

SIEMENS

SIMATIC

Automation System S7-400 CPU Specifications

Reference Manual

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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)

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 100 ms grid 500 ms grid 1000 ms grid	Max. 1024 Max. 128 Max. 512 Max. 1024
- IM 460 - IM 463-2	Max. 6 Max. 4	- Number of additional values per message - With 100 ms grid - With 500, 1000 ms grid	Max. 1 Max. 10
Number of DP masters		Block-related messages	Yes
- Integrated - Via IM 467 - Via CP 443-5 Extended	2 Max. 4 Max. 10	Simultaneously active ALARM_S/SQ blocks and ALARM_D/DQ blocks	Max. 200
IM 467 cannot be used with the CP 443-5 Extended		ALARM_8 blocks	Yes
IM 467 cannot be used with the CP 443-1 EX40 in PN IO mode		- Number of communication jobs for ALARM_8 blocks and blocks for S7 communication (can be set) - Preset	Max. 1800 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 - CP 440 - CP 441 - Profibus and Ethernet CPs incl. CP 443-5 Extended and IM 467	Limited by the number of slots and the number of connections Limited by the number of slots Limited by the number of connections 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 - Resolution - Accuracy at - Power off - Power on	Yes 1 ms Deviation per day 1.7 s Deviation per day 8.6 s	Number of variables	Max. 70
Operating hours counters	8	Force	Yes
- Number - Value Range - Granularity - Retentive	0 to 7 0 to 32767 hours 1 hour Yes	- Variables - Number of variables	Inputs/outputs, memory markers, distributed inputs/outputs Max. 512
Time synchronization	Yes	Status block	Yes
In PLC, on MPI and DP	as master or slave	Single sequence	Yes
		Diagnostic buffer	Yes
		- Number of entries - Preset	Max. 3200 (can be set) 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