



SIMATIC S7-1500 Compact CPU CPU 1511C-1PN, central processing unit with working memory 175 KB for program and 1 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 1. interface: PROFINET IRT with 2 port switch, 60 NS bit-performance, incl. front connector push-in, SIMATIC memory card necessary

General information	
Product type designation	CPU 1511C-1 PN
HW functional status	FS03
Firmware version	V2.9
Product function	
<ul style="list-style-type: none"> <li>I&amp;M data</li> </ul>	Yes; I&M0 to I&M3
<ul style="list-style-type: none"> <li>Isochronous mode</li> </ul>	Yes; With minimum OB 6x cycle of 625 $\mu$ s (distributed)
Engineering with	
<ul style="list-style-type: none"> <li>STEP 7 TIA Portal configurable/integrated from version</li> </ul>	V17 (FW V2.9) / V15 (FW V2.5) or higher; with older TIA Portal versions configurable as 6ES7511-1CK00-0AB0
Configuration control	
via dataset	Yes
Display	
Screen diagonal [cm]	3.45 cm
Control elements	
Number of keys	8
Mode buttons	2
Supply voltage	
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	
<ul style="list-style-type: none"> <li>Mains/voltage failure stored energy time</li> </ul>	5 ms; Refers to the power supply on the CPU section
<ul style="list-style-type: none"> <li>Repeat rate, min.</li> </ul>	1/s
Input current	
Current consumption (rated value)	0.8 A; Without load; 9.8 A: CPU + load
Current consumption, max.	1 A; Without load; 10 A: CPU + load
Inrush current, max.	1.9 A; Rated value
I <sup>2</sup> t	0.34 A <sup>2</sup> ·s
Digital inputs	
<ul style="list-style-type: none"> <li>from load voltage L+ (without load), max.</li> </ul>	20 mA; per group
Digital outputs	
<ul style="list-style-type: none"> <li>from load voltage L+, max.</li> </ul>	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
24 V encoder supply	

<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)	8.5 W
<b>Power loss</b>	
Power loss, typ.	11.8 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>	175 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
<b>CPU processing times</b>	
for bit operations, typ.	60 ns
for word operations, typ.	72 ns
for fixed point arithmetic, typ.	96 ns
for floating point arithmetic, typ.	384 ns
<b>CPU-blocks</b>	
Number of elements (total)	4 000; Blocks (OB, FB, FC, DB) and UDTs
<b>DB</b>	
<ul style="list-style-type: none"> <li>• Number range</li> <li>• Size, max.</li> </ul>	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 1 Mbyte; For DBs with absolute addressing, the max. size is 64 KB
<b>FB</b>	
<ul style="list-style-type: none"> <li>• Number range</li> <li>• Size, max.</li> </ul>	0 ... 65 535 175 kbyte
<b>FC</b>	
<ul style="list-style-type: none"> <li>• Number range</li> <li>• Size, max.</li> </ul>	0 ... 65 535 175 kbyte
<b>OB</b>	
<ul style="list-style-type: none"> <li>• Size, max.</li> <li>• Number of free cycle OBs</li> <li>• Number of time alarm OBs</li> <li>• Number of delay alarm OBs</li> <li>• Number of cyclic interrupt OBs</li> <li>• Number of process alarm OBs</li> <li>• Number of DPV1 alarm OBs</li> <li>• Number of isochronous mode OBs</li> <li>• Number of technology synchronous alarm OBs</li> <li>• Number of startup OBs</li> <li>• Number of asynchronous error OBs</li> <li>• Number of synchronous error OBs</li> <li>• Number of diagnostic alarm OBs</li> </ul>	175 kbyte 100 20 20 20; With minimum OB 3x cycle of 500 µs 50 3 1 2 100 4 2 1
<b>Nesting depth</b>	
<ul style="list-style-type: none"> <li>• per priority class</li> </ul>	24
<b>Counters, timers and their retentivity</b>	
<b>S7 counter</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	2 048
<b>Retentivity</b>	
— adjustable	Yes
<b>IEC counter</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	Any (only limited by the main memory)
<b>Retentivity</b>	

