MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

Siemens

PRODUCT MODEL

6ES7336-1HE00-0AB0

Fail-Safe Analog Input Module. Relevant section pages: 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 215, 216, 217, 223, 224, 225, 232, 233, 234, 235, 236, 237, 238. Adjacent model text on shared pages is outside this product reference.

OFFICIAL SOURCE

Fail-safe signal modules; 07/2013, A5E00085586-11

Siemens original documentation and product reference

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Amikon Limited prepared this independent reference package. Selected manufacturer pages follow with their original content and pagination visible.

SIEMENS

SIMATIC

Automation System S7-300 ET 200M Distributed I/O Device Fail-safe signal modules

Installation and Operating Manual

Translation of original operating instructions

Preface

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07/2013

A5E00085586-11

Legal information

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A5E00085586-11
℗ 09/2013 Technical data subject to change

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Preface

[ID: 431798411]

Purpose of this manual

This reference manual provides a pool of information about the control functions, the functionality and technical specifications of the fail-safe signal modules of a S7-300 system.

Basic knowledge required

Working with this manual requires general knowledge of automation engineering. It is also assumed that you have sufficient knowledge of the *STEP 7* Basic Software, of the S7-300 automation system, and of the ET 200M distributed I/O device.

Scope of this manual

Module	Order number	as of product version
Safety protector	6ES7195-7KF00-0XA0	03
Bus module for safety protector	6ES7195-7HG00-0XA0	01
SM 326; DI 24 x DC 24 V	6ES7326-1BK02-0AB0	01
SM 326; DI 8 x NAMUR	6ES7326-1RF00-0AB0	05
SM 326; DO 8 x DC 24V/2A PM	6ES7326-2BF41-0AB0	01
SM 326; DO 10 x DC 24V/2A	6ES7326-2BF01-0AB0	01
SM 326; F-DO 10 x DC 24V/2A PP	6ES7326-2BF10-0AB0	01
SM 336; AI 6 x 13Bit	6ES7336-1HE00-0AB0	04
SM 336; F-AI 6 x 0/4 ... 20 mA HART	6ES7336-4GE00-0AB0	01

What's new compared to the previous version

This manual was updated and supplemented with the description of:

- Support of PROFINET IO
- the new functions of the SM 326; F-DO 10 x DC 24V/2A PP
- the new functions of the SM 326; DI 24 x DC 24 V
- the new functions of the SM 326; DO 8 x DC 24 V/2A PM
- SIL3/Cat.4/PLe can be achieved without safety protector (see section "Safety protector (Page 321)")

9.2.2 Properties, front view, wiring diagram and block diagram [ID: 431719051]

Order number

6ES7336-1HE00-0AB0

Properties

SM 336; AI 6 x 13Bit has the following properties:

- 6 analog inputs with electrical isolation between channels and the backplane bus
- Input ranges:

  0 to 20 mA or 4 to 20 mA, 0 to 10 V in standard mode

  4 to 20 mA in safety mode
- Short circuit-proof power supply of 2- or 4-wire transducers by the module
- External sensor supply possible
- Group fault display (SF)
- Safety mode display (SAFE)
- Sensor supply display (Vs)
- Programmable diagnostics functions
- Programmable diagnostic interrupt
- Supports operation in standard and safety mode

Use of inputs

You can use the inputs as follows:

- In standard mode
  - All 6 channels for current measurement 0 to 20 mA or 4 to 20 mA, or
  - Up to 4 channels for voltage measurement 0 to 10 V and the remaining 2 channels for current measurement.
  - Other combinations of current and voltage measurements; make allowances for voltage measurement restrictions defined earlier.
- In safety mode
  - All 6 channels for current measurements 4 to 20 mA.

Address assignment

The following figure shows the assignment of channels to addresses.

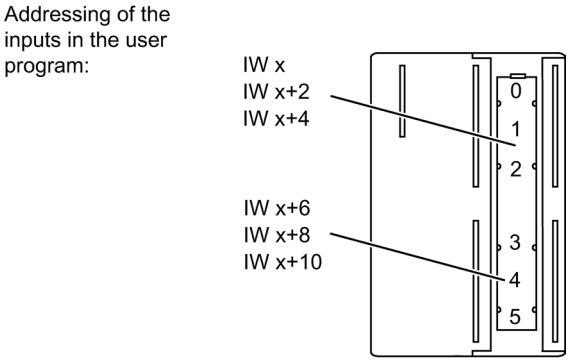


Figure 9-1 Address assignment for SM 336; AI 6 x 13Bit

Front view

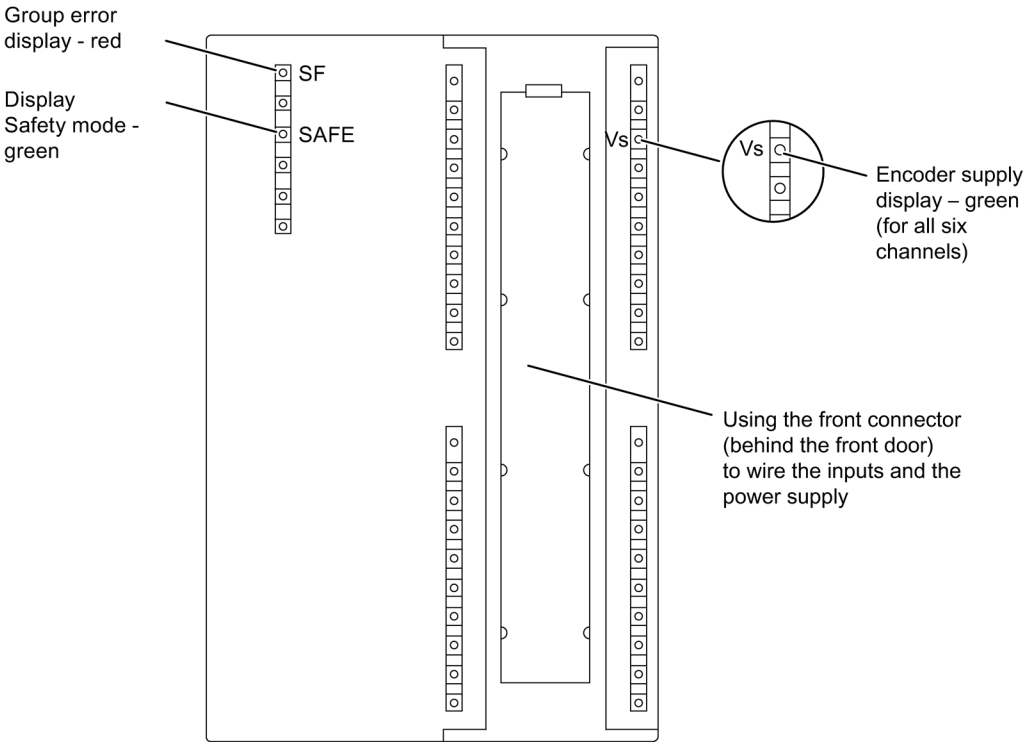


Figure 9-2 Front view of SM 336; AI 6 x 13Bit

Wiring and block diagram

The following figure shows the the wiring and block diagram of SM 336; AI 6 x 13Bit. The internal circuitry of the connections on the left side of the figure correspond to the circuitry of the connections on the right. The wiring and block diagrams of analog sensors for the different applications are shown in the next chapters.

