Configurations for communication

applications
& TOOLS

Selection Criteria for Networks and Services

SIEMENS

Contents

1 Introduction

1.1 What are selection criteria ?

The aim of the selection criteria is to facilitate the selection of the right components.

The selection criteria provide the different **comparison criteria** (properties, features etc.) of the different **components** in a concise way. If it is possible or useful these comparison criteria are also evaluated.

The selection criteria are provided in the form of tables, the components are listed in the top line and the corresponding comparison criteria in the first column.

Table 1-1

	Component 1	**Component 2**	**Component 3**
Comparison Criteria 1			
Comparison Criteria 2			
Comparison Criteria 2			

1.2 What are functional models?

Functional models are to explain system correlations and background information of the comparison criteria listed in the selection criteria. They provide the background knowledge required in order to effectively use the selection criteria.

1.3 Brief description of this document

This document includes selection criteria and functional models for the SIMATIC communication possibilities and the corresponding properties.

The **selection criteria** contain the characteristics for:

- The selection criteria of the networks
- The selection criteria of the communications services.

The **functional models** comprise amongst others the following topics:

- Features of the communications networks and services
- Description of the bus access methods
- Correlation of connection and connection resources.
- Routing
- Clock-synchronization and equidistance
- IT functions for SIMATIC automation devices
- Concept for Component based Automation

2 Selection criteria for communication networks and services

This section provides the criteria for the selection of communications networks or services. This information is provided in the form of tables in which a number of networks or services are compared with one another. The selection criteria are subdivided into two sub-sections of equal importance.

2.1 Selection criteria for communications networks

According to the individual requirements of the automation levels (command, cell, field, and actuator-sensor level), there are different communication networks for industrial communication.

- You are provided with a selection of systems which can be connected to the different communication networks.
- Possible components which can be connected to the individual network type are also listed.
- Characteristics and properties of the network types are compared with one another.
- A selection of important further network functions is given.
- You are provided with a comparison explaining which communication services can be operated via which network.

2.2 Selection criteria of the communications services

Industrial communication is based on different sub-networks on which different services are available.

- The interfaces for the S7-300/400, the C7, and for PG/PC to the different communication services are listed.
- You are provided with an overview of the important properties of the individual communication services.
- You will learn whether there are acknowledgement mechanisms for the different communication services and on which protocol level these mechanisms are used.
- The corresponding specification of inputs for the individual communication service is listed with respect to the user interface.
- Figures for data consistency in the individual communications services are provided.

2.1 Selection criteria of the communication networks

The industrial communication networks used in the SIMATIC are explained and compared with one another. Networks for *process and field communication* as well as for *data communication* are listed. The key topics are the following:

Comparison of network types and connectable systems In this table, a selection of connectable systems is evaluated with regard to the network type via which the different connectable systems can best be integrated into the communication.
Connecting systems and devices to a network For the SIMATIC S7, C7, and for PG/PC, the modules and software required to connect them to a communications network are listed. Connection for SIMATIC S7 and C7 Connection for PG, PC
Important characteristics and properties of the networks This table contains important properties and characteristics for the individual network types and compares them with other network types.
Network functions When selecting a network type and a system connection, certain functions may be important which are described by the network properties but which are not necessarily integrated in the system connection (e.g. HTML browser for IT functions). A number of network functions are compared with one another with regard to the network types.
Available communications services/functions for a network type This table informs you on the individual communications services which are available via a selected network. This table is also an introduction to the second sub-section of the selection criteria, the “Selection criteria of the communications services“ where the individual communications services are compared with one another.

2.1.1 Comparison of network types and connectable systems

You want to integrate a certain device into the communication. The following table provides a selection of the current systems in the field of automation. For the underlined systems, the hardware and software required for the connection to the respective communications network is listed in the subsequent tables.

Networks / Connectable systems	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**WLAN**
Direct connection	- not possible / + possible / ++ recommended							
Analog and binary inputs/outputs	++	++	+	-	-	-	-	-
Intelligent field devices (e.g. ET200)	-	++	+	-	-	-	-	-
Field devices in the ex-range	-	-	++	-	-	-	-	-
EIB components	-	-	-	++	-	-	-	-
Motion Control	-	++ 1)	-	-	-	-	-	-
SIMATIC S7/C7	-	++	-	-	++	++	++	(+) 2)
SIMATIC HMI	-	++	-	-	++	++	++	+
S5, SIMATIC 505	-	+	-	-	-	++	++	-
PCS7 ES/OS 3)	-	-	-	-	-	-	++	-
PCS7 AS 3)	-	++	-	-	-	-	++	-
PG / PC and WinAC	-	++	-	+	++	++	++	+

1) Motion Control applications for the clock-synchronized PROFIBUS DP.
2) WLAN: Connection to S7-300 via CP is being prepared.
3) For PCS7 V6.0 recommended connections for engineering systems (ES), operating systems (OS), and automation systems (AS).

2.1.2 Connecting systems and devices to a network

- This chapter explains components for the connection of the **SIMATIC S7/C7** and of **PG/PCs** to a communications network.

Connections for SIMATIC S7/C7 and for PG/PC are listed separately.

Interfaces for the connection of SIMATIC S7-200/300/400 and C7 to a network
Interfaces for the connection of a PG/PC to a network

2.1.2.1 Interfaces to connect the SIMATIC S7-200/300/400 and C7 to a network

The table below comprises a list of possible **communication processors (CP)** and **interface modules (IM)** for the direct connection of the **S7-200/300/400** and the **SIMATIC C7** to a communications network. The central processing units (CPU) and their integrated interfaces are not listed in this table. These can be found in the catalog CA01 or in the A&D Mall.

Networks / Connection	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Indirect connection via bus couplers and links	DP/ASi - Link		DP/PA-Koppler und -Link	DP/EIB-Link				
S7-200	CP 243-2	EM 277			EM 277		CP 243-1	
							CP 243-1 IT	
S7-300/C7 1)	CP 343-2P	CP 342-5				CP 343-5	CP 343-1	CP 343-7 (being prepared)
	C7-621 ASi (integrated)	CP 342-5 FO					CP 343-1IT	
							CP 343-1 PN	
S7-400		CP 443-5 Extended				CP 443-5 Basic	CP 443-1	
		IM 467					CP 443-1 IT	

Networks / Connection	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
S7-400		IM 467 FO					CP 444 MAP	

1) The central processing units of the SIMATIC C7 and the S7-300 are identical with regard to their functions. For further information please refer to the catalog CA01 or the A&D Mall.

2.1.2.2 Interfaces to connect PG and PC to a network

The following table comprises a list of the interfaces for the connection of PG and PC to a communications network. The connection is realized via **hardnet** or **softnet** communication processors (CP).

For both hardnet and softnet communication processors additional **driver software** is required for the access to the respective communications service. This software is marked in red with software and is listed below the CP.

Networks / Connection	Process or field communication				Data communication			
	AS interface	PROFIBUS DP	PROFIBUS PA	EIB	MPI	PROFIBUS	Industrial Ethernet	Wireless LAN
Hardnet cards	1)							
PG, PC 2)		CP5613 (PCI) Software: DP-5613			CP5613 (PCI)	CP5613 (PCI) Software: S7-5613 FMS-5613	CP 1613 Software: IE S7-1613 IE PG-1613 IE TF-1613	
		CP5613 FO (PCI) Software: like CP5613 (PCI)			CP5613 FO (PCI)	CP5613 FO (PCI) Software: like CP5613 (PCI)		
PG, PC		CP5614 (PCI) Software: like CP5613 (PCI)			CP5614 (PCI)	CP5614 (PCI) Software: like CP5613 (PCI)		

Networks / Connection	Process or field communication				Data communication			
	AS interface	PROFIBUS DP	PROFIBUS PA	EIB	MPI	PROFIBUS	Industrial Ethernet	Wireless LAN
2)		CP5614 FO (PCI) Software: like CP5613 (PCI)			CP5614 FO (PCI)	CP5614 FO (PCI) Software: like CP5613 (PCI)		
Softnet cards 1)								
PG, PC 2)		CP5511 (PCMCIA) oder: CP 5512 (PC-Card) or: CP 5611 (PCI) Software: PB SOFTNET DP PB SOFTNET DP-Slave			CP5511 (PCMCIA) or: CP 5512 (PC-Card) or: CP 5611 (PCI)	CP5511 (PCMCIA) or: CP 5512 (PC-Card) or: CP 5611 (PCI) Software: PB SOFTNET S7	CP 1612 (PCI) or: CP 1512 (PC-Card) Software: IE SOFTNET-S7 IE SOFTNET PG	CP 1515 (PCMCIA) Software: IE SOFTNET-S7 IE SOFTNET PG *being prepared:* *CP 7515 (PCMCIA)*

1) **Hardnet:** CP with own micro processor. Interface software runs on the CP. Load reduction for the PC regarding communication tasks.
Softnet: CP without micro processor. Protocol software runs on the PC. PC load because of communication tasks.
In case of PCs access to Industrial Ethernet also possible via Ethernet cards, e.g. 3Com (softnet version).

2) PGs feature a CP5611-compatible communication processor for MPI / PROFIBUS.
In case of SIMATIC PCs (panel, box, or rack PC), interfaces can be selected, e.g. PROFIBUS / MPI or Industrial Ethernet. Interfaces to MPI/PROFIBUS are already integrated in the WinAC Slot PLCs.

2.1.3 Characteristics and properties of the networks.

The table below provides important characteristics when selecting a network. Check whether in case of a certain network e.g. the required number of stations can be realized, e.g. for PROFIBUS a maximum of 126 stations.

