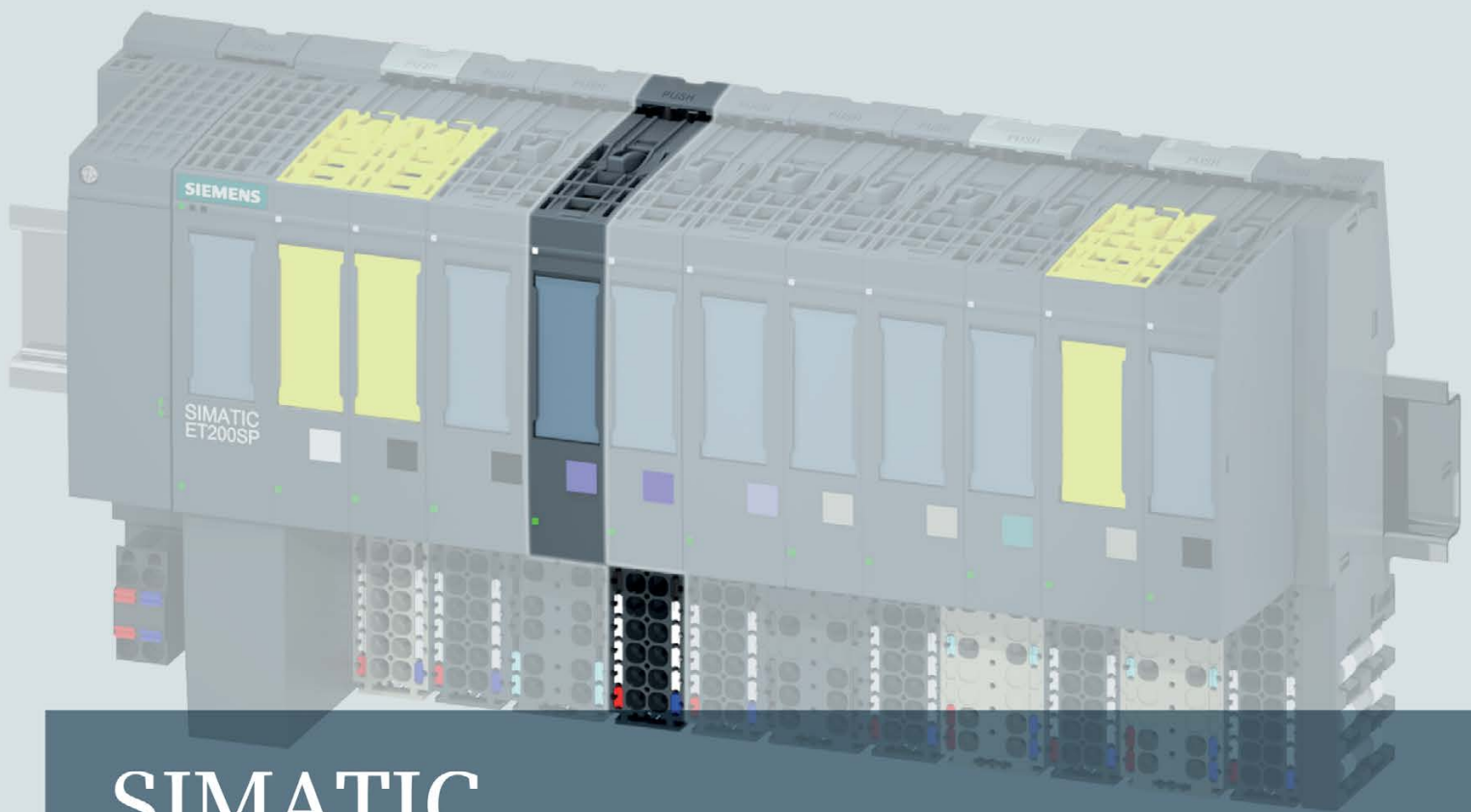


SIEMENS



SIMATIC

ET 200SP

Analog input module AI 8xU BA (6ES7134-6FF00-0AA1)

Manual

Edition

03/2015

Answers for industry.

SIEMENS

SIMATIC

ET 200SP Analog input module AI 8xU BA (6ES7134-6FF00-0AA1)

Manual

Preface

Documentation guide

1

Product overview

2

Wiring up

3

Parameters/address space

4

Interrupts/diagnostics alarms

5

Technical specifications

6

Parameter data record

A




Representation of analog
values

B

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.
NOTICE
indicates that property damage can result if proper precautions are not taken.


