communication partners have equal rights and can both offer and use services.

The "Read from network" (NETR) and "Write to network" (NETW) instructions in the user program of one S7-200 access the process data in another S7-200.

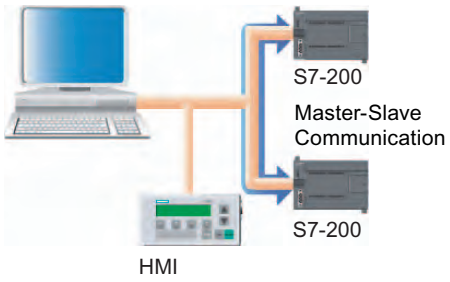


Figure 8-3 Complex PPI Network Principle

PPI Network with S7-300 or S7-400

You can connect an S7-300 or S7-400 to a PPI network. S7-300/400 can access the data in an S7-200 by using the X_PUT and X_GET instructions in the user program. In STEP 7 and NetPro to configure the PPI network as an MPI network, with the S7-200 as a slave device.

Point-to-Point

9

9.1 Introduction

Point-to-point communication allows the serial transfer of data between two stations, for example with a:

- Non-Siemens device (for example printer, barcode reader)
- SIMATIC controller

Point-to-point communication is in particular a good alternative when devices with serial interfaces are to be connected tp the SIMATIC controllers.

9.2 Features

9.2.1 Basic Principles

The point-to-point connection (PtP) enables data to be exchanged over a serial interface between:

- Automation systems and non-Siemens devices
- Automation systems
- Automation systems and programming devices/PCs

Figure 9-1 Point-to-Point Connection

Point-to-point connection has the following properties:

- Using standard procedures or loadable drivers to adapt to the protocol of the communication partner
- Using ASCII characters to define a customized procedure
- Communicating with other end devices, such as operator panels, printers, or card readers

9.2.2 Network Architectures

In a point-to-point connection two communication partners are connected directly to each other - as the name says.

9.2.3 Network Components

The two communication partners at the point-to-point connection are connected by means of prefabricated connecting cables.

9.2.4 Connection Systems

If you manufacture your own connecting cables, you can use a multitude of connectors, for example RS 232.

9.3 Technologies

9.3.1 Transmission Modes

In a point-to-point connection the data are transferred asynchronously and serially. The following are used, for example, as interfaces:

- RS 232 (V.24)
- 20 mA (TTY)
- RS 422/485 (X.27)

Various procedures are used in the process, for example:

- Printer drivers (uni-directional)
- ASCII drivers (bi-directional)
- 3964 (R) procedure (bi-directional)

9.3.2 Access Methods

There is no special access method for a point-to-point connections because this is dependent on the utilized driver.

KNX/EIB (KONNEX) 10

10.1 Introduction

Overview

The EIB (European Installation Bus) is now commonly used in Europe in building systems. EIB is supported by many representatives of the electrical and building services automation sector who have come together under the auspices of the European Installation Bus Association (EIBA) . A defined standard interface allows products from different manufacturers to be used in a common installation.

Features

The universal bus system KONNEX (KNX) fulfils higher requirements on flexibility and comfort of the electrical installation. It is a multi-master network for standardized network communication in the entire home and building system technology.

KNX/EIB is maintained by the KONNEX Association and is based on the following standards:

- EN 50090
- ENV 13154-2
- ENV 133321-2
- ANSI EIA 776

KNX/EIB encompasses the following technologies:

- EIB (European Installation Bus)
- EHS (European Home Systems)
- BatiBUS

Further Information

KONNEX germany homepage:

- http://www.knx.de

10.2 Features

10.2.1 Basic Principles

Overview

In conventional building systems the individual services, such as heating and lighting, are planned separately and implemented separately. A separate line is required for each function (signal and power supply)

In KNX/EIB all the services are planned and implemented together. All the operational functions and sequences are controlled and monitored by a common line.

Features

The KNX/EIB system consists of the following components:

- Sensors (for example probes, anemometers) generate commands and pack these into telegrams.
- Actuators (for example switching relays for light, blinds) convert the received telegrams in actions.
- A bus line combines the sensors and actuators.

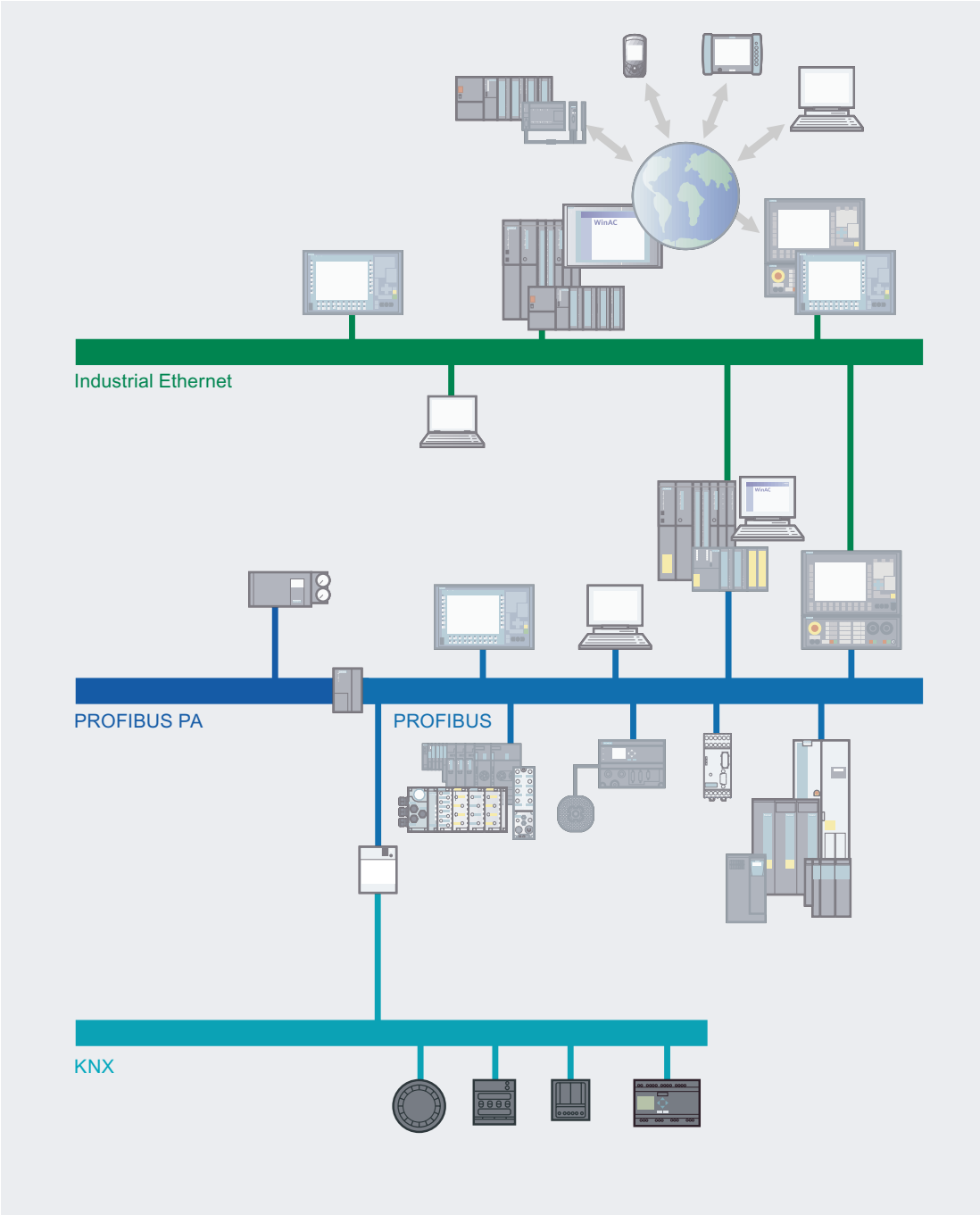


Figure 10-1 KNX - Overview

The devices communicate using standardized commands. The programming and configuration of the nodes is carried out with a special Engineering Tool Software (ETS):

- ETS is a multi-vendor tool for the practical planning, commissioning and maintenance of KNX/EIB installations.
- ETS, which is provided by the EIBA umbrella organization, assures compatible interaction (interoperability) of components from different manufacturers.

A KNX/EIB visualization enables the user to view the desired system statuses and to operate remote controls. Add-on programs such as time, interrupt, and data recording tools, etc., transform an EIB display into a full management station for the building automation system.

Finally, KNX/EIB services such as remote maintenance, remote readout of consumption data, and security services are offered.

The functionality of any existing EIB system can be expanded with KNX. In addition, seamless integration of additional services such as networking of electrical equipment (household appliances, etc.) is possible.

Training

Certified training centers offer qualified training in locations throughout Germany.

Advantages

The decisive feature of KNX/EIB is the reduction in lines, resulting in further advantages:

- Building installations can be accomplished more easily and later expanded and modified without difficulty.
- If the usage or room configuration changes, the KNX/EIB system can be adapted by simply reassigning (reparameterizing) the bus nodes without having to re-lay the lines.
- The bus cable can be tapped at any time and does not require a terminating resistor.

10.2.2 Network Architectures

Overview

The network can be divided into areas, lines and nodes per line.

Features

A KNX/EIB network has the following structure:

- A network encompasses up to 15 sections.
  A maximum of 14,000 nodes are possible in a network.
- One section contains up to 15 lines as well as a main line.

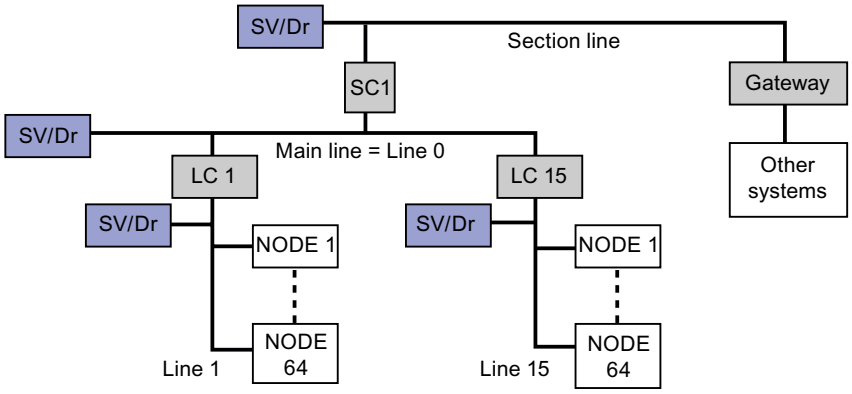


Figure 10-2 KNX/EIB - Architecture

- A line encompasses a maximum of 64 nodes, with line amplifiers a maximum of 255.
  The maximum line length amounts to 1,000 m.
  A unique address is assigned to every node by parametrization.
- The bus cable can be tapped at any time and does not require a terminating resistor.
  However, the bus cable may not be laid as a ring circuit.

Couplers

Couplers are used as line amplifiers, line couplers and section couplers:

- When line amplifiers are used, up to 255 nodes can be connected to a line.
- Line couplers isolate the lines electrically from each other. Furthemore they filter the telegrams so that only those telegrams are sent into other lines that have to be received there. This minimizes the bus load. ETS creates so-called filter tables on the basis of the parameterization that are then loaded into the couplers.
- Section couplers connect the main line of a section with the area line of the overall network.
- In systems with a high communication load (for example for visualizations or communication with management levels), it is possible to connect the main lines to Ethernet via gateways. This increases the transmission capacity. As a result systems with even more nodes can be built up.

10.2.3 Network Components

The network components of KNX/EIB are the bus line and the couplers.

10.2.4 Connection Systems

The KNX/EIB components are connected to the bus line by means of EIB terminals.

10.3 Technologies

10.3.1 Transmission Methods

Overview

At KNX/EIB the data are transferred serially to various media.

Features

The data transfer is carried out serially with 9.6 kbps in the form of voltage differences. The nodes send an acknowledgement when they have received a telegram.

KNX/EIB supports the following transmission media:

- Twisted pair (copper)
- Powernet PL
- Radio
- Infrared
- Fiber-optic conductor (fiber-glass)
- Internet
- ISDN

Radio and infrared provide good possibilities for retrofitting buildings.

In the case of a two-wire cable (twisted pair copper cable) the data as well as the voltage supply (24 VDC) are routed in a short-circuit-proof manner.

10.3.2 Access Methods

Overview

Data exchange is carried out by means of telegrams analogously to Ethernet, meaning that the individual bus nodes can transmit independently of each other. If a collision occurs, the respective telegram is transmitted again and the transmitting node receives a confirmation of receipt.

Features

A wired Ethernet network operates according to the CSMA/CD access method (Carrier Sense Multiple Access with Collision Detection). Once the ready-to-send node has listened in on the cable and identifies it to be free (Carrier Sense, CS), the data are transmitted. During transmission, the transmitting node can detect a collision (Collision Detection, CD) between itself and other simultaneously transmitting nodes (Multiple Access, MA) based on a faulted signal level. In this case the transmitter terminates the transmission process.

In KNX/EIB, this mechanism is applied in the same way except that collisions are deliberately avoided (Collision Avoidance, CA). For this reason, KNX/EIB does not use the CSMA/CD method, in which permitted collisions are detected. Rather, KNX/EIB uses the CSMA/CA method (Carrier Sense Multiple Access with Collision Avoidance). Before every transmission every node checks whether the medium is free.

10.4 Configurations

10.4.1 Device Family

Sensors and actuators are connected to KNX/EIB. SIMATIC components are coupled via links.

10.4.2 Gateways

By using a DP/EIB link, you can connect a KNX/EIB network as a subnet to PROFIBUS DP. This allows you to connect the functions of the building automation to the automation world of the manufacturing and process industry.

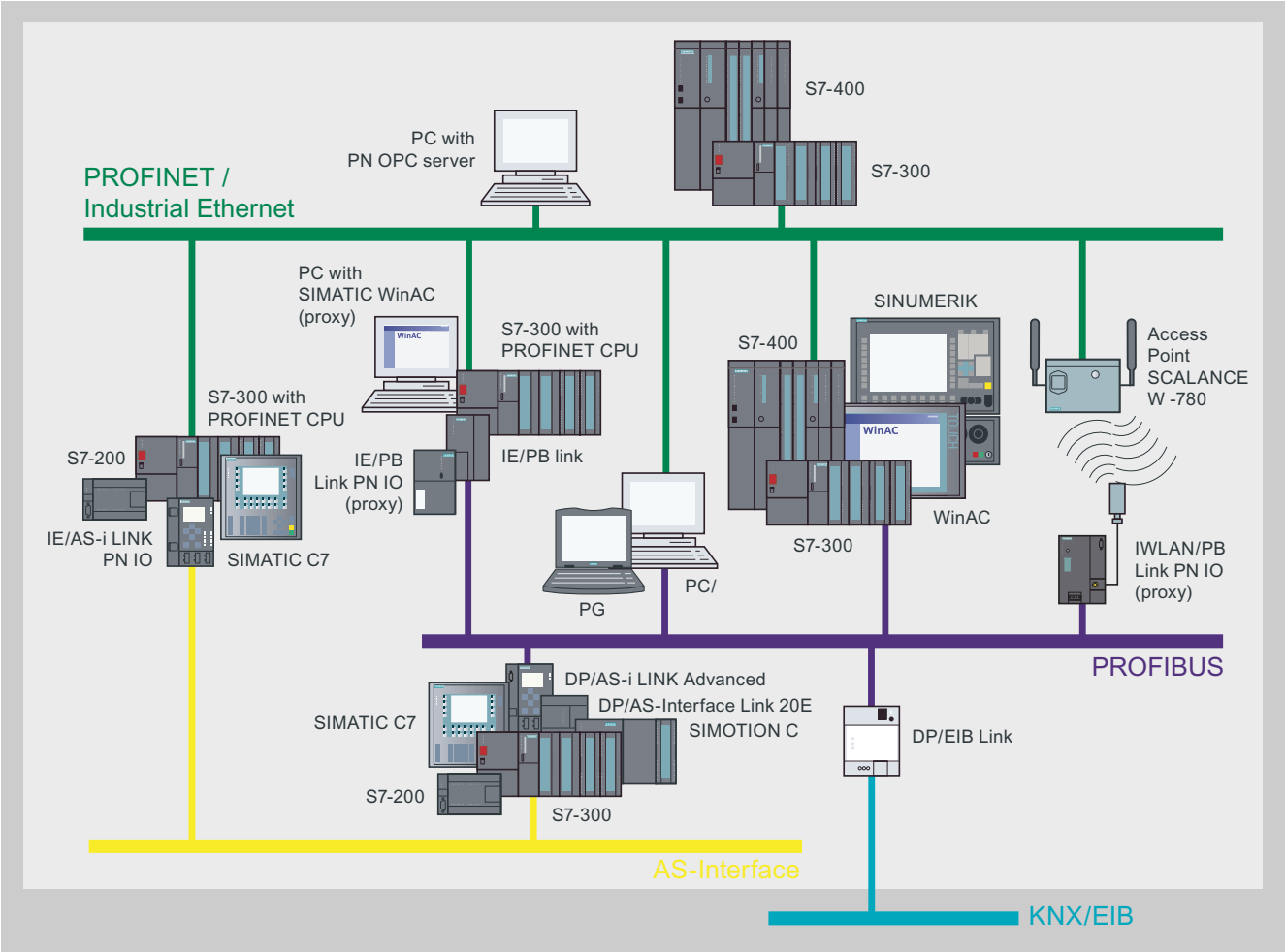


Figure 10-3 Gateway KNX/EIB to PROFIBUS

10.4.3 Connection of Other Systems

KNX/EIB can also be connected by means of corresponding interfaces to other systems, for example:

- Control centers of other systems for building automation (for example SICLIMAT)
- Public telephone network (for example ISDN)

In the case of higher amounts of data so-called gateways are used that implement the respective protocols of the participating networks.

All major manufacturers of building automation systems currently offer this type of connection. The connection of KNX/EIB to open Standard Building Automation and Control Network (BACnet) is also becoming more revalent. However, interfaces are also required for subsystems or auxiliary systems, e.g., for simultaneous operation of EIB systems and media systems over a common computer screen.

The connection between KNX/EIB and the Internet is becoming increasingly important - particularly in the home field. It allows important data, such as the room temperature to be checked and, if necessary, adjusted, while away from home.

Configuration and Parameter Assignment Tools 11

11.1 Tools and their Use

Configuration, Service, and Diagnostics for Communication

The tools presented below are available for configuring, servicing, and diagnosing communication and its components.

Additional information on the individual tools is presented following the table.

Table 11-1 Tools and their Use

Tool	Use
Station Configuration Editor	Initial configuration, configuration and servicing of a PC station
SIMATIC NCM PC / STEP 7 configuration tool	Configuration of communication components and services
Configuration wizard	Creation of projects in SIMATIC NCM PC or STEP 7
Symbol File Configurator	Creation of symbol files for symbolic variable access
"Set PC station" Configuration Console	Configuration and diagnosis of PC hardware components and of PC user programs
OPC Scout	Test of OPC application and commissioning of OPC server
System program "dcomcnfg" - DCOM settings	Configuration of DCOM and the required COM objects with the Windows system program
Request Editor	Creation of service-specific request buffer for acyclic communication
Configuration information service	Information on events that occurred due to trace requests
Set PG/PC interface	Selection of interface parameter assignment for the bus connection
S7 connection diagnostics	Checking configured S7 connections
S7-REDCONNECT	Communication from PC applications (e.g., WinCC) via redundant networks with S7-400H
NetPro	• Creation of a graphic view of your network (one or more subnets) • Definition of subnet properties / parameters • Specification of node properties for the networked modules • Documentation of the network configuration
HW Config	Configuration of PROFIBUS DP and PROFINET IO
NCM diagnostics	Dynamic information on the operating state of communication functions of modules connected online
NCM firmware loader	Download of new firmware releases to SIMATIC NET modules
SCOPE for AS-Interface	Monitor program for evaluating the data traffic in AS-i networks during commissioning and operation
COM PROFIBUS	Configuration and commissioning of PROFIBUS DP and PROFIBUS FM in SIMATIC S5
SIMATIC iMAP	Graphic configuration of communication in distributed automation solutions
ETS (KNX/EIB)	Programming of nodes and assignment of group addresses
Primary Setup Tool	Tool for assigning the IP address in new communication devices
Amprolyzer	Tool for diagnostics and checking of PROFIBUS networks

Station Configuration Editor

The Station Configuration Editor gives you access to the component management function of the station manager in the PC station. The Station Configuration Editor is required for the initial configuration (alternative to remote configuration) as well as for configuring and servicing a PC station.

Configuration tool SIMATIC NCM PC / STEP 7

SIMATIC NCM PC is the central tool that you use to configure the communication services for your PC station. The configuration data generated with this tool must be downloaded to the PC station or exported. This makes the PC station ready for communication.

Configuration wizard

The configuration wizard is used for creating projects in SIMATIC NCM PC or STEP 7. It enables automatic transfer of configuration data to the local PC station. Thus, it provides greater certainty of consistent configuration data.

A typical use case, for example, is the transfer of PC station configuration data to a "temporary" STEP 7 project. The initial configuration in the Component Configurator should be completed. This project can then be transferred to an engineering station (by using the copy function to insert the PC station in a different project or by importing the project in a multiproject).

Symbol File Configurator

The Symbol File Configurator can be used to create symbol files that enable symbolic variable access via the SIMATIC NET OPC Server.

A symbol file is structured hierarchically and similar to a file system in this regard.

"Set PC station" Configuration Console

The "Set PC station" Configuration Console is embedded as snap-in program in the Microsoft Management Console (MMC) and provides versatile options of configuring and diagnosing PC hardware components and PC user programs.

Settings on the OPC servers provided with the communication software can also be made in the configuration console.

Tasks supported by the "Set PC station" Configuration Console for handling the communication system of a SIMATIC PC station:

- Commissioning and operation
- Editing the configuration
- Diagnostics

OPC Scout

The OPC Scout can be used to test an OPC application or commission the OPC server.

To do so, you must be familiar with the terminology and mechanisms of OPC (OPC server and OPC client). You will find basic information as well as detailed information in the Industrial Communication with PG/PC manual.

System program "dcomcnfg" - DCOM settings

For a client to utilize a COM object on another computer, the properties of the COM object must be configured on the client computer and on the remote computer.

The Windows system program dcomcnfg is used to configure DCOM and the required COM objects.

Request Editor

This tool is used to create service-specific request buffers for acyclic communication.

Configuration information service

The information services provides information on events that occurred due to activated trace requests. Users can input trace requests on the "Set PC station" Configuration Console.

Set PG/PC interface

You can operate your PG or PC on various bus systems used for networking automation systems (e.g., MPI bus, PROFIBUS, Industrial Ethernet).

Each of your integrated and installed interfaces is represented by an interface parameter assignment. An interface parameter assignment is the parameter set of an interface.

Your applications (STEP 7, WinCC, etc.) access your interfaces via one or more access points (an access point establishes the connection between an application, an interface parameter assignment, and a module). The selection of the access point of an application and its interface parameter assignment sets the access path.

During parameter assignment of the PG/PC interface, you select the interface parameter assignment that is suitable for connection to the respective bus. If necessary, you can adapt the properties of the interface parameter assignment to the application-specific conditions.

Note

For STEP 7, only the "S7ONLINE (STEP 7)" access point is used.

S7 connection diagnostics

You can use the "S7 connection diagnostics" program to check which S7 connections are configured on your PC. The S7 connections are read with the associated connection details from the configuration data of the Station Configuration Editor.

The current connection status is also displayed.

The following S7 connections types are differentiated:

- S7 connection
- S7 connection, fault-tolerant

S7-REDCONNECT

S7-REDCONNECT provides for problem-free communication between PC applications (e.g., WinCC) and S7-400H over redundant connections.

Industrial Ethernet and PROFIBUS networks can be configured redundantly using switches of the SCALANCE X product line, OSM, ESM, and OLM. A ring closure means that the network can continue to function if one transmission path of the network fails; if a network component fails, only the nodes connected to it are inaccessible.

NetPro

Regardless of whether you want to carry out communication via global data communication or via communication blocks in the user program: The basis for communication is always a previously configured network.

Configuration and parameterization of your system network is extremely simple and straightforward with NetPro.

With NetPro:

- You create a graphical view of your network (one or more subnets).
- You specify the subnet properties/parameters for each subnet.
- You specify the node properties for each networked module.
- You document your network configuration.

NCM diagnostics

The NCM S7 diagnostics supplies dynamic information on the operating status of communication functions for modules that are connected online.

NCM firmware loader

The firmware loader enables you to reload new firmware releases to SIMATIC NET modules. It is used for:

- PROFIBUS modules
- Industrial Ethernet modules
- Modules for gateways (e.g., IE/PB link)

New firmware must be loaded if, for example, the functionality of the firmware has been expanded. To find out whether a firmware update is necessary, contact your local SIEMENS representative.

SCOPE for AS-Interface

The diagnostics software SCOPE for AS-i is a monitoring program which can record and analyze data traffic on AS-i networks in the commissioning phase or when the system is in operation. SCOPE for AS-Interface can be run on a PC together with the AS-i master interface module CP 2413 in Windows.

SCOPE for AS-Interface offers the following functions:

- Online display of all master and slave user data at a glance (data monitor)
- Monitoring of slave activities
- Online display of basic statistics on the bus traffic
- Trigger and filter functions for recording
- Recording of all data traffic in a ring buffer
- Documentation functions

COM PROFIBUS

COM PROFIBUS is available for easy configuring and commissioning of PROFIBUS DP and PROFIBUS FM in SIMATIC S5.

Functions:

- Easy configuration of DP masters and DP slaves
- Easy configuration of FMS masters and FMS stations
- Setting the transmission rate for PROFIBUS
- Direct data transmission from and to the master (export/import)
- Support for commissioning with diagnostic functions
- Displaying status of inputs and outputs, setting outputs to a defined value (modifying)
- Documentation of the configuration

The configuration documentation enables simple, operator-prompted creation of the address list and the parameters for slave devices.

The following settings can be made:

- PROFIBUS address
- Addressing range to be used to address the I/O modules
- Start addresses of the I/O modules
- Slave-specific parameter assignment, e.g., measuring range of an analog input channel.

Furthermore, the following can be performed:

- Adjustment of the transmission rate
- Adjustment of the failure characteristics
- Support for the diagnostic repeater (to start topology determination)

With COM PROFIBUS, faults can be isolated during commissioning or normal operation provided there is an online connection between the PG/PC and PROFIBUS DP.

