SIEMENS

SIMATIC

ET 200SP
Analog input module AI 2xSG 4-/6-wire HS (7MH4134-6LB00-0DA0)

Equipment Manual

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7MH4134-6LB00-0DA0

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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.

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Introduction

1

Purpose of the documentation

This manual supplements the ET 200SP distributed I/O system 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.

Conventions

CPU: The term "CPU" as used in this manual refers to both the central modules of the S7-1500 automation system and to the CPUs/interface modules of the ET 200SP distributed I/O system.

STEP 7: We use "STEP 7" as synonym for all versions of "STEP 7 (TIA Portal)" to refer to the configuration and programming software in this documentation.

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.

1.1 Use in hazardous area

WARNING

Use in hazardous area

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.
- Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

WARNING

Incorrect installation

Risk of explosion in the hazardous area. For use in hazardous areas according to Class I, Division 2 or Class I, Zone 2 or for use in the EU according to ATEX 2014/34/EU, observe the following conditions:

- Install the device in a control cabinet or enclosure.
- The control cabinet or enclosure meets at least the requirements of IP54 according to IEC/EN 60079-7 and pollution degree 2 or better according to IEC/EN 60664-1.

WARNING

If the device is installed in a cabinet, the inner temperature of the cabinet corresponds to the ambient temperature of the device.

WARNING

Opening the device

DO NOT OPEN WHEN ENERGIZED.

WARNING

Replacing components

EXPLOSION HAZARD

SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2 OR ZONE 2.

WARNING

Impermissible repair of the device

- Repair must be carried out by Siemens authorized personnel only.

⚠ CAUTION
To prevent injury and damage, read the manual before using the device.

Document history

The overview below summarizes the most important changes in the documentation when compared to the previous edition.

The most important changes in the documentation when compared with the respective previous edition are given in the table below.

Manual edition	Comments
10/2022	Section Certificates and approvals (Page 59) revised
05/2020	Min./max. peak value memory (Page 38) added

See also

Mounting (Page 17)

Product compatibility

The following table describes compatibility between manual edition, device revision, engineering system and the engineering system.

Manual edition	Comments	Device revision	Engineering system
10/2022	-	FW: 1.0.1 or higher	STEP 7 TIA Portal V14 SP1 or higher STEP 7 V5.6 or higher
05/2020	-	FW: 1.0.0 or higher	STEP 7 TIA Portal V14 SP1 or higher STEP 7 V5.6 or higher

1.2 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/global/en/products/automation/topic-areas/industrial-cybersecurity.html.

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/global/en/products/services/cert.html.

Safety instructions

2

Safety notices when using the device according to Hazardous Locations (HazLoc)

If you use the device under HazLoc conditions you must also keep to the following safety notices in addition to the general safety notices for protection against explosion:

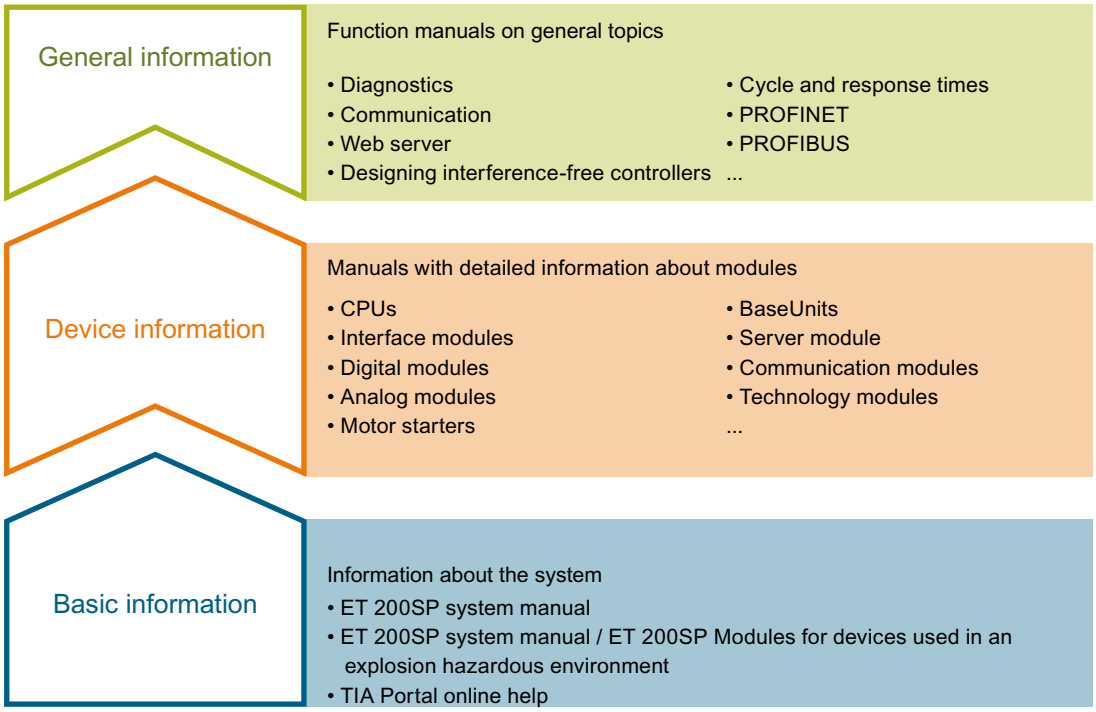
This equipment is suitable for use in Class I, Zone 2, Group IIC or non-hazardous locations only.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.

Documentation Guide

3

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 (http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/Pages/Default.aspx).

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 (http://support.automation.siemens.com/WW/view/en/84133942).

"mySupport"

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.

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

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

"mySupport" - Documentation

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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.

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

You can find "mySupport" on the Internet.

"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 (http://support.industry.siemens.com/my/ww/en/CAxOnline).

Application examples

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

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

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).
This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.
With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

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

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independent of 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, incl. fail-safe inputs and outputs.

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.

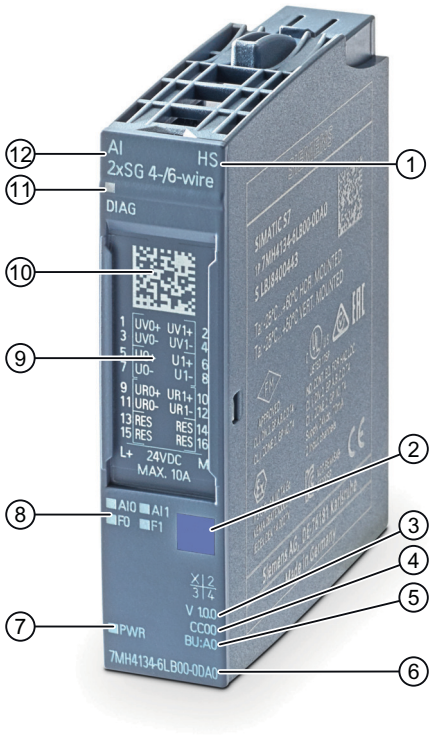
See also

My Documentation Manager (http://support.industry.siemens.com/My/ww/en/documentation)

Product overview

4

View of the module



① Function class
② Color labeling module type
③ Function and firmware version
④ Color code for selecting the color-coded labels
⑤ BaseUnit type
⑥ Article number
⑦ LED for supply voltage
⑧ LEDs for channel status
⑨ Connection diagram
⑩ 2D matrix code
⑪ LED for diagnostics
⑫ Module type and designation

Figure 4-1 View of the AI 2xSG 4-/6-wire HS module

Properties

The module has the following technical properties:

- Analog input module with 2 inputs
- Measurement type voltage of 4-wire and 6-wire strain gauges (full bridges)
  4.85 VDC supply voltage of full bridge
- Input ranges
  - ± 0.5 ... 320 mV/V, resolution 28 bits including sign
  - 16-bit oversampling including sign
- Electrically isolated from supply voltage L+
- Configurable diagnostics (per channel)
- Hardware interrupt on limit violation can be set per channel (two high and two low limits per channel)
- Min./max. peak value memory

The module supports the following functions:

- Firmware update
- I&M identification data
- Reconfiguration in RUN
- PROFIenergy
- Isochronous mode
- Oversampling

Accessories

The following accessories must be ordered separately:

- Labeling strips
- Reference identification label
- Shield connector

See also

You can find more information on accessories in the ET 200SP distributed I/O system system manual.

Mounting

5

5.1 Basic safety notes

5.1.1 UL/FM Special conditions for use

Safety notices on use in hazardous areas

General safety notices relating to protection against explosion

⚠ WARNING
EXPLOSION HAZARD Replacing components may impair suitability for Class 1, Division 2 or Zone 2.

⚠ WARNING
Substitution of components may impair suitability of the equipment.

5.1.1.1 Safety information according to FM and UL

Safety information for use according to FM and UL

If you use the device under FM conditions you must also keep to the following safety notices in addition to the general safety notices for protection against explosion:

⚠ WARNING
Substitution of components may impair suitability for Division 2.

⚠ WARNING
Do not remove or replace while circuit is live when a flammable or combustible atmosphere is present.

WARNING

Explosion hazard

Do not disconnect equipment when a flammable or combustible atmosphere is present.

WARNING

EXPLOSION HAZARD

The device is designed for operation in closed housing or control cabinet. The inner service temperature of the enclosure/control cabinet corresponds to the ambient temperature of the module. Use cables with a maximum permitted operating temperature of at least 20 °C higher than the maximum ambient temperature.

WARNING

Wall mounting outside of the control cabinet or housing does not fulfill the requirements of the FM approval.

WARNING

Wall mounting is only permitted if the requirements for the housing, the installation regulations, the clearance and separating regulations for the control cabinets or housings are adhered to. The control cabinet cover or housing must be secured so that it can only be opened with a tool. An appropriate strain-relief assembly for the cable must be used.