If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

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

Trademarks

All names identified by ® are registered trademarks of Siemens AG. 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.

Preface

Purpose of the documentation

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

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

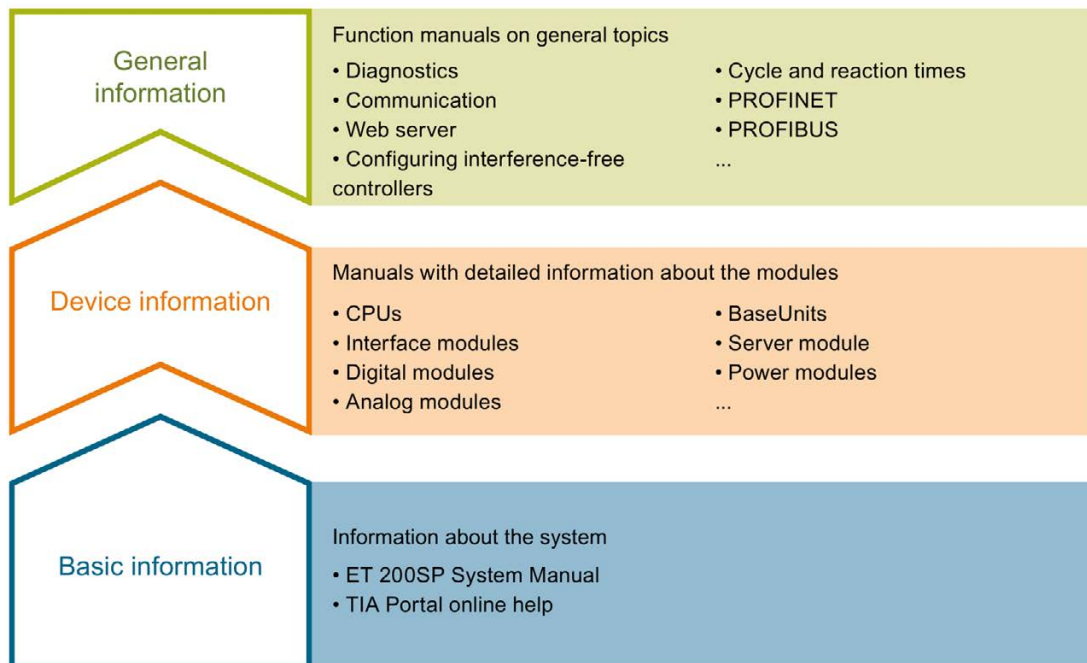
Table of contents

	Preface	4
1	Documentation guide	6
2	Product overview	8
	2.1 Properties	8
3	Wiring up	10
	3.1 Wiring and block diagram	10
4	Parameters/address space	12
	4.1 Measuring types and ranges	12
	4.2 Parameters	13
	4.3 Explanation of the parameters	15
	4.4 Address space	17
5	Interrupts/diagnostics alarms	18
	5.1 Status and error displays	18
	5.2 Interrupts	20
	5.3 Diagnostics alarms.....	20
6	Technical specifications	21
	6.1 Technical specifications	21
A	Parameter data record	24
	A.1 Dependencies when configuring with GSD file.....	24
	A.2 Parameter assignment and structure of the parameter data record.....	25
B	Representation of analog values	29
	B.1 Representation of input ranges.....	30
	B.2 Representation of analog values in voltage measuring ranges.....	31

Documentation guide

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

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



Basic information

The system manual 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.

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>).

My Documentation Manager

The My Documentation Manager is used to combine entire manuals or only parts of these to your own manual.

You can export the manual as PDF file or in a format that can be edited later.

You can find the My Documentation Manager on the Internet (<http://support.industry.siemens.com/My/ww/en/documentation>).

Application examples

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

CAX Download Manager

The CAX Download Manager is used to access the current product data for your CAX or CAe systems.

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 the CAX Download Manager on the Internet (<http://support.industry.siemens.com/my/ww/en/CAXOnline>).

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>).

