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ET 200S distributed I/O 2AI I 4WIRE HS analog electronic module (6ES7134-4GB62-0AB0)

Manual

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Safety Guidelines

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.

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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.

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NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

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Note the following:

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Siemens AG
Automation and Drives
Postfach 48 48
90327 NÜRNBERG
GERMANY

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Preface

Preface

Purpose of the manual

This manual supplements the *ET 200S Distributed I/O System* Operating Instructions. General functions for the ET 200S are described in the *ET 200S Distributed I/O System* Operating Instructions.

The information in this document along with the operating instructions enables you to commission the ET 200S.

Basic knowledge requirements

To understand these operating instructions you should have general knowledge of automation engineering.

Scope of the manual

This manual applies to this ET 200S module. It describes the components that are valid at the time of publication.

Recycling and disposal

Thanks to the fact that it is low in contaminants, this ET 200S module is recyclable. For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Additional support

If you have any questions relating to the products described in these operating instructions, and do not find the answers in this document, please contact your local Siemens representative.

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Properties

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1.1 2AI I 4WIRE HS analog electronic module (6ES7134-4GB62-0AB0)

Properties

- 2 inputs for current measurement per channel
- Current-limited sensor supply (90 mA)
- Input ranges:
  - 4 mA to 20 mA, resolution 15 bits
  - 0 mA to 20 mA, resolution 15 bits
  - ± 20 mA, resolution 15 bits + sign
- Supports isochronous operation
  - Minimum time for the isochronous DP cycle (T_{DPmin}): 250 µs
  - Minimum conversion time of the input modules (T_{WE}): 100 µs
- Firmware update of electronic module is possible.

Note

Inputs must not be connected in series for the current measurement.

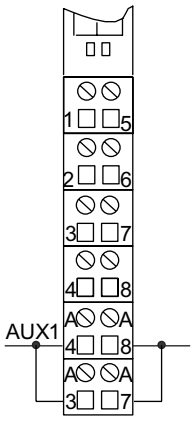
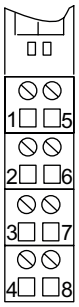
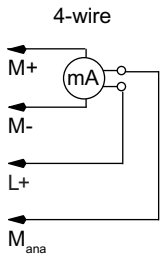
General terminal assignment

Note

Terminals 4, 8, A4, A8, A3 and A7 are only available at specified terminal modules.

Terminal assignment for 2AI I 4WIRE HS (6ES7134-4GB62-0AB0)				
Terminal	**Assignment**	**Terminal**	**Assignment**	**Notes**
1	M_{0+}	**5**	M_{1+}	• M_{n+}: Input signal "+", Channel n • M_{n-}: Input signal "-", Channel n • L+ Power supply for four-wire measuring transducer • M_{ana}: Ground (of power module) • AUX1: Protective-conductor terminal or potential bus (freely usable up to 230 VAC)
2	M_{0-}	**6**	M_{1-}	
3	L+	**7**	L+	
4	M_{ana}	**8**	M_{ana}	
A4	AUX1	**A8**	AUX1	
A3	AUX1	**A7**	AUX1	

Usable terminal modules

Usable terminal modules for 2AI I 4WIRE HS (6ES7134-4GB62-0AB0)		
TM-E15C26-A1 (6ES7193-4CA50-0AA0)	TM-E15C24-01 (6ES7193-4CB30-0AA0)	← Spring terminal
TM-E15S26-A1 (6ES7193-4CA40-0AA0)	TM-E15S24-01 (6ES7193-4CB20-0AA0)	← Screw-type terminal
TM-E15N26-A1 (6ES7193-4CA80-0AA0)	TM-E15N24-01 (6ES7193-4CB70-0AA0)	← Fast Connect
		Sample connection 

