



SIMATIC S7-1500 analog input module AI 8xU/I/RTD/TC ST, 16 bit resolution, accuracy 0.3%, 8 channels in groups of 8; 4 channels for RTD measurement, common mode voltage 10 V; Diagnostics; Hardware interrupts; Delivery including infeed element, shield bracket and shield terminal: Front connector (screw terminals or push-in) to be ordered separately

| General information                                       |                    |
|-----------------------------------------------------------|--------------------|
| Product type designation                                  | AI 8xU/I/RTD/TC ST |
| HW functional status                                      | FS04               |
| Firmware version                                          | V2.0.0             |
| • FW update possible                                      | Yes                |
| Product function                                          |                    |
| • I&M data                                                | Yes; I&M0 to I&M3  |
| • Prioritized startup                                     | No                 |
| • Measuring range scalable                                | No                 |
| • Scalable measured values                                | No                 |
| • Adjustment of measuring range                           | No                 |
| Engineering with                                          |                    |
| • STEP 7 TIA Portal configurable/integrated as of version | V12 / V12          |
| • STEP 7 configurable/integrated as of version            | V5.5 SP3 / -       |
| • PROFIBUS as of GSD version/GSD revision                 | V1.0 / V5.1        |
| • PROFINET as of GSD version/GSD revision                 | V2.3 / -           |
| Operating mode                                            |                    |
| • Oversampling                                            | No                 |

- MSI

Yes

## CiR – Configuration in RUN

Reparameterization possible in RUN

Yes

Calibration possible in RUN

Yes

## Supply voltage

Type of supply voltage

DC

Rated value (DC)

24 V

permissible range, lower limit (DC)

20.4 V

permissible range, upper limit (DC)

28.8 V

Reverse polarity protection

Yes

## Input current

Current consumption, max.

240 mA; with 24 V DC supply

## Encoder supply

24 V encoder supply

- Short-circuit protection

Yes

- Output current, max.

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.

2.7 W

## Analog inputs

Number of analog inputs

8

- For current measurement

8

- For voltage measurement

8

- For resistance/resistance thermometer measurement

4

- For thermocouple measurement

8

permissible input voltage for voltage input (destruction limit), max.

28.8 V

permissible input current for current input (destruction limit), max.

40 mA

Technical unit for temperature measurement adjustable

Yes; °C/°F/K

Input ranges (rated values), voltages

- 0 to +5 V

No

- 0 to +10 V

No

- 1 V to 5 V

Yes

- Input resistance (1 V to 5 V)

100 kΩ

- -1 V to +1 V

Yes

- Input resistance (-1 V to +1 V)

10 MΩ

|                                            |                                                                      |
|--------------------------------------------|----------------------------------------------------------------------|
| • -10 V to +10 V                           | Yes                                                                  |
| • Input resistance (-10 V to +10 V)        | 100 k $\Omega$                                                       |
| • -2.5 V to +2.5 V                         | Yes                                                                  |
| • Input resistance (-2.5 V to +2.5 V)      | 10 M $\Omega$                                                        |
| • -25 mV to +25 mV                         | No                                                                   |
| • -250 mV to +250 mV                       | Yes                                                                  |
| • Input resistance (-250 mV to +250 mV)    | 10 M $\Omega$                                                        |
| • -5 V to +5 V                             | Yes                                                                  |
| • Input resistance (-5 V to +5 V)          | 100 k $\Omega$                                                       |
| • -50 mV to +50 mV                         | Yes                                                                  |
| • Input resistance (-50 mV to +50 mV)      | 10 M $\Omega$                                                        |
| • -500 mV to +500 mV                       | Yes                                                                  |
| • Input resistance (-500 mV to +500 mV)    | 10 M $\Omega$                                                        |
| • -80 mV to +80 mV                         | Yes                                                                  |
| • Input resistance (-80 mV to +80 mV)      | 10 M $\Omega$                                                        |
| Input ranges (rated values), currents      |                                                                      |
| • 0 to 20 mA                               | Yes                                                                  |
| • Input resistance (0 to 20 mA)            | 25 $\Omega$ ; Plus approx. 42 ohms for overvoltage protection by PTC |
| • -20 mA to +20 mA                         | Yes                                                                  |
| • Input resistance (-20 mA to +20 mA)      | 25 $\Omega$ ; Plus approx. 42 ohms for overvoltage protection by PTC |
| • 4 mA to 20 mA                            | Yes                                                                  |
| • Input resistance (4 mA to 20 mA)         | 25 $\Omega$ ; Plus approx. 42 ohms for overvoltage protection by PTC |
| Input ranges (rated values), thermocouples |                                                                      |
| • Type B                                   | Yes                                                                  |
| • Input resistance (Type B)                | 10 M $\Omega$                                                        |
| • Type C                                   | No                                                                   |
| • Type E                                   | Yes                                                                  |
| • Input resistance (Type E)                | 10 M $\Omega$                                                        |
| • Type J                                   | Yes                                                                  |
| • Input resistance (type J)                | 10 M $\Omega$                                                        |
| • Type K                                   | Yes                                                                  |
| • Input resistance (Type K)                | 10 M $\Omega$                                                        |
| • Type L                                   | No                                                                   |
| • Type N                                   | Yes                                                                  |
| • Input resistance (Type N)                | 10 M $\Omega$                                                        |
| • Type R                                   | Yes                                                                  |
| • Input resistance (Type R)                | 10 M $\Omega$                                                        |
| • Type S                                   | Yes                                                                  |
| • Input resistance (Type S)                | 10 M $\Omega$                                                        |
| • Type T                                   | Yes                                                                  |
| • Input resistance (Type T)                | 10 M $\Omega$                                                        |