Networks / Features	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Complete name	Actuator-Sensor Interface	Process Field Bus, Distributed I/O	Process Field Bus, Process Automation	European Installation Bus	Multi -Point - Interface	Process Field Bus	Industrial Ethernet (SINEC H1)	(Industrial) Wireless LAN (also Wireless Ethernet)
Standardization	EN 50295	IEC 61158 / EN 50170	IEC 61158-2 / EN 50170	EN 50090 ENV 13154-2 ENV 13321-2 ANSI EIA 776	SIEMENS-specific (following the PROFIBUS standard)	IEC 61158 / EN 50170	IEEE 802.3 IEEE 802.3u	IEEE 802.11b, (DSSS Modulation) (being prepared: IEEE 802.11a, g, i
Topology	line, tree, star	line, tree, ring, star, redundant ring	line, tree, star	line, tree, star	line	line, tree, ring, star, redundant ring	line, tree, ring, star, redundant ring	IBSS, BSS, ESS (with roaming)
Bus access	Cyclical polling (master-slave method) cyclical data acceptance by the host (PLC, PC)	Token passing and cyclical polling	Token passing and cyclical polling	CSMA/CA	Token passing	Token passing	CSMA/CD	CSMA/CS with acknowledge-ment ACK
Bus administration (station hierarchy)	Master Slave (single master)	Master Slave (multi master)	Master Slave (multi master)	Multi master	Multi master	Multi master	Multi master	Multi master
Transmission rate	167 kbits/sec	up to 12 Mbit/s	31.25 kbits/sec	9.6 kbits/sec	187,5 kbits/s /	up to 12	10 Mbits/s	High: 11

Networks / Features	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
physical					12Mbit/s	Mbits/s	100 Mbits/s for Fast Ethernet 200 MBit/s für Fast Ethernet + Full Duplex	Mbits/s Low: 1 Mbit/s Depending on transmission quality (Fall Back)
Typical cycle time in master/slave systems	max. 5 ms in case of 31 Slaves max. 10 ms in case of 62 slaves (A/B technology)	1 – 2 ms in case of 12 Mbits/s, 5 ms in case of 1,5 Mbits/s	approx. 65 ms, typ. 200ms in case of 31.25 KBits/s	approx. 100 ms	-	-	-	-
Typical user data amount per telegram	4 bits	240 bytes	240 bytes	max. 14 bytes	64 bytes	max 237 bytes	250 bytes	like Industrial Ethernet
Maximum number of stations	31 62 (in A/B-technology)	126	8 in the ex-range 31 in the non-ex-range	per line: 64, max. 12 lines per range, max. 15 ranges, unit: 11520	32 (also 126)	126	more than 1000	like Industrial Ethernet
Typical number of stations	up to 20	20 – 30	approx. 6 in case of ex; 15 - 20 non-ex	200	up to 10	up to16	up to100	5-10 stations per access point (channel), max. 3 channels.

Networks / Features	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Network size locally electrical	max. 500 m (with repeater / extender)	up to 9,6 km	Ex max. 700 m; 1900 m in case of optimal station distribution	Line max. 1000 m	50m 100m (with repeater)	up to 9,6 km	up to1,5 km	-
Network size locally optical	-	up to 90 km	-	up to17 km	up to 100 m	up to 90 km	up to 200 km,	-
Network size locally wireless	-	max 15 m (via infrared module in case of max. 1,5 Mbits/s)	-	Max. 8 m (via infrared) Radio (e.g. accomodation unit)	-	-	-	Inside: up to 30m Outside: up to 100m in case of 11Mbits/s
Redundancy-capable	No	Yes	No	No	No	Yes	Yes	-
Types of protection	IP 20 IP 65 ... 67	IP 20 IP 65 ... 67	IP 20, IP 65-67 [Eex ia]	IP 20, IP44	IP 20	IP 20	IP20	IP20
Connection technology	special insulation displacement technology	RS 485 and OWG	IEC 61158-2, RS485,	RS 232 RJ 45	RS 485 and OWG	RS 485 and OWG	AUI (Ethernet), Sub D in case of ITP, RJ 45	RJ45 (Ethernet)
Bus medium	electrical	electrical optical infrared (15m)	electrical	Twisted Pair, powerline, infrared, radio	electrical optical	electrical optical	electrical optical	Radio in the toll-free 2,4-GHz-ISM-band
ISO/OSI protocol layers	none	1, 2, 7	1, 2, 7	1, 2, 3, 4, 7	1, 2, 7	1, 2, 4, 7	1, 2, 3, 4, 7	1,2,3,4,7
Hamming distance	2	4	4	2	4	4	2	-
Reaction in case of failed transmission	Repetition	Repetition	Repetition	Repetition	Repetition	Repetition	Repetition	Repetition

Networks / Features	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Reaction in case of a failure or switching-off of a station	Error message in case of attempted transmission	Error message in case of attempted transmission	Error message in case of attempted transmission	-	Error message in case of attempted transmission	Error message in case of attempted transmission	Error message in case of attempted transmission	Error message in case of attempted transmission
Engineering, e.g. bus parameters	no configuration necessary	have to be configured	have to be configured	Configuration and parameterization software ETS 2	have to be configured	have to be configured	have to be configured	have to be configured

2.1.4 Network functions

Network functions can be of importance in the selection of network type and system connection. These network functions are described by the network properties, but are not integrated in every system connection (e.g. CP). The following table shows a selection of important network functions and whether these are available in the different network types.

Networks / Functions	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Data transmission	-	Yes 1)	-	-	Yes	Yes	Yes	Yes
I/O connection	Yes	Yes	Yes	Yes	-	-	-	
Clock synchronization / maximum accuracy	-	Yes / 10ms	-	Yes / -	Yes / 200ms	Yes / 10ms	Yes / 10ms 2)	Yes / 10ms
WAN connection (e.g. ISDN)	-	-	-	Yes	-	-	Yes	Yes
IT functions	-	-	-	Yes	-	-	Yes	Yes
Possibilities for remote access	-	Teleservice, S7 routing	S7 routing	EIB/ISDN coupler	Teleservice, S7 routing	Teleservice, S7 routing	S7 routing ISDN routing	S7 routing
S7 routing	-	Ja	Ja	-	Ja	Ja	Ja	Ja
Clock synchronization	-	Yes	-	-	-	-	-	-
Redundancy	-	Yes	-	-	-	Yes	Yes	Not specified

1) Intelligent slaves to PROFIBUS DP via acyclic services or internode communications (broadcast)

2) in case of PC only with Hardnet

3) with EIB/ISDN coupler or EIB interface for Ethernet UDP/IP

2.1.5 Which communication services and functions are available via which networks?

The communication in the SIMATIC S7 is based on different networks on which different communication services (services) are available. Which communication services are provided depends on the network type. The access to the communication services is realized via the integrated interface in the central processing unit (CPU) of the S7/C7 or via additional communication processors (CP) or interface modules (IM).

The following table shows which services and functions are provided by which network type.

Networks / Services		Process or field communication				Data communication			
		AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
Services									
AS Interface (AS-I)		Yes	-	-	-	-	-	-	-
Global data communication (GD)		-	-	-	-	Ja	-	-	-
PG/OP	PG communication	-	Yes	Yes	-	Yes	Yes	Yes	Yes
PG/OP	OP communication (access with SIMATIC HMI)	-	Yes	-	-	Yes	Yes	Yes (only WinCC)	Yes (only WinCC)
S7 basic communication		-	-	-	-	Yes	Yes	-	-
S7 communication, using:									
• ISO transport		-	-	-	-	-	-	Yes	Yes
• ISO on TCP		-	-	-	-	-	-	Yes	Yes
• FDL		-	Yes	-	-	Yes	Yes	-	-
SEND/RECEIVE, using: 1)									
• ISO transport		-	-	-	-	-	-	Yes	Yes
• ISO-on-TCP		-	-	-	-	-	-	Yes	Yes
• TCP/IP		-	-	-	Yes	-	-	Yes	Yes
• UDP		-	-	-	Yes	-	-	Yes	Yes
• FDL		-	Yes	-	-	-	Yes	-	-

Networks / Services	Process or field communication				Data communication			
	AS interface	**PROFIBUS DP**	**PROFIBUS PA**	**EIB**	**MPI**	**PROFIBUS**	**Industrial Ethernet**	**Wireless LAN**
MAP 2)	-	-	-	-	-	-	Yes	Yes
FMS 2)	-	-	-	-	-	Yes	-	-
PROFIBUS-DP	-	Yes	-	-	-	Yes	-	-
PROFInet (PN)	-	-	-	-	-	-	Yes	Yes
Functions, solutions								
IT functions 3)	-	-	-	Yes	-	-	Yes	Yes
Component based Automation 4)	-	Yes	-	-	-	-	Yes	Yes

1) The SEND/RECEIVE interface is also termed as “S5-compatible communication” which is a collective term for services which are displayed at level 4 of the OSI 7 layer model.

2) MAP and FMS together are also termed as “standard communication”.

3) IT functions are based on the TCP/IP protocol. They include the services for email (SMTP), File Transfer (FTP) and for web server (HTTP).

4) Component based Automation is a Siemens solution for the realization of modular automation solutions; it uses PROFInet on the Industrial Ethernet and PROFIBUS DP for the distributed I/O.

2.2 Selection criteria of the communication services

This chapter describes the selection criteria for the current communication services in the SIMATIC. Every communication service provides certain communication functions with defined performance characteristics. The communication services also depend on the network type (→ Selection criteria of the communications networks). The following tables shows a comparison of the performance characteristics of the individual communication services. For background information on the individual communication services please refer to → Functional models.

Communications services on the interfaces of the S7-300/400 CPUs The interfaces for the S7-300/400 and the C7 to the different communications services are listed in a table.
Communications services on the interfaces for PG/PCs The interfaces for PG and PC to the different communications services are listed in a table.
Properties and functions of the communications services The table lists and compares certain properties of the different communications services.
Acknowledgement mechanisms of the individual communications services A table informs you whether and at which level of the protocol architecture an acknowledgement mechanism is available in the data transmission via the different communication services.
User interfaces and specification of inputs A table indicates the amount of data that can be handled by the different communication services.
Data consistency The data consistency of the different communication services is compared and listed in a table.

2.2.1 Communication services on the interfaces of the S7-300/400 CPUs

The following table lists the different communication processors (CP) of the SIMATIC S7-300/400 and their access to the individual communication services.

