



SIMATIC S7-1500 Analog input/output module AI 4x U/I/RTD/TC ST; 4 channels in groups of 4; Hardware interrupts; Diagnostics AQ 2x U/I ST; 2 channels in groups of 2; Substitute value; Diagnostics Common mode voltage approx. 10 V 16 bit; Accuracy 0.3%; Delivery including push-in front connector, infeed element, shield bracket and shield terminal

| General information  |   |
|--|---|
| Product type designation   | AI 4xU/I/RTD/TC /AQ 2xU/I ST                        |
| HW functional status   | From FS01   |
| Firmware version   | V1.0.0  |
| <ul style="list-style-type: none"> <li>FW update possible</li> </ul>                                     | Yes   |
| 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>                                       | No  |
| <ul style="list-style-type: none"> <li>Prioritized startup</li> </ul>                                    | No  |
| <ul style="list-style-type: none"> <li>Measuring range scalable</li> </ul>                               | No  |
| <ul style="list-style-type: none"> <li>Scalable measured values</li> </ul>                               | No  |
| <ul style="list-style-type: none"> <li>Adjustment of measuring range</li> </ul>                          | No  |
| <ul style="list-style-type: none"> <li>Output range scalable</li> </ul>                                  | No  |
| Engineering with   |   |
| <ul style="list-style-type: none"> <li>STEP 7 TIA Portal configurable/integrated from version</li> </ul> | V13 / V13.0.2                                       |
| <ul style="list-style-type: none"> <li>STEP 7 configurable/integrated from version</li> </ul>            | V5.5 SP3 / -  |
| <ul style="list-style-type: none"> <li>PROFIBUS from GSD version/GSD revision</li> </ul>                 | V1.0 / V5.1   |
| <ul style="list-style-type: none"> <li>PROFINET from GSD version/GSD revision</li> </ul>                 | V2.3 / -  |
| Operating mode   |   |
| <ul style="list-style-type: none"> <li>Oversampling</li> </ul>   | No  |
| <ul style="list-style-type: none"> <li>MSI</li> </ul>  | Yes   |
| <ul style="list-style-type: none"> <li>MSO</li> </ul>  | Yes   |
| CiR - Configuration in RUN   |   |
| Reparameterization possible in RUN   | Yes   |
| Calibration possible in RUN  | Yes   |
| Supply voltage   |   |
| Rated value (DC)   | 24 V  |
| permissible range, lower limit (DC)  | 19.2 V  |
| permissible range, upper limit (DC)  | 28.8 V  |
| Reverse polarity protection  | Yes   |
| Input current  |   |
| Current consumption, max.  | 200 mA  |
| Encoder supply   |   |
| 24 V encoder supply  |   |
| <ul style="list-style-type: none"> <li>Short-circuit protection</li> </ul>                               | Yes   |
| <ul style="list-style-type: none"> <li>Output current, max.</li> </ul>                                   | 20 mA; Max. 47 mA per channel for a duration < 10 s |
| Power  |   |
| Power available from the backplane bus   | 0.7 W   |

| Power loss   |   |
|--|---|
| Power loss, typ.   | 3.3 W   |
| Analog inputs  |   |
| Number of analog inputs  | 4   |
| <ul style="list-style-type: none"> <li>• For current measurement</li> <li>• For voltage measurement</li> <li>• For resistance/resistance thermometer measurement</li> <li>• For thermocouple measurement</li> </ul>  | 4<br>4<br>2<br>4  |
| permissible input voltage for voltage input (destruction limit), max.  | 28.8 V  |
| permissible input current for current input (destruction limit), max.  | 40 mA   |
| Constant measurement current for resistance-type transmitter, typ.   | 150 Ohm, 300 Ohm, 600 Ohm, Pt100, Pt200, Ni100: 1.25 mA; 6 000 Ohm, Pt500, Pt1000, Ni1000, LG-Ni1000: 0.625 mA; PTC: 0.472 mA   |
| Technical unit for temperature measurement adjustable  | Yes; °C/°F/K  |
| Analog input with oversampling   | No  |
| Standardization of measured values   | No  |
| Input ranges (rated values), voltages  |   |
