AMIKON TECHNICAL DOCUMENTATION

Installation Instructions

Siemens 6ES7336-1HE00-0AB0

Fail-Safe Analog Input Module

CURRENT INPUTS	RESOLUTION	SAFETY RANGE	CONNECTOR
6	13 bits plus sign	4-20 mA	40 pins

For qualified personnel only. Isolate the equipment and follow the complete manufacturer and site safety procedures. This reference does not replace the approved project design or the full installation manual.

01 PREPARATION AND WIRING CHECKS

- Set the correct start-address-based PROFIsafe switch configuration.
- Use only 4-20 mA arrangements in safety mode.
- Follow internal/external sensor-supply and power-dip precautions.
- Apply the MANA and common-mode rules for the connected transducers.
- Use the appropriate single or redundant sensor scheme and discrepancy settings.
- Preserve the 40-pin terminal arrangement and voltage/current distinction.

02 ORIGINAL WIRING REFERENCE

Original source PDF pages 198, 38, 39, 40, 46, 47, 199, 200, 201, 203, 204, 205, 206, 215, 216, 223, 224, 225, 196, 197, 202, 207, 217, 232, 233, 234, 235, 236, 237, 238. The following pages retain the original Siemens drawings and printed page numbers.

Siemens original documentation and product reference

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.

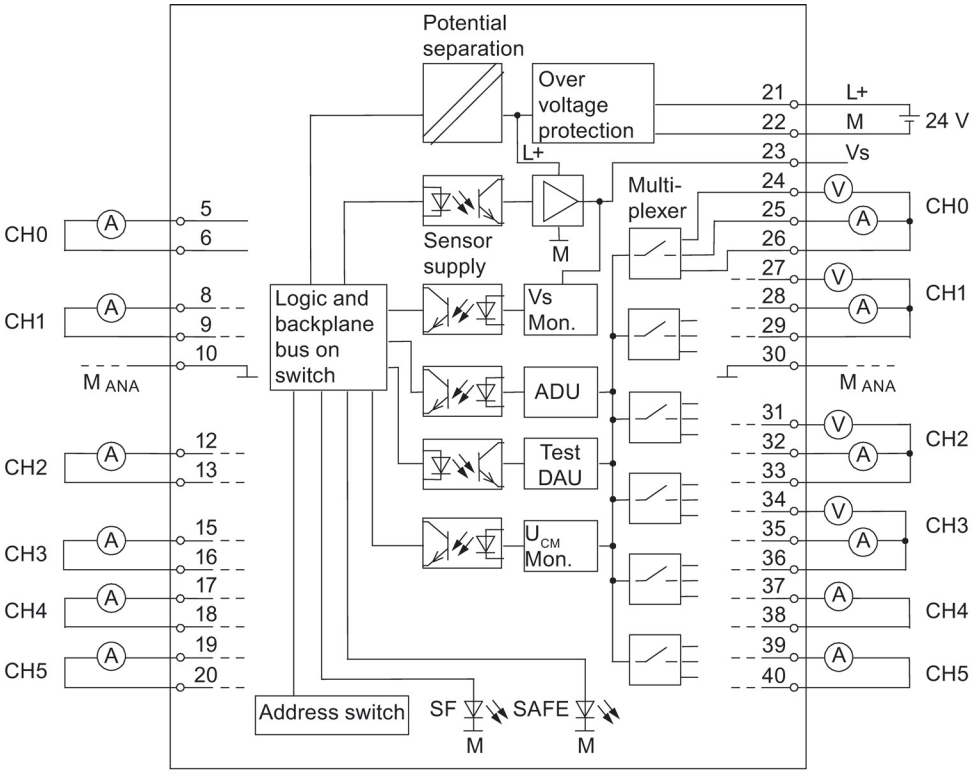


Figure 9-3 Wiring and block diagram of SM 336; AI 6 x 13Bit and internal sensor supply

Channel numbers

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

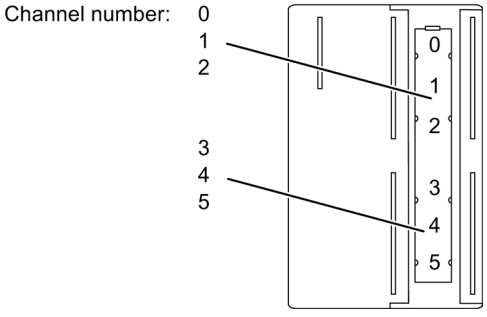


Figure 9-4 Channel numbers for SM 336; AI 6 x 13Bit

4.3.2 Assigning PROFIsafe Address (Starting Address of F-SM) [ID: 431545227]

Introduction

In order to use

- SM 326; DI 24 x DC 24 V (order no. 6ES7326-1BK00-0AB0),
- SM 326; DI 8 x NAMUR,
- SM 326; DO 10 x DC 24V/2A and the
- SM 336; AI 6 x 13 Bit

in safety mode, you must perform the following steps:

1. Set the module start address
2. Set safety mode
3. Set the start address of the fail-safe signal module at the address switch before you install it

Setting the module start address

You set the module start address similar to S7-300 standard I/O modules in the object properties of the module using *STEP 7HW Config*(for information on the permitted address space, refer to the *Channel addressing* chapter).

