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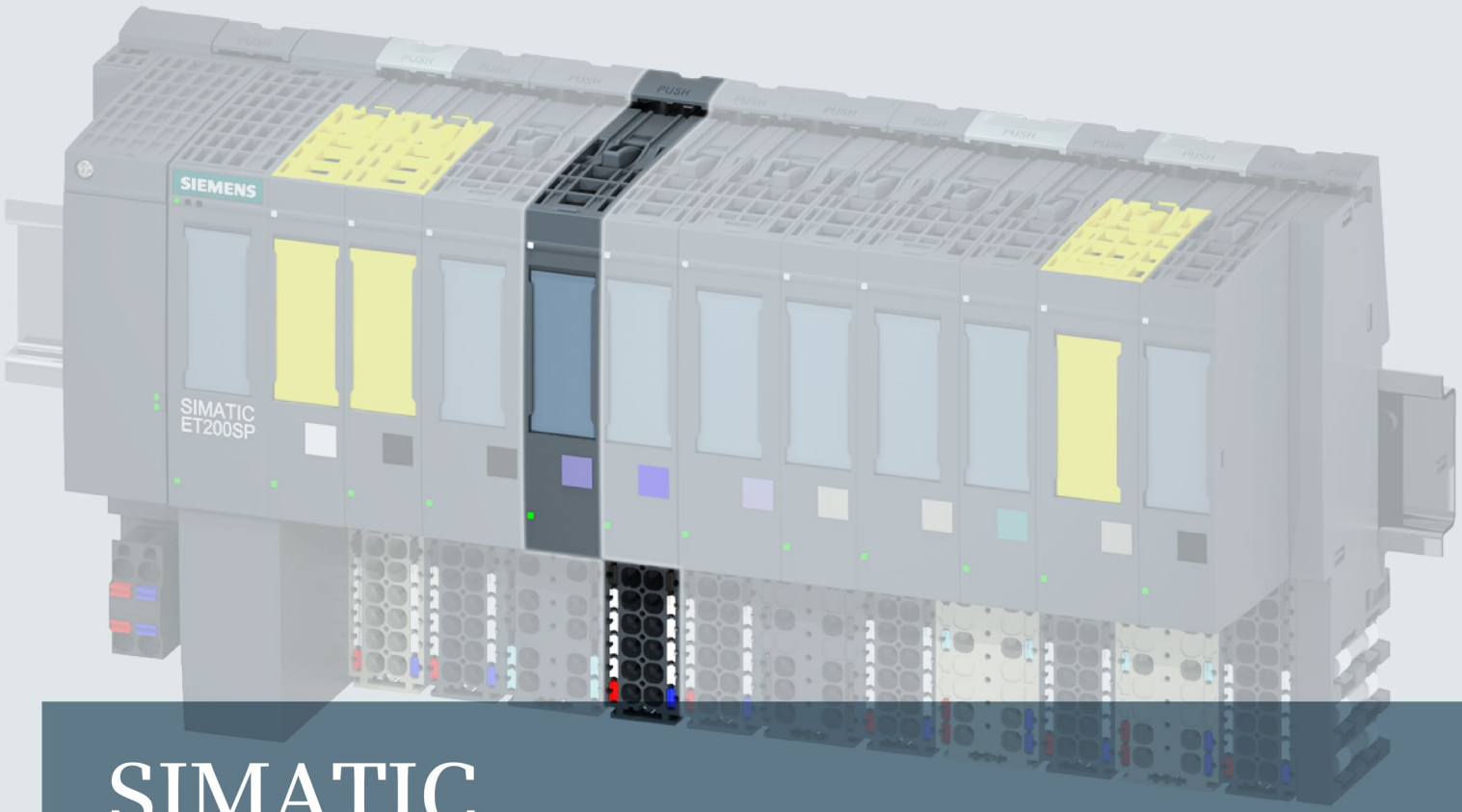

SIMATIC

ET 200SP

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

Manual

Edition 12/2015

Answers for industry.

SIEMENS

SIMATIC

ET 200SP
Analog input module AI 2xU ST (6ES7134-6FB00-0BA1)

Manual

12/2015

A5E36104728-AA

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.

