



SIMATIC S7-1500 Compact CPU CPU 1512C-1 PN, central processing unit with working memory 250 KB for program and 1 MB for data, 32 digital inputs, 32 digital outputs, 5 analog inputs, 2 analog outputs, 6 high speed counters, 4 high speed outputs for PTO/PWM/frequency output 1. interface: PROFINET IRT with 2 port switch, 48 NS bit-performance, incl. front connector push-in, SIMATIC memory card necessary

General information	
Product type designation	CPU 1512C-1 PN
HW functional status	FS01
Firmware version	V2.6
Product function	
• I&M data	Yes; I&M0 to I&M3
Engineering with	
• STEP 7 TIA Portal configurable/integrated as of version	V15.1 (FW V2.6) / V15 (FW V2.5) or higher; with older TIA Portal versions configurable as 6ES7512-1CK00-0AB0
Configuration control	
via dataset	Yes
Display	
Screen diagonal [cm]	3.45 cm
Control elements	
Number of keys	8
Mode buttons	2
Supply voltage	

Type of supply voltage	24 V DC
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
<b>Mains buffering</b>	
<ul style="list-style-type: none"> <li>• Mains/voltage failure stored energy time</li> <li>• Repeat rate, min.</li> </ul>	5 ms; Refers to the power supply on the CPU section 1/s
<b>Input current</b>	
Current consumption (rated value)	0.8 A; Without load; 18.8 A: CPU + load
Current consumption, max.	1 A; Without load; 19 A: CPU + load
Inrush current, max.	1.9 A; Rated value
$I^2t$	0.34 A <sup>2</sup> ·s
<b>Digital inputs</b>	
<ul style="list-style-type: none"> <li>• from load voltage L+ (without load), max.</li> </ul>	20 mA; per group
<b>Digital outputs</b>	
<ul style="list-style-type: none"> <li>• from load voltage L+, max.</li> </ul>	30 mA; Per group, without load
<b>Output voltage</b>	
Rated value (DC)	24 V
<b>Encoder supply</b>	
Number of outputs	2; One common 24 V encoder supply per 16 digital inputs
<b>24 V encoder supply</b>	
<ul style="list-style-type: none"> <li>• 24 V</li> <li>• Short-circuit protection</li> <li>• Output current, max.</li> </ul>	Yes; L+ (-0.8 V) Yes 1 A
<b>Power</b>	
Infeed power to the backplane bus	10 W
Power consumption from the backplane bus (balanced)	9 W
<b>Power loss</b>	
Power loss, typ.	15.2 W
<b>Memory</b>	
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes
<b>Work memory</b>	
<ul style="list-style-type: none"> <li>• integrated (for program)</li> <li>• integrated (for data)</li> </ul>	250 kbyte 1 Mbyte
<b>Load memory</b>	
<ul style="list-style-type: none"> <li>• Plug-in (SIMATIC Memory Card), max.</li> </ul>	32 Gbyte
<b>Backup</b>	
<ul style="list-style-type: none"> <li>• maintenance-free</li> </ul>	Yes

CPU processing times	
for bit operations, typ.	48 ns
for word operations, typ.	58 ns
for fixed point arithmetic, typ.	77 ns
for floating point arithmetic, typ.	307 ns

CPU-blocks	
Number of elements (total)	2 000; 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 Mbyte; For DBs with absolute addressing, the max. size is 64 KB

FB	
• Number range	0 ... 65 535
• Size, max.	250 kbyte

FC	
• Number range	0 ... 65 535
• Size, max.	250 kbyte

OB	
• Size, max.	250 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 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.	128 kbyte; In total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 88 KB
Extended retentive data area (incl. timers, counters, flags), max.	1 Mbyte; When using PS 6 0W 24/48/60 V DC HF
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
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	