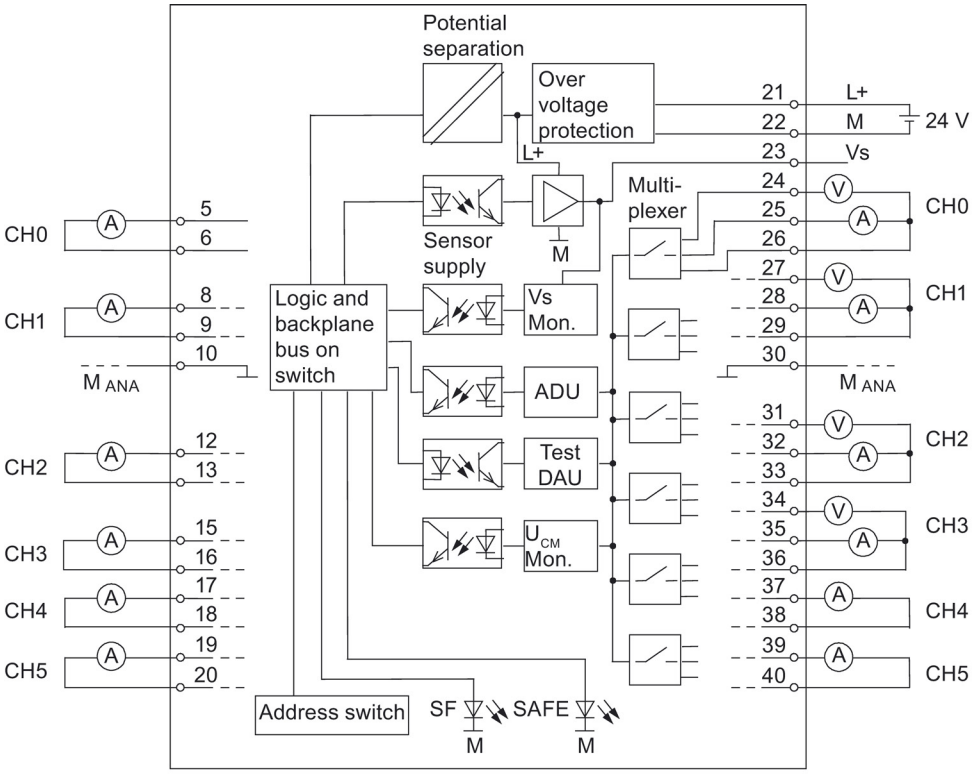


Figure 9-3 Wiring and block diagram of SM 336; AI 6 x 13Bit and internal sensor supply

Channel numbers

The channel numbers are used to uniquely identify the inputs and to assign channel-specific diagnostic messages.

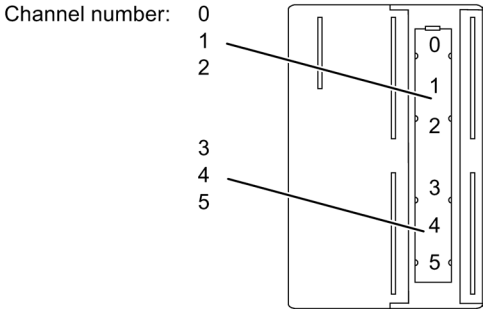


Figure 9-4 Channel numbers for SM 336; AI 6 x 13Bit

Sensor supply

WARNING

Voltage dips of the power supply are not buffered by the module and, thus, affect the sensor supply.

This can cause the measured value to be false.

You can avoid voltage dips by using a voltage supply according to the NAMUR recommendation (see Chapter " Safe Functional Extra-Low Voltage for Fail-Safe Signal Modules (Page 46) "). Alternatively, use a transducer with an appropriate battery backup or diagnostics.

External sensor supply

The figures below shows how you can supply power to the sensors by means of an external sensor supply (for example, from another module: 1L+).

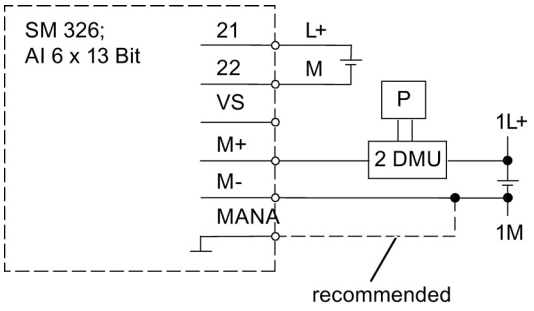


Figure 9-5 External encoder supply, 2-wire transducer for SM 336; AI 6 x 13Bit

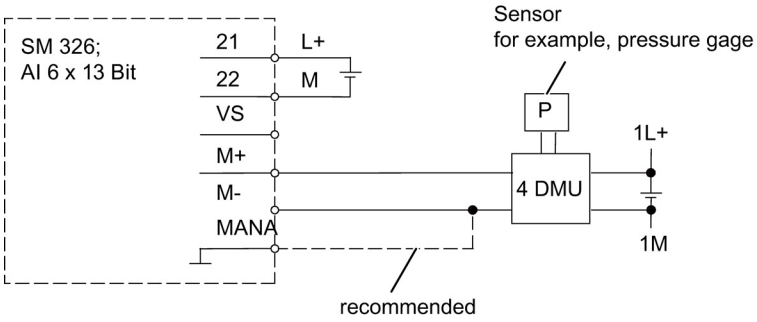


Figure 9-6 External encoder supply, 4-wire transducer for SM 336; AI 6 x 13Bit

⚠WARNING

The **stability** of the external sensor supply must conform to the desired safety requirement class SIL 2, 3. To ensure that the sensor functions problem-free, we recommend one of the following options:

- Use of a **redundant** external sensor supply

  or
- **Monitoring** of the external sensor supply for undervoltage/overvoltage, including shutdown of the sensor supply when a fault is detected (single-channel for SIL 2; two-channel for SIL 3)

Recommendation: Internal sensor supply

You are strongly advised to use the short circuit-proof internal sensor supply of the module. This internal sensor supply is monitored and its status is indicated at the Vs LED (see Figure *Front view of SM 336; AI 6 x 13 Bit*).

