MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

Siemens

PRODUCT MODEL

6ES7135-6HD00-0BA1

Four-channel analog output module. Relevant section pages: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30. Adjacent model text on shared pages is outside this product reference.

OFFICIAL SOURCE

Analog Output Module AQ 4xU/I ST (6ES7135-6HD00-0BA1); 03/2016, A5E03573365-AD

Siemens original documentation and product reference

Original 03/2016 manual excerpt. Hardware-specific capabilities may differ from later versions; no unconditional RUN reconfiguration or low-temperature capability is asserted. A Standard AQ module has no standalone fail-safe rating.

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SIEMENS

SIMATIC

ET 200SP
Analog Output Module AQ 4xU/I ST (6ES7135-6HD00-0BA1)

Manual

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03/2016

A5E03573365-AD

Legal information

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Preface

Purpose of the documentation

This manual supplements the system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293).

Functions that generally relate to the system are described in this manual.

The information provided in this manual and in the system/function manuals supports you in commissioning the system.

Changes compared to previous version

Changes described in this manual, compared to the edition 07/2014:

- 3-wire connection for voltage output
- Derating trend for current output for modules as of hardware version FS 06.

Conventions

CPU: When the term "CPU" is used in this manual, it applies to the CPUs of the S7-1500 automation system as well as to the CPUs/interface modules of the distributed I/O system ET 200SP.

STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

Please also observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product or on the section of the documentation to which particular attention should be paid.

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To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet (http://support.automation.siemens.com).

Product overview

2

2.1 Properties

Article number

6ES7135-6HD00-0BA1

View of the module

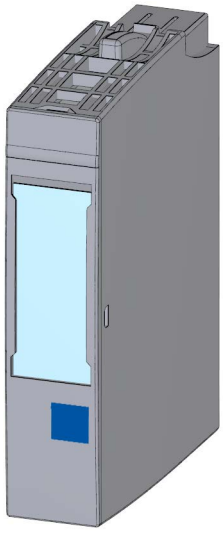


Image 2-1 View of the module AQ 4×U/I ST

Properties

The module has the following technical properties:

- Analog output module with 4 outputs
  - For current output and
  - voltage output
- Output range for current output:
  - ±20 mA, resolution 16 bits including sign
  - 0 to 20 mA, resolution 15 bits
  - 4 to 20 mA, resolution 14 bits
- Output range for voltage output:
  - ±10 V, resolution 16 bits including sign
  - ±5 V, resolution 15 bits including sign
  - 0 to 10 V, resolution 15 bits
  - 1 to 5 V, resolution 13 bits
- Electrically isolated from supply voltage L+
- Configurable diagnostics per module

The module supports the following functions:

- Firmware update
- I&M identification data
- Configuration in RUN
- PROFIenergy

Table 2- 1 Version dependencies of other module functions

Function	Product version of the module as of	Firmware version of the module as of
Value status	1	V1.1.0

You can configure the module with STEP 7 (TIA Portal) and with a GSD file.

Accessories

The following accessories must be ordered separately:

- Labeling strips
- Color identification labels
- Reference identification label
- Shield connector

See also

You will find additional information on the accessories in the ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293) system manual.

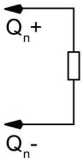
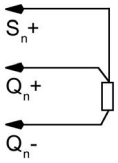
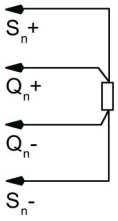
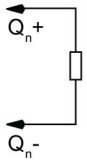
Wiring up

3

3.1 Terminal assignment

General terminal assignment

Table 3- 1 Terminal assignment

Terminal assignment for AQ 4×U/I ST (6ES7135-6HD00-0BA1)						
Terminal	**Assignment**	**Terminal**	**Assignment**	**Explanation**	**BaseUnit**[1]	**Color identification label**
1	Q_0+	**2**	Q_1+	• Q_n+: Analog output voltage/current (positive), channel n • Q_n-: Analog output voltage/current (negative), channel n • S_n+: Sensor line positive, channel n • S_n-: Sensor line negative, channel n	A0 A1	---
3	Q_2+	**4**	Q_3+			
5	Q_0-	**6**	Q_1-			
7	Q_2-	**8**	Q_3-			
9	S_0+	**10**	S_1+			
11	S_2+	**12**	S_3+			
13	S_0-	**14**	S_1-			
15	S_2-	**16**	S_3-			
L+	24 VDC	**M**	M			
Voltage 2-wire connection 		Voltage 3-wire connection 		Voltage 4-wire connection 		Current 

[1] Usable BaseUnit types, can be identified by the last two digits of the article number.

