

## Product Information on Manual

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### SIMATIC S7-300

Analog Output Module SM 332; AO 8 × 12 Bit as of Version  $\frac{X|2}{3|4}$

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#### New Analog Output Module Available

The S7-300 Analog Output Module SM 332; AO 8 × 12 Bit has been added to the S7-300 family. The order number for this module is 6ES7 332-5HF00-0AB0.

This product information includes details about the characteristics and technical specifications of the Analog Output Module SM 332; AO 8 × 12 Bit. Refer to the *S7-300 Installation and Hardware Manual* for more information about the S7-300 product family.

You will also learn:

- How to start up the analog output module
- The output ranges available for the analog output module
- How to configure the analog input module

#### Additional Assistance

For assistance in answering technical questions, for training on this product, or for ordering, contact your Siemens distributor or sales office.

# 1 **Characteristic Features and Technical Specifications of the Analog Output Module SM 332; AO 8 × 12 Bit**

## **Order No.**

6ES7 332-5HF00-0AB0

## **Characteristic Features**

The Analog Output Module SM 332; AO 8 × 12 Bit has the following characteristic features:

- 8 outputs in 8 channel groups
- Individual output channels can be programmed as voltage and current outputs
- Resolution 12 bits
- Programmable diagnostics
- Programmable diagnostic interrupt
- Isolated to backplane bus interface and load voltage

## Terminal Connection Diagram

Figure 1 shows the analog terminal connection diagram and the wiring diagram for the Output Analog Module SM 332 AO 8 × 12 Bit.

The detailed technical specifications for this analog output module are on the following page.