<ul style="list-style-type: none"> <li>• Via CM</li> </ul>	6; A maximum of 6 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Number of IO Controllers</b>	
<ul style="list-style-type: none"> <li>• integrated</li> </ul>	1
<ul style="list-style-type: none"> <li>• Via CM</li> </ul>	6; A maximum of 6 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Rack</b>	
<ul style="list-style-type: none"> <li>• Modules per rack, max.</li> </ul>	32; CPU + 31 modules
<ul style="list-style-type: none"> <li>• Number of lines, max.</li> </ul>	1
<b>PtP CM</b>	
<ul style="list-style-type: none"> <li>• Number of PtP CMs</li> </ul>	the number of connectable PtP CMs is only limited by the number of available slots
<b>Time of day</b>	
<b>Clock</b>	
<ul style="list-style-type: none"> <li>• Type</li> </ul>	Hardware clock
<ul style="list-style-type: none"> <li>• Backup time</li> </ul>	6 wk; At 40 °C ambient temperature, typically
<ul style="list-style-type: none"> <li>• Deviation per day, max.</li> </ul>	10 s; Typ.: 2 s
<b>Operating hours counter</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	16
<b>Clock synchronization</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• in AS, master</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• in AS, slave</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• on Ethernet via NTP</li> </ul>	Yes
<b>Digital inputs</b>	
integrated channels (DI)	32
Digital inputs, parameterizable	Yes
Source/sink input	P-reading
Input characteristic curve in accordance with IEC 61131, type 3	Yes
<b>Digital input functions, parameterizable</b>	
<ul style="list-style-type: none"> <li>• Gate start/stop</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Capture</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Synchronization</li> </ul>	Yes
<b>Input voltage</b>	
<ul style="list-style-type: none"> <li>• Type of input voltage</li> </ul>	DC
<ul style="list-style-type: none"> <li>• Rated value (DC)</li> </ul>	24 V
<ul style="list-style-type: none"> <li>• for signal "0"</li> </ul>	-3 to +5V
<ul style="list-style-type: none"> <li>• for signal "1"</li> </ul>	+11 to +30V
<b>Input current</b>	
<ul style="list-style-type: none"> <li>• for signal "1", typ.</li> </ul>	2.5 mA
<b>Input delay (for rated value of input voltage)</b>	

<b>for standard inputs</b>	
— 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
<b>for interrupt inputs</b>	
— parameterizable	Yes; Same as for standard inputs
<b>for technological functions</b>	
— parameterizable	Yes; Same as for standard inputs
<b>Cable length</b>	
• 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
<b>Digital outputs</b>	
Type of digital output	Transistor
integrated channels (DO)	32
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; connector X12: L+ (-53 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
<b>Digital output functions, parameterizable</b>	
• 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
• Pulse train	Yes; also for pulse/direction interface
<b>Switching capacity of the outputs</b>	
• 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
<b>Load resistance range</b>	