— adjustable	Yes
<b>S7 times</b>	
• Number	2 048
<b>Retentivity</b>	
— adjustable	Yes
<b>IEC timer</b>	
• Number	Any (only limited by the main memory)
<b>Retentivity</b>	
— adjustable	Yes
<b>Data areas and their retentivity</b>	
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
<b>Flag</b>	
• Size, max.	16 kbyte
• Number of clock memories	8; 8 clock memory bit, grouped into one clock memory byte
<b>Data blocks</b>	
• Retentivity adjustable	Yes
• Retentivity preset	No
<b>Local data</b>	
• per priority class, max.	64 kbyte; max. 16 KB per block
<b>Address area</b>	
Number of IO modules	1 024; max. number of modules / submodules
<b>I/O address area</b>	
• Inputs	32 kbyte; All inputs are in the process image
• Outputs	32 kbyte; All outputs are in the process image
<b>per integrated IO subsystem</b>	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
<b>per CM/CP</b>	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
<b>Subprocess images</b>	
• Number of subprocess images, max.	32
<b>Hardware configuration</b>	
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)
<b>Number of DP masters</b>	
• Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Number of IO Controllers</b>	
• integrated	1
• Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Rack</b>	
• Modules per rack, max.	32; CPU + 31 modules
• Number of lines, max.	1
<b>PtP CM</b>	
• Number of PtP CMs	the number of connectable PtP CMs is only limited by the number of available slots
<b>Time of day</b>	
<b>Clock</b>	
• Type	Hardware clock
• Backup time	6 wk; At 40 °C ambient temperature, typically
• Deviation per day, max.	10 s; Typ.: 2 s
<b>Operating hours counter</b>	
• Number	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)	16
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>	
for standard inputs	
<ul style="list-style-type: none"> <li>parameterizable</li> </ul>	Yes; none / 0.05 / 0.1 / 0.4 / 1.6 / 3.2 / 12.8 / 20 ms
<ul style="list-style-type: none"> <li>at "0" to "1", min.</li> </ul>	4 µs; for parameterization "none"
<ul style="list-style-type: none"> <li>at "0" to "1", max.</li> </ul>	20 ms
<ul style="list-style-type: none"> <li>at "1" to "0", min.</li> </ul>	4 µs; for parameterization "none"
<ul style="list-style-type: none"> <li>at "1" to "0", max.</li> </ul>	20 ms
for interrupt inputs	
<ul style="list-style-type: none"> <li>parameterizable</li> </ul>	Yes; Same as for standard inputs
for technological functions	
<ul style="list-style-type: none"> <li>parameterizable</li> </ul>	Yes; Same as for standard inputs
<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 input frequency, encoder and cable quality; max. 50 m at 100 kHz
<ul style="list-style-type: none"> <li>unshielded, max.</li> </ul>	600 m; for technological functions: No
<b>Digital outputs</b>	
Type of digital output	Transistor
integrated channels (DO)	16
Current-sourcing	Yes; Push-pull output
Short-circuit protection	Yes; electronic/thermal
<ul style="list-style-type: none"> <li>Response threshold, typ.</li> </ul>	1.6 A with standard output, 0.5 A with high-speed output; see manual for details
Limitation of inductive shutdown voltage to	-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
<b>Digital output functions, parameterizable</b>	
<ul style="list-style-type: none"> <li>Switching tripped by comparison values</li> </ul>	Yes; As output signal of a high-speed counter
<ul style="list-style-type: none"> <li>PWM output</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	4
<ul style="list-style-type: none"> <li>Cycle duration, parameterizable</li> </ul>	Yes
