

ET 200PA SMART I/O modules

10.1 Module overview

The following I/O modules are available in the ET 200PA SMART system:

Module	Article no.	Article no. (with conformal coating)
Digital input module DI16xDC24V	6ES7650-8DK70-0AA0	6ES7650-8DK70-1AA0
Digital input module DI32xDC24V	6ES7650-8DK80-0AA0	6ES7650-8DK80-1AA0
Digital output module DO16xDC24V/0.5A	6ES7650-8EK70-0AA0	6ES7650-8EK70-1AA0
Digital output module DO32xDC24V/0.5A	6ES7650-8EK80-0AA0	6ES7650-8EK80-1AA0
Analog input module AI8x13Bit	6ES7650-8AE60-0AA0	6ES7650-8AE60-1AA0
Analog input module AI8x16Bit	6ES7650-8AK60-0AA0	6ES7650-8AK60-1AA0
Analog input module AI16x16Bit	6ES7650-8AK70-0AA0	6ES7650-8AK70-1AA0
Analog input module AI8xTC/4xRTD	6ES7650-8AR60-0AA0	6ES7650-8AR60-1AA0
Analog input module AI 8 x 16-bit HART ¹	6ES7650-8AT60-0AA0	6ES7650-8AT60-1AA0
Analog output module AO8x12Bit	6ES7650-8BK60-0AA0	6ES7650-8BK60-1AA0
Analog output module AO 8 x 16-bit HART ¹	6ES7650-8BT60-0AA0	6ES7650-8BT60-1AA0

¹ Available as of PCS 7 V9.0 SP2 and the corresponding update collection

In addition to the ET 200PA SMART I/O modules specified in this table, the following modules can also be used in an ET 200PA SMART system.

- Numerous S7-300 standard I/O modules and HART analog modules that are also approved for use in an ET 200PA SMART in the list of released modules PCS 7 (as of V8.1).
- Numerous counter modules and point-to-point couplings which are also approved for use in an ET 200PA SMART in the list of released modules PCS 7 (as of V8.1).

If you are using modules from the S7-300 series of modules, you can find information for them in the following manuals:

- Automation System S7-300, Module Data (<http://support.automation.siemens.com/WW/view/en/8859629>)
- ET 200M, Signal Modules for Process Automation (<http://support.automation.siemens.com/WW/view/en/7215812>)
- ET 200M Distributed I/O Device HART Analog Modules (<http://support.automation.siemens.com/WW/view/en/22063748>)

Number of outputs	8 output channels	8 output channels
Resolution	12 bits	15 bits + sign
Output type	Channel by channel: • Current • Voltage	Channel by channel: • Current
Configurable diagnostics	Yes	Yes
Diagnostic interrupt	Can be set	Can be set
Substitute value output	No	Yes
Potential relationships	Floating between: • Backplane bus interface • Load voltage	Floating between: • Backplane bus interface • Load voltage

Basics

For basics regarding the basic procedure for connecting loads/actuators to analog inputs (current outputs) as well as basics of the analog value processing and specifications regarding the analog value formats used in each case, refer to:

"Automation System S7-300, Module Data" <http://support.automation.siemens.com/WW/view/en/8859629>".

Cables for analog signals

Always use shielded twisted-pair cables for the analog signals. This reduces the noise interference. You should ground the shield of the analog cables at both ends.

If potential differences exist between the cable ends, an equipotential bonding current may flow via the shield and disturb the analog signals. In this case, you must provide for a low-resistance equipotential bonding, and, if necessary, ground the shield only at one end of the cable.

Observe the generally applicable information on connecting loads/actuators in the SIMATIC S7-300 Automation System Module Data manual on the Internet (<http://support.automation.siemens.com/WW/view/en/8859629>).

