



Figure similar

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   |  |
| • I&M data   | Yes; I&M0 to I&M3  |
| • Isochronous mode                                       | Yes; With minimum OB 6x cycle of 625 µs (distributed)  |
| Engineering with   |  |
| • STEP 7 TIA Portal configurable/integrated from version | 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  |  |
| • 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)                        | 0.8 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   |  |
| • 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  |
| 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)<br>Yes<br>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<br>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<br>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<br>175 kbyte  |
| <b>FC</b>  |  |
| <ul style="list-style-type: none"> <li>• Number range</li> <li>• Size, max.</li> </ul>   | 0 ... 65 535<br>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<br>100<br>20<br>20<br>20; With minimum OB 3x cycle of 500 µs<br>50<br>3<br>1<br>2<br>100<br>4<br>2<br>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   |
| Retentivity  |   |
| — adjustable   | Yes   |
| IEC timer  |   |
| • Number   | Any (only limited by the main memory)   |
| Retentivity  |   |
| — 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  |
| 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  |
| <b>Address area</b>  |   |
| Number of IO modules   | 1 024; 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  |
| <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) |
| 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  |
| <b>Time of day</b>   |   |
| 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   |
| • in AS, master  | Yes   |
| • in AS, device  | Yes   |
| • on Ethernet via NTP  | 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   |
| 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                     | -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  |   |
| • 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                                  |

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|---|--|
| • for signal "1", min.  | 23.2 V; L+ (-0.8 V)  |
| <b>Output current</b>   |  |
| • 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   |
| <b>Output delay with resistive load</b>                               |  |
| • "0" to "1", max.  | 200 µs   |
| • "1" to "0", max.  | 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>                              |  |
| • for logic links   | Yes; for technological functions: No   |
| • for uprating  | No   |
| • for redundant control of a load                                     | Yes; for technological functions: No   |
| <b>Switching frequency</b>  |  |
| • 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  |
| <b>Total current of the outputs</b>                                   |  |
| • 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            |
| <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>   |  |
| • 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   |
| <b>Analog inputs</b>  |  |
| 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  |
| 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>                          |  |
| • 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   |
| <b>Input ranges (rated values), currents</b>                          |  |
| • 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  |
| • -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  |

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| 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  |
| • 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   |  |

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|---|--|
| <ul style="list-style-type: none"> <li>• 2-wire sensor</li> </ul>   | Yes  |
| — permissible quiescent current (2-wire sensor), max.   | 1.5 mA   |
| <b>Encoder signals, incremental encoder (asymmetrical)</b>  |  |
| <ul style="list-style-type: none"> <li>• Input voltage</li> </ul>   | 24 V   |
| <ul style="list-style-type: none"> <li>• Input frequency, max.</li> </ul>   | 100 kHz  |
| <ul style="list-style-type: none"> <li>• Counting frequency, max.</li> </ul>  | 400 kHz; with quadruple evaluation   |
| <ul style="list-style-type: none"> <li>• Signal filter, parameterizable</li> </ul>  | Yes  |
| <ul style="list-style-type: none"> <li>• Incremental encoder with A/B tracks, 90° phase offset</li> </ul>                                       | Yes  |
| <ul style="list-style-type: none"> <li>• Incremental encoder with A/B tracks, 90° phase offset and zero track</li> </ul>                        | Yes  |
| <ul style="list-style-type: none"> <li>• pulse encoder</li> </ul>   | Yes  |
| <ul style="list-style-type: none"> <li>• pulse encoder with direction</li> </ul>  | Yes  |
| <ul style="list-style-type: none"> <li>• pulse encoder with one impulse signal per count direction</li> </ul>                                   | 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>   |  |
| <ul style="list-style-type: none"> <li>• Voltage, relative to input range, (+/-)</li> </ul>   | 0.3 %  |
| <ul style="list-style-type: none"> <li>• Current, relative to input range, (+/-)</li> </ul>   | 0.3 %  |
| <ul style="list-style-type: none"> <li>• Resistance, relative to input range, (+/-)</li> </ul>  | 0.3 %  |
| <ul style="list-style-type: none"> <li>• Resistance thermometer, relative to input range, (+/-)</li> </ul>                                      | Pt100 Standard: ±2 K, Pt100 Climate: ±1 K, Ni100 Standard: ±1.2 K, Ni100 Climate: ±1 K     |
| <ul style="list-style-type: none"> <li>• Voltage, relative to output range, (+/-)</li> </ul>  | 0.3 %  |
| <ul style="list-style-type: none"> <li>• Current, relative to output range, (+/-)</li> </ul>  | 0.3 %  |
| <b>Basic error limit (operational limit at 25 °C)</b>   |  |
| <ul style="list-style-type: none"> <li>• Voltage, relative to input range, (+/-)</li> </ul>   | 0.2 %  |
| <ul style="list-style-type: none"> <li>• Current, relative to input range, (+/-)</li> </ul>   | 0.2 %  |
| <ul style="list-style-type: none"> <li>• Resistance, relative to input range, (+/-)</li> </ul>  | 0.2 %  |
| <ul style="list-style-type: none"> <li>• Resistance thermometer, relative to input range, (+/-)</li> </ul>                                      | Pt100 Standard: ±1 K, Pt100 Climate: ±0.5 K, Ni100 Standard: ±0.6 K, Ni100 Climate: ±0.5 K |
| <ul style="list-style-type: none"> <li>• Voltage, relative to output range, (+/-)</li> </ul>  | 0.2 %  |
| <ul style="list-style-type: none"> <li>• Current, relative to output range, (+/-)</li> </ul>  | 0.2 %  |
| <b>Interference voltage suppression for <math>f = n \times (f_1 \pm 1 \%)</math>, <math>f_1</math> = interference frequency</b>                 |  |
| <ul style="list-style-type: none"> <li>• Series mode interference (peak value of interference &lt; rated value of input range), min.</li> </ul> | 30 dB  |
| <ul style="list-style-type: none"> <li>• Common mode voltage, max.</li> </ul>   | 10 V   |
| <ul style="list-style-type: none"> <li>• Common mode interference, min.</li> </ul>  | 60 dB; at 400 Hz: 50 dB  |
| <b>Interfaces</b>   |  |
| Number of PROFINET interfaces   | 1  |
| <b>1. Interface</b>   |  |
| <b>Interface types</b>  |  |
| <ul style="list-style-type: none"> <li>• RJ 45 (Ethernet)</li> </ul>  | Yes; X1  |
| <ul style="list-style-type: none"> <li>• Number of ports</li> </ul>   | 2  |
| <ul style="list-style-type: none"> <li>• integrated switch</li> </ul>   | Yes  |
| <b>Protocols</b>  |  |
| <ul style="list-style-type: none"> <li>• IP protocol</li> </ul>   | Yes; IPv4  |
| <ul style="list-style-type: none"> <li>• PROFINET IO Controller</li> </ul>  | Yes  |
| <ul style="list-style-type: none"> <li>• PROFINET IO Device</li> </ul>  | Yes  |
| <ul style="list-style-type: none"> <li>• SIMATIC communication</li> </ul>   | Yes  |
| <ul style="list-style-type: none"> <li>• Open IE communication</li> </ul>   | Yes; Optionally also encrypted   |
| <ul style="list-style-type: none"> <li>• Web server</li> </ul>  | Yes  |
| <ul style="list-style-type: none"> <li>• Media redundancy</li> </ul>  | Yes  |
| <b>PROFINET IO Controller</b>   |  |


