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Data sheet 6ES7511-1CL03-0AB0



SIMATIC S7-1500 compact CPU CPU 1511C-1 PN, central processing unit with work memory 300 KB for program and 1.5 MB for data, 16 digital inputs, 16 digital outputs, 5 analog inputs, 2 analog outputs, 6 high-speed counters, 4 high-speed outputs for PTO/PWM/frequency output, 1st interface: PROFINET IRT with 2-port switch, 25 ns bit performance, including push-in front connector, SIMATIC Memory Card required

General information	
Product type designation	CPU 1511C-1 PN
HW functional status	FS01
Firmware version	V4.0
● FW update possible	Yes
Product function	
● I&M data	Yes; I&M0 to I&M3
● Isochronous mode	Yes; with minimal OB 6x cycle of 500 µs (distributed)
● SysLog	Yes
Engineering with	
● STEP 7 TIA Portal configurable/integrated from version	V20 (FW V4.0) / V19 (FW V3.1) or higher; configurable with older TIA Portal versions as 6ES7511-1CK01-0AB0
Configuration control	
via dataset	Yes
Display	
Screen diagonal [cm]	3.45 cm
Control elements	
Number of keys	8
Mode buttons	2
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V; 20.4 V DC, for supplying the digital inputs/outputs
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Mains buffering	
● Mains/voltage failure stored energy time	5 ms; Refers to the power supply on the CPU section
● Repeat rate, min.	1/s
Input current	
Current consumption (rated value)	0.62 A; without DI/DO load
Current consumption, max.	0.9 A; without DI/DO load
Inrush current, max.	1.22 A; Rated value
I^2t	0.6 $A^2 \cdot s$
Digital inputs	
● from load voltage L+ (without load), max.	20 mA; per group
Digital outputs	
● from load voltage L+, max.	30 mA; Per group, without load
output voltage / header	
Rated value (DC)	24 V
Encoder supply	
Number of outputs	1; One common 24 V encoder supply

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24 V encoder supply	
● 24 V	Yes; L+ (-0.8 V)
● Short-circuit protection	Yes
● Output current, max.	1 A
Power	
Infeed power to the backplane bus	10 W
Power consumption from the backplane bus (balanced)	8.5 W
Power loss	
Power loss, typ.	5 W
Memory	
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes
Work memory	
● integrated (for program)	300 kbyte
● integrated (for data)	1.5 Mbyte
Load memory	
● Plug-in (SIMATIC Memory Card), max.	32 Gbyte
Backup	
● maintenance-free	Yes
CPU processing times	
for bit operations, typ.	6 ns
for word operations, typ.	7 ns
for fixed point arithmetic, typ.	9 ns
for floating point arithmetic, typ.	37 ns
CPU-blocks	
Number of elements (total)	4 000; 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.	1.5 Mbyte; For DBs with absolute addressing, the max. size is 64 KB
FB	
● Number range	0 ... 65 535
● Size, max.	300 kbyte
FC	
● Number range	0 ... 65 535
● Size, max.	300 kbyte
OB	
● Size, max.	300 kbyte
● 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 250 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

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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.	256 kbyte; in total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 216 KB
Extended retentive data area (incl. timers, counters, flags), max.	1.5 Mbyte; When using PS 6 0W 24/48/60 V DC HF
Flag	
● Size, 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
Local data	
● per priority class, max.	64 kbyte; max. 16 KB per block
Address area	
Number of IO modules	2 048; 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
per CM/CP	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
Subprocess images	
● Number of subprocess images, max.	32
Hardware configuration	
Number of distributed IO systems	32; 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 DP masters	
● Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
Number of IO Controllers	
● integrated	1
● Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
Rack	
● Modules per rack, max.	32; CPU + 31 modules
● Number of lines, max.	1
PtP CM	
● Number of PtP CMs	the number of connectable PtP CMs is only limited by the number of available slots
Time of day	
Clock	
● Type	Hardware 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
● to DP, master	Yes; via PROFIBUS CM / CP
● on DP, device	Yes; via PROFIBUS CM / CP
● in AS, master	Yes

