



SIMATIC S7-400, CPU416F-3 PN/DP Central processing unit with: Work memory 16 MB, (8 MB code, 8 MB data), interfaces 1st interface MPI/DP 12 Mbit/s, (X1), 2nd interface Ethernet/PROFINET (X5) 3rd interface IF 964-DP plug-in (IF1)

General information	
Product type designation	CPU 416F-3 PN/DP
HW functional status	01
Firmware version	V7.0
Product function	
<ul style="list-style-type: none"> • Isochronous mode 	Yes; Via PROFIBUS DP or PROFINET interface
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	10 µs
Supply voltage	
Rated value (DC)	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 	16 Mbyte
<ul style="list-style-type: none"> • integrated (for program) 	8 Mbyte
<ul style="list-style-type: none"> • integrated (for data) 	8 Mbyte
<ul style="list-style-type: none"> • expandable 	No
Load memory	
<ul style="list-style-type: none"> • expandable FEPRM 	Yes; with Memory Card (FLASH)
<ul style="list-style-type: none"> • expandable FEPRM, max. 	64 Mbyte
<ul style="list-style-type: none"> • integrated RAM, max. 	1 Mbyte
<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.	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.	12.5 ns
for word operations, typ.	12.5 ns
for fixed point arithmetic, typ.	12.5 ns
for floating point arithmetic, typ.	25 ns

CPU-blocks

DB	
• Number, max.	10 000; Number range: 1 to 16000
• Size, max.	64 kbyte

FB	
• Number, max.	5 000; Number range: 0 to 7999
• Size, max.	64 kbyte

FC	
• Number, max.	5 000; 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	8; OB 10-17
• Number of delay alarm OBs	4; OB 20-23
• Number of cyclic interrupt OBs	9; OB 30-38 (shortest cycle that can be set = 500 µs)
• Number of process alarm OBs	8; OB 40-47
• Number of DPV1 alarm OBs	3; OB 55-57
• Number of isochronous mode OBs	4; OB 61-64
• 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	2

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 (incl. timers, counters, flags), max.	Total working and load memory (with backup battery)
Flag	
• Size, max.	16 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.	32 kbyte
• preset	16 kbyte
Address area	
I/O address area	
• Inputs	16 kbyte
• Outputs	16 kbyte
Process image	
• Inputs, adjustable	16 kbyte
• Outputs, adjustable	16 kbyte
• Inputs, default	512 byte
• Outputs, default	512 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	131 072
— of which central	131 072
• Outputs	131 072
— of which central	131 072
Analog channels	
• Inputs	8 192
— of which central	8 192
• Outputs	8 192
— of which central	8 192
Hardware configuration	
Number of expansion units, max.	21
connectable OPs	95
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	1
• via CP	10; CP 443-5 Extended
• via IM 467	4
• 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
• via interface module	1; IF 964-DP
• Number of pluggable S5 modules (via adapter capsule in central device), max.	6
Number of IO Controllers	
• integrated	1
• 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 • CP, PtP • PROFIBUS and Ethernet CPs 	Limited by number of slots or number of connections CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections 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) • 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 • to IF 964 DP 	Yes Yes Yes Yes Yes Yes Yes Yes; As client Yes
Time difference in system when synchronizing via	
<ul style="list-style-type: none"> • Ethernet, max. • MPI, max. 	10 ms 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	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. 	44; 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	

• Number of connections, max.	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
• 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	32
• 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	PROFINET
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	96
Interface types	
• RJ 45 (Ethernet)	Yes
• Number of ports	2

• integrated switch	Yes
Protocols	
• 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
• Point-to-point connection	No
• Media redundancy	Yes
PROFINET IO Controller	
• Transmission rate, max.	100 Mbit/s
Services	
— PG/OP communication	Yes
— S7 communication	Yes
— Isochronous mode	Yes; Only with IRT and the High Performance option
— 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 communication	Yes
— Isochronous mode	No
— 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	
<ul style="list-style-type: none"> • Number of connections, max. 	94
<ul style="list-style-type: none"> • Local port numbers used at the system end 	0, 20, 21, 25, 80, 102, 135, 161, 34962, 34963, 34964, 65532, 65533, 65534, 65535
<ul style="list-style-type: none"> • Keep-alive function, supported 	Yes
3. Interface	
Interface type	Pluggable interface module (IF)
Plug-in interface modules	IF 964-DP (MLFB: 6ES7964-2AA04-0AB0)
Isolated	Yes
automatic detection of transmission rate	No
Number of connection resources	32
Interface types	
<ul style="list-style-type: none"> • RS 485 	Yes
<ul style="list-style-type: none"> • Output current of the interface, max. 	150 mA
Protocols	
<ul style="list-style-type: none"> • MPI 	No
<ul style="list-style-type: none"> • PROFIBUS DP master 	Yes
<ul style="list-style-type: none"> • PROFIBUS DP slave 	Yes
PROFIBUS DP master	
<ul style="list-style-type: none"> • Number of connections, max. 	32
<ul style="list-style-type: none"> • Transmission rate, max. 	12 Mbit/s
<ul style="list-style-type: none"> • Number of DP slaves, max. 	125
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.	8 kbyte
— Outputs, max.	8 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	
<ul style="list-style-type: none"> • Number of connections 	32
<ul style="list-style-type: none"> • GSD file 	http://support.automation.siemens.com/WW/view/en/113652
<ul style="list-style-type: none"> • Transmission rate, max. 	12 Mbit/s
<ul style="list-style-type: none"> • automatic baud rate search 	No
<ul style="list-style-type: none"> • Address area, max. 	32; Virtual slots
<ul style="list-style-type: none"> • User data per address area, max. 	32 byte
<ul style="list-style-type: none"> — of which consistent, max. 	32 byte
Services	
— PG/OP communication	Yes
— 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