<ul style="list-style-type: none"> <li>• lower limit</li> </ul>	48 Ω; 240 ohms with high-speed output, i.e. when using a high-speed output; see manual for details
<ul style="list-style-type: none"> <li>• upper limit</li> </ul>	12 kΩ
<b>Output voltage</b>	
<ul style="list-style-type: none"> <li>• Type of output voltage</li> </ul>	DC
<ul style="list-style-type: none"> <li>• for signal "0", max.</li> </ul>	1 V; With high-speed output, i.e. when using a high-speed output; see manual for details
<ul style="list-style-type: none"> <li>• for signal "1", min.</li> </ul>	23.2 V; L+ (-0.8 V)
<b>Output current</b>	
<ul style="list-style-type: none"> <li>• for signal "1" rated value</li> </ul>	0.5 A; 0.1 A with high-speed output, i.e. when using a high-speed output, observe derating; see manual for details
<ul style="list-style-type: none"> <li>• for signal "1" permissible range, min.</li> </ul>	2 mA
<ul style="list-style-type: none"> <li>• for signal "1" permissible range, max.</li> </ul>	0.6 A; 0.12 A with high-speed output, i.e. when using a high-speed output, observe derating; see manual for details
<ul style="list-style-type: none"> <li>• for signal "0" residual current, max.</li> </ul>	0.5 mA
<b>Output delay with resistive load</b>	
<ul style="list-style-type: none"> <li>• "0" to "1", max.</li> </ul>	200 μs
<ul style="list-style-type: none"> <li>• "1" to "0", max.</li> </ul>	500 μs; Load-dependent
<b>for technological functions</b>	
<ul style="list-style-type: none"> <li>— "0" to "1", max.</li> </ul>	5 μs; Depending on the output used, see additional description in manual
<ul style="list-style-type: none"> <li>— "1" to "0", max.</li> </ul>	5 μs; Depending on the output used, see additional description in manual
<b>Parallel switching of two outputs</b>	
<ul style="list-style-type: none"> <li>• for logic links</li> </ul>	Yes; For technological functions: No
<ul style="list-style-type: none"> <li>• for uprating</li> </ul>	No
<ul style="list-style-type: none"> <li>• for redundant control of a load</li> </ul>	Yes; For technological functions: No
<b>Switching frequency</b>	
<ul style="list-style-type: none"> <li>• with resistive load, max.</li> </ul>	100 kHz; For high-speed output, 100 Hz for standard output
<ul style="list-style-type: none"> <li>• with inductive load, max.</li> </ul>	0.5 Hz; Acc. to IEC 60947-5-1, DC-13; observe derating curve
<ul style="list-style-type: none"> <li>• on lamp load, max.</li> </ul>	10 Hz
<b>Total current of the outputs</b>	
<ul style="list-style-type: none"> <li>• Current per channel, max.</li> </ul>	0.5 A; see additional description in the manual
<ul style="list-style-type: none"> <li>• Current per group, max.</li> </ul>	8 A; see additional description in the manual
<ul style="list-style-type: none"> <li>• Current per power supply, max.</li> </ul>	4 A; 2 power supplies for each group, current per power supply max. 4 A, see additional description in manual
<b>for technological functions</b>	
<ul style="list-style-type: none"> <li>— Current per channel, max.</li> </ul>	0.5 A; see additional description in the manual
<b>Relay outputs</b>	
<ul style="list-style-type: none"> <li>• Number of relay outputs</li> </ul>	0
<b>Cable length</b>	
<ul style="list-style-type: none"> <li>• shielded, max.</li> </ul>	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
<ul style="list-style-type: none"> <li>• For current measurement</li> </ul>	4; max.
<ul style="list-style-type: none"> <li>• For voltage measurement</li> </ul>	4; max.
<ul style="list-style-type: none"> <li>• For resistance/resistance thermometer measurement</li> </ul>	1
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
<b>Input ranges (rated values), voltages</b>	
<ul style="list-style-type: none"> <li>• 0 to +10 V</li> </ul>	Yes; Physical measuring range: ± 10 V
<ul style="list-style-type: none"> <li>• Input resistance (0 to 10 V)</li> </ul>	100 kΩ
<ul style="list-style-type: none"> <li>• 1 V to 5 V</li> </ul>	Yes; Physical measuring range: ± 10 V
<ul style="list-style-type: none"> <li>• Input resistance (1 V to 5 V)</li> </ul>	100 kΩ
<ul style="list-style-type: none"> <li>• -10 V to +10 V</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Input resistance (-10 V to +10 V)</li> </ul>	100 kΩ
<ul style="list-style-type: none"> <li>• -5 V to +5 V</li> </ul>	Yes; Physical measuring range: ± 10 V
<ul style="list-style-type: none"> <li>• Input resistance (-5 V to +5 V)</li> </ul>	100 kΩ
<b>Input ranges (rated values), currents</b>	
<ul style="list-style-type: none"> <li>• 0 to 20 mA</li> </ul>	Yes; Physical measuring range: ± 20 mA
<ul style="list-style-type: none"> <li>• Input resistance (0 to 20 mA)</li> </ul>	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC
<ul style="list-style-type: none"> <li>• -20 mA to +20 mA</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Input resistance (-20 mA to +20 mA)</li> </ul>	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC
<ul style="list-style-type: none"> <li>• 4 mA to 20 mA</li> </ul>	Yes; Physical measuring range: ± 20 mA
<ul style="list-style-type: none"> <li>• Input resistance (4 mA to 20 mA)</li> </ul>	50 Ω; Plus approx. 55 ohm for overvoltage protection by PTC
<b>Input ranges (rated values), resistance thermometer</b>	
<ul style="list-style-type: none"> <li>• Ni 100</li> </ul>	Yes; Standard/climate
<ul style="list-style-type: none"> <li>• Input resistance (Ni 100)</li> </ul>	10 MΩ
<ul style="list-style-type: none"> <li>• Pt 100</li> </ul>	Yes; Standard/climate
<ul style="list-style-type: none"> <li>• Input resistance (Pt 100)</li> </ul>	10 MΩ
<b>Input ranges (rated values), resistors</b>	
<ul style="list-style-type: none"> <li>• 0 to 150 ohms</li> </ul>	Yes; Physical measuring range: 0 ... 600 ohms
<ul style="list-style-type: none"> <li>• Input resistance (0 to 150 ohms)</li> </ul>	10 MΩ
<ul style="list-style-type: none"> <li>• 0 to 300 ohms</li> </ul>	Yes; Physical measuring range: 0 ... 600 ohms
<ul style="list-style-type: none"> <li>• Input resistance (0 to 300 ohms)</li> </ul>	10 MΩ
<ul style="list-style-type: none"> <li>• 0 to 600 ohms</li> </ul>	Yes