<ul style="list-style-type: none"> <li>ON period, min.</li> </ul>	0 %
<ul style="list-style-type: none"> <li>ON period, max.</li> </ul>	100 %
<ul style="list-style-type: none"> <li>Resolution of the duty cycle</li> </ul>	0.0036 %; For S7 analog format, min. 40 ns
<ul style="list-style-type: none"> <li>Frequency output</li> </ul>	Yes
<b>Switching capacity of the outputs</b>	
<ul style="list-style-type: none"> <li>with resistive load, max.</li> </ul>	0.5 A; 0.1 A with high-speed output, i.e. when using a high-speed output; see manual for details
<ul style="list-style-type: none"> <li>on lamp load, max.</li> </ul>	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> <li>• upper limit</li> </ul>	48 Ω; 240 ohms with high-speed output, i.e. when using a high-speed output; see manual for details 12 kΩ
<b>Output voltage</b>	
<ul style="list-style-type: none"> <li>• Type of output voltage</li> <li>• for signal "0", max.</li> <li>• for signal "1", min.</li> </ul>	DC 1 V; With high-speed output, i.e. when using a high-speed output; see manual for details 23.2 V; L+ (-0.8 V)
<b>Output current</b>	
<ul style="list-style-type: none"> <li>• for signal "1" rated value</li> <li>• for signal "1" permissible range, min.</li> <li>• for signal "1" permissible range, max.</li> <li>• for signal "0" residual current, max.</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 2 mA 0.6 A; 0.12 A with high-speed output, i.e. when using a high-speed output, observe derating; see manual for details 0.5 mA
<b>Output delay with resistive load</b>	
<ul style="list-style-type: none"> <li>• "0" to "1", max.</li> <li>• "1" to "0", max.</li> </ul>	200 μs 500 μs; Load-dependent
<b>for technological functions</b>	
— "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
<b>Parallel switching of two outputs</b>	
<ul style="list-style-type: none"> <li>• for logic links</li> <li>• for uprating</li> <li>• for redundant control of a load</li> </ul>	Yes; for technological functions: No No Yes; for technological functions: No
<b>Switching frequency</b>	
<ul style="list-style-type: none"> <li>• with resistive load, max.</li> <li>• with inductive load, max.</li> <li>• on lamp load, max.</li> </ul>	100 kHz; For high-speed output, 100 Hz for standard output 0.5 Hz; Acc. to IEC 60947-5-1, DC-13; observe derating curve 10 Hz
<b>Total current of the outputs</b>	
<ul style="list-style-type: none"> <li>• Current per channel, max.</li> <li>• Current per group, max.</li> <li>• Current per power supply, max.</li> </ul>	0.5 A; see additional description in the manual 8 A; see additional description in the manual 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>	
— Current per channel, max.	0.5 A; see additional description in the manual
<b>Relay outputs</b>	
• Number of relay outputs	0
<b>Cable length</b>	
<ul style="list-style-type: none"> <li>• shielded, max.</li> <li>• unshielded, 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 600 m; for technological functions: No
<b>Analog inputs</b>	
Number of analog inputs <ul style="list-style-type: none"> <li>• For current measurement</li> <li>• For voltage measurement</li> <li>• For resistance/resistance thermometer measurement</li> </ul>	5; 4x for U/I, 1x for R/RTD 4; max. 4; max. 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             <ul style="list-style-type: none"> <li>— Input resistance (0 to 10 V)</li> </ul> </li> <li>• 1 V to 5 V             <ul style="list-style-type: none"> <li>— Input resistance (1 V to 5 V)</li> </ul> </li> </ul>	Yes; Physical measuring range: ± 10 V 100 kΩ Yes; Physical measuring range: ± 10 V 100 kΩ