Isolated transducers

The isolated transducers are not bonded to local earth potential. These transducers can be operated with floating potential. Local conditions or interference may cause potential differences U_{CM} (static or dynamic) between the measuring lines M- of the input channels and the reference point of the measuring circuit M_{ANA}.

It is advisable to wire M- to M_{ANA} to prevent common mode voltages in excess of the permitted value for U_{CM} when operating the equipment in areas subject to heavy EMC interference.

Non-isolated transducers

The non-insolated transducers are bonded to local earth potential. Always interconnect M_{ANA} with earth potential. Local conditions or interference may cause potential differences U_{CM} (static or dynamic) between the locally distributed measuring points.

If common mode voltage exceeds the permissible value for U_{CM}, you must provide for equipotential bonding conductors between the measuring points.

Improving current measuring precision at channels 0 through 3 of the analog input module

It is advisable to interconnect unused voltage inputs with the corresponding current input when using channels 0 to 3 of SM 336; AI 6 x 13Bit for current measurements. See the figure below. This measure improves precision by approx. 0.2%.

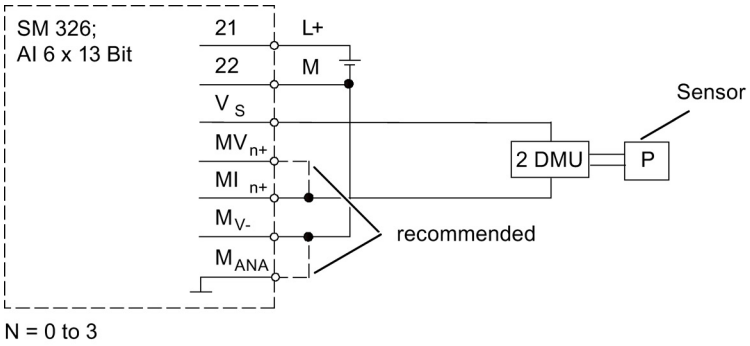


Figure 9-7 Improving current measuring precision at channels 0 through 3 using 2 DMU

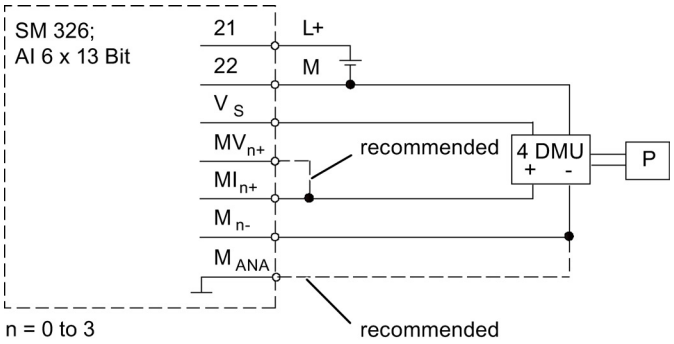


Figure 9-8 Improving current measuring precision at channels 0 through 3 using 4 DMU

9.2.3 Applications of SM 336; AI 6 x 13 Bit [ID: 56062553099]

Selecting the application

The figure below helps you to select an application based on availability and fail-safe operation requirements. The next pages provide information on the module wiring and parameter settings in *STEP 7*.

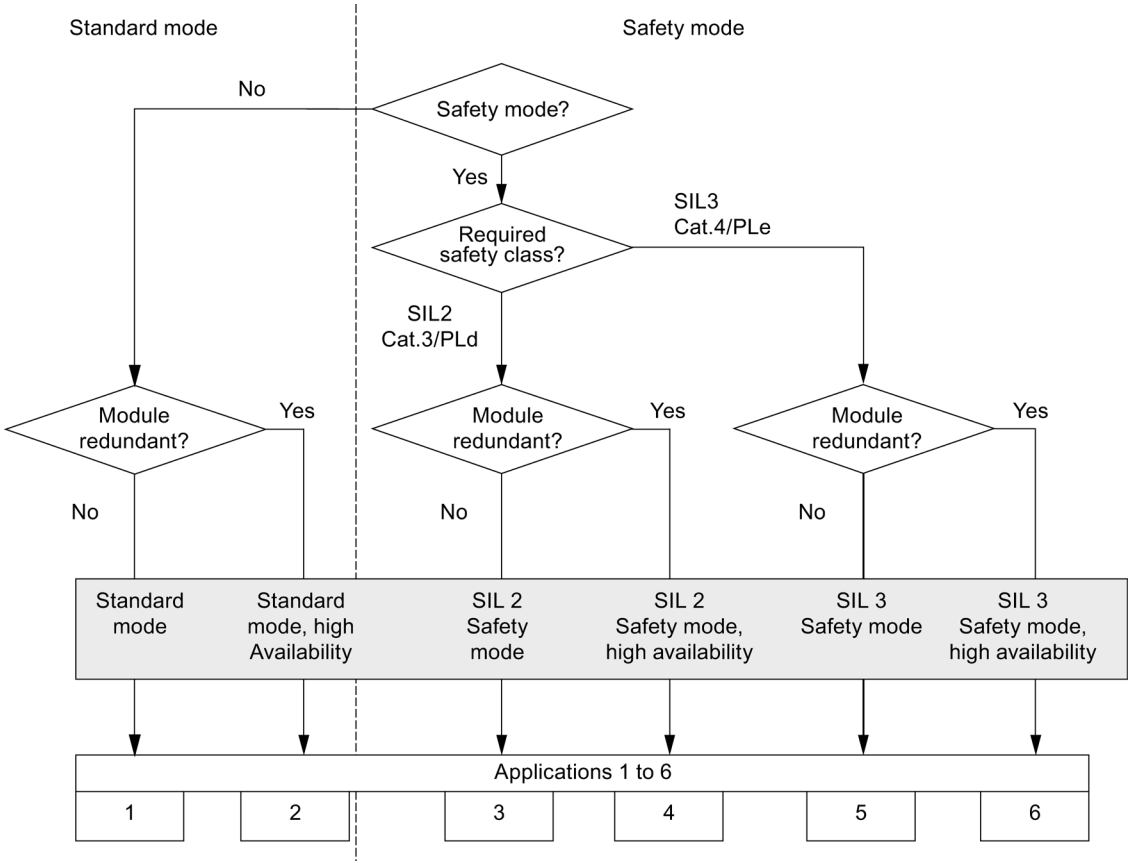


Figure 9-9 Application Selection - SM 336; AI 6 x 13 Bit

WARNING

The maximum Safety Integrity Level is determined by the sensor quality and the length of the proof-test interval according to the IEC 61508:2000 standard. If the sensor quality does not meet Safety Integrity Level requirements, always wire redundant sensors and connect them via two channels.