|                                                     |                       |
|-----------------------------------------------------|-----------------------|
| • Type TXK/TXK(L) to GOST                           | No                    |
| Input ranges (rated values), resistance thermometer |                       |
| • 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 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                    |
| Input ranges (rated values), resistors              |                       |
| • 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                                      | Yes                                                                                                         |
| <b>Cable length</b>                                                    |                                                                                                             |
| • shielded, max.                                                       | 800 m; for U/I, 200 m for R/RTD, 50 m for TC                                                                |
| <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 (to be considered in R/RTD/TC measurement)                                                             |
| — 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 Hz                                                                                       |
| • 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                                                                                                         |

## Encoder

| Connection of signal encoders                                                                                                                                                                                        |                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• for voltage measurement</li> </ul>                                                                                                                                          | Yes                                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• for current measurement as 2-wire transducer                             <ul style="list-style-type: none"> <li>— Burden of 2-wire transmitter, max.</li> </ul> </li> </ul> | Yes<br>820 $\Omega$                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• for current measurement as 4-wire transducer</li> </ul>                                                                                                                     | Yes                                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• for resistance measurement with two-wire connection</li> </ul>                                                                                                              | Yes; Only for PTC                                                                                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• for resistance measurement with three-wire connection</li> </ul>                                                                                                            | Yes; All measuring ranges except PTC; internal compensation of the cable resistances                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• for resistance measurement with four-wire connection</li> </ul>                                                                                                             | Yes; All measuring ranges except PTC                                                                                                                                                                                                                            |
| Errors/accuracies                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                 |
| Linearity error (relative to input range), (+/-)                                                                                                                                                                     | 0.02 %                                                                                                                                                                                                                                                          |
| Temperature error (relative to input range), (+/-)                                                                                                                                                                   | 0.005 %/K; With TC type T 0.02 $\pm$ % / K                                                                                                                                                                                                                      |
| Crosstalk between the inputs, max.                                                                                                                                                                                   | -80 dB                                                                                                                                                                                                                                                          |
| Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)                                                                                                                                            | 0.02 %                                                                                                                                                                                                                                                          |
| Temperature error of internal compensation                                                                                                                                                                           | $\pm 6$ °C                                                                                                                                                                                                                                                      |
| Operational error limit in overall temperature range                                                                                                                                                                 |                                                                                                                                                                                                                                                                 |
| <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>                                                                                                           | Ptxxx standard: $\pm 1.5$ K, Ptxxx climate: $\pm 0.5$ K, Nixxx standard: $\pm 0.5$ K, Nixxx climate: $\pm 0.3$ K                                                                                                                                                |
| <ul style="list-style-type: none"> <li>• Thermocouple, relative to input range, (+/-)</li> </ul>                                                                                                                     | Type B: $> 600$ °C $\pm 4.6$ K, type E: $> -200$ °C $\pm 1.5$ K, type J: $> -210$ °C $\pm 1.9$ K, type K: $> -200$ °C $\pm 2.4$ K, type N: $> -200$ °C $\pm 2.9$ K, type R: $> 0$ °C $\pm 4.7$ K, type S: $> 0$ °C $\pm 4.6$ K, type T: $> -200$ °C $\pm 2.4$ K |
| Basic error limit (operational limit at 25 °C)                                                                                                                                                                       |                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>• Voltage, relative to input range, (+/-)</li> </ul>                                                                                                                          | 0.1 %                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• Current, relative to input range, (+/-)</li> </ul>                                                                                                                          | 0.1 %                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• Resistance, relative to input range, (+/-)</li> </ul>                                                                                                                       | 0.1 %                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• Resistance thermometer, relative to input range, (+/-)</li> </ul>                                                                                                           | Ptxxx standard: $\pm 0.7$ K, Ptxxx climate: $\pm 0.2$ K, Nixxx standard: $\pm 0.3$ K, Nixxx climate: $\pm 0.15$ K                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• Thermocouple, relative to input range, (+/-)</li> </ul>                                                                                                                     | Type B: $> 600$ °C $\pm 1.7$ K, type E: $> -200$ °C $\pm 0.7$ K, type J: $> -210$ °C $\pm 0.8$ K, type K: $> -200$ °C $\pm 1.2$ K, type N: $> -200$ °C $\pm 1.2$ K, type R: $> 0$ °C $\pm 1.9$ K, type S: $> 0$ °C $\pm 1.9$ K, type T: $> -200$ °C $\pm 0.8$ K |
| Interference voltage suppression for $f = n \times (f_1 \pm 1 \%)$ , $f_1$ = interference frequency                                                                                                                  |                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>• Series mode interference (peak value of interference <math>&lt;</math> rated value of input range), min.</li> </ul>                                                         | 40 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                                                                                                                                                                                                                                                           |