Setting safety mode

Set "Safety mode" in the object properties of the module in *HW Config*.

Address switch

The 10-bit DIP switch for addressing is installed in the rear panel of the fail-safe signal modules. This switch is used to determine:

- whether to operate the module in safety mode or in standard mode
- In safety mode: the module start address (PROFIsafe address = start address/8 of the F-SM)

The F-SMs are set by default for operation in "standard mode", that is, all switches are in up position. Alternatively, you can set all switches to down position. See figure below.

Setting the address switch

Verify the correct setting of the address switch **before you start installation**.

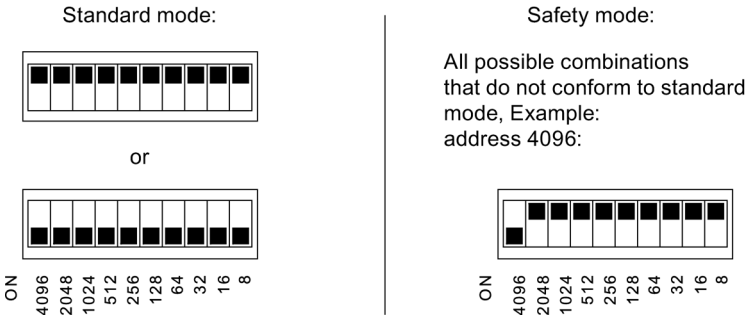


Figure 4-1 Example of address switch (DIP switch) settings

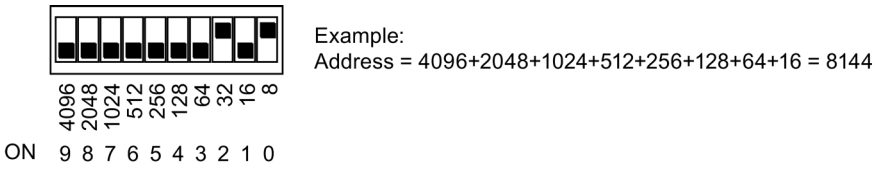


Figure 4-2 Example for calculation of the start address

Note

An address switch of the smallest possible dimensions is installed for reasons of space saving. This makes it sensitive to pressure and objects with sharp edges. Always use a suitable tool to manipulate the address switch.

A variety of tools suitable for activating the address switch are available on the market, for example, the Grayhill DIPSTICK. A ballpoint pen may be employed if used carefully. It is imperative to avoid any burring that would prevent the switch from reaching its home position. Do not use screwdrivers or knives to manipulate the address switch.

Addressing rules

WARNING

Rule for PROFIBUS subnets:

The PROFIsafe destination address and, thus, the switch setting on the address switch of the F-I/O must be unique network-wide* and station-wide** (system-wide). For S7-300 F-SMs and ET 200S, ET 200eco and ET 200pro F-modules, you can assign a maximum of 1022 different PROFIsafe destination addresses.

Exception: The F-I/O in different I-slaves may be assigned the same PROFIsafe destination address, as they are only addressed within the station, that is, by the F-CPU in the I-slave.

Rules for Ethernet subnets and hybrid configurations of PROFIBUS and Ethernet subnets:

The PROFIsafe destination address and, thus, the address switch setting on the F-I/O have to be unique only*** within the Ethernet subnet, including all lower-level PROFIBUS subnets, and station-wide** (system-wide). For S7-300 F-SMs and ET 200S, ET 200eco and ET 200pro F-modules, you can assign a maximum of 1022 different PROFIsafe destination addresses.

Exception: The F-I/O in different I-slaves may be assigned the same PROFIsafe destination address, as they are only addressed within the station, that is, by the F-CPU in the I-slave.

The networked nodes of an Ethernet subnet are characterized by having IP addresses with the same subnet address, which means the IP addresses match in the digits that have the value "1" in the subnet mask.

Example:

IP address: 140.80.0.2.

Subnet mask: 255.255.0.0 = 11111111.11111111.00000000.00000000

Meaning: Bytes 1 and 2 of the IP address define the subnet; subnet address = 140.80.

* A network consists of one or several subnets. "Network-wide" means beyond the boundaries of the subnet.