|   |  |
|---|--|
| <b>Services</b>   |  |
| — 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 |
| <b>Update time for IRT</b>  |  |
| — 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 625 µs of the isochronous OB is decisive                                    |
| — for send cycle of 500 µs  | 500 µs to 8 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 µs 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 µs: 375 µs, 625 µs ... 3 875 µs)   |
| <b>Update time for RT</b>   |  |
| — 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   |
| <b>PROFINET IO Device</b>   |  |
| <b>Services</b>   |  |
| — 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  |
| <b>Interface types</b>  |  |
| <b>RJ 45 (Ethernet)</b>   |  |
| • 100 Mbps  | Yes  |
| • Autonegotiation   | Yes  |
| • Autocrossing  | Yes  |
| • Industrial Ethernet status LED  | Yes  |
| <b>Protocols</b>  |  |
| <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, recommended 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 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, 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, recommended 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                                     |
| • Number of variables, max.                                |  |
| — of which status variables, max.                          | 200; per job   |
| — of which control variables, max.                         | 200; per job   |
| <b>Forcing</b>   |  |
| • Forcing  | Yes  |
| • 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>Diagnoses</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  |

|  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Monitoring of the supply voltage (PWR-LED)</li> <li>• Channel status display</li> <li>• for channel diagnostics</li> <li>• Connection display LINK TX/RX</li> </ul>   | Yes<br>Yes<br>Yes; For analog inputs/outputs<br>Yes  |
| <b>Supported technology objects</b>  |  |
| Motion Control   | 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</li> </ul>  | 800  |
| <ul style="list-style-type: none"> <li>• Required Motion Control resources               <ul style="list-style-type: none"> <li>— per speed-controlled axis</li> <li>— per positioning axis</li> <li>— per synchronous axis</li> <li>— per external encoder</li> <li>— per output cam</li> <li>— per cam track</li> <li>— per probe</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)</li> <li>— Number of positioning axes at motion control cycle of 8 ms (typical value)</li> </ul> </li> </ul> | 40<br>80<br>160<br>80<br>20<br>160<br>40<br><br>5<br>10  |
| Controller   |  |
| <ul style="list-style-type: none"> <li>• PID_Compact</li> <li>• PID_3Step</li> <li>• PID-Temp</li> </ul>   | Yes; Universal PID controller with integrated optimization<br>Yes; PID controller with integrated optimization for valves<br>Yes; PID controller with integrated optimization for temperature      |
| Counting and measuring   |  |
| <ul style="list-style-type: none"> <li>• High-speed counter</li> </ul>   | Yes  |
| <b>Integrated Functions</b>  |  |
| Counter  |  |
| <ul style="list-style-type: none"> <li>• Number of counters</li> <li>• Counting frequency, max.</li> </ul>   | 6; Of which max. 4x A/B/N<br>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>   | Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>Yes<br>Yes  |
| <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>  | 2; per count channel; see manual for details<br>Yes<br>Yes   |
| <b>Position detection</b>  |  |
| <ul style="list-style-type: none"> <li>• Incremental acquisition</li> <li>• Suitable for S7-1500 Motion Control</li> </ul>   | Yes<br>Yes   |
| <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>  | Yes<br>Yes<br>2  |
| <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>   | 0.04 Hz<br>400 kHz; with quadruple evaluation<br>2.5 µs<br>25 s  |
| <b>Accuracy</b>  |  |
| <ul style="list-style-type: none"> <li>— Frequency measurement</li> <li>— Cycle duration measurement</li> <li>— Velocity measurement</li> </ul>  | 100 ppm; depending on measuring interval and signal evaluation<br>100 ppm; depending on measuring interval and signal evaluation<br>100 ppm; depending on measuring interval and signal evaluation |
| <b>Potential separation</b>  |  |
| 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.                   | -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 |
| 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: 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  |
| last modified:                                    | 7/13/2024   |