

SIMATIC

S7-300 Automation System Module data

Manual



The following supplement is part of this documentation:

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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.



Danger

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



Warning

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



Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

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

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

Qualified Personnel

The 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.

Prescribed Usage

Note the following:



Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Purpose of the manual

The information contained in this manual can be used as a reference to operating, to functions, and to the technical data of the signal modules, power supply modules and interface modules of the S7-300.

How to install, for example assemble and wire, an S7-300 or ET 200M system using those modules is described in the relevant manuals for establishing the system.

Basic knowledge required

This manual presumes a general knowledge in the field of automation engineering.

Range of validity of this manual

The manual describes the components based on the data valid at the time of its release.

SIEMENS reserves the right of including a product information for each new module, and for each module of a later version.

Changes compared to the previous version

Changes / enhancements compared to the previous version described in this manual:

- The 'Analog modules' chapter has been revised extensively and split into
 - Fundamentals of analog value processing
 - Representation of the analog values of analog modules
 - Modules overview of analog modules
- Packet assembling of documentation packet changed
- Various corrections were made.

Position in the overall documentation structure

The following documentation forms part of the S7-300 documentation package. You can also find this on the Internet at: <http://support.automation.siemens.com/WW/view/de/> and the relevant article ID.

Name of the manual	Description
Manual CPU 31xC and CPU 31x, Technical Data Article ID: 12996906	Control and display elements, communication, memory concept, cycle and reaction times, technical data
Operating Manual S7-300, CPU 31xC and CPU 31x: Installation Contribution ID: 13008499	Project design, installation, wiring, addressing, commissioning, maintenance and test functions, diagnostics and troubleshooting.
System Manual PROFINET system description Contribution ID: 19292127	Basic knowledge of PROFINET: Network components, data exchange and communication, PROFINET IO, Component-Based Automation, application sample of PROFINET IO and Component-Based Automation
Programming Manual Migration from PROFIBUS DP to PROFINET IO Contribution ID: 19289930	Guideline for PROFIBUS DP to PROFINET IO migration.
Manual CPU 31xC: Technological Functions Contribution ID: 12429336	Description of the technological functions: positioning, counting, point-to-point coupling, loop control. The CD contains examples of the technological functions
CD containing examples	
YOU ARE CURRENTLY READING the Manual S7-300 Automation System: Module Data Contribution ID: 8859629	Description of the functions and technical data of signal/ power supply/ interface modules.
Instructions List CPU 31xC and CPU 31x Contribution ID: 13206730	List of the CPU's instruction set and corresponding execution times. Listing of executable blocks.
Getting Started Available anthology of Getting Started manuals: - S7-300 Getting Started Contribution ID: 15390497 - PROFINET Getting Started Collection Contribution ID: 19290251	The Getting Started documentation provides step-by-step instructions focused on commissioning a fully functional application.

Other manuals on S7-300 and ET 200M

Name of the manual	Description
Reference Manual - CPU Data: CPU 312 IFM - 318-2 DP - Contribution ID: 8860591	Control and display elements, communication, memory concept, cycle and reaction times, technical data
Installation Manual S7-300 Automation System: Installation: CPU 312 IFM – 318-2 DP Contribution ID: 15390415	Project design, installation, wiring, addressing, commissioning, maintenance and test functions, diagnostics and troubleshooting.
Configuration Manual ET 200M signal modules for process automation Contribution ID: 7215812	Description of the integration in process automation, parameter configuration using SIMATIC PDM, digital input modules, digital output modules.
Manual Distributed I/O Device ET 200M HART analog modules Contribution ID: 22063748	Description of configuration and commissioning of HART analog modules
Manual Distributed I/O Device ET 200M Contribution ID: 1142798	Description of project design, assembly and wiring

Sign posts

The manual contains various features supporting quick access to specific information:

- The manual starts with a table of contents, including an index of the tables contained in the manual.
- Key terms are explained in the glossary.
- You can use the index to find the key parts of the manual.

Recycling and disposal

The S7-300 components are ecologically compatible, and thus suitable for recycling. For ecologically compatible recycling and disposal of your old device, contact a certificated disposal service for electronic scrap.

CE approval

See chapter *General technical data > Standards and approvals*.

Approvals

See chapter *General technical data > Standards and certificates*.

Mark for Australia (C-Tick-Mark)

See chapter *General technical data > Standards and certificates*.

Standards

See chapter *General technical data > Standards and certificates*.

See also

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General technical data

1.1 Standards and certifications

Introduction

General technical data include:

- standards and test values satisfied by modules of the S7-300 automation system
- test criteria of S7-300 modules.

CE Label



The S7-300 automation system satisfies requirements and safety-related objectives according to EC Directives listed below, and conforms with the harmonized European standards (EN) for programmable controllers announced in the Official Journals of the European Community:

- 73/23/EEC "Electrical Equipment Designed for Use within Certain Voltage Limits" (Low-Voltage Directive)
- 89/336/EEC "Electromagnetic Compatibility" (EMC Directive)
- 94/9/EU "Devices and protection systems for use as prescribed in potentially explosive areas" (Guidelines for Explosion Protection)

The EC Declarations of Conformity are available to the responsible authorities at:

Siemens Aktiengesellschaft
Automation & Drives
A&D AS RD ST PLC
PO Box 1963
D-92209 Amberg

UL certification



Underwriters Laboratories Inc., to

- UL 508 (Industrial Control Equipment)

CSA certification



Canadian Standards Association to

- C22.2 No. 142 (Process Control Equipment)

or



Underwriters Laboratories Inc., to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

or



HAZ. LOC.

Underwriters Laboratories Inc., to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)
- UL 1604 (Hazardous Location)
- CSA-213 (Hazardous Location)

APPROVED for use in

Class I, Division 2, Group A, B, C, D Tx;

Class I, Zone 2, Group IIC Tx

Note

Currently valid certifications can be found on the rating of the relevant module.

FM certification



Factory Mutual Research (FM) to
Approval Standard Class Number 3611, 3600, 3810
APPROVED for use in Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx



to EN 60079-15:2003 (Electrical apparatus for potentially explosive atmospheres; Type of protection "n")

 II 3 G EEx nA II Parts 4..6

Tick-mark for Australia



The S7-300 automation system satisfies requirements of standards to
AS/NZS 2064 (Class A).

IEC 61131

The S7-300 automation system satisfies requirements and criteria to
IEC 61131-2 (Programmable Controllers, Part 2: Equipment Requirements and Tests.)

Marine approvals

Classification Societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

Use in industry

SIMATIC products are designed for industrial applications.

Table 1-1 Use in industry

Field of application	Noise emission requirements	Noise immunity requirements
Industry	EN 61000-6-4: 2001	EN 61000-6-2: 2001

Use in residential areas

To operate an S7-300 in a residential area, it's RF emission must comply with Limit Value Class B to EN 55011.

Suitable measures for achieving RF suppression to Limit Value Class B:

- S7-300 installation in grounded switch cabinets / cubicles
- Use of noise filters in the supply lines



Warning

There is a risk of injury or of damage to assets.

In potentially explosive environments, there is a risk of injury or damage if you disconnect any connectors while the S7-300 is in operation.

Always isolate the S7-300 operated in such areas before you disconnect and connectors.

1.2 Electromagnetic Compatibility

Definition

Electromagnetic compatibility (EMC) is the ability of an electrical installation to function satisfactorily in its electromagnetic environment without interfering with that environment.

The S7-300 modules also satisfy requirements of EMC legislation for the European domestic market. Compliance of the S7-300 system with specifications and directives on electric design is prerequisite.

Pulseshaped disturbance

The table below shows the EMC compatibility of S7 modules in areas subject to pulse-shaped disturbance.

Pulse-shaped disturbance	Test voltage	corresponds with degree of severity
Electrostatic discharge to IEC 61000-4-2	Air discharge: ± 8 kV Contact discharge ± 4 kV	3 2
Burst pulses (high-speed transient disturbance) to IEC 61000-4-4.	2 kV (power supply lines) 2 kV (signal lines > 3 m) 1 kV (signal lines < 3 m)	3 3
High-energy single pulse (surge) to IEC 61000-4-5 External protective circuit required (refer to <i>S7-300 Automation System, Hardware and Installation</i> , Chapter "Lightning and overvoltage protection")		3
asymmetric coupling	2 kV (power supply lines) DC with protective elements 2 kV (signal/ data line only > 3 m), with protective elements as required	
symmetric coupling	1 kV (power supply lines) DC with protective elements 1 kV (signal/ data line only > 3 m), with protective elements as required	

Additional measures

When connecting an S7-300 system to the public network, always ensure compliance with Limit Value Class B to EN 55022.

Sinusoidal disturbance

The table below shows the EMC compatibility of S7-300 modules in areas subject to sinusoidal disturbance.

Sinusoidal disturbance	Test values	corresponds with degree of severity
RF radiation (electromagnetic fields) to IEC 61000-4-3	10 V/m, with 80% amplitude modulation of 1 kHz in the 80 MHz to 1000 MHz range 10 V/m, with 50% pulse modulation at 900 MHz	3
RF conductance on cables and cable shielding to IEC 61000-4-6	Test voltage 10 V, with 80% amplitude modulation of 1 kHz in the 9 MHz to 80 MHz range	3

Emission of radio interference

Electromagnetic interference to EN 55011: Limit Class A, Group 1 (measured at a distance of 10 m.)

Frequency	Noise emission
30 MHz to 230 MHz	< 40 dB (μV/m)Q
230 MHz to 1000 MHz	< 47 dB (μV/m)Q

Noise emission via AC mains to EN 55011: Limit value class A, Group 1.

Frequency	Noise emission
0.15 MHz to 0.5 MHz	< 79 dB (μV/m)Q < 66 dB (μV/m)M
0.5 MHz to 5 MHz	< 73 dB (μV/m)Q < 60 dB (μV/m)M
5 MHz to 30 MHz	< 73 dB (μV/m)Q < 60 dB (μV/m)M

1.3 Shipping and storage conditions for modules and backup batteries

Introduction

The shipping and storage conditions of S7-300 modules surpass requirements to IEC 61131-2. The data below apply to modules shipped or put on shelf in their original packing.

The modules are compliant with climatic conditions to IEC 60721-3-3, Class 3K7 (storage), and with IEC 60721-3-2, Class 2K4 (shipping.)

Mechanical conditions are compliant with IEC 60721-3-2, Class 2M2.

Shipping and storage conditions for modules

Type of condition	Permissible range
Free fall (in shipping package)	≤ 1 m
Temperature	- 40 °C to + 70 °C
Barometric pressure	1080 hPa to 660 hPa (corresponds with an altitude of -1000 m to 3500 m)
Relative humidity	10% to 95%, no condensation
Sinusoidal oscillation to IEC 60068-2-6	5 Hz to 9 Hz: 3.5 mm 9 Hz to 150 Hz: 9.8 m/s ²
Shock to IEC 60068-2-29	250 m/s ² , 6 ms, 1000 shocks

Shipment of backup batteries

Backup batteries should always be shipped in their original package. Note the regulations governing the transport of hazardous goods. The backup battery has a lithium content of approx. 0.25 g.

Storing backup batteries

Always store backup batteries in a cool and dry place. The batteries have a maximum shelf life of 5 years.



Warning

Improper handling of backup batteries can result in injury and damage to property. Improperly handled backup batteries may explode or cause severe burns.

Observe the following rules when handling the backup batteries of your S7-300 automation system:

- Never charge the batteries
- Never heat the batteries
- Never throw the batteries in an open fire
- Never damage the batteries mechanically (drill, squeeze, etc.)

1.4 Mechanical and ambient climatic conditions for S7-300 operation

Operating conditions

S7-300 systems are designed for stationary use in weather-proof locations. The operating conditions surpass requirements to DIN IEC 60721-3-3.

- Class 3M3 (mechanical requirements)
- Class 3K3 (climatic requirements)

Use with additional measures

The S7-300 may not be used under the conditions outlined below without taking additional measures:

- at locations with a high degree of ionizing radiation
- in aggressive environments caused, for example, by
 - the development of dust
 - corrosive vapors or gases
 - strong electric or magnetic fields
- in installations requiring special monitoring, for example
 - elevators
 - electrical plants in potentially hazardous areas

An additional measure could be an installation of the S7-300 in a cabinet or housing.

Mechanical environmental conditions

The table below shows the mechanical environmental conditions in the form of sinusoidal oscillations.

Frequency band	Continuous	Infrequently
10 Hz ≤ f ≤ 58 Hz	0.0375 mm amplitude	0.75 mm amplitude
58 Hz ≤ f ≤ 150 Hz	0.5 g constant acceleration	1 g constant acceleration

Reducing vibrations

If your S7-300 modules are exposed to severe shock or vibration, take appropriate measures to reduce acceleration or the amplitude.

We recommend the installation of the S7-300 on damping materials (for example, rubber-bonded-to-metal mounting.)

Test of mechanical environmental conditions

The table below provides important information with respect to the type and scope of the test of ambient mechanical conditions.

Condition tested	Test Standard	Comment
Vibration	Vibration test to IEC 60068-2-6 (sinusoidal)	Type of oscillation: Frequency sweeps with a rate of change of 1 octave/minute. 10 Hz $\leq f \leq$ 58 Hz, constant amplitude 0.075 mm 58 Hz $\leq f \leq$ 150 Hz, constant acceleration 1 g Duration of oscillation: 10 frequency sweeps per axis at each of three vertically aligned axes
Shock	Shock, tested to IEC 60068-2-27	Type of shock: half-sine Shock intensity: 15 g peak value, 11 ms duration Shock direction: 3 shocks in each direction (+/-) at each of three vertically aligned axes
Continuous shock	Shock, tested to IEC 60068-2-29	Type of shock: half-sine Shock intensity: 25 g peak value, 6 ms duration Shock direction: 1000 shocks in each direction (+/-) at each of three vertically aligned axes

Climatic environmental conditions

The S7-300 may be operated on following environmental conditions:

Environmental conditions	Permissible range	Comments
Temperature: horizontal mounting position: vertical mounting position:	0°C to 60°C 0°C to 40°C	
Relative humidity	10 % to 95 %	No condensation, corresponds to relative humidity (RH) Class 2 to IEC 61131, Part 2
Barometric pressure	1080 hPa to 795 hPa	Corresponds with an altitude of -1000 m to 2000 m
Concentration of pollutants	SO ₂ : < 0.5 ppm; RH < 60 %, no condensation H ₂ S: < 0.1 ppm; RH < 60 %, no condensation	Test: 10 ppm; 4 days Test: 1 ppm; 4 days

1.5 Information on insulation tests, protection class, degree of protection and rated voltage of the S7-300

Test voltage

Proof of dielectric strength must be provided in the type test at a test voltage to IEC 61131-2:

Circuits with rated voltage V_n to other circuits or ground.	Test voltage
< 50 V	500 VDC
< 150 V	2500 VDC
< 250 V	4000 VDC

Protection class

Protection class I to IEC 60536, i.e., a protective conductor must be connected to the mounting rail!

Protection against the ingress of foreign matter and water

- Degree of protection IP 20 to IEC 60529, i.e., protection against contact with standard probes.

No protection against the ingress of water.

1.6 Rated voltages of the S7-300

Rated operating voltages

The S7-300 modules operate at different rated voltages. The table shows the rated voltages and corresponding tolerances.

Rated voltages	Tolerance
24 VDC	20.4 VDC to 28.8 VDC
120 VAC	93 VAC to 132 VAC
230 VAC	187 VAC to 264 VAC

1.7 SIPLUS S7-300 Modules

Definition

SIPLUS S7-300 modules can be used under extended environmental conditions. Meaning of "extended environmental conditions":

- suitable for operation at - 25 °C to + 60 °C
- infrequent, short-term condensation permitted
- increased mechanical stress permissible

Comparison with "standard" modules

The functionality and technical data of SIPLUS S7-300 modules and of "standard" modules are identical.

The mechanical/climatic environmental conditions and the method of testing these have changed.

SIPLUS S7-300 modules have a separate order number (see the table below.)

Project design in STEP 7

SIPLUS S7-300 modules are not included in the hardware catalog. Please design your plant based on the relevant "standard" modules shown in the table below.

SIPLUS S7-300 Modules

The table below lists all SIPLUS S7-300 modules.

In addition, we included the order numbers of the corresponding "standard" modules to support project design. You can refer to specifications and technical data in the special "standard" module section.

You will find more information about SIPLUS and contacts on the Internet at <http://www.automation.siemens.com/siplus>

Table 1-2 SIPLUS S7-300 Modules

Module type	SIPLUS S7-300 modules for the use under extended environmental conditions	"Standard" modules
	as of order no.	
PS 305; 2A PS 307; 5A	6AG1 305-1BA80-0AA0 6AG1 307-1EA80-0AA0	--- 6ES7307-1EA00-0AA0
IM 153-1	6AG1 153-1AA03-2XB0	6ES7153-1AA03-0XB0
CPU 312C CPU 313C CPU 314 CPU 315-2 DP	6AG1 312-5BD00-2AB0 6AG1 313-5BE00-2AB0 6AG1 314-1AF10-2AB0 6AG1 315-2AG10-2AB0	6ES7312-5BD00-0AB0 6ES7313-5BE00-0AB0 6ES7314-1AF10-0AB0 6ES7315-2AG10-0AB0
IM 365	6AG1365-0BA01-2AA0	6ES7365-0BA01-0AA0
Digital input module SM 321; DI 16 x DC 24V SM 321; DI 32 x DC 24V SM 321; DI 16 x DC 24V SM 321; DI 16 x DC 24 V-125 V SM 321; DI 8 x AC 120/230V	6AG1 321-1BH02-2AA0 6AG1 321-1BL00-2AA0 6AG1 321-7BH01-2AB0 6AG1 321-1CH20-2AA0 6AG1 321-1FF01-2AA0	6ES7321-1BH02-0AA0 6ES7321-1BL00-0AA0 6ES7321-7BH01-0AB0 6ES7321-1CH20-0AA0 6ES7321-1FF01-0AA0
Digital output module SM 322; DO 16 x DC 24V/0.5A SM 322; DO 8 x Rel. AC 230V/5A SM 322; DO 8 x DC 48-125 V/1.5 A SM 322; DO 8 x AC 120/230V/2A SM 322; DO 8 x DC 24V/0.5A	6AG1 322-1BH01-2AA0 6AG1 322-1HF10-2AA0 6AG1 322-1CF00-2AA0 6AG1 322-1FF01-2AA0 6AG1 322-8BF00-2AB0	6ES7322-1BH01-0AA0 6ES7322-1HF10-0AA0 6ES7322-1CF00-0AA0 6ES7322-1FF01-0AA0 6ES7322-8BF00-0AB0
Digital I/O module SM 323; DI8/DO8 x DC 24V/0.5A	6AG1 323-1BH01-2AA0	6ES7323-1BH01-0AA0
Analog input module SM 331; AI 2 x 12Bit	6AG1 331-7KB02-2AB0	6ES7331-7KB02-0AB0
Analog output module SM 332; AO 2 x 12Bit	6AG1 332-5HB01-2AB0	6ES7332-5HB01-0AB0
Analog IO module SM 334; AI4/AO 2 x 12Bit	6AG1 334-0KE00-2AB0	6ES7334-0KE00-0AB0

1.8 Mechanical and climatic environmental operating conditions for SIPLUS S7-300 modules

Mechanical environmental conditions

Operating category: to IEC 721 3-3, Class 3M4.

Test of mechanical environmental conditions

The table provides information on the type and scope of the test of mechanical environmental conditions for SIPLUS S7-300 modules.

Table 1-3 SIPLUS S7-300 Modules: Test of mechanical environmental conditions

Condition tested	Test Standard	Remarks
Vibration	Vibration test acc. to IEC 60068-2-6 (sinusoidal)	Type of oscillation: Frequency sweep at a rate of change of 1 octave/minute. 5 Hz ≤ f ≤ 9 Hz, constant Amplitude 3.5 mm 9 Hz ≤ f ≤ 150 Hz, constant Acceleration 1 g duration of oscillation: 10 frequency sweeps at each of three vertically aligned axes
Shock	Shock, tested acc. to IEC 60068-2-27	Type of shock: half-sine Severity of shock: 15 g peak value, 11 ms duration Direction of shock: 3 shocks each in +/- direction in each of the three vertically aligned axes

Climatic environmental conditions

Climatic environmental operating conditions of SIPLUS S7-300 modules:

Operating category: to IEC 721 3-3, Class 3K5.

Table 1-4 SIPLUS S7-300 Modules: Climatic environmental conditions

Ambient temperature	Permitted range	Remarks
Temperature: Horizontal mounting position: Vertical mounting position:	-25 °C to 60 °C -25 °C to 40 °C	-
Relative humidity	5 % to 95 %	Infrequent, short-term condensation, corresponds with a relative humidity (RH) Class 2 to IEC 61131 Part 2
Pollutant concentration (to IEC 721 3-3; Class 3C3)	SO ₂ : < 0.5 ppm; Relative humidity < 60 % H ₂ S: < 0.1ppm; Relative humidity < 60%	Test: 10 ppm; 4 days 1 ppm; 4 days

Power supply modules

Introduction

Various 24-VDC power supply modules are available for your S7-300 PLC and the sensors/actuators.

Power supply modules

This chapter contains the technical data of the S7-300 power supply modules.

In addition to technical data, this chapter describes:

- The characteristics
- Wiring diagram
- Block Diagram
- Line protection
- Reaction to atypical operating conditions

2.1 Power Supply Module PS 305; 2 A; (6AG1305-1BA80-0AA0)

Order number "SIPLUS S7-300 module"

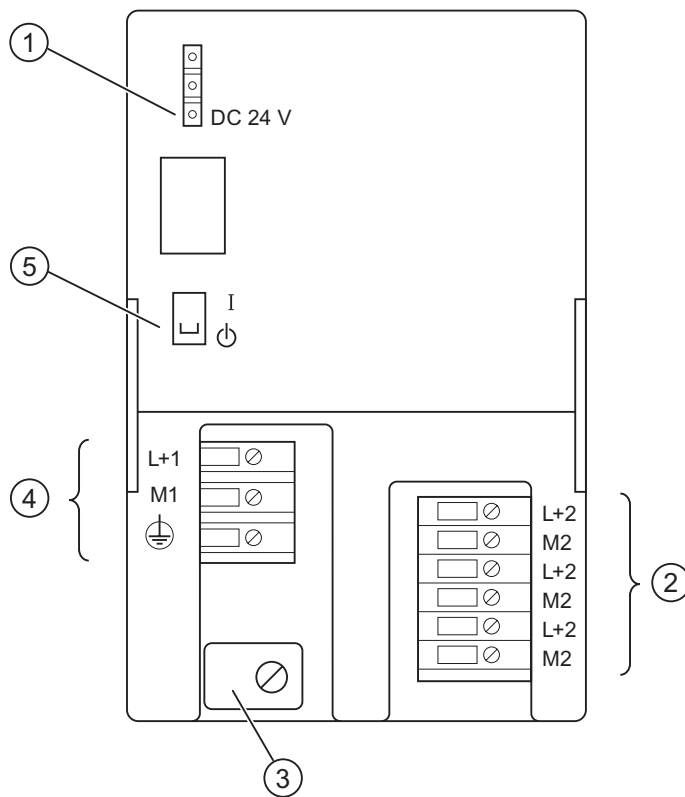
6AG1 305-1BA80-0AA0

Properties

Properties of the PS 305 power supply module (2 A):

- Output current 2 A
- Output voltage 24 VDC; short circuit-proof, open circuit-proof
- Connection to DC power supply
(rated input voltage 24/48/72/96/110 VDC)
- Safety isolation to EN 60 950
- May be used as load power supply

Wiring diagram of PS 305; 2 A



- ① "24 VDC output voltage present" display
- ② Terminals for 24 VDC output voltage
- ③ Strain-relief
- ④ Mains and protective conductor terminals
- ⑤ 24 VDC On/Off switch

Block diagram of PS 305; 2 A

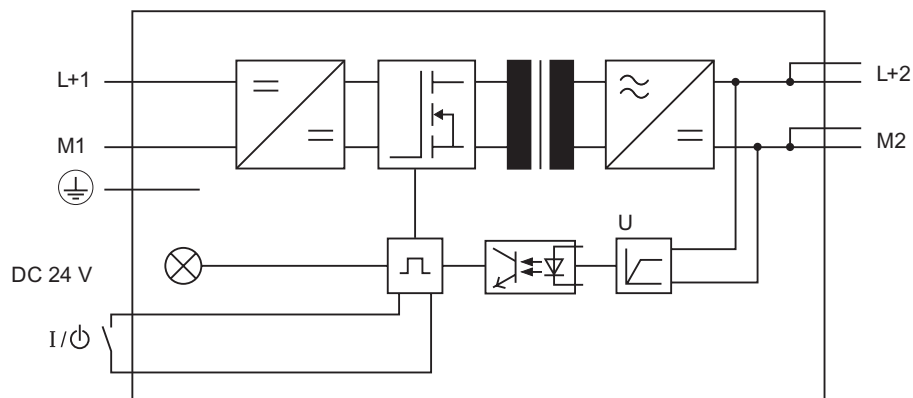


Figure 2-1 Block diagram of power supply module PS 305; 2 A

Line protection

The mains supply of the PS 305 power supply module (2 A) should be protected with a miniature circuit-breaker (for example Siemens 5SN1 series) of the following rating:

- Rated current at 110 VDC: 10 A
- Tripping characteristics (type): C.

Reaction to atypical operating conditions

Table 2-1 Reaction of the PS 305;(2 A) power supply module to atypical operating conditions

If ...	... then ...	24 VDC LED
... the output circuit is overloaded: • $I > 3.9 \text{ A}$ (dynamic) • $3 \text{ A} < I \leq 3.9 \text{ A}$ (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	flashes
... short-circuit at the output	Output voltage 0 V; automatic voltage recovery after short-circuit is eliminated	off
overvoltage on primary side	risk of destruction	-
undervoltage on primary side	Automatic shut-down; automatic voltage recovery	off

Technical data of PS 305; 2 A (6ES7305-1BA80-0AA0)

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 120
Weight	approx. 740 g
Input parameters	
Input voltage • Rated value • Voltage range	24/48/72/96/110 VDC 16.8 VDC to 138 VDC
Rated input current • at 24 V • at 48 V • at 72 V • at 96 V • at 110 V	2.7 A 1.3 A 0.9 A 0.65 A 0.6 A
Inrush current (at 25 °C)	20 A
I^2t (at inrush current)	5 A ² s
Output parameters	
Output voltage • Rated value • Permissible range	24 VDC 24 V $\pm$ 3 %, open circuit-proof
• Rampup time	max. 3 s

Technical data	
Output current	2 A; ¹⁾
• Rated value	parallel connection supported
Short-circuit protection	electronic, non-latching, 1.65 to 1.95 x I _N
Residual ripple	max. 150 mV _{pp}
Electrical parameters	
Safety class to IEC 536 (DIN VDE 0106, Part 1)	I, with protective conductor
Isolation rating	
• Rated isolation voltage (24 V to input)	150 VAC
• Test voltage	2800 VDC
Safety isolation	SELV circuit
Buffering of power supply failure (at 24/48/72/96/110 V)	> 10 ms
• Repeat rate	min. 1 s
Efficiency	75 %
Power consumption	64 W
Power loss	16 W
Diagnostics	
"Output voltage present" display	yes, green LED

¹⁾ at a limited input voltage range > 24 V (DC 24 ... 138 V), PS 305 can be loaded to 3 A.

2.2 Power supply module PS 307; 2 A; (6ES7307-1BA00-0AA0)

Order number

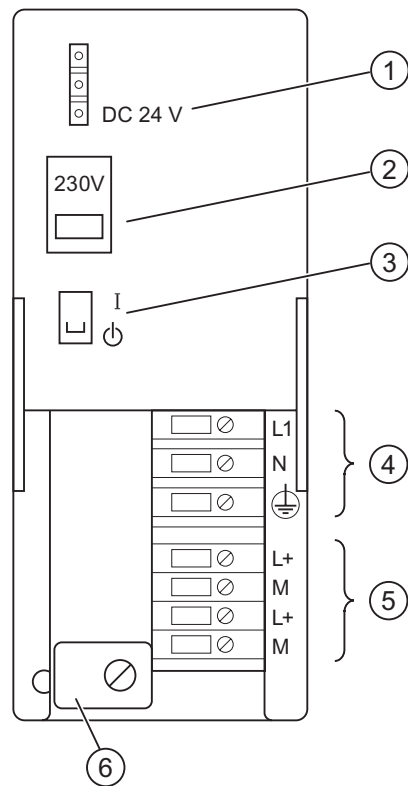
6ES7307-1BA00-0AA0

Properties

Properties of the PS 307; 2 A power supply module:

- Output current 2 A
- Output voltage 24 VDC; short circuit-proof, open circuit-proof
- Connection to singlephase AC mains
(rated input voltage 120/230 VAC, 50/60 Hz)
- Safety isolation to EN 60 950
- May be used as load power supply

Wiring diagram of PS 307; 2 A



- ① "24 VDC output voltage present" display
- ② Mains selector switch
- ③ 24 VDC On/Off switch
- ④ Mains and protective conductor terminals
- ⑤ Terminals for 24 VDC output voltage
- ⑥ Strain-relief

Block diagram of PS 307; 2 A

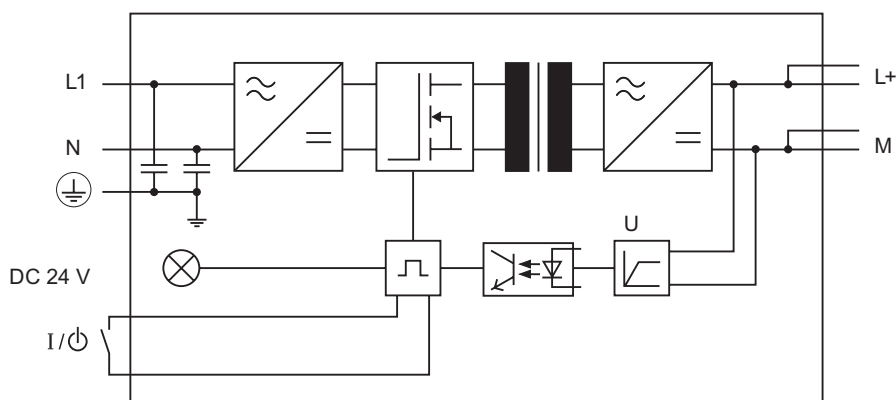


Figure 2-2 Block diagram of power supply module PS 307; 2 A

Line protection

The mains supply of the PS 307; 2A power supply module should be protected with a miniature circuit-breaker (for example Siemens 5SN1 series) of the following rating:

- Rated current at 230 VAC: 6 A
- Tripping characteristics (type): C.