Note

You must not install the device on a wall in hazardous areas.

5.1.2 ATEX/IECx special conditions for use

WARNING

Incorrect installation

Risk of explosion in the hazardous area. For use in hazardous areas according to Class I, Division 2 or Class I, Zone 2 or for use in the EU according to ATEX 2014/34/EU, observe the following conditions:

- Install the device in a control cabinet or enclosure.
- The control cabinet or enclosure meets at least the requirements of IP54 according to IEC/EN 60079-7 and pollution degree 2 or better according to IEC/EN 60664-1.

Note

You must not install the device on a wall in hazardous areas.

WARNING

Transient overvoltages

Take measures to ensure that temporary transient overvoltages of more than 119 V do not occur.

5.1.3 Safety notices for installation

Safety notices

When installing the device, keep to the safety notices listed below.

WARNING

If a device is operated in an ambient temperature of more than 50 °C, the temperature of the device housing may be higher than 70 °C. The device must therefore be installed so that it is only accessible to service personnel or users that are aware of the reason for restricted access and the required safety measures at an ambient temperature higher than 50 °C.

WARNING

If the device is installed in a cabinet, the inner temperature of the cabinet corresponds to the ambient temperature of the device.

5.2 Mounting on the SIMATIC ET 200SP

The electronic weighing system described here is a module of the SIMATIC ET 200SP series and can be directly connected to the automation system's bus system. The 15 mm wide module has very low installation and cabling requirements.

The module is snapped onto the ET 200SP base unit (BU). You must use base units of type A0 (→ Accessories (Page 61)).

The load cells, power supply and serial interfaces are connected via the terminal box.

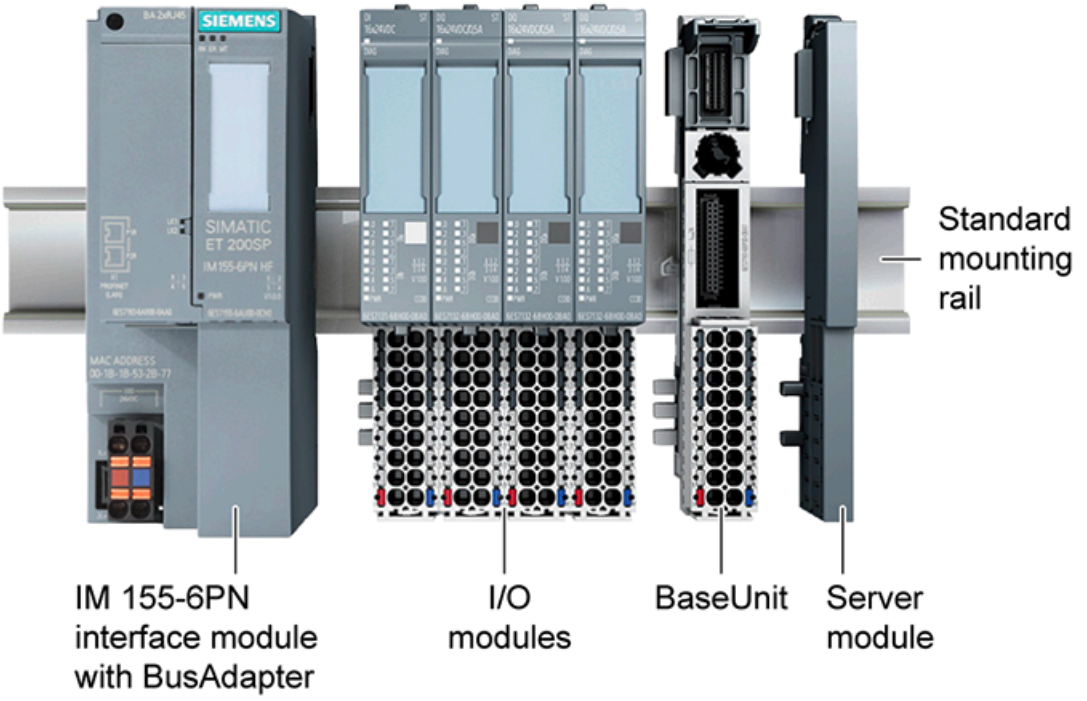


Figure 5-1 Installation of the I/O or SIWAREX modules

Connecting

6

6.1 Basic safety notes

6.1.1 ATEX/IECx special conditions for use

⚠ WARNING

WARNING – EXPLOSION HAZARD:

DO NOT CONNECT OR DISCONNECT EQUIPMENT WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

⚠ WARNING

Transient overvoltages

Take measures to ensure that temporary transient overvoltages of more than 119 V do not occur.

6.2 Wiring and block diagram

This section includes the block diagrams of the AI 2xSG 4-/6-wire HS module with pin assignment for a 4-wire connection and for a 6-wire connection.

For more information on wiring the BaseUnit, refer to the System Manual ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293).

Note

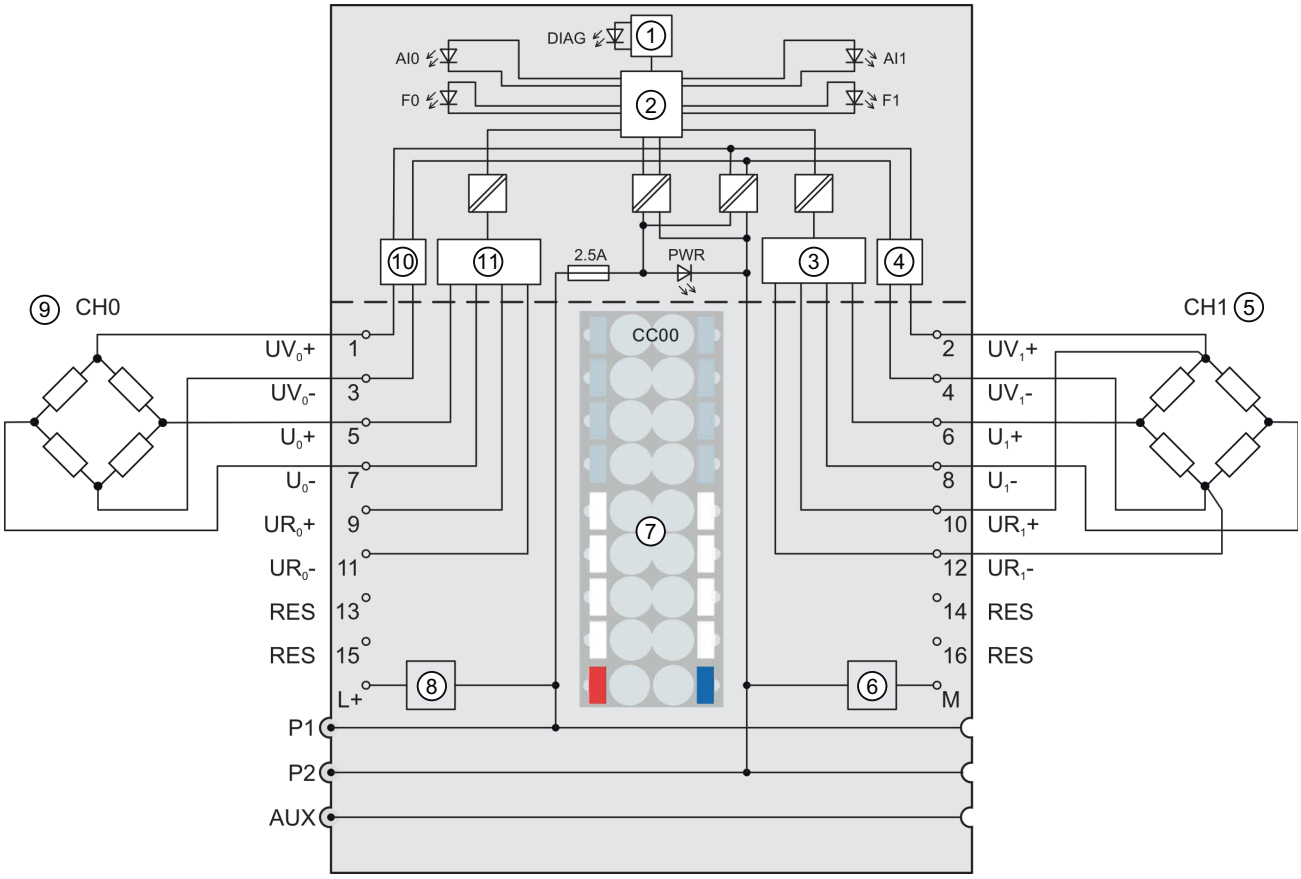
You may use and combine the different wiring options for all channels.

Note

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

Connecting the full bridge

The figure below shows the block diagram and the 4-wire/6-wire connection of the analog input module on the BaseUnit BU type A0.



①	Backplane bus interface	⑦	Color identification label CCxx (optional)
②	MCU (microcontroller)	⑧	Filter connection supply voltage (only when light-colored BaseUnit is present)
③	Filter and Analog-to-Digital Converter (ADC)	⑨	4-wire connection DMS bridge
④	DMS bridge supply voltage	⑩	DMS bridge supply voltage
⑤	6-wire connection DMS bridge	⑪	Filter and Analog-to-Digital Converter (ADC)
⑥	Filter connection supply voltage (only when light-colored BaseUnit is present)		
U_n+	Voltage input positive, channel n	RES	Reserve must remain disconnected for future function enhancements
U_n-	Voltage input negative, channel n	M_n	Reference ground to U_{Vn}, channel n
U_{Vn}+	Positive supply voltage, channel n	L+	24 V DC (supply only with light-colored BaseUnit)
U_{Vn}-	Supply voltage ground reference, channel n	P1, P2, AUX	Internal self-establishing voltage buses Connection to the left (dark-colored BaseUnit) Connection interrupted to the left (light-colored BaseUnit)
U_{Rn}+	SENSE voltage positive, channel n	DIAG	Diagnostics LED (green, red)

U_{Rn}-	SENSE voltage ground reference, channel n	AI0, AI1	Channel status LED (green)
PWR	Power LED (green)	F0, F1	Channel fault LED (red)

Figure 6-1 Wiring and block diagrams for 4-wire connection

Note

Always specify the connection type used in the hardware configuration (4-wire or 6-wire) to ensure correct operation of the module.

