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Data sheet 6ES7516-2GN00-0AB0



SIMATIC DP, CPU 1516PRO F-2 PN for ET 200pro, Central processing unit with work memory 1.5 MB for program and 5 MB for data, 1st interface: PROFINET IRT with 3-port switch, 2nd interface: PROFINET RT, 10 ns bit performance, degree of protection: IP65/67, SIMATIC Memory Card required, Connection module required

General information	
Product type designation	CPU 1516pro F-2 PN
HW functional status	FS02
Firmware version	V2.8
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes; Via X1, with minimum OB 6x cycle of 500 µs
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V16 (FW V2.8) / V14 (FW V2.0) or higher
Configuration control	
via dataset	Yes
Control elements	
Mode selector switch	1
Supply voltage	
Type of supply voltage	24 V DC
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V

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Reverse polarity protection	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms

Input current	
Current consumption (rated value)	0.31 A
Inrush current, max.	0.4 A; Rated value
I^2t	0.001 $A^2 \cdot s$

Power	
Infeed power to the backplane bus	2.275 W

Power loss	
Power loss, typ.	5.3 W

Memory	
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes
Work memory	
• integrated (for program)	1.5 Mbyte
• integrated (for data)	5 Mbyte
Load memory	
• Plug-in (SIMATIC Memory Card), max.	32 Gbyte
Backup	
• maintenance-free	Yes

CPU processing times	
for bit operations, typ.	10 ns
for word operations, typ.	12 ns
for fixed point arithmetic, typ.	16 ns
for floating point arithmetic, typ.	64 ns

CPU-blocks	
Number of elements (total)	8 000; Blocks (OB, FB, FC, DB) and UDTs
DB	
• Number range	1 ... 60 999; subdivided into: number range that can be used by the user: 1 ... 59 999, and number range of DBs created via SFC 86: 60 000 ... 60 999
• Size, max.	5 Mbyte; For non-optimized block accesses, the max. size of the DB is 64 KB
FB	
• Number range	0 ... 65 535
• Size, max.	1 Mbyte
FC	
• Number range	0 ... 65 535
• Size, max.	1 Mbyte
OB	

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• Size, max.	1 Mbyte
• Number of free cycle OBs	100
• Number of time alarm OBs	20
• Number of delay alarm OBs	20
• Number of cyclic interrupt OBs	20; With minimum OB 3x cycle of 500 µs
• Number of process alarm OBs	50
• Number of DPV1 alarm OBs	3
• Number of isochronous mode OBs	1
• Number of technology synchronous alarm OBs	2
• Number of startup OBs	100
• Number of asynchronous error OBs	4
• Number of synchronous error OBs	2
• Number of diagnostic alarm OBs	1
Nesting depth	
• per priority class	24

Counters, timers and their retentivity	
S7 counter	
• Number	2 048
Retentivity	
— adjustable	Yes
IEC counter	
• Number	Any (only limited by the main memory)
Retentivity	
— adjustable	Yes
S7 times	
• Number	2 048
Retentivity	
— adjustable	Yes
IEC timer	
• Number	Any (only limited by the main memory)
Retentivity	
— adjustable	Yes

Data areas and their retentivity	
Retentive data area (incl. timers, counters, flags), max.	512 kbyte; In total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 472 KB
Flag	
• Number, max.	16 kbyte
• Number of clock memories	8; 8 clock memory bit, grouped into one clock memory byte
Data blocks	
• Retentivity adjustable	Yes
• Retentivity preset	No

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Local data	
• per priority class, max.	64 kbyte; max. 16 KB per block
Address area	
Number of IO modules	8 192; max. number of modules / submodules
I/O address area	
• Inputs	32 kbyte; All inputs are in the process image
• Outputs	32 kbyte; All outputs are in the process image
per integrated IO subsystem	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
Hardware configuration	
Number of distributed IO systems	64; A distributed I/O system is characterized not only by the integration of distributed I/O via PROFINET or PROFIBUS communication modules, but also by the connection of I/O via AS-i master modules or links (e.g. IE/PB-Link)
Number of IO Controllers	
• integrated	2
• Via CM	0
Rack	
• Modules per rack, max.	16; Expansion width max. 1.2 m
• Number of lines, max.	1
Time of day	
Clock	
• Backup time	6 wk; At 40 °C ambient temperature, typically
• Deviation per day, max.	10 s; Typ.: 2 s
Operating hours counter	
• Number	16
Clock synchronization	
• supported	Yes
• in AS, master	Yes
• in AS, slave	Yes
• on Ethernet via NTP	Yes
Interfaces	
Number of PROFINET interfaces	2
Number of PROFIBUS interfaces	0
1. Interface	
Interface types	
• RJ 45 (Ethernet)	Yes; X1 P3
• Number of ports	3; 2x M12 + 1x RJ45
• integrated switch	Yes
Protocols	

