SIEMENS

SIMATIC

S7
S7-1200 Programmable controller

System Manual

Preface

Product overview 1

New features 2

STEP 7 programming software 3

Installation 4

PLC concepts 5

Device configuration 6

Programming concepts 7

Basic instructions 8

Extended instructions 9

Technology instructions 10

Communication 11

Web server 12

Communication processor and Modbus TCP 13

TeleService communication (SMTP email) 14

Online and diagnostic tools 15

Technical specifications A

Calculating a power budget B

Ordering Information C

Device exchange and spare parts compatibility D

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A.11.2 SM 1231 RTD

SM 1231 RTD specifications

Table A-176 General specifications

Technical data	SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x 16 bit
Article number	6ES7231-5PD32-0XB0	6ES7231-5PF32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	70 x 100 x 75
Weight	220 grams	270 grams
Power dissipation	1.5 W	
Current consumption (SM Bus)	80 mA	90 mA
Current consumption (24 V DC) [1]	40 mA	

[1] 20.4 to 28.8 V DC (Class 2, Limited Power, or sensor power from CPU)

Table A-177 Analog inputs

Technical data		SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x16 bit
Number of inputs		4	8
Type		Module referenced RTD and Ω	
Range Nominal range (data word) Overshoot/undershoot range (data word) Overflow/underflow (data word)		See RTD Sensor selection table (Page 1296).	
Resolution	Temperature	0.1 °C/0.1 °F	
	Resistance	15 bits plus sign	
Maximum withstand voltage		± 35 V	
Noise rejection		85 dB for the selected noise reduction (10 Hz, 50 Hz, 60 Hz or 400 Hz)	
Common mode rejection		> 120dB	
Impedance		≥ 10 MΩ	
Isolation	Field side to logic	707 V DC (type test)	
	Field to 24 V DC	707 V DC (type test)	
	24 V DC to logic	707 V DC (type test)	
Channel to channel isolation		none	
Accuracy		See RTD Sensor selection table (Page 1296).	
Repeatability		±0.05% FS	
Maximum sensor dissipation		0.5 m W	
Measuring principle		Integrating	
Module update time		See Noise reduction selection table (Page 1296).	
Cable length (meters)		100 meters to sensor max.	
Wire resistance		20 Ω, 2.7 Ω for 10 Ω RTD max.	

Table A-178 Diagnostics

Technical data	SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x16 bit
Overflow/underflow [1,2]	Yes	
Wire break [3]	Yes	
24 V DC low voltage [1]	Yes	

[1] The overflow, underflow and low voltage diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

[2] For resistance ranges underflow detection is never enabled.

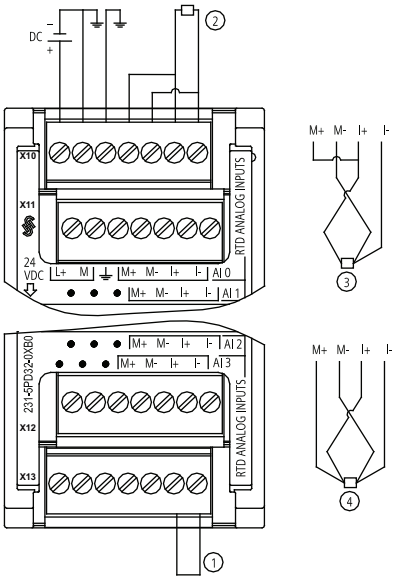
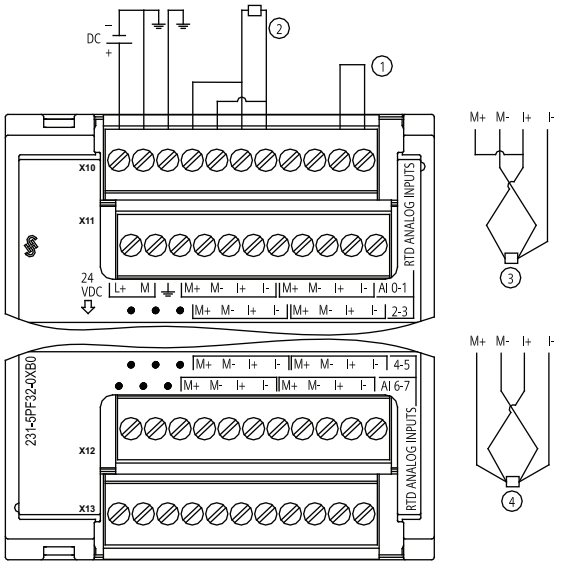
[3] When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

The SM 1231 RTD analog signal module measures the value of resistance connected to the module inputs. The measurement type can be selected as either "Resistor" or "Thermal resistor".