Wiring schemes

Three wiring schemes are available for each application, depending on the type of measurement.

Table 9- 4 Wiring scheme of SM 336; AI 6 x 13 Bit

Wiring scheme	Measurement type	Range	Channels	Abbreviation in *HW Config*
A	Current measurement with 2-wire transducer	4 to 20 mA	0 to 5	2DMU
B	Current measurement with 4-wire transducer	4 to 20 mA 0 to 20 mA*	0 to 5	4DMU
C	Voltage measurement*	0 V to 10 V	0 to 3	V
* Current measurement 0 to 20 mA and voltage measurement are only supported in standard mode.				

Note

In the wiring schemes below, the connections to the reference point of the measuring circuit M_{ANA} are represented by a dashed line. This means these connections are recommended options (see section "Properties, front view, wiring diagram and block diagram (Page 196)").

A dashed connection between two or four sensors indicates that these sensors measure the same process variable.

9.2.4 Application 1 : Standard Mode [ID: 431724427]

Introduction

Below are the wiring schemes and the parameter assignment of SM 336; AI 6 x 13Bit for

- Application 1: Standard mode

Diagnostic messages, possible causes of the problem and their corrective measures are found in tables *Diagnostic messages of SM 336; AI 6 x 13Bit* and *Diagnostic messages and associated corrective measures for SM 336; AI 6 x 13Bit* in chapter "Diagnostic Messages for SM 336; AI 6 x 13 Bit (Page 232)".

Wiring scheme A, current measurement 4 to 20 mA with 2-wire transducer for application 1

You can interconnect six process signals with an analog module. Sensor supply Vs is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 2-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

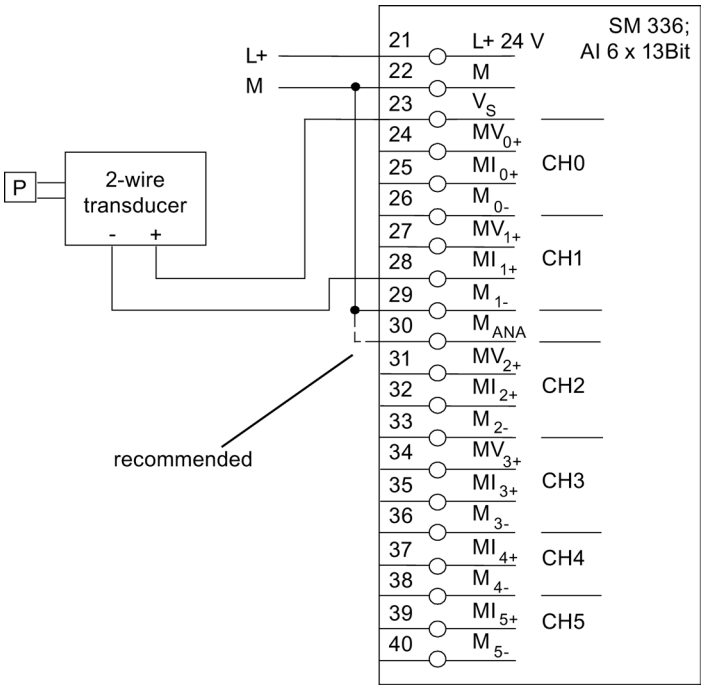


Figure 9-10 Current measurement 4 to 20 mA, 2-wire transducer for application 1 with SM 336; AI 6 x 13Bit

Wiring scheme B, current measurement 0 to 20 mA with 4-wire transducer for application 1

You can interconnect six process signals with an analog module. Sensor supply Vs is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 4-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

The wire-break check function reduces the measuring range to 4 to 20 mA.

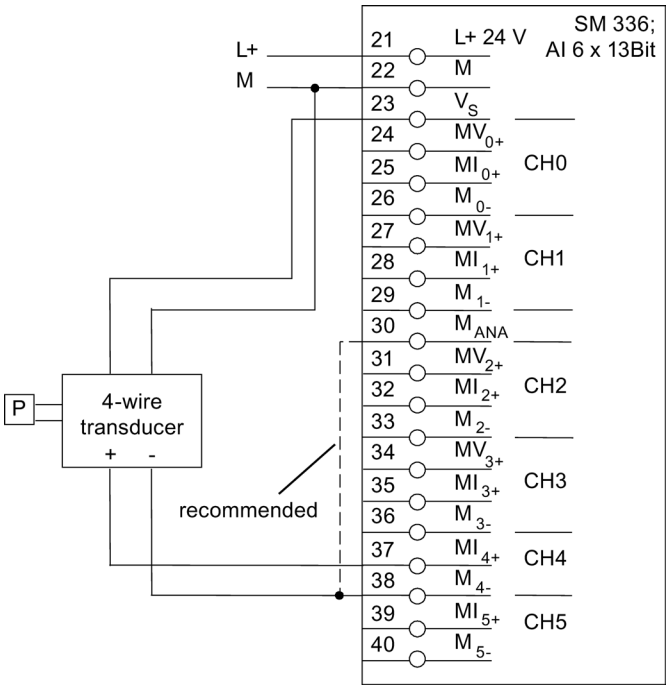


Figure 9-11 Current measurement 4 to 20 mA, 4-wire transducer for application 1 with SM 336; AI 6 x 13Bit

Wiring scheme C, voltage measurement 0 V to 10 V, for application 1

You can interconnect four process signals with an analog module. Sensor supply Vs is provided by the analog module for 4 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 4-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

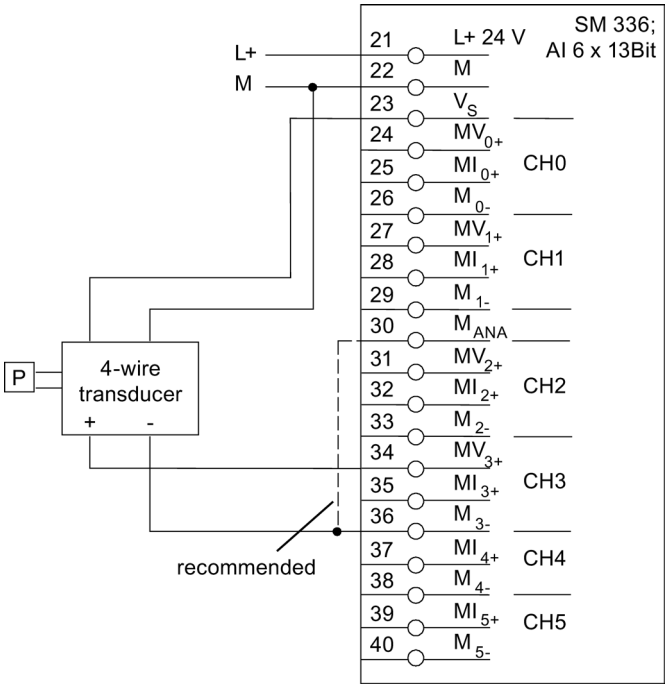


Figure 9-12 Voltage measurement 0 to 10 V for application 1 with SM 336; AI 6 x 13Bit

