

SIEMENS



Manual

SIMATIC

S7-1500 / ET 200MP

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

Edition

08/2018

support.industry.siemens.com

SIEMENS

SIMATIC

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

Manual

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

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Disclaimer of Liability

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 manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

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

Compared to the previous version, this manual contains the following changes:

- New licensing conditions and copyright information of the Open Source Software
- New technical specifications

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 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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Open Source Software

Open-source software is used in the firmware of the I/O modules. 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.

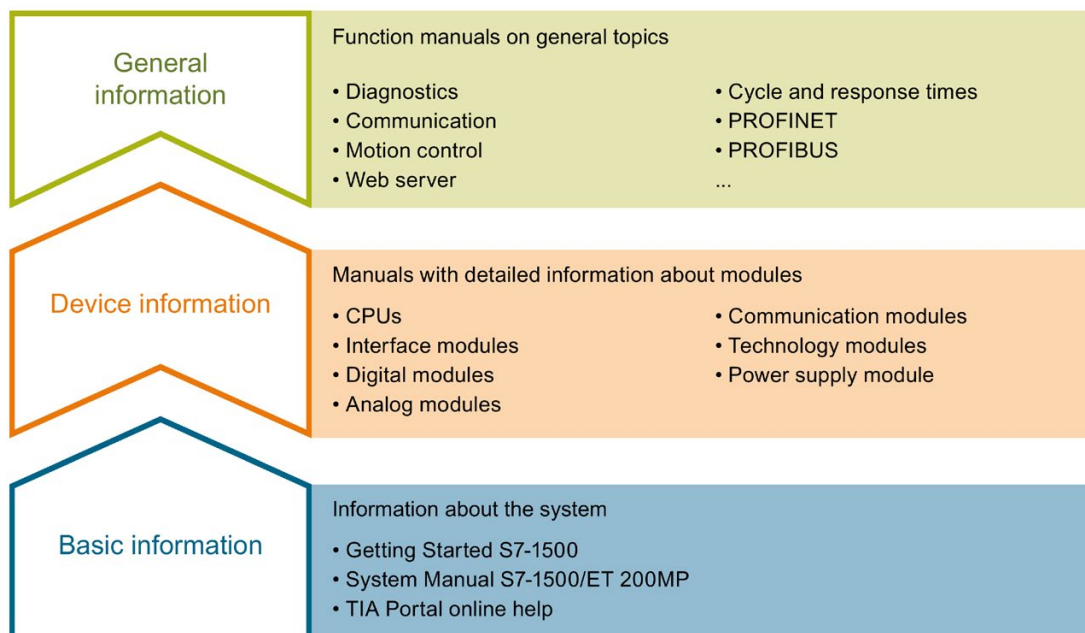
For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information relating to this on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109757558>).

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Documentation guide

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.



Basic information

The 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

Product manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and 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, OPC UA.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742691>).

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

You can download the product information free of charge from the Internet (<https://support.industry.siemens.com/cs/us/en/view/68052815>).

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 (<https://support.industry.siemens.com/cs/ww/en/view/86140384>).

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

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You must register once to use the full functionality of "mySupport".

You can find "mySupport" on the Internet (<https://support.industry.siemens.com/My/ww/en>).

"mySupport" - Documentation

In the Documentation area in "mySupport" you can 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 "mySupport" - Documentation on the Internet (<http://support.industry.siemens.com/My/ww/en/documentation>).

"mySupport" - CAx data

In the CAx data area in "mySupport", you can access the current product data for your CAx or CAe system.

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 "mySupport" - CAx data on the Internet (<http://support.industry.siemens.com/my/ww/en/CAxOnline>).

Application examples

The application examples support 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 on individual products.

You will find the application examples on the Internet (<https://support.industry.siemens.com/sc/ww/en/sc/2054>).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).

This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet (<http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool>).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independent of the TIA Portal.

General function overview:

- Network browsing and creation of a table showing the accessible devices in the network.
- Flashing of device LEDs or HMI display to locate a device
- Downloading of addresses (IP, subnet, gateway) to a device
- Downloading the PROFINET name (station name) to a device
- Placing a CPU in RUN or STOP mode
- Setting the time in a CPU to the current time of your PG/PC
- Downloading a new program to a CPU or an HMI device
- Downloading from CPU, downloading to CPU or deleting recipe data from a CPU
- Downloading from CPU or deleting data log data from a CPU
- Backup/restore of data from/to a backup file for CPUs and HMI devices
- Downloading service data from a CPU
- Reading the diagnostics buffer of a CPU
- Performing a CPU memory reset
- Resetting devices to factory settings
- Downloading a firmware update to a device

You can find the SIMATIC Automation Tool on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/98161300>).

PRONETA

With SIEMENS PRONETA (PROFINET network analysis), you analyze the PROFINET network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET network and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a system.

You can find SIEMENS PRONETA on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/67460624>).

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and optimal exploitation of resources

You can find SINETPLAN on the Internet (<https://www.siemens.com/sinetplan>).