Parameters/address space

7

7.1 Measurement types and measuring ranges

The analog input module has the following measuring ranges:

Table 7-1 Measuring ranges

Measurement type	Measuring range	Resolution
Voltage	± 0.5 ... 320 mV/V	16 bits including sign (oversampling) 28 bits including sign (normal/isochronous operation without oversampling)

The tables of the measuring ranges as well as overflow, overrange, etc., can be found in the section Representation of analog values (Page 75).

7.2 Parameters

Parameters of the AI 2xSG 4-/6-wire HS

The effective range of the parameters depends on the type of configuration. The following configurations are possible:

- Central operation on 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. With configuration in the user program, the parameters are transferred to the modules via data records with the "WRREC" instruction; see section Parameter assignment (Page 64).

The following parameter settings are possible:

Table 7-2 Configurable parameters and their defaults (GSD file)

Parameter	Value range	Default	Reconfiguration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Line frequency	50/60 Hz	50 Hz	No	Module	Module
Measurement type	deactivated / 4-wire strain gauge full bridge / 6-wire strain gauge full bridge	4-wire strain gauge full bridge	Yes	Channel	Channel
Line frequency filter	Enabled/disabled	Activated	Yes	Channel	Channel
Measuring range	0.5 ... 320 mV/V	2 mV/V	Yes	Channel	Channel
Sampling rate	0.1 ... 6.5535 ms	1 ms	Yes	Channel	Channel
Moving average value filter	0 ... 655.35 ms	0 ms	Yes	Channel	[1]
Prefilter "Input lock B"	0 ... 655.35 ms	0 ms	Yes	Channel	[1]
IIR low-pass filter limit frequency	0 ... 6553.5 Hz	0 Hz (=off)	Yes	Channel	[1]
IIR low-pass filter ordinal number	1 ... 4	4	Yes	Channel	[1]
Notch filter frequency	0 ... 1000.0 Hz	0 Hz (=off)	Yes	Channel	[1]
Notch filter quality Q	5.0 ... 250.0	100	Yes	Channel	[1]
Diagnostics: No supply voltage L+	• Locking • Enabling	Locking	Yes	Channel	Channel
Diagnostics Short circuit / wire break at sensor	• Locking • Enabling	Locking	Yes	Channel	Channel
Diagnostics: Underflow	• Locking • Enabling	Locking	Yes	Channel	Channel

Parameter	Value range	Default	Reconfiguration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics: Overflow	• Locking • Enabling	Locking	Yes	Channel	Channel
Hardware interrupt high limit 1	• Locking • Enabling	Locking	Yes	Channel	[1]
Hardware interrupt low limit 1	• Locking • Enabling	Locking	Yes	Channel	[1]
Hardware interrupt high limit 2	• Locking • Enabling	Locking	Yes	Channel	[1]
Hardware interrupt low limit 2	• Locking • Enabling	Locking	Yes	Channel	[1]
High limit 1 (exceeded)	± 2147483648	100.000.000	Yes	Channel	[1]
Low limit 1 (undershot)	± 2147483648	-100,000,000	Yes	Channel	[1]
High limit 2 (exceeded)	± 2147483648	100.000.000	Yes	Channel	[1]
Low limit 2 (undershot)	± 2147483648	-100,000,000	Yes	Channel	[1]
High limit 1 (exceeded) - hysteresis	0 ... 4294967295	100.000.000	Yes	Channel	[1]
Low limit 1 (undershot) - hysteresis	0 ... 4294967295	100.000.000	Yes	Channel	[1]
High limit 2 (exceeded) - hysteresis	0 ... 4294967295	100.000.000	Yes	Channel	[1]
Low limit 2 (undershot) - hysteresis	0 ... 4294967295	100.000.000	Yes	Channel	[1]
Potential group	• Use potential group of the left module (dark-colored BaseUnit) • Enable new potential group (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 still assign these parameters using the data record 128 as described in the column "GSD file PROFINET IO" (see table above). The parameter length of the I/O module is 13 bytes.

Note

Unused channels

"Deactivate" the unused channels in the parameter assignment.

A deactivated channel always returns the value $7FFF_H$.

7.3 Description of parameters

Diagnostics no supply voltage L+

Enabling of the diagnostics alarm for missing or insufficient supply voltage L+.

Diagnostics Short circuit / wire break at sensor

Enabling of the diagnostics in the event of a short-circuit of the encoder supply. In addition, a wire break is also detected at +/-U_{Rn} with configured 6-wire technology. Threshold see section Technical specifications (Page 49).

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.

Note

If the diagnostics "Short circuit / wire break at sensor" and "Underflow" are activated at the same time and a wire break occurs, both diagnostics messages are reported by the module.

Potential group

You can use the "Potential group" parameter to specify whether the module is inserted in a light-colored or dark-colored BaseUnit.

A potential group always starts with an I/O module that is inserted on a light-colored BaseUnit. All modules inserted to the right of this on dark-colored BaseUnits belong to the same potential group, because the dark-colored BaseUnits are supplied via the light-colored BaseUnits.

The potential group ends with a new light-colored BaseUnit or the end of the station.

Line frequency

Defines the line frequency of the power supply grid.

Adjustment range: 50 or 60 Hz

Measurement type

Deactivated / 4-wire strain gauge full bridge / 6-wire strain gauge full bridge

Line frequency filter

Enables or disables a line frequency filter which suppresses the power supply grid frequency (50/60 Hz) set under "Line frequency". Because the filter also filters for a multiple of 50/60 Hz, it may be better to disable the filter.

Measuring range

Defines the characteristic value of the connected DMS sensor. Any setting values is scaled to +/- 100,000,000 digits in the module.

Sampling rate

Defines the sampling rate of the analog input module.

Moving average value filter

Defines the period of the moving average value filter.

Prefilter "Input lock B"

Defines the period of the prefilter for the "Input lock B" operating mode. This is a moving average value filter which prefilters the signal when it exits "Input lock B" mode.

IIR low-pass filter limit frequency

Defines the line frequency of the low-pass filter.

IIR low-pass filter ordinal number

Defines the ordinal number of the low-pass filter and therefore has a direct effect on the edge steepness of the filter.

Notch filter frequency

Defines the frequency of the notch filter. The filter is used to filter the specified frequency from the input signal.

Notch filter quality Q

Defines the quality of the notch filter.

7.4 Oversampling

Function

Oversampling is the acquisition of data in constant bus cycle segments (sub-cycles). The configured number n of sub-cycles corresponds to one PROFINET bus cycle.

Oversampling is useful whenever you require acquisition of data with high time resolution but without using an extremely short PROFINET bus cycle and thus fast CPU cycles.

With oversampling, a PROFINET bus cycle is divided into constant bus sub-cycles:

- One measured value is acquired in each sub-cycle.
- The minimum PROFINET bus cycle is 125 µs. Only a subset of functions is available for shorter sub-cycles.
- The shortest possible sub-cycle is 100 µs.
- You can configure oversampling:
  - For channel 0 (1-channel operation)
  - For channel 0/1 (2-channel operation)
- The number of sub-cycles can be set as follows:
  - From 2 to 14 for one channel
  - From 2 to 6 for two channels

Requirement

Oversampling is only possible when isochronous mode is set.

Configuration

You configure oversampling with the following parameter:

- Sampling rate

Note

Do not use a reduction ratio for blocks in the case of configuration with oversampling in the runtime groups of your user program. This will ensure that the data processing in the user program of the CPU is synchronized with the acquisition on the module.

Overview of the operating modes

Function	Normal operation	Oversampling	
		1-channel operation	2-channel operation
Isochronous mode	Yes, optional	Yes, required	
• Shortest send clock	• 125 µs isochronous • 100 µs non-isochronous	125 µs	
Oversampling	No	Yes	
• Number of oversampling levels (sampling rate)	-	2 ...14	2 ... 6
• Shortest sub-cycle (= shortest sampling time)	-	100 µs	
Hardware interrupt	x	-	
Filter functions	x	x	
± 320 mV/V	x	x	
Overflow/underflow	x	x	
Short circuit/wire break at U_{Rn}	x	x	
Load voltage diagnostics	x	x	
Value status (QI)	x	x	
Address space	16 bytes	32 bytes	

Sampling interval

The duration of a subcycle is the sampling interval. The cycle time T (send clock) for isochronous mode is specified in the configuration software. This time, divided by the configured sampling rate n_{Sample}, yields the sampling interval t_{Sample} of the module.