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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.

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A5E36104728-AA
℗ 12/2015 Subject to change

Preface

Purpose of the documentation

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

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

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

Conventions

CPU: When the term "CPU" is used in this manual, 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.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. You can find more information about industrial security on the Internet (http://www.siemens.com/industrialsecurity).

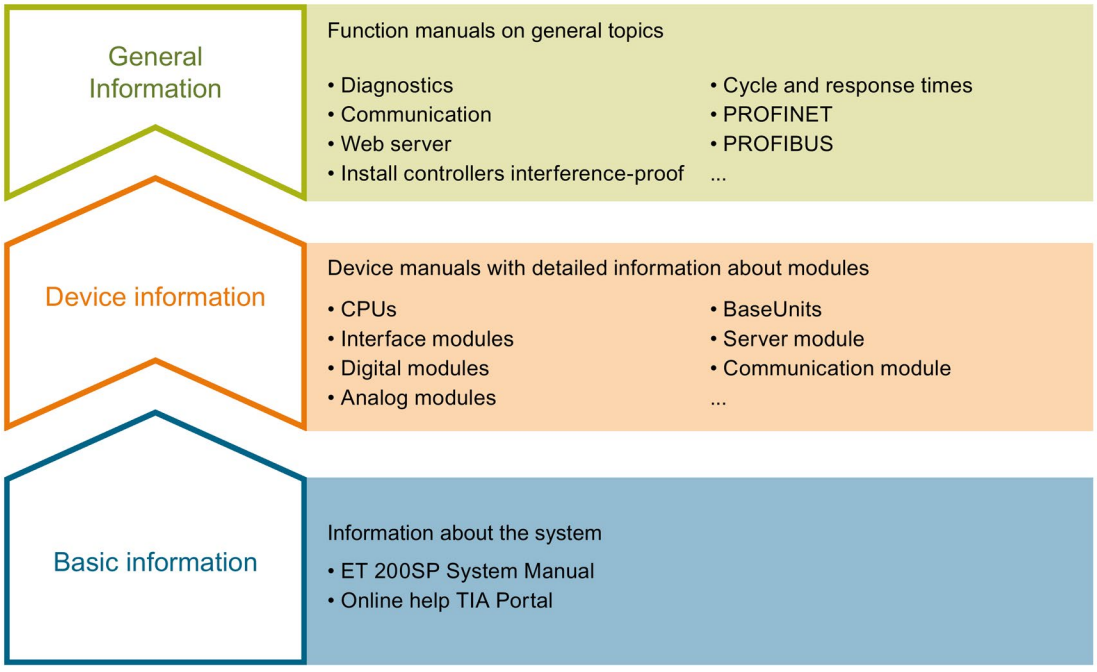
To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet (http://support.automation.siemens.com).

Table of contents

Documentation guide

1

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 describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200SP. distributed I/O system. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, terminal 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, designing interference-free controllers.

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 most of your Industry Online Support.

In "mySupport" you can store filters, favorites and tags, request CAx data and put together your personal library in the Documentation area. Furthermore, your data is automatically filled into support requests and you always have an overview of your current requests.

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

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

"mySupport" - Documentation

In the Documentation area of "mySupport", you have the possibility to combine complete manuals or parts of them to make your own manual.
You can export the manual in PDF format or in an editable format.

You can find "mySupport" - Documentation in the Internet (http://support.industry.siemens.com/My/ww/en/documentation).

"mySupport" - CAx Data

In the CAx Data area of "mySupport", you can have 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 in 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 in individual products.

You can 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).