Reaction to atypical operating conditions

Table 2-2 Reaction of the PS 307; 2A power supply module to atypical operating conditions

If ...	... then ...	24 VDC LED
the output circuit is overloaded: • $I > 2.6 \text{ A}$ (dynamic) • $2 \text{ A} < I \leq 2.6 \text{ A}$ (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	flashes
short-circuit at the output	Output voltage 0 V; automatic voltage recovery after short-circuit is eliminated	off
overvoltage on primary side	risk of destruction	-
undervoltage on primary side	Automatic shut-down; automatic voltage recovery	off

Technical data of PS 307; 2 A (6ES7307-1BA00-0AA0)

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	50 x 125 x 120
Weight	approx. 420 g
Input parameters	
Input voltage	AC 120 V/230 V
• Rated value	
Mains frequency	
• Rated value	50 Hz or 60 Hz
• Permissible range	47 Hz to 63 Hz
Rated input current	0.5 A 0.8 A
• at 230 V	
• at 120 V	
Inrush current (at 25 °C)	20 A
I ² t (at inrush current)	1 A ² s
Output parameters	
Output voltage	24 VDC 24 V ± 5 %, open circuit-proof max. 2.5 s
• Rated value	
• Permissible range	
• Rampup time	
Output current	2 A, parallel wiring not supported
• Rated value	
Short-circuit protection	electronic, non-latching 1.1 to 1.3 x I _N
Residual ripple	max. 150 mV _{pp}
Electrical parameters	
Safety class to IEC 536 (DIN VDE 0106, Part 1)	I, with protective conductor
Isolation rating	AC 250 V DC 2800 V
• Rated insulation voltage (24 V to L1)	
• Test voltage	
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V)	min. 20 ms
• Repeat rate	min 1 s
Efficiency	83 %
Power consumption	58 W
Power loss	typ. 10 W
Diagnostics	
"Output voltage present" display	yes, green LED

2.3 PS 307; 5 A power supply module; (6ES7307-1EAx0-0AA0)

Order number: "Standard module"

6ES7307-1EA00-0AA0

Order number "SIPLUS S7 module"

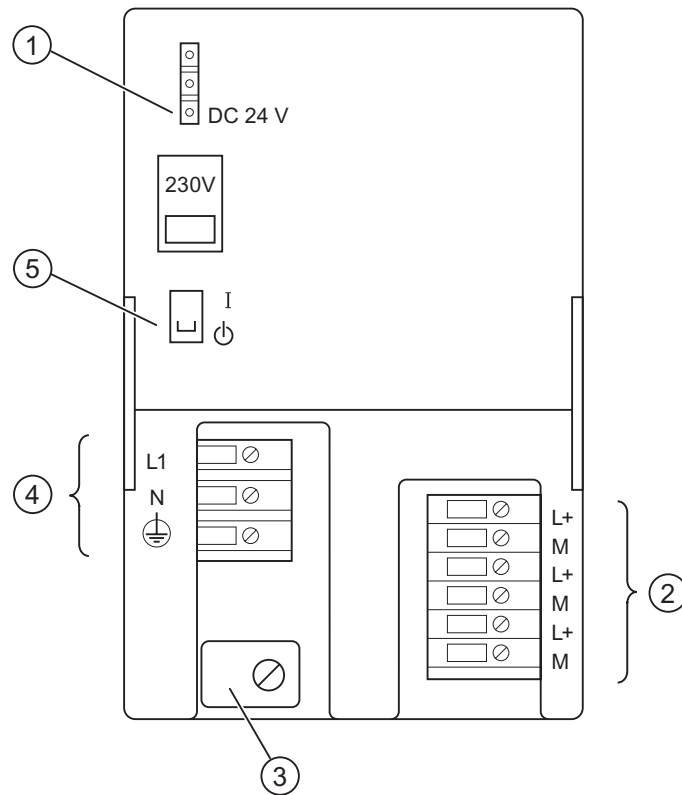
6AG1 307-1EA80-0AA0

Properties

Properties of the PS 307; 5 A power supply module:

- Output current 5 A
- Output voltage 24 VDC; short circuit-proof, open circuit-proof
- Connection to singlephase AC mains
(rated input voltage 120/230 VAC, 50/60 Hz)
- Safety isolation to EN 60 950
- May be used as load power supply

Wiring diagram of PS 307; 5 A



- ① "24 VDC output voltage present" display
- ② Terminals for 24 VDC output voltage
- ③ Strain-relief
- ④ Mains and protective conductor terminals
- ⑤ 24 VDC On/Off switch
- ⑥ Mains selector switch

Block diagram of PS 307; 5 A

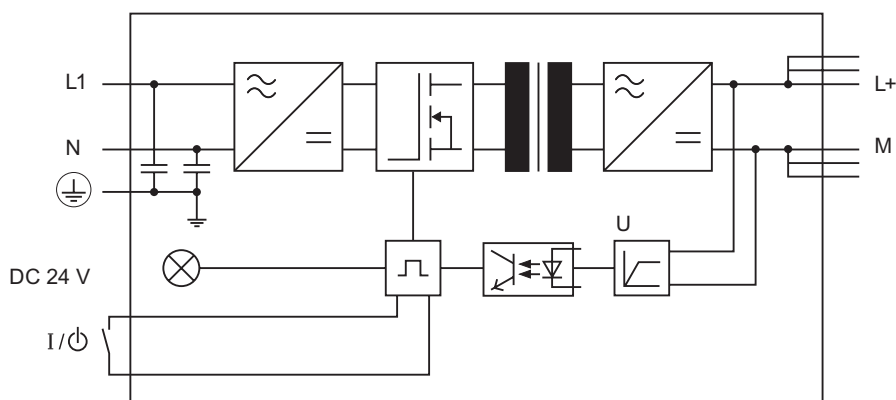


Figure 2-3 Block diagram of the PS 307; 5A

Line protection

To protect the mains supply line of the PS 307; 5 A power supply module, you should install a miniature circuit-breaker (for example Siemens 5SN1 series) of the following rating:

- Rated current at 230 VAC: 10 A
- Tripping characteristics (type): C.

Reaction to atypical operating conditions

Table 2-3 Reaction of the PS 307; 5A power supply module to atypical operating conditions

If ...	... then ...	24 VDC LED
the output circuit is overloaded: • $I > 6.5 \text{ A}$ (dynamic) • $5 \text{ A} < I \leq 6.5 \text{ A}$ (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	flashes
short-circuit at the output	Output voltage 0 V; automatic voltage recovery after short-circuit is eliminated	off
overvoltage on primary side	risk of destruction	-
undervoltage on primary side	Automatic shut-down; automatic voltage recovery	off

Technical data of PS 307; 5 A (6ES7307-1EA00-0AA0)

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 120
Weight	approx. 740 g
Input parameters	
Input voltage	
• Rated value	120 / 230 VAC
Mains frequency	
• Rated value	50 Hz or 60 Hz
• Permissible range	47 Hz to 63 Hz
Rated input current	
• at 120 V	2 A
• at 230 V	1 A
Inrush current (at 25 °C)	45 A
I ² t (at inrush current)	1.2 A ² s
Output parameters	
Output voltage	
• Rated value	24 VDC
• Permissible range	24 V ± 5 %, open circuit-proof
• Rampup time	max. 2.5 s
Output current	
• Rated value	5 A parallel wiring not supported
Short-circuit protection	electronic, non-latching 1.1 to 1.3 x I _N
Residual ripple	max. 150 mV _{pp}
Electrical parameters	
Safety class to IEC 536 (DIN VDE 0106, Part 1)	I, with protective conductor
Isolation rating	
• Rated isolation voltage (24 V to L1)	250 VAC
• Test voltage	2800 VDC
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V)	min. 20 ms
• Repeat rate	min 1 s
Efficiency	87 %
Power consumption	138 W
Power loss	typ. 18 W
Diagnostics	
"Output voltage present" display	yes, green LED

Technical data of PS 307; 5 A (6AG1307-1EA80-0AA0)

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 120
Weight	approx. 570 g
Input parameters	
Input voltage	
• Rated value	120/230 VDC
Mains frequency	
• Rated value	50 Hz or 60 Hz
• Permissible range	47 Hz to 63 Hz
Rated input current	
• at 120 V	2.1 A
• at 230 V	1.2 A
Inrush current (at 25 °C)	45 A
I ² t (at inrush current)	1.8 A ² s
Output parameters	
Output voltage	
• Rated value	DC 24 V
• Permissible range	24 ± V 3 %
• Rampup time	max. 3 s
Output current	
• Rated value	5 A; parallel wiring not supported
Short-circuit protection	electronic, non-latching
	1.1 to 1.3 x I _N
Residual ripple	max. 150 mV _{pp}
Electrical parameters	
Safety class to IEC 536 (DIN VDE 0106, Part 1)	I, with protective conductor
Isolation rating	
• Rated isolation voltage (24 V to L1)	AC 250 V
• Test voltage	DC 2800 V
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V)	min. 20 ms
• Repeat rate	min. 1 s
Efficiency	84 %
Power consumption	143 W
Power loss	23 W
Diagnostics	
"Output voltage present" display	yes, green LED

2.4 PS 307; 10 A power supply module; (6ES7307-1KA00-0AA0)

Order number

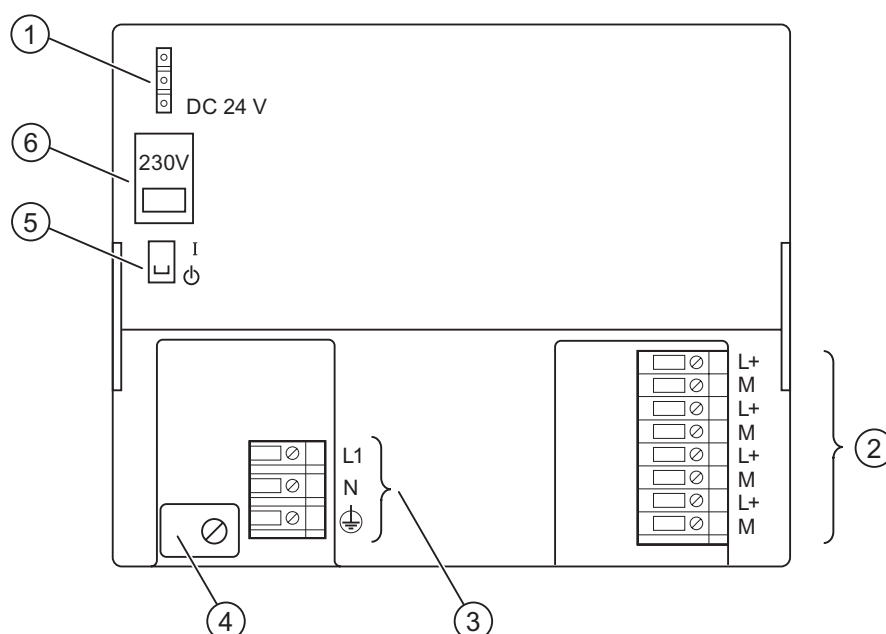
6ES7307-1KA00-0AA0

Properties

Properties of the PS 307; 10 A power supply module:

- Output current 10 A
- Output voltage 24 VDC; short circuit-proof, open circuit-proof
- Connection to singlephase AC mains
(rated input voltage 120/230 VAC, 50/60 Hz)
- Safety isolation to EN 60 950
- May be used as load power supply

Wiring diagram of PS 307; 10 A



- ① "24 VDC output voltage present" display
- ② Terminals for 24 VDC output voltage
- ③ Mains and protective conductor terminals
- ④ Strain-relief
- ⑤ 24 VDC On/Off switch
- ⑥ Mains selector switch

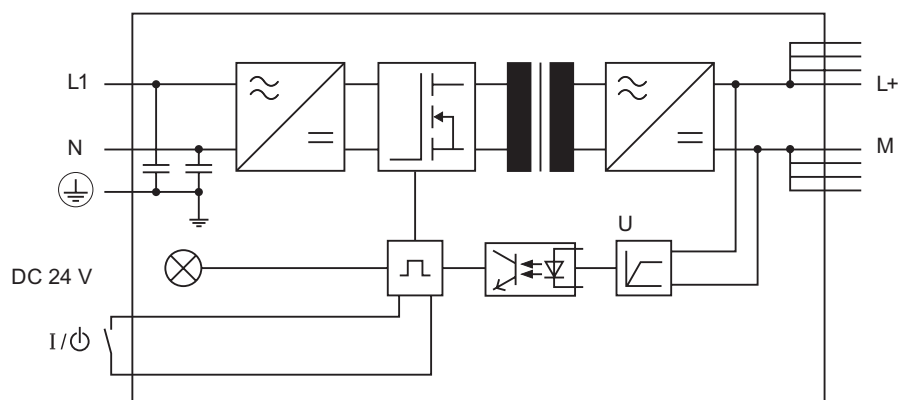
Block diagram of PS 307; 10 A

Figure 2-4 Block diagram of the PS 307; 10A power supply module

Line protection

To protect the mains supply line of the PS 307; 10A power supply module, you should install a miniature circuit-breaker (for example Siemens 5SN1 series) of the following rating:

- Rated current at 230 VAC: 16 A
- Tripping characteristics (type): C.

Reaction to atypical operating conditions

Table 2-4 Reaction of the PS 307; 10A power supply module to atypical operating conditions

If ...	Module reaction	24 VDC LED
.output circuit is overloaded: • $I > 13 \text{ A}$ (dynamic) • $10 \text{ A} < I \leq 13 \text{ A}$ (static)	Voltage dip, automatic voltage recovery Voltage drop (reduction of service life)	flashes
short-circuit at the output	Output voltage 0 V; automatic voltage recovery after short-circuit is eliminated	off
overvoltage on primary side	risk of destruction	-
undervoltage on primary side	Automatic shut-down; automatic voltage recovery	off

Technical data of PS 307; 10 A (6ES7307-1KA00-0AA0)

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	200 x 125 x 120
Weight	1.2 kg
Input parameters	
Input voltage	
• Rated value	120 / 230 VAC
Mains frequency	
• Rated value	50 Hz or 60 Hz
• Permissible range	47 Hz to 63 Hz
Rated input current	
• at 230 V	1.7 A
• at 120 V	3.5 A
Inrush current (at 25 °C)	55 A
I ² t (at inrush current)	9 A ² s
Output parameters	
Output voltage	
• Rated value	24 VDC
• Permissible range	24 V ± 5 %, open circuit-proof
• Rampup time	max. 2.5 s
Output current	
• Rated value	10 A, parallel wiring not supported
Short-circuit protection	electronic, non-latching 1.1 to 1.3 x I _N
Residual ripple	max. 150 mV _{pp}
Electrical parameters	
Safety class to IEC 536 (DIN VDE 0106, Part 1)	I, with protective conductor
Isolation rating	
• Rated isolation voltage (24 V to L1)	AC 250 V
• Test voltage	DC 2800 V
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V)	min. 20 ms
• Repeat rate	min 1 s
Efficiency	89 %
Power consumption	270 W
Power loss	typ. 30 W
Diagnostics	
"Output voltage present" display	yes, green LED

Digital modules

Chapter layout

Topical structure of this chapter:

1. Chapter overview of which modules are available and described here
2. Overview of essential module properties
3. Steps in selecting and commissioning the digital module
4. General information, i.e. global data applicable to all digital modules (parameter assignment and diagnostics, for example)
5. Module-specific information (properties, connection and block diagrams, technical data and special features of the module):
 - a) for digital input modules
 - b) for digital output modules
 - c) for relay output modules
 - d) for digital IO modules

Installation and wiring

You will find information about installation and wiring in Operating Instructions S7-300, CPU 31xC, and CPU 31x: Installation. Online at:
<http://support.automation.siemens.com/WW/view/de/13008499>.

Further information

The structure of parameter sets (data records 0, 1 and 128) is described in the system data section of the appendix. You must be familiar with this structure if you want to modify module parameters in the STEP 7 user program.

The structure of diagnostic data (data records 0 and 1) is described in the system data section of the appendix. You must be familiar with this structure if you want to analyze diagnostics data of the modules in the STEP 7 user program.

See also

Principles of programming signal modules in the user program (Page A-1)

Evaluating diagnostic data of signal modules in the user program (Page B-1)

3.1 Module overview

Introduction

The tables below summarize the essential properties of the digital modules. This overview supports you in selecting a module to suit your requirements.

Overview of properties

The table below shows essential properties of the digital input modules

Table 3-1 Digital input modules:

Properties	Module					
	SM 321; DI 32 x DC 24 V (-1BL00-)	SM 321; DI 32 x AC 120 V (-1EL00-)	SM 321; DI 16 x DC 24 V (-1BH02-)	SM 321; DI 16 x DC 24 V High Speed (-1BH10-)	SM 321; DI 16 x DC 24 V with process and diagnostic interrupt (-7BH01-)	SM 321; DI 16 x DC 24 V; source input (-1BH50-)
Number of inputs	32 DI; electrically isolated in groups of 16	32 DI; electrically isolated in groups of 8	16 DI; electrically isolated in groups of 16	16 DI; electrically isolated in groups of 16	16 DI; electrically isolated in groups of 16	16 DI, source input, electrically isolated in groups of 16
Rated input voltage	24 VDC	120 VAC	24 VDC	24 VDC	24 VDC	24 VDC
Suitable for...	Switches; 2-wire, 3-wire and 4-wire proximity switches (BEROs)					
Isochronous mode supported	No	No	No	Yes	Yes	No
Programmable diagnostics function	No	No	No	No	Yes	No
Diagnostic interrupt	No	No	No	No	Yes	No
Edge-triggered hardware interrupt	No	No	No	No	Yes	No
Adjustable input delay times	No	No	No	No	Yes	No
Special features	-	-	-	-	2 short circuit- proof encoder supplies per 8 channels; external redundant supply of encoders is supported	-

Table 3-2 Digital input modules: Overview of properties (continued)

Properties	Module					
	SM 321; DI 16 x 24/48VUC (-1CH00-)	SM 321; DI 16 x 48-125 VDC (-1CH20-)	SM 321; DI 16 x 120/230 VAC (-1FH00-)	SM 321; DI 16 x NAMUR (-7TH00-) *	SM 321; DI 8 x 120/230 VAC (-1FF01-)	SM 321; DI 8 x 120/230 VAC ISOL (-1FF10-)
Number of inputs	16 DI; electrically isolated in groups of 1	16 DI; electrically isolated in groups of 8	16 DI; electrically isolated in groups of 4	16 DI; electrically isolated in groups of 2	8 DI; electrically isolated in groups of 2	8 DI; electrically isolated in groups of 1
Rated input voltage	24 VDC to 48 VDC, 24 VAC to 48 VAC	48 VDC to 125 VDC	120/230 VAC	120/230 VAC	120/230 VAC	120/230 VAC
Suitable for...	Switches; 2-wire, 3-wire and 4-wire proximity switches (BEROs)		Switches; 2-wire / 3-wire AC proximity switches	NAMUR encoder	Switches; 2-wire / 3-wire AC proximity switches	
Supports isochronous mode	No	No	No	No	No	No
Programmable diagnostics function	No	No	No	Yes	No	No
Diagnostic interrupt	No	No	No	Yes	No	No
Edge-triggered hardware interrupt	No	No	No	No	No	No
Adjustable input delays	No	No	No	No	No	No
Special features	-	-	-		-	-

* A description of this module can be found in Manual ET 200M signal modules for process automation. You will find this manual online at:
<http://support.automation.siemens.com/WW/view/de/7215812>.

Overview of properties

The table below shows essential properties of the digital output modules

Table 3-3 Digital output modules

Properties	Module					
	SM 322; DO 32 x DC 24 V/ 0.5 A (-1BL00-)	SM 322; DO 32 x AC 120/230V/ 1 A (-1FL00-)	SM 322; DO 16 x DC 24 V/ 0.5 A (-1BH01-)	SM 322; DO 16 x DC 24 V/ 0.5 A High Speed (-1BH10-)	SM 322; DO 16 x UC 24/48 V (-5GH00-)	SM 322; DO 16 x DC 120/230 V/ 1 A (-1FH00-)
Number of outputs	32 DO; electrically isolated in groups of 8	32 DO; electrically isolated in groups of 8	16 DO; electrically isolated in groups of 8	16 DO; electrically isolated in groups of 8	16 DO; electrically isolated in groups of 1	16 DO; electrically isolated in groups of 8
Output current	0.5 A	1.0 A	0.5 A	0.5 A	0.5 A	0.5 A
Rated load voltage	24 VDC	120 VAC	24 VDC	24 VDC	24 VDC to 48 VDC, 24 VAC to 48 VAC	120/230 VAC
Suitable for...	solenoid valves, DC contactors and signal lamps					
Supports isochronous mode	No	No	No	Yes	No	No
Programmable diagnostics function	No	No	No	No	Yes	No
Diagnostic interrupt	No	No	No	No	Yes	No
Substitution value output	No	No	No	No	Yes	No
Special features	-					

Table 3-4 Digital output modules: Overview of properties (continued)

Properties	Module					
	SM 322; DO 16 x DC 24 V/ 0.5 A (-8BH00-) (-8BH01-)	SM 322; DO 8 x DC 24 V/ 2 A (-1BF01-)	SM 322; DO 8 x DC 24 V/0.5 A, with diagnostic interrupt (-8BF00-)	SM 322; DO 8 x DC 48- 125 V/ 1.5 A (-1CF00-)	SM 322; DO 8 x AC 120/ 230 V/2A (-1FF01-)	SM 322;DO 8 x AC120/ 230 V/ 2A ISOL (-5FF00-)
Number of outputs	16 DO; electrically isolated in groups of 4	8 DO; electrically isolated in groups of 4	8 DO; electrically isolated in groups of 8	8 DO; electrically isolated in groups of 4, with reverse polarity protection	8 DO; electrically isolated in groups of 4	8 DO; electrically isolated in groups of 1
Output current	0.5 A	2 A	0.5 A	1.5 A	2 A	2 A
Rated load voltage	24 VDC	24 VDC	24 VDC	48 VDC to 125 VDC	120/230 VAC	120/230 VAC

Properties	Module					
	SM 322; DO 16 x DC 24 V/ 0.5 A (-8BH00-) (-8BH01-)	SM 322; DO 8 x DC 24 V/ 2 A (-1BF01-)	SM 322; DO 8 x DC 24 V/0.5 A, with diagnostic interrupt (-8BF00-)	SM 322; DO 8 x DC 48- 125 V/ 1.5 A (-1CF00-)	SM 322; DO 8 x AC 120/ 230 V/2A (-1FF01-)	SM 322;DO 8 x AC120/ 230 V/ 2A ISOL (-5FF00-)
Suitable for...	solenoid valves, DC contactors and signal lamps				AC solenoid valves, contactors, motor starters, FHP motors and signal lamps.	
Supports isochronous mode	No	No	No	No	No	No
Programmable diagnostics function	Yes	No	Yes	No	No	Yes
Diagnostic interrupt	Yes	No	Yes	No	No	Yes
Substitution value output	Yes	No	Yes	No	No	Yes
Special features	Redundant load control is supported	-	Redundant load control is supported	-	Fuse tripping indication Replaceable fuse for each group	-

* A description of this module can be found in Manual ET 200M signal modules for process automation. You will find this manual online at:
<http://support.automation.siemens.com/WW/view/de/7215812>.

Overview of properties

The table below shows the essential properties relay output modules

Table 3-5 Relay output modules

Properties	Module			
	SM 322; DO 16 x Rel. AC 120 V (-1HH01-)	SM 322; DO 8 x Rel. AC 230 V (-1HF01-)	SM 322; DO 8 x Rel. AC 230 V/ 5 A (-5HF00-)	SM 322; DO 8 x Rel. AC 230 V/ 5 A (-1HF10-)
Number of outputs	16 outputs, electrically isolated in groups of 8	8 outputs, electrically isolated in groups of 2	8 outputs, electrically isolated in groups of 1	8 outputs, electrically isolated in groups of 1
Rated load voltage	24 VDC to 120 VDC, 48 VAC to 230 VAC	24 VDC to 120 VDC, 48 VAC to 230 VAC	24 VDC to 120 VDC, 24 VAC to 230 VAC	24 VDC to 120 VDC, 48 VAC to 230 VAC
Suitable for...	AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps			
Supports isochronous mode	No	No	No	No
Programmable diagnostics function	No	No	Yes	No
Diagnostic interrupt	No	No	Yes	No
Substitution value output	No	No	Yes	No
Special features	-			

Overview of properties

The table below shows the essential properties of digital IO modules

Table 3-6 Digital IO modules

Properties	Module		
	SM 323; DI 16/DO 16 x DC 24 V/ 0.5 A (-1BL00-)	SM 323; DI 8/DO 8 x DC 24 V/0.5 A (-1BH01-)	SM 327; DI 8/DX 8 x DC 24 V/0.5 A, programmable (-1BH00-)
Number of inputs	16 inputs, electrically isolated in groups of 16	8 inputs, electrically isolated in groups of 8	8 digital inputs, plus 8 separately programmable inputs/outputs, electrically isolated in groups of 16
Number of outputs	16 outputs, electrically isolated in groups of 8	8 outputs, electrically isolated in groups of 8	
Rated input voltage	24 VDC	24 VDC	24 VDC
Output current	0.5 A	0.5 A	0.5 A
Rated load voltage	24 VDC	24 VDC	24 VDC
Inputs suitable for...	Switches and 2-/3-/4-wire proximity switches (BEROs).		
Outputs suitable for...	solenoid valves, DC contactors and signal lamps		
Supports isochronous mode	No	No	No
Programmable diagnostics	No	No	No
Diagnostic interrupt	No	No	No
Edge-triggered hardware interrupt	No	No	No
Adjustable input delay times	No	No	No
Substitution value output	No	No	No
Special features	-		

3.2 Steps in selecting and commissioning the digital module

Introduction

The table below contains the steps required to successfully complete commission of digital modules.

Although this sequence is suggested, you may nonetheless carry out specific steps, or install or commission other modules, at your own time (for example, assigning parameters to the module).

Step sequence

Table 3-7 Steps in selecting and commissioning the digital module

Step	Procedure	See...
1.	Selecting the module	<i>Modules overview</i> and the specific module chapter
2.	Installing the module in the SIMATIC S7 system	<i>Installation</i> chapter in the relevant PLC Installation Manual: - S7-300 Automation System, Hardware and Installation, or S7-400 / M7-400 Automation System, Hardware and Installation or - Distributed I/O Device ET 200M
3.	Assigning module parameters	<i>Diagnostics of the digital modules</i>
4.	Commission the configuration	<i>Commissioning</i> chapter in the relevant PLC installation manual: - S7-300 Automation System, Hardware and Installation, or S7-400 / M7-400 Automation System, Hardware and Installation or - Distributed I/O Device ET 200M
5.	If commissioning was not successful, analysis of the configuration	Chapter <i>Diagnostics of digital modules</i>

See also

Module overview (Page 3-2)

Programming digital modules (Page 3-8)

Diagnostics of digital modules (Page 3-9)

Parameters of digital output modules (Page A-4)

3.3 Programming digital modules

Introduction

Digital modules may have different properties. You can program the properties of certain modules.

All information in this chapter applies only to programmable digital modules:

- Digital input module SM 321; DI 16 x DC 24 V, with hardware and diagnostic interrupts, isochronous; (6ES7321-7BH01-0AB0)
- Digital output module SM 322; DO 8 x DC 24 V/0.5 A, with diagnostic interrupt; (6ES7322-8BF00-0AB0)
- Digital output module SM 322; DO 8 x AC120/230 V /2A ISOL (6ES7322-5FF00-0AB0)
- Relay output module SM 322; DO 8 x Rel. AC230V /5A (6ES7322-5HF00-0AB0)
- Digital IO module SM 327; DI 8/DX 8 x DC 24 V/0.5 A (6ES7327-1BH00-0AB0)

Programming tools

Only program the digital modules in STEP 7 while the CPU is in STOP.

After you defined all parameters, download these from your PG to the CPU. During its STOP → RUN transition, the CPU transfers the parameters to the relevant digital modules.

Static and dynamic parameters

Parameters are organized by static and dynamic properties.

Set the static parameters while the CPU is in STOP, as described earlier.

You may also edit dynamic parameters in the active user program of an S7 PLC using SFCs. However, the parameters set in STEP 7 will be applied again after a RUN → STOP, STOP → RUN transition of the CPU. The appendix *Parameter sets of the signal modules* describes the assignment of module parameters in the user program.

Parameters	configurable using	CPU operating state
static	PG (STEP 7 HW CONFIG)	STOP
dynamic	PG (STEP 7 HW CONFIG)	STOP
	SFC 55 in the user program	RUN

Parameters of digital modules

The configurable parameters are described in the specific module chapter.

See also

Parameters of digital input modules (Page A-2)

3.4 Diagnostics of digital modules

Introduction

The information provided in this chapter applies only to S7-300 digital modules with diagnostics functions.

- Digital input module SM 321; DI 16 x DC 24 V, with hardware and diagnostic interrupts, isochronous; (6ES7321-7BH01-0AB0)
- Digital output module SM 322; DO 16 x UC 24/48 V (6ES7322-5GH00-0AB0)
- Digital output module SM 322; DO 8 x DC 24 V/0.5 A, with diagnostic interrupt; (6ES7322-8BF00-0AB0)
- Digital output module SM 322; DO 8 x AC120/230 V /2A ISOL (6ES7322-5FF00-0AB0)
- Relay output module SM 322; DO 8 x Rel. AC230V /5A (6ES7322-5HF00-0AB0)

Programmable and non-programmable diagnostic messages

We distinguish between programmable and non-programmable diagnostic messages.

You only obtain programmable diagnostic messages if you have enabled diagnostics at the relevant parameters. Program the "Diagnostics" parameter block in STEP 7.

Digital modules always return non-programmable diagnostic messages, irrespective of diagnostics being enabled.

Reactions to diagnostic message in STEP 7

Actions initiated by diagnostic messages:

- The diagnostic message will be entered in the diagnostics data of the digital module, and is then passed to the CPU.
- The SF LED on the digital module is lit.
- When "Enable Diagnostic Interrupt" is set in STEP 7, the system triggers a diagnostic interrupt and calls OB82.

Reading diagnostic messages

You can read detailed diagnostic messages using SFCs in the user program (refer to the appendix "Diagnostic data of signal modules").

In STEP 7, you can view the cause of error by reading the module diagnostics data (refer to the STEP 7 Online Help.)

Diagnostic message using the SF LED

Digital modules with diagnostics function indicate errors at their SF LED (group error LED.) The SF LED lights up when the digital module generates a diagnostic message. It goes dark after all error states are cleared.

The SF LED also lights up to indicate external errors (short-circuit at the encoder supply), regardless of the CPU operating state (at POWER ON.)

Diagnostic messages and interrupt processing of digital modules

For information on diagnostic messages, their possible causes, troubleshooting measures, and possible interrupts refer to the specific module chapter.

3.5 How to protect digital modules from inductive overvoltages

Inductive overvoltages

Overvoltages occur when inductive reactance is deactivated. Examples of this are relay coils and contactors.

Integrated overvoltage protection

The digital output modules of S7-300 have integrated overvoltage protection equipment.

Extra overvoltage protection

Inductive reactances should only be configured with extra overvoltage protection equipment in the following instances:

- If SIMATIC output current circuits can be deactivated by extra fitted contacts (e.g. relay contacts).
- If the inductive reactances are not activated by SIMATIC modules.

Note: Ask the suppliers of inductive reactances what size of overvoltage protection equipment should be used.

Example

The following diagram shows an output current circuit which make extra overvoltage protection equipment necessary.

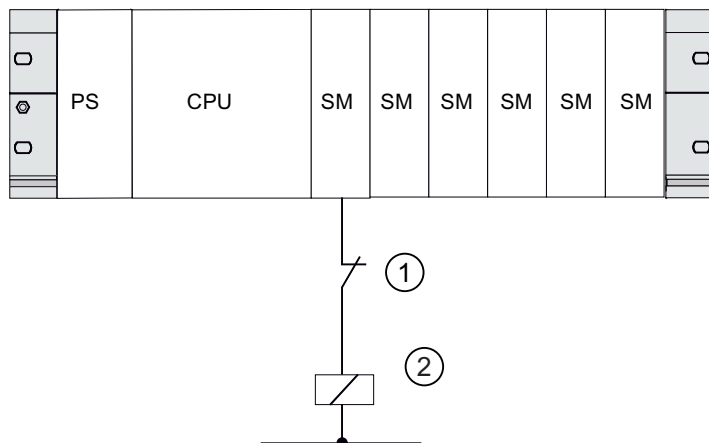


Figure 3-1 Relay contact for emergency stop in output current circuit

- ① Contact in output current circuit
- ② Inductive reactance needs a protective circuit

Configuration of coils operated with direct current

Coils operated with direct current are shown in the following diagram and configured with diodes or Z diodes.

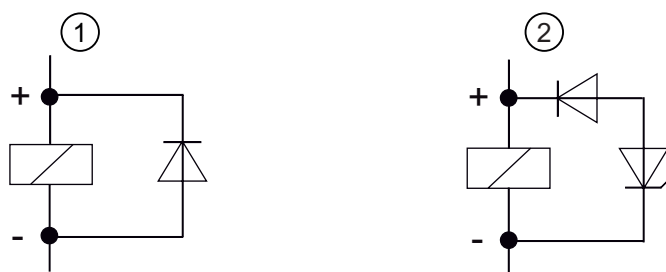


Figure 3-2 Configuration of coils operated with direct current

- ① with diode
- ② with Z diode

Configuration with diodes/Z diodes has the following characteristics:

- Switching overvoltages can be fully avoided. Z diode has higher transient voltage.
- High cut-out delay (6 to 9 times higher than without protective configuration).

Z diode cuts out faster than with the diode configuration.

Wiring of coils operated with alternating current

Coils operated with alternating current are shown in the diagram and are configured with varistors or RC elements.

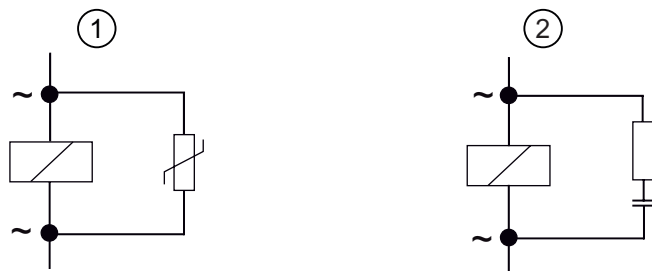


Figure 3-3 Wiring of coils operated with alternating current

- ① with varistor
- ② with RC element

Configuration with varistor has the following characteristics:

- The amplitude of transient voltage is limited but not damped.
- The steepness of the overvoltage remains the same.
- The cut-out delay is low.

Configuration with RC elements has the following characteristics:

- The amplitude and steepness of the switching overvoltage are reduced.
- The cut-out delay is low.

