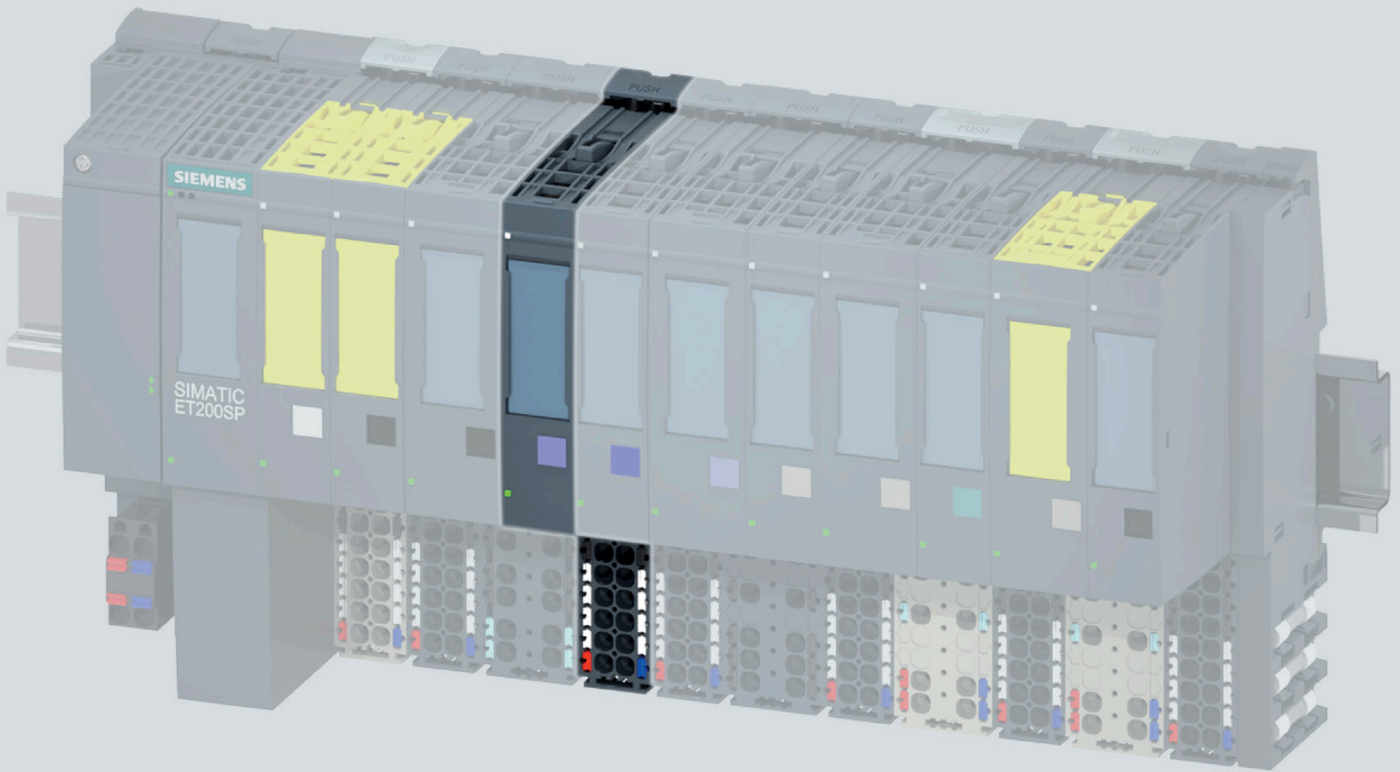


SIEMENS



Manual

SIMATIC

ET 200SP

Analog input module
AI 4xU/I 2-wire ST (6ES7134-6HD01-0BA1)

Edition

06/2020

support.industry.siemens.com

SIEMENS

SIMATIC

ET 200SP

Analog Input Module AI 4xU/I 2-wire ST

(6ES7134-6HD01-0BA1)

Equipment Manual

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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.

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| |
|--|
| ⚠ 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. |

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

Preface

Purpose of the documentation

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

Functions that generally relate to the system are described in this 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 diagram has been modified.

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.

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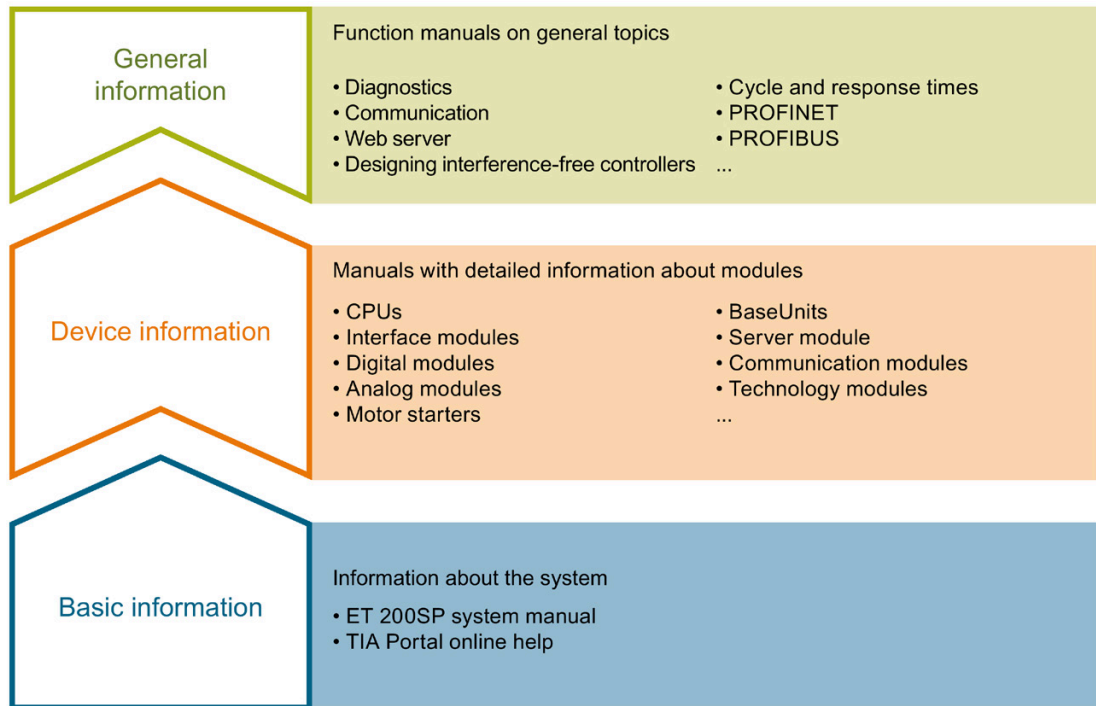
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Documentation guide

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.



