MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

Siemens

PRODUCT MODEL

6ES7134-6HD00-0BA1

Voltage and Current Input Module. Source PDF pages: manual pp. 2-35. Adjacent model text on shared pages is outside this product reference.

OFFICIAL SOURCE

Analog Input Module AI 4xU/I 2-wire ST (6ES7134-6HD00-0BA1); 07/2014, A5E03572832-AC

Source: Siemens 07/2014, A5E03572832-AC. Original manufacturer pages follow this cover.

Siemens July 2014 AC manual from an independent archive, not a latest-edition claim. Original pages 2-35 retain safety and complete module context. Quality information requires product version 1 and firmware V1.1.0.

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SIEMENS

SIMATIC

ET 200SP
Analog Input Module
AI 4xU/I 2-wire ST
(6ES7134-6HD00-0BA1)

Manual

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07/2014

A5E03572832-AC

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⚠WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

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indicates that minor personal injury can result if proper precautions are not taken.

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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 manual.

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

Conventions

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 and on the section of the documentation to which particular attention should be paid.

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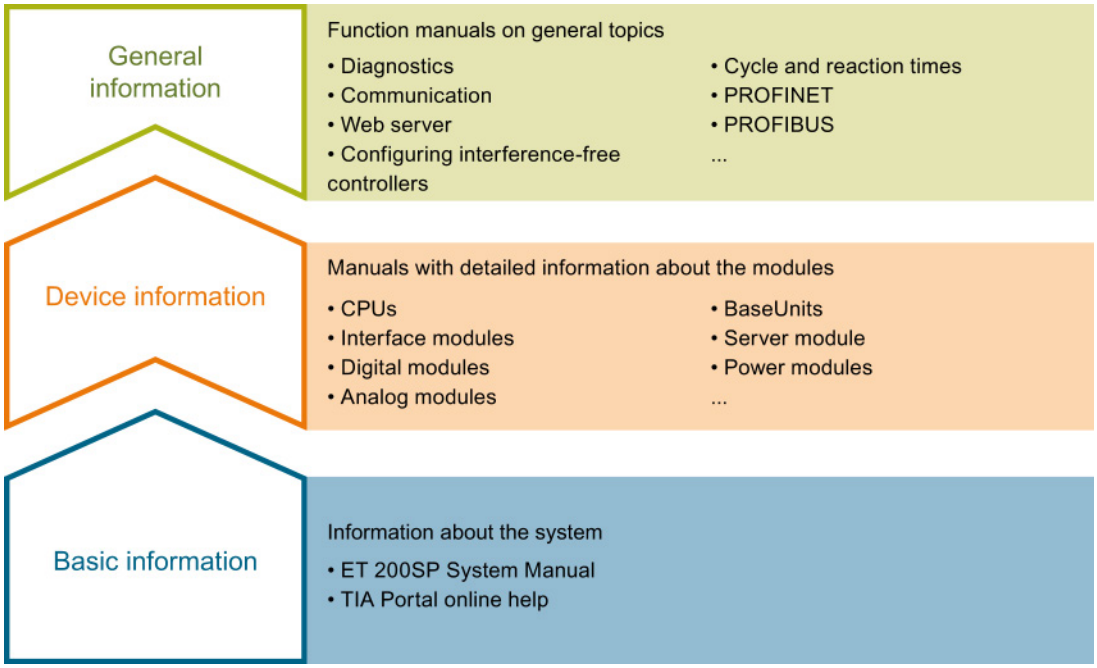
Documentation guide

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

Device information

Manuals contain a compact description of the module-specific information, such as properties, terminal diagrams, characteristics, 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, Motion Control, Web server.

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.automation.siemens.com/WW/view/en/38715968).

Applications & Tools

Applications & Tools supports 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 Applications & Tools on the Internet (http://support.automation.siemens.com/WW/view/en/20208582).

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.automation.siemens.com/WW/view/en/42455541).

