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SIMATIC

S7-1500/ET 200MP
Analog output module AQ 4xU/I ST (6ES7532-5HD00-0AB0)

Manual

01/2013

A5E03484696-01

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A5E03484696-01
℗ 01/2013 Technical data subject to change

Preface

Purpose of the documentation

This manual supplements the system manuals:

- S7-1500 Automation System
- ET 200MP distributed I/O system

Functions that generally concern the systems are described in these manuals.

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

Conventions

The term "CPU" is used in this manual both for the CPUs of the S7-1500 automation system, as well as for interface modules of the ET 200MP distributed I/O system.

Please also observe notes marked as follows:

Note

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Table of contents

Documentation guide

1

Introduction

This modular documentation of the SIMATIC products covers diverse topics concerning your automation system.

The complete documentation for the S7-1500 and ET 200MP systems consists of the respective system manual, function manuals and manuals.

The STEP 7 information system (Online Help) also helps you configure and program your automation system.

Overview of the documentation provided for analog output module AQ 4xU/I ST

The following table lists further documentation that you will need when using the AQ 4xU/I ST analog output module.

Table 1- 1 Documentation for analog output module AQ 4xU/I ST

Topic	Documentation	Most important contents
System description	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual	• Application planning • Installation • Wiring • Commissioning
	ET 200MP distributed I/O system (http://support.automation.siemens.com/WW/view/en/59193214) system manual	
Configuring interference-free controllers	Function manual Configuring interference-free controllers (http://support.automation.siemens.com/WW/view/en/59193566)	• Basics • Electromagnetic compatibility • Lightning protection
System diagnostics	Function manual System diagnostics (http://support.automation.siemens.com/WW/view/en/59192926)	• Overview • Diagnostic evaluation of hardware/software
Analog value processing	Function manual Analog value processing (http://support.automation.siemens.com/WW/view/en/59193559)	• Basics of analog technology (wiring, processing, installation technology), etc. • Description/explanation of meanings, e.g. conversion and cycle time, basic and operation limits, etc.

SIMATIC manuals

All current manuals for the SIMATIC products are available for download free of charge from the Internet (http://www.siemens.com/automation/service&support).

Product overview

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2.1 Properties

Order number

6ES7532-5HD00-0AB0

View of the module

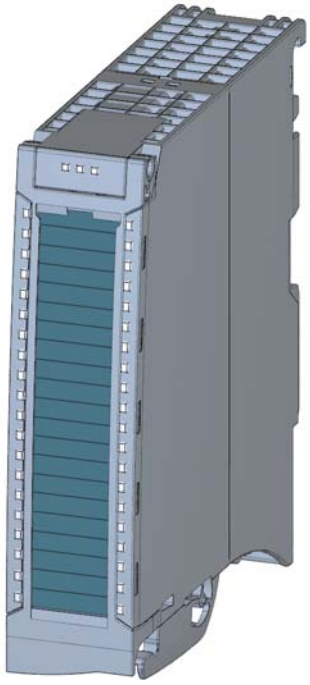

Figure 2-1 View of the AQ 4xU/I ST module

Properties

The module has the following properties:

- Technical properties
  - 4 analog outputs
  - Selection of channels for voltage output
  - Selection of channels for current output
  - Resolution: 16 bits including sign
  - Channel-based configurable diagnostics
- Supported functions
  - Firmware update
  - Calibration in runtime
  - Identification data I&M0 to I&M3
  - Reconfiguration in RUN (channel based)

Accessories

The following components are supplied with the module and are also available on separate order as spare parts:

- Shield bracket
- Shield terminal
- Power supply element
- Labeling strips
- U-connector
- Universal front door

Other components

The following component must be ordered separately:

Front connectors, including potential jumpers and cable ties

Wiring

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The following figures show the block diagram of the module and various wiring options.

For more information on front connector wiring and creating cable shields, for example, refer to the "Wiring" section in the S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) and ET 200MP distributed I/O system (http://support.automation.siemens.com/WW/view/en/59193214) system manuals.

Note

You may use and combine the different wiring options for all channels.

Note

Do not insert the potential jumpers included with the front connector!

Abbreviations used

QV_n	Voltage output channel
QI_n	Current output channel
S_n+/S_n-	Sense line channel
L+	Supply voltage connection
M	Ground connection
M_{ANA}	Reference potential of the analog circuit
CHx	Channel or display of the channel status
PWR	Display for the supply voltage

Pin assignment for the power supply element

The power supply element is plugged onto the front connector for powering the analog module. Wire the supply voltage to terminals 41 (L+) and 44 (M). Use terminals 42 (L+) and 43 (M) to loop the potential to the next module.