Services / Connection via		AS-i	GD	PG/ OP	S7 basic	S7 comm.	SEND/RECEIVE					FMS	MAP	DP	IT 1)	PN V1.0 2)
							ISO	ISO on TCP	TCP/IP	UDP	FDL					
CPU-integrated interfaces	CPU-MPI	-	Yes	Yes	Yes	Yes	-	-	-	-	-	-	-	-	-	-
	CPU-DP	-	-	Yes	Yes	Yes 3)	-	-	-	-	-	-	-	Yes	-	-
	CPU-Ethernet 4)	-	-	Yes	-	Yes	-	-	-	-	-	-	-	-	-	Yes
S7-300 / C7	CP 342-5	-	Yes	Yes	-	Yes	-	-	-	-	Yes	-	-	Yes	-	-
	CP 343-1	-	Yes	Yes	-	Yes	Yes 5)	Yes	Yes	Yes	-	-	-	-	-	-
	CP 343-1 IT	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	Yes	-
	CP 343-1 PN	-	Yes	Yes	-	Yes	-	Yes	Yes	Yes	-	-	-	-	-	Yes
	CP343-2P, (in C7 621 ASi)	Yes	-	Yes	-	-	-	-	-	-	-	-	-	-	-	-
	CP 343-5	-	Yes	Yes	-	Yes	-	-	-	-	Yes	Yes	-	-	-	-
S7-400	CP 443-1	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	-
	CP 443-1 IT	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	Yes	-
	CP 443-5 Bas.	-	Yes	Yes	-	Yes	-	-	-	-	Yes	Yes	-	-	-	-
	CP 443-5 Ext.	-	Yes	Yes	-	Yes	-	-	-	-	Yes	-	-	Yes	-	-
S7-400	CP 444	-	Yes	Yes	-	Yes	-	-	-	-	-	-	Yes	-	-	-

Services / Connection via		AS-i	GD	PG/ OP	S7 basic	S7 comm.	SEND/RECEIVE					FMS	MAP	DP	IT 1)	PN V1.0 2)
							ISO	ISO on TCP	TCP/IP	UDP	FDL					
	IM 467	-	Yes	Yes	-	-	-	-	-	-	-	-	-	Yes	-	-

1) IT comprises: SMTP functionality (sending emails), FTP client server, http or PPP server. → IT-CP

2) PROFInet V1.0 for Industrial Ethernet under Component based Automation.

3) operation with S7 communication via the internal CPU interface depends on the CPU and the product family;
in case of the S7-300 CPU 315-2DP e.g. S7 communication is only possible as server, in case of the S7-400 CPU 414-2DP e.g. also as client.

4) planned: CPU 317-2 PN/DP with integrated interface to PROFIBUS DP and PROFInet V2.0 (available approximately 12/03),
including Soft Real Time.

5) CP 343-1 version...-EX20 or higher does not support ISO transport

2.2.2 Communication services on the interfaces for PG/PCs

The following table lists the communication processors (CP) which are available for the connection of PG/PC to Profibus and Industrial Ethernet. In addition to the CP a driver software is required which makes it possible for an application or a program on the PG/PC to access certain variables of a communications service via the network.

Note: PG/PC does not feature a direct connection for the access to AS-i. The networks PROFIBUS DP and AS Interface can be linked by means of the DP/AS-i link.

Services / Connection via		GD	PG/OP 1)	S7-Basis	S7	SEND/RECEIVE					FMS	MAP/MMS	DP	IT 2)	PN V1.0
						ISO	ISO on TCP	TCP/IP	UDP	FDL					
PROFIBUS	Software														
Hardnet CP 5613 CP5613 FO CP 5614 CP 5614 FO	CP with DP-Base 3)	-	Yes	-	-	-	-	-	-	Yes	-	-	Yes	-	-
	DP-5613 4)	-	Yes	-	-	-	-	-	-	Yes	-	-	Yes	-	-
	S7-5613	-	Yes	-	Yes	-	-	-	-	Yes	-	-	-	-	-
	FMS-5613	-	Yes	-	-	-	-	-	-	Yes	Yes	-	-	-	-
Softnet CP 5511 CP 5512 CP 5611	SOFTNET-DP	-	Yes	-	-	-	-	-	-	Yes	-	-	Yes	-	-
	SOFTNET-DP Slave	-	Yes	-	-	-	-	-	-	-	-	-	Yes (slave)	-	-
	SOFTNET-S7	-	Yes	-	Yes	-	-	-	-	Yes	-	-	-	-	-
	STEP 7	-	Yes	-	-	-	-	-	-	-	-	-	-	-	-
INDUSTRIAL ETHERNET	Software														
Hardnet CP 1613 (PCI)	S7-1613	-	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	Yes	-
	S7-REDCONNECT 5)	-	Yes	-	Yes	Yes	-	-	-	-	-	-	-	-	-
	TF-1613	-	Yes	-	-	Yes	Yes	Yes	Yes	-	-	Yes	-	-	-

Services / Connection via		GD	PG/OP 1)	S7-Basis	S7	SEND/RECEIVE					FMS	MAP/MMS	DP	IT 2)	PN V1.0
						ISO	ISO on TCP	TCP/IP	UDP	FDL					
	PG-1613	-	Yes	-		Yes	Yes	-	-	-	-	-	-	-	-
Softnet CP 1612 CP 1512 Or: Ethernet on Board	SOFTNET-S7	-	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	Yes	Yes
	SOFTNET-PG	-	Yes	-	-	-	-	-	-	-	-	-	-	-	Yes

1) PG/OP communication is supported by all CPs.

2) The IT functionality is available in connection with the Windows software of the PC.

3) The CP5613/5614 delivery includes DP-Base.

4) DP-5613 in connection with OPC-Server is recommended.

5) S7-REDCONNECT in Hardnet-CP 1613 for S7 communication for redundant networks (H-systems)

Definitions:

- **Hardnet:** CP with own micro processor. Interface software runs on the CP. Load reduction for the PC regarding communication tasks.
- **Softnet:** CP without micro processor. Protocol software runs on the PC. PC load because of communication tasks.

2.2.3 Properties of the communication services

The following table compares the basic properties of the individual communication services.

Services / Properties	AS-i	GD	PG/OP-conections		S7 basic comm.	S7comm. 1)			SEND/RECEIVE 2)					FMS	MAP	DP	IT			PN V1.0
			PG	OP		ISO	ISO on TCP	FDL	ISO	ISO on TCP	TCP/ IP	UDP	FDL				HTTP	FTP	SMTP	3)
Configured unilateral connection	-	-	-	-	-	Yes			Yes			-	Yes	Yes	Yes	-	-	Yes	Yes	-
Configured bilateral connection	-	Yes	-	-	-	Yes			Yes			Yes	Yes	Yes	Yes	-	-	-	-	-
Static connecting	Yes	Yes	-	Yes	-	Yes			Yes			Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes
Dynamic connecting	-	-	Yes	-	Yes	-			-			-	-	-	-	-	Yes	-	-	-
Broadcast connection possible	-	-	-	-	-	-			-			Yes only send	Yes	Yes	-	-	-			-
Multicast connection possible	-	-	-	-	-	-			-			Yes send/ receive	Yes	-	-	Yes 3)	-			-
WAN-capable connection	-	-	Yes 4)	-	-	-	Yes	-	-	Yes	Yes	Yes	-	-	-	-	Yes			Yes
Event-controlled or program-controlled data transfer possible	-	Yes only S7-400	-	Yes	Yes	Yes			Yes			Yes	Yes	Yes	Yes	Yes 5)	-	Yes	Yes	Yes 6)

1) The S7 communication can be realized on MPI, PROFIBUS, and Industrial Ethernet. For the communication on the different network types different protocols (ISO, ISO on TCP or FDL) are used which are defined during configuration.
2) The following applies for unilaterally configured connections of the S5-compatible communication:
   FETCH/WRITE services only via ISO, ISO on TCP, and TCP/IP connections possible.
3) Direct data exchange (internode communications) in standard DPV2: Input data can be transferred rapidly and directly to intelligent DP slaves in the same physical PROFIBUS DP sub-network by simple DP slaves or intelligent DP slaves without being transferred to the DP master first; this applies also in case of cross DP master system applications.
4) PG communication (diagnosis, loading programs, loading hardware) via WAN can be realized e.g. with ISDN routers (remote access).
   see also →*S7 routing*
   Note: *OP communication is not possible via WAN.*
5) Extension standard DPV1, DPV2: program-controlled acyclic master-slave communication possible.
6) for Component based Automation in step V1.0 with PROFInet V1.0 as standard for the communication via Industrial Ethernet with the protocols TCP/IP and COM/DCOM. The communication on PROFIBUS is realized via the standard PROFIBUS DP (no internode communications possible).
   Note: *In case of Component based Automation the communication variables are linked graphically using the interconnection editor SIMATIC iMap. During system operation the variables are checked for changes at defined time intervals, the transmission frequency. If the value of a variable does not change within this defined period of time, this variable is not transferred again. The value of a variable is only transferred if this value changes (event-oriented transmission).*

2.2.4 Acknowledgement mechanisms of the individual communication services

The following table shows in which level of the ISO 7 layer model the acknowledgement mechanisms for the data transmission are located.

Services / Acknowledgement	AS-i	GD	PG/OP-connection		S7 basic comm.	S7-comm.	SEND/RECEIVE					FMS	MAP	DP	IT			PN V1.0
			PG	OP			ISO	ISO on TCP	TCP/IP	UDP	FDL				HTTP	FTP	SMTP	
Level 7 acknowledgement	-	-	-	-	Yes	Yes	-	-	-	-	-	Yes	Yes		-			-
Level 2 / 4 acknowledgement	Yes 1)	-	-	-	Yes	Yes	Yes	Yes	Yes	-	Yes	-	-	Yes	Yes			Yes 2)
No acknowledgement	-	Yes	-	-	-	-	-	-	-	Yes	-	-	-		-			-

1) In AS-i there is no strict assignment to the OSI levels like in case of common field buses. The acknowledgement is realized implicitly by means of command calls during data transmission. The scope of functions of the AS interface is described in the AS interface master specification.

2) For the communication under Component based Automation on Industrial Ethernet.

Definitions:

Level 2 and 4 acknowledgement: The acknowledgement is sent by the CPU or the CP of the communication partner (system), the data are not yet stored in the storage (e.g. data block).

Level 7 acknowledgement: The acknowledgement is sent by the user program receive block. Data are stored in the data storage (e.g. data block).

No acknowledgement: The transmission of telegrams is not acknowledged, i.e. the loss of messages is not detected by the send block and is therefore not reported and displayed. In the program a routine for a user acknowledgement and for the verification of the receipt of the telegram has to be created by the user.

2.2.5 User interfaces and specification of inputs

The following table list the data amount that can be transmitted by the different communication services and the corresponding user interface.

Note: The listed figures/values often depend on the automation system SIMATIC S7-300 or 400 or the PG/PC and the CPU used. All figures and values are maximum figures/values. The indicated data amounts apply for the most recent version of the products (CPU, CP etc.) as of 07/03. If you use the blocks, the technical data sheets for the respective CPU or CP must always be assessed previously.