Block diagram

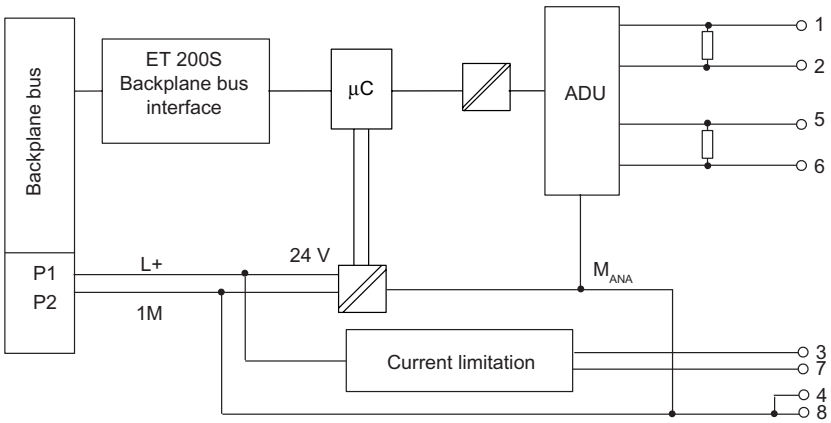


Figure 1-1 Block diagram of the 2AI I 4WIRE HS

Technical specifications for 2AI I 4WIRE HS (6ES7134-4GB62-0AB0)

Dimensions and weight	
Width (mm)	15
Weight	Approx. 40 g
Module-specific data	
Supports isochronous operation	Yes
Supports I&M functions	Yes
Number of inputs	2
Cable length	
• Shielded	Max. 200 m
Parameter length	12 bytes (4 bytes when used as 6ES7134 4FB60 0AB0)
Address space	4 bytes
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Galvanic isolation	
• Between channels and backplane bus	Yes
• Between channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the backplane bus (U_{ISO})	75 V DC, 60 V AC
Insulation test voltage	500 VDC
Current consumption	
• Power supply and load voltage L+ (no load)	Max. 130 mA[1]
Power dissipation of the module	Typically 2 W
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	Can be assigned parameters[2]
Diagnostics function	
• Group error display	Red "SF" LED
• Diagnostic information readable	Possible[3]

Analog value generation		
Measuring principle	SAR (**S**uccessive **A**pproximation **R**egister)	
Cycle time/resolution:		
• Conversion time in µs (per channel)	15	
• Cycle time in ms (per module)	0,25	
• Resolution (including overrange)	4 to 20 mA/15 bit 0 to 20 mA/15 bit ± 20 mA/15 bit + sign	
Suppression of interference, limits of error		
Crosstalk between the inputs	< 50 dB	
Operational limit (in the entire temperature range, with reference to the input range)	± 0,3 %	
Basic error limit (operational limit at 25°C with reference to input range)	± 0,2 %	
Temperature error (with reference to the input range)	±0.01 %/K	
Linearity error (with reference to the input range)	± 0,03 %	
Repeatability (in steady state at 25°C with reference to input range)	± 0,1 %	
Sensor power supply outputs		
Number of outputs	2	
Output voltage • With load	 L+ (-2.5 V)	
Output current • Rated value • Permitted range	 80 mA (per channel) 0 mA to 80 mA	
Short-circuit protection	Yes, electronic	
Data for selecting a sensor		
Input range (rated value)/input resistance		
• Current	4 to 20 mA/106 Ω 0 to 20 mA/106 Ω ± 20 mA/106 Ω	
Connection of the sensors		
• For current measurement as two-wire transmitter	Supported	
Maximum input current for current input (destruction limit)	30 mA	
Smoothing of the measured values	Yes, can be assigned parameters in 4 steps by means of digital filtering	
	Step	**Time constant**
	None	1 x cycle time
	Weak	4 x cycle time
	Medium	16 x cycle time
	Strong	32 x cycle time

[1] Without encoder supply voltage

[2] For interface modules with process interrupt capability only

[3] Parameter assignment error/ violation of low limit/ violation of high limit/ open circuit (only with 4 to 20 mA)/ process interrupt lost

Firmware update

To add functions and for troubleshooting, it is possible to load firmware updates to the operating system memory of the electronic module using STEP 7 HW Config.