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● in AS, device	Yes
● on Ethernet via NTP	Yes
Digital inputs	
integrated channels (DI)	16
Digital inputs, parameterizable	Yes
Source/sink input	P-reading
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Digital input functions, parameterizable	
● Gate start/stop	Yes
● Capture	Yes
● Synchronization	Yes
Input voltage	
● Type of input voltage	DC
● Rated value (DC)	24 V
● for signal "0"	-3 to +5V
● for signal "1"	+11 to +30V
Input current	
● for signal "1", typ.	2.5 mA
Input delay (for rated value of input voltage)	
for standard inputs	
— parameterizable	Yes; none / 0.05 / 0.1 / 0.4 / 1.6 / 3.2 / 12.8 / 20 ms
— at "0" to "1", min.	4 µs; for parameterization "none"
— at "0" to "1", max.	20 ms
— at "1" to "0", min.	4 µs; for parameterization "none"
— at "1" to "0", max.	20 ms
for interrupt inputs	
— parameterizable	Yes; Same as for standard inputs
for technological functions	
— parameterizable	Yes; Same as for standard inputs
Cable length	
● shielded, max.	1 000 m; 600 m for technological functions; depending on input frequency, encoder and cable quality; max. 50 m at 100 kHz
● unshielded, max.	600 m; for technological functions: No
Digital outputs	
Type of digital output	Transistor
integrated channels (DO)	16
Current-sourcing	Yes; Push-pull output
Short-circuit protection	Yes; electronic/thermal
● Response threshold, typ.	1.6 A with standard output, 0.5 A with high-speed output; see manual for details
Limitation of inductive shutdown voltage to	connector X11: -0.8 V
Controlling a digital input	Yes
Accuracy of pulse duration	Up to ±100 ppm ±2 µs at high-speed output; see manual for details
minimum pulse duration	2 µs; With High Speed output
Digital output functions, parameterizable	
● Switching tripped by comparison values	Yes; As output signal of a high-speed counter
● PWM output	Yes
— Number, max.	4
— Cycle duration, parameterizable	Yes
— ON period, min.	0 %
— ON period, max.	100 %
— Resolution of the duty cycle	0.0036 %; For S7 analog format, min. 40 ns
● Frequency output	Yes
Switching capacity of the outputs	
● with resistive load, max.	0.5 A; 0.1 A with high-speed output, i.e. when using a high-speed output; see manual for details
● on lamp load, max.	5 W; 1 W with high-speed output, i.e. when using a high-speed output; see manual for details
Load resistance range	
● lower limit	48 Ω; 240 ohms with high-speed output, i.e. when using a high-speed output; see manual for details
● upper limit	12 kΩ
Output voltage	