3.6 Digital input module SM 321; DI 32 x DC 24 V; (6ES7321-1BL00-0AA0)

Order number: "Standard module"

6ES7321-1BL00-0AA0

Order number: "SIPLUS S7-300 module"

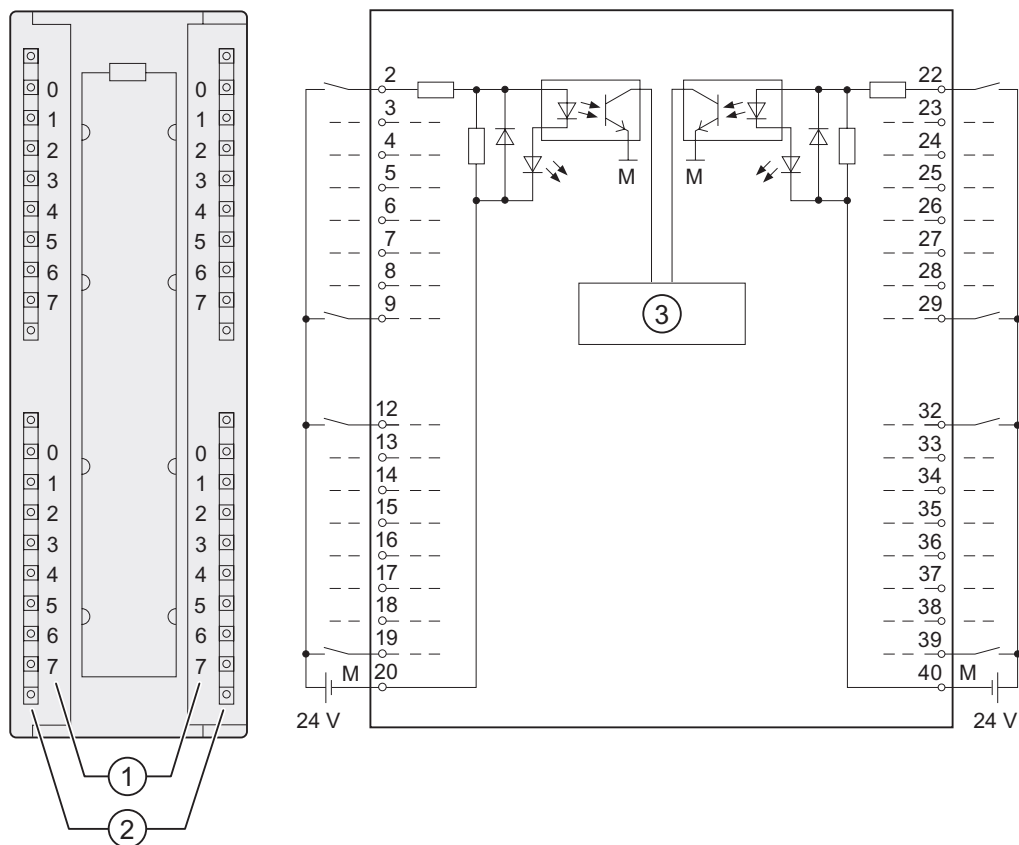
6AG1 321-1BL00-2AA0

Properties

Properties of SM 321; DI 32 x DC 24 V:

- 32 inputs, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- suitable for switches and 2- /3-/4-wire proximity switches (BEROs)

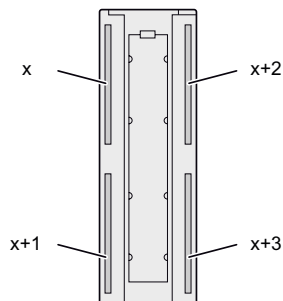
Wiring and block diagrams of SM 321; DI 32 x DC 24 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Terminal assignment of SM 321; DI 32 x DC 24 V

The figure below shows the channel addressing (input byte x up to input byte x+3).



Technical data of SM 321; DI 32 x DC 24 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 260 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	32
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Front connector	40-pin
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
• horizontal mounting position	
up to 40 °C	32
up to 60 °C	16
• vertical mounting position	32
up to 40 °C	
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	Yes
– in groups of	16
Permissible potential difference	
• between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 15 mA
Power loss of the module	typ. 6.5 W

Technical data	
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage - Rated value - for "1" signal - for "0" signal	24 VDC 13 V to 30 V - 30 V to + 5 V
Input current with "1" signal	typ. 7 mA
Input delay - at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	with 40-pin front connector

3.7 Digital output module SM 321; DI 32 x AC 120 V; (6ES7321-1EL00-0AA0)

Order number

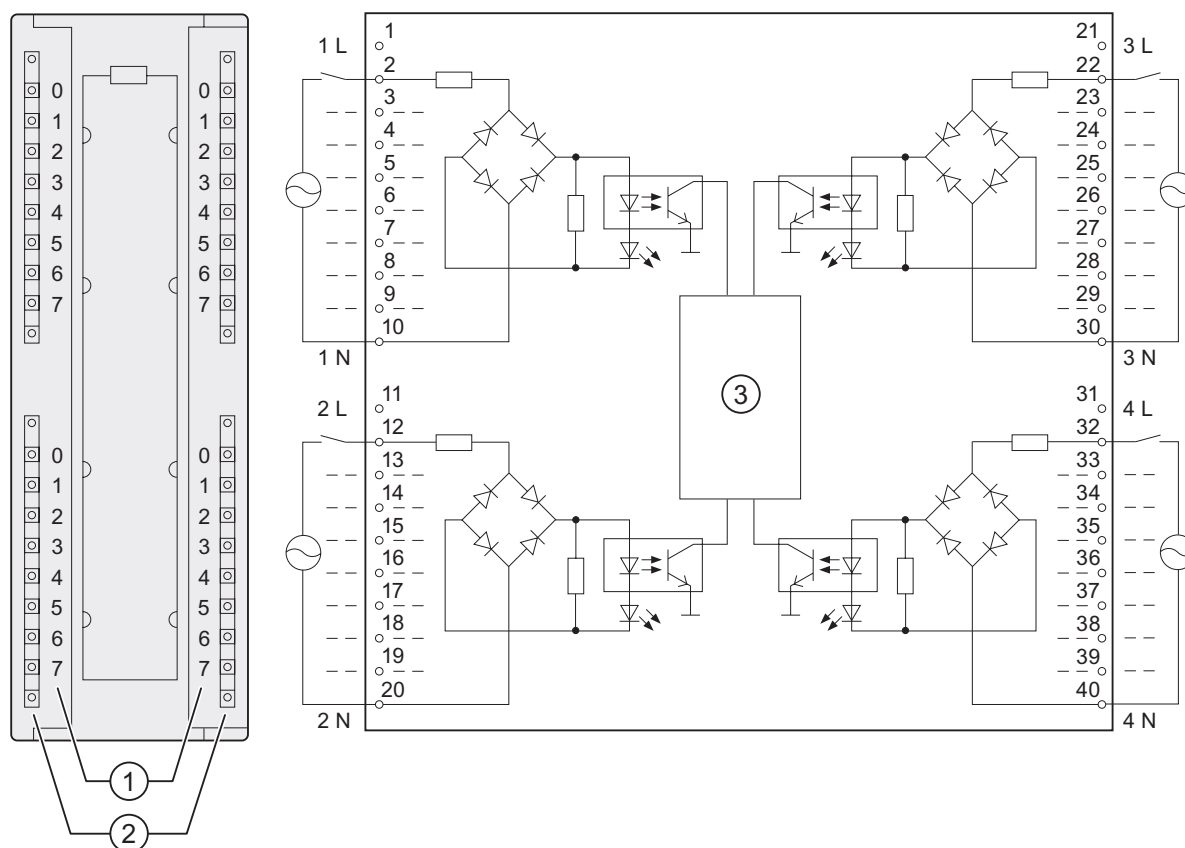
6ES7321-1EL00-0AA0

Properties

Properties of SM 321; DI 32 x 120 VAC:

- 32 inputs, electrically isolated in groups of 8
- Rated input voltage 120 VAC
- Suitable for switches and 2-/3-wire AC proximity switches

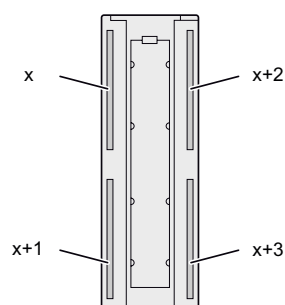
Wiring and block diagrams SM 321; DI 32 x AC 120 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Terminal assignment

The figure below shows the channel addressing (input byte x up to input byte x+3).



Technical data of SM 321; DI 32 x AC 120 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 300 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	32
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
• horizontal mounting position up to 40 °C up to 60 °C	32 24
• vertical mounting position up to 40 °C	32
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels in groups of	Yes 8
Permissible potential difference	
• between M _{internal} and inputs	120 VAC
• between inputs of different groups	250 VAC
Isolation test voltage	2500 VDC
Current consumption	
• from the backplane bus	max. 16 mA
Power loss of the module	typ. 4 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
• Rated value	120 VAC
• for "1" signal	74 V to 132 V
• for "0" signal	0 V to 20 V
• Frequency band	47 Hz to 63 Hz
Input current	
• with "1" signal	typ. 21 mA
Input delay	
• at "0" to "1" transitions	max. 15 ms
• at "1" to "0" transitions	max. 25 ms
Input characteristics	to IEC 61131, type 2
Connection of 2-wire BEROs	supported
• Permissible quiescent current	max. 4 mA
Wiring signal transducers	with 40-pin front connector

3.8 Digital input module SM 321; DI 16 x DC 24 V; (6ES7321-1BL02-0AA0)

Order number: "Standard module"

6ES7321-1BH02-0AA0

Order number: "SIPLUS S7-300 module"

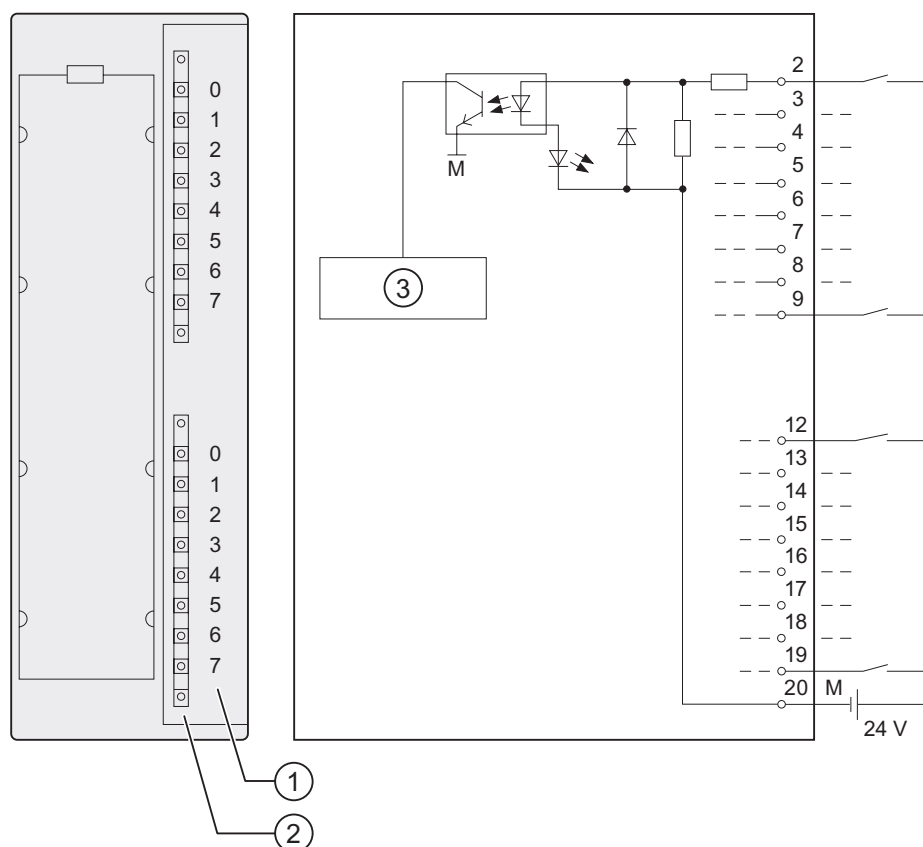
6AG1 321-1BH02-2AA0

Properties

Properties of SM 321; DI 16 x DC 24 V:

- 16 inputs, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- suitable for switches and 2-/3-/4-wire proximity switches (BEROs)

Wiring and block diagrams of SM 321; DI 16 x DC 24 V



- ① Channel number
 ② Status display - green
 ③ Backplane bus interface

Technical data of SM 321; DI 16 x DC 24 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	16
Cable length - unshielded - shielded	max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs - horizontal mounting position up to 60 °C - vertical mounting position up to 40 °C	16 16
Electrical isolation - between channels and the backplane bus - between channels - in groups of	Yes Yes 16
Permissible potential difference between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption from the backplane bus	max. 10 mA
Power loss of the module	typ. 3.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage - Rated value - for "1" signal - for "0" signal	24 VDC 13 V to 30 V - 30 V to + 5 V
Input current with "1" signal	typ. 7 mA
Input delay - at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	with 20-pin front connector

3.9 Digital input module SM 321; DI 16 x DC 24 V High Speed; (6ES7321-1BH10-0AA0)

Order number:

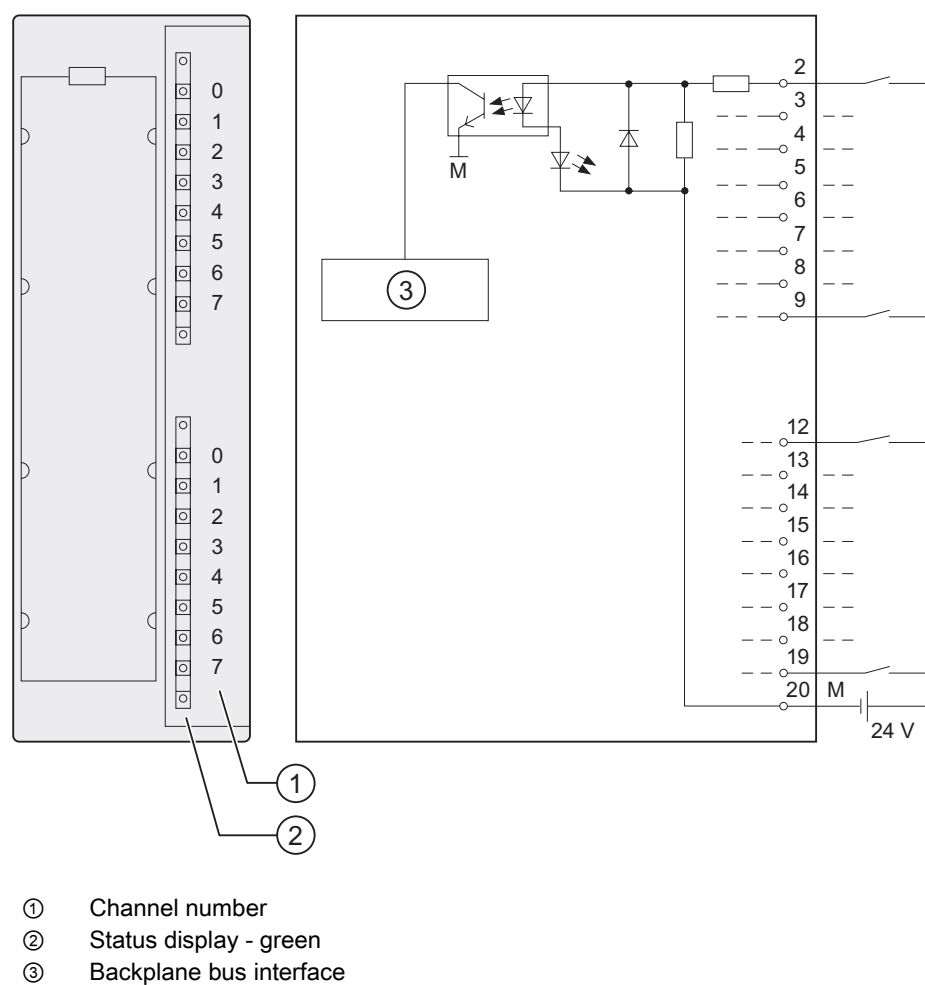
6ES7321-1BH10-0AA0

Properties

Properties of SM 321; DI 16 x DC 24 V High Speed:

- 16 inputs, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- suitable for switches and 2-/3-/4-wire proximity switches (BEROs)
- Supports isochronous mode

Wiring and block diagrams of SM 321; DI 16 x DC 24 V High Speed



Technical data of SM 321; DI 16 x DC 24 V High Speed

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	Yes
Number of inputs	16
Cable length - unshielded - shielded	max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs - horizontal mounting position up to 60 °C - vertical mounting position up to 40 °C	16 16
Electrical isolation between channels and the backplane bus	Yes
Permissible potential difference - between different circuits - between channels - in groups of	75 VDC / 60 VAC Yes 16
Isolation test voltage	500 VDC
Current consumption from the backplane bus	max. 110 mA
Power loss of the module	typ. 3.8 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage - Rated value - for "1" signal - for "0" signal	24 VDC 13 V to 30 V - 30 V to + 5 V
Input current with "1" signal	typ. 7 mA
Input delay - at "1" to "0" - at "1" to "0"	25 µs to 75 µs 25 µs to 75 µs
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	with 20-pin front connector

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Order number: "Standard module"

6ES7321-7BH01-0AB0

Order number: "SIPLUS S7-300 module"

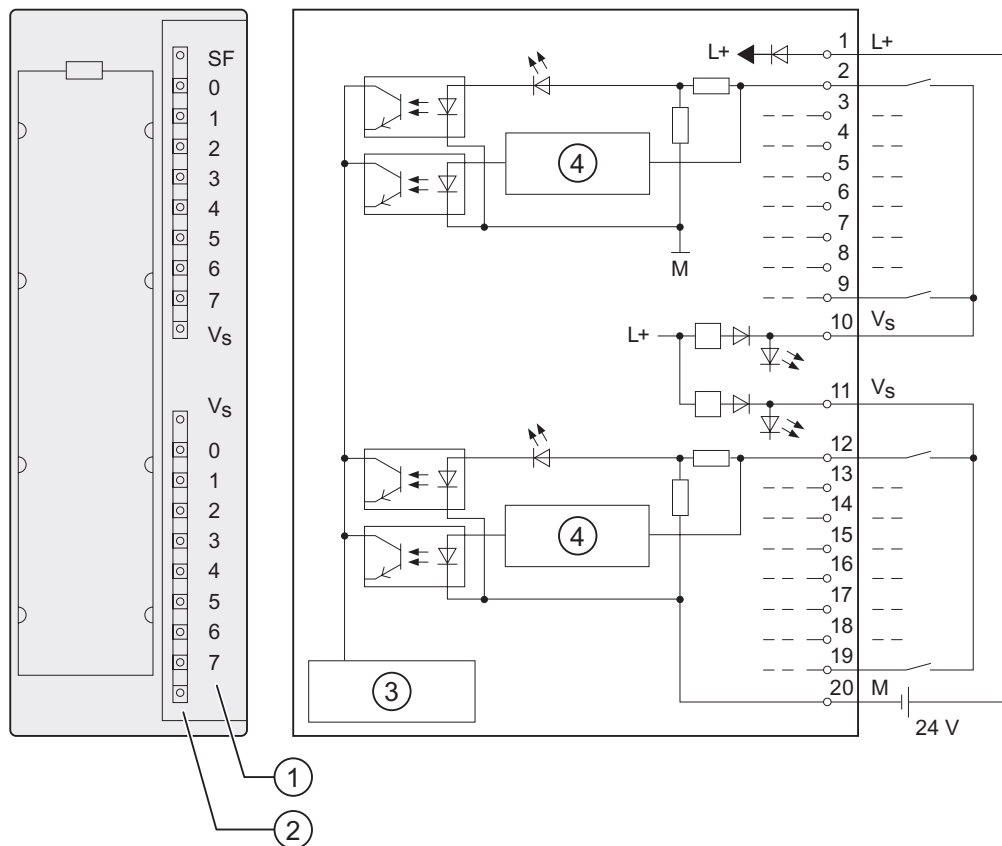
6AG1 321-7BH01-2AB0

Properties

Properties of SM 321; DI 16 x 24 VDC with hardware and diagnostic interrupts:

- 16 inputs, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- Input characteristics to IEC 61131, Type 2
- suitable for switches and 2-/3-/4-wire proximity switches (BEROs)
- 2 short circuitproof encoder supplies for each group of 8 channels
- external redundant encoder supply is supported
- "Encoder supply (Vs)" status display
- Group error display (SF)
- Supports isochronous mode
- Supports the "CiR" function
- Programmable diagnostics
- Programmable diagnostic interrupt
- Programmable hardware interrupts
- Programmable input delays

Wiring and block diagrams of SM 321; DI 16 x DC 24 V



- ① Channel number
- ② Status displays - green
Error displays - red
Encoder supply Vs -green
- ③ Backplane bus interface
- ④ Wire-break detection

Wiring diagram of the redundant encoder supply

The figure below shows how an additional redundant voltage source can be used to supply encoders via V_s .

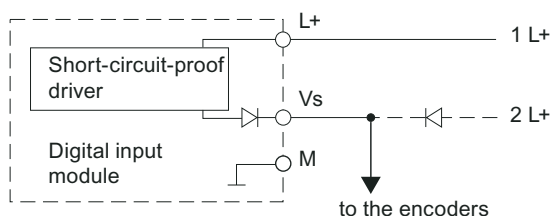


Figure 3-4 Wiring diagram of the redundant supply of encoders of SM 321; DI 16 x DC 24 V

Wiring diagram of the shunt circuit of transducers

For wire-break detection, it is necessary to connect a shunt resistor to the transducer contacts.

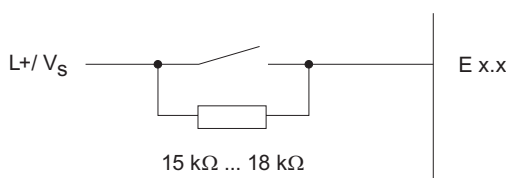


Figure 3-5 Wiring diagram of the shunt circuit of transducers of SM 321; DI 16 x DC 24 V

Technical data of SM 321; DI 16 x DC 24 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	Yes
Support of CiR	Yes
Reaction of non-programmed inputs	return the process value which was valid before configuration
Number of inputs	16
Cable length	
- unshielded - shielded	max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated supply voltage L+ for electronics and encoders	24 VDC
Reverse polarity protection	Yes

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Technical data	
Number of simultaneously controlled inputs	
horizontal mounting position up to 60 °C	16
vertical mounting position up to 40 °C	16
Electrical isolation	
- between channels and the backplane bus - between channels – in groups of	Yes 16
Permissible potential difference	
between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
from the backplane bus	max. 130 mA
from load voltage L + (without encoder supply V_S)	max. 90 mA
Power loss of the module	typ. 4 W
Status, interrupts, diagnostics	
Status display	
Inputs	green LED per channel
Encoder supplies (V_S)	green LED per output
Interrupts	
- Hardware interrupt - Diagnostic interrupt	programmable programmable
Diagnostics functions	programmable
Group error display	red LED (SF)
Reading diagnostics information	supported
Monitoring of	
Wirebreak	yes, sensing I < 1 mA
Encoder supply outputs	
Number of outputs	2
Output voltage	
on load	min. L+ (- 2.5 V)
Output current	
- Rated value - Permissible range	120 mA 0 mA to 150 mA
Additional (redundant) supply	supported
Short-circuit protection	Yes, electronic
Transducer selection data	
Input voltage	
- Rated value - for "1" signal - for "0" signal	24 VDC 13 V to 30 V -30 V to +5 V

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Technical data	
Input current	
• with "1" signal	typ. 7 mA
Input characteristics	to IEC 61131, type 2
Connection of 2-wire BEROs	supported
• Permissible quiescent current	max. 2 mA
Wiring signal transducers	with 20-pin front connector
Shunt circuit of the encoder, for wire-break detection	10 kohms to 18 kohms
Time/frequency	
Internal preparation time for status processing (non-synchronous operation)	
• Enable hardware and diagnostics interrupt	max. 40 ms
Input delay	
• programmable	Yes
• Rated value	typ. 0.1/0.5/3/15/20 ms

3.10.1 Isochronous mode

Properties

Reproducible reaction times (i.e. of the same length) are achieved in a SIMATIC system by means of a constant DP bus cycle, and synchronization of the single cyclic processes outlined below:

- Cyclic user program execution. The length of the cycle time may vary due to acyclic program branching.
- Independent and variable DP cycle on the PROFIBUS subnet
- Cyclic operation of the backplane bus of the DP slave.
- Cyclic signal conditioning and conversion at the electronic modules of the DP slave.

The constant DP cycle runs in synchronism and at the same length. The CPU run levels (OB61 to OB64) and isochronous IO are synchronized with this cycle. I/O data are therefore transferred at defined and constant intervals (isochronous mode.)

Requirements

- The DP master and slave must support isochronous mode. STEP 7 V5.2 or higher.

Mode of operation: Isochronous

Conditions of isochronous mode:

Filtering and processing time T_{WE} between reading actual values and writing these to the transfer buffer (the value defined for T_{WE} applies, irrespective of the enable status of hardware interrupts or diagnostics)	255 μ s to 345 μ s
includes an input delay time of	100 μ s
T_{DPmin}	2.5 ms
Diagnostic interrupt	max. 4 x T_{DP}

Note

In "isochronous" mode, the input delay is automatically set to 100 ms, regardless of the input delay setting in STEP 7

Further information

For further information on isochronous mode, refer to the STEP 7 Online Help, and to the *Distributed IO System ET 200M* and *"Isochrone mode"* manuals.

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

3.10.2 Parameters of SM 321; DI 16 x DC 24 V

Programming

The general procedure for programming digital modules is described in *Configuring digital modules*.

Parameters of SM 321; DI 16 x DC 24 V

The table below shows an overview of configurable parameters and their default settings for SM 321; DI 16 x DC 24 V.

The default settings apply if you have not set any parameters in STEP 7.

Table 3-8 Parameters of SM 321; DI 16 x DC 24 V

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt	Yes/no Yes/no	No No	Dynamic	Module
Input delay/voltage type	0.1 ms (DC) 0.5 ms (DC) 3 ms (DC) 15 ms (DC) 20 ms (DC/AC)	(DC)	static	Module
Diagnostics - Encoder supply missing - Wirebreak	Yes/no Yes/no	No No	static	Channel group
Hardware interrupt trigger - Positive edge - Negative edge	Yes/no Yes/no	No No	Dynamic	Channel group

Allocating the encoder supplies to channel groups

The module's two encoder supplies, supply power to two channel groups: Inputs 0 to 7 and inputs 8 to 15. You also configure diagnostics for the encoder supply at those two channel groups.

Assigning interrupt parameters to channel groups

The table below shows which channels you can group for interrupt processing.

You will need the channel group number to set the SFC parameters in the user program.

Table 3-9 Assigning interrupt parameters to the inputs of SM 321; DI 16 x DC 24 V

Parameter...	configurable in the following channel groups	Channel group number
Hardware interrupt (triggered by positive, negative, or both edges)	0 and 1	0
	2 and 3	1
	4 and 5	2
	6 and 7	3
	8 and 9	4
	10 and 11	5
	12 and 13	6
	14 and 15	7
Diagnostic interrupt for missing encoder supply	0 to 7 8 to 15	-
Diagnostic interrupt for wire-break	0 and 1	0
	2 and 3	1
		:

Tolerances of the programmable input delays

Table 3-10 Tolerances of the input delays at SM 321; DI 16 x DC 24 V

Programmed input delay	Tolerance
0.1 ms	60 μ s to 140 μ s
0.5 ms	400 ms to 900 ms
3 ms (default)	2.6 ms to 3.3 ms
15 ms	12 ms to 15 ms
20 ms	17 ms to 23 ms

See also

Programming digital modules (Page 3-8)

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

3.10.3 Diagnostics of SM 321; DI 16 x DC 24 V

Diagnostics messages of SM 321; DI 16 x DC 24 V

The table below shows an overview of the diagnostic messages of SM 321; DI 16 x DC 24 V.

Table 3-11 Diagnostics messages of SM 321; DI 16 x DC 24 V

Diagnostics message	LED	Scope of diagnostics	programmable
Encoder supply missing	SF	Channel group	Yes
Wirebreak	SF	Channel group	
Module not programmed	SF	Channel group	
External auxiliary voltage missing	SF	Module	No
Internal auxiliary voltage missing	SF	Module	
Fuse blown	SF	Module	
Incorrect module parameters	SF	Module	
Watchdog time-out	SF	Module	
EPROM error	SF	Module	
RAM error	SF	Module	
Hardware interrupt lost	SF	Module	

Note

Prerequisite for detecting errors indicated by programmable diagnostic messages is an appropriate configuration of the digital module in STEP 7.

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Causes of error and troubleshooting

Table 3-12 Diagnostic Messages of the SM 321; DI 16 x DC 24 V, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid error
Encoder supply missing	Overload at encoder supply	Eliminate overload
	Short-circuit to M at encoder supply	Eliminate the short-circuit
External auxiliary voltage missing	Power supply L+ to module missing	Feed supply L+
Internal auxiliary voltage missing	Power supply L+ to module missing	Feed supply L+
	Fuse blown in module	Replace the module
Fuse blown	Fuse blown in module	Replace the module
Incorrect module parameters	Implausible parameter or combination thereof	Program the module
Watchdog time-out	Infrequent high electromagnetic interference	Eliminate interference
	Module defective	Replace the module
EPROM error	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
	Module defective	Replace the module
RAM error	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
	Module defective	Replace the module
Hardware interrupt lost	The module can not output an interrupt, because the previous interrupt was not acknowledged; possibly a configuration error	Change interrupt processing in the CPU, and reprogram the module as required
		The error persists until the module is assigned new parameters
Module not programmed	Startup error	Program the module

3.10.4 Reactions of SM 321; DI 16 x DC 24 V

Influence of the operating state and supply voltage on input values

The SM 321; DI 16 x DC 24 input values are determined by the CPU's operating state and the module's power supply.

Table 3-13 Dependency of input values on the CPU's operating state, and on the L+ power supply of SM 321; DI 16 x DC 24 V

CPU operating state		Power supply L+ at digital module	input value of the digital module
POWER ON	RUN	L+ present	Process value
		L+ missing	0 signal
	STOP	L+ present	Process value
		L+ missing	0 signal
POWER OFF	-	L+ present	-
		L+ missing	-

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Reaction to power failure

Failure of the SM 321; DI 16 x DC 24 power supply is always indicated by the module's SF LED. This information is also available on the module.

The input value is initially held for the duration of 20 ms to 40 ms before the zero signal is transferred to the CPU. Supply voltage dips <20 ms do not influence the process value (see the table above.)

Diagnostics interrupts are triggered according to parameter settings (see *Interrupts of SM 321; DI 16 x DC 24 V*).

Power supply failure with redundant external encoder supply

Note

When an external redundant power source is connected in parallel to the sensor supply (Vs) and the L+ power supply fails, the module does not report failure of the encoder supply, but rather failure of the internal and/or external auxiliary voltage, and/or a blown fuse.

Short-circuit at the encoder supply Vs

The relevant Vs LED goes dark if a short-circuit is detected at the encoder supply Vs, irrespective of parameter settings.

3.10.5 Interrupts of SM 321; DI 16 x DC 24 V

Introduction

This chapter describes the interrupt reaction of SM 321; DI 16 x DC 24 V. We distinguish the following interrupts:

- Diagnostic interrupt
- Hardware interrupt

For detailed information on the OBs and SFCs mentioned below, refer to the STEP 7 Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if parameters are not set accordingly. You can enable interrupts in STEP 7 (see the chapter *Parameters of SM 321; DI 16 x DC 24 V*).

*3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts
(6ES7321-7BH01-0AB0)*

Diagnostic interrupt

When diagnostic interrupts are enabled, incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of an interrupt.

The CPU interrupts user program execution, and executes diagnostic interrupt OB82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

Hardware interrupt

SM 321; DI 16 x DC 24 V can trigger a hardware interrupt for each channel group at the positive, negative, or both edges of a signal transition.

Program each channel group separately. The parameters can be changed at any time (in RUN mode in the user program.)

Incoming hardware interrupts initiate hardware interrupt processing in the CPU (OB 40), and the CPU interrupts execution of the user program, or of lower priority classes.

You can define the reaction of the PLC to a signal edge transitions in the user program of hardware interrupt OB 40. The module acknowledges the hardware interrupt when the program exits the hardware interrupt OB.

The module can write one interrupt per channel to the stack. If no run levels of a higher priority class are pending processing, the CPU processes the buffered interrupts (of all modules) in the order of their occurrence.

Hardware interrupt lost

A "Hardware interrupt lost" diagnostics interrupt is generated, if a successive interrupt occurs at the same channel before the CPU has processed the previously buffered interrupt.

The CPU does not register any further interrupts at this channel unless it has completed processing of the stacked interrupts of the same channel.

3.10 Digital input module SM 321; DI 16 x 24 VDC; with hardware and diagnostic interrupts (6ES7321-7BH01-0AB0)

Interrupt-triggering channels

The relevant hardware interrupt-triggering channel is registered in the OB40_POINT_ADDR tag of the start information of OB 40. The figure shows the bit assignments of DWORD 8 in the local data.