Product overview

2

2.1 Properties

Article number

6ES7134-6HD00-0BA1

View of the module

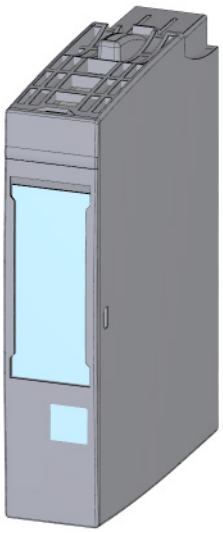


Figure 2-1 View of the module AI 4×U/I 2-wire ST

Properties

The module has the following technical properties:

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

The module supports the following functions:

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

Table 2- 1 Version dependencies of other module functions

Function	Product version of the module as of	Firmware version of the module as of
Value status	1	V1.1.0

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 will 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.

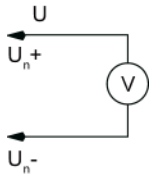
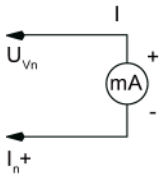
Wiring up

3

3.1 Terminal assignment

General terminal assignment

Table 3- 1 Terminal assignment

Terminal assignment for AI 4×U/I 2-wire ST (6ES7134-6HD00-0BA1)						
Terminal	**Assign-ment**	**Terminal**	**Assign-ment**	**Explanation**	**BaseUnit**[1]	**Color identification label (terminals 1 to 16)**
1	U_0+	**2**	U_1+	Voltage input (terminals 1 to 8) • U_n+: Input signal "+", channel n • U_n-: Input signal "-", channel n	A0 A1	 CC03 6ES7193-6CP03-2MA0
3	U_2+	**4**	U_3+			
5	U_0-	**6**	U_1-			
7	U_2-	**8**	U_3-			
9	U_{V0}	**10**	U_{V1}	Current input (terminals 9 to 16) • U_{Vn}: Supply voltage channel n • I_n+: Current input "+", channel n		
11	U_{V2}	**12**	U_{V3}			
13	I_0+	**14**	I_1+			
15	I_2+	**16**	I_3+			
L+	24 VDC	**M**	M			
Voltage input  				Current input  		

[1] Usable BaseUnit types, can be identified by the last two digits of the article number.

Note

The first BaseUnit of a station must be a light-colored BaseUnit. Also keep this in mind during the configuration.