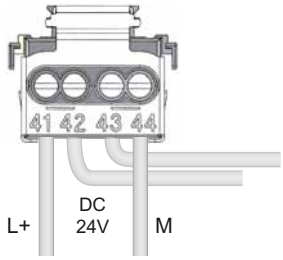
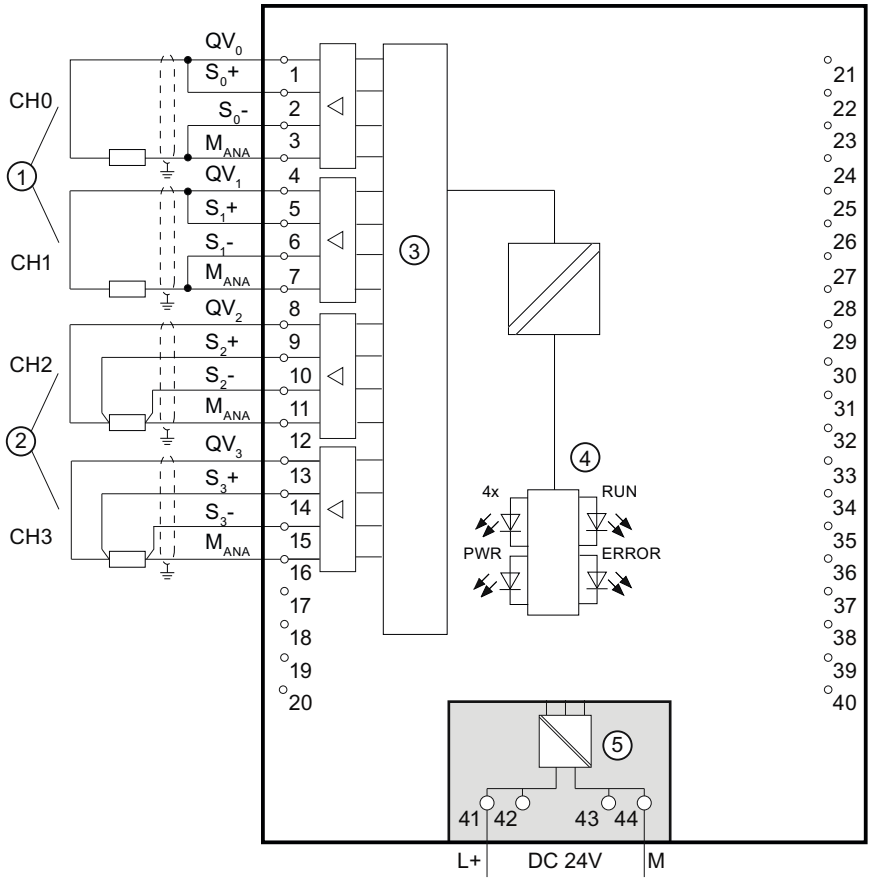


Figure 3-1 Power supply element wiring

Block diagram and terminal assignment for the voltage output

The following figure shows an example of the wiring options:

- 2-wire connection, without compensation for line resistances.
- 4-wire connection, with compensation for line resistances.

