



***** Replacement part ***** SIMATIC S7-400, CPU 412-2 Central processing unit with: work memory 512 KB, (256 KB code, 256 KB of data), 1st interface MPI/DP 12 Mbit/s, 2nd interface PROFIBUS DP

General information	
Product type designation	CPU 412-2
HW functional status	03
Firmware version	V5.3
Product function	
<ul style="list-style-type: none"> • Isochronous mode 	Yes; For PROFIBUS only
Engineering with	
<ul style="list-style-type: none"> • Programming package 	STEP 7 V5.3 SP2 or higher with HW update
CiR - Configuration in RUN	
CiR synchronization time, basic load	100 ms
CiR synchronization time, time per I/O byte	30 µs
Supply voltage	
Rated value (DC)	Power supply via system power supply
Input current	
from backplane bus 5 V DC, typ.	0.9 A
from backplane bus 5 V DC, max.	1.1 A
from backplane bus 24 V DC, max.	300 mA; 150 mA per DP interface
from interface 5 V DC, max.	90 mA; At each DP interface
Power loss	
Power loss, typ.	4.5 W
Power loss, max.	5 W
Memory	
Type of memory	RAM
Work memory	
<ul style="list-style-type: none"> • integrated 	512 kbyte
<ul style="list-style-type: none"> • integrated (for program) 	256 kbyte
<ul style="list-style-type: none"> • integrated (for data) 	256 kbyte
<ul style="list-style-type: none"> • expandable 	No
Load memory	
<ul style="list-style-type: none"> • expandable FEPR0M 	Yes; with Memory Card (FLASH)
<ul style="list-style-type: none"> • expandable FEPR0M, max. 	64 Mbyte
<ul style="list-style-type: none"> • integrated RAM, max. 	512 kbyte
<ul style="list-style-type: none"> • expandable RAM 	Yes; with Memory Card (RAM)
<ul style="list-style-type: none"> • expandable RAM, max. 	64 Mbyte
Backup	
<ul style="list-style-type: none"> • present 	Yes
<ul style="list-style-type: none"> • with battery 	Yes; all data
<ul style="list-style-type: none"> • without battery 	No
Battery	
Backup battery	

• Backup current, typ.	125 µA; up to 40 °C
• Backup current, max.	550 µA
• Backup time, max.	See reference manual, module data, Chapter 3.3
• Feeding of external backup voltage to CPU	5 V DC to 15 V DC

CPU processing times

for bit operations, typ.	75 ns
for word operations, typ.	75 ns
for fixed point arithmetic, typ.	75 ns
for floating point arithmetic, typ.	225 ns

CPU-blocks

DB

• Number, max.	3 000; Number range: 1 to 16000
• Size, max.	64 kbyte

FB

• Number, max.	1 500; Number range: 0 to 7999
• Size, max.	64 kbyte

FC

• Number, max.	1 500; Number range: 0 to 7999
• Size, max.	64 kbyte

OB

• Number, max.	see instruction list
• Size, max.	64 kbyte
• Number of free cycle OBs	1; OB 1
• Number of time alarm OBs	2; OB 10, 11
• Number of delay alarm OBs	2; OB 20, 21
• Number of cyclic interrupt OBs	2; OB 32, 35 (shortest cycle that can be set = 500 µs)
• Number of process alarm OBs	2; OB 40, 41
• Number of DPV1 alarm OBs	3; OB 55-57
• Number of isochronous mode OBs	2; OB 61-62
• Number of multicomputing OBs	1; OB 60
• Number of background OBs	1; OB 90
• Number of startup OBs	3; OB 100-102
• Number of asynchronous error OBs	9; OB 80-88
• Number of synchronous error OBs	2; OB 121, 122

Nesting depth

• per priority class	24
• additional within an error OB	1

Counters, timers and their retentivity

S7 counter

• Number	2 048
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Retentivity

— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	Z 0 to Z 7

Counting range

— lower limit	0
— upper limit	999

IEC counter

• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)

