

SIMATIC S7-400, CPU414F-3 PN/DP CENTRAL PROCESSING UNIT WITH: 4 MB WORKING MEMORY, (2 MB KB CODE, 2 MB DATA), INTERFACES: 1. IF MPI/DP 12 MBIT/S (X1), 2. IF ETHERNET/PROFINET (X5), 3. IF IF964-DP PLUGABLE (IF1)

General information

Product type designation	CPU414F-3 PN/DP
Hardware product version	01
Firmware version	V7.0
Engineering with	
<ul style="list-style-type: none"> Programming package 	STEP 7 V5.5 or higher with HSP 262

CiR - Configuration in RUN

CiR synchronization time, basic load	100 ms
CiR synchronization time, time per I/O byte	15 µs

Supply voltage

Rated value (DC)	
<ul style="list-style-type: none"> 24 V DC 	No; Power supply via system power supply

Input current

from backplane bus 5 V DC, typ.	1.3 A
from backplane bus 5 V DC, max.	1.6 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.	6.5 W
Power loss, max.	8 W

Memory

Type of memory	RAM
Work memory	
<ul style="list-style-type: none"> integrated integrated (for program) integrated (for data) expandable 	4 Mbyte 2 Mbyte 2 Mbyte No
Load memory	
<ul style="list-style-type: none"> expandable FEPR0M expandable FEPR0M, max. integrated RAM, max. expandable RAM 	Yes; with Memory Card (FLASH) 64 Mbyte 512 kbyte Yes; with Memory Card (RAM)

• expandable RAM, max.	64 Mbyte
Backup	
• present	Yes
• with battery	Yes; all data
• without battery	No
Battery	
Backup battery	
• Backup current, typ.	180 µA; up to 40 °C
• Backup current, max.	850 µA
• Backup time, max.	Dealt with in the module data manual with the secondary conditions and the factors of influence
• Feeding of external backup voltage to CPU	5 V DC to 15 V DC
CPU processing times	
for bit operations, typ.	18.75 ns
for word operations, typ.	18.75 ns
for fixed point arithmetic, typ.	18.75 ns
for floating point arithmetic, typ.	37.5 ns
CPU-blocks	
DB	
• Number, max.	6 000; Number range: 1 to 16000
• Size, max.	64 kbyte
FB	
• Number, max.	3 000; Number range: 0 to 7999
• Size, max.	64 kbyte
FC	
• Number, max.	3 000; 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	4; OB 10-13
• Number of delay alarm OBs	4; OB 20-23
• Number of cyclic interrupt OBs	4; OB 32, 33, 34, 35 (shortest cycle that can be set = 500 µs)
• Number of process alarm OBs	4; OB 40-43
• Number of DPV1 alarm OBs	3; OB 55-57
• Number of isochronous mode OBs	3; OB 61-63
• Number of multicomputing OBs	1; OB 60
• Number of background OBs	1; OB 90
• Number of startup OBs	2; 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
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 in total	Total working and load memory (with backup battery)
Flag	
• Number, max.	8 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
Data blocks	

• Number, max.	6 000; Number range: 1 to 16000
• Size, max.	64 kbyte
Local data	
• adjustable, max.	16 kbyte
• preset	8 kbyte
Address area	
I/O address area	
• Inputs	8 kbyte
• Outputs	8 kbyte
of which distributed	
— MPI/DP interface, inputs	2 kbyte
— MPI/DP interface, outputs	2 kbyte
— DP interface, inputs	6 kbyte
— DP interface, outputs	6 kbyte
— PROFINET interface, inputs	8 kbyte
— PROFINET interface, outputs	8 kbyte
Process image	
• Inputs, adjustable	8 kbyte
• Outputs, adjustable	8 kbyte
• Inputs, default	256 byte
• Outputs, default	256 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	65 536
— of which central	65 536
• Outputs	65 536
— of which central	65 536
Analog channels	
• Inputs	4 096
— of which central	4 096
• Outputs	4 096
— of which central	4 096
Hardware configuration	
Number of expansion units, max.	21
connectable OPs	63
Multicomputing	Yes; 4 CPUs max. (with UR1 or UR2)
Interface modules	
• Number of connectable IMs (total), max.	6