When the diagnostic repeater is used in the DP network, the location and type of the fault can be displayed graphically in COM PROFIBUS.

SIMATIC iMAP

SIMATIC iMap is a component-based software tool for configuring communication in distributed automation solutions. SIMATIC iMap is used to graphically configure the data exchange between technological modules.

SIMATIC iMap is based on PROFINET, i.e. the standard communications protocol of the PROFIBUS User Organisation (PUO), in order to ensure compatibility of data exchange between "intelligent field devices" of different manufacturers.

SIMATIC iMap can be integrated as a higher-level configuration tool in existing concepts, e.g., Totally Integrated Automation. In this case, the library elements are created using STEP 7.

ETS (KNX/EIB)

The ETS software is used to program the nodes and assign the group addresses. ETS, which is provided by the EIBA umbrella organization, assures compatible interaction of components from different manufacturers.

PST (Primary Setup Tool)

Tool for assigning the IP address for communication devices.

The following options are available for assigning an IP address to a non-configured device that is lacking one:

- DHCP
- STEP 7
- NCM PC
- Via Primary Setup Tool V3.0

The only requirement for using the Primary Setup Tool is that the devices are accessible via Ethernet.

The Primary Setup Tool uses the DLC protocol for the communication between the modules.

Supported operating systems

The Primary Setup Tool can be installed and executed under the following operating systems:

- Windows XP Professional
- Windows 2000 Professional SP2

Amprolyzer

The Amprolyzer (Advanced Multicard Profibus AnaLYZER) is a diagnostic software tool for PROFIBUS. The tool is an important aid for commissioning and service engineers when testing PROFIBUS networks. For the device manufacturer Amprolyzer is an indispensable tool for developing PROFIBUS products.

Functions

- Comprehensive list of all PROFIBUS nodes located on the bus
- Overview diagnostics with the current operating statuses of the nodes
- Bus statistics with the number of events, e.g., timeouts and message frame repetitions
- Automatic detection of the transmission rate
- Message frame recording with trigger and filter options with respect to events and message frame contents, including time stamp
- Storage and export of message frame recordings in Excel format
- Support for Windows 2000 (min. SP2) / Windows XP Professional

Further Information

Your Area of Interest	Document
Configuration tool SIMATIC NCM PC / STEP 7	"Commissioning PC Stations - Introduction and Getting Started" manual and the STEP 7 documentation and online help.
Configuration wizard	"Commissioning PC Stations – Introduction and Getting Started" manual.
Symbol File Configurator	"Commissioning PC Stations – Introduction and Getting Started" manual.
"Set PC station" Configuration Console	"Commissioning PC Stations – Introduction and Getting Started" manual.
OPC Scout	"Commissioning PC Stations – Introduction and Getting Started" manual.
System program "dcomcnfg" - DCOM settings	"Commissioning PC Stations – Introduction and Getting Started" manual.
NCM S7 Diagnostics	For more information on the NCM S7 diagnostic procedures and a checklist for using the diagnostics in typical problem scenarios, refer to the manuals for NCM. • "S7-CPs for Industrial Ethernet - Configuring and Commissioning" manual • "S7-CPs for PROFIBUS - Configuring and Commissioning" manual • "NCM-S7 for PROFIBUS/FMS" manual
SCOPE for AS-Interface	Windows conventions are used to operate this software. The detailed function scope is available in the SIMATIC NET catalog and the product manual.
Installing the Primary Setup Tool	The Primary Setup Tool is available from Siemens Automation and Drives Service & Support on the Internet under the article ID 19440762. You can access this entry at the following URL: http://support.automation.siemens.com/WW/view/en/19440762
Amprolyzer	Amprolyzer is available from Siemens Automation and Drives Service & Support on the Internet under Entry ID 18609432. You can access this entry at the following URL: http://support.automation.siemens.com/WW/view/en/18609432

11.2 Tools for your task

Configuration, Service, and Diagnostics for Communication

The following SIMATIC tools are available, depending on your task.

Table 11-2 Tasks and Available Tools

You want to ...	Tool for this task ...
Assign IP addresses for communication devices (address initialization)	Primary Setup Tool
Perform the initial configuration of a PC station	Station Configuration Editor
Configure or service a PC station	Station Configuration Editor SIMATIC NCM PC
Perform diagnostics on the components of a PC station	Set PC station
Select the interface parameter assignment for the bus connection of a PC/PG	Set PG/PC interface
Load new firmware releases in SIMATIC NET modules	NCM firmware loader
Create a project	STEP 7 (SIMATIC NCM PC)
Configure communication components and services	STEP 7
Create a graphic view of your network	NetPro
Specify subnet properties/parameters	NetPro / HW Config
Specify node properties for the networked modules	NetPro / HW Config
Configure and commission PROFIBUS DP (PROFIBUS FM)	COM PROFIBUS
Perform diagnostics on PROFIBUS networks	Amprolyzer Diagnostic repeater for PROFIBUS DP
Graphically configure communication in distributed automation solutions	SIMATIC iMAP
Program nodes in KNX systems and assign group addresses	ETS
Create or edit a symbol file (symbol-protected variable access)	STEP 7 (Symbol File Configurator)
Perform diagnostics on PC user programs	Set PC station
Test the OPC applications	OPC Scout
Configure DCOM and required COM objects	dcomcnfg (Windows System Program)
Create a service-specific request buffer for acyclic communication	Request Editor
Evaluate information on events that occurred due to trace requests	Configuration information service
Check configured S7 connections	S7 connection diagnostics
Configure communication between PC applications and S7-400H	S7-REDCONNECT
Document the network configuration	NetPro
Dynamic information on the operating status of modules connected online	NCM diagnostics
Evaluate the data traffic in AS-i networks (commissioning)	SCOPE for AS-Interface

Glossary

10 Base-T/F

Ethernet standard that allows transmission of 10 Mbps.

100 Base-T/F

Ethernet standard that allows transmission of up to 100 Mbps.

1000 Base-T/F

Ethernet standard that allows transmission of up to 1000 Mbps.

Accumulator

Accumulators represent CPU register and are used as buffer memory for download, transfer, comparison, calculation and conversion operations.

Address

An address is the identifier of a specific address or address area. Examples: Input I 12.1; Flag Word MW 25; Data Block DB 3.

Analog module

Analog modules convert process values (e.g. temperature) into digital values which can be processing in the CPU, or they convert digital values into analog manipulated variables.

API

API (Application Process Identifier) is a parameter the value of which specifies the IO data processing process (application).

The PROFINET standard IEC 61158 assigns profiles to specific APIs (PROFIdrive, PROFIslave), and these are defined in the context of the PROFINET Nutzerorganisation.

The standard API is 0.

Application

An application is a program that runs directly on the MS-DOS / Windows operating system. Applications on the PG include, for example, the STEP 5 basic package, GRAPH 5 and others.

→ *User program*

Backplane bus

The backplane bus is a serial data bus. It supplies power to the modules and is also used by the modules to communicate with each other. Bus connectors interconnect the modules.

Backup memory

Backup memory ensures buffering of the memory areas of a CPU without backup battery. It backs up a configurable number of timers, counters, flag bits, data bytes and retentive timers, counters, flag bits and data bytes).

BERO

A position switch that works without any touch or contact being involved. A distinction is drawn between inductive and capacitive BEROs.

Bus

A bus is a communication medium connecting several nodes. Data can be transferred via serial or parallel circuits, that is, via electrical conductors or fiber optic.

Bus segment

A bus segment is a self-contained section of a serial bus system. Bus segments are interconnected via repeaters.

CAT 3

Twisted-pair cable does not always the same thing. Several versions are specified in the Ethernet standard.

There are several categories, however only CAT 3 and CAT 5 are relevant for networks. The two types of cable differ in the maximum permitted frequency and the values for attenuation (weakening of the signal over a certain distance).

CAT 3 is a twisted-pair cable for Ethernet with 10 Base-T.

CAT 5 is a twisted-pair cable for Fast Ethernet with 100 Base-T.

CAT 5

→ *CAT 3*

Category 3

→ *CAT 3*

Category 5

→ *CAT 3*

Changeover contact

Auxiliary switch with only one contact piece that has a closed position for when the switching device is closed and another closed position for when it is open.

Clock flag bits

Flag bit which can be used to generate clock pulses in the user program (1 byte per flag bit).

Note

When operating with S7300 CPUs, make sure that the byte of the clock memory bit is not overwritten in the user program!

Coaxial Cable

A coaxial cable, also known as "coax", is a metallic cabling system used in high-frequency transmission, for example, as the antenna cable for radios and televisions as well as in modern networks in which high data transmission rates are required. In a coaxial cable, an inner conductor is surrounded by an outer tube-like conductor. The two conductors are separated by a dielectric layer. In contrast to other cables, this design provides a high degree of immunity to and low emission of electromagnetic interference.

Code block

A SIMATIC S7 code block contains part of the **STEP 7** user program. (in contrast to a DB: this contains only data.)

COM

Component **O**bject **M**odel - specification of the Microsoft Corporation for Windows objects, on an OLE basis.

Automation systems are mapped on objects in PROFINET CBA. An object consists of interfaces and properties. Using these interfaces and properties, two objects can communicate.

→ *DCOM*

Communication processor

Communications processors are modules for point-to-point and bus links.

Compress

The PG online function "Compress" is used to rearrange all valid blocks in CPU RAM in one continuous area of user memory, starting at the lowest address. This eliminates fragmentation which occurs when blocks are deleted or edited.

Configuration

Assignment of modules to module racks/slots and (e.g. for signal modules) addresses.

Consistent data

Data which are related in their contents and not to be separated are referred to as consistent data.

For example, the values of analog modules must always be handled as a whole, that is, the value of an analog module must not be corrupted as a result of read access at two different points of time.

Counters

Counters are part of CPU system memory. The content of "Counter cells" can be modified by **STEP 7** instructions (for example, up/down count.)

CP

→ *Communication processor*

CPU

Central processing unit = CPU of the S7 automation system with a control and arithmetic unit, memory, operating system, and interface for programming device.

→ *CPU*

CRC

Cyclic Redundancy Check

Cyclic Redundancy Check. A checksum used in transmission protocols to detect errors in frames.

Cut Through

In the Cut Through process not the entire data package is stored temporarily in a buffer, but is passed directly onto the target port as soon as the first 6 bytes (target address) have been read. The times required by the data package to pass the switch are then minimal. The data are only stored temporarily in accordance with the Store and Forward process when the section between the target part and the port of the next switch is occupied.

Cycle time

The cycle time represents the time a CPU requires for one execution of the user program.

Cyclic interrupt

→ *Interrupt, cyclic interrupt*

Data block

Data blocks (DB) are data areas in the user program which contain user data. There are global data blocks which can be accessed by all code blocks, and instance data blocks which are assigned to a specific FB call.

Data, static

Static data can only be used within a function block. These data are saved in an instance data block that belongs to a function block. Data stored in an instance data block are retained until the next function block call.

Data, temporary

Temporary data represent local data of a block. They are stored in the L-stack when the block is executed. After the block has been processed, these data are no longer available.

DCOM

Distributed **COM** - expansion of the COM standard for the remote object communication beyond device restrictions. DCOM sets a protocol on the RPC, which in turn uses TCP/IP as a basis. Exchange PROFINET CBA devices with the help of DCOM data that is not time-sensitive - e.g. process data, diagnostic data, configurations etc..

DCOM technology is supported by PROFINET Version V1.0 and higher.

The PNO provides its users with a portable DCOM protocol stack customized for PROFINET. This eliminates dependency on Microsoft and its further developments in this technology while at the same time ensuring compatibility with Microsoft products.

→ *COM*

Diagnostic buffer

The diagnostics buffer represents a buffered memory area in the CPU. It stores diagnostic events in the order of their occurrence.

Diagnostic interrupt

Modules capable of diagnostics operations report detected system errors to the CPU by means of diagnostic interrupts.

Diagnostics

→ *System diagnostics*

DP master

A master which behaves in accordance with EN 50170, Part 3 is known as a DP master.

DP slave

A slave operated on PROFIBUS with PROFIBUS DP protocol and in accordance with EN 50170, Part 3 is referred to as DP slave.

DPV1

The designation DPV1 means extension of the functionality of the acyclical services (to include new interrupts, for example) provided by the DP protocol. The DPV1 functionality has been incorporated into IEC 61158/EN 50170, volume 2, PROFIBUS.

Electrically isolated

The reference potential of the control and on-load power circuits of isolated I/O modules is electrically isolated; for example, by optocouplers, relay contact or transformer. I/O circuits can be interconnected with a root circuit.

Encoder

Encoders (sensors) are used for the precise detection of digital signals and paths, positions, speeds, revolutions, weights, etc.

Equipotential bonding

Electrical connection (equipotential bonding conductor) which eliminates potential difference between electrical equipment and external conductive bodies by drawing potential to the same or near the same level, in order to prevent disturbing or dangerous voltages between these bodies.

Error display

One of the possible reactions of the operating system to a runtime error is to output an error message. Further reactions: Error reaction in the user program, CPU in STOP.

Error handling via OB

After the operating system has detected a specific error (e.g. access error with **STEP 7**), it calls a dedicated block (Error OB) that determines further CPU actions.

Error response

Reaction to a runtime error. Reactions of the operating system: It sets the automation system to STOP, indicates the error, or calls an OB in which the user can program a reaction.

ERTEC

ERTEC - Enhanced Real Time Ethernet Controller"

The new ASICs ERTEC200 and ERTEC400 intended for automation applications support the PROFINET protocol and are required for the IRT operation. As PROFINET is an open standard, "the" Siemens AG offers these PROFINET ASICs for the development of its own devices. ASIC is the acronym for Application Specific Integrated Circuits. PROFINET ASICs are components with a wide range of functions for the development of your own devices. They implement the requirements of the PROFINET standard in a circuit and allow extremely high packing densities and performance.

For you, the benefits of ERTEC are as follows:

- Simple integration of switch functionality in devices
- Simple and cost-effective setup of bus structures
- Minimization of the communication load of devices

Fast Ethernet

→ *100 Base-T/F*

FB

→ *Function block*

FC

→ *Function*

Flag bits

Flag bits are part of the CPU's system memory. They store intermediate results of calculations. They can be accessed in bit, word or dword operations.

Flash EPROM

FEPROMs can retain data in the event of power loss, same as electrically erasable EEPROMs. However, they can be erased within a considerably shorter time (FEPROM = Flash Erasable Programmable Read Only Memory). They are used on Memory Cards.

Force

The Force function can be used to assign the variables of a user program or CPU (also: inputs and outputs) constant values.

In this context, please note the limitations listed in the *Overview of the test functions section in the chapter entitled Test functions, Diagnostics and Troubleshooting in the S7-300 Installation manual*.

Function

According to IEC 1131-3, a function (FC) is a code block without static data. A function allows transfer of parameters in user program. Functions are therefore suitable for programming frequently occurring complex functions, e.g. calculations.

Function block

According to IEC 1131-3, a function block (FB) is a code block with static data. An FB allows the user program to pass parameters. Function blocks are therefore suitable for programming frequently occurring complex functions, e.g. controls, mode selections.

Functional ground

Grounding which has the sole purpose of safeguarding the intended function of electrical equipment. With functional grounding you short-circuit interference voltage which would otherwise have an unacceptable impact on equipment.

GD circuit

A GD circuit comprises a number of CPUs sharing data by means of global data communication, and is used as follows:

- A CPU broadcasts a GD packet to the other CPUs.
- A CPU sends and receives a GD packet from another CPU.

A GD circuit is identified by a GD circuit number.

GD element

A GD element is generated by assigning shared global data. It is identified by a unique global data ID in the global data table.

GD packet

A GD packet can consist of one or several GD elements transmitted in a single message frame.

Global data

Global data can be addressed from any code block (FC, FB, OB). In particular, this refers to flag bits M, inputs I, outputs Q, timers, counters and data blocks DB. Global data can be accessed via absolute or symbolic addressing.

Global data communication

Global data communication is a method of transferring global data between CPUs (without CFBs).

Ground

The conductive earth whose electrical potential can be set equal to zero at any point.

Ground potential can be different from zero in the area of grounding electrodes. The term reference ground is frequently used to describe this situation.

Grounding means, to connect an electrically conductive component via an equipotential grounding system to a grounding electrode (one or more conductive components with highly conductive contact to earth).

Chassis ground is the totality of all the interconnected passive parts of a piece of equipment on which dangerous fault-voltage cannot occur.

GSD file

The properties of a PROFINET device are described in a GSD file (General Station Description) that contains all the information required for configuration.

Similar to PROFIBUS, you can implement a PROFINET device in STEP 7 by installing a GSD file.

In PROFINET IO, the GSD file is in XML format. The structure of the GSD file is compliant with ISO 15734, which is the world-wide standard for device descriptions.

In PROFIBUS, the GSD file is in ASCII format.

HART

English: **H**ighway **A**dressable **R**emote **T**ransducer

IEEE

Institute of Electrical and Electronics Engineers

IEEE 802

Institute of Electrical and Electronics Engineers

LAN/MAN Standards Committee

IEEE 802.3

Institute of Electrical and Electronics Engineers

Fast Ethernet working committee

Industrial Ethernet

Area and cell network in accordance with the standard IEEE 802.3 (Ethernet), IEEE 802.3u and IEEE 802.11 a/b/g/h (Wireless LAN).

Industrial Ethernet is an extension of the Ethernet standard. Industrial Ethernet combines rules and standards that have the aim of allowing Ethernet to be used in industrial production. Industrial Ethernet creates the possibility of connecting the conventional office network with the devices for controlling monitoring production processes.

Devices in Industrial Ethernet fulfill particular requirements with regard to usage in an industrial environment.

Requirement	Property
Protection against dust and splash water	Increased degree of protection IP 65/67
Mounting	DIN rail 35 mm
Resistance to vibration	
Extended operating temperature range	
Transfer of the data in real-time	Isochronous real-time
Failure safety	Ring topology with redundant line

Industrial Ethernet

→ *100 Base-T/F*

Instance data block

The **STEP 7** user program assigns an automatically generated DB to every call of a function block. The instance data block stores the values of inputs / outputs and in/out parameters, as well as local block data.

Interface, MPI-capable

→ *MPI*

Interrupt

The CPU's operating system knows 10 different priority classes for controlling user program execution. These priority classes include interrupts, e.g. process interrupts. When an interrupt is triggered, the operating system automatically calls an assigned OB. In this OB the user can program the desired response (e.g. in an FB).

Interrupt, cyclic interrupt

A cyclic interrupt is generated periodically by the CPU in a configurable time pattern. A corresponding OB will be processed.

Interrupt, delay

The delay interrupt belongs to one of the priority classes in SIMATIC S7 program processing. It is generated on expiration of a time started in the user program. A corresponding OB will be processed.

Interrupt, delay

→ *Interrupt, delay*

Interrupt, diagnostic

→ *Diagnostic interrupt*

Interrupt, process

→ *Process interrupt*

Interrupt, status

A status interrupt can be generated by a DPV1 slave and causes OB 55 to be called on the DPV1 master. For detailed information on OB 55, see the *Reference Manual System software for S7-300/400: System and Standard Functions*.

Interrupt, time-of-day

The time-of-day interrupt belongs to one of the priority classes in SIMATIC S7 program processing. It is generated at a specific date (or daily) and time-of-day (e.g. 9:50 or hourly, or every minute). A corresponding OB will be processed.

Interrupt, update

An update interrupt can be generated by a DPV1 slave and causes OB56 to be called on the DPV1 master. For detailed information on OB56, see the *Reference Manual System software for S7-300/400: System and Standard Functions*.

Interrupt, vendor-specific

A vendor-specific interrupt can be generated by a DPV1 slave. It causes OB57 to be called on the DPV1 master.

For detailed information on OB 57, see the *Reference Manual System Software for S7-300/400: System and Standard Functions*.

IO controller

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO device

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO supervisor

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO system

→ *PROFINET IO System*

IP

Internet Protocol

Collection of program routines which the TCP protocol accesses

ISO

International Organization for Standardization

Isochronous Real-Time Communication, IRT

At PROFINET with IRT the communication cycle is subdivided into different, time-specific channels for this purpose. The first channel is used for isochronous real-time communication (IRT), followed by real-time communication (RT) and standard TCP/IP communication. In this way, both types of data data transfer exist together without interfering with each other.

When this transmission method is implemented in ERTEC-ASICs (Enhanced Real-Time Ethernet Controller), cycle times of 0.25 ms and jitter accuracy below 1 µs are achieved.

KNX/EIB

KNX/EIB is a multi-master network for standardized network communication in the home and building system technology. KNX/EIB is maintained by the KONNEX Association and is based, inter alia, on the standard EN 50090.

LAN

Local area network to which several computers are connected within an enterprise. The LAN therefore has a limited geographical span and is solely available to a company or institution.

Load memory

Load memory is part of the CPU. It contains objects generated by the programming device. It is implemented either as a plug-in Memory Card or permanently integrated memory.

Load power supply

Power supply to the signal / function modules and the process I/O connected to them.

Local data

→ *Data, temporary*

Maintenance demand

Continuously reliable function of a PROFINET device can be achieved by means of the early detection and remedy of potential faults - before they cause a production breakdown.

In addition to this, different maintenance information belonging to the maintenance demand is defined.

A system alarm "maintenance demand" can be defined for various wearing parameters and, for example, when reaching a specific number of operating hours it is recommended that you inspect some of the components.

The maintenance demand alarm is sent if, within a foreseeable period of time, it is necessary to replace the component in question.

Example - printer:

The maintenance demand alarm is then sent if the toner / printer cartridge needs to be replaced within a period of several days.

Maintenance required

Continuously reliable function of a PROFINET device can be achieved by means of the early detection and remedy of potential faults - before they cause a production breakdown.

In addition to this, different maintenance information belonging to the maintenance required is defined.

A system alarm "maintenance required" can be defined for various wearing parameters and, for example, when reaching a specific number of operating hours it is recommended that you inspect some of the components.

The maintenance required alarm is sent if, with a short period of time, it is necessary to replace the component in question.

Example - printer:

The maintenance required alarm is then sent if the toner / printer cartridge needs to be replaced immediately.

Master

When a master is in possession of the token, it can send data to other nodes and request data from other nodes (= active node).

→ *Slave*

MBP

Manchester Coding and **B**us **P**owering

Memory Card (MC)

Memory Cards are memory media for CPUs and CPs. They are implemented in the form of RAM or FEPROM. An MC differs from a Micro Memory Card only in its dimensions (MC is approximately the size of a credit card).

Micro Memory Card (MMC)

Micro Memory Cards are memory media for CPUs and CPs. Their only difference to the Memory Card is the smaller size.

Module parameters

Module parameters are values which can be used to configure module behavior. A distinction is made between static and dynamic module parameters.

MPI

The multipoint interface (MPI) is the programming device interface of SIMATIC S7. It enables multiple-node operation (PGs, text-based displays, OPs) on one or several PLCs. Each node is identified by a unique address (MPI address).

MPI address

→ *MPI*

NAMUR

Normenausschuss für Mess- und Regelungstechnik (German standardization committee for measurement and control engineering)

Nesting depth

A block can be called from another by means of a block call. Nesting depth is referred to as the number of simultaneously called code blocks.

Network

A network consists of one or more interconnected subnets with any number of nodes. Several networks can exist alongside each other.

Non-isolated

The reference potential of the control and on-load power circuits of non-isolated I/O modules is electrically interconnected.

OB

→ *Organization blocks*

OB priority

The CPU operating system distinguishes between different priority classes, for example, cyclic program execution, process interrupt controlled program processing. Each priority class is assigned organization blocks (OBs) in which the S7 user can program a response. The OBs are assigned different default priority classes. These determine the order in which OBs are executed or interrupt each other when they appear simultaneously.

OLE

Object Linking and Embedding - Central architectural principle of Windows. OLE is a Microsoft technology that enables linking of objects and data exchange between programs.

OPC

OLE for Process Control - Industrial standard that allows vendor-independent access to industrial communication networks, defined on the basis of OLE.

OPC (OLE for Process Control) refers to a standard interface for communication in automation engineering. With OPC, you can access OLE (Object Linking and Embedding). OLE is the component model of Microsoft. Components are the software objects or applications that make their functionality available to other applications.

Communication via the OPC interface is based on COM/DCOM. In this case, the object is the process image.

The OPC interface was designed as an industry standard by leading automation companies with the support of the Microsoft Corporation. Previously, applications that access process data were restricted to the access mechanisms of the communications network of one manufacturer. Now, the standardized OPC interface provides a uniform method of accessing the communication networks of any vendor.

OPC

→ *OPC client*

→ *OPC server*

OPC client

An OPC client is a user program that accesses process data via the OPC interface. Access to the process data is made possible by the OPC server.

→ *OPC*

→ *OPC server*

OPC server

The OPC server provides the OPC client with a wide range of functions with which it can communicate via industrial networks.

You will find more detailed information in the *Industrial Communication with PG/PC* manual.

→ *OPC*

→ *OPC client*

Operating state

SIMATIC S7 automation systems know the following operating states: STOP, START, RUN.

Operating system

The CPU OS organizes all functions and processes of the CPU which are not associated to a specific control task.

→ *CPU*

Organization blocks

Organization blocks (OBs) form the interface between CPU operating system and the user program. The sequence for user program execution is determined in the organization blocks.

Parameters

1. Variable of a **STEP 7** code block
2. Variable for declaring module response (one or several per module). All modules have a suitable basic factory setting which can be customized in **STEP 7**.
There are static and dynamic parameters.

Parameters, dynamic

Unlike static parameters, you can change dynamic module parameters during runtime by calling an SFC in the user program, e.g. limit values of an analog signal input module.

Parameters, static

Unlike dynamic parameters, static parameters of modules cannot be changed by the user program. You can only modify these parameters by editing your configuration in **STEP 7**, for example, modification of the input delay parameters of a digital signal input module.

PCD

The PROFINET component description is the description of the components you have generated in your engineering system (for example, STEP 7). The PCD is an XML file that you can import into SIMATIC iMap so that you can configure the PROFINET CBA communication.

Peer-to-peer communication

In peer-to-peer communication the communication partners have equal rights and can both offer and use services.