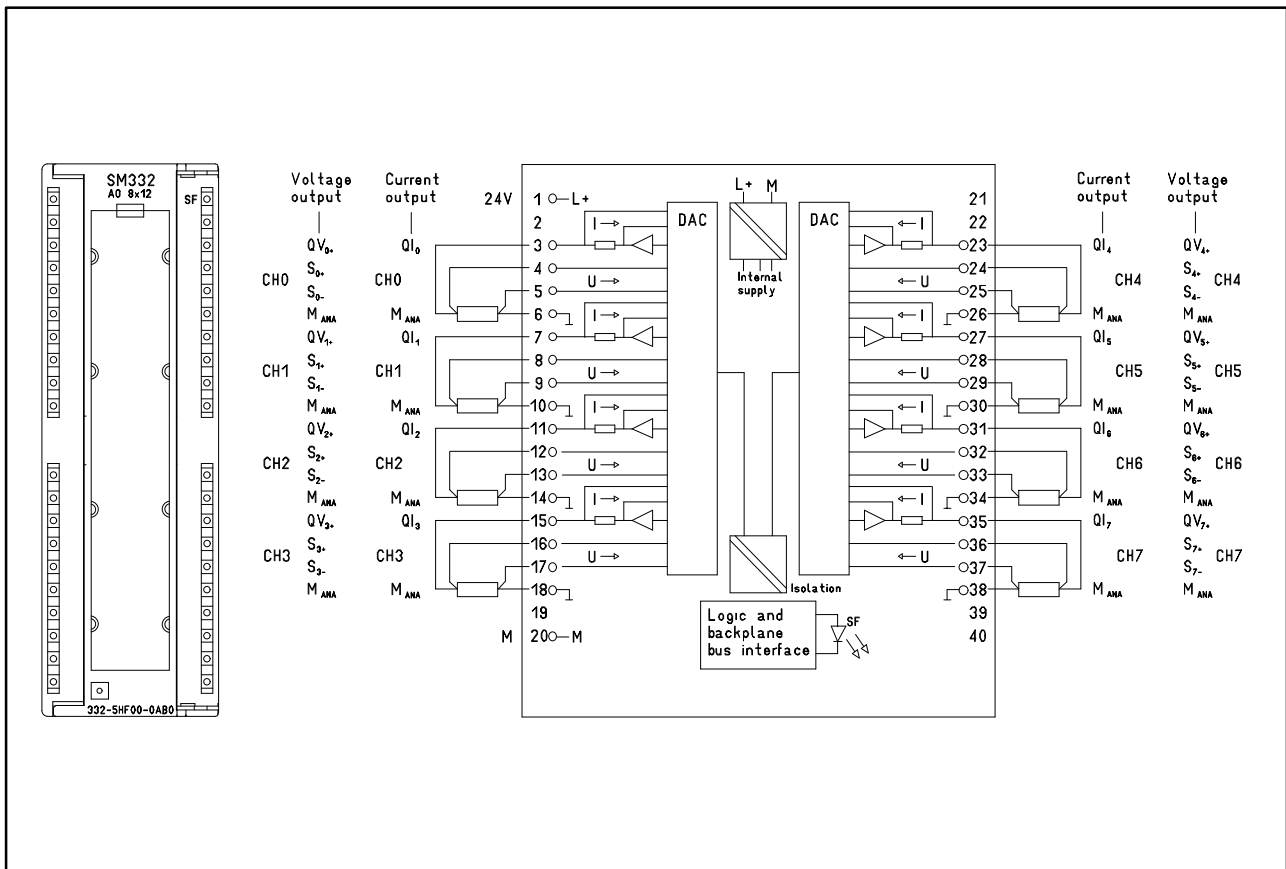


Figure 1 Connection Diagram of Analog Output Module SM 332; AO 8 x 12 Bit

### Note

Switching the rated load voltage (L+) on and off, can cause wrong intermediate values at the output for approximately 10 ms.

## Hazardous Location Information

“Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods [Article 501-4 (b) of the National Electric Code, NFPA 70] and in accordance with the authority having jurisdiction.”

Peripheral equipment must be suitable for the location it is used in.

The equipment must be suitable for use in Class I, Div. 2, Groups A, B, C, and D Hazardous Locations and nonhazardous locations only.



### **Warning** **Explosion Hazard**

Substitution of components may impair suitability for Class I, Div. 2 Hazardous Locations. Different or lesser quality components may cause an explosion or other hazardous situation, which could result in death or serious injury, and/or damage to equipment.

To avoid potentially hazardous situations, always use the appropriate components.



### **Warning** **Explosion Hazard**

Never disconnect equipment before powering off or before ascertaining that the area is nonhazardous. Disconnecting equipment before powering off or in a hazardous area may cause an explosion, which could result in death or serious injury, and/or damage to equipment.

To avoid potentially hazardous situations, always power off equipment and assure that the area is nonhazardous before disconnecting.

Dimensions and Weight		Analog Value Generation	
Dimensions W × H × D	40 × 125 × 120mm (1.56 × 4.88 × 4.68 in.)	Resolution including sign	
Weight	approx. 272 g (9.6 oz.)	<ul style="list-style-type: none"> <li>+/- 10 V; +/- 20 mA</li> <li>0 to 10 V; 0 to 20 mA; 1 to 5 V; 4 to 20 mA</li> </ul>	11 bits+sign 12 bits
Data for Specific Module		Conversion time (per channel)	0.8 ms
Number of inputs	8	Settling time	
Length of cable		<ul style="list-style-type: none"> <li>For resistive load</li> <li>For capacitive load</li> <li>For inductive load (1mH)</li> <li>For inductive load (10 mH)</li> </ul>	0.2 ms 3.3 ms 0.5 ms 3.3 ms
<ul style="list-style-type: none"> <li>Shielded</li> </ul>	max. 200 m (218 yd.)	Injection of substitute values	No
Voltages, currents, potentials		Interference Suppression, Limits of Error	
Rated voltage of the electronics L+	24 VDC	Crosstalk between the outputs	> 40 dB
<ul style="list-style-type: none"> <li>Reverse polarity protection</li> </ul>	Yes	Operational limit (in the entire temperature range, with reference to the output range)	
Insulation		<ul style="list-style-type: none"> <li>Voltage output</li> <li>Current output</li> </ul>	±0.5% ±0.6%
<ul style="list-style-type: none"> <li>Between channels and backplane bus</li> <li>Between channels and power supply of the electronics</li> <li>Between the channels</li> <li>Between channels and load voltage L+</li> </ul>	Yes Yes No Yes	Basic error (operational limit at 25° C, with reference to the output range)	
Permitted potential difference		<ul style="list-style-type: none"> <li>Voltage output</li> <li>Current output</li> </ul>	± 0.4% ± 0.5%
<ul style="list-style-type: none"> <li>Between S- and M<sub>ANA</sub> (U<sub>CM</sub>)</li> <li>Between M<sub>ANA</sub> and M<sub>internal</sub> (U<sub>ISO</sub>)</li> </ul>	3 VDC 60 VAC / 75 VDC	Temperature error (with reference to the output range)	±0.002% /K
Insulation Tested with	500 VDC	Linearity error (with reference to the output range)	± 0.05%
Current source		Repeatability (in steady state at 25° C, with reference to the output range)	±0.05%
<ul style="list-style-type: none"> <li>From the back plane bus</li> <li>From the power supply L+ (without load)</li> </ul>	max. 100 mA max. 340 mA	Output ripple; bandwidth 0 to 50Khz (with reference to the output range)	±0.05%
Power dissipation of the module	typ. 6.0 W		