<ul style="list-style-type: none"> • Number of connectable IM 460s, max. 	6
<ul style="list-style-type: none"> • Number of connectable IM 463s, max. 	4; IM 463-2
Number of DP masters	
<ul style="list-style-type: none"> • integrated 	1
<ul style="list-style-type: none"> • via CP 	10; CP 443-5 Extended
<ul style="list-style-type: none"> • via IM 467 	4
<ul style="list-style-type: none"> • Mixed mode IM + CP permitted 	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"> • via interface module 	1; IF 964-DP
<ul style="list-style-type: none"> • Number of pluggable S5 modules (via adapter capsule in central device), max. 	6
Number of IO Controllers	
<ul style="list-style-type: none"> • integrated 	1
<ul style="list-style-type: none"> • via CP 	4; Max. 4 in the central controller; no mixed operation of different CP 443-1 types in PROFINET IO mode
Number of operable FMs and CPs (recommended)	
<ul style="list-style-type: none"> • FM 	Limited by number of slots and number of connections
<ul style="list-style-type: none"> • CP, PtP 	CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections
<ul style="list-style-type: none"> • PROFIBUS and Ethernet CPs 	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
Slots	
<ul style="list-style-type: none"> • required slots 	2
Time of day	
Clock	
<ul style="list-style-type: none"> • Hardware clock (real-time) 	Yes
<ul style="list-style-type: none"> • retentive and synchronizable 	Yes
<ul style="list-style-type: none"> • Resolution 	1 ms
<ul style="list-style-type: none"> • Deviation per day (buffered), max. 	1.7 s; Power off
<ul style="list-style-type: none"> • Deviation per day (unbuffered) max. 	8.6 s; For power On
Operating hours counter	
<ul style="list-style-type: none"> • Number 	16
<ul style="list-style-type: none"> • Number/Number range 	0 to 15
<ul style="list-style-type: none"> • Range of values 	SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2 ³¹ - 1 hours
<ul style="list-style-type: none"> • Granularity 	1 hour
<ul style="list-style-type: none"> • retentive 	Yes
Clock synchronization	
<ul style="list-style-type: none"> • supported 	Yes
<ul style="list-style-type: none"> • to MPI, master 	Yes
<ul style="list-style-type: none"> • to MPI, slave 	Yes
<ul style="list-style-type: none"> • to DP, master 	Yes

• to DP, slave	Yes
• in AS, master	Yes
• in AS, slave	Yes
• on Ethernet via NTP	Yes; As client
• to IF 964 DP	Yes
Time difference in system when synchronizing via	
• Ethernet, max.	10 ms
• MPI, max.	200 ms

Interfaces	
Interfaces/bus type	1 x MPI/PROFIBUS DP, 1 x PROFINET (2 ports), 1 x PROFIBUS DP (optionally pluggable)
Number of RS 485 interfaces	1; Combined MPI / PROFIBUS DP
Number of other interfaces	1; PROFIBUS DP with IF 964-DP (plug-in option; MLFB: 6ES7964-2AA04-0AB0)

1. Interface

Interface type	Integrated
Physics	RS 485 / PROFIBUS + MPI
Isolated	Yes
Power supply to interface (15 to 30 V DC), max.	150 mA
Number of connection resources	MPI: 32, DP: 16

Functionality	
• MPI	Yes
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	Yes

MPI	
• 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

Services	
— 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

DP master	
• 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

Services	
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— 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
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
— S7 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	PROFINET
Physics	Ethernet RJ45
Isolated	Yes
automatic detection of transmission rate	Yes; Autosensing
Autonegotiation	Yes
Autocrossing	Yes
Change of IP address at runtime, supported	Yes; Assignment by higher-level IO-Controller or by the user program with SFB104 "IP_CONF"
Number of connection resources	64
Interface types	
• Number of ports	2
• integrated switch	Yes
Media redundancy	
• supported	Yes
• Switchover time on line break, typ.	200 ms
• Number of stations in the ring, max.	50
Functionality	
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• PROFINET CBA	Yes
• PROFIBUS DP master	No
• PROFIBUS DP slave	No
• Open IE communication	Yes
• Web server	Yes
— Number of HTTP clients	5
• Point-to-point connection	No
PROFINET IO Controller	
• Transmission rate, max.	100 Mbit/s
Services	
— PG/OP communication	Yes
— S7 routing	Yes
— S7 communication	Yes
— Isochronous mode	Yes; Only with IRT and the High Performance option
— Open IE communication	Yes
— Shared device	Yes
— Prioritized startup	Yes

