10.8 Specifications of the CPU 416-3 (6ES7416-3XR05-0AB0)

Data

	6ES7416-3XR05-0AB0
General information	
Product type designation	CPU 416-3
Hardware version	04
Firmware version	V5.3
Engineering with	
Programming package	as of STEP7 V 5.3 SP2 with HW Update
CiR Configuration in RUN	
CiR synchronization time, base load	100 ms
CiR synchronization time, time per I/O byte	10 µs
Power supply	
Rated value (DC)	
• 24 V DC	No; voltage supplied via the system voltage supply
Input current	
From backplane bus 5 V DC, typ.	1.1 A
From backplane bus 5 V DC, max.	1.3 A
From the backplane bus 24 V DC, max.	450 mA; 150 mA per DP interface
From interface 5 V DC, max.	90 mA; for each DP interface
Power loss	
Typical power loss	5.5 W
Power loss, max.	6 W
Memory	
Type of memory	RAM
Work memory	
Integrated	11.2 MB
integrated (for program)	5.6 MB
integrated (for data)	5.6 MB
Expandable	No
Load memory	
Expandable FEPROM	Yes; with memory card (FLASH)
Expandable FEPROM, max.	64 MB
integrated RAM, max.	1 MB
Expandable RAM	Yes; with memory card (RAM)
Expandable RAM, max.	64 MB
Battery backup	
Available	Yes
With battery	Yes; all data
Without battery	No

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Battery	
Backup battery	
Backup battery current, typ.	125 µA; to 40 °C
Backup battery current, max.	550 µA
Backup battery time, max.	See the Module specifications reference manual, section 3.3.
Feed of external backup voltage to the CPU	5 to 15 V DC
CPU processing times	
For bit operations, typ.	30 ns
For word operations, typ.	30 ns
For integer arithmetic, typ.	30 ns
For floating-point arithmetic, typ.	90 ns
CPU blocks	
DB	
Number, max.	10000; number range: 1 to 16000
Size, max.	64 KB
FB	
Number, max.	5000; number range: 0 to 7999
Size, max.	64 KB
FC	
Number, max.	5000; number range: 0 to 7999
Size, max.	64 KB
OB	
Size, max.	64 KB
Number of free-cycle OBs	1; OB 1
Number of time-of-day interrupt OBs	8; OB 10-17
Number of time-delay interrupt OBs	4; OB 20-23
Number of cyclic interrupt OBs	9; OB 30-38 (smallest configurable cycle = 500 µs)
Number of hardware interrupt OBs	8; OB 40-47
Number of DPV1 interrupt OBs	3; OB 55-57
Number of isochronous OBs	4; OB 61-64
Number of multi-computing 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 levels within an error OB	2

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Counters, timers and their retentivity	
S7 counters	
Number	2048
Retentivity	
• Adjustable	Yes
• Low limit	0
• High limit	2047
• Default	C 0 to C 7
Counting range	
• Low limit	0
• High limit	999
IEC counters	
Available	Yes
Type	SFB
Number	Unlimited (limited only by the work memory)
S7 timers	
Number	2048
Retentivity	
• Adjustable	Yes
• Low limit	0
• High limit	2047
• Default	No retentive timers
Time range	
• Low limit	10 ms
• High limit	9990 s
IEC timers	
Available	Yes
Type	SFB
Number	Unlimited (limited only by the work memory)
Data areas and their retentivity	
Retentive data area, total	Total work and load memory (with backup battery)
Bit memories	
Number, max.	16 KB; size of bit memory address area
Retentivity available	Yes
Default retentivity	MB 0 to MB 15
Number of clock memories	8; in 1 memory byte
Local data	
Adjustable, max.	32 KB
Default	16 KB

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Address area	
I/O address area	
Inputs	16 KB
Outputs	16 KB
of which are distributed	
• MPI/DP interface, inputs	2 KB
• MPI/DP interface, outputs	2 KB
• DP interface, inputs	8 KB
• DP interface, outputs	8 KB
Process image	
Inputs, adjustable	16 KB
Outputs, adjustable	16 KB
Inputs, preset	512 bytes
Outputs, preset	512 bytes
Consistent data, max.	244 bytes
Access to consistent data in the process image	Yes
Process image partitions	
Number of process image partitions, max.	15
Digital channels	
Inputs	131072
• of which are central	131072
Outputs	131072
• of which are central	131072
Analog channels	
Inputs	8192
• of which are central	8192
Outputs	8192
• of which are central	8192
Hardware configuration	
Number of expansion units, max.	21
Multicomputing	Yes; max. 4 CPU (with UR1 or UR2)
Interface modules	
Number of plug-in IMs (total), max.	6
Number of plug-in IM 460s, max.	6
Number of plug-in IM 463s, max.	4; IM 463-2