• Input resistance (0 to 600 ohms)	10 M $\Omega$
<b>Cable length</b>	
• 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 k $\Omega$
• with voltage outputs, capacitive load, max.	100 nF
• with current outputs, max.	500 $\Omega$
• with current outputs, inductive load, max.	1 mH

### Cable length

• shielded, max.	200 m
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### Analog value generation for the inputs

<b>Integration and conversion time/resolution per channel</b>	
• 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

<b>Integration and conversion time/resolution per channel</b>	
• 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
• 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 $f = n \times (f_1 \pm 1 \%)$ , $f_1 =$ 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
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### 1. Interface

#### Interface types

• Number of ports	2
• integrated switch	Yes
• RJ 45 (Ethernet)	Yes; X1

#### Protocols

• IP protocol	Yes; IPv4
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• SIMATIC communication	Yes
• Open IE communication	Yes
• Web server	Yes
• Media redundancy	Yes; MRP Automanager according to IEC 62439-2 Edition 2.0

#### PROFINET IO Controller

##### Services

— PG/OP communication	Yes
— S7 routing	Yes
— Isochronous mode	Yes

— Open IE communication	Yes
— IRT	Yes
— MRP	Yes; As MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50
— MRPD	Yes; Requirement: IRT
— PROFINergy	Yes
— 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

#### Update time for IRT

— for send cycle of 250 $\mu$ s	250 $\mu$ s to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 $\mu$ s of the isochronous OB is decisive
— for send cycle of 500 $\mu$ s	500 $\mu$ s to 8 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 $\mu$ s of the isochronous OB is decisive
— 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 $\mu$ s: 375 $\mu$ s, 625 $\mu$ s ... 3 875 $\mu$ s)

#### Update time for RT

— for send cycle of 250 $\mu$ s	250 $\mu$ s to 128 ms
— for send cycle of 500 $\mu$ s	500 $\mu$ s 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

— PG/OP communication	Yes
— S7 routing	Yes
— Isochronous mode	No
— Open IE communication	Yes

— IRT	Yes
— MRP	Yes; As MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50
— MRPD	Yes; Requirement: IRT
— PROFlenergy	Yes; Per user program
— 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 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
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### SIMATIC communication

• 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. 5 multicast circuits
• DHCP	No
• SNMP	Yes
• DCP	Yes

• LLDP	Yes
<b>Web server</b>	
• HTTP	Yes; Standard and user pages
• HTTPS	Yes; Standard and user pages
<b>OPC UA</b>	
• Runtime license required	Yes
• OPC UA client	Yes
— 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, max.	1 000
— 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
— 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
— Application authentication	Yes
— Security policies	Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— User authentication	"anonymous" or by user name & password
— 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.	20

— Sampling time, min.	100 ms
— Send time, min.	500 ms
— Number of server methods, max.	20
— Number of inputs/outputs per server method, max.	20
— Number of monitored items, max.	1 000; 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.	1 000
<b>Further protocols</b>	
• MODBUS	Yes; MODBUS TCP
<b>Media redundancy</b>	
• Switchover time on line break, typ.	200 ms; For MRP, bumpless for MRPD
• Number of stations in the ring, max.	50
<b>Isochronous mode</b>	
Isochronous operation (application synchronized up to terminal)	Yes; With minimum OB 6x cycle of 625 µs (distributed)
Equidistance	Yes
<b>S7 message functions</b>	
Number of login stations for message functions, max.	32
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.	2 500
Number of simultaneously active program alarms	
• Number of program alarms	300
• Number of alarms for system diagnostics	100
• Number of alarms for motion technology objects	80
<b>Test commissioning functions</b>	
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
<b>Status/control</b>	
• 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
<b>Forcing</b>	
• Forcing, variables	Peripheral inputs/outputs
• Number of variables, max.	200
<b>Diagnostic buffer</b>	
• present	Yes
• Number of entries, max.	1 000
— of which powerfail-proof	500
<b>Traces</b>	
• Number of configurable Traces	4; Up to 512 KB of data per trace are possible
<b>Interrupts/diagnostics/status information</b>	
<b>Alarms</b>	
• Diagnostic alarm	Yes
• Hardware interrupt	Yes
<b>Diagnostic messages</b>	
• 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
<b>Diagnostics indication LED</b>	
• 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
<b>Supported technology objects</b>	
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 (except cam disks)	800
• 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