Product overview

2.1 Properties

Article number

6ES7532-5HD00-0AB0

View of the module

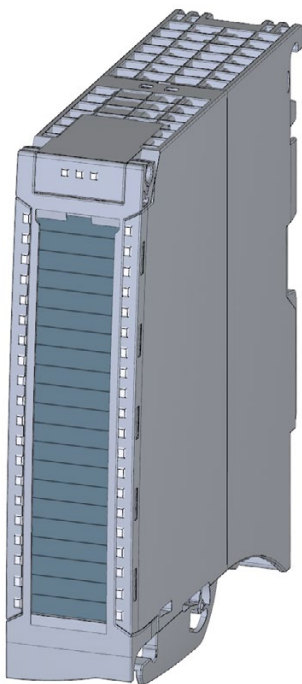


Figure 2-1 View of the AQ 4xU/I ST module

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.

Compatibility

The following table shows the compatibility of the modules and the dependencies between hardware functional status (FS) and firmware version (FW) used:

Hardware functional status	Firmware version	Note
FS01	V1.0.0 to V2.0.x	Upgrade to downgrade possible between V1.0.0 and V2.0.x
FS02	V1.0.0 to V2.0.x	
FS03	V2.1.0	No upgrade or downgrade possible
FS04	V2.2.0 or higher	Upgrade and downgrade possible between V2.2.0 and higher

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 can be ordered separately:

Front connectors, including potential jumpers and cable ties

You can find additional information on accessories in the system manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Wiring

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

You can find information on wiring the front connector, creating a cable shield, etc. in the Wiring section of the system manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Note

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

Do not insert the potential jumpers supplied with the front connector.

Abbreviations used

QV_n	Voltage output channel
QI_n	Current output channel
S_n+/S_n-	Sense line channel
L+	Connection for supply voltage
M	Ground connection
M_{ANA}	Reference potential of the analog circuit

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.

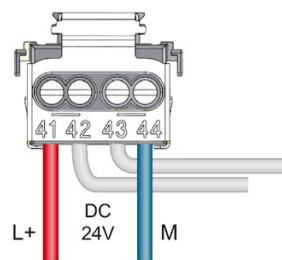
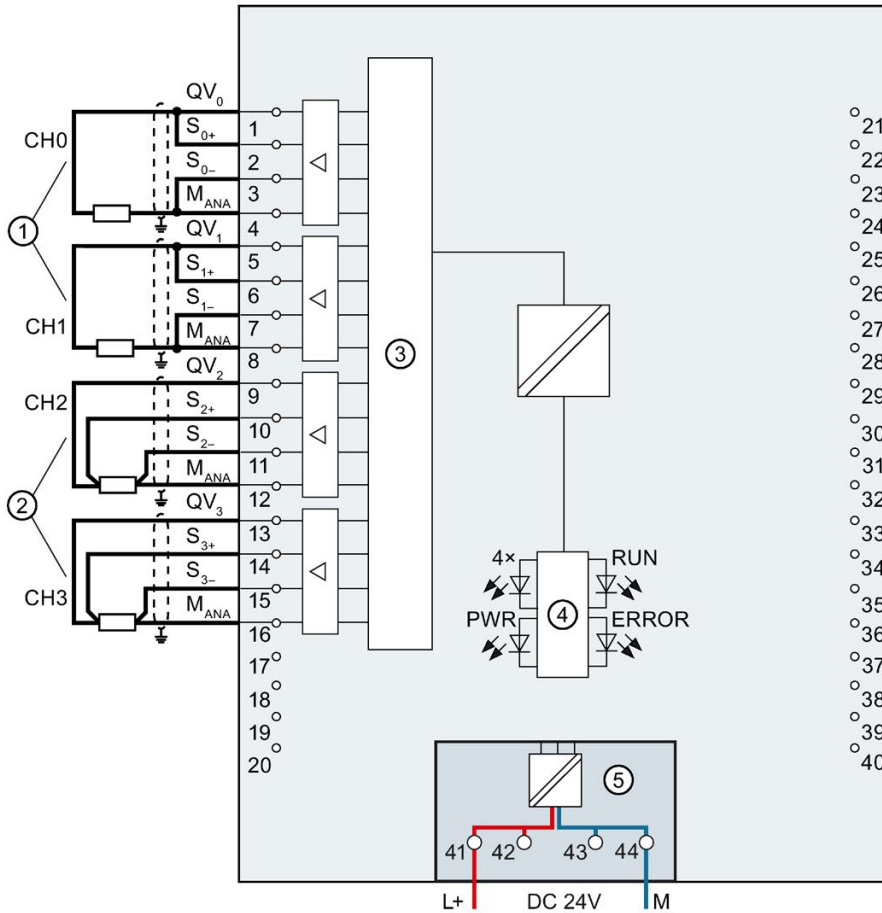


Figure 3-1 Power supply element wiring

Block diagram and pin 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.