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• IP protocol	Yes; IPv4
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• SIMATIC communication	Yes
• Open IE communication	Yes; Optionally also encrypted
• Web server	Yes
• Media redundancy	Yes; MRP Automanager according to IEC 62439-2 Edition 2.0
PROFINET IO Controller	
Services	
— PG/OP communication	Yes
— Isochronous mode	Yes
— Direct data exchange	Yes; Requirement: IRT and isochronous mode (MRPD optional)
— IRT	Yes
— PROFIenergy	Yes
— Prioritized startup	Yes; Max. 32 PROFINET devices
— Number of connectable IO Devices, max.	256; In total, up to 1 000 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET
— Of which IO devices with IRT, max.	64
— Number of connectable IO Devices for RT, max.	256
— of which in line, max.	256
— Number of IO Devices that can be simultaneously activated/deactivated, max.	8; in total across all interfaces
— Number of IO Devices per tool, max.	8
— Updating times	The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data
Update time for IRT	
— for send cycle of 250 µs	250 µs to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 500 µs of the isochronous OB is decisive
— for send cycle of 500 µs	500 µs to 8 ms
— for send cycle of 1 ms	1 ms to 16 ms
— for send cycle of 2 ms	2 ms to 32 ms
— for send cycle of 4 ms	4 ms to 64 ms
— With IRT and parameterization of "odd" send cycles	Update time = set "odd" send clock (any multiple of 125 µs: 375 µs, 625 µs ... 3 875 µs)
Update time for RT	
— for send cycle of 250 µs	250 µs to 128 ms
— for send cycle of 500 µs	500 µs to 256 ms
— for send cycle of 1 ms	1 ms to 512 ms
— for send cycle of 2 ms	2 ms to 512 ms
— for send cycle of 4 ms	4 ms to 512 ms

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PROFINET IO Device	
Services	
— PG/OP communication	Yes
— Isochronous mode	No
— IRT	Yes
— PROFIenergy	Yes; per user program
— Prioritized startup	No
— Shared device	Yes
— Number of IO Controllers with shared device, max.	4
— Asset management record	Yes; per user program

2. Interface	
Interface types	
• RJ 45 (Ethernet)	No
• Number of ports	1; 1x M12
• integrated switch	No
Protocols	
• IP protocol	Yes; IPv4
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• SIMATIC communication	Yes
• Open IE communication	Yes; Optionally also encrypted
• Web server	Yes
• Media redundancy	No
PROFINET IO Controller	
Services	
— PG/OP communication	Yes
— Isochronous mode	No
— Direct data exchange	No
— IRT	No
— PROFIenergy	Yes
— Prioritized startup	No
— Number of connectable IO Devices, max.	32; In total, up to 1 000 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET
— Number of connectable IO Devices for RT, max.	32
— of which in line, max.	32
— Number of IO Devices that can be simultaneously activated/deactivated, max.	8; in total across all interfaces
— Number of IO Devices per tool, max.	8

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— Updating times	The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data
Update time for RT	
— for send cycle of 1 ms	1 ms to 512 ms
PROFINET IO Device	
Services	
— PG/OP communication	Yes
— Isochronous mode	No
— IRT	No
— PROFIenergy	Yes; per user program
— Prioritized startup	No
— Shared device	Yes
— Number of IO Controllers with shared device, max.	4
— Asset management record	Yes; per user program
Interface types	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Number of connections	
• Number of connections, max.	128; Via integrated interfaces of the CPU
• Number of connections reserved for ES/HMI/web	10
• Number of connections via integrated interfaces	128
• Number of S7 routing paths	16
Redundancy mode	
• H-Sync forwarding	Yes
Media redundancy	
— MRP	Yes; as MRP redundancy manager and/or MRP client
— MRPD	Yes; Requirement: IRT
— Switchover time on line break, typ.	200 ms; For MRP, bumpless for MRPD
— Number of stations in the ring, max.	50
SIMATIC communication	
• S7 routing	Yes
• S7 communication, as server	Yes
• S7 communication, as client	Yes
• User data per job, max.	See online help (S7 communication, user data size)
Open IE communication	

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• TCP/IP	Yes
— Data length, max.	64 kbyte
— several passive connections per port, supported	Yes
• ISO-on-TCP (RFC1006)	Yes
— Data length, max.	64 kbyte
• UDP	Yes
— Data length, max.	2 kbyte; 1 472 bytes for UDP broadcast
— UDP multicast	Max. 5 multicast circuits
• DHCP	No
• SNMP	Yes
• DCP	Yes
• LLDP	Yes
Web server	
• HTTP	Yes; Standard and user pages
• HTTPS	Yes; Standard and user pages
OPC UA	
• Runtime license required	Yes
• OPC UA Client	Yes; Data access (read, write), method call, custom address space
— Application authentication	Yes
— Security policies	Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— User authentication	"anonymous" or by user name & password
— Number of connections, max.	10
— Number of nodes of the client interfaces, max.	2 000
— Number of elements for one call of OPC_UA_NodeGetHandleList/OPC_UA_ReadList/OPC_UA_WriteList, max.	300
— Number of elements for one call of OPC_UA_NameSpaceGetIndexList, max.	20
— Number of elements for one call of OPC_UA_MethodGetHandleList, max.	100
— Number of simultaneous calls of the client instructions per connection (except OPC_UA_ReadList,OPC_UA_WriteList,OPC_UA_MethodCall), max.	1
— Number of simultaneous calls of the client instructions OPC_UA_ReadList,OPC_UA_WriteList and OPC_UA_MethodCall, max.	5
— Number of registerable nodes, max.	5 000