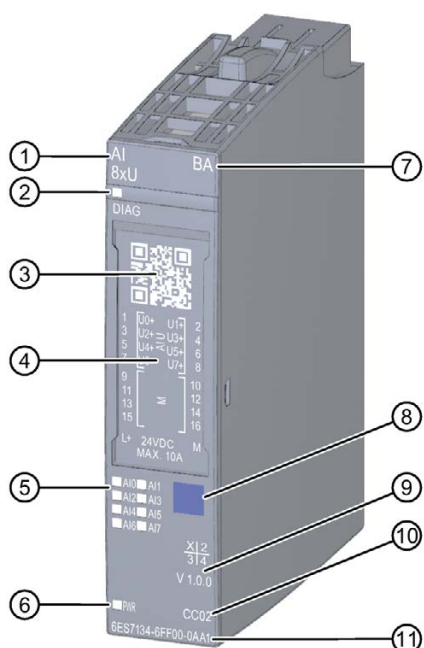
Product overview

2.1 Properties

Article number

6ES7134-6FF00-0AA1

View of the module



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

Figure 2-1 View of the AI 8xU BA module

Properties

The module has the following technical properties:

- Analog input module with 8 inputs (single-ended)
- Input ranges for voltage measurement:
 - ± 10 V, resolution 16 bits including sign
 - 0 to 10 V, resolution 15 bits
- Cycle time of the module (all channels) 10 ms
- Configurable diagnostics (per module)

The module supports the following functions:

- Firmware update
- I&M identification data
- Reconfiguration in RUN

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

Wiring up

3.1 Wiring and block diagram

This section includes the block diagram of the AI 8xU BA module with the terminal assignments for a 2-wire connection.

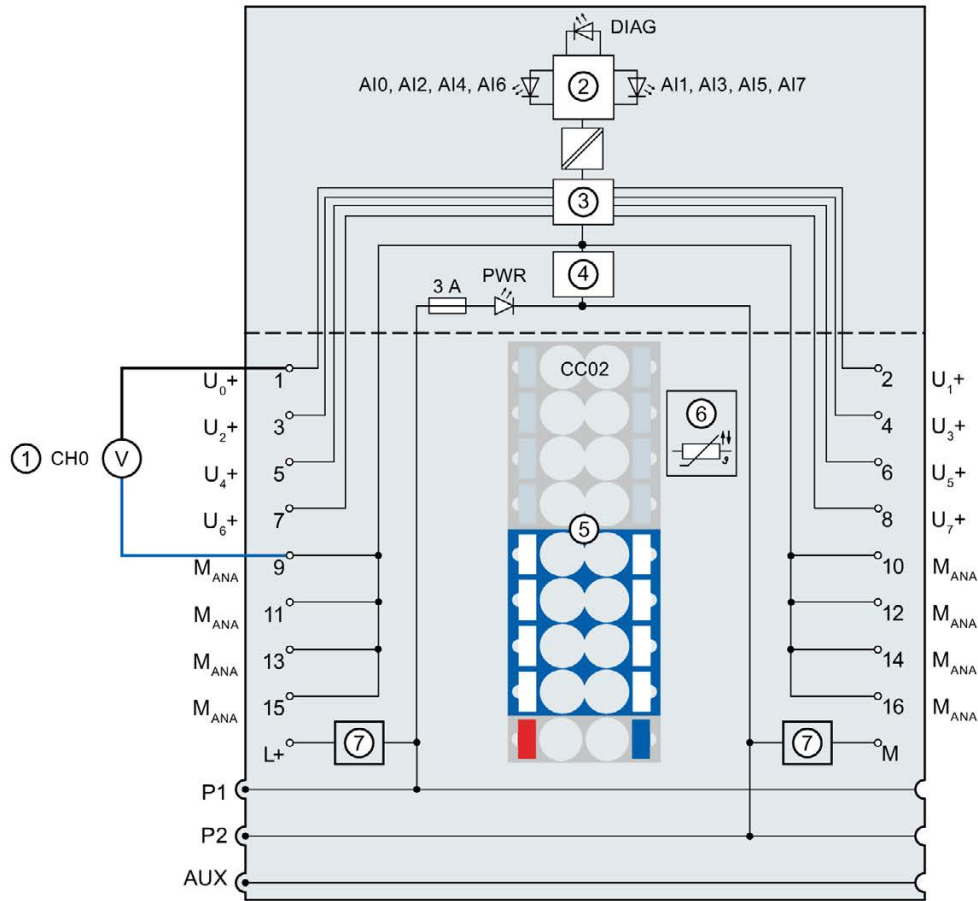
You can find information on wiring the BaseUnit in the ET 200SP distributed I/O system (<http://support.automation.siemens.com/WW/view/en/58649293>) system manual.