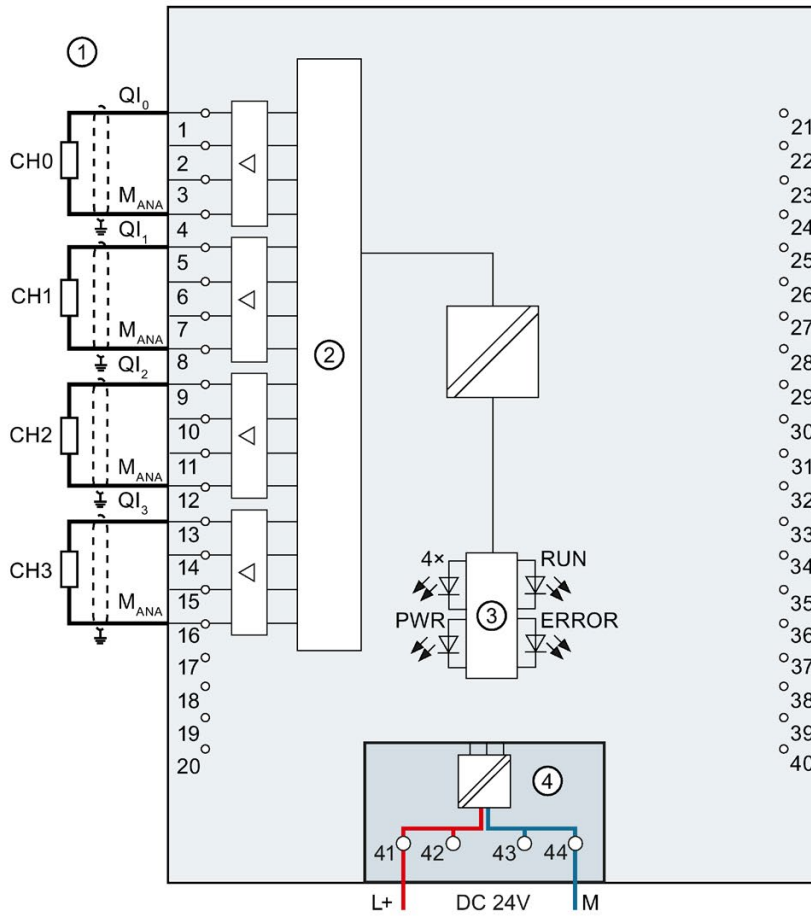


- | | | |
|---|-------|---|
| ① 2-wire connection (jumper at the front connector) | CHx | Channel or 4 x channel status (green/red) |
| ② 4-wire connection | RUN | Status display LED (green) |
| ③ Digital-to-analog converter (DAC) | ERROR | Error display LED (red) |
| ④ Backplane bus interface | PWR | LED for power supply (green) |
| ⑤ Supply voltage via power supply module | | |

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

Block diagram and pin assignment for the current output

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



- | | | |
|--|-------|---|
| ① Load on current outputs | CHx | Channel or 4 x channel status (green/red) |
| ② Digital-to-analog converter (DAC) | RUN | Status display LED (green) |
| ③ Backplane bus interface | ERROR | Error display LED (red) |
| ④ Supply voltage via power supply module | PWR | LED for power supply (green) |

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

Parameters/address space

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	Representation of analog values
Voltage	1 V to 5 V 0 V to 10 V ± 10 V	See Representation of analog values in the voltage output ranges (Page 41)
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	See Representation of analog values in the current output ranges (Page 43)
Disabled	-	-

The tables of the output ranges, overflow, overrange, etc. are provided in the appendix Representation of analog values (Page 39).

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 35)

Table 4- 2 Configurable parameters and their defaults

Parameters	Range of values	Default setting	Parameter assignment 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**

4.2 Parameters

Parameters	Range of values	Default setting	Parameter assignment in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Output					
• Output type	Current/voltage	Voltage	Yes	Channel	Channel
• Output range	See chapter Output ranges (Page 16)	±10 V	Yes	Channel	Channel
• Reaction to CPU STOP	<ul style="list-style-type: none"> • Turn off • Keep last value • Output substitute value 	Turn off	Yes	Channel	Channel
• Substitute value	See Table B-4 Valid substitute value for the output range (Page 38)	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	Abbreviation/module name in the GSD file	Configuration software, e.g., with STEP 7 (TIA Portal)	
		Integrated in hardware catalog 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" stands, for example, for the module start address output byte x.