<b>Status, Interrupts, Diagnostics</b>	
Interrupts	
• Diagnostics interrupt	Yes, parameters can be assigned
Diagnostics functions	Yes, parameters can be assigned
• Group error display	Red LED (SF)
• Diagnostics information can be displayed	Possible
<b>Data for Selecting an Actuator</b>	
Output range (rated values)	
• Voltage	± 10 V 0 to 10 V 1 to 5 V
• Current	± 20 mA 0 to 20 mA 4 to 20 mA
Load resistance (in the nominal range of the Output)	
• For voltage outputs	Min. 1KΩ
Capacitive load	Max. 1 uF
• For current output at $U_{CM} < 1\text{ V}$	Max. 500 Ω
Inductive load	Max. 600 Ω Max. 10 mH
Voltage output	
Short-circuit protection	Yes
Short-circuit current	Max. 25 mA
Current output	
No-load voltage	Max. 18 V
Destruction limit against voltages/currents applied from outside	
• Voltage to the outputs against $M_{ANA}$	Max. 18 V continuous; 75 V for max. 1 s (pulse duty factor 1:20)
• Current	Max. DC 50 mA
Connection of actuators	
• For voltage output	
Two-conductor connection	Possible
Four-conductor connection	Possible
• For current output	
Two-conductor connection	Possible

## 2 Starting Up the Analog Output Module SM 332; AO 8 × 12 Bit

### Parameter Assignment

The Analog Output Module SM 332; AO 8 × 12 Bit is set using one of the following methods.

- With STEP 7 (see the *STEP 7 User Manual*)
- In the user program by means of SFCs (see the *STEP 7 System and Standard Functions Reference Manual*)

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### Note

If you modify output ranges when the Analog Output Module SM 332; AO 8 x 12 Bit is in operation, intermediate values can appear at the output.

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### Default Setting

The Analog Output Module SM 332; AO 8 × 12 Bit has default settings for the type of output, diagnostics, interrupts, etc. (see Table 1).

These default settings apply if you do not re-initialize the module with STEP 7.

Table 1 Parameters and Default Settings for the AnalogOutput Module SM 332 AO 8 x 12 Bit.

Parameter	SM 332; AO 8 × 12 Bit		Parameter Type	Scope
	Value Range	Default Settings		
Enable • Diagnostics interrupt	Yes/No	No	Dynamic	Module
Diagnostics • Channel Diagnostics	Yes/No	No	Static	Channel
Response with CPU-STOP	LWH Hold last value ASS Output de-energized	ASS	Dynamic	Channel
Output • Output Type	Deactivated Voltage Current	U	Dynamic	Channel
• Output Range	0 to 20 mA 4 to 20 mA ± 20 mA 1 to 5 V 0 to 10 V ± 10 V	± 10 V	Dynamic	Channel

### Parameter Assignment in the User Program

You can configure each output channel of the SM 332; AO 8 × 12 Bit individually. This allows you to assign individual parameters for each output channel. When you set the parameters in the user program, the parameters are assigned to channel groups. Each output channel of the Analog Output Module SM 332; AO 8 × 12 Bit is then assigned to one channel group, i.e. output channel 0 = channel group 0.