| <ul style="list-style-type: none"> <li>• 0 to +5 V</li> <li>• 0 to +10 V</li> <li>• 1 V to 5 V <ul style="list-style-type: none"> <li>— Input resistance (1 V to 5 V)</li> </ul> </li> <li>• -1 V to +1 V <ul style="list-style-type: none"> <li>— Input resistance (-1 V to +1 V)</li> </ul> </li> <li>• -10 V to +10 V <ul style="list-style-type: none"> <li>— Input resistance (-10 V to +10 V)</li> </ul> </li> <li>• -2.5 V to +2.5 V <ul style="list-style-type: none"> <li>— Input resistance (-2.5 V to +2.5 V)</li> </ul> </li> <li>• -25 mV to +25 mV</li> <li>• -250 mV to +250 mV <ul style="list-style-type: none"> <li>— Input resistance (-250 mV to +250 mV)</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> <li>• -50 mV to +50 mV <ul style="list-style-type: none"> <li>— Input resistance (-50 mV to +50 mV)</li> </ul> </li> <li>• -500 mV to +500 mV <ul style="list-style-type: none"> <li>— Input resistance (-500 mV to +500 mV)</li> </ul> </li> <li>• -80 mV to +80 mV <ul style="list-style-type: none"> <li>— Input resistance (-80 mV to +80 mV)</li> </ul> </li> </ul> | No<br>No<br>Yes<br>100 kΩ<br>Yes<br>10 MΩ<br>Yes<br>100 kΩ<br>Yes<br>10 MΩ<br>Yes<br>10 MΩ<br>No<br>Yes<br>10 MΩ<br>Yes<br>100 kΩ<br>Yes<br>10 MΩ<br>Yes<br>10 MΩ<br>Yes<br>10 MΩ                                 |
| Input ranges (rated values), currents  |   |
| <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>  | Yes<br>25 Ω; Plus approx. 42 ohms for overvoltage protection by PTC<br>Yes<br>25 Ω; Plus approx. 42 ohms for overvoltage protection by PTC<br>Yes<br>25 Ω; Plus approx. 42 ohms for overvoltage protection by PTC |
| Input ranges (rated values), thermocouples   |   |
| <ul style="list-style-type: none"> <li>• Type B <ul style="list-style-type: none"> <li>— Input resistance (Type B)</li> </ul> </li> <li>• Type C</li> <li>• Type E <ul style="list-style-type: none"> <li>— Input resistance (Type E)</li> </ul> </li> <li>• Type J <ul style="list-style-type: none"> <li>— Input resistance (type J)</li> </ul> </li> <li>• Type K <ul style="list-style-type: none"> <li>— Input resistance (Type K)</li> </ul> </li> <li>• Type L</li> <li>• Type N <ul style="list-style-type: none"> <li>— Input resistance (Type N)</li> </ul> </li> <li>• Type R</li> </ul>  | Yes<br>10 MΩ<br>No<br>Yes<br>10 MΩ<br>Yes<br>10 MΩ<br>Yes<br>10 MΩ<br>No<br>Yes<br>10 MΩ<br>Yes   |

|  |                       |
|--|-----------------------|
| — Input resistance (Type R)                                | 10 MΩ                 |
| • Type S   | Yes                   |
| — Input resistance (Type S)                                | 10 MΩ                 |
| • Type T   | Yes                   |
| — Input resistance (Type T)                                | 10 MΩ                 |
| • Type U   | No                    |
| • Type TXK/TXK(L) to GOST                                  | No                    |
| <b>Input ranges (rated values), resistance thermometer</b> |                       |
| • Cu 10  | No                    |
| • Cu 10 according to GOST                                  | No                    |
| • Cu 50  | No                    |
| • Cu 50 according to GOST                                  | No                    |
| • Cu 100   | No                    |
| • Cu 100 according to GOST                                 | No                    |
| • Ni 10  | No                    |
| • Ni 10 according to GOST                                  | No                    |
| • Ni 100   | Yes; Standard/climate |
| — Input resistance (Ni 100)                                | 10 MΩ                 |
| • Ni 100 according to GOST                                 | No                    |
| • Ni 1000  | Yes; Standard/climate |
| — Input resistance (Ni 1000)                               | 10 MΩ                 |
| • Ni 1000 according to GOST                                | No                    |
| • LG-Ni 1000   | Yes; Standard/climate |