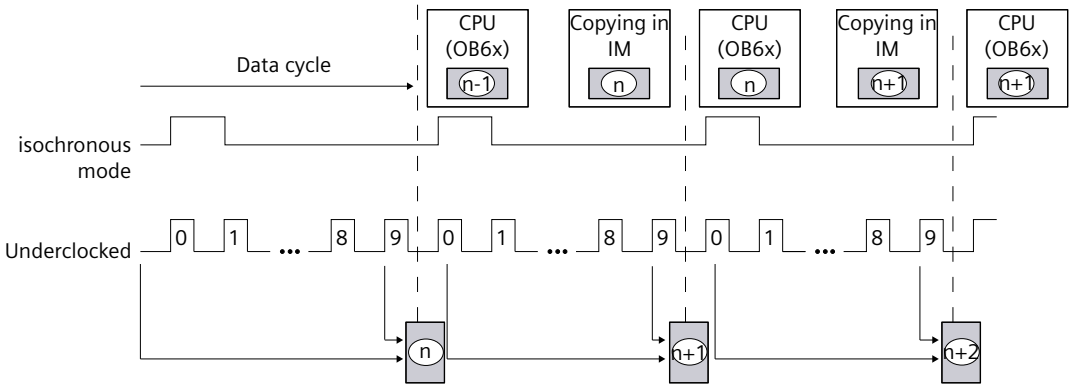
Example calculation:

$$t_{Sample} = \frac{T}{n_{Sample}} = \frac{1\ ms}{10} = 100\ \mu s$$

Figure 7-1 Example of calculating the sampling interval

Chronological sequence

The figure shows the chronological sequence for oversampling. The acquired measured vales of a data cycle with oversampling are only copied to the interface module in the subsequent bus cycle and are then available to the processing CPU one bus cycle later.



① n = measured values from bus cycle n

Figure 7-2 Oversampling

7.5 Address space

Note

Take into account the set mode of the module when programming because the address space can differ.

Address space for normal and isochronous operation

Table 7-3 Assignment in the process image of the inputs

IByte	Bit	Name and meaning
x	0 ... 7	Measured value channel 0 (DINT)
x + 1	0 ... 7	
x + 2	0 ... 7	
x + 3	0 ... 7	
x + 4	0 ... 7	Refresh counter channel 0 (UINT)
x + 5	0 ... 7	
x + 6	0	Channel 0 Measuring range exceeded
	1	Channel 0 Measuring range undershot
	2	Channel 0 Short-circuit / wire break at the sensor
	3	Channel 0 No load voltage L+
	4	Channel 0 ADC faulty
	5	Channel 0 Internal memory error
	6	Channel 0 Watchdog error
	7	Channel 0 Internal error - module defective
x + 7	0	QI bit 0: Bad 1: Good
	1	Input lock 0: Inactive 1: active
	2	Reserved
	3	Measuring range exceeded (common mode)
	4	Limit 1, low limit undershot
	5	Limit 1, high limit exceeded
	6	Limit 2, low limit undershot
	7	Limit 2, high limit exceeded

Note

The allocation of channel 1 is identical. To determine the respective parameter addresses, add an offset of 8 bytes to the parameter addresses of channel 0.

Address space for oversampling with one channel

Table 7-4 Assignment in the process image of the inputs

IByte	Bit	Name and meaning
x	0 ... 7	Channel 0 at sub-cycle 1 (INT)
x + 1	0 ... 7	
x + 2	0 ... 7	Channel 0 at sub-cycle 2 (INT)
x + 3	0 ... 7	
x + 4	0 ... 7	Channel 0 at sub-cycle 3 (INT)
x + 5	0 ... 7	
x + 6 to x + 25	0 ... 7	Channel 0 at sub-cycle 4 to 13 (INT)
x + 26	0 ... 7	Channel 0 at sub-cycle 14 (INT)
x + 27	0 ... 7	
x + 28	0 ... 7	Channel 0 at refresh counter (UINT)
x + 29	0 ... 7	
x + 30	0	Channel 0 status Measuring range exceeded
	1	Channel 0 status Measuring range undershot
	2	Channel 0 status short-circuit / wire break at sensor
	3	Channel 0 status No load voltage L+
	4	Channel 0 status ADC faulty
	5	Channel 0 status Internal memory error
	6	Channel 0 status Watchdog error
	7	Channel 0 status Internal error - module defective
x + 31	0	Channel 0 status QI bit 0: Bad 1: Good
	1	Channel 0 status Input lock 0: Inactive 1: active
	2	Reserved
	3	Reserved
	4 ... 7	Reserved

Address space for oversampling with two channels

The following figure shows the assignment of the address space for oversampling with two channels. It is always addressed by IByte x. A maximum of 6 sub-cycles are possible. If less than 6 sub-cycles are set, the addresses not in use are filled with $7FFF_H$.

Table 7-5 Assignment in the process image of the inputs

IByte	Bit	Name and meaning
x	0 ... 7	Channel 0 at sub-cycle 1 (INT)
x + 1	0 ... 7	
x + 2	0 ... 7	Channel 0 at sub-cycle 2 (INT)
x + 3	0 ... 7	
x + 4	0 ... 7	Channel 0 at sub-cycle 3 (INT)
x + 5	0 ... 7	
x + 6 to x + 9	0 ... 7	Channel 0 at sub-cycle 4 to 5 (INT)
x + 10	0 ... 7	Channel 0 at sub-cycle 6 (INT)
x + 11	0 ... 7	
x + 12	0 ... 7	Channel 0 at refresh counter (UINT)
x + 13	0 ... 7	
x + 14	0	Channel 0 status Measuring range exceeded
	1	Channel 0 status Measuring range undershot
	2	Channel 0 status short-circuit / wire break at sensor
	3	Channel 0 status No load voltage L+
	4	Channel 0 status ADC faulty
	5	Channel 0 status Internal memory error
	6	Channel 0 status Watchdog error
	7	Channel 0 status Internal error - module defective
x + 15	0	Channel 0 status QI bit 0: Bad 1: Good
	1	Channel 0 status Input lock 0: Inactive 1: active
	2	Reserved
	3	Reserved
	4 ... 7	Reserved
x + 16	0 ... 7	Channel 1 at sub-cycle 1 (INT)
x + 17	0 ... 7	
x + 18	0 ... 7	Channel 1 at sub-cycle 2 (INT)
x + 19	0 ... 7	
x + 20	0 ... 7	Channel 1 at sub-cycle 3 (INT)
x + 21	0 ... 7	

IByte	Bit	Name and meaning
x + 22 to x + 25	0 ... 7	Channel 1 at sub-cycle 4 to 5 (INT)
x + 26	0 ... 7	Channel 1 at sub-cycle 6 (INT)
x + 27	0 ... 7	
x + 28	0 ... 7	Channel 1 at refresh counter (UINT)
x + 29	0 ... 7	
x + 30	0	Channel 1 status Measuring range exceeded
	1	Channel 1 status Measuring range undershot
	2	Channel 1 status short-circuit / wire break at sensor
	3	Channel 1 status No load voltage L+
	4	Channel 1 status ADC faulty
	5	Channel 1 status Internal memory error
	6	Channel 1 status Watchdog error
	7	Channel 1 status Internal error - module defective
x + 31	0	Channel status 1 QI bit 0: Bad 1: Good
	1	Channel 1 status Input lock 0: Inactive 1: active
	2	Reserved
	3	Reserved
	4 ... 7	Reserved

Process image output

Table 7-6 Process image of the outputs

QByte	Bit	Name and meaning
x	0 ... 7	Input lock channel 0
x+1	0	Activate max. peak value memory channel 0
	1	Activate min. peak value memory channel 0
	2 ... 7	Reserved
x+2	0 ... 7	Reserved
x+3	0 ... 7	Reserved
x+4	0 ... 7	Input lock channel 1
x+5	0	Activate max. peak value memory channel 1
	1	Activate min. peak value memory channel 1
	2 ... 7	Reserved
x+6	0 ... 7	Reserved
x+7	0 ... 7	Reserved

7.6 Input lock

"Input lock" freezes the measuring value. "Input Lock" can be helpful, for example, in case of known interferences to prevent feeding these interferences into the filters of the analog input module.

There are various "Input lock" options.

QByte	Bit	Stop Input lock	Start Input lock A	Start Input lock B
x	0	0	1	0
	1	0	0	1
	2	0	0	0
	3	0	0	0
	4	0	0	0
	5	0	0	0
	6	0	0	0

Input lock A

Once input lock A is activated, no new measured values are fed into the filters of the analog input module. The measured value in the process image input is frozen. Only by stopping input lock A is the measured value refreshed again or the module-internal filters supplied with new values.

Input lock B

Once input lock B is activated, the measured value in the process image input is frozen. After stopping input lock B, the measured value is prefiltered and refreshed again. This prefiltering is done with a configurable average value filter (see prefilter Input lock B).

Note

Switching between Input lock A and Input lock B

It is not possible to switch directly between Input lock A and Input lock B.

- To change to a different input lock you must stop the currently active input lock.

7.7 Min./max. peak value memory

The module has an internal min. and max. peak value memory for each channel. The peak value memories can be activated or deactivated separately via control bits (see Table 7-6 Process image of the outputs (Page 36)).

The peak value memory has the advantage that peak values can be recorded internally in the module, independent of the CPU cycle, using the configured sampling (up to 10 kHz). The peak values determined can be read out at any time from the user program via acyclic data transfers (READ_REC system function). In addition to the actual peak values, the corresponding value of the refresh counter and channel status are also stored. Time references to the peak value can be calculated in this way. The channel status provides information about the status of the module at the time of the recorded peak value. The peak value memories for channel A are located in data record 10, those for channel 1 in data record 11.

To start peak value acquisition, the respective control bit must undergo an edge transition from 0 to 1. If the control bits are set to 0 again, the last peak values determined remain frozen in the memory. The stored peak values can be read into the user program by reading the respective data record. At a new edge transition to 1, the current measured value is set as the new current peak value.