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● Type of output voltage	DC
● for signal "0", max.	1 V; With high-speed output, i.e. when using a high-speed output; see manual for details
● for signal "1", min.	23.2 V; L+ (-0.8 V)
Output current	
● for signal "1" rated value	0.5 A; 0.1 A with high-speed output, i.e. when using a high-speed output, observe derating; see manual for details
● for signal "1" permissible range, min.	2 mA
● for signal "1" permissible range, max.	0.6 A; 0.12 A with high-speed output, i.e. when using a high-speed output, observe derating; see manual for details
● for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
● "0" to "1", max.	200 µs
● "1" to "0", max.	500 µs; Load-dependent
for technological functions	
— "0" to "1", max.	5 µs; Depending on the output used, see additional description in manual
— "1" to "0", max.	5 µs; Depending on the output used, see additional description in manual
Parallel switching of two outputs	
● for logic links	Yes; for technological functions: No
● for uprating	No
● for redundant control of a load	Yes; for technological functions: No
Switching frequency	
● with resistive load, max.	100 kHz; For high-speed output, 100 Hz for standard output
● with inductive load, max.	0.5 Hz; Acc. to IEC 60947-5-1, DC-13; observe derating curve
● on lamp load, max.	10 Hz
Total current of the outputs	
● Current per channel, max.	0.5 A; see additional description in the manual
● Current per group, max.	8 A; see additional description in the manual
● Current per power supply, max.	4 A; 2 power supplies for each group, current per power supply max. 4 A, see additional description in manual
for technological functions	
— Current per channel, max.	0.5 A; see additional description in the manual
Relay outputs	
● Number of relay outputs	0
Cable length	
● shielded, max.	1 000 m; 600 m for technological functions; depending on output frequency, load, and cable quality; max. 50 m at 100 kHz
● unshielded, max.	600 m; for technological functions: No
Analog inputs	
Number of analog inputs	5; 4x for U/I, 1x for R/RTD
● For current measurement	4; max.
● For voltage measurement	4; max.
● For resistance/resistance thermometer measurement	1
integrated channels (AI)	5
permissible input voltage for voltage input (destruction limit), max.	28.8 V
permissible input current for current input (destruction limit), max.	40 mA
Cycle time (all channels), min.	1 ms; Dependent on the parameterized interference frequency suppression; for details, see conversion procedure in manual
Technical unit for temperature measurement adjustable	Yes; °C/°F/K
Input ranges (rated values), voltages	
● 0 to +10 V	Yes; Physical measuring range: ± 10 V
— Input resistance (0 to 10 V)	100 kΩ
● 1 V to 5 V	Yes; Physical measuring range: ± 10 V
— Input resistance (1 V to 5 V)	100 kΩ
● -10 V to +10 V	Yes
— Input resistance (-10 V to +10 V)	100 kΩ
● -5 V to +5 V	Yes; Physical measuring range: ± 10 V
— Input resistance (-5 V to +5 V)	100 kΩ
Input ranges (rated values), currents	
● 0 to 20 mA	Yes; Physical measuring range: ± 20 mA
— Input resistance (0 to 20 mA)	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC

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● -20 mA to +20 mA	Yes
— Input resistance (-20 mA to +20 mA)	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC
● 4 mA to 20 mA	Yes; Physical measuring range: ± 20 mA
— Input resistance (4 mA to 20 mA)	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC
Input ranges (rated values), resistance thermometer	
● Ni 100	Yes; Standard/climate
— Input resistance (Ni 100)	10 MΩ
● Pt 100	Yes; Standard/climate
— Input resistance (Pt 100)	10 MΩ
Input ranges (rated values), resistors	
● 0 to 150 ohms	Yes; Physical measuring range: 0 ... 600 ohms
— Input resistance (0 to 150 ohms)	10 MΩ
● 0 to 300 ohms	Yes; Physical measuring range: 0 ... 600 ohms
— Input resistance (0 to 300 ohms)	10 MΩ
● 0 to 600 ohms	Yes
— Input resistance (0 to 600 ohms)	10 MΩ
Cable length	
● shielded, max.	800 m; for U/I, 200 m for R/RTD
Analog outputs	
integrated channels (AO)	2
Voltage output, short-circuit protection	Yes
Cycle time (all channels), min.	1 ms; Dependent on the parameterized interference frequency suppression; for details, see conversion procedure in manual
Output ranges, voltage	
● 0 to 10 V	Yes
● 1 V to 5 V	Yes
● -10 V to +10 V	Yes
Output ranges, current	
● 0 to 20 mA	Yes
● -20 mA to +20 mA	Yes
● 4 mA to 20 mA	Yes
Load impedance (in rated range of output)	
● with voltage outputs, min.	1 kΩ
● with voltage outputs, capacitive load, max.	100 nF
● with current outputs, max.	500 Ω
● with current outputs, inductive load, max.	1 mH
Cable length	
● shielded, max.	200 m
Analog value generation for the inputs	
Integration and conversion time/resolution per channel	
● Resolution with overrange (bit including sign), max.	16 bit
● Integration time, parameterizable	Yes; 2.5 / 16.67 / 20 / 100 ms, acts on all channels
● Interference voltage suppression for interference frequency f1 in Hz	400 / 60 / 50 / 10
Smoothing of measured values	
● parameterizable	Yes
● Step: None	Yes
● Step: low	Yes
● Step: Medium	Yes
● Step: High	Yes
Analog value generation for the outputs	
Integration and conversion time/resolution per channel	
● Resolution with overrange (bit including sign), max.	16 bit
Settling time	
● for resistive load	1.5 ms
● for capacitive load	2.5 ms
● for inductive load	2.5 ms
Encoder	
Connection of signal encoders	
● for voltage measurement	Yes
● for current measurement as 4-wire transducer	Yes