| — Input resistance (LG-Ni 1000)                            | 10 MΩ                 |
| • Ni 120   | No                    |
| • Ni 120 according to GOST                                 | No                    |
| • Ni 200   | No                    |
| • Ni 200 according to GOST                                 | No                    |
| • Ni 500   | No                    |
| • Ni 500 according to GOST                                 | No                    |
| • Pt 10  | No                    |
| • Pt 10 according to GOST                                  | No                    |
| • Pt 50  | No                    |
| • Pt 50 according to GOST                                  | No                    |
| • Pt 100   | Yes; Standard/climate |
| — Input resistance (Pt 100)                                | 10 MΩ                 |
| • Pt 100 according to GOST                                 | No                    |
| • Pt 1000  | Yes; Standard/climate |
| — Input resistance (Pt 1000)                               | 10 MΩ                 |
| • Pt 1000 according to GOST                                | No                    |
| • Pt 200   | Yes; Standard/climate |
| — Input resistance (Pt 200)                                | 10 MΩ                 |
| • Pt 200 according to GOST                                 | No                    |
| • Pt 500   | Yes; Standard/climate |
| — Input resistance (Pt 500)                                | 10 MΩ                 |
| • Pt 500 according to GOST                                 | No                    |
| <b>Input ranges (rated values), resistors</b>              |                       |
| • 0 to 150 ohms  | Yes                   |
| — Input resistance (0 to 150 ohms)                         | 10 MΩ                 |
| • 0 to 300 ohms  | Yes                   |
| — Input resistance (0 to 300 ohms)                         | 10 MΩ                 |
| • 0 to 600 ohms  | Yes                   |
| — Input resistance (0 to 600 ohms)                         | 10 MΩ                 |
| • 0 to 3000 ohms   | No                    |
| • 0 to 6000 ohms   | Yes                   |
| — Input resistance (0 to 6000 ohms)                        | 10 MΩ                 |
| • PTC  | Yes                   |
| — Input resistance (PTC)                                   | 10 MΩ                 |
| <b>Thermocouple (TC)</b>                                   |                       |
| <b>Temperature compensation</b>                            |                       |

|  |   |
|--|---|
| — parameterizable  | Yes   |
| — internal temperature compensation                                    | Yes   |
| — external temperature compensation via RTD                            | Yes   |
| — Compensation for 0 °C reference point temperature                    | Yes; fixed value can be set   |
| — Reference channel of the module                                      | No  |
| <b>Cable length</b>  |   |
| • shielded, max.   | 800 m; for U/I, 200 m for R/RTD, 50 m for TC  |
| <b>Analog outputs</b>  |   |
| Number of analog outputs   | 2   |
| Voltage output, short-circuit protection                               | Yes   |
| Voltage output, short-circuit current, max.                            | 24 mA   |
| Current output, no-load voltage, max.                                  | 22 V  |
| Cycle time (all channels), min.  | 3.2 ms; ±0.5 ms, regardless of the number of activated channels   |
| <b>Output ranges, voltage</b>  |   |
| • 0 to 10 V  | Yes   |
| • 1 V to 5 V   | Yes   |
| • -5 V to +5 V   | No  |
| • -10 V to +10 V   | Yes   |
| <b>Output ranges, current</b>  |   |
| • 0 to 20 mA   | Yes   |
| • -20 mA to +20 mA   | Yes   |
| • 4 mA to 20 mA  | Yes   |
| <b>Connection of actuators</b>   |   |
| • for voltage output two-wire connection                               | Yes   |
| • for voltage output four-wire connection                              | Yes   |