The structure of the peak value data records is as follows:

Table 7-7 Data record 10 (peak value memory channel 0)

Byte	Bit	Name and meaning
x + 0	0 ... 7	Max. peak value channel 0 (DINT)
x + 1	0 ... 7	
x + 2	0 ... 7	
x + 3	0 ... 7	
x + 4	0 ... 7	Max. peak value refresh counter channel 0 (UINT)
x + 5	0 ... 7	
x + 6	0 ... 7	Max. peak value status channel 0 (UINT)
x + 7	0 ... 7	
x + 8	0 ... 7	Min. peak value channel 0 (DINT)
x + 9	0 ... 7	
x + 10	0 ... 7	
x + 11	0 ... 7	
x + 12	0 ... 7	Min. peak value refresh counter channel 0 (UINT)
x + 13	0 ... 7	
x + 14	0 ... 7	Min. peak value status channel 0 (UINT)
x + 15	0 ... 7	

Data record length = 16 bytes

Table 7-8 Data record 11 (peak value memory channel 1)

Byte	Bit	Name and meaning
x + 0	0 ... 7	Max. peak value channel 1 (DINT)
x + 1	0 ... 7	
x + 2	0 ... 7	
x + 3	0 ... 7	
x + 4	0 ... 7	Max. peak value refresh counter channel 0 (UINT)
x + 5	0 ... 7	
x + 6	0 ... 7	Max. peak value status channel 1 (UINT)
x + 7	0 ... 7	
x + 8	0 ... 7	Min. peak value channel 1 (DINT)
x + 9	0 ... 7	
x + 10	0 ... 7	
x + 11	0 ... 7	
x + 12	0 ... 7	Min. peak value refresh counter channel 1 (UINT)
x + 13	0 ... 7	
x + 14	0 ... 7	Min. peak value status channel 1 (UINT)
x + 15	0 ... 7	

Data record length = 16 bytes

General procedure for using the peak value memory

1. Start the desired peak value memory via the corresponding control bit in the PIQ.
2. Stop the recording of the peak value via the respective control bit.
3. Read the data record with the desired peak value from the application program using SFB READ_REC.

Note

The peak value memory function is only available in non-isochronous mode of the module.

See also

Address space (Page 33)

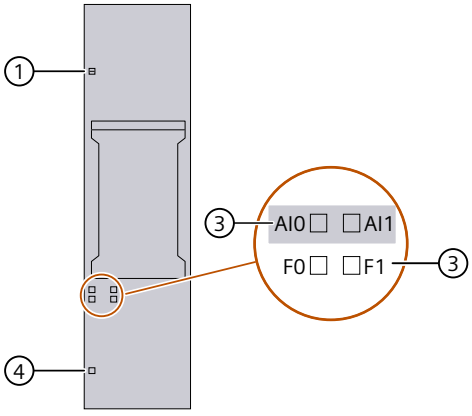
Interrupts/diagnostics interrupts

8

8.1 Status and error displays

LED displays

The figure below shows the LED display of the AI 2xSG 4-/6-wire HS.



1 DIAG (green/red)
2 Channel status (green)
3 Channel fault (red)
4 PWR (green)

Figure 8-1 LED displays

Meaning of the LEDs

The following tables contain the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in section Diagnostics alarms (Page 45).

DIAG LED

Table 8-1 Error display of the DIAG LED

DIAG	Meaning
Off	Backplane bus supply of the ET 200SP not OK
Flashes	Module parameters not assigned

DIAG	Meaning
On	Module parameters assigned and no module diagnostics
Flashes	Module parameters assigned and module diagnostics

Channel status/channel fault LED

Table 8-2 Status/error display of the channel status/channel fault LED

Channel status	Channel fault	Meaning
Off	Off	Channel deactivated or no load voltage L+
On	Off	Channel activated and no channel diagnostics
Off	On	Channel activated and channel diagnostics
On	On	Not permitted (error)

PWR LED

Table 8-3 Status display of the PWR LED

PWR	Meaning
Off	No supply voltage L+
On	Supply voltage L+ present

8.2 Interrupts

The analog input module AI 2xSG 4-/6-wire HS supports hardware and diagnostic interrupts.

Hardware interrupts cannot be used in Oversampling mode.

Evaluating hardware interrupts with IO controller

The module generates a hardware interrupt at the following events:

- Low limit 1 violated
- High limit 1 violated
- Low limit 2 violated
- High limit 2 violated

If an interrupt occurs, a corresponding interrupt OB is called in the CPU of the IO controller.

S7-1500

Detailed information on the event is available in the STEP 7 online help.

The block interface is shown here with optimized block access, which is set in the TIA Portal by default.

Name	Data type	Comment
LADDR	HW_IO	Hardware identifier of the module triggering the interrupt
USI	WORD	USI (High/Low)
IChannel	USInt	Channel that triggered the hardware interrupt
EventType	Byte	Error event

S7-300/400 or a different CPU

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

The channel of the module that triggered the hardware interrupt is entered in the start information of OB4x in the OB4x_POINT_ADDR tag. The following figure shows the assignment to the bits of double word 8 in local data.

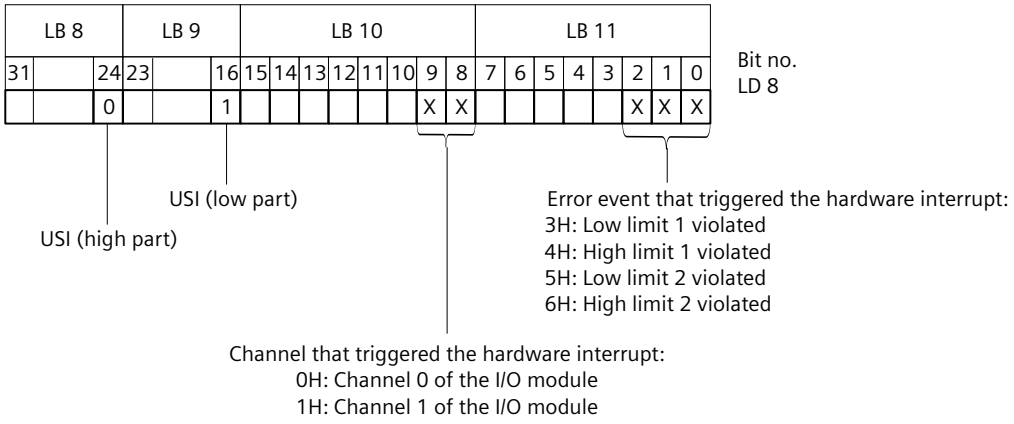


Figure 8-2 OB4x_POINT_ADDR tag

Structure of the additional interrupt information

Table 8-4 Structure of USI = W#16#0001

Data block name		Content	Comment	Bytes
USI		W#16#0001	User Structure Identifier: Additional interrupt info for hardware interrupts of the I/O module	2
The channel that triggered the hardware interrupt follows.				
	Channel	B#16#00 to B#16#01	Channel 0 and 1 of the I/O module	1
The error event that triggered the hardware interrupt follows.				
	Error event	B#16#03	Low limit 1 violated	1
		B#16#04	High limit 1 violated	
		B#16#05	Low limit 2 violated	
		B#16#06	High limit 2 violated	

Diagnostics interrupt

The module generates a diagnostics interrupt at the following events:

- Short circuit / wire break
- High limit violated
- Low limit violated
- Error
- Parameter assignment error
- No load voltage
- Channel temporarily unavailable

8.3 Diagnostics alarms

A diagnostic alarm is output for each diagnostics event and the DIAG LED on the module flashes. The diagnostic alarms can, for example, be read from the diagnostic buffer of the CPU. You can evaluate the error codes with the user program.

Table 8-5 Diagnostics alarms, their meanings and corrective measures

Diagnostics alarm	Error code	Meaning	Solution
Overflow	7_H	The value is above the overrange.	Correct the output value
Underflow	8_H	Value is below the underrange.	Correct the output value
Error	9_H	Internal module error has occurred (diagnostic alarm on channel 0 applies to the entire module).	Replace the module
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel temporarily unavailable	$1F_H$	Update of the firmware is being performed or has been canceled. The module does not read any process values in this state.	• Wait for firmware update • Restart the firmware update
Hardware interrupt lost	16^H	Hardware interrupt queue is full	-
Short circuit / wire break at sensor	124_H	Short circuit at the sensor supply (UVn +/-) or wire break at the reference voltage input (URn +/-). Wire break can only be detected with 6-wire sensors.	Check wiring and correct, if necessary
Error in input circuit	313_H	A/D converter is faulty	• Check EMC-compliant wiring in case of recurring message • Replacement of the module
Invalid/inconsistent firmware	$11B_H$	Module-internal checksum error	Replace the module in case of recurring message
Channel/component temporarily unavailable	103_H	Restart due to watchdog reset	Replace the module in case of recurring message

Service and maintenance

9

9.1 Basic safety instructions

Note

The device is maintenance-free.

⚠ WARNING

Impermissible repair of the device

- Repair must be carried out by Siemens authorized personnel only.