Note

The first BaseUnit of a station must be a light-colored BaseUnit. Also keep this in mind during the configuration.

You will find additional information on the BaseUnit types in the ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293) system manual.

3.2 Schematic circuit diagram

Schematic circuit diagram

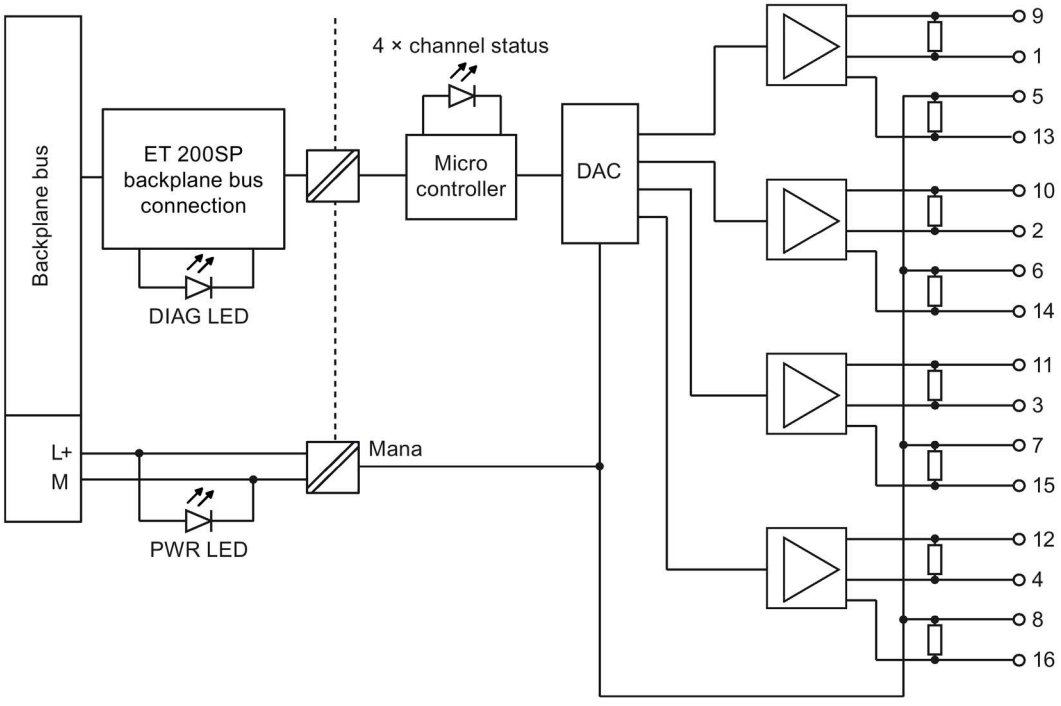


Image 3-1 Schematic circuit diagram for AQ 4×U/I ST

Parameters/address space

4

4.1 Output ranges

The analog output module AQ 4×U/I ST has the following measuring ranges:

Table 4- 1 Output ranges

Output type	Output ranges	Resolution
Current	± 20 mA	16 bits including sign
	0 to 20 mA	15 bits
	4 to 20 mA	14 bits
Voltage	±10 V	16 bits including sign
	±5 V	15 bits including sign
	0 to 10 V	15 bits
	1 to 5 V	13 bits

The tables of the output ranges, overflow, overrange, etc. can be found in section Representation of analog values (Page 34).

4.2 Parameters

Parameters of the AQ 4xU/I ST

The effective range of the parameters depends on the type of configuration. The following configurations are possible:

- Central operation with an S7-1500 CPU
- Distributed operation on PROFINET IO in an ET 200SP system
- Distributed operation on PROFIBUS DP in an ET 200SP system

When assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module using the data records; refer to the section Parameter assignment and structure of the parameter data record (Page 31).