Note

When you launch the firmware update, the old firmware is deleted. If the firmware update is interrupted or canceled, the electronic module will no longer be capable of functioning. Restart the firmware update and wait until it has completed successfully.

Note

If the ET 200S is operated in conjunction with an S7-300 CPU with PROFIBUS DP interface or an ET 200S Interface Module IM151-3 PN HIGH SPEED, a station failure of the ET 200S can occur during the firmware update.

I&M functions and firmware update

The interface modules identified in the table below (as of order number) can be used to read and write I&M data from the module and for the firmware update.

Interface module	as of order number
IM151-1 HIGH FEATURE	6ES7151-1BA02-0AB0
IM151-3 PN	6ES7151-3AA22-0AB0
IM151-3 PN HIGH FEATURE	6ES7151-3BA22-0AB0
IM151-3 PN FO	6ES7151-3BB22-0AB0
IM151-7 CPU	6ES7151-7AA20-0AB0

1.2 Compatibility with the predecessor module

Compatible with 4AI 2WIRE HS analog electronic module (6ES7134-4GB61-0AB0 / 6ES7134-4GB60-0AB0)

If you configure the 2AI 4WIRE HS (6ES7134-4GB62-0AB0) as the predecessor module (6ES7134-4GB61-0AB0/ 6ES7134-4GB60-0AB0), it behaves compatibly.

The following technical specifications of the 2AI 4WIRE HS (6ES7134-4GB62-0AB0) are set according to the predecessor module (6ES7134-4GB61-0AB0/ 6ES7134-4GB60-0AB0):

Technical specifications for 2AI 4WIRE HS 6ES7134-4GB62-0AB0		**configured as 6ES7134-4GB61-0AB0/ 6ES7134-4GB60-0AB0**
Analog value generation		
Cycle time in ms (per module)	0.25 ms	1 ms
Resolution (including overrange)	4 to 20 mA/15 bits	4 to 20 mA/13 bits
	0 to 20 mA/15 bits	0 to 20 mA/13 bits
	± 20 mA/15 Bit	± 20 mA/13 Bit
Sensor selection data		
Smoothing of the measured values	**Time constant**	**Time constant**
	1 x cycle time	1 x cycle time
	4 x cycle time	64 x cycle time
	16 x cycle time	128 x cycle time
	32 x cycle time	512 x cycle time

Current consumption and power loss

Note the change in the current consumption and power loss of the 2AI 4WIRE HS (6ES7134-4GB62-0AB0) compared to the predecessor module (6ES7134-4GB61-0AB0/ 6ES7132-4GB60-0AB0).

Parameters

2

2.1 Parameters

Table 2-1 Parameters for analog input module

2AI I 4WIRE HS	Range of values	Default setting	Applicability
Group diagnostics (parameter assignment error, internal error)	• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow	• Disable • Enable	Disable	Module
Diagnostics: Wire break*	• Disable • Enable	Disable	Channel
Smoothing	• None • Weak • Medium • Strong	None	Channel
Hardware interrupt enable	• Disable • Enable	Disable	Module
Type/range of measurement	• Deactivated • 4 to 20 mA • 0 mA to 20 mA • ± 20 mA	4 to 20 mA	Channel
High limit	• low to high limit of the overrange	Depending on the measuring range	Channel
Low limit	• Low to high limit of the nominal range	Depending on the measuring range	Channel
* in the measuring range 4 to 20 mA only			

Note

If you deactivate a channel of the electronic module, you do not gain any advantages in terms of speed due to the measuring procedure.

2.2 Parameter description

Smoothing

The individual measured values are smoothed by digital filtering. The smoothing can be adjusted in four steps, in which the smoothing factor k multiplied by the cycle time of the electronic module equals the time constant of the smoothing filter. The higher the smoothing, the greater the time constant of the filter.

The following diagrams show the step response with the various smoothing factors depending on the number of module cycles.