See also

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

3.2 Schematic circuit diagram

Schematic circuit diagram

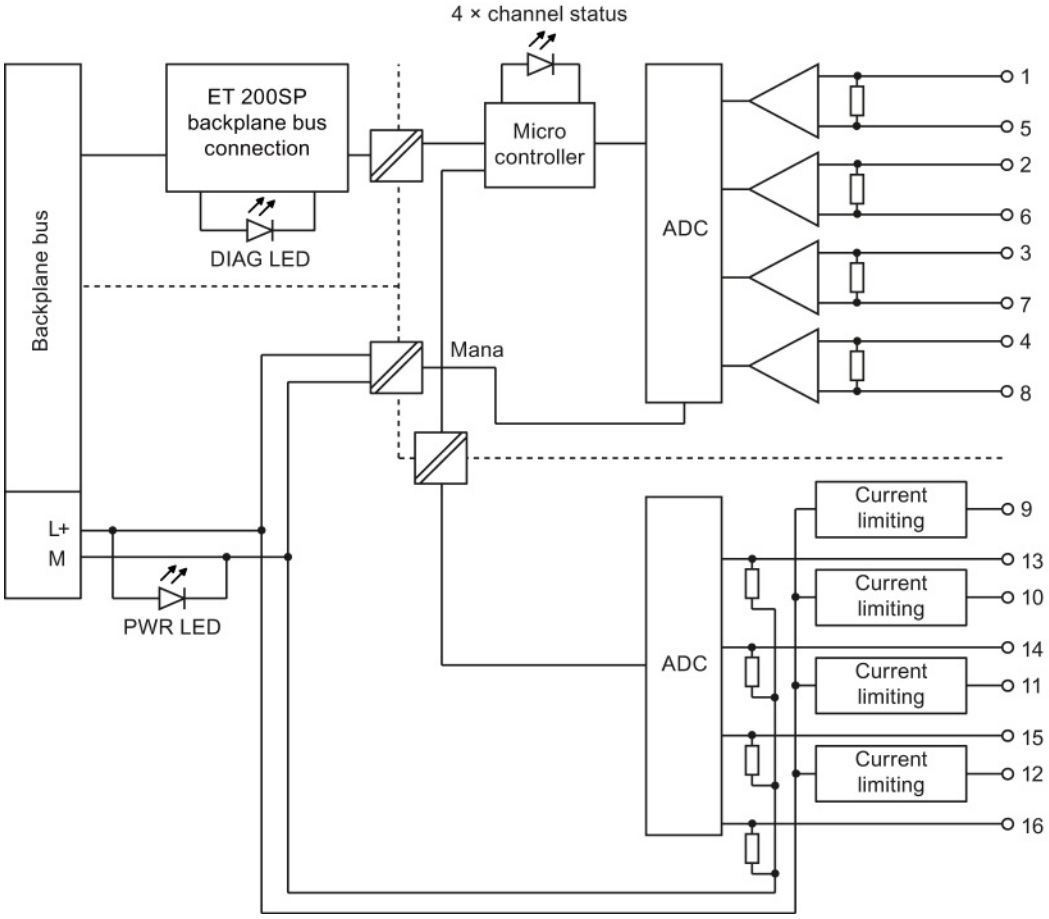


Figure 3-1 Schematic circuit diagram for AI 4×U/I 2-wire ST

Parameters/address space

4

4.1 Measuring types and ranges

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

Table 4- 1 Measuring ranges

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

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

4.2 Parameters

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

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

- Central operation with an S7-1500 CPU
- Distributed operation on PROFINET IO in an ET 200SP system
- Distributed operation on PROFIBUS DP in an ET 200SP system

When assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module using the data records; refer to the section Parameter assignment and structure of the parameter data record (Page 28).

The following parameter settings are possible:

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

Parameter	Value range	Default	Configuration 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	• Disable • Enable	Disable	yes	Module	Module
Diagnostics Underflow	• Disable • Enable	Disable	yes	Module	Module
Diagnostics Wire break	• Disable • Enable	Disable	yes	Module	Module
Measuring type/range	• deactivated • Voltage +/- 5 V • Voltage +/- 10 V • Voltage 1..5 V • Voltage 0..10 V • Current (2-wire transducer) 0..20 mA • Current (2-wire transducer) 4..20 mA	Current (2-wire transducer) 4..20 mA	yes	Channel	Channel

Parameter	Value range	Default	Configur-ation in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Smoothing	• none • weak • medium • strong	none	yes	Channel	Channel
Interference frequency suppression	• 60 Hz • 50 Hz[1] • 16.6 Hz	50 Hz	yes	Channel	Module
Potential group	• Use potential group of the left module • Allow new potential group	Use potential group of the left module	no	Module	Module

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

Note

Unused channels

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

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

4.3 Explanation of the parameters

Diagnostics no supply voltage L+

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

Diagnostics short-circuit to ground

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

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

Diagnostics overflow

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

Diagnostics underflow

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

Diagnostics wire break

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

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

Type/range of measurement

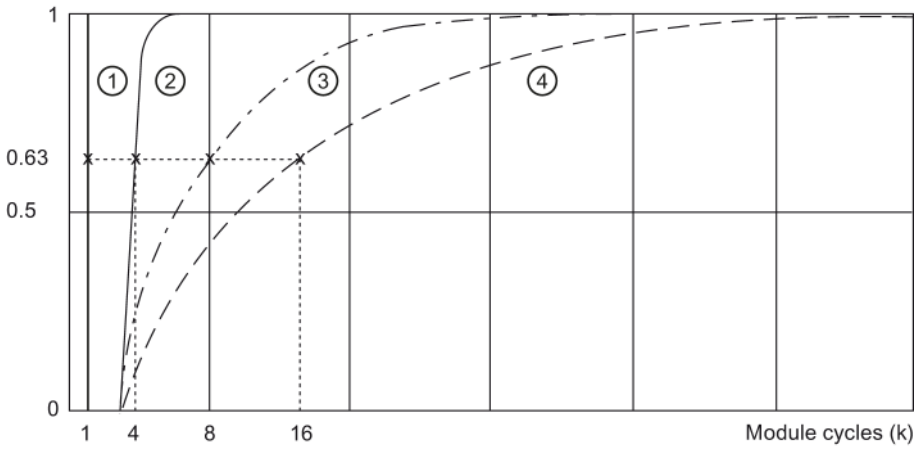
Refer to the section Measuring types and ranges (Page 13).

Smoothing

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

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

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



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

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

Interference frequency suppression

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

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

Potential group

Specifies that a BaseUnit with voltage supply feed-in is located in this slot (see 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 to 3 in this byte are assigned to a channel. They provide information about the validity of the analog value.

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

Bit = 0: Channel is disabled or there is a fault/error on the module.

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

Address space

The following figure shows the assignment of the address space for the AI 4×U/I 2-wire ST with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

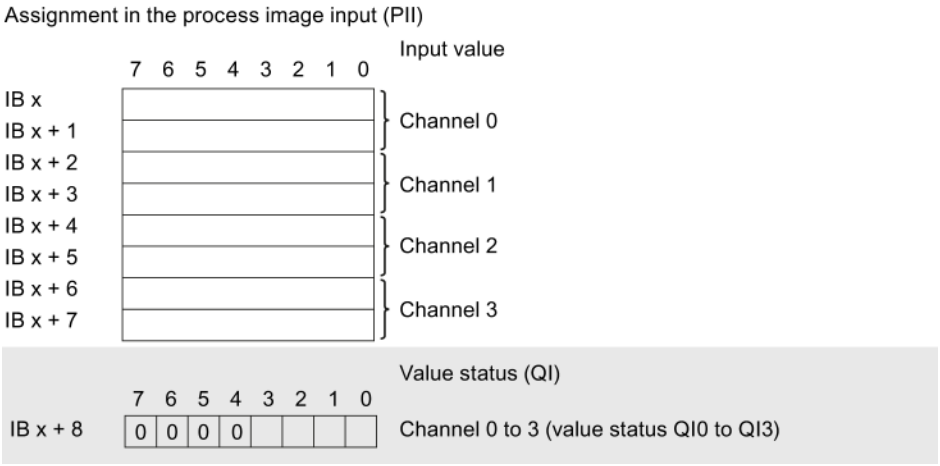


Figure 4-2 Address space of the AI 4×U/I 2-wire ST with value status

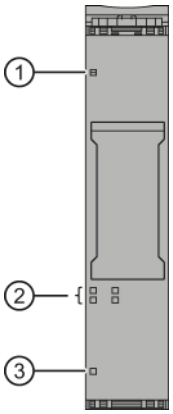
Interrupts/diagnostics alarms

5

5.1 Status and error display

LED display

The figure below shows the LED displays of the AI 4xU/I 2-wire ST.



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

Figure 5-1 LED display

Meaning of the LED displays

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

DIAG LED

Table 5- 1 DIAG LED fault/error display

DIAG LED	Meaning
off	Backplane bus supply of the ET 200SP not OK
Flashes	Module parameters not assigned
on	Module parameters assigned and no module diagnostics
Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 5- 2 Status display of the channel status LED

Channel status LED	Meaning
off	Channel disabled
on	Channel enabled

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 4×U/I 2-wire ST supports diagnostics interrupts.

Diagnostics interrupt

The module generates a diagnostics interrupt for the following events:

- Channel temporarily unavailable
- Short-circuit (current, voltage 1..5 V)
- Wire break (current 4..20 mA)
- 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 on the module flashes. 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 meaning and how to deal with them

Diagnostics alarm	Error code	Meaning	Remedy
Channel temporarily unavailable	$1F_H$	Firmware being updated. The module does not perform any measurements during this time.	–
Short-circuit (current)*	1_H	Sensor supply to ground	Correct the module/encoder tuning
		Input to sensor supply	
Short-circuit (1 to 5 V)	1_H	Short-circuit of input signal	Correct the module/encoder tuning
		Open input	Connect input
Line break (current)	6_H	Impedance of encoder circuit too high.	Use a different encoder type or modify the wiring, for example, using cables with a larger cross-section
		Wire break between the module and sensor	Connect the cable
		Channel not connected (open)	• Disable diagnostics • Connect the sensor contacts
High limit violated	7_H	Value is above the overrange.	Correct the module/encoder tuning
Low limit violated	8_H	Value is below the underrange.	Correct the module/encoder tuning
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
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type

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

Technical specifications

6

6.1 Technical specifications

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

	6ES7134-6HD00-0BA1
Product type designation	AI 4xU/I 2-wire ST
General information	
Firmware version	V1.1
Usable BaseUnits	BU type A0, A1
Color code for module-specific color identification label	CC03
Product function	
I&M data	Yes
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V11 SP2 / V13
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 / -
CiR Configuration in RUN	
Configuration in RUN possible	Yes
Installation type/mounting	
Rack mounting possible	Yes
Front installation possible	Yes
Rail mounting possible	Yes
Wall/direct mounting 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
Input current	
Current consumption, max.	37 mA; without encoder supply

	6ES7134-6HD00-0BA1
Encoder supply	
24 V encoder supply	
24 V	Yes
Short-circuit protection	Yes
Output current, max.	20 mA; max. 50 mA per channel for a duration < 10 s
Power loss	
Power loss, typ.	0.85 W; without encoder supply voltage
Address area	
Address space per module	
Address space per module, max.	8 bytes; + 1 byte for QI information
Analog inputs	
Number of analog inputs	4
Maximum permitted input voltage for voltage input (destruction limit)	30 V
Maximum permitted input current for current input (destruction limit)	50 mA
Cycle time (all channels), min.	Sum of the basic conversion times and additional processing times (depending on the parameter assignment of the enabled channels)
A/D resolution at analog input	16 bits
Analog inputs, configurable	Yes
Configurable input variable	Yes
Input ranges	
Voltage	Yes
Current	Yes
Thermocouple	No
Resistance thermometer	No
Resistance	No
Input ranges (rated values), voltages	
0 to +10 V	Yes; 15 bits
Input resistance (0 to 10 V)	120 kΩ
1 to 5 V	Yes; 15 bits
Input resistance (1 to 5 V)	120 kΩ
-10 V to +10 V	Yes; 16 bits including sign
Input resistance (-10 V to +10 V)	120 kΩ
-5 V to +5 V	Yes; 16 bits including sign
Input resistance (-5 V to +5 V)	120 kΩ
Input ranges (rated values), currents	
0 to 20 mA	Yes; 15 bits
Input resistance (0 to 20 mA)	100 Ω; + approx. 0.7 V diode forward voltage
4 to 20 mA	Yes; 15 bits
Input resistance (4 to 20 mA)	100 Ω; + approx. 0.7 V diode forward voltage
Cable length	
Cable length shielded, max.	1000 m; 200 m for voltage measurement

	6ES7134-6HD00-0BA1
Analog value formation	
Measuring principle	Integrating (sigma-delta)
Integration and conversion time / resolution per channel	
Resolution with overrange (bits including sign), max.	16 bits
Integration time configurable	Yes
Interference suppression for interference frequency f1 in Hz	16.6 / 50 / 60 Hz
Conversion time (per channel)	180 / 60 / 50 ms
Measured value smoothing	
Configurable	Yes
Setting: None	Yes
Setting: Weak	Yes
Setting: Medium	Yes
Setting: Strong	Yes
Encoders	
Connection of the signal transmitters	
for voltage measurement	Yes
for current measurement as 2-wire transducer	Yes
• Load of the 2-wire transducer, max.	650 Ω
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 %
Current in relation to input range, (+/-)	± 0.5 %
Basic error limit (operational limit at 25 °C)	
Voltage in relation to input range, (+/-)	± 0.3 %
Current 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 < nominal value of the input range), min.	70 dB
Common mode voltage, max.	10 V
Common mode interference, min.	90 dB

	6ES7134-6HD00-0BA1
Interrupts/diagnostics/status information	
Interrupts	
Diagnostics interrupt	Yes
Diagnostics alarms	
Monitoring of supply voltage	Yes
Wire break	Yes; for 4 to 20 mA
Short-circuit	Yes; for 1 to 5 V or for 2-wire operation: Short-circuit of the encoder supply to ground or short-circuit of an input to the encoder supply
Group error	Yes
Overflow/underflow	Yes
Diagnostics display LED	
Monitoring of the supply voltage (PWR LED)	Yes; green LED
Channel status display	Yes; green LED
For module diagnostics	Yes; green/red LED
Electrical isolation	
Electrical isolation of channels	
Between the channels	Yes, per channel group between the group of the 2-wire current inputs and the group of the voltage inputs
Between the channels and the backplane bus	Yes
Between the channels and the supply voltage of the electronics	Yes; only for voltage inputs
Permitted potential difference	
Between different circuits	75 VDC / 60 VAC (basic isolation)
Between the inputs (UCM)	10 VDC
Insulation	
Insulation tested with	707 VDC (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 measuring type and measuring range for PROFINET.

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

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

Configuring with a PROFIBUS GSD file

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

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

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

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

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 that the parameters set in STEP 7 will be valid again after a restart.

Output parameter STATUS

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

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

Structure of data record 128

Note

Channel 0 contains the diagnostics for the entire module.

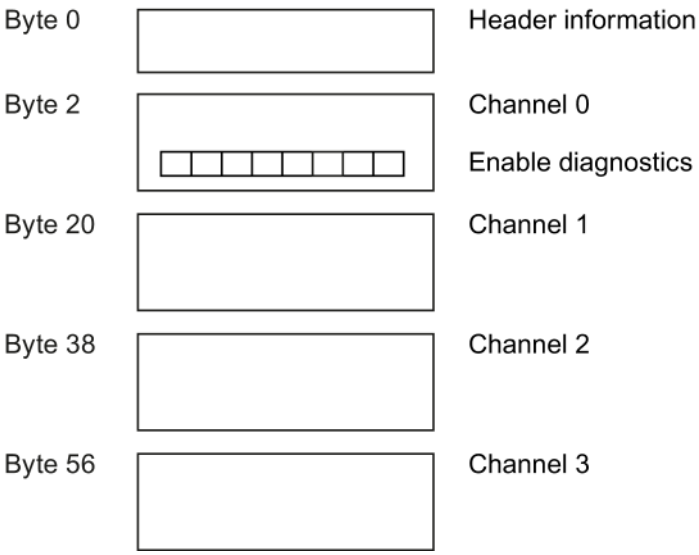


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

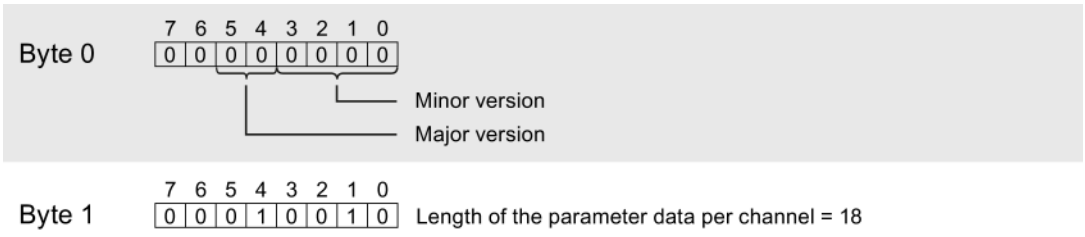


Figure A-2 Header information

Parameters

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

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

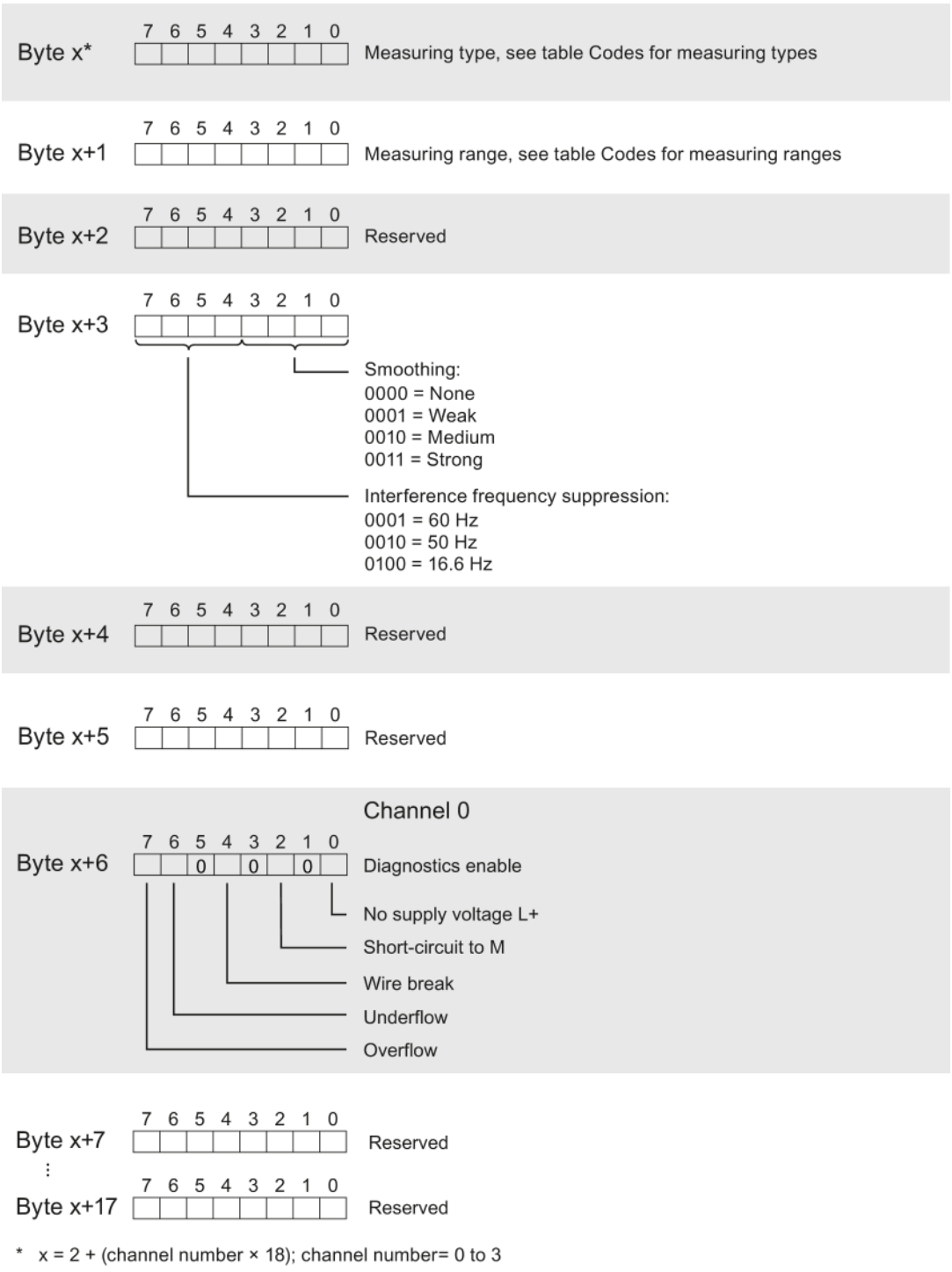


Figure A-3 Structure of byte x to x+17 for channels 0 to 3

Codes for the measuring type

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

Table A- 1 Codes for the measuring type

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

Codes for the measuring range

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

Table A- 2 Codes for the measuring range

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

Representation of analog values

B

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

Measured value resolution

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

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

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

Note

The digitalized temperature values are the result of a conversion in the analog module. The following resolution therefore does not apply to temperature values.

Table B- 1 Resolution of the analog values

Resolution in bits including sign	Values		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
14	4	4_H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
15	2	2_H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
16	1	1_H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

B.1 Representation of input ranges

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

Table B- 2 Bipolar input ranges

Dec. value	Measured value in %	Data word																Range
		2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32767	>117.589	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Underrange
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
-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.2 Representation of analog values in voltage measuring ranges

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

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

Values		Voltage measuring range		Range
Dec.	Hex.	±10 V	±5 V	
32767	7FFF	>11.759 V	>5.879 V	Overflow
32511	7EFF	11.759 V	5.879 V	Overrange
27649	6C01			
27648	6C00	10 V	5 V	Nominal range
20736	5100	7.5 V	3.75 V	
1	1	361.7 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

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

Values		Voltage measuring range		Range
Dec.	Hex.	1 to 5 V	0 to 10 V	
32767	7FFF	>5.704 V	>11.759 V	Overflow
32511	7EFF	5.704 V	11.759 V	Overrange
27649	6C01			
27648	6C00	5 V	10 V	Nominal range
20736	5100	4 V	7.5 V	
1	1	1 V + 144.7 µV	0 V + 361.7 µV	
0	0	1 V	0 V	
-1	FFFF		Negative values are not possible	Underrange
-4864	ED00	0.296 V		
-32768	8000	<0.296 V		Underflow

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

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

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

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

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