PG

→ *Programming device*

PLC

Programmable controllers (PLCs) are electronic controllers whose function is saved as a program in the control unit. Therefore, the configuration and wiring of the unit does not dependend on the PLC function. A programmable logic controller has the structure of a computer; it consists of a CPU with memory, input/output modules and an internal bus system. The I/O and the programming language are oriented to control engineering needs.

A PLC in the context of SIMATIC S7 --> is a programmable logic controller.

→ *CPU*

→ *PLC*

PNO

→ *PROFIBUS International*

Priority class

The S7 CPU operating system provides up to 26 priority classes (or "Program execution levels"). Specific OBs are assigned to these classes. The priority classes determine which OBs interrupt other OBs. Multiple OBs of the same priority class do not interrupt each other. In this case, they are executed sequentially.

Process image

The process image is part of CPU system memory. At the start of cyclic program execution, the signal states at the input modules are written to the process image of the inputs. At the end of cyclic program execution, the signal status of the process image of the outputs is transferred to the output modules.

Process interrupt

A process interrupt is triggered by interrupt-triggering modules as a result of a specific event in the process. The process interrupt is reported to the CPU. The assigned organization block will be processed according to interrupt priority.

Product version

The product version identifies differences between products which have the same order number. The product version is incremented when forward-compatible functions are enhanced, after production-related modifications (use of new parts/components) and for bug fixes.

PROFIBUS

Process Field Bus - European fieldbus standard.

→ *PROFIBUS DP*

→ *PROFIBUS International*

PROFIBUS DP

A PROFIBUS with the DP protocol that complies with EN 50170. DP stands for distributed peripheral I/O (fast, real-time, cyclic data exchange). From the perspective of the user program, the distributed I/O is addressed in exactly the same way as the central I/O.

→ *PROFIBUS*

→ *PROFIBUS International*

PROFIBUS International

Technical committee that defines and further develops the PROFIBUS and PROFINET standard.

Also known as the PROFIBUS User Organization (PNO).

Home page http://www.profibus.com

PROFINET

→ *PROFIBUS International*

PROFINET ASIC

Refer to ERTEC

PROFINET Component Description

→ *PCD*

PROFINET IO Controller

Device via which the connected IO devices are addressed. This means that the IO controller exchanges input and output signals with assigned field devices. The IO controller is often the controller on which the automation program runs.

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

PROFINET IO Device

Distributed field device assigned to one of the IO controllers (for example, remote I/O, valve terminal, frequency converter, switches)

→ *PROFINET IO Controller*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

PROFINET IO Supervisor

PG/PC or HMI device for commissioning and diagnostics.

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO System*

PROFINET IO System

PROFINET IO controller with assigned PROFINET IO devices.

→ *PROFINET IO Device*

→ *PROFINET IO Controller*

Programming device

Basically speaking, PGs are compact and portable PCs which are suitable for industrial applications. They are identified by a special hardware and software for programmable logic controllers.

RAM

Work memory is a RAM memory in the CPU which is accessed by the processor during user program execution.

RAM (Random Access Memory) is a semiconductor read/write memory.

RAM

Work memory is a RAM memory in the CPU which is accessed by the processor during user program execution.

RAM (Random Access Memory) is a semiconductor read/write memory.

Real-Time Communication

Industrial communication in which supervisors take part in communication involves runtimes during communication that are too long for production automation. When communicating time-critical IO user data, PROFINET therefore uses its own real-time channel, rather than TCP/IP.

Reduction factor

The reduction rate determines the send/receive frequency for GD packets on the basis of the CPU cycle.

Reference ground

→ *Ground*

Reference potential

Voltages of participating circuits are referenced to this potential when they are viewed and/or measured.

Repeater

Repeaters have the task of interconnecting several network segments in local networks. In the process the received electrical or optical signals are conditioned and sent to the next network node. In the conditioning process the noise and distortions (caused by the execution time) are separated from the signal and the pulse shape is restored to distortion-free.

Restart

On CPU start-up (e.g. after is switched from STOP to RUN mode via selector switch or with POWER ON), OB100 (restart) is initially executed, prior to cyclic program execution (OB1). On restart, the input process image is read in and the **STEP 7** user program is executed, starting at the first instruction in OB1.

Retentive memory

A memory area is considered retentive if its contents are retained even after a power loss and transitions from STOP to RUN. The non-retentive area of memory flag bits, timers and counters is reset following a power failure and a transition from the STOP mode to the RUN mode.

Retentive can be the:

- Flag bits
- S7 timers
- S7 counters
- Data areas

Router

A router connects two subnetworks with each other. A router works in a way similar to a switch. With a router, however, it is also possible to specify which communications nodes can communicate via the router and which cannot. Communication nodes on different sides of a router can only communicate with each other if you have explicitly enabled communication between the two nodes via the router. Real time data cannot be replaced beyond subnetwork limits.

Runtime error

Errors occurred in the PLC (that is, not in the process itself) during user program execution.

Segment

→ *bus segment*

SELV/PELV

Term indicating circuits with safety extra-low voltage.

SITOP power supplies from Siemens, for example, provide this protection.

For more detailed information, refer to the EN 60950-1 (2001) standard.

SFB

→ *System function block*

SFC

→ *System function*

Signal module

Signal modules (SM) form the interface between the process and the PLC. There are digital input and output modules (input/output module, digital) and analog input and output modules (input/output module, analog).

SIMATIC

The term denotes Siemens products and systems for industrial automation.

SIMATIC iMap

Engineering tool for configuration, commissioning, and monitoring of modular distributed automation systems. It is based on the PROFINET standard.

SIMATIC NET

Siemens business area for industrial communication, networks, and network components.

Slave

A slave can only exchange data after being requested to by the master.

→ *Master*

STARTUP

A START-UP routine is executed at the transition from STOP to RUN mode. Can be triggered by means of the mode selector switch, or after power on, or by an operator action on the programming device. An S7-300 performs a restart.

STEP 7

Engineering system. Contains programming software for the creation of user programs for SIMATIC S7 controllers.

Store and Forward

In the Store and Forward process the switch stores the telegrams and rows them into a queue. The telegrams are then forwarded selectively to the specific port that can access the addressed node (Store and Forward).

Substitute value

Substitute values are configurable values which output modules transfer to the process when the CPU switches to STOP mode.

In the event of an I/O access error, a substitute value can be written to the accumulator instead of the input value which could not be read (SFC 44).

System diagnostics

System diagnostics refers to the detection, evaluation, and signaling of errors that occur within the PLC, for example programming errors or module failures. System errors can be indicated by LEDs or in **STEP 7**.

System function

A system function (SFC) is a function integrated in the operating system of the CPU that can be called when necessary in the STEP 7 user program.

System function block

System function blocks (SFB) are integrated in the CPU operating system and can be called in the STEP 7 user program.

System memory

System memory is an integrated RAM memory in the CPU. System memory contains the address areas (e.g. timers, counters, flag bits) and data areas that are required internally by the operating system (for example, communication buffers).

System status list

The system status list contains data that describe the current status of an S7-300 or S7-400. You can always use this list to obtain an overview of:

- The configuration of the S7-300
- the current CPU configuration and configurable signal modules
- the current status and processes in the CPU and in configurable signal modules.

TCP/IP

Ethernet in actual fact is only a data transport system, comparable with a highway as system for transporting goods and passengers. The actual data transport is handled by so-called protocols, comparable with cars and commercial vehicles transporting passengers and goods on the highway.

Tasks handled by the basic protocols Transmission Control Protocol (TCP) and Internet Protocol (IP) (TCP/IP in short form):

1. On the sender, the data is encapsulated in packets.
2. The packets are transported via Ethernet to the correct recipient.
3. At the receiver, the data packets are reassembled in the correct order.
4. Bad packets are sent repeatedly until they are received correctly.

Most higher-level protocols use TCP/IP to handle the tasks. This is how, for example, the Hyper Text Transfer Protocol (HTTP) transfers documents on the World Wide Web (WWW) that are written in Hyper Text Markup Language (HTML). Without this technology, you would not be able to view Web sites in your Internet browser.

Terminating resistor

The terminating resistor is used to avoid reflections on data links.

Timer

→ *Timers*

Timers

Timers are part of CPU system memory. The content of timer cells is automatically updated by the operating system, asynchronously to the user program. STEP 7 instructions are used to define the precise function of the timer cell (for example, on-delay) and to initiate their execution (for example, start).

TOD interrupt

→ *Interrupt, time-of-day*

Token

Allows access to the bus for a limited time.

Topology

Structure of a network. Common structures include:

- Bus topology
- Ring topology
- Star topology
- Tree topology

Transmission rate

Data transfer rate (in bps)

Twisted Pair

Fast Ethernet via twisted-pair cables is based on the IEEE 802.3u standard (100 Base-TX). Transmission medium is a shielded 2x2 twisted-pair cable with an impedance of 100 Ohm (AWG 22). The transmission characteristics of this cable must meet the requirements of category 5 (see glossary).

The maximum length of the connection between end device and network component must not exceed 100 m. The ports are implemented according to the 100 Base-TX standard with the RJ-45 connector system.

Ungrounded

Having no direct electrical connection to ground

User memory

User memory contains the code blocks / data blocks of the user program. User memory can be integrated in the CPU, or stored on plug-in Memory Cards or memory modules. However, the user program is principally processed from the RAM of the CPU.

User program

In SIMATIC, a distinction is made between the operating system of the CPU and user programs. The user program contains all instructions, declarations and data for signal processing required to control a plant or a process. It is assigned to a programmable module (for example CPU or FM) and can be structured in smaller units (blocks).

→ *Operating system*

→ *STEP 7*

Varistor

Voltage-dependent resistor

WAN

A network with a span beyond that of a local area network allowing, for example, intercontinental operation. Legal rights do not belong to the user but to the provider of the transmission networks.

XML

XML (Extensible Markup Language) is an easily understood and easily learnt data description language. Information is exchanged with the aid of legible XML documents. These contain continuous text with added structuring information.

Index

- Orthogonal Frequency Division Multiplexing, 3-8

A

Access points, 3-12
AS-Interface
  AS-i services, 5-5
  ASIsafe, 5-6
  Overview, 5-1

C

Client Modules, 3-13
CSMA/CD, 2-9

D

Data exchange broadcast, 4-8
Data transfer
  PROFINET, 2-8

E

EIB, 10-1
E-mail connection
  Establishing, 2-16
E-mail service
  Overview, 2-16
E-Mail Services, 2-16
Ethernet services, 2-14
Extensible Authentication Protocol (EAP), 3-10

F

Fast Ethernet
  Common properties and differences to Ethernet, 2-3
FTP connection
  Setting up, 2-15
FTP service, 2-15
  General, 2-15
  Integration in STEP 7, 2-15

G

Gateway
  Access Point, 3-14
  IWLAN/PB Link PN IO, 3-14
Global Communication, 7-4

H

HMI devices, 2-33

I

Industrial Ethernet
  Overview, 2-1, 3-3
  Properties, 2-3
Industrial WLAN
  Access methods, 3-8
  Active and passive network components, 3-6
  Ad hoc network, 3-5
  Advantages, 3-2
  Information security, 3-9
  Infrastructure mode, 3-5
  IWLAN/PB Link PN IO, 3-14
  Modulation method, 3-8
  Network types, 3-5
  Redundancy mode, 3-7
Industrial WLAN
  Transmission mode, 3-7
interfaces
  RS 232, 20 mA, RS 422/485, 9-2
ISO Transport Services, 2-27
Isochronous mode, 4-8
Isochronous Real-Time, 2-9
ISOonTCP services, 2-27, 2-28
IT functions
  Overview, 2-14
IT security service
  Precautions, 2-13

K

KNX/EIB, 10-1
KONNEX, 10-1

M

MAC Filter, 3-10
MBP, 4-7
Mobile data transfer
SIMATIC NET device family, 3-1
MPI, 7-1

N

Network management
General, 2-17

O

OPC
Configuration limits, 2-19
OPC Services, 2-19
Communication services supported, 2-19

P

PC-based automation, 2-33
PG/OP communication, 2-29
PG/OP communication services
OP functions, 2-29
Programming device / PC functions, 2-29
PG/OP Communication Services, 2-29
Point-to-point communication, 9-1
PPI
Communication services, 8-3
Overview, 8-1
PPI network, 8-3
PROFIBUS
Fieldbus Data Link, 4-15
Overview, 4-1
PROFIBUS DP, 4-8
PROFIBUS FMS, 4-15
PROFIBUS PA, 4-9
PROFIdrive, 4-11
PROFIsafe, 4-12
to Industrial WLAN, 3-14
PROFIdrive, 2-23
PROFINET
Basic principles, 2-3
Cable installation, 2-6
components, 2-22
controller, 2-32
Data transfer, 2-8
device, 2-33
Fault-tolerant systems, 2-7
Function blocks, 2-27
HMI devices, 2-33
Isochronous Real-Time, 2-9
Media and topologies, 2-4, 2-5
Passive and active network components, 2-5
PROFIdrive, 2-23
PROFINET CBA, 2-21
PROFINET IO Services, 2-20
PROFIsafe, 2-24
Real-time, 2-8
Ring redundancy, 2-7
Specifications of the plug-in connections, 2-5
Switching mechanisms, 2-9
PROFINET CBA, 2-21
PROFIsafe, 2-24
Fail-safe transmissions, 2-26

R

Radio transmission, 3-4
Real Time, 2-8
Real-Time Communication, 2-8
Redundant systems, 2-7
Routing, 4-18
RS 485
For PROFIBUS:, 4-7
RS 485-iS
For PROFIBUS:, 4-7

S

S7 Basic Communication Services, 7-3
S7 Communication Services, 2-30
Communication blocks, 2-30
Sequence Spread Spectrum (DSSS), 3-8
SIMATIC components, 2-31
SNMPServices
Diagnostics, 2-18
Features, 2-17
Use, 2-18

T

TCP/IP service, 2-26

U

UDP services, 2-28
    Transmission reliability, 2-28

W

Wi-Fi Protected Access (WPA), 3-9
Wired Equivalent Privacy (WEP), 3-9
WPA2 und Advanced Encryption Standard (AES), 3-9

Industrial Communication for Automation

simatic net

SIEMENS

Brochure • April 2006

Introduction

Your requirements

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

To fulfill these demands, all the machines in your plant must work perfectly together. Therefore, rely upon open, transparent automation communication not just within the whole company but also for external communication. Avoid isolated automation and information technology solutions by assuring:

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

Our offer

Communication networks are of utmost importance for automation solutions. SIMATIC NET – networking for industry offers a wide selection of modular blocks designed for industry, which help to efficiently solve your communication tasks:

- In the different automation areas
- Across the complete workflow
- For the complete plant life cycle
- For all sectors

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

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

Contents

Worldwide trends

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

Industrial Ethernet	
Industrial Ethernet (IEEE 802.3, IEEE 802.3u and IEEE 802.11 WLAN) – the international network standard for all levels	
PROFINET – the open Industrial Ethernet standard for automation	
PROFIBUS	
PROFIBUS (IEC 61158/EN 50170) – the international standard for the field level is the worldwide market leader for field busses	
AS-Interface	
AS-Interface (IEC 62026-2/EN 50295) links sensors and actuators using a two-wire cable, as a low-priced alternative to a wiring harness	
KNX	
KNX/EIB (EN 50090, ANSI EIA 776) is the universal bus system for the complete house and building technology. KNX was developed by the Konnex Association on the basis of EIB (European Installation Bus)	

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

	Page
Introduction	2
Industrial Communication	4
Bus systems for industry	6
Industrial Ethernet	8
PROFINET	10
Network components	18
Industrial Security	19
Industrial Mobile Communication	20
Network performance and technologies	22
Active network components	23
PROFIBUS	24
AS-Interface	26
Network transitons	28
Connection technology and transmission media	29
Safety & Security	30
Fail-safe communication	32
High-availability communication / Redundancy	35
SINAUT Telecontrol	36
Diagnostics	38
Practice-related data	39
Industrial Ethernet devices and services	40
PROFIBUS devices and services	43
Industrial Communication – Advantages	46

Industrial Communication for Totally Integrated Automation

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

The advantages of Totally Integrated Automation can be seen not just at the design and engineering stage but also during installation, commissioning, operation and maintenance.

Automation solutions can be developed at a minimum of effort allowing a more flexible and quicker adaptation to market demands.

Plants can be extended or altered without having to interrupt production.

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

PROFINET ...
for increasing productivity in your plant

You need a seamless information flow for your strategic decisions within your company – for the first manufacturing step through operation up to the management level.
In order to achieve this you already rely on efficiency and transparency in your engineering.

PROFINET, the open and innovative standard based on

Industrial Ethernet fulfils all the demands of industrial automation and guarantees a uniform company-wide communication.

PROFINET enables distributed field devices to be connected directly to Industrial Ethernet and can be used for the solution of synchronous Motion Control applications. In addition,

PROFINET supports distributed automation with the help of component technology, vertical integration, and the solution

of safety-related tasks. Naturally, PROFINET also supports controller-controller communication.

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

Totally Integrated Automation from Siemens has proved in successful applications across the globe the dimensions in which transparent solutions can be reached with common tools and uniform mechanisms. A key role in this has been played by the development of SIMATIC NET industrial communication. A new milestone in this development is SCALANCE, the new generation of components for the creation of transparent networks:

- Wired – electrical or optical – or wireless via Industrial Wireless LAN (IWLAN)
- In industry and similar environments.

And this in three different forms:

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

A complete solution consists of

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

SIMATIC NET offers all necessary components to create a complete system solution and supports the following bus systems:

Industrial Ethernet (IEEE 802.3 and 802.3u) –
is the international standard for area networks.
At present Industrial Ethernet is the number one network in the LAN landscape, with a market share of over 90%. Industrial Ethernet is ideal for the creation of powerful long distance communication networks.

PROFINET –
The international standard uses Industrial Ethernet and makes real-time communication in the field level a reality, also integrating the enterprise level. PROFINET uses existing IT-standards to realize synchronous Motion Control applications, efficient manufacturer-independent engineering and high machine and plant availability on Industrial Ethernet. PROFINET supports distributed automation and enables fail-safe applications, as well as controller-controller communication.

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

AS-Interface (IEC 62026/EN 50295) –

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

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

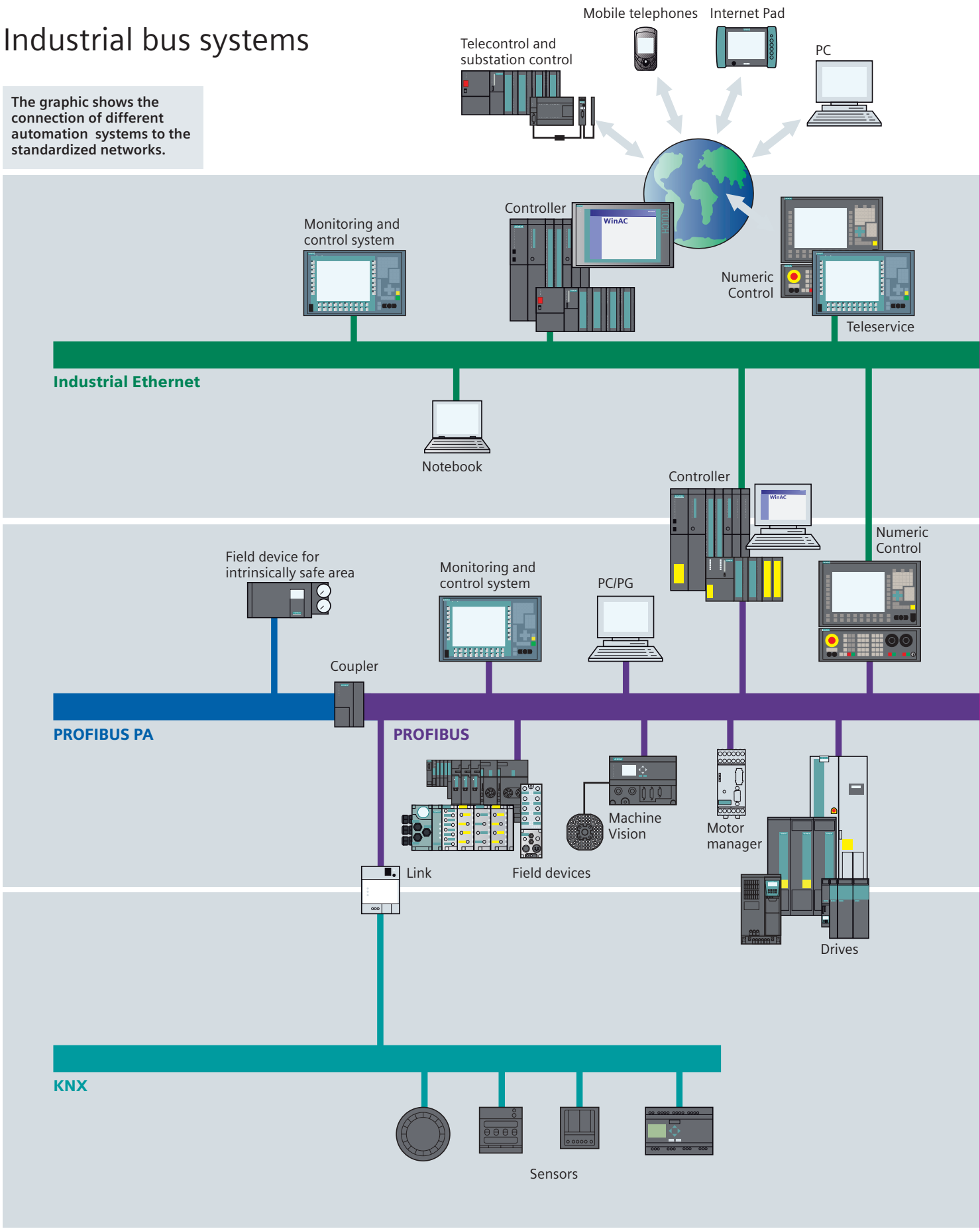
Network transitions are implemented using PLCs or links. Configuration and diagnosis cane be performed from any point in the plant.

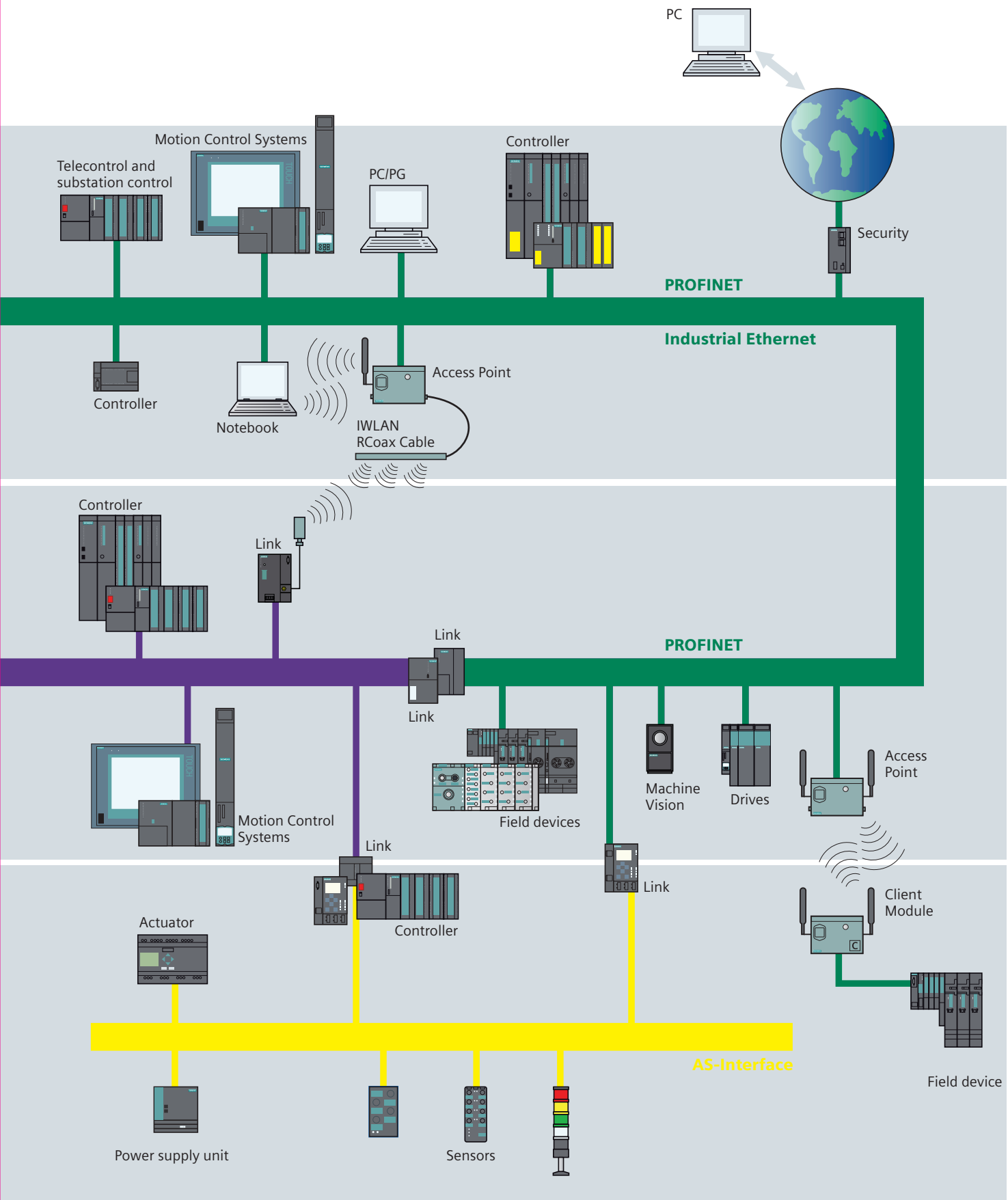
Bus system	Industrial Ethernet	PROFINET	PROFIBUS DP	AS-Interface
Level				
Enterprise Resource Planning (ERP) (e.g. PC)	■	□		
Control (e.g. S7-300)	■	■	□	
Motion Control (e.g. SIMOTION)	□	■	■	
intelligent field devices (e.g. ET 200S)	□	■	■	□
simple field devices (e.g. digital I/O-modules)		□	■	■
Sensor/actuator		□	□	■
Drives (e.g. SINAMICS)	□	■	■	
Fail-safe Communication		■	■	■

not suitable □ suitable ■ ideal

Industrial bus systems

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




PC
Motion Control Systems
Telecontrol and substation control
PC/PG
Controller
Security
PROFINET
Industrial Ethernet
Controller
Notebook
Access Point
IWLAN
RCoax Cable
Controller
Link
Link
PROFINET
Link
Motion Control Systems
Field devices
Machine Vision
Drives
Access Point
Link
Controller
Link
Client Module
Actuator
AS-Interface
Field device
Power supply unit
Sensors

Industrial Ethernet

Industrial Ethernet offers a powerful area and cell network in accordance with standard IEEE 802.3 (ETHERNET), IEEE 802.3u and IEEE 802.11 a/b/g/h (Wireless LAN) for industry.