| • for current output two-wire connection                               | Yes   |
| <b>Load impedance (in rated range of output)</b>                       |   |
| • with voltage outputs, min.   | 1 kΩ; 0.5 kΩ at 1 to 5 V  |
| • with voltage outputs, capacitive load, max.                          | 1 μF  |
| • with current outputs, max.   | 750 Ω   |
| • with current outputs, inductive load, max.                           | 10 mH   |
| <b>Cable length</b>  |   |
| • shielded, max.   | 800 m; for current, 200 m for voltage   |
| <b>Analog value generation for the inputs</b>                          |   |
| <b>Integration and conversion time/resolution per channel</b>          |   |
| • Resolution with overrange (bit including sign), max.                 | 16 bit  |
| • Integration time, parameterizable                                    | Yes   |
| • Integration time (ms)  | 2,5 / 16,67 / 20 / 100 ms   |
| • Basic conversion time, including integration time (ms)               | 9 / 23 / 27 / 107 ms  |
| — additional conversion time for wire-break monitoring                 | 9 ms  |
| — additional conversion time for resistance measurement                | 150 ohm, 300 ohm, 600 ohm, Pt100, Pt200, Ni100: 2 ms, 6000 ohm, Pt500, Pt1000, Ni1000, LG-Ni1000, PTC: 4 ms |
| • Interference voltage suppression for interference frequency f1 in Hz | 400 / 60 / 50 / 10  |
| • Time for offset calibration (per module)                             | Basic conversion time of the slowest channel  |
| <b>Smoothing of measured values</b>                                    |   |
| • parameterizable  | Yes   |
| • Step: None   | Yes   |
| • Step: low  | Yes   |
| • Step: Medium   | Yes   |
| • Step: High   | Yes   |
| <b>Analog value generation for the outputs</b>                         |   |
| <b>Integration and conversion time/resolution per channel</b>          |   |
| • Resolution with overrange (bit including sign), max.                 | 16 bit  |
| • Conversion time (per channel)  | 0.5 ms  |
| <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>  |  |
| Connection of signal encoders   |  |
| • for voltage measurement   | Yes  |
| • for current measurement as 2-wire transducer<br>— Burden of 2-wire transmitter, max.  | Yes<br>820 Ω   |
| • for current measurement as 4-wire transducer  | Yes  |
| • for resistance measurement with two-wire connection   | Yes; Only for PTC  |
| • for resistance measurement with three-wire connection   | Yes; All measuring ranges except PTC; internal compensation of the cable resistances   |
| • for resistance measurement with four-wire connection  | Yes; All measuring ranges except PTC   |
| <b>Errors/accuracies</b>  |  |
| Linearity error (relative to input range), (+/-)  | 0.02 %   |
| Temperature error (relative to input range), (+/-)  | 0.005 %/K; With TC type T 0.02 ± % / K   |
| Crosstalk between the inputs, max.  | -80 dB   |
| Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)   | 0.02 %   |
| 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), (+/-)   | 0.002 %/K  |
| Crosstalk between the outputs, max.   | -100 dB  |
| Repeat accuracy in steady state at 25 °C (relative to output range), (+/-)  | 0.05 %   |
| Temperature error of internal compensation  | ±6 °C  |
| note regarding accuracy   | at temperatures below 0 °C, the figures for operating error and temperature error are doubled  |
| <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, (+/-)  | 0.3 %; Ptxxx standard: ±1.5 K, Ptxxx climate: ±0.5 K, Nixxx standard: ±0.5 K, Nixxx climate: ±0.3 K  |
| • Thermocouple, relative to input range, (+/-)  | 0.3 %; Type B: > 600 °C ±4.6 K, type E: > -200 °C ±1.5 K, type J: > -210 °C ±1.9 K, type K: > -200 °C ±2.4 K, type N: > -200 °C ±2.9 K, type R: > 0 °C ±4.7 K, type S: > 0 °C ±4.6 K, type T: > -200 °C ±2.4 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, (+/-)   | 0.1 %  |