- "Resistor": The nominal range full scale value will be decimal 27648.
- "Thermal resistor": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253). The climatic range values will be reported in degrees multiplied by one hundred (for example, 25.34 degrees will be reported as decimal 2534).

The SM 1231 RTD module supports measurements with 2-wire, 3-wire and 4-wire connections to the sensor resistor.

Table A-179 Wiring diagrams for the RTD SMs

SM 1231 RTD 4 x 16 bit (6ES7231-5PD32-0XB0)	SM 1231 RTD 8 x 16 bit (6ES7231-5PF32-0XB0)
	

① Loop-back unused RTD inputs

② 2-wire RTD ③ 3-wire RTD ④ 4-wire RTD

NOTE: Connectors must be gold. See Appendix C, Spare Parts for article number.

Table A-180 Connector Pin Locations for SM 1231 RTD 4 x 16 bit (6ES7231-5PD32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0 M+ /RTD	AI 1 M+ /RTD	AI 2 M+ /RTD	AI 3 M+ /RTD
5	AI 0 M- /RTD	AI 1 M- /RTD	AI 2 M- /RTD	AI 3 M- /RTD
6	AI 0 I+ /RTD	AI 1 I+ /RTD	AI 2 I+ /RTD	AI 3 I+ /RTD
7	AI 0 I- /RTD	AI 1 I- /RTD	AI 2 I- /RTD	AI 3 I- /RTD

Table A-181 Connector Pin Locations for SM 1231 RTD 8 x 16 bit (6ES7231-5PF32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0 M+ /RTD	AI 2 M+ /RTD	AI 4 M+ /RTD	AI 6 M+ /RTD
5	AI 0 M- /RTD	AI 2 M- /RTD	AI 4 M- /RTD	AI 6 M- /RTD
6	AI 0 I+ /RTD	AI 2 I+ /RTD	AI 4 I+ /RTD	AI 6 I+ /RTD
7	AI 0 I- /RTD	AI 2 I- /RTD	AI 4 I- /RTD	AI 6 I- /RTD
8	AI 1 M+ /RTD	AI 3 M+ /RTD	AI 5 M+ /RTD	A7 M+ /RTD
9	AI 1 M- /RTD	AI 3 M- /RTD	AI 5 M- /RTD	AI 7 M- /RTD
10	AI 1 I+ /RTD	AI 3 I+ /RTD	AI 5 I+ /RTD	AI 7 I+ /RTD
11	AI 1 I- /RTD	AI 3 I- /RTD	AI 5 I- /RTD	AI 7 I- /RTD

Note

The RTD unused channels can be deactivated. No error will occur if an unused channel is deactivated.

The RTD module needs to have the current loop continuous to eliminate extra stabilization time which is automatically added to an unused channel that is not deactivated. For consistency the RTD module should have a resistor connected (like the 2-wire RTD connection).

A.11.2.1 Selection tables for the SM 1231 RTD

Table A-182 Ranges and accuracy for the different sensors supported by the RTD modules

Temperature coefficient	RTD type	Under range minimum[1]	Nominal range low limit	Nominal range high limit	Over range maximum[2]	Normal range accuracy @ 25 °C	Normal range accuracy -20 °C to 60 °C
Pt 0.003850 ITS90 DIN EN 60751	Pt 100 climatic	-145.00 °C	-120.00 °C	145.00 °C	155.00 °C	±0.20 °C	±0.40 °C
	Pt 10	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±1.0 °C	±2.0 °C
	Pt 50	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±0.5 °C	±1.0 °C
	Pt 100						
	Pt 200						
	Pt 500						
	Pt 1000						
Pt 0.003902 Pt 0.003916 Pt 0.003920	Pt 100	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	± 0.5 °C	±1.0 °C
	Pt 200	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	± 0.5 °C	±1.0 °C
	Pt 500						
	Pt 1000						
Pt 0.003910	Pt 10	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±1.0 °C	±2.0 °C
	Pt 50	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±0.8 °C	±1.6 °C
	Pt 100						
	Pt 500						
Ni 0.006720 Ni 0.006180	Ni 100	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
	Ni 120						
	Ni 200						
	Ni 500						
	Ni 1000						
LG-Ni 0.005000	LG-Ni 1000	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
Ni 0.006170	Ni 100	-105.0 °C	-60.0 °C	180.0 °C	212.4 °C	±0.5 °C	±1.0 °C
Cu 0.004270	Cu 10	-240.0 °C	-200.0 °C	260.0 °C	312.0 °C	±1.0 °C	±2.0 °C
Cu 0.004260	Cu 10	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±0.6 °C	±1.2 °C
	Cu 100						
Cu 0.004280	Cu 10	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±0.7 °C	±1.4 °C
	Cu 100						

[1] RTD values below the under-range minimum value report -32768.

[2] RTD values above the over-range maximum value report +32767.