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

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

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

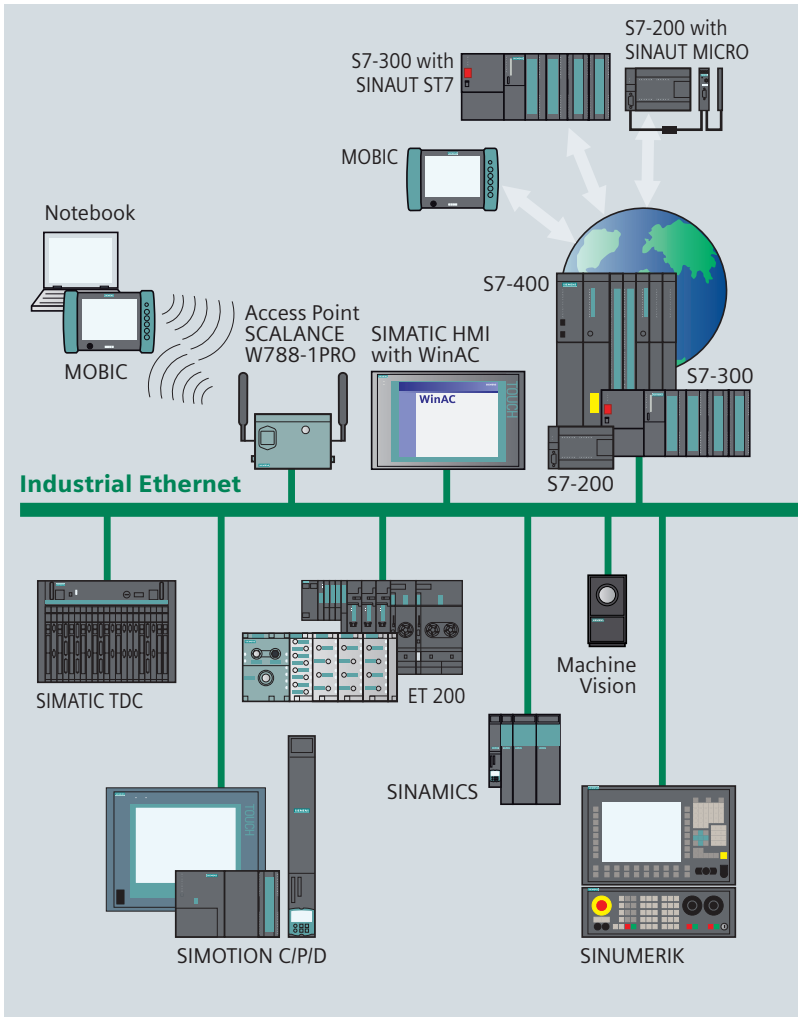
You can choose your data throughput rate to suit your particular needs, as integrated compatibility makes it possible to introduce new technology in stages.

With a market share of over 90% Ethernet is number one worldwide in today's LAN landscape.

Ethernet provides important benefits for your application:

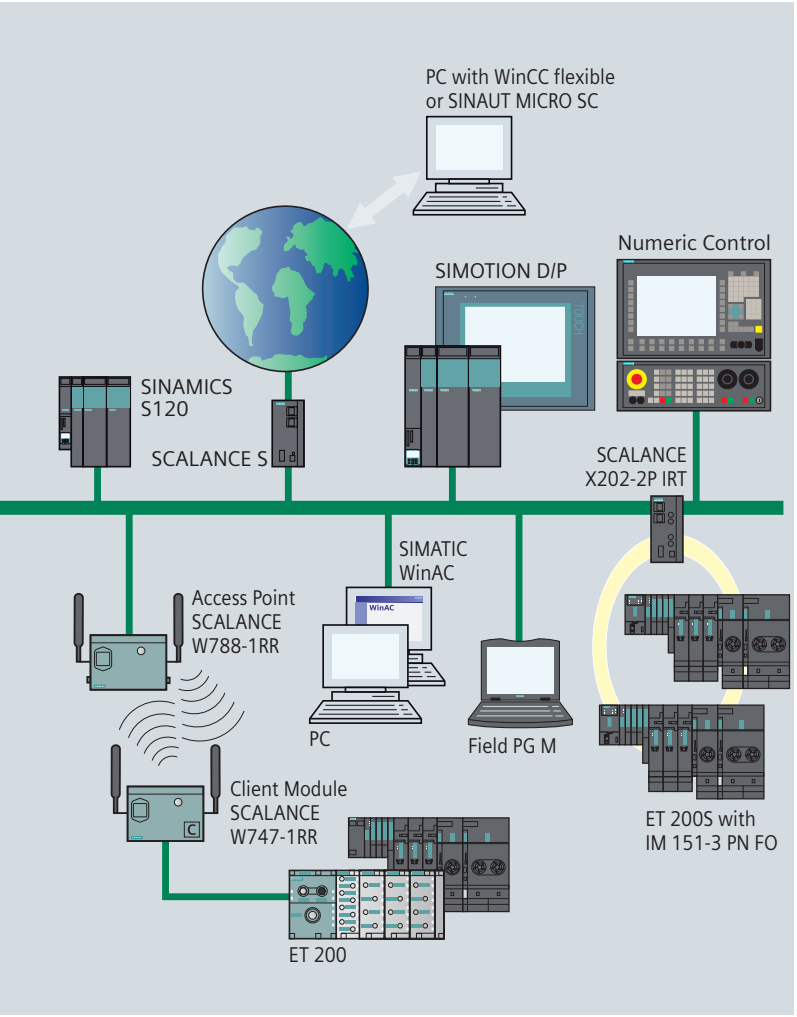
- Fast commissioning thanks to a simple connection technology
- High availability, as existing plants can be expanded without any side effects
- Virtually unlimited communication capabilities due to scaleable performance using switching technology and high data rates
- Networking of widely varied types of applications such as office and production applications
- Company-wide communication thanks to WAN (Wide Area Network) link-ups such as ISDN and Internet
- Investment protection thanks to continual compatibility developments
- Data storage for Industrial Wireless LAN (IWLAN)
- "Rapid Roaming"
  for extremely rapid passing on of moving nodes between various access points.
- Precise time-based assignment of events in the overall plant by means of plant-wide clock control.

SIMATIC NET uses this well-proven, reliable technology. Siemens has already supplied far more than two million nodes for rough and noise prone industrial sites worldwide.



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

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



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

PG/OP communication

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

S7 communication

S7 communication is the integrated communication function (System Function Block) for S7-400 or loadable function blocks for S7-300, which have been optimised for SIMOTION and for SIMATIC S7/C7/WinAC. They also make it possible to link PCs and workstations to SIMATIC. The amount of useful data per request may not exceed 64 Kbyte.

S7 communication provides simple, powerful communication services as well as a network independent software interface.

S5 compatible communication (SEND/RECEIVE)

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

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

Standard communication

Standard communication consists of standardized data communication protocols such as FTP. With Industrial Ethernet failsafe communication is also possible.

OPC

(OLE for Process Control)
is a standardised, open, vendor-independent interface. It is used to interface OPC-capable Windows applications to S7 communication, to S5-compatible communication (SEND/RECEIVE) and to PROFINET.

Information technology (IT) with email and Web technology

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

Socket interface for Industrial Ethernet

This interface enables data communication with computers via TCP/IP. Users can freely program the data exchange for this PC- and Unix-world interface.

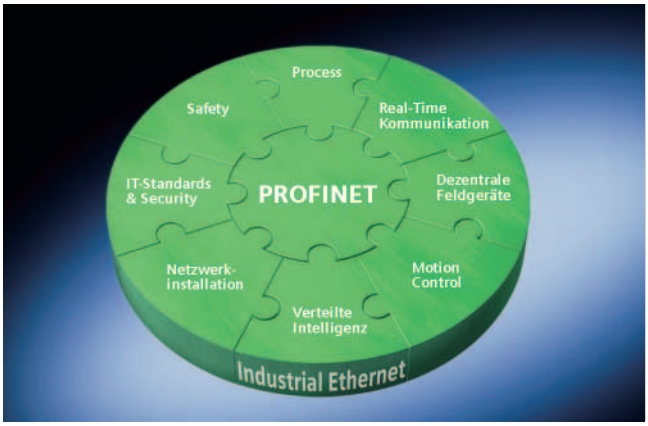
In the SIMATIC S7 and SIMATIC TDC SEND/RECEIVE (S/R) blocks are used to access to TCP/IP.

PROFINET communication services

- PROFINET IO to connect distributed field devices to Industrial Ethernet
- PROFINET CBA for modular plant construction to achieve distributed automation configurations based on ready-made components

PROFINET –
the open standard for automation

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



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

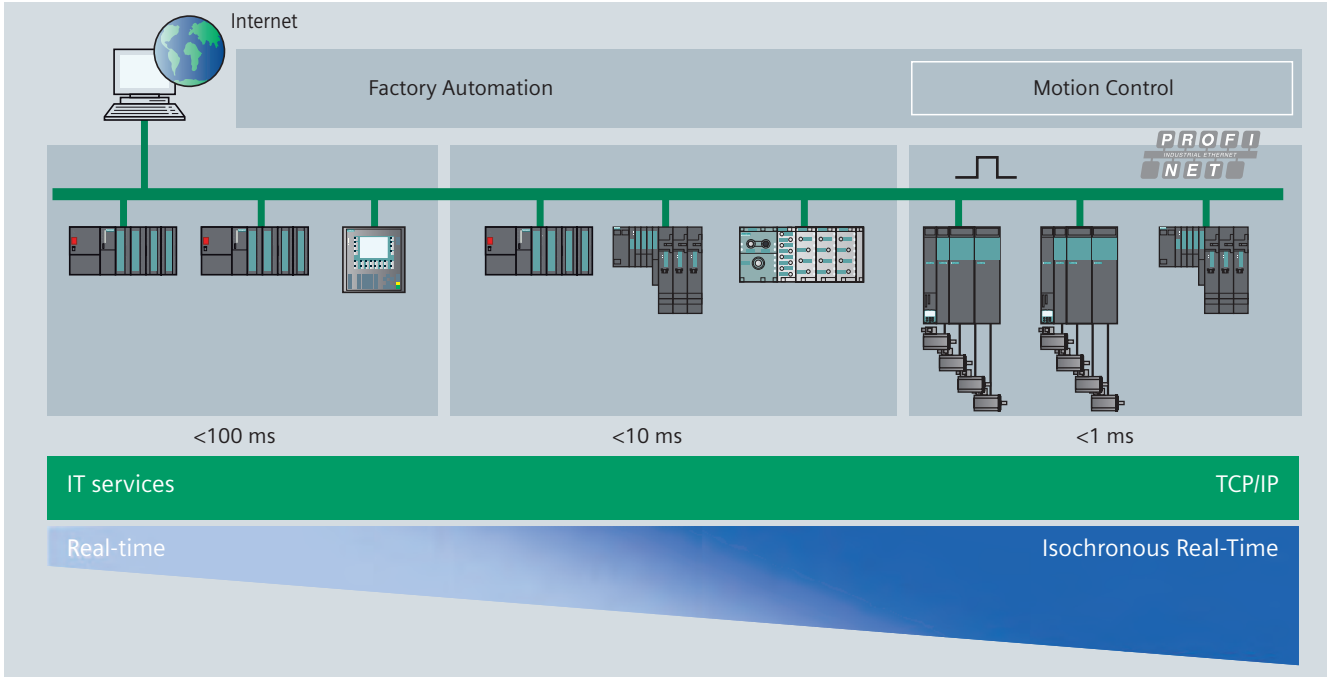
Existing field bus systems e.g. PROFIBUS can be simply integrated without changes in the existing devices.
PROFINET takes account of:

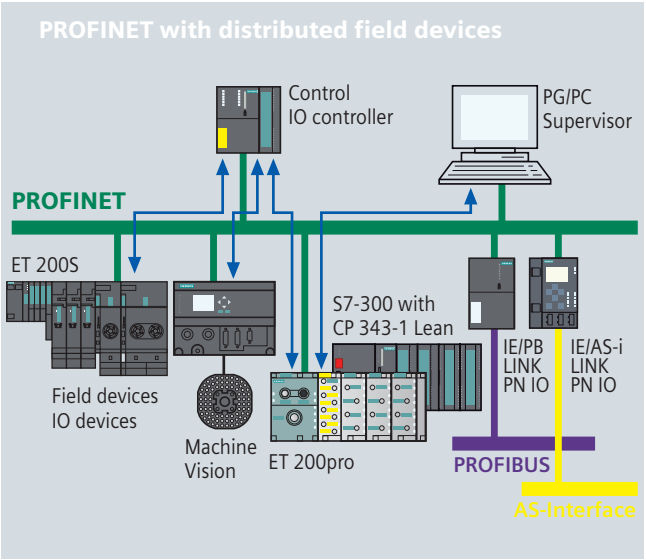
Real-time communication

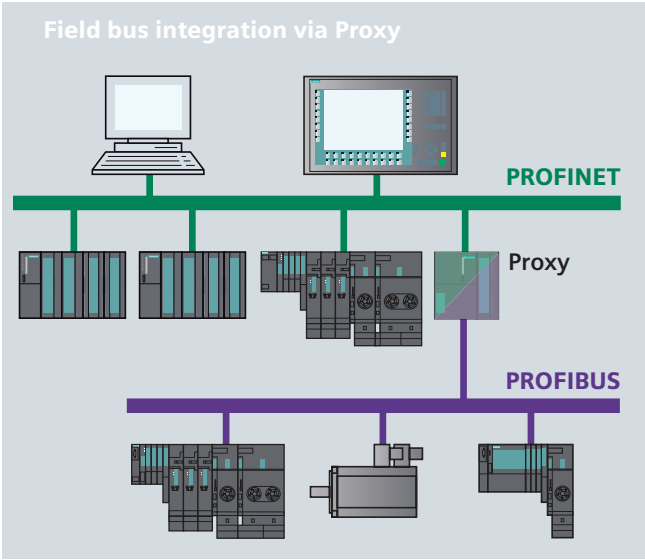
PROFINET is based on Industrial Ethernet and uses TCP/IP (Transport Control Protocol/Internet Protocol) for parameterization, configuration and diagnostics. Real-time communication for the transmission of user/process data can take place on the same cable. PROFINET devices support the following real-time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

- **Real-time (RT)**
  makes use of different priorities and optimises the communication stack of the bus nodes. This ensures a high performance data transfer in the area of industrial automation using standard network components.
- **Isochronous Real-time (IRT)**
  For critical tasks, hardware-supported Isochronous Real-Time (IRT) is available - e.g., for motion control applications and high performance applications in factory automation.

The ASICs ERTEC (Enhanced Real-Time Ethernet Controller) supports both real-time features and is the basic technology for integrated system solutions using PROFINET.
As well as being integrated into Siemens products, the ERTEC technology will also be made available to other manufacturers. Support for the development of proprietary devices is provided in the form of development kits and competence centers.







Distributed field devices (PROFINET IO)

PROFINET enables the connection of distributed field devices (IO devices e.g. signal modules) directly onto Industrial Ethernet. Using STEP 7 these field devices can be assigned to a central controller (so-called IO controller). Existing modules and devices can still be used thanks to PROFINET proxies, thus ensuring investment protection. A configuration with standard and fail-safe modules in one single station is also possible.

An IO supervisor can be used in HMI or other diagnostic programs – similar to PROFIBUS – to provide detailed plant diagnostics. Data transmission takes place using real-time communication, configuration and diagnostics use TCP/IP or IT standards. The simple and field-proven engineering has been transferred from PROFIBUS to PROFINET here. From the viewpoint of programming with STEP 7, there is also no difference between accessing an I/O device via PROFIBUS or PROFINET. Based on the expertise accumulated with PROFIBUS, users can configure field devices on Industrial Ethernet extremely easily.

By retaining the device model, the same diagnostics information is available on PROFINET as on PROFIBUS. Along with device diagnostics, module-specific and channel-specific data can be read from the devices, enabling user-friendly and fast location of faults.

Apart from star, tree and ring structures, PROFINET systematically supports the line structure of the established fieldbuses.

By integrating switch functionality into the devices, as is the case with the S7-300 with CP 343-1 Lean or the distributed field devices SIMATIC ET 200S or ET 200pro, the usual line structures can be formed which are directly adapted to the machine or plant structure. This makes cabling less complex and eliminates the need for components such as external switches.

In addition to the products with degree of protection IP20, a complete portfolio is also available with degree of protection IP65, such as the field device ET 200pro or the switch SCALANCE X208PRO.

Field bus integration

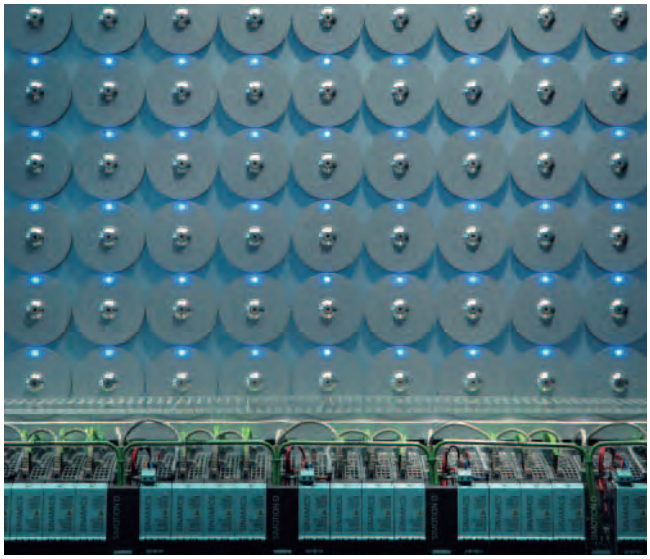
Proxies can be used to integrate existing field bus systems into new networks. This means that, for example, a PROFIBUS or AS-Interface master can access devices connected to Industrial Ethernet via a proxy that supports PROFINET. This means that investments and devices already made by plant and machine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

- PROFINET is the open Industrial Ethernet standard for automation
- PROFINET is based on Industrial Ethernet
- PROFINET uses TCP/IP and IT standards
- PROFINET is Real-time Ethernet and IRT
- PROFINET supports seamless integration of field bus systems
- PROFINET supports fail-safe communi-cation via PROFIsafe

PROFINET –
the open standard for automation

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

Isochronous real-time communication and standard IT communication can be used simultaneously on the same cable without disturbing each another.

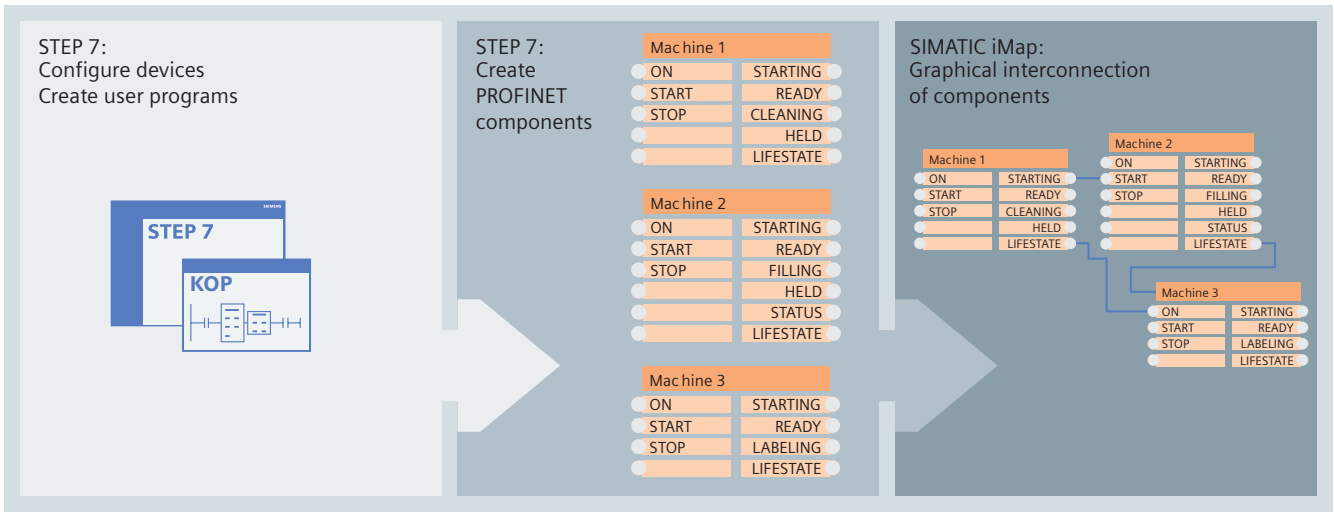


Distributed intelligence and machine-machine-communication (PROFINET CBA)

PROFIBUS International has defined a standard for the realization of modular plant structures: PROFINET CBA (Component Based Automation). In the area of plant and machine construction the experiences gathered with modularization have been very promising. Frequently required parts are prefabricated so that they can be quickly combined to form an individual unit when an order is placed. PROFINET CBA allows this modularization concept to be extended to automation technology by means of special software components.

Software components are encapsulated reusable software functions. These can be individual technological functions such as controllers as well as application programs of entire machines. The components work as building blocks that may be flexibly combined - regardless of their internal programming. The communication between software components is exclusively done via component interfaces. From outside only the variables required for the combination with other components are accessible at these interfaces.

Software components are created with STEP 7 or other manufacturer-specific tools. SIMATIC iMap serves to generally configure the overall plant by graphically interconnecting the components. The degree of modularization does not determine the number of required automation devices. Assignment to a central or several distributed automation devices allows optimum utilization of the available automation hardware.



Network installation

Although PROFINET fulfils all the requirements for Industrial Ethernet in automation, no expert knowledge is required to install a PROFINET network. Network topologies in line, ring, tree or star structures can be simply realised using rugged cabling and connectors.
The "PROFINET installa-tion guide" gives a detailed description of all the necessary steps required for a successful network installation. Depending on the requirements either copper or fibre optic cables can be selected and devices from various manufacturers can be connected using standardised rugged connectors (IP65/IP67).
For address allocation and network diagnostics PROFINET uses the IT standards DCP (Discover Configuration Protocol) and SNMP (Simple Network Management Protocol).
PROFINET offers new functions and applications for the wireless communication with Industrial Wireless LAN. This replaces technologies that are often subject to wear and tear, such as contact conductors, and it enables the use of automated guided vehicles, and personalized operator panels or maintenance devices. Industrial WLAN is based on the standard but also offers additional functions that enable high-performance connection of field devices to controllers:

- „Data reserving“
  is used to reserve the bandwidth between an access point and a defined client, thus ensuring reliable high performance for this client, regardless of the number of clients operated at the access point.
- „Rapid Roaming“
  for extremely rapid passing on of moving nodes between various access points.

These expansions to the standard enable high-performance wireless applications with PROFINET and SCALANCE W right down to the field level.

IT Standards & Security

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

PROFINET provides a scaleable security concept which prohibits data manipulation, unauthorised data access and operator errors without the necessity of expert IT knowledge and without obstructing the flow of production. This is achieved with the software and hardware modules of the SCALANCE S family.

Safety

The well-proven PROFIBUS safety profile PROFIsafe, which enables the transmission of both standard and safety data on one bus cable, can also be used with PROFINET. Standard switches, proxies and links can also be used for fail-safe communication. Fail-safe communication with Wireless LAN (WLAN) is also possible.
This means that PROFINET also supports standard and fail-safe applications with a uniform configuration across the complete network, both for new plants or for the extension of existing plants.

Process

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

Optical PROFINET network structures with POF/PCF cabling

Optical fibers are recommended as an alternative for copper conductors in the case of strong electromagnetic interferences in the surrounding environment and for open-air plants and if no equipotential bonding is provided or electromagnetic emissions are to be avoided.

In optical network structures glass-fiber optical waveguides are used for large distances whereas for shorter distances plastic optical fibers made of light guiding plastics like Polymer Optic Fiber (POF) or plastic-coated glass fibers such as Polymer Cladded Fiber (PCF) are employed.

On the basis of Totally Integrated Automation Siemens A&D offers a comprehensive system solution including passive and active network components and distributed field devices with integrated POF/PCF interfaces. To ensure high availability the conductors are monitored for attenuation due to material ageing during commissioning and during network operation.

Passive network components

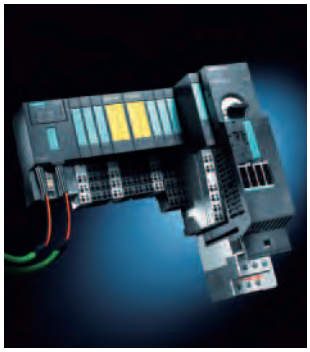
The new SC RJ connection system for polymer optic fiber and polymer cladded fiber facilitates fiber optic cabling for machine oriented use. The new SC RJ connectors allow fast and easy assembly on site. They are standardized for PROFINET within the PROFIBUS International organization so that devices of different manufacturers can be interconnected.

Depending on their type, the plastic optical fibers devised for the SC RJ connection system can be used universally or for particular purposes in drag chains.

