

SIMATIC

ET 200SP

**Analog output module AQ 2xI ST
(6ES7135-6GB00-0BA1)**

Equipment Manual

Introduction

1

Industrial cybersecurity

2

Product overview

3

Wiring

4

Parameters/address space

5

Interrupts/diagnostics alarms

6

Technical specifications

7

Parameter data record

A

Representation of analog
values

B

Legal information

Warning notice system

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.

Qualified Personnel

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.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

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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.

Table of contents

1	Introduction.....	5
1.1	ET 200SP Documentation Guide.....	6
1.1.1	Information classes ET 200SP.....	6
1.1.2	Basic tools.....	8
1.1.3	MultiFieldbus Configuration Tool (MFCT).....	10
1.1.4	SIMATIC Technical Documentation.....	11
2	Industrial cybersecurity.....	13
2.1	Introduction to industrial cybersecurity.....	13
2.2	Cybersecurity information.....	13
3	Product overview.....	14
3.1	Properties	14
4	Wiring.....	16
4.1	Wiring diagram.....	16
4.2	Schematic circuit diagram.....	17
5	Parameters/address space.....	18
5.1	Output ranges.....	18
5.2	Parameters.....	18
5.3	Explanation of the parameters.....	20
5.4	Address space.....	21
6	Interrupts/diagnostics alarms.....	23
6.1	Status and error display.....	23
6.2	Interrupts.....	24
6.3	Diagnostics alarms.....	25
7	Technical specifications.....	26
7.1	Technical specifications.....	26
A	Parameter data record.....	30
A.1	Dependencies when configuring with GSD file.....	30
A.2	Parameter assignment and structure of the parameter data record.....	31

B Representation of analog values..... 35

 B.1 Representation of analog values..... 35

 B.2 Representation of output ranges..... 35

 B.3 Representation of analog values in the current output ranges..... 36

Introduction

Purpose of the documentation

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

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

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

Changes compared to previous version

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

- Wiring and block diagrams have been revised.
- The technical specifications have been updated.

Conventions

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

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

Please also observe notes marked as follows:

NOTE

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

Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

1.1 ET 200SP Documentation Guide

1.1.1 Information classes ET 200SP



The documentation for the SIMATIC ET 200SP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require.

You can download the documentation free of charge from the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/109742709>).

Basic information



The System Manual describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200SP distributed I/O system.

The STEP 7 online help supports you in the configuration and programming.

Examples:

- ET 200SP System Manual
- System Manual ET 200SP HA/ET 200SP modules for devices used in a hazardous area
- Online help TIA Portal

Device information



Equipment manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Motor Starter
- BaseUnits Equipment Manuals
- Equipment Manual Server Module
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules

General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC ET 200SP distributed I/O system.

Examples:

- Function Manual ET 200AL/ET 200SP Mixed Configuration
- Function Manual Diagnostics
- Function Manual Communication
- PROFINET Function Manual
- PROFIBUS Function Manual
- Function Manual Designing Interference-free Controllers
- MultiFieldbus Function Manual

Product Information

Changes and supplements to the manuals are documented in a Product Information. The Product Information takes precedence over the device and system manuals.

You can find the latest Product Information on the ET 200SP distributed I/O system on the Internet. (<https://support.industry.siemens.com/cs/de/en/view/73021864>)

Manual Collection ET 200SP

The Manual Collection contains the complete documentation on the SIMATIC ET 200SP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/cn/en/view/84133942>)

Manual Collection fail-safe modules

The Manual Collection contains the complete documentation on the fail-safe SIMATIC modules, gathered together in one file.

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/109806400>)

1.1.2 Basic tools

Tools

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools, the TIA Selection Tool assembles the already known configurators for automation technology into a single 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.

(<https://support.industry.siemens.com/cs/ww/en/view/109767888>)

SIMATIC Automation Tool

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

The SIMATIC Automation Tool offers a wide range of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Assignment of addresses (IP, subnet, Gateway) and device name (PROFINET device) to a CPU
- Transfer of the date and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- RUN/STOP mode switchover
- CPU localization through LED flashing
- Reading out of CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Firmware update of the CPU and connected modules

You can find the SIMATIC Automation Tool on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/98161300>)

PRONETA

SIEMENS PRONETA (PROFINET network analysis) is a commissioning and diagnostic tool for PROFINET networks. PRONETA Basic has two core functions:

- In the network analysis, you get an overview of the PROFINET topology. Compare a real configuration with a reference installation or make simple parameter changes, e.g. to the names and IP addresses of the devices.
- The "IO test" is a simple and rapid test of the wiring and the module configuration of a plant, including documentation of the test results.

You can find SIEMENS PRONETA Basic on the Internet:

(<https://support.industry.siemens.com/cs/ww/en/view/67460624>)

SIEMENS PRONETA Professional is a licensed product that offers you additional functions. It offers you simple asset management in PROFINET networks and supports operators of automation systems in automatic data collection/acquisition of the components used through various functions:

- The user interface (API) offers an access point to the automation cell to automate the scan functions using MQTT or a command line.
- With PROFlenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFlenergy and change these as needed.
- The data record wizard supports PROFINET developers in reading and writing acyclic PROFINET data records quickly and easily without PLC and engineering.

You can find SIEMENS PRONETA Professional on the Internet.

(<https://www.siemens.com/proneta-professional>)

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 the optimal use of resources

You can find SINETPLAN on the Internet

(<https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html>).

1.1.3 MultiFieldbus Configuration Tool (MFCT)

MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is a PC-based software and supports the configuration of MultiFieldbus- and DALI-devices. In addition, the MFCT offers convenient options for mass firmware updates of ET 200 devices with MultiFieldbus- support and reading service data for many other Siemens devices.

Functional scope of the MFCT

- MultiFieldbus configuration:
Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
Device selection and online configuration of DALI devices.
- TM FAST:
Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.

System/installation requirements for MFCT

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (<https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0>))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe))

The download of the tool and further information as well as documentation on the individual functions of the MFCT can be found on the Internet.

(<https://support.industry.siemens.com/cs/de/en/view/109773881>)

1.1.4 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.

The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:



Industry Online Support International

(<https://support.industry.siemens.com/cs/ww/en/view/109742705>)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:



Quick introduction to the technical documentation of automation products per video (<https://support.industry.siemens.com/cs/us/en/view/109780491>)



YouTube video: Siemens Automation Products - Technical Documentation at a Glance (<https://youtu.be/TwLSxxRQsA>)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

With "mySupport" you can get the most out of your Industry Online Support.

Registration	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
Support requests	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
Documentation	In the Documentation area you can build your personal library.
Favorites	You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries.
Recently viewed articles	The most recently viewed pages in mySupport are available under "Recently viewed articles".
CAX data	The CAX data area gives you access to the latest product data for your CAX or CAE system. You configure your own download package with a few clicks: • 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" on the Internet. (<https://support.industry.siemens.com/My/ww/en>)

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 can find the application examples on the Internet.
(<https://support.industry.siemens.com/cs/ww/en/ps/ae>)

Industrial cybersecurity

2.1 Introduction to industrial cybersecurity

Digitalization and the increasing networking of machines and industrial plants are also increasing the risk of cyberattacks. Appropriate protective measures are therefore mandatory, particularly in the case of critical infrastructure facilities.

Refer to the general information and measures on the subject of industrial cybersecurity in the ET 200SP Distributed I/O System

(<https://support.industry.siemens.com/cs/ww/en/view/58649293>) System Manual.

This section provides an overview of security-relevant information pertaining to your SIEMENS device.

2.2 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit

<https://www.siemens.com/cybersecurity-industry>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

<https://new.siemens.com/cert>.

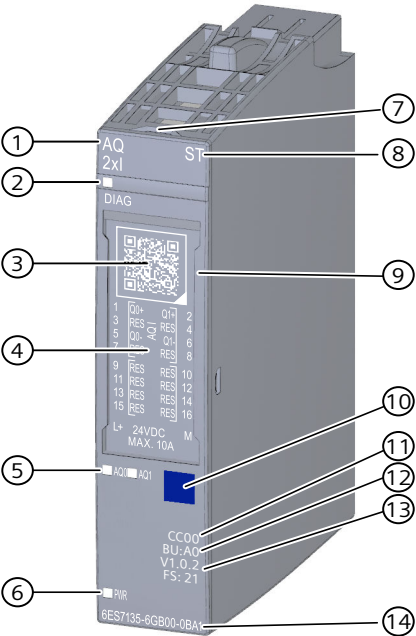
Product overview

3.1 Properties

Article number

6ES7135-GB00-0BA1

View of the module



- | | |
|--|--|
| ① Module type and name | ⑧ Function class |
| ② LED for diagnostics | ⑨ Insertion option for optional labeling strip |
| ③ QR code for identification link | ⑩ Color coding module type |
| ④ Wiring diagram | ⑪ Color code for selecting the color identification labels |
| ⑤ LEDs for channel status | ⑫ BU type |
| ⑥ LED for supply voltage | ⑬ Firmware and function version |
| ⑦ Slot for optional equipment labeling plate | ⑭ Article number |

Figure 3-1 View of the module AQ 2xI ST

Properties

The module has the following technical properties:

- Analog output module with 2 outputs
 - for current output
- Output range for current output:
 - ± 20 mA, resolution 16 bits including sign
 - 0 mA to 20 mA, resolution 15 bits
 - 4 to 20 mA, resolution 14 bits
- Electrically isolated from supply voltage L+
- Configurable diagnostics (per module)
- Configurable substitute values (per channel)

The module supports the following functions:

- Firmware update
- I&M identification data
- Configuration in RUN
- PROFlenergy
- Value status

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

Accessories

The following accessories must be ordered separately:

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

See also

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

Wiring

4.1 Wiring diagram

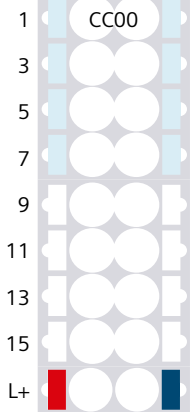
This section shows the wiring diagram of the AQ 2xI ST module with the pin assignments. You can find information on wiring the BaseUnit in the System Manual ET 200SP distributed I/O system (<http://support.automation.siemens.com/WW/view/en/58649293>).

NOTE

The load group of the module must begin with a light-colored BaseUnit. Keep this in mind also during the configuration.

Pin assignment

The following table shows an example of the pin assignment of the analog output module AQ 2xI ST on the BaseUnit BU type A0/A1:

Description	Signal	Terminal	BaseUnit BU type A0/A1	Terminal	Signal	Description
Analog output current positive, channel 0	Q ₀ +	1		2	Q ₁ +	Analog output current positive, channel 1
-	RES ¹⁾	3		4	RES ¹⁾	-
Analog output current negative, channel 0	Q ₀ -	5		6	Q ₁ -	Analog output current negative, channel 1
-	RES ¹⁾	7		8	RES ¹⁾	-
-	RES ¹⁾	9		10	RES ¹⁾	-
-	RES ¹⁾	11		12	RES ¹⁾	-
-	RES ¹⁾	13		14	RES ¹⁾	-
-	RES ¹⁾	15		16	RES ¹⁾	-
24 V DC supply voltage ²⁾	L+	L+	L+	M	M	Ground

¹⁾ Reserve, must remain unused for future function extensions

²⁾ Infeed only with light-colored BaseUnit

Connection types

2-wire connection for current output



4.2 Schematic circuit diagram

This section contains the schematic circuit diagram of the AQ 2xI ST analog output module.

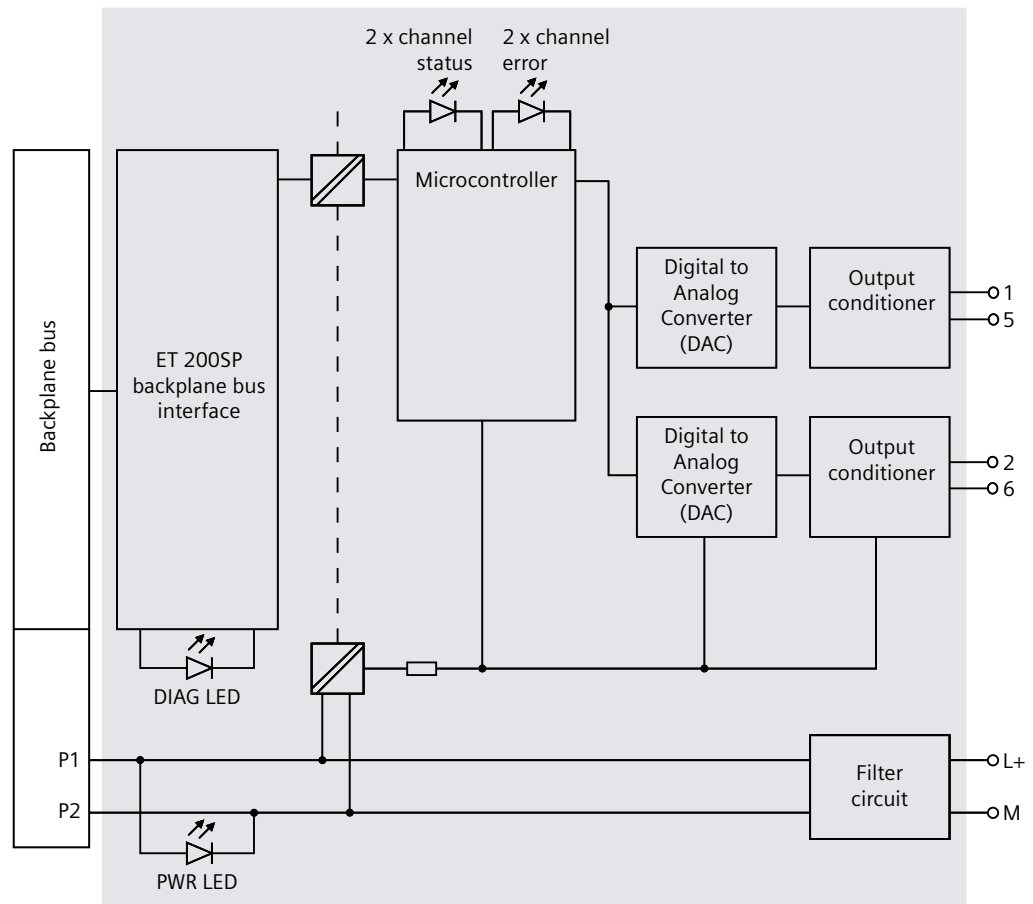


Figure 4-1 Schematic circuit diagram AQ 2xI ST analog output module

Parameters/address space

5.1 Output ranges

The analog output module AQ 2xI ST has the following output ranges:

Table 5-1 Output ranges

Output type	Output ranges	Resolution
Current	± 20 mA	16 bits incl. sign
	0 mA to 20 mA	15 bits
	4 mA to 20 mA	14 bits

The tables of the output ranges, overflow, overrange, etc. can be found in section Representation of analog values [\(Page 35\)](#).

5.2 Parameters

Parameters of the AQ 2xI ST

Specify the module properties with the various parameters during parameter assignment of the module with STEP 7. The following table lists the configurable parameters. The efficiency range of the configurable parameters depends on the type of configuration.

The following configurations are possible:

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

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

The following parameter settings are possible:

Table 5-2 Configurable parameters and their defaults (GSD file)

Parameters	Range of values	Default	Parameter reassignment in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics: No supply voltage L+	• Disable • Enable	Disable	Yes	Module	Module
Diagnostics: Overflow ¹	• Disable • Enable	Disable	Yes	Module	Module ¹
Diagnostics: Underflow ¹	• Disable • Enable	Disable	Yes	Module	
Diagnostics: Wire break ²	• Disable • Enable	Disable	Yes	Module	Module
Output type/range	• Deactivated • Current +/- 20 mA • Current 0 - 20 mA • Current 4 - 20 mA	Current 4 - 20 mA	Yes	Channel	Channel
Reaction to CPU STOP	• Turn off • Keep last value • Output substitute value	Turn off	Yes	Channel	Module
Substitute value	For permissible substitute values for the various output ranges, see appendix Parameter assignment and structure of the parameter data record (Page 31), Substitute values → Codes for substitute values table	0	Yes	Channel	Channel
Potential group	• Use potential group of the left module (module plugged into a dark-colored BaseUnit) • Enable new potential group (module plugged into light-colored BaseUnit)	Use potential group of the left module	No	Module	Module

¹ Due to the limited number of parameters of a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the parameter assignment options are restricted. If required, you can assign these parameters using data record 128 as described in the "GSD file PROFINET IO" column (see table above). The parameter length of the I/O module is 7 bytes.

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

NOTE

Unused channels

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

5.3 Explanation of the parameters

Diagnostics: No supply voltage L+

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

Diagnostics: Overflow

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

Diagnostics: Underflow

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

Diagnostics: Wire break

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

Output type / output range

See section Output ranges [\(Page 18\)](#).

Reaction to CPU STOP

Determines the behavior of the module at CPU STOP.

Substitute value

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

Potential group

A potential group consists of a group of directly adjacent I/O modules within an ET 200SP station, which are supplied via a common supply voltage.

A potential group begins with a light-colored BaseUnit through which the required voltage is supplied for all modules of the potential group. The light-colored BaseUnit interrupts the three self-assembling voltage buses P1, P2, and AUX to the left neighbor.

Specify the slot in which a light-colored BaseUnit with supply voltage infeed or a dark-colored BaseUnit is to be located (see ET 200SP Distributed I/O System

(<http://support.automation.siemens.com/WW/view/en/58649293>) System Manual).

All additional I/O modules of this potential group are plugged into dark-colored BaseUnits. You take the potential of the self-assembling voltage buses P1, P2 and AUX from the left neighbor.

A potential group ends with the dark-colored BaseUnit, which follows a light-colored BaseUnit or server module in the station configuration.

5.4 Address space

Configuration options

The following configurations are possible:

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

Evaluating the value status

If you enable the value status for the analog module, an additional byte is occupied in the input address space. Bits 0 and 1 in this byte are assigned to a channel. They provide information about the validity of the analog value.

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

Bit = 0: Channel is deactivated or there is a fault on the module.

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

5.4 Address space

Address space

The following figure shows the assignment of the address space for the AQ 2×I ST with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

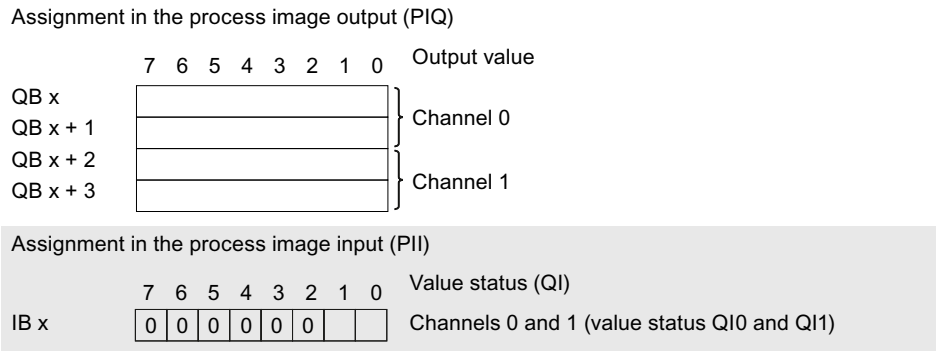


Figure 5-1 Address space of the AQ 2×I ST with value status

Interrupts/diagnostics alarms

6.1 Status and error display

LED display

The following figure shows you the LED display of the AQ 2xI ST.

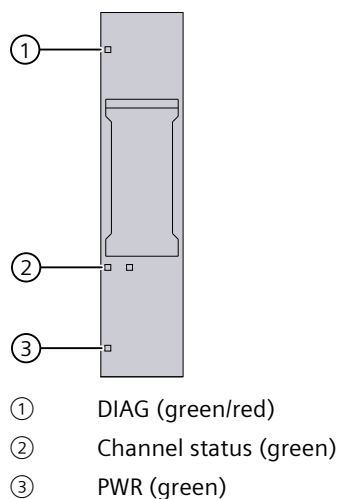


Figure 6-1 LED display

Meaning of the LEDs

The following tables show the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in section Diagnostics alarms ([Page 25](#)).

DIAG LED

Table 6-1 Error display of the DIAG LED

DIAG LED	Meaning
□ Off	Backplane bus supply of the system is disrupted or switched off.
⚡ Flashes	Module parameters not assigned
■ On	Module parameters assigned and no module diagnostics
⚡ Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 6-2 Status display of the channel status LED

Channel status LED	Meaning
□ Off	Channel disabled
■ On	Channel activated

PWR LED

Table 6-3 Status display of the PWR LED

PWR LED	Meaning
□ Off	Missing supply voltage L+
■ On	Supply voltage L+ present

6.2 Interrupts

The AQ 2xI ST analog output module supports diagnostics interrupts.

Diagnostics interrupts

The module generates a diagnostic interrupt at the following events:

- Line break (current)
- High limit violated
- Low limit violated
- Error
- Parameter assignment error
- Supply voltage missing
- Channel temporarily unavailable

6.3 Diagnostics alarms

A diagnostics alarm is generated and the DIAG-LED flashes on the module for each diagnostics event. You can read out the diagnostics alarms, for example, in the diagnostics buffer of the CPU. You can evaluate the error codes with the user program.

Table 6-4 Diagnostics alarms, their meaning and corrective measures

Diagnostics alarm	Error code	Meaning	Solution
Wire break	6 _H	Actuator circuit impedance too high	Use a different actuator type or modify the wiring, e.g. use cables with larger cross-section
		Wire break between the module and actuator	Connect the cable
		Channel not connected (open)	- Disable the channel ("output type" parameter) - Connect the channel
High limit violated	7 _H	The output value specified by the user program exceeds the overrange.	Correct the output value
Low limit violated	8 _H	The output value specified by the user program is below the underrange.	Correct the output value
Error	9 _H	Internal module error occurred.	Replace module
Parameter assignment error	10 _H	- The module cannot evaluate parameters for the channel. - Incorrect parameter assignment.	Correct the parameter assignment
Supply voltage missing	11 _H	Missing or insufficient supply voltage L+	- Check the supply voltage L+ at the BaseUnit - Check BaseUnit type
Channel temporarily unavailable	1F _H	Firmware update is currently in progress or has been canceled. The module does not output any process or substitute values in this state.	- Wait for firmware update. - Restart the firmware update.

Technical specifications

7.1 Technical specifications

Technical specifications of the AQ 2xI ST

The following table lists the technical specifications on the issue date. A data sheet including daily updated technical specifications is available on the Internet (<https://support.industry.siemens.com/cs/ww/de/pv/6ES7135-6GB00-0BA1/td?dl=en>).

Article number	6ES7135-6GB00-0BA1
General information	
Product type designation	AQ 2xI ST
HW functional status	from FS21
Firmware version	V1.0.2
• FW update possible	Yes
usable BaseUnits	BU type A0, A1
Color code for module-specific color identification plate	CC00
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	No
• Output range scalable	No
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V13 SP1 / -
• STEP 7 configurable/integrated from version	V5.5 SP3 / -
• PROFIBUS from GSD version/GSD revision	GSD Revision 5
• PROFINET from GSD version/GSD revision	GSDML V2.3
Operating mode	
• Oversampling	No
• MSO	No
CiR - Configuration in RUN	
Reparameterization possible in RUN	No
Calibration possible in RUN	No

Article number	6ES7135-6GB00-0BA1
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Input current	
Current consumption, max.	110 mA
Power loss	
Power loss, typ.	1.5 W
Address area	
Address space per module	
• Address space per module, max.	4 byte; + 1 byte for QI information
Hardware configuration	
Automatic encoding	Yes
• Mechanical coding element	Yes
• Type of mechanical coding element	Type A
Analog outputs	
Number of analog outputs	2
Cycle time (all channels), min.	1 ms
Analog output with oversampling	No
Output ranges, current	
• 0 to 20 mA	Yes; 15 bit
• -20 mA to +20 mA	Yes; 16 bit incl. sign
• 4 mA to 20 mA	Yes; 14 bit
Connection of actuators	
• for current output two-wire connection	Yes
Load impedance (in rated range of output)	
• with current outputs, max.	500 Ω
• with current outputs, inductive load, max.	1 mH
Destruction limits against externally applied voltages and currents	
• Voltages at the outputs	30 V
Cable length	
• shielded, max.	1 000 m
Analog value generation for the outputs	
Integration and conversion time/resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit

7.1 Technical specifications

Article number	6ES7135-6GB00-0BA1
Settling time	
• for resistive load	0.1 ms; Typical value
• for inductive load	0.5 ms
Errors/accuracies	
Linearity error (relative to output range), (+/-)	0.03 %
Temperature error (relative to output range), (+/-)	0.005 %/K
Crosstalk between the outputs, min.	-50 dB
Repeat accuracy in steady state at 25 °C (relative to output range), (+/-)	0.05 %
Operational error limit in overall temperature range	
• Voltage, relative to output range, (+/-)	0.5 %
• Current, relative to output range, (+/-)	0.5 %
Basic error limit (operational limit at 25 °C)	
• Voltage, relative to output range, (+/-)	0.3 %
• Current, relative to output range, (+/-)	0.3 %
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Substitute values connectable	Yes
Alarms	
• Diagnostic alarm	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	Yes
• Group error	Yes
• Overflow/underflow	Yes; Module-wise
Diagnostics indication LED	
• Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
• Channel status display	Yes; green LED
• for channel diagnostics	No
• for module diagnostics	Yes; green/red DIAG LED
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• between the channels and the power supply of the electronics	Yes
Isolation	
Isolation tested with	707 V DC (type test)

Article number	6ES7135-6GB00-0BA1
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C; < 0 °C as of FS03
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C; < 0 °C as of FS03
• vertical installation, max.	50 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200SP System Manual
Dimensions	
Width	15 mm
Height	73 mm
Depth	58 mm
Weights	
Weight, approx.	31 g

Dimension drawing

See manual ET 200SP BaseUnits

(<http://support.automation.siemens.com/WW/view/en/59753521>)

Parameter data record

A.1 Dependencies when configuring with GSD file

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

Configuring with a PROFINET GSD file

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

Output type	Output range	Diagnostics				Reaction to CPU STOP	Substitute value
		No supply voltage L+	Overflow	Underflow	Wire break		
Deactivated		*	*	*	*	*	*
Current	±20 mA	x	x	x	x	x	x
	0 mA to 20 mA	x	x	x	x	x	x
	4 mA to 20 mA	x	x	x	x	x	x

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

Configuring with a PROFIBUS GSD file

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

Output type	Output range	Diagnostics				Reaction to CPU STOP	Substitute value
		No supply voltage L+	Overflow	Underflow	Wire break		
Deactivated		*	*	*	*	*	*
Current	±20 mA	x	x	x	x	x	x
	0 mA to 20 mA	x	x	x	x	x	x
	4 mA to 20 mA	x	x	x	x	x	x

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

A.2 Parameter assignment and structure of the parameter data record

The data record of the module has an identical structure, regardless of whether you configure the module with PROFIBUS DP or PROFINET IO. With data record 128, you can reassign the module parameters in your user program, regardless of your programming. This means that you can use all the functions of the module even if you configured it via PROFIBUS-GSD.

Parameter assignment in the user program

You can change the parameters of the module in RUN. For example, the voltage or current values of selected channels can be changed in RUN without having an effect on the other channels.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the module using data record 128. The parameters set in STEP 7 are not changed in the CPU, which means that the parameters set in STEP 7 will be valid again after a restart.

Output parameter STATUS

If errors occur when transferring parameters with the "WRREC" instruction, the module continues operation with the previous parameter assignment. The STATUS output parameter contains a corresponding error code.

You will find a description of the "WRREC" instruction and the error codes in the STEP 7 online help.

Structure of data record 128

NOTE

Channel 0 includes the diagnostics enable for the entire module.

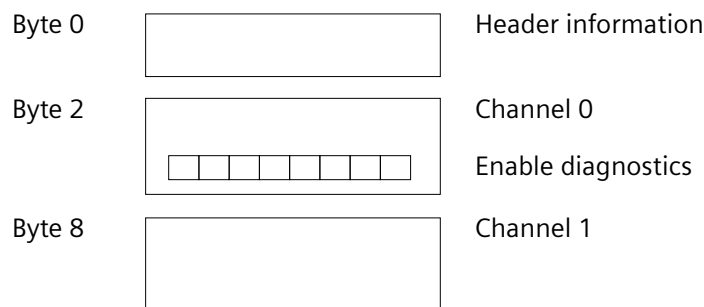


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

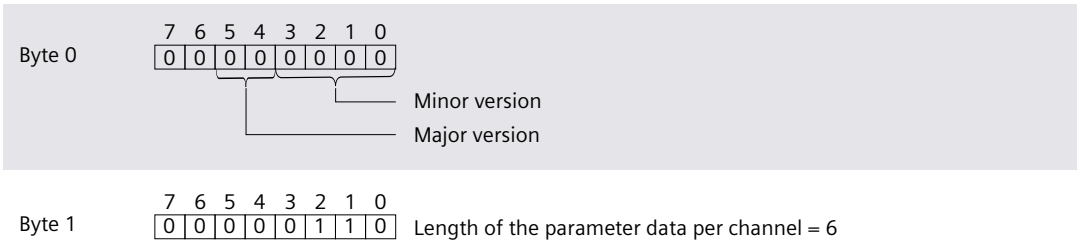
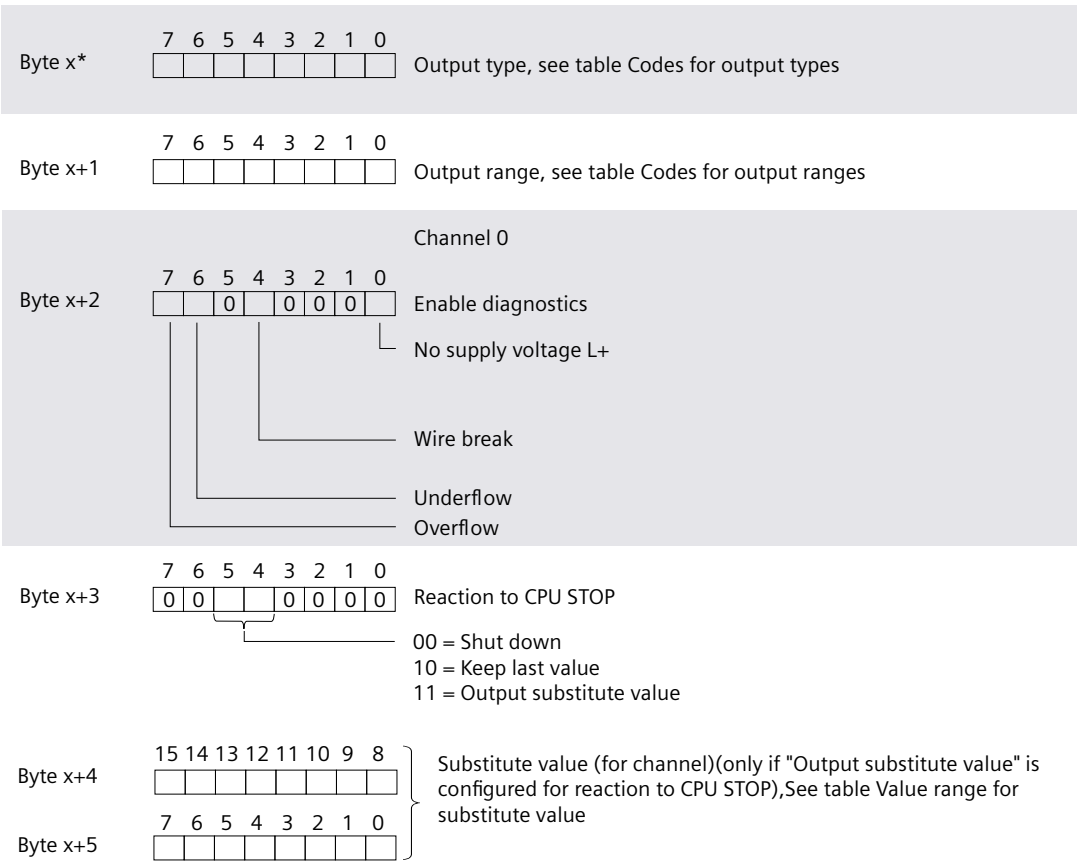


Figure A-2 Header information

Parameters

The following figure shows the structure of the parameters for channels 0 and 1. You enable a parameter by setting the corresponding bit to "1".



* x = 2 + (channel number × 6); channel number = 0 and 1

Figure A-3 Structure of bytes x to x+5 for channels 0 and 1

Codes for output types

The following table contains the codes for the output types of the analog output module. You enter this coding in byte x (see previous figure).

Table A-1 Codes for output types

Output type	Code
Deactivated	0000 0000
Current	0000 0011

Codes for output ranges

The following table contains the codes for the output ranges of the analog output module. You enter these codes in byte x+1 of data record 128 (see previous figure).

Table A-2 Codes for output ranges

Output range	Code
Current	
±20 mA	0000 0000
0 mA to 20 mA	0000 0001
4 mA to 20 mA	0000 0010

Value range for substitute value

The following table contains the value ranges for the substitute values. You must enter the corresponding codes in bytes x+4 and x+5 (see previous figure).

Output range	Permissible value range
Current	
±20 mA	-29031 to 29030
0 mA to 20 mA	0 to 29030
4 to 20 mA	-692 to 29376

Error transmitting the data record

The module always checks all the values of the transferred data record. The module applies the values from the data record only when all values have been transmitted without errors.

The WRREC instruction for writing data records returns the appropriate error codes if there are errors in the STATUS parameter.

The following table shows the module-specific error codes and their meaning for parameter data record 128.

Error code in the STATUS parameter (hexadecimal)				Meaning	Solution
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	xx	Number of the data record unknown	Enter valid number for data record.
DF	80	B1	xx	Length of the data record incorrect	Enter valid value for data record length.
DF	80	B2	xx	Slot invalid or unavailable	- Check the station to determine if the module is plugged in or pulled. - Check assigned values for the parameters of the WREC instruction.
DF	80	I0	xx	Incorrect version or error in the header information	Correct the version, length and number of parameter blocks.
DF	80	I1	xx	Parameter error	Check the parameters of the module.

Representation of analog values

B.1 Representation of analog values

This appendix describes the analog values for all output ranges supported by the AQ 2xI ST analog module.

Measured value resolution

The digitized analog value is the same for all output values at the same nominal range. Analog values are output as fixed point numbers in two's complement.

In the following table, you will find the representation of the binary analog values and the associated decimal or hexadecimal units of the analog values.

The resolutions 15 and 16 bits including sign are shown. Each analog value is entered left aligned into the ACCU. The bits marked with "x" are set to "0".

Table B-1 Possible resolutions of the analog values

Resolution in bits	Values		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
15	2	2 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
16	1	1 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

B.2 Representation of output ranges

In the following tables, you can find the digitized representation of the bipolar and unipolar range output ranges. The resolution is 16 bits.

Table B-2 Bipolar output ranges

Dec. value	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	
≥32512	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	Overrange
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	Nominal 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	

Dec. value	Output value in %	Data word																Range
-27649	100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Underrange
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
≤ -32513	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Minimum output value

Table B-3 Unipolar output ranges

Dec. value	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	
≥32512	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	Overrange
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	Nominal 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

B.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 B-4 Current output range ±20 mA

Values			Current output range	Range
	Dec.	Hex.	±20 mA	
118.5149%	32767	7FFF	21 mA	Overflow*
	29031	7167		
105%	29030	7166	21 mA	Overrange
	27649	6C01	20 mA + 723.4 nA	
100%	27648	6C00	20 mA	Nominal 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	-20 mA + 723.4 nA	Underrange

* Outputs positive maximum value or negative minimum value

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

Values			Current output range	Range
-105%	-29031	8E99	-21 mA	Underrange
	-29032	8E98	-21 mA	Underflow*
-118.519%	-32768	8000		

* Outputs positive maximum value or negative minimum value

Table B-5 Current output range 0 to 20 mA

Values			Current output range	Range
	Dec.	Hex.	0 to 20 mA	
118.5149%	32767	7FFF	21 mA	Overflow*
	29031	7167		
105%	29030	7166	21 mA	Overrange
	27649	6C01	20 mA + 723.4 nA	
100%	27648	6C00	20 mA	Nominal range
75%	20736	5100	15 mA	
0.003617%	1	1	723.4 nA	
0%	0	0	0 mA	
	-1	FFFF	0 mA	Underflow*
-118.519%	-32768	8000		

* Outputs positive maximum value or negative minimum value

Table B-6 Current output ranges 4 to 20 mA

Values			Current output range	Range
	Dec.	Hex.	4 to 20 mA	
118.5149%	32767	7FFF	21 mA	Overflow*
	29377	72C1		
106.25%	29376	72C0	21 mA	Overrange
	27649	6C01	20 mA + 578.7 nA	
100%	27648	6C00	20 mA	Nominal range
75%	19008	4A40	16 mA	
0.003617%	1	1	4 mA + 578.7 nA	
0%	0	0	4 mA	
	-1	FFFF	3.9995 mA	Underrange
-2.5%	-692	FD4C	3.6 mA	
	-693	FD4B	3.6 mA	Underflow*
-118.519%	-32768	8000		

* Outputs positive maximum value or negative minimum value