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● for resistance measurement with two-wire connection	Yes
● for resistance measurement with three-wire connection	Yes
● for resistance measurement with four-wire connection	Yes
Connectable encoders	
● 2-wire sensor	Yes
— permissible quiescent current (2-wire sensor), max.	1.5 mA
Encoder signals, incremental encoder (asymmetrical)	
● Input voltage	24 V
● Input frequency, max.	100 kHz
● Counting frequency, max.	400 kHz; with quadruple evaluation
● Signal filter, parameterizable	Yes
● Incremental encoder with A/B tracks, 90° phase offset	Yes
● Incremental encoder with A/B tracks, 90° phase offset and zero track	Yes
● pulse encoder	Yes
● pulse encoder with direction	Yes
● pulse encoder with one impulse signal per count direction	Yes
Errors/accuracies	
Linearity error (relative to input range), (+/-)	0.1 %
Temperature error (relative to input range), (+/-)	0.005 %/K
Crosstalk between the inputs, max.	-60 dB
Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)	0.05 %
Output ripple (relative to output range, bandwidth 0 to 50 kHz), (+/-)	0.02 %
Linearity error (relative to output range), (+/-)	0.15 %
Temperature error (relative to output range), (+/-)	0.005 %/K
Crosstalk between the outputs, max.	-80 dB
Repeat accuracy in steady state at 25 °C (relative to output range), (+/-)	0.05 %
Operational error limit in overall temperature range	
● Voltage, relative to input range, (+/-)	0.3 %
● Current, relative to input range, (+/-)	0.3 %
● Resistance, relative to input range, (+/-)	0.3 %
● Resistance thermometer, relative to input range, (+/-)	Pt100 Standard: ±2 K, Pt100 Climate: ±1 K, Ni100 Standard: ±1.2 K, Ni100 Climate: ±1 K
● Voltage, relative to output range, (+/-)	0.3 %
● Current, relative to output range, (+/-)	0.3 %
Basic error limit (operational limit at 25 °C)	
● Voltage, relative to input range, (+/-)	0.2 %
● Current, relative to input range, (+/-)	0.2 %
● Resistance, relative to input range, (+/-)	0.2 %
● Resistance thermometer, relative to input range, (+/-)	Pt100 Standard: ±1 K, Pt100 Climate: ±0.5 K, Ni100 Standard: ±0.6 K, Ni100 Climate: ±0.5 K
● Voltage, relative to output range, (+/-)	0.2 %
● Current, relative to output range, (+/-)	0.2 %
Interference voltage suppression for f = n x (f1 +/- 1 %), f1 = interference frequency	
● Series mode interference (peak value of interference < rated value of input range), min.	30 dB
● Common mode voltage, max.	10 V
● Common mode interference, min.	60 dB; at 400 Hz: 50 dB
Interfaces	
Number of PROFINET interfaces	1
1. Interface	
Interface types	
● RJ 45 (Ethernet)	Yes; X1
● Number of ports	2
● integrated switch	Yes
Protocols	
● IP protocol	Yes; IPv4
● PROFINET IO Controller	Yes
● PROFINET IO Device	Yes
● SIMATIC communication	Yes