Product overview

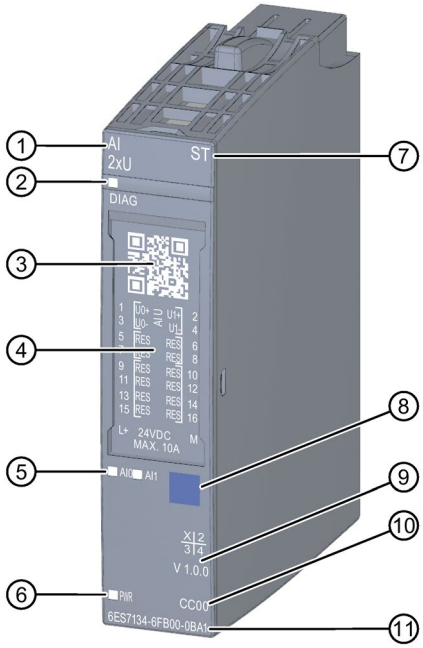
2

2.1 Properties

Article number

6ES7134-6FB00-0BA1

View of the module



① Module type and name
② LED for diagnostics
③ 2D matrix code
④ Wiring diagram
⑤ LEDs for channel status
⑥ LED for supply voltage
⑦ Function class
⑧ Color coding module type
⑨ Function and firmware version
⑩ Color code for selecting the color identification labels
⑪ Article number

Image 2-1 View of the module AI 2×U ST

Properties

The module has the following technical properties:

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

The module supports the following functions:

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

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

Accessories

The following accessories must be ordered separately:

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

See also

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

Wiring

3

3.1 Wiring and block diagram

This section includes the block diagram of the AI 2xU ST module with the terminal assignments.

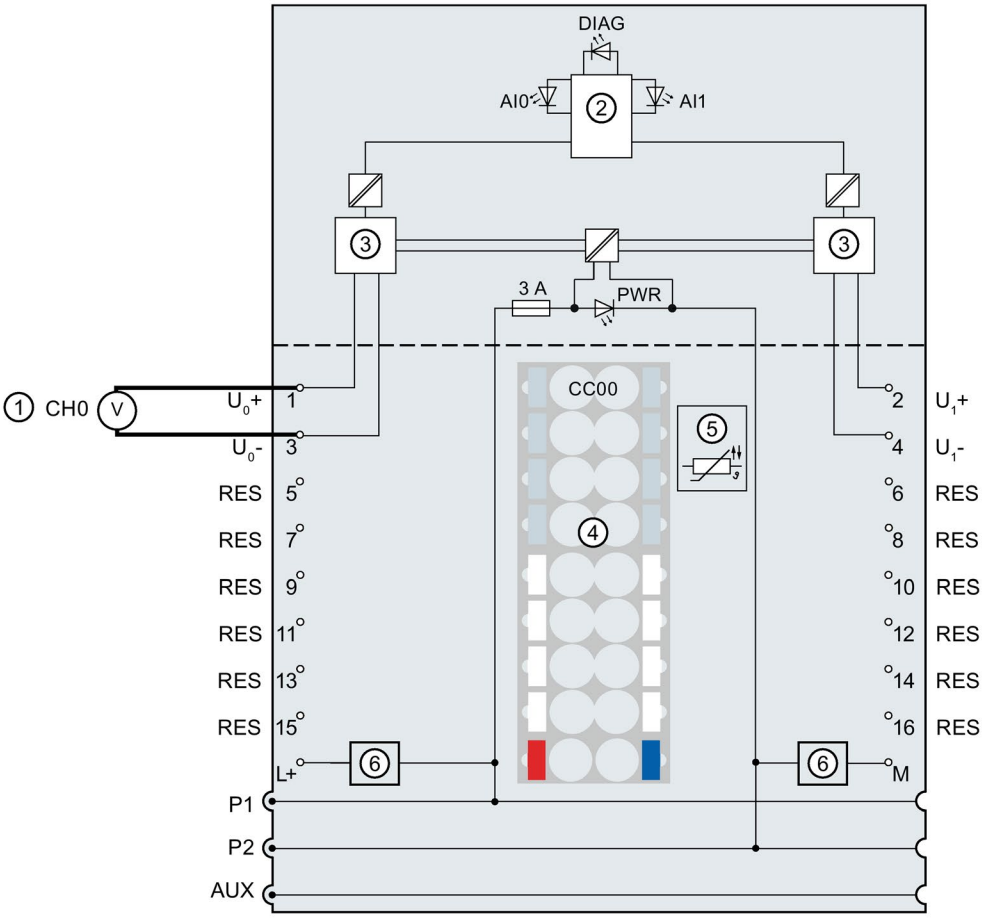
You can find information on wiring the BaseUnit in the ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293) system manual.