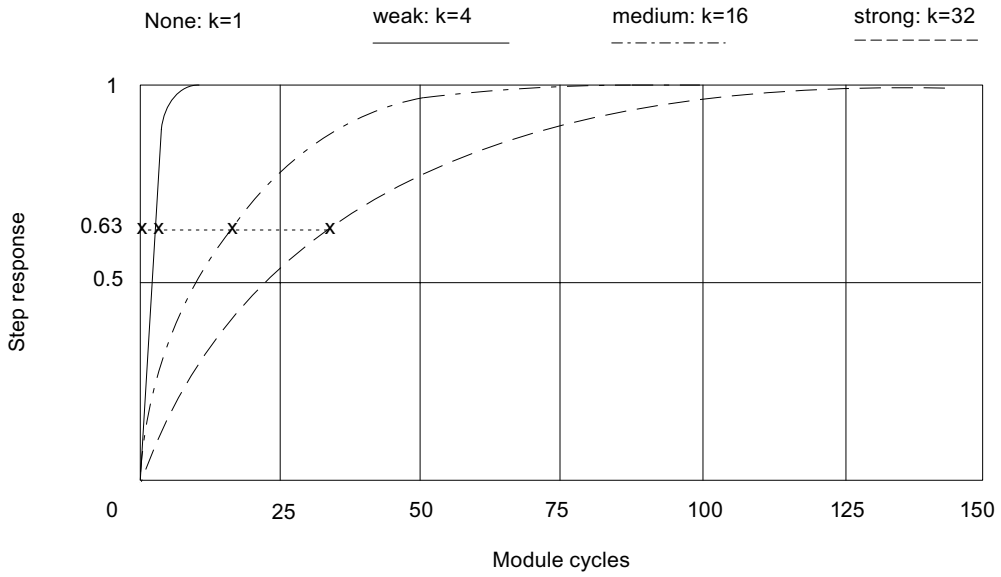


Figure 2-1 Smoothing for 2AI I 4WIRE HS (as of 6ES7134-4GB62-0AB0)

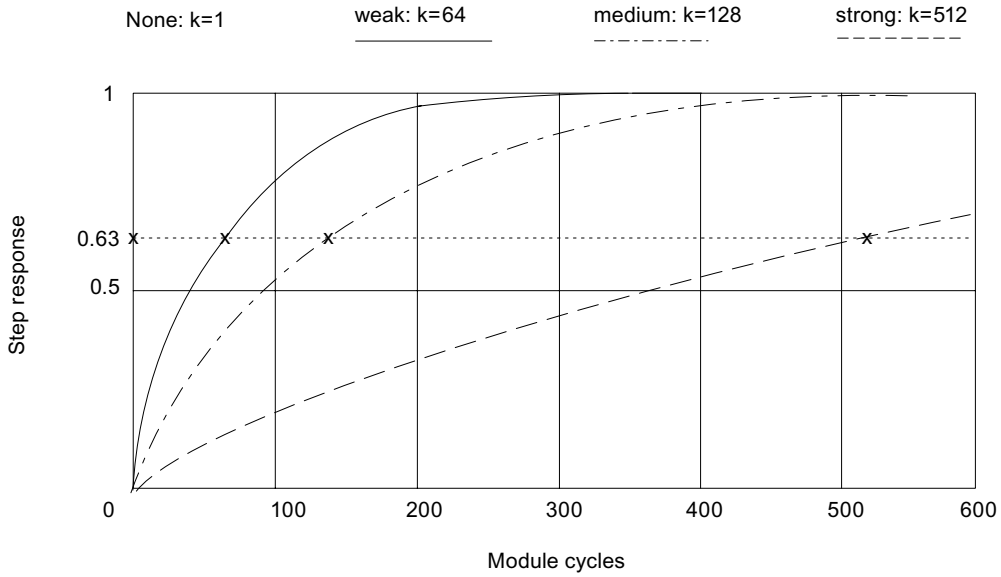


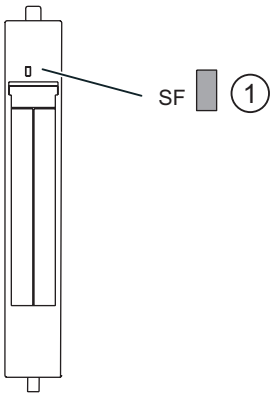
Figure 2-2 Smoothing for 2AI I 4WIRE HS (6ES7134-4GB61-0AB0/ 6ES7134-4GB60-0AB0)