Byte	Tag	Data type		Description
6/7	OB40_MDL_ADDR	WORD	B#16#0	Address of the interrupt-triggering module
starting at 8	OB40_POINT_ADDR	DWORD	see the figure below	Indication of the interrupt-triggering inputs

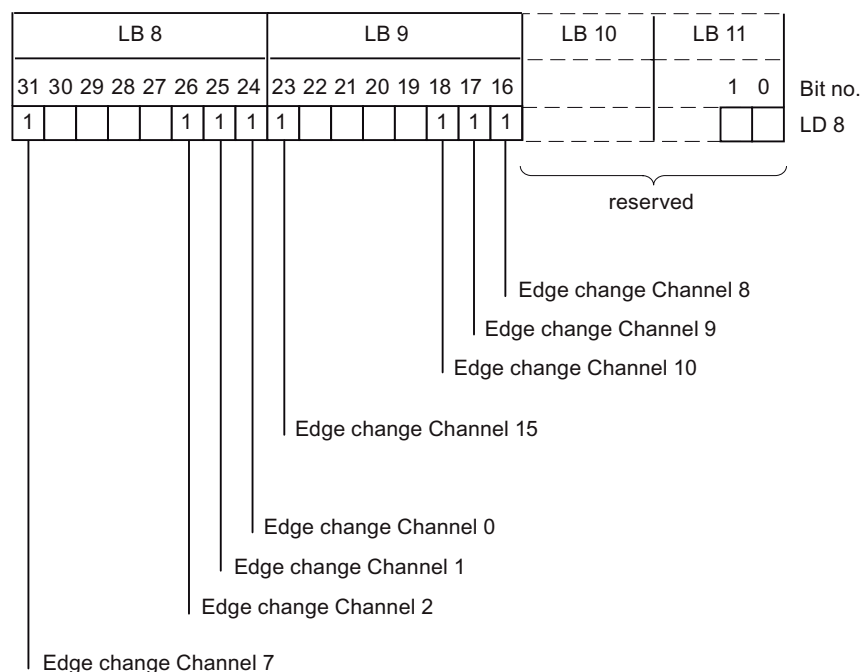


Figure 3-6 Start Information of OB 40: which event has triggered the hardware interrupt

See also

Parameters of SM 321; DI 16 x DC 24 V (Page 3-27)

3.11 Digital input module SM 321; DI 16 x DC 24 V; source reading; (6ES7321-1BH50-0AA0)

Order number

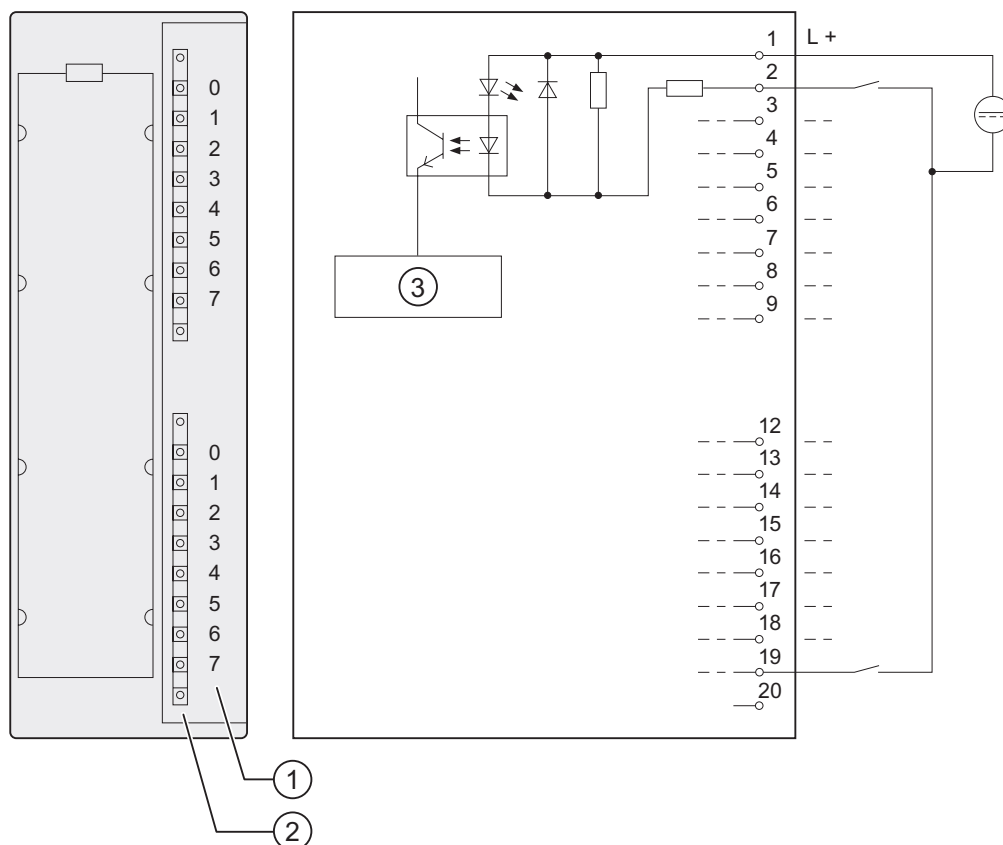
6ES7321-1BH50-0AA0

Properties

Properties of SM 321; DI 16 x DC 24 V; source input:

- 16 inputs, source input, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- suitable for switches and 2- /3-/4-wire proximity switches (BEROs)

Wiring and block diagrams of SM 321; DI 16 x DC 24 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 321; DI 16 x DC 24 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	16
Cable length - unshielded - shielded	max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
horizontal mounting position up to 60 °C	16
vertical mounting position up to 40 °C	16
Electrical isolation between channels and the backplane bus	Yes
Between channels in groups of	Yes 16
Permissible potential difference between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption from the backplane bus	max. 10 mA
Power loss of the module	typ. 3.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage (reference potential L+)	
- Rated value - for "1" signal - for "0" signal	24 VDC -13 V to -30 V +30 V to -5 V
Input current with "1" signal	typ. 7 mA
Input delay - at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	with 20-pin front connector

3.12 Digital input module SM 321; DI 16 x 24/48 VUC (6ES7321-1CH00-0AA0)

Order number

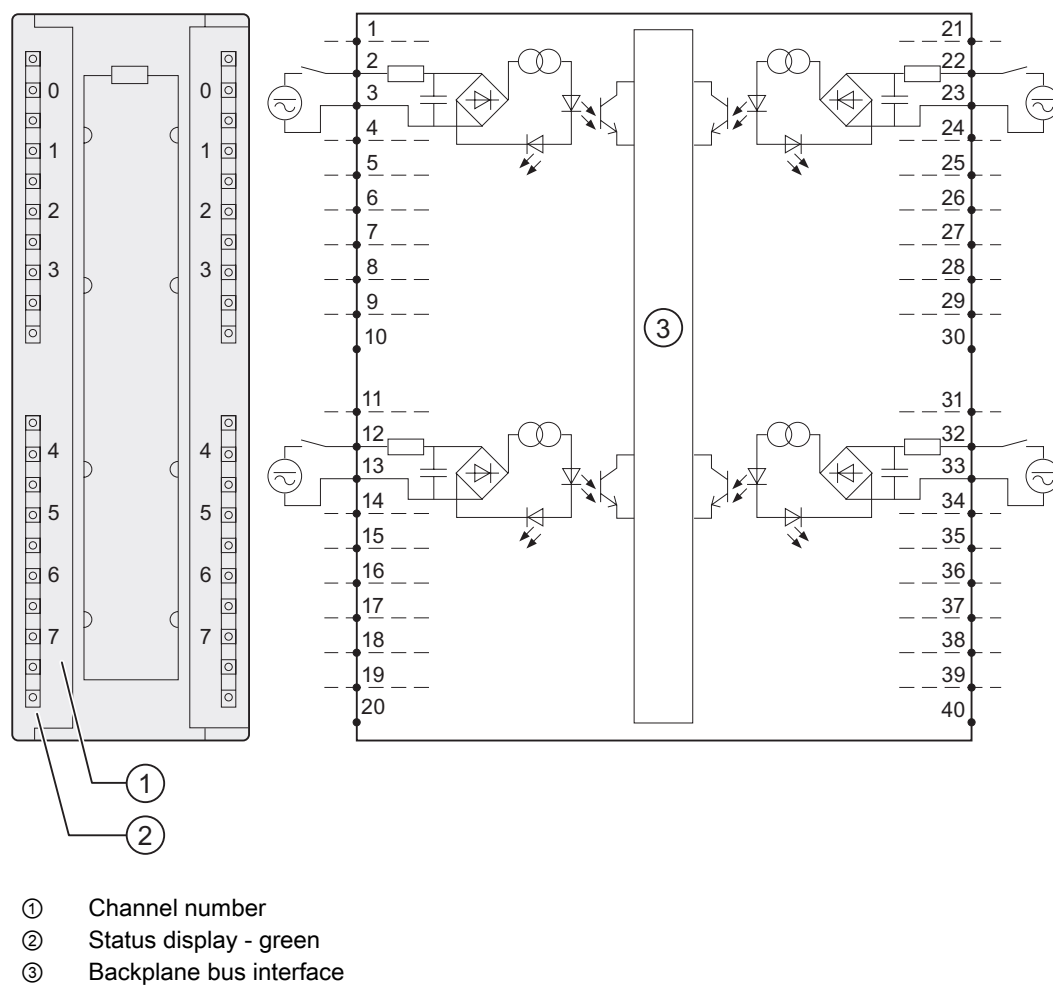
6ES7321-1CH00-0AA0

Properties

Properties of SM 321; DI 16 x UC24/48 V:

- 16 inputs, electrically isolated
- Electrical isolation between channels of 120 V AC
- Rated input voltage 24 VDC/VAC to 48 VDC/VAC
- Inputs are fully independent and may be wired as required

Wiring and block diagrams of SM 321; DI 16 x UC 24/48 V



Technical data of SM 321; DI 16 x UC 24/48 V

Technical data	
Dimensions and weight	
Dimensions W x H x D	40 x 125 x 117
Weight	approx. 260 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
• horizontal mounting position up to 60 °C	16
• other mounting positions up to 40 °C	16
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels in groups of	Yes 1
Permissible potential difference	
• Between channels and the backplane bus	170 VDC, 120 VAC
• between inputs of different groups	170 VDC, 120 VAC
Isolation test voltage	
• Between channels and the backplane bus	1500 VAC
• between inputs of different groups	1500 VAC
Current consumption	
• from the backplane bus	max. 100 mA
Power loss of the module	
• Operation with 24 V	typ. 1.5 W
• Operation with 48 V	typ. 2.8 W
Status, interrupts, diagnostics	
Status display	Green LEDs per channel
Interrupts	None
Diagnostics functions	None
Encoder selection data	
Input voltage	
• Rated value	24 VDC/VAC or 48 VDC/VAC
• with "1" signal	14 V to 60 V
• with "0" signal	-5 V to 5 V
• Frequency band	0 Hz to 63 Hz
Input current	
• with "1" signal	typ. 2.7 mA
• with "0" signal	-1 mA to +1 mA
Input delay	
• at "1" to "0"	max. 16 ms
• at "1" to "0"	max. 16 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	supported
• Permissible quiescent current	max. 1 mA
Wiring signal transducers	with 40-pin front connector

3.13 Digital input module SM 321; DI 16 x 48-125 VDC; (6ES7321-1CH20-0AA0)

Order number: "Standard module"

6ES7321-1CH20-0AA0

Order number: "SIPLUS S7-300 module"

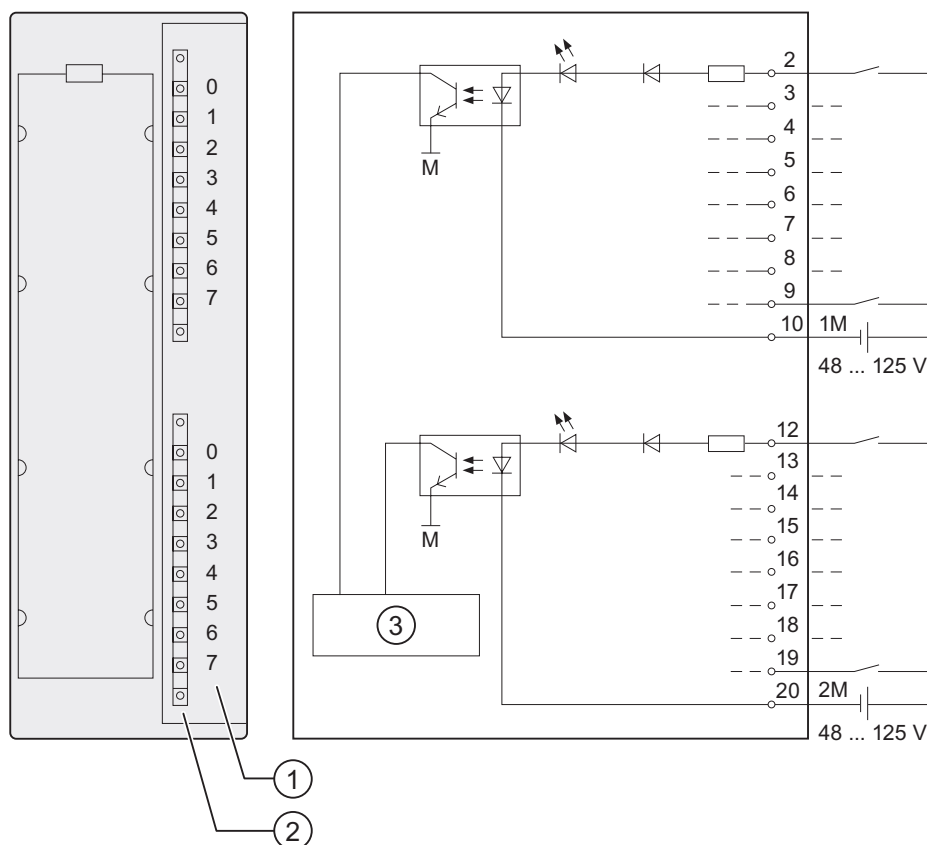
6AG1 321-1CH20-2AA0

Properties

Properties of SM 321; DI 16 x DC 48-125 V:

- 16 inputs, electrically isolated in groups of 8
- Rated input voltage 48 VDC to 125 VDC
- suitable for switches and 2- /3-/4-wire proximity switches (BEROs)

Wiring and block diagrams of SM 321; DI 16 x DC 48-125 V



Technical data of SM 321; DI 16 x DC 48-125 V

Technical data		
Dimensions and weight		
Dimensions W x H x D (mm)	40 x 125 x 120	
Weight	approx. 200 g	
Module-specific data		
Isochronous mode supported	No	
Number of inputs	16	
Cable length unshielded shielded	max. 600 m max. 1000 m	
Voltages, currents, electrical potentials		
Number of simultaneously controlled input at V_i	up to 60 V	up to 146 V
horizontal mounting position up to 50 °C up to 60 °C	8 8	8 6
vertical mounting position up to 40 °C	8	8
Electrical isolation		
between channels and the backplane bus	Yes	
between channels in groups of	Yes 8	
Permissible potential difference between different circuits	146 VDC / 132 VAC	
Isolation test voltage	1500 VDC	
Current consumption from the backplane bus	max. 40 mA	
Power loss of the module	typ. 4.3 W	
Status, interrupts, diagnostics		
Status display	green LED per channel	
Interrupts	None	
Diagnostics functions	None	
Transducer selection data		
Input voltage		
Rated value	48 VDC to 125 VDC	
for "1" signal	30 V to 146 V	
for "0" signal	-146 V to 15 V	
Input current with "1" signal	typ. 3.5 mA	
Input delay - at "1" to "0" - at "1" to "0"	0.1 ms to 3.5 ms 0.7 ms to 3.0 ms	
Input characteristics	to IEC 61131, type 1	
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1 mA	
Wiring signal transducers	with 20-pin front connector	

3.14 Digital input module SM 321; DI 16 x 120/230 VAC (6ES7321-1FH00-0AA0)

Order number

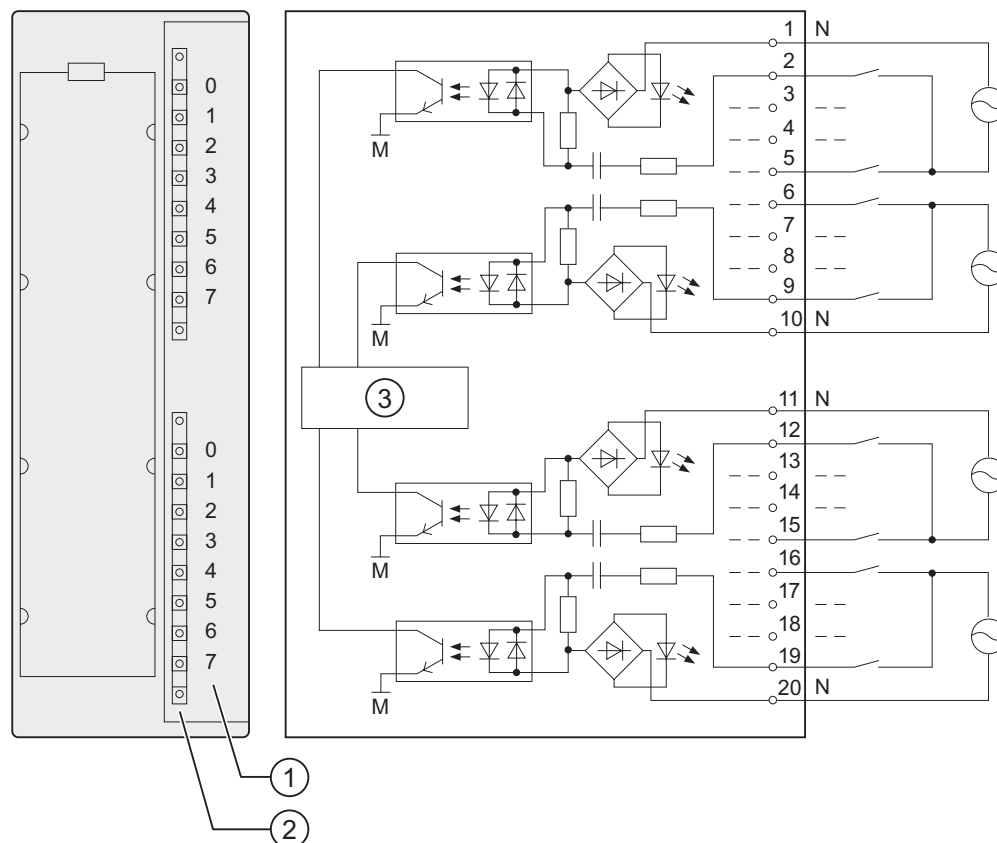
6ES7321-1FH00-0AA0

Properties

Properties of SM 321, DI 16 x AC 120/230 V:

- 16 inputs, electrically isolated in groups of 4
- rated input voltage 120/230 VAC
- Suitable for switches and 2-/3-wire proximity switches (AC)

Wiring and block diagrams of SM 321; DI 16 x AC 120/230 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 321; DI 16 x 120/230 VAC:

Technical data	
Dimensions and weight	
Dimensions W x H x D	40 x 125 x 117
Weight	approx. 240 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 V
All load voltages must be connected to a common phase	
Number of simultaneously controlled inputs	
• Horizontal mounting position up to 60 °C	16
• Vertical mounting position up to 40 °C	16
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels in groups of	Yes 4
Permissible potential difference	
• between M _{internal} and inputs	230 VAC
• between inputs of different groups	500 VAC
Isolation test voltage	4000 VDC
Current consumption	
• from the backplane bus	max. 29 mA
Power loss of the module	typ. 4.9 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
• Rated value	120/230 VAC
• for "1" signal	79 V to 264 V
• for "0" signal	0 V to 40 V
• Frequency band	47 Hz to 63 Hz
Input current	
• with "1" signal	
120 V, 60 Hz	typ. 6.5 mA
230 V, 50 Hz	typ. 16.0 mA

Technical data	
Input delay - at "0" to "1" transitions - at "1" to "0" transitions	max. 25 ms max. 25 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 2 mA
Wiring signal transducers	with 20-pin front connector

3.15 Digital input module SM 321; DI 8 x 120/230 VAC (6ES7321-1FH01-0AA0)

Order number: "Standard module"

6ES7321-1FF01-0AA0

Order number: "SIPLUS S7-300 module"

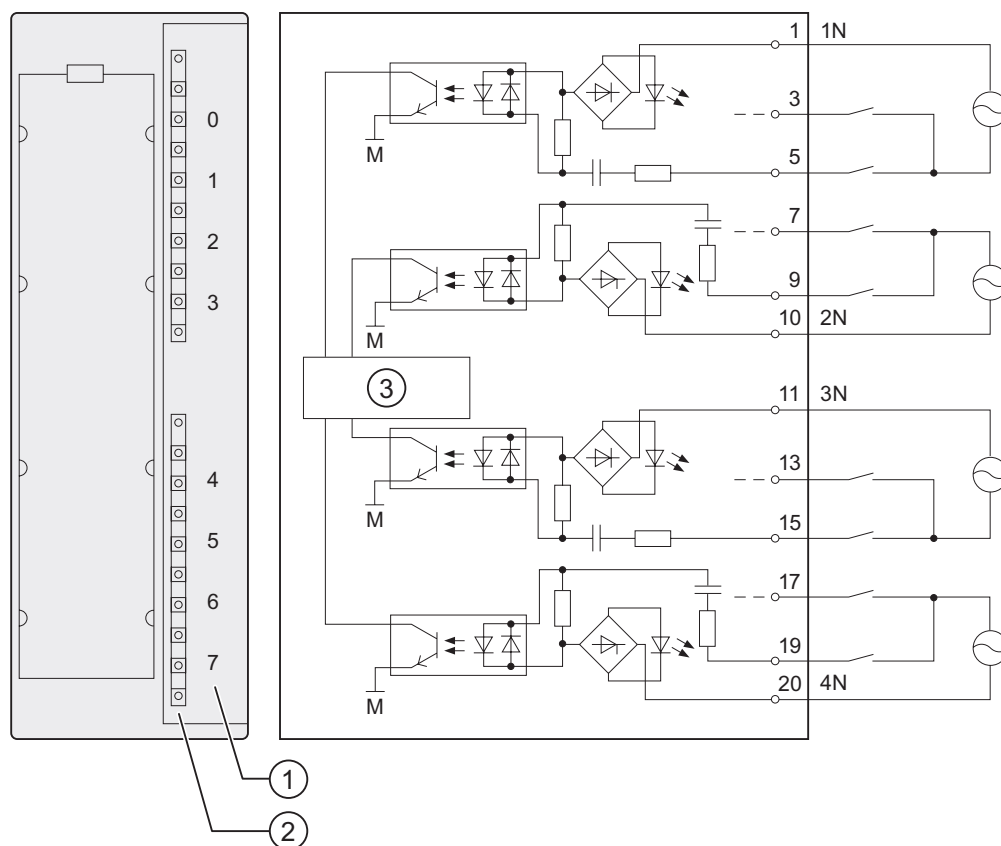
6AG1 321-1FF01-2AA0

Properties

Properties of SM 321, DI 8 x AC 120/230 V:

- 8 inputs, electrically isolated in groups of 2
- rated input voltage 120/230 VAC
- suitable for switches and 2-/3-wire AC proximity switches

Wiring and block diagrams of SM 321; DI 8 x AC 120/230 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 321; DI 8 x AC 120/230 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 240 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
horizontal mounting position up to 60 °C	8
vertical mounting position up to 40 °C	8
Electrical isolation	
between channels and the backplane bus	Yes
between channels in groups of	Yes 2
Permissible potential difference	
between M_{internal} and inputs	230 VAC
between inputs of different groups	500 VAC
Isolation test voltage	4000 VDC
Current consumption	
from the backplane bus	max. 29 mA
Power loss of the module	typ. 4.9 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
- Rated value - for "1" signal - for "0" signal - Frequency band	120/230 VAC 79 V to 264 V 0 V to 40 V 47 Hz to 63 Hz
Input current	
with "1" signal 120 V, 60 Hz 230 V, 50 Hz	typ. 6.5 mA typ. 11 mA
Input delay	
- at "1" to "0" - at "1" to "0"	max. 25 ms max. 25 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	supported
Permissible quiescent current	max. 2 mA
Wiring signal transducers	with 20-pin front connector

3.16 Digital input module SM 321; DI 8 x 120/230 VAC ISOL (6ES7321-1FF10-0AA0)

Order number

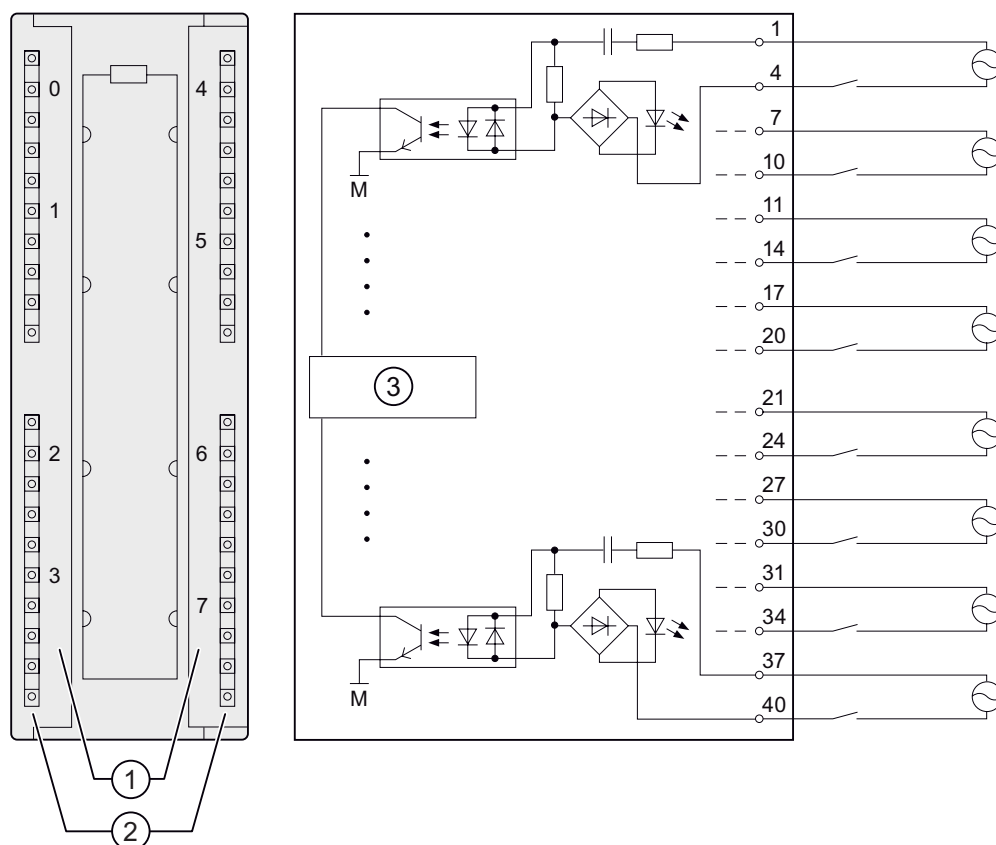
6ES7321-1FF10-0AA0

Properties

Properties of the digital input module SM 321; DI 8 x AC 120/230 V ISOL:

- 8 inputs, electrically isolated in groups of 1
- 120/230 VAC rated input voltage
- Suitable for switches and 2-/3-/4-wire AC proximity switches

Wiring and block diagrams of SM 321; DI 8 x 120/230 VAC ISOL



- ① Channel number
 ② Status display - green
 ③ Backplane bus interface

Technical data of SM 321; DI 8 x AC 120/230 V ISOL

Technical data	
Dimensions and weight	
Dimensions W × H × D	40 × 125 × 117
Weight	approx. 240 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
All load voltages must be connected to a common phase	
Number of simultaneously controlled inputs	
• Horizontal mounting position up to 60 °C	8
• Vertical mounting position up to 40 °C	8
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels	Yes
in groups of	1
Permissible potential difference	
• between M _{internal} and inputs	230 VAC
• between inputs of different groups	500 VAC
Isolation test voltage	
• between M _{internal} and inputs	1500 VAC
• between inputs of different groups	2000 VAC
Current consumption	
• from the backplane bus	max. 100 mA
Power loss of the module	typ. 4.9 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
• Rated value	120/230 VAC
• for "1" signal	79 V to 264 V
• for "0" signal	0 V to 40 V
• Frequency band	47 Hz to 63 Hz

3.17 Digital output module SM 322; DO 32 x 24 VDC/ 0.5 A; (6ES7322-1BL00-0AA0)

Technical data	
Input current with "1" signal 120 V, 60 Hz 230 V, 50 Hz	typ. 7.5 mA typ. 17.3 mA
Input delay - at "0" to "1" transitions - at "1" to "0" transitions	max. 25 ms max. 25 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	supported
Permissible quiescent current	max. 2 mA
Wiring signal transducers	with 40-pin front connector

3.17 Digital output module SM 322; DO 32 x 24 VDC/ 0.5 A; (6ES7322-1BL00-0AA0)

Order number

6ES7322-1BL00-0AA0

Properties

Properties of SM 322; DO 32 x DC 24 V/0.5 A:

- 32 outputs, electrically isolated in groups of 8
- Output current 0.5 A
- Rated load voltage 24 VDC
- suitable for solenoid valves, DC contactors and signal lamps

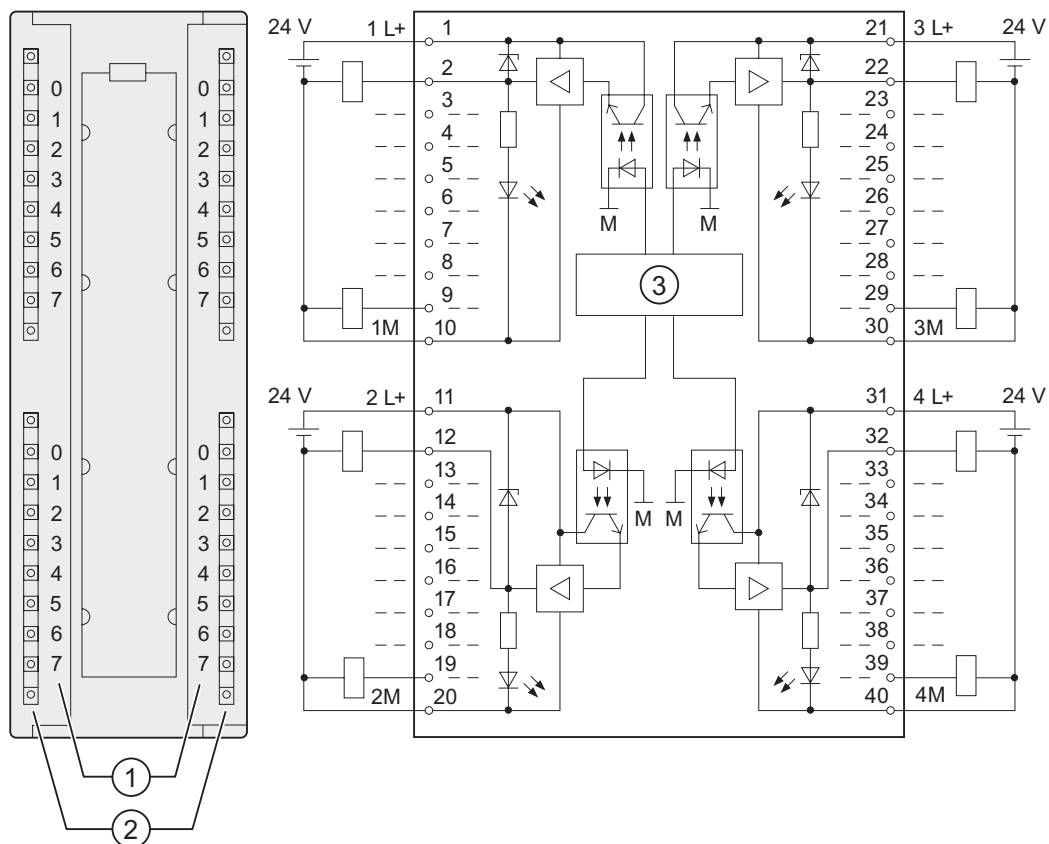
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 322; DO 32 x DC 24 V/0.5 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

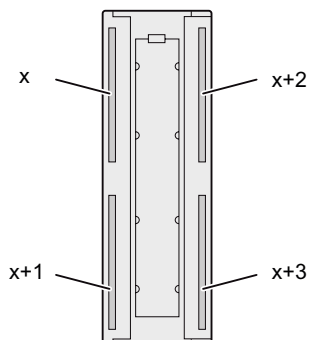
Wiring and block diagrams of SM 322; DO 32 x 24 VDC/0.5 A



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Terminal assignment

The figure below shows the channel addressing (output byte x up to output byte x+3).



