

SIEMENS

SIMATIC

Automation System S7-400 CPU Specifications

Reference Manual

Preface, Contents	1
Structure of a CPU 41x	2
Special functions of a 41x CPU	3
S7-400 in PROFIBUS DP mode	4
Memory Concept and Startup Scenarios	5
Cycle and Reaction Times of the S7-400	6
Technical Specifications	7
IF 964-DP Interface Submodule	
Index	

This manual is part of the documentation package with the order number
6ES7498-8AA04-8BA0

Edition 08/2008

A5E00267840-03

Safety Guidelines

This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:



Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.



Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.



Caution

indicates that minor personal injury can result if proper precautions are not taken.

Caution

indicates that property damage can result if proper precautions are not taken.

Notice

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:



Warning

This device and its components 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.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

SIMATIC®, SIMATIC HMI® and SIMATIC NET® are registered trademarks of SIEMENS AG.

Third parties using for their own purposes any other names in this document which refer to trademarks might infringe upon the rights of the trademark owners.

Copyright Siemens AG 2006 All rights reserved

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

Siemens AG
Industry Sector
Postfach 4848
D- 90327 Nuernberg

Siemens Aktiengesellschaft

Disclaim of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Siemens AG 2008
Technical data subject to change.

A5E00267840

Preface

Purpose of the Manual

The manual contains reference information on operator actions, descriptions of functions and technical specifications of the central processing units, power supply modules and interface modules of the S7-400.

How to configure, assemble and wire these modules (and other) in an S7-400 system is described in the installation manuals for each system.

Required Basic Knowledge

You will need general knowledge of automation to understand this manual.

Target Group

General knowledge in the field of automation technology is presumed.

Prerequisite is also sufficient knowledge in the use of computers or PC-type equipment (programming devices, for example) with Windows 2000 or XP operating system. The S7-400 system is configured in STEP 7 standard software. You should therefore have sufficient knowledge of this standard software. This knowledge is provided in the "Programming with STEP 7" manual.

Please note the information on the safety of electronic control systems in the appendix of this manual, in particular when operating an S7-400 in safety-relevant areas.

Scope of this Manual

The manual applies to the S7-400 automation system, including the following CPUs:

- CPU 412-1; (6ES7412-1XF04-0AB0)
- CPU 412-2; (6ES7412-2XG04-0AB0)
- CPU 414-2; (6ES7414-2XG04-0AB0)
- CPU 414-3; (6ES7414-3XJ04-0AB0)
- CPU 416-2; (6ES7416-2XK04-0AB0)
- CPU 416-2F; (6ES7416-2FK04-0AB0)
- CPU 416-3; (6ES7416-3XL04-0AB0)
- CPU 417-4; (6ES7417-4XL04-0AB0)

Technical Specifications

6

Chapter overview

In Section	You Will Find	On Page
6.1	Technical Specifications of the CPU 412-1; (6ES7412-1XF04-0AB0)	6-2
6.2	Technical Specifications of the CPU 412-2; (6ES7412-2XG04-0AB0)	6-6
6.3	Technical Specifications of the CPU 414-2; (6ES7414-2XG04-0AB0)	6-10
6.4	Technical Specifications of the CPU 414-3; (6ES7414-3XJ04-0AB0)	6-14
6.5	Technical Specifications of the CPU 416-2; (6ES7416-2XK04-0AB0, 6ES7416-2FK04-0AB0)	6-18
6.6	Technical Specifications of the CPU 416-3; (6ES7416-3XL04-0AB0)	6-22
6.7	Technical Specifications of the CPU 417-4; (6ES7417-4XL04-0AB0)	6-26
6.8	Technical Specifications of the Memory Cards	6-30