<ul style="list-style-type: none"> <li>• Positioning axis <ul style="list-style-type: none"> <li>— Number of positioning axes at motion control cycle of 4 ms (typical value)</li> <li>— Number of positioning axes at motion control cycle of 8 ms (typical value)</li> </ul> </li> </ul>	<p>5</p> <p>10</p>
<b>Controller</b> <ul style="list-style-type: none"> <li>• PID_Compact</li> <li>• PID_3Step</li> <li>• PID-Temp</li> </ul>	<p>Yes; Universal PID controller with integrated optimization</p> <p>Yes; PID controller with integrated optimization for valves</p> <p>Yes; PID controller with integrated optimization for temperature</p>
<b>Counting and measuring</b> <ul style="list-style-type: none"> <li>• High-speed counter</li> </ul>	<p>Yes</p>

### Integrated Functions

Number of counters	6
Counting frequency (counter) max.	400 kHz; with quadruple evaluation
<b>Counting functions</b>	
<ul style="list-style-type: none"> <li>• Continuous counting</li> <li>• Counter response parameterizable</li> <li>• Hardware gate via digital input</li> <li>• Software gate</li> <li>• Event-controlled stop</li> <li>• Synchronization via digital input</li> <li>• Counting range, parameterizable</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Comparator</b>	
<ul style="list-style-type: none"> <li>— Number of comparators</li> <li>— Direction dependency</li> <li>— Can be changed from user program</li> </ul>	<p>2; per count channel; see manual for details</p> <p>Yes</p> <p>Yes</p>
<b>Position detection</b>	
<ul style="list-style-type: none"> <li>• Incremental acquisition</li> <li>• Suitable for S7-1500 Motion Control</li> </ul>	<p>Yes</p> <p>Yes</p>
<b>Measuring functions</b>	
<ul style="list-style-type: none"> <li>• Measuring time, parameterizable</li> <li>• Dynamic measurement period adjustment</li> <li>• Number of thresholds, parameterizable</li> </ul>	<p>Yes</p> <p>Yes</p> <p>2</p>
<b>Measuring range</b>	
<ul style="list-style-type: none"> <li>— Frequency measurement, min.</li> <li>— Frequency measurement, max.</li> <li>— Cycle duration measurement, min.</li> <li>— Cycle duration measurement, max.</li> </ul>	<p>0.04 Hz</p> <p>400 kHz; with quadruple evaluation</p> <p>2.5 <math>\mu</math>s</p> <p>25 s</p>
<b>Accuracy</b>	
<ul style="list-style-type: none"> <li>— Frequency measurement</li> <li>— Cycle duration measurement</li> </ul>	<p>100 ppm; depending on measuring interval and signal evaluation</p> <p>100 ppm; depending on measuring interval and signal evaluation</p>

— 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

## Isolation

Isolation tested with 707 V DC (type test)

## Ambient conditions

### Ambient temperature during operation

- horizontal installation, min. 0 °C
- 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. 0 °C
- 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

### Programming

#### 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

- |   |     |
|---|-----|
| • Password for display                    | Yes |
| • Protection level: Write protection      | Yes |
| • Protection level: Read/write protection | Yes |
| • Protection level: Complete protection   | Yes |

### Cycle time monitoring

- |               |                               |
|---------------|-------------------------------|
| • lower limit | adjustable minimum cycle time |
| • upper limit | adjustable maximum cycle time |

### Dimensions

Width	110 mm
Height	147 mm
Depth	129 mm

### Weights

Weight, approx.	1 360 g
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**last modified:** 06/10/2019