Services / Interface	AS-i	GD	PG/OP connect-ion.		S7 basic comm.	S7comm.			SEND/RECEIVE					FMS	MAP	DP	IT			PN V1.0
			PG	OP		ISO	ISO on TCP	FDL	ISO	ISO on TCP	TCP/ IP	UDP	FDL				HTTP	FTP	SMTP	
Cyclical polling by the operating system or master-slave polling	8 bits	GD-packet 22/ 54 bytes 1,2)	-	-	-	-			-	-	-	-	-	-	-	I/O: 244/ 244 bytes	-	-	-	3)
SFC 60 "GD_SND" SFC 61 "GD_RCV"	-	GD-packet 22/ 54 bytes 1,2)	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-
FC1 DP_SEND FC2 DP_RECV (Indication of value for master/slave, novel CPs)	-	-	-	-	-	-			-	-	-	-	-	-	-	2160/ 240 bytes	-	-	-	-
SFC 14 "DPRD_DAT" SFC 15 "DPWR_DAT"	-	-	-	-	-	-			-	-	-	-	-	-	-	64 bytes	-	-	-	-

Services / Interface	AS-i	GD	PG/OP connect-ion.		S7 basic comm.	S7comm.			SEND/RECEIVE					FMS	MAP	DP	IT			PN V1.0
			PG	OP		ISO	ISO on TCP	FDL	ISO	ISO on TCP	TCP/ IP	UDP	FDL				HTTP	FTP	SMTP	
SFC 65 "X_SEND" SFC 66 "X_RCV"	-	-	-	-	76 bytes	-			-	-	-	-	-	-	-	-	-	-	-	-
SFC 68 "X_PUT" SFC 73 "I_PUT"	-	-	-	-	84 bytes	-			-	-	-	-	-	-	-	-	-	-	-	-
SFC 67 "X_GET" SFC 72 "I_GET"	-	-	-	-	94 bytes	-			-	-	-	-	-	-	-	-	-	-	-	-
(S7-300/S7-400) FB15/SFB15 PUT FB14/SFB14 GET	-	-	-	-	-	(S7-300/ S7-400) 160/400 bytes			-	-	-	-	-	-	-	-	-	-	-	-
(S7-300/S7-400) FB8/SFB8 USEND FB9/SFB9 URCV	-	-	-	-	-	(S7-300/ S7-400) 160/440 bytes			-	-	-	-	-	-	-	-	-	-	-	-
(S7-300/S7-400) FB12/SFB12 BSEND FB13/SFB13 BRCV	-	-	-	-	-	(S7-300/ S7-400) 32/ 64 Kbytes			-	-	-	-	-	-	-	-	-	-	-	-
(S7-300/S7-400) FC5 AG_SEND FC6 AG_RECV	-	-	-	-	-	-			8192/ 240 bytes (8192 bytes for more recent versions of Ethernet CPs of the S7-300) 1)			2048 /240 bytes 1)	240 bytes	-	-	-	-		2 KB 5)	-

Services / Interface	AS-i	GD	PG/OP connect-ion.		S7 basic comm.	S7comm.			SEND/RECEIVE					FMS	MAP	DP	IT			PN V1.0
			PG	OP		ISO	ISO on TCP	FDL	ISO	ISO on TCP	TCP/ IP	UDP	FDL				HTTP	FTP	SMTP	
(S7-300/S7-400) FC50 AG_LSEND FC60 AG_LRECV	-	-	-	-	-	-			8192 bytes			2048 bytes	240 bytes	-	-	-	-	-	2 KB 5)	-
FB3 READ	-	-	-	-	-	-			-	-	-	-	-	237 bytes	-	-	-	-	-	-
FB4 REPORT FB6 WRITE	-	-	-	-	-	-			-	-	-	-	-	233 bytes	-	-	-	-	-	-
FB3 READ FB4 REPRT FB6 WRITE	-	-	-	-	-	-			-	-	-	-	-	-	235 bytes	-	-	-	-	-
FB3 READ4K FB4 REPRT4K FB6 WRITE4K	-	-	-	-	-	-			-	-	-	-	-	-	4096 bytes	-	-	-	-	-
FC40 FTP_CONNECT FC41 FTP_STORE FC42 FTP_RETRIEVE FC43 FTP_DELETE FC44 FTP_QUIT	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	64 KB 4)	-	-
HTML-BROWSER	-	-	-	-	-	-			-	-	-	-	-	-	-	-	8 MB 6)	-	-	-
SIMATIC Software, e.g. STEP 7, ProTool/Pro	-	-	any	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-

1) SIMATIC S7-300 / S7-400
2) refers to the amount of user data per GD packet
   GD packet in case of S7-300 for CPU 318 with a maximum of 54 bytes, in case of S7-400 for CPU 317 with a maximum of 64 bytes.
3) PROFInet V1.0 for the communication on Industrial Ethernet and PROFIBUS DP under Component based Automation. The communication is graphically configured using the interconnection editor SIMATIC iMap. The maximum number of graphical connections which are used for communication by the individual system devices are the basic data of the communication under Component based Automation The user program does not use explicit communication blocks. Information on the maximum number of connections can be found in the data sheets for the PROFInet devices (Win AC PN, IE/PB link, CP 343-1 PN) or in the manuals for the SIMATIC iMap.
4) Writing, reading of data blocks via FTP with FTP_STORE and FTP_RETRIEVE: 64 Kbytes correspond to the maximum length of a data block on the S7-400 that can be written. The user data to be transferred is preceded by a FTP file system header of 20 bytes, which is part of the user data to be transferred.
5) Sending an email with AG_SEND/AG_LSEND; 2 Kbytes correspond to the maximum size of an email including attachment.
6) Maximum size of the HTML page on the file system of the IT-CP.

2.2.6 Data consistency

Data which belong together in terms of content and which describe a process status at a defined point in time are termed as consistent data. In order to maintain consistency these data may not be changed or up-dated during processing or transmission. The following table lists the data consistency for the different communications services.
For further information on data consistency please refer to the A&D Product Support, Entry-ID: 11646774

Services / Data consistency	AS-i	GD	PG/OP-connection.		S7 basic comm.	S7- comm.			SEND/RECEIVE					FMS	MAP	DP	IT			PN V1.0
			PG	OP		ISO	ISO on TCP	FDL	ISO	ISO on TCP	TCP/IP	UDP	FDL				HTTP	FTP	SMTP	
Range	8 Bits	8/32 bytes 1)	2)	3)	5)	8/32 bytes 1)			8192 bytes 2)	8192 bytes 2)	8192 bytes 2)	2048 bytes 2)	240 bytes 2)	238/32 bytes 4)	-	128 bytes	2)	2)	2)	6)

1) S7-300/S7-400

2) The transmission is realized consistently across the entire range.

3) The data consistency depends on the S7-300/400 or C7-600 CPU used or the respective HMI device and has to be considered in the user program of the target system.

4) Client/Server

5) The data consistency depends on the S7-300/400 or C7-600 CPU used. The figures for data consistency can be found in the data sheets (technical data) of the respective CPU.

6) PROFInet V1.0 using PROFIBUS DP for Component based Automation:
PROFInet V1.0 via Industrial Ethernet with TCP/IP and DCOM transferred consistently.

3 Functional Models

3.1 Description of the communication networks

Via communication networks several devices can be connected in a bus system in order to perform data exchange. Communication networks comprise components, procedures, and protocols of the two lower layers of the OSI 7 layer reference model.

For important characteristics of the individual network types please refer to table "Characteristics and properties of the networks".

3.1.1 Network types for process and field communication

Process or field communication is used to connect actuators / sensors to a CPU. This connection can be realized via integrated interfaces in the CPU or via other connections (IMs, CPs). To do this the SIMATIC offers the AS Interface, PROFIBUS DP, PROFIBUS PA, and EIB.

3.1.1.1 AS interface

The AS interface is used wherever individual actuators/sensors are spatially distributed in the machine and the corresponding environment. Via links the AS interface can be connected to the PROFIBUS DP and can be operated as sub-network on the PROFIBUS DP.

3.1.1.2 EIB (European Installation Bus)

The EIB was originally developed by SIEMENS and is nowadays used as open bus system for implementation in building services automation and is maintained and represented by the independent user organization EIB Association (EIBA).

Its purpose is to record, control, monitor, and report any operational functions of buildings or larger pieces or real estate. The following transmission media can be used for EIB:

- EIB.TP: 2-wire connection (Twisted Pair)
- EIB.PL: Network connection (Powerline)
- EIB.RF: Radio transmission (Radio Frequency)
- EIB.net: Ethernet up to 10 Mbits/sec according to IEEE802.2

The DP/EIB link connects the functions of the building automation and the electrical installation technology to the PROFIBUS DP on the basis of instabus EIB . EIB can thus be operated as sub-network on PROFIBUS DP.

3.1.1.3 Profibus DP

Profibus DP is a high-performance, open, and robust field bus system with short reaction times in order to connect distributed I/Os (e.g. SIMATIC ET 200) as DP slaves to controls as DP master. PROFIBUS DP and PROFIBUS FMS are similar systems. As both use the same transmission technology and a uniform bus access protocol, they can be operated simultaneously.

PROFIBUS DP master classes

DP master class 1
DP master class 1 is the central component of PROFIBUS DP. As DP master the central control or a PC exchanges information with the distributed stations which are termed as DP slaves in a defined, recurring message cycle.

DP master class 2
Devices of this type are programming, configuration or operating units which are used to configure the DP systems or to operate the system during operation (diagnosis). A DP master class 2 can e.g. read input, output, diagnosis, and configuration data of the slaves.

PROFIBUS DP slave functionalities

DP-V0 (basic functionality)
for configuration, parameterization, cyclically reading of input data, writing of outputs, and reading of diagnosis data.

DP-V1:

- Acyclical services for the writing and reading of parameters and data records (realized with low priority and parallel to the rapid cyclical user data transfer).
- Novel alarm and diagnosis functions (slaves can independently request a diagnosis, alarm acknowledgement parallel to the cyclical data communication)

DP-V2 (new):

- Interndode communications of the data
- Clock-synchronization (equidistant Profibus)

Note:
The listed DP functionalities DBV1/DPV2 are optional function extensions and compatible with the DPV0 basic functionality. (You can continue to operate existing devices, however limited to the current function scope). In order to use the functions DPV1 and DPV2, only those units (slaves) can be used which support these functions.