** "Station-wide" means for one station in *HW Config* (for example, an S7-300 station or I-slave)

*** Across Ethernet subnets, excluding cyclic PROFINET IO communication (RT communication)

Address inconsistency

A parameter assignment error is generated if addressing is inconsistent, for example, if the module address differs from the address set in *HW Config*. The module does not enter safety mode.

See also

Addressing the Channels (Page 35)

5.1 Safe Functional Extra-Low Voltage for Fail-Safe Signal Modules [ID: 431563275]

PELV

⚠ WARNING

Fail-safe signal modules must be operated with safe functional extra low voltage (SELV, PELV). That is, the fail-safe modules may only be exposed to a maximum fault voltage of V_m. Rule for all fail-safe signal modules:

$V_m < 60.0$ V

Additional information about PELV is available in the data sheets of the power supply modules to be installed, for example.

All system components which supply electrical power in any form must meet this condition.

Each additional power circuit (24 V DC) installed in the system must be operated with safe functional extra low voltage (SELV, PELV). Refer to the data sheets or contact the manufacturer for information.

You should also note that the sensors and actuators connected to the I/O modules may be connected to an auxiliary power supply. Make sure that such auxiliary power supplies conform to PELV requirements. The process signal of a 24 V digital module may not develop a fault voltage in excess of V_m.

⚠ WARNING

All power sources such as the internal and external 24 V DC load voltage supplies, and the 5 VDC bus voltage must be galvanically interconnected so that any development of cumulative voltage at the individual voltage sources which may lead to a fault voltage higher than V_m is safely ruled, irrespective of any potential differences.

Make sure that the conductor cross-sections used for the galvanic interconnections are compliant with S7-300 installation guidelines (see the *S7-300 Automation System: CPU 31xC and CPU 31x: installation* Operating Instructions).

The fail-safe signal modules and all their standard components can be operated in standard and safety mode on a single or on several shared power supply modules.

Power supply requirements for compliance with the NAMUR recommendation

Note

Always use power supply modules/units (230 V AC → 24 V DC) with integrated function for power failure backup for the duration of at least 20 ms in accordance with NAMUR recommendation NE 21, IEC 61131-2, and EN 298. Power supply components available (examples):

S7-400

- 6ES7407-0KA01-0AA0 for 10 A
- 6ES7407-0KR00-0AA0 for 10 A

S7-300

- 6ES7307-1BA00-0AA0 for 2 A
- 6ES7307-1EA00-0AA0 for 5 A
- 6ES7307-1KA00-0AA0 for 10 A

These requirements, of course, also apply to power supply modules/units which are not produced according to S7-300/400 installation technology.

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+).

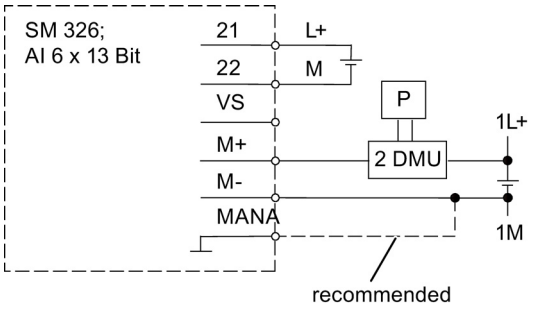


Figure 9-5 External encoder supply, 2-wire transducer for SM 336; AI 6 x 13Bit

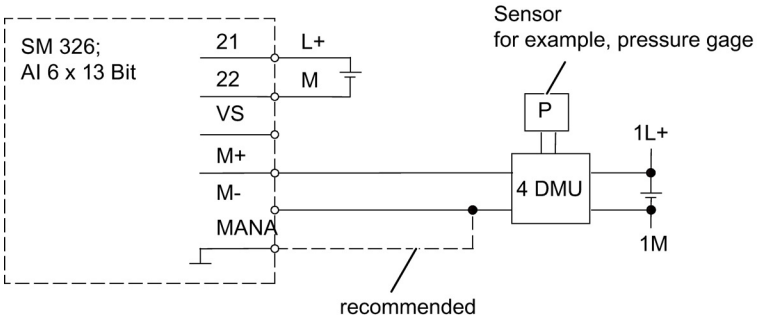


Figure 9-6 External encoder supply, 4-wire transducer for SM 336; AI 6 x 13Bit

⚠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%.

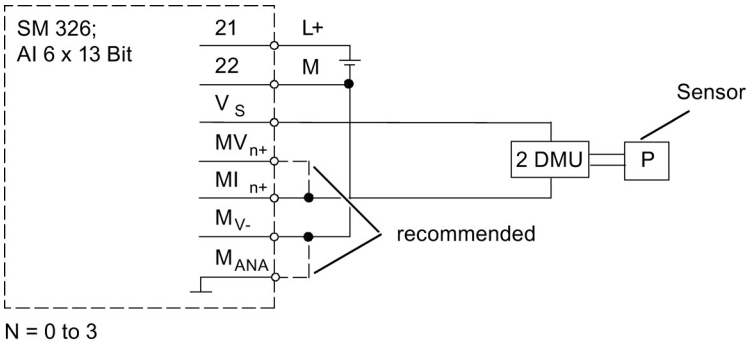


Figure 9-7 Improving current measuring precision at channels 0 through 3 using 2 DMU

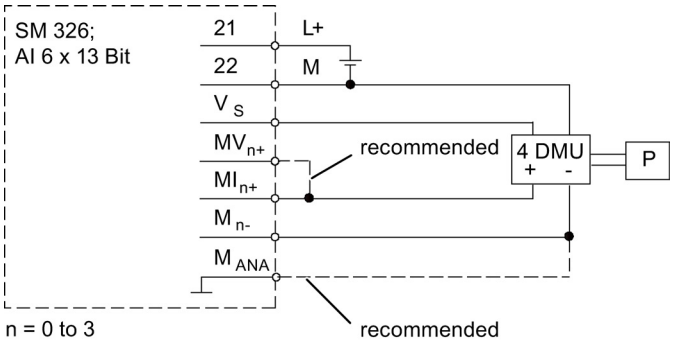


Figure 9-8 Improving current measuring precision at channels 0 through 3 using 4 DMU

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)").

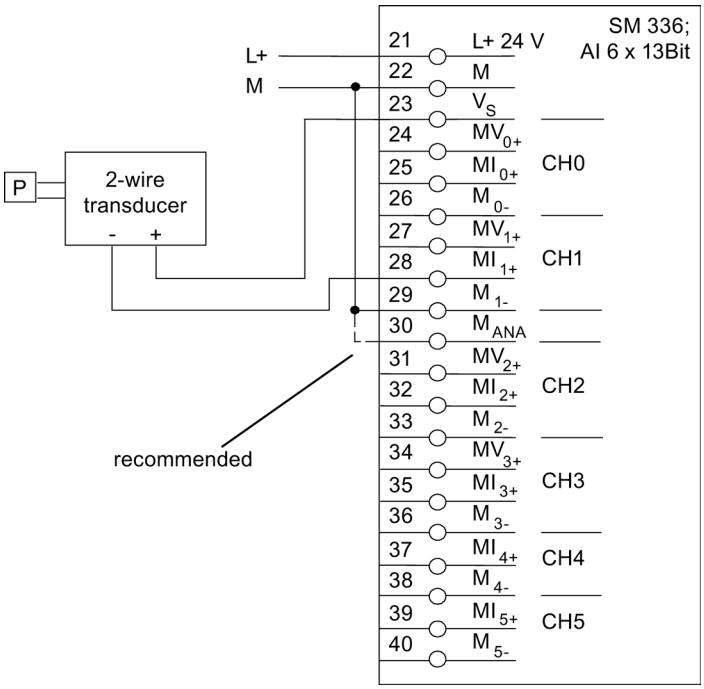


Figure 9-10 Current measurement 4 to 20 mA, 2-wire transducer for application 1 with SM 336; AI 6 x 13Bit

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.

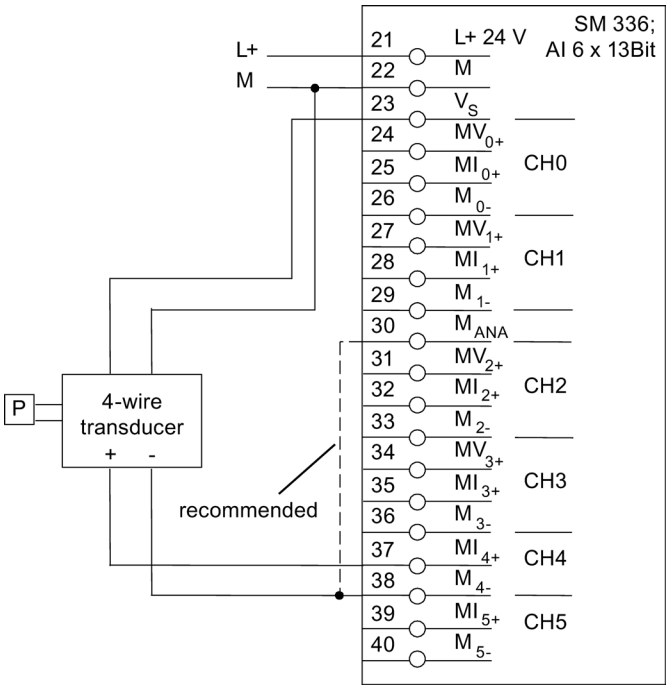


Figure 9-11 Current measurement 4 to 20 mA, 4-wire transducer for application 1 with SM 336; AI 6 x 13Bit

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)").

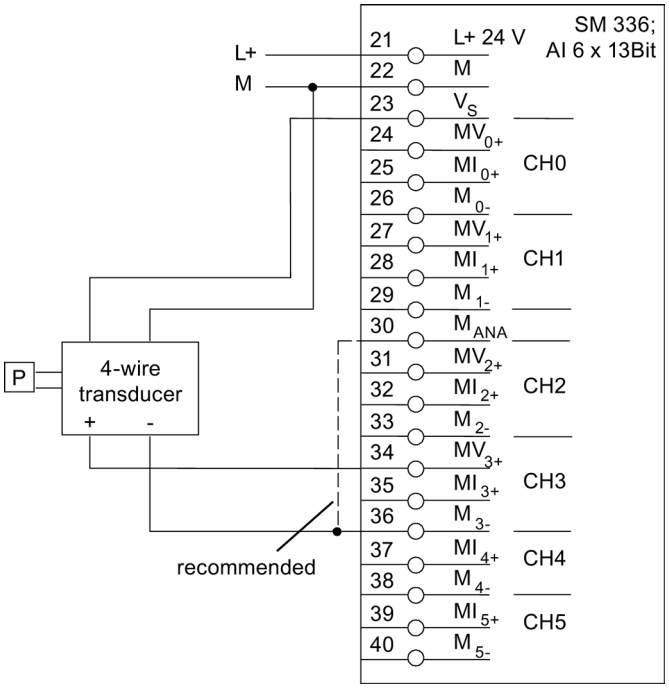


Figure 9-12 Voltage measurement 0 to 10 V for application 1 with SM 336; AI 6 x 13Bit

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)").

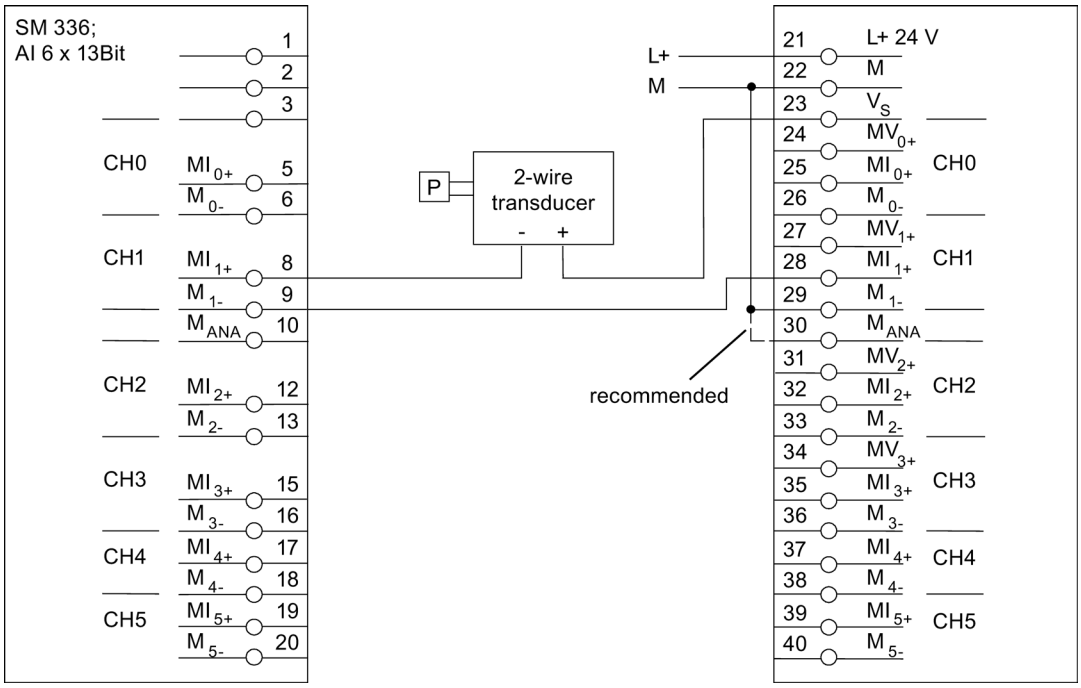


Figure 9-13 Current measurement 4 to 20 mA, 2-wire transducer for application 3 with SM 336; AI 6 x 13Bit

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)").

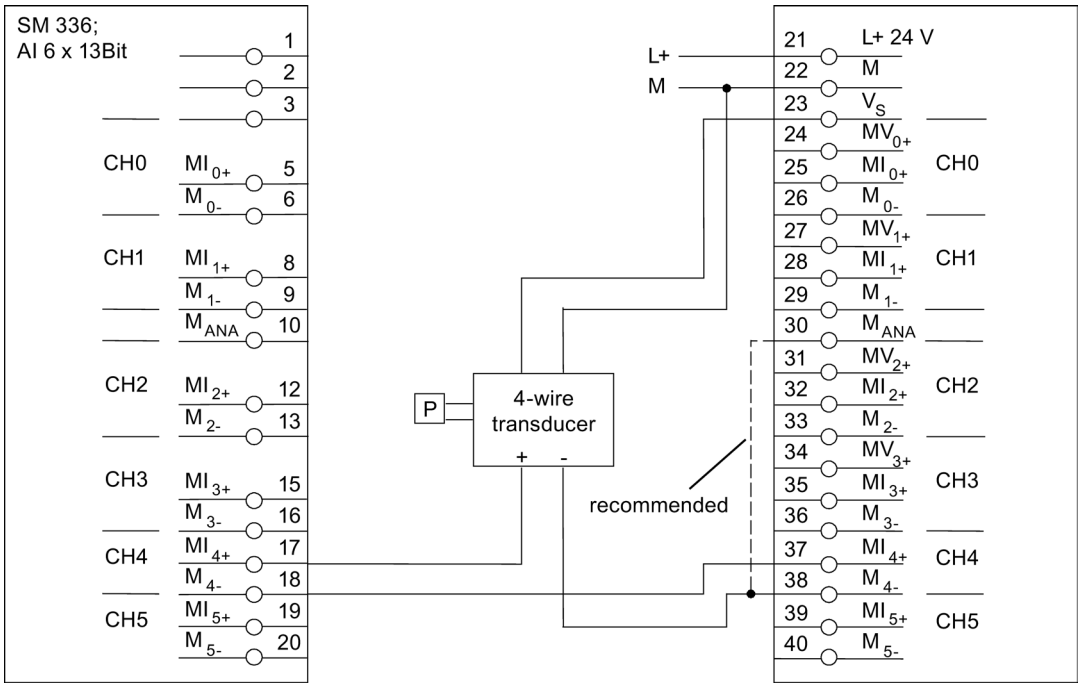


Figure 9-14 Current measurement 4 to 20 mA, 4-wire transducer for application 3 with SM 336; AI 6 x 13Bit

WARNING

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

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)").

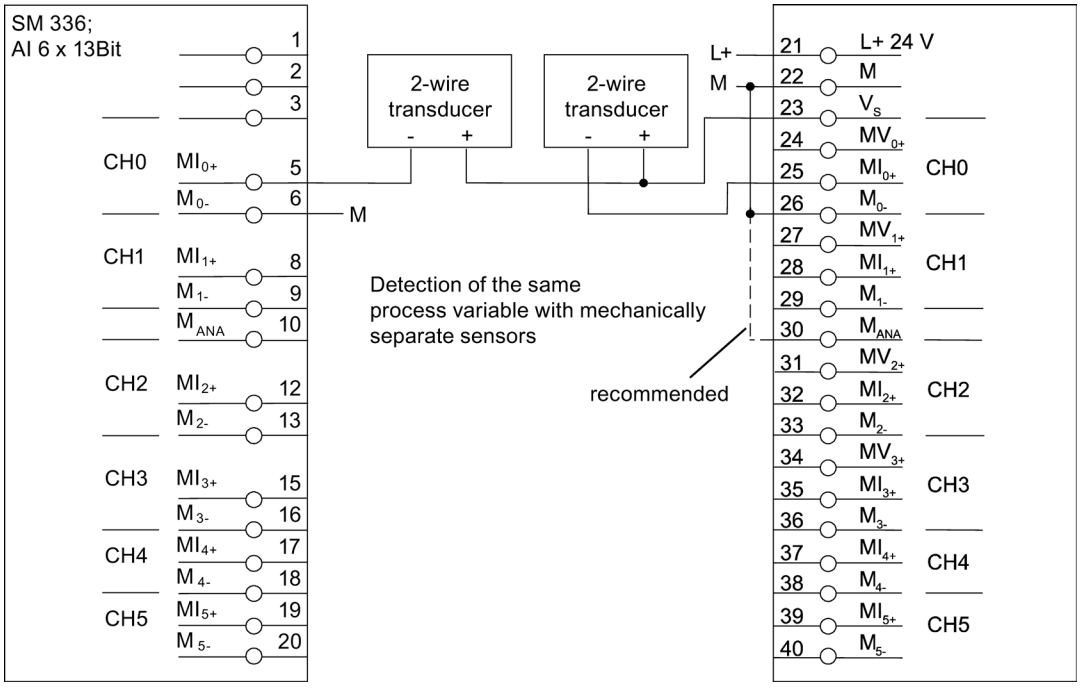


Figure 9-15 Current measurement 4 to 20 mA, 2-wire transducer for application 5 with SM 336; AI 6 x 13Bit

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)").

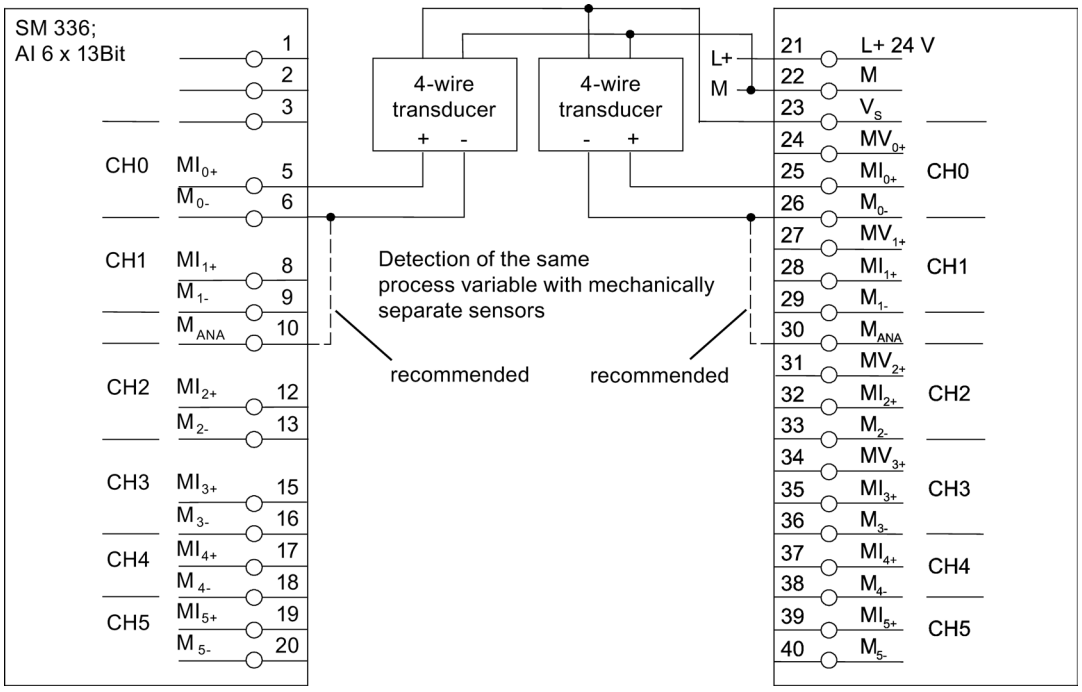


Figure 9-16 Current measurement 4 to 20 mA, 4-wire transducer for application 5 with SM 336; AI 6 x 13Bit

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 $7FFF_H$.

9.2.2 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.

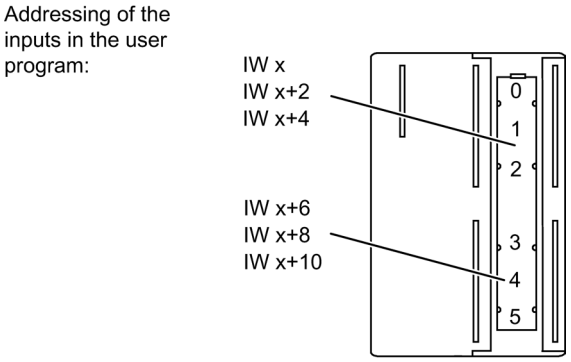


Figure 9-1 Address assignment for SM 336; AI 6 x 13Bit

Front view

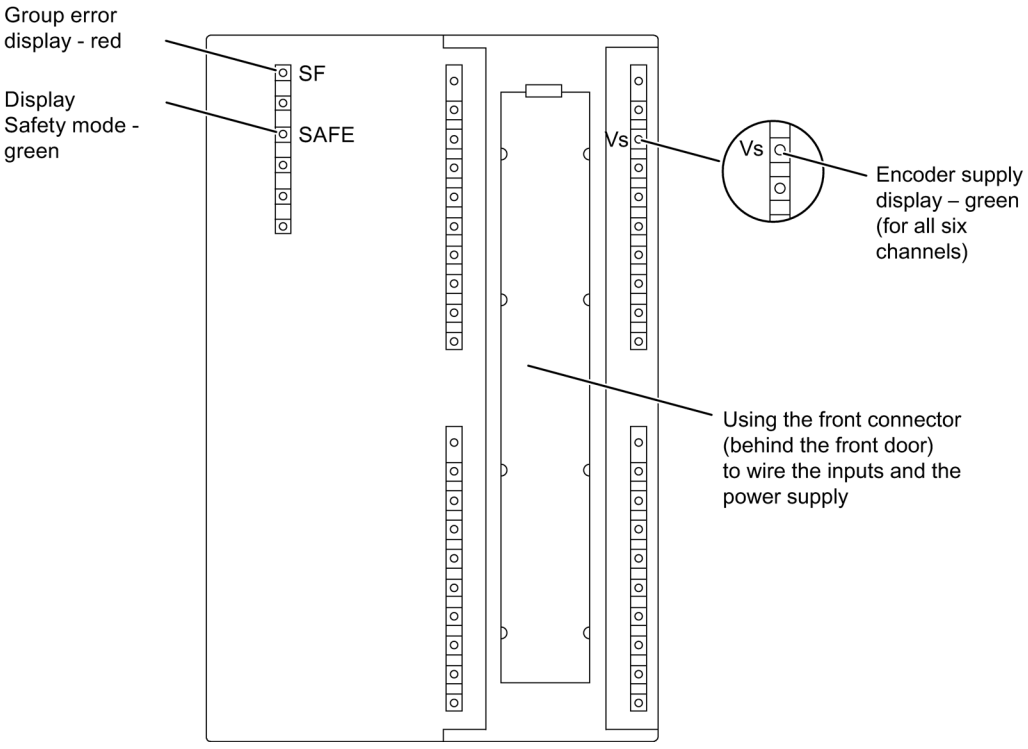


Figure 9-2 Front view of SM 336; AI 6 x 13Bit

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*.

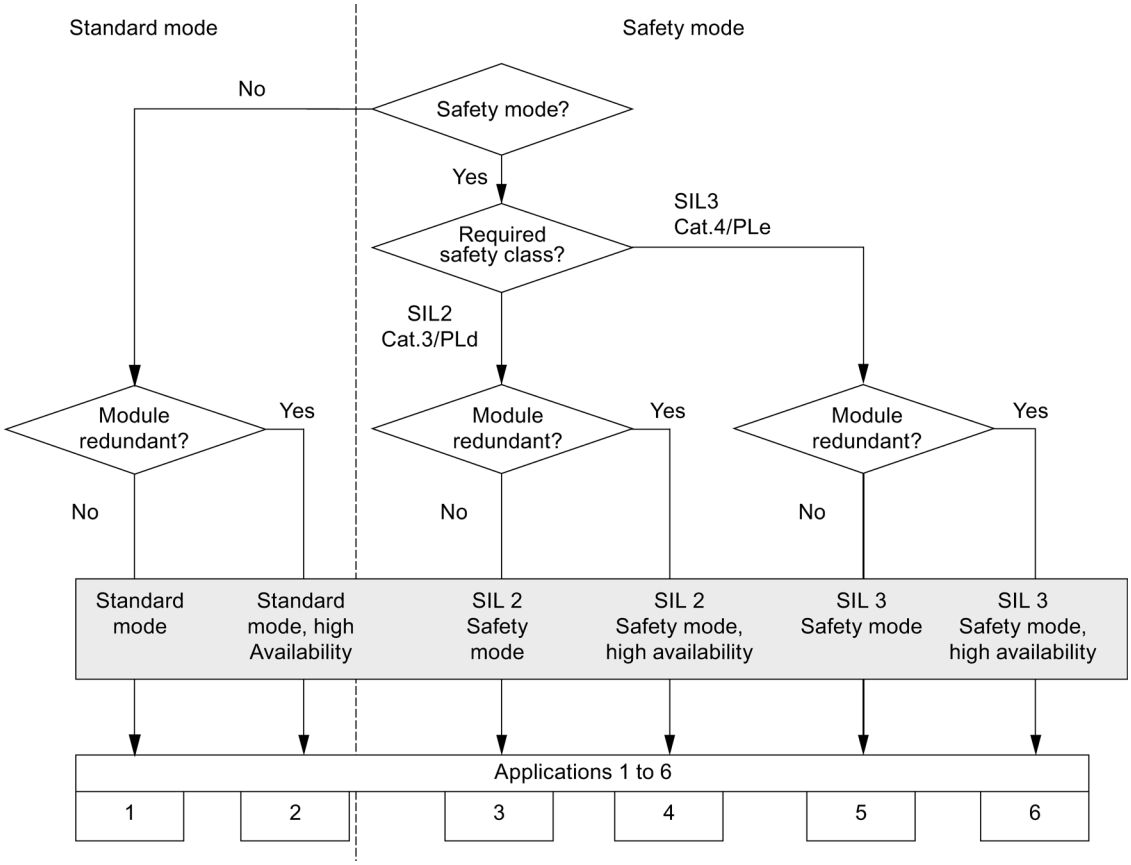


Figure 9-9 Application Selection - SM 336; AI 6 x 13 Bit

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.

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

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

9.2.10 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.