6.5 Technical Specifications of the CPU 416-2; (6ES7416-2XK04-0AB0, 6ES7416-2FK04-0AB0)

CPU and Version		Data Areas and Their Retentivity	
MLFB	6ES7416-2XK04-0AB0 6ES7416-2FK04-0AB0	Total retentive data areas (including memory bits; times; counts)	Total working and load memory (with backup battery)
• Firmware version	V 4.0.0	Memory markers	16 Kbytes
Associated programming package	As of STEP 7 5.2 SP1 HF3 with HW-Update	• Retentivity can be set	From MB 0 to MB 16383
Memory		• Preset retentivity	From MB 0 to MB 15
Working memory		Clock memories	8 (1 memory byte)
• Integrated	1.4 Mbytes for code 1.4 Mbytes for data	Data blocks	Max. 4095 (DB 0 reserved)
Load memory		• Size	Max. 64 Kbytes
• Integrated	256 Kbytes RAM	Local data (can be set)	Max. 32 Kbytes
• Expandable FEPR0M	With memory card (FLASH) up to 64 Mbytes	• Preset	16 Kbytes
• Expandable RAM	With memory card (RAM) up to 64 Mbytes	Blocks	
Backup with battery	Yes, all data	OBs	See instruction list
Typ. processing times		• Size	Max. 64 Kbytes
Processing times for		Nesting depth	
• Bit operations	0.04 µs	• Per priority class	24
• Word instructions	0.04 µs	• Additionally in an error OB	2
• Integer math instructions	0.04 µs	FBs	Max. 2048
• Floating-point math instructions	0.12 µs	• Size	Max. 64 Kbytes
Timers/Counters and Their Retentivity		FCs	Max. 2048
S7 counters	2048	• Size	Max. 64 Kbytes
• Retentivity can be set	From Z 0 to Z 2047	Address Areas (Inputs/Outputs)	
• Preset	From Z 0 to Z 7	Total I/O address area	16 Kbytes/16 Kbytes
• Counting range	1 to 999	• Of which distributed	incl. diagnostics addresses for I/O interfaces, etc.
IEC counter	Yes	MPI/DP interface	2 Kbytes/2 Kbytes
• Type	SFB	DP interface	8 Kbytes/8 Kbytes
S7 timers	2048	Process Image	16 Kbytes/16 Kbytes (can be set)
• Retentivity can be set	From T 0 to T 2047	• Preset	512 bytes/512 bytes
• Preset	No retentive timers	• Number of partial process images	Max. 15
• Time range	10 ms to 9990 s	• Consistent data	Max. 244 bytes
IEC timers	Yes	Digital channels	Max. 131072/ Max. 131072
• Type	SFB	• Of which central	Max. 131072/ Max. 131072
		Analog channels	Max. 8192/ Max. 8192
		• Of which central	Max. 8192/ Max. 8192

Configuration		S7 Message Functions	
Central racks/expansion units	Max. 1/21	Number of stations that can log on for message functions (e.g. WIN CC or SIMATIC OP)	Max. 12
Multicomputing	Max. 4 CPUs (with UR1 or UR2)	Symbol-related messages	Yes
Number of plug-in IMs (overall)	Max. 6	- Number of messages - Overall Max. 1024 100 ms grid Max. 128 500 ms grid Max. 512 1000 ms grid Max. 1024 - Number of additional values per message - With 100 ms grid Max. 1 - With 500, 1000 ms grid Max. 10	
- IM 460 Max. 6 - IM 463-2 Max. 4		Block-related messages	Yes
Number of DP masters		Simultaneously active ALARM_S/SQ blocks and ALARM_D/DQ blocks	Max. 200
- Integrated 2 - Via IM 467 Max. 4 - Via CP 443-5 Extended Max. 10		ALARM_8 blocks	Yes
IM 467 cannot be used with the CP 443-5 Extended		Number of communication jobs for ALARM_8 blocks and blocks for S7 communication (can be set)	Max. 1800
IM 467 cannot be used with the CP 443-1 EX40 in PN IO mode		Preset 600	
Number of plug-in S5 modules via adapter casing (in the central rack)	Max. 6	Process control reports	Yes
Operable function modules and communication processors		Number of archives that can log on simultaneously (SFB 37 AR_SEND)	32
- FM Limited by the number of slots and the number of connections - CP 440 Limited by the number of slots - CP 441 Limited by the number of connections - Profibus and Ethernet CPs incl. CP 443-5 Extended and IM 467 Max. 14		Test and Startup Functions	
Time		Monitor/modify variable	Yes
Clock	Yes	Variables Inputs/outputs, memory markers, DB, distributed inputs/outputs, timers, counters	
- Buffered Yes - Resolution 1 ms - Accuracy at - Power off Deviation per day 1.7 s - Power on Deviation per day 8.6 s		Number of variables Max. 70	
Operating hours counters	8	Force	Yes
- Number 0 to 7 - Value Range 0 to 32767 hours - Granularity 1 hour - Retentive Yes		Variables Inputs/outputs, memory markers, distributed inputs/outputs	
Time synchronization	Yes	Number of variables Max. 512	
In PLC, on MPI and DP as master or slave		Status block	Yes
		Single sequence	Yes
		Diagnostic buffer	Yes
		- Number of entries Max. 3200 (can be set) - Preset 120	
		Number of breakpoints	4

Communication Functions	
Programming device/OP communication	Yes
Number of connectable OPs	63 without message processing, 12 with message processing
Number of connection resources for S7 connections via all interfaces and CPs	64, with one each of those reserved for PG and OP
Global data communication	Yes
• Number of GD circuits	Max. 16
• Number of GD packages	
– Sender	Max. 16
– Receiver	Max. 32
• Size of GD packages	Max. 64 bytes
– Of which consistent	1 variable
S7 basic communication	Yes
• MPI Mode	via SFC X_SEND, X_RCV, X_GET and X_PUT
• DP Master Mode	via SFC I_GET and I_PUT
• User data per job	Max. 76 bytes
– Of which consistent	1 variable
S7 communication	Yes
• User data per job	Max. 64 Kbytes
– Of which consistent	1 variable (462 bytes)
S5-compatible communication	via FC AG_SEND and AG_RECV, max. via 10 CP 443-1 or 443-5)
• User data per job	Max. 8 Kbytes
– Of which consistent	240 bytes
Standard communication (FMS)	Yes (via CP and loadable FB)
Interfaces	
1st Interface	
Type of interface	Integrated
Physical	RS 485/Profibus
Isolated	Yes
Power supply to interface (15 VDC to 30 VDC)	Max. 150 mA
Number of connection resources	MPI: 44 DP: 32, a diagnostic repeater in the segment reduces the number of connection resources by 1
Functionality	
• MPI	Yes
• PROFIBUS DP	DP master/DP slave
1st Interface MPI Mode	
• Utilities	
– Programming device/OP communication	Yes
– Routing	Yes
– Global data communication	Yes
– S7 basic communication	Yes
– S7 communication	Yes
• Transmission rates	Up to 12 Mbps

