

SIMATIC S7-400, CPU 412-1 Central processing unit with: Work memory 512 KB, (256 KB code, 256 KB data), interface MPI/DP 12 Mbit/s,



General information	
Product type designation	CPU 412-1
HW functional status	01
Firmware version	V7.0
Product function	
<ul style="list-style-type: none"> <li>• Isochronous mode</li> </ul>	Yes; For PROFIBUS only
Engineering with	
<ul style="list-style-type: none"> <li>• Programming package</li> </ul>	STEP 7 V5.4 or higher with HSP 261
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)	
<ul style="list-style-type: none"> <li>• 24 V DC</li> </ul>	No; Power supply via system power supply
Input current	
from backplane bus 5 V DC, typ.	0.7 A
from backplane bus 5 V DC, max.	0.8 A
from backplane bus 24 V DC, max.	150 mA; 150 mA per DP interface

from interface 5 V DC, max.	90 mA; At the DP interface
<b>Power loss</b>	
Power loss, typ.	3.5 W
Power loss, max.	4 W
<b>Memory</b>	
Type of memory	RAM
<b>Work memory</b>	
<ul style="list-style-type: none"> <li>integrated</li> </ul>	512 kbyte
<ul style="list-style-type: none"> <li>integrated (for program)</li> </ul>	256 kbyte
<ul style="list-style-type: none"> <li>integrated (for data)</li> </ul>	256 kbyte
<ul style="list-style-type: none"> <li>expandable</li> </ul>	No
<b>Load memory</b>	
<ul style="list-style-type: none"> <li>expandable FEPRM</li> </ul>	Yes; with Memory Card (FLASH)
<ul style="list-style-type: none"> <li>expandable FEPRM, max.</li> </ul>	64 Mbyte
<ul style="list-style-type: none"> <li>integrated RAM, max.</li> </ul>	512 kbyte
<ul style="list-style-type: none"> <li>expandable RAM</li> </ul>	Yes; with Memory Card (RAM)
<ul style="list-style-type: none"> <li>expandable RAM, max.</li> </ul>	64 Mbyte
<b>Backup</b>	
<ul style="list-style-type: none"> <li>present</li> </ul>	Yes
<ul style="list-style-type: none"> <li>with battery</li> </ul>	Yes; all data
<ul style="list-style-type: none"> <li>without battery</li> </ul>	No
<b>Battery</b>	
<b>Backup battery</b>	
<ul style="list-style-type: none"> <li>Backup current, typ.</li> </ul>	180 $\mu$ A; up to 40 °C
<ul style="list-style-type: none"> <li>Backup current, max.</li> </ul>	850 $\mu$ A
<ul style="list-style-type: none"> <li>Backup time, max.</li> </ul>	Dealt with in the module data manual with the secondary conditions and the factors of influence
<ul style="list-style-type: none"> <li>Feeding of external backup voltage to CPU</li> </ul>	5 V DC to 15 V DC
<b>CPU processing times</b>	
for bit operations, typ.	31.25 ns
for word operations, typ.	31.25 ns
for fixed point arithmetic, typ.	31.25 ns
for floating point arithmetic, typ.	62.5 ns
<b>CPU-blocks</b>	
<b>DB</b>	
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	3 000; Number range: 1 to 16000
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	64 kbyte
<b>FB</b>	
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	1 500; Number range: 0 to 7999
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	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
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
Retentivity	
— adjustable	Yes
— lower limit	0

— upper limit	2 047
— preset	No times retentive
<b>Time range</b>	
— lower limit	10 ms
— upper limit	9 990 s
<b>IEC timer</b>	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
<b>Data areas and their retentivity</b>	
retentive data area in total	Total working and load memory (with backup battery)
<b>Flag</b>	
• Number, 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
<b>Local data</b>	
• adjustable, max.	8 kbyte
• preset	4 kbyte
<b>Address area</b>	
<b>I/O address area</b>	
• Inputs	4 kbyte
• Outputs	4 kbyte
<b>Process image</b>	
• 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
<b>Subprocess images</b>	
• Number of subprocess images, max.	15
<b>Digital channels</b>	
• Inputs	32 768
— of which central	32 768
• Outputs	32 768
— of which central	32 768
<b>Analog channels</b>	
• Inputs	2 048
— of which central	2 048
• Outputs	2 048