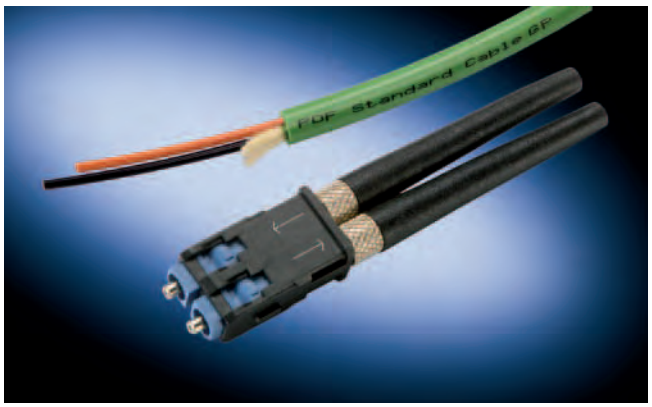
Industrial Ethernet switches and media converters

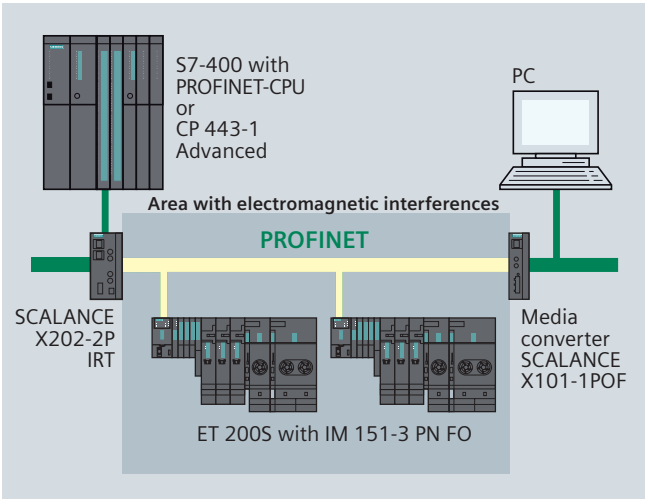
The SCALANCE X101-1POF media converter is ideally suited for the integration of devices with POF interfaces into existing network structures, as it converts electrical into optical signals. The media converter and the SCALANCE X200-4P IRT /X201-3P IRT / X202-2P IRT Industrial Ethernet switches were specially developed for the SC RJ cabling system. The integrated ASIC ERTEC provides the IRT functionality for the switches. This makes the switches suitable for real-time communication. They can be diagnosed and configured via STEP 7.

Distributed I/O



By means of the integrated POF interfaces of the new IM 151-3 PN FO interface module and the SC RJ cabling system, the SIMATIC ET 200S product family can be integrated into an optical PROFINET network. This allows, for the first time, the operation of safety-oriented PROFIsafe modules on the ET 200 via optical fiber connection. Existing modules can be used further, which makes them a safe investment. The integrated two-port switch allows easy creation of line structures directly adapted to the machine or plant structure.





PROFINET products on Industrial Ethernet
PROFINET CBA

Programmable controllers

CPU 315-2 PN/DP
CPU 315F-2 PN/DP
CPU 317-2 PN/DP
CPU 317F-2 PN/DP
CPU 319-3 PN/DP
CPU 414-3 PN/DP
CPU 416-3 PN/DP
CPU 416F-3 PN/DP
NEW

CPU within a CBA component that allows data to be exchanged with other components over PROFINET and, with the proxy, over PROFIBUS

WinAC Basis with PN option
Software PLC, based on WinAC Basis WinAC PN acts as a proxy for PROFIBUS devices

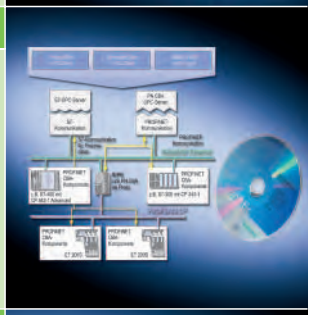
System interfacing for SIMATIC S7 and SINUMERIK

CP 343-1
Communications processor to integrate an existing S7-300 or a SINUMERIK 840D into a CBA application.

CP 343-1 Advanced
CP 443-1 Advanced
Communications processors with integral switch (CP 443-1 Advanced only) to integrate a SIMATIC S7-300/S7-400 or a SINUMERIK 840D (CP 343-1 Advanced only) into a CBA application.

System interfacing for PG/PC

PN CBA OPC server
Permits direct access to variables in PROFINET CBA components via the OPC interface



Network transitions

IE/PB Link
CBA proxy for integration of existing PROFIBUS devices into a CBA application The IE/PB Link also offers S7 and data set routing

Engineering Tools

SIMATIC iMap
Multi-vendor software for graphic configuring of communication between components

PROFINET products on Industrial Ethernet
PROFINET IO

Programmable controllers

CPU 315-2 PN/DP
CPU 315F-2 PN/DP
CPU 317-2 PN/DP
CPU 317F-2 PN/DP
CPU 319-3 PN/DP
CPU 414-3 PN/DP
CPU 416-3 PN/DP
CPU 416F-3 PN/DP NEW

CPUs as IO controller for processing the process signals and for directly connecting field devices to Industrial Ethernet

System interfacing for SIMATIC S7 and SINUMERIK

CP 343-1
Communications processor for the connection of S7-300 or of SINUMERIK 840D to Industrial Ethernet.

Field devices are connected as IO devices via S7-300 to Industrial Ethernet using this.

CP 343-1 Lean
Communications processor with integrated 2 port switch for the connection of S7-300 to Industrial Ethernet. The CP allows linking to an IO controller as intelligent IO device

CP 343-1 Advanced NEW
CP 443-1 Advanced
Communications processors with integrated switch (CP 443-1 Advanced only) as IO controller for the system conenction of field devices to SIMATIC S7-300/S7-400 or SINUMERIK 840D (CP 343-1 Advanced only).

System interfacing for PG/PC

CP 1616
PCI module for the connection of PG/PC to Industrial Ethernet with ASIC ERTEC 400 and integrated 4-port real-time switch. CP 1616 can be used both as IO control-ler and as IO device.

CP 1604
PC/104-Plus module for the connection of PC/104-Plus systems and SIMATIC Microbox with PC/104-Plus interface to Industrial Ethernet with ASIC ERTEC 400 and integrated 4-port real-time switch. CP 1604 can be used both as IO control-ler and as IO device..

Development Kit DK-16xx PN IO
Software development kit for CP 1616 and CP 1604 with LINUX driver in source code for the transfer to PC-based operating systems

SOFTNET PN IO
Communications software for operation of a PC / workstation as IO controller

Network transitions

IE/PB Link PN IO
PROFINET proxy for transparent interfacing of existing PROFIBUS devices to an IO controller via Industrial Ethernet.

IE/AS-i LINK PN IO NEW
PROFINET proxy for modular interfacing of existing AS-Interface slaves to an IO controller via Industrial Ethernet.

IWLAN/PB Link PN IO
PROFINET proxy for transparent interfacing of existing PROFIBUS devices to an IO controller via Industrial Wireless LAN (IWLAN).

Distributed IO

IM 151-3 PN
IM 151-3 PN HF
IM 151-3 PN FO NEW
Interface module for direct connection of ET 200S as IO device, with integrated 2 port switch for configuration of line structures (also via LWL).

PN/PN Coupler NEW
PROFINET module for a cross-plant, fast and deterministic IO data link between two PROFINET networks.

IM 154-4 PN HF
Interface module for direct connection of ET 200pro as IO device with integrated switch for the configuration of line structures with a high degree of protection (IP65/IP67).

Motion Control & Drives

CBE 20, CBE 30 NEW
CBE 20 and CBE 30 are the PROFINET boards for connection of SINAMICS S120 or SIMOTION D to PROFINET.

CU 310 PN NEW
Control Unit with PROFINET interface for SINAMICS S120 AC-Drives.

MCI-PN NEW
With MCI-PN SIMOTION P, the PC-based version of SIMOTION, is connected to PROFINET.

Engineering Tools

STEP 7 / SIMOTION SCOUT
For configuring in the tried and tested PROFIBUS manner

SINEMA E NEW
For planning, simulating and configuring industrial WLAN applications according to the 802.11 a/b/g standard.

Technology components

ERTEC 400
Ethernet Controller with integrated 4-port switch, ARM 946 RISC and PCI interface, data processing for both Real-time (RT) and Isochronous Real-time (IRT) with PROFINET.

ERTEC 200 NEW
Ethernet Controller with integrated 2-port switch, ARM 946 RISC, data processing for Real-time (RT) and Isochronous Real-time (IRT) with PROFINET.

Development Kit DK-ERTEC 400 PN IO
Development Kit DK-ERTEC 200 PN IO NEW
The development kits support the development of in-house PROFINET IO devices.

PROFINET IO Development Kit
Development kit based on standard Ethernet ASIC for the development of in-house PROFINET IO devices

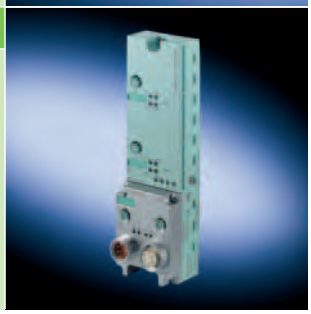
Image processing systems

VS120
Vision sensor as IO device for object testing.

VS130-2
Vision sensor as IO device for reading 2D codes.

RFID systems

RF180C NEW
RFID communication module for all SIMATIC RF/MOBY identification systems.



Network components for Industrial Ethernet and PROFINET
Network infrastructure

Passive network components

The quick assembly system for SIMATIC NET Industrial Ethernet – FastConnect (FC) – means that the structured cabling known in the office-world can be used in a rugged industrial environment. FastConnect cables can be assembled quickly and easily on-site.

In addition to the range of copper based FastConnect products including industrial installation cables, sockets, plugs and patch cables there is also a wide range of optical transmission media available.

Industrial Ethernet Switches and media converters

The product family SCALANCE X offers a graded switch portfolio (Entry Level, unmanaged, managed and modular) and media converters.
In addition to the facility for the configuration and diagnostics of SCALANCE X switches using STEP 7, these provide optimized data transmission of PROFINET real-time telegrams through priority assignment derived from IEEE 802.1Q.

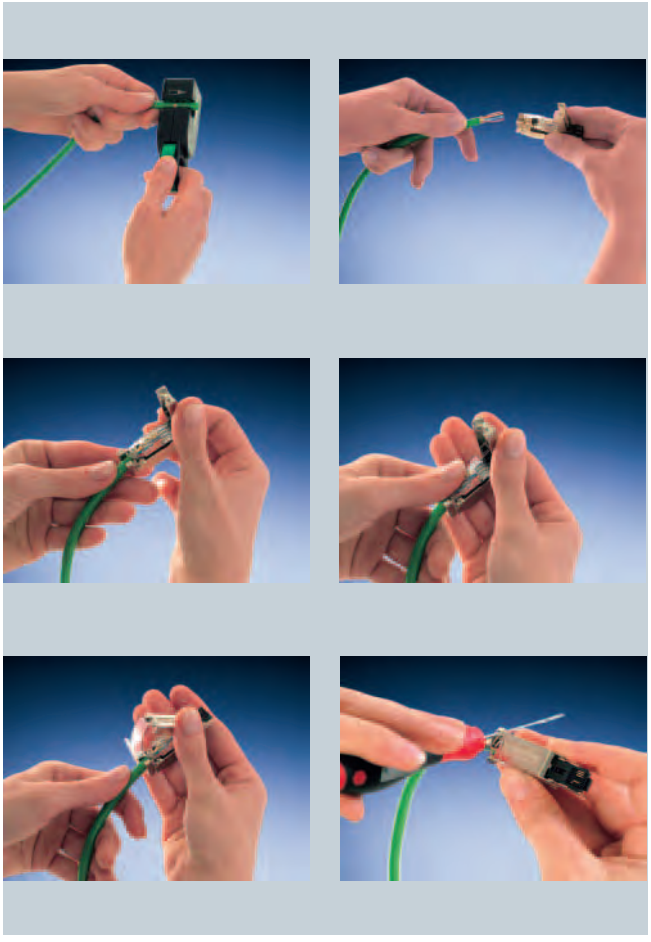
The network components control the data flow between the devices on the basis of these priorities.
Switches with copper and optical fiber conductor interfaces and integrated ASIC ERTEC are available for isochronous real-time requirements (IRT).
The various media converters of the SCALANCE X product line are ideally suited for converting electrical signals into optical signals.

Industrial Wireless LAN

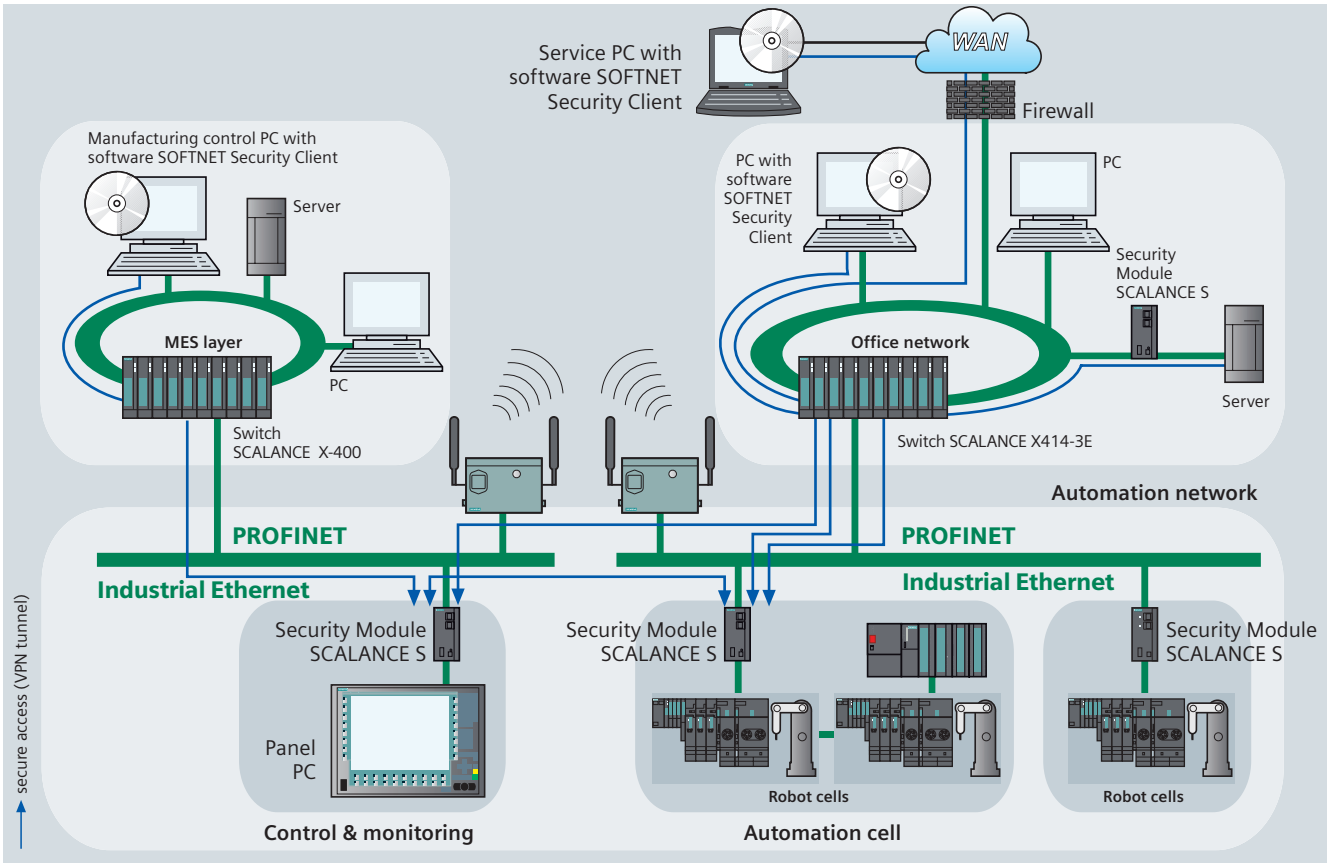
SCALANCE W, increased mobility and flexibility using Industrial Wireless LAN components for Industrial Ethernet and PROFINET, also for fail-safe communication.

Industrial Security

SCALANCE S, security modules for protection of automation networks and security when exchanging data between automation systems.



Industrial Security for automation networks



Modern automation technology is built on communication and the networking of individual production islands. This means that the integration of automation components into office networks and company Intranets is becoming more important:

- Remote access for service purposes
- Increasing use of IT mechanisms such as Web servers and email in automation devices
- Use of wireless LANs

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

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

Advantages of the SCALANCE S security concept

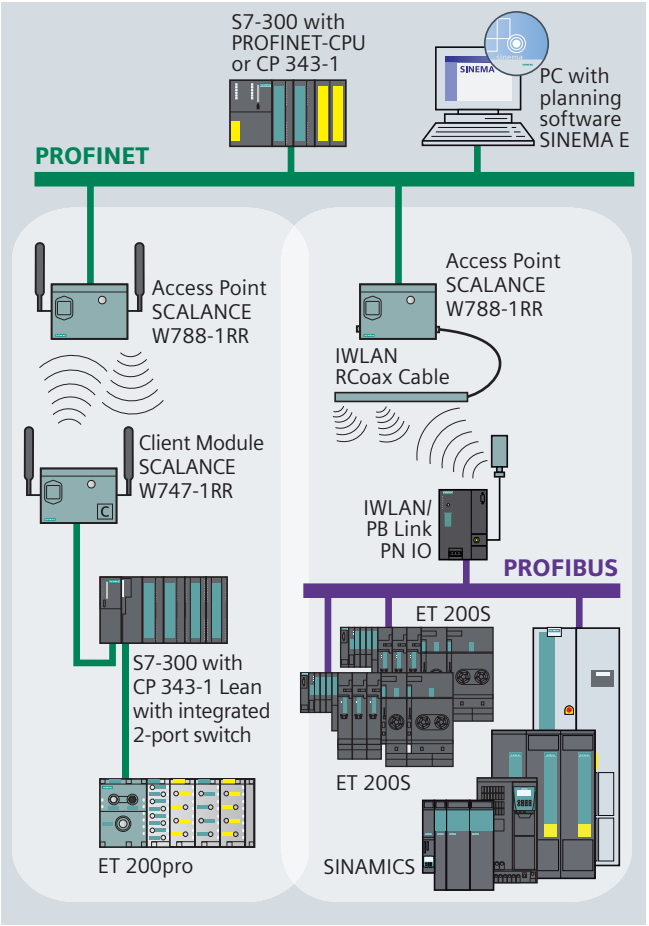
- Protects against spying and data manipulation
- Protects against communication overload
- Protects against mutual influences
- Protects against incorrect addressing
- User friendly and simple configuration and administration without special knowledge about IT security
- No changes or adjustments of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

SCALANCE S Security Modules offer scaleable security functionality:

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

Protected communication with Safety and Security
see page 30

Industrial Mobile Communication



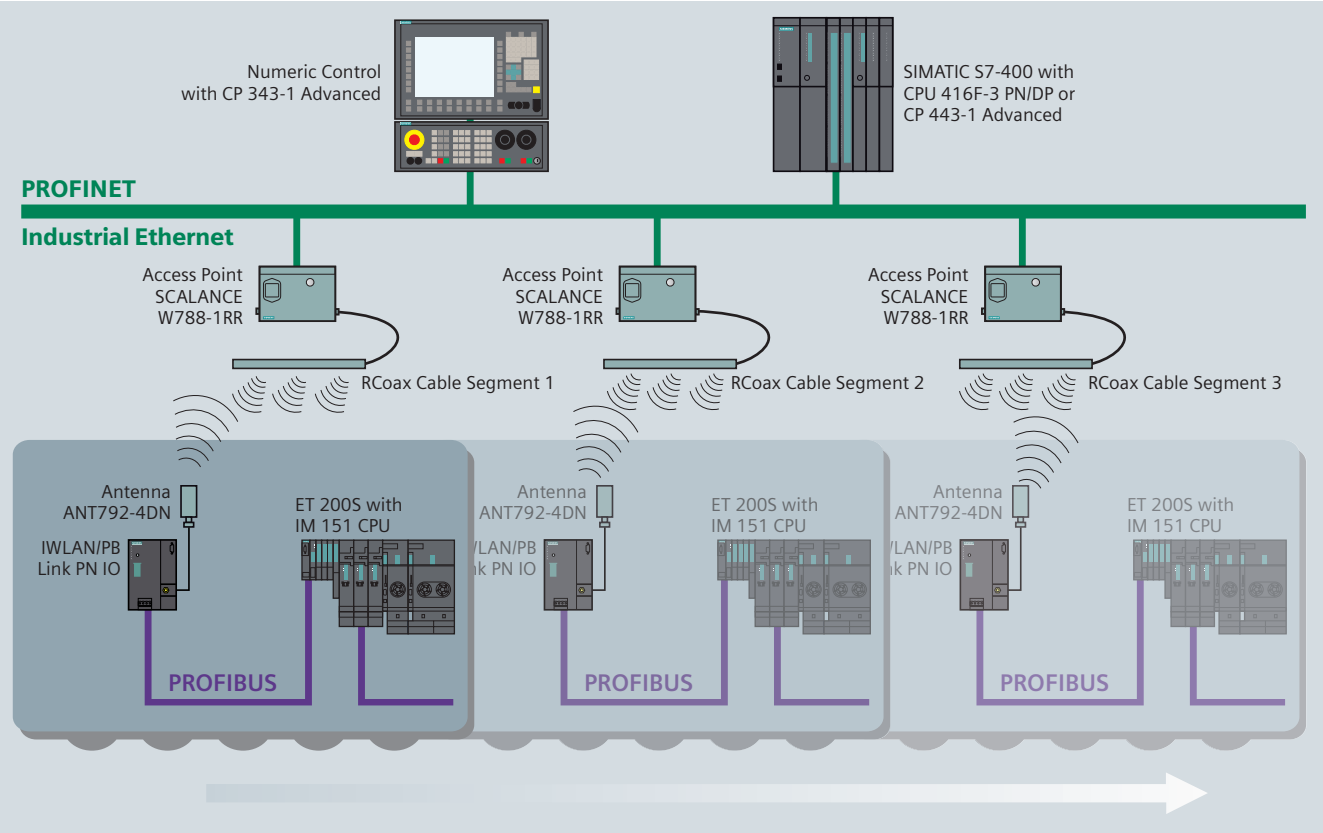
The key to future marketing successes lies in the ability to access data independent of time and place.
Processes can be considerably improved by using mobile devices networked across wireless LANs. The great advantage of a wireless solution lies in the simple and flexible accessibility of mobile devices. These advantages can be used by implementing mobile solutions using Industrial Mobile Communication (IMC) products from SIMATIC NET. These products are developed on the basis of international standards e.g. according to IEEE 802.11, GSM, GPRS or UMTS.
Fail-safe wireless communication via Industrial Wireless LAN is also possible.

Advantages of wireless communication networks

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

SCALANCE W – wireless communication

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



Applications for RCoax Cable

- In difficult areas for radio transmission (e.g. in tunnels, channels and lift shafts), where the main focus is not on unlimited mobility but on safe data transmission by means of a service-friendly solution without mechanical wear. This is made possible by the defined conical radio field along the RCoax cables.
- The RCoax cables ensure a wear-free and reliable wireless link specially suited for conveyor systems, robots and every type of rail-mounted vehicle (monorail conveyors, driverless transport systems).
- Two cables for Industrial Wireless LAN use with the frequency bands 2.4 GHz and 5 GHz.

Application examples

- Monorail conveyors
- Automated guided vehicle system (AGVS)
- Cranes
- Stacker cranes
- Transfer lines
- Tool-changing trolleys
- Robots
- Railway stations
- Underground railway systems
- Railway wagons
- Lifts
- Theater stages

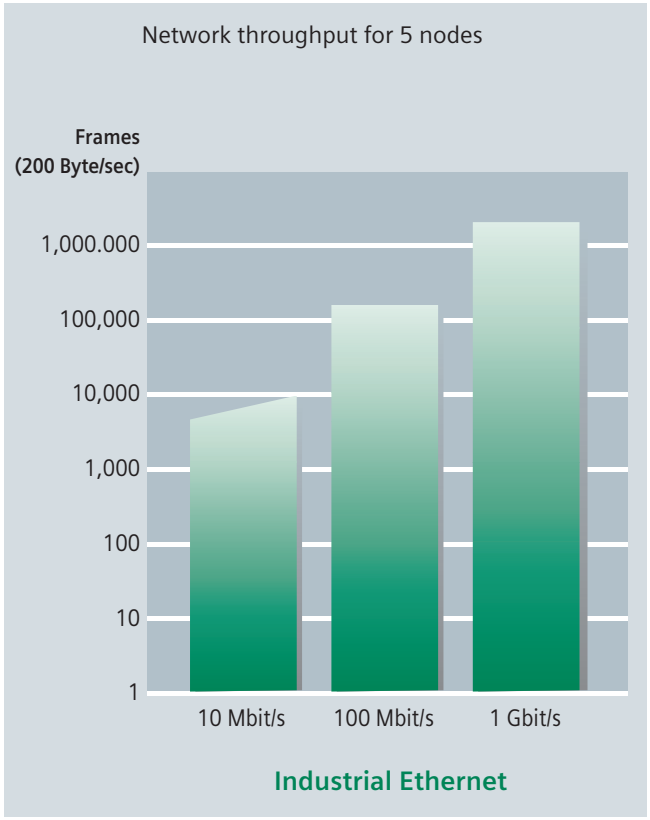
Additional network components for IWLAN

- IWLAN/PB Link PN IO
- SCALANCE W-700
- Accessories:
  - Antennae
  - Termination Impedance
  - Lighting Protector
  - Power Supply

Industrial Ethernet
network performance and technologies

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

- **Fast Ethernet** with 100 Mbit/s:
  Telegrams are transported much faster than with 10 Mbit/s and therefore reserve the bus for a much shorter time.
- **Gigabit Ethernet** with 1 Gbit/s:
  Compared to Fast Ethernet Gigabit Ethernet is a factor of 10 times faster and transport time on the bus is reduced to a tenth of the time.
  The 8-wire FastConnect cabling system from SIMATIC NET ensures that transmission rates of up to 1 Gbit/s are possible.
- **Full Duplex** excludes collisions:
  The data throughput increases enormously since common retries are unnecessary. Data can be sent and received simultaneously between 2 stations. The data throughput over a Full Duplex connection thus increases to 200 Mbit/s with Fast Ethernet and to 2 Gbit/s with Gigabit Ethernet.
- **Switching** enables parallel communication:
  Dividing the network into segments using a switch reduces the network load. Local data traffic in each network segment is independent of the traffic on the rest of the network, thereby making it possible for several frames to be in transport at the same time. The performance improvements stem from the fact that multiple frames are underway at the same time.
- **Autosensing** is the term used for network nodes (end devices and network components) which automatically detect the transmission rate of a signal (10 Mbit/s, 100 Mbit/s or 1 Gbit/s) and support autonegotiation.



Active network components for Industrial Ethernet

SCALANCE X is the new product family of Industrial Ethernet switches from SIMATIC NET. Switches are active network components aimed at distributing data to specified addressees. The SCALANCE X product range comprises different product lines, each one building on the previous one and optimally developed for the task in hand.
With the SCALANCE X products the network infrastructure is made available for PROFINET applications.