S7 times

• Number	2 048
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Retentivity

— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	No times retentive

Time range

— lower limit	10 ms
— upper limit	9 990 s
IEC timer	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
Data areas and their retentivity	
Retentive data area (incl. timers, counters, flags), max.	Total working and load memory (with backup battery)
Flag	
• Size, max.	4 kbyte; Size of bit memory address area
• Retentivity available	Yes
• Retentivity preset	MB 0 to MB 15
• Number of clock memories	8; in 1 memory byte
Local data	
• adjustable, max.	8 kbyte
• preset	4 kbyte
Address area	
I/O address area	
• Inputs	4 kbyte
• Outputs	4 kbyte
Process image	
• Inputs, adjustable	4 kbyte
• Outputs, adjustable	4 kbyte
• Inputs, default	128 byte
• Outputs, default	128 byte
• consistent data, max.	244 byte
• Access to consistent data in process image	Yes
Subprocess images	
• Number of subprocess images, max.	15
Digital channels	
• Inputs	32 768
— of which central	32 768
• Outputs	32 768
— of which central	32 768
Analog channels	
• Inputs	2 048
— of which central	2 048
• Outputs	2 048
— of which central	2 048
Hardware configuration	
Integrated power supply	No
Number of expansion units, max.	21
connectable OPs	31
Multicomputing	Yes; 4 CPUs max. (with UR1 or UR2)
Interface modules	
• Number of connectable IMs (total), max.	6
• Number of connectable IM 460s, max.	6
• Number of connectable IM 463s, max.	4; IM 463-2
Number of DP masters	
• integrated	2
• via CP	10; CP 443-5 Extended
• via IM 467	4
• Mixed mode IM + CP permitted	No; IM 467 not suitable for use with CP 443-5 Ext. and CP 443-1 EX4x, EX20, GX20 (in PROFINET IO mode)
• via interface module	0
• Number of pluggable S5 modules (via adapter capsule in central device), max.	6
Number of IO Controllers	
• integrated	0
• via CP	4; No mixed operation of CP443-1 EX40 and CP443-1 EX 41/EX20/GX20, max. 4 in central controller

Number of operable FMs and CPs (recommended)	
<ul style="list-style-type: none"> • FM • CP, PtP • PROFIBUS and Ethernet CPs 	Limited by number of slots and number of connections CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections 14; Of which 10 CPs max. or IMs as DP master, 4 PROFINET controller maximum
Slots	
<ul style="list-style-type: none"> • required slots 	1
Time of day	
Clock	
<ul style="list-style-type: none"> • Hardware clock (real-time) • retentive and synchronizable • Resolution • Deviation per day (buffered), max. • Deviation per day (unbuffered), max. 	Yes Yes 1 ms 1.7 s; Power off 8.6 s; For power On
Operating hours counter	
<ul style="list-style-type: none"> • Number • Number/Number range • Range of values • Granularity • retentive 	16 0 to 15 SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2 ³¹ - 1 hours 1 h Yes
Clock synchronization	
<ul style="list-style-type: none"> • supported • to MPI, master • to MPI, slave • to DP, master • to DP, slave • in AS, master • in AS, slave • on Ethernet via NTP 	Yes Yes Yes Yes Yes Yes Yes No; Via CP
Time difference in system when synchronizing via	
<ul style="list-style-type: none"> • MPI, max. 	200 ms
Interfaces	
Interfaces/bus type	1 x MPI/PROFIBUS DP, 1 x PROFIBUS DP
Number of RS 485 interfaces	2; Combined MPI / PROFIBUS DP and PROFIBUS DP
Optical interface	No
1. Interface	
Interface type	MPI/PROFIBUS DP
Isolated	Yes
Interface types	
<ul style="list-style-type: none"> • RS 485 • Output current of the interface, max. 	Yes 150 mA
Protocols	
<ul style="list-style-type: none"> • MPI • PROFIBUS DP master • PROFIBUS DP slave 	Yes Yes Yes
MPI	
<ul style="list-style-type: none"> • Number of connections • Transmission rate, max. 	32; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1 12 Mbit/s
Services	
<ul style="list-style-type: none"> — PG/OP communication — Routing — Global data communication — S7 basic communication — S7 communication — S7 communication, as client — S7 communication, as server 	Yes Yes Yes Yes Yes Yes Yes
PROFIBUS DP master	
<ul style="list-style-type: none"> • Number of connections, max. • Transmission rate, max. 	16; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1 12 Mbit/s