## Hardware configuration

Number of expansion units, max.	21
connectable OPs	47
Multicomputing	Yes; 4 CPUs max. (with UR1 or UR2)
<b>Interface modules</b>	
<ul style="list-style-type: none"> <li>Number of connectable IMs (total), max.</li> </ul>	6
<ul style="list-style-type: none"> <li>Number of connectable IM 460s, max.</li> </ul>	6
<ul style="list-style-type: none"> <li>Number of connectable IM 463s, max.</li> </ul>	4; IM 463-2
<b>Number of DP masters</b>	
<ul style="list-style-type: none"> <li>integrated</li> </ul>	1
<ul style="list-style-type: none"> <li>via CP</li> </ul>	10; CP 443-5 Extended
<ul style="list-style-type: none"> <li>via IM 467</li> </ul>	4
<ul style="list-style-type: none"> <li>Mixed mode IM + CP permitted</li> </ul>	No; IM 467 cannot be used jointly with CP 443-5 Ext. or CP 443-1 in PROFINET IO mode
<ul style="list-style-type: none"> <li>via interface module</li> </ul>	0
<ul style="list-style-type: none"> <li>Number of pluggable S5 modules (via adapter capsule in central device), max.</li> </ul>	6
<b>Number of IO Controllers</b>	
<ul style="list-style-type: none"> <li>integrated</li> </ul>	0
<ul style="list-style-type: none"> <li>via CP</li> </ul>	4; Max. 4 in the central controller; no mixed operation of different CP 443-1 types in PROFINET IO mode
<b>Number of operable FMs and CPs (recommended)</b>	
<ul style="list-style-type: none"> <li>FM</li> </ul>	Limited by number of slots and number of connections
<ul style="list-style-type: none"> <li>CP, PtP</li> </ul>	CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections
<ul style="list-style-type: none"> <li>PROFIBUS and Ethernet CPs</li> </ul>	14; In total max. 10 CPs as DP master and PROFINET controller, of which up to 10 IMs or CPs as DP master and up to 4 CPs as PROFINET controller
<b>Slots</b>	
<ul style="list-style-type: none"> <li>required slots</li> </ul>	1
<b>Time of day</b>	
<b>Clock</b>	
<ul style="list-style-type: none"> <li>Hardware clock (real-time)</li> </ul>	Yes
<ul style="list-style-type: none"> <li>retentive and synchronizable</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Resolution</li> </ul>	1 ms
<ul style="list-style-type: none"> <li>Deviation per day (buffered), max.</li> </ul>	1.7 s; Power off
<ul style="list-style-type: none"> <li>Deviation per day (unbuffered), max.</li> </ul>	8.6 s; For power On
<b>Operating hours counter</b>	
<ul style="list-style-type: none"> <li>Number</li> </ul>	16
<ul style="list-style-type: none"> <li>Number/Number range</li> </ul>	0 to 15
<ul style="list-style-type: none"> <li>Range of values</li> </ul>	SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2 <sup>31</sup> - 1 hours

• Granularity	1 h
• retentive	Yes
<b>Clock synchronization</b>	
• supported	Yes
• to MPI, master	Yes
• to MPI, slave	Yes
• to DP, master	Yes
• to DP, slave	Yes
• in AS, master	Yes
• in AS, slave	Yes
• on Ethernet via NTP	No; Via CP
• to IF 964 DP	No
<b>Time difference in system when synchronizing via</b>	
• MPI, max.	200 ms
<b>Interfaces</b>	
Interfaces/bus type	1 x MPI/PROFIBUS DP
Number of RS 485 interfaces	1; Combined MPI / PROFIBUS DP
<b>1. Interface</b>	
Interface type	Integrated
Physics	RS 485 / PROFIBUS + MPI
Isolated	Yes
Power supply to interface (15 to 30 V DC), max.	150 mA
<b>Protocols</b>	
• MPI	Yes
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	Yes
<b>MPI</b>	
• Number of connections	32; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1
• Transmission rate, max.	12 Mbit/s
<b>Services</b>	
— PG/OP communication	Yes
— Routing	Yes
— Global data communication	Yes
— S7 basic communication	Yes
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
<b>PROFIBUS DP master</b>	
• Number of connections, max.	16; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1

• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	32
<b>Services</b>	
— 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
<b>Address area</b>	
— Inputs, max.	2 kbyte
— Outputs, max.	2 kbyte
<b>User data per DP slave</b>	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
<b>PROFIBUS DP slave</b>	
• Number of connections	16
• GSD file	<a href="http://support.automation.siemens.com/WW/view/en/113652">http://support.automation.siemens.com/WW/view/en/113652</a>
• 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
<b>Services</b>	
— 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
<b>Transfer memory</b>	
— Inputs	244 byte
— Outputs	244 byte
<b>Protocols</b>	
<b>Open IE communication</b>	
• ISO-on-TCP (RFC1006)	Via CP 443-1 Adv. and loadable FB
— Data length, max.	1 452 bytes via CP 443-1 Adv.
<b>Web server</b>	
• supported	No
<b>Isochronous mode</b>	
Equidistance	Yes
Number of DP masters with isochronous mode	1
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
<b>Communication functions</b>	
PG/OP communication	Yes
• Number of connectable OPs without message processing	47
• Number of connectable OPs with message processing	47; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
<b>Global data communication</b>	
• 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
• Size of GD packet (of which consistent), max.	1 variable
<b>S7 basic communication</b>	
• supported	Yes
• User data per job, max.	76 byte
• User data per job (of which consistent), max.	1 variable
<b>S7 communication</b>	
• supported	Yes
• as server	Yes
• as client	Yes