Protocols

Redundancy mode	
Media redundancy	
— Switchover time on line break, typ.	200 ms
— Number of stations in the ring, max.	50

SIMATIC communication	
• S7 routing	Yes

Open IE communication	
• TCP/IP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	94
— Data length, max.	32 kbyte
— several passive connections per port, supported	Yes
• ISO-on-TCP (RFC1006)	Yes; Via integrated PROFINET interface or CP 443-1 and loadable FBs
— Number of connections, max.	94
— Data length, max.	32 kbyte; 1 452 bytes via CP 443-1 Adv.
• UDP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	94
— Data length, max.	1 472 byte

Web server	
• supported	Yes
• User-defined websites	Yes
• Number of HTTP clients	5

Isochronous mode

Equidistance	Yes
Number of DP masters with isochronous mode	2
User data per isochronous slave, max.	244 byte
shortest clock pulse	1 ms; 0.5 ms without use of SFC 126, 127
max. cycle	32 ms

communication functions / header

PG/OP communication	Yes
• Number of connectable OPs without message processing	95
• Number of connectable OPs with message processing	95; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes

Global data communication	
• supported	Yes
• Number of GD loops, max.	16
• Number of GD packets, transmitter, max.	16
• Number of GD packets, receiver, max.	32
• Size of GD packets, max.	54 byte
• Size of GD packet (of which consistent), max.	1 variable

S7 basic communication	
• communication function / S7 basic communication	Yes
• User data per job, max.	76 byte
• User data per job (of which consistent), max.	1 variable

S7 communication	
• 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; 1 variable

S5 compatible communication	
• 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.	64/64
Standard communication (FMS)	
• supported	Yes; Via CP and loadable FB
communication functions / PROFINET CBA (with set target communication load) / header	
• 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	6 000
• Data length of all incoming connections master/slave, max.	65 000 byte
• Data length of all outgoing connections master/slave, max.	65 000 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
performance data / PROFINET CBA / remote interconnection / with acyclic transfer / header	
— Sampling interval, min.	200 ms; Depending on preset communication load, number of interconnections and data length used
— Number of incoming interconnections	500
— Number of outgoing interconnections	500
— Data length of all incoming interconnections, max.	16 000 byte
— Data length of all outgoing interconnections, max.	16 000 byte
— data volume / as user data for remote interconnections / in the case of acyclic transmission / with PROFINET CBA / per connection / maximum	2 000 byte
performance data / PROFINET CBA / remote interconnection / with cyclic transfer / header	
— Transmission frequency: Transmission interval, min.	1 ms; Depending on preset communication load, number of interconnections and data length used
— number of remote connections to input variables / with PROFINET CBA / with cyclic transfer / maximum	300
— number of remote connections to output variables / with cyclical transfer / with PROFINET CBA / maximum	300
— data volume / as user data for remote interconnections with input variables / with cyclical transfer / with PROFINET CBA / maximum	4 800 byte
— data volume / as user data for remote interconnections with output variables / with cyclical transfer / with PROFINET CBA / maximum	4 800 byte
— data volume / as user data for remote interconnections / with cyclical transfer / with PROFINET CBA / per connection / maximum	450 byte
performance data / PROFINET CBA / HMI variables via PROFINET / acyclic / header	
— 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	1 500
— Data length of all HMI variables, max.	48 000 byte
performance data / PROFINET CBA / PROFIBUS proxy functionality / header	
— supported	Yes; 32 PROFIBUS slaves max. connectable
— Data length per connection, max.	240 byte; Slave-dependent
Number of connections	
• overall	96
• usable for PG communication	95
— reserved for PG communication	1
— adjustable for PG communication, max.	0
• usable for OP communication	95
— reserved for OP communication	1
— adjustable for OP communication, max.	0
• usable for S7 basic communication	94
— reserved for S7 basic communication	0
— adjustable for S7 basic communication, max.	0
• usable for S7 communication	94

— reserved for S7 communication	0
— adjustable for S7 communication, max.	0
• usable for routing	47
— reserved for routing	0
— adjustable for routing, max.	0
S7 message functions	
Number of login stations for message functions, max.	95; Max. 95 with Alarm_S/SQ and Alarm_D/DQ (OPs); max. 16 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.	1 000; 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.	4 000
• preset, max.	600
Process control messages	Yes
Number of archives that can log on simultaneously (SFB 37 AR_SEND)	32
Number of messages	
• overall, max.	1 024
• in 100 ms grid, max.	128
• in 500 ms grid, max.	512
• in 1000 ms grid, max.	1 024
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.	512
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 3G Ex nA IIC T4 Gc
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C

• max.	60 °C
configuration / header	
Configuration software	
• STEP 7	Yes
configuration / programming / header	
• 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
configuration / programming / number of simultaneously active SFC / header	
— 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
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
• 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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