Basic information

The System Manual and Getting Started describe 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.

Device information

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

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200SP distributed I/O system, e.g. diagnostics, communication, Web server, motion control and OPC UA.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742709>).

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

You can download the product information free of charge from the Internet (<https://support.industry.siemens.com/cs/us/en/view/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.automation.siemens.com/WWW/view/en/84133942>).

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With "mySupport", your personal workspace, you make the best out of your Industry Online Support.

In "mySupport", you can save filters, favorites and tags, request CAx data and compile your personal library in the Documentation area. In addition, your data is already filled out in support requests and you can get an overview of your current requests at any time.

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

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

"mySupport" - CAx data

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

You configure your own download package with a few clicks.

In doing so you can select:

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

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

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

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

TIA Selection Tool

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

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

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

You can find the TIA Selection Tool on the Internet (<https://new.siemens.com/global/en/productservices/automation/topics/tia/tia-selection-tool.html>).

SIMATIC Automation Tool

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

The SIMATIC Automation Tool provides a multitude of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Address assignment (IP, subnet, gateway) and station 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 by means of LED flashing
- Reading out of CPU error information
- Reading of the CPU diagnostics 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) allows you to analyze the plant network during commissioning. PRONETA features two core functions:

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

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

SINETPLAN

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

The advantages at a glance

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

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

Product overview

2.1 Properties

Article number

6ES7134-6HD01-0BA1 (number in pack: 1 unit)

6ES7134-6HD01-2BA1 (number in pack: 10 units)

View of the module

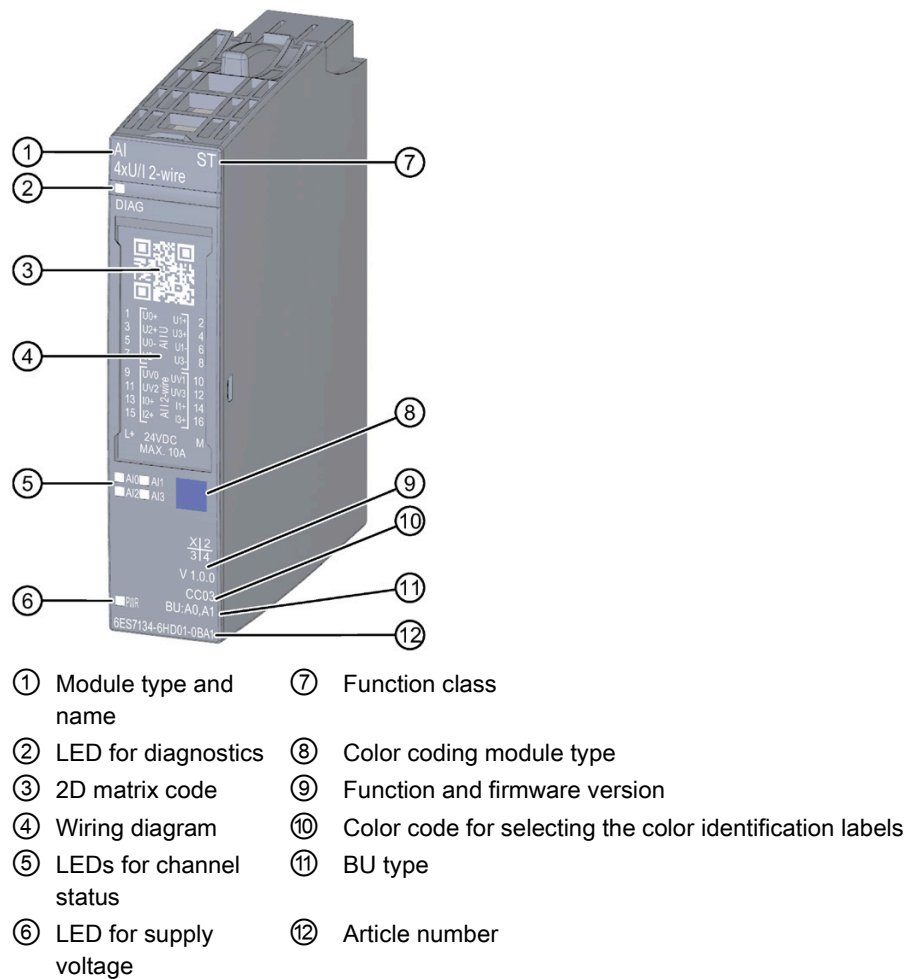


Figure 2-1 View of the module AI 4xU/I 2-wire ST

Properties

The module has the following technical properties:

- Analog input module with 4 inputs
- Measuring type voltage and current for 2-wire transducer (can be set for each channel)
- Input ranges for voltage measurement:
 - ±10 V, resolution 16 bits including sign
 - ±5 V, resolution 16 bits including sign
 - 1 to 5 V, resolution 15 bits
 - 0 to 10 V, resolution 15 bits
- Input ranges for current measurement:
 - 4 to 20 mA, resolution 15 bits
 - 0 to 20 mA, resolution 15 bits
- Electrically isolated from the supply voltage L+ (only for voltage measuring type)
- Permitted common mode voltage: 10 V_{SS}
- Configurable diagnostics per module

The module supports the following functions:

Table 2- 1 Version dependencies of the functions

| Function | HW ver- sion | FW ver- sion | STEP 7 | | GSD file | |
|-------------------------------------|-----------------|---------------------|--------------------------------|---|----------------|----------------|
| | | | TIA Portal | V5.x | PROFINET IO | PROFIBUS DP |
| Firmware update | FS01 | V2.0.0 or higher | V14 or higher with HSP 0239 | V5.5 SP3 or higher with HSP 0227 V7.0 or higher | X | X |
| Identification data I&M0 to I&M3 | FS01 | V2.0.0 or higher | V14 or higher with HSP 0239 | V5.5 SP3 or higher with HSP 0227 V7.0 or higher | X | X |
| Reconfiguration in RUN | FS01 | V2.0.0 or higher | V14 or higher with HSP 0239 | V5.5 SP3 or higher with HSP 0227 V7.0 or higher | X | X |
| PROFInergy | FS01 | V2.0.0 or higher | V14 or higher with HSP 0239 | V5.5 SP3 or higher with HSP 0227 V7.0 or higher | X | X |
| Value status | FS01 | V2.0.0 or higher | V14 or higher with HSP 0239 | V5.5 SP3 or higher with HSP 0227 V7.0 or higher | X | X |

Accessories

The following accessories must be ordered separately:

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

See also

You will find additional information on the accessories in the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/58649293>) system manual.

Wiring up

3.1 Wiring and block diagram

This section includes the block diagram of the AI 4xU/I 2-wire ST module with the terminal assignments.

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

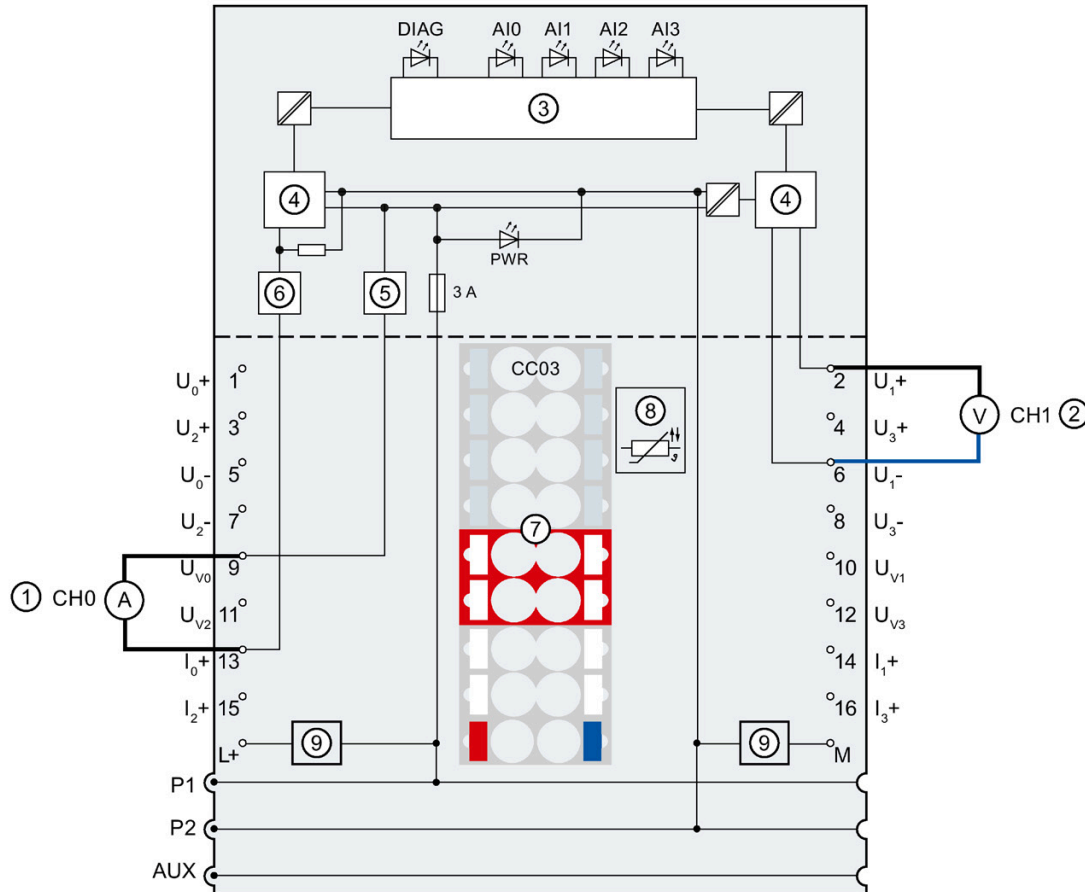
You can use and combine the different wiring options for all channels.

Note

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

Wiring: Voltage and current measurement 2-wire connection

The following figure shows the block diagram and an example of the terminal assignment of the analog input module AI 4xU/I 2-wire ST on the BaseUnit BU type A0/A1.



- | | | | |
|---|---|--------------------|---|
| ① | 2-wire connection for current measurement (2-wire transducer) | U _n + | Voltage input positive, channel n |
| ② | 2-wire connection for voltage measurement | U _n - | Voltage input negative, channel n |
| ③ | Backplane bus interface | U _{vn} | Supply voltage, channel n |
| ④ | Analog-to-digital converter (ADC) | I _n + | Current input positive, channel n |
| ⑤ | Short-circuit protection | L+ | 24 V DC (infeed only with light BaseUnit) |
| ⑥ | Current limitation | M | Ground |
| ⑦ | Color-coded label with color code CC03 (optional) | P1, P2, AUX | Internal self-assembling voltage buses Connection to left (dark BaseUnit) Connection to left interrupted (light BaseUnit) |
| ⑧ | Temperature recording for BU type A1 only (function cannot be used for this module) | DIAG | Diagnostics LED (green, red) |
| ⑨ | Supply voltage filter circuit (only when light BaseUnit is present) | AI0, AI1, AI2, AI3 | Channel status LED (green) |
| | | PWR | Power LED (green) |

Figure 3-1 Wiring and block diagram for voltage and current measurement

Parameters/address space

4.1 Measuring types and ranges

The analog input module AI 4×U/I 2-wire ST has the following measuring ranges:

Table 4- 1 Measuring ranges

| Measuring type | Measuring range | Resolution |
|-----------------------------|-----------------|------------------------|
| Voltage | ± 5 V | 16 bits including sign |
| | ±10 V | 16 bits including sign |
| | 1 to 5 V | 15 bits |
| | 0 to 10 V | 15 bits |
| Current (2-wire transducer) | 0 mA to 20 mA | 15 bits |
| | 4 to 20 mA | 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 38).