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— Number of registerable method calls of OPC_UA_MethodCall, max.	100
— Number of inputs/outputs when calling OPC_UA_MethodCall, max.	20
• OPC UA Server	Yes; Data access (read, write, subscribe), method call, custom address space; embedded 2017 UA server profile V1.02
— Application authentication	Yes
— Security policies	Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— User authentication	"anonymous" or by user name & password
— Number of sessions, max.	48
— Number of accessible variables, max.	100 000
— Number of registerable nodes, max.	20 000
— Number of subscriptions per session, max.	20
— Sampling interval, min.	100 ms
— Publishing interval, min.	200 ms
— Number of server methods, max.	50
— Number of inputs/outputs per server method, max.	20
— Number of monitored items, max.	2 000; for 1 s sampling interval and 1 s send interval
— Number of server interfaces, max.	10
— Number of nodes for user-defined server interfaces, max.	5 000
Further protocols	
• MODBUS	Yes; MODBUS TCP

S7 message functions	
Number of login stations for message functions, max.	32
Program alarms	Yes
Number of configurable program messages, max.	10 000; Program messages are generated by the "Program_Alarm" block, ProDiag or GRAPH
Number of loadable program messages in RUN, max.	5 000
Number of simultaneously active program alarms	
• Number of program alarms	1 000
• Number of alarms for system diagnostics	200
• Number of alarms for motion technology objects	160

Test commissioning functions	
Joint commission (Team Engineering)	Yes; Parallel online access possible for up to 8 engineering systems
Status block	Yes; Up to 8 simultaneously (in total across all ES clients)
Single step	No
Number of breakpoints	8

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Status/control	
• Status/control variable	Yes
• Variables	Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters
• Number of variables, max.	
— of which status variables, max.	200; per job
— of which control variables, max.	200; per job
Forcing	
• Forcing	Yes
• Forcing, variables	Peripheral inputs/outputs
• Number of variables, max.	200
Diagnostic buffer	
• present	Yes
• Number of entries, max.	3 200
— of which powerfail-proof	500
Traces	
• Number of configurable Traces	4; Up to 512 KB of data per trace are possible

Interrupts/diagnostics/status information	
Diagnostics indication LED	
• RUN/STOP LED	Yes
• ERROR LED	Yes
• MAINT LED	Yes
• Monitoring of the supply voltage (PWR-LED)	Yes; green "24 V DC" LED
• Connection display LINK TX/RX	Yes

Supported technology objects	
Motion Control	Yes; Note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool or SIZER
• Number of available Motion Control resources for technology objects	2 400
• Required Motion Control resources	
— per speed-controlled axis	40
— per positioning axis	80
— per synchronous axis	160
— per external encoder	80
— per output cam	20
— per cam track	160
— per probe	40
• Positioning axis	
— Number of positioning axes at motion control cycle of 4 ms (typical value)	7
— Number of positioning axes at motion control cycle of 8 ms (typical value)	14

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Controller	
• PID_Compact	Yes; Universal PID controller with integrated optimization
• PID_3Step	Yes; PID controller with integrated optimization for valves
• PID-Temp	Yes; PID controller with integrated optimization for temperature
Counting and measuring	
• High-speed counter	Yes

Standards, approvals, certificates	
Highest safety class achievable in safety mode	
Probability of failure (for service life of 20 years and repair time of 100 hours)	
— Low demand mode: PFDavg in accordance with SIL3	< 2.00E-05
— High demand/continuous mode: PFH in accordance with SIL3	< 1.00E-09

Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-25 °C
• horizontal installation, max.	55 °C
• vertical installation, min.	-25 °C
• vertical installation, max.	55 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual

Configuration	
Programming	
Programming language	
— LAD	Yes; incl. failsafe
— FBD	Yes; incl. failsafe
— STL	Yes
— SCL	Yes
— GRAPH	Yes
Know-how protection	
• User program protection/password protection	Yes
• Copy protection	Yes
• Block protection	Yes
Access protection	
• Protection level: Write protection	Yes
• Protection level: Read/write protection	Yes
• Protection level: Write protection for Failsafe	Yes

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• Protection level: Complete protection	Yes
Cycle time monitoring	
• lower limit	adjustable minimum cycle time
• upper limit	adjustable maximum cycle time

Dimensions	
Width	135 mm
Height	130 mm
Depth	65 mm

Weights	
Weight, approx.	614 g

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