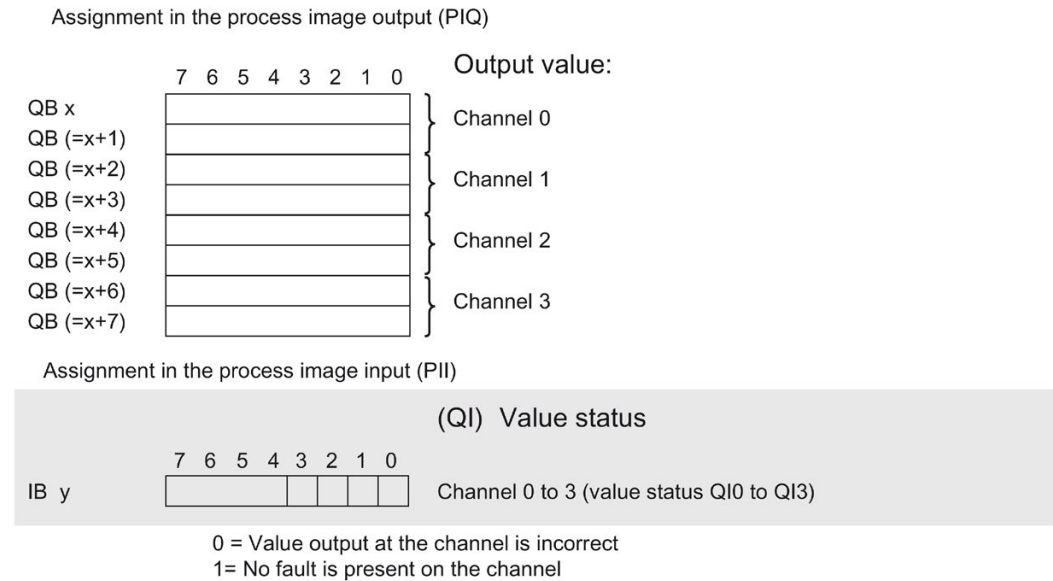


Figure 4-1 Address space for configuration as 1 x 4-channel AQ 4xU/I ST with value status

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 IO controllers depends on the interface module used. Observe the information in the manual for the particular interface module.

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

Assignment in process image output (PIQ) and input (PII)

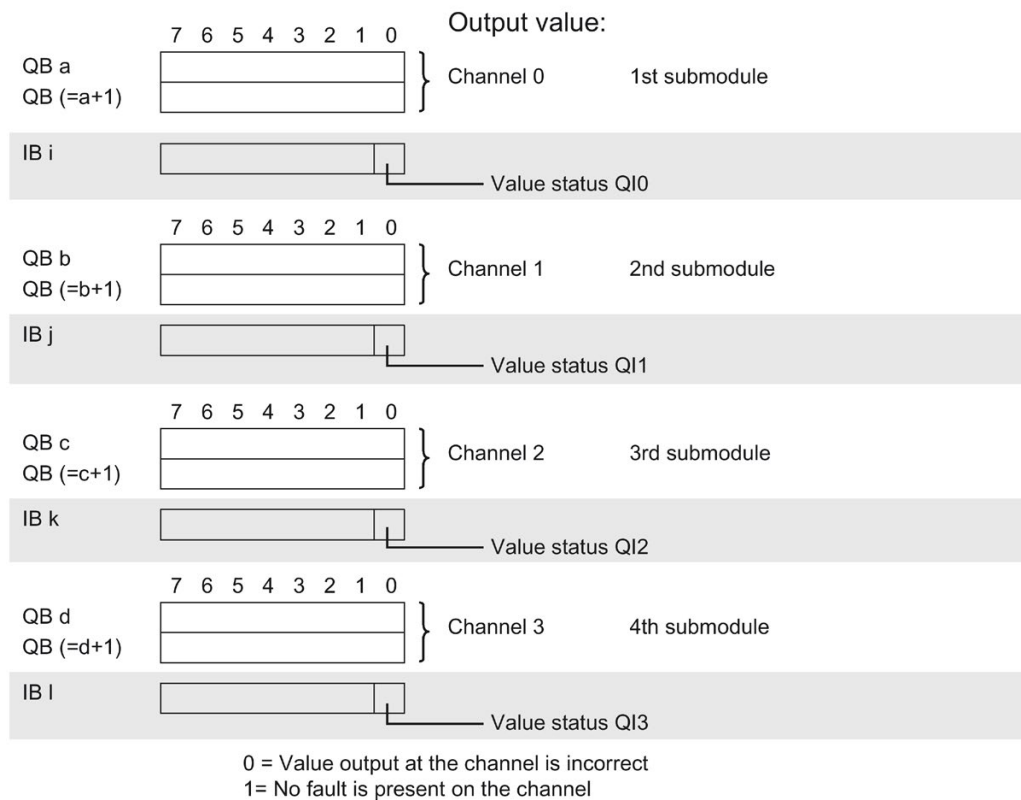


Figure 4-2 Address space for configuration as 4 x 1-channel AQ 4xU/I ST S QI with value status

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 IO controllers depends 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.