|                                                                 |                                                                    |
|-----------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Isochronous mode</b>                                         |                                                                    |
| Isochronous operation (application synchronized up to terminal) | No                                                                 |
| <b>Interrupts/diagnostics/status information</b>                |                                                                    |
| Diagnostics function                                            | Yes                                                                |
| <b>Alarms</b>                                                   |                                                                    |
| • Diagnostic alarm                                              | Yes                                                                |
| • Limit value alarm                                             | Yes; two upper and two lower limit values in each case             |
| <b>Diagnostic messages</b>                                      |                                                                    |
| • Monitoring the supply voltage                                 | Yes                                                                |
| • Wire-break                                                    | Yes; Only for 1 to 5 V, 4 to 20 mA, TC, R, and RTD                 |
| • Overflow/underflow                                            | Yes                                                                |
| <b>Diagnostics indication LED</b>                               |                                                                    |
| • RUN LED                                                       | Yes; Green LED                                                     |
| • ERROR LED                                                     | Yes; Red LED                                                       |
| • Monitoring of the supply voltage (PWR-LED)                    | Yes; Green LED                                                     |
| • Channel status display                                        | Yes; Green LED                                                     |
| • for channel diagnostics                                       | Yes; Red LED                                                       |
| • for module diagnostics                                        | Yes; Red LED                                                       |
| <b>Potential separation</b>                                     |                                                                    |
| <b>Potential separation channels</b>                            |                                                                    |
| • between the channels                                          | No                                                                 |
| • between the channels, in groups of                            | 8                                                                  |
| • between the channels and backplane bus                        | Yes                                                                |
| • between the channels and the power supply of the electronics  | Yes                                                                |
| <b>Isolation</b>                                                |                                                                    |
| Isolation tested with                                           | 707 V DC (type test)                                               |
| <b>Standards, approvals, certificates</b>                       |                                                                    |
| Suitable for applications according to AMS 2750                 | Yes; Declaration of Conformity, see online support entry 109757262 |
| Suitable for applications according to CQI-9                    | Yes; Based on AMS 2750 E                                           |
| <b>Ambient conditions</b>                                       |                                                                    |
| <b>Ambient temperature during operation</b>                     |                                                                    |
| • horizontal installation, min.                                 | 0 °C                                                               |
| • horizontal installation, max.                                 | 60 °C                                                              |
| • vertical installation, min.                                   | 0 °C                                                               |
| • vertical installation, max.                                   | 40 °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

## Dimensions

|        |        |
|--------|--------|
| Width  | 35 mm  |
| Height | 147 mm |
| Depth  | 129 mm |

## Weights

|                 |       |
|-----------------|-------|
| Weight, approx. | 310 g |
|-----------------|-------|

## Other

|       |                                                                                                                                                                                                                                                                                                                                                                   |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Note: | Additional basic error and noise for integration time = 2.5 ms:<br>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; thermocouple: Type B, R, S: $\pm 3$ K, type E, J, K, N, T: $\pm 1$ K |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**last modified:**

10/22/2019 