3.1.1.4 Profibus PA

PROFIBUS PA (Process Automation) expands PROFIBUS DP by an intrinsically safe transmission technology. The PA profile determines unit parameters and unit behavior of typical field units vendor-independently and facilitates the exchange and operation of the units. It makes the measuring and controlling via a 2-wire connection possible. Devices can be maintained, connected or disconnected during operation even in case of a danger of explosion. The PA profile was developed in close coordination with the process industry (NAMUR) and meets the special requirements of this application sector. Profibus PA can be operated as sub-network on the PROFIBUS DP via DP/PA couplers or links.

3.1.2 Network types for data communication

The connection of the units can be realized via the integrated interfaces on the automation system (CPU) or via communication processors (CPs)

The data transmission is usually realized on an event-controlled basis by calling a communication block. For data communication, the SIMATIC S7 offers the Multi-Point-Interface (MPI), PROFIBUS, and Industrial Ethernet.

3.1.2.1 MPI (Multi-Point-Interface)

The multi-point-capable interface MPI (Multi Point Interface) is an integrated interface on every SIMATIC automation system S7/C7, on SIMATIC PCs, PGs, and OPs/PPs/TDs. In the SIMATIC, MPI offers an interface to the PG/OP communication as well as a simple networking capability for the exchange of smaller data amounts via the S7 basic communication, global data communication and S7 communication services.

MPI electrically uses the standard RS485 (like PROFIBUS) as transmission medium and can also be transmitted via optical wave guides (OWG).

3.1.2.2 PROFIBUS FMS (Fieldbus Message Specification)

PROFIBUS was originally developed jointly by a number of companies, amongst others by Siemens, the versions that are available today are FMS, DP, and PA.

- PROFIBUS FMS is the original PROFIBUS specification and makes it possible to transmit structured data between two PROFIBUS stations which support the FMS standard.
- PROFIBUS DP was developed as “rapid subset” of PROFIBUS FMS for the cyclical I/O communication between DP master and DP slave.
- PROFIBUS PA uses the extended PROFIBUS DP protocol for data transmission and was developed especially for the connection of PROFIBUS DP in sectors with high requirements on explosion protection.

As PROFIBUS FMS and PROFIBUS DP use the same transmission technology and a uniform bus access protocol they can be operated simultaneously. PROFIBUS PA is connected to PROFIBUS DP via couplers or links (DP/PA couplers).

Data transmission with PROFIBUS FMS

PROFIBUS FMS is particularly useful as the data structures are transmitted in a device-independent form and are then converted into the device-specific form in the end device. PROFIBUS can thus be used for all devices which understand FMS. PROFIBUS FMS is used for data communication in systems with moderate to low real time requirements.

3.1.2.3 Industrial Ethernet (IE)

Industrial Ethernet is being used as communications network for the command level and the cell level and is based on the IEE802.3 standard for communication between computers and automation systems. It can be used to exchange large amounts of data also over long distances. From the physical point of view Ethernet uses an electrical network which is based on a shielded coaxial line, Twisted Pair cabling, or an optical network on the basis of an optical wave guide. CSMA/CD is used as access method.

In automation, the following services/protocols are being used on Industrial Ethernet.

- S7 communication
- PG/OP communication
- S5-compatible communication (ISO transport, ISO-on-TCP, TCP/IP, and UDP)
- Standard communication (MAP)

3.1.2.4 Wireless LAN (WLAN)

Wireless LAN (WLAN) is a local radio network which works in the 2.4 GHz frequency band. WLAN products are based on the IEEE 802.11b standard, the data rates range from 1Mbit/s to 11 Mbits/s. The WLAN can be connected to a local Ethernet network via WAN-Access Points.

WLAN is also termed as Wireless Ethernet – protocols like TCP/IP are used in the same way as in case of Industrial Ethernet. The only differences between WLAN and Industrial Ethernet are the physical principle of the data transmission and the access method: CSMA/CD in case of Industrial Ethernet, CSMA/CA in case of WLAN.

3.1.2.5 The Wide Area Network (WAN)

The Wide Area Network (WAN) can be defined as a network with an area of >25 km. Examples for WAN are the public telephone network or the INTERNET. In automation, the connection to a WAN is very important.

Via PG routing, WAN enables amongst other things remote access to programming and automation units for the loading of programs or remote diagnosis and makes it possible to monitor a system status via an internet browser or report events or incidents via email.

A WAN connection can be established via the following services:

- S7 communication
- S5-compatible communication
- PG communication (remote programming and diagnosis via network or WAN)

Note: In order to use IT functions for SIMATIC automation devices via a WAN connection, the IT-CP was developed, which features an integrated web server, generates emails, and can be used to realize data communication with other automation systems via FTP.

3.2 Description of the communication services and protocols

Data communication is realized via the sub-networks MPI; PROFIBUS, and Industrial Ethernet and comprises the following communication protocols. For important characteristics of the individual communication services, please refer to the table "Properties of the communications services"

3.2.1 Global Data Communication (GD)

The Global Data Communication (GD) is a simple communication possibility which is integrated in the operating system of the CPUs. By means of GD communication the cyclical data exchange of global data like e.g. inputs, outputs, flags, and sections of data blocks between CPUs can be realized via the integrated MPI. The cyclical data exchange is realized with the normal process image exchange. The reaction time depends on the cycle of the user program and amounts to n times the length of this cycle (GD scaling factor) on the send and receive side.

- Data amount in case of S7-300 approx. 22 bytes, in case of S7-400 up to 54 bytes
- Cyclically controlled communication
- Event-controlled communication possible (only in case of S7-400 with SFC 60 "GD_SND" and SFC 61 "GD_RCV")
- The data that are sent / received are configured only in a GD table in STEP7 (no program required)
- Function realized via the MPI of the CPU and via the K-bus of the S7-400
- Broadcast call (data are sent without feedback message) data integrity is therefore not guaranteed
- Maximum number of 15 CPUs

3.2.2 PG/OP communication

PG/OP communication is used for the communication between PG/OP and the SIMATIC stations like e.g. loading of programs, performing tests, loading diagnosis and configuration data or operating and monitoring a system or plant via OPs. The functions of the PG/OP communication are integrated in every SIMATIC station (operating system). PG/OP communication can be used on all MPI, PROFIBUS, Industrial Ethernet sub-networks (IE only for OP communication with WinCC). For STEP 7 V5 or higher, the PG can be used to reach the S7 stations online also if they are not within sub-network limits. The network transition is located in a SIMATIC station which has interfaces to the respective sub-networks.

A high degree of data integrity is reached because of the automatic repetition of incomplete or incorrect telegrams on the MPI, on PROFIBUS, and on Industrial Ethernet.

The PG/OP communication features the following functions:

- ***PG communication***
  complete functionality for the programming of the SIMATIC automation devices with STEP 7 (e.g. download of the hardware configuration, loading of STEP7 programs, online

operation of the SIMATIC stations, and test and diagnosis programs) via the sub-networks MPI, PROFIBUS, and Industrial Ethernet. Connection to a WAN e.g. via ISND routers (S7 routing) also possible.

- ***OP communication***
  reading and writing of variables and automatic sending of data to the HMI stations without additional communication functions in the user program of the communication partner. The data consistency depends on the S7-300/400 or C7-600 CPU used and has to be considered in the user program of the target system.

3.2.3 S7 basic communication

The S7 basic communication is already integrated in every SIMATIC S7/M7 device and provides simple functions for the transmission of small data amounts (variables/data) via MPI and PROFIBUS DP.

- Connection configuration is not required.
- Data amount: a maximum of 76 bytes for SEND/RECV in case of the S7-300/400. (S7-200 only possible as server).
- Event-controlled block call, unilateral or bilateral integration into program.
- The SFC blocks for event-controlled communication do not take up a user program as they are integrated in the operating system.
- The connections which determine which modules communicate with one another are assigned directly in the communication blocks.
- A high degree of data integrity is reached because of the automatic repetition of the sending of incomplete or incorrect telegrams. The transmission of the data is acknowledged by the communication partner on the ISO layer 7. This is displayed in the corresponding block.

3.2.4 S7 communication

The S7 communication is already integrated in every SIMATIC device. As the S7 communication corresponds to a service of the application layer (layer 7) it can be used on all sub-networks (MPI, PROFIBUS; Industrial Ethernet).

- Secure transmission of a section (DB, MB or process image); data transmission is only completed once the receive function of the communication partner has received the data (BSEND/BRCV).
- Rapid, not acknowledged transmission of data independent of the processing status of the function at the partner's station. At the partner's station the data can be overwritten with more recent data (USEND/URCV).
- Program-controlled writing and reading of variables without additional communication function in the partner's user program (PUT/GET). These functions are executed in the server's operating system. The partner is not notified.
- Monitoring functions which provide the current operating status of the communication partner's CPU . Control functions to stop the communication partner's CPU or initiate a restart.

- Data amount: a maximum of 400 bytes in case of PUT/GET, 440 bytes in case of USEND/UREC, 64 kbytes in case of BSEND/BREC.
- Event-controlled block call, unilateral or bilateral integration into the program and configuration of the blocks.
- The SFB blocks for event-controlled communication do not take up a user program as they are integrated into the operating system. Only the corresponding instance data blocks (IDB) take up memory space in the user program.
- Communication takes place via the MPI of the CPUs and the CPs for PROFIBUS or Industrial Ethernet. In case of the S7-400 the K-bus (backplane bus) is also used.
- Communication takes place via configured, static connections.
- A high degree of data integrity is reached because of the automatic repeated sending of incomplete or incorrect telegrams on MPI, PROFIBUS, and Industrial Ethernet (layer 2 of the ISO reference model). The transmission of the data is acknowledged by the communication partner on ISO layer 7. This is displayed in the corresponding block.

3.2.5 SEND/RECEIVE (S5-compatible communication)

The SEND/RECEIVE interface was originally a part of the SIMATIC S5 and is therefore also termed as "*S5-compatible communication*" in the SIMATIC C7. Via the SEND/RECEIVE interface the program-controlled (event-controlled) communication via a configured configuration from one SIMATIC S7 to another SIMATIC S7, to a SIMATIC S5, to the PC/PG, and to any other station (client-client or client-server) is realized .