Technical specifications

10

10.1 New technical specifications 7MH41346LB000DA0

Core statement

The technical specifications for 7MH4134-6LB00-0DA0 are:

Article number	7MH4134-6LB00-0DA0
General information	
Product type designation	AI 2xSG 4-/6-wire HS
HW functional status	01
Firmware version	V1.0.1
• FW update possible	Yes
usable BaseUnits	BU type A0
Color code for module-specific color identification plate	CC00
Product function	
• I&M data	Yes; I&M0 to I&M3
• Measuring range scalable	Yes
• Scalable measured values	No
• Adjustment of measuring range	Yes; ±0.5 ... 320 mV/V
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V14 SP1
• STEP 7 configurable/integrated from version	V5.6
• PROFIBUS from GSD version/GSD revision	V03.01.105
• PROFINET from GSD version/GSD revision	GSDML V2.33
Operating mode	
• Oversampling	Yes; 2 channels per module
• MSI	No
CiR - Configuration in RUN	
Reparameterization possible in RUN	Yes
Calibration possible in RUN	No
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
Encoder supply	
Output voltage (DC)	4.85 V
Short-circuit protection	Yes
Output current	
• Rated value	60 mA; Per channel
Power	
Power available from the backplane bus	65 mW
Power loss	
Power loss, typ.	1.5 W
Address area	
Address space per module	
• Address space per module, max.	32 byte

Article number	7MH4134-6LB00-0DA0
• Inputs	32 byte
• Outputs	8 byte
Hardware configuration	
Automatic encoding	Yes
• Mechanical coding element	Yes
Analog inputs	
Cycle time (all channels), min.	100 µs
Analog input with oversampling	Yes
• Values per cycle, max.	14
• Resolution, min.	100 µs
Input ranges	
• Strain gauges (full bridges)	Yes
Cable length	
• shielded, max.	500 m
Analog value generation for the inputs	
Measurement principle	Sigma Delta
Integration and conversion time/resolution per channel	
• Integration time, parameterizable	Yes
• Interference voltage suppression for interference frequency f1 in Hz	60 / 50 Hz / no
• Conversion time (per channel)	100 µs
Smoothing of measured values	
• IIR low-pass filter frequency	0.01 ... 600 Hz
• IIR low-pass filter ordinal number	1 ... 4
• Notch filter frequency	0.1 ... 1 000 Hz
• Notch filter quality	5.00 ... 250.00
• Average value filter	0.1 ... 655.3 ms
Encoder	
Connection of signal encoders	
• For strain gauges (full bridges) with 4-conductor connection	Yes
• For strain gauges (full bridges) with 6-conductor connection	Yes
• Resistance of full bridge, min.	80 Ω
• Resistance of full bridge, max.	5 000 Ω
Errors/accuracies	
Linearity error (relative to input range), (+/-)	0.025 %
Temperature error (relative to input range), (+/-)	0.0005 %/°C; Strain gauge full bridge, 6-conductor connection
Temperature coefficient, zero point	≤ ±0.25 µV/K
Temperature coefficient, span, 4-wire connection (in relation to end value)	≤ ±5 ppm/K

Article number	**7MH4134-6LB00-0DA0**
Temperature coefficient, span, 6-wire connection (in relation to end value)	≤ ±10 ppm/K
Basic error limit (operational limit at 25 °C)	
• Voltage, relative to input range, (+/-)	0.05 %; See manual for details
Isochronous mode	
Filtering and processing time (TCI), min.	87 µs
Bus cycle time (TDP), min.	125 µs
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Limit value alarm	Yes; two upper and two lower limit values in each case
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	Yes
• Short-circuit	Yes
• Group error	Yes
• Overflow/underflow	Yes
Diagnostics indication LED	
• Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED
• for module diagnostics	Yes; green/red DIAG LED
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• between the channels and the power supply of the electronics	Yes
Isolation	
Isolation tested with	707 V DC (type test)
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-25 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-25 °C
• vertical installation, max.	50 °C
Altitude during operation relating to sea level	
• Ambient air temperature-barometric pressure-altitude	Tmin ... Tmax at 1 140 hPa ... 795 hPa (-1 000 m ... +2 000 m) // Tmin ... (Tmax - 1 K/100 m) at 795 hPa ... 701 hPa (+2 000 m ... +3 000 m)
Dimensions	
Height	73 mm
Depth	58 mm

Article number	**7MH4134-6LB00-0DA0**
Weights	
Weight, approx.	45 g

10.2 Mechanical requirements and data

Construction	
Insulation	Tested with 707 V DC (type test)
Dimension	15 mm wide, see manual ET 200SP BaseUnits (http://support.automation.siemens.com/WW/view/en/59753521)
Weight	Approx. 45 g

Operating conditions in accordance with IEC 60721	
Operation	IEC60721-3-3 Class 3M3, stationary use, weather-proofed
Storage/transport	IEC 60721-3-2 Class 2M2 without precipitation

Mechanical requirements and data		
Testing	**Standards**	**Limits**
Vibrational load during operation	IEC 61131-2:2007 IEC 60068-2-6:2007 Test Fc	5 to 8.4 Hz: 3.5 mm out. 8.4 to 150 Hz: 9.8 m/s^2 (=1 g)
Shock load during operation	IEC 61131-2:2007 IEC 0068-2-27:2008 Test Ea	150 m/s^2 (approx. 15 g), half sine Duration: 11 ms
Vibration load during transport	IEC 60068-2-6:2007 Test Fc	5 to 8.4 Hz: 3.5 mm out. 8.4 to 500 Hz: 9.8 m/s^2
Shock load during transport	IEC 60068-2-27:2008 Test Ea	250 m/s^2 (approx. 25 g), half sine Duration: 6 ms
Free fall	IEC 61131-2:2007 IEC 60068-2-31:2008 Test Ec, procedure 1	In product packaging: 300 mm drop height In shipping packaging: 1.0 m drop height

10.3 Electrical, EMC and climatic requirements

Table 10-1 **Product safety**

Requirement	Standards	Comments/measures	
Safety regulations	IEC 61010-1:2010 +C1:2011 + C2:2013 IEC 61010-2-201:2014 UL 61010-1:2005 UL 61010-201:2014 IEC 61131-2:2007 CSA C22.2 No.142-M1987 (R2014) IEC 60664:2007	Overvoltage category II Pollution degree 2	
Protection class	IEC 61140:2016 IEC 61131-2:2007	To maintain the safety characteristics of extra-low voltage circuits, external connections to the analog circuits and the 24 V DC nominal power supplies must be powered by approved sources that fulfill the requirements according to the various standards for SELV, PELV, NEC Class 2, voltage limited or power limited. The ground connection for the DIN rail serves as a functional ground for dissipating interference currents.	
IP degree of protection	DIN IEC 60529:2010 +A1:2000 + A2:2013	IP 20: Protection against contact with standard probe Protection against solid bodies with diameters in excess of 12.5 mm No special protection against water	
Electrical isolation stability	IEC 61131-2:2007 CSA C22.2 No.142-M1987 (R2014)	Between the channels	No
		Between the channels and the backplane bus	707 V DC (type test)
		Between the channels and the power supply	707 V DC (type test)
Use in hazardous areas	IEC 60079-0 :2009 IEC 60079-7 :2015	See Product Information "Use of modules in zone 2 hazardous areas" (Product information (https://support.industry.siemens.com/cs/ww/en/view/19692172)).	
Electromagnetic compatibility	IEC 61000-6-2 :2004 IEC 61000-6-4 :2007+ A1:2011	All shielded cables must be grounded at both ends to comply with the requirements for electromagnetic compatibility. If the shielded cable is routed out of the hazardous area for explosion-proof equipment, both ends of the cable shield must be connected to the potential equalization.	

Table 10-2 Requirements: Interference emission in industrial area in accordance with EN 61000-6-4

Comments	Standard	Limits
Emission of radio interference (interference field strength)	Class A industrial environment: IEC/CISPR 16-2-3 :2006 EN55016-2-3 :2006	30 – 230 MHz, 40 dB(mV/m) Q 230 – 1000 MHz, 47 dB(mV/m) Q -- 1 GHz to 3 GHz / 76 dB(mV/m) peak, 56 dB(mV/m) average 3 GHz to 6 GHz / 80 dB(mV/m)
Emission on power supply cables	Class A: Industrial environment: IEC/CISPR 16-2-1 :2009 EN 55016-2-1 :2004	Class A: Industrial environment 0.15 ... 0.5 MHz, 79 dB (µV) Q 0.15 ... 0.5 MHz, 66 dB (µV) M 0.5 ... 30 MHz, 73 dB (µV) Q 0.5 ... 30 MHz, 60 dB (µV) M
Emission conducted Ethernet	EN 61000-6-4: 2007+A1:2011 IEC/CISPR 22 :2008 EN55022 :2010	0.15 ... 0.5 MHz: 53 dB (µA) to 43 dB (µA) Q 40 dB (µA) – 30 dB (µA) M 0.5 ... 30 MHz: 43 dB (µA) to 30 dB (µA) M

Note

Radio interference is possible

This is a device of class A. The device may cause radio interference in residential areas. Implement appropriate measures (e.g.: use in 8MC cabinets) to prevent radio interference.

Table 10-3 Requirements: Interference immunity in industrial area in accordance with EN 61000-6-2

Comments	Standard	Severity level
Burst pulses on power supply cables	DIN EN 61000-4-2 :2009 DIN EN 61000-4-3 :2011 DIN EN 61000-4-4 :2013 DIN EN 61000-4-5 :2015 DIN EN 61000-4-6 :2014 IEC 61000-4-2 :2008 IEC 61000-4-3 :2006 +A1:2007 +A2:2010 IEC 61000-4-4 :2012 IEC 61000-4-5 :2014 IEC 61000-4-6 :2014 NAMUR NE21:2011 DIN EN 61131-2 :2008 IEC 61131-2 :2007	±2.0 kV 5/50 ns/5 kHz ±2.0 kV 5/50 ns/100 kHz
Burst pulses on data and signal cables		±2.0 kV 5/50 ns/5 kHz ±2.0 kV 5/50 ns/100 kHz
Electrostatic discharge (ESD)		2, 4, 6 kV direct/indirect
Electrostatic air discharge (ESD)		2, 4, 6, 8 kV
Surge on power supply cables[2)]		±1.0 kV line to line ±2.0 kV line to earth
Electromagnetic RF fields		80 MHz to 3 GHz: 20 V/m
Induced conducted interference		10 kHz to 80 MHz: 10 V_{eff}

1) Not applicable for shielded cables and symmetric ports

2) An external fuse must be provided to comply with the requirement (e.g. Lightning conductor BVTAD24, Dehn & Söhne company)

Ambient conditions

The module can be used under the following conditions:

(Also observe the operating conditions of the ET 200SP system)

Table 10-4 Operating conditions in accordance with IEC 60721

Operation	IEC60721-3-3: Class 3K3, stationary use, weather-proofed
Storage/transport	IEC 60721-3-2 class 2K4 without precipitation

Table 10-5 Climatic requirements

Comments		Ambient conditions	Areas of application
Operating temperature	Vertical installation	-25 to +50 °C	
	Horizontal installation	-25 to +60 °C	
Storage and transport temperature		-40 to +70 °C	
Relative humidity		5 ... 95%	No condensation; corresponds to relative humidity (RH) stress level 2 to DIN IEC 61131-2
Contaminant concentration		SO_2: < 0.5 ppm H_2S: < 0.1 ppm	RH < 60%, no condensation

Air pressure	During operation [1]	IEC 60068-2-13	1080 to 700 hPa (-1000 to +3000 m above sea level)
	Transport and storage	IEC 60068-2-13	1080 to 660 hPa (-1000 to +3500 m above sea level)

[1] As of 2000 m above sea level, a derating of the upper ambient temperature of -1°C / 100 m has to be taken into consideration.