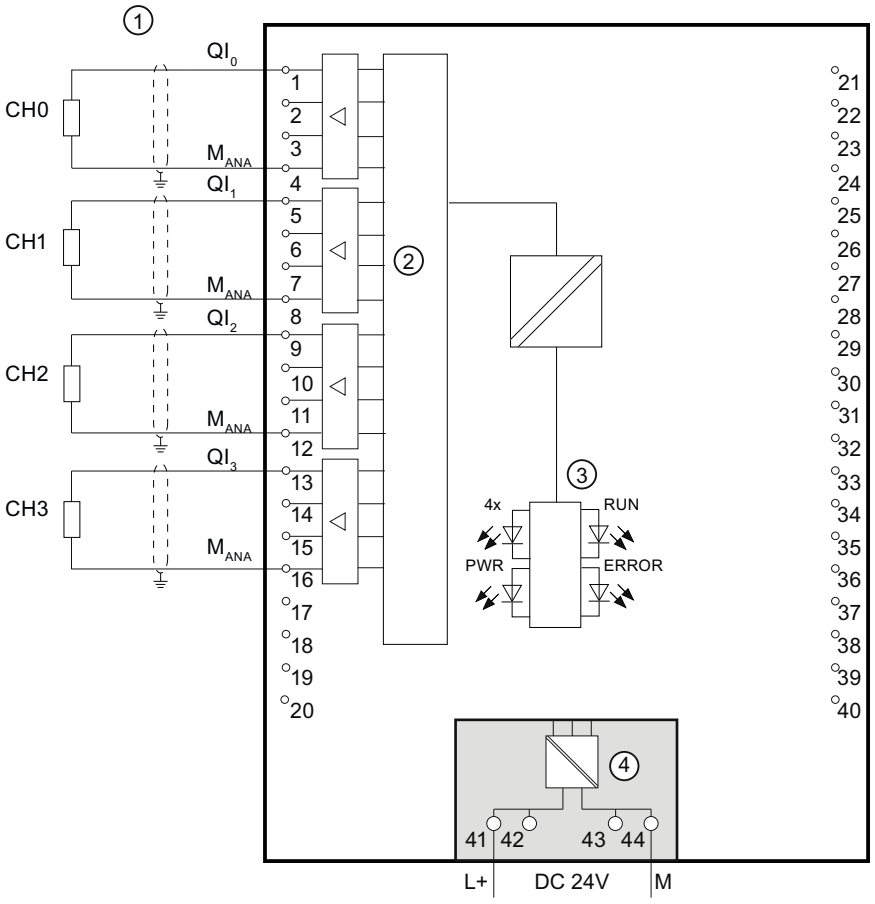


① 2-wire connection (jumper at the front connector)
② 4-wire connection
③ Digital Analog Converter (DAC)
④ Backplane bus interface
⑤ Power via supply module

Figure 3-2 Block diagram and terminal assignment for the voltage output

Block diagram and terminal assignment for the current output

The following figure shows an example of the terminal assignment for current output circuitry.



① Load on current outputs
② Digital Analog Converter (DAC)
③ Backplane bus interface
④ Power via supply module

Figure 3-3 Block diagram and terminal assignment for the current output

Parameters/address space

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4.1 Output ranges

The module is set to voltage output type by default with output range ±10 V. You need to edit the module parameters with STEP 7 if you want to use a different output range or output type.

Output type and output ranges

The following table shows the output type and the respective output ranges.

Table 4- 1 Output type and output ranges

Output type	Output range
Voltage	1 V to 5 V 0 V to 10 V ±10 V
Current	0 to 20 mA 4 to 20 mA ±20 mA
Disabled	-

The tables of the output ranges, overflow, overshoot range, etc. are available in the appendix Representation of analog values (Page 33).

4.2 Parameters

AQ 4xU/I ST parameters

When assigning the module parameters with STEP 7, you use different parameters to specify the module properties. The following table lists the configurable parameters.

When assigning parameters in the user program, use the WRREC instruction to transfer the parameters to the module by means of data records; see chapter Parameter assignment and structure of the parameter data record. (Page 29)

Table 4- 2 Configurable parameters and their defaults

Parameters	Range of values	Default setting	Configurable in RUN	Effective range
Diagnostics				
• Missing supply voltage L+	Yes/No	No	Yes	Channel*
• Wire break	Yes/No	No	Yes	Channel
• Short-circuit to ground	Yes/No	No	Yes	Channel
• Underflow	Yes/No	No	Yes	Channel
• Overflow	Yes/No	No	Yes	Channel
Output				
• Output type	Current/voltage	Voltage	Yes	Channel
• Output range	See chapter Output ranges (Page 15)	±10 V	Yes	Channel
• Reaction to CPU STOP	• Turn off • Keep last value • Output substitute value	Turn off	Yes	Channel
• Substitute value	Must be in the valid voltage/current output range; see Table B-3 Valid substitute value for the output range (Page 31)	0	Yes	Channel

* If you enable diagnostics for multiple channels, you will receive an alarm surge on failure of the supply voltage because each enabled channel will detect this fault. You can prevent this message burst by assigning the diagnostics function to one channel only.

Short-circuit detection

The diagnostics for short circuit to ground can be configured for the voltage output type. A short-circuit detection is not possible for small output values; the output voltages must therefore be below -0.1 V or above +0.1 V.

Open-circuit detection

The diagnostics for open circuit can be configured for the current output type. An open-circuit detection is not possible for small output values; the output voltages must therefore be below -0.2 mA or above +0.2 mA.

4.3 Declaration of parameters

Missing supply voltage L+

Enabling of the diagnostics, with missing or too little supply voltage L+.

Wire break

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

Short-circuit to ground

Enabling of the diagnostics if a short-circuit of the output to M_{ANA} occurs.

Overflow

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

Underflow

Enabling of the diagnostics when the output value violates the underrange.

Reaction to CPU STOP

Determines the reaction of the output to the CPU going into STOP state.