By means of the FETCH/WRITE services the SIMATIC S5 or any non-SIMATIC devices have direct access to system memory sections in the SIMATIC S7 CPU (client-server). The FETCH/WRITE interface is primarily used for the connection of the SIMATIC S7 to the SIMATIC S5 and to other non-S7-stations (e.g. PC).

- FETCH (fetch data)
  The connection partner (SIMATIC S5 or non-S7-station) has access to and can read system data in the SIMATIC S7.
- WRITE (write data)
  The connection partner (SIMATIC S5 or non-S7-station) has access to and can write system data in the SIMATIC S7.

The services of the SEND/RECEIVE interface are based on all standard protocols according to layer 4 of the ISO reference model. This is the reason why they are also referred to as open communication. Communication via Industrial Ethernet and PROFIBUS is realized via these services.

- Data amount on Profibus (FDL) up to 240 bytes, on Industrial Ethernet up to 8 kbytes.
- Event-controlled block call, bilateral integration into the program and configuration of the blocks.
- The blocks (FC) which are delivered with the parameterization masks (NCM) for the CPs have to be loaded in the user program.
- The communication uses CPs for PROFIBUS and Industrial Ethernet.
- The connections which determine which modules communicate with one another have to be configured in STEP7 and Netpro.

The following services belong to the SEND/RECEIVE interface:

- ***ISO transport services***
  ISO transport provides the SEND/RECEIVE interface services for the transmission of data by means of configured connections via Industrial Ethernet. The connection is automatically monitored by the ISP transport service. The communication with any communication partner on the same sub-network (e.g. SIMATIC S5 or PC) which supports the sending and receiving of data according to ISO transport is realized. Large data amounts (up to 8kbytes) can be transmitted.
  A very high level of data integrity is reached by the automatic repeated sending in ISO transport and additional block test mechanisms (CRC check on layer 2). The receipt of the data is acknowledged by the communication partner's ISO transport service (displayed in the block).

- ***ISO-on-TCP***
  Data transmission via open communication via TCP/IP networks according to TCP/IP transport protocol (layer 4) on Industrial Ethernet between the SIMATIC S7 and PCs or third-party systems. The extended RFC1006 standard is used to realize the data flow in a block-oriented way (defined message blocks in accordance with the ISO standard).
  By means of block-orientation, data amounts of a variable length (up to 8 kbytes) can be transmitted via a configured connection.
  A very high level of data integrity is reached by automatic repetition and additional block test mechanisms (CRC check on layer 2). The communication partner sends an acknowledge signal to confirm the receipt of the data (displayed in the block).

- ***TCP/IP***
  Data transmission according to TCP/IP transport protocol on layer 4 of the ISO reference model on Industrial Ethernet between the SIMATIC S7 and PCs or third-party systems. As TCP provides data flow communication without blocking the data in messages, the user does not receive an explicit acknowledgement per sent message.
  By means of the TCP service, the socket interface to TCP/IP which exists in almost every end system is supported. Interconnected data blocks (up to 8 kbytes) can be transmitted between two Ethernet stations. As there is no block-orientation, the same amount of data is transmitted each time even if the actual amount of user data may be smaller. In comparison with ISP-on-TCP, data transmission is more time-consuming in this case.
  The data transmission with TCP/IP is realized via Industrial Ethernet and also via WAN (e.g. ISDN telephone network or Internet).
  A very high level of data integrity is achieved by automatic repetition and additional block test mechanisms (CRC check on layer 2). The receipt of the data is acknowledged by the communication partner (displayed in the block).

- ***UDP*** (User Datagram Protocol)
  Simple data transmission without acknowledgement (datagram service) according to ISO layer 4. Interconnected data blocks (up to 2 kbytes) can be transmitted between two Ethernet stations on IP. The data transmission is realized via Industrial Ethernet and also via WAN (e.g. ISDN telephone network or Internet).
  In contrast to TCP, UDP is a connectionless protocol. As the receipt of the data is not acknowledged, UDP telegrams are not secure. UDP is mostly used where an acknowledgement is sent by the user anyway.
  Note: UDP does not feature acknowledgements in order to avoid "floods of data". If a telegram is e.g. sent to 100 partners, 100 acknowledgements (1 per partner) would be

received simultaneously. Such floods of data cannot be assessed and processed by the sending module (CP).

- ***FDL (SDA/SDN)***
  FDL (Fieldbus Data Link) provides services for the transmission of medium amounts of data (max. 240 bytes) on the PROFIBUS sub-network. The FDL service of the SIMATIC S7 supports the functions SDA (Send Data with Acknowledge) and SDN (Send Data with No Acknowledge). The FDL service can be classified as belonging to ISO layer 2. The receipt of the data is acknowledged by the communication partner's FDL service.
  A high degree of data integrity is reached by means of automatic repetition and additional test mechanisms (parity bit per character and check total on layer 2).

3.2.6 Standard communication (FMS, MMS)

Standard communication refers to standardized protocols for data communication.

- Event-controlled block calls; unilateral or bilateral integration into the program and configuration of the blocks.
- The blocks (FC; FBs) which are delivered with the parameterization masks for the CPs have to be loaded in the user program.
- The function uses the CPs for PROFIBUS (FMS) and Industrial Ethernet (MMS).
- The connections which determine which modules communicate with one another have to be configured in STEP7.

1. **PROFIBUS FMS (Fieldbus Message Specification)**
   provides services for the transmission of structured data (FMS variables) via static connections. The FMS service can be classified as belonging to ISO layer 7 and makes also open communication with third-party devices possible. The services provided by FMS include services for reading, writing, and reporting of FMS variables via FMS connections.
   The partner confirms the receipt of the data by sending an acknowledgement indicating that the remote communication partner's application has received the data correctly. A very high degree of data integrity is reached by means of automatic repetition and additional test mechanisms (parity bit per character and check total on layer 2).
   Data transmission with the FMS service is realized only via PROFIBUS sub-networks.

2. **MMS services according to MAP 3.0**
   MAP (Manufacturing Automation Protocol) provides MMS services for the transmission of structured data (MMS variables) and makes also open communication with third-party devices possible. The MMS service (Manufacturing Message Specification) can be classified as belonging to ISO layer 7. The MMS services provided by MAP include the functions for reading and writing of MMS variables via MAP connections.
   The partner confirms the receipt of the data by sending an acknowledgement indicating that e.g. the remote communication partner's application has received the data correctly.
   Data transmission with the MMS service is realized exclusively via Industrial Ethernet.

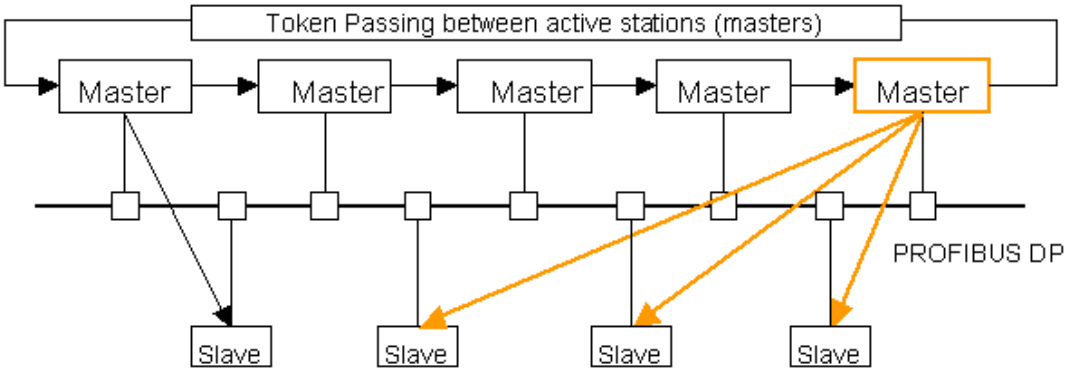
3.3 Distinctions between bus access methods

If several stations exist on a bus and send telegrams simultaneously this may lead to collisions. In order to prevent this from happening, access to the bus is controlled by different bus access methods. These access methods are either deterministic or stochastic methods.

- In case of the ***deterministic procedures***, the sequence for the access of the different stations is determined. These methods include Token-Passing and the Master-Slave procedure which e.g. control the bus access in case of PROFIBUS DP /FMS.
- In case of **stochastic (*coincidental, non-determined*) methods** the stations have access to the bus at any time. However, prior to data transmission the station has to check whether the transmission channel is free. These methods include CSMA/CD which controls the bus access e.g. in case of Industrial Ethernet.

The following section explains the different access methods Token-Passing and Master-Slave in case of PROFIBUS and CSMA/CD and CSMA/CA in case of Industrial Ethernet.

3.3.1 **Token-Passing** (e.g. PROFIBUS DP / FMS; MPI)



The above illustration shows a system with several active stations (masters). The first and the last master communicate with lower-level passive stations (slaves). These slaves are assigned to the respective master. The access method between the masters is realized via Token-Passing. The master's access to the lower-level slaves is termed as Master-Slave method.

Token-Passing (standardized in IEEE802.5) realizes a collision-free bus access between the active stations (***masters***). The send authorization (***Token***) circulates between the active stations which form a logical ring (***Token Ring***).

- Several active stations (masters) form the "logical Token Ring" in a determined order; every active station knows the other active stations and their respective order within the logical ring (the order is independent of the topological order of the active stations on the bus).

- The access authorization for the medium (the Token) is forwarded from one active station to another following the order that is determined by the logical ring. A maximum bus rotation time for the Token guarantees the receipt of the Token within a determined period of time, the ***token rotation time.***

- Once a station has received the Token (which was sent to this station), it may send telegrams. The period of time during which the station may send telegrams is defined by the so-called ***token hold time***. Once this period of time expires the station may only send high-priority messages. If the station does not have any messages to be sent, it directly forwards the Token to the next station in the logical ring.

3.3.2 Master-Slave method (e.g. PROFIBUS DP, AS Interface)

Master-Slave system: PROFIBUS DP communication takes place by means of cyclical data exchange between a complete active automation device (**DP Master**) and the active or passive periphery devices (**DP Slaves**) which are assigned to this master.

- If there are several masters on the bus, this is referred to as ***Multi-Master system***. The masters forward the send authorization from one to another as done in case of the token ring procedure. The masters form independent master-slave systems with their respective passive stations. The bus access is thus a ***Token-Passing based on a Master-Slave system***.