Note

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

Connection: Voltage measurement 2-wire connection

The following figure shows the block diagram and an example for the terminal assignment of the analog input module AI 8xU BA 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	M_{ANA}	Ground of the analog inputs
③	Analog-to-digital converter (ADC)	$L+$	24 V DC (infeed only with light-colored BaseUnit)
④	Current limitation	M	Ground
⑤	Color identification label CCxx (optional)	$P1, P2,$ AUX	Internal self-assembling voltage buses Connection to left (dark-colored BaseUnit) Connection to left interrupted (light-colored BaseUnit)
⑥	Temperature recording for BU type A1 only (function cannot be used for this module)	$DIAG$	Diagnostics LED (green, red)
⑦	Filter connection supply voltage (only when light-colored BaseUnit is present)	$AI0$ to $AI7$	Channel status LED (green)
		PWR	Power LED (green)

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

Parameters/address space

4.1 Measuring types and ranges

The analog input module AI 8xU BA has the following measuring ranges:

Table 4- 1 Measuring ranges

Measurement type	Measuring range	Resolution
Voltage	0 to 10 V	15 bits
	± 10 V	16 bits including sign

You will find the tables of the measuring ranges as well as overflow, overrange, etc., in the section Representation of analog values (Page 29).

4.2 Parameters

AI 8xU BA parameters

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

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

When assigning the parameters in the user program, the "WRREC" instruction transfers the parameters to the module using data records, see section Parameter assignment and structure of the parameter data record (Page 25)).

The following parameter settings are possible:

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

Parameter	Range of values	Default	Reconfigura- tion in RUN	Effective range with configura- tion software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics: No supply voltage L+	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Module	Module
Diagnostics: Overflow	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Module	Module ¹
Diagnostics: Underflow	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Module	
Type/range of meas- urement	<ul style="list-style-type: none"> • Deactivated • Voltage +/- 10 V • Voltage 0 to 10 V 	Voltage (+/- 10 V)	Yes	Channel	Channel
Smoothing	<ul style="list-style-type: none"> • None • Weak • Medium • Strong 	None	Yes	Channel	Channel

4.2 Parameters

Parameter	Range of values	Default	Reconfiguration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Interference frequency suppression	<ul style="list-style-type: none"> 60 Hz (50 ms) 50 Hz (60 ms)² 16.6 Hz (180 ms) 4800 Hz (0.625 ms) 60 Hz (18.75 ms)³ 50 Hz (22.5 ms)^{2,3} 16.6 Hz (67.5 ms)³ 	50 Hz (60 ms)	Yes	Channel	Module
Potential group	<ul style="list-style-type: none"> 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 Only when configuring using a PROFIBUS GSD file; does not apply to configuration with STEP 7 via HSP: The parameter assignment options are limited because PROFIBUS GSD configuration limits the number of parameters to a maximum of 244 bytes for each ET 200SP station. If required, you can still assign this parameter 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 8 bytes.
- ² Interference frequency suppression: Noise at 400 Hz is automatically included in the filtering at 50 Hz.
- ³ By selecting this interference frequency suppression with shorter integration time, the attenuation of the interference frequency that can be achieved is reduced (see Technical specifications).

Note**Unused channels**

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

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: 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.

Type/range of measurement

See the section Measurement types and measuring ranges (Page 12).