Note

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

Wiring: Voltage measurement 2-wire connection

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



①	2-wire connection for voltage measurement	U_n+	Voltage input positive, channel n
②	Backplane bus interface	U_n-	Voltage input negative, channel n
③	Analog-to-digital converter (ADC)	RES	Reserve, must remain unused for future function extensions
④	Color-coded label with color code CC00 (optional)	L+	24 V DC (infeed only with light-colored BaseUnit)
⑤	Temperature recording for BU type A1 only (function cannot be used for this module)	P1, P2, AUX	Internal self-assembling voltage buses Connection to left (dark-colored BaseUnit) Connection to left interrupted (light-colored BaseUnit)
⑥	Filter connection supply voltage (only when light-colored BaseUnit is present)	DIAG	Diagnostics LED (green, red)
		AI0, AI1	Channel status LED (green)
		PWR	Power LED (green)

Image 3-1 Wiring and block diagram for voltage measurement 2-wire connection

Parameters/address space

4

4.1 Measuring types and ranges

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

Table 4- 1 Measuring ranges

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

You will find the tables of the measuring ranges as well as overflow, overrange, etc., in the section Representation of analog values (Page 32).

4.2 Parameters

Parameters of the AI 2xU ST

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 section Parameter assignment and structure of the parameter data record (Page 28).

The following parameter settings are possible:

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

Parameter	Range of values	Default	Parameter reassignment in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics: No supply voltage L+	• Disable • Enable	Disable	Yes	Module	Module
Diagnostics: Short-circuit to ground	• Disable • Enable	Disable	Yes	Module	Module
Diagnostics: Overflow [1]	• Disable • Enable	Disable	Yes	Module	Module [1]
Diagnostics: Underflow [1]	• Disable • Enable	Disable	Yes	Module	
Measurement type/measuring range	• Deactivated • Voltage +/- 5 V • Voltage +/- 10 V • Voltage 0..10 V • Voltage 1..5 V	Voltage +/- 10 V	Yes	Channel	Channel
Smoothing	• None • Weak • Medium • Strong	None	Yes	Channel	Channel

Parameter	Range of values	Default	Parameter reassignment in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Interference frequency suppression	• 60 Hz (50 ms) • 50 Hz (60 ms) [2] • 16.6 Hz (180 ms) • None	50 Hz (60 ms)	Yes	Channel	Module
Potential group	• Use potential group of the left module (module plugged into a dark BaseUnit) • Enable new potential group (module plugged into light-colored BaseUnit)	Use potential group of the left module	No	Module	Module

[1] Due to the limited number of parameters of a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the parameter assignment options are restricted. If required, you can assign these parameters using data record 128 as described in the "GSD file PROFINET IO" column (see table above). The parameter length of the I/O module is 4 bytes.

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

Note

Unused channels

Disable the unused channels in the parameter assignment.

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

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

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

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

Diagnostics: Overflow

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

Diagnostics: Underflow

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

Measurement type/measuring range

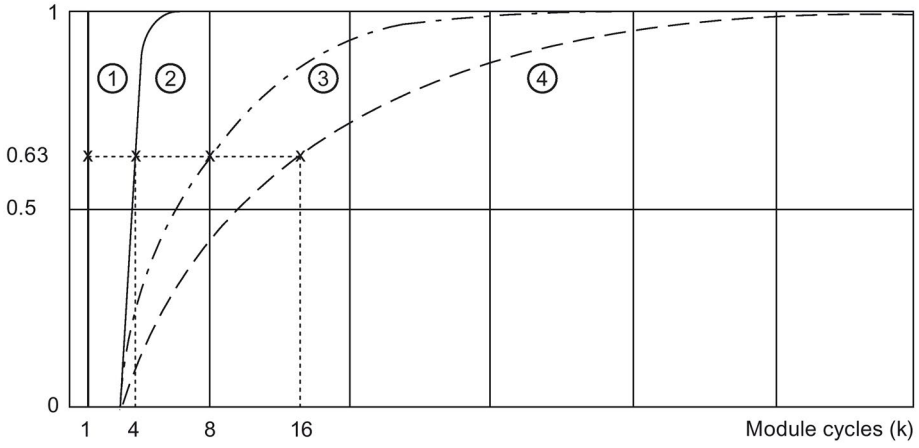
Refer to the section Measuring types and ranges (Page 13).