- Only the master which is currently in possession of the send authorization can address its assigned slave devices. The slaves are cyclically polled by the master (***cyclical polling***). The slaves can only send or receive data at their master's request.

- In case of a ***Mono-Master system*** only one master is active on the bus during operating phases. The shortest bus cycle times are reached by means of this system configuration.

3.3.3 CSMA/CD (e.g. Industrial Ethernet)

As can be seen from the above illustration, there can be several stations on one bus. These stations are all at the same level. There are no slave stations. In case of CSMA/CD the sequence for bus access is not determined. In contrast to the Token method, in CSMA/CD a station has access to the bus at any time (stochastic method). If no other station accessed the bus at that time, data transmission can take place.

Avoidance of a collision: If several stations simultaneously try to send data via the bus this may lead to a collision. Prior to any sending attempt it is therefore necessary for the stations to check whether the transmission channel is free (CS=Carrier Sense). If the channel is free, the respective station starts the data transmission. If another station has started data transmission almost simultaneously (MA=Multiple Access) this leads to a collision which has to be detected (CD=Collision Detect). For a short period of time so-called jam signals are transmitted which can be heard by all connected stations. The two sending stations are thus notified of the collision and stop their sending process in order to start another sending attempt after a stochastic waiting time.

3.3.4 CSMA/CA (e.g. Wireless LAN)

In contrast to the CSMA/CD method for Industrial Ethernet, where a collision of simultaneously sending stations is detected during sending (Collision Detection, CD) because of a disturbed level, collisions are avoided in case of LAN (Collision Avoidance, CA) by reserving the transmission channel for the sending station for a certain period of time.

However, during the actual sending procedure, the station cannot detect whether the data flow is interrupted or impaired because of collision.

Avoidance of a collision: A collision may occur if two stations simultaneously start to send a message because they had both previously found that the transmission channel was free. This type of collision is avoided as short handshake telegrams are exchanged between the partners prior to the actual sending of the data (collisions are unlikely because of the limited length and thus very short sending time of these telegrams). By means of these handshake telegrams, the duration of the subsequent actual data transmission is specified so that no other station sends data during this period of time. Once the data transmission is completed, the partner confirms the receipt of the data by sending the ACK telegram (acknowledge telegram). If no ACK telegram is received, the transmission procedure is repeated. The transmission channel can otherwise be used by the other stations to send their data.

3.4 Connections

A connection is a logic assignment of two communication partners in order to execute communication services. The connection is directly linked with a communications service. The connection can already be established i.e. configured between the connection partners. But it may also be established during runtime of the system.

3.4.1 Configured connection

Configured connections are connections which were established prior to the communication in a configuration tool (e.g. STEP 7. Netpro, ProTool). Configured connections are established once during startup of the CPU or the CP and are then permanently available (static connection).

- The **advantage** is that there is no connecting and disconnecting during operation and rapid communication is thus possible.
- The **disadvantage** is that no new connections (communication links) can be established if all connection resources are used by the static connection.

3.4.2 Non-configured connection

In case of non-configured connections the connection is established upon explicit request in the user program (dynamic connecting). The connection was not configured. The communication partner is specified by the target address in the communication block. Once the communication has been completed, the established connection can be canceled or maintained. Whether to cancel or maintain the connection after the communication was completed is determined during configuration directly in the communication block.

- The **advantage** is that any number of communication links is possible. The limit of the connections that can maximally be used **simultaneously** has to be complied with. Only the maximum number of connections which is permitted for the respective component (connection resources) can be used simultaneously.
- The **disadvantage** is that connecting and disconnecting have to be considered for the communication performance, i.e. the net data throughput is reduced.

The following table lists the connection properties of the different communication services and compares the protocol types that are used:

Type of connection	Communications service
Configured connections	GD communication S7 communication ISO communication ISO on TCP communication TCP/IP communication FDL communication IT communication: *FTP, SMTP, HTTP* MAP communication PROFInet OP communication PROFIBUS DP UDP communication
Non-configured connections	PG communication S7 basic communication

3.4.3 Connection resources

In case of the S7 CPUs the connection resources are assigned by the operating system and cannot be used differently. The number of connections of a S7 CPU is limited and depends on the CPU used. If there are no more connection resources available, the CPU cannot establish any additional connections. Data communication is then delayed or cannot be realized at all.

3.5 Terms, functions

The following section explains a number of terms which represent special functions for the communication in the SIMATIC.

3.5.1 S7 Routing

S7 routing makes the PG communication via several sub-networks possible without having to program a user program for the network transition. This function is executed independently by the operating system of the CPU/CP. Sub-networks can be:

- MPI (including teleservice)
- Profibus (CPs, IM 467 and integrated CPU – DP interfaces)
- Industrial Ethernet

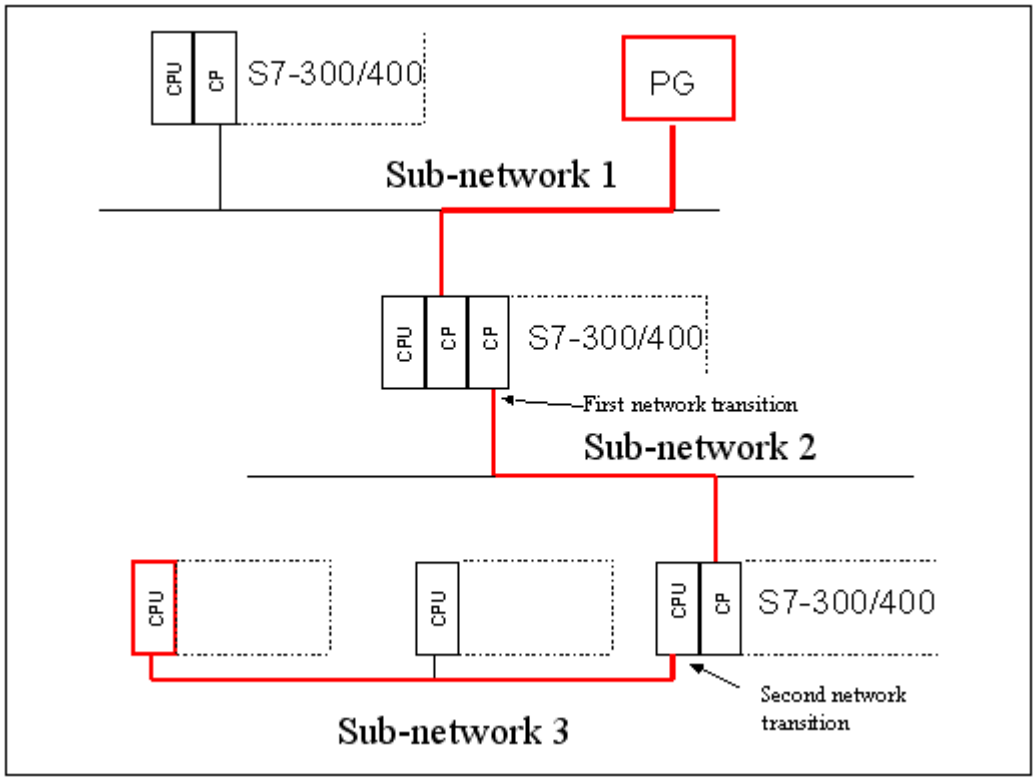


Illustration: S7 routing via 2 network transitions.

3.5.2 IT functions for the IT-CP

IT functions (IT = Internet Technology) use the connection to the Wide Area Network (e.g. public telephone network, Internet). In the SIMATIC, special IT-CPs provide the function scope for the direct connection of automation devices to the Intranet/Internet. An IT-CP provides the following IT functions:

FTP (File Transfer Protocol)

With the standard **F**ile **T**ransfer **P**rotocol, files can be fetched directly from or transmitted to other computers after authentication. Via the IT-CP, non-SIMATIC systems can write, read, and delete data in data blocks of the CPU via FTP. The CPU can send data blocks as files to other computers and read or delete files by non-SIMATIC systems.

Application: Using the FTP client function, data from e.g. a data block can be stored on or fetched from a FTP server as a file. The FTP server function is used for the transmission of files (HTML pages, image files,…) to the file system of the CP443-1IT.

HTTP (Hyper Text Transfer Protocol)

The **H**yper **T**ext **T**ransfer **P**rotocol transmits both documents which were composed in the Hyper Text Markup Language HTML and other components from a server in the World Wide Web to the browser client which requested these data. In contrast to FTP, the data are stored here only temporarily in the so-called cache for rapid display. HTTP is not suited for the transmission of larger files from the client to the server.

Application: The IT-CP features a web server on board. HTML pages can e.g. be called from the IT-CP via standard browsers in order to monitor the system. For visualization and in order to provide the HTML pages with S7 variables, amongst other things applets or JAVA beans are included.

SMTP (Simple Mail Transfer Protocol)

The Simple Mail Transfer Protocol is based directly on layer 4 of the ISO layer model and makes it possible to send emails via a data network. Within SMTP there is a command language which is used to transmit the individual parts of an email to the server. An email client then fetches the message with the Post Office Protocol (POP3) from the server. Sending emails on the IT-CP is realized in the user program by FC calls.

Application: The S7 station can trigger an alarm and send a corresponding text message in the form of an email. Such emails can also include attachments.

Note: For information on the individual IT functions of the IT-CP please refer to the manual “SIMATIC NET IT-CP for CP343-1 IT and CP 443-1 IT” which can be downloaded in the A&D Customer Support. The entry ID is 1172744.

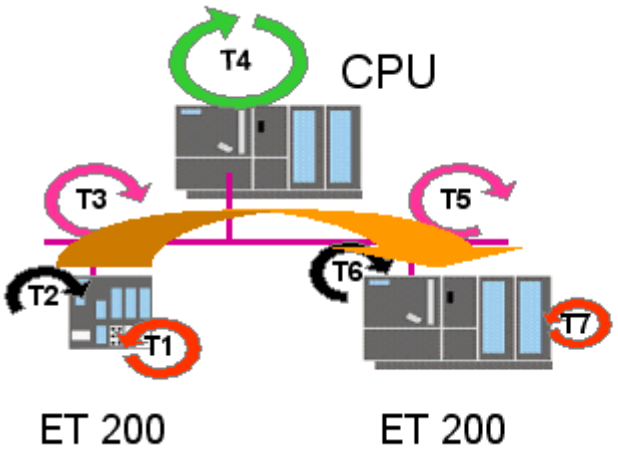
3.5.3 Equidistance and clock-synchronization for PROFIBUS DP

Equidistance is a PROFIBUS standard. It can be realized as all cycles apart from OB 1 in the user program of the CPU are of the same length (equidistant) and are clock-synchronized. The equidistance clock rate of the DP master is used as clock and is sent to the DP slaves as telegram. Equidistant cycle times are a precondition for the clocked PROFIBUS DP.

