

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Amikon cover with selected official Siemens pages

SIMATIC S7-1200

6ES7232-4HB32-0XB0

SM 1232 TWO-CHANNEL ANALOG OUTPUT MODULE

OFFICIAL SOURCE

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A.10.2 SM 1232 analog output module specifications

Table A-149 General specifications

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Article number	6ES7232-4HB32-0XB0	6ES7232-4HD32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	
Weight	180 grams	
Power dissipation	1.8 W	2.0 W
Current consumption (SM Bus)	80 mA	
Current consumption (24 V DC)	45 mA (no load)	

Table A-150 Analog outputs

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Number of outputs	2	4
Type	Voltage or current	
Range	± 10 V, 0 to 20 mA, or 4 mA to 20 mA	
Resolution	Voltage: 14 bits Current: 13 bits	
Full scale range (data word)	Voltage: -27,648 to 27,648 ; Current: 0 to 27,648 Refer to the output ranges for voltage and current (Page 1286).	
Accuracy (25 °C / -20 to 60 °C)	$\pm 0.3\%$ / $\pm 0.6\%$ of full scale	
Settling time (95% of new value)	Voltage: 300 μ s (R), 750 μ s (1 μ F) Current: 600 μ s (1 mH), 2 ms (10 mH)	
Load impedance	Voltage: $\geq 1000 \Omega$ Current: $\leq 600 \Omega$	
Maximum output short circuit current	Voltage mode: ≤ 24 mA Current mode: ≥ 38.5 mA	
Behavior on RUN to STOP	Last value or substitute value (default value 0)	
Isolation (field side to logic)	none	
Isolation (24 V to output)	none	
Cable length (meters)	100 m twisted and shielded	

Table A-151 Diagnostics

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Overflow/underflow	Yes	
Short to ground (voltage mode only)	Yes	
Wire break (current mode only) ¹	Yes	
24 V DC low voltage ²	Yes	

¹ Short circuit detection is only possible when the output voltage is less than -0.5 V or greater than +0.5 V.

² Wire break detection is only possible when the output current is greater than 1 mA.

A.10 Analog signal modules (SMs)

Table A-152 Wiring diagrams for the analog output SMs

SM 1232 AQ 2 x 14 bit (6ES7232-4HB32-0XB0)	SM 1232 AQ 4 x 14 bit (6ES7232-4HD32-0XB0)
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A-153 Connector pin locations for SM 1232 AQ 2 x 14 bit (6ES7232-4HB32-0XB0)

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	No connection	AQ 0M
5	No connection	AQ 0
6	No connection	AQ 1M
7	No connection	AQ 1

Table A-154 Connector pin locations for SM 1232 AQ 4 x 14 bit (6ES7232-4HD32-0XB0)

Pin	X10 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection
2	M / 24 V DC	No connection	No connection
3	Functional Earth	No connection	No connection
4	No connection	AQ 0M	AQ 2M
5	No connection	AQ 0	AQ 2

Pin	X10 (gold)	X12 (gold)	X13 (gold)
6	No connection	AQ 1M	AQ 3M
7	No connection	AQ 1	AIQ 3

A.10.3 SM 1234 analog input/output module specifications

Table A-155 General specifications

Technical data	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Article number	6ES7234-4HE32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75
Weight	220 grams
Power dissipation	2.4 W
Current consumption (SM Bus)	80 mA
Current consumption (24 V DC)	60 mA (no load)

Table A-156 Analog inputs

Model	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Number of inputs	4
Type	Voltage or Current (differential): Selectable in groups of 2
Range	± 10 V, ± 5 V, ± 2.5 V, 0 to 20 mA, or 4 mA to 20 mA
Full scale range (data word)	-27648 to 27648
Overshoot/undershoot range (data word)	Voltage: 32511 to 27649 / -27649 to -32512 Current: 32511 to 27649 / 0 to -4864 Refer to the section on input ranges for voltage and current (Page 1285).
Overflow/underflow (data word)	Voltage: 32767 to 32512 / -32513 to -32768 Current: 32767 to 32512 / -4865 to -32768 Refer to the section on input ranges for voltage and current (Page 1285).
Resolution	12 bits + sign bit
Maximum withstand voltage/current	± 35 V / ± 40 mA
Smoothering	None, weak, medium, or strong Refer to the section on step response times (Page 1284).
Noise rejection	400, 60, 50, or 10 Hz Refer to the section on sample rates (Page 1284).
Input impedance	≥ 9 M Ω , FS 07 and above ≥ 1 M Ω (voltage) / ≥ 270 Ω , < 290 Ω (current)
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	$\pm 0.1\%$ / $\pm 0.2\%$ of full scale
Analog to digital conversion time	625 μ s (400 Hz rejection)
Common mode rejection	40 dB, DC to 60 Hz

