

Siemens 6ES7416-3FS06-0AB0 Manual

Brand	Siemens
Product Series	Siemens
Product Type	designation CPU416F-3 PN/DP

Description

6ES7416-3FS06-0AB0

SIMATIC S7-400, CPU416F-3 PN/DP CENTRAL PROCESSING

UNIT WITH: 16 MB WORKING MEMORY, (8 MB KB CODE, 8 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 CPU416F-3 PN/DP

Hardware product version 01

Firmware version V6.0

Engineering with

- Programming package STEP 7 V5.5 or higher/iMap V3.0 + iMap STEP 7 Add-on V3.0 SP5 or higher

CiR – Configuration in RUN

CiR synchronization time, basic load 100 ms

CiR synchronization time, time per I/O byte 10 µs; Time per I/O byte

Supply voltage

Rated value (DC)

- 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. 1.5 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. 7.5 W

Memory

Type of memory other

Work memory

- integrated 16 Mbyte
- integrated (for program) 8 Mbyte
- integrated (for data) 8 Mbyte
- expandable No

Load memory

- expandable FEPR0M Yes; with Memory Card (FLASH)
- expandable FEPR0M, max. 64 Mbyte
- integrated RAM, max. 1 Mbyte

- expandable RAM 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. 125 μ A; up to 40 °C
- Backup current, max. 450 μ A
- 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. 30 ns

for word operations, typ. 30 ns

for fixed point arithmetic, typ. 30 ns

for floating point arithmetic, typ. 90 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 μ s)
- 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

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- 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. 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

Data blocks

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

Local data

- adjustable, max. 32 kbyte
- preset 16 kbyte

Address area

I/O address area

- Inputs 16 kbyte
- Outputs 16 kbyte

of which distributed

- MPI/DP interface, inputs 2 kbyte
- MPI/DP interface, outputs 2 kbyte
- DP interface, inputs 8 kbyte
- DP interface, outputs 8 kbyte
- PROFINET interface, inputs 8 kbyte
- PROFINET interface, outputs 8 kbyte

Process image

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- 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 not suitable for use with CP 443-5 Ext. and CP 443-1

EX4x, EX20, GX20 (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; 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)

- FM Limited by number of slots or number of connections
- CP, PtP CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections
- 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

- required slots 2

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Time of day

Clock

- Hardware clock (real-time) Yes
- retentive and synchronizable Yes
- Resolution 1 ms
- Deviation per day (buffered), max. 1.7 s; Power off
- Deviation per day (unbuffered), max. 8.6 s; For power On

Operating hours counter

- Number 16
- Number/Number range 0 to 15
- Range of values SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2^{31} - 1 hours
- Granularity 1 hour
- retentive Yes

Clock synchronization

- 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 Yes; As client
- to IF 964 DP Yes

Time difference in system when synchronizing via

- Ethernet, max. 10 ms
- MPI, max. 200 ms

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Interfaces

Number of RS 485 interfaces 2

Number of other interfaces 0

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: 44, DP: 32

Functionality

- MPI Yes
- PROFIBUS DP master Yes
- PROFIBUS DP slave Yes
- Number of connections 44; 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. 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
- 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 32

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

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— 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 96

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

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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. 1024 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. 94

• Local port numbers used at the system end 0, 20, 21, 25, 80, 102, 135, 161, 34962, 34963, 34964, 65532, 65533, 65534, 65535

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- 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 32

Functionality

- MPI No
- PROFIBUS DP master Yes
- PROFIBUS DP slave Yes

DP master

- Number of connections, max. 32

- Transmission rate, max. 12 Mbit/s

- 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

DP slave

- Number of connections 32

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

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— 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

- 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

- supported 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

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- 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

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; 1452 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

- 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 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

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 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 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 1 500

— Data length of all HMI variables, max. 48 000 byte

PROFIBUS proxy functionality

— supported Yes; 32 PROFIBUS slaves max. connectable

— Data length per connection, max. 240 byte; Slave-dependent

Number of connections

- overall 96

- usable for PG communication

— reserved for PG communication 1

— adjustable for PG communication, max. 0

- usable for OP communication

— reserved for OP communication 1

— adjustable for OP communication, max. 0

- usable for S7 basic communication

— reserved for S7 basic communication 0

— adjustable for S7 basic communication, max.

0

- usable for S7 communication

— reserved for S7 communication 0

— adjustable for S7 communication, max. 0

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- usable for routing
- 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. 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. 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

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EMC

Emission of radio interference acc. to EN 55 011

- Limit class A, for use in industrial areas Yes
- Limit class B, for use in residential areas No

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
- D_ACT_DP 8
- RD_REC 8
- WR_REC 8
- WR_PARM 8
- PARM_MOD 1
- WR_DPARM 2
- DPNRM_DG 8
- RDSYSST 8
- DP_TOPOL 1

Number of simultaneously active SFBs

- RDREC 8
- WRREC 8

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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