The following parameter settings are possible:

Table 4- 2 Settable parameters and their defaults (GSD file)

Parameters	Value range	Default	Configuration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics No supply voltage L+	• Disable • Enable	Disable	yes	Module	Module
Diagnostics: Short-circuit[1]	• Disable • Enable	Disable	yes	Module	Module
Diagnostics Overflow	• Disable • Enable	Disable	yes	Module	Module
Diagnostics Underflow	• Disable • Enable	Disable	yes	Module	Module
Diagnostics wire break[2]	• Disable • Enable	Disable	yes	Module	Module
Output type/range	• deactivated • Voltage +/- 10 V • Voltage +/- 5 V • Voltage 0..10 V • Voltage 1..5 V • Current +/- 20 mA • Current 0 - 20 mA • Current 4 - 20 mA	Current 4 - 20 mA	yes	Channel	Channel
Reaction to CPU STOP	• Turn off • Keep last value • Output substitute value	Turn off	yes	Channel	Module

Parameters	Value range	Default	Configuration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Substitute value	For permissible substitute values for the various output ranges, see appendix Parameter data record (Page 30), Substitute values → Codes for substitute value table	0	yes	Channel	Channel
Potential group	• Use potential group of the left module • Allow new potential group	Use potential group of the left module	no	Module	Module

1 no diagnostics detection between -0.5 V and +0.5 V (no short-circuit detection)

2 no diagnostics detection between -3 mA and +3 mA (no wire break detection)

Note

Unused channels

"Disable" the unused channels in the parameter assignment. This improves the temperature characteristics of the module, see Derating, section Technical specifications (Page 25).

A disabled channel always returns the value "no current or voltage".

4.3 Explanation of the parameters

Diagnostics no supply voltage L+

Enabling of the diagnostics for no or insufficient supply voltage L+.

Diagnostics: Short-circuit

Enabling of the diagnostics when a short-circuit of the actuator supply occurs.

Diagnostics overflow

Enabling of the diagnostics when the output value exceeds the overrange.

Diagnostics underflow

Enabling of the diagnostics when the output value exceeds the overrange, falls below the minimum output value or reaches underflow.

Diagnostics wire break

Enabling of the diagnostics if the line to the actuator is broken.

Output type / output range

See section Output ranges (Page 16)

Reaction to CPU STOP

Determines the behavior of the module at CPU STOP.

Substitute value

The substitute value is the value that the module outputs in case of a CPU STOP.

Potential group

Specifies that a BaseUnit with voltage supply feed-in is located in this slot (see system manual ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293)).

4.4 Address space

Configuration options

The following configurations are possible:

- Configuration 1: Without value status
- Configuration 2: With value status

Evaluating the value status

If you enable the value status for the analog module, an additional byte is occupied in the input address space. Bits 0 to 3 in this byte are assigned to a channel. They provide information about the validity of the analog value.

Bit = 1: There are no faults/errors on the module.

Bit = 0: Channel is disabled or there is a fault/error on the module.

If a fault/error occurs on a channel with this module, the value status for all channels is 0.

Address space

The following figure shows the assignment of the address space for the AQ 4×U/I ST with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