<ul style="list-style-type: none"> <li>• -10 V to +10 V <ul style="list-style-type: none"> <li>— Input resistance (-10 V to +10 V)</li> </ul> </li> <li>• -5 V to +5 V <ul style="list-style-type: none"> <li>— Input resistance (-5 V to +5 V)</li> </ul> </li> </ul>	<p>Yes</p> <p>100 k<math>\Omega</math></p> <p>Yes; Physical measuring range: <math>\pm 10</math> V</p> <p>100 k<math>\Omega</math></p>
<b>Input ranges (rated values), currents</b>	
<ul style="list-style-type: none"> <li>• 0 to 20 mA <ul style="list-style-type: none"> <li>— Input resistance (0 to 20 mA)</li> </ul> </li> <li>• -20 mA to +20 mA <ul style="list-style-type: none"> <li>— Input resistance (-20 mA to +20 mA)</li> </ul> </li> <li>• 4 mA to 20 mA <ul style="list-style-type: none"> <li>— Input resistance (4 mA to 20 mA)</li> </ul> </li> </ul>	<p>Yes; Physical measuring range: <math>\pm 20</math> mA</p> <p>50 <math>\Omega</math>; Plus approx. 55 ohm for overvoltage protection by PTC</p> <p>Yes</p> <p>50 <math>\Omega</math>; Plus approx. 55 ohm for overvoltage protection by PTC</p> <p>Yes; Physical measuring range: <math>\pm 20</math> mA</p> <p>50 <math>\Omega</math>; Plus approx. 55 ohm for overvoltage protection by PTC</p>
<b>Input ranges (rated values), resistance thermometer</b>	
<ul style="list-style-type: none"> <li>• Ni 100 <ul style="list-style-type: none"> <li>— Input resistance (Ni 100)</li> </ul> </li> <li>• Pt 100 <ul style="list-style-type: none"> <li>— Input resistance (Pt 100)</li> </ul> </li> </ul>	<p>Yes; Standard/climate</p> <p>10 M<math>\Omega</math></p> <p>Yes; Standard/climate</p> <p>10 M<math>\Omega</math></p>
<b>Input ranges (rated values), resistors</b>	
<ul style="list-style-type: none"> <li>• 0 to 150 ohms <ul style="list-style-type: none"> <li>— Input resistance (0 to 150 ohms)</li> </ul> </li> <li>• 0 to 300 ohms <ul style="list-style-type: none"> <li>— Input resistance (0 to 300 ohms)</li> </ul> </li> <li>• 0 to 600 ohms <ul style="list-style-type: none"> <li>— Input resistance (0 to 600 ohms)</li> </ul> </li> </ul>	<p>Yes; Physical measuring range: 0 ... 600 ohms</p> <p>10 M<math>\Omega</math></p> <p>Yes; Physical measuring range: 0 ... 600 ohms</p> <p>10 M<math>\Omega</math></p> <p>Yes</p> <p>10 M<math>\Omega</math></p>
<b>Cable length</b>	
<ul style="list-style-type: none"> <li>• shielded, max.</li> </ul>	800 m; for U/I, 200 m for R/RTD
<b>Analog outputs</b>	
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
<b>Output ranges, voltage</b>	
<ul style="list-style-type: none"> <li>• 0 to 10 V</li> <li>• 1 V to 5 V</li> <li>• -10 V to +10 V</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Output ranges, current</b>	
<ul style="list-style-type: none"> <li>• 0 to 20 mA</li> <li>• -20 mA to +20 mA</li> <li>• 4 mA to 20 mA</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Load impedance (in rated range of output)</b>	
<ul style="list-style-type: none"> <li>• with voltage outputs, min.</li> <li>• with voltage outputs, capacitive load, max.</li> <li>• with current outputs, max.</li> <li>• with current outputs, inductive load, max.</li> </ul>	<p>1 k<math>\Omega</math></p> <p>100 nF</p> <p>500 <math>\Omega</math></p> <p>1 mH</p>
<b>Cable length</b>	
<ul style="list-style-type: none"> <li>• shielded, max.</li> </ul>	200 m
<b>Analog value generation for the inputs</b>	
<b>Integration and conversion time/resolution per channel</b>	
<ul style="list-style-type: none"> <li>• Resolution with overrange (bit including sign), max.</li> <li>• Integration time, parameterizable</li> <li>• Interference voltage suppression for interference frequency f1 in Hz</li> </ul>	<p>16 bit</p> <p>Yes; 2.5 / 16.67 / 20 / 100 ms, acts on all channels</p> <p>400 / 60 / 50 / 10</p>
<b>Smoothing of measured values</b>	
<ul style="list-style-type: none"> <li>• parameterizable</li> <li>• Step: None</li> <li>• Step: low</li> <li>• Step: Medium</li> <li>• Step: High</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Analog value generation for the outputs</b>	
<b>Integration and conversion time/resolution per channel</b>	
<ul style="list-style-type: none"> <li>• Resolution with overrange (bit including sign), max.</li> </ul>	16 bit