Diagnostics

3

3.1 Diagnostics using LED display

LED display



① Batch error (red)

Status and error displays

Event (LED)	Cause	Remedy
SF		
On	No configuration or incorrect module plugged in. No load voltage.present There is a diagnostic message.	Check the parameter assignment. Check the load voltage. Evaluate the diagnostics.

3.2 Error types

Analog input module error types

Table 3-1 Error types

Error type		Meaning	Remedy
31_D	11111: Channel temporarily unavailable	The firmware is being updated. Channel 0 applies to the entire module. The module does not perform any measurements during this time.	--
22_D	10110: Hardware interrupt lost	A hardware interrupt was not detected.	Correction or coordination of the program, process, module
16_D	10000: Parameter assignment error	Module cannot use the parameter for the channel: Inserted module does not match the configuration. Faulty parameter assignment.	Correct the configuration (align actual and set configuration). Correct the parameter assignment (diagnostics wire break only for the allowed measuring range parameterized).
9_D	01001: Errors	Internal module error (diagnostics message at channel 0 applies to the entire module)	Replace the module.
8_D	01000: Lower value limit fallen below	Value is below the underrange.	Correct the module/actuator tuning.
7_D	00111: Violation of higher limit	Value is above the overrange.	Correct the module/actuator tuning.
6_D	00110: Open circuit	Line to the encoder interrupted.	Correct the process wiring.

3.3 Interrupts

Hardware interrupt of analog input modules

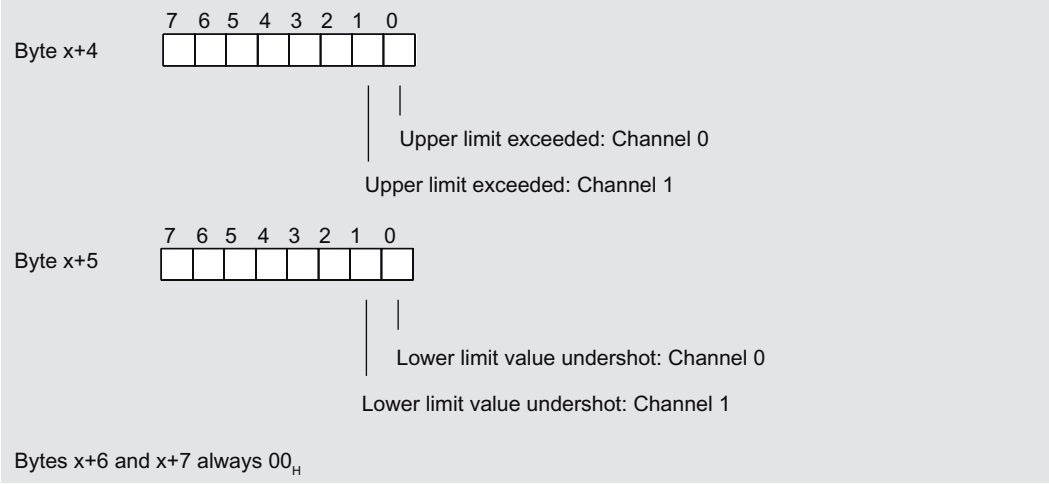


Figure 3-1 Structure as of Byte x+4 and Byte x+5 for hardware interrupt (analog input)

Analog value representation

4

4.1 Introduction

Electronic modules with analog outputs

With the electronic module with analog inputs, continuously variable signals, such as those occurring in temperature measurement and resistance measurement, can be acquired, evaluated, and converted to digital values for further processing.