Technical data of SM 322; DO 32 x DC 24 V/0.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 260 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	32
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position up to 40 °C up to 60 °C	max. 4 A max. 3 A
• vertical mounting position up to 40 °C	max. 2 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels in groups of	Yes 8
Permissible potential difference	
• between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 110 mA
• from load voltage L+ (no-load)	max. 160 mA
Power loss of the module	typ. 6.6 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Actuator selection data	
Output voltage	
• with "1" signal	min. L+ (-0.8 V)
Output current	
• with "1" signal	
Rated value	0.5 A
Permissible range	5 mA to 0.6 A
• with "0" signal (residual current)	max. 0.5 mA

Technical data	
Output delay (resistive load)	
• at "1" to "0"	max. 100 µs
• at "1" to "0"	max. 500 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 100 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (-53 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 1 A
Wiring the actuators	with 40-pin front connector

3.18 Digital output module SM 322; DO 32 x 120/230 VAC/1 A; (6ES7322-1FL00-0AA0)

Order number

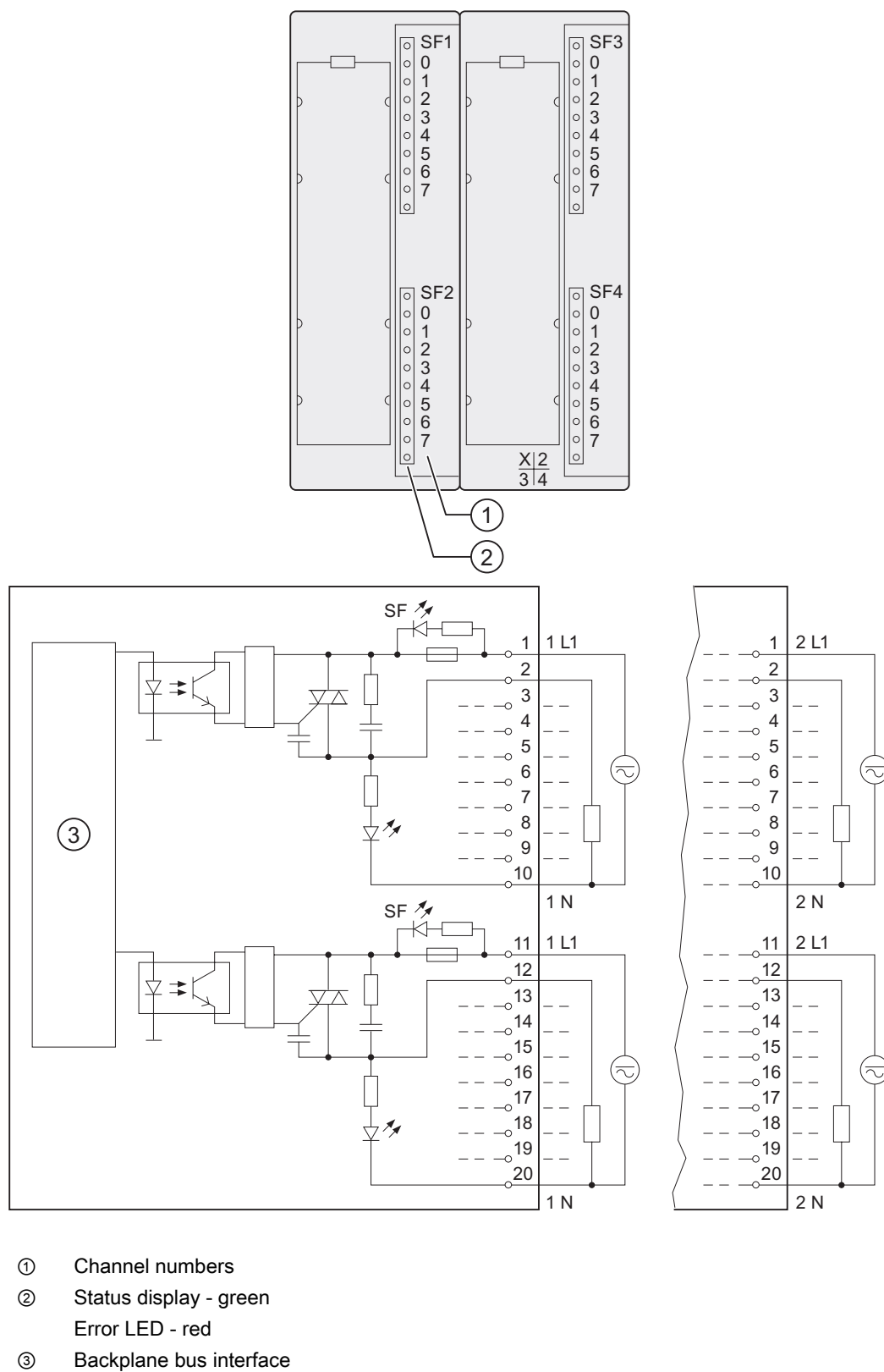
6ES7322-1FL00-0AA0

Properties

Properties of SM 322; DO 32 x AC 120/230 V/1 A:

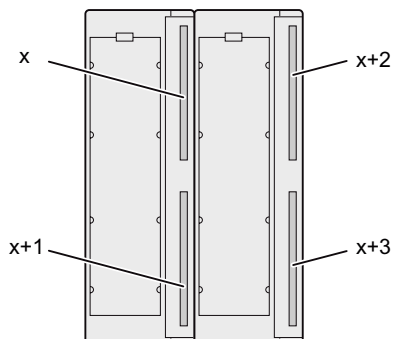
- 32 outputs, fused and electrically isolated in groups of 8
- Output current 1.0 A
- Rated load voltage 120/230 VAC
- Blown fuse indicator for each group
- Suitable for AC solenoids, contactors, starters, FHP motors and signal lamps
- Group error display (SF)

Wiring and block diagrams of SM 322; DO 32 x AC 120/230 V/1 A



Terminal assignment

The figure below shows the channel addressing (output byte x up to output byte x+3)



Technical data of SM 322; DO 32 x AC 120/230 V/1 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 117
Weight	approx. 500 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	32
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
• Permitted frequency range	47 Hz to 63 Hz
Cumulative current of outputs (per group)	
• horizontal mounting position up to 60 °C up to 40 °C	max. 3 A max. 4 A
• vertical mounting position up to 40 °C	max. 4 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels in groups of	Yes 8
Permissible potential difference	
• between M _{internal} and outputs	250 VAC
• between outputs of different groups	250 VAC
Isolation test voltage	4000 VDC

3.18 Digital output module SM 322; DO 32 x 120/230 VAC/1 A; (6ES7322-1FL00-0AA0)

Technical data	
Current consumption	
• from the backplane bus	max. 190 mA
• from load voltage L1 (no-load)	max. 10 mA
Power loss of the module	typ. 25 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	No
Diagnostics functions	Yes
• Group error display	red LED (SF)
Actuator selection data	
Output voltage	
• with "1" signal	min. L1 (-0.8 V)
Output current	
• with "1" signal	
Rated value	1 A
Permissible range	10 mA to 1 A
Permitted inrush current (per group)	10 A (for 2 AC scan cycles)
• leakage current at "0" signal	max. 2 mA
Output delay (resistive load)	
• at "1" to "0"	1 AC cycle
• at "1" to "0"	1 AC cycle
Blocking voltage zero transition	max. 60 V
Size of the motor starter	max. size 4 to NEMA
Lamp load	max. 50 W
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 10 Hz
• with inductive load to IEC 947-5-1, AC 15	max. 0.5 Hz
• with lamp load	1 Hz
Short circuit-proof output	No
Wiring the actuators	with 20-pin* front connector

*The necessary front connection version is needed twice here

3.19 Digital output module SM 322; DO 16 x 24 VDC/ 0.5 A; (6ES7322-1BL01-0AA0)

Order number: "Standard module"

6ES7322-1BH01-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 322-1BH01-2AA0

Properties

Properties of SM 322; DO 16 x DC 24 V/0.5 A:

- 16 outputs, electrically isolated in groups of 8
- Output current 0.5 A
- Rated load voltage 24 VDC
- suitable for solenoid valves, DC contactors and signal lamps

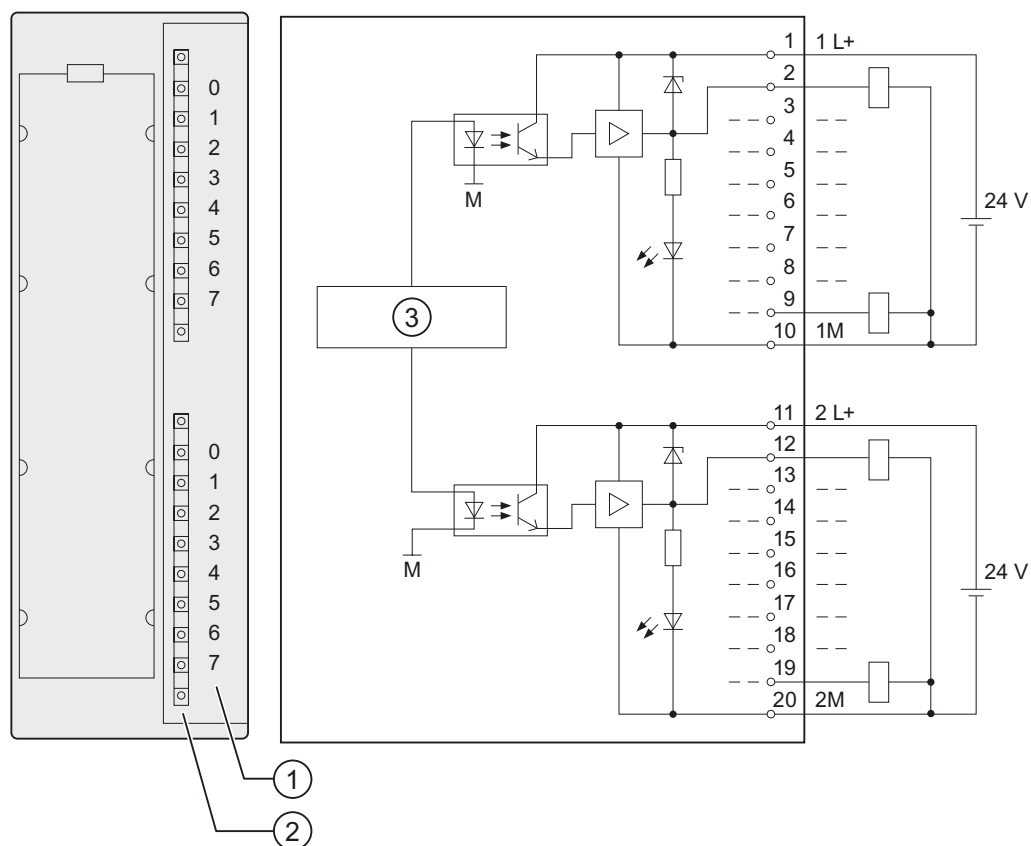
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 322; DO 16 x DC 24 V/0.5 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

Wiring and block diagrams of SM 322; DO 16 x DC 24 V/0.5 A



- ① Channel number
 ② Status display - green
 ③ Backplane bus interface

Technical data of SM 322; DO 16 x DC 24 V/0.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 190 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
horizontal mounting position up to 40 °C up to 60 °C	max. 4 A max. 3 A
vertical mounting position up to 40 °C	max. 2 A
Electrical isolation	
between channels and the backplane bus	Yes
between channels in groups of	Yes 8
Permissible potential difference	
between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
- from the backplane bus - from load voltage L+ (no-load)	max. 80 mA max. 80 mA
Power loss of the module	typ. 4.9 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Actuator selection data	
Output voltage	min. L+ (-0.8 V)
with "1" signal	
Output current	
with "1" signal Rated value Permissible range	0.5 A 5 mA to 0.6 A
with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
at "1" to "0"	max. 100 µs
at "1" to "0"	max. 500 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel	
for redundant load control	supported (only outputs of the same group)
for performance increase	not supported
Control of a digital input	supported

Technical data	
Switching frequency	
• with resistive load	max. 100 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (-53 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 1 A
Wiring the actuators	with 20-pin front connector

3.20 Digital output module SM 322; DO 16 x DC 24 V/ 0.5 A High Speed; (6ES7322-1BL01-0AA0)

Order number:

6ES7322-1BH10-0AA0

Properties

Properties of SM 322; DO 16 x DC 24 V/0.5 A High Speed:

- 16 outputs, electrically isolated in groups of 8
- Output current 0.5 A
- Rated load voltage 24 VDC
- suitable for solenoid valves, DC contactors and signal lamps
- Isochronous mode supported

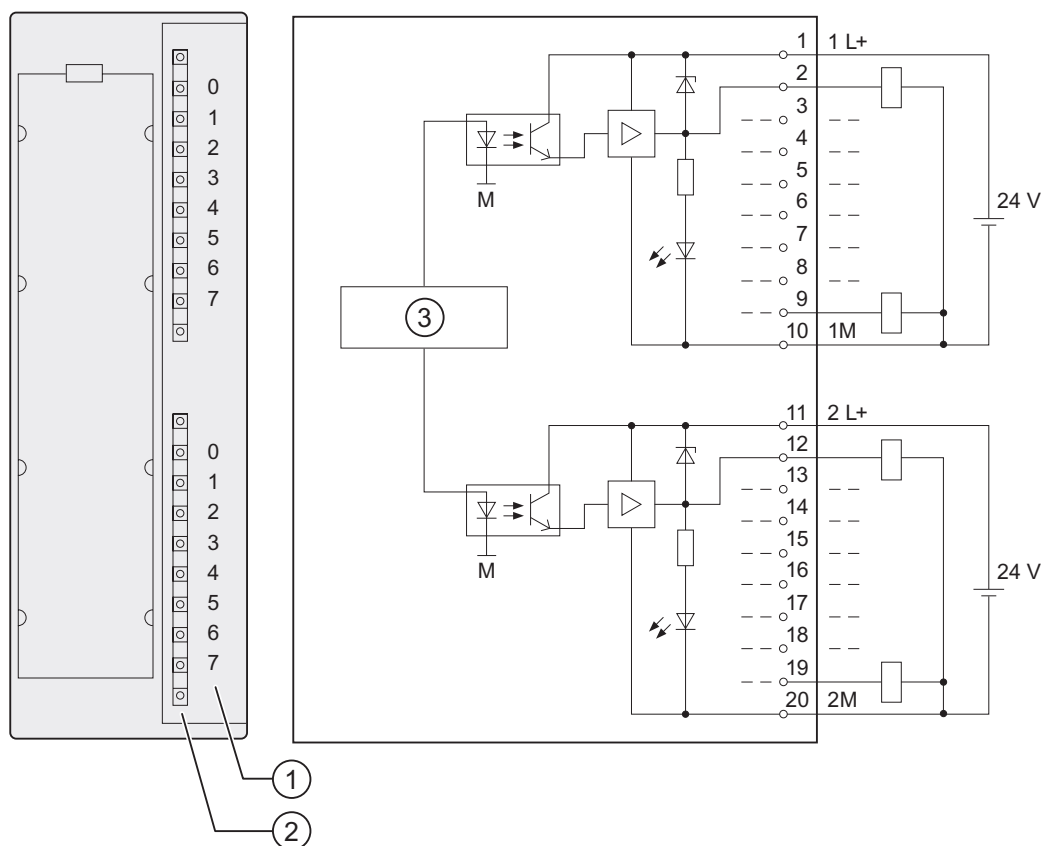
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 322; DO 16 x DC 24 V/0.5 A High Speed, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

Wiring and block diagrams of SM 322; DO 16 x DC 24 V/0.5 A High Speed



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 322; DO 16 x DC 24 V/0.5 A High Speed

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	Yes
Number of outputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

3.20 Digital output module SM 322; DO 16 x DC 24 V/ 0.5 A High Speed; (6ES7322-1BL01-0AA0)

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
- horizontal mounting position - up to 40 °C - up to 60 °C	max. 4 A max. 3 A
- vertical mounting position - up to 40 °C	max. 2 A
Electrical isolation	
between channels and the backplane bus	Yes
- between channels - in groups of	Yes 8
Permissible potential difference	
between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
- from the backplane bus - from load voltage L+ (no-load)	max. 70 mA max. 110 mA
Power loss of the module	typ. 5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Actuator selection data	
Output voltage	min. L+ (-0.8 V)
with "1" signal	
Output current	
- with "1" signal - Rated value - Permissible range	0.5 A 5 mA to 0.6 A
with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
at "1" to "0"	max. 100 µs
at "1" to "0"	max. 200 µs
Internal module cycle time between the backplane bus and the output driver input	
at "0" to "1" transitions	0.1 µs to 20 µs
at "1" to "0" transitions	0.1 µs to 20 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W

Technical data	
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 1000 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (-53 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 1 A
Wiring the actuators	with 20-pin front connector

3.21 Digital output module SM 322; DO 16 x UC 24/48 V; (6ES7322-5GH00-0AB0)

Order number

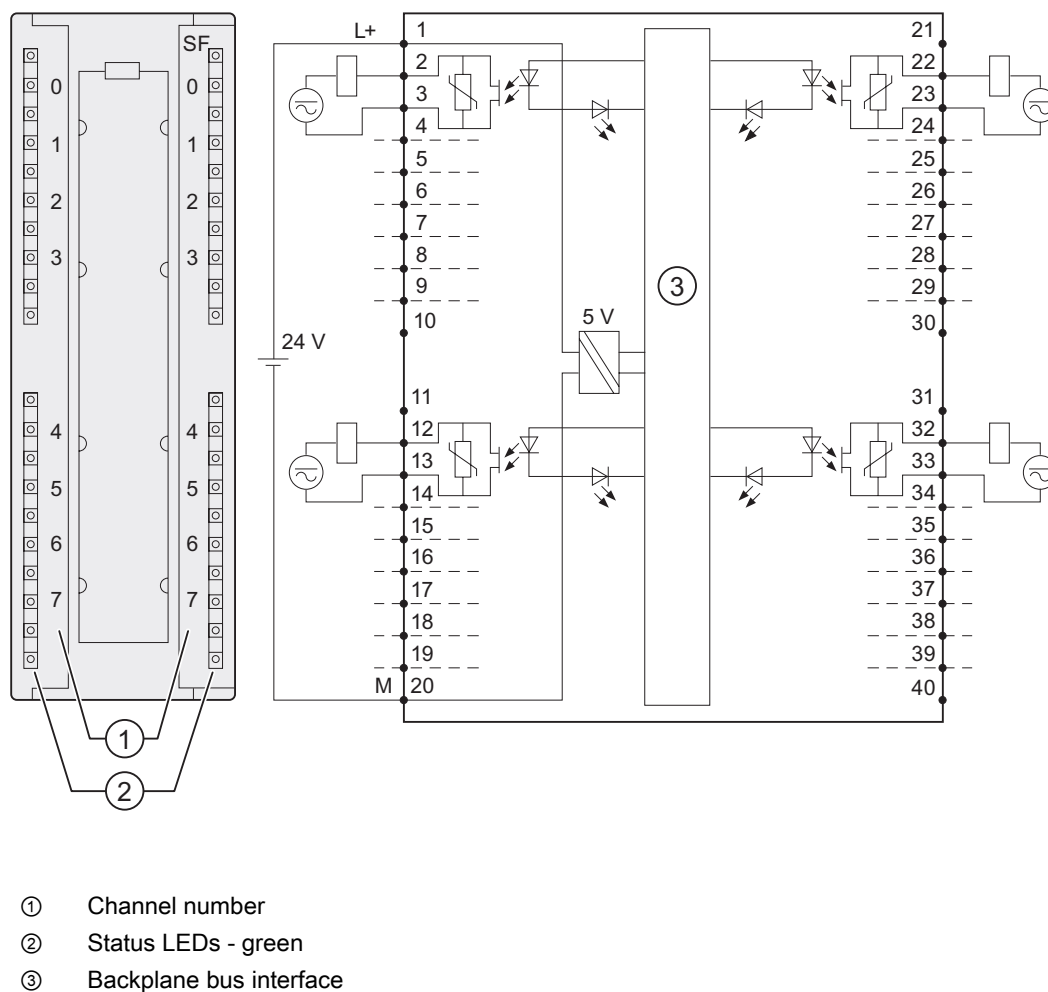
6ES7322-5GH00-0AB0

Properties

Properties of the SM 322; DO 16 x UC24/48 V digital output module:

- 16 electrically isolated static relay outputs
- Electrical isolation between channels of 120 V
- Switching characteristics: $R_{DS\ ON}$ is typically 0.25 Ohm, and $R_{DS\ OFF}$ is typically greater than 100 GOhm
- Designed for load voltages up to 48 V AC or DC, no minimum load voltage
- Designed for output loads up to 0.5 A, no minimum load current
- Outputs are fully independent and support any wiring configuration
- Set substitution values or "Hold last values" can be programmed at the outputs for CPU STOP.
- The module supports diagnostics of programming errors and of external power failure
- Suitable for AC solenoids, actuators, motor starters, FHP motors and signal lamps

Wiring and block diagrams of SM 322; DO 16 x UC 24/48 V



Technical data of SM 322; DO 16 x UC 24/48 V

Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 260 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Dimensions and weight	
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
- Reverse polarity protection - Power failure buffering	Yes min. 5 ms
Cumulative current of outputs (per group)	
horizontal mounting position up to 60 °C	max. 0.5 A
other mounting positions up to 40 °C	max. 0.5 A
Cumulated current of outputs (per module)	
horizontal mounting position up to 60 °C	max. 8 A
other mounting positions up to 40 °C	max. 8 A
Electrical isolation	
between channels and the backplane bus	Yes
between channels and electronics power supply	Yes
Between channels in groups of	Yes 1
Permissible potential difference	
between channels and the backplane bus	170 VDC, 120 VAC
between channels and electronics power supply	170 VDC, 120 VAC
between outputs of different groups	170 VDC, 120 VAC
Isolation test voltage	
between channels and the backplane bus	1500 VAC
between channels and electronics power supply	1500 VAC
between outputs of different groups	1500 VAC
Current consumption	
- from the backplane bus - from power supply L+	max. 100 mA max. 200 mA
Power loss of the module	typ. 2.8 W
Status, interrupts, diagnostics	
Status display	Green LEDs per channel
Diagnostics functions	
Group error display	red LED (SF)
Interrupts	
- Diagnostic interrupt - Reading diagnostics information	programmable supported
Actuator selection data	
Output voltage	
with "1" signal	min. L+ (-0.25 V)
Output current	
- with signal "1", permissible rated inrush current (per group) - with "0" signal (residual current)	0.5 A, max. 1.5 A (max. 50 ms) max. 10 µA

3.21 Digital output module SM 322; DO 16 x UC 24/48 V; (6ES7322-5GH00-0AB0)

Dimensions and weight	
Output delay (resistive load)	
- at "1" to "0" - at "1" to "0"	max. 6 ms max. 3 ms
External fuse for relay outputs	Fuse, I^2t :1 A ² s, fast-blow fuse*
Lamp load	max. 2.5 W
Internal parallel wiring of 2 outputs	Varistor, 85 V
- for redundant load control - for performance increase	supported not supported
Control of a digital input	supported
Switching frequency	
- with resistive load - with inductive load to IEC 947-5-1; DC 12 AC/12 - with lamp load	max. 10 Hz max. 0.5 Hz max. 0.5 Hz
Wiring the actuators	With 40-pin front connector

* Outputs must be protected by a 250 V fast-blow fuse (recommended fuses: Wickman 194-1100 1.1 A and Littelfuse 0217-800 V 800 mA.)

When mounted in a hazardous area to National Electric Code (NEC), always remove the fuse when the module is outside of the potentially explosive atmosphere, and use a suitable tool.

3.21.1 Parameters of the digital output module SM 322 DO 16 x UC24/48 V

Programming

The tables below show data record numbers for static and dynamic parameters.

Table 3-14 Data record 0 (static parameters):

Parameters	Comment
Enable diagnostics	Enabling an interrupt as a reaction to module failure caused by faulty parameter, hardware error, or voltage error.

Table 3-15 Data record 1 (dynamic parameters):

Parameters	Comment
Reaction to CPU STOP	
Hold last value	
Substitution value output	
Substitution value	
Substitution value	Each bit represents an output

This module supports fail state/substitution value outputs when the CPU changes from RUN to STOP.

Status displays

Each output of this module is equipped with a green LED to indicate the relay state. In addition, a red LED (SF) indicates the diagnostics status of the module.

Diagnostics, troubleshooting

Diagnostic data are assigned according to the technical data listed below.

The four system diagnostics data bytes can be read in the additional interrupt information as data record 0, or in the first 4 bytes of data record 1.

Structure of the data record and system diagnostics for SM 322 DO 16x UC 24/48V

Structure of data record 1:

Table 3-16 Structure of the data record for SM 322 DO 16 x UC 24/48 V

Data record 1 byte address	Available information	Contents
0..3	System-specific diagnostics data	4 bytes
4	Channel type	72h
5	Diagnostics data length per channel [in bytes]	0
6	Number of channels	16
7	Channel error vector	0 bit per channel
8..15	Channel-specific diagnostics data	0 byte per channel

System diagnostics for SM 322;DO 16 x UC24/48 V:

Table 3-17 System diagnostics for SM 322 DO 16 x UC 24/48 V

System diagnostics byte 1:		Technical data
D0:	Module error	Yes
D1:	Internal error	Yes
D2:	External error	Yes
D3:	Channel error	No
D4:	External auxiliary voltage missing	Yes
D5:	Front connector missing	No
D6:	Module not programmed	Yes
D7:	Incorrect parameters	Yes
System diagnostics byte 2:		
D0..D3:	Module class	1111
D4:	Channel information available	No
D5:	User information available	No
D6:	Diagnostic interrupt from substitute	No
D7:	Reserve	

3.21 Digital output module SM 322; DO 16 x UC 24/48 V; (6ES7322-5GH00-0AB0)

System diagnostics byte 1:		Technical data
System diagnostics byte 3:		
D0:	Wrong/missing memory module	No
D1:	Communication error	No
D2:	RUN/STOP operating state	No
D3:	Watchdog time-out	Yes
D4:	Internal power failure	No
D5:	Battery 1 low	No
D6:	Backup system failure	No
System diagnostics byte 4:		
D7:	Reserve	
D0:	Rack failure	No
D1:	Processor failure	Yes
D2:	EPROM error	Yes
D3:	RAM error	Yes
D4:	DAC error	No
D5:	Fuse blown	No
D6:	Hardware interrupt lost	No
D7:	Reserve	
Channel-specific diagnostics byte		
D0:	Faulty parameter settings	No
D1:	Grounding error	No
D2:	Short-circuit to P	No
D3:	Short-circuit to M	No
D4:	Wirebreak	No
D5:	Reserve	
D6:	Load voltage missing	No
D7:	Overtemperature	No

3.22 Digital output module SM 322; DO 16 x AC 120/230 V/1 A; (6ES7322-1FH00-0AA0)

Order number

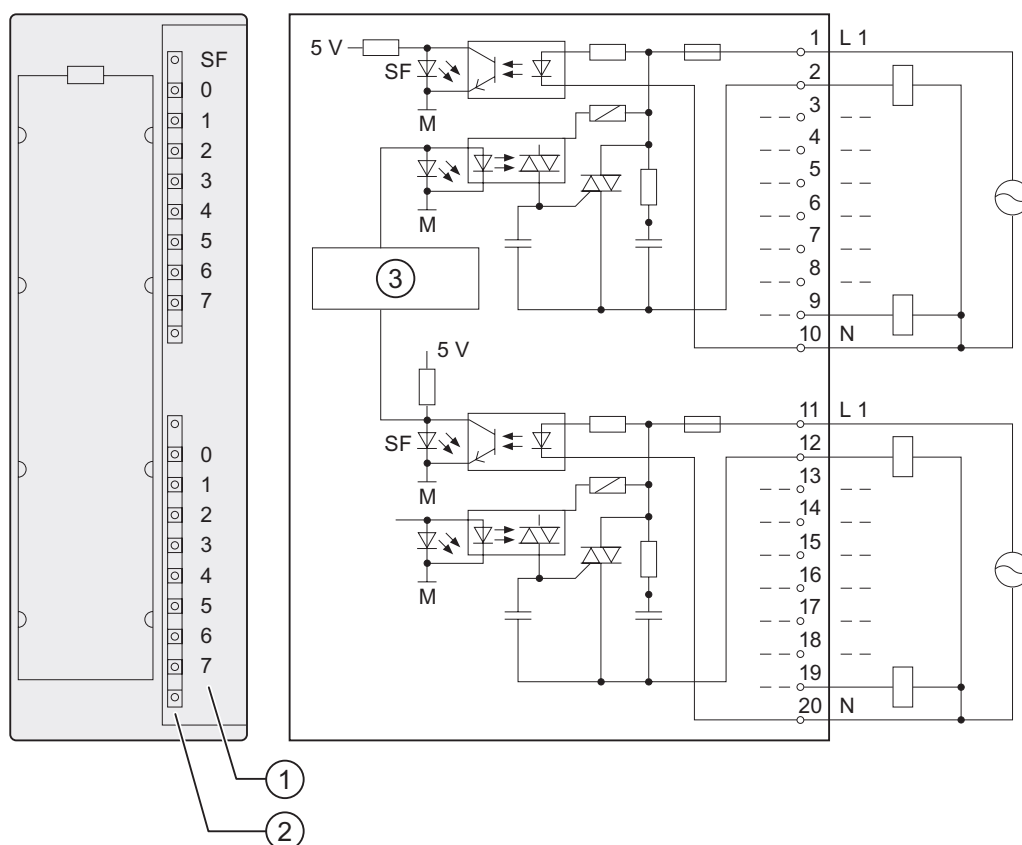
6ES7322-1FH00-0AA0

Properties

Properties of the digital output module SM 322; DO 16 x AC120/230 V/1 A:

- 16 outputs, fused and electrically isolated in groups of 8
- Output current 1 A
- Rated load voltage 120/230 VAC
- Suitable for AC solenoids, actuators, motor starters, FHP motors and signal lamps

Wiring and block diagrams of SM 322 DO 16 x AC120/230 V/1 A



- ① Channel number
- ② Status LEDs - green
Error LED - red
- ③ Backplane bus interface

Technical data of SM 322; DO 16 x AC 120/230 V/1 A

Technical data	
Dimensions and weight	
Dimensions W x H x D	40 x 125 x 117
Weight	approx. 275 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Load voltage L1 All load voltages must be connected to the same phase	120/230 VAC
Cumulative current of outputs (per group)	
• horizontal mounting position up to 40 °C up to 60 °C	max. 4 A max. 2 A
• vertical mounting position up to 40 °C	max. 2 A
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels in groups of	Yes 8
Permissible potential difference	
• between M _{internal} and outputs	230 VAC
• between outputs of different groups	500 VAC
Isolation test voltage	4000 VDC
Current consumption	
• from the backplane bus	max. 200 mA
• from load voltage L+ (no-load)	max. 2 mA
Power loss of the module	typ. 8.6 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	
• Diagnostic interrupt	No
Diagnostics functions	red LED (SF)
• Group error display	(fuse or no L1/N)
Actuator selection data	
Output voltage	
• with "1" signal	min. L 1 (- 1.5 V)
– At maximum current	min. L 1 (-8.5 V)
– At minimum current	

Technical data	
Output current	
with "1" signal	
Rated value	1 A
Permissible range at 0 °C to 40 °C	10 mA to 1 A
Permissible range at 0°C to 60°C	10 mA to 0.5 A
Permissible inrush current (per group)	max. 20 A (with 2 half-waves)
with "0" signal (residual current)	max. 2 mA
Blocking voltage	max. 60 V
Zero transition	
Size of the motor starter	max. size 4 to NEMA
Lamp load	max. 50 W
Wiring two outputs in parallel	
for redundant load control	supported (only outputs of the same group)
for performance increase	No
Control of a digital input	supported
Switching frequency	
with resistive load	max. 10 Hz
with inductive load to IEC 947-5-1, AC 15	max. 0.5 Hz
with lamp load	max. 1 Hz
Short circuit-proof output	Fuse 8 A, 250 V; per group
Fuse-tripping current	min. 40 A
Response time	max. 300 ms
Replacement fuses	8 A fuse, fast-blowing
Wickman	19 194-8 A
Schurter	SP001.1014
Littlefuse	217.008
Fuse holder	
Wickman	19 653
Wiring the actuators	with 20-pin front connector

3.23 Digital output module SM 322; DO 8 x DC 24 V/ 2 A; (6ES7322-1BF01-0AA0)

Order number

6ES7322-1BF01-0AA0

Properties

Properties of SM 322; DO 8 x DC 24 V/2 A:

- 8 outputs, electrically isolated in groups of 4
- Output current 2 A
- Rated load voltage 24 VDC
- suitable for solenoid valves, DC contactors and signal lamps