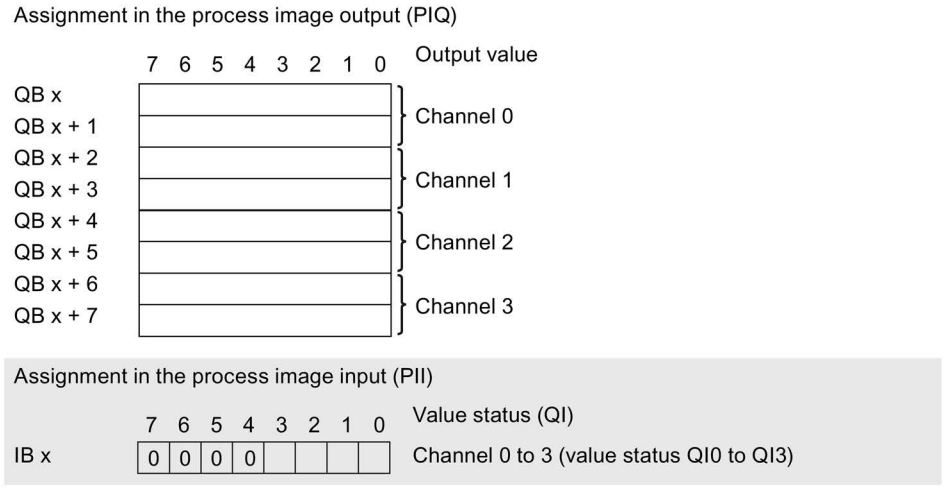


Image 4-1 Address space of the AQ 4×U/I ST with value status

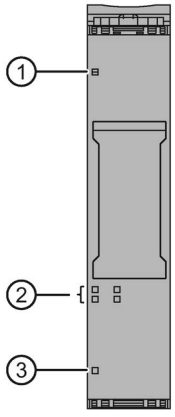
Interrupts/diagnostics alarms

5

5.1 Status and error display

LED display

The figure below shows the LED displays of the AQ 4xU/I ST.



① DIAG (green/red)
② Channel status (green)
③ PWR (green)

Image 5-1 LED display

Meaning of the LED displays

The following tables show the meaning of the status and error displays. Measures for dealing with diagnostics alarms can be found in the section Diagnostics alarms (Page 24).

DIAG LED

Table 5- 1 DIAG LED fault/error display

DIAG LED	Meaning
▫ off	Backplane bus supply of the ET 200SP not OK
☼ Flashes	Module parameters not assigned
■ on	Module parameters assigned and no module diagnostics
☼ Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 5- 2 Status display of the channel status LED

Channel status LED	Meaning
▫ off	Channel disabled
■ on	Channel enabled

PWR LED

Table 5- 3 Status display of the PWR LED

PWR LED	Meaning
▫ off	No supply voltage L+
■ on	Supply voltage L+ present

5.2 Interrupts

The analog output module AQ 4×U/I ST supports diagnostic interrupts.

Diagnostics interrupt

The module generates a diagnostics interrupt for the following events:

- Channel temporarily unavailable
- Short-circuit (voltage)
- Overtemperature
- Line break (current)
- High limit violated
- Low limit violated
- Error
- Parameter assignment error
- No load voltage

5.3 Diagnostics alarms

A diagnostics alarm is output for each diagnostics event and the DIAG LED on the module flashes. The diagnostics alarms can, for example, be read from the diagnostics buffer of the CPU. You can evaluate the error codes with the user program.

Table 5- 4 Diagnostics alarms, their meaning and how to deal with them

Diagnostics alarm	Error code	Meaning	Remedy
Channel temporarily unavailable	$1F_H$	Firmware being updated. The module is currently not performing any outputs.	–
		The channel is currently being calibrated.	
Short-circuit	1_H	Short-circuit of the actuator supply	Correct the process wiring
Overtemperature	4_H	Thermal overload of the I/O module	Correct the process wiring
Wire break	6_H	Actuator circuit impedance too high.	Use a different actuator type or wire differently, e.g. use cables with a larger cross-section
		Wire break between the module and actuator	Connect the cable
		Channel not connected (open)	• Disable the channel ("output type" parameter) • Connect the channel
High limit violated	7_H	The output value specified by the user program exceeds the overrange.	Correct the output value
Low limit violated	8_H	The output value specified by the user program is below the underrange.	Correct the output value
Error	9_H	Internal module error occurred.	Replace module
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct the parameter assignment
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type

Technical specifications

6

6.1 Technical specifications

Technical specifications of AQ 4×U/I ST

	6ES7135-6HD00-0BA1
Product type designation	AQ 4xU/I ST
General information	
Firmware version	V1.1
Usable BaseUnits	BU type A0, A1
Color code for module-specific color identification label	CC00
Product function	
I&M data	Yes
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V11 SP2 / V13
STEP 7 can be configured/integrated as of version	V5.5 SP3 / -
PROFIBUS as of GSD version/GSD revision	GSD revision 5
PROFINET as of GSD version/GSD revision	V2.3 / -
CiR Configuration in RUN	
Configuration in RUN possible	Yes
Installation type/mounting	
Rack mounting possible	Yes
Front installation possible	Yes
Rail mounting possible	Yes
Wall/direct mounting possible	No
Supply voltage	
Type of supply voltage	DC
Rated value (DC)	24 V
Valid range low limit (DC)	19.2 V
Valid range high limit (DC)	28.8 V
Reverse polarity protection	Yes
Input current	
Current consumption, max.	150 mA
Power loss	
Power loss, typ.	1.5 W
Address area	
Address space per module	
Address space per module, max.	8 bytes; + 1 byte for QI information