Table 10-6 Reliability

Mean time between failures MTBF	Typical 120 years @Ta= 40 °C

10.4 Certificates and approvals

- All certificates are available online at Certificates (https://support.industry.siemens.com/cs/ww/en/ps/7MH4134-6LB00-0DA0/cert).
- The current approvals for your device can be found on the nameplate.
- When using the electronic weighing system, observe the requirements specified in the safety notes for hazardous areas.

	→ CE approval
	Explosion protection in accordance with c-UL-us (USA/Canada)
	FM approval for Zone 2
	Explosion protection in accordance with ATEX DEKRA 19ATEX0094 X EN IEC 60079-0: 2018 EN 60079-7: 2015 + A1: 2018
	Explosion protection in accordance with UKCA DEKRA 21UKEX0016X
	Explosion protection in accordance with IECEx DEK 19.0054X IEC 60079-0: 2017 (Ed.7) IEC 60079-7: 2015 (Ed.5.1)
	→ EAC certificate, available soon
	→ Tick mark for Australia and New Zealand
	→ KCC approval
	The modules are RoHS compliant according to EU Directive 2016/65/EU

Accessories

11

11.1 BaseUnit type A0 (essential)

You can order accessories online: Industry Mall (https://mallstage.industry.siemens.com/mall/en/b0/Catalog/Products/10038765?tree=CatalogTree)

The following accessories are not included in the scope of delivery:

- **Mandatory**: BaseUnit of the type U0
  - For opening a new potential group
    BU15P-16+A0+2D[1] or
    BU15P-16+A10+2D[1]
  - For continuing the potential group
    BU15P-16+A0+2B[1]
    BU15P-16+A10+2B[1]
    [1] FM-certified

  An overview of the BaseUnits that you can use with the electronic weighing system can be found in the Product Information for the documentation of the ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293).
  Information regarding selection of the suitable BaseUnit can be found in the ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/73021864) system manual and in the ET 200SP BaseUnits (http://support.automation.siemens.com/WW/view/en/58532597/133300) manual.

Parameter data record

A

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.

Configuration with PROFINET GSD file and with PROFIBUS GSD file

The properties and their dependencies on measuring type and measuring range for PROFINET and PROFIBUS are listed in the table.

Measurement type	Measuring range	Diagnostics				Hardware interrupts	
		No supply voltage L+	Short-circuit to ground	Overflow / underflow	Wire break	PROFINET	PROFIBUS
Deactivated		*	*	*	*	*	*
Voltage	±320 mV	x	x	x	x	x	x

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

A.2 Parameter assignment

Parameter assignment in the user program

You can re-configure the module in RUN. You can, for example, change voltage or current values in single channels in RUN without this change having an effect on the other channels.

Note

Following a firmware update, you need to re-configure the I/O module before you can use the new functions.

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 the parameters set in STEP 7 are valid again after a restart.

In addition, the data records 0 and 1 are available which contain the channel-specific parameters for channel 0 (data record 0) and channel 1 (data record 1). These data records allow for the fastest, channel-specific parameter assignment in RUN.

Note

Changing parameters in RUN

A parameter data record that has content different from the startup parameter assignment results in a brief exit from clocked measuring mode and renewed synchronization with the fieldbus cycle. The slowest channel provides the "internal" measuring cycle.

STATUS output parameter

The module ignores errors that occur during the transfer of parameters with the "WRREC" instruction and continues operation with the previous parameter assignment. The STATUS output parameter contains a corresponding error code.

The description of the "WRREC" instruction and the error codes is available in the STEP 7 online help.

See also

Description of parameters (Page 28)

A.3 Parameter data record 128

Structure of parameter data record 128 for the entire module

Byte	Name and meaning
0 ... 1	Header information
2 ... 3	Module header information
4 ... 9	Module parameters
10 ... 11	Channel header information
12 ... 69	Channel parameter block 0
70 ... 127	Channel parameter block 1

Header information

The following tables show the structure of the header information.

Byte	Bit	Allocation	Name and meaning
0	0	0	Minor version
	1	0	
	2	0	
	3	0	
	4	1	Major version
	5	0	
	6	0	Reserved
	7	0	

Byte	Bit	Number of the next parameter structures = 2
1	0	0
	1	1
	2	0
	3	0
	4	0
	5	0
	6	0

Module header information

The following tables show the structure of the header information module.

Byte	Bit	Length of the next module parameter blocks = 1
2	0	1
	1	0
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0

Byte	Bit	Length of the next module parameter block = 6
3	0	0
	1	0
	2	1
	3	0
	4	0
	5	0
	6	0
	7	0

Module parameter block

The following table shows the structure of the module parameter block. Enable a parameter by setting the corresponding bit to "1".

Byte	Bit	Name and meaning
4	0	Isochronous mode 0: OFF 1: ON
	1	1/2 channel mode (only with oversampling) 0: 1-channel mode 1: 2 channel mode
	2	Line frequency 0: 50 Hz 1: 60 Hz
	3 ... 7	Reserved
5	0 ... 3	Sampling rate 0 ... 13 (sub-cycle 1 ... 14); only with oversampling operating mode
	4 ... 7	Reserved
6 ... 9	0 ... 7	Reserved

Channel header information

The following tables show the structure of the header information channel.

Byte	Bit	Number of the next channel parameter blocks = 2
10	0	0
	1	1
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0

Byte	Bit	Length of the next channel parameter block = 58
11	0	0
	1	1
	2	0
	3	1
	4	1
	5	1
	6	0
	7	0

Channel parameter block

The following tables show the structure of the channel parameter block. Enable a parameter by setting the corresponding bit to "1".

x = 12 + (channel number x 58); channel number 0 to 1

More information on the parameters is available in the section Description of parameters (Page 28).

Byte	Bit	Name and meaning
x	0 ... 7	Reserved
x + 1	0	Channel function 0: Channel deactivated 1: Channel activated
	1	4/6-wire technology 0: 4-wire technology 1: 6-wire technology
	2	Line frequency suppression 0: OFF 1: ON
	3 ... 7	Reserved

Byte	Bit	Name and meaning
x + 2	0 ... 7	Measuring range (data format DINT)
x + 3	0 ... 7	
x + 4	0 ... 7	
x + 5	0 ... 7	
x + 6	0 ... 7	Sampling rate (data format UInt; 0.1 ms increments)
x + 7	0 ... 7	
x + 8	0 ... 7	Average value filter (data format UInt; 0.1 ms increments)
x + 9	0 ... 7	
x + 10	0 ... 7	Prefilter time Input lock mode B (data format UInt; 0.1 ms increments)
x + 11	0 ... 7	
x + 12	0 ... 7	Limit frequency Low-pass filter (data format UInt; 0.1 Hz increments)
x + 13	0 ... 7	
x + 14	0 ... 7	Ordinal number low-pass filter (data format Uint; 1 ... 4)
x + 15	0 ... 7	
x + 16	0 ... 7	Notch filter frequency (data format UInt; 0.1 Hz increments)
x + 17	0 ... 7	
x + 18	0 ... 7	Notch filter quality (data format UInt; 0.01 Hz increments)
x + 19	0 ... 7	
x + 20	0 ... 3	Reserved
	4	Hardware interrupt high limit 2 exceeded
	5	Hardware interrupt low limit 2 undershot
	6	Hardware interrupt high limit 1 exceeded
	7	Hardware interrupt low limit 1 undershot
x + 21	0	No supply voltage L+
	1	Reserved
	2	Short circuit / wire break at sensor
	3	Reserved
	4	Measuring range undershot
	5	Reserved
	6	Measuring range exceeded
	7	Reserved
x + 22	0 ... 7	Hardware interrupt, low limit 1 (data format DInt)
x + 23	0 ... 7	
x + 24	0 ... 7	
x + 25	0 ... 7	
x + 26	0 ... 7	Hardware interrupt, hysteresis low limit 1 (data format DInt)
x + 27	0 ... 7	
x + 28	0 ... 7	
x + 29	0 ... 7	
x + 30	0 ... 7	Hardware interrupt, high limit 1 (data format DInt)
x + 31	0 ... 7	
x + 32	0 ... 7	
x + 33	0 ... 7	

Byte	Bit	Name and meaning
x + 34	0 ... 7	Hardware interrupt, hysteresis high limit 1 (data format DInt)
x + 35	0 ... 7	
x + 36	0 ... 7	
x + 37	0 ... 7	
x + 38	0 ... 7	Hardware interrupt, low limit 2 (data format DInt)
x + 39	0 ... 7	
x + 40	0 ... 7	
x + 41	0 ... 7	
x + 42	0 ... 7	Hardware interrupt, hysteresis low limit 2 (data format DInt)
x + 43	0 ... 7	
x + 44	0 ... 7	
x + 45	0 ... 7	
x + 46	0 ... 7	Hardware interrupt, high limit 2 (data format DInt)
x + 47	0 ... 7	
x + 48	0 ... 7	
x + 49	0 ... 7	
x + 50	0 ... 7	Hardware interrupt, hysteresis high limit 2 (data format DInt)
x + 51	0 ... 7	
x + 52	0 ... 7	
x + 53	0 ... 7	
x + 54	0 ... 7	Reserved
x + 55	0 ... 7	
x + 56	0 ... 7	
x + 57	0 ... 7	

A.4 Parameter data records 0 and 1

Structure of parameter data records 0 and 1 for channels 0 and 1

Byte	Name and meaning
0 ... 1	Header information
2 ... 3	Channel header information
4 ... 61	Channel parameter block channel x

Header information

The following tables show the structure of the header information.

Byte	Bit	Alloca-tion	Name and meaning
0	0	0	Minor version
	1	0	
	2	0	
	3	0	
	4	1	Major version
	5	0	
	6	0	Reserved
	7	0	

Byte	Bit	Number of the next parameter structures = 2
1	0	0
	1	1
	2	0
	3	0
	4	0
	5	0
	6	0

Channel header information

The following tables show the structure of the header information channel.

Byte	Bit	Number of the next channel parameter blocks = 2
2	0	0
	1	1
	2	0
	3	0
	4	0
	5	0
	6	0
	7	0

Byte	Bit	Length of the next channel parameter block = 58
3	0	0
	1	1
	2	0
	3	1
	4	1
	5	1
	6	0
	7	0

Channel parameter block

The following tables show the structure of the channel parameter block. Enable a parameter by setting the corresponding bit to "1".

More information on the parameters is available in the section Description of parameters (Page 28).

Byte	Bit	Name and meaning
4	0 ... 7	Reserved
5	0	Channel function 0: Channel deactivated 1: Channel activated
	1	4/6-wire technology 0: 4-wire technology 1: 6-wire technology
	2	Line frequency suppression 0: OFF 1: ON
	3 ... 7	Reserved

Byte	Bit	Name and meaning
6	0 ... 7	Measuring range (data format Real)
7	0 ... 7	
8	0 ... 7	
9	0 ... 7	
10	0 ... 7	Sampling rate (data format UInt; 0.1 ms increments)
11	0 ... 7	
12	0 ... 7	Average value filter (data format UInt; 0.1 ms increments)
13	0 ... 7	
14	0 ... 7	Prefilter time Input lock mode B (data format UInt; 0.1 ms increments)
15	0 ... 7	
16	0 ... 7	Limit frequency Low-pass filter (data format UInt; 0.1 Hz increments)
17	0 ... 7	
18	0 ... 7	Ordinal number low-pass filter (data format Uint; 1 ... 4)
19	0 ... 7	
20	0 ... 7	Notch filter frequency (data format UInt; 0.1 Hz increments)
21	0 ... 7	
22	0 ... 7	Notch filter quality (data format UInt; 0.01 Hz increments)
23	0 ... 7	
24	0 ... 3	Reserved
	4	Hardware interrupt high limit 2 exceeded
	5	Hardware interrupt low limit 2 undershot
	6	Hardware interrupt high limit 1 exceeded
	7	Hardware interrupt low limit 1 undershot
25	0	No supply voltage L+
	1	Reserved
	2	Short circuit / wire break at sensor
	3	Reserved
	4	Measuring range undershot
	5	Reserved
	6	Measuring range exceeded
	7	Reserved
26	0 ... 7	Hardware interrupt, low limit 1 (data format DInt)
27	0 ... 7	
28	0 ... 7	
29	0 ... 7	
30	0 ... 7	Hardware interrupt, hysteresis low limit 1 (data format DInt)
31	0 ... 7	
32	0 ... 7	
33	0 ... 7	
34	0 ... 7	Hardware interrupt, high limit 1 (data format DInt)
35	0 ... 7	
36	0 ... 7	
37	0 ... 7	

Byte	Bit	Name and meaning
38	0 ... 7	Hardware interrupt, hysteresis high limit 1 (data format DInt)
39	0 ... 7	
40	0 ... 7	
41	0 ... 7	
42	0 ... 7	Hardware interrupt, low limit 2 (data format DInt)
43	0 ... 7	
44	0 ... 7	
45	0 ... 7	
46	0 ... 7	Hardware interrupt, hysteresis low limit 2 (data format DInt)
47	0 ... 7	
48	0 ... 7	
49	0 ... 7	
50	0 ... 7	Hardware interrupt, high limit 2 (data format DInt)
51	0 ... 7	
52	0 ... 7	
53	0 ... 7	
54	0 ... 7	Hardware interrupt, hysteresis high limit 2 (data format DInt)
55	0 ... 7	
56	0 ... 7	
57	0 ... 7	
58	0 ... 7	Reserved
59	0 ... 7	
60	0 ... 7	
61	0 ... 7	

A.5 Parameters specifications

1. Enter the desired values for the parameters according to the specifications in the following table.
2. The corresponding parameter addresses are listed in sections Parameter data record 128 (Page 65) and Parameter data records 0 and 1 (Page 70).

The table refers to the structure of the parameter data record 128. The parameter addresses of the parameter data records 0 and 1 are different.

Parameter	Adjustment range	Meaning	Operating instruction
Measuring range (data type UDInt)	5000 to 3200000	5000 corresponds to 0.5 mV/V 3200000 corresponds to 320 mV/V	• Enter the required value in the data double word (DWord) x + 2.
Sampling rate (data type UInt)	1 .. 65535	1 corresponds to 0.1 ms 65535 corresponds to 6553.5 ms	• Enter the required value in the data double word (DWord) x + 6.
Average value filter (data type UInt)	10 ... 65535	10 corresponds to 0.1 ms 65535 corresponds to 655.35 ms 0 disables the filter	• Enter the required value in the data double word (DWord) x + 8.
Prefilter Input lock mode B (data type UInt)	0 ... 65535	1 corresponds to 0.01 ms 65535 corresponds to 655.35 ms 0 disables the filter	• Enter the required value in the data double word (DWord) x + 10.
Low-pass filter limit frequency (data type UInt)	0 ... 65535	1 corresponds to 0.1 Hz 65535 corresponds to 6553.5 Hz 0 disables the filter	• Enter the required value in the data double word (DWord) x + 12.
Ordinal number IIR low-pass filter (data type UInt)	1 ... 4		• Enter the required value in the data double word (DWord) x + 14.
Notch filter frequency (data type UInt)	1 ... 10000	1 corresponds to 0.1 Hz 10000 corresponds to 1000.0 Hz 0 disables the filter	• Enter the required value in the data double word (DWord) x + 16.
Notch filter quality (data type UInt)	500 ... 25000	500 corresponds to 5.0 25000 corresponds to 250.0	• Enter the required value in the data double word (DWord) x + 18.
High/low limits 1 and 2 (data type DInt)	-2147483648 ... 2147483648	The unit of the limits is digits – identical to the unit of the measured value.	• Enter the required value in the data double word (DWord) x + 22, x + 30, x + 38 or x + 46.
Hysteresis high/low limits 1 and 2 (data type DInt)	0 ... 4294967295	The unit of the hysteresis is digits – identical to the unit of the measured value.	• Enter the required value in the data double word (DWord) x + 26, x + 34, x + 42 or x + 50.

Representation of analog values

B

B.1 Representation of analog values for analog inputs

This appendix describes the analog values for all measuring that you can use with the analog input module.

Measured value resolution

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**
13	8	8_H	SIGN 0 0 0 0 0 0 0	0 0 0 0 1 x x x
14	4	4_H	SIGN 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
28	2	2_H	SIGN 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
16	1	1_H	SIGN 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

B.2 Representation of the input range

The tables below show the digital representation of the input range.

Table B-2 Input range for normal and isochronous mode

Dec. value	Measured value in %	Range
≥ 120,000,001	≥ 120%	Overflow
120,000,000	120%	Overshoot range
100,000,001	>100%	
100,000,000	100%	Nominal range
0		
-100,000,000	-100%	
-100,000,001	< -100%	Underrange
-120,000,000	-120%	
≤ -120,000,001	≤ -120%	Underflow

Table B-3 Input range for oversampling mode

Dec. value	Measured value in %	Range
≥ 30,001	≥ 120%	Overflow
30,000	120%	Overshoot range
25,001	>100%	
25,000	100%	Nominal range
0		
-25,000	-100%	
-25,001	< -100%	Underrange
-30.000	-120%	
≤ -30,001	≤ -120%	Underflow

Note

The module still supplies measured values even when the overflow or underflow range is exceeded or undershot. No substitute value is output in this case.

B.3 Analog value representation

The table below contains the decimal and hexadecimal values (codings) of the voltage measuring range. As an example, we are looking at the characteristic values 1.0 mV/V and 2.0 mV/V. The internal module power supply is 4.85 VDC.

Table B-4 Voltage measuring range 1.0 mV/V and 2 mV/V

Values		**Voltage measuring range**		**Range**
Dec.	**Hex.**	**1 mV/V**	**2 mV/V**	
≥ 120,000,001	≥ 7270E01	> 5.82 mV	> 11.64 mV	Overflow
120,000,000	7270E00	5.82 mV	11.64 mV	Overshoot range
100,000,001	5F5E101	> 4.85 mV	> 9.7 mV	
100,000,000	5F5E100	4.85 mV	9.7 mV	Nominal range
0			0	
-100,000,000	FA0A1F00	-4.85 mV	-9.7 mV	
-100,000,001	FA0A1EFF	< -4.85 mV	< -9.7 mV	Underrange
-120,000,000	F8D8F200	-5.82 mV	-11.64 mV	
≤ -120,000,001	≤ F8D8F1FF	< -5.82 mV	< -11.64 mV	Underflow

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