### Unused Output Channels

To ensure the unused output channels of the Analog Output Module SM 332; AO 8 × 12 Bit are not active. You must deactivate them and leave them open. Deactivate the output channel using the "Output" parameter block when you program with STEP 7.

### 3 Output Ranges for the Analog Output Module SM 332; AO 8 x 12 Bit

#### Analog Outputs

You can use the outputs of the Analog Output Module SM 332; AO 8 × 12 Bit as:

- Voltage outputs
- Current outputs

Set the outputs group-wise, using STEP 7 for programming the output type.

#### Output Ranges

Set the output ranges for the voltage and/or current outputs with STEP 7.

Table 2 lists all the possible output ranges for the Analog Output Module SM 332; AO 8 × 12 Bit.

Table 2 Output Ranges for Analog Output Module

Selected Type of Output	Description	Output Range
Voltage	Table 3 and Table 4 show the digital analog values in the analog output range.	1 to 5V 0 to 10 V ± 10 V
Current	Table 3 and Table 4 show the digital analog values in the analog output measuring range.	0 to 20 mA 4 to 20 mA ± 20 mA

#### Default Settings

The Analog Output Module SM 332; AO 8 × 12 Bit has default settings for the output type “voltage” and output range “+/-10V”. You can use this output type with this output range without changing the parameters of the SM 332; AO 8 × 12 Bit with STEP 7.

#### Wire-Break Check

The Analog Output Module SM 332; AO 8 × 12 Bit carries out a wire-break check for current outputs only.

#### Short-Circuit Check

The Analog Output Module SM 332; AO 8 × 12 Bit carries out a short-circuit check for voltage outputs only.

## 4 Analog Value Representation of the Output Ranges for the Analog Output Module SM 332; AO 8 × 12 Bit

### Introduction

The tables in this section contain the digitized analog values for the various output ranges of the analog output module.

### How to Read the Output-Value Tables

Tables 3 and 4 contain the digital analog values for the various output ranges.

Since the binary representation for the analog values is always the same, these tables only contain the output values and the units.

### Voltage and Current Output Ranges

Table 3 shows the representation of the digitized output value:

- For the voltage output ranges  $\pm 10$  V and
- For the current output range  $\pm 20$  mA.

Table 3 Representation of the Digital Output Value of the Analog Output Module (Voltage and Current Output Ranges)

Range	System Word Units		Output Range $\pm$ 10 V	Output Range $\pm$ 20 mA
	Decimal	Hexadecimal		
Overflow	32767	7FFF <sub>H</sub>	0.0000	0.0000
Overrange	32511	7EFF <sub>H</sub>	11.7589	23.515
	⋮	⋮	⋮	⋮
	27649	6C01 <sub>H</sub>	10.0004	20.0007
Nominal Range	27648	6C00 <sub>H</sub>	10.00	20.000
	20736	5100 <sub>H</sub>	7.5	14.998
	⋮	⋮	⋮	⋮
	-20736	AF00 <sub>H</sub>	-7.5	-14.998
	-27648	9400 <sub>H</sub>	-10.00	-20.000
Underrange	-27649	93FF <sub>H</sub>	-10.0004	-20.0007
	⋮	⋮	⋮	⋮
	-32512	8100 <sub>H</sub>	-11.7589	-23.515
Underflow	-32768	8000 <sub>H</sub>	0.0000	0.0000

## Voltage and Current Output Ranges

Table 4 shows the representation of the digitized output value:

- For the voltage output ranges 1 to 5 V, 0 to 10 V and
- For the current output ranges 0 to 20 mA, 4 to 20 mA

Table 4 Representation of the Digital Output Value of the Analog Output Module (Voltage and Current Output Ranges)