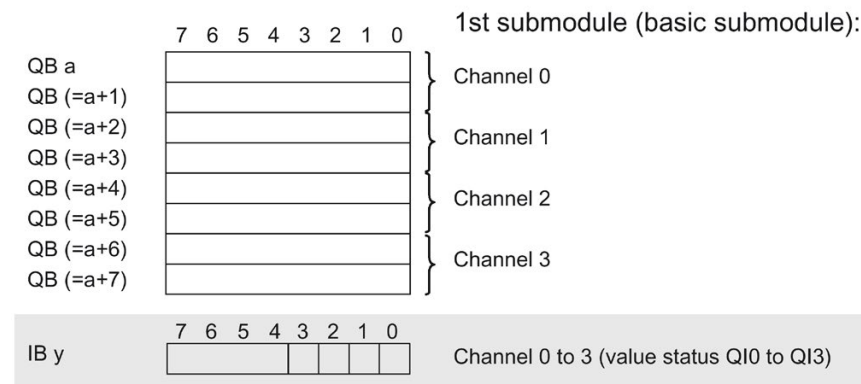
For the 1st submodule (=basic submodule), the value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

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:

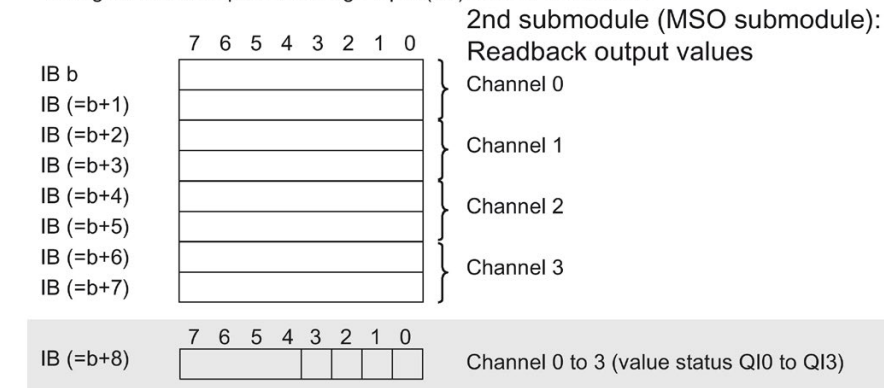
- The basic submodule is not yet configured (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.
- The IO controller of the basic submodule is in STOP or POWER OFF state.

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

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



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



0 = Value output at the channel is incorrect
1 = No fault is present on the channel

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

4.4 Address space

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

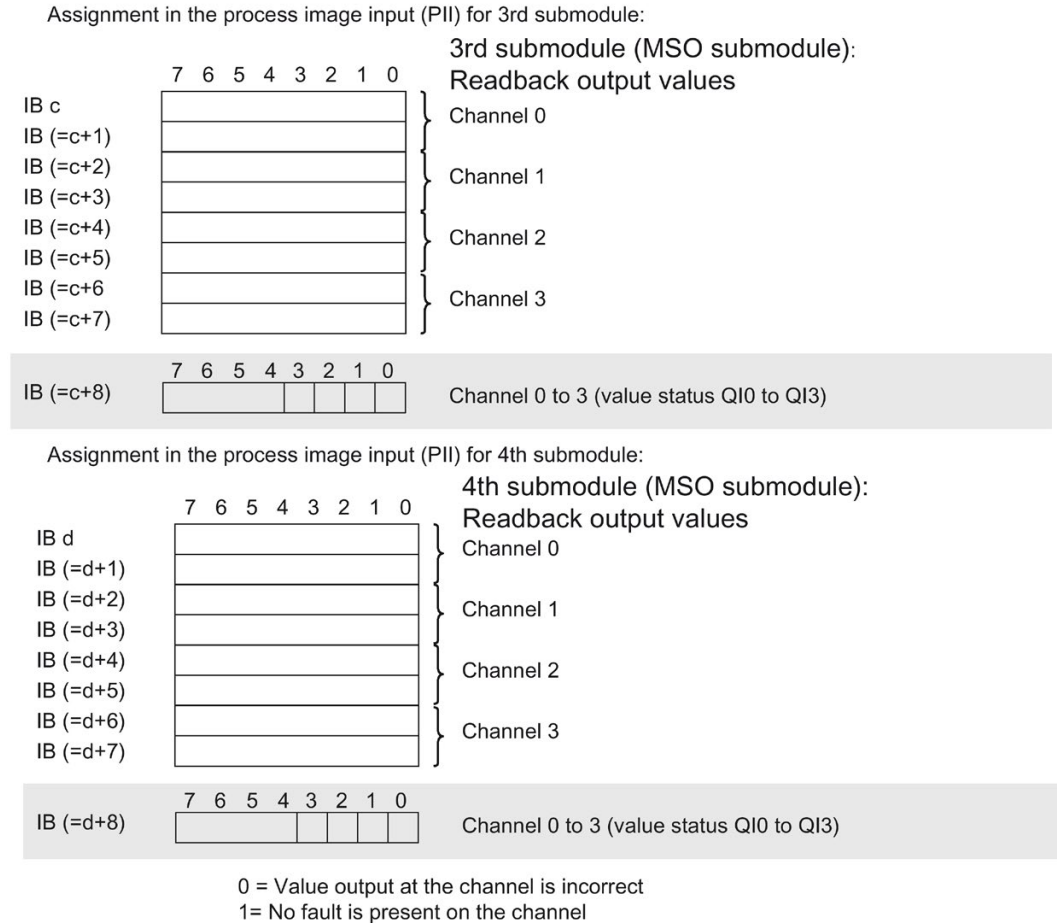


Figure 4-4 Address space for configuration as 1 x 4-channel AQ 4xU/I ST MSO with value status

Reference

You can find information on the Shared Input/Output (MSI/MSO) function in the section Module-Internal Shared Input/Output (MSI/MSO) of the PROFINET with STEP 7 V13 (<https://support.industry.siemens.com/cs/ww/en/view/49948856>) function manual.