Assignable parameters for application 1

Table 9- 5 Parameters for application 1 of SM 336; AI 6 x 13Bit

Parameters	Range of values in standard mode	Type	Effective range
"Inputs 1" tab			
Enable diagnostic interrupt	Activated/deactivated	Static	Module
Interference frequency	50 Hz/60 Hz	Static	Module
Group diagnostics	Activated/deactivated	Static	Channel
Wire-break check (only for 4 to 20 mA)	Activated/deactivated	Static	Channel
Measurement type	• Deactivated • 4DMU • 2DMU • V	Static	Channel
Measuring range	• 4 to 20 mA • 0 to 20 mA • 0 to 10 V	static	channel
"Inputs 2" tab			
Safety mode	No (standard mode)	Static	Module
Monitoring time	—	Static	Module
"Redundancy" tab			
Redundancy	none	Static	Module

9.2.6 Application 3: Safety mode SIL2/Cat.3/PLd [ID: 431729803]

Introduction

Below are the wiring schemes and the parameter assignment of SM 336; AI 6 x 13Bit for

- Application 3: Safety Mode SIL2/Cat.3/PLd.

Diagnostic messages, possible causes of the problem and their corrective measures are found in tables *Diagnostic messages of SM 336; AI 6 x 13Bit* and *Diagnostic messages and associated corrective measures for SM 336; AI 6 x 13 Bit* in chapter "Diagnostic Messages for SM 336; AI 6 x 13 Bit (Page 232)".

Wiring scheme A, current measurement 4 to 20 mA with 2-wire transducer for application 3

You can interconnect six process signals with an analog module. Sensor supply V_S is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 2-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

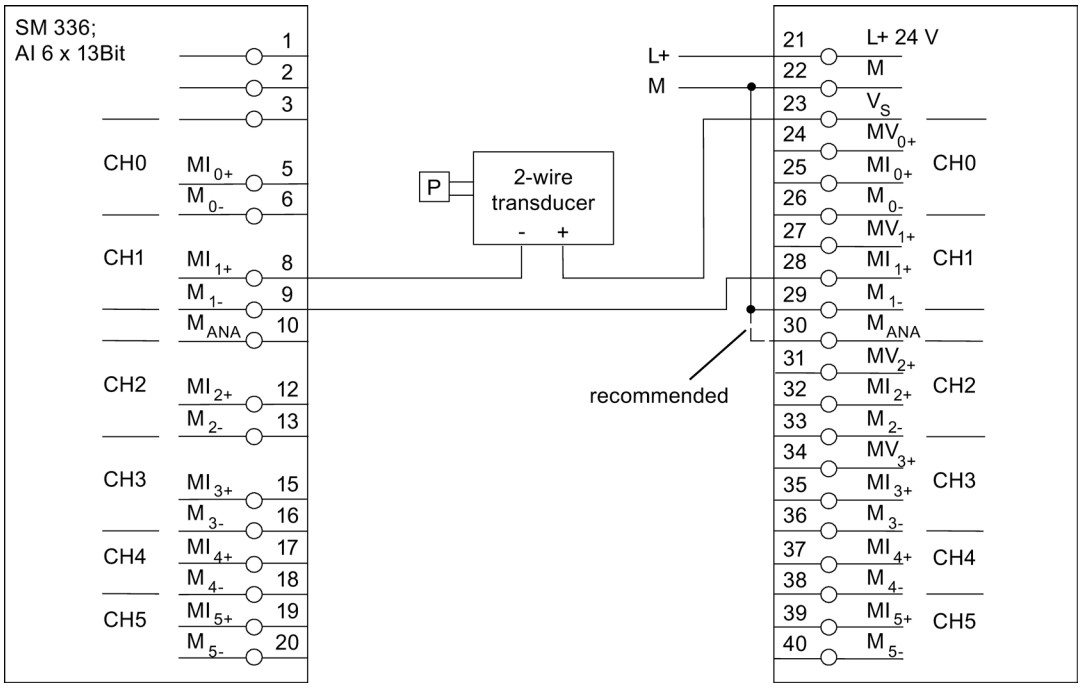


Figure 9-13 Current measurement 4 to 20 mA, 2-wire transducer for application 3 with SM 336; AI 6 x 13Bit

WARNING

To achieve SIL3/Cat.4/PLe using this wiring, you must use a suitably qualified sensor.

Wiring scheme B, current measurement 4 to 20 mA with 4-wire transducer for application 3

You can interconnect six process signals with an analog module. Sensor supply V_S is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 4-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

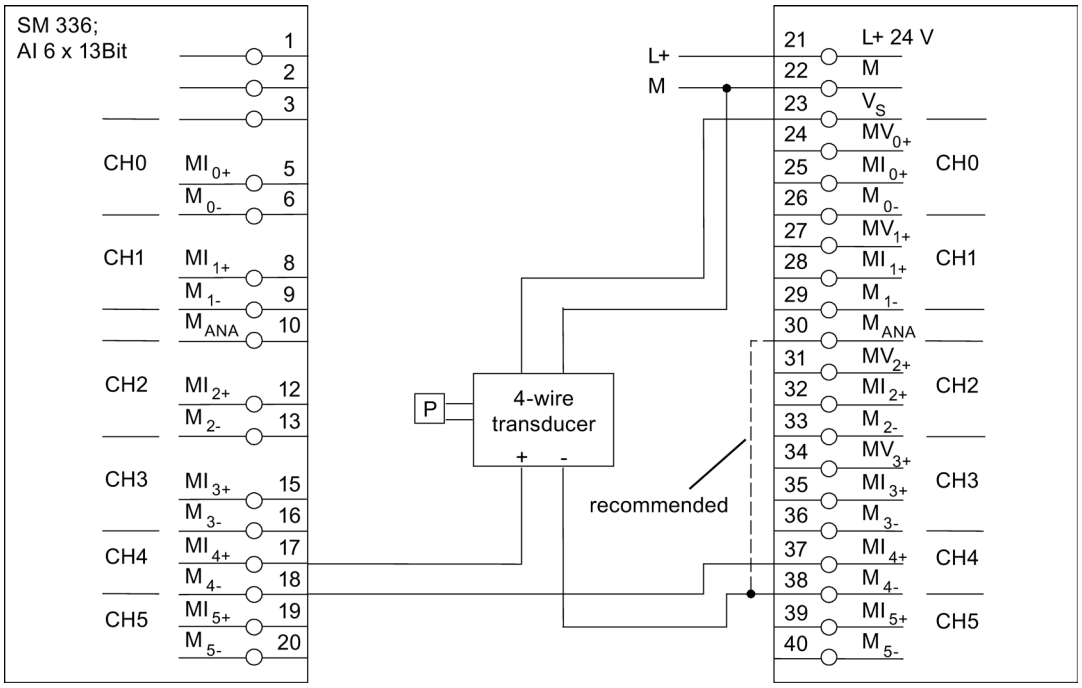


Figure 9-14 Current measurement 4 to 20 mA, 4-wire transducer for application 3 with SM 336; AI 6 x 13Bit

WARNING

To achieve SIL3/Cat.4/PLe using this wiring, you must use a suitably qualified sensor.