SCALANCE X005 Entry Level

Unmanaged Switch with five ports and diagnostics on the device for use in machine or plant islands.

SCALANCE X-100 unmanaged

Switches with electrical and/or optical ports, redundant power supply and signalling contact for use in "local-machine" applications.

SCALANCE X-100 unmanaged media converter

Media converter for converting electrical signals into optical signals.

SCALANCE X-200 managed

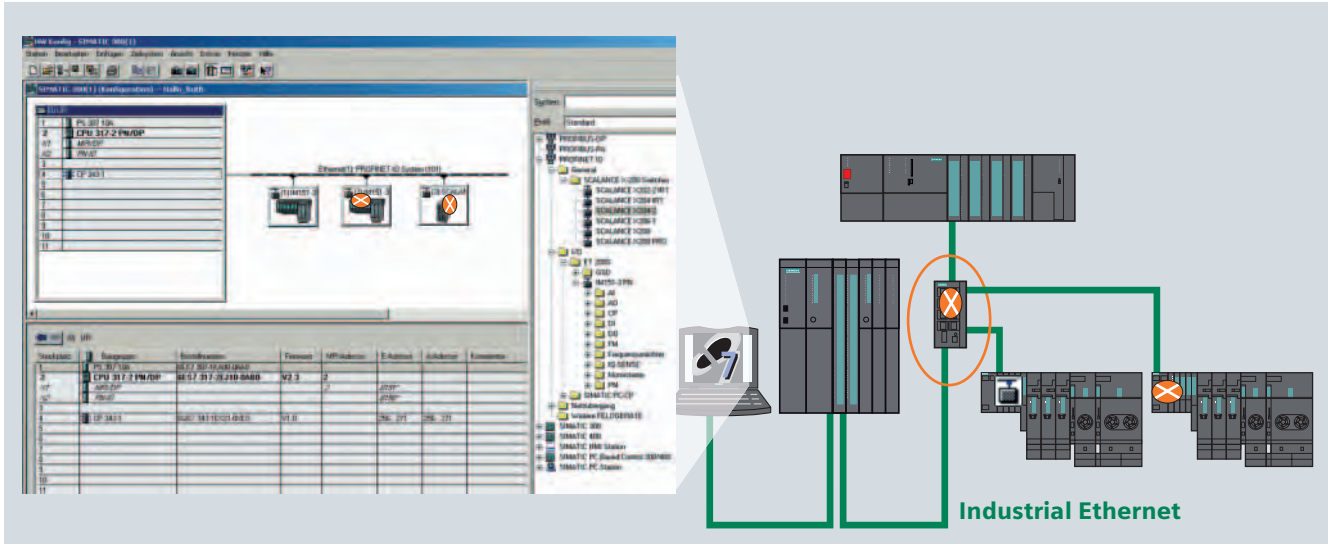
Can be universally used from local machine applications up to subplant networks. Configuration and remote diagnostics are integrated in the engineering tool STEP 7giving the customer advantages in engineering, commissioning and operation. Devices with high degree of protection level allow mounting outside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

These switches can also be used in plant subsections where there are demands for hard real-time communication and high availability (SCALANCE X-200 IRT). Standard data traffic (no real-time requirements) can also take place on the same cable thus eliminating the need for two separate networks.

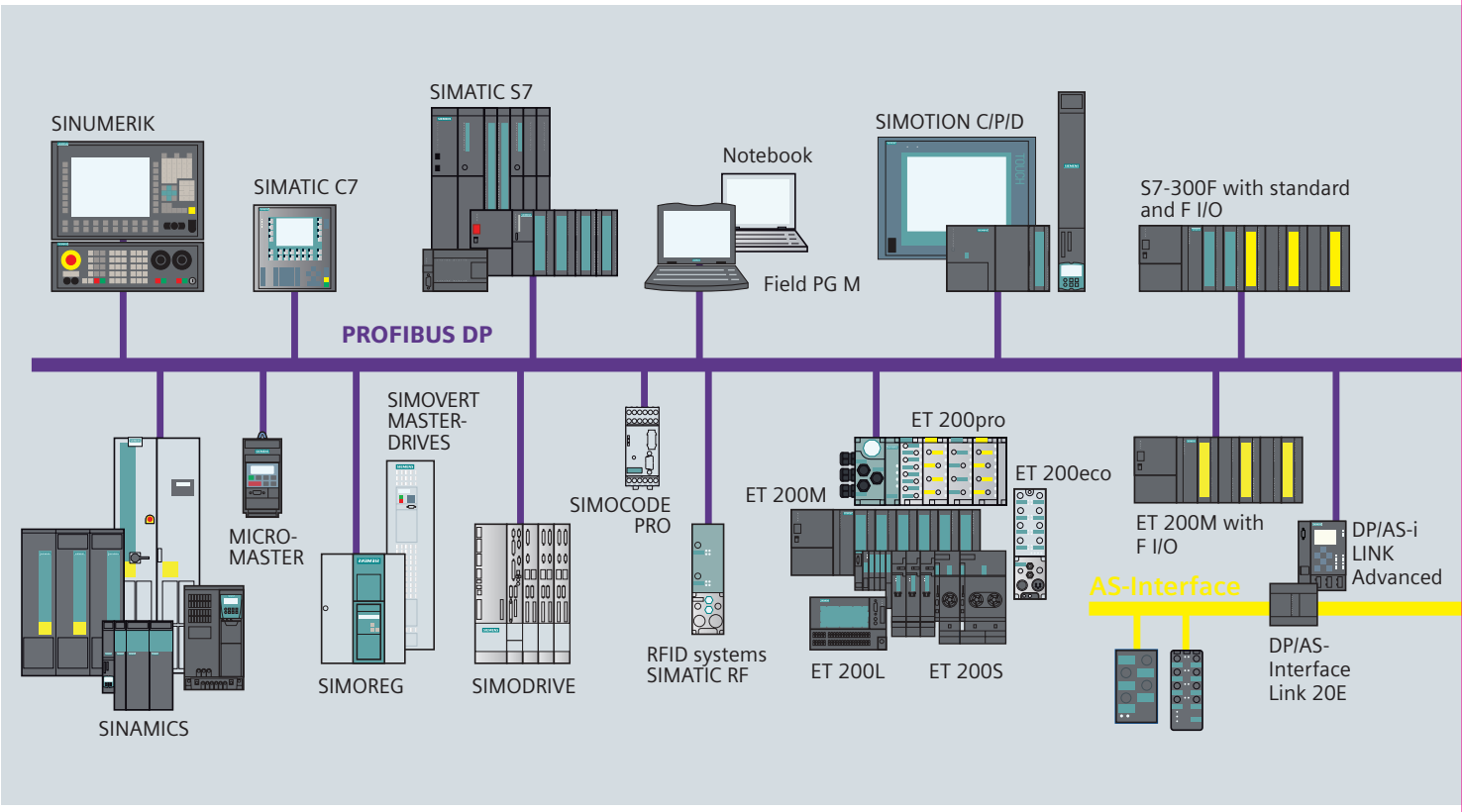
SCALANCE X-400 modular

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

Routing functions on Layer 3 facilitate communication between network segments with different IP address ranges.



PROFIBUS



PROFIBUS is used for the connection of field devices such as distributed peripheries or drives with automation systems such as SIMATIC S7, SIMOTION, SINUMERIK or PCs.
PROFIBUS is an open, high performance, robust field bus system with short reaction times and compliant with IEC 61158. There are different PROFIBUS protocols for various applications.

PROFIBUS DP
(Distributed Periphery)

is used for the connection of distributed field devices e.g. SIMATIC ET 200 or drives with very quick reaction times. PROFIBUS DP is used when actuators/sensors in the machine or plant (e.g. at the field level) are widely distributed.

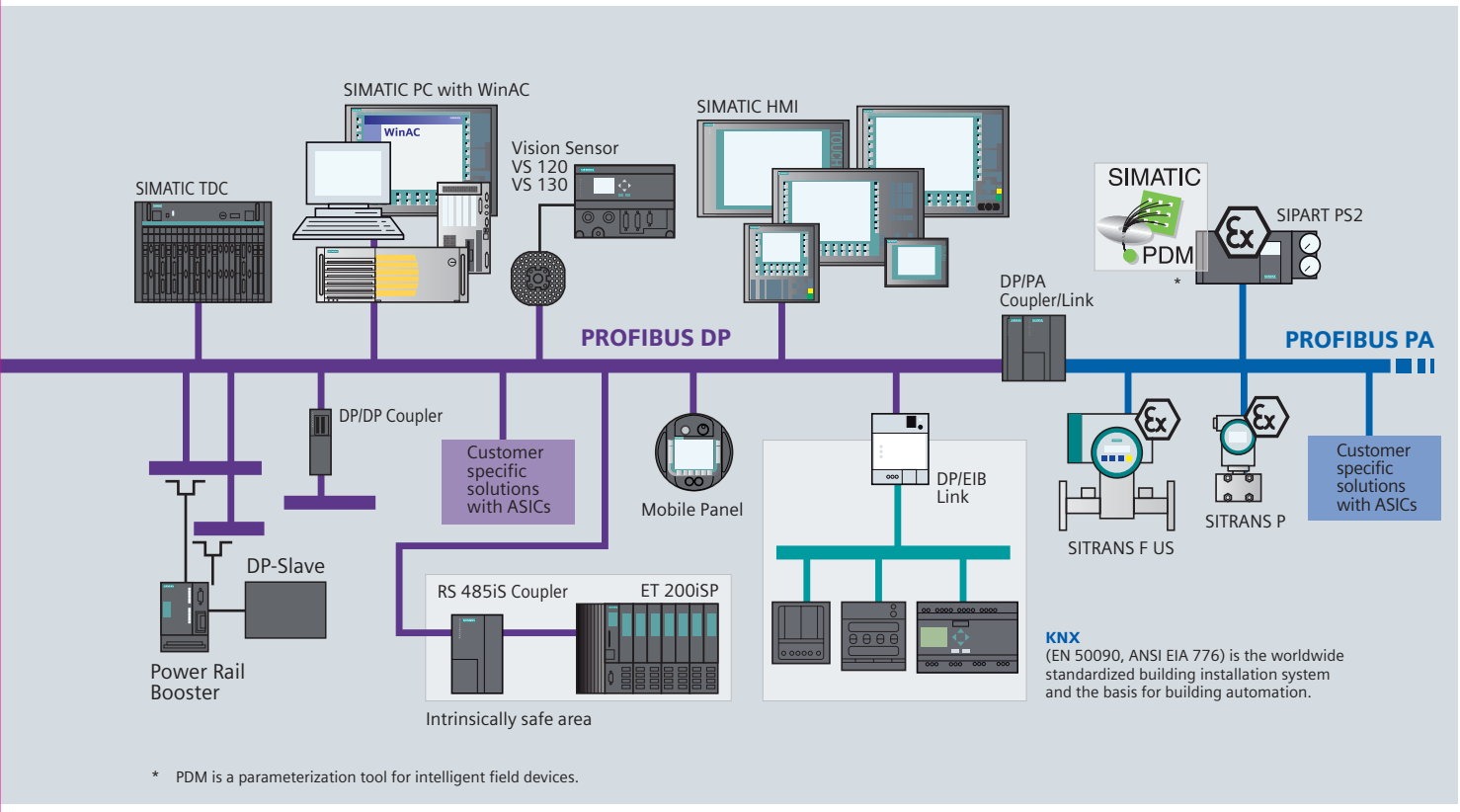
In this case the actuators/sensors are connected to the field devices, which are supplied with output data according to the master/slave principle and provide the PLC or PC with input data.

Openness on the whole range
Thanks to the openness of PROFIBUS DP it is of course possible to connect standardized components from various manufacturers together on the network. The IEC 61158/EN 50170 standard protects the customers investments.
Member companies worldwide are supplying a great variety of products with PROFIBUS DP interface for field use.
Siemens has a wide product range varying from CPUs, network components, communication software up to different field devices.
If you are a field device manufacturer, then we can offer you a wide range of products such as ASICs, training, certifications and a lot more.

PROFIsafe
allows standard and fail-safe communication on the same bus cable. It is the solution for fail-safe communication via standard busses using the PROFIBUS services.

Fail-safe PROFIBUS **communication** with PROFIsafe

see page 32



* PDM is a parameterization tool for intelligent field devices.

Isochronous mode

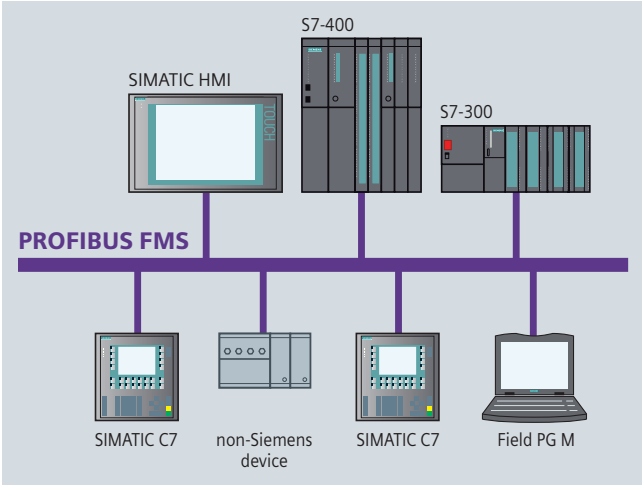
CPU, drives, I/O and user program are synchronized to the PROFIBUS clock. The function "Isochronous mode" is supported by the SIMATIC S7-400 CPUs, SIMOTION/SINUMERIK and servo drives. The drives are activated using the PROFIdrive profile.

PROFIBUS PA
(Process Automation)

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

PROFIBUS FMS
(Fieldbus Message Specification)

For data communication between automation systems from different manufacturers. This means that not only Motion Control tasks but also distributed general control and measuring tasks can be accurately processed.



AS-Interface

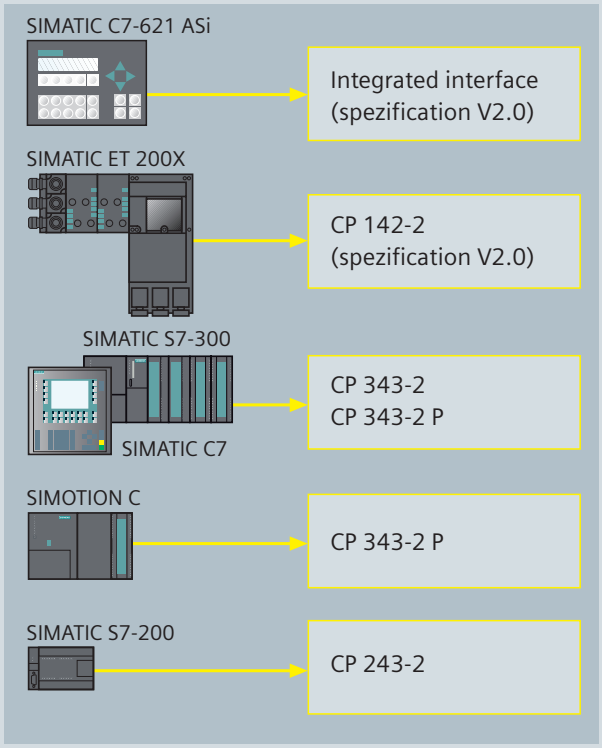
Sensors, valves, actuators, drives – many different components are used in the field level.
All of these actuators/sensors must be interfaced to an automation system.
Today distributed I/Os are being used in the field level as intelligent on-site outposts, so to speak.
As a price efficient alternative to a cable harness, AS-Interface connects the components using a two-wire cable.
AS-Interface is used where individual actuators/sensors are spatially distributed throughout the machine (e.g., in a bottling plant).
The AS-Interface is an open international standard IEC 62026-2/EN 50295 and is supported world-wide by 280 member firms of the AS International Association, among which there are leading manufacturers of actuators and sensors.
The system has proved its worth in the field since 1994, and with more than 10 million installed nodes, it is the unchallenged market leader among bit-oriented bus systems.
AS-Interface is a single master system. There are communications processors (CPs) available for SIMATIC and for SIMOTION which operate as masters for controlling field communication.

The AS-Interface specifications V2.1 and V3.0permit interfacing of up to 62 slaves. The AS interface specification 3.0 allows a maximum of 1000 digital inputs/outputs (profile S-7.A.A: 8DI/8DO as A/B slave) to be connected. New profiles permit extended addressing also for analog slaves. The "fast analog profile" speeds up the transmission of analog values. Thanks to the integrated analog value processing in the masters, accessing analog values is as easy as accessing digital ones. The connection of SIMATIC S7 Controller, WinAC or other systems to AS-Interface is realized by means of IE/AS-i LINK PN IO, DP/AS-i LINK Advanced or via the DP/AS Interface Link 20E.

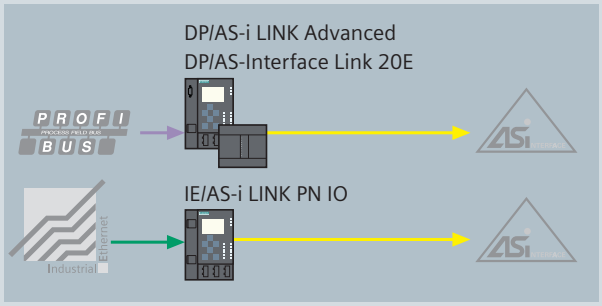
Fail-safe AS-Interface **communication** with ASisafe

see page 34

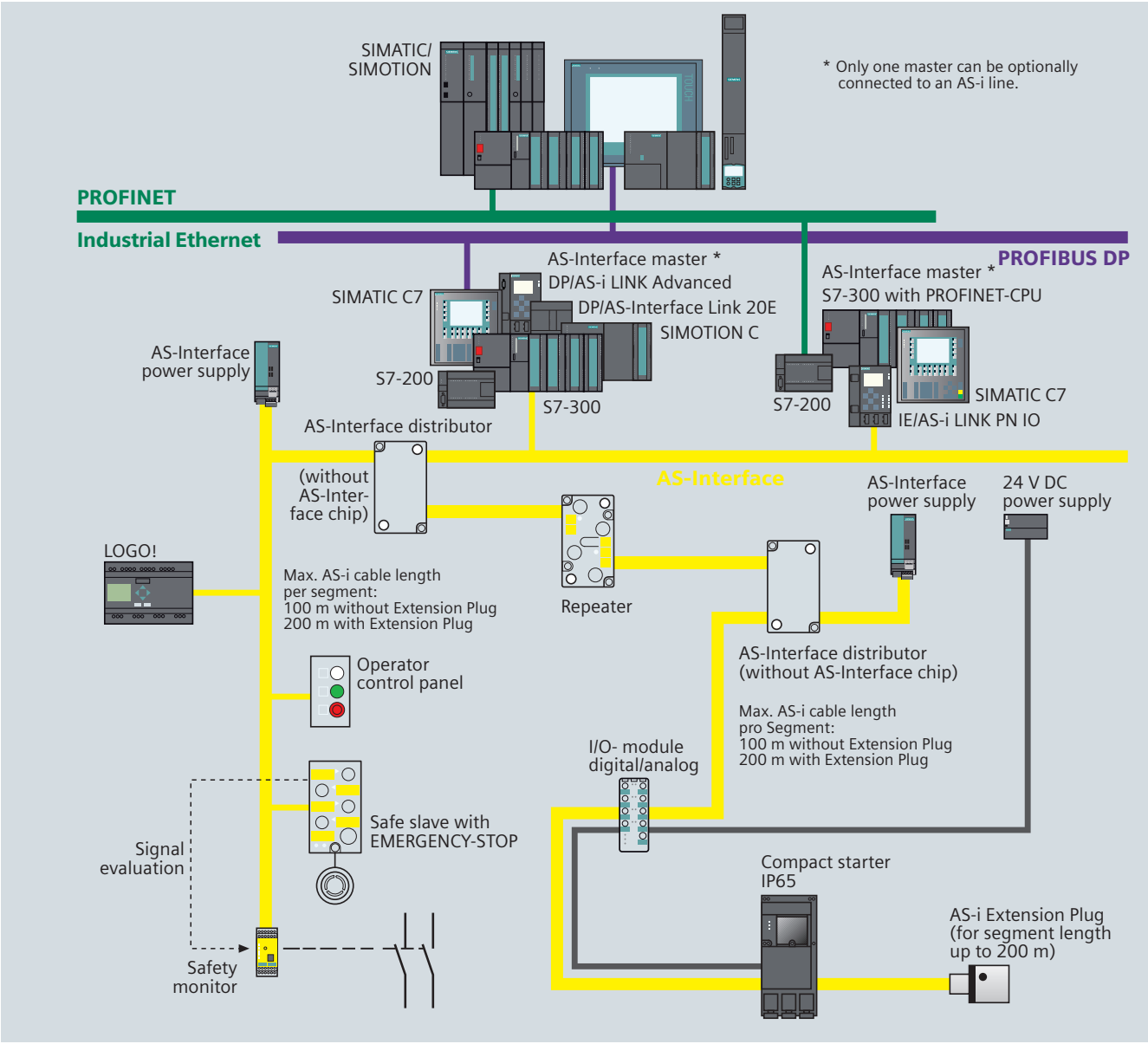
AS-Interface master



AS-Interface Links



The DP/AS-i LINK Advanced or the DP/AS-Interface Link 20E (IP20) are available for connecting the AS-Interface directly to PROFIBUS DP, making it possible to use AS-Interface as a PROFIBUS DP sub-network.
The IE/AS-i LINK PN IO allows direct linking of AS-Interface to Industrial Ethernet and thus a seamless integration into the PROFINET environment.



This is how you save money

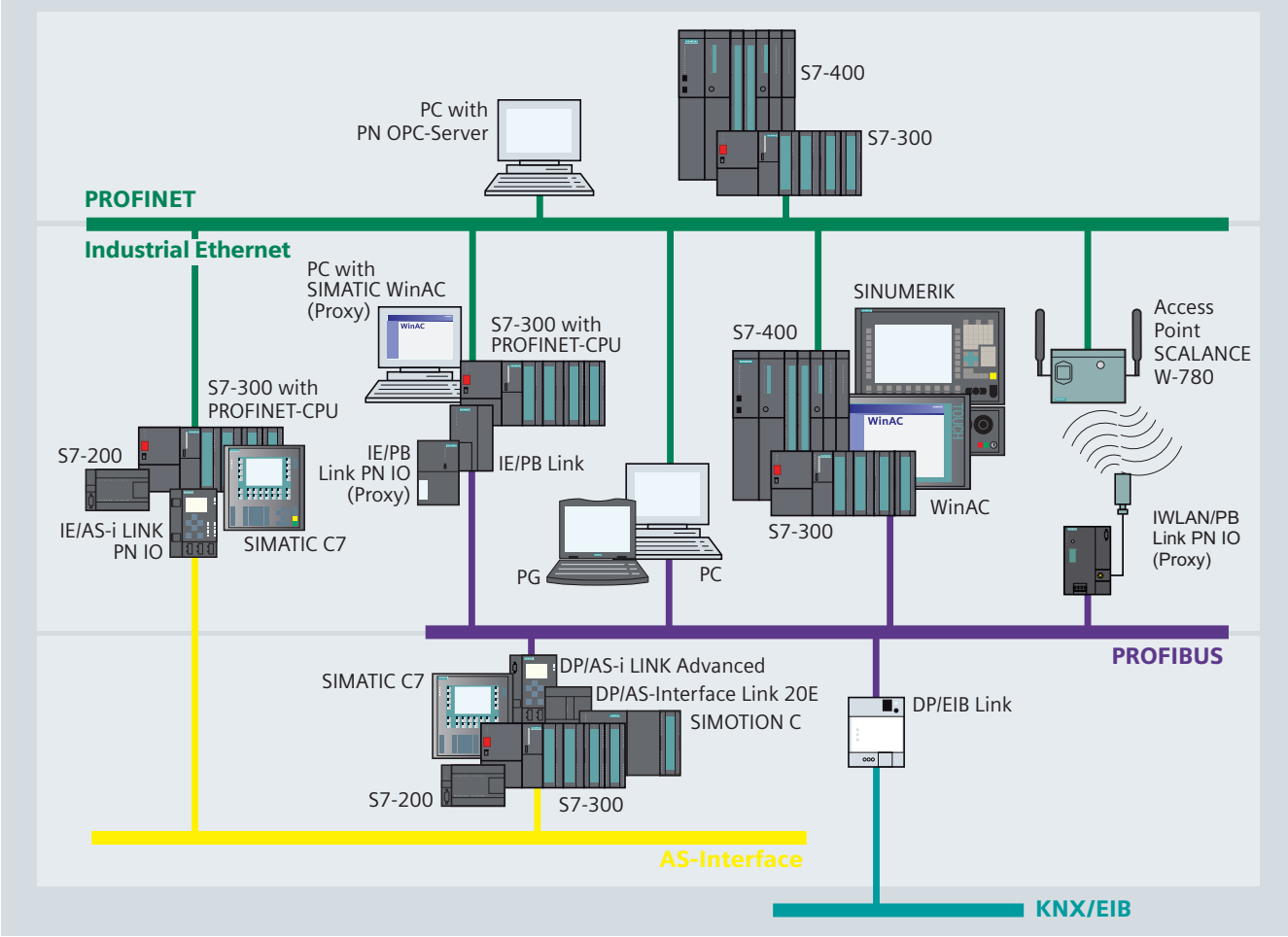
AS-Interface replaces costly and expensive cable harnesses and connects binary actuators and sensors such as proximity switches, valves and indicator lights to a PLC, for example, SIMATIC.

In practice this results in simple installation procedure as data and power are transmitted over **one** cable.

Thanks to a specially developed (yellow) flat cable and cable-piercing technology, the AS-Interface slaves can be tapped at any point.

This concept gives you enormous flexibility and is exceptionally cost-saving. Special installation and commissioning knowledge are unnecessary. In addition, easy cable installation, a clear cable structure and the special design of the AS-Interface cable reduce the risk of errors as well as service and maintenance costs.