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● Open IE communication	Yes; Optionally also encrypted
● Web server	Yes
● Media redundancy	Yes
PROFINET IO Controller	
Services	
— Isochronous mode	Yes
— Direct data exchange	Yes; Requirement: IRT and isochronous mode (MRPD optional)
— IRT	Yes
— PROFIenergy	Yes; per user program
— Prioritized startup	Yes; Max. 32 PROFINET devices
— Number of connectable IO Devices, max.	128; In total, up to 512 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.	128
— of which in line, max.	128
— 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
— PROFINET Security Class	1
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
PROFINET IO Device	
Services	
— Isochronous mode	No
— IRT	Yes
— PROFIenergy	Yes; per user program
— Shared device	Yes
— Number of IO Controllers with shared device, max.	4
— activation/deactivation of I-devices	Yes; per user program
— Asset management record	Yes; per user program
— PROFINET Security Class	SNMP Configuration and DCP Read Only
Interface types	
RJ 45 (Ethernet)	
● 100 Mbps	Yes
● Autonegotiation	Yes
● Autocrossing	Yes
● Industrial Ethernet status LED	Yes
Protocols	
Number of connections	
● Number of connections, max.	128; via integrated interfaces of the CPU and connected CPs / CMs
● Number of connections reserved for ES/HMI/web	10
● Number of connections via integrated interfaces	88
● Number of S7 routing paths	16
Redundancy mode	
● H-Sync forwarding	Yes
Media redundancy	

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— Media redundancy	only via 1st interface (X1)
— MRP	Yes; MRP Automanager according to IEC 62439-2 Edition 2.0, MRP Manager; MRP Client
— MRP interconnection, supported	Yes; as MRP ring node according to IEC 62439-2 Edition 3.0
— 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	
● PG/OP communication	Yes; encryption with TLS V1.3 pre-selected
● S7 routing	Yes
● Data record 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	
● 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	Yes; max. 78 multicast circuits
● DHCP	Yes
● DNS	Yes
● SNMP	Yes
● DCP	Yes
● LLDP	Yes
● Encryption	Yes; Optional
Web server	
● HTTP	Yes; Standard and user pages
● HTTPS	Yes; Standard and user pages
● web API	
— Number of sessions, max.	50
— number of simultaneous HTTP calls, max.	4
— HTTP request body, max.	131 072 byte
OPC UA	
● Runtime license required	Yes; "Small" license required
● OPC UA Client	Yes; Data Access (registered Read/Write), Method Call
— Application authentication	Yes
— Security policies	Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— User authentication	"anonymous" or by user name & password
— Number of connections, max.	4
— Number of nodes of the client interfaces, recommended max.	1 000
— Number of elements for one call of OPC_UA_NodeGetHandleList/OPC_UA_ReadList/OPC_U 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 for session management, per connection, max.	1
— Number of simultaneous calls of the client instructions for data access, per connection, max.	5
— Number of registerable nodes, max.	5 000
— 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, alarms & condition (A&C), custom address space, role-based access control

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— Application authentication	Yes
— Security policies	available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256, Aes128Sha256RsaOaep, Aes256Sha256RsaPss
— User authentication	"anonymous" or by user name & password
— GDS support (certificate management)	Yes
— Number of sessions, max.	32
— Number of accessible variables, max.	50 000
— Number of registerable nodes, max.	10 000
— Number of subscriptions per session, max.	50
— Sampling interval, min.	100 ms
— Publishing interval, min.	200 ms
— Number of server methods, max.	20; max. 20 concurrently running jobs each for asynchronous instructions OPC_UA_ServerMethodPre and OPC_UA_ServerMethodPost
— Number of inputs/outputs per server method, max.	20
— Number of monitored items, recommended max.	4 000; for 1 s sampling interval and 1 s send interval
— Number of server interfaces, max.	10 of each "Server interfaces" / "Companion specification" type and 20 of the type "Reference namespace"
— Number of nodes for user-defined server interfaces, max.	15 000
● Alarms and Conditions	Yes
— Number of program alarms	100
— Number of alarms for system diagnostics	50
Further protocols	
● MODBUS	Yes; MODBUS TCP
S7 message functions	
Number of login stations for message functions, max.	32
number of subscriptions, max.	250
number of tags/attributes for subscriptions, max.	2 000
Program alarms	Yes
Number of configurable program messages, max.	5 000; 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	600
● Number of alarms for system diagnostics	100
● Number of alarms for motion technology objects	160
Test commissioning functions	
Joint commission (Team Engineering)	Yes; Parallel online access possible for up to 5 engineering systems
Status block	Yes; Up to 8 simultaneously (in total across all ES clients)
Single step	No
Number of breakpoints	8
Profiling	Yes
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.	1 000
— of which powerfail-proof	500
Traces	
● Number of configurable Traces	4
● Memory size per trace, max.	512 kbyte
Interrupts/diagnostics/status information	
Alarms	
● Diagnostic alarm	Yes