• Number of DP slaves, max.	32
Services	
— PG/OP communication	Yes
— Routing	Yes; S7 routing
— Global data communication	No
— S7 basic communication	Yes
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Equidistance	Yes
— Isochronous mode	Yes
— SYNC/FREEZE	Yes
— Activation/deactivation of DP slaves	Yes
— Direct data exchange (slave-to-slave communication)	Yes
— DPV1	Yes
Address area	
— Inputs, max.	2 kbyte
— Outputs, max.	2 kbyte
User data per DP slave	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
PROFIBUS DP slave	
• Number of connections	16
• GSD file	http://support.automation.siemens.com/WW/view/en/113652
• Transmission rate, max.	12 Mbit/s
• automatic baud rate search	No
• Address area, max.	32; Virtual slots
• User data per address area, max.	32 byte
— of which consistent, max.	32 byte
Services	
— PG/OP communication	Yes; with interface active
— Routing	Yes; with interface active
— Global data communication	No
— S7 basic communication	No
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Direct data exchange (slave-to-slave communication)	No
— DPV1	No
Transfer memory	
— Inputs	244 byte
— Outputs	244 byte
2. Interface	
Interface type	PROFIBUS DP
Isolated	Yes
Number of connection resources	16
Interface types	
• RS 485	Yes
• Output current of the interface, max.	150 mA
Protocols	
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	Yes
PROFIBUS DP master	
• Number of connections, max.	16
• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	64

Services	
— PG/OP communication	Yes
— Routing	Yes; S7 routing
— Global data communication	No
— S7 basic communication	Yes
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Equidistance	Yes
— Isochronous mode	Yes
— SYNC/FREEZE	Yes
— Activation/deactivation of DP slaves	Yes
— Direct data exchange (slave-to-slave communication)	Yes
— DPV1	Yes
Address area	
— Inputs, max.	4 kbyte
— Outputs, max.	4 kbyte
User data per DP slave	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
PROFIBUS DP slave	
• Number of connections	16
• GSD file	http://support.automation.siemens.com/WW/view/en/113652
• Transmission rate, max.	12 Mbit/s
• Address area, max.	32
• User data per address area, max.	32 byte
— of which consistent, max.	32 byte
Services	
— Routing	Yes
Transfer memory	
— Inputs	244 byte
— Outputs	244 byte
Protocols	
SIMATIC communication	
• S7 routing	Yes
Open IE communication	
• ISO-on-TCP (RFC1006)	Via CP 443-1 and loadable FB
— Data length, max.	1 452 bytes via CP 443-1 Adv.
Web server	
• supported	No
Isochronous mode	
Equidistance	Yes
Number of DP masters with isochronous mode	2
User data per isochronous slave, max.	244 byte
shortest clock pulse	1.5 ms; 0.5 ms without use of SFC 126, 127
max. cycle	32 ms
communication functions / header	
PG/OP communication	
• Number of connectable OPs without message processing	31
• Number of connectable OPs with message processing	31; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
Global data communication	
• supported	Yes
• Number of GD loops, max.	8
• Number of GD packets, transmitter, max.	8
• Number of GD packets, receiver, max.	16
• Size of GD packets, max.	54 byte

<ul style="list-style-type: none"> • Size of GD packet (of which consistent), max. 	1 variable
S7 basic communication	
<ul style="list-style-type: none"> • communication function / S7 basic communication 	Yes
<ul style="list-style-type: none"> • User data per job, max. 	76 byte
<ul style="list-style-type: none"> • User data per job (of which consistent), max. 	1 variable
S7 communication	
<ul style="list-style-type: none"> • supported 	Yes
<ul style="list-style-type: none"> • as server 	Yes
<ul style="list-style-type: none"> • as client 	Yes
<ul style="list-style-type: none"> • User data per job, max. 	64 kbyte
<ul style="list-style-type: none"> • User data per job (of which consistent), max. 	462 byte; 1 variable
S5 compatible communication	
<ul style="list-style-type: none"> • supported 	Yes; Via FC AG_SEND and AG_RECV, max. via 10 CP 443-1 or 443-5
<ul style="list-style-type: none"> • User data per job, max. 	8 kbyte
<ul style="list-style-type: none"> • User data per job (of which consistent), max. 	240 byte
<ul style="list-style-type: none"> • Number of simultaneous AG-SEND/AG-RECV orders per CPU, max. 	24/24
Standard communication (FMS)	
<ul style="list-style-type: none"> • supported 	Yes; Via CP and loadable FB
Number of connections	
<ul style="list-style-type: none"> • overall 	32
<ul style="list-style-type: none"> • usable for PG communication <ul style="list-style-type: none"> — reserved for PG communication — adjustable for PG communication, max. 	31 1 0
<ul style="list-style-type: none"> • usable for OP communication <ul style="list-style-type: none"> — reserved for OP communication — adjustable for OP communication, max. 	31 1 0
<ul style="list-style-type: none"> • usable for S7 basic communication <ul style="list-style-type: none"> — reserved for S7 basic communication — adjustable for S7 basic communication, max. 	30 0 0
<ul style="list-style-type: none"> • usable for S7 communication <ul style="list-style-type: none"> — reserved for S7 communication — adjustable for S7 communication, max. 	30 0 0
<ul style="list-style-type: none"> • usable for routing <ul style="list-style-type: none"> — reserved for routing — adjustable for routing, max. 	15 0 0
S7 message functions	
Number of login stations for message functions, max.	31; Max. 31 with Alarm_S/SQ and Alarm_D/DQ (OPs); max. 8 with Alarm_8 and Alarm_P (e.g. WinCC)
Symbol-related messages	Yes
SCAN procedure	Yes
Program alarms	Yes
Process diagnostic messages	Yes
simultaneously active Alarm-S blocks, max.	250; Simultaneously active alarm_S/SQ blocks or alarm_D/DQ blocks
Alarm 8-blocks	Yes
<ul style="list-style-type: none"> • Number of instances for alarm 8 and S7 communication blocks, max. 	300
<ul style="list-style-type: none"> • preset, max. 	150
Process control messages	Yes
Number of archives that can log on simultaneously (SFB 37 AR_SEND)	4
Number of messages	
<ul style="list-style-type: none"> • overall, max. 	256
<ul style="list-style-type: none"> • in 100 ms grid, max. 	0
<ul style="list-style-type: none"> • in 500 ms grid, max. 	256
<ul style="list-style-type: none"> • in 1000 ms grid, max. 	256
Number of additional values	
<ul style="list-style-type: none"> • with 100 ms grid, max. 	0
<ul style="list-style-type: none"> • with 500, 1000 ms grid, max. 	1
Test commissioning functions	
Status block	Yes; Up to 2 simultaneously
Single step	Yes