Network transitions



Network transitions between different bus systems are implemented through links, PLCs or PCs. In the latter 2 cases integrated interfaces and communications processors (CPs) are used. Links forward the data without any kind of changes from one network to another.
Such links are:

- IE/PB Link and IE/PB Link PN IO for the transition from Industrial Ethernet to PROFIBUS (also for fail-safe communication)
- IE/AS-i LINK PN IO für den Übergang von Industrial Ethernet zu AS-Interface
- IWLAN/PB Link PN IO for the transition from IWLAN to PROFIBUS
- DP/AS-i LINK Advanced and DP/AS-Interface Link 20E for the transition from PROFIBUS to AS-Interface
- DP/EIB Link for the transition from PROFIBUS to KNX/EIB

When PLCs such as SIMATIC S7-200, S7-300, S7-400, SINUMERIK or SIMOTION C, data is exchanged between the networks via communications processors or integrated interfaces.
The data is pre-processed using a controller before being forwarded to the next network.

PROFINET network transition with proxy functionality

PROFIBUS segments can be linked to Industrial Ethernet by means of devices with a representative function, so-called PROFINET proxies.
This can be done using a solution involving SIMATIC WinAC PN, SIMATIC S7-300/400 CPUs with DP- and PN interface, IE/PB Link or via IE/PB Link PN IO. An access point SCALANCE W-700 with IWLAN/PB Link PN IO can be used for a wireless network transition. This means that all standard PROFIBUS slaves can be used without any modification in PROFINET.

Connection technology and transmission media

Structured cabling compliant with ISO IEC 11801/EN 50173

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

This means that the existing RJ45 standard cabling technology can be used in an industrial environment thereby enabling industry-standard, structured cabling by means of installation cables and sockets.
Significant cost-savings can be reached thanks to the quick and secure assembly system.

FastConnect – the quick assembly system for Industrial Ethernet and PROFIBUS

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

- **IE FC TP cables**
  with special construction for fast assembly as FC TP Standard, FC TP Trailing , FC TP Flexible and FC TP Marine Cable (PROFINET compliant)
- Convenient insulation displacement system with the **FastConnect Stripping Tool**, which strips the outer shield and the braided shield with a precise measurement in one operation. The cables prepared in this way are connected to the FastConnect products using the insulation piercing method.

- **IE FC RJ45 Plugs (90°, 145° and 180°)**
  are resistant to interference thanks to their rugged metal housing and are the ideal solution for the installation of RJ45 connectors in the field (PROFINET compliant). The sleeves of the SCALANCE products and the IE FC RJ45 Plug provide additional strain relief and bending strain relief of the connection.
- **IE FC RJ45 Modular Outlet**
  also for Gigabit cabling
- **PROFIBUS FastConnect cables**
  shielded, 2-wire cables in different versions: a standard type, one with a PE sheathing, one with PUR sheathing and a halogen free one. There are also cables for underground installation, trailing cables and for use in intrinsically safe areas.
- **PROFIBUS bus connectors**
  with 30°, 35°, 60°, 90° and 180° cable outlet

Data transmission via slip rings with movable communication nodes

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

Optical data transmission

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

Wireless data transmission

With Industrial Wireless LAN a local radio network for wireless communication can be set up using an access point such as the SCALANCE W 788-1PRO and a wireless card such as the CP 7515. RCoax radiating cables operated as antennae from SCALANCE W access points provide reliable radio links in areas challenging for radio, e.g. for monorail conveyors, cra-nes, stacker cranes.

Safety & Security in Automation

Modern automation systems must be safe and secure. The terms "safety" or "security" have different meanings in conjunction with automation systems (PLCs, computers, drives, etc.) and networks.

Machine safety

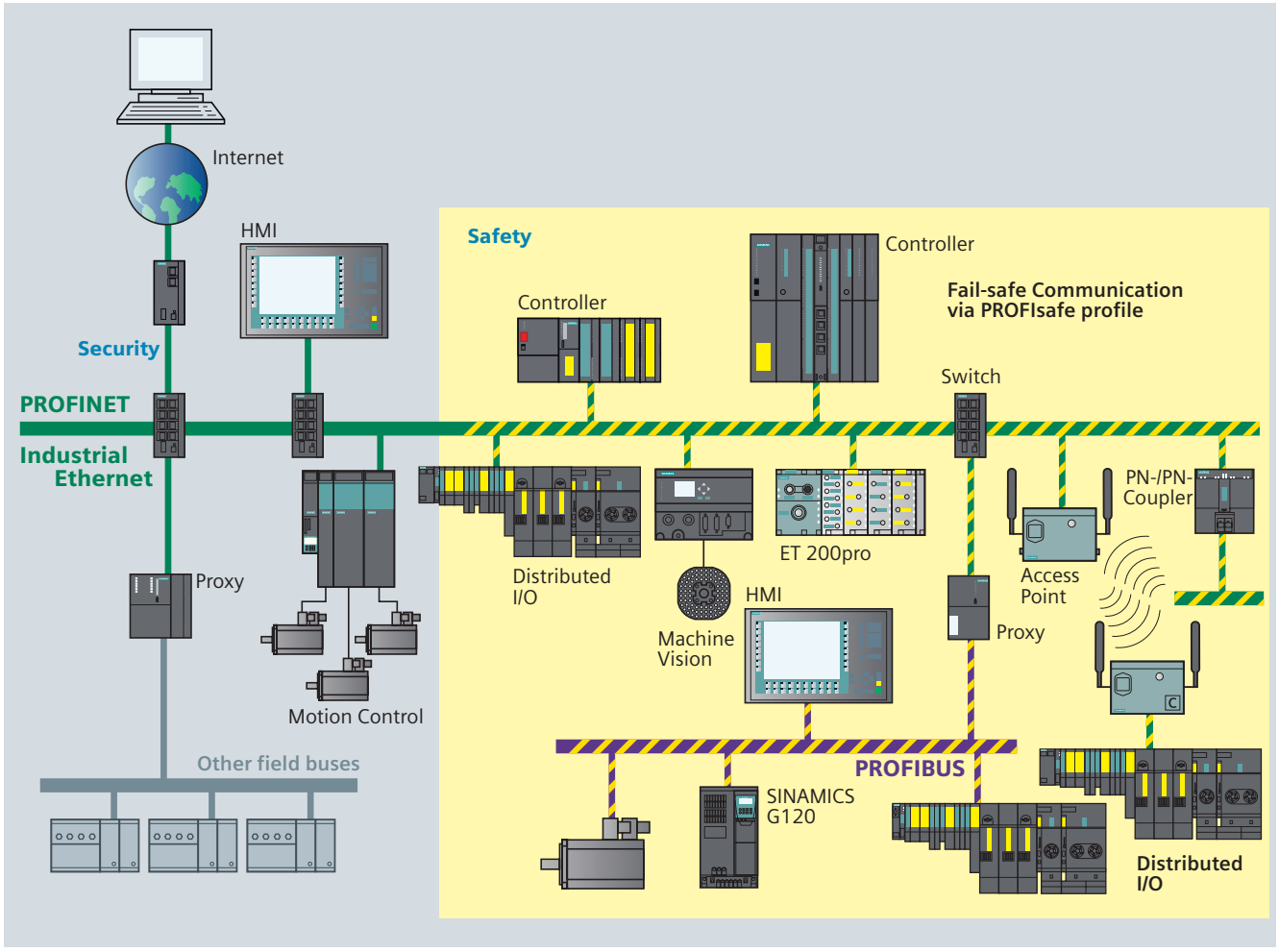
The objective of safety engineering is to protect people, machines and the environment from hazards and damages caused by machine malfunctions (hardware or software faults).
To do so, the whole system from the sensor to the evaluator and actuator must be regarded as a coherent entity.
This objective is reached through functional safety, which means that the machine always performs the safety function correctly.
The insensitivity to occurring faults and errors is the decisive criterion for the safety integrity of a machine (i.e., the consequences of a fault in the machine).

The following technical measures enable the safety integrity to be improved:

- Diagnostics
- Redundancy
- Selection of immune and robust components

With "Safety Integrated", TIA provides an integrated, safe overall system with various product families, supported by:

- PROFIsafe, the safety profile based on PROFIBUS and PROFINET
- ASIsafe, the safety-related version of the actuator-sensor communication system AS-Interface.



Information security – Security

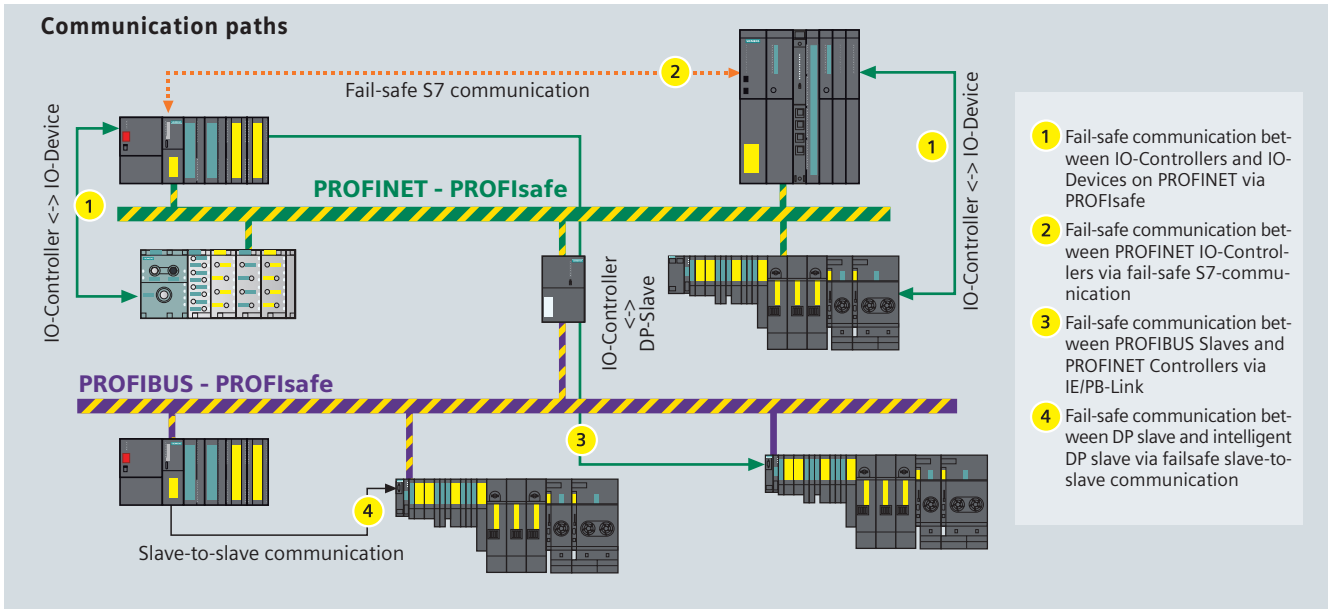
is used with regard to the security of information within a system, that is

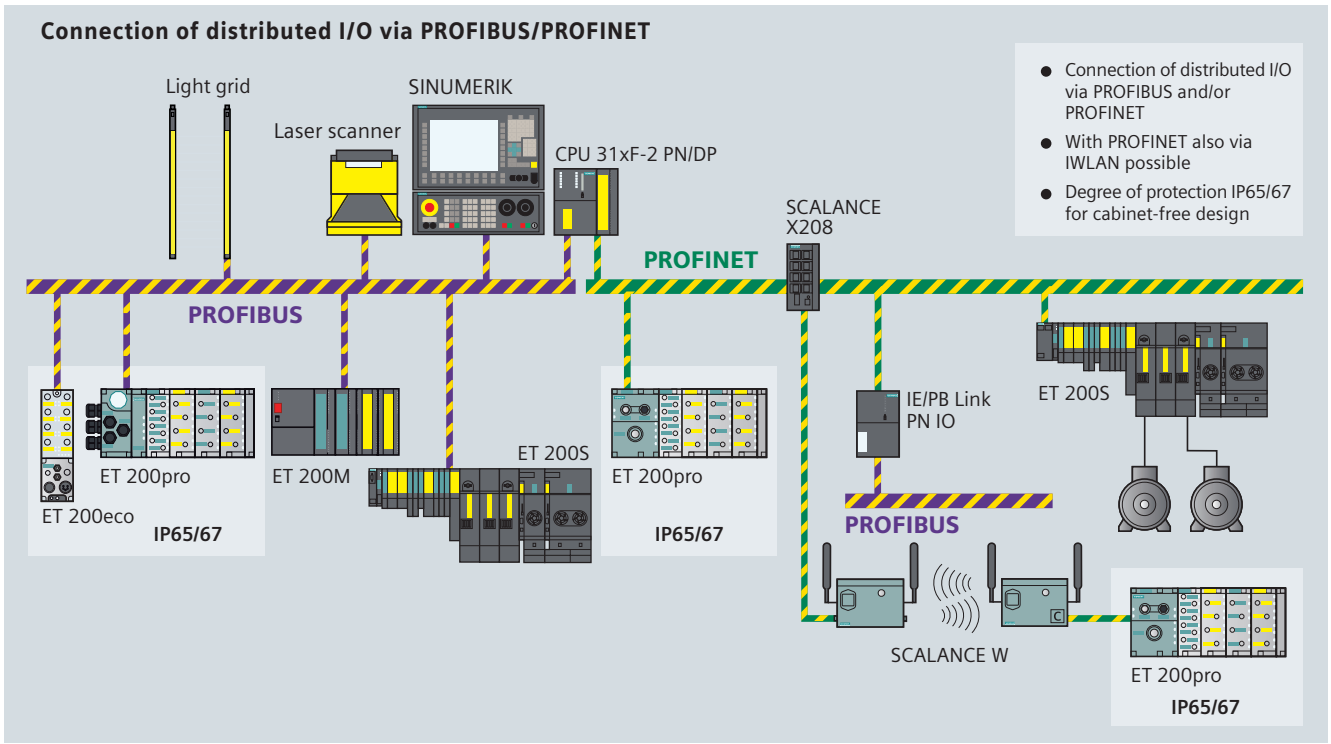
- Protection from espionage and data manipulation
- Protection against overloading of the communication system
- Protection against mutual interference
- Protection against addressing mistakes
- Easy, user friendly configuration and administration without the need for specialist knowledge using IT security techniques
- Changes or modifications to the existing network structure are not necessary
- No changes or modification of the existing applications or network stations are necessary
- Rugged, industry-compatible design

SCALANCE S security modules from Siemens offer a scaleable security functionality:

- Firewall for protecting the programmable controllers from unauthorized access regardless of the size of the network to be protected
- Supplementary or alternative VPN (Virtual Private Network) for reliable authentication of the communication partners and encryption of the transmitted data
- SOFTNET security client for secure access from PCs and notebooks to programmable controllers protected by SCALANCE S

Fail-safe communication
PROFIsafe





Safety technology with Safety Integrated

Safety engineering has been integrated into the standard automation for several years - on the basis of SIMATIC S7 Controllers, PROFIBUS and PROFIsafe. Since then, this trend-setting solution has proved successful in many thousands of applications worldwide.

The product spectrum of Safety Integrated comprises all necessary components from sensors and controllers to the actuators and is certified for the Safety Integrated Levels of the IEC 61508 up to SIL 3, as well as Category 4 of the EN 954-1.

Expansion with PROFINET

The range has now been extended to include PROFINET-standard components, so that a complete product range with failsafe controllers, failsafe distributed IO and a corresponding engineering environment is available with immediate effect. This includes controllers for the mid to upper performance range, digital input/output modules as well as motor starters and frequency converters with IP20 protection and also IP65/67 protection for cabinet-free construction.
The new failsafe controllers have interfaces for PROFIBUS and PROFINET. The failsafe input/output modules can be operated via corresponding bus interface modules that can be connected either to PROFIBUS or PROFINET.

PROFIsafe protocol

The "PROFIsafe" protocol profile, first developed for PROFIBUS DP, is used for communication between fail-safe controllers (SIMATIC, SINUMERIK) and fail-safe distributed I/Os. PROFIsafe was the first communication standard based on IEC 61508 to allow standard communication and fail-safe communication on the same bus. With SIL3 (Safety Integrity Level 3), Category 4 (EN 954-1) it fulfills the highest demands for the manufacturing and process industries. PROFIsafe has been tested and approved by TÜV (German Technical Inspectorate) and by the BGIA (BG-Institute for Occupational Safety and Health).

PROFIsafe Openness

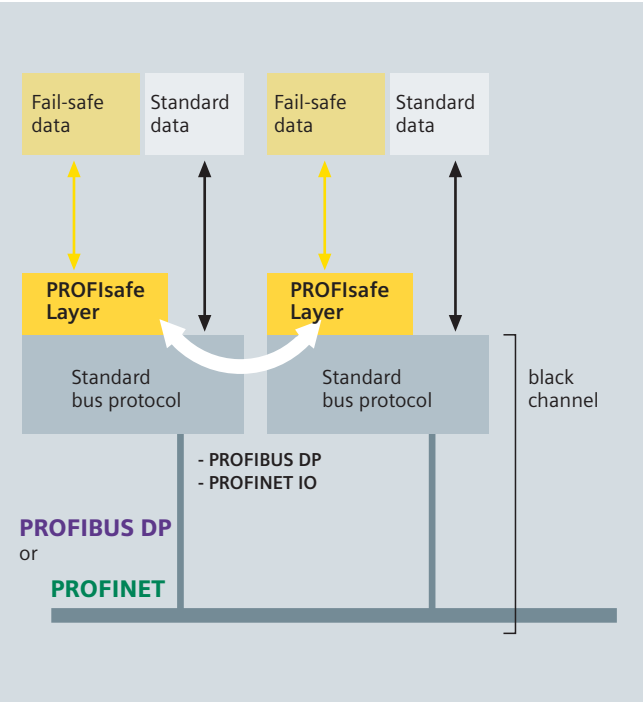
The PROFIsafe protocol V2 supports fail-safe communication for the open standard busses – either the well-proven **PROFIBUS DP** or all variants of the new fast bus system **PROFINET IO**. With the PA version PROFIBUS PA (IEC 61158-2) the integrated distributed automation expands into the process world, e.g. in hazardous areas. PROFIsafe is also use in the state-of-the-art radio technology.

PROFIsafe functionality

PROFIsafe prevents transmission errors due to problems such as incorrect addressing, loss, delay etc. by:

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

The fail-safe SIMATIC components are part of **Safety Integrated**, the Siemens safety program based on SIRIUS, SIMATIC and SINUMERIC/SIMODRIVE products. PROFIsafe and ASIsafe are used for fail-safe communication. You find detailed informationen on Fail-safe communication in the "Safety Integrated system manual", 5th edition, chapter 4.



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

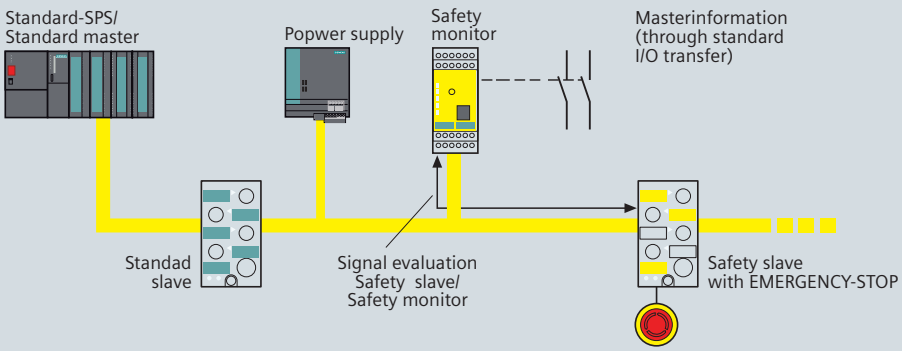
Some advantages at a glance

- Same operating philosophy for standard and safety-related communication
- One PROFIBUS/PROFINET cable for both standard and safety-related communication
- Uniform configuring of standard and safety-related communication
- One engineering tool for the creation of standard and safety program
- Comfortable duplication of a solution on several machines/plants by copying the safety program
- Common data management for standard and safety program
- Shorter standstill times due to integrated diagnostics from sensors over the controller to the HMI system
- Support of fail-safe communi-cation via Wireless LAN

ASIsafe

The fail-safe SIMATIC components are part of **Safety Integrated**, the Siemens safety program based on SIRIUS, SIMATIC and SINUMERIC/SIMODRIVE products. PROFIsafe and ASIsafe are used for fail-safe communication. You find detailed informationen on Fail-safe communication in the "Safety Integrated system manual", 5th edition, chapter 4.

ASIsafe



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

Some advantages at a glance

- Minimum maintenance and standstill times due to integrated diagnostics
- Possibility of a costeffective design, without fail-safe PLC and without a special master
- Increased flexibility through software-supported configuration
- Comfortable duplication of a solution on several machines/plants by copying of the safety program
- Faster overview of plant safety functionality using a simple graphical tool
- Direct, simple integration of hardware such as emergency-off switches, protective door switches or safety light arrays through integral AS-Interface slaves

Configuration software asimon2+

Simpler system commissioning

- Progressive teach-in of code sequences of secure AS-I slaves with diagnostic information
- Selectable number of simulated slaves

Simpler diagnosis via AS interface

- Assignment of a fixed diagnosis index to the software function block
- Signalling of signal and relay outputs via AS interface

New function blocks

- Monitoring block "zero sequence detection"
- Start blocks "activation via standard slave" and "activation via monitor input" (level sensitive)
- Block "operational ON/OFF switching via monitor input"

Extension of function blocks

- Monitoring blocks with selectable functions "on site acknowledgement" and "starting test"
- Output blocks "door lock by delay time" and "door lock by zero-speed switch and delay time" now optionally with STOP1 for release circuit 1

High-availability communication and redundancy

Process or field communication

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

High-availability systems

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

In the case of a failsafe, fault-tolerant construction, the communication between the failsafe CPUs takes place via failsafe S7 communication blocks.

Redundant networks

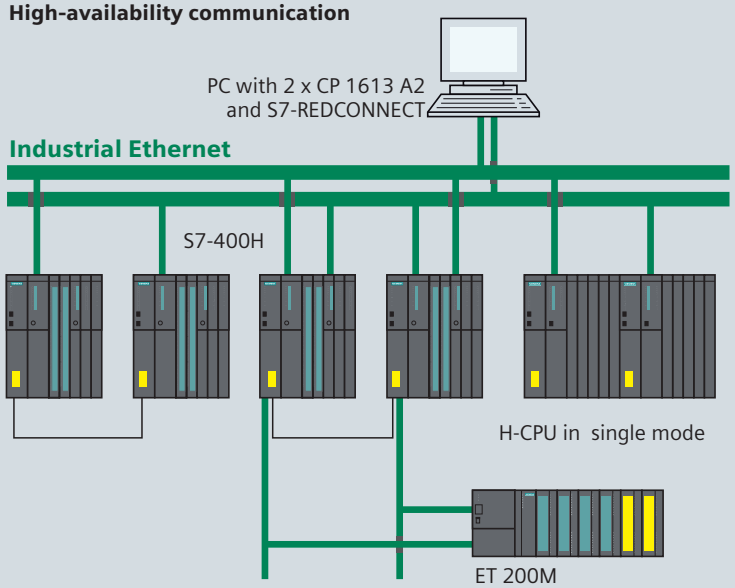
S7-REDCONNECT ensures problem-free communication between PC-applications (such as WinCC) and the S7-400H via redundant networks. PC-applications which already use S7 communication (e.g. via the OPC interface) may continue to be used without any modifications. Industrial Ethernet and PROFIBUS networks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

High-speed redundancy

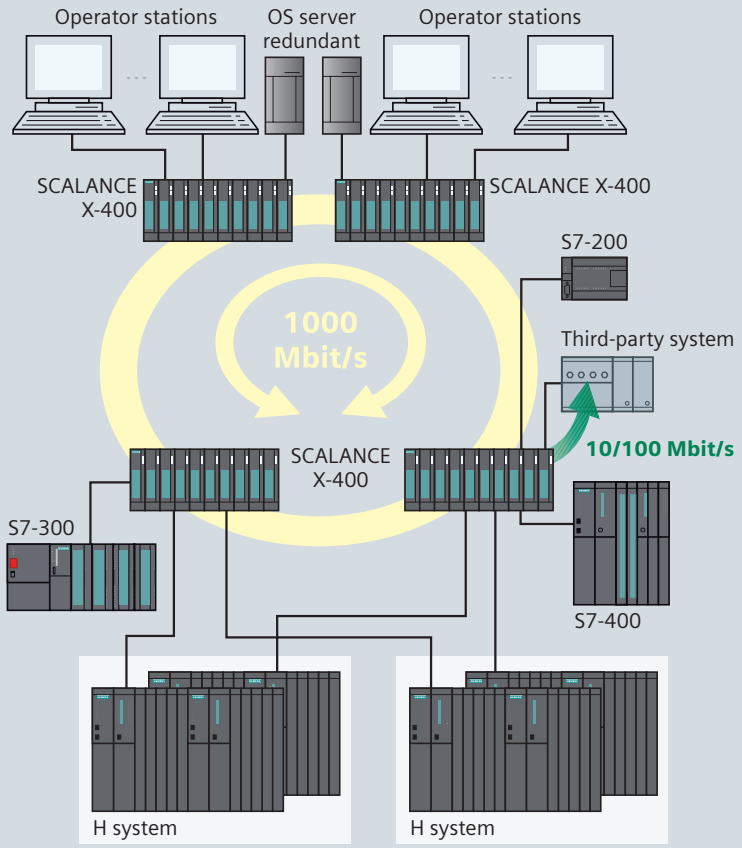
Extremely fast reconfiguration of the network following an error is indispensable for industrial applications, because the connected data terminals will otherwise disconnect logical communication links. This would result in a process running out of control or emergency shutdown of the plant.

To achieve the necessary fast response times, SIMATIC NET uses a specially developed procedure for controlling redundancy. After an error (cable break or switch failure) a network can then be reconfigured to form a functional network infrastructure in a fraction of a second (less than 0.3 seconds in an optical ring consisting of 50 switches) and logical connections are not disconnected.

High-availability communication



Redundant networks



Fault messages, Telecontrol and monitoring
SINAUT Telecontrol

SINAUT, the telecontrol system based on SIMATIC S7, is made up of two independent systems:

- SINAUT ST7
  Versatile telecontrol system based on SIMATIC S7-300, SIMATIC S7-400 and WinCC for fully automatic monitoring and control of process stations exchanging data with each other or with one or several control centers via WAN or Ethernet (TCP/IP).
- SINAUT MICRO
  For monitoring and controlling distributed plants by means of wireless communication (GPRS) based on S7-200 and WinCC flexible or WinCC. Thanks to its bidirectional communication feature SINAUT MICRO can fulfil simple telecontrol tasks.

For both systems an OPC server is offered permitting connection to an external centralized control system (OPC client).