Interrupts/diagnostics alarms

5.1 Status and error displays

LED displays

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

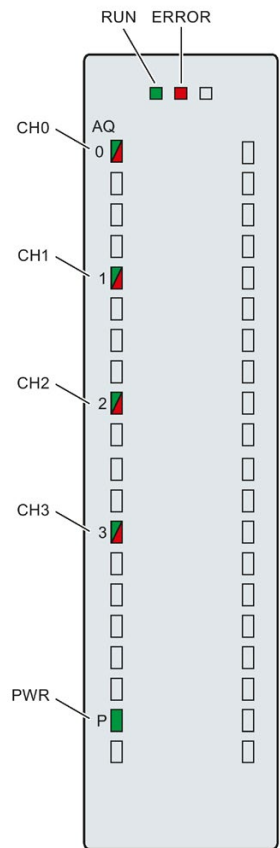


Figure 5-1 LED displays of the AQ 4xU/I ST module

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 28).

RUN and ERROR LED

Table 5- 1 Status and error displays RUN and ERROR

LED		Meaning	Solution
RUN	ERROR		
□ Off	□ Off	Voltage missing or too low at backplane bus	<ul style="list-style-type: none"> Switch on the CPU and/or the system power supply modules. Verify that the U connectors are inserted. Check whether 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	Solution
□ 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	Solution
□ Off	Channel deactivated	---
■ On	Channel configured and OK	---
■ On	Diagnostics 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.

You can find detailed information on the event in the error organization block with the "RALRM" instruction (read additional interrupt info) and in the STEP 7 online help.

Diagnostic interrupt

The module generates a diagnostic interrupt at the following events:

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

5.3 Diagnostics alarms

A diagnostics alarm is generated and the ERROR LED flashes on the module for each diagnostics event. The diagnostics alarms can be read out in the diagnostics buffer of the CPU, for example. 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	Solution
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	Actuator 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)	<ul style="list-style-type: none"> • Disable the channel ("output type" parameter) • Connect the channel
Overflow	7 _H	The output value set by the user program violates the valid rated range/overrange.	Correct the output value
Underflow	8 _H	The output value set by the user program violates the valid rated range/underrange.	Correct the output value
Parameter assignment error	10 _H	<ul style="list-style-type: none"> • The module cannot evaluate parameters for the channel • Incorrect parameter assignment 	Correct the parameter assignment
Load voltage missing	11 _H	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module

Technical specifications

Technical specifications of the AQ 4xU/I ST

The following table shows the technical specifications as of 08/2018. You will find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/de/en/pv/6ES7532-5HD00-0AB0/td?dl=en>).

Article number	6ES7532-5HD00-0AB0
General information	
Product type designation	AQ 4xU/I ST
HW functional status	FS04
Firmware version	V2.2.0
<ul style="list-style-type: none"> FW update possible 	Yes
Product function	
<ul style="list-style-type: none"> I&M data 	Yes; I&M0 to I&M3
<ul style="list-style-type: none"> Output range scalable 	No
Engineering with	
<ul style="list-style-type: none"> STEP 7 TIA Portal configurable/integrated as of version 	V12 / V12
<ul style="list-style-type: none"> STEP 7 configurable/integrated as of version 	V5.5 SP3 / -
<ul style="list-style-type: none"> PROFIBUS as of GSD version/GSD revision 	V1.0 / V5.1
<ul style="list-style-type: none"> PROFINET as of GSD version/GSD revision 	V2.3 / -
Operating mode	
<ul style="list-style-type: none"> Oversampling 	No
<ul style="list-style-type: none"> MSO 	Yes
CiR – Configuration in RUN	
Reparameterization possible in RUN	Yes
Calibration possible in RUN	Yes
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Input current	
Current consumption, max.	190 mA; with 24 V DC supply

Article number	6ES7532-5HD00-0AB0
Power	
Power available 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, no-load voltage, max.	22 V
Cycle time (all channels), min.	3.2 ms; independent of number of activated channels
Output ranges, voltage	
• 0 to 10 V	Yes
• 1 V to 5 V	Yes
• -5 V to +5 V	No
• -10 V to +10 V	Yes
Output ranges, current	
• 0 to 20 mA	Yes
• -20 mA to +20 mA	Yes
• 4 mA to 20 mA	Yes
Connection of actuators	
• for voltage output two-wire connection	Yes
• for voltage output four-wire connection	Yes
• for current output two-wire connection	Yes
Load impedance (in rated range of output)	
• with voltage outputs, min.	1 k Ω ; 0.5 k Ω at 1 to 5 V
• with voltage outputs, capacitive load, max.	1 μ F
• with current outputs, max.	750 Ω
• with current outputs, inductive load, max.	10 mH
Cable length	
• shielded, max.	800 m; for current, 200 m for voltage
Analog value generation for the outputs	
Integration and conversion time/resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit
• Conversion time (per channel)	0.5 ms

Article number	6ES7532-5HD00-0AB0
Settling time	
<ul style="list-style-type: none"> for resistive load for capacitive load for inductive load 	<p>1.5 ms</p> <p>2.5 ms</p> <p>2.5 ms</p>
Errors/accuracies	
Output ripple (relative to output range, bandwidth 0 to 50 kHz), (+/-)	0.02 %
Linearity error (relative to output range), (+/-)	0.15 %
Temperature error (relative to output range), (+/-)	0.002 %/K
Crosstalk between the outputs, max.	-100 dB
Repeat accuracy in steady state at 25 °C (relative to output range), (+/-)	0.05 %
Operational error limit in overall temperature range	
<ul style="list-style-type: none"> Voltage, relative to output range, (+/-) Current, relative to output range, (+/-) 	<p>0.3 %</p> <p>0.3 %</p>
Basic error limit (operational limit at 25 °C)	
<ul style="list-style-type: none"> Voltage, relative to output range, (+/-) Current, relative to output range, (+/-) 	<p>0.2 %</p> <p>0.2 %</p>
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Substitute values connectable	Yes
Alarms	
<ul style="list-style-type: none"> Diagnostic alarm 	Yes
Diagnostic messages	
<ul style="list-style-type: none"> Monitoring the supply voltage Wire-break Short-circuit Overflow/underflow 	<p>Yes</p> <p>Yes; Only for output type "current"</p> <p>Yes; Only for output type "voltage"</p> <p>Yes</p>
Diagnostics indication LED	
<ul style="list-style-type: none"> RUN LED ERROR LED Monitoring of the supply voltage (PWR-LED) Channel status display for channel diagnostics 	<p>Yes; Green LED</p> <p>Yes; Red LED</p> <p>Yes; Green LED</p> <p>Yes; Green LED</p> <p>Yes; Red LED</p>

Article number	6ES7532-5HD00-0AB0
<ul style="list-style-type: none"> • for module diagnostics 	Yes; Red LED
Potential separation	
Potential separation channels	
<ul style="list-style-type: none"> • between the channels 	No
<ul style="list-style-type: none"> • between the channels, in groups of 	4
<ul style="list-style-type: none"> • between the channels and backplane bus 	Yes
<ul style="list-style-type: none"> • Between the channels and load voltage L+ 	Yes
Permissible potential difference	
between S- and MANA (UCM)	8 V DC
Isolation	
Isolation tested with	707 V DC (type test)
Decentralized operation	
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.