Range	System Word Units		Output Range 1 to 5 V	Output Range 0 to 10 V	Output Range 0 to 20 mA	Output Range 4 to 20 mA
	Decimal	Hexadecimal				
Overflow	32767	7FFF <sub>H</sub>	0.0000	0.0000	0.0000	0.0000
Ovrange	32511	7EFF <sub>H</sub>	5.8794	11.7589	23.515	22.810
	⋮	⋮	⋮	⋮	⋮	⋮
Nominal Range	27649	6C01 <sub>H</sub>	5.0002	10.0004	20.0007	20.0005
	27648	6C00 <sub>H</sub>	5.000	10.00	20.000	20.000
	20736	5100 <sub>H</sub>	4.000	7.50	14.998	16.000
Underrange	⋮	⋮	⋮	⋮	⋮	⋮
	0	0 <sub>H</sub>	1.000	0.000	0.000	4.000
	-1	FFFF <sub>H</sub>	0.9999	0.0000	0.0000	3.9995
Underflow	⋮	⋮	⋮	⋮	⋮	⋮
	-6912	E500 <sub>H</sub>	0.0000	0.0000	0.0000	0.0000
Underflow	-32768	8000 <sub>H</sub>	0.0000	0.0000	0.0000	0.0000

## 5 Parameter Sets for the Analog Output Module SM 332; AO 8 × 12 Bit

### Parameter Assignment in the User Program

You have already set the parameters for the S7-300 module using STEP 7. You can use an SFC in the user program to change the AO 8 × 12 Bit module dynamic parameters. You can also use an SFC in the user program to transfer the parameters from the CPU to the addressed module.

### Parameters Stored in Data Records

The parameters for the AO 8 × 12 Bit module are stored in two data records: records 0 and 1.

### Modifiable Parameters

You can change the parameters of record 1 and pass them to the AO 8 × 12 Bit module using SFC 55. This does not change the parameters set on the CPU. You cannot change the S7-300 parameters of record 0 in the user program.

The following section shows an overview of the parameters that are stored in records 0 and 1 for the AO 8 × 12 Bit module.

### SFCs for Parameter Assignment

The following SFCs are available for assigning the parameters for the AO 8 × 12 Bit module in the user program.

Table 5 SFCs for Assigning Module Parameters

SFC No.	Identifier	Application
55	WR_PARM	Transfer modifiable parameters (record 1 and 0) to the addressed signal module.
56	WR_DPARAM	Transfer parameters (records 0 and 1) from the CPU to the addressed signal module.
57	PARAM_MOD	Transfer all parameters (records 0 and 1) from the CPU to the addressed signal module.

### Description of the Parameters

The following section contains all the modifiable parameters for the AO 8 × 12 Bit module.

The parameters for the AO 8 × 12 Bit module are described in this Product Information document and in the online help of STEP 7.

## 6 Parameters of the Analog Output Module SM 332; AO 8 × 12 Bit

### Parameters

Table 6 contains all the parameters that you can set for the Analog Output Module SM 332; AO 8 × 12 Bit. The comparison shows the configuration methods available for each parameter.

- STEP 7 programming device.
- SFC 55 "WR\_PARM"

The parameters you set using STEP 7 can also be transferred to the module using SFCs 56 and 57.

Table 6 Parameters for the Analog Output Module SM 332; AO 8 × 12 bit

Parameter	Data Record No.	Configurable with...	
		...SFC 55	...Programming Device
Diagnostics:Channel diagnostics	0	No	Yes
Diagnostic interrupt enable	1	Yes	Yes
Behavior on CPU STOP	1	Yes	Yes
Output type	1	Yes	Yes
Output range	1	Yes	Yes
Note: Before you can enable the diagnostic interrupt in record 1 of the user program, you must first enable the diagnostics in record 0 with STEP 7.			

## Structure of Data Record 1

Figure 2 shows the structure of data record 1 for the parameters of the Analog Output Module SM 332; AO 8 × 12 bit.

You can activate a parameter by setting the corresponding bit in byte 0 to “1”.