Assignable parameters for application 3

Table 9- 7 Parameters for application 3 of SM 336; AI 6 x 13Bit

Parameters	Range of values in safety mode	Type	Effective range
"Inputs 1" tab			
Enable diagnostic interrupt	Yes/no	Static	Module
Interference frequency	50 Hz/60 Hz	Static	Module
Group diagnostics	Yes/no	Static	Channel
Wire-break check (only for 4 to 20 mA)	Yes/no	Static	Channel
Measurement type	• Deactivated • 4DMU • 2DMU	Static	Channel
Measuring range	4 to 20 mA	Static	Channel
"Inputs 2" tab			
Safety mode	• According to SIL 2 • 1 sensor	Static	Module
Monitoring time	10 ms to 10000 ms	Static	Module
"Redundancy" tab			
Redundancy	none	Static	Module

9.2.8 Application 5: Safety mode SIL3/Cat.4/PLe [ID: 431735179]

Introduction

Below are the wiring schemes and the parameter assignment of SM 336; AI 6 x 13Bit for

- Application 5: Safety mode SIL3/Cat.4/PLe.

Diagnostic messages, possible causes of the problem and their corrective measures are found in tables *Diagnostic messages of SM 336; AI 6 x 13Bit* and *Diagnostic messages and associated corrective measures for SM 336; AI 6 x 13Bit* in chapter "Diagnostic Messages for SM 336; AI 6 x 13 Bit (Page 232)".

Wiring scheme A, current measurement 4 to 20 mA with 2-wire transducer for application 5

You can interconnect six process signals with an analog module. Two redundant sensors are connected to two *opposite inputs* of the analog module for each process signal (1oo2 evaluation). Sensor supply V_S is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 2-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

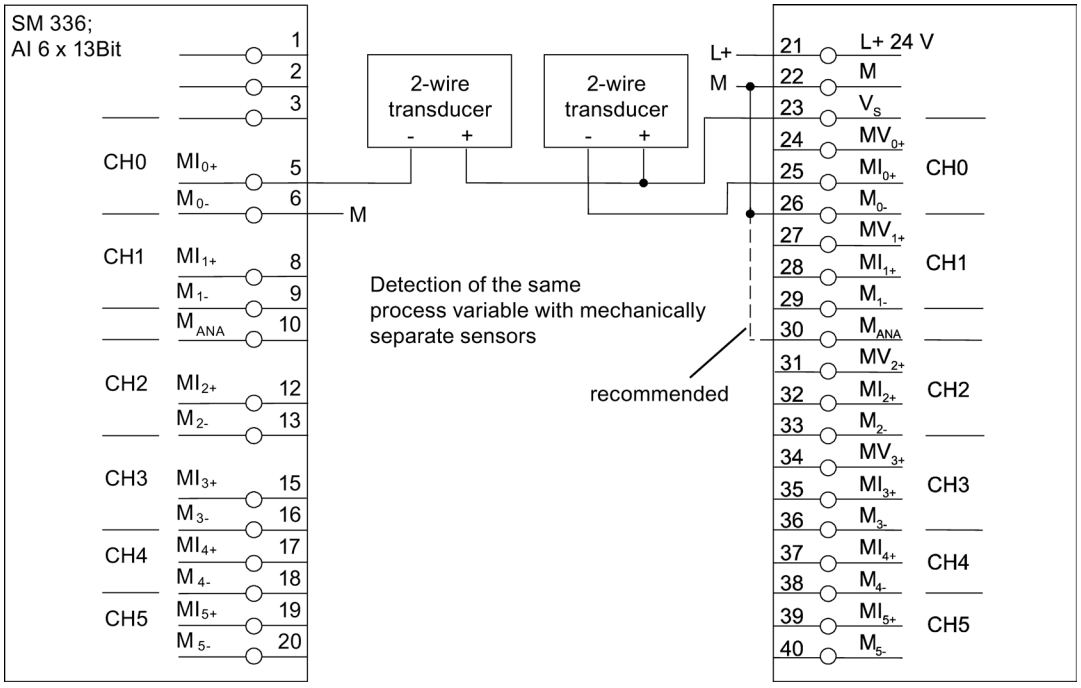


Figure 9-15 Current measurement 4 to 20 mA, 2-wire transducer for application 5 with SM 336; AI 6 x 13Bit

WARNING

To achieve SIL3/Cat.4/PLe using this wiring, you must use a suitably qualified sensor and it may require an 1oo2 evaluation.

Wiring scheme B, current measurement 4 to 20 mA with 4-wire transducer for application 5

You can interconnect six process signals with an analog module. Two redundant sensors are connected to two *opposite inputs* of the analog module for each process signal (1oo2 evaluation). Sensor supply V_S is provided by the analog module for 6 channels. The sensors can also be connected to an external sensor supply (see figure *External sensor supply, 4-wire transducer for SM 336; AI 6 x 13Bit* in chapter "Properties, front view, wiring diagram and block diagram (Page 196)").