4.2 Analog value representation for measuring range with SIMATIC S7

Analog value representation

With the same nominal range, the digitized analog value is the same for input and output values. Analog values are represented in two's complement.

The following table shows the analog value representation for the analog electronic modules.

Table 4-1 Analog value representation (SIMATIC S7 format)

Resolution	Analog value															
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance of the bits	S	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}

Sign

The sign (S) of the analog value is always in bit number 15:

- "0" → +
- "1" → –

Analog values

The following table shows the representation of the binary analog values and the corresponding decimal and hexadecimal representation of the units of the analog values.

The table below shows the 11, 12, 13, 14, and 15 bit resolutions + sign. Each analog value is entered left aligned in the ACCU. The bits marked with "x" are set to "0".

Table 4-2 Analog values (SIMATIC S7 format)

Resolution in bits	Units		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
11+S	16	10_H	S 0 0 0 0 0 0 0	0 0 0 1 x x x x
12+S	8	8_H	S 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13+S	4	4_H	S 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
14+S	2	4_H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
15 + sign	1	1_H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

4.3 Measuring ranges

Introduction

The following tables contain the digitized analog values for the measuring ranges of the analog input modules.

Since the binary representation of the analog values is always the same, these tables only compare the measuring ranges with the units.

Measuring ranges for current: 0 to 20 mA, 4 to 20 mA

Table 4-3 SIMATIC S7 format: Measuring ranges 0 to 20 mA, 4 to 20 mA

Measuring range 0 to 20 mA	Measuring range 4 to 20 mA	Units		Range
		Decimal	Hexadecimal	
> 23,5178	> 22,8142	32767	$7FFF_H$	Overflow
23,5178 : 20,0007	22,8142 : 20,0005	32511 : 27649	$7EFF_H$: $6C01_H$	Overshoot range
20,0000 15,0000 : 0,0000	20,0000 16,0000 : 4,0000	27648 20736 : 0	$6C00_H$ 5100_H : 0_H	Nominal range
Negative values are not supported	3,9995 . 1,1852	-1 : -4864	$FFFF_H$: $ED00_H$	Underrange
	< 1,1852	-32768	8000_H	Underflow

Current measuring range: ±20 mA

Table 4-4 SIMATIC S7 format: Measuring range ±20 mA

Measuring range ±20 mA	Units		Range
	Decimal	Hexadecimal	
> 23,5150	32767	$7FFF_H$	Overflow
23,5150 : 20,0007	32511 : 27649	$7EFF_H$: $6C01_H$	Overshoot range
20,0000 14,9980 : -14,9980 -20,0000	27648 20736 : -20736 -27648	$6C00_H$ 5100_H : $AF00_H$ 9400_H	Nominal range
-20,0007 : -23,5160	-27649 : -32512	$93FF_H$: 8100_H	Underrange
< -23,5160	-32768	8000_H	Underflow

Measured values in the event of a wire break in relation to enabled diagnostics

The following additional information applies to the current measuring range 4 to 20 mA:

Table 4-5 Measured values in the event of a wire break in relation to enabled diagnostics

Format	Parameter assignment[1]	Measured values		Description
		Decimal	Hexadecimal	
S7	• "Wire break" diagnostics enabled	32767	$7FFF_H$	• "Open circuit" diagnostic message
	• "Wire break" diagnostics disabled • "Overflow/underflow" diagnostics enabled	-32767	8000_H	• Measured value after leaving the underrange • "Lower limit value undershot" diagnostic message
	• "Wire break" diagnostics disabled • "Overflow/underflow" diagnostics disabled	-32767	8000_H	• Measured value after leaving the underrange
[1] Measuring range limits for wire break and underflow detection: At 1.185 mA				

4.4 Effect on analog value representation

4.4.1 Effect of the supply voltage and the operating state on analog input values

The input values of the analog modules are dependent on the supply voltage for electronics/encoders and on the operating state of the PLC (CPU of the DP master). This is illustrated by the table below.