Smoothing

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

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



① No smoothing (k = 1)
② Weak (k = 4)
③ Medium (k = 8)
④ Strong (k = 16)

Image 4-1 Smoothing for AI 2xU ST

Interference frequency suppression

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

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

Potential group

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

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

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.

See also

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

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 and 1 in this byte are assigned to a channel. They provide information about the validity of the analog value.

Bit = 1: No fault is present on the channel.

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

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

Address space

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

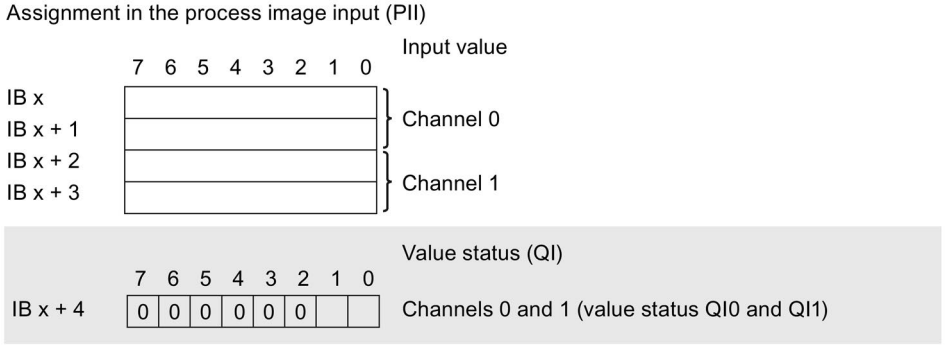


Image 4-2 Address space of the AI 2×U ST with value status

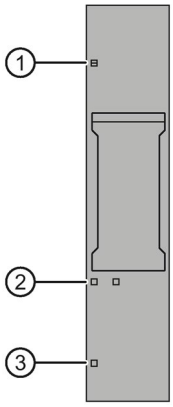
Interrupts/diagnostics alarms

5

5.1 Status and error display

LED display

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



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

Image 5-1 LED display

Meaning of the LEDs

The following tables show the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in section Diagnostics alarms (Page 22).

DIAG LED

Table 5- 1 Error display of the DIAG LED

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	Missing supply voltage L+
On	Supply voltage L+ present

5.2 Interrupts

The AI 2×U ST analog input module supports diagnostics interrupts.

Diagnostics interrupts

The module generates a diagnostic interrupt at the following events:

- Short-circuit (voltage 1 V to 5 V)
- High limit violated
- Low limit violated
- Error
- Parameter assignment error
- Supply voltage missing
- Channel temporarily unavailable

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 corrective measures

Diagnostics alarm	Error code	Meaning	Solution
Short-circuit (1 to 5 V)	1_H	Short-circuit of input signal	Correct interplay between module and encoder
		Open input	Connect input
High limit violated	7_H	Value is above the overrange.	Correct interplay between module and encoder
Low limit violated	8_H	Value is below the underrange.	Correct interplay between module and encoder
Error	9_H	Internal module error occurred.	Replace module
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct the parameter assignment
Supply voltage missing	11_H	Missing or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel temporarily unavailable	$1F_H$	Firmware update is currently in progress or has been canceled. The module does not read process values in this state.	• Wait for firmware update. • Restart the firmware update.

Technical specifications

6

6.1 Technical specifications

Technical specifications of the AI 2×U ST

	6ES7134-6FB00-0BA1
General information	
Product type designation	ET 200SP, AI 2xU Standard
Firmware version	V1.0
• FW update possible	Yes
Usable BaseUnits	BU type A0, A1
Color code for module-specific color identification label	CC00
Product function	
I&M data	Yes; I&M0 to I&M3
Scalable measuring range	No
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V13 SP1
STEP 7 can be configured/integrated as of version	V5.5 SP3 / -
PROFIBUS as of GSD version/GSD revision	GSD revision 5
PROFINET as of GSD version/GSD revision	GSDML V2.3
Operating mode	
Oversampling	No
MSI	No
CiR Configuration in RUN	
Configuration in RUN possible	Yes
Calibration in RUN possible	No
Supply voltage	
Rated value (DC)	24 V
Valid range, low limit (DC)	19.2 V
Valid range, high limit (DC)	28.8 V
Polarity reversal protection	Yes
Input current	
Current consumption, max.	37 mA
Encoder supply	
24 V encoder supply	
24 V	No
Additional 24 V encoder supply	
24 V	No

	6ES7134-6FB00-0BA1
Power loss	
Power loss, typ.	0.9 W
Address area	
Address space per module	
Address space per module, max.	4 bytes; + 1 byte for QI information
Analog inputs	
Number of analog inputs	2
Maximum permissible input voltage for voltage input (destruction limit)	30 V
Cycle time (all channels), min.	500 µs
Input ranges (rated values), voltages	
0 to +10 V	Yes; 15 bits
Input resistance (0 to 10 V)	180 kΩ
1 V to 5 V	Yes; 15 bits
Input resistance (1 V to 5 V)	180 kΩ
-10 V to +10 V	Yes; 16 bits incl. sign
Input resistance (-10 V to +10 V)	180 kΩ
-5 V to +5 V	Yes; 16 bits incl. sign
Input resistance (-5 V to +5 V)	180 kΩ
Cable length	
Shielded, max.	200 m
Formation of analog values for the inputs	
Measuring principle	Sigma Delta
Integration and conversion time/resolution per channel	
Resolution with overrange (bit including sign), max.	16 bits
Integration time configurable	Yes
Interference voltage suppression for interference frequency f1 in Hz	16.6 / 50 / 60 Hz / off
Conversion time (per channel)	50 ms @ 60 Hz, 60 ms @ 50 Hz, 180 ms @ 16.6 Hz, 250 µs without filter
Measured value smoothing	
Number of levels	4
Configurable	Yes
Setting: None	Yes; 1 x cycle time
Setting: Weak	Yes; 4 x cycle time
Setting: Medium	Yes; 8 x cycle time
Setting: Strong	Yes; 16 x cycle time

	6ES7134-6FB00-0BA1
Encoders	
Connection of the signal transmitters	
For voltage measurement	Yes
Errors/accuracies	
Linearity error (in relation to input range), (+/-)	0.01%
Temperature error (in relation to input range), (+/-)	0.005%/K
Crosstalk between inputs, min.	-50 dB
Repeat accuracy in settled state at 25 °C (in relation to input range), (+/-)	0.05%
Operational limit in the entire temperature range	
Voltage in relation to input range, (+/-)	0.5%
Basic error limit (operational limit at 25 °C)	
Voltage in relation to input range, (+/-)	0.3%
Interference voltage suppression for f = n x (f1 +/-1%), f1 = interference frequency	
Series-mode interference (peak of the interference < rated value of the input range), min.	70 dB
Common mode voltage, max.	10 V
Common mode interference, min.	90 dB
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Interrupts	
Diagnostics interrupt	Yes
Limit interrupt	No
Diagnostics alarms	
Diagnostics	Yes
Monitoring of the supply voltage	Yes
Wire break	No
Short-circuit	Yes; with 1 to 5 V
Group error	Yes
Overflow/underflow	Yes
Diagnostics indicator LED	
Monitoring of the supply voltage (PWR LED)	Yes; green PWR LED
Channel status display	Yes; green LED
For channel diagnostics	No
For module diagnostics	Yes; green/red DIAG LED

	6ES7134-6FB00-0BA1
Electrical isolation	
Electrical isolation of channels	
Between the channels	No
Between the channels and backplane bus	Yes
Between the channels and voltage supply of the electronics	Yes
Permitted potential difference	
Between different circuits	75 V DC / 60 V AC (basic isolation)
Between the inputs (UCM)	10 Vss
Isolation	
Isolation tested with	707 V DC (type test)
Dimensions	
Width	15 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

A.1 Dependencies when configuring with GSD file

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

Configuring with a PROFINET GSD file

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

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

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

Configuring with a PROFIBUS GSD file

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

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

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

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

Parameter assignment in the user program

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

Changing parameters in RUN

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

Output parameter STATUS

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

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

Structure of data record 128

Note

Channel 0 includes the diagnostics enable for the entire module.

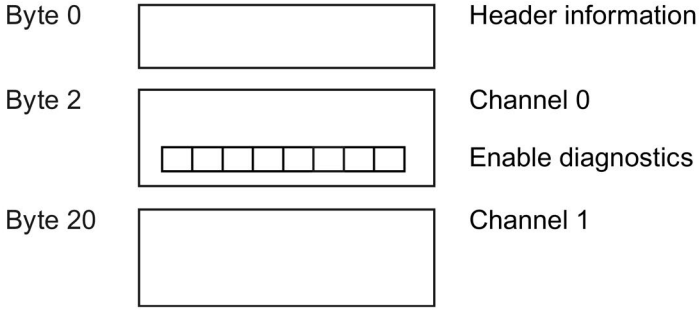


Image A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

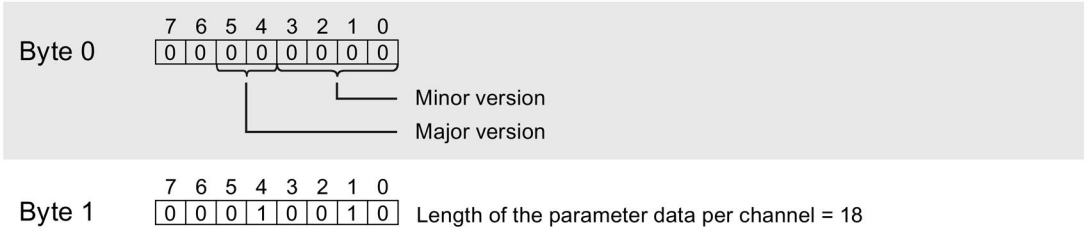
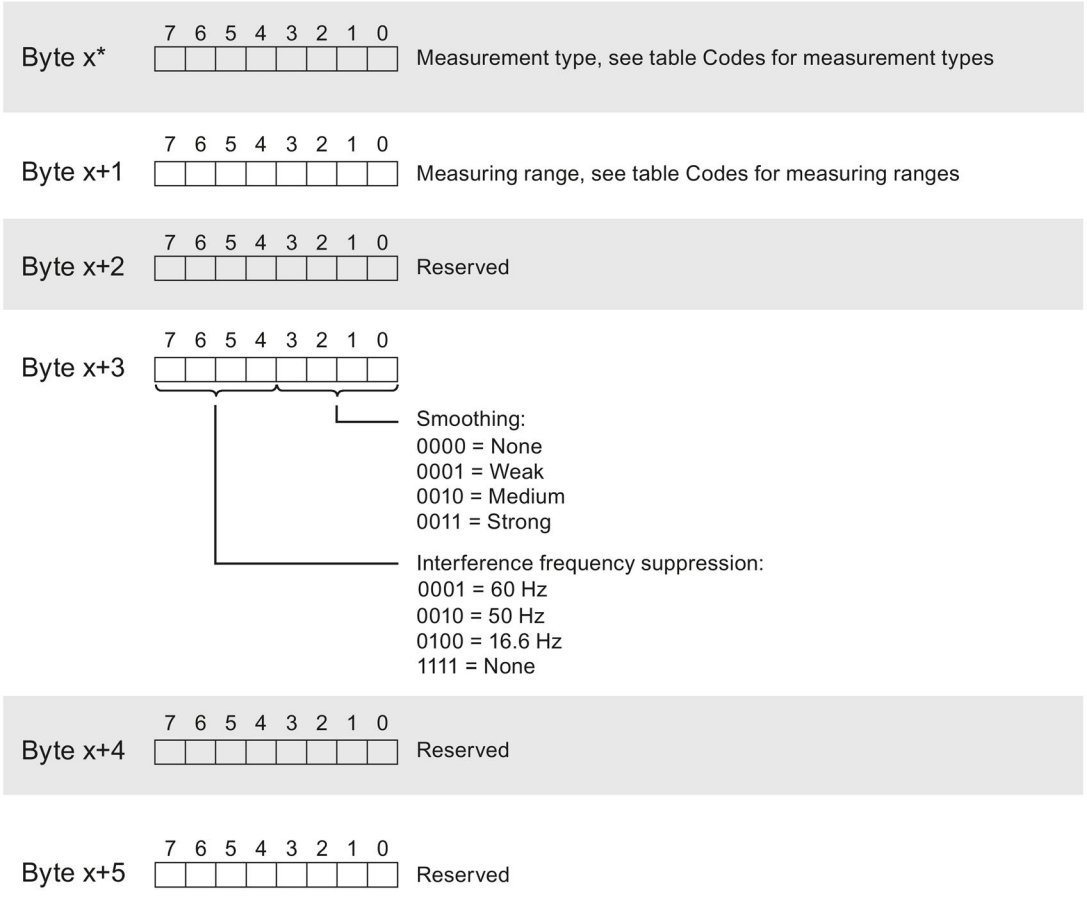


Image A-2 Header information

Parameters

The following figure shows the structure of the parameters for channels 0 and 1.

You enable a parameter by setting the corresponding bit to "1".



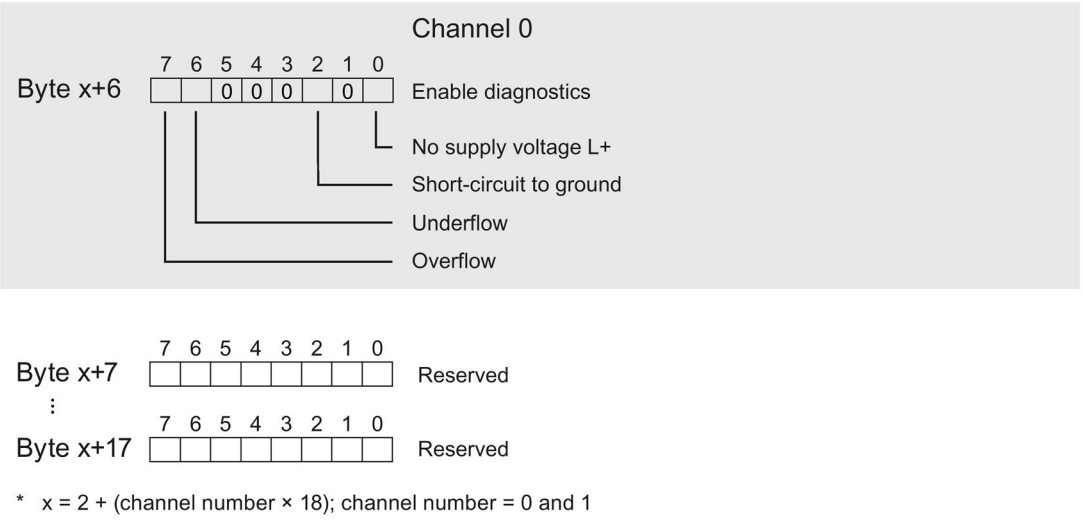


Image A-3 Structure of bytes x to x+17 for channels 0 and 1

Codes for measurement types

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

Table A- 1 Codes for measurement types

Measurement type	Code
Deactivated	0000 0000
Voltage	0000 0001

Codes for measuring ranges

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

Table A- 2 Codes for measuring ranges

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

Error transmitting the data record

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

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

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

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

Representation of analog values

B

B.1 Representation of analog values

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

Measured value resolution

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

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

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

Table B- 1 Resolution of the analog values

Resolution in bits including sign	Values		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
15	2	2_H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 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 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	
-32768	<-117.593	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

Table B- 3 Unipolar input ranges

Dec. value	Measured value in %	Data word																Range
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32767	>117.589	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Underrange
-4864	-17.593	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	
-32768	<-17.593	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

B.3 Representation of analog values in voltage measuring ranges

Voltage measuring range ±10 V to ±5 V

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

System		Voltage measuring range		Range
dec	hex	±10 V	±5 V	
32767	7FFF	>11.759 V	>5.879 V	Overflow
32511	7EFF	11.759 V	5.879 V	Overrange
27649	6C01			
27648	6C00	10 V	5 V	Nominal range
20736	5100	7.5 V	3.75 V	
1	1	361.7 µV	180.8 µV	
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

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

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

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