| • Current, relative to input range, (+/-)   | 0.1 %  |
| • Resistance, relative to input range, (+/-)  | 0.1 %  |
| • Resistance thermometer, relative to input range, (+/-)  | 0.1 %; Ptxxx standard: ±0.7 K, Ptxxx climate: ±0.2 K, Nixxx standard: ±0.3 K, Nixxx climate: ±0.15 K   |
| • Thermocouple, relative to input range, (+/-)  | 0.1 %; Type B: > 600 °C ±1.7 K, type E: > -200 °C ±0.7 K, type J: > -210 °C ±0.8 K, type K: > -200 °C ±1.2 K, type N: > -200 °C ±1.2 K, type R: > 0 °C ±1.9 K, type S: > 0 °C ±1.9 K, type T: > -200 °C ±0.8 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.                                      | 40 dB  |
| • Common mode voltage, max.   | 10 V   |
| • Common mode interference, min.  | 60 dB  |
| <b>Interrupts/diagnostics/status information</b>  |  |
| Diagnostics function  | Yes  |
| Substitute values connectable   | Yes  |
| <b>Alarms</b>   |  |
| • Diagnostic alarm  | Yes  |
| • Limit value alarm   | Yes; two upper and two lower limit values in each case   |
| <b>Diagnoses</b>  |  |

|   |  |
|---|--|
| <ul style="list-style-type: none"> <li>Monitoring the supply voltage</li> <li>Wire-break</li> </ul>   | Yes<br>Yes; only for input type 1 ... 5 V, 4 ... 20 mA, TC, R, RTD and output type current   |
| <ul style="list-style-type: none"> <li>Short-circuit</li> <li>Overflow/underflow</li> </ul>   | Yes; Only for output type "voltage"<br>Yes   |
| <b>Diagnostics indication LED</b>   |  |
| <ul style="list-style-type: none"> <li>RUN LED</li> <li>ERROR LED</li> <li>Monitoring of the supply voltage (PWR-LED)</li> <li>Channel status display</li> <li>for channel diagnostics</li> <li>for module diagnostics</li> </ul> | Yes; green LED<br>Yes; red LED<br>Yes; green LED<br>Yes; green LED<br>Yes; red LED<br>Yes; red LED   |
| <b>Potential separation</b>   |  |
| <b>Potential separation analog inputs</b>   |  |
| <ul style="list-style-type: none"> <li>between the channels</li> <li>between the channels, in groups of</li> <li>between the channels and backplane bus</li> <li>Between the channels and load voltage L+</li> </ul>              | No<br>4<br>Yes<br>Yes  |
| <b>Potential separation analog outputs</b>  |  |
| <ul style="list-style-type: none"> <li>between the channels</li> <li>between the channels, in groups of</li> <li>between the channels and backplane bus</li> <li>Between the channels and load voltage L+</li> </ul>              | No<br>2<br>Yes<br>Yes  |
| <b>Permissible potential difference</b>   |  |
| between the inputs (UCM)  | 20 V DC  |
| Between the inputs and MANA (UCM)   | 10 V DC  |
| between S- and MANA (UCM)   | 8 V DC   |
| <b>Isolation</b>  |  |
| Isolation tested with   | 707 V DC (type test)   |
| <b>Ambient conditions</b>   |  |
| <b>Ambient temperature during operation</b>   |  |
| <ul style="list-style-type: none"> <li>horizontal installation, min.</li> <li>horizontal installation, max.</li> <li>vertical installation, min.</li> <li>vertical installation, max.</li> </ul>                                  | -25 °C; From FS03<br>60 °C<br>-25 °C; From FS03<br>40 °C   |
| <b>Altitude during operation relating to sea level</b>  |  |
| <ul style="list-style-type: none"> <li>Installation altitude above sea level, max.</li> </ul>   | 5 000 m; Restrictions for installation altitudes > 2 000 m, see manual   |
| <b>Dimensions</b>   |  |
| Width   | 25 mm  |
| Height  | 147 mm   |
| Depth   | 129 mm   |
| <b>Weights</b>  |  |
| Weight, approx.   | 250 g  |
| <b>Other</b>  |  |
| Note:   | Supplied incl. 40-pole push-in front connectors. Additional basic error and noise for integration time = 2.5 ms: Voltage: $\pm 250$ mV ( $\pm 0.02\%$ ), $\pm 80$ mV ( $\pm 0.05\%$ ), $\pm 50$ mV ( $\pm 0.05\%$ ); resistance: 150 Ohms ( $\pm 0.02\%$ ); resistance thermometer: Pt100 climate: $\pm 0.08$ K, Ni100 climate: $\pm 0.08$ K; thermolement: Type B, R, S: $\pm 3$ K, type E, J, K, N, T: $\pm 1$ K |

last modified:

4/27/2022 