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Number of DP masters	
Integrated	2
Via IM 467	4
Via CP	10; CP 443-5 Extended
Mixed IM + CP operation allowed	No; IM 467 cannot be used in combination with CP 443-5 Ext. and CP 443-1 EX4x, EX20, GX20 (in PROFINET IO mode)
Via interface module	1
Number of plug-in S5 modules (via adapter bay, in the central controller), max.	6
Number of IO controllers	
Integrated	0
Via CP	4; No mixed operation CP443-1 EX40 and CP443-1 EX 41/EX20/GX20, max. 4 in central controller
Number of usable FMs and CPs (recommendation)	
FM	Limited by the number of slots and connections
CP, point-to-point	CP 440: limited by the number of slots; CP 441: Limited by the number of connections
PROFIBUS and Ethernet CPs	14; of which a maximum of 10 can be CPs or IMs as DP master, maximum 4 PROFINET controllers
Slots	
Slots required	2
Time of day	
Clock	
Hardware clock (real-time clock)	Yes
With battery backup, can be synchronized	Yes
Resolution	1 ms
Deviation per day (with battery backup), max.	1.7 s; Power off
Deviation per day (without battery backup), max.	8.6 s; with 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 hour
Resolution	1 hour
Retentive	Yes
Time synchronization	
Supported	Yes
on MPI, master	Yes
on MPI, slave	Yes
on DP, master	Yes
on DP, slave	Yes
in the AS, master	Yes
in the AS, slave	Yes
On Ethernet via NTP	No; via CP
On IF 964 DP	Yes

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Time difference in the system with synchronization via	
MPI, max.	200 ms
Interfaces	
Interfaces/bus type	1x MPI/PROFIBUS DP, 1x PROFIBUS DP, 1x PROFIBUS DP (optionally plug-in)
Number of RS 485 interfaces	2
Number of other interfaces	0
with optical interface	
1st interface	
Interface type	Integrated
Hardware	RS 485 / PROFIBUS + MPI
Electrically isolated	Yes
Power supply at interface (15 to 30 V DC), max.	150 mA
Number of connection resources	MPI: 44, DP: 32
Functionality	
MPI	Yes
DP master	Yes
DP slave	Yes
MPI	
Number of connections	44; a diagnostics repeater in the segment reduces the number of connection resources on the segment by 1
Transmission rate, max.	12 Mbps
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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DP master	
Number of connections, max.	32; a diagnostics repeater in the segment reduces the number of connection resources on the segment by 1
Transmission rate, max.	12 Mbps
Number of DP slaves, max.	32
Services	
• PG/OP communication	Yes
• Global data communication	No
• S7 basic communication	Yes
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Support for constant bus cycle time	Yes
• Isochronous mode	Yes
• SYNC/FREEZE	Yes
• Enabling/disabling of DP slaves	Yes
• Direct data exchange (peer-to-peer)	Yes
• DPV1	Yes
Address area	
• Inputs, max.	2 KB
• Outputs, max.	2 KB
User data per DP slave	
• User data per DP slave, max.	244 bytes
• Inputs, max.	244 bytes
• Outputs, max.	244 bytes
• Slots, max.	244
• Per slot, max.	128 bytes

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DP slave	
Number of connections	32
GSD file	http://support.automation.siemens.com/WW/view/en/113652
Transmission rate, max.	12 Mbps
Automatic baud rate detection	No
Address area, max.	32; virtual slots
User data per address area, max.	32 bytes
Consistent user data per address area, max.	32 bytes
Services	
• PG/OP communication	Yes; with active interface
• S7 routing	Yes; with active interface
• Global data communication	No
• S7 basic communication	No
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Direct data exchange (peer-to-peer)	No
• DPV1	No
Transfer memory	
• Inputs	244 bytes
• Outputs	244 bytes
2nd interface	
Interface type	Integrated
Hardware	RS 485 / PROFIBUS
Electrically isolated	Yes
Power supply at interface (15 to 30 V DC), max.	150 mA
Number of connection resources	32
Functionality	
DP master	Yes
DP slave	Yes

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DP master	
Number of connections, max.	32
Transmission rate, max.	12 Mbps
Number of DP slaves, max.	125
Services	
• PG/OP communication	Yes
• Global data communication	No
• S7 basic communication	Yes
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Support for constant bus cycle time	Yes
• Isochronous mode	Yes
• SYNC/FREEZE	Yes
• Enabling/disabling of DP slaves	Yes
• Direct data exchange (peer-to-peer)	Yes
• DPV1	Yes
Address area	
• Inputs, max.	8 KB
• Outputs, max.	8 KB
User data per DP slave	
• User data per DP slave, max.	244 bytes
• Inputs, max.	244 bytes
• Outputs, max.	244 bytes
• Slots, max.	244
• Per slot, max.	128 bytes
DP slave	
Number of connections	32
GSD file	http://support.automation.siemens.com/WW/view/en/113652
Transmission rate, max.	12 Mbps
Address area, max.	32
User data per address area, max.	32 bytes
Consistent user data per address area, max.	32 bytes
Transfer memory	
• Inputs	244 bytes
• Outputs	244 bytes