SINAUT ST7

SINAUT ST7 allows a unified communication concept (TIA) and complete integration into the SIMATIC environment. Due to modular layout and support of different network forms and operating modes including Ethernet, flexible network structures can be created that may also contain redundant interfaces.

The networks can be optimally adapted to local conditions by making use of all transmission media available (e.g., dedicated lines, radio transmission, public switched systems, SMS, FAX).

The supplied software packages and STEP 7 allow an easy and cost-efficient initial configuration of highly complex networks and extensions.

Control center

As the central control station you can have:

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

SINAUT WAN networks

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

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

SINAUT via Ethernet

SINAUT communication over Ethernet or TCP/IP-based networks is possible between the station and the control point as well as between stations. Requirements for this are fixed IP addresses and connections similar to dedicated lines.

Event triggered data transmission

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

Local data storage

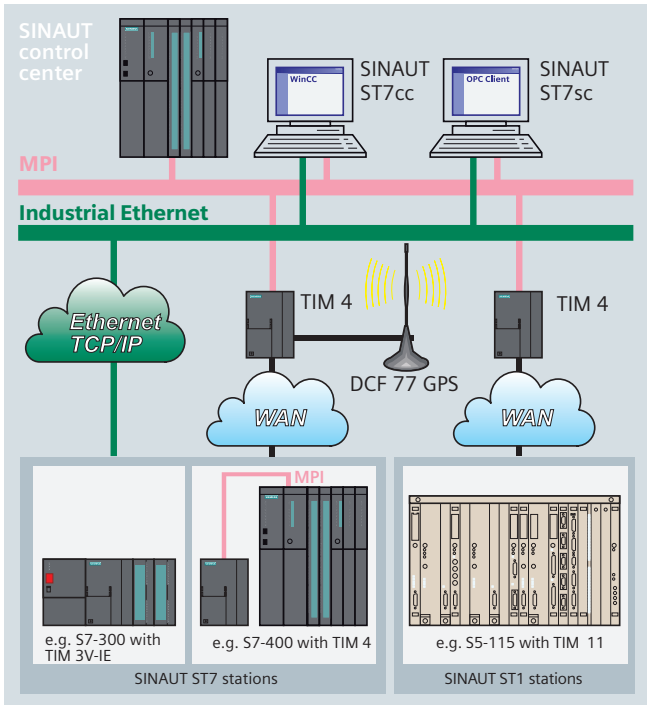
A special feature of the SINAUT ST7 system transmission module TIM is the local storage of the data frames (incl. time stamp) if the communication path is down, if a partner fails or if costs are to be minimized in a dial-up network.

Date and time are always up-to-date

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

SINAUT remote programming and diagnostics

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



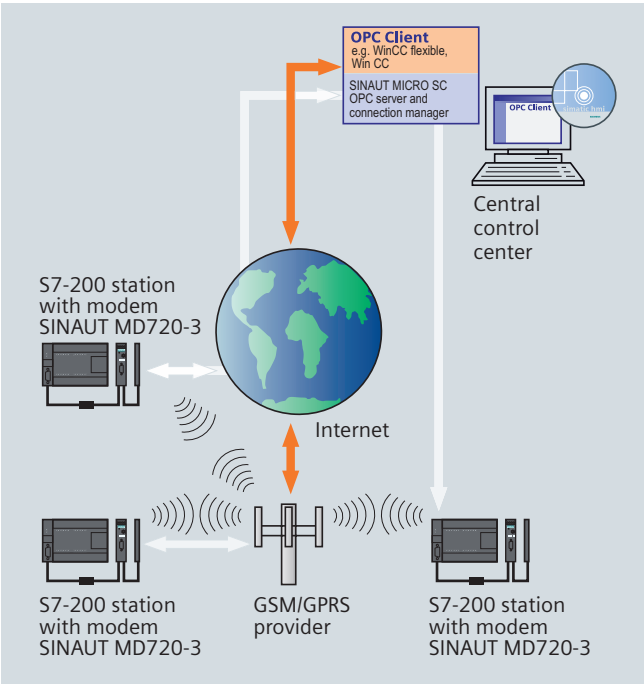
SINAUT MICRO

SINAUT MICRO is a cost-efficient supplement for monitoring and controlling simple telecontrol tasks. It consists of a GSM-GPRS modem, an OPC and connection management software optimized for GPRS and a S7-200 program block package. With this package up to 256 SIMATIC S7-200 stations can easily and safely communicate with each other and with the control center over the GPRS mobile network. They are permanently online. SINAUT MICRO is the ideal solution for transmitting smaller volumes of data wirelessly. The system is configured with STEP 7 Micro/WIN.

The maintenance personnel can access the secured center from their home PCs via Internet Browser and query or set current values of the connected S7-200 stations. This means, for example, that fault messages directly sent by S7-200 remote stations and received by mobile phone in the form of SMS or faxes can be immediately analyzed in the center, which shortens reaction times considerably.

The routing functionality of the OPC server SINAUT MICRO SC allows bidirectional communication between S7-200 stations connected via the SINAUT MD720-3 modem.

Under WinCC the OPC server SINAUT MICRO can be combined with SINAUT ST7cc to create a cost-optimized central fault signalling and telecontrol system that can be extended as required.



SIMATIC TeleService

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

Diagnostics

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

Industrial Ethernet diagnostics

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

Diagnostics with STEP 7/SIMOTION SCOUT

STEP 7 offers:

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

Diagnostics using IT functions

Pre-configured diagnostic pages can be displayd on a system with standard web browsers.

The following communications processors and network components support diagnostics using IT functions:

- S7-300 CPU with PROFINET interface
- S7-400 CPU with PROFINET interface
- CP 243-1 IT
- CP 343-1 Advanced
- CP 443-1 Advanced
- CP 1616
- CP 1604
- SCALANCE X-200 and X-400
- SCALANCE W-700
- SIMOTION with the option SIMOTION IT diagnostics
- SINUMERIK with MCIS products

SNMP diagnostics

SNMP (Simple Network Management Protocol) is a special protocol for the administration of TCP/IP networks.

- PROFINET devices also support diagnostics via SNMP.
- The following Industrial Ethernet components offer diagnostic possibilities via SNMP:
  - SNMP OPC-Server
  - Industrial Ethernet Switches (SCALANCE X, OSM, ESM, ELS)

The use of SNMP OPC Server enables access to device information from SNMP capable Ethernet components via the OPC interface. In addition simple diagnostics and detailed information about network load or redundant network structures can also be displayed.

Diagnostic features with Industrial Ethernet Switches:

- Display of information about the status of the network
- On-site diag-nostics of data traffic with LED
- Remote diagnostics, integrated in STEP 7

PROFIBUS diagnostics

Commissioning with the bus tester

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

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

Operation with the Diagnostics-repeater

The diagnostics repeater is capable of diagnosing the cable during operation. It shows the topology of the automation systems and recognizes the following cable errors:

- Wire-break
- Short circuit of signal cables
- Missing terminating resistor

Diagnostics in STEP 7/SIMOTION SCOUT

In STEP 7/SIMOTION SCOUT the automation system topology is displayed graphically (overview diagnostics). Diagnostics symbols indicate diagnostics information about the monitored devices (e.g. PROFIBUS slave failed).
A detailed window gives more detailed information about the individual modules (module status), for example:

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

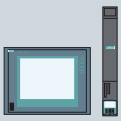
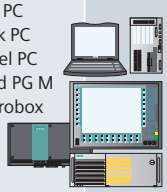
Practical data

Bus system	AS-Interface	PROFIBUS DP	Industial Ethernet / PROFINET
Criterion			
Data transmission rate	Updating time of ≤ 5 ms	9.6 Kbit/s – 12 Mbit/s selectable 31.25 Kbit/s [1)]	10/100 Mbit/s 1 Gbit/s (not with PROFINET)
Number of nodes maximum	62	125 125 DP/PA Links [1)] 31 field devices per [1)] DP/PA Link	more than 1000
Network size • LAN (Local Area Network)	electrical up to 600 m: - with Extension Plug up to 200 m - with Repeater or Extender up to 300 m - with Repeater and Extension Plug up to 600 m	- electrical up to 9.6 km - optical up to 90 km Intrins. safe: max 1.0 km [1)] non intrins. safe: 1.9 km [1)]	- electrical up to 5 km - optical up to 150 km
• WAN (Wide Area Network)			- worldwide using TCP/IP - wireless LAN
Topology	Line Tree Star	Line Tree Ring Star	Line Tree Ring Star

[1)] with PROFIBUS PA

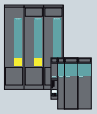
The table contains values gained from our experiences on different sites and ist intended to serve as a recommendation for the selection of the optimum network.

Industrial Ethernet devices and services
Communications processor (CP) – supported functions

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	PROFINET CBA	PROFINET IO	IT function	PROFIsafe
SIMATIC									
S7-200		CP 243-1	■	■					
		CP 243-1 IT	■	■				■	
S7-300 C7		CP 343-1	■	■	■	■	■		
		CP 343-1 Advanced	■	■	■	■	■	■	
		CP 343-1 Lean	■	■ 1)	■		■ 2)		
		TIM 3V-IE	■	■ 3)					
		TIM 3V-IE Advanced	■	■ 3)					
S7-400		CP 443-1	■	■	■				
		CP 443-1 Advanced	■	■	■	■	■	■	■ 4)
SIMATIC TDC		CP 5100			■				
		CP 51M1			■				
PCS 7 PC	 S7-1613 S7-REDCONNECT Development Kit DK-16xx PN IO	CP 1613 A2	■	■	■				
		CP 1616					■		
		CP 443-1	■	■	■				
SIMOTION									
SIMOTION P/D		MCI-PN 5)	■	■			■	■ 7)	
		CBE 30 6)	■	■			■	■ 7)	
SIMATIC PC/PG									
Box PC Rack PC Panel PC Field PG M Microbox	 S7-1613 S7-REDCONNECT Development Kit DK-16xx PN IO SOFTNET PN IO PN CBA OPC-Server SOFTNET S7/ SOFTNET S7 Lean	CP 1613 A2	■	■	■				
		CP 1616					■		
		CP 1604					■		
		CP 1612					■		
		CP 1612				■			
		CP 1612	■	■	■				
		CP 7515	■	■	■				
PC-based Automation									
WinAC	 WinAC Basis, WinAC RTX WinAC Slot 412/416	CP 1613 A2/1612 8)	■	■	■ 9)	■ 10)			
		CP 1613 A2/1612 8)	■	■					

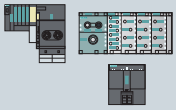
1) Only as server
2) IO device only
3) Only with SINAUT ST7 telecontrol protocol
4) With CPU 416F
5) In connection with SIMOTION P
6) In connection with SIMOTION D
7) In connection with SIMOTION IT-Diag
8) Also with integrated Ethernet interface of SIMATIC PC
9) With Industrial DataBridge
10) WinAC Basis with optional package

Communications processor (CP) – supported functions

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	PROFINET CBA	PROFINET IO	IT funktion	PROFIsafe
SINAMICS									
S120		CBE 20 for SINAMICS S120 Multi-axis layout with CU 320	■				■		
SINUMERIK									
840D		CP 343-1	■	■	■	■	■		
		CP 343-1 Advanced	■	■	■	■	■	■	
Netzkomponenten [1]									
SCALANCE X-200 X-200IRT		X204-2 / X204-2LD X206-1 / X206-1LD X208 / X208PRO X202-2IRT / X204IRT X200-4P IRT / X201-3P IRT X202-2P IRT					■	■	
SCALANCE X-400		X414-3E						■	
SCALANCE W		W-780/W-740						■	
		IE/AS-i LINK PN IO					■	■	
		IWLAN/PB LINK PN IO					■	■	

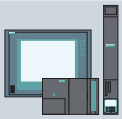
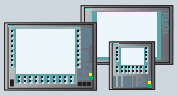
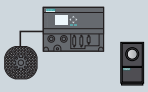
1) The components of the SCALANCE X, SCALANCE W and SCALANCE S product families can be used in all Industrial Ethernet networks for both, the configuration of the network and for data processing

Integrated interface – supported functions

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	PROFINET CBA	PROFINET IO	IT function	PROFIsafe
SIMATIC									
S7-300 C7		CPU 315/317-2 PN/DP	■	■	■ [1]	■	■		
		CPU 315/317F-2 PN/DP	■	■	■ [1]	■	■		■
		CPU 319-3 PN/DP	■	■	■ [1]	■	■		
S7-400		CPU 414-3 PN/DP	■	■	■ [1]	■	■		
		CPU 416-3 PN/DP	■	■	■ [1]	■	■		
		CPU 416F-3 PN/DP	■	■	■ [1]	■	■		■
ET 200S ET 200pro		IM 151-3 PN	■				■		
		IM 151-3 PN HF IM 151-3 PN FO	■				■		■
		IM 154-4 PN HF	■				■		■
		PN/PN Coupler	■				■		■

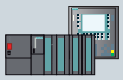
1) open Industrial Ethernet communication

Industrial Ethernet devices and services
Integrated interface – supported functions

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	PROFINET CBA	PROFINET IO	IT function	PROFIsafe
SINAMICS									
S120		CU 310 PN for SINAMICS S120 AC-Drives	■				■		
SINUMERIK									
		810D/840D	■ 1)	■				■	
		840D sl	■					■	
		840Di/Di sl	■					■	
SIMOTION									
SIMOTION C/P/D		integrated interface	■	■	■			■ 2)	
SIMATIC PC/PG									
Box PC Rack PC Panel PC Field PG M		SOFTNET S7/ S7 Lean	integrated interface	■	■	■			
		SOFTNET PN IO	integrated interface					■	
		PN CBA OPC server	integrated interface				■		
PC-based Automation									
WinAC		WinAC MP	integrated interface	■	■				
SIMATIC HMI									
Panels		TP/OP 270, MP 270/MP 370	■	■					
		TP/OP 177	■	■					
Visualization software PC/PG		WinCC flexible	■	■					
		WinCC	■	■	■				
SIMATIC Sensors									
Machine vision		VS 120/VS 130-2		■			■		
		VS 72x		■					
RFID-Systeme		RF180C		■			■		

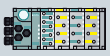
1) With SINUMERIK PCU 50/50.3/70
2) In connection with SIMOTION IT-Diag

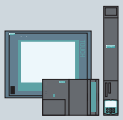
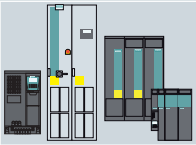
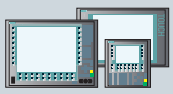
PROFIBUS devices and services
Communications processors (CP) – supported functions

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	DP/PA	FMS	OPC	PROFIsafe
SIMATIC									
S7-300 C7		CP 342-5/CP 342-5 FO	■	■	■	■			
		CP 343-5	■	■	■		■		
S7-400		CP 443-5 Basic	■	■	■		■		
		CP 443-5 Extended	■	■	■	■			■ (with CPU 416F)
		IM 467/467 FO				■			
SIMATIC TDC		CP 50M0				■			
SIMOCODE pro									
		CP 5512	■	■	■	■			
		CP 5611 A2	■	■	■	■			
SINUMERIK									
840D		CP 342-5/CP 342-5FO	■	■	■	■			
		CP 343-5	■	■	■		■		
SIMATIC PC/PG									
Box PC Rack PC Panel PC Field PG M		SOFTNET-DP SOFTNET-DP Slave CP 5512/CP 5611 A2	■ 1)		■ 2)	■		■	
		SOFTNET-S7 CP 5512/CP 5611 A2	■ 1)	■	■			■	
		DP-5613 CP with DP base CP 5613 A2/CP 5613 FO	■		■	■		■	
		S7-5613 CP 5614 A2/CP 5614 FO	■	■	■			■	
		FMS-5613 CP 5614 A2/CP 5614 FO	■		■		■	■	
PC-based Automation									
WinAC		WinAC RTX CP 5613 A2	■	■		■ (without PA)			
		WinAC base CP 5611 A2	■	■		■ (without PA)			
		CP 5613 A2	■	■		■ (without PA)			
PC/Notebook									
PC		SOFTNET-DP SOFTNET-DP Slave CP 5512/CP 5611 A2	■ 1)		■ 2)	■		■	
		SOFTNET-S7 CP 5512/CP 5611 A2	■ 1)	■	■			■	
		DP-5613 CP with DP base CP 5613 A2/CP 5613 FO	■		■	■		■	
		S7-5613 CP 5614 A2/CP 5614 FO	■	■	■			■	
		FMS-5613 CP 5614 A2/CP 5614 FO	■		■		■	■	

1) In connection with STEP 7
2) Not with SOFTNET-DP slave

Integrated interface – supported functions

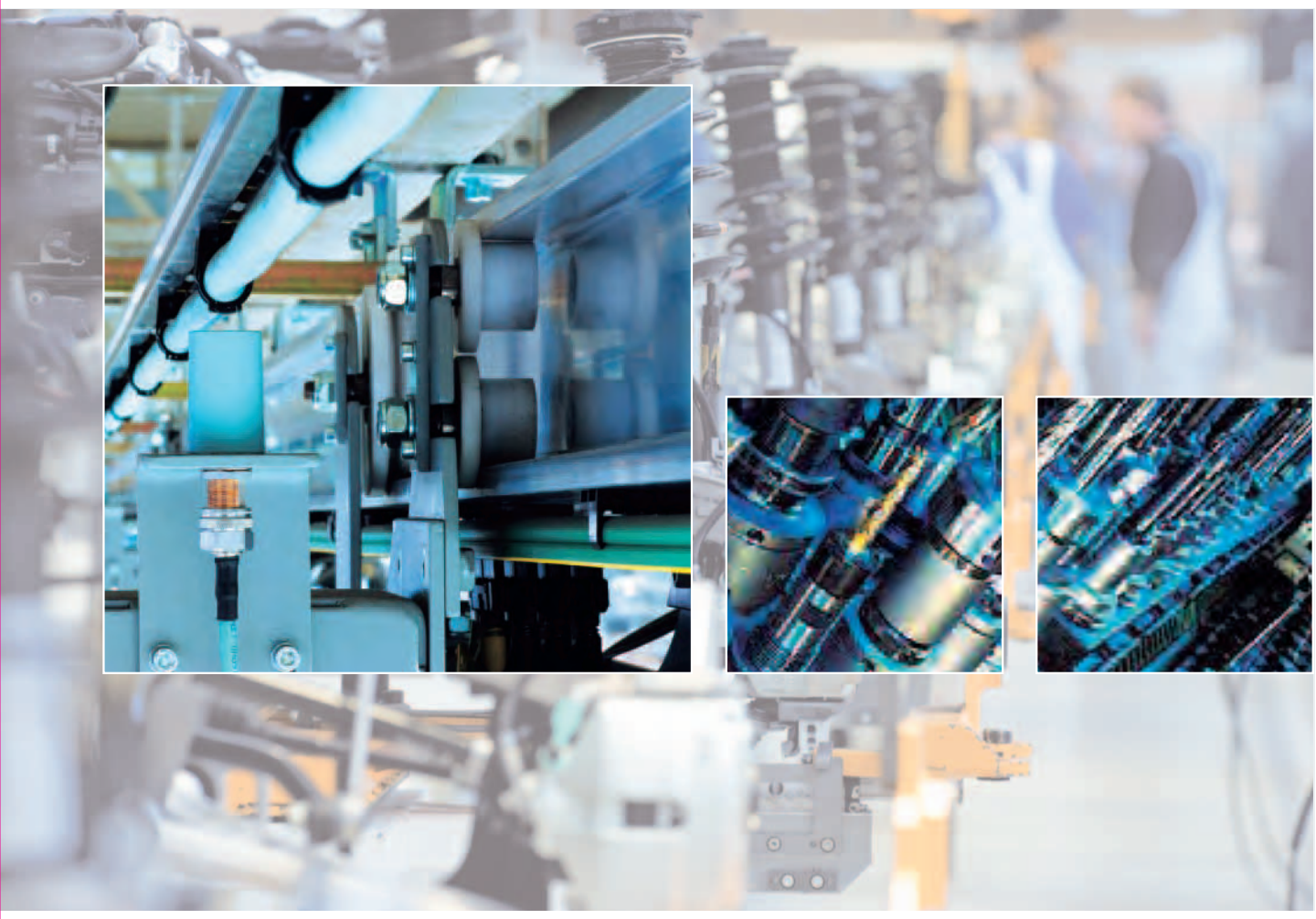
The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	DP/PA	FMS	OPC	PROFIsafe
SIMATIC									
S7-300 C7									
		C7-635/636	■	■		■			
		CPU 315F/317F	■	■		■			■
S7-400									
		CPU 414H/417H	■	■		■			■
		CPU 416F	■	■		■			■
		CPU 41x -2/3 FM 458-1 DP (synchronous)	■	■		■			
		CPUs with DP interface	■	■		■			
ET 200S									
		IM 151-1	■			■			
		IM 151-1 HF	■			■			■
		IM 151-7 CPU	■	■		■			
		IM 151-7 F-CPU	■	■		■			■
ET 200eco									
		BM141/-142/-143/-148	■			■			■ (BM 148 only)
ET 200M									
		IM 153-1	■			■			
		IM 153-2	■	■		■			■
ET 200pro									
		IM 154-1 DP	■			■			
		IM 154-2 DP HF	■			■			■
SINUMERIK									
									
		810D/840Di/840Di sl	■	■		■			
		840D/840D sl	■	■		■			■ (from NCU *.4)

The following products support the listed functions or can be used in connection with this function.		Product	PG/OP	S7 communication	S5 compatible communication	DP/PA	FMS	OPC	PROFIsafe
SIMOTION									
SIMOTION C/P/D		C230-2	■	■		■		■	
		P350	■	■		■		■	
		D425/435/445	■	■		■		■	
SINAMICS									
		G120/G130/150, S120/150	■			■			■ (SINAMICS G120 only)
SIMATIC PC/PG									
Box PC Rack PC Panel PC Field PG M		SOFTNET-DP • Box PC 627/840/ Microbox PC 420 • Rack PC 840/IL43 • Panel PC 477/577/ 677/877 • Field PG M	■ 1)		■	■		■	
		SOFTNET-DP Slave	■ 1)			■		■	
PC-based Automation									
WinAC		WinAC Slot 412/416	■	■		■			
		WinAC MP	■			■			
SIMATIC HMI									
Panels		OP, TP, MP	■	■	■				
Visualization software PC/PG		WinCC flexible	■	■	■			■	
		WinCC	■	■	■	■	■	■	
SIMATIC Sensors									
Machine vision		VS 120/VS 130-2		■					
		VS 72x		■					
RFID systems		ASM 456		■		■			

1) in connection with STEP 7

Industrial Communication from Automation and Drives – Advantages at a glance

- **Overall solution from the bus system right up to the engineering and diagnostics tools**
- **Investment protection thanks to compatible further development based on international standards**
- **Establishment of networked, safety-related applications using the PROFIsafe safety profile for PROFIBUS and PROFINET**
- **Integrated communication from the field level to the enterprise level (Enterprise Resource Planning)**
- **Real-time communication and data transfer on an Ethernet bus system**
- **High degree of mobility and flexibility through Industrial Wireless LAN**
- **Reliable protection of the automation solution against addressing errors or unauthorized access, for example**
- **Reliable, rugged and safe network components with integral diagnostics functions**



Fax form

This publication has provided you with an overview of communication methods and networks used in Totally Integrated Automation. Brochures and catalogs are available to provide more detailed information on specific devices, technologies and functionalities.
Please use this fax form and you will receive the documentation you request within a few days.
We thank you for your interest and are looking forward to receiving your fax!

Brochures

- ☐ Totally Integrated Automation
- ☐ Component Based Automation
- ☐ SIMATIC PCS 7 Process Control System
- ☐ Network solutions with Industrial Ethernet
- ☐ PROFINET
- ☐ Industrial Ethernet Communication / SCALANCE X
- ☐ Industrial Ethernet FastConnect
- ☐ Industrial Mobile Communication / SCALANCE W
- ☐ Industrial Security / SCALANCE S
- ☐ Network solutions with PROFIBUS
- ☐ AS-Interface
- ☐ SIMATIC Controller
- ☐ SIMATIC S7-200
- ☐ SIMATIC Technology
- ☐ SIMATIC Safety Integrated
- ☐ SIMATIC ET 200
- ☐ Logic module LOGO!
- ☐ SIMATIC PC
- ☐ SIMATIC Industrie Software
- ☐ SIMATIC IT
- ☐ SIMATIC Panels
- ☐ SIMATIC WinCC flexible
- ☐ SIMOTION
- ☐ SINAMICS
- ☐ SINUMERIK
- ☐ Variable-Speed Drives
- ☐ SIMATIC Sensors
- ☐ SINAUT TELECONTROL
- ☐ SIMATIC Power Rail Booster
- ☐ SIMOCODE pro – SIRIUS motor management and control devices

Catalogs

- ☐ The offline Mall of Automation and Drives Catalog CA01 - on CD-ROM

Please send your fax to:

Siemens AG,
Infoservice A&D/Z068

++49 9 11 - 9 78 33 21

From

Name

Company

Position

ZIP code/City

Country

Street

Telephone

Fax

Further Information can be found in the Internet

Technical documentation can be found in the SIMATIC Manuals Guide:
www.siemens.com/simatic-doku

For a personal meeting you will find the contact partner in your area under:
www.siemens.com/automation/partner

You can order online in the Internet at the A&D mall under:
www.siemens.com/automation/mall

All about PROFINET can be found under:
www.siemens.com/profinet

Additional information about SIMATIC NET can be found under:
www.siemens.com/automation/simatic-net

In various SIMATIC NET components (e.g. SCALANCE, OSM/ESM, CPs with IT functions) comprehensive parameter and diagnostic functions (e.g. Web Server, network management) are available via open protocols and interfaces.
The open interfaces create an access to components which can however result in misuse though illegal activities.
By using these functions and the open interfaces and protocols (e.g. SNMP, HTTP, Telnet) suitable security measurements should be taken to ensure there is no unauthorized access to components and networks, particularly those connected to the WAN/Internet.
Automation networks should be separated from the company network by means of suitable firewall systems, e.g. SCALANCE S.

Subject to change without prior notice| Order No. 6ZB5530-1AE02-0BB0 | DISPO 26000 | KB 0406 WE 5. EN / 601389 | Printed in Germany |

Siemens AG

Automation and Drives
Industrial Automation Systems
Postfach 48 48
90327 NÜRNBERG
GERMANY

www.siemens.com/automation