Number of breakpoints	4
Status/control	
<ul style="list-style-type: none"> • Status/control variable • Variables • Number of variables, max. 	<p>Yes; Up to 16 variable tables</p> <p>Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters</p> <p>70; Status/control</p>
Forcing	
<ul style="list-style-type: none"> • Forcing • Forcing, variables • Number of variables, max. 	<p>Yes</p> <p>Inputs, outputs, bit memories, peripheral inputs, peripheral outputs</p> <p>64</p>
Diagnostic buffer	
<ul style="list-style-type: none"> • present • Number of entries, max. <ul style="list-style-type: none"> — adjustable — preset 	<p>Yes</p> <p>400</p> <p>Yes</p> <p>120</p>
Service data	
<ul style="list-style-type: none"> • can be read out 	Yes
Standards, approvals, certificates	
CE mark	Yes
CSA approval	Yes
UL approval	Yes
cULus	Yes
FM approval	Yes
RCM (formerly C-TICK)	Yes
KC approval	Yes
EAC (formerly Gost-R)	Yes
Use in hazardous areas	
<ul style="list-style-type: none"> • ATEX 	ATEX II 3G Ex nA IIC T4 Gc
Ambient conditions	
Ambient temperature during operation	
<ul style="list-style-type: none"> • min. • max. 	<p>0 °C</p> <p>60 °C</p>
configuration / header	
Configuration software	
<ul style="list-style-type: none"> • STEP 7 	Yes
configuration / programming / header	
<ul style="list-style-type: none"> • Command set • Nesting levels • Access to consistent data in process image • System functions (SFC) • System function blocks (SFB) 	<p>see instruction list</p> <p>7</p> <p>Yes</p> <p>see instruction list</p> <p>see instruction list</p>
Programming language	
<ul style="list-style-type: none"> — LAD — FBD — STL — SCL — CFC — GRAPH — HiGraph® 	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
configuration / programming / number of simultaneously active SFC / header	
<ul style="list-style-type: none"> — DPSYC_FR — D_ACT_DP — RD_REC — WR_REC — WR_PARM — PARM_MOD — WR_DPARAM — DPNRM_DG — RDSYSST — DP_TOPOL 	<p>2; SFC 11; per interface</p> <p>8; SFC 12; per interface</p> <p>8; SFC 59; per interface</p> <p>8; SFC 58; per interface</p> <p>8; SFC 55; per interface</p> <p>1; SFC 57; per interface</p> <p>2; SFC 56; per interface</p> <p>8; SFC 13; per interface</p> <p>8</p> <p>1; SFC 103; per interface</p>
configuration / programming / number of simultaneously active SFB / header	

- RDREC 8; SFB 52; per interface, but not more than 32 across all external interfaces
- WRREC 8; SFB 53; per interface, but not more than 32 across all external interfaces

Know-how protection	
• User program protection/password protection	Yes
Dimensions	
Width	25 mm
Height	290 mm
Depth	219 mm
Weights	
Weight, approx.	700 g

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