<b>Settling time</b>	
• for resistive load	1.5 ms
• for capacitive load	2.5 ms
• for inductive load	2.5 ms
<b>Encoder</b>	
<b>Connection of signal encoders</b>	
• 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
<b>Connectable encoders</b>	
• 2-wire sensor	Yes
— permissible quiescent current (2-wire sensor), max.	1.5 mA
<b>Encoder signals, incremental encoder (asymmetrical)</b>	
• 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
<b>Errors/accuracies</b>	
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 %
<b>Operational error limit in overall temperature range</b>	
• 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 %
<b>Basic error limit (operational limit at 25 °C)</b>	
• 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 %
<b>Interference voltage suppression for <math>f = n \times (f_1 \pm 1 \%)</math>, <math>f_1 =</math> interference frequency</b>	
• 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
- Open IE communication Yes; Optionally also encrypted
- Web server Yes
- Media redundancy Yes

### PROFINET IO Controller

#### Services

- PG/OP communication Yes
- Isochronous mode Yes
- Direct data exchange Yes; Requirement: IRT and isochronous mode (MRPD optional)
- IRT Yes
- PROFlenergy Yes; per user program
- Prioritized startup Yes; Max. 32 PROFINET devices
- Number of connectable IO Devices, max. 128; In total, up to 256 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
- Isochronous mode No
- IRT Yes
- PROFlenergy 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

## Interface types

<b>RJ 45 (Ethernet)</b>	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
• Industrial Ethernet status LED	Yes

## Protocols

<b>Number of connections</b>	
• Number of connections, max.	96; 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	64
• Number of S7 routing paths	16
<b>Redundancy mode</b>	
• H-Sync forwarding	Yes
<b>Media redundancy</b>	
— 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
<b>SIMATIC communication</b>	
• PG/OP communication	Yes; encryption with TLS V1.3 pre-selected
• 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)
<b>Open IE communication</b>	
• 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	Yes
• DNS	Yes
• SNMP	Yes
• DCP	Yes
• LLDP	Yes
• Encryption	Yes; Optional
<b>Web server</b>	
• HTTP	Yes; Standard and user pages
• HTTPS	Yes; Standard and user pages
<b>OPC UA</b>	
• Runtime license required	Yes; "Small" license required
• 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/C 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_M 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
— 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.	20
— Sampling interval, min.	100 ms
— Publishing interval, 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 of each "Server interfaces" / "Companion specification" type and 20 of the type "Reference namespace"
— Number of nodes for user-defined server interfaces, max.	1 000
● Alarms and Conditions	Yes
— Number of program alarms	100
— Number of alarms for system diagnostics	50
<b>Further protocols</b>	
● MODBUS	Yes; MODBUS TCP
<b>Isochronous mode</b>	
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	600
● 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

