SIEMENS

SIMATIC

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

Manual

Answers for industry.

SIEMENS

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

Manual

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Legal information

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This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Purpose of the documentation

This manual supplements the system manuals:

- S7-1500 Automation System
- ET 200MP Distributed I/O System

Functions that relate in general to the systems are described in these manuals.

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

Changes compared to previous version

Changes described in this manual, compared to the previous version:

- Module integrated in hardware catalog STEP 7 (TIA Portal) V13, Update 3 or higher with the functions:
  - Module-internal shared output (MSO) for Shared Device
  - Configurable submodules, e.g., for Shared Device
- Appendix Open Source Software amended

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

A note contains important information regarding the product described in the documentation or its handling, or draws special attention to a section of the documentation.

Security information

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Open Source Software

Open-source software is used in the firmware of the product described. Open Source Software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open source software over and above the intended program sequence, or for any faults caused by modifications to the software.
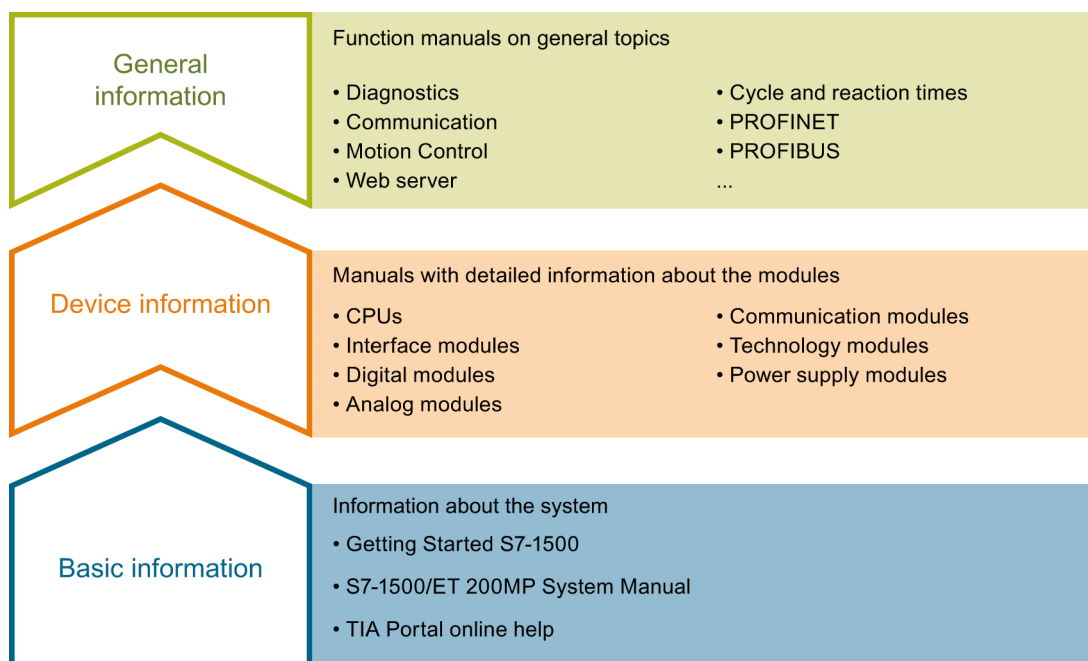
For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information relating to this in the appendix.

Table of contents

Documentation guide

<div style="text-align: right; font-size: 3em;">1</div>

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.

General information	Function manuals on general topics	
	• Diagnostics	• Cycle and reaction times
	• Communication	• PROFINET
	• Motion Control	• PROFIBUS
	• Web server	...

Device information	Manuals with detailed information about the modules	
	• CPUs	• Communication modules
	• Interface modules	• Technology modules
	• Digital modules	• Power supply modules
	• Analog modules	

Basic information	Information about the system
	• Getting Started S7-1500
	• S7-1500/ET 200MP System Manual
	• TIA Portal online help

Basic information

System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

Device information

Manuals contain a compact description of the module-specific information, such as properties, terminal diagrams, characteristics, technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC S7-1500 and ET 200MP systems, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (http://www.automation.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-controllers/Pages/Default.aspx).

Changes and supplements to the manuals are documented in a Product Information.

Manual Collection S7-1500 / ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (http://support.automation.siemens.com/WW/view/en/86140384).

My Documentation Manager

The My Documentation Manager is used to combine entire manuals or only parts of these to your own manual.
You can export the manual as PDF file or in a format that can be edited later.

You can find the My Documentation Manager on the Internet (http://support.automation.siemens.com/WW/view/en/38715968).

Applications & Tools

Applications & Tools supports you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus in individual products.

You can find Applications & Tools on the Internet (http://support.automation.siemens.com/WW/view/en/20208582).

CAx Download Manager

The CAx Download Manager is used to access the current product data for your CAx or CAe systems.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- Manuals, characteristics, operating manuals, certificates
- Product master data

You can find the CAx Download Manager on the Internet (http://support.automation.siemens.com/WW/view/en/42455541).

Product overview

<div style="text-align:right; font-size:3em;">2</div>

2.1   Properties

Article number
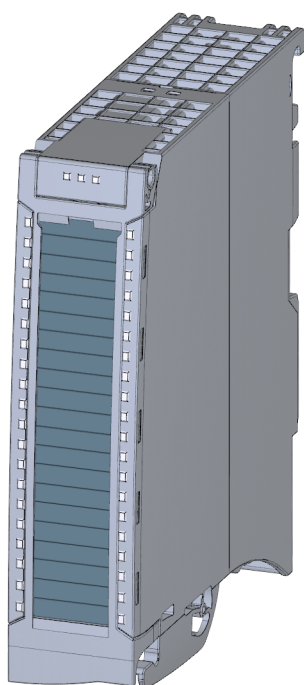
6ES7532-5HD00-0AB0

View of the module

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

Properties

The module has the following technical properties:

- 4 analog outputs
- Selection of channels for voltage output
- Selection of channels for current output
- Resolution: 16 bits including sign
- Configurable diagnostics (per channel)

The module supports the following functions:

Table 2- 1   Version dependencies of the module functions

Function	Firmware version of the module	Configuration software	
		STEP 7 (TIA Portal)	GSD file in STEP 7 (TIA Portal) V12 or higher, or STEP 7 V5.5 SP3 or higher
Firmware update	V1.0.0 or higher	V12 or higher	X
Identification data I&M0 to I&M3	V1.0.0 or higher	V12 or higher	X
Parameter assignment in RUN	V1.0.0 or higher	V12 or higher	X
Calibration in runtime	V1.0.0 or higher	V12 or higher	X
Module-internal Shared Output (MSO)	V2.0.0 or higher	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
Configurable submodules / submodules for Shared Device	V2.0.0 or higher	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
Configurable after interface module IM 155-5 DP ST	V2.0.0 or higher	V13 or higher	X

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

Accessories

The following accessories are supplied with the module and can also be ordered separately 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

You can find more information on accessories in the S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual and the ET 200MP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/59193214) system manual.

Wiring

3

This section contains the block diagram of the module and outlines various connection 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.
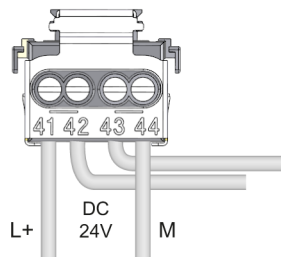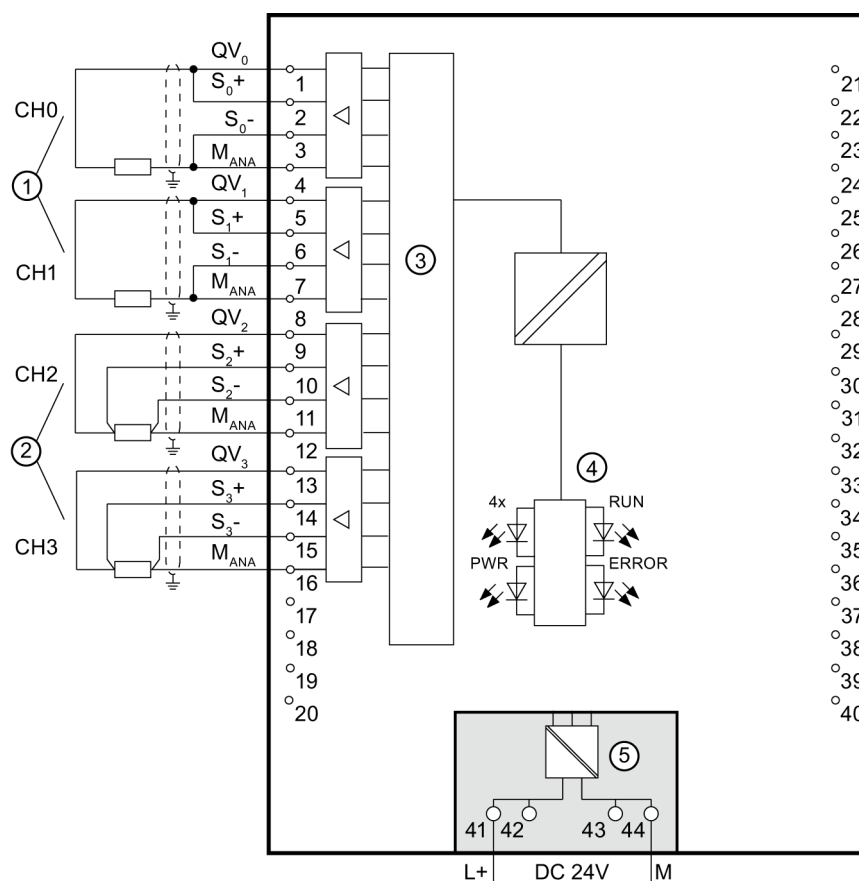

Figure 3-1   Power supply element wiring

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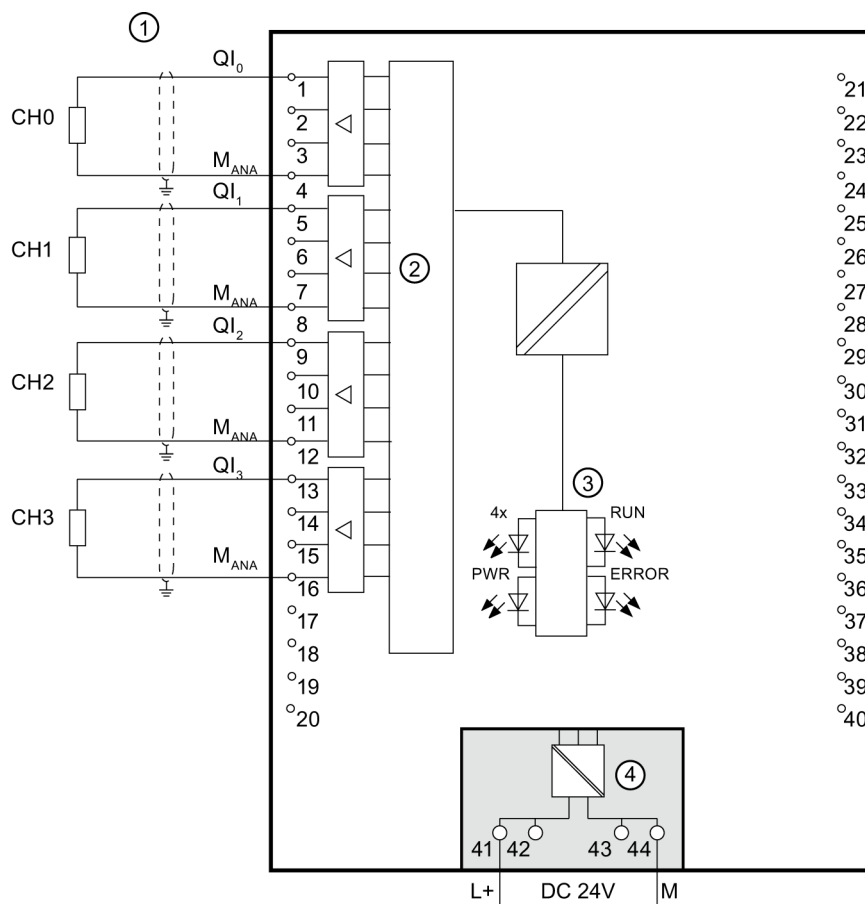
① Load on current outputs
② Digital Analog Converter (DAC)
③ Backplane bus interface
④ Power via supply module

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

Parameters/address space

<div style="text-align: right; font-size: 3em;">4</div>

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 37).

4.2 Parameters

AQ 4xU/I ST parameters

When you assign the module parameters in STEP 7, you use various parameters to specify the module properties. The following table lists the configurable parameters. The effective range of the configurable parameters depends on the type of configuration. The following configurations are possible:

● Central operation with a S7-1500 CPU

● Distributed operation on PROFINET IO in an ET 200MP system

● Distributed operation on PROFIBUS DP in an ET 200MP system

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 33)

Table 4- 2   Configurable parameters and their defaults

Parameters	Range of values	Default setting	Parameter as-signment in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics					
● Missing supply voltage L+	Yes/No	No	Yes	Channel*	Module**
● Wire break	Yes/No	No	Yes	Channel	Module**
● Short circuit to M	Yes/No	No	Yes	Channel	Module**
● Underflow	Yes/No	No	Yes	Channel	Module**
● Overflow	Yes/No	No	Yes	Channel	Module**
Output					
● Output type	Current/voltage	Voltage	Yes	Channel	Channel
● Output range	See chapter Output ranges (Page 15)	±10 V	Yes	Channel	Channel
● Reaction to CPU STOP	● Turn off ● Keep last value ● Output sub-stitute value	Turn off	Yes	Channel	Channel
● Substitute value	See Table B-4 Valid substitute value for the output range (Page 36)	0	Yes	Channel	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.

** You can set the effective range of the diagnostics for each channel in the user program with data records 64 to 67.

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

The module can be configured differently in STEP 7; see following table. Depending on the configuration, additional/different addresses are assigned in the process image of the outputs/inputs.

Configuration options of AQ 4xU/I ST

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

When you configure the module by means of the GSD file, the configurations are available under different abbreviations/module names.

The following configurations are possible:

Table 4- 3   Configuration options

Configuration	Abbrevia-tion/module name in the GSD file	Configuration software, e.g., with STEP 7 (TIA Portal)	
		Integrated in hardware cata-log STEP 7 (TIA Portal)	GSD file in STEP 7 (TIA Portal) V12 or higher or STEP 7 V5.5 SP3 or higher
1 x 4-channel without value status	AQ 4xU/I ST	V12 or higher	X
1 x 4-channel with value status	AQ 4xU/I ST QI	V12 or higher	X
4 x 1-channel without value status	AQ 4xU/I ST S	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
4 x 1-channel with value status	AQ 4xU/I ST S QI	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
1 x 4-channel with value status for module-internal Shared Output with up to 4 sub-modules	AQ 4xU/I ST MSO	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)

Value status (Quality Information, QI)

The value status is always activated for the following module names:

- AQ 4xU/I ST QI
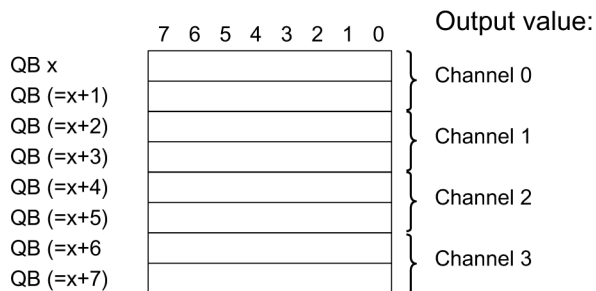- AQ 4xU/I ST S QI
- AQ 4xU/I ST MSO

An additional bit is assigned to each channel for the value status. The bit for the value status indicates if the output value specified by the user program is actually pending at the module terminal (0 = value is incorrect).

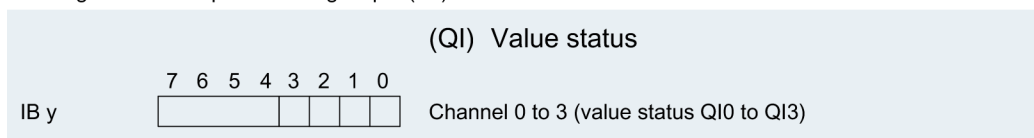## Address space of the AQ 4xU/I ST

The following figure shows the address space allocation for the configuration as 4-channel module. You can freely assign the start address for the module. The addresses of the channels are derived from the start address.

"QB x" represents the module start address output byte x.

Assignment in the process image output (PIQ)

Output value:

	7 6 5 4 3 2 1 0	
QB x		} Channel 0
QB (=x+1)		
QB (=x+2)		} Channel 1
QB (=x+3)		
QB (=x+4)		} Channel 2
QB (=x+5)		
QB (=x+6		} Channel 3
QB (=x+7)		

Assignment in the process image input (PII)

(QI) Value status

	7 6 5 4 3 2 1 0	
IB y		Channel 0 to 3 (value status QI0 to QI3)

0= read in value at channel is incorrect

Figure 4-1   Address space for configuration as 1 x 4-channel AQ 4xU/I ST with value status

Address space for configuration as 4 x 1-channel AQ 4xU/I ST S QI

For the configuration as a 4 x 1-channel module, the channels of the module are divided into multiple submodules. The submodules can be assigned to different IO controllers when the module is used in a shared device.

The number of usable submodules is dependent on the interface module used. Observe the information in the manual for the particular interface module.

Contrary to the 1 x 4-channel module configuration, each of the four submodules has a freely assignable start address.

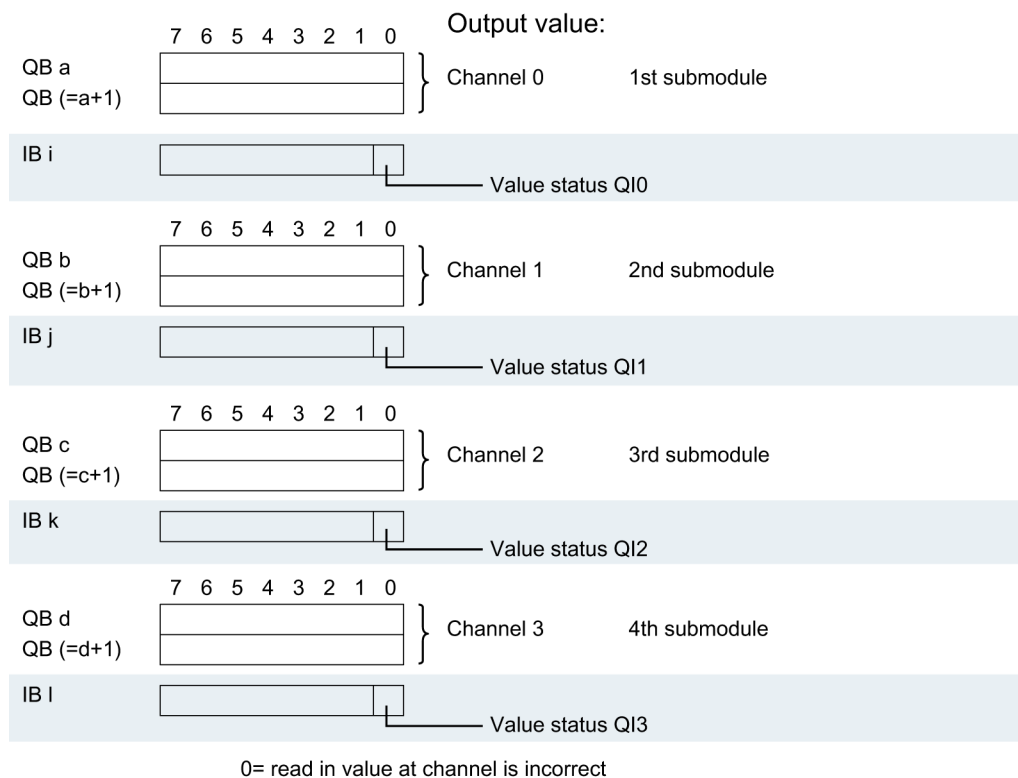Figure 4-2   Address space for configuration as 4 x 1-channel AQ 4xU/I ST S QI with value status

Address space for configuration as 1 x 4-channel AQ 4xU/I ST MSO

For the configuration as a 1 x 4-channel module (module-internal shared output, MSO), channels 0 to 3 of the module are copied to multiple submodules. Channels 0 to 3 are then available with identical values in various submodules. These submodules can be assigned to up to four IO controllers when the module is used in a shared device.

● The IO controller to which submodule 1 is assigned has write access to outputs 0 to 3.

● The IO controllers to which submodule 2, 3, or 4 is assigned have read access to outputs 0 to 3.

The number of usable submodules is dependent on the interface module used. Please observe the information in the manual for the particular interface module.

Value status (Quality Information, QI)

The meaning of the value status depends on the submodule on which it occurs.

For the first submodule (=basic submodule), the value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.
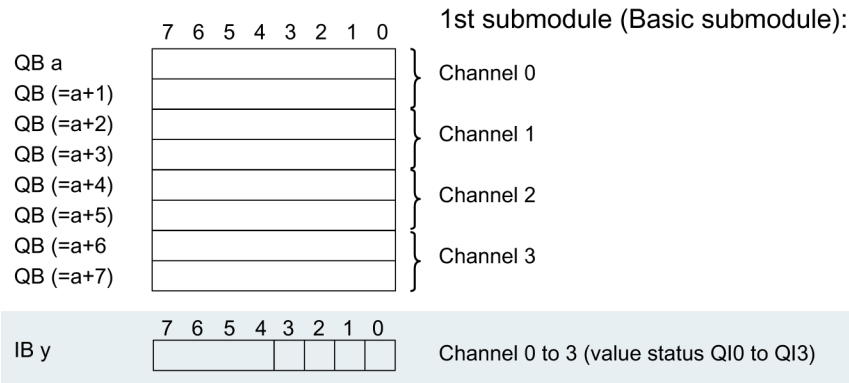
For the 2nd to 4th submodule (=MSO submodule), the value status 0 indicates that the value is incorrect or one of the following errors has occurred:

● The basic submodule is not yet configured (not ready).

● The connection between the IO controller and the basic submodule has been interrupted.

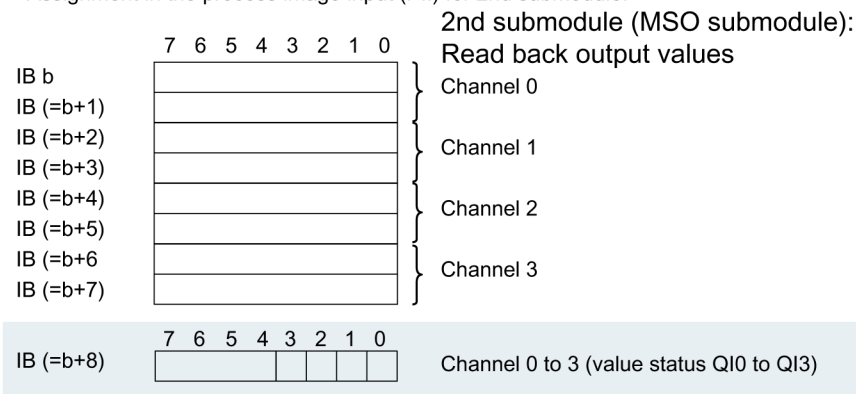● The IO controller of the basic submodule is in STOP or POWER OFF state.

The following figure shows the assignment of the address space with submodules 1 and 2.

Assignment in the process image output (PIQ) and input (PII) for 1st submodule:

1st submodule (Basic submodule):

	7 6 5 4 3 2 1 0	
QB a		Channel 0
QB (=a+1)		
QB (=a+2)		Channel 1
QB (=a+3)		
QB (=a+4)		Channel 2
QB (=a+5)		
QB (=a+6)		Channel 3
QB (=a+7)		

	7 6 5 4 3 2 1 0	
IB y		Channel 0 to 3 (value status QI0 to QI3)

Assignment in the process image input (PII) for 2nd submodule:

2nd submodule (MSO submodule):
Read back output values

	7 6 5 4 3 2 1 0	
IB b		Channel 0
IB (=b+1)		
IB (=b+2)		Channel 1
IB (=b+3)		
IB (=b+4)		Channel 2
IB (=b+5)		
IB (=b+6)		Channel 3
IB (=b+7)		

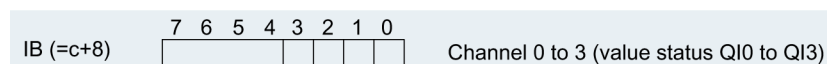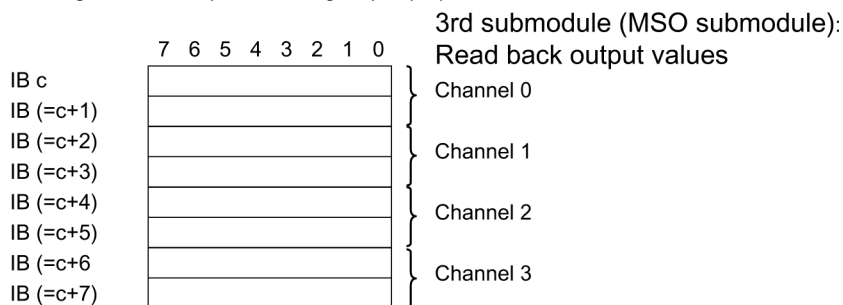|	7 6 5 4 3 2 1 0	
IB (=b+8)		Channel 0 to 3 (value status QI0 to QI3)

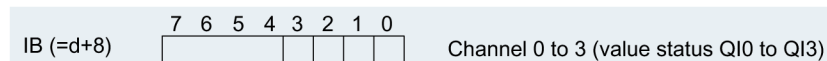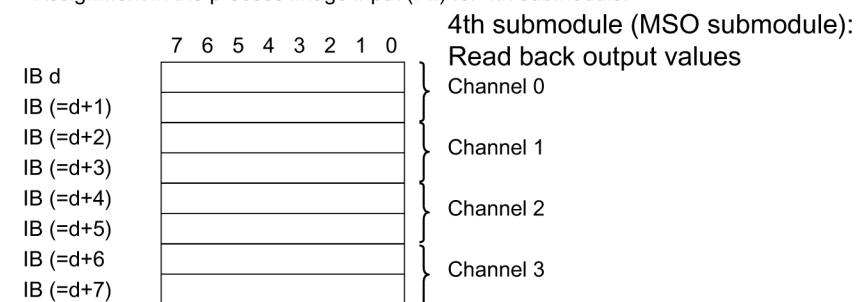0= read in value at channel is incorrect

Figure 4-3   Address space for configuration as 1 x 4-channel AQ 4xU/I ST MSO with value status

The following figure shows the assignment of the address space with submodules 3 and 4.

Assignment in the process image input (PII) for 3rd submodule:

3rd submodule (MSO submodule):
Read back output values

```
        7  6  5  4  3  2  1  0
IB c    ┌─────────────────────┐  ┐
IB (=c+1)│                    │  ├ Channel 0
        ├─────────────────────┤  ┘
IB (=c+2)│                    │  ┐
IB (=c+3)│                    │  ├ Channel 1
        ├─────────────────────┤  ┘
IB (=c+4)│                    │  ┐
IB (=c+5)│                    │  ├ Channel 2
        ├─────────────────────┤  ┘
IB (=c+6)│                    │  ┐
IB (=c+7)│                    │  ├ Channel 3
        └─────────────────────┘  ┘
```

```
            7  6  5  4  3  2  1  0
IB (=c+8)   ┌──────────┬──┬──┬──┬──┐
            │          │  │  │  │  │    Channel 0 to 3 (value status QI0 to QI3)
            └──────────┴──┴──┴──┴──┘
```

Assignment in the process image input (PII) for 4th submodule:

4th submodule (MSO submodule):
Read back output values

```
        7  6  5  4  3  2  1  0
IB d    ┌─────────────────────┐  ┐
IB (=d+1)│                    │  ├ Channel 0
        ├─────────────────────┤  ┘
IB (=d+2)│                    │  ┐
IB (=d+3)│                    │  ├ Channel 1
        ├─────────────────────┤  ┘
IB (=d+4)│                    │  ┐
IB (=d+5)│                    │  ├ Channel 2
        ├─────────────────────┤  ┘
IB (=d+6)│                    │  ┐
IB (=d+7)│                    │  ├ Channel 3
        └─────────────────────┘  ┘
```

```
            7  6  5  4  3  2  1  0
IB (=d+8)   ┌──────────┬──┬──┬──┬──┐
            │          │  │  │  │  │    Channel 0 to 3 (value status QI0 to QI3)
            └──────────┴──┴──┴──┴──┘
```

0= read in value at channel is incorrect

Figure 4-4   Address space for configuration as 1 x 4-channel AQ 4xU/I ST MSO with value status

Interrupts/diagnostics alarms 5

5.1 Status and error displays

LED displays

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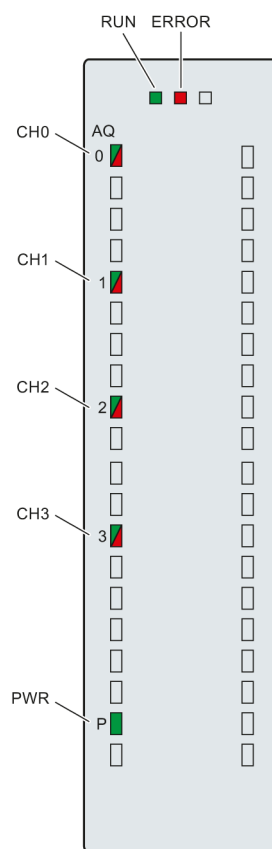

Figure 5-1   LED displays of the module AQ 4xU/I ST

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic reports can be found in chapter Diagnostics alarms (Page 27).

RUN and ERROR LED

Table 5- 1 Status and error displays RUN and 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 (at least one error at one channel, e.g., wire break).	Evaluate the diagnostics data and eliminate the error (e.g., wire break).
☼ Flashes	☼ Flashes	Hardware defective	Replace the module.

PWR LED

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	---

CHx LED

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 Diagnostics alarms

A diagnostics alarm is output for each diagnostics event and the ERROR LED flashes on the module. 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.

If the module is operated distributed with PROFIBUS DP in an ET 200MP system, you have the option to read out diagnostics data with the instruction RDREC or RD_REC using data record 0 and 1. The structure of the data records is available on the Internet in the "Manual for interface module IM 155-5 DP ST (6ES7155-5BA00-0AB0)".

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

Diagnostics alarm	Error code	Meaning	Remedy
Short-circuit to ground	1_H	Overload at output	Eliminate overload
		Short-circuit of output Q_V to M_{ANA}	Eliminate the short-circuit
Wire break	6_H	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_H	The output value set by the user program exceeds the valid rated range/overshoot range.	Correct the output value
Underflow	8_H	The output value set by the user program undershoots the valid rated range/undershoot range.	Correct the output value
Load voltage missing	11_H	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module

Technical specifications

<div style="text-align: right; font-size: 3em;">6</div>

Technical specifications of the AQ 4xU/I ST

	6ES7532-5HD00-0AB0
Product type designation	AQ 4xU/I ST
General information	
Hardware version	E01
Firmware version	V2.0.0
Product function	
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 / -
Operating mode	
MSO	Yes
CiR Configuration in RUN	
Parameter assignment in RUN possible	Yes
Calibration in RUN possible	Yes
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 the 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 V 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	
Cable length shielded, max.	800 m; for current, 200 m for voltage
Analog value formation	
Integration and conversion time / resolution per channel	
Resolution with overrange (bit including sign), max.	16 bit
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 %
Operational limit in overall 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 %

	6ES7532-5HD00-0AB0
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; only for output type current
Short-circuit	Yes; only for output type voltage
Overflow/underflow	Yes
Diagnostics indicator 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 isolation)
between S- and MANA (UCM)	+/- 8 V
Isolation	
Isolation tested with	707 V DC (type test)
Distributed mode	
Prioritized startup	No
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.
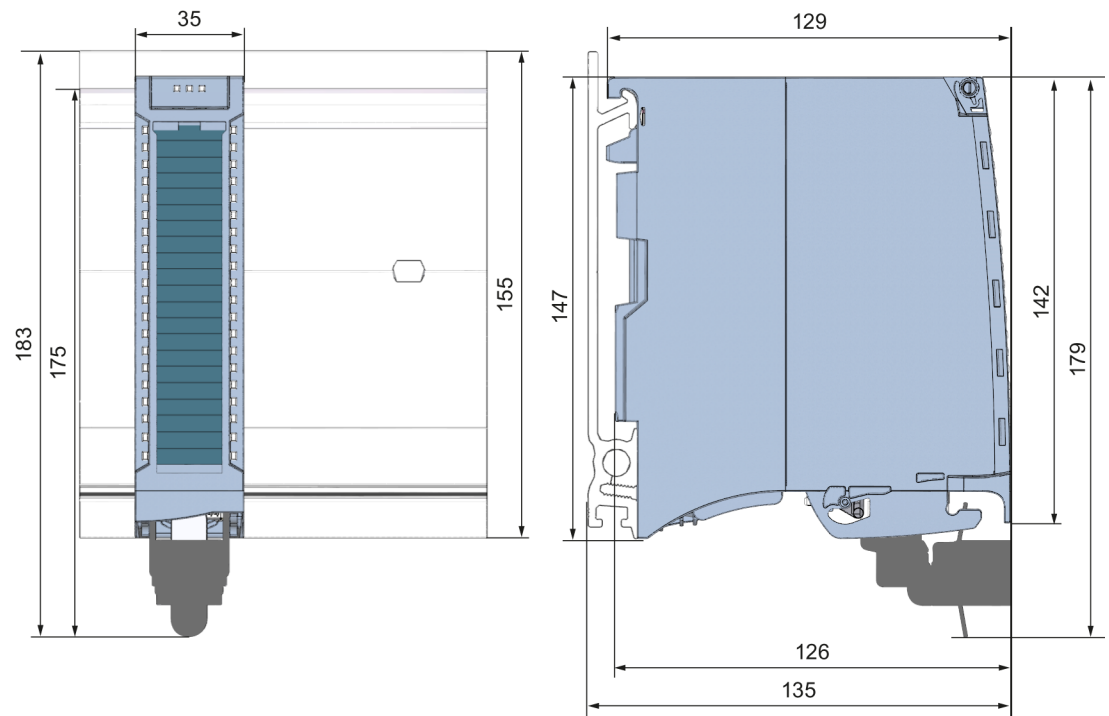

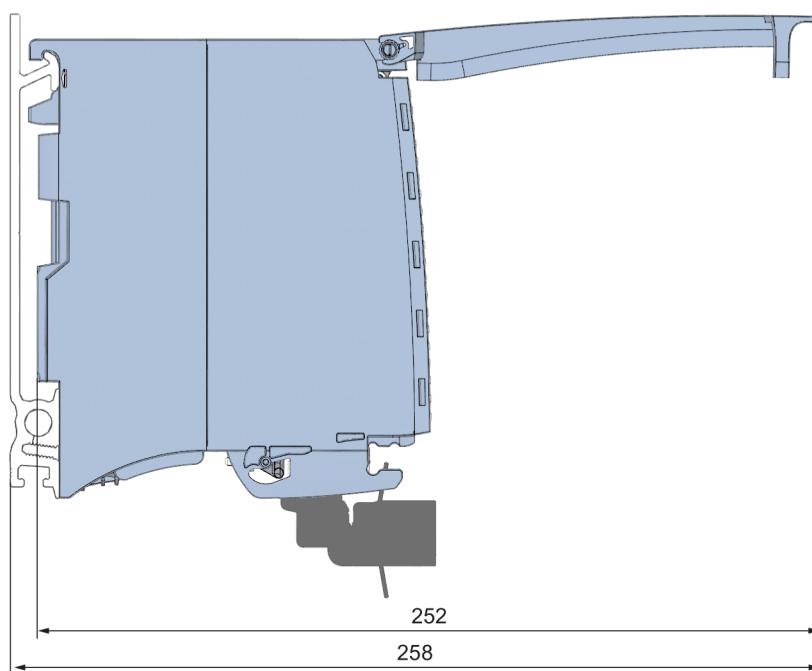Figure A-1   Dimensional drawing of the AQ 4xU/I ST module

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

Parameter data records

<div style="text-align: right; font-size: 2em;">B</div>

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

The data records of the module have an identical structure, regardless of whether you configure the module with PROFIBUS DP or PROFINET IO.

Dependencies for configuration with GSD file

When configuring the module with a GSD file, remember that the settings of some parameters are dependent on each other. The parameters are only checked for plausibility by the module after the transfer to the module.

The following table lists the parameters that depend on one another.

Table B- 1   Dependencies of parameters for configuration with GSD file

Device-specific parameters (GSD file)	Dependent parameters
Short circuit to M	With **output type** voltage only
Wire break	With **output type** current only
Substitute value	Only if **Reaction to CPU STOP -> Output substitute value** is configured

Parameter assignment in the user program

You have the option to assign module parameters in RUN (e.g., the voltage or current values of selected channels can be edited in RUN without having an effect on the other channels).

Parameter assignment in RUN

The WRREC instruction is used to transfer the parameters to the module using data records 64 to 67. The parameters set in STEP 7 do not change in the CPU, which means the parameters set in STEP 7 are still valid after a restart.

The parameters are only checked for plausibility by the module after the transfer to the module.

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 is available in the STEP 7 online help.

Operation of the module behind a PROFIBUS DP interface module

If the module is operated behind a PROFIBUS DP interface module, the parameter data records 0 and 1 are not read back. You get the diagnostics data records 0 and 1 for the read back parameter data records 0 and 1. You can find more information in the Interrupts section of the PROFIBUS DP interface module device manual on the Internet (http://support.automation.siemens.com/WW/view/en/78324181).

Assignment of data record and channel

The channel parameters in data records 64 to 67 are available for 1x 4-channel configuration 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

For configuration 4 x 1-channel, the module has 4 submodules with one channel each. The parameters for the channel are available in data record 64 and are assigned as follows:

- Data record 64 for channel 0 (submodule 1)

- Data record 64 for channel 1 (submodule 2)

- Data record 64 for channel 2 (submodule 3)

- Data record 64 for channel 3 (submodule 4)

Address the respective submodule for data record transfer.

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.

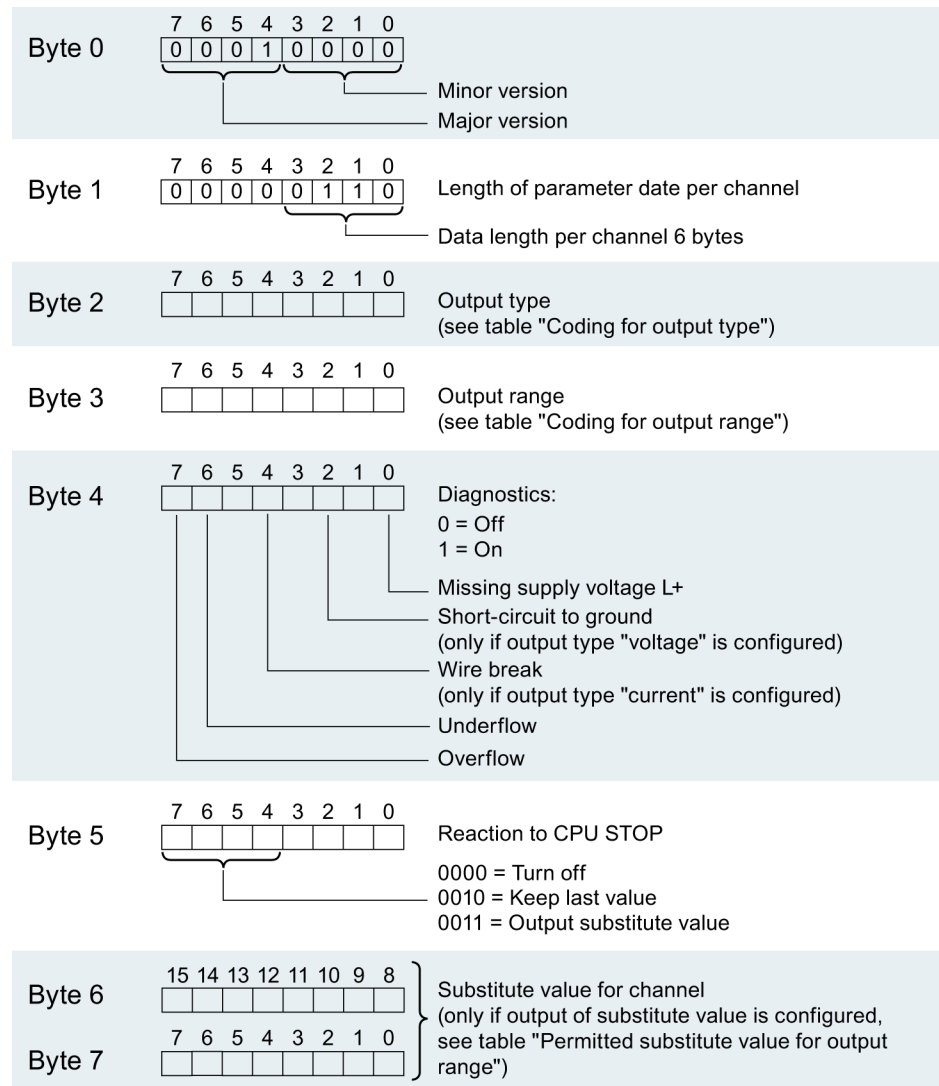Enable a parameter by setting the corresponding bit to "1".

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- 2   Code for the output type

Output type	Code
Deactivated	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- 3   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 mA to 20 mA	0000 0001
4 mA 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- 4   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 mA to 20 mA	-6912 ... +32511
0 mA to 20 mA	0 ... +32511

Representation of analog values

<div style="text-align: right; font-size: 2em;">C</div>

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 digitalized representation of the output ranges by bipolar and unipolar range. 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	
75 %	20736	5100	15 mA	
0.003617 %	1	1	723.4 nA	Rated range
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	
75 %	20736	5100	16 mA	
0.003617 %	1	1	4 mA	Rated range
0 %	0	0	4 mA	
	-1	FFFF		Undershoot range
-25 %	-6912	E500	0 mA	
<-25 %	<-6912	<E500	0 mA	Minimum output value

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