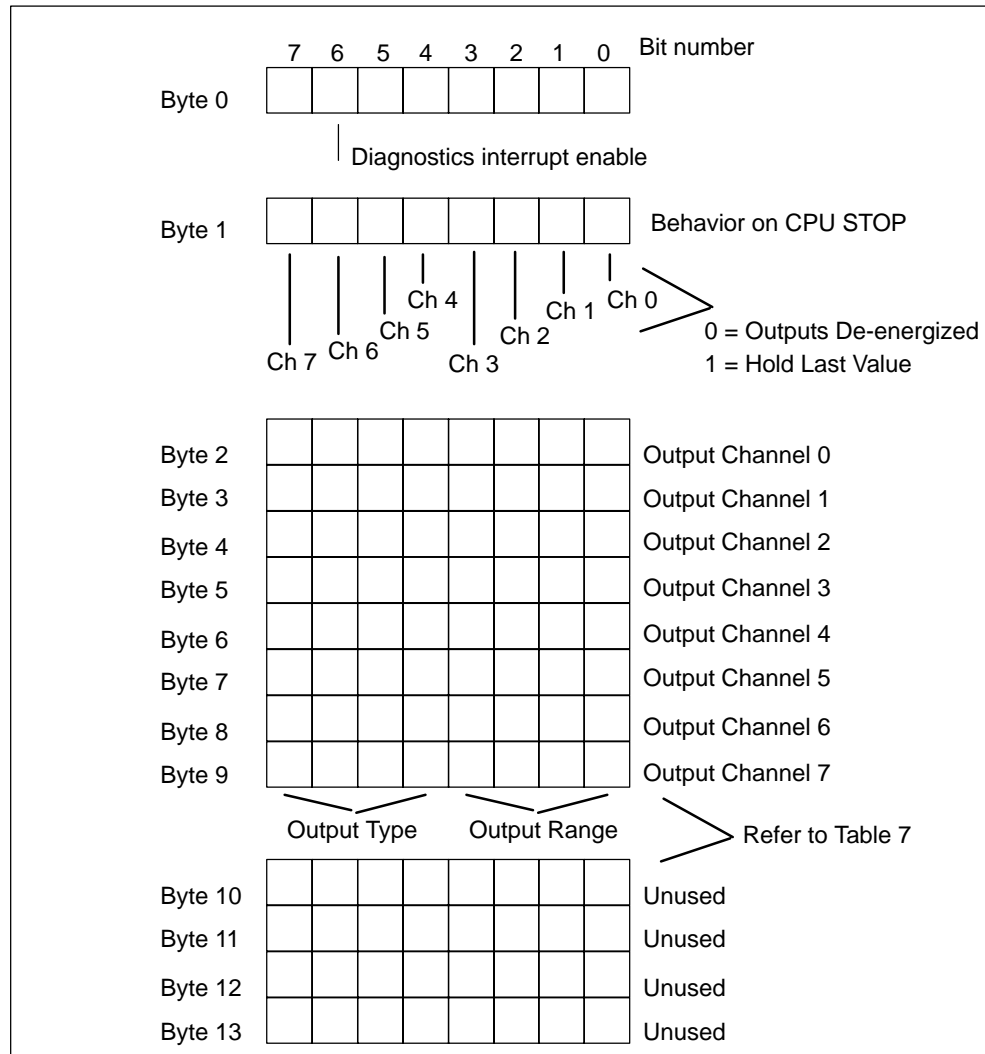


Figure 2 Data Record 1 for Parameters of the Analog Output Module SM 332; AO 8 × 12 Bit

## Output Type and Output Range

Table 7 contains all the output ranges for the Analog Output Module SM 332; AO 8 × 12 Bit. Table 7 also shows the codes for the output type and the output range. You must enter these codes, according to the output range desired, in the appropriate bytes of data record 1 (see Figure 2).

Table 7 Codes for the Output Ranges of the Analog Output Module SM332:AO 8 × 12 Bit

<b>Output Type</b>	<b>Code</b>	<b>Output Range</b>	<b>Code</b>
Deactivated	2#0000	Deactivated	2#0000
Voltage	2#0001	1 to 5 V 0 to 10 V ± 10 V	2#0111 2#1000 2#1001
Current	2#0010	0 to 20 mA 4 to 20 mA ± 20 mA	2#0010 2#0011 2#0100