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3rd interface	
Interface type	Plug-in interface module (IF), technical specifications as for 2nd interface
Plug-in interface modules	IF 964-DP (MLFB: 6ES7964-2AA04-0AB0)
Hardware	RS 485 / PROFIBUS
Electrically isolated	Yes
Power supply at interface (15 to 30 V DC), max.	150 mA
Automatic determination of transmission rate	No
Number of connection resources	32
Functionality	
MPI	No
DP master	Yes
DP slave	Yes
DP master	
Number of connections, max.	32
Transmission rate, max.	12 Mbps
Number of DP slaves, max.	125
Services	
• PG/OP communication	Yes
• Global data communication	No
• S7 basic communication	No
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Support for constant bus cycle time	Yes
• Isochronous mode	Yes
• SYNC/FREEZE	Yes
• Enabling/disabling of DP slaves	Yes
• Direct data exchange (peer-to-peer)	Yes
• DPV1	Yes
Address area	
• Inputs, max.	8 KB
• Outputs, max.	8 KB
User data per DP slave	
• User data per DP slave, max.	244 bytes
• Inputs, max.	244 bytes
• Outputs, max.	244 bytes
• Slots, max.	244
• Per slot, max.	128 bytes

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DP slave	
Number of connections	32
GSD file	http://support.automation.siemens.com/WW/view/en/113652
Transmission rate, max.	12 Mbps
Automatic baud rate detection	No
Address area, max.	32
User data per address area, max.	32 bytes
Consistent user data per address area, max.	32 bytes
Services	
• PG/OP communication	Yes
• S7 routing	Yes; with active interface
• Global data communication	No
• S7 basic communication	No
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Direct data exchange (peer-to-peer)	No
• DPV1	No
Transfer memory	
• Inputs	244 bytes
• Outputs	244 bytes
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	Yes; only with PROFIBUS
Number of DP masters with isochronous mode	3
User data per isochronous slave, max.	244 bytes
Constant bus cycle time	Yes
Minimum clock cycle	1 ms; 0.5 ms without use of SFC 126, 127
Maximum clock cycle	32 ms
Communication functions	
PG/OP communication	Yes
• Number of connectable OPs without message processing	63
• Number of connectable OPs with message processing	63; when using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
Global data communication	
Supported	Yes
Number of GD circles, max.	16
Number of GD packets, sender, max.	16
Number of GD packets, receiver, max.	32
Size of GD packets, max.	54 bytes
Size of GD packets (of which are consistent), max.	1 variable

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S7 basic communication	
Supported	Yes
User data per job, max.	76 bytes
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 KB
User data per job (of which consistent), max.	462 bytes; 1 variable
S5-compatible communication	
Supported	Yes; via FC AG_SEND and AG_RECV, maximum via 10 CP 443-1 or 443-5
User data per job, max.	8 KB
User data per job (of which consistent), max.	240 bytes
Number of simultaneous AG-SEND/AG-RECV jobs per CPU, max.	64/64
Standard communication (FMS)	
Supported	Yes; via CP and loadable FBs
Open IE communication	
ISO-on-TCP (RFC1006)	via CP 443-1 and loadable FB
• Data length, max.	1452 bytes via CP 443-1 Adv.
Web server	
Supported	No
Number of connections	
Total	64
Suitable for PG communication	63
• Reserved for PG communication	1
• Assignable for PG communication, max.	0
Suitable for OP communication	63
• Reserved for OP communication	1
• Assignable for OP communication, max.	0
Suitable for S7 basic communication	62
• Reserved for S7 basic communication	0
• Assignable for S7 basic communication, max.	0
Suitable for S7 communication	62
• Reserved for S7 communication	0
• Assignable for S7 communication, max.	0
Suitable for routing	31
• Reserved for routing	0
• Assignable for routing, max.	0

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S7 message functions	
Number of stations that can be logged on for signaling 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 diagnostics messages	Yes
Simultaneously active Alarm_S blocks, max.	1000; simultaneously active Alarm_S/SQ blocks and Alarm_D/DQ blocks
Alarm_8 blocks	Yes
• Number of instances for Alarm_8 and S7 communication blocks, max.	4000
• Preset, max.	600
Process control messages	Yes
Number of archives that can be logged on simultaneously (SFB 37 AR_SEND)	32
Number of messages	
Total, max.	1024
In 100 ms interval, max.	128
in 500 ms interval, max.	512
in 1000 ms interval, max.	1024
Number of additional values	
In 100 ms interval, max.	1
In 500, 1000 ms interval, max.	10
Test and commissioning functions	
Block status	Yes; up to 2 simultaneously
Single-step	Yes
Number of breakpoints	4
Status/modify	
Status/modify variable	Yes; up to 16 variable tables
Variables	Inputs/outputs, bit memory, DB, I/O inputs/outputs, timers, counters
Number of variables, max.	70; Status / Modify
Forcing	
Forcing	Yes
Force, variables	Inputs, outputs, bit memories, distributed I/O
Number of variables, max.	512

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Diagnostics buffer	
Available	Yes
Number of entries, max.	3200
• Adjustable	Yes
• Default	120
Service data	
Readable	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	
Programming	
Instruction set	See instruction list
Nesting levels	7
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

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• 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
• 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/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