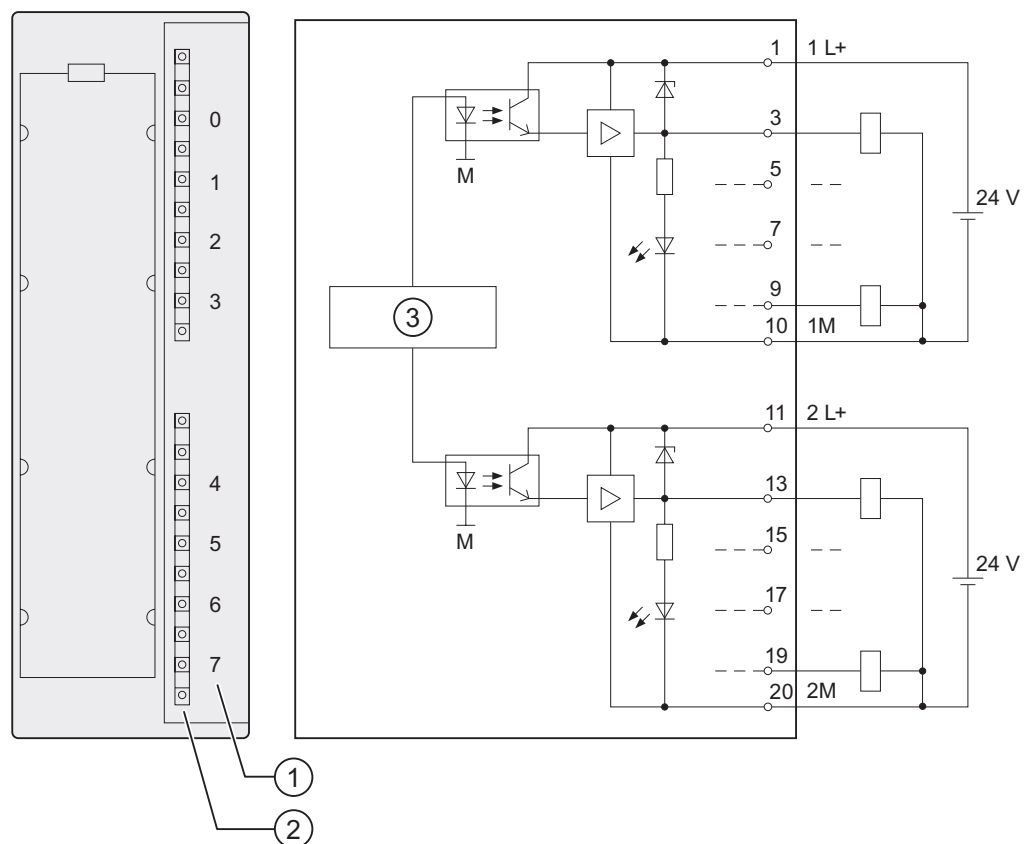
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 322; DO 8 x DC 24 V/2 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

Wiring and block diagrams of SM 322; DO 8 x 24 VDC/2 A



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 322; DO 8 x DC 24 V/2 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 190 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	

3.23 Digital output module SM 322; DO 8 x DC 24 V/ 2 A; (6ES7322-1BF01-0AA0)

Technical data	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position up to 60 °C	max. 4 A
• vertical mounting position up to 40 °C	max. 4 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels in groups of	Yes 4
Permissible potential difference	
• between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 40 mA
• from load voltage L+ (no-load)	max. 60 mA
Power loss of the module	typ. 6.8 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Actuator selection data	
Output voltage	min. L+ (-0.8 V)
• with "1" signal	
Output current	
• with "1" signal	
Rated value	2 A
Permissible range	5 mA to 2.4 A
• with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• at "1" to "0"	max. 100 µs
• at "1" to "0"	max. 500 µs
Load resistance range	12 Ω to 4 kΩ
Lamp load	max. 10 W
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 100 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L+ (-48 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 3 A
Wiring the actuators	with 20-pin front connector

3.24 Digital output module SM 322; DO 8 x DC 24 V/ 0.5 A; with diagnostics interrupt; (6ES7322-8BF00-0AB0)

Order number: "Standard module"

6ES7322-8BF00-0AB0

Order number: "SIPLUS S7-300 module"

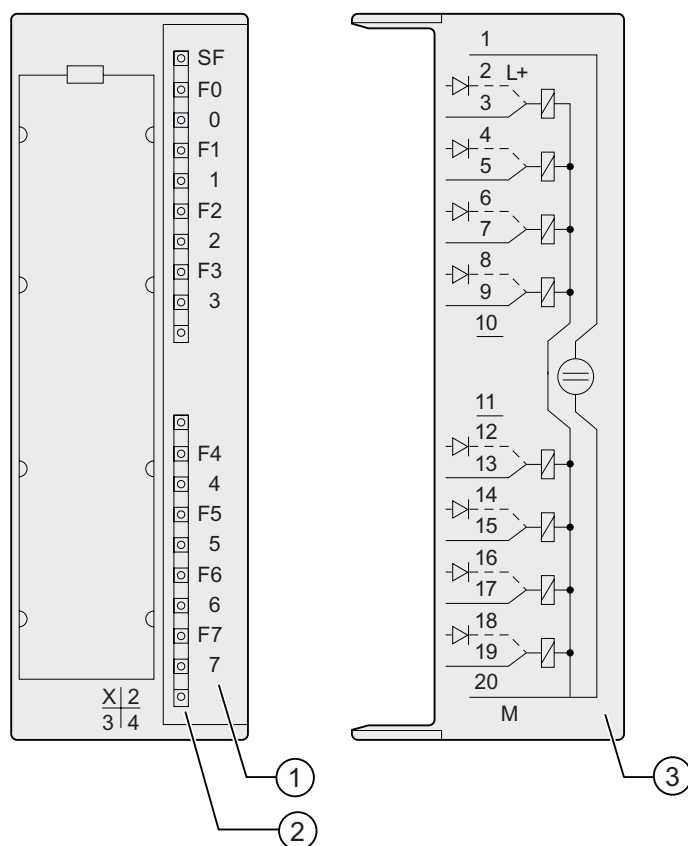
6AG1 322-8BF00-2AB0

Properties

Properties of SM 322; DO 8 x DC 24 V/0.5 A:

- 8 outputs, electrically isolated in groups of 8
- Output current 0.5 A
- Rated load voltage 24 VDC
- suitable for solenoid valves, DC contactors and signal lamps
- 2 terminals per output
 - Output without series diode
 - Output with series diode (for redundant load control)
- Group error display (SF)
- Channel-specific status and error LEDs
- Programmable diagnostics
- Programmable diagnostic interrupt
- Programmable substitution value output

Wiring and block diagrams of SM 322; DO 8 x 24 VDC/0.5 A



- ① Channel number, channel error (F)
- ② Status display - green
Error LED - red
- ③ Wiring diagram

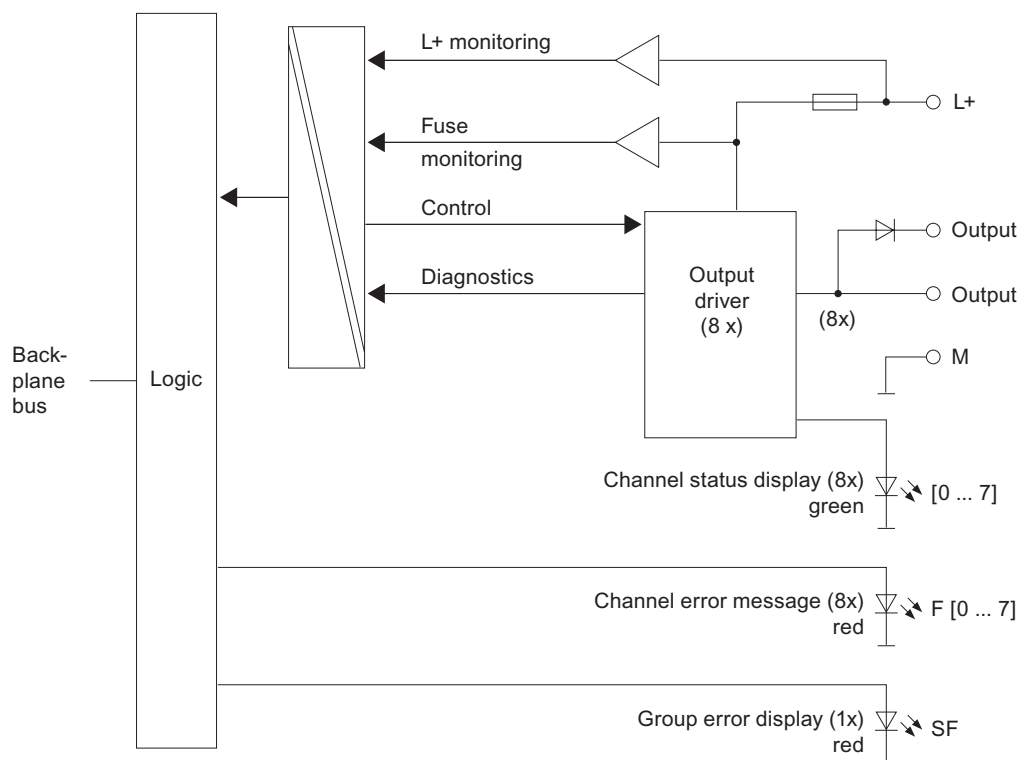


Figure 3-7 Block diagram of SM 322; DO 8 x DC 24 V/0.5 A

Redundant control of a load

The output with series diode can be used for redundant load control. Redundant control without external circuitry is possible using two different signal modules. Both modules must be connected to the common reference potential M.

Note

It is not possible to detect external short-circuits to L+ at output with series diode.

3.24 Digital output module SM 322; DO 8 x DC 24 V/ 0.5 A; with diagnostics interrupt; (6ES7322-8BF00-0AB0)

Technical data of SM 322; DO 8 x DC 24 V/0.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 210 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current (per group) of outputs without series diode	
• horizontal mounting position	
up to 40 °C	max. 4 A
up to 60 °C	max. 3 A
• vertical mounting position	max. 4 A
up to 40 °C	
Cumulative current of outputs (per group) with series diode	
• horizontal mounting position	
up to 40 °C	max. 3 A
up to 60 °C	max. 2 A
• vertical mounting position	max. 3 A
up to 40 °C	
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels	Yes
in groups of	8
Permissible potential difference	
• between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 70 mA
• from load voltage L+ (no-load)	max. 90 mA
Power loss of the module	typ. 5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	programmable
• Diagnostic interrupt	

Technical data	
Diagnostics functions - Group error display - Channel error display (F) - Reading diagnostics data	programmable red LED (SF) red LED (F) per channel supported
Actuator selection data	
Output voltage with "1" signal without series diode with series diode	min. L + (- 0.8 V) min. L+ (-1.6 V)
Output current	
with "1" signal Rated value Permissible range	0.5 A 10 mA to 0.6 A ¹⁾
with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load) - at "0" to "1" transitions - at "1" to "0" transitions	max. 180 µs max. 245 µs
Load resistance range	48 Ω to 3 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel	
for redundant load control	Only outputs with series diode and common reference potential
for performance increase	not supported
Control of a digital input	supported 1 binary input to IEC 61131, Type 2; Type 1, with disabled wire-break monitoring
Switching frequency - with resistive load - with inductive load to IEC 947-5-1, DC 13 - with lamp load	max. 100 Hz max. 2 Hz max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (-45 V)
Short circuit-proof output	Yes, electronic
Threshold	typ. 0.75 A to 1.5 A
Wiring the actuators	with 20-pin front connector

1) 5 mA to 0.6 A, with disabled wire-break monitoring

3.24.1 Parameters of SM 322; DO 8 x DC 24 V/0.5 A

Programming

The general procedure of programming digital modules is described in the chapter Programming digital modules.

Parameters of SM 322; DO 8 x DC 24 V/0.5 A

The table below lists the configurable parameters of SM 322; DO 8 x DC 24 V/0.5 A, including defaults.

The defaults apply if you have not set any parameters in **STEP 7**.

Table 3-18 Parameters of SM 322; DO 8 x DC 24 V/0.5 A

Parameters	Range of values	Default	Parameter type	Scope
Enable				
• Diagnostic interrupt	Yes/no	No	Dynamic	Module
Reaction to CPU STOP	Set substitution value (SSV) Hold last value (HLV)	SSV		
Diagnostics				
• Wirebreak	Yes/no	No	Static	Channel
• Load voltage L+ missing	yes/no	No		
• Short-circuit to M	yes/no	No		
• Short-circuit to L+	Yes/no	No		
Set substitution value "1"	Yes/no	No	Dynamic	Channel

3.24.2 Diagnostics of SM 322; DO 8 x DC 24 V/0.5 A

Diagnostics messages of SM 322; DO 8 x DC 24 V/0.5 A

The table provides an overview of the diagnostic messages of SM 322;
DO 8 x DC 24 V/0.5 A

Table 3-19 Diagnostics messages of SM 322; DO 8 x DC 24 V/0.5 A

Diagnostics message	LED	Scope of diagnostics	programmable
Wire-break*	SF	Channel	Yes
Load voltage missing	SF	Channel	Yes
Short-circuit to M	SF	Channel	Yes
Short-circuit to L+	SF	Channel	Yes
External auxiliary voltage missing	SF	Module	No
Internal auxiliary voltage missing	SF	Module	No
Fuse blown	SF	Module	No
Watchdog time-out	SF	Module	No
EPROM error	SF	Module	No
RAM error	SF	Module	No

* The module detects a wire-break at a current < 1 mA.
If configured accordingly, the
SF LED and corresponding channel error LED light up when a wire-break is detected.

Note

Prerequisite for the detection of errors indicated by programmable diagnostic messages is an appropriate configuration of the digital module in *STEP 7*.

Causes of error and troubleshooting

Table 3-20 Diagnostic messages of SM 322; DO 8 x DC 24 V/0.5 A, causes of error and troubleshooting

Diagnostics message	Error detection condition ...	Possible cause of error	To correct or avoid error
Wirebreak	Only when output = "1"	Wire-break between the module and actuator	Connect the cable
		Channel not connected (open)	Disable the "Diagnose Wire-break" parameter for the channel in <i>STEP 7</i>
Load voltage missing	Only when output = "1"	Defective output	Replace the module
Short-circuit to M	Only when output = "1"	Overload at output	Eliminate overload
		Short-circuit of output to M	Eliminate the short-circuit
Short-circuit to L+	generally	Short-circuit at output to L+ of the module power supply	Eliminate the short-circuit
External auxiliary voltage missing	generally	Power supply L+ to module missing	Feed supply L+
Internal auxiliary voltage missing	generally	Power supply L+ to module missing	Feed supply L+
		Fuse blown in module	Replace the module
Fuse blown	generally	Fuse blown in module	Replace the module
Watchdog time-out	generally	Infrequent high electromagnetic interference	Eliminate interference
		Module defective	Replace the module
EPROM error	generally	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
		Module defective	Replace the module
RAM error	generally	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
		Module defective	Replace the module

3.24.3 Reaction of SM 322; DO 8 x DC 24 V/0.5 A

Influence of the operating state and supply voltage on output values

The output values of SM 322; DO 8 x DC 24V/0.5 A are determined by the CPU's operating state and the module's power supply.

Table 3-21 Influence of the CPU operating state and of the supply voltage L+ of SM 322; DO 8 24 VDC/0.5 A on output values.

CPU operating state		Power supply L+ at digital module	Output value of the digital module
POWER ON	RUN	L+ present	CPU value
		L+ missing	0 signal
	STOP	L+ present	Substitution value/last value (default = 0 signal)
		L+ missing	0 signal
POWER OFF	-	L+ present	0 signal
		L+ missing	0 signal

Reaction to power failure

Failure of the power supply to SM 322; DO 8 x DC 24V/0.5 A is always indicated at the module's SF LED. This information is also available on the module (entry in diagnostics data.)

Triggering of diagnostics interrupts is determined by the parameter settings (see the next chapter 3.24.4 *Interrupts of SM 322; DO 8 x DC 24/0.5 A*).

See also

Parameters of SM 322; DO 8 x DC 24 V/0.5 A (Page 3-77)

3.24.4 Interrupts of SM 322; DO 8 x DC 24 V/0.5 A

Introduction

The SM 322; DO 8 x DC 24 V/0.5 A can trigger diagnostic interrupts.

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if parameters are not set accordingly. Program the interrupt enable parameter in **STEP 7**.

Diagnostic interrupt

When diagnostic interrupts are enabled, incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of an interrupt.

The CPU interrupts user program execution, and executes diagnostic interrupt OB82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

See also

Parameters of SM 322; DO 8 x DC 24 V/0.5 A (Page 3-77)

3.25 Digital output module SM 322; DO 8 x DC 48-125 V/1.5 A; (6ES7322-1CF00-0AA0)

Order number: "Standard module"

6ES7322-1CF00-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 322-1CF00-2AA0

Properties

Properties of SM 322; DO 8 x DC 48-125 V/1.5 A:

- 8 outputs, with reverse polarity protection, and electrically isolated in groups of 4
- Output current 1.5 A
- Rated load voltage 48 VDC to 125 VDC
- suitable for solenoid valves, DC contactors and signal lamps
- Group error display (SF)

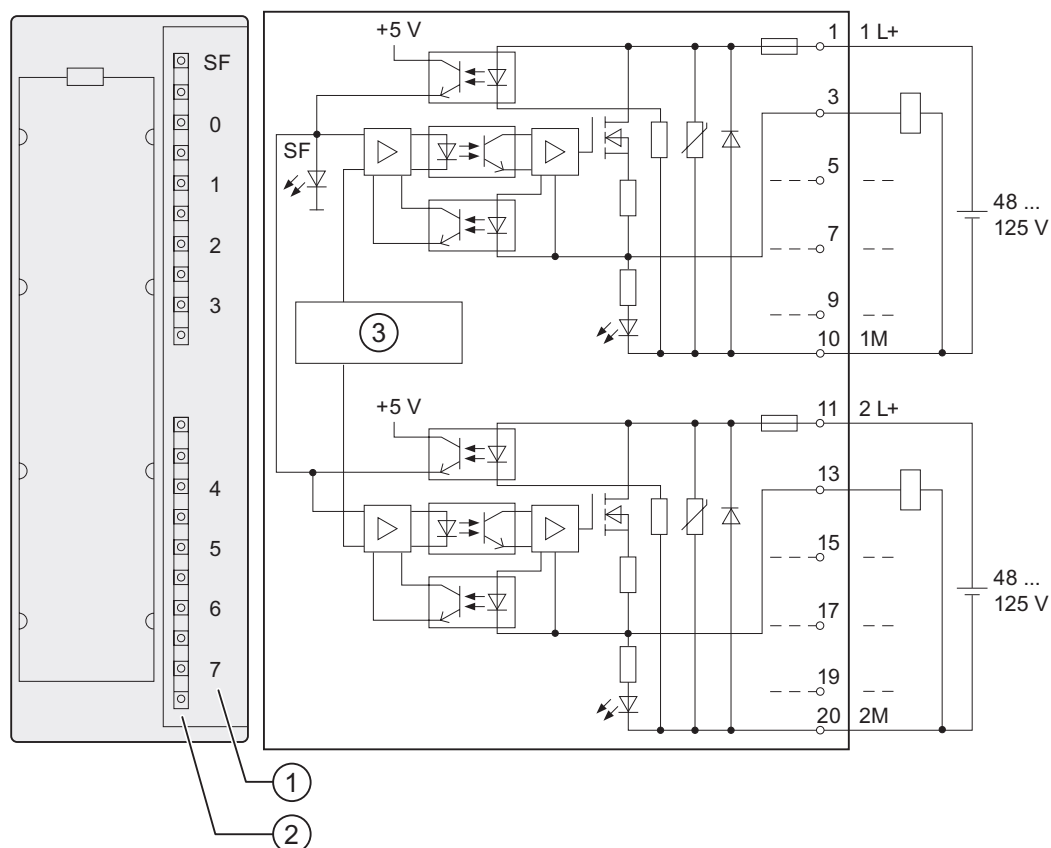
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the power supply, the outputs of SM 322; DO 8 x DC 48-125 V/1.5 A will carry a "1" signal for the duration of approx. 50 µs due to the circuit structure.

Wiring and block diagrams of SM 322; DO 8 x DC 48-125 V/1.5 A



Technical data of M 322; DO 8 x DC 48-125 V/1.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 250 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	48 VDC to 125 VDC
• Reverse polarity protection	Yes, by fusing ¹⁾
Cumulative current of outputs (per group)	
• horizontal mounting position up to 40 °C up to 50 °C up to 60 °C	max. 6 A max. 4 A max. 3 A
• vertical mounting position up to 40 °C	max. 4 A
Electrical isolation	Yes
• between channels and the backplane bus	
• between channels in groups of	Yes 4
Permissible potential difference	
• between different circuits	146 VDC / 132 VAC
Isolation test voltage	1500 VAC
Current consumption	
• from the backplane bus	max. 100 mA
• from load voltage L+ (no-load)	max. 2 mA
Power loss of the module	typ. 7.2 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	
• Group error display	red LED (SF) ²⁾
Actuator selection data	
Output voltage	
• with "1" signal	min. L+ (-1.2 V)
Output current	
• with "1" signal	
Rated value	1.5 A
Permissible range	10 mA to 1.5 A
• Permitted surge current	max. 3 A for a duration of 10 ms
• with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• at "1" to "0"	max. 2 ms
• at "1" to "0"	max. 15 ms
Lamp load	max. 15 W at 48 V max. 40 W at 125 V

3.26 Digital output module SM 322; DO 8 x AC 120/230 V/2 A; (6ES7322-1FF01-0AA0)

Technical data	
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 25 Hz
• with inductive load	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. M (-1V)
Short circuit-proof output	Yes, electronic ³⁾
• Threshold	typ. 4.4 A
Replacement fuses	Fuse 6.3 A/250 V, fast-blow, 5 x 20 mm
• Schurter	SP0001.1012
• Wickman	194-1630-0
Fuse holder	
• Wickman	653 0000 040
Wiring the actuators	with 20-pin connector

1) Fuses on this module are only supplementary. External excess current protection (suitable for branch circuits conforming to local regulations for electrical engineering) is required in the supply lines of the load circuit.

2) Potential errors are:

- No load voltage
- Fuse defective
- Output overloaded

3) If an overload condition is detected, the output is disabled for the duration of approx. 2.4 s.

3.26 Digital output module SM 322; DO 8 x AC 120/230 V/2 A; (6ES7322-1FF01-0AA0)

Order number: "Standard module"

6ES7322-1FF01-0AA0

Order number: "SIPLUS S7-300 module"

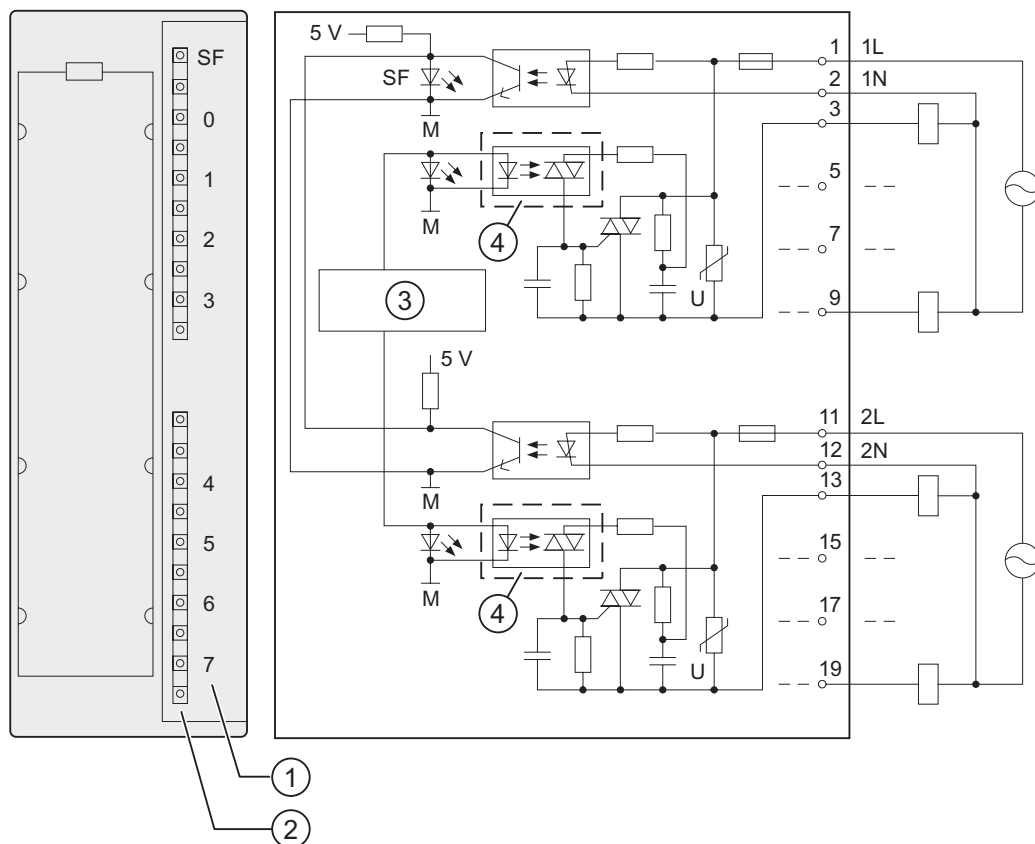
6AG1 322-1FF01-2AA0

Properties

Properties of SM 322; DO 8 x AC 120/230 V/2 A:

- 8 outputs, fused and electrically isolated in groups of 4
- Output current 2 A
- Rated load voltage 120/230 VAC
- suitable for AC solenoid valves, contactors, motor starters, FHP motors and signal lamps.
- Group error display (SF)

Wiring and block diagrams of SM 322; DO 8 x AC 120/230 V/2 A



- ① Channel number
- ② Status display - green
Error LED - red
- ③ Backplane bus interface
- ④ Optotriac

Technical data of SM 322; DO 8 x AC 120/230 V/2 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 275 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
• Permitted frequency range	47 Hz to 63 Hz
Cumulative current of outputs (per group)	
• horizontal mounting position up to 40 °C up to 60 °C	max. 4 A max. 2 A
• vertical mounting position up to 40 °C	max. 2 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	Yes
in groups of	4
Permissible potential difference	
• between M _{internal} and outputs	230 VAC
• between outputs of different groups	500 VAC
Isolation test voltage	1500 VAC
Current consumption	
• from the backplane bus	max. 100 mA
• from load voltage L1 (no-load)	max. 2 mA
Power loss of the module	typ. 8.6 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	Yes
• Group error display	red LED (SF) ²⁾
Actuator selection data	
Output voltage	
• with "1" signal	
– At maximum current	min. L1 (-1.5 V)
– At minimum current	min. L1 (-8.5 V)
Output current	
• with "1" signal	
Rated value	AC 2 A ¹⁾
permissible range at 0 °C to 40 °C	10 mA to 2 A
permissible range at 40 °C to 60 °C	10 mA to 1 A
Permitted inrush current (per group)	max. 20 A (max. 1 AC cycle)
• with "0" signal (residual current)	max. 2 mA
Output delay (resistive load)	
• at "1" to "0"	max. 1 AC cycle
• at "1" to "0"	max. 1 AC cycle

3.27 Digital output module SM 322; DO 8 x AC 120/230 V/2 A ISOL (6ES7322-5FF00-0AB0)

Technical data	
Minimum load current	10 mA
Zero transition	max. 60 V
Size of the motor starter	max. size 5 to NEMA
Lamp load	max. 50 W
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 10 Hz
• with inductive load to IEC 947-5-1, AC 15	max. 0.5 Hz
• with lamp load	max. 1 Hz
Short circuit-proof output	Fuse, 8 A/250 V; per group
• Fuse-tripping current	min. 40 A
• Response time	max. 300 ms
Replacement fuses	8 A fuse/fast-blow
• Wickman	194-1800-0
• Schurter	SP001.1013
• Littelfuse	217.008
Fuse holder	
• Wickman	653 07
Wiring the actuators	with 20-pin front connector

1) The load current must not be half-wave

2) Potential errors are:

- No load voltage
- Fuse defective

3.27 Digital output module SM 322; DO 8 x AC 120/230 V/2 A ISOL (6ES7322-5FF00-0AB0)

Order number

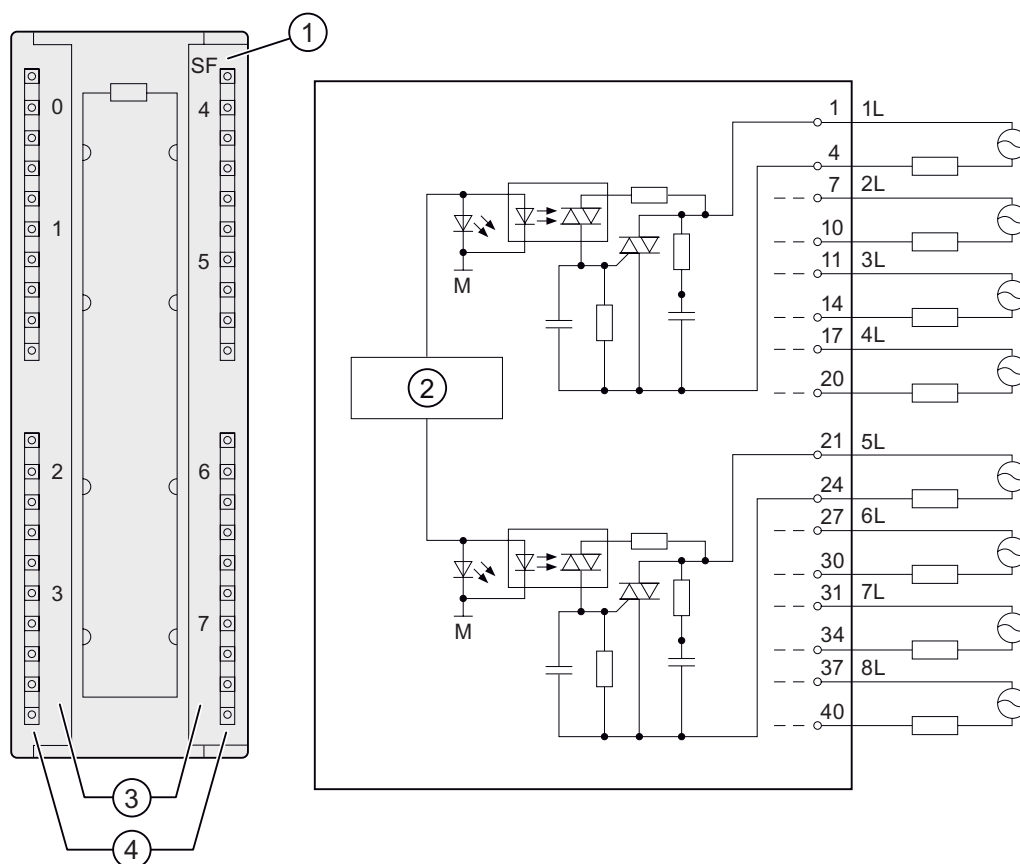
6ES7322-5FF00-0AB0

Properties

Properties of digital output module SM 322; DO 8 x AC 120/230 V/2 A ISOL:

- 8 outputs, electrically isolated
- Group error display
- Channelspecific status LEDs
- Programmable diagnostics
- Programmable diagnostic interrupt
- Programmable substitution value output
- Output current 2 A
- Rated load voltage 120/230 VAC
- Suitable for AC solenoid valves, contactors, motor starters, FHP motors and signal lamps

Wiring and block diagrams of SM 322; DO 8 x AC 120/230 V/2 A ISOL



- ① Group error display - red
- ② Backplane bus interface
- ③ Channel number
- ④ Status display - green

Technical data of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Technical data	
Dimensions and weight	
Dimensions W x H x D	40 x 125 x 117
Weight	approx. 275 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
Cumulative current of outputs (module)	
- Horizontal mounting position - up to 40 °C - up to 60 °C	max. 8 A max. 4 A
- vertical mounting position - up to 40 °C	max. 4 A
Electrical isolation	
between channels and the backplane bus	Yes
- between channels - in groups of	Yes 1
Permissible potential difference	
between M_{internal} and outputs	230 VAC
between outputs	500 VAC
Isolation test voltage	
between M_{internal} and outputs	1500 VAC
between outputs of different groups	2000 VAC
Current consumption	
- from the backplane bus - from load voltage L1 (no-load)	max. 100 mA max. 2 mA
Power loss of the module	typ. 8.6 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts Diagnostic interrupt	programmable
Diagnostics functions Group error display	red LED (SF)
Actuator selection data	
Output voltage - with "1" signal - At maximum current - At minimum current	min. L1 (-1.5 V) min L1 (-8.5 V)
Output current	
- with "1" signal - Rated value - permissible range at 0 °C to 40 °C - permissible range at 40 °C to 60 °C - Permissible inrush current (per group)	2 A 10 mA to 2 A 10 mA to 1 A max. 20 A (with 2 half-waves)
with "0" signal (residual current)	max. 2 mA
Zero transition	max. 60 V
Size of the motor starter	max. size 5 to NEMA

3.27 Digital output module SM 322; DO 8 x AC 120/230 V/2 A ISOL (6ES7322-5FF00-0AB0)

Technical data	
Lamp load	max. 50 W
Wiring two outputs in parallel	
• for redundant load control	supported
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 10 Hz
• with inductive load to IEC 947-5-1, AC 15	max. 0.5 Hz
• with lamp load	max. 1 Hz
Short circuit-proof output	Yes, 3.15 A / 250 V fuse, fast-blow
Wiring the actuators	with 20-pin front connector

Note

The outputs must be protected by a high-speed, fast-blow 3.15 A 250 VAC fuse. When installed in a hazardous area to National Electric Code, the area must be designated safe before you replace the fuse. Always use a suitable tool.