3.5.3.1 PROFIBUS DP without clock-synchronization:

The time required for the reading of a signal on the I/O device (T1), the processing of the signal in the master's user program (T4), and the output on a second I/O device (T7) depends on several **individual cycle times**. The total cycle time of the system is never identical.

The illustration below shows the PROFIBUS DP master-slave system without clock-synchronization. The total cycle time depends on the individual cycles T1 to T7.

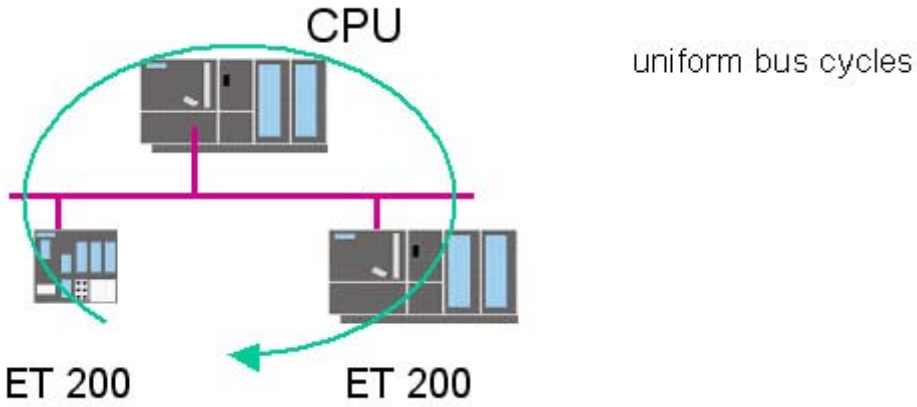


T1: input signal
T2: backplane bus ET 200
T3: PROFIBUS DP
T4: CPU program cycle
T5: PROFIBUS DP
T6: backplane bus ET 200
T7: ouput signal

Requirements: For advanced controlling, positioning, and motion control applications, identical (reproducible) bus cycle times are required. Reproducible reaction times can be reached by means of DP bus cycles of the same length (equidistant).

3.5.3.2 PROFIBUS DP with clock-synchronization

The clock-synchronous mode was developed especially for SIMATIC automation systems and uses the standard for the equidistant PROFIBUS cycle. The illustration below shows a PROFIBUS DP master-slave system using clock-synchronization.



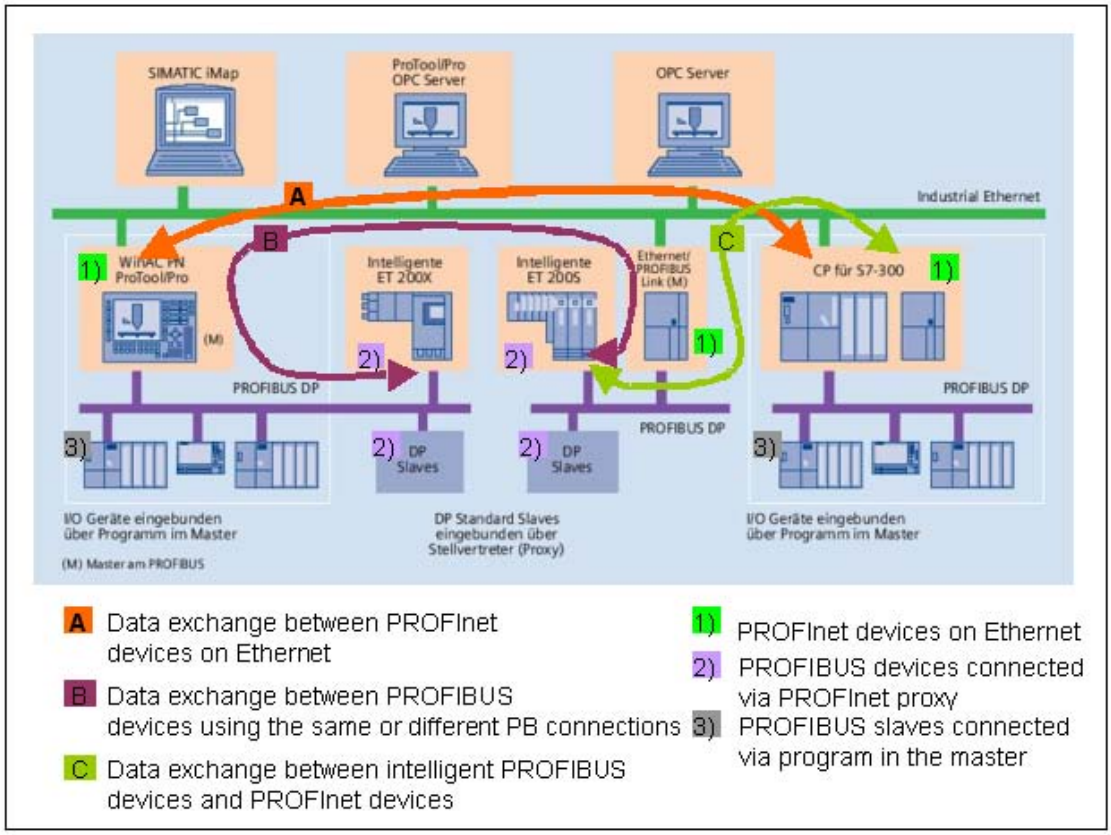
- The reading of the input data is synchronized with the equidistant PROFIBUS cycle, all input data are read at the same time.
- The output of the output data is synchronized with the DP cycle, all output data become effective simultaneously.
- All input and output data are transferred consistently. This means that all data of the process image relate to one another logically and in terms of time.
- The process reaction times are thus identical and shorter because of the non-existent cycle jumps.

3.6 Component based Automation

Component based Automation (CbA) is a Siemens solution for the realization of modular automation solutions on the basis of PROFInet and PROFIBUS DP. It makes vendor-independent engineering possible and takes the technology of the entire system into account.

- ***PROFInet V1.0*** is a PNO (PROFIBUS user organization) standard for the transmission of engineering and time-uncritical data on Industrial Ethernet using the TCP/IP and COM/DCOM protocols. The transmission frequency of the data amounts to approx. 100 … 200 ms
- ***PROFInet V2.0*** for Component based Automation (planned for early 2004) additionally uses the real-time channel Soft Realtime (SRT) for the transmission of time-uncritical process data on Industrial Ethernet which will replace the time-consuming TCP/IP. The transmission frequency of the data is thus increased and will amount to approx. 10 … 20 ms.

Based on an example for a system configuration, the following illustration shows the PROFInet communication of the individual PROFINET components.



Depending on how a unit is incorporated in the PROFInet communication, there are the following types of devices:
PROFInet device: Features an Ethernet connection and participates directly in the PROFInet communication.
PROFIBUS device: Features only a Profibus connection as slave. Can only participate in the PROFInet communication as PROFInet component if it is connected to PROFInet via a PROFInet master with proxy function.
Via the **proxy functionality** a PROFIBUS device can not only communicate with its master but also with all other stations involved in the PROFInet communication.

Properties of Component based Automation:

- Component based Automation enables consistent communication via fieldbus and Ethernet with IT standards. Both Ethernet solutions and combinations of Ethernet and PROFIBUS are possible.
- Further PROFIBUS segments can be connected to Ethernet via PROFInet devices with proxy function (Win AC PN, IE/PB link). All PROFIBUS devices (standard slaves and intelligent devices) can thus participate in the PROFInet communication on Ethernet. The proxy concept also supports the connection of any fieldbus applications, i.e. already existing parts of the system can be integrated into the communication.
- S7-300 controls with any PROFIBUS DP master systems can be connected to a Component based Automation system via the Industrial Ethernet connection CP 343-1 PN. Lower-level PROFIBUS networks of the control can thus be integrated into the PROFIBUS communication (a PN CP for the direct connection of the S7-400 is planned for early 2004).
- Via standardized communication mechanisms (ActiveX, COM/DCOM, and OPC) process information of the PROFInet variables can be accessed from higher-level analyze tools, e.g. WinCC.
- Access to variables which are not used for PROFInet communication but for e.g. higher-level HMI (e.g. diagnosis information) is realized via the S7 communication.

4 Bibliography

This document was written using the following literature:

Manuals, catalogs by SIEMENS:

- **Communication with SIMATIC**, Communication manual for SIMATIC NET
- **NCM S7 for Industrial Ethernet** – Manual for SIMATIC NET NCM S7 for Industrial Ethernet
- **NCM S7 for PROFIBUS, Vol. 1 and 2** – Manuals for SIMATIC NET NCM S7 for Profibus
- **STEP 7 Software – Online Help:** Help on STEP 7, Topic “Configuring Connections and Data Exchange”
- **SIMATIC HMI Communication – Manual**
- **Component based Automation –** Configuring Plants with SIMATIC iMAP**,** Manual
- **Catalog IK PI,** Industrial Communication and Field
- **Catalog ST 70,** Products for Totally Integrated Automation and Micro Automation

Further literature (German):

- **Bustechnologien für die Automation**, W. Kriesel/ T. Heimbold / D. Telschow, Hüthig Verlag Heidelberg
- **Feldbusse und Geräte-Kommunikationssysteme**, Gruhler, G/STA-Reutlingen, Franzis-Verlag
- **Industrieautomation mit Ethernet-TCP/IP und Web-Technologie,** Frank J. Furrer, Hüthig-Verlag Heidelberg

5 Further sources of information

INTERNET

- Current product information, FAQs, **manuals**, tips, and downloads that are useful during implementation are provided in the internet by the A&D Customer Support

  http://support.automation.siemens.com

- For product descriptions e.g. on automation devices and SIMATIC NET network components please refer to the A&D Mall (interactive catalog by Siemens A&D)

  → **A&D MALL**

AS-Interface AS-International Association http://www.as-interface.com	Industrial Ethernet IAONA Industrial Automation Open Networking Alliance http://www.iaona-eu.com
EIB European Installation Bus Association http://www.eiba.org	PROFIBUS, PROFInet http://www.profibus.com

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