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Data sheet 6ES7416-3ES07-0AB0



SIMATIC S7-400, CPU 416-3 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 416-3 PN/DP
HW functional status	01
Firmware version	V7.0
Product function	
● Isochronous mode	Yes; Via PROFIBUS DP or PROFINET interface
Engineering with	
● 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
Storage	
Type of memory	RAM
Work memory	
● integrated	16 Mbyte
● integrated (for program)	8 Mbyte
● integrated (for data)	8 Mbyte
● expandable	No
Load memory	
● expandable FEPROM	Yes; with Memory Card (FLASH)
● expandable FEPROM, 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	

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● 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	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	2
Counters, timers and their retentivity	
S7 counter	
● Number	2 048
Retentivity	
— adjustable	Yes
— 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 timer	
● Number	2 048
Retentivity	
— adjustable	Yes
— preset	No times retentive
Time range	
— lower limit	10 ms
— upper limit	9 990 s

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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)	
● FM	Limited by number of slots or number of connections

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● 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
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 h
● retentive	Yes
Clock synchronization	
● supported	Yes
● to MPI, master	Yes
● on MPI, device	Yes
● to DP, master	Yes
● on DP, device	Yes
● in AS, master	Yes
● in AS, device	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	MPI/PROFIBUS DP
Isolated	Yes
Interface types	
● RS 485	Yes
● Output current of the interface, max.	150 mA
Protocols	
● MPI	Yes
● PROFIBUS DP master	Yes
● PROFIBUS DP device	Yes
MPI	
● 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

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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
● max. number of DP devices	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 devices	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 device	
— user data per DP device, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
PROFIBUS DP device	
● 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"
Interface types	

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● 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 device	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

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— 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
● 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
Interface types	
● RS 485	Yes
● Output current of the interface, max.	150 mA
Protocols	
● MPI	No
● PROFIBUS DP master	Yes
● PROFIBUS DP device	Yes
PROFIBUS DP master	
● Number of connections, max.	32
● Transmission rate, max.	12 Mbit/s
● max. number of DP devices	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 devices	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 device	
— user data per DP device, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
PROFIBUS DP device	
● 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	

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— 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
payload per isochronous device, max.	244 byte
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 with message processing	95; When using Alarm_S/SQ and Alarm_D/DQ
● Number of connectable OPs without message processing	95
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

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● 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
PROFINET CBA (at set setpoint communication load)	
● Setpoint for the CPU communication load	20 %
● Number of remote interconnection partners	32
● number of master/device functions	150
● total of all master/device connections	6 000
● data length of all incoming master/device connections, max.	65 000 byte
● data length of all outgoing master/device connections, 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 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	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	

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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 marking	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	

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● 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
Classifications	

	Version	Classification
eClass	16	27-24-22-07
eClass	14	27-24-22-07
eClass	12	27-24-22-07
eClass	9.1	27-24-22-07
eClass	9	27-24-22-07
eClass	8	27-24-22-07
eClass	7.1	27-24-22-07
eClass	6	27-24-22-07
ETIM	10	EC000236
ETIM	9	EC000236
ETIM	8	EC000236
ETIM	7	EC000236
IDEA	4	3565
UNSPSC	15	32-15-17-05

Approvals / Certificates

General Product Approval

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EG-Konf.	Miscellaneous	UKCA	UL	Miscellaneous	RCM

General Product Approval			For use in hazardous locations		
China RoHS	Miscellaneous	Manufacturer Declaration	IECEx	ATEX	FM

For use in hazardous locations				Maritime application	
CCC	IECEx	Type Examination Certificate	ATEX	ABS	BUREAU VERITAS

Maritime application					Environment
DNV	LRS	NK / Nippon Kaiji Kyokai	RINA	CCS (China Classification Society)	EPD

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