4.2 Parameters

Parameters of the AI 4xU/I 2-wire ST

Specify the module properties with the various parameters in the course of your STEP 7 configuration. The following table lists the configurable parameters. The effective range of the configurable parameters depends on the type of configuration. The following configurations are possible:

- Central operation with 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 the section Parameter assignment and structure of the parameter data record (Page 33).

The following parameter settings are possible:

Table 4- 2 Configurable parameters and their defaults (GSD file)

| Parameter | Value range | Default | Configura- tion 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 | <ul style="list-style-type: none"> • Disable • Enable | Disable | Yes | Module | Module |
| Diagnostics Underflow | <ul style="list-style-type: none"> • Disable • Enable | Disable | Yes | Module | Module |
| Diagnostics Wire break | <ul style="list-style-type: none"> • Disable • Enable | Disable | Yes | Module | Module |
| Measuring type/range | <ul style="list-style-type: none"> • deactivated • Voltage +/- 5 V • Voltage +/- 10 V • Voltage 1..5 V • Voltage 0..10 V • Current (2-wire transducer) 0..20 mA • Current (2-wire transducer) 4..20 mA | Current (2-wire transducer) 4..20 mA | Yes | Channel | Channel |

4.2 Parameters

| Parameter | Value range | Default | Configura- tion in RUN | Effective range with configuration software, e.g. STEP 7 (TIA Portal) | |
|--|---|--|---------------------------|---|-------------------------|
| | | | | GSD file PROFINET IO | GSD file PROFIBUS DP |
| Smoothing | <ul style="list-style-type: none"> • None • weak • medium • strong | None | Yes | Channel | Channel |
| Interference frequency suppression ² | <ul style="list-style-type: none"> • 60 Hz • 50 Hz¹ • 16.6 Hz | 50 Hz | Yes | Channel | Module ³ |
| Potential group | <ul style="list-style-type: none"> • Use potential group of the left module (module plugged into a dark BaseUnit) • Enable new potential group (module plugged into light BaseUnit) | Use potential group of the left module | No | Module | Module |

- ¹ ...Interference frequency suppression: Noise at 400 Hz is automatically included in the filtering at 50 Hz.
- ² The settings in the "Interference frequency suppression" parameter have a direct effect on the conversion time of the channel. The analog value is therefore also affected by additionally set filtering via the "Smoothing" parameter.
- ² 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. The parameter length of the I/O module is 5 bytes with PROFIBUS GSD configuration. If necessary, you can set this parameter by using the data record 128, see the appendix "Parameter data set".

Note

Unused channels

Disable unused channels in the parameter assignment to improve the cycle time of the module.

A disabled channel always returns the value 7FFF_H.

4.3 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

Enabling of the diagnostics in the event of a short-circuit of the encoder supply to ground or of an input to the encoder supply. Short-circuit is also detected in the range 1 to 5 V, when both input signals are short-circuited.

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.

Diagnostics Wire break

Enabling of the diagnostics if the module has no current flow or the current is too weak to be measured at the relevant input.

The wire break and underflow diagnostics can be activated simultaneously. If both diagnostics events occur simultaneously, the wire break diagnostics info is output.

Type/range of measurement

Refer to the section Measuring types and ranges (Page 16).

Smoothing

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

Smoothing time = number of module cycles (k) x 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.

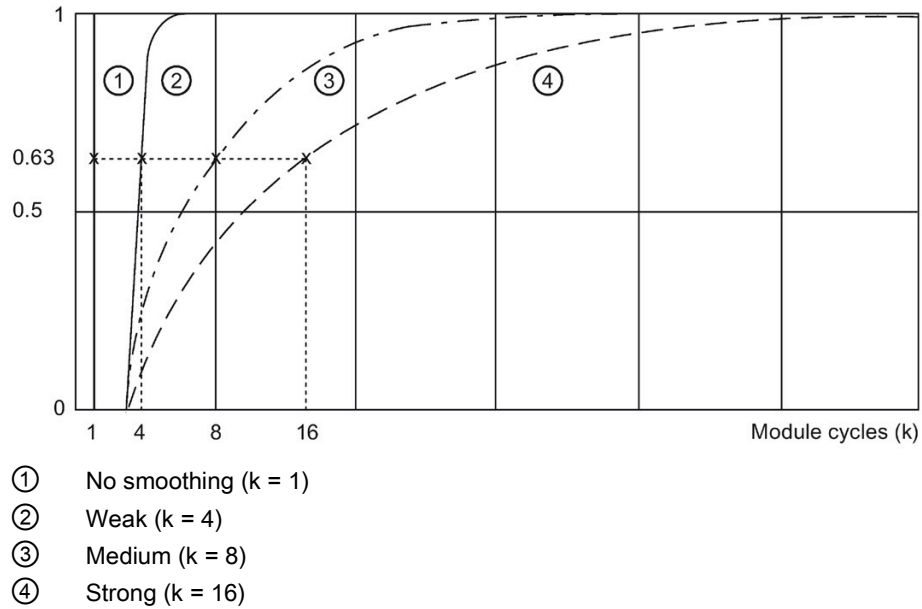


Figure 4-1 Smoothing with AI 4xU/I 2-wire ST

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 supply 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.

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.

4.4 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 to 3 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 disabled or there is a fault/error on the module.

If a fault/error 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 4xU/I 2-wire 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)

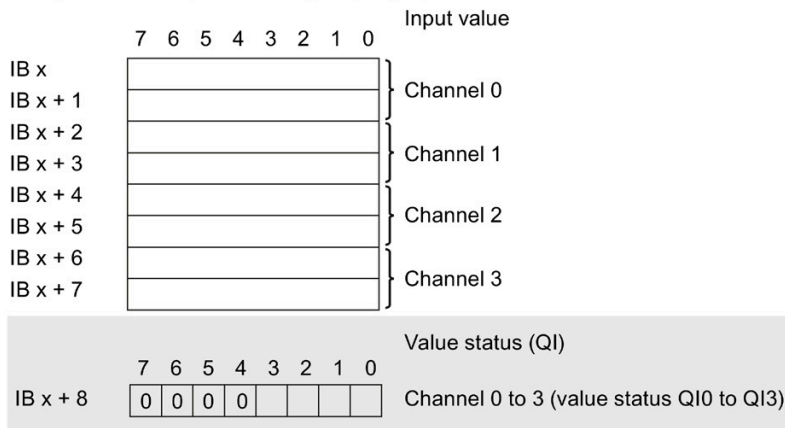


Figure 4-2 Address space of the AI 4xU/I 2-wire ST with value status

Interrupts/diagnostics alarms

5.1 Status and error display

LED display

The figure below shows the LED displays (status and error displays) of the AI 4xU/I 2-wire ST.

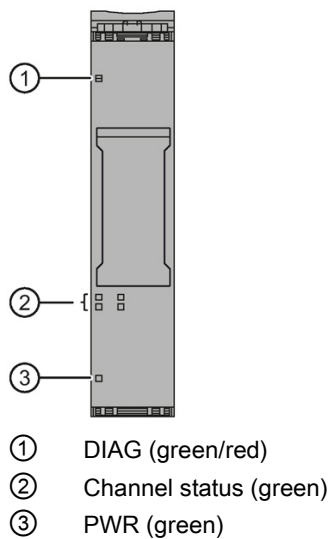






Figure 5-1 LED display

Meaning of the LED displays

The following tables show the meaning of the status and error displays. Measures for dealing with diagnostics alarms can be found in the section Diagnostics alarms (Page 25).



DIAG LED

Table 5- 1 DIAG LED fault/error display

| DIAG LED | Meaning |
|--|--|
|  Off | Backplane bus supply of the ET 200SP not OK |
|  Flashes | Module parameters not assigned |
|  On | Module parameters assigned and no module diagnostics |
|  Flashes | Module parameters assigned and module diagnostics |



Channel status LED

Table 5- 2 Status display of the channel status LED

| Channel status LED | Meaning |
|--|-------------------|
|  Off | Channel disabled |
|  On | Channel activated |

PWR LED

Table 5- 3 Status display of the PWR LED

| PWR LED | Meaning |
|--|---------------------------|
|  Off | No supply voltage L+ |
|  On | Supply voltage L+ present |

5.2 Interrupts

The analog input module AI 4xU/I 2-wire ST supports diagnostics interrupts.

Diagnostics interrupt

The module generates a diagnostics interrupt for the following events:

- Channel temporarily unavailable
- Short-circuit (current, voltage 1..5 V)
- Wire break (current 4 to 20 mA)
- Low limit violated
- High limit violated
- Error
- Parameter assignment error
- Supply voltage missing

5.3 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 5- 4 Diagnostics alarms, their meaning and how to deal with them

| Diagnostics alarm | Error code | Meaning | Solution |
|----------------------------|------------|---|--|
| Short-circuit (current)* | 1H | Sensor supply to ground | Correct the module/encoder tuning |
| | | Input to sensor supply | |
| Short-circuit (1 to 5 V)** | 1H | Short-circuit of input signal | Correct the module/encoder tuning |
| | | Open input | Connect input |
| Wire break (current) ** | 6H | Impedance of encoder circuit too high. | Use a different encoder type or modify the wiring, for example, using cables with a larger cross-section |
| | | Wire break between the module and sensor | Connect the cable |
| | | Channel not connected (open) | <ul style="list-style-type: none"> • Disable diagnostics • Connect the sensor contacts |
| High limit violated | 7H | Value is above the overrange. | Correct the module/encoder tuning |
| Low limit violated | 8H | Value is below the underrange. | Correct the module/encoder tuning |
| Error | 9H | Internal module error occurred. | Replace module |
| Parameter assignment error | 10H | <ul style="list-style-type: none"> • The module cannot evaluate parameters for the channel. • Incorrect parameter assignment. | Correct the parameter assignment |

5.3 Diagnostics alarms

| Diagnostics alarm | Error code | Meaning | Solution |
|---------------------------------|-----------------|--|---|
| Supply voltage missing | 11 _H | No or insufficient supply voltage L+ | <ul style="list-style-type: none">• Check supply voltage L+ on the BaseUnit• Check BaseUnit type |
| Channel temporarily unavailable | 1F _H | Firmware update in progress or update has been canceled. The module does not read any process values in this state. | <ul style="list-style-type: none">• Wait for firmware update.• Restart the firmware update. |

* Short-circuit of the encoder supply to ground and/or of the input signal to the encoder supply of a channel can have a temporary effect on other channels (duration < 0.5 s). This means the short-circuit diagnostics can also be reported for unaffected channels and/or the measured value can be affected temporarily.

** In case of activated smoothing the module calculates the measured values across several module cycles. The module only generates the short circuit or wire break diagnosis if the smoothed measured value is stable. After the short-circuit or wire break has been eliminated, the module supplies stable measured values again depending on the set smoothing level.

Technical specifications

6.1 Technical specifications

Technical specifications of the AI 4×U/I 2-wire ST

The following table shows the technical specifications as of 06/2020. You will find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/pv/6ES7134-6HD01-0BA1/td?dl=en>).

| Article number | 6ES7134-6HD01-0BA1 |
|---|--|
| General information | |
| HW functional status | From FS02 |
| Firmware version | |
| <ul style="list-style-type: none"> FW update possible | Yes |
| usable BaseUnits | BU type A0, A1 |
| Color code for module-specific color identification plate | CC03 |
| 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 as of version | V14 / - |
| <ul style="list-style-type: none"> STEP 7 configurable/integrated as of version | V5.6 and higher |
| <ul style="list-style-type: none"> PCS 7 configurable/integrated as of version | V8.1 SP1 |
| <ul style="list-style-type: none"> PROFIBUS as of GSD version/GSD revision | One GSD file each, Revision 3 and 5 and higher |
| <ul style="list-style-type: none"> PROFINET as of 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 |

| | |
|---|--|
| Article number | 6ES7134-6HD01-0BA1 |
| 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; without sensor supply |
| 24 V encoder supply | |
| <ul style="list-style-type: none"> • 24 V | Yes |
| <ul style="list-style-type: none"> • Short-circuit protection | Yes |
| <ul style="list-style-type: none"> • Output current, max. | 20 mA; max. 50 mA per channel for a duration < 10 s |
| Power loss | |
| Power loss, typ. | 0.85 W; Without encoder supply voltage |
| Address area | |
| Address space per module | |
| <ul style="list-style-type: none"> • Address space per module, max. | 8 byte; + 1 byte for QI information |
| Hardware configuration | |
| Automatic encoding | |
| <ul style="list-style-type: none"> • Mechanical coding element | Yes |
| Selection of BaseUnit for connection variants | |
| <ul style="list-style-type: none"> • 2-wire connection | BU type A0, A1 |
| Analog inputs | |
| Number of analog inputs | 4; Differential inputs |
| permissible input voltage for voltage input (destruction limit), max. | 30 V |
| permissible input current for current input (destruction limit), max. | 50 mA |
| Cycle time (all channels), min. | Sum of the basic conversion times and additional processing times (depending on the parameterization of the active channels) |
| Input ranges (rated values), voltages | |
| <ul style="list-style-type: none"> • 0 to +10 V <ul style="list-style-type: none"> – Input resistance (0 to 10 V) | Yes; 15 bit 120 kΩ |
| <ul style="list-style-type: none"> • 1 V to 5 V <ul style="list-style-type: none"> – Input resistance (1 V to 5 V) | Yes; 15 bit 120 kΩ |
| <ul style="list-style-type: none"> • -10 V to +10 V <ul style="list-style-type: none"> – Input resistance (-10 V to +10 V) | Yes; 16 bit incl. sign 120 kΩ |
| <ul style="list-style-type: none"> • -5 V to +5 V <ul style="list-style-type: none"> – Input resistance (-5 V to +5 V) | Yes; 16 bit incl. sign 120 kΩ |

| | |
|---|---|
| Article number | 6ES7134-6HD01-0BA1 |
| Input ranges (rated values), currents | |
| <ul style="list-style-type: none"> • 0 to 20 mA <ul style="list-style-type: none"> – Input resistance (0 to 20 mA) • 4 mA to 20 mA <ul style="list-style-type: none"> – Input resistance (4 mA to 20 mA) | <p>Yes; 15 bit</p> <p>100 Ω; + approx. 0.7 V diode forward voltage</p> <p>Yes; 15 bit</p> <p>100 Ω; + approx. 0.7 V diode forward voltage</p> |
| Cable length | |
| <ul style="list-style-type: none"> • shielded, max. | 1 000 m; 200 m for voltage measurement |
| Analog value generation for the inputs | |
| Measurement principle | integrating (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) | <p>16 bit</p> <p>Yes</p> <p>16.6 / 50 / 60 Hz</p> <p>180 / 60 / 50 ms</p> |
| Smoothing of measured values | |
| <ul style="list-style-type: none"> • Number of smoothing levels • parameterizable | <p>4; None; 4/8/16 times</p> <p>Yes</p> |
| Encoder | |
| Connection of signal encoders | |
| <ul style="list-style-type: none"> • for voltage measurement • for current measurement as 2-wire transducer <ul style="list-style-type: none"> – Burden of 2-wire transmitter, max. • for current measurement as 4-wire transducer | <p>Yes</p> <p>Yes</p> <p>650 Ω</p> <p>No</p> |
| 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, (+/-) • Current, relative to input range, (+/-) | <p>0.5 %</p> <p>0.5 %</p> |

6.1 Technical specifications

| | |
|--|---|
| Article number | 6ES7134-6HD01-0BA1 |
| Basic error limit (operational limit at 25 °C) | |
| <ul style="list-style-type: none"> Voltage, relative to input range, (+/-) Current, relative to input range, (+/-) | <p>0.3 %</p> <p>0.3 %</p> |
| 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. | <p>70 dB</p> <p>10 V</p> <p>90 dB</p> |
| Interrupts/diagnostics/status information | |
| Diagnostics function | Yes |
| Alarms | |
| <ul style="list-style-type: none"> Diagnostic alarm Limit value alarm | <p>Yes</p> <p>No</p> |
| Diagnostic messages | |
| <ul style="list-style-type: none"> Monitoring the supply voltage Wire-break Short-circuit Group error Overflow/underflow | <p>Yes</p> <p>Yes; at 4 to 20 mA</p> <p>Yes; with 1 to 5 V or 2-wire mode: Short-circuit of the encoder supply to ground or of an input to the encoder supply</p> <p>Yes</p> <p>Yes</p> |
| Diagnostics indication LED | |
| <ul style="list-style-type: none"> Monitoring of the supply voltage (PWR-LED) Channel status display for channel diagnostics for module diagnostics | <p>Yes; green LED</p> <p>Yes; green LED</p> <p>No</p> <p>Yes; green/red LED</p> |
| Potential separation | |
| Potential separation channels | |
| <ul style="list-style-type: none"> between the channels between the channels and backplane bus between the channels and the power supply of the electronics | <p>Yes; channel group-specific between 2-wire current input group and voltage input group</p> <p>Yes</p> <p>Yes; only for voltage inputs</p> |
| Permissible potential difference | |
| between the inputs (UCM) | 10 V DC |

| | |
|--|--|
| Article number | 6ES7134-6HD01-0BA1 |
| Isolation | |
| Isolation tested with | 707 V DC (type test) |
| Standards, approvals, certificates | |
| Suitable for applications according to AMS 2750 | Yes; Declaration of Conformity, see online support entry 109757262 |
| Suitable for applications according to CQI-9 | Yes |
| Ambient conditions | |
| Ambient temperature during operation | |
| <ul style="list-style-type: none"> • horizontal installation, min. • horizontal installation, max. • vertical installation, min. • vertical installation, max. | <ul style="list-style-type: none"> -30 °C 60 °C -30 °C 50 °C |
| Altitude during operation relating to sea level | |
| <ul style="list-style-type: none"> • Installation altitude above sea level, max. | 5 000 m; Restrictions for installation altitudes > 2 000 m, see 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 measuring type and measuring range for PROFINET.

| Measuring type | Measuring range | Diagnostics | | | | |
|-----------------------------|-----------------|----------------------|--------------------|----------|-----------|------------|
| | | No supply voltage L+ | Short-circuit to M | Overflow | Underflow | Wire break |
| deactivated | | * | * | * | * | * |
| Voltage | ±5 V | x | - | x | x | - |
| | ±10 V | x | - | x | x | - |
| | 1..5 V | x | x | x | x | - |
| | 0..10 V | x | - | x | x | - |
| Current (2-wire transducer) | 0..20 mA | x | x | x | x | - |
| | 4..20 mA | 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 measuring type and measuring range for PROFIBUS.

| Measuring type | Measuring range | Diagnostics | | | |
|-----------------------------|-----------------|----------------------|--------------------|------------------------|------------|
| | | No supply voltage L+ | Short-circuit to M | Overflow/ Underflow | Wire break |
| deactivated | | * | * | * | * |
| Voltage | ±5 V | x | - | x | - |
| | ±10 V | x | - | x | - |
| | 1..5 V | x | x | x | - |
| | 0..10 V | x | - | x | - |
| Current (2-wire transducer) | 0..20 mA | x | x | x | - |
| | 4..20 mA | 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 reconfigure the module 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 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 contains the diagnostics for the entire module.

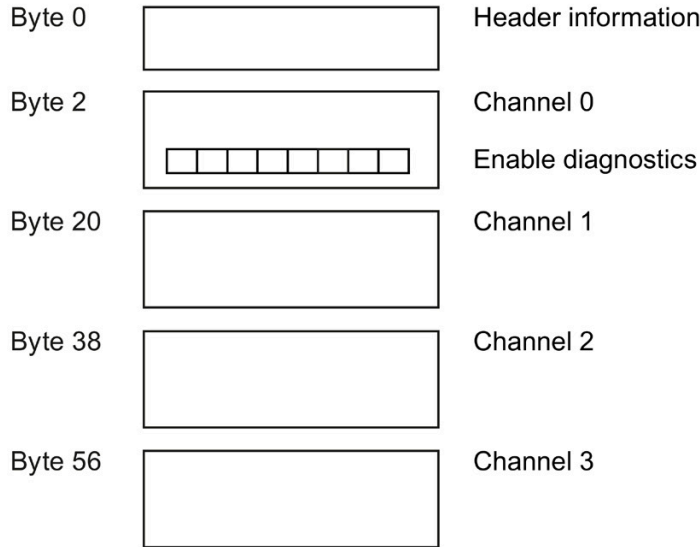


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

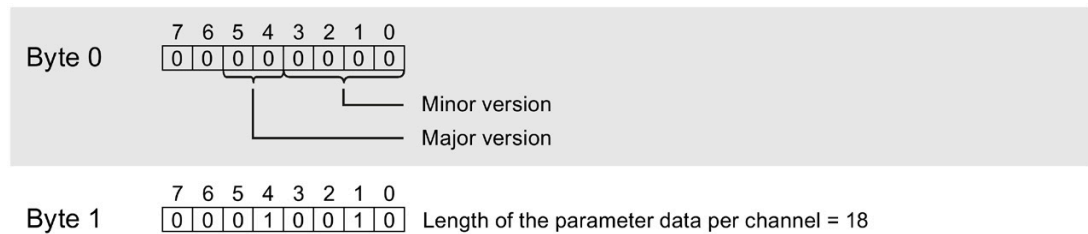
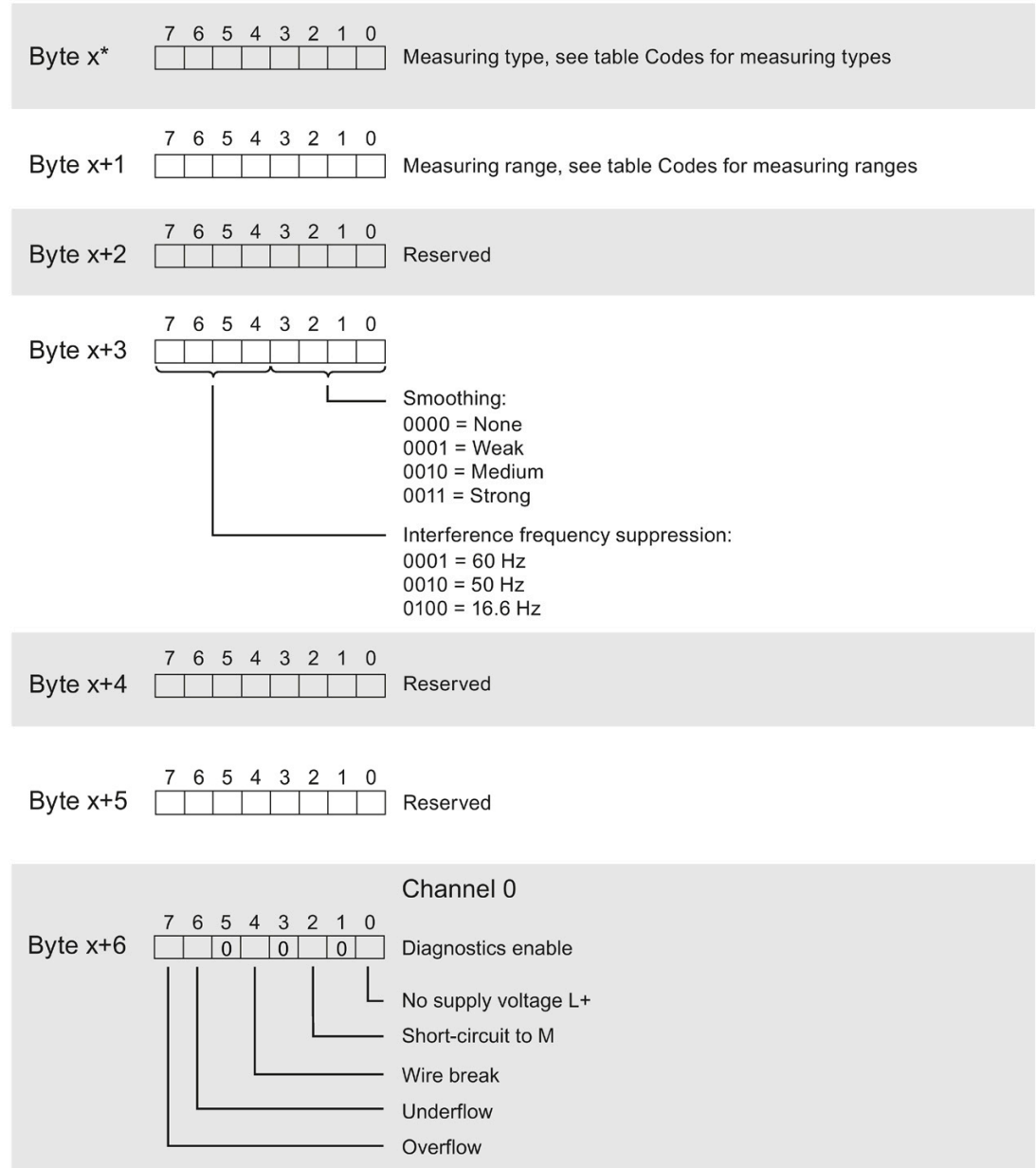


Figure A-2 Header information

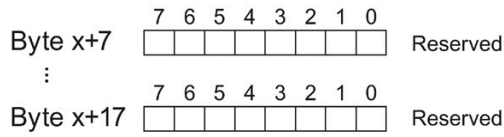
A.2 Parameter assignment and structure of the parameter data record

Parameter

The figure below shows the structure of the parameters for channels 0 to 3.
 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 to 3

Figure A-3 Structure of byte x to x+17 for channels 0 to 3

Codes for the measuring type

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 the measuring type

| Measuring type | Coding |
|----------------------------|-----------|
| Deactivated | 0000 0000 |
| Voltage | 0000 0001 |
| Current, 2-wire transducer | 0000 0011 |

Codes for the measuring range

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 the measuring range

| Measuring type | Coding |
|----------------|-----------|
| Voltage | |
| ±5 V | 0000 1000 |
| ±10 V | 0000 1001 |
| 1 to 5 V | 0000 1010 |
| 0 to 10 V | 0000 1011 |
| Current | |
| 0 to 20 mA | 0000 0010 |
| 4 to 20 mA | 0000 0011 |

A.3 Error in transferring the data record analog input

Error transferring the data record

The module always checks all values of the data record to be sent. 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 corresponding error codes when errors occur in the STATUS parameter, see also the description of the "STATUS" parameter in the STEP 7 online help).

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

| Error code in STATUS parameter (hexadecimal) | | | | Meaning | Solution |
|---|--------|--------|--------|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | | |
| DF | 80 | B0 | xx | Number of the data record unknown. | Enter a valid number for the data record. |
| DF | 80 | B1 | xx | Length of the data record incorrect. | Enter a valid value for the data record length. |
| DF | 80 | B2 | xx | Slot invalid or cannot be accessed. | <ul style="list-style-type: none"> Check the station to determine whether the module is plugged or pulled. Check the assigned values for the parameters of the WRREC instruction. |
| DF | 80 | E0 | xx | Wrong version or error in the header information. | Correct the version, length and number of parameter blocks. |
| DF | 80 | E1 | 01 | Reserved bit set | Check the parameters of the module. |
| DF | 80 | E1 | 02 | Invalid diagnostics enable bit set for operating mode. | Check the parameters of the module. |
| DF | 80 | E1 | 05 | Invalid coding set for measuring range / measurement type. | Check the parameters of the module. |
| DF | 80 | E1 | 08 | Invalid coding set for interference frequency suppression / integration time. | Check the parameters of the module. |
| DF | 80 | E1 | 09 | Invalid coding for smoothing. | Check the parameters of the module. |

Representation of analog values

This appendix shows the analog values for all measuring ranges that you can use with the analog 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 |
| 14 | 4 | 4 _H | Sign 0 0 0 0 0 0 0 | 0 0 0 0 0 1 x x |
| 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.1 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 | |
| -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 | Underflow |
| -32768 | <-117.593 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

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 | |
| -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.2 Representation of analog values in voltage measuring ranges

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

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

| Values | | 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 | | | Underrange |
| -32512 | 8100 | -11.759 V | -5.879 V | |
| -32768 | 8000 | <-11.759 V | <-5.879 V | Underflow |

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

| Values | | Voltage measuring range | | Range |
|--------|------|-------------------------|---------------------|---------------|
| Dec. | Hex. | 1 to 5 V | 0 to 10 V | |
| 32767 | 7FFF | >5.704 V | >11.759 V | Overflow |
| 32511 | 7EFF | 5.704 V | 11.759 V | Overrange |
| 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 | | | |
| -4864 | ED00 | 0.296 V | -1.759 V * | Underrange ** |
| -32768 | 8000 | <0.296 V | <-1.759 V * | |
| | | | | Underflow ** |

* negative values are only possible if the module (6ES7134-6GD01-0BA1) with FW version V2.0.0 and higher is configured.

** no underrange/underflow if the predecessor module (6ES7134-6GD00-0BA1) is configured.

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

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

Table B- 6 Current measuring ranges 0 to 20 mA and 4 to 20 mA

| Values | | Current measuring range | | Range |
|--------|------|-------------------------|-----------------|---------------|
| Dec. | Hex. | 0 to 20 mA * | 4 to 20 mA | |
| 32767 | 7FFF | >23.52 mA | >22.81 mA | Overflow |
| 32511 | 7EFF | 23.52 mA | 22.81 mA | Overrange |
| 27649 | 6C01 | | | |
| 27648 | 6C00 | 20 mA | 20 mA | Nominal range |
| 20736 | 5100 | 15 mA | 16 mA | |
| 1 | 1 | 723.4 nA | 4 mA + 578.7 nA | |
| 0 | 0 | 0 mA | 4 mA | |
| -1 | FFFF | | | |
| -4864 | ED00 | -3.52 mA | 1.185 mA | Underrange |
| -32768 | 8000 | <-3.52 mA | <1.185 mA | |
| | | | | Underflow |

* For measuring type "2-wire transducer", negative values are not possible for the range "0 to 20 mA". Therefore, no underrange or underflow exists here.