Table A-139 SM 1223 DI 8 x 120/230 V AC, DQ 8 x Relay (6ES7223-1QH32-0XB0)

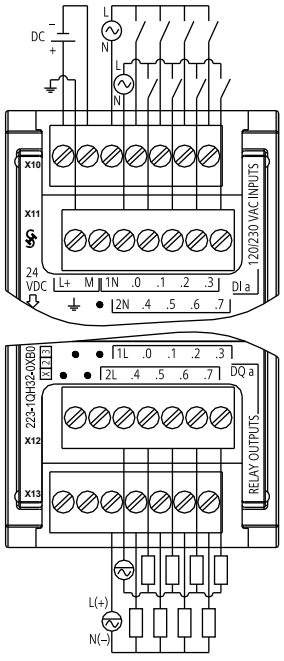


Table A-140 Connector Pin Locations for SM 1223 DI 8 x 120/240 V AC, DQ 8 x Relay (6ES7223-1QH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	1N	2N	1L	2L
4	DI a.0	DI a.4	DQ a.0	DQ a.4
5	DI a.1	DI a.5	DQ a.1	DQ a.5
6	DI a.2	DI a.6	DQ a.2	DQ a.6
7	DI a.3	DI a.7	DQ a.3	DQ a.7

A.10 Analog signal modules (SMs)

A.10.1 SM 1231 analog input module specifications

Table A-141 General specifications

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Article number	6ES7231-4HD32-0XB0	6ES7231-4HF32-0XB0	6ES7231-5ND32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75		

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Weight	180 grams		
Power dissipation	2.2 W	2.3 W	2.0 W
Current consumption (SM Bus)	80 mA	90 mA	80 mA
Current consumption (24 V DC)	45 mA		65 mA

Table A-142 Analog inputs

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Number of inputs	4	8	4
Type	Voltage or current (differential): Selectable in groups of 2		Voltage or current (differential)
Range	±10 V, ±5 V, ±2.5 V, 0 to 20 mA, or 4 mA to 20 mA		±10 V, ±5 V, ±2.5 V, ±1.25 V, 0 to 20 mA or 4 mA to 20 mA
Full scale range (data word)	-27648 to 27648 voltage / 0 to 27648 current		
Overshoot/undershoot range (data word) Refer to the section on analog input ranges for voltage and current (Page 1246).	Voltage: 32511 to 27649 / -27649 to -32,512 Current: 32511 to 27649 / 0 to -4864		
Overflow/underflow (data word) Refer to the section on input ranges for voltage and current (Page 1246).	Voltage: 32767 to 32512 / -32513 to -32768 Current 0 to 20 mA: 32767 to 32512 / -4865 to -32768 Current 4 to 20 mA: 32767 to 32512 (values below -4864 indicate open wire)		
Resolution1	12 bits + sign bit		15 bits + sign bit
Maximum withstand voltage/current	±35 V / ±40 mA		
Smoothing	None, weak, medium, or strong Refer to the section on step response times (Page 1245).		
Noise rejection	400, 60, 50, or 10 Hz Refer to the section on sample rates (Page 1245).		
Input impedance Before parametertization Voltage Current	 ≥ 1 MΩ ≥ 9 MΩ, FS 06 and above ≥ 1 MΩ ≥ 270 Ω, < 290 Ω		 ≥ 1 MΩ ≥ 1 MΩ < 315 Ω, > 280 Ω
Isolation Field side to logic Logic to 24 V DC Field side to 24 V DC Channel to channel	None		 707 V DC (type test) 707 V DC (type test) 500 V DC (type test) None
Accuracy (25 °C / -20 to 60 °C)	±0.1% / ±0.2% of full scale		±0.1% / ±0.3% of full scale
Measuring principle	Actual value conversion		
Common mode rejection	40 dB, DC to 60 Hz		
Operational signal range[1]	Signal plus common mode voltage must be less than +12 V and greater than -12 V		
Cable length (meters)	100 m, twisted and shielded		

[1] Voltages outside the operational range applied to one channel may cause interference on other channels.

Table A-143 Diagnostics

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Overflow/underflow	Yes		
24 V DC low voltage	Yes		
Open wire	4 to 20 mA range only (if input is below -4864; 1.185 mA)		

SM 1231 current measurment

You can implement current measurement with either a 2-wire transducer or 4-wire transducer as shown in the following figure:

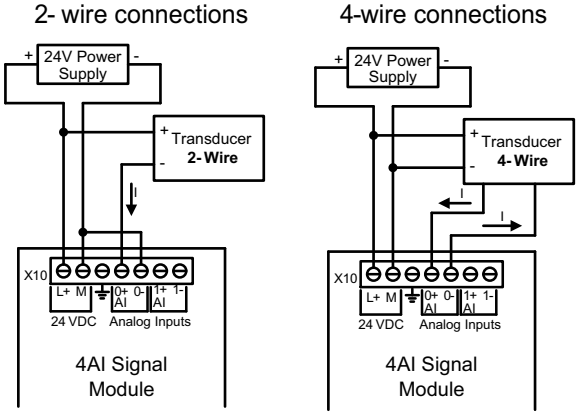


Table A-144 Wiring diagrams for the analog input SMs

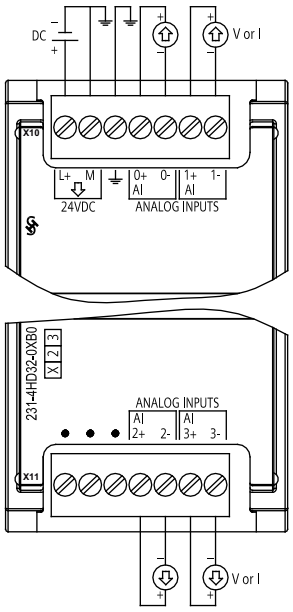
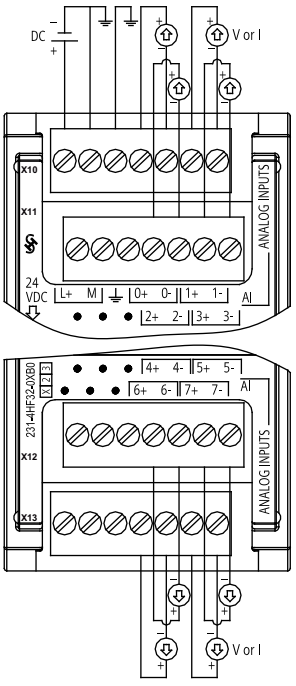
SM 1231 AI 4 x 13 bit (6ES7231-4HD32-0XB0)	SM 1231 AI 8 x 13 bit (6ES7231-4HF32-0XB0)
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A-145 Connector pin locations for SM 1231 AI 4 x 13 bit (6ES7231-4HD32-0XB0)

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

Table A-146 Connector pin locations for SM 1231 AI 8 x 13 bit (6ES7231-4HF32-0XB0)

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+	AI 2+	AI 4+	AI 6+
5	AI 0-	AI 2-	AI 4-	AI 6-
6	AI 1+	AI 3+	AI 5+	AI 7+
7	AI 1-	AI 3-	AI 5-	AI 7-

Pin	X10 (gold)	X11 (gold)	X13 (gold)
4	AI 0+	AI 2+	AQ 0M
5	AI 0-	AI 2-	AQ 0
6	AI 1+	AI 3+	AQ 1M
7	AI 1-	AI 3-	AQ 1

Note

Unused voltage input channels should be shorted.

Unused current input channels should be set to the 0 to 20 mA range and/or disable broken wire error reporting.

Inputs configured for current mode will not conduct loop current unless the module is powered and configured.

Current input channels will not operate unless external power is supplied to the transmitter.

A.10.4 Step response of the analog inputs

Table A-161 Step response (ms), 0 to full-scale measured at 95%

Smoothing selection (sample averaging)	Noise reduction/rejection frequency (Integration time selection)			
	400 Hz (2.5 ms)	60 Hz (16.6 ms)	50 Hz (20 ms)	10 Hz (100 ms)
None (1 cycle): No averaging	4 ms	18 ms	22 ms	100 ms
Weak (4 cycles): 4 samples	9 ms	52 ms	63 ms	320 ms
Medium (16 cycles): 16 samples	32 ms	203 ms	241 ms	1200 ms
Strong (32 cycles): 32 samples	61 ms	400 ms	483 ms	2410 ms

A.10.5 Sample time and update times for the analog inputs

Table A-162 Sample and module update times for all channels

Rejection frequency (Integration time)	Sample and module update times for all channels			
	400 Hz (2.5 ms)	60 Hz (16.6 ms)	50 Hz (20 ms)	10 Hz (100 ms)
4-channel x 13 bit SM	0.625 ms	4.17 ms	5 ms	25 ms
8-channel x 13 bit SM	1.25 ms	4.17 ms	5 ms	25 ms
4-channel x 16 bit SM	0.417 ms	0.397 ms	0.400 ms	0.400 ms

A.10.6 Measurement ranges of the analog inputs for voltage and current (SB and SM)

Table A-163 Analog input representation for voltage (SB and SM)

System		Voltage Measuring Range				
Decimal	**Hexadecimal**	**±10 V**	**±5 V**	**±2.5 V**	**±1.25 V**	
32767	7FFF[1]	11.851 V	5.926 V	2.963 V	1.481 V	Overflow
32512	7F00					
32511	7EFF	11.759 V	5.879 V	2.940 V	1.470 V	Overshoot range
27649	6C01					
27648	6C00	10 V	5 V	2.5 V	1.250 V	Rated range
20736	5100	7.5 V	3.75 V	1.875 V	0.938 V	
1	1	361.7 µV	180.8 µV	90.4 µV	45.2 µV	
0	0	0 V	0 V	0 V	0 V	
-1	FFFF					
-20736	AF00	-7.5 V	-3.75 V	-1.875 V	-0.938 V	
-27648	9400	-10 V	-5 V	-2.5 V	-1.250 V	
-27649	93FF					Undershoot range
-32512	8100	-11.759 V	-5.879 V	-2.940 V	-1.470 V	
-32513	80FF					Underflow
-32768	8000	-11.851 V	-5.926 V	-2.963 V	-1.481 V	

[1] 7FFF can be returned for one of the following reasons: overflow (as noted in this table), before valid values are available (for example immediately upon a power up), or if a wire break is detected.

Table A-164 Analog input representation for current (SB and SM)

System		Current measuring range		
Decimal	**Hexadecimal**	**0 mA to 20 mA**	**4 mA to 20 mA**	
32767	7FFF	> 23.52 mA	> 22.81 mA	Overflow
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Nominal range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4 mA	
-1	FFFF			Undershoot range
-4864	ED00	-3.52 mA	1.185 mA	
32767[1]	7FFF		< 1.185 mA	Wire break (4 to 20 mA) (Page 1134)
-32768	8000	< -3.52 mA		Underflow (0 to 20 mA)

[1] The wire break value of 32767 (16#7FFF) is always returned regardless of the state of the wire break alarm.