Technical specifications

A.10 Analog signal modules (SMs)

Model	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
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-157 Analog outputs

Technical data	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Number of outputs	2
Type	Voltage or current
Range	±10 V or 0 to 20 mA or 4 mA to 20 mA
Resolution	Voltage: 14 bits ; Current: 13 bits
Full scale range (data word)	Voltage: -27648 to 27648; Current: 0 to 27648 Refer to the section on output ranges for voltage and current (Page 1286).
Accuracy (25 °C / -20 to 60 °C)	±0.3% / ±0.6% of full scale
Settling time (95% of new value)	Voltage: 300 µs (R), 750 µs (1 uF) Current: 600 µs (1 mH), 2 ms (10 mH)
Load impedance	Voltage: ≥ 1000 Ω Current: ≤ 600 Ω
Maximum output short circuit current	Voltage mode: ≤ 24 mA Current mode: ≥ 38.5 mA
Behavior on RUN to STOP	Last value or substitute value (default value 0)
Isolation (field side to logic)	none
Isolation (24 V to output)	none
Cable length (meters)	100 m twisted and shielded

Table A-158 Diagnostics

Model	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Overflow/underflow	Yes
Short to ground (voltage mode only) ¹	Yes on outputs
Wire break (current mode only) ²	Yes on outputs
24 V DC low voltage	Yes

¹ Short circuit detection is only possible when the output voltage is less than -0.5 V or greater than +0.5 V.

² Wire break detection is only possible when the output current is greater than 1 mA.

SM 1234 current measurement

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

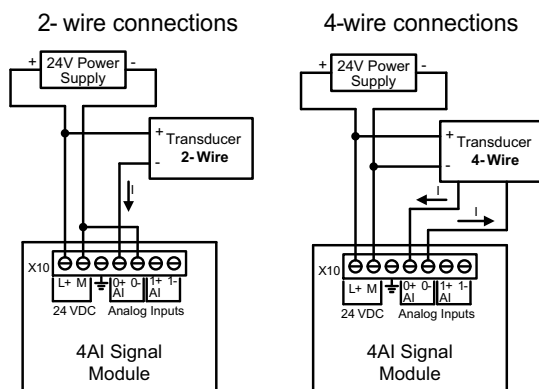


Table A-159 Wiring diagrams for the analog input/output SM

SM 1234 AI 4 x 13 Bit / AQ 2 x 14 bit (6ES7234-4HE32-0XB0)	
The diagram shows the wiring for the SM 1234 AI 4 x 13 Bit / AQ 2 x 14 bit module. It includes connections for a 24V DC power supply to the X10 connector (pins 1, 2, 3, 4) and the X11 connector (pins 1, 2, 3, 4). The module is labeled "ANALOG INPUTS" and "ANALOG OUTPUTS".	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A-160 Connector pin locations for SM 1234 AI 4 x 13 Bit / AQ 2 x 14 bit (6ES7234-4HE32-0XB0)

Pin	X10 (gold)	X11 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection
2	M / 24 V DC	No connection	No connection
3	Functional Earth	No connection	No connection

A.10 Analog signal modules (SMs)

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)
-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.

See also

Determining the type of wire break condition from an SM 1231 module (Page 1173)

A.10.7 Measurement ranges of the analog outputs for voltage and current (SB and SM)

Table A-165 Analog output representation for voltage (SB and SM)

System		Voltage Output Range	
Decimal	Hexadecimal	± 10 V	
32767	7FFF	See note 1	Overflow
32512	7F00	See note 1	
32511	7EFF	11.76 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
1	1	361.7 μ V	
0	0	0 V	
-1	FFFF	-361.7 μ V	
-20736	AF00	-7.5 V	
-27648	9400	-10 V	
-27649	93FF		Undershoot range
-32512	8100	-11.76 V	
-32513	80FF	See note 1	Underflow
-32768	8000	See note 1	

¹ In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.

Table A-166 Analog output representation for current (SB and SM)

System		Current output range		
Decimal	Hexadecimal	0 mA to 20 mA	4 mA to 20 mA	
32767	7FFF	See note 1	See note 1	Overflow
32512	7F00	See note 1	See note 1	
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Rated range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4mA	
-1	FFFF		4 mA to 578.7 nA	
-6912	E500		0 mA	Undershoot range
-6913	E4FF			
-32512	8100			Not possible. Output value limited to 0 mA.
-32513	80FF	See note 1	See note 1	
-32768	8000	See note 1	See note 1	Underflow

¹ In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.