Table 4-6 Relationship between the analog input values for the operating state of the PLC (CPU of the master) and the supply voltage L+

Operating state of the PLC (CPU of the DP master)		Supply voltage L+ on ET 200S (power module)	Input value of the electronic module with analog inputs (evaluation possible on the CPU of the DP master)
POWER ON	RUN	L+ present	Process values
			$7FFF_H$ until first conversion after startup, or after assignment of parameters for the module is completed.
		L+ missing	$7FFF_H$
POWER ON	STOP	L+ present	Process value
		L+ missing	$7FFF_H$
POWER OFF	-	L+ present	-
		L+ missing	-

4.4.2 Effect of the value range on the 2 AI I 4WIRE HS analog input

The way electronic modules respond to analog inputs depends on where the input values fall within the value range. This is illustrated by the table below.

Table 4-7 Response of the analog modules, depending on where the analog input value falls within the range of values

Measured value within ...	Input value in SIMATIC S7 format	Input value in SIMATIC S5 format
Nominal range	Measured value	Measured value
Over-/underrange	Measured value	Measured value
Overflow	$7FFF_H$	End of the overshoot range +1 plus overflow bit
Underflow	8000_H	End of the underrange -1 plus overflow bit
Before setting parameters or with faulty parameters[1]	$7FFF_H$	$7FFF_H$

Connecting

5

5.1 Connecting measuring sensors

Introduction

You can connect current transmitters to the 2AI 4WIRE HS analog input modules to act as:

- Connecting 4-wire transducers.

In this chapter you will find out how to connect the measuring encoders and what to watch out for when doing so.

Cables for analog signals

You should use shielded and twisted-pair cables for the analog signals. This reduces the effect of interference. You should ground the shield of the analog cables at both ends. If there are differences in potential between the cable ends, an equipotential bonding current that may interfere with the analog signals will flow across the shield. If this is the case, you should only ground the shield at one end of the cable.

Analog input modules

The analog input modules are galvanically isolated:

- Between the logic and backplane bus
- No isolation: Link between M_{ANA} and central grounding point

Note

Ensure that this difference in potential U_{ISO} does not exceed the permitted value. If there is a possibility of exceeding the permitted value, establish a connection between terminal M_{ANA} and the central grounding point.

Connecting measuring encoders to analog inputs

There can be only a limited potential difference U_{CM} (common mode) between the measuring lines M- of the input channels and the reference point of the measuring circuit M_{ANA}. To ensure that the permitted value is not exceeded, you must take different steps depending on the whether the encoders are isolated or non-isolated. The steps you have to take are described in this chapter.

Abbreviations used

The meanings of the abbreviations in the figures below are as follows:

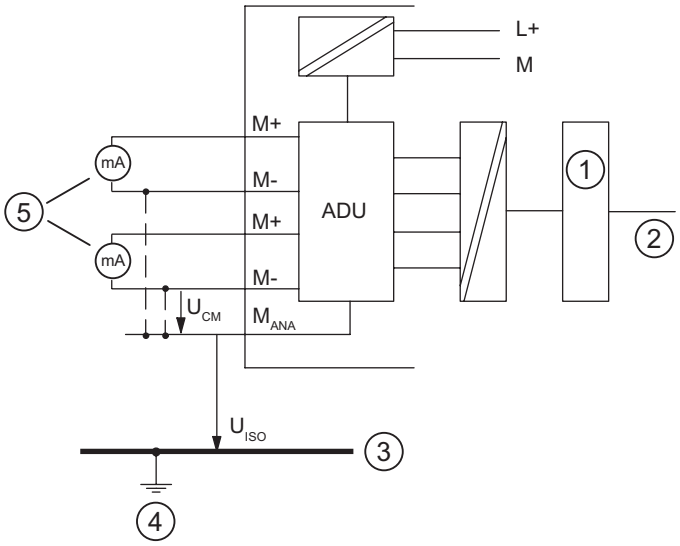
M +	Measuring line (positive)
M-	Measuring line (negative)
M_{ANA}	Analog measuring circuit reference potential
M	Ground connection
L+	Rated load voltage 24 V DC
U_{CM}	Potential difference between inputs
U_{ISO}	Potential difference between M- and central grounding point

Isolated measuring sensors

The isolated measuring sensors are not connected to the local ground potential. These can be potential-free. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the measuring lines M- of the input channels and the reference point of the measuring circuit M_{ANA}.