3.27.1 Parameters of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Parameters of SM 322; DO 8 x AC 120/230 V/2 A ISOL

The table below lists the configurable parameters of SM 322; DO 8 x AC120/230 V/2 A ISOL, including defaults.

The defaults apply if you have not set any parameters in *STEP 7*.

Table 3-22 Parameters of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Parameters	Range of values	Defaults	Parameter type	Scope
Enable				
• Diagnostic interrupts	Yes/no	No	Dynamic	Module
Reaction to CPU STOP	Set substitution value Hold last value	SSV	Dynamic	Channel
Set substitution value "1"	Yes/no	No	Dynamic	Channel

Programming

For detailed information on parameters of the digital output module, refer to the appendix.

See also

Parameters of digital output modules (Page A-4)

Programming digital modules (Page 3-8)

3.27.2 Diagnostics of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Diagnostic messages of SM 322; DO 8 x AC 120/230 V/2 A ISOL

The table below provides an overview of the diagnostic messages of SM 322; DO 8 x 120/230 VAC/2 A ISOL.

Table 3-23 Diagnostic messages of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Diagnostics message	LED	Scope of diagnostics	programmable
Watchdog time-out	SF	Module	No
EPROM error	SF	Module	No
RAM error	SF	Module	No

Causes of error and troubleshooting

Table 3-24 shows the diagnostic messages of SM 322; DO 8 x AC 120/230V/2 A ISOL, causes of error and troubleshooting.

Table 3-24 Diagnostic messages of SM 322; DO 8 x AC 120/230V/2 A ISOL, error causes and troubleshooting

Diagnostics message	Error detection	Possible cause of error	To correct or avoid errors
Watchdog time-out	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module
EPROM error	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module
RAM error	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module

3.27.3 Interrupts of SM 322; DO 8 x AC 120/230 V/2 A ISOL

Introduction

The SM 322; DO 8 x AC 120/230 V/2 A ISOL can trigger diagnostic interrupts.

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if parameters are not set accordingly. Program the interrupt enable parameter in **STEP 7**.

Diagnostic interrupt

When diagnostic interrupts are enabled, incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of interrupt.

The CPU interrupts execution of the user program and processes diagnostic interrupt OB 82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

Load restrictions in horizontal mounting position

In horizontal mounting position, the module loads must be restricted so that two adjacent inputs or outputs do not exceed their rated load.

Load restrictions in vertical mounting position

In vertical mounting position, the module loads must be restricted so that four adjacent inputs or outputs do not exceed their rated load.

See also

Parameters of SM 322; DO 8 x DC 24 V/0.5 A (Page 3-77)

3.28 Relay output module SM 322; DO 16 x Rel. AC 120/230 V; (6ES7322-1HH01-0AA0)

Order number

6ES7322-1HH01-0AA0

Properties

Properties of SM 322; DO 16 x Rel. AC 120/230 V:

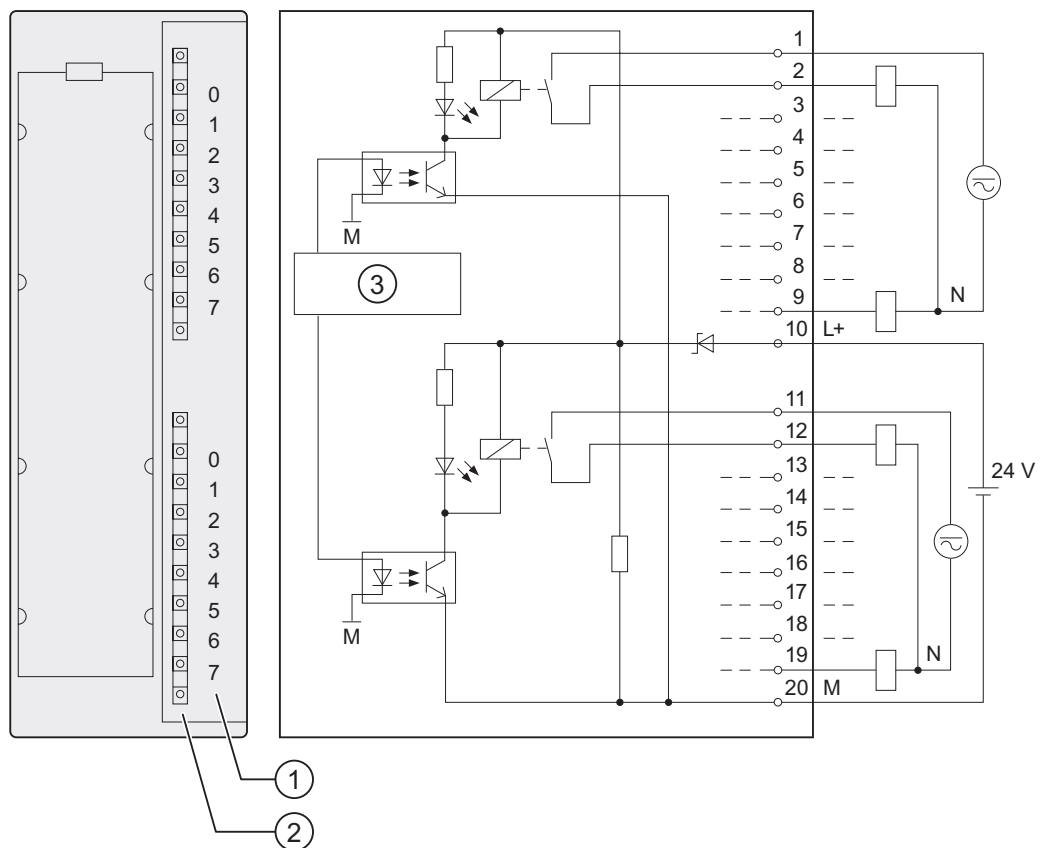
- 16 outputs, electrically isolated in groups of 8
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

Reaction to a shutdown of the power supply

Note

The internal 200-ms buffer capacitance discharges sufficient power after power off to allow the user program to set a defined relay state.

Wiring and block diagrams of SM 322; DO 16 x Rel. AC 120/230 V



Technical data of SM 322; DO 16 x Rel. AC 120/230 V

Technical data		
Dimensions and weight		
Dimensions W x H x D (mm)	40 x 125 x 117	
Weight	approx. 250 g	
Module-specific data		
Isochronous mode supported	No	
Number of outputs	16	
Cable length - unshielded - shielded	max. 600 m max. 1000 m	
Voltages, currents, electrical potentials		
Rated power supply L+ to the relays	24 VDC	
Cumulative current of outputs (per group)	max. 8 A	
Electrical isolation		
between channels and the backplane bus	Yes	
between channels in groups of	Yes 8	
Permissible potential difference		
between M_{internal} and the power supply to relays	75 VDC / 60 VAC	
between M_{internal} and the power supply to relays and outputs	230 VAC	
between outputs of different groups	500 VAC	
Isolation test voltage		
between M_{internal} and the power supply to relays	500 VDC	
between M_{internal} and the power supply to relays and outputs	1500 VAC	
between outputs of different groups	2000 VAC	
Current consumption - from the backplane bus - from power supply L+	max. 100 mA max. 250 mA	
Power loss of the module	typ. 4.5 W	
Status, interrupts, diagnostics		
Status display	green LED per channel	
Interrupts	None	
Diagnostics functions	None	
Actuator selection data		
Thermal current, continuous	max. 2 A	
Minimum load voltage / current	10 V / 10 mA	
Short-circuit current to IEC 947-5-1	200 A, with B10/B16 circuit breaker	
Switching capacity and service life of contacts		
with resistive load		

Technical data		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	2.0 A	0.1 million
	1.0 A	0.2 million
	0.5 A	1.0 million
60 VDC	0.5 A	0.2 million
120 VDC	0.2 A	0.6 million
24 VAC	1.5 A	1.5 million
48 VAC	1.5 A	1.5 million
60 VAC	1.5 A	1.5 million
120 VAC	2.0 A	1.0 million
	1.0 A	1.5 million
	0.5 A	2.0 million
230 VAC	2.0 A	1.0 million
	1.0 A	1.5 million
	0.5 A	2.0 million
with inductive load to IEC 947-5-1 DC13/AC15		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	2.0 A	0.05 million
	1.0 A	0.1 million
	0.5 A	0.5 million
60 VDC	0.5 A	0.1 million
120 VDC	0.2 A	0.3 million
24 VAC	1.5 A	1 million
48 VAC	1.5 A	1 million
60 VAC	1.5 A	1 million
120 VAC	2.0 A	0.7 million
	1.0 A	1.0 million
	0.5 A	1.5 million
230 VAC	2.0 A	0.7 million
	1.0 A	1.0 million
	0.5 A	1.5 million
An external protective circuit will increase the service life of contacts.		
Size of the motor starter	max. size 5 to NEMA	
Lamp load	50 W / AC 230 V 5 W / DC 24 V	
Contact protection (internal)	None	
Wiring two outputs in parallel		
for redundant load control	supported (only outputs of the same group)	
for performance increase	not supported	
Control of a digital input	supported	
Switching frequency		
Mechanical	max. 10 Hz	
with resistive load	max. 1 Hz	
with inductive load to IEC 947-5-1, DC13/AC15	max. 0.5 Hz	
with lamp load	max. 1 Hz	
Wiring the actuators	with 20-pin front connector	

3.29 Relay output module SM 322; DO 8 x Rel. AC 230 V; (6ES7322-1HF01-0AA0)

Order number

6ES7322-1HF01-0AA0

Properties

Properties of SM 322; DO 8 x Rel. AC 230 V

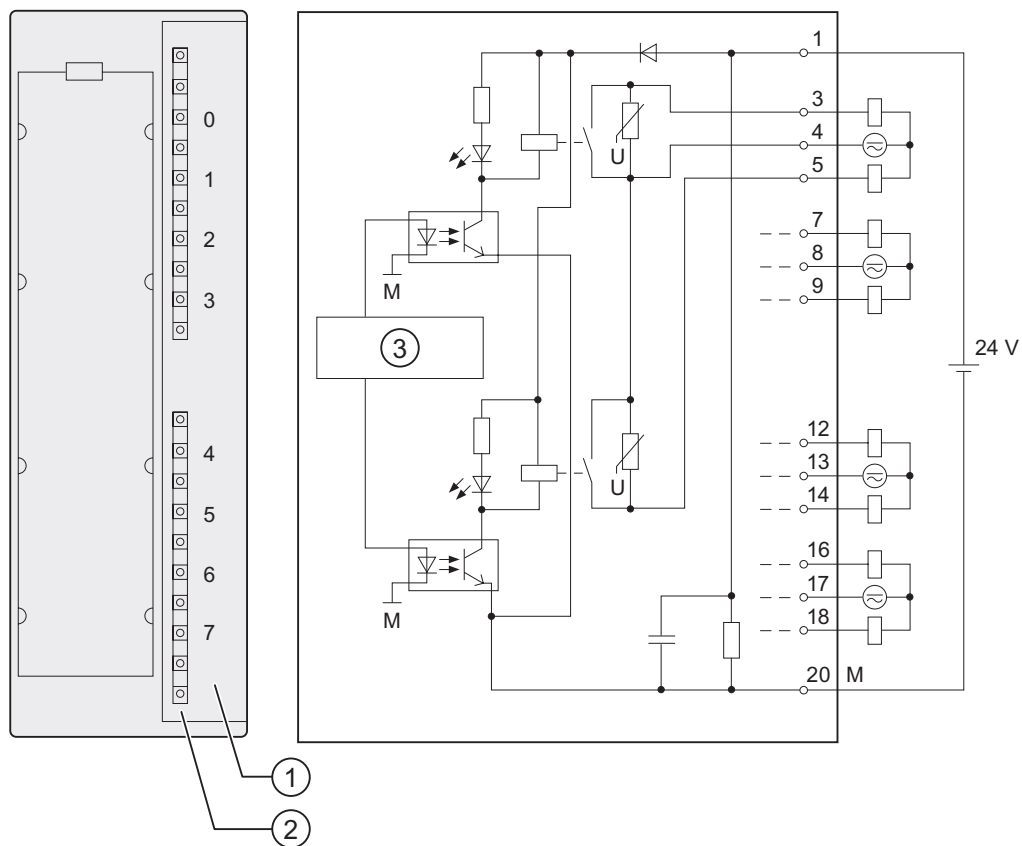
- 8 outputs, electrically isolated in groups of 2
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

Reaction to a shutdown of the power supply

Note

Applicable only to SM 322; DO 8 x Rel. VAC version 1: The internal 200-ms buffer capacitance discharges sufficient power after power off to allow the user program to set a defined relay state.

Wiring and block diagrams of SM 322; DO 8 x Rel. AC 230 V



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 322; DO 8 x Rel. AC 230 V

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 190 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

3.29 Relay output module SM 322; DO 8 x Rel. AC 230 V; (6ES7322-1HF01-0AA0)

Technical data	
Voltages, currents, electrical potentials	
Rated power supply L+ to the relays	24 VDC
Cumulative current of outputs (per group)	max. 4 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels in groups of	Yes 2
Permissible potential difference	
• between M _{internal} and the power supply to relays	75 VDC / 60 VAC
• between M _{internal} and the power supply to relays and outputs	230 VAC
• between outputs of different groups	500 VAC
Isolation test voltage	
• between M _{internal} and the power supply to relays	500 VDC
• between M _{internal} and the power supply to relays and outputs	2000 VAC
• between outputs of different groups	2000 VAC
Current consumption	
• from the backplane bus	max. 40 mA
• from power supply L+	max. 160 mA
Power loss of the module	typ. 3.2 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Actuator selection data	
Thermal current, continuous	max. 3 A
Minimum load voltage / current	10 V / 5 mA
Short circuit-proof to IEC 947-5-1 ²⁾	With circuit-breaker, characteristics B, for: cos Φ 1.0: 600 A cos Φ 0.5...0.7: 900 A With 8 A Diazed fuse: 1000 A
Switching capacity and service life of contacts	
• with resistive load	

Technical data		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	2.0 A	0.7 million
	1.0 A	1.6 million
	0.5 A	4 million
	0.5 A	1.6 million
	0.2 A	1.6 million
	2.0 A	1.6 million
	2.0 A	1.2 million
	2.0 A	0.5 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 Mio ²⁾
60 VDC	2.0 A	0.5 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 million
120 VDC	2.0 A	0.5 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 million
	2.0 A	0.5 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 million
• with inductive load to IEC 947-5-1 DC13/AC15		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	2.0 A	0.3 million
	1.0 A	0.5 million
	0.5 A	1.0 million
	0.5 A	0.5 million
	0.2 A	0.3 million ²⁾
	1.5 A	1 million
	1.5 A	1 million
	2.0 A	0.2 million
	1.0 A	0.7 million
	0.7 A	1 million
60 VDC	0.5 A	2.0 million
	2.0 A	0.3 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	2.0 Mio ²⁾
120 VDC	2.0 A	0.3 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 million
	2.0 A	0.5 million ²⁾
	1.0 A	0.7 million ²⁾
	0.5 A	1.5 million
Contact protection (internal)	Varistor SIOV-CU4032 K275 G	
An external protective circuit will increase the service life of contacts.		
Actuator selection data [continued]		
Lamp load ¹⁾	max. 50 W	
	Power	Number of switching cycles (typ.)
Lamp load (230 VAC) ²⁾	700 W	25000
	1500 W	10000
Energy-saving lamps/fluorescent lamps with electronic ballast ²⁾	10 x 58 W	25000
Fluorescent lamps, conventionally compensated ²⁾	1 x 58 W	25000
Fluorescent lamps, non-compensated ²⁾	10 x 58 W	25000

3.30 Relay output module SM 322; DO 8 x Rel. AC 230V/5A; (6ES7322-5HF00-0AB0)

Technical data	
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• Mechanical	max. 10 Hz
• with resistive load	max. 2 Hz
• with inductive load to IEC 947-5-1, DC13/AC15	max. 0.5 Hz
• with lamp load	max. 2 Hz
Wiring the actuators	with 20-pin front connector

1) Product version 1

2) Product version 2 or higher

3.30 Relay output module SM 322; DO 8 x Rel. AC 230V/5A; (6ES7322-5HF00-0AB0)

Order number

6ES7322-5HF00-0AB0

Properties

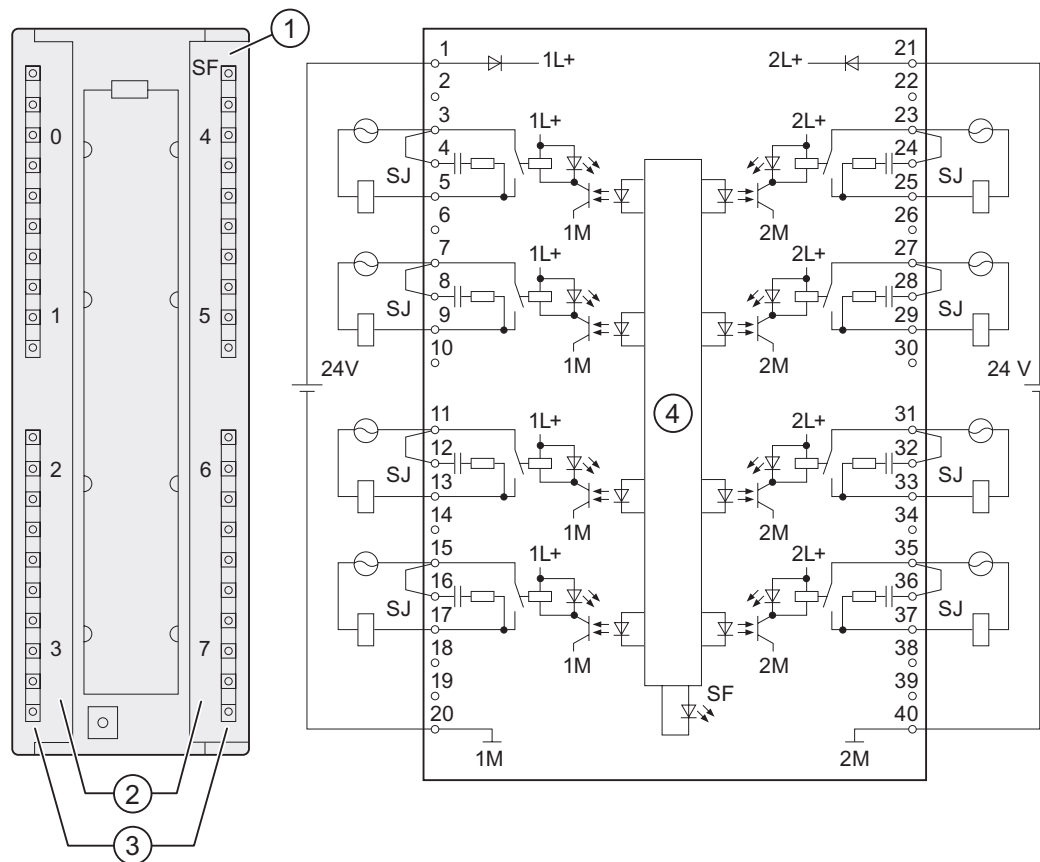
Properties of relay output module SM 322; DO 8 x Rel. AC 230V/5A:

- 8 outputs, electrically isolated
- Load voltage 24 VDC to 120 VDC, 24 VAC to 230 VAC
- Suitable for AC solenoid valves, contactors, motor starters, FHP motors and signal lamps
- You can protect the contacts with an RC quenching element by setting a jumper (SJ.)
- Group error display
- Channelspecific status LEDs
- Programmable diagnostic interrupt
- Programmable substitution value output

Overvoltage protection of contacts

You can protect the contacts against overvoltage by bridging (SJ) the module terminals 3 and 4, 7 and 8, 12 and 13 etc. (refer to the figure below.)

Wiring and block diagrams of SM 322; DO 8 x Rel. AC 230V/5A

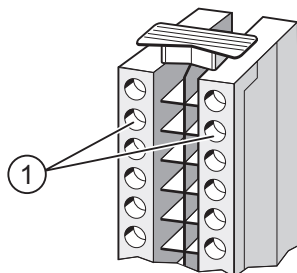


- ① Error LED - red
- ② Channel number
- ③ Status display - green
- ④ Backplane bus interface

Operation on safety extra-low voltage (SELV)

Make allowances for the special feature outlined below when operating the 6ES7322-5HF00-0AB0 relay output module on SELV:

To operate a terminal on SELV, the horizontally adjacent terminal may not be operated at a rated voltage higher than 120 VUC. When terminals are operated at voltages above 120 VUC, the creepage distances and air gaps of the 40-pin front connector do not meet SIMATIC requirements of safe electrical isolation.



- ① If one of two horizontally adjacent terminals is operated on SELV, the adjacent terminal may not be operated at more than 120 VUC.

Technical data of SM 322; DO 8 x Rel. AC 230V/5A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 320 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
• Reverse polarity protection	Yes
Cumulative current of outputs (per group)	
• horizontal mounting position up to 60°	max. 5 A
• vertical mounting position up to 40°	max. 5 A
Electrical isolation	
• between channels and the backplane bus	Yes
• Between channels and the power supply to relays	Yes
• between channels	Yes
in groups of	1

Technical data		
Permissible potential difference		
• between M _{internal} and the power supply to relays	75 VDC / 60 VAC	
• between M _{internal} and the power supply to relays and outputs	250 VAC	
• between outputs of different groups	500 VAC	
Isolation test voltage		
• between M _{internal} and the power supply to relays	500 VDC	
• between M _{internal} and the power supply to relays and outputs	1500 VAC	
• between outputs of different groups	2000 VAC	
Current consumption		
• from the backplane bus	max. 100 mA	
• from power supply L+	max. 160 mA	
Power loss of the module		typ. 3.5 W
Status, interrupts, diagnostics		
Status display		green LED per channel
Interrupts		
• Diagnostic interrupt	programmable	
Diagnostics functions		programmable
• Group error display	red LED (SF)	
• Reading diagnostics information	supported	
Actuator selection data		
Thermal current, continuous		max. 5 A
Minimum load voltage / current		10 V /10 mA ¹⁾
Residual current		11.5 mA ²⁾
Short circuit-proof to IEC 947-5-1		With circuit-breaker, characteristics B, for: cos Φ 1.0: 600 A cos Φ 0.5...0.7: 900 A With 8 A Diazed fuse: 1000 A
Switching capacity and service life of contacts		
• with resistive load		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	5.0 A	0.2 million
24 VDC	2.5 A	0.4 million
24 VDC	1.0 A	0.9 million
24 VDC	0.2 A	1.7 million
24 VDC	0.1 A	2 million
120 VDC	0.2 A	1.7
120 VDC	0.1 A	2 million
230 VAC	5.0 A	0.2 million
230 VAC	2.5 A	0.4 million
230 VAC	1.0 A	0.9 million
230 VAC	0.2 A	1.7 million
230 VAC	0.1 A	2 million

3.30 Relay output module SM 322; DO 8 x Rel. AC 230V/5A; (6ES7322-5HF00-0AB0)

Technical data		
• with inductive load		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	5.0 A	0.1 million
24 VDC	2.5 A	0.25 million
24 VDC	1.0 A	0.5 million
24 VDC	0.2 A	1 million
24 VDC	0.1 A	1.2 million
120 VDC	0.1 A	1.2 million
230 VAC	5.0 A	0.1 million
230 VAC	2.5 A	0.25 million
230 VAC	1.0 A	0.5 million
230 VAC	0.2 A	1 million
230 VAC	0.1 A	1.2 million
An RC quenching element (jumper "SJ" inserted), or an external protection circuit, extends the service life of contacts.		
Size of the motor starter	max. size 5 to NEMA	
	Power	Number of switching cycles (typ.)
Lamp load (230 VAC)	1000 W	25000
	1500 W	10000
Energy-saving lamps/fluorescent lamps with electronic ballast	10 x 58 W	25000
Fluorescent lamps, conventionally compensated	1 58 W	25000
Fluorescent lamps, non-compensated	10 x 58 W	25000
Contact protection	RC quenching element; 330 Ω, 0.1 μF	
Wiring two outputs in parallel		
• for redundant load control	supported (only outputs with the same load voltage)	
• for performance increase	not supported	
Control of a digital input	supported	
Switching frequency		
• Mechanical	max. 10 Hz	
• with resistive load	max. 2 Hz	
• with inductive load to IEC 947-5-1, DC13/AC15	max. 0.5 Hz	
• with lamp load	max. 2 Hz	
Wiring the actuators	with 40-pin front connector	

1) without inserted jumper (SJ).

2) with AC load voltage and inserted jumper (SJ) No residual current if the jumper (SJ) is not installed.

Note

The residual current of an RC quenching element connected to IEC Type 1 inputs may cause unwanted signal states. Remove the SJ jumper to rectify this error.

3.30.1 Parameters of SM 322; DO 8 x Rel. AC 230V/5A

Parameters of SM 322; DO 8 x Rel. AC 230V/5A

The table below provides an overview of configurable parameters and defaults for SM 322; DO 8 x Rel. AC 230V/5A.

The defaults apply if you have not set any parameters in **STEP 7**.

Table 3-25 Parameters of SM 322; DO 8 x Rel. AC 230V/5A

Parameters	Range of values	Defaults	Parameter type	Scope
Enable				
• Diagnostic interrupts	Yes/no	No	Dynamic	Module
Reaction to CPU STOP	Set substitution value Hold last value	SSV	Dynamic	Channel
Set substitution value "1"	Yes/no	No	Dynamic	Channel

See also

Programming digital modules (Page 3-8)

3.30.2 Diagnostics of SM 322; DO 8 x Rel. AC 230V/5A

Diagnostics messages of SM 322; DO 8 x Rel. AC 230V/5A

The table below provides an overview of the diagnostic messages of SM 322; DO 8 x Rel. AC 230V/5A.

Table 3-26 Diagnostics messages of SM 322; DO 8 x Rel. AC 230V/5A

Diagnostics message	LED	Scope of diagnostics	programmable
Watchdog time-out	SF	Module	No
EPROM error	SF	Module	No
RAM error	SF	Module	No

Causes of error and troubleshooting

Table 3-27 Diagnostic messages of SM 322; DO 8 x Rel. AC230V/5A, cause of error and troubleshooting

Diagnostics message	Error detection	Possible cause of error	To correct or avoid errors
Watchdog time-out	generally	infrequent high level of electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module
EPROM error	generally	infrequent high level of electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module
RAM error	generally	infrequent high level of electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Module defective	Replace the module

3.30.3 Interrupts of SM 322; DO 8 x Rel. AC 230V/5A

Introduction

The SM 322; DO 8 x Rel. AC 230V/5A can trigger diagnostic interrupts.

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if not set accordingly. Program the interrupt enable parameter in **STEP 7**.

Diagnostic interrupt

When diagnostic interrupts are enabled, incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of interrupt.

The CPU interrupts user program execution, and executes diagnostic interrupt OB82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

See also

Parameters of SM 322; DO 8 x DC 24 V/0.5 A (Page 3-77)

3.31 Relay output module SM 322; DO 8 x Rel. AC 230 V/5 A; (6ES7322-1HF10-0AA0)

Order number: "Standard module"

6ES7322-1HF10-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 322-1HF10-2AA0

Properties

Properties of SM 322; DO 8 x Rel. AC 230 V/5 A:

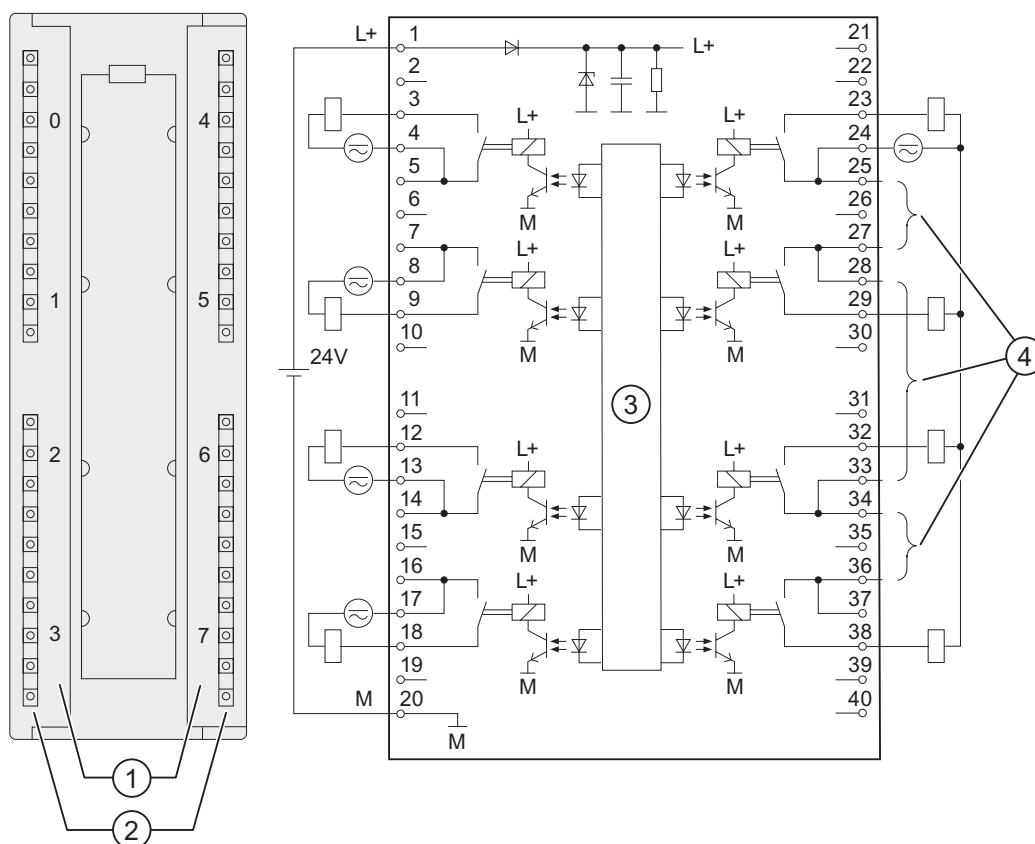
- 8 outputs, electrically isolated in groups of 1
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

Measures to take for switching currents > 3 A

Note

Always use connecting cables with a cross-section of 1.5 mm² when operating with switching currents > 3 A in order to reduce any temperature rise in the connector area of the module to a minimum.

Wiring and block diagrams of the SM 322; DO 8 x Rel. AC 230 V/5 A



- ① Channel number
- ② Status displays - green
- ③ Backplane bus interface
- ④ Options of looping the power supply to contacts

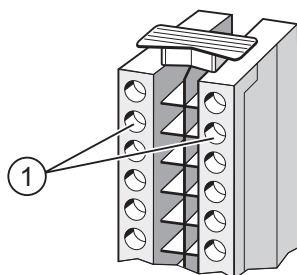
$I_{\text{Accumulated current}} \leq 8 \text{ A at } T_U \leq 30 \text{ °C}$

$I_{\text{Accumulated current}} \leq 5 \text{ A at } T_U \leq 60 \text{ °C}$

Operation on safety extra-low voltage (SELV)

Make allowances for the special feature outlined below when operating relay output module 322-1HF10 on SELV:

To operate a terminal on SELV, the horizontally adjacent terminal may not be operated at a rated voltage higher than 120 VUC. When terminals are operated at voltages above 120 VUC, the creepage distances and air gaps of the 40-pin front connector do not meet SIMATIC requirements of safe electrical isolation.



- ① If one of two horizontally adjacent terminals is operated on SELV, the adjacent terminal may not be operated at more than 120 VUC.

Technical data of SM 322; DO 8 x Rel. AC 230 V/5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 320 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated power supply L+ to the relays	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position	
up to 30 °C	max. 8 A
up to 60 °C	max. 5 A
• vertical mounting position	
up to 40 °C	max. 5 A
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	Yes
in groups of	1

Technical data		
Permissible potential difference		
• between M _{internal} and the power supply to relays	75 VDC / 60 VAC	
• between M _{internal} and the power supply to relays and outputs	250 VAC	
• between outputs of different groups	500 VAC	
Isolation test voltage		
• between M _{internal} and the power supply to relays	500 VDC	
• between M _{internal} and the power supply to relays and outputs	1500 VAC	
• between outputs of different groups	2000 VAC	
Current consumption		
• from the backplane bus	max. 40 mA	
• from power supply L+	max. 125 mA	
Power loss of the module		typ. 4.2 W
Status, interrupts, diagnostics		
Status display	green LED per channel	
Interrupt	None	
Diagnostics functions	None	
Actuator selection data		
Thermal current, continuous		max. 8 A
Minimum load voltage / current		10 V / 5 mA
Short-circuit current to IEC 947-5-1		With circuit-breaker, characteristics B, for: cos Φ 1.0: 600 A cos Φ 0.5...0.7: 900 A With 8 A Diazed fuse: 1000 A
Switching capacity and service life of contacts		
• with resistive load		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	8.0 A	0.1 million
	4.0 A	0.3 million
	2.0 A	0.7 million
	0.5 A	4.0 million
60 VDC	0.5 A	4 million
120 VDC	0.2 A	1.6 million
48 VAC	8.0 A	0.1 million
	2.0 A	1.6 million
60 VAC	8.0 A	0.1 million
	2.0 A	1.2 million
120 VAC	8.0 A	0.1 million
	4.0 A	0.3 million
	2.0 A	0.5 million
	1.0 A	0.7 million
	0.5 A	1.5 million
230 VAC	8.0 A	0.1 million
	4.0 A	0.3 million
	2.0 A	0.5 million
	1.0 A	0.7 million
	0.5 A	1.5 million

3.31 Relay output module SM 322; DO 8 x Rel. AC 230 V/5 A; (6ES7322-1HF10-0AA0)

Technical data		
Switching capacity and service life of contacts		
with inductive load to IEC 947-5-1 DC13/AC15		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	2.0 A	0.3 million
	1.0 A	0.5 million
	0.5 A	1 million
60 VDC	0.5 A	0.5 million
	0.3 A	1 million
120 VDC	0.2 A	0.5 million
48 VAC	3.0 A	0.5 million
	1.5 A	1 million
60 VAC	3.0 A	0.3 million
	1.5A	1 million
120 VAC	3.0 A	0.2 million
	2.0 A	0.3 million
	1.0 A	0.7 million
	0.5 A	2 million
230 VAC	3.0 A	0.1 million
	2.0 A	0.3 million
	1.0 A	0.7 million
	0.5 A	2.0 million
Aux. contactors Size 0 (3TH28)		30 million
An external protective circuit will increase the service life of contacts.		
	Power	Number of switching cycles (typ.)
Lamp load (230 VAC)	1000 W	25000
	1500 W	10000
Energy-saving lamps/fluorescent lamps with electronic ballast	10 x 58 W	25000
Fluorescent lamps, conventionally compensated	1 x 58 W	25000
Fluorescent lamps, non-compensated	10 x 58 W	25000
Contact protection (internal)	None	
Wiring two outputs in parallel		
For redundant actuation of a load	supported	
for performance increase	not supported	
Control of a digital input	supported	
Switching frequency		
Mechanical	max. 10 Hz	
with resistive load	max. 2 Hz	
with inductive load to IEC 947-5-1, DC13/AC15	max. 0.5 Hz	
with lamp load	max. 2 Hz	
Wiring the actuators	with 40-pin front connector	

3.32 Digital IO module SM 323; DI 16/DO 16 x DC 24 V/0.5 A; (6ES7323-1BL00-0AA0)

Order number

6ES7323-1BL00-0AA0

Properties

Properties of SM 323; DI 16/DO 16 x DC 24 V/0.5 A:

- 16 inputs, electrically isolated in groups of 16
- 16 outputs, electrically isolated in groups of 8
- Rated input voltage 24 VDC
- Rated load voltage 24 VDC
- Inputs suitable for switches and 2-/3-/4-wire proximity switches (BEROs)
- Outputs suitable for solenoid valves, DC contactors and indicator lights

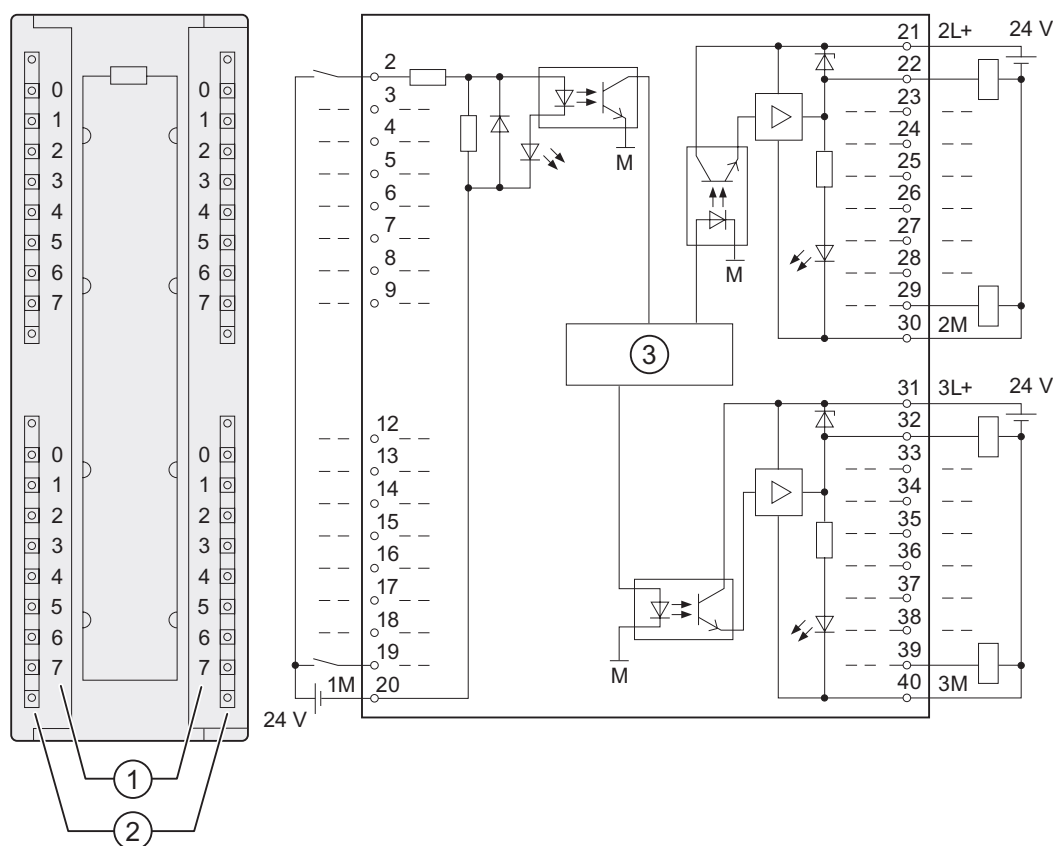
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 323; DI 16/DO 16 x DC 24 V/0.5 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

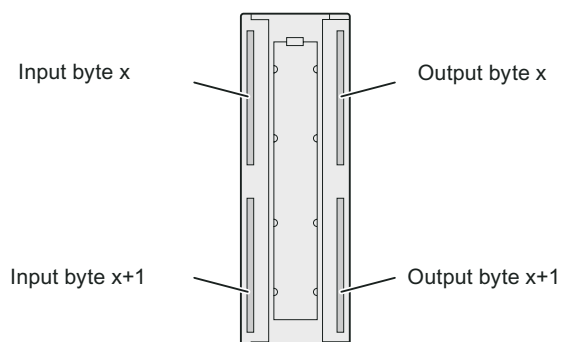
Wiring and block diagram of SM 323; DI 16/DO 16 x DC 24 V/0.5 A



- ① Channel number
- ② Status displays - green
- ③ Backplane bus interface

Terminal assignment

The figure below shows the assignment of channels to the IO addresses.



Technical data of SM 323; DI 16/DO 16 x DC 24 V/0.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 260 g
Module-specific data	
Isochronous	No
Number of inputs	16
Number of outputs	16
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
• horizontal mounting position	
up to 40 °C	16
up to 60 °C	8
• vertical mounting position	16
up to 40 °C	
Cumulative current of outputs (per group)	
• horizontal mounting position	
up to 40 °C	max. 4 A
up to 60 °C	max. 3 A
• vertical mounting position	max. 2 A
up to 40 °C	
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	Yes
Inputs in groups of	16
Outputs in groups of	8
Permissible potential difference	
• between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 80 mA
• from load voltage L+ (no-load)	max. 80 mA
Power loss of the module	typ. 6.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None

3.32 Digital IO module SM 323; DI 16/DO 16 x DC 24 V/0.5 A; (6ES7323-1BL00-0AA0)

Technical data	
Transducer selection data	
Input voltage - Rated value - for "1" signal - for "0" signal	24 VDC 13 to 30 V - 30 V to + 5 V
Input current with "1" signal	typ. 7 mA
Input delay - at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	with 40-pin front connector
Actuator selection data	
Output voltage with "1" signal	min. L + (- 0.8 V)
Output current - with "1" signal - Rated value - Permissible range - with "0" signal (residual current)	0.5 A 5 mA to 0.6 A max. 0.5 mA
Output delay (resistive load) - at "1" to "0" - at "1" to "0"	max. 100 µs max. 500 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel - for redundant load control - for performance increase	supported (only outputs of the same group) not supported
Control of a digital input	supported
Switching frequency - with resistive load - with inductive load to IEC 947-5-1, DC 13 - with lamp load	max. 100 Hz max. 0.5 Hz max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (- 53 V)
Short circuit-proof output Threshold	Yes, electronic typ. 1 A
Wiring the actuators	with 40-pin front connector

3.33 Digital IO module SM 323; DI 8/DO 8 x DC 24 V/0.5 A; (6ES7323-1BL01-0AA0)

Order number: "Standard module"

6ES7323-1BH01-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 323-1BH01-2AA0

Properties

Properties of SM 323; DI 8/DO 8 x DC 24 V/0.5 A:

- 8 inputs, electrically isolated in groups of 8
- 8 outputs, electrically isolated in groups of 8
- Rated input voltage 24 VDC
- Rated load voltage 24 VDC
- Inputs suitable for switches and 2-/3-/4-wire proximity switches (BEROs)
- Outputs suitable for solenoid valves, DC contactors and indicator lights

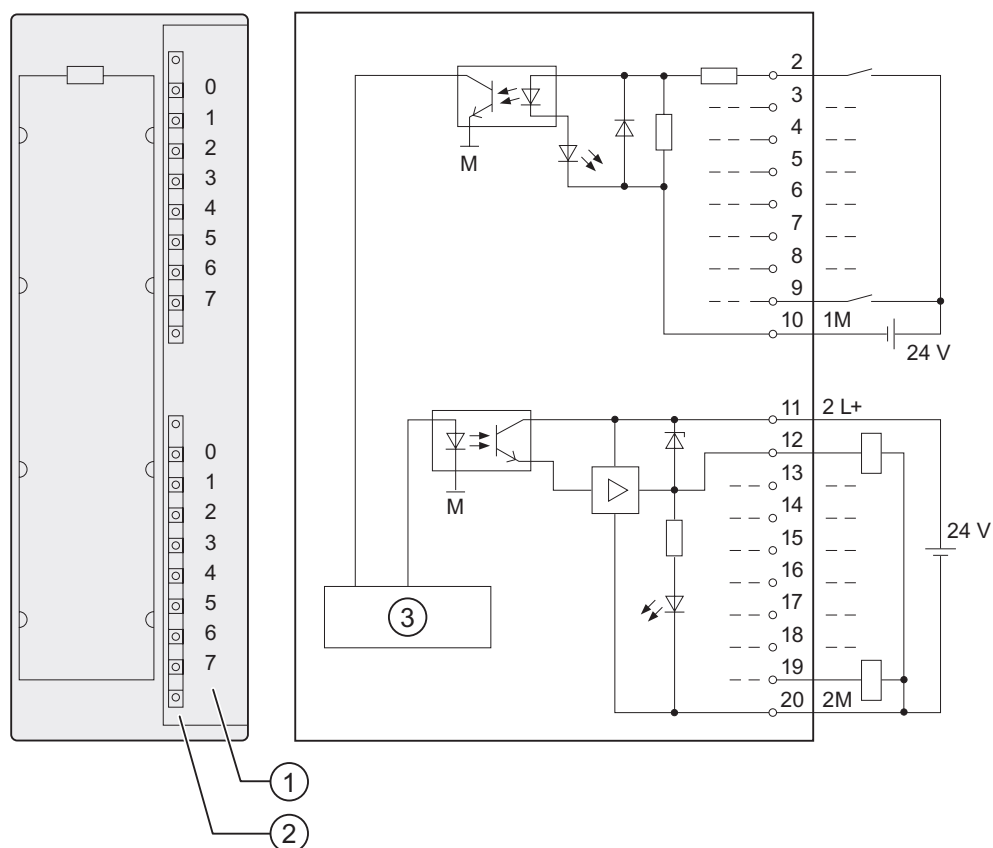
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 323; DI 8/DO 8 x DC 24 V/0.5 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

Wiring and block diagram of SM 323; DI 8/DO 8 x DC 24 V/0.5 A



- ① Channel number
- ② Status displays - green
- ③ Backplane bus interface

Technical data of SM 323; DI 8/DO 8 x DC 24 V/0.5 A

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Number of outputs	8
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
- horizontal mounting position up to 60 °C - vertical mounting position up to 40 °C	8
	8
Cumulative current of outputs (per group)	
- horizontal mounting position up to 60 °C - vertical mounting position up to 40 °C	max. 4 A
	max. 4 A
Electrical isolation	
between channels and the backplane bus	Yes
between channels	Yes
Inputs in groups of	8
Outputs in groups of	8
Permissible potential difference	
between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
- from the backplane bus - from load voltage L+ (no-load)	max. 40 mA max. 40 mA
Power loss of the module	typ. 3.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
- Rated value - for "1" signal - for "0" signal	24 VDC 13 to 30 V - 30 to 5 V
Input current	
with "1" signal	typ. 7 mA
Input delay	
- at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	supported
Permissible quiescent current	max. 1.5 mA
Wiring signal transducers	with 20-pin front connector

3.33 Digital IO module SM 323; DI 8/DO 8 x DC 24 V/0.5 A; (6ES7323-1BL01-0AA0)

Technical data	
Actuator selection data	
Output voltage	
• with "1" signal	min. L + (- 0.8 V)
Output current	
• with "1" signal	
Rated value	0.5 A
Permissible range	5 mA to 0.6 A
• with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• at "1" to "0"	max. 100 µs
• at "1" to "0"	max. 500 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel	
• for redundant load control	supported (only outputs of the same group)
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 100 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L + (- 53 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 1 A
Wiring the actuators	with 20-pin front connector

3.34 Digital IO module SM 327; DI 8/DO 8 x DC 24 V/0.5 A; programmable (6ES7327-1BH00-0AB0)

Order number

6ES7327-1BH00-0AB0

Properties

Properties of SM 327; DI 8/DO 8 x DC 24 V/0.5 A:

- 8 digital inputs, plus 8 separately programmable inputs/outputs, electrically isolated in groups of 16
- Rated input voltage 24 VDC
- Inputs suitable for switches and 2-/3-/4-wire proximity switches (BEROs)
- Output current 0.5 A
- Rated load voltage 24 VDC
- Outputs suitable for solenoid valves, DC contactors and indicator lights
- Dynamic change of parameters in RUN (CiR-compatible), separately at each channel.
- Readback of outputs.

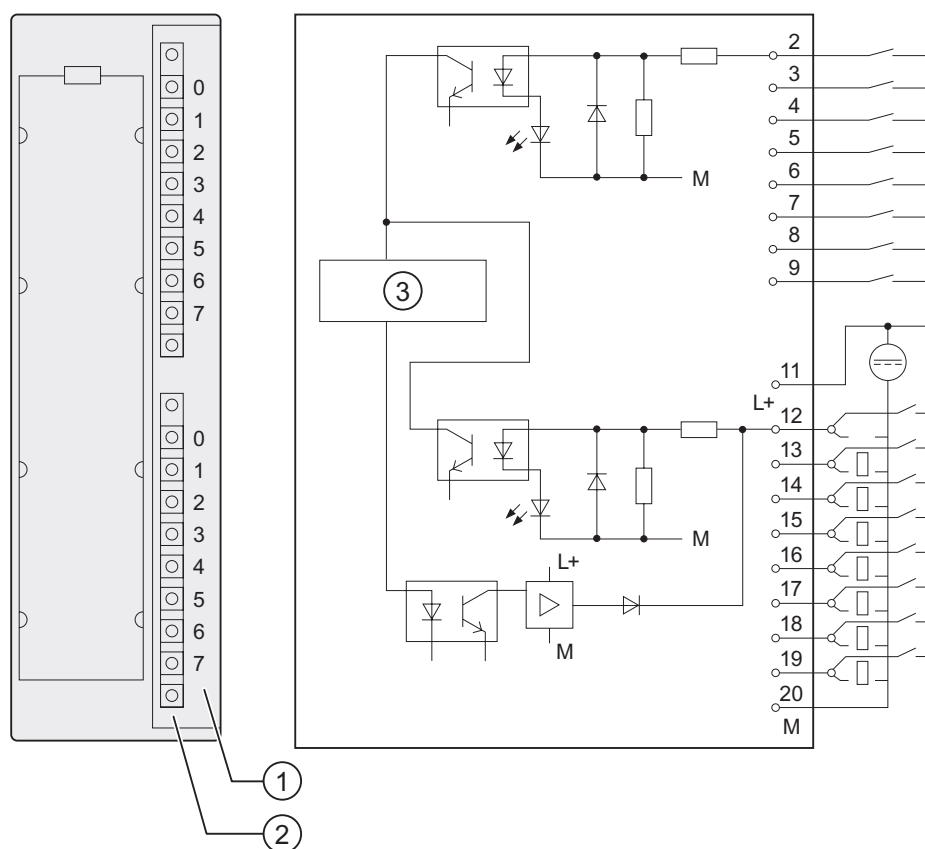
Use of the module with high-speed counters

Please note when using the module in combination with high-speed counters:

Note

When using a mechanical contact to switch on the 24-V power supply to SM 327; DI 8/DO 8 x DC 24 V/0.5 A, its outputs will carry "1" signal for the duration of approx. 50 µs, due to the circuit structure.

Wiring and block diagram of SM 327; DI 8/DO 8 x DC 24 V/0.5 A, programmable



- ① Channel number
- ② Status display - green
- ③ Backplane bus interface

Technical data of SM 327; DI 8/DO 8 x DC 24 V/0.5 A, programmable

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8 digital
Number of inputs/outputs	8, can be programmed separately
Cable length	
• unshielded	max. 600 m
• shielded	max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
horizontal mounting position up to 60 °C	16
vertical mounting position up to 40 °C	16
Cumulative current of outputs (per group)	
- horizontal mounting position up to 40 °C - up to 60 °C - vertical mounting position up to 40 °C	max. 4 A max. 3 A max. 2 A
Electrical isolation	
between channels and the backplane bus	Yes
between channels	No
Permissible potential difference	
between different circuits	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
- from the backplane bus - from load voltage L+ (no-load)	max. 60 mA max. 20 mA
Power loss of the module	typ. 3 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input voltage	
- Rated value - for "1" signal - for "0" signal	24 VDC 15 V to 30 V - 30 to 5 V
Input current	
with "1" signal	typ. 6 mA
Input delay	
- at "1" to "0" - at "1" to "0"	1.2 ms to 4.8 ms 1.2 ms to 4.8 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	
Permissible quiescent current	supported max. 1.5 mA
Wiring signal transducers	With 20-pin front connector

3.34 Digital IO module SM 327; DI 8/DO 8 x DC 24 V/0.5 A; programmable (6ES7327-1BH00-0AB0)

Technical data	
Actuator selection data	
Output voltage	
• with "1" signal	min. L+ (-1.5 V)
Output current	
• with "1" signal	
Rated value	0.5 A
Permissible range	5 mA to 0.6 A
• with "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• at "1" to "0"	max. 350 µs
• at "1" to "0"	max. 500 µs
Load resistance range	48 Ω to 4 kΩ
Lamp load	max. 5 W
Wiring two outputs in parallel	
• for redundant load control	supported
• for performance increase	not supported
Control of a digital input	supported
Switching frequency	
• with resistive load	max. 100 Hz
• with inductive load to IEC 947-5-1, DC 13	max. 0.5 Hz
• with lamp load	max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. L+ (-54 V)
Short circuit-proof output	Yes, electronic
• Threshold	typ. 1 A
Wiring the actuators	With 20-pin front connector

3.34.1 Parameters of SM 327; DI 8/DX 8 x DC 24 V/0.5 A

Programming

The general procedure of programming digital modules is described in the chapter Programming digital modules.

Parameters of SM 327; DI 8/DO 8 x DC 24 V/0.5 A, programmable

The table below provides an overview of configurable and defaults for SM 327; DI 8/DO 8 x VDC 24/0.5 A.

The defaults apply if you have not set any parameters in *STEP 7*.

The comparison illustrates the parameters you can edit:

- using *STEP 7*
- using SFC 55 "WR_PARM"
- using SFB 53 "WRREC" (for GSD, for example).

Parameters set in *STEP 7* may also be transferred to the module using SFCs 56 and 57, and SFB 53 (refer to the *STEP 7* Online Help).

Table 3-28 Parameters of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Parameters	Range of values	Presetting	Parameter type	Scope	Data record number	Programmable using ...	
						SFC 55, SFB 53	PG
Digital output	Yes/no	No	Dynamic	Channel	1	Yes	Yes

See also

Parameters of SM 322; DO 8 x DC 24 V/0.5 A (Page 3-77)

3.34.1.1 Structure of data record 1 of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Structure of data record 1

The figure below shows the structure of data record 1 of the dynamic parameters of SM 327; DI 8/DO 8 x DC 24 V/0.5 A.

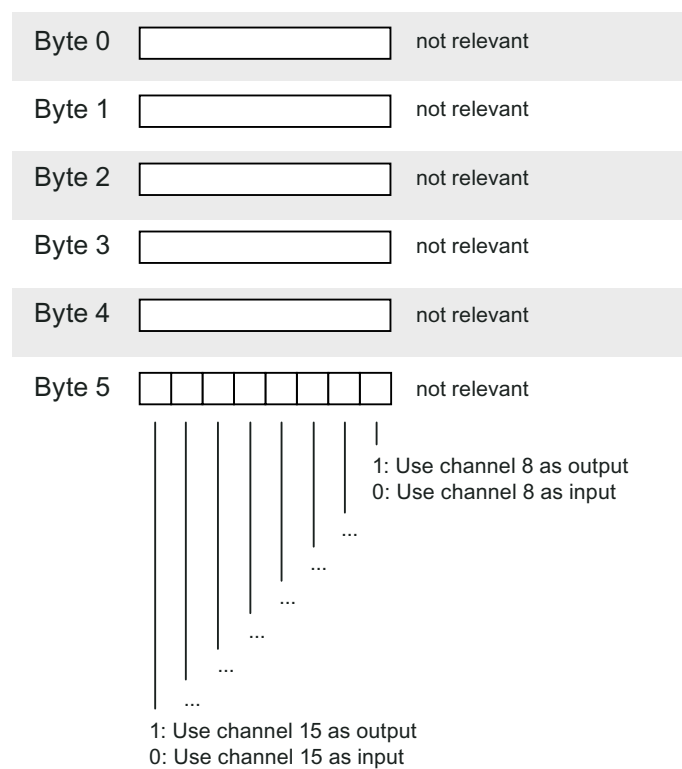


Figure 3-8 Structure of data record 1 of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Readability of outputs

Readability provides a simple form of diagnosis. You can use this to establish whether the information which is issued to the process ("1" or "0") actually arrives there.

The digital outputs can be read back to the user data area: When Q11.3 is configured as an output, for example, it can be read back via I11.3. See the figure below

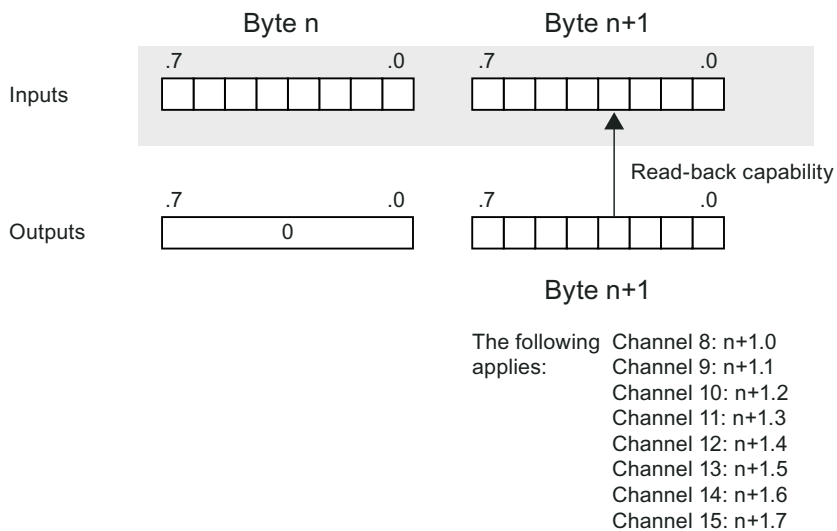


Figure 3-9 Readability of the outputs of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Principles of analog value processing

4.1 Overview

Introduction

This chapter contains a description of the basic procedure for connecting signal transducers to analog inputs and analog outputs and points to which particular attention must be paid.

The figures below do not show the connecting lines required to connect the electrical potentials of the analog input module and transducers.

Always adhere to the general information on connecting transducers.

You will find special connection options described for the corresponding module.

Installation and wiring

You will find information about installation and wiring in Operating Instructions S7-300, CPU 31xC, and CPU 31x: Installation Online at:
<http://support.automation.siemens.com/WW/view/de/13008499>.

4.2 Wiring transducers to analog inputs

Sensors which can be connected to analog inputs

You can connect the following sensors to the analog input modules depending on type of measurement:

- Voltage transducers
- Current transducers
 - As 2-wire transducer
 - As 4-wire transducer
- Resistors
- Thermocouples

Cables for analog signals

Always use shielded twisted-pair cables to wire analog signals. This reduces interference. Connect both ends of the analog cable shield to ground.

Any potential difference between the cable ends may cause an equipotential current on the shield, and thus disturbance on analog signals. If this happens, you have to ensure a low-ohm potential compensation and if necessary only ground the shield to a cable end.

Electrically isolated analog input modules

Electrically isolated analog input modules are not electrically interconnected at the reference point of the measuring circuit (M_{ANA} and/or M) and the M terminal of the CPU/IM153.

Always use electrically isolated analog input modules if there is a risk of a potential difference V_{ISO} developing between the reference point of measuring circuit (M_{ANA} and/or M -) and the M terminal of the CPU/IM153 .

To ensure that the permissible potential difference V_{ISO} does not exceed the permissible value, use an equipotential bonding conductor between terminal M_{ANA} and the M terminal of CPU/IM153.

Non-isolated analog input modules

When working with non-isolated analog input modules you have to produce a low-ohm connection between the reference point of measuring circuit M_{ANA} and the M terminal of the CPU or interface module IM 153. To do this, connect terminal M_{ANA} to the M terminal of the CPU or interface module IM 153. A potential difference between M_{ANA} and the M terminal of the CPU or interface module IM 153 may distort the analog signal.

Limited potential difference CMV

The permissible potential difference U_{CM} (CMV/Common Mode) must not be exceeded. A potential difference U_{CM} may arise between

- the measurement inputs ($M+$ / $M-$) and the reference point of measuring circuit M_{ANA}
- the measuring inputs of the channels themselves.

The following diagrams show the actions required when wiring transducers.

4.2.1 Wiring electrically isolated transducers

Electrically isolated transducers

Electrically isolated sensors are not connected to local ground potential (local ground.) They can be operated in electrically isolated mode.

Potential differences may develop between electrically isolated sensors. Those potential differences may be caused by disturbance, or may develop as a result of the local distribution of transducers.

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

Note

With modules where $V_{CM} \leq 2.5$ V, you have to connect M- and M_{ANA} (see following diagrams).

Wiring electrically isolated transducer to electrically isolated AI

The CPU / IM 153 can be operated in grounded mode or ungrounded mode.

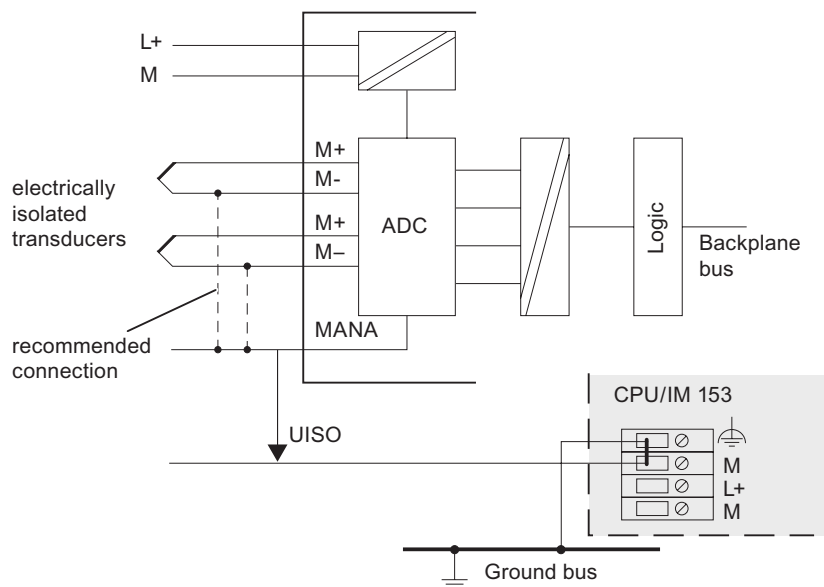


Figure 4-1 Wiring electrically isolated transducers to electrically isolated AI

Wiring electrically isolated transducer to a non-isolated AI

The CPU / IM 153 can be operated in grounded mode or ungrounded mode.

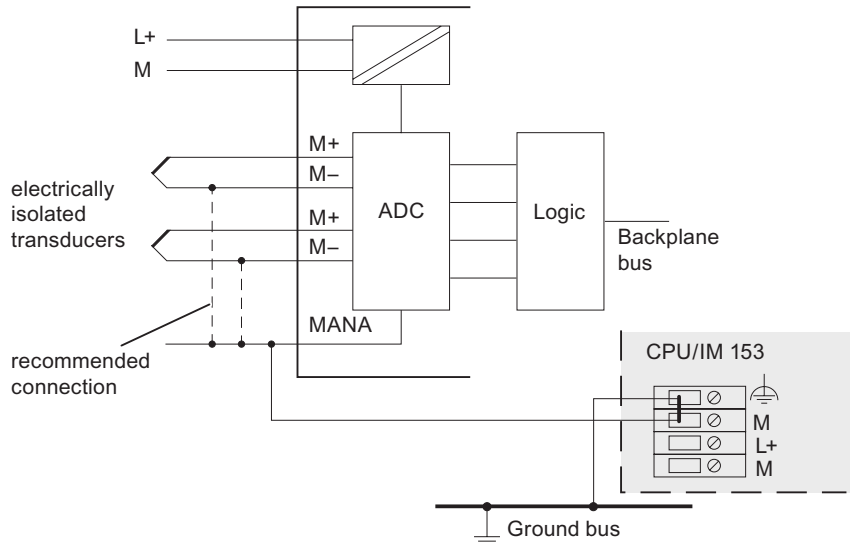


Figure 4-2 Wiring electrically isolated transducers to a non-isolated AI

Note

If you are wiring a 2-wire current measuring transducer and resistance transducer, you must not produce a connection between M- and M_{ANA}. The current would then discharge via a connecting line between M- and M_{ANA} and the measurement would be distorted. This also applies to inputs which are programmed accordingly, but remain unused.

4.2.2 Wiring electrically non-isolated transducers

Non-isolated transducer

Non-isolated sensors are connected to local ground potential (local ground.) Always connect M_{ANA} to local ground when using non-isolated transducers.

Local conditions or disturbance may cause potential differences CMV (static or dynamic) between locally distributed measuring points. If the permissible CMV values is exceeded, interconnect the measuring points by means of equipotential conductors.

Wiring non-isolated transducer to electrically isolated AI

When wiring non-isolated transducers to electrically isolated modules, the CPU / IM 153 can be operated in grounded mode or ungrounded mode.

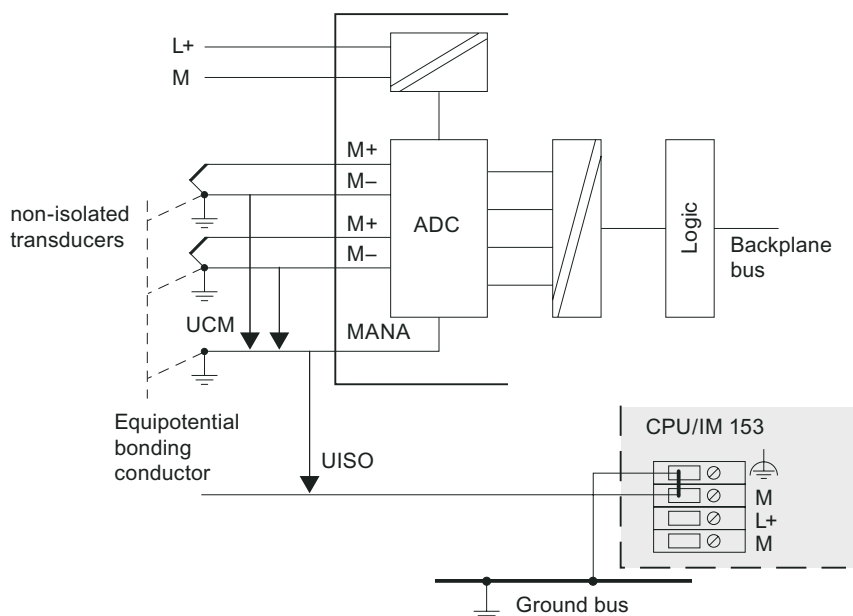


Figure 4-3 Wiring non-isolated transