

SIMATIC

ET 200SP

**Analog input module AI 2xU ST
(6ES7134-6FB00-0BA1)**

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

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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	Connection diagram.....	16
4.2	Schematic circuit diagram.....	17
5	Parameters/address space.....	18
5.1	Measuring types and ranges.....	18
5.2	Parameters.....	18
5.3	Explanation of the parameters.....	20
5.4	Address space.....	22
6	Interrupts/diagnostics alarms.....	24
6.1	Status and error display.....	24
6.2	Interrupts.....	26
6.3	Diagnostics alarms.....	26
7	Technical specifications.....	27
7.1	Technical specifications.....	27
A	Parameter data record.....	32
A.1	Dependencies when configuring with GSD file.....	32
A.2	Parameter assignment and structure of the parameter data record.....	33
A.3	Error codes.....	36

B Representation of analog values..... 37

 B.1 Representation of analog values..... 37

 B.2 Representation of input ranges..... 37

 B.3 Representation of analog values in voltage measuring ranges..... 38

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: <ul style="list-style-type: none">• 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>.

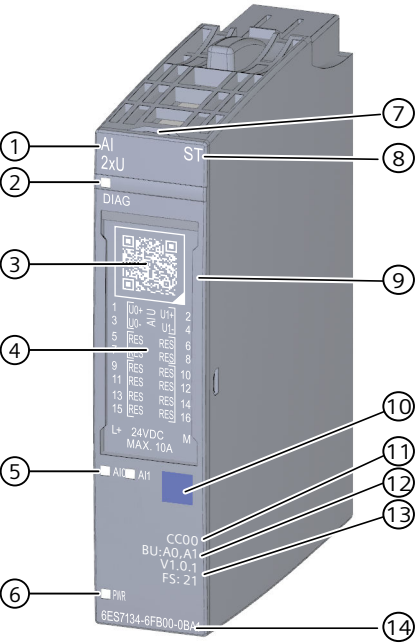
Product overview

3.1 Properties

Article number

6ES7134-6FB00-0BA1

View of the module



- | | |
|--|--|
| ① Module type and name | ⑧ Function class |
| ② LED for diagnostics | ⑨ Insertion option for optional labeling strips |
| 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 revision level and release number |
| ⑦ Slot for optional reference identification label | ⑭ Article number |

Figure 3-1 View of the module AI 2xU ST

Properties

The module has the following technical properties:

- Analog input module with 2 inputs
- Voltage measurement type (can be set per channel)
- Input ranges for voltage measurement:
 - ± 5 V, resolution 16 bits including sign
 - ± 10 V, resolution 16 bits including sign
 - 1 to 5 V, resolution 15 bits
 - 0 to 10 V, resolution 15 bits
- Electrically isolated from supply voltage L+
- Permitted common mode voltage: $10 V_{SS}$
- Configurable diagnostics (per module)

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 Connection diagram

This section shows the connection diagram of the AI 2xU ST module with the terminal assignments for a 2-wire connection.

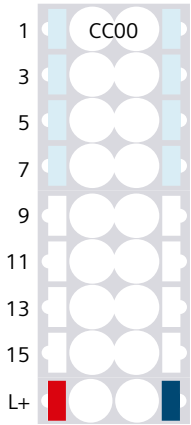
You can find information on wiring the BaseUnit in the ET 200SP distributed I/O system (<http://support.automation.siemens.com/WW/view/en/58649293>) System Manual.

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 input module AI 2xU ST on the BaseUnit BU type A0/A1:

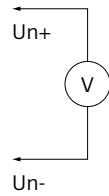
Description	Signal	Terminal	BaseUnit BU type A0/A1	Terminal	Signal	Description
Analog input voltage positive, channel 0	U_{0+}	1		2	U_{1+}	Analog input voltage positive, channel 1
Analog input voltage negative, channel 0	U_{0-}	3		4	U_{1-}	Analog input voltage negative, channel 1
-	RES ¹⁾	5		6	RES ¹⁾	-
-	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 voltage output



4.2 Schematic circuit diagram

This section contains the schematic circuit diagram of the AI 2xU ST analog output module.

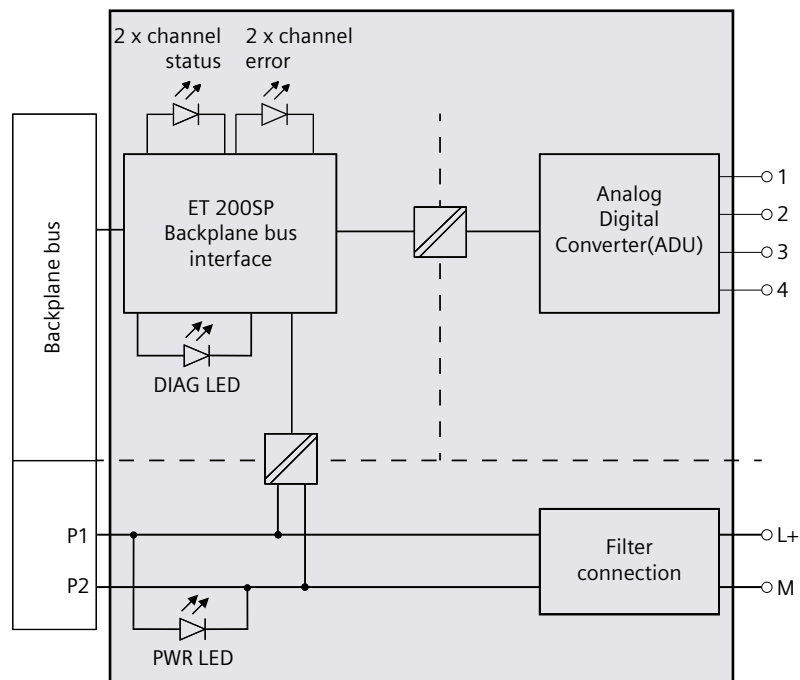


Figure 4-1 Schematic circuit diagram AI 2xU ST analog output module

Parameters/address space

5.1 Measuring types and ranges

The analog input module AI 2xU ST has the following measuring ranges:

Table 5-1 Measuring ranges

Measurement type	Measuring range	Resolution
Voltage	± 5 V	16 bits incl. sign
	± 10 V	16 bits incl. sign
	1 to 5 V	15 bits
	0 to 10 V	15 bits

You will find the tables of the measuring ranges as well as overflow, overrange, etc., in the section Representation of analog values [\(Page 37\)](#).

5.2 Parameters

Parameters of the AI 2xU 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 or on an ET 200SP Open Controller
- Distributed operation on PROFINET IO in an ET 200SP system
- Distributed operation on PROFIBUS DP in an ET 200SP system

In addition to assigning parameters with the configuration software, you can also set the parameters in RUN mode (dynamically) using the user program.

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 [\(Page 33\)](#).

The following parameter settings are possible:

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

Parameter	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+	<ul style="list-style-type: none"> Disable Enable 	Disable	Yes	Module	Module
Diagnostics: Short-circuit to ground	<ul style="list-style-type: none"> Disable Enable 	Disable	Yes	Module	Module
Diagnostics: Overflow ¹	<ul style="list-style-type: none"> Disable Enable 	Disable	Yes	Module	Module ¹
Diagnostics: Underflow ¹	<ul style="list-style-type: none"> Disable Enable 	Disable	Yes	Module	
Measurement type/measuring range	<ul style="list-style-type: none"> Deactivated Voltage +/- 5 V Voltage +/- 10 V Voltage 0..10 V Voltage 1..5 V 	Voltage +/- 10 V	Yes	Channel	Channel
Smoothing	<ul style="list-style-type: none"> None Weak Medium Strong 	None	Yes	Channel	Channel
Interference frequency suppression	<ul style="list-style-type: none"> 60 Hz (50 ms) 50 Hz (60 ms) ² 16.6 Hz (180 ms) None 	50 Hz (60 ms)	Yes	Channel	Module
Potential group	<ul style="list-style-type: none"> Use potential group of the use the left module (module plugged into a dark-colored BaseUnit) Enable new potential group (module plugged into a 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 4 bytes.

² Interference frequency suppression: Noise at 400 Hz is automatically included in the filtering at 50 Hz.

NOTE

Unused channels

Disable the unused channels in the parameter assignment.

A deactivated channel always returns the value 7FFF_H.

NOTE

Note that the settings in the "Interference frequency suppression" parameter have a direct effect on the cycle time of the module. The analog value is therefore also affected by additionally set filtering via the "Smoothing" parameter.

5.3 Explanation of the parameters

Diagnostics: No supply voltage L+

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

Diagnostics: Short-circuit to ground

Diagnostics are enabled when both input signals are short-circuited in the range 1 to 5 V.

The short-circuit and underflow diagnostics can be activated simultaneously. If both diagnostics events occur simultaneously, however, the short-circuit diagnostics suppresses the underflow diagnostics. Short-circuit is output as the diagnostics event.

Diagnostics: Overflow

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

Diagnostics: Underflow

Enabling of the diagnostics when the measured value falls below the underrange.

Measurement type/measuring range

Refer to the section Measuring types and ranges [\(Page 18\)](#).

Smoothing

The individual measured values are smoothed by filtering. The smoothing can be set in 4 levels.

Smoothing time = number of module cycles (k) \times cycle time of the module.

The following figure shows how many module cycles it takes for the smoothed analog value to approach 100%, depending on the configured smoothing. This applies to every signal change at the analog input.

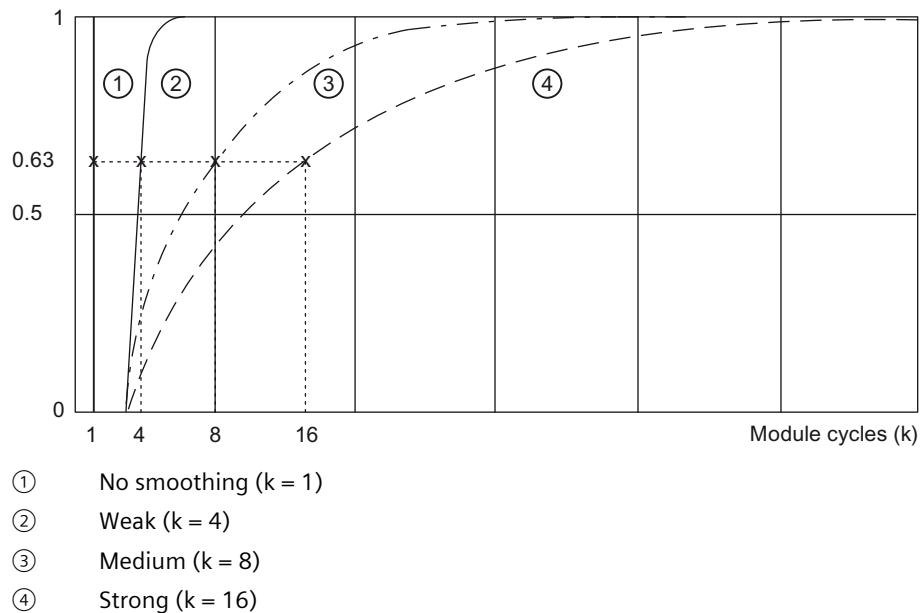


Figure 5-1 Smoothing for AI 2xU ST

Interference frequency suppression

Suppresses the interference affecting analog input modules that is caused by the frequency of the AC voltage network used.

The frequency of the AC voltage network can negatively affect the measured value, in particular when measuring in the low voltage range and with thermocouples. With this parameter, the user specifies the line frequency that is predominant in the plant.

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: No fault is present on the channel.

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.

Address space

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

Assignment in the process image input (PII)

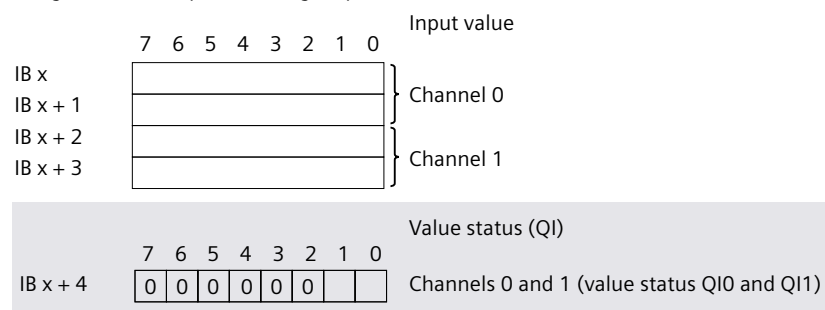


Figure 5-2 Address space of the AI 2×U ST with value status

Interrupts/diagnostics alarms

6.1 Status and error display

LED display

The following figure shows you the LED display of the AI 2xU ST.

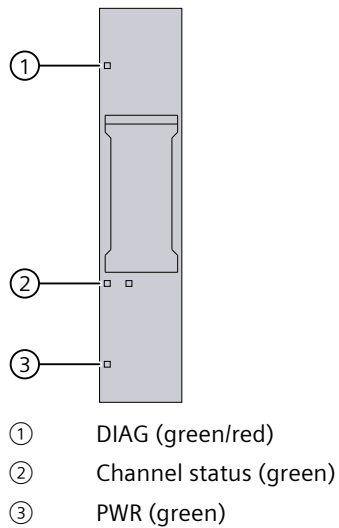






Figure 6-1 LED display

Meaning of the LEDs

The meaning of the status and error messages is described in the following tables. Corrective measures for diagnostics alarms can be found in section Diagnostics alarms ([Page 26](#)).



DIAG LED

Table 6-1 Error display of the DIAG LED

DIAG LED	Meaning
 Off	The system's backplane bus supply is faulty or switched off
 Flashes	Module parameters not assigned
 On	Module parameters assigned and no module/channel diagnostics data available
 Flashes	Module parameters assigned and module/channel diagnostics available



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 AI 2xU ST analog input module supports diagnostics interrupts.

Diagnostics interrupts

The module generates a diagnostic interrupt at the following events:

- Short-circuit (voltage 1 V to 5 V)
- High limit violated
- Low limit violated
- Error
- Parameter assignment error
- Supply voltage missing
- Channel/component temporarily not available

6.3 Diagnostics alarms

A diagnostics alarm is generated and the DIAG LED flashes red 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
Short-circuit (1 to 5 V)	1 _H	Short-circuit of input signal	Correct interplay between module and encoder
		Open input	Connect input
High limit violated	7 _H	Value is above the overrange	Correct interplay between module and encoder
Low limit violated	8 _H	Value is below the underrange	Correct interplay between module and encoder
Error	9 _H	Internal module error has occurred	Replace module
Parameter assignment error	10 _H	<ul style="list-style-type: none"> • 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+	<ul style="list-style-type: none"> • Check the supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel/component temporarily not available	1F _H	Firmware update is currently in progress or has been canceled. The module does not read process values in this state.	<ul style="list-style-type: none"> • Wait for firmware update • Restart the firmware update

Technical specifications

7.1 Technical specifications

Technical specifications of the AI 2xU 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/6ES7134-6FB00-0BA1/td?dl=en>).

Article number	6ES7134-6FB00-0BA1
General information	
Product type designation	AI 2xU ST
HW functional status	from FS21
Firmware version	V1.0.1
<ul style="list-style-type: none"> FW update possible 	Yes
usable BaseUnits	BU type A0, A1
Color code for module-specific color identification plate	CC00
Product function	
<ul style="list-style-type: none"> I&M data 	Yes; I&M0 to I&M3
<ul style="list-style-type: none"> Isochronous mode 	No
<ul style="list-style-type: none"> Measuring range scalable 	No
Engineering with	
<ul style="list-style-type: none"> STEP 7 TIA Portal configurable/integrated from version 	V13 SP1
<ul style="list-style-type: none"> STEP 7 configurable/integrated from version 	V5.5 SP3 / -
<ul style="list-style-type: none"> PROFIBUS from GSD version/GSD revision 	One GSD file each, Revision 3 and 5 and higher
<ul style="list-style-type: none"> PROFINET from GSD version/GSD revision 	GSDML V2.3
Operating mode	
<ul style="list-style-type: none"> Oversampling 	No
<ul style="list-style-type: none"> MSI 	No
CiR - Configuration in RUN	
Reparameterization possible in RUN	Yes
Calibration possible in RUN	No

7.1 Technical specifications

Article number	6ES7134-6FB00-0BA1
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.	37 mA
Encoder supply	
24 V encoder supply	
• 24 V	No
Additional 24 V encoder supply	
• 24 V	No
Power loss	
Power loss, typ.	0.9 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
Selection of BaseUnit for connection variants	
• 1-wire connection	BU type A0, A1
• 2-wire connection	BU type A0, A1
Analog inputs	
Number of analog inputs	2
• For voltage measurement	2
permissible input voltage for voltage input (destruction limit), max.	30 V
Cycle time (all channels), min.	500 µs
Input ranges (rated values), voltages	
• 0 to +10 V	Yes; 15 bit
– Input resistance (0 to 10 V)	180 kΩ
• 1 V to 5 V	Yes; 15 bit
– Input resistance (1 V to 5 V)	180 kΩ
• -10 V to +10 V	Yes; 16 bit incl. sign
– Input resistance (-10 V to +10 V)	180 kΩ
• -5 V to +5 V	Yes; 16 bit incl. sign
– Input resistance (-5 V to +5 V)	180 kΩ

Article number	6ES7134-6FB00-0BA1
Cable length <ul style="list-style-type: none"> shielded, max. 	200 m
Analog value generation for the inputs	
Measurement principle	Sigma Delta
Integration and conversion time/resolution per channel <ul style="list-style-type: none"> Resolution with overrange (bit including sign), max. Integration time, parameterizable Interference voltage suppression for interference frequency f1 in Hz Conversion time (per channel) 	16 bit Yes 16.6 / 50 / 60 Hz / off 50 ms @ 60 Hz, 60 ms @ 50 Hz, 180 ms @ 16.6 Hz, 250 µs without filter
Smoothing of measured values <ul style="list-style-type: none"> Number of smoothing levels parameterizable Step: None Step: low Step: Medium Step: High 	4 Yes Yes Yes; 4x smoothing Yes; 8x smoothing Yes; 16x smoothing
Encoder	
Connection of signal encoders <ul style="list-style-type: none"> for voltage measurement 	Yes
Errors/accuracies	
Linearity error (relative to input range), (+/-)	0.01 %
Temperature error (relative to input range), (+/-)	0.005 %/K
Crosstalk between the inputs, min.	-50 dB
Repeat accuracy in steady state at 25 °C (relative to input range), (+/-)	0.05 %
Operational error limit in overall temperature range <ul style="list-style-type: none"> Voltage, relative to input range, (+/-) 	0.5 %
Basic error limit (operational limit at 25 °C) <ul style="list-style-type: none"> Voltage, relative to input range, (+/-) 	0.3 %
Interference voltage suppression for $f = n \times (f1 \pm 1 \%)$, f1 = interference frequency <ul style="list-style-type: none"> Series mode interference (peak value of interference < rated value of input range), min. Common mode voltage, max. Common mode interference, min. 	70 dB 10 V 90 dB

7.1 Technical specifications

Article number	6ES7134-6FB00-0BA1
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Limit value alarm	No
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	No
• Short-circuit	Yes; at 1 to 5 V
• 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
Permissible potential difference	
between the inputs (UCM)	10 Vpp
Isolation	
Isolation tested with	707 V DC (type test)
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C; < 0 °C as of FS04
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C; < 0 °C as of FS04
• 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

Article number	6ES7134-6FB00-0BA1
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 measurement type and measuring range for PROFINET.

Measurement type	Measuring range	Diagnostics			
		No supply voltage L+	Short-circuit to ground	Overflow	Underflow
Deactivated		*	*	*	*
Voltage	±5 V	x	-	x	x
	±10 V	x	-	x	x
	1 V to 5 V	x	x	x	x
	0 V to 10 V	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 measurement type and measuring range for PROFIBUS.

Measurement type	Measuring range	Diagnostics			
		No supply voltage L+	Short-circuit to ground	Overflow	Underflow
Deactivated		*	*	*	*
Voltage	±5 V	x	-	x	x
	±10 V	x	-	x	x
	1 V to 5 V	x	x	x	x
	0 V to 10 V	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 reassign the module parameters 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.

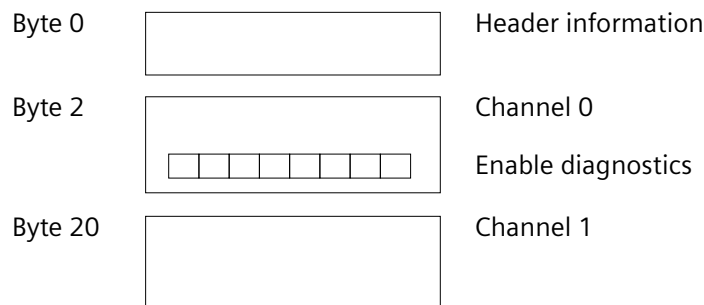


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

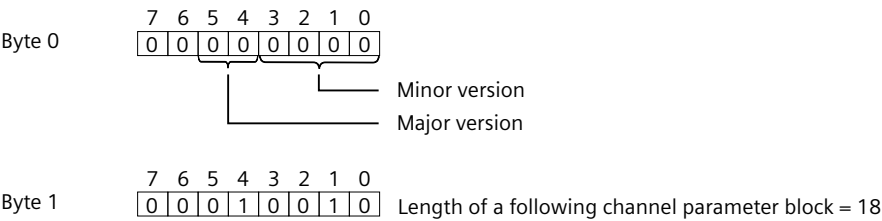
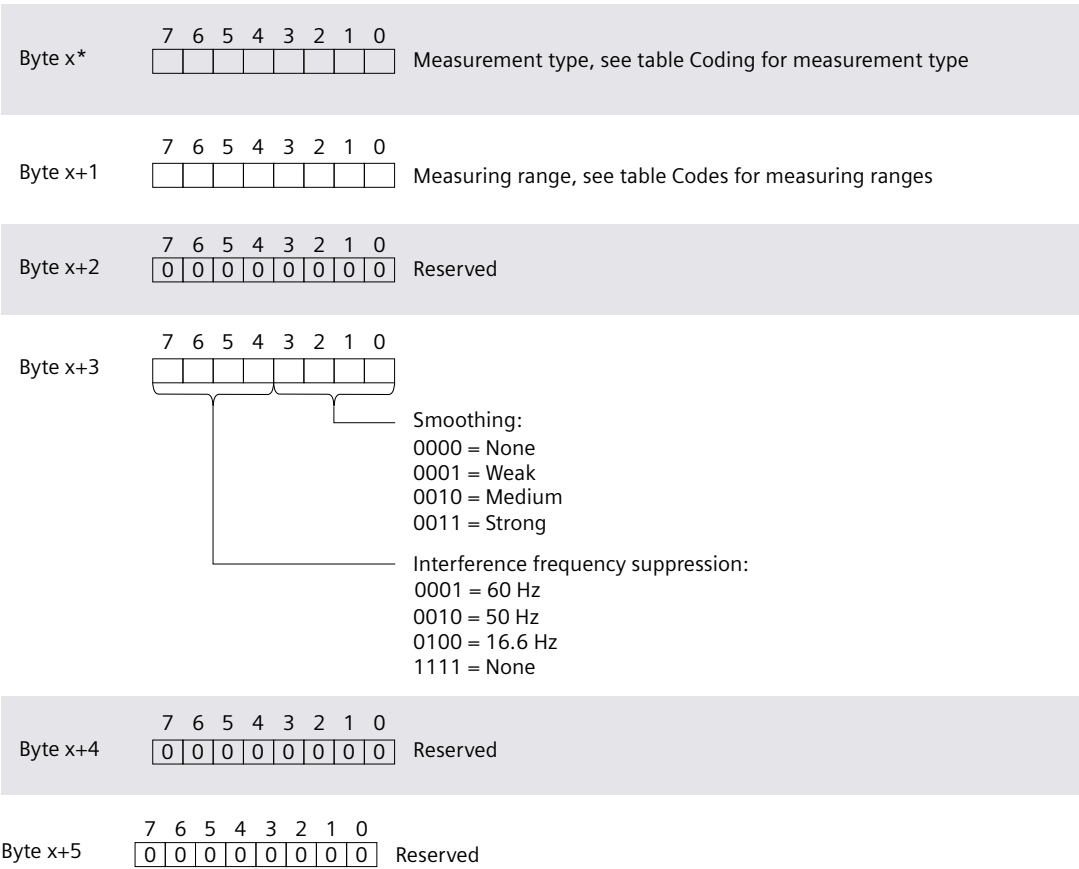


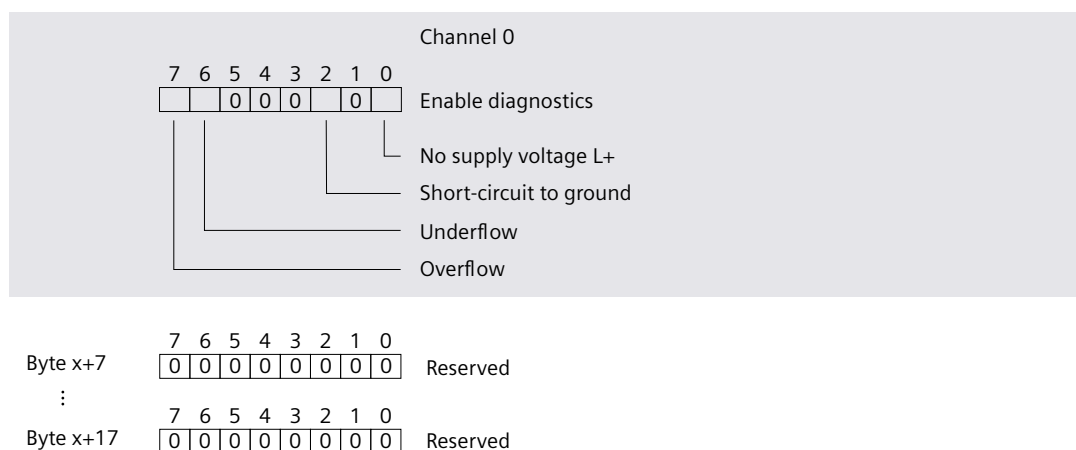
Figure A-2 Header information

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".



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



* $x = 2 + (\text{channel number} \times 18)$; channel number = 0 and 1

Figure A-3 Structure of bytes x to x+17 for channels 0 and 1

Codes for measurement types

The following table contains the codes for the measuring types of the analog input module. You must enter these codes at byte x (see previous figure).

Table A-1 Codes for measurement types

Measurement type	Code
Deactivated	0000 0000
Voltage	0000 0001

Codes for measuring ranges

The following table contains the codes for the measuring ranges of the analog input module. You enter these codes at byte x+1 (see previous figure).

Table A-2 Codes for measuring ranges

Measurement type	Code
Voltage	
±5 V	0000 1000
±10 V	0000 1001
1 to 5 V	0000 1010
0 to 10 V	0000 1011

A.3 Error codes

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	Module not accessible	<ul style="list-style-type: none"> 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 shows the analog values for all measuring ranges that you can use with the analog input module.

Measured value resolution

The resolution of the analog values differs depending on the analog module and its assigned parameters.

The table below shows the representation of binary analog values and of the associated decimal and hexadecimal units of the analog values.

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

Table B-1 Resolution of the analog values

Resolution in bits including sign	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 1 x
16	1	1 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 1

B.2 Representation of input ranges

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

Table B-2 Bipolar input ranges

Dec. value	Measured 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	
32767	>117.589	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
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	Measured 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	
-32768	<-117.593	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

Table B-3 Unipolar input ranges

Dec. value	Measured 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	
32767	>117.589	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
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	Underrange
-4864	-17.593	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	
-32768	<-17.593	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

B.3 Representation of analog values in voltage measuring ranges

Voltage measuring range ± 10 V to ± 5 V

Table B-4 Voltage measuring range ± 10 V to ± 5 V

System		Voltage measuring range		Range
dec	hex	± 10 V	± 5 V	
32767	7FFF	>11.759 V	>5.879 V	Overflow
32511	7EFF	11.759 V	5.879 V	Overrange
27649	6C01			
27648	6C00	10 V	5 V	Nominal range
20736	5100	7.5 V	3.75 V	
1	1	361.7 μ V	180.8 μ V	
0	0	0 V	0 V	
-1	FFFF			
-20736	AF00	-7.5 V	-3.75 V	
-27648	9400	-10 V	-5 V	
-27649	93FF			
-32512	8100	-11.759 V	-5.879 V	Underrange
-32768	8000	<-11.759 V	<-5.879 V	
				Underflow

Voltage measuring ranges 1 V to 5 V and 0 V to 10 V

Table B-5 Voltage measuring ranges 1 V to 5 V and 0 V to 10 V

System		Voltage measuring range		Range
dec	hex	1 V to 5 V	0 V to 10 V	
32767	7FFF	>5.704 V	>11.759 V	Overflow
32511	7EFF	5.704 V	11.759 V	Ovrange
27649	6C01			
27648	6C00	5 V	10 V	Nominal range
20736	5100	4 V	7.5 V	
1	1	1 V + 144.7 μ V	0 V + 361.7 μ V	
0	0	1 V	0 V	
-1	FFFF			Underrange
-4864	ED00	0.296 V	-1.759 V	
-32768	8000	<0.296 V	<-1.759 V	Underflow