In environments with a high level of EMC interference, it is advisable to connect M- to M_{ANA} in order to prevent the permissible U_{CM} value from being exceeded.

The following schematic representation illustrates the connection of isolated measuring sensors to the analog input modules.



① Logic
② Backplane bus
③ Ground bus
④ Central grounding point
⑤ Isolated measuring sensors

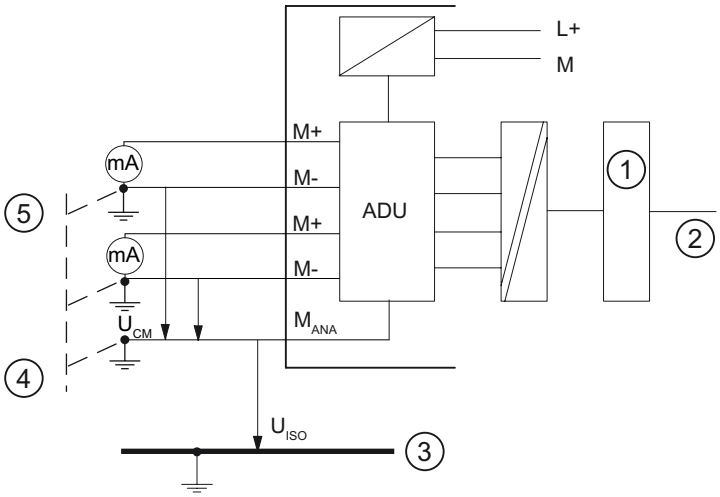
Non-isolated measuring sensors

The non-isolated measuring sensors are connected to the local ground potential. You must connect M_{ANA} to the ground potential. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the locally distributed measuring points.

If the permitted value for U_{CM} is exceeded, there must be equipotential bonding conductors between the measuring points.

The following schematic representation illustrates the connection of non-isolated measuring sensors to an optically isolated analog input module.

Connection of non-isolated measuring sensors to an optically isolated analog input module:



① Logic
② Backplane bus
③ Ground bus
④ Equipotential bonding conductor
⑤ Non-isolated measuring sensors

Operating four-wire transducers on an external voltage supply

If there is galvanic isolation between the output and the supply of the measuring transducer, you can connect it to the 2AI I 4WIRE without additional connections.

If there is no galvanic isolation between the output and the transmitter supply, you can only connect the transmitter to the 2 AI I 4WIRE if the reference potential of the supply voltages (24 V DC) is the same.

If there is an increase in interference radiation, a connection between M- and M_{ANA} on the terminal module of the 2 AI I 4WIRE is recommended.

Sensor selection

Note the following factors when selecting the sensors:

- Length, impedance, and capacitance of the cable
- Reaction speed of the utilized sensors

5.2 Wiring unused channels of the analog input modules

Rules

Pay attention to the following instructions when wiring unused channels:

- "Deactivate" unused input channels when assigning parameters.
- A deactivated channel always returns the value $7FFF_H$.
- The cycle time remains unchanged at 250 µs.

5.3 Using the shield connection

Rules

To prevent interference we recommend the following for analog electronic modules:

- Use shielded wires to the sensors and actuators.
- Lay out the wire shields on the shield connection.
- Connect the shield connection to the ground bus with low impedance.

Note

The permitted limit values can be exceeded (up to <10%) at the measuring inputs of the electronic module in the event of cable-related HF radiation up to 100 kHz. This is made necessary by the specified measuring procedure.

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