	6ES7135-6HD00-0BA1
Analog outputs	
Number of analog outputs	4
Voltage output, short-circuit current, max.	45 mA
Cycle time (all channels), min.	5 ms
Output ranges, voltage	
0 to 10 V	Yes; 15 bits
1 to 5 V	Yes; 13 bits
-5 to +5 V	Yes; 15 bits including sign
-10 to +10 V	Yes; 16 bits including sign
Output ranges, current	
0 to 20 mA	Yes; 15 bits
-20 to +20 mA	Yes; 16 bits including sign
4 to 20 mA	Yes; 14 bits
Connection of actuators	
for voltage output two-wire connection	Yes
for voltage output three-wire connection	Yes
for voltage output four-wire connection	Yes
for current output two-wire connection	Yes
Load resistance (in nominal range of the output)	
For voltage outputs, min.	2 kΩ
For voltage outputs, capacitive load, max.	1 µF
For current outputs, max.	500 Ω
For current outputs, inductive load, max.	1 mH
Destruction limit for externally applied voltages and currents	
Voltages at the outputs	30 V
Cable length	
Cable length shielded, max.	1000 m; 200 m for voltage output
Analog value formation	
Oscillation time	
For resistive load	0.1 ms
For capacitive load	1 ms
For inductive load	0.5 ms
Errors/accuracies	
Linearity error (in relation to output range), (+/-)	±0.03 %
Temperature error (in relation to output range), (+/-)	0.005 %/K
Crosstalk between outputs, min.	-50 dB
Repeat accuracy in settled state at 25 °C (in relation to output range), (+/-)	±0.05 %
Operational limit in the entire temperature range	
Voltage in relation to output range, (+/-)	±0.5 %
Current in relation to output range, (+/-)	±0.5 %

	6ES7135-6HD00-0BA1
Basic error limit (operational limit at 25 °C)	
Voltage in relation to output range, (+/-)	±0.3 %
Current in relation to output range, (+/-)	±0.3 %
Interrupts/diagnostics/status information	
Substitute values can be applied	Yes
Interrupts	
Diagnostics interrupt	Yes
Diagnostics alarms	
Diagnostics	Yes
Monitoring of supply voltage	Yes
Wire break	Yes
Short-circuit	Yes
Overflow/underflow	Yes
Diagnostics display LED	
Monitoring of the supply voltage (PWR LED)	Yes; green LED
Channel status display	Yes; green LED
For module diagnostics	Yes; green/red LED
Electrical isolation	
Electrical isolation of channels	
Between the channels	No
Between the channels and the backplane bus	Yes
Between the channels and the supply voltage of the electronics	Yes
Permitted potential difference	
Between different circuits	75 VDC / 60 VAC (basic isolation)
Insulation	
Insulation tested with	707 VDC (type test)
Environmental conditions	
Operating temperature	
Horizontal installation, min.	0 °C
Horizontal installation, max.	60 °C
Vertical installation, min.	0 °C
Vertical installation, max.	50 °C
Dimensions	
Width	15 mm
Weights	
Weight, approx.	31 g

Derating trend for permitted load during power output and horizontal mounting position:

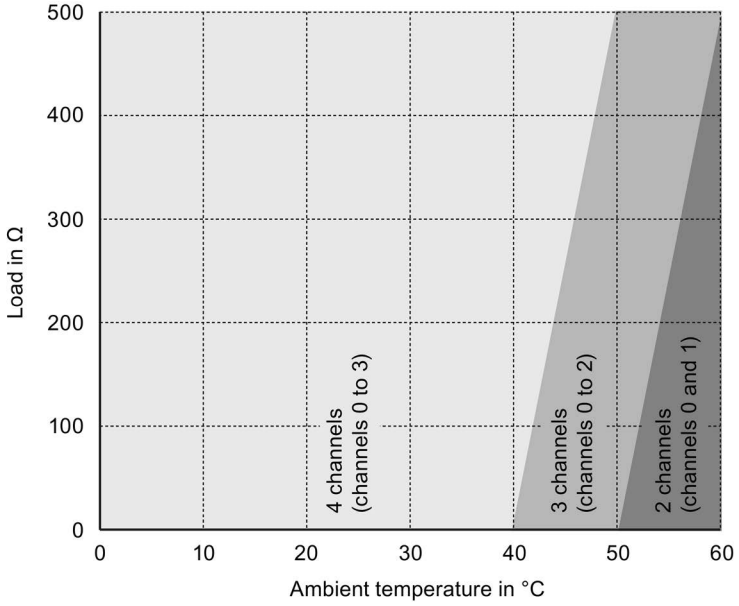


Image 6-1 Derating trend current output (horizontal)

Derating trend for permitted load during power output and vertical mounting position:

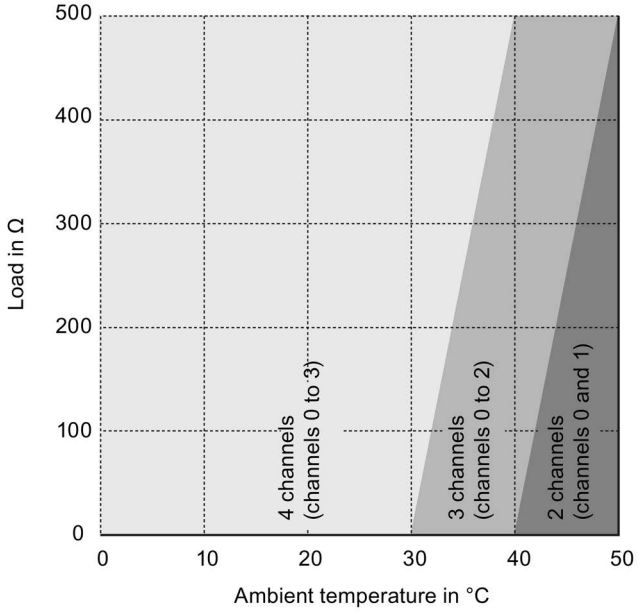


Image 6-2 Derating trend current output (vertical)

Parameter data record

A

A.1 Dependencies when configuring with GSD file

When configuring the module with a GSD file, remember that the settings of some parameters are dependent on each other.

Configuring with a PROFINET GSD file

The table lists the properties and their dependencies on the output type and output range for PROFINET.

Output type	Output range	Diagnostics					Reaction to CPU STOP	Substitute value
		No supply voltage L+	Short-circuit to M	Overflow	Underflow	Wire break		
deactivated		*	*	*	*	*	*	*
Voltage	±5 V	x	x	x	x	-	x	x
	±10 V	x	x	x	x	-	x	x
	1..5 V	x	x	x	x	-	x	x
	0..10 V	x	x	x	x	-	x	x
Current	±20 mA	x	-	x	x	x	x	x
	0..20 mA	x	-	x	x	x	x	x
	4..20 mA	x	-	x	x	x	x	x

x = Property is allowed, - = Property is **not allowed**, * = Property is not relevant

Configuring with a PROFIBUS GSD file

The table lists the properties and their dependencies on the output type and output range for PROFIBUS.

Output type	Output range	Diagnostics				Reaction to CPU STOP	Substitute value
		No supply voltage L+	Short-circuit to M	Overflow/ Underflow	Wire break		
deactivated		*	*	*	*	*	*
Voltage	±5 V	x	x	x	-	x	x
	±10 V	x	x	x	-	x	x
	1..5 V	x	x	x	-	x	x
	0..10 V	x	x	x	-	x	x
Current	±20 mA	x	-	x	x	x	x
	0..20 mA	x	-	x	x	x	x
	4..20 mA	x	-	x	x	x	x

x = Property is allowed, - = Property is **not allowed**, * = Property is not relevant