• User data per job, max.	64 kbyte
• User data per job (of which consistent), max.	462 byte
<b>S5 compatible communication</b>	
• supported	Yes; Via FC AG_SEND and AG_RECV, max. via 10 CP 443-1 or 443-5
• User data per job, max.	8 kbyte
• User data per job (of which consistent), max.	240 byte
• Number of simultaneous AG-SEND/AG-RECV orders per CPU, max.	24/24
<b>Standard communication (FMS)</b>	
• supported	Yes; Via CP and loadable FB
<b>Number of connections</b>	
• overall	48
• usable for PG communication	47
— reserved for PG communication	1
— adjustable for PG communication, max.	0
• usable for OP communication	47
— reserved for OP communication	1
— adjustable for OP communication, max.	0
• usable for S7 basic communication	46
— reserved for S7 basic communication	0
— adjustable for S7 basic communication, max.	0
• usable for S7 communication	46
— reserved for S7 communication	0
— adjustable for S7 communication, max.	0
• usable for routing	23
— reserved for routing	0
— adjustable for routing, max.	0
<b>S7 message functions</b>	
Number of login stations for message functions, max.	47; Max. 47 with Alarm_S/SQ and Alarm_D/DQ (OPs); max. 8 with Alarm, Alarm_8, Alarm_8P, Notify and Notify_8 (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
• Number of instances for alarm 8 and S7 communication blocks, max.	300
• preset, max.	150

Process control messages	Yes
Number of archives that can log on simultaneously (SFB 37 AR_SEND)	4
<b>Number of messages</b>	
• overall, max.	256
• in 100 ms grid, max.	0
• in 500 ms grid, max.	256
• in 1000 ms grid, max.	256
<b>Number of additional values</b>	
• with 100 ms grid, max.	0
• with 500, 1000 ms grid, max.	1
<b>Test commissioning functions</b>	
Status block	Yes; Up to 16 simultaneously
Single step	Yes
Number of breakpoints	16
<b>Status/control</b>	
• Status/control variable	Yes; Up to 16 variable tables
• Variables	Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters
• Number of variables, max.	70; Status/control
<b>Forcing</b>	
• Forcing	Yes
• Forcing, variables	Inputs/outputs, bit memories, distributed I/Os
• Number of variables, max.	64
<b>Diagnostic buffer</b>	
• present	Yes
• Number of entries, max.	3 200
— adjustable	Yes
— preset	120
<b>Service data</b>	
• can be read out	Yes
<b>Standards, approvals, certificates</b>	
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
<b>Use in hazardous areas</b>	
• ATEX	ATEX II 3G Ex nA IIC T4 Gc

## Ambient conditions

### Ambient temperature during operation

- min. 0 °C
- max. 60 °C

## Configuration

### Configuration software

- STEP 7 Yes

### Programming

- Command set see instruction list
- Nesting levels 7
- Access to consistent data in process image Yes
- System functions (SFC) see instruction list
- System function blocks (SFB) see instruction list

### Programming language

- LAD Yes
- FBD Yes
- STL Yes
- SCL Yes
- CFC Yes
- GRAPH Yes
- HiGraph® Yes

### Number of simultaneously active SFCs

- DPSYC\_FR 2; SFC 11; per interface
- D\_ACT\_DP 8; SFC 12; per interface
- RD\_REC 8; SFC 59; per interface
- WR\_REC 8; SFC 58; per interface
- WR\_PARM 8; SFC 55; per interface
- PARM\_MOD 1; SFC 57; per interface
- WR\_DPARM 2; SFC 56; per interface
- DPNRM\_DG 8; SFC 13; per interface
- RDSYSST 8; SFC 51
- DP\_TOPOL 1; SFC 103; per interface

### Number of simultaneously active SFBs

- 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
- Block encryption Yes; With S7 block Privacy

## Dimensions

Width	25 mm
Height	290 mm
Depth	219 mm
<b>Weights</b>	
Weight, approx.	700 g
<b>last modified:</b>	10/09/2020