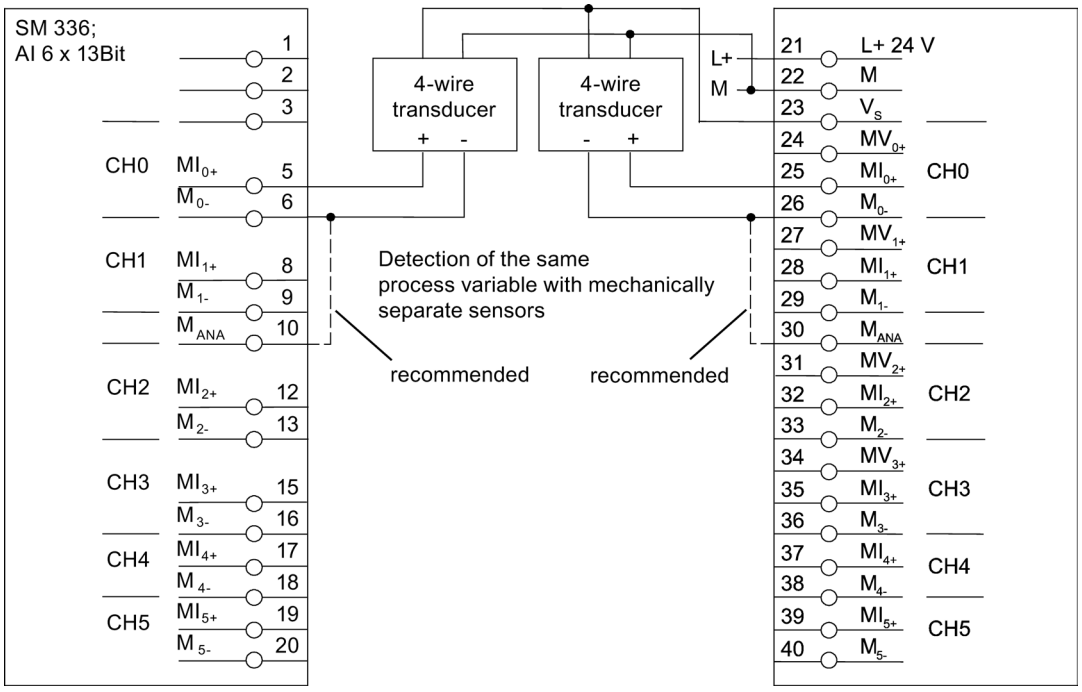


Figure 9-16 Current measurement 4 to 20 mA, 4-wire transducer for application 5 with SM 336; AI 6 x 13Bit

WARNING

To achieve SIL3/Cat.4/PLe using this wiring, you must use a suitably qualified sensor and it may require an 1oo2 evaluation.

Assignable parameters for application 5

Table 9- 9 Parameters for application 5 of SM 336; AI 6 x 13Bit

Parameters	Range of values in safety mode	Type	Effective range
"Inputs 1" tab			
Enable diagnostic interrupt	Activated/deactivated	Static	Module
Interference frequency	50 Hz/60 Hz	Static	Module
Group diagnostics	Activated/deactivated	static	channel
Wire-break check	Activated/deactivated	Static	Channel
Measurement type	• Deactivated • 4DMU • 2DMU	Static	Channel
Measuring range	4 to 20 mA	Static	Channel
"Inputs 2" tab			
Safety mode	• According to SIL 3 • 2 sensors	Static	Module
Monitoring time	10 ms to 10000 ms	static	module
Discrepancy time	10 to 10000 ms	static	module
Tolerance window in terms of the measuring range	0 to 20% in 1% increments	Static	Module
Standard value	MIN/MAX	Static	Module
"Redundancy" tab			
Redundancy	none	Static	Module

Discrepancy analysis for fail-safe analog input modules

If you have configured safety mode in accordance with SIL 3, you can configure a discrepancy time and an absolute tolerance window (as a % of the 4 mA to 20 mA measuring range) for each input of the analog input module. In addition, configure the standard value (MIN = lower value / MAX = higher value) to be applied and transferred to the F-CPU.

If the difference between the two measured values is outside of the tolerance window for longer than the configured discrepancy time, this error is signaled and the fail-safe value ($7FFF_H$) is transferred. In *S7 Distributed Safety*, the fail-safe value 0 is provided in the PII for the safety program in place of $7FFF_H$.

9.2.10 Diagnostic Messages for SM 336; AI 6 x 13 Bit [ID: 431743243]

Possible diagnostic messages

The following table provides an overview of the diagnostic messages for SM 336; AI 6 x 13Bit.

Diagnostic messages are assigned either to a channel or to the entire module. Some diagnostic messages occur only in certain applications.

Table 9- 11 Diagnostic messages of SM 336; AI 6 x 13Bit

Diagnostic message	Signaled in the application		Effective range of diagnostics	Assignable
Wire break	**1, 2, 3, 4, 5, 6**	A, B	Channel	Yes
Discrepancy error	**4, 6**			
Common mode fault	**1, 2, 3, 4, 5, 6**	A, B, C	Channel	No
Overflow or underflow of the measured value (see "Wire break and underflow") in Chapter " Analog value representation (Page 194) ")	**1, 2, 3, 4, 5, 6**	A, B, C		
Incorrect module parameters	**1, 2, 3, 4, 5, 6**	A, B, C	module	
Parameter assignment error (with specification of consecutive number)				
ADC/DAC error				
No external auxiliary voltage				
Communications error (CPU in Stop)				
Time monitoring activated (watchdog)				
EPROM / RAM fault				
Processor failure				
CRC signature error	**3, 4, 5, 6**	A, B, C		
Timeout of safety message frame monitoring				
Message frame error	**1, 2**			

Causes of the problem and corrective measures

The table below shows possible causes of the problem and appropriate corrective measures for the individual diagnostic messages of SM 336; AI 6 x 13Bit.

Table 9- 12 Diagnostic messages and associated corrective measures for SM 336; AI 6 x 13Bit

Diagnostic message	Possible causes of the problem	Corrective measures
Wire break (only in the 4 to 20 mA measuring range)	Interruption of the measuring lead between the module and sensor	Reestablish the cable connection
	Incorrect measuring range setting	Set the 4 to 20 mA measuring range
Discrepancy error	Assigned tolerance window exceeded on expiration of the discrepancy time	Extend the tolerance window and/or discrepancy window
	Wire break	Eliminate the wire break Check the process signal.
	Deviation between two inputs outside limits of safety mode to SIL 2	Wiring error: wire the analog signal to both inputs, or replace the module
Common mode fault	Potential difference U_{CM} between the inputs (M-) and reference potential of measuring circuit (M_{ANA}) too high.	Interconnect M- with M_{ANA}
Overflow or underflow of the measured value (see "Wire break and underflow") in Chapter "Analog value representation (Page 194)")	Measuring range fallen below	Use a suitable sensor; check the wiring (sensor polarity reversed)
	Measuring range exceeded	Use a suitable sensor; sensor polarity reversed
	Current through sensor too high at startup	—
Incorrect module parameters	Faulty parameters transferred to module	Assign new module parameters
Parameter assignment error (with specification of a consecutive number; for example, "16": incorrect address)	Error in dynamic parameter reassignment	Check the parameter assignment in the user program Contact SIMATIC Customer Support if necessary
ADC/DAC error	Internal error during analog value test	Replace the module
	Internal voltage monitoring has reported a fault	
No external auxiliary voltage	Module supply voltage L+ missing	Connect supply voltage L+
Communication error	Error in communication between the CPU and the module, for example, due to defective PROFIBUS connection or electromagnetic interference in excess of limits.	Check the PROFIBUS connection Eliminate the interference
	Timeout of safety message frame monitoring	Check the monitoring time parameters