<ul style="list-style-type: none"> <li>Number of variables, max. <ul style="list-style-type: none"> <li>of which status variables, max. 200; per job</li> <li>of which control variables, max. 200; per job</li> </ul> </li> </ul>	
<b>Forcing</b>	
<ul style="list-style-type: none"> <li>Forcing Yes</li> <li>Forcing, variables Peripheral inputs/outputs</li> <li>Number of variables, max. 200</li> </ul>	
<b>Diagnostic buffer</b>	
<ul style="list-style-type: none"> <li>present Yes</li> <li>Number of entries, max. 1 000 <ul style="list-style-type: none"> <li>of which powerfail-proof 500</li> </ul> </li> </ul>	
<b>Traces</b>	
<ul style="list-style-type: none"> <li>Number of configurable Traces 4; Up to 512 KB of data per trace are possible</li> </ul>	
<b>Interrupts/diagnostics/status information</b>	
<b>Alarms</b>	
<ul style="list-style-type: none"> <li>Diagnostic alarm Yes</li> <li>Hardware interrupt Yes</li> </ul>	
<b>Diagnoses</b>	
<ul style="list-style-type: none"> <li>Monitoring the supply voltage Yes</li> <li>Wire-break Yes; for analog inputs/outputs, see description in manual</li> <li>Short-circuit Yes; for analog outputs, see description in manual</li> <li>A/B transition error at incremental encoder Yes</li> </ul>	
<b>Diagnostics indication LED</b>	
<ul style="list-style-type: none"> <li>RUN/STOP LED Yes</li> <li>ERROR LED Yes</li> <li>MAINT LED Yes</li> <li>STOP ACTIVE LED Yes</li> <li>Monitoring of the supply voltage (PWR-LED) Yes</li> <li>Channel status display Yes</li> <li>for channel diagnostics Yes; For analog inputs/outputs</li> <li>Connection display LINK TX/RX Yes</li> </ul>	
<b>Supported technology objects</b>	
<b>Motion Control</b>	Yes; Note: The number of technology objects affects the cycle time of the PLC program; selection guide via the TIA Selection Tool
<ul style="list-style-type: none"> <li>Number of available Motion Control resources for technology objects 800</li> <li>Required Motion Control resources <ul style="list-style-type: none"> <li>per speed-controlled axis 40</li> <li>per positioning axis 80</li> <li>per synchronous axis 160</li> <li>per external encoder 80</li> <li>per output cam 20</li> <li>per cam track 160</li> <li>per probe 40</li> </ul> </li> <li>Positioning axis <ul style="list-style-type: none"> <li>Number of positioning axes at motion control cycle of 4 ms (typical value) 5</li> <li>Number of positioning axes at motion control cycle of 8 ms (typical value) 10</li> </ul> </li> </ul>	
<b>Controller</b>	
<ul style="list-style-type: none"> <li>PID_Compact Yes; Universal PID controller with integrated optimization</li> <li>PID_3Step Yes; PID controller with integrated optimization for valves</li> <li>PID-Temp Yes; PID controller with integrated optimization for temperature</li> </ul>	
<b>Counting and measuring</b>	
<ul style="list-style-type: none"> <li>High-speed counter Yes</li> </ul>	
<b>Integrated Functions</b>	
<b>Counting functions</b>	
<ul style="list-style-type: none"> <li>Continuous counting Yes</li> <li>Counter response parameterizable Yes</li> <li>Hardware gate via digital input Yes</li> <li>Software gate Yes</li> </ul>	

• Event-controlled stop	Yes
• Synchronization via digital input	Yes
• Counting range, parameterizable	Yes
<b>Comparator</b>	
— Number of comparators	2; per count channel; see manual for details
— Direction dependency	Yes
— Can be changed from user program	Yes
<b>Position detection</b>	
• Incremental acquisition	Yes
• Suitable for S7-1500 Motion Control	Yes
<b>Measuring functions</b>	
• Measuring time, parameterizable	Yes
• Dynamic measurement period adjustment	Yes
• Number of thresholds, parameterizable	2
<b>Measuring range</b>	
— 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
<b>Accuracy</b>	
— 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
<b>Potential separation</b>	
<b>Potential separation digital inputs</b>	
• between the channels	No
• between the channels, in groups of	16
<b>Potential separation digital outputs</b>	
• between the channels	No
• between the channels, in groups of	16
<b>Potential separation channels</b>	
• between the channels and backplane bus	Yes
• Between the channels and load voltage L+	No
<b>Isolation</b>	
Isolation tested with	707 V DC (type test)
<b>Ambient conditions</b>	
<b>Ambient temperature during operation</b>	
• horizontal installation, min.	-25 °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.	-25 °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
<b>Ambient temperature during storage/transportation</b>	
• min.	-40 °C
• max.	70 °C
<b>Altitude during operation relating to sea level</b>	
• Installation altitude above sea level, max.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual
<b>configuration / header</b>	
<b>configuration / programming / header</b>	
<b>Programming language</b>	
— LAD	Yes
— FBD	Yes
— STL	Yes
— SCL	Yes
— GRAPH	Yes
<b>Know-how protection</b>	
• 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: Complete protection	Yes
programming / cycle time monitoring / header	
• 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.	1 050 g
<b>last modified:</b>	11/3/2021 