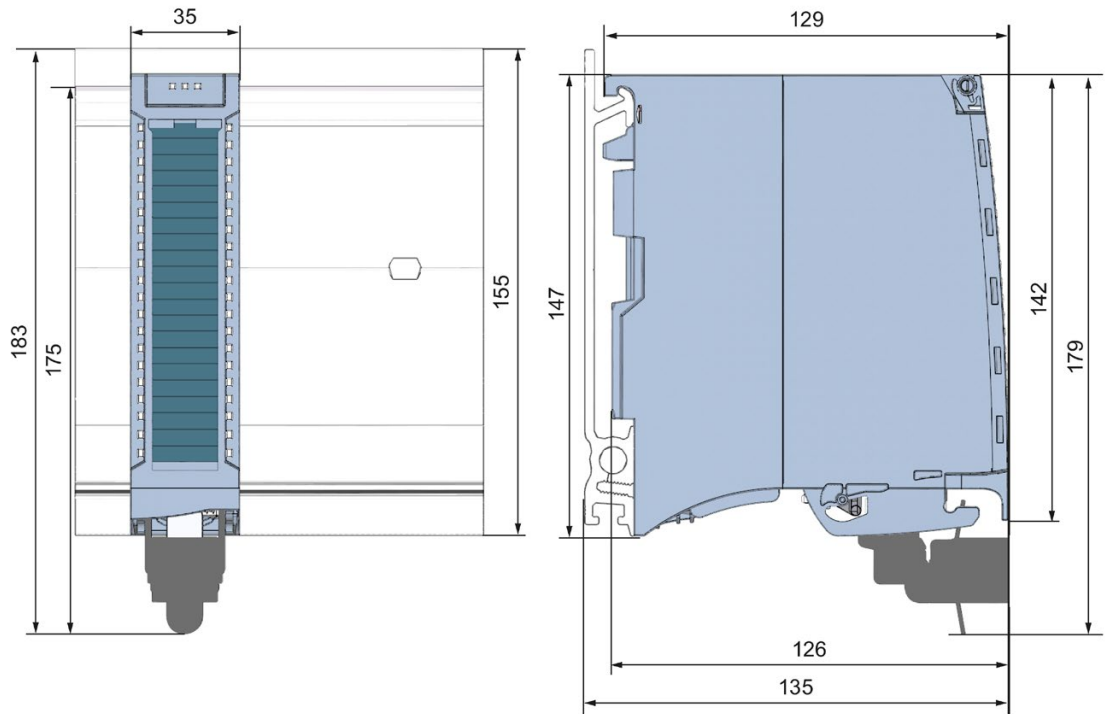


Figure A-1 Dimensional drawing of the AQ 4xU/I ST module



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

Parameter data records

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".

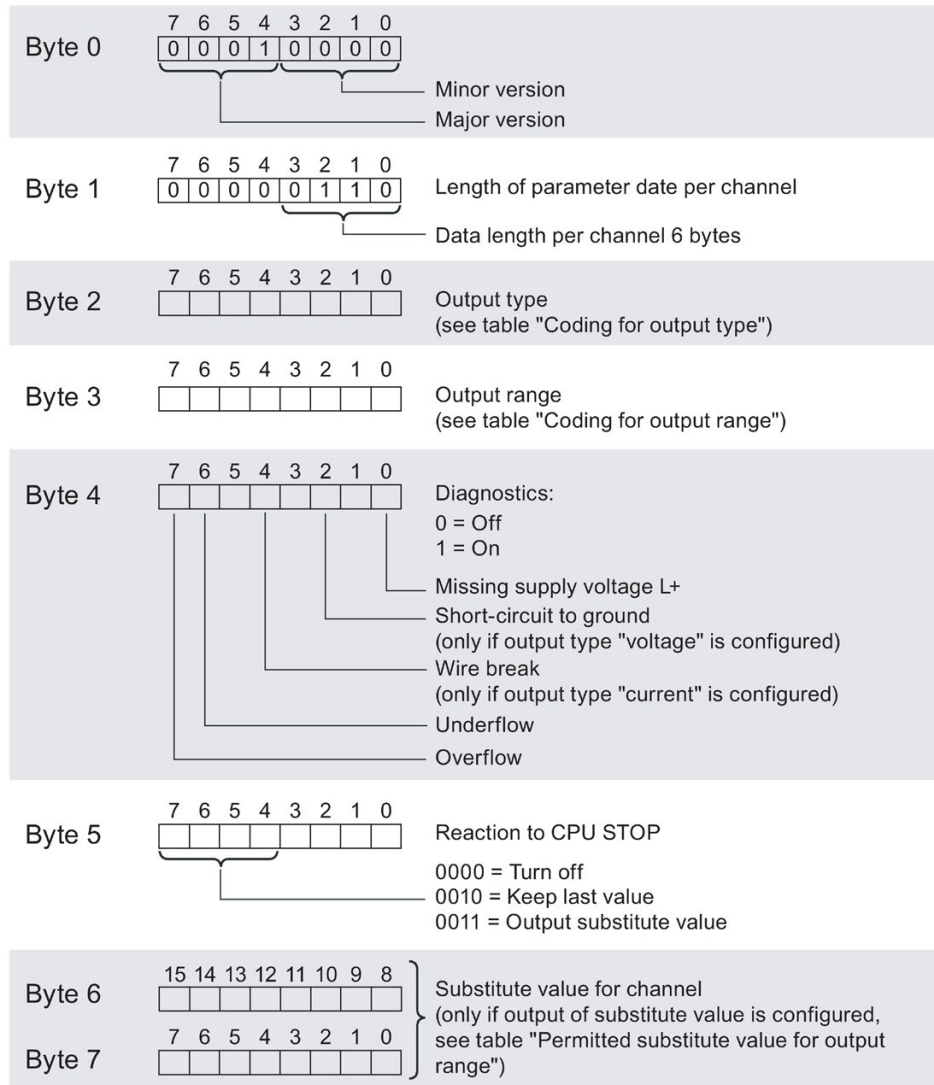


Figure B-1 Structure of data record 64: Bytes 0 to 7

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

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	1H	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 μ V	
0 %	0	0	0 V	
	-1	FFFF	-361.7 μ V	
-75 %	-20736	AF00	-7.5 V	
-100 %	-27648	9400	-10 V	
	-27649	93FF		
-117.593 %	-32512	8100	-11.76 V	Undershoot range
<-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 μ V	
0 %	0	0	0 V	
<0 %	<0	<0	0 V	

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	Minimum output value
<-117.593%	<-32512	<8100	-23.52 mA	

Table C- 8 Current output range 0 mA 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 mA 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 + 578.7 nA	
0%	0	0	4 mA	
	-1	FFFF	4 mA - 578.7 nA	Undershoot range
-25%	-6912	E500	0 mA	
<-25%	<-6912	<E500	0 mA	Minimum output value