Smoothing

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

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

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

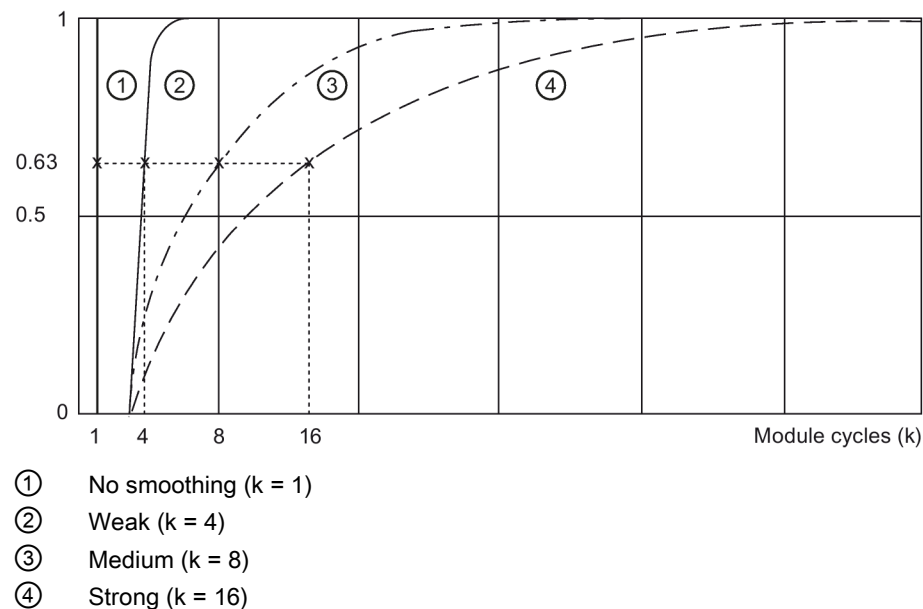


Figure 4-1 Smoothing for AI 8xU BA

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 alternating voltage network may negatively affect the measured value, in particular when measuring in the low voltage range. With this parameter, the user specifies the line frequency that is predominant in the plant.

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.

See also

ET 200SP Distributed I/O System
(<http://support.automation.siemens.com/WW/view/en/58649293>)

4.4 Address space

Address space

The figure below shows the assignment of the address space for AI 8×U BA.

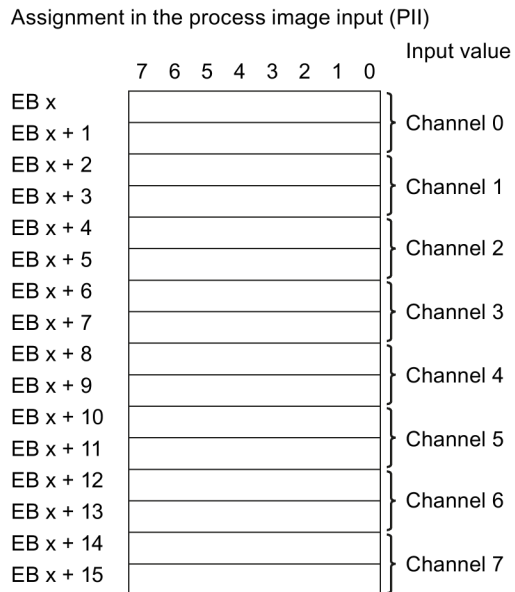


Figure 4-2 Address space of AI 8×U BA

Interrupts/diagnostics alarms

5.1 Status and error displays

LED displays

The figure below shows the LED displays of the AI 8xU BA.

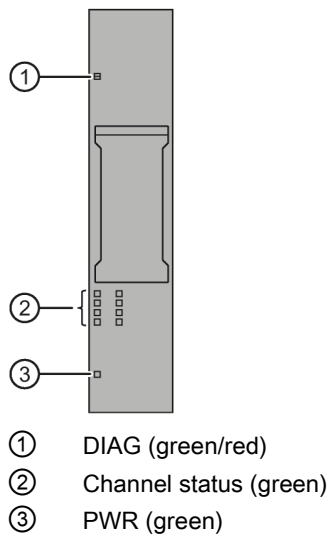






Figure 5-1 LED displays

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 20).



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 deactivated
 On	Channel activated

PWR LED

Table 5- 3 Status display of the PWR LED

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

5.2 Interrupts

The analog input module AI 8xU BA supports diagnostics interrupts.

Diagnostic interrupt

The module generates a diagnostic interrupt at the following events:

- Channel temporarily unavailable
- Low limit violated
- High limit violated
- Error
- Parameter assignment error
- No load voltage

5.3 Diagnostics alarms

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

Table 5- 4 Diagnostics alarms, their meanings and corrective measures

Diagnostics alarm	Error code	Meaning	Solution
High limit violated	7H	Value is above overrange.	Correct interplay between module and encoder
Low limit violated	8H	Value is below underrange.	Correct interplay between module and encoder
Error	9H	Internal module error occurred.	Replace module
Parameter assignment error	10H	<ul style="list-style-type: none"> • The module cannot evaluate parameters for the channel. • Incorrect parameter assignment. 	Correct the parameter assignment
No load voltage	11H	No or insufficient supply voltage L+	<ul style="list-style-type: none"> • Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel temporarily unavailable	1FH	Firmware update in progress or update has been canceled. The module does not read any process values in this state.	<ul style="list-style-type: none"> • Wait for firmware update • Restart the firmware update

Technical specifications

6.1 Technical specifications

Technical specifications of the AI 8xU BA

	6ES7134-6FF00-0AA1
Product type designation	ET 200SP, 8xU Basic
General information	
Firmware version	V1.0
<ul style="list-style-type: none"> FW update possible 	Yes
Usable BaseUnits	BU type A0, A1
Color code for module-specific color identification label	CC02
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	V2.3 / -
Operating mode	
Oversampling	No
MSI	No
CiR Configuration in RUN	
Reconfiguration 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.	25 mA
Power loss	
Power loss, typ.	0.7 W

6ES7134-6FF00-0AA1	
Address area	
Address space per module	
Address space per module, max.	16 bytes
Analog inputs	
Number of analog inputs	8; single-ended
Maximum permitted input voltage for voltage input (destruction limit)	30 V
Cycle time (all channels), min.	1 ms; per channel
Input ranges (rated values), voltages	
0 to +10 V	Yes; 15 bits
Input resistance (0 to 10 V)	100 kΩ
-10 V to +10 V	Yes; 16 bits including sign
Input resistance (-10 V to +10 V)	100 kΩ
Cable length	
Shielded, max.	200 m
Formation of analog values for the inputs	
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	16.67 / 50 / 60 / 4 800 (16.67 / 50 / 60)
Conversion time (per channel)	ms; 180 / 60 / 50 / 0.625 (67.5 / 22.5 / 18.75)
Measured value smoothing	
Number of steps	4; none; 4/8/16 times
Configurable	Yes
Encoders	
Connection of the signal transmitters	
For voltage measurement	Yes
For current measurement as 4-wire transducer	No
Errors/accuracies	
Linearity error (in relation to input range), (+/-)	± 0.01%
Temperature error (in relation to input range), (+/-)	± 0.005%
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; with conversion time 67.5 / 22.5 / 18.75 ms; 40 dB

6ES7134-6FF00-0AA1	
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Interrupts	
Diagnostic interrupt	Yes
Limit interrupt	No
Diagnostics alarms	
Diagnostics	Yes
Monitoring of supply voltage	Yes
Wire break	No
Short-circuit	No
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
Electrical isolation	
Electrical isolation of channels	
Between the channels	No
Between the channels and the backplane bus	Yes
Between the channels and the supply voltage of the electronics	No
Permitted potential difference	
Between different circuits	75 V DC/60 V AC (basic insulation)
Insulation	
Insulation tested with	707 V DC (type test)
Dimensions	
Width	15 mm
Weights	
Weight, approx.	31 g

Dimension drawing

See the manual ET 200SP BaseUnits
(<http://support.automation.siemens.com/WW/view/en/59753521>)

Parameter data record

A.1 Dependencies when configuring with GSD file

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

Configuring with a PROFINET GSD file

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

Measurement type	Measuring range	Diagnostics		
		No supply voltage L+	Overflow	Underflow
Deactivated		*	*	*
Voltage	±10 V	x	x	x
	0 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+	Overflow/underflow
Deactivated		*	*
Voltage	±10 V	x	x
	0 to 10 V	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

The module can be re-configured 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 the parameters set in STEP 7 are valid again after a restart.

STATUS output parameter

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

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

Structure of data record 128

Note

Channel 0 contains the diagnostics for the entire module.

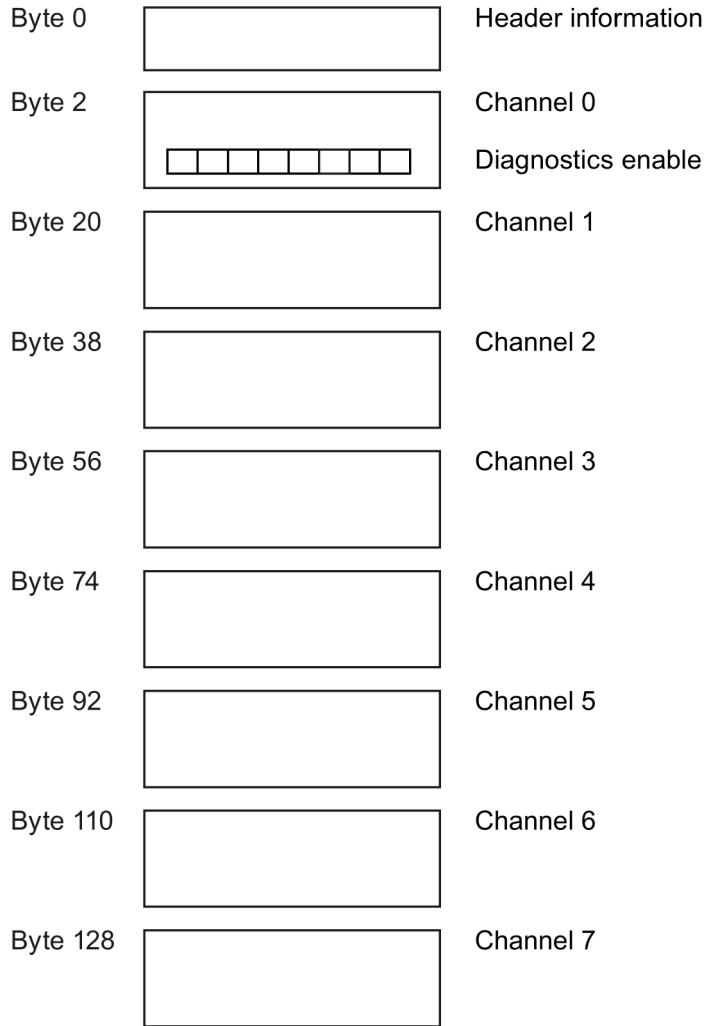


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

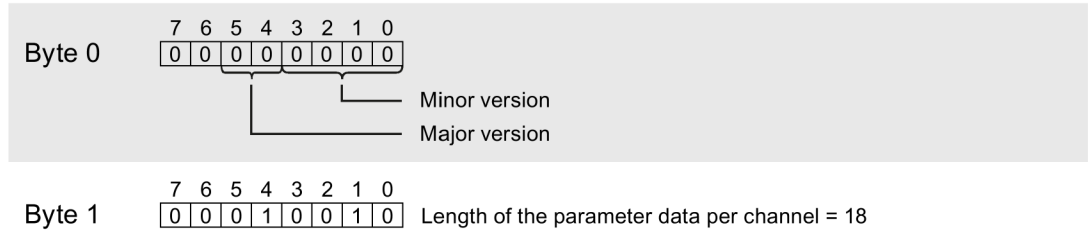
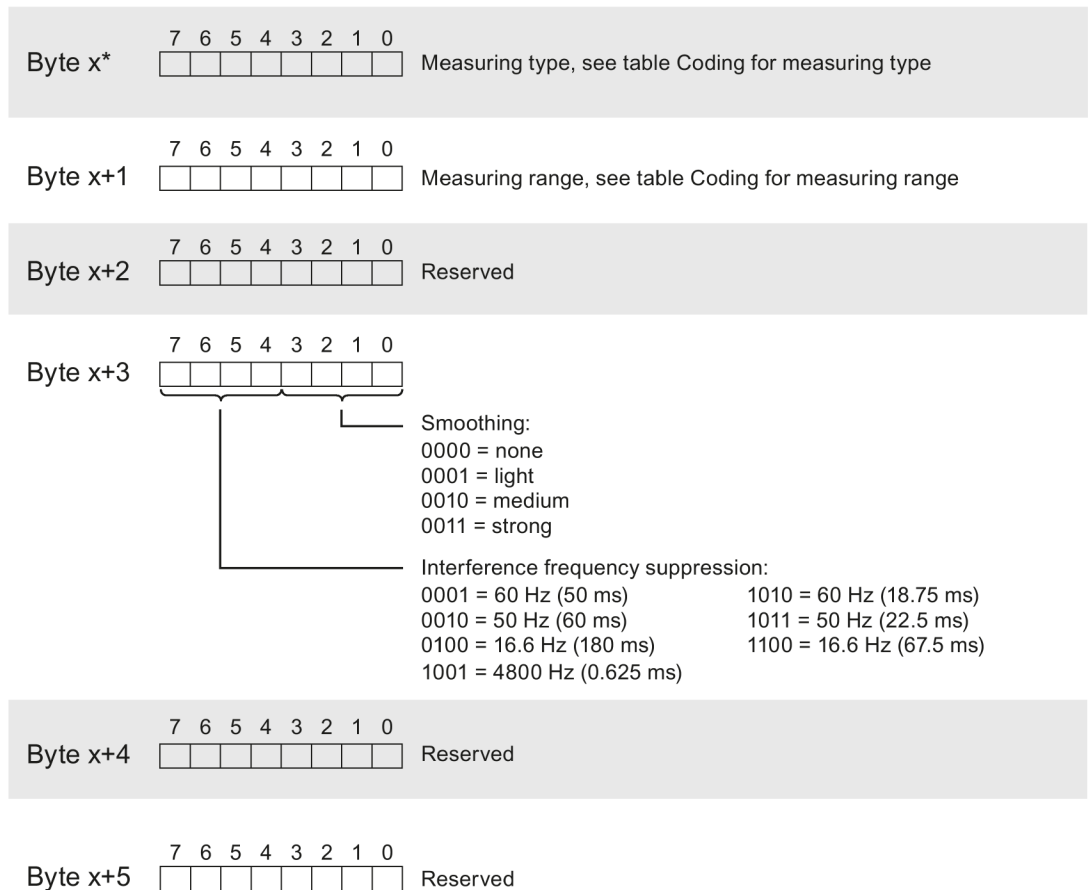


Figure A-2 Header information

Parameters

The figure below shows the structure of the parameters for channels 0 to 7.

Enable a parameter by setting the corresponding bit to "1".



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

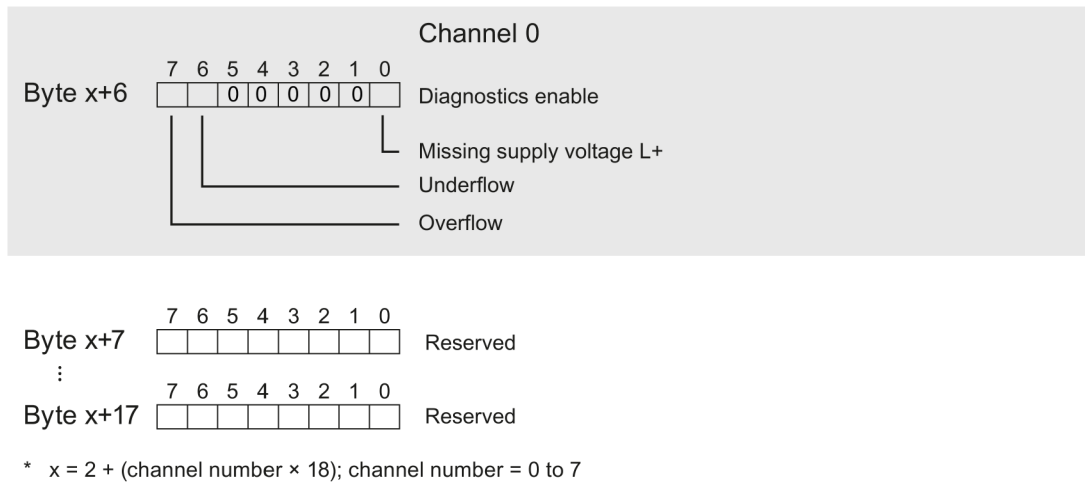


Figure A-3 Structure of byte x to x+17 for channels 0 to 7

Codes for measurement types

The following table contains the codes for the measurement 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

Measuring range	Code
±10 V	0000 1001
0 to 10 V	0000 1011

Representation of analog values

Measured value resolution

The resolution of the analog values differs depending on the analog module and its parameter assignment.

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
16	1	1H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

B.1 Representation of input ranges

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

Table B-2 Bipolar input ranges

Dec. value	Measured value in %	Data word																Range
		2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
32767	>117.589	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	Underrange
-27649	-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Underflow
-32768	<-117.593	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table B-3 Unipolar input ranges

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

B.2 Representation of analog values in voltage measuring ranges

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

Table B- 4 Voltage measuring range ± 10 V

Values		Voltage measuring range	Range
Dec.	Hex.	± 10 V	
32767	7FFF	>11.759 V	Overflow
32511	7EFF	11.759 V	Overrange
27649	6C01		
27648	6C00	10 V	Nominal range
20736	5100	7.5 V	
1	1	361.7 μ V	
0	0	0 V	
-1	FFFF		
-20736	AF00	-7.5 V	
-27648	9400	-10 V	
-27649	93FF		Underrange
-32512	8100	-11.759 V	
-32768	8000	<-11.759 V	Underflow

Table B- 5 Voltage measuring range 0 to 10 V

Values		Voltage measuring range	Range
Dec.	Hex.	0 to 10 V	
32767	7FFF	>11.759 V	Overflow
32511	7EFF	11.759 V	Overrange
27649	6C01		
27648	6C00	10 V	Nominal range
20736	5100	7.5 V	
1	1	0 V + 361.7 μ V	
0	0	0 V	
-1	FFFF		
-4864	ED00	-1.759 V	
-32768	8000	< -1.759 V	