Substitute value

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

4.4 Address space

Address space of AQ 4xU/I ST

The following figure shows the address space allocation for the configuration as 4-channel AQ 4xU/I ST with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

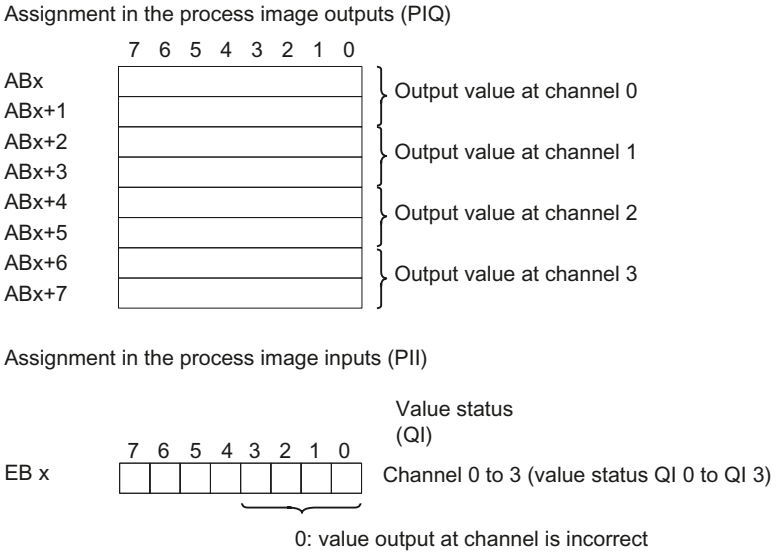

Figure 4-1 Address space of AQ 4xU/I ST with value status

Configuration options of AQ 4xU/I ST

The following configurations are possible:

- Configuration 1: 1 x 4-channel (no value status)
- Configuration 2: 1 x 4-channel (with value status)

Evaluating the value status

An additional byte is occupied in the input address space if you enable the value status for the analog module. Bits 0 to 3 in this byte are assigned to a channel and return information about the validity of the analog value (0 = incorrect value).

Interrupts/diagnostic alarms

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5.1 Status and error displays

LED displays

The following figure shows you the LED displays (status and error displays) of AQ 4xU/I ST.

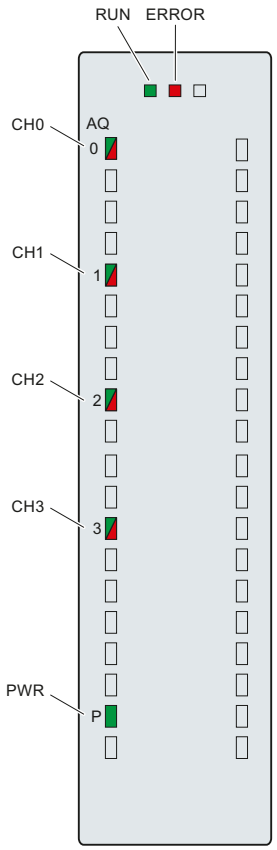

Figure 5-1 LED displays of the module AQ 4xU/I ST

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Corrective measures for diagnostic alarms can be found in chapter Diagnostic alarms (Page 21).

Table 5- 1 Status and error displays RUN/ERROR

LED		Meaning	Remedy
RUN	ERROR		
□ Off	□ Off	Voltage missing or too low at backplane bus	• Switch on the CPU and/or the system power supply modules. • Verify that the U connectors are inserted. • Check to see if too many modules are inserted.
☼ Flashes	□ Off	The module starts and flashes until the valid parameter assignment is set.	---
■ On	□ Off	Module is configured	
■ On	☼ Flashes	Indicates module errors (there is an error on at least one channel, for example a wire break).	Evaluate the diagnostic data and eliminate the error (e.g. wire break).
☼ Flashes	☼ Flashes	Hardware defective	Replace the module.

Table 5- 2 PWR status display

LED PWR	Meaning	Remedy
□ Off	Supply voltage L+ too low or missing	Check the supply voltage.
■ On	Supply voltage L+ is present and OK	---

Table 5- 3 CHx status display

LED CHx	Meaning	Remedy
□ Off	Channel deactivated	---
■ On	Channel configured and OK	---
■ On	Diagnostic alarm: e.g., wire break, overflow, underflow	Check the wiring. Disable diagnostics.

5.2 Interrupts

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

Diagnostic interrupt

The module generates a diagnostic interrupt at the following events:

- Missing supply voltage L+
- Short-circuit to ground
- Wire break
- Overflow
- Underflow

For more information on the error event, refer to the error OB with the RALRM instruction (read additional interrupt information) and to the STEP 7 online help.