Diagnostic message	Possible causes of the problem	Corrective measures
	CRC signature error, for example, due to electromagnetic interference in excess of limits.	Eliminate the interference
	CPU is in STOP	Read the diagnostics buffer
Time monitoring activated (watchdog)	Excessive electromagnetic interference at times	Eliminate the interference
	Defective module	Replace the module
EPROM fault RAM fault	Excessive electromagnetic interference at times	Eliminate the interference and cycle power OFF/ON
	Defective module	Replace the module
Processor failure	Electromagnetic interference has exceeded limits	Eliminate the interference
	Defective module	Replace the module
	Switching rate exceeded	Reduce switching rate
CRC signature error	CRC signature error during communication between the CPU and the module has occurred, for example, due to electromagnetic interference in excess, faults during sign-of-life monitoring error or standard program accesses F-SM.	Eliminate the interference
Timeout of safety message frame monitoring	Assigned monitoring time exceeded	Check the monitoring time parameters
	Startup of the fail-safe signal module	—
Message frame error	Sign-of-life and/or CRC signature entered in the data message frame	Check the sign-of-life and CRC signature entries in the data message frame for "0" value

9.2.11 Technical data - SM 336; AI 6 x 13Bit [ID: 8681228811]

Overview

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 120
Weight	Approx. 480 g
Module-specific specifications	
Number of inputs	6
Assigned address area	
• In the I/O input area	16 bytes
• In the I/O output area	4 bytes
Cable length	
• Shielded	Max. 200 m
Front connectors	40-pin
Maximum achievable Safety Integrity Level in safety mode	
• According to IEC 61508:2000	Max. SIL 3
• According to ISO 13849-1:2006 or EN ISO 13849-1:2008	Max. Cat. 4/PLe
Fail-safe performance characteristics	
• low demand mode (average probability of failure on demand) SIL 3	< 1.00E-05
• high demand / continuous mode (probability of a dangerous failure per hour)SIL 3	< 1.00E-09
Proof-test interval	10 years
Surge protection of supply voltages L+ and L_{ext} in accordance with IEC 1000-4-5 (internal)	±0.5 kV, 1.2/50 µs
Surge protection of analog inputs and sensor supply voltage in accordance with IEC 1000-4-5 (internal)	±2 kV, 1.2/50 µs
Voltages, currents, potentials	
Rated supply voltage of electronics L+	24 V DC
• Reverse polarity protection	Yes
• Power failure ride-through	5 ms
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels and the power supply of the electronics	Yes, only with external sensor supply

Technical specifications	
• Between channels	No
• Between the power supply and sensor supply	No
Permitted potential difference	
• Between inputs and M_{ANA} (U_{CM})	6.0 V DC
• Between M_{ANA} and M_{intern} (U_{ISO})	75 V DC, 60 V AC
Insulation test voltage	500V DC / 350V AC for 1min or 600V DC for 1s
Current consumption	
• From backplane bus	Max. 90 mA
• From supply voltage L+	Typ. 160 mA
Common-mode voltage (CMV)	
• Permitted common mode voltage between the inputs (U_{CM})	Max. ±6 V
• Monitoring of common mode voltage	Yes, operating range > 6 V or < -6 V
Power loss of the module	4.25 W, typical
Analog value generation	
Measuring principle	Integrating
Integration/conversion time	
• Configurable	Yes
• Integration time At 50 Hz At 60 Hz	 20.00 ms 16.66 ms
• Resolution, including overrange	13 bits + sign
Response time per activated channel	
• At 50 Hz	Max. 50 ms
• At 60 Hz	Max. 44 ms
Basic response time	
• At 50 Hz	Max. 50 ms
• At 60 Hz	Max. 44 ms
Acknowledgment time corresponds to Max. response time = max. response time per channel × N + max. basic response time (N = number of active channels)	

Technical specifications	
Noise suppression, error limits	
Noise suppression for f=n × (50/60 Hz±1%), n=1, 2, etc.	Min. 38 dB
Common-mode interference (U_{CM} ≤ 6 $V_{r.m.s.}$)	Min. 75 dB
Crosstalk between inputs	Min. 75 dB
Basic error limit (operational limit at 25 °C, relative to input range)	
• Current input	± 0.40%
• Voltage input	± 0.40%
Temperature error (relative to input range)	± 0.002%/K
Linearity error (relative to input range)	± 0.05%
Repeatability (in transient state at 25 °C, relative to input range)	± 0.05%
Operational limit (across the temperature range, relative to input range)	
• Current	± 0.48%
• Voltage	± 0.48%
Status, Interrupts, Diagnostics	
Interrupts	
• Process interrupt	No
• Diagnostic interrupt	Yes, assignable
Diagnostics functions	Yes, assignable
• Indication of safety-oriented operation	Green LED (SAFE)
• Sensor supply monitoring	Green LED (Vs)
• Group fault display	Red LED (SF)
• Diagnostic information can be read out	Yes
Fail-safe values can be switched to	Configurable in safety program

Technical specifications	
Sensor supply output	
• Number of outputs	1
Output voltage	
• Loaded	Minimum L+ (-1.5 V)
Output current	
• Rated value	1.0 A
• Approved range	0 to 1.3 A
Short-circuit protection	Yes, electronic
Electrical isolation in accordance with DIN VDE 0160	
• Between output Vs and the backplane bus	Yes
• Between output and L+	No
• Test voltage	600 V DC
• Rated insulation voltage	75 V DC/60 V AC
Sensor selection data	
Input range (rated values)/input resistance in standard mode	
• Voltage	0 to 10 V/59 kΩ
• Current	0 mA to 20 mA 4 to 20 mA/107 Ω
Input range (rated values)/input resistance in safety mode	
• Current	4 to 20 mA/107 Ω
Permitted input voltage for voltage input (destruction limit)	Max. 30 V continuous; Max. 38 V for max. 1 s (pulse duty factor 1:20)
Permitted input current for current input (destruction limit)	Max. 40 mA
Signal sensor connection	
• For voltage measurement	Possible
• For current measurement	Possible
• As 4-wire transducer	Possible
• As 2-wire transducer	Possible
• Load of 2-wire transducer	Max. 600 Ω

Note

The maximum cable lengths currently specified in this manual ensure against functional impairment, even without more precise examination of the boundary conditions. If the boundary conditions, such as EMC, cable type, cable routing, etc. are examined more closely, longer cables can be used for all F-SMs.