1st Interface DP Master Mode	
• Utilities	
– Programming device/OP communication	Yes
– Routing	Yes
– S7 basic communication	Yes
– S7 communication	Yes
– Constant bus cycle time	Yes
– SYNC/FREEZE	Yes
– Enable/disable DP slaves	Yes
• Transmission rates	Up to 12 Mbps
• Number of DP slaves	Max. 32
• Address area	Max. 2 Kbytes inputs/ 2 Kbytes outputs
• User data per DP slave	Max. 244 bytes inputs, max. 244 bytes outputs, max. 244 slots each with max. 128 bytes
• User data per DP slave	
Note:	
• The accumulated number of input bytes at the slots may not exceed 244	
• The accumulated number of output bytes at the slots may not exceed 244	
• The maximum address area of the interface (max. 2KB inputs/ 2 KB outputs) accumulated by 32 slaves may not be exceeded	
1st Interface DP Slave Mode	
You can only configure the CPU once as a DP slave even if the CPU has several interfaces.	
• Utilities	
– Monitor/modify	Yes
– Programming	Yes
– Routing	Yes
• DDB (GSD) file	http://www.ad.siemens.de/csi_e/gsd
• Transmission rate	Up to 12 Mbps
• Intermediate memory	244 bytes inputs/ 244 bytes outputs
– virtual slots	Max. 32
– User data per address area	Max. 32 bytes
– Of which consistent	32 bytes
2nd Interface	
Type of interface	Integrated
Physical	RS 485/Profibus
Isolated	Yes
Power supply to interface (15 VDC to 30 VDC)	Max. 150 mA
Number of connection resources	32, a diagnostic repeater on the segment reduces the number of connection resources by 1

Functionality	
● PROFIBUS DP	DP Master/DP Slave
2nd Interface DP Master Mode	
● Utilities	
– Programming device/OP communication	Yes
– Routing	Yes
– S7 basic communication	Yes
– S7 communication	Yes
– Constant bus cycle time	Yes
– SYNC/FREEZE	Yes
– Enable/disable DP slaves	Yes
● Transmission rates	Up to 12 Mbps
● Number of DP slaves	Max. 125
● Address area	Max. 8 Kbytes inputs/ 8 Kbytes outputs
● User data per DP slave	Max. 244 bytes inputs / 244 bytes outputs distributed over 244 slots each with 128 bytes
2nd Interface DP Slave Mode	
As for the 1st interface	
Programming	
Programming language	LAD, FBD, STL, SCL
Instruction set	See instruction list
Bracket levels	8
System functions (SFC)	See instruction list
Number of SFCs active at the same time for every strand	
● DP_SYC_FR	2
● D_ACT_DP	4
● RD_REC	8
● WR_REC	8
● WR_PARM	8
● PARM_MOD	1
● WR_DPARM	2
● DPNRM_DG	8
● RDSYSST	1 to 8
● DP_TOPOL	1
System function blocks (SFB)	See instruction list
Number of SFBs active at the same time	
● RD_REC	8
● WR_REC	8
User program protection	Password protection
Access to consistent data in the process image	Yes

CiR synchronization time	
Base load	100 ms
Time per I/O byte	40 μs
Clock synchronism	
User data per clock synchronous slave	Max. 244 bytes
Maximum number of bytes and slaves in a process image partition	The following applies: Number of bytes/100 + number of slaves <40
Constant bus cycle time	Yes
Shortest clock pulse	1 ms
Longest pulse clock see manual <i>Clock Synchronism</i>	0.5 ms without use of SFC 126, 127
Dimensions	
Mounting dimensions W×H×D (mm)	25×290×219
Slots required	1
Weight	approx. 0.72 kg
Voltages, Currents	
Current consumption from S7-400 bus (5 VDC)	Typ. 1.0 A Max. 1.2 A
Current consumption from the S7-400 bus (24 VDC) The CPU does not consume any current at 24 V, and it only makes this voltage available at the MPI/DP interface.	Total current consumption of the components connected to the MPI/DP interfaces, with a maximum of 150 mA per interface
Backup current	Typ. 550 μA Max. 1539 μA
maximum backup time	See manual <i>Module Specifications</i> , chapter 3.3
Incoming supply of external backup voltage to the CPU	5 VDC to 15 VDC
Power loss	Typ. 4.5 W