5.3 Diagnostic alarms

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

Table 5- 4 Diagnostic alarms, their meaning and corrective measures

Diagnostic alarm	Error code	Meaning	Remedy
Load voltage missing	17_D	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module
Short-circuit to ground	1_D	Overload at output	Eliminate overload
		Short-circuit of output Q_V to M_{ANA}	Eliminate the short-circuit
Wire break	6_D	Encoder circuit impedance too high	Use a different actuator type or modify the wiring, for example, use cables with larger cross-section
		Wirebreak between the module and actuator	Connect the cable
		Channel not connected (open)	• Disable the channel ("output type" parameter) • Connect the channel
Overflow	7_D	The output value set by the user program exceeds the valid rated range/overshoot range.	Correct the output value
Underflow	8_D	The output value set by the user program undershoots the valid rated range/undershoot range.	Correct the output value

Technical specifications

6

Technical specifications of the AQ 4xU/I ST

	6ES7532-5HD00-0AB0
Product type designation	AQ 4xU/I ST
General information	
Hardware version	I01
Firmware version	V1.0.0
• I&M data	Yes; IM0 to IM3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V12.0 / V12.0
STEP 7 can be configured/integrated as of version	as of V5.5 SP3 / -
Supply voltage	
Type of supply voltage	DC
• Rated value (DC)	24 V
• Valid range, low limit (DC)	20.4 V
• Valid range, high limit (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
• Current consumption, max.	190 mA; (with 24 V DC supply)
Power	
• Power consumption from backplane bus	0.6 W
Power loss	
• Power loss, typ.	4 W
Analog outputs	
• Number of analog outputs	4
• Voltage output, short-circuit protection	Yes
• Voltage output, short-circuit current, max.	24 mA
• Current output, open-circuit voltage, max.	22 V
• Cycle time (all channels) min.	3.2 ms; (regardless of the number of activated channels)

	6ES7532-5HD00-0AB0
Output ranges, voltage	
• 0 V to 10 V	Yes
• 1 V to 5 V	Yes
• -10 to +10 V	Yes
Output ranges, current	
• 0 mA to 20 mA	Yes
• -20 mA to +20 mA	Yes
• 4 mA to 20 mA	Yes
Connection of actuators	
• for voltage output 2-wire connection	Yes
• for voltage output 4-wire connection	Yes
• for current output 2-wire connection	Yes
Load resistance (in the rated output range)	
• for voltage outputs, min.	1 kOhm; 0.5 kOhm at 1 to 5 V
• for voltage outputs, capacitive load, max.	1 µF
• for current outputs, max.	750 Ω
• for current outputs, inductive load, max.	10 mH
Cable length	
• Shielded cable length, max.	800 m; for current, 200 m for voltage
Analog value formation	
Integration and conversion time/ resolution per channel	
• Conversion time (per channel)	0.5 ms
Settling time	
• for resistive load	1.5 ms
• for capacitive load	2.5 ms
• for inductive load	2.5 ms
Errors/accuracies	
• Output ripple (referenced to the output range, bandwidth 0 to 50 kHz)	± 0.02 %
• Linearity error (referenced to the output range)	± 0.15 %
• Temperature error (referenced to the output range)	± 0.002 %
• Crosstalk between outputs, max.	-100 dB
• Repetition accuracy in settled state at 25 °C (referenced to the output range)	± 0.05 %

	6ES7532-5HD00-0AB0
Operational limits across the entire temperature range	
• Voltage, referenced to the output range	± 0.3 %
• Current, referenced to the output range	± 0.3 %
Basic error limit (operational limit at 25 °C)	
• Voltage, referenced to the output range	± 0.2 %
• Current, referenced to the output range	± 0.2 %
Interrupts/diagnostics/status information	
• Substitute values can be applied	Yes
Interrupts	
• Diagnostic interrupt	Yes
Diagnostic alarms	
Diagnostics	Yes
• Monitoring of supply voltage	Yes
• Wire break	Yes; only for output type current
• Short-circuit	Yes; only for output type voltage
• Overflow/Underflow	Yes
Diagnostic display LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• Monitoring of supply voltage	Yes; green LED
• Channel status display	Yes; green LED
• For channel diagnostics	Yes; red LED
• For module diagnostics	Yes; red LED
Electrical isolation	
Electrical isolation of channels	
• Between the channels	No
• Between the channels, in groups of	4
• Between the channels and the backplane bus	Yes
• Between the channels and the load voltage L+	Yes
Permitted potential difference	
Between MANA and M internal (UISO)	75 V DC / 60 V AC (basic insulation)
between S- and MANA (UCM)	+/- 8 V
Insulation	
Insulation tested with	707 V DC (type test)

	6ES7532-5HD00-0AB0
Distributed mode	
• Supports Fast Startup	Yes; 500 ms
Dimensions	
• Width	35 mm
• Height	147 mm
• Depth	129 mm
Weights	
• Weight, approx.	310 g

Dimensional drawing

A

The dimensional drawing of the module on the mounting rail, as well as a dimensional drawing with open front panel are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

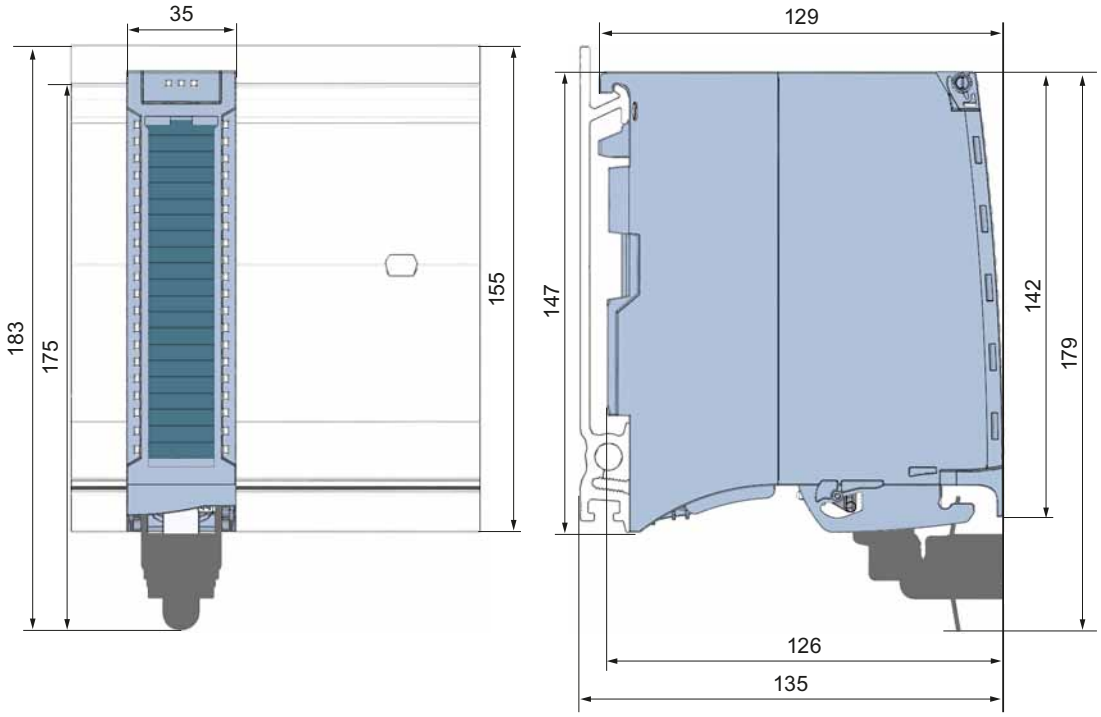

Figure A-1 Dimensional drawing of the AQ 4xU/I ST module

Figure A-2 Dimensional drawing of the AQ 4xU/I ST module, side view with open front panel

Parameter data records

B

B.1 Parameter assignment and structure of the parameter data records

Parameter assignment in the user program

The module can be reconfigured in RUN (for example, the voltage or current values of selected channels can be edited in RUN without having an effect on the other channels).

Changing parameters in RUN

Instruction WRREC is used to transfer the parameters by means of data records 64 to 67 to the module. The parameters set in STEP 7 will not be changed in the CPU, which means the parameters set in STEP 7 will be valid after a restart.

Output parameter STATUS

The module ignores errors that occurred during the transfer of parameters with the WRREC instruction and continues operation with the previous parameter assignment. However, a corresponding error code is written to the STATUS output parameter.

The description of the WRREC instruction and the error codes are available in the STEP 7 Online Help.

Assignment of data record and channel

The channel parameters of the module are included in data records 64 to 67 and are assigned as follows:

- Data record 64 for channel 0
- Data record 65 for channel 1
- Data record 66 for channel 2
- Data record 67 for channel 3

Data record structure

The example in the following figure shows the structure of data record 64 for channel 0. The structure of channels 1 to 3 is identical. The values in byte 0 and byte 1 are fixed and may not be changed.

Enable a parameter by setting the corresponding bit to "1".

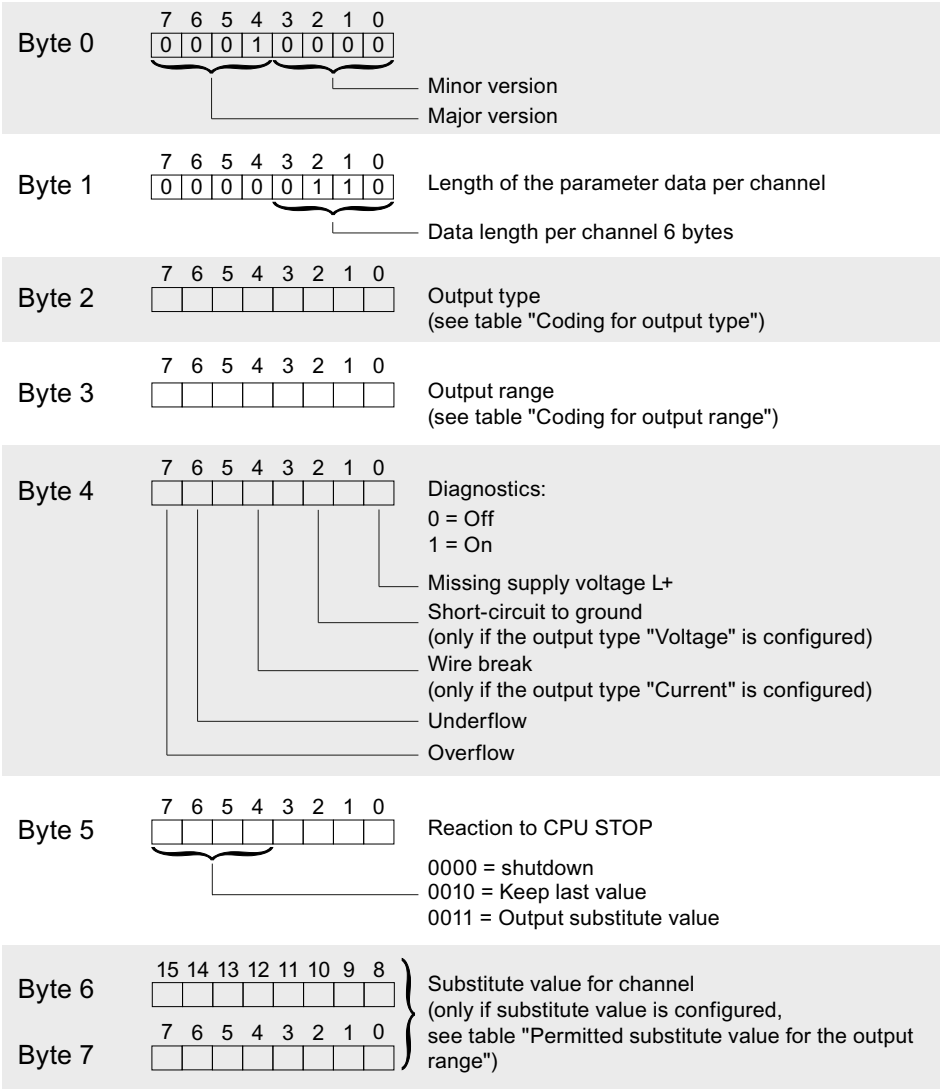

Figure B-1 Structure of data record 64: Bytes 0 to 7

Output type codes

The following table lists all output types of the analog output module along with their codes. Enter these codes at byte 2 of the data record for the corresponding channel (see the previous figure).

Table B- 1 Code for the output type

Output type	Code
Disabled	0000 0000
Voltage	0000 0001
Current	0000 0010

Codes for the output ranges

The following table lists all voltage and current output ranges of the analog output module along with their codes. In each case, enter these codes at byte 3 of the respective data record (see previous figure).

Table B- 2 Output range code

Output range for voltage	Code
1 V to 5 V	0000 0011
0 V to 10 V	0000 0010
±10 V	0000 0000
Output range for current	**Code**
0 to 20 mA	0000 0001
4 to 20 mA	0000 0010
±20 mA	0000 0000

Valid substitute values

The following table lists all output ranges for the valid substitute values. Enter these substitute values at bytes 6 and 7 of the data record for the corresponding channel (see the previous figure). The binary representation of output ranges is available on the Internet in Function Manual Analog value processing for SIMATIC.

Table B- 3 Valid substitute value for the output range

Output range	Valid substitute value
±10 V	-32512 ... +32511
1 V to 5 V	-6912 ... +32511
0 V to 10 V	0 ... +32511
±20 mA	-32512 ... +32511
4 to 20 mA	-6912 ... +32511
0 to 20 mA	0 ... +32511

Representation of analog values

C

Introduction

This appendix describes the analog values for all output ranges supported by the AQ 4xU/I ST analog module.

Measured value resolution

Each analog value is written left aligned to the tags. The bits marked with "x" are set to "0".

Table C- 1 Resolution of the analog values

Resolution in bits including sign	Values		Analog value	
	dec	hex	high byte	low byte
16	1	1_H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

C.1 Representation of output ranges

The tables below set out the digitized representation of the output ranges, separated by bipolar and unipolar input ranges. The resolution is 16 bits.

Table C- 2 Bipolar output ranges

Value dec.	Output value in %	Data word																Range
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Maximum output value*
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Rated range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Undershoot range
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Minimum output value**

* When values > 32511 are specified, the output value is limited to 117.589%.

** When values < -32512 are specified, the output value is limited to -117.593%.

Table C- 3 Unipolar output ranges

Value dec.	Output value in %	Data word																Range
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32511	117.589	0	1	1	1	1	1	1	1	x	x	x	x	x	x	x	x	Maximum output value*
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Rated range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Minimum output value**

* When values > 32511 are specified, the output value is limited to 117.589%.

** When values < 0 are specified, the output value is limited to 0%.

C.2 Representation of analog values in the voltage output ranges

The tables below list the decimal and hexadecimal values (codes) of the possible voltage output ranges.

Table C- 4 Voltage output range ±10 V

Values			Voltage output range	Range
	dec	hex	±10 V	
>117.589 %	>32511	>7EFF	11.76 V	Maximum output value
117.589 %	32511	7EFF	11.76 V	Overshoot range
	27649	6C01		
100 %	27648	6C00	10 V	Rated range
75 %	20736	5100	7.5 V	
0.003617 %	1	1	361.7 µV	
0 %	0	0	0 V	
	-1	FFFF	-361.7 µV	
-75 %	-20736	AF00	-7.5 V	
-100 %	-27648	9400	-10 V	
	-27649	93FF		Undershoot range
-117.593 %	-32512	8100	-11.76 V	
<-117.593 %	<-32512	< 8100	-11.76 V	Minimum output value

Table C- 5 Voltage output range 0 V to 10 V

Values			Voltage output range	Range
	dec	hex	0 V to 10 V	
>117.589 %	>32511	>7EFF	11.76 V	Maximum output value
117.589 %	32511	7EFF	11.76 V	Overshoot range
	27649	6C01		
100 %	27648	6C00	10 V	Rated range
75 %	20736	5100	7.5 V	
0.003617 %	1	1	361.7 µV	
0 %	0	0	0 V	
<0 %	<0	<0	0 V	Minimum output value

Table C- 6 Voltage output range 1 V to 5 V

Values			Voltage output range	Range
	dec	hex	1 V to 5 V	
>117.589 %	>32511	>7EFF	5.70 V	Maximum output value
117.589 %	32511	7EFF	5.70 V	Overshoot range
	27649	6C01		
100 %	27648	6C00	5 V	Rated range
75 %	20736	5100	4 V	
0.003617 %	1	1	1 V +144.7 µV	
0 %	0	0	1 V	
	-1	FFFF	1 V -144.7 µV	Undershoot range
-25 %	-6912	E500	0 V	
<-25 %	<-6912	< E500	0 V	Minimum output value

C.3 Representation of analog values in the current output ranges

The tables below list the decimal and hexadecimal values (codes) of the possible current output ranges.

Table C- 7 Current output range ±20 mA

Values			Current output range	Range
	dec	hex	±20 mA	
>117.589 %	>32511	>7EFF	23.52 mA	Maximum output value
117.589 %	32511	7EFF	23.52 mA	Overshoot range
	27649	6C01		
100 %	27648	6C00	20 mA	Rated range
75 %	20736	5100	15 mA	
0.003617 %	1	1	723.4 nA	
0 %	0	0	0 mA	
	-1	FFFF	-723.4 nA	
-75 %	-20736	AF00	-15 mA	
-100 %	-27648	9400	-20 mA	
	-27649	93FF		Undershoot range
-117.593 %	-32512	8100	-23.52 mA	
<-117.593 %	<-32512	<8100	-23.52 mA	Minimum output value

Table C- 8 Current output range 0 to 20 mA

Values			Current output range	Range
	dec	hex	0 mA to 20 mA	
>117.589 %	>32511	>7EFF	23.52 mA	Maximum output value
117.589 %	32511	7EFF	23.52 mA	Overshoot range
	27649	6C01		
100 %	27648	6C00	20 mA	Rated range
75 %	20736	5100	15 mA	
0.003617 %	1	1	723.4 nA	
0 %	0	0	0 mA	
<0 %	<0	<0	0 mA	Minimum output value

Table C- 9 Current output range 4 to 20 mA

Values			Current output range	Range
	dec	hex	4 mA to 20 mA	
>117.589 %	>32511	>7EFF	22.81 mA	Maximum output value
117.589 %	32511	7EFF	22.81 mA	Overshoot range
	27649	6C01		
100 %	27648	6C00	20 mA	Rated range
75 %	20736	5100	16 mA	
0.003617 %	1	1	4 mA	
0 %	0	0	4 mA	
	-1	FFFF		Undershoot range
-25 %	-6912	E500	0 mA	
<-25 %	<-6912	<E500	0 mA	Minimum output value