10.5.1 Analog output module AO 8 x 12 Bit

Article numbers

Standard module: 6ES7 650-8BK60-0AA0

Module with conformal coating: 6ES7 650-8BK60-1AA0

Properties

- 8 outputs in one group
- The output can be configured for each channel:

Possible selection	As of product version	Ranges
Current output	Product version 1	• 0 mA to 20 mA • 4 mA to 20 mA • +/-20 mA
Voltage output	Product version 3	• 1 V to 5 V • 0 V to 10 V • +/-10 V

Note

If you operate the module redundantly, the range for the power supply is set to 4...20 mA.

- Resolution 12 bits
- HART-compliant (for current output)
- Configurable diagnostics
- Configurable diagnostic interrupt
- Floating relative to backplane bus interface and load voltage
- Configuration in Run (CiR) supported

Note

When the rated load voltage (L+) is switched off and on, the outputs can output incorrect voltage/current values for approximately 500 ms.

Technical specifications of the AO 8 x 12 Bit

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	Approx. 272 g
Module-specific data	
Configuration in RUN possible	Yes
Behavior of the non-assigned outputs	Output the last valid output value before the parameter assignment
Supports isochronous mode	No
Number of outputs	8
Cable length Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ Reverse polarity protection	24 V DC Yes
- Electrical isolation - Between channels and backplane bus - Between channels and electronics power supply - Between channels - Between channels and load voltage L+	 Yes Yes No Yes
Permissible potential difference Between S and M_{ANA} (U_{CM})	3 V DC
Isolation tested with	500 V DC
Current consumption - From backplane bus - From supply voltage L+	Max. 100 mA Max. 340 mA
Power loss of the module	Typ. 6.0 W
Analog value formation	
Resolution, including sign ± 10 V; ± 20 mA; 4 mA to 20 mA; 1 V to 5 V 0 V to 10 V; 0 mA to 20 mA; - Conversion time (per channel)	 11 bits + sign 12 bits max. 0.8 ms
Transient recovery time - With resistive load - With capacitive load - With inductive load	0.2 ms 3.3 ms 0.5 ms (1 mH) 3.3 ms (10 mH)
Noise suppression, error limits	
Crosstalk between outputs	> 40 dB
Operational limit (across entire temperature range, relative to measurement range end value of the selected output range)	

Technical specifications	
• Voltage output (as of product version 3)	$\pm 0.5\%$
• Current output	$\pm 0.6\%$
Basic error limit (operational limit at 25 °C, relative to the measurement range end value of the selected output range)	
• Output voltage	$\pm 0.4\%$
• Output current	$\pm 0.5\%$
• Temperature error (relative to output range)	$\pm 0.002\%/K$
• Linearity error (relative to output range)	$+ 0.05\%$
• Repeat accuracy (in transient state at 25 °C, relative to output range)	$\pm 0.05\%$
• Output ripple; bandwidth 0 kHz to 50 kHz (relative to output range)	$\pm 0.05\%$
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	Configurable
Diagnostic functions	Configurable
• Group error display	Red LED (SF)
• Diagnostic information can be read	Supported
Actuator selection data	
Output ranges (rated values)	
• Voltage (as of product version 3)	$\pm 10\text{ V}$ 0 V to 10 V 1 V to 5 V
• Current	$\pm 20\text{ mA}$ 0 mA to 20 mA 4 mA to 20 mA
Load resistance (in the nominal range of the output)	
• for voltage outputs (as of product version 3) – Capacitive load	min. 1 k Ω max. 1 μF
• At current outputs – At $U_{CM} < 1\text{ V}$ – With inductive load	Max. 500 Ω Max. 600 Ω max. 10 mH
Voltage output	
• Short-circuit protection	Yes
• Short-circuit current	max. 25 mA
Current output	
• Noload voltage	Max. 18 V
• Destruction limit against external voltages/currents	Max. 18 V continuous; 75 V for max. 1 s (duty factor 1:20)
• Voltage at outputs to M_{ANA}	Max. 50 mA DC
• Current	
Connection of the actuators	Using a 40-pin front connector (as of FD 3) possible
• for voltage output 4-wire connection	
• for current output 2-wire connection	