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Analog input/output modules

General

Overview



- Analog inputs and outputs for the S7-300
- For solving even more complex tasks involving analog process signals
- For connecting analog actuators and sensors without additional amplifiers

Application

Analog I/O modules contain analog inputs/outputs for the SIMATIC S7-300. Analog sensors and actuators can be connected to the SIMATIC S7-300 via these modules.

Analog I/O modules offer the user the following advantages:

- Optimal adaptation;
  the number of inputs/outputs can be adapted to the task via modules that can be combined in any way. There is no need for surplus investment.
- Powerful analog technology;
  different I/O areas and high resolution enable connection of a wide variety of analog sensors and actuators

Design

Analog input modules are characterized by the following mechanical features:

Compact design;
the rugged plastic housing contains:

- Red LEDs for group faults/ errors
- Front connector protected by the front panel
- Labeling area on the front panel

Easy assembly;
the module is mounted on the DIN rail and connected to the adjacent modules via bus connectors. There are no slot rules: The input addresses are defined by the slots.

User-friednly wiring;
the modules are wired by means of a plug-in front connector. When the connector is plugged in for the first time, a coding element engages so that the connector can only be plugged into modules of the same type.
When the module is replaced, the front connector can be used in its fully wired state for the new module of the same type.

Overview



- Analog inputs for the SIMATIC S7-300
- For connecting voltage and current sensors, thermocouples, resistors and resistance thermometers

Application

Analog input modules convert analog signals from the process to digital signals for internal processing within the S7-300.

Voltage and current sensors, thermocouples, resistors and resistance thermometers can be connected as sensors.

Function

Features also include:

- Configurable resolution from 9 to 15 bits + sign (for different conversion times)
- A variety of measuring ranges:
  The basic current/voltage measuring ranges are set mechanically with range cards; fine adjustment is made with the STEP 7 "Hardware Configuration" function on a programming device.
- Interrupt capability:
  The module transmits diagnostic and limit value interrupts to the programmable controller's CPU.
- Diagnostics:
  The module sends extensive diagnostic information to the CPU.

Technical specifications

SM 331	6ES7 331-	7KF01-0AB0	7KB01-0AB0 / 7KB81-0AB0[1)]	7NF00-0AB0
Number of inputs		8	2	8
• for resistance measurements		4	1	—
Rated load voltage L+		24 V DC	24 V DC	—
• Polarity reversal protection		Yes	Yes	—
Input ranges/ input resistance				
• Voltage		± 80 mV/10 Mohms ± 250 mV/10 Mohms ± 500 mV/10 Mohms ± 1 V/10 Mohms ± 2.5 V/100 kohms ± 5 V/100 Mohms 1 to 5 V/100 Mohms ± 10 V/100 Mohms	± 80 mV/10 Mohms ± 250 mV/10 Mohms ± 500 mV/10 Mohms ± 1 V/10 Mohms ± 2.5 V/100 kohms ± 5 V/100 Mohms 1 to 5 V/100 Mohms ± 10 V/100 Mohms	± 5 mV/2 Mohms 1 to 5 V/2 Mohms ± 10 V/2 Mohms
• Current		± 10 mA/25 ohms ± 3.2 mA/25 ohms ± 20 mA/25 ohms 0 to 20 mA/25 ohms 4 to 20 mA/25 ohms	± 10 mA/25 ohms ± 3.2 mA/25 ohms ± 20 mA/25 ohms 0 to 20 mA/25 ohms 4 to 20 mA/25 ohms	± 20 mA/250 ohms 0 to 20 mA/250 ohms 4 to 20 mA/250 ohms
• Resistance		150 ohms/10 Mohms 300 ohms/10 Mohms 600 ohms/10 Mohms	150 ohms/10 Mohms 300 ohms/10 Mohms 600 ohms/10 Mohms	—
• Thermocouples		Type E, N, J, K/10 Mohms	Type E, N, J, K/10 Mohms	—
• Resistance thermometers		Pt 100 standard/ 10 Mohms Ni 100 standard	Pt 100 standard/ 10 Mohms Ni 100 standard	—
Permissible input voltage for voltage input	max.	20 V	20 V	50 V
Permissible input current for current input	max.	40 mA	40 mA	32 mA

1) With extended temperature range

SM 331 analog input modules (continued)

3

Technical specifications (continued)

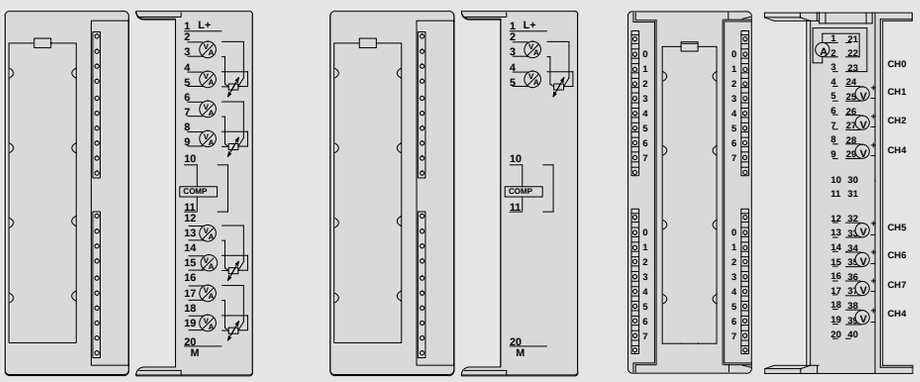
SM 331	6ES7 331-	7KF01-0AB0					7KB01-0AB0 / 7KB81-0AB0[1]					7NF00-0AB0				
Optical isolation to backplane bus		Yes					Yes					Yes				
Characteristic linearization																
• for thermocouples		Type N, E, J, K					Type N, E, J, K					—				
• for resistance thermometers		Pt 100 (standard range) Ni 100 (standard range)					Pt 100 (standard range) Ni 100 (standard range)					—				
Temperature compensation		Configurable					Configurable					—				
• Internal		Possible					Possible					—				
• External with compensation sok-ket		Possible					Possible					—				
• External with Pt 100		—					—					—				
Conversion time[2]/ resolution (per channel)																
• Integration time		2.5	16.6	20	100	ms	2.5	16.6	20	100	ms	2.5	16.7	20	100	ms
• Resolution (S=sign)																
unipolar		9	12	12	14	bits	9	12	12	14	bits	15	15	15	15	bits
bipolar		9+S	12+S	12+S	14+S	bits	9+S	12+S	12+S	14+S	bits	15+S	15+S	15+S	15+S	bits
• Interference voltage suppression for interference frequency		400	60	50	10	Hz	400	60	50	10	Hz	100	60	50	10	Hz
Operating error limit (over entire temperature range referred to input range)	max.	± 1 %					± 1 %					± 0.1 % (voltage) ± 0.3 % (current)				
Basic error limit (operating error limit at 25 °C, referred to input range)	max.	± 0.6 %					± 0.6 %					± 0.05 % (voltage) ± 0.05 % (current)				
Interrupts																
• Limit-value interrupt		Configurable					Configurable					Configurable channels 0 and 2				
• Diagnostics interrupt		Configurable channels 0 and 2					Configurable channel 0					Configurable				
Diagnostics		Red LED for group faults and errors, diagnostic information can be read out					Red LED for group faults and errors, diagnostic information can be read out					Red LED for group faults and errors, diagnostic information can be read out				
Cable length (shielded)	max.	200 m (50 m at 80 mV)					200 m (50 m at 80 mV)					200 m				
Power consumption																
• from backplane bus	max.	60 mA	60 mA				60 mA	60 mA				130 mA				
• from L+	max.	200 mA	80 mA				200 mA	80 mA				—				
Power loss	typ.	1.3 W					1.3 W					0.6 W				
Optical isolation, tested at		500 V DC					500 V DC					500 V AC				
Dimensions (W x H x D) in mm		40x125x120					40x125x120					40 x 125 x 120				
Weight		250 g					250 g					270 g				

1) With extended temperature range
2) Further specifications are required for calculating the cycle time. You can find these in the manual “S7-300 Installation and Hardware”.

Ordering data

	Order No.
SM 331 analog input modules incl. labeling strips, bus connector, range cards;	
• with 8 inputs	**6ES7 331-7KF01-0AB0**
• with 2 inputs	**6ES7 331-7KB01-0AB0**
• with 2 inputs, extended temperature range	**6ES7 331-7KB81-0AB0**
• with 8 inputs, enhanced resolution	**6ES7 331-7NF00-0AB0**
Range card for analog inputs 1 module for 2 analog inputs; 2 cards (spare part)	**6ES7 974-0AA00-0AA0**
Front connector (1 pc.)	
• 20-pin, with screw-type terminals	**6ES7 392-1AJ00-0AA0**
• 20-pin, with spring-loaded term.	**6ES7 392-1BJ00-0AA0**
• 40-pin, with screw-type terminals	**6ES7 392-1AM00-0AA0**
• 40-pin, with spring-loaded term.	**6ES7 392-1BM01-0AA0**
Bus connector 1 pc. (spare part)	**6ES7 390-0AA00-0AA0**

	Order No.
Shield connecting element 80 mm wide, with two rows for 4 shield terminal elements each	**6ES7 390-5AA00-0AA0**
Terminal element (2 pcs.)	
• for 2 cables with diam. 2 to 6 mm	**6ES7 390-5AB00-0AA0**
• for 1 cable with diam. 3 to 8 mm	**6ES7 390-5BA00-0AA0**
• for 1 cable with diam. 4 to 13 mm	**6ES7 390-5CA00-0AA0**
Labeling cover (10 pcs.) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XY00-0AA0**
Labeling strips (10 pcs., spare part) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XX00-0AA0**



6ES7 331-7KF01-0AB0

6ES7 331-7KB01-0AB0
6ES7 331-7KB81-0AB0

6ES7 331-1BL00-0AA0

Fig. 1/10 Terminal connection diagram of the SM 331 analog input modules

Analog input/output modules

SM 332 analog output modules

Overview



- Analog outputs for SIMATIC S7-300
- For connecting analog actuators

Application

Analog output modules convert digital signals from the S7-300 to analog signals for the process.

Function

Features also include:

- Resolution 12 to 15 bits.
- A variety of voltage and current ranges:
  Ranges are set independently for each channel by means of parameterization software.
- Interrupt capability:
  The module transmits diagnostic and limit value interrupts to the programmable controller's CPU on occurrence of errors.
- Diagnostics:
  The module sends extensive diagnostic information to the CPU.

Technical specifications

SM 332	6ES7 332-	5HD01-0AB0	5HB01-0AB0 5HB81-0AB0[1)]	7ND00-0AB0
Number of outputs		4	2	4
Rated load voltage		24 V DC	24 V DC	24 V DC
Output ranges				
• Voltage outputs		0 to 10 V; ± 10 V; 1 to 5 V	0 to 10 V; ± 10 V; 1 to 5 V	0 to 10 V; ± 10 V; 1 to 5 V
• Current outputs		4 to 20 mA; ± 20 mA; 0 to 20 mA	4 to 20 mA; ± 20 mA; 0 to 20 mA	4 to 20 mA; ± 20 mA; 0 to 20 mA
Load impedance				
• Voltage outputs	max.	1 kohms	1 kohms	1 kohms
• Current outputs	max.	0.5 kohms	0.5 kohms	0.5 kohms
• Capacitive loads	max.	1 µF	1 µF	1 µF
• Inductive loads	max.	1 mH	1 mH	1 mH
Voltage output				
• Short-circuit protection		Yes	Yes	Yes
• Short-circuit current	max.	25 mA	25 mA	40 mA
Power output				
• Open-circuit current	max.	18 V	18 V	18 V
Optical isolation				
to backplane bus		Yes	Yes	Yes
Resolution		11 bits + sign (at ± 10 V; ± 20 mA, 4 to 20 mA, 1 to 5 V); 12 bits at 0 to 10 V; to 20 mA)	11 bits + sign (at ± 10 V; ± 20 mA, 4 to 20 mA, 1 to 5 V); 12 bits at 0 to 10 V; to 20 mA)	15 bits + sign
Conversion time per channel	max.	0.8 ms	0.8 ms	1.5 ms
Settling time				
• Resistive loads		0.1 ms	0.1 ms	0.2 ms
• Capacitive loads		3.3 ms	3.3 ms	0.5 ms
• Inductive loads		0.5 ms	0.5 ms	0.5 ms
Substitute values		Configurable	Configurable	Configurable

1) With extended temperature range

Technical specifications (continued)

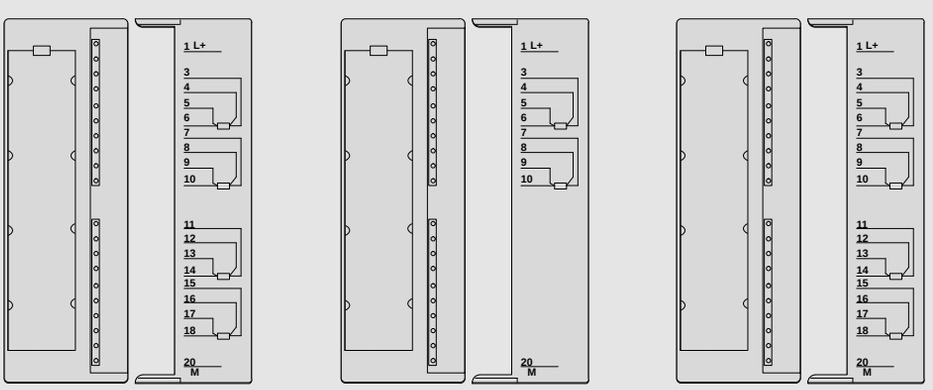
SM 332	6ES7 332-	5HD01-0AB0	5HB01-0AB0 5HB81-0AB0[1)]	7ND00-0AB0
Operational limit (0 to 60 °C, referred to output range)				
• Voltage		± 0.5 %	± 0.5 %	± 0.12 %
• Current		± 0.6 %	± 0.6 %	± 0.18 %
Basic error (operational limit at 25 °C, referred to output range)				
• Voltage		± 0.2 %	± 0.2 %	± 0.01 %
• Current		± 0.3 %	± 0.3 %	± 0.01 %
Interrupts				
• Diagnostic interrupt		Yes	Yes	Yes
Diagnostics		Red LED for group fault error; diagnostics information can be read out	Red LED for group fault error; diagnostics information can be read out	Red LED for group fault error; diagnostics information can be read out
Cable length (shielded)	max.	200 m	200 m	200 m
Power consumption				
• from backplane bus	max.	60 mA	60 mA	60 mA
• from L+	max.	240 mA	135 mA	240 mA
Power loss	typ.	3 W	3 W	3 W
Optical isolation, tested at		500 V DC	500 V DC	500 V DC
Dimensions (W x H x D) in mm		40 x 125 x 120	40 x 125 x 120	40 x 125 x 120
Weight	approx.	220 g	220 g	220 g

1) With extended temperature range

Ordering data

	Order No.
SM 332 analog output modules incl. labeling strips, bus connector	
• with 4 outputs	**6ES7 332-5HD01-0AB0**
• with 4 outputs, 15 bits	**6ES7 332-7ND00-0AB0**
• with 2 outputs	**6ES7 332-5HB01-0AB0**
• with 2 outputs, extended temperature range	**6ES7 332-5HB81-0AB0**
Bus connector (1 pc., spare part)	**6ES7 390-0AA00-0AA0**
Front connector (1 pc.)	
• 20-pin, with screw-type terminals	**6ES7 392-1AJ00-0AA0**
• 20-pin, with spring-loaded terminals	**6ES7 392-1BJ00-0AA0**
Shield-connecting element 80 mm wide, with two rows for 4 shield terminal elements each	**6ES7 390-5AA00-0AA0**

	Order No.
Terminal element (2 pcs.)	
• for 2 cables with diam. 2 to 6 mm	**6ES7 390-5AB00-0AA0**
• for 1 cable with diam. 3 to 8 mm	**6ES7 390-5BA00-0AA0**
• for 1 cable with diam. 4 to 13 mm	**6ES7 390-5CA00-0AA0**
Labeling cover (10 pcs.) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XY00-0AA0**
Labeling strips (10 pcs., spare part) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XX00-0AA0**



6ES7 332-5HD01-0AB0 | 6ES7 332-5HB01-0AB0 6ES7 332-5HB81-0AB0 | 6ES7 332-7ND00-0AB0

Fig. 1/11 Terminal connection diagram of the SM 332 analog output modules

Analog input/output modules

SM 334 analog input/output module

Overview



- Analog inputs and outputs for SIMATIC S7-300
- For connecting analog sensors and actuators

Application

The analog input/output module converts

- analog signals from the process to digital values for the S7-300, and
- digital signals from the S7-300 to analog signals for the process.

Function

The analog input/output module also includes:

- 4 inputs, 2 outputs
- 8-bit input resolution
- 8-bit output resolution
- Measuring ranges of 0 to 10 V or 0 to 20 mA: The range is selected by means of the appropriate connections on the module.

Technical specifications

SM 334	6ES7 334-	0CE01-0AA0	0KE00-0AB0
Inputs		4	4
• for resistance measurement		—	4
Rated load voltage L+		24 V DC	24 V DC
Input ranges/ input resistance		0 to 10V/100kohms 0 to 20mA/ 50kohms	0 to 10V/100kohms 10-kohm resistance, Pt 100
Permissible input voltage for voltage input	max.	20 V	20 V
Permissible input current for current input	max.	20 mA	—
Optical isolation		No	Yes
Resolution		8 bits	12 bits
Operational limit (over entire temperature range, referred to input range)			
• Voltage		± 0.9 %	± 0.7 %
• Current		± 0.8 %	—
• 10 kohms		—	± 3.0 %
• Pt 100		—	± 0.7 %
Basic error (operational limit at 25 °C, referred to output range)			
• Voltage		± 0.7 %	± 0.5 %
• Current		± 0.6 %	—
• 10 kohms		—	± 2.0 %
• Pt 100		—	± 0.5 %
Interrupts			
• Limit-value interrupt		—	—
• Diagnostics interrupt		—	—
Diagnostics		—	—

SM 334	6ES7 334-	0CE01-0AA0	0KE00-0AB0
Outputs		2	2
Output ranges			
• Voltage outputs		0 to 10 V	0 to 10 V
• Current outputs		0 to 20 mA	—
Load impedance			
• Voltage outputs	min.	5 kohms	2.5 kohms
• Current outputs	max.	0.3 kohms	—
• Capacitive loads	max.	1 µF	1 µF
• Inductive loads	max.	1 mH	—
Voltage output			
• Short-circuit protection		Yes	Yes
• Short-circuit current	max.	11 mA	10 mA
Power output			
• Open-circuit current	max.	15 V	—
Optical isolation to backplane bus		No	Yes
Resolution		8 bits	12 bits
Cycle time (all channels/AI + AO)		5 ms	85 ms
Settling time			
• Resistive loads	max.	0.3 ms	0.8 ms
• Capacitive loads	max.	3 ms	0.8 ms
• Inductive loads	max.	0.3 ms	—
Substitute values		—	—
Operational limit (0 to 60 °C, referred to output range)			
• Voltage		± 0.6 %	± 1.0 %
• Current		± 1.0 %	—

Technical specifications

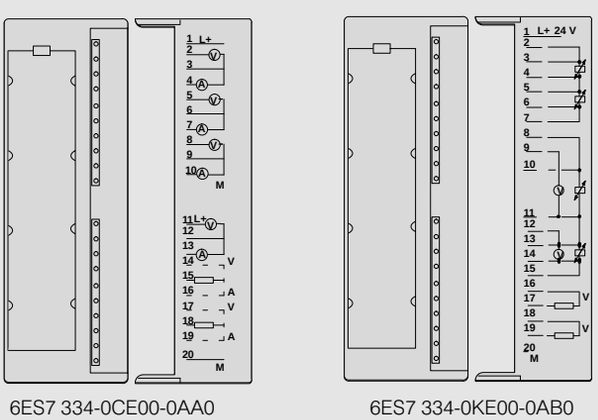
SM 334	6ES7 334-	0CE01-0AA0	0KE00-0AB0
Outputs (continued)			
Basic error (operational limit at 25 °C, referred to output range)			
• Voltage		± 0.4 %	± 0.85 %
• Current		± 0.8 %	—
Interrupts			
• Diagnostic interrupt		—	—

SM 334	6ES7 334-	0CE01-0AA0	0KE00-0AB0
General			
Cable length (shielded)	max.	200 m	100 m
Power consumption			
• from S7-300 backplane bus	max.	55 mA	60 mA
• from L+	max.	110 mA	80 mA
Power loss	typ.	2.6 ohms	2 ohms
Dimensions (W x H x D) in mm		40 x 125 x 120	40 x 125 x 120
Weight		285 g	200 g

Ordering data

	Order No.
SM 334 analog input/output module[1] incl. labeling strips, bus connector;	
• with 4 inputs and 2 outputs	**6ES7 334-0CE01-0AA0**
• with 4 inputs and 2 outputs; resistance measurement, Pt 100	**6ES7 334-0KE00-0AB0**
Bus connector (1 pc., spare part)	**6ES7 390-0AA00-0AA0**
Front connector (1 pc.)	
• 20-pin, with screw-type terminals	**6ES7 392-1AJ00-0AA0**
• 20-pin, with spring-loaded terminals	**6ES7 392-1BJ00-0AA0**
Shield connecting element 80 mm wide, with two rows for 4 shield terminal elements each	**6ES7 390-5AA00-0AA0**

	Order No.
Terminal element (2 pcs.)	
• for 2 cables with diam. 2 to 6 mm	**6ES7 390-5AB00-0AA0**
• for 1 cable with diam. 3 to 8 mm	**6ES7 390-5BA00-0AA0**
• for 1 cable with diam. 4 to 13 mm	**6ES7 390-5CA00-0AA0**
Labeling cover (10 pcs.) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XY00-0AA0**
Labeling strips (10 pcs., spare part) for signal modules (except 32-channel modules), function modules and CPU 312 IFM	**6ES7 392-2XX00-0AA0**



6ES7 334-0CE00-0AA0 6ES7 334-0KE00-0AB0

Fig. 1/12 Terminal connection diagram of the SM 334 analog input/output module

Analog input/output modules

SM 338 POS input module

Overview



- Interface between up to 3 absolute encoders (SSI) and the CPU
- For providing the position encoder values for further processing in the STEP 7 program
- Enables the controller to respond direct to encoder values in mobile systems.

Application

The POS input module converts

- SSI position encoder signals from the process to digital values for the S7-300.

The acquired values can be processed direct in the STEP 7 program thus enabling direct response to encoder values in mobile systems.

In addition, SSI position encoder statuses can be frozen via two internal digital inputs. This makes possible further time-critical applications in the area of position encoding.

Function

The POS input module has the following:

- 3 SSI encoder inputs
- 2 digital inputs
- 24 V DC encoder supply

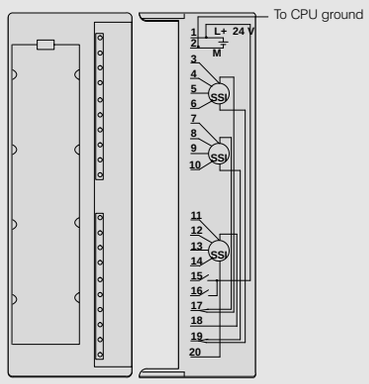
Technical specifications

General		
Rated load voltage L+		24 V DC
• Acceptable range		20.4 to 28.2 V
Isolation		No
Encoder supply		
• Output voltage		L+ – 0.8 V
• Output current	max.	900 mA
Interrupts		
• Diagnostic interrupt		Configurable
Current consumption		
• from S7-300 backplane bus	max.	160 mA
• from L+	max.	10 mA
Power loss	typ.	3 ohms
Dimensions (W x H x D) in mm		40 x 125 x 120
Weight		235 g

SSI encoder inputs		
Position encoding		Absolute
Cable length (shielded)	max.	320 m at 125 kHz 160 m at 250 kHz 60 m at 500 kHz 20 m at 1 MHz
Digital inputs		
Input voltage		
• with “1” signal		11 to 30.2 V
• with “0” signal		–3 to 5 V
Input current		
• with “1” signal	typ.	9 mA
• with “0” signal	max.	2 mA
Input delay		300 µs
Connection of 2-wire BERO		Yes
Cable length (shielded)	max.	600 m

Ordering data

	Order No.	Order No.
SM 338 POS input module for acquiring SSI encoder values from up to 3 absolute encoders; incl. labeling strips, bus connectors	**6ES7 338-4BC00-0AB0**	



6ES7 338-4BG00-0AB0

Fig. 1/13 Terminal connection diagram of the SM 338 POS input module

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