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● Hardware interrupt	Yes
Diagnoses	
● Monitoring the supply voltage	Yes
● Wire-break	Yes; for analog inputs/outputs, see description in manual
● Short-circuit	Yes; for analog outputs, see description in manual
● A/B transition error at incremental encoder	Yes
Diagnostics indication LED	
● RUN/STOP LED	Yes
● ERROR LED	Yes
● MAINT LED	Yes
● STOP ACTIVE LED	Yes
● Monitoring of the supply voltage (PWR-LED)	Yes
● Channel status display	Yes
● for channel diagnostics	Yes; For analog inputs/outputs
● Connection display LINK TX/RX	Yes
Supported technology objects	
Motion Control	Yes; Note: The number of technology objects affects the cycle time of the PLC program; selection guide via the TIA Selection Tool
● Number of available Motion Control resources for technology objects	1 120
● 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)	11
— Number of positioning axes at motion control cycle of 8 ms (typical value)	14
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
Integrated Functions	
Counter	
● Number of counters	6; Of which max. 4x A/B/N
● Counting frequency, max.	400 kHz; with quadruple evaluation
Counting functions	
● Continuous counting	Yes
● Counter response parameterizable	Yes
● Hardware gate via digital input	Yes
● Software gate	Yes
● Event-controlled stop	Yes
● Synchronization via digital input	Yes
● Counting range, parameterizable	Yes
Comparator	
— Number of comparators	2; per count channel; see manual for details
— Direction dependency	Yes
— Can be changed from user program	Yes
Position detection	
● Incremental acquisition	Yes
● Suitable for S7-1500 Motion Control	Yes
Measuring functions	
● Measuring time, parameterizable	Yes
● Dynamic measurement period adjustment	Yes
● Number of thresholds, parameterizable	2

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Measuring range	
— Frequency measurement, min.	0.04 Hz
— Frequency measurement, max.	400 kHz; with quadruple evaluation
— Cycle duration measurement, min.	2.5 µs
— Cycle duration measurement, max.	25 s
Accuracy	
— Frequency measurement	100 ppm; depending on measuring interval and signal evaluation
— Cycle duration measurement	100 ppm; depending on measuring interval and signal evaluation
— Velocity measurement	100 ppm; depending on measuring interval and signal evaluation
Potential separation	
Potential separation digital inputs	
● between the channels	No
● between the channels, in groups of	16
Potential separation digital outputs	
● between the channels	No
● between the channels, in groups of	16
Potential separation channels	
● between the channels and backplane bus	Yes
● Between the channels and load voltage L+	No
product functions / security / header	
PROFINET Security Class	1
signed firmware update	Yes
Secure Boot	Yes
safely removing data	Yes
Ambient conditions	
Ambient temperature during operation	
● horizontal installation, min.	-30 °C; No condensation
● horizontal installation, max.	60 °C; note derating data for onboard I/O in the manual. Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off
● vertical installation, min.	-30 °C; No condensation
● vertical installation, max.	40 °C; note derating data for onboard I/O in the manual. Display: 40 °C, at an operating temperature of typically 40 °C, the display is switched off
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 / header	
configuration / programming / header	
Programming language	
— LAD	Yes
— FBD	Yes
— STL	Yes
— SCL	Yes
— GRAPH	Yes
Know-how protection	
● User program protection/password protection	Yes
● Copy protection	Yes
● Block protection	Yes
Access protection	
● protection of confidential configuration data	Yes
● Password for display	Yes
● Protection level: Write protection	Yes
● Protection level: Read/write protection	Yes
● Protection level: Write protection for Failsafe	No
● Protection level: Complete protection	Yes
● User administration	Yes; device-wide and centralized
● Number of users	100
● Number of groups	100
● Number of roles	50
programming / cycle time monitoring / header	

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● lower limit	adjustable minimum cycle time
● upper limit	adjustable maximum cycle time
Dimensions	
Width	85 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	935 g; with front connector

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