— Number of IO devices with prioritized startup, max.	32
— Number of connectable IO Devices, max.	256
— Of which IO devices with IRT, max.	64
— of which in line, max.	64
— Number of IO Devices with IRT and the option "high flexibility"	256
— of which in line, max.	61
— Number of connectable IO Devices for RT, max.	256
— of which in line, max.	256
— Activation/deactivation of IO Devices	Yes
— Number of IO Devices that can be simultaneously activated/deactivated, max.	8
— IO Devices changing during operation (partner ports), supported	Yes
— Number of IO Devices per tool, max.	8; 8 parallel calls of the SFC 12 "D_ACT_DP" possible per line. Max. 32 IO Devices changing during operation (partner ports) are supported
— Device replacement without swap medium	Yes
— Send cycles	250 µs, 500 µs, 1 ms, 2 ms, 4 ms additionally with IRT with high performance: 250 µs to 4 ms in 125 µs frame
— Updating time	250 µs to 512 ms; minimum value depends on preset communication share for PROFINET IO, on the number of IO Devices and on the amount of configured user data, see PROFINET system description

Address area

— Inputs, max.	8 kbyte
— Outputs, max.	8 kbyte
— User data consistency, max.	1 024 byte

PROFINET IO Device

Services

— PG/OP communication	Yes
— S7 routing	Yes
— S7 communication	Yes
— Isochronous mode	No
— Open IE communication	Yes
— IRT	Yes
— Prioritized startup	Yes
— Shared device	Yes
— Number of IO Controllers with shared device, max.	2

Transfer memory

— Inputs, max.	1 440 byte; Per IO Controller with shared device
— Outputs, max.	1 440 byte; Per IO Controller with shared device
Submodules	
— Number, max.	64
— User data per submodule, max.	1 024 byte
PROFINET CBA	
• acyclic transmission	Yes
• cyclic transmission	Yes
Open IE communication	
• Number of connections, max.	62
• Local port numbers used at the system end	0, 20, 21, 25, 80, 102, 135, 161, 34962, 34963, 34964, 65532, 65533, 65534, 65535
• Keep-alive function, supported	Yes

3. Interface

Interface type	Pluggable interface module (IF)
Plug-in interface modules	IF 964-DP (MLFB: 6ES7964-2AA04-0AB0)
Physics	RS 485 / PROFIBUS
Isolated	Yes
Power supply to interface (15 to 30 V DC), max.	150 mA
automatic detection of transmission rate	No
Number of connection resources	16
Functionality	
• MPI	No
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	Yes
DP master	
• Number of connections, max.	16
• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	96
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
— DPV0	Yes
— DPV1	Yes
Address area	
— Inputs, max.	6 kbyte
— Outputs, max.	6 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
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
— S7 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
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	Yes; Via PROFIBUS DP or PROFINET interface
Number of DP masters with isochronous mode	2
User data per isochronous slave, max.	244 byte
Equidistance	Yes
shortest clock pulse	1 ms; 0.5 ms without use of SFC 126, 127

max. cycle	32 ms
Communication functions	
PG/OP communication	Yes
<ul style="list-style-type: none"> • Number of connectable OPs without message processing • Number of connectable OPs with message processing 	63 63; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
Global data communication	
<ul style="list-style-type: none"> • supported • Number of GD loops, max. • Number of GD packets, transmitter, max. • Number of GD packets, receiver, max. • Size of GD packets, max. • Size of GD packet (of which consistent), max. 	Yes 8 8 16 54 byte 1 variable
S7 basic communication	
<ul style="list-style-type: none"> • supported • User data per job, max. • User data per job (of which consistent), max. 	Yes 76 byte 1 variable
S7 communication	
<ul style="list-style-type: none"> • supported • as server • as client • User data per job, max. • User data per job (of which consistent), max. 	Yes Yes Yes 64 kbyte 462 byte; 1 variable
S5 compatible communication	
<ul style="list-style-type: none"> • supported • User data per job, max. • User data per job (of which consistent), max. • Number of simultaneous AG-SEND/AG-RECV orders per CPU, max. 	Yes; Via FC AG_SEND and AG_RECV, max. via 10 CP 443-1 or 443-5 8 kbyte 240 byte 24/24
Standard communication (FMS)	
<ul style="list-style-type: none"> • supported 	Yes; Via CP and loadable FB
Open IE communication	
<ul style="list-style-type: none"> • TCP/IP <ul style="list-style-type: none"> — Number of connections, max. — Data length, max. — several passive connections per port, supported • ISO-on-TCP (RFC1006) 	Yes; via integrated PROFINET interface and loadable FBs 62 32 kbyte Yes Yes; Via integrated PROFINET interface or CP 443-1 Adv. and loadable FBs

— Number of connections, max.	62
— Data length, max.	32 kbyte; 1452 bytes via CP 443-1 Adv.
• UDP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	62
— Data length, max.	1 472 byte
Web server	
• supported	Yes
• Number of HTTP clients	5
• User-defined websites	Yes
PROFINET CBA (at set setpoint communication load)	
• Setpoint for the CPU communication load	20 %
• Number of remote interconnection partners	32
• Number of functions, master/slave	150
• Total of all master/slave connections	4 500
• Data length of all incoming connections master/slave, max.	45 000 byte
• Data length of all outgoing connections master/slave, max.	45 000 byte
• Number of device-internal and PROFIBUS interconnections	1 000
• Data length of device-internal und PROFIBUS interconnections, max.	16 000 byte
• Data length per connection, max.	2 000 byte
Remote interconnections with acyclic transmission	
— Sampling frequency: Sampling time, min.	200 ms; Depending on preset communication load, number of interconnections and data length used
— Number of incoming interconnections	250
— Number of outgoing interconnections	250
— Data length of all incoming interconnections, max.	8 000 byte
— Data length of all outgoing interconnections, max.	8 000 byte
— Data length per connection, max.	2 000 byte
Remote interconnections with cyclic transmission	
— Transmission frequency: Transmission interval, min.	1 ms; Depending on preset communication load, number of interconnections and data length used
— Number of incoming interconnections	300
— Number of outgoing interconnections	300
— Data length of all incoming interconnections, max.	4 800 byte
— Data length of all outgoing interconnections, max.	4 800 byte
— Data length per connection, max.	450 byte

HMI variables via PROFINET (acyclic)	
— Number of stations that can log on for HMI variables (PN OPC/iMap)	2x PN OPC/1x iMap
— HMI variable updating	500 ms
— Number of HMI variables	1 000
— Data length of all HMI variables, max.	32 000 byte

PROFIBUS proxy functionality	
— supported	Yes; 32 PROFIBUS slaves max. connectable
— Data length per connection, max.	240 byte; Slave-dependent

Number of connections	
• overall	64
• usable for PG communication	63
— reserved for PG communication	1
— adjustable for PG communication, max.	0
• usable for OP communication	63
— reserved for OP communication	1
— adjustable for OP communication, max.	0
• usable for S7 basic communication	62
— reserved for S7 basic communication	0
— adjustable for S7 basic communication, max.	0
• usable for S7 communication	62
— reserved for S7 communication	0
— adjustable for S7 communication, max.	0
• usable for routing	31
— reserved for routing	0
— adjustable for routing, max.	0

S7 message functions	
Number of login stations for message functions, max.	63; Max. 63 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
Block related messages	Yes
Process diagnostic messages	Yes
simultaneously active Alarm-S blocks, max.	400; 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.	1 200
• preset, max.	300
Process control messages	Yes

Number of archives that can log on simultaneously (SFB 37 AR_SEND)	16
Number of messages	
• overall, max.	512
• in 100 ms grid, max.	128
• in 500 ms grid, max.	256
• in 1000 ms grid, max.	512
Number of additional values	
• with 100 ms grid, max.	1
• with 500, 1000 ms grid, max.	10
Test commissioning functions	
Status block	Yes; Up to 16 simultaneously
Single step	Yes
Number of breakpoints	16
Status/control	
• 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
Forcing	
• Forcing	Yes
• Forcing, variables	Inputs/outputs, bit memories, distributed I/Os
• Number of variables, max.	256
Diagnostic buffer	
• present	Yes
• Number of entries, max.	3 200
— adjustable	Yes
— preset	120
Service data	
• 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	
• ATEX	ATEX II 3 G 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	50 mm
Height	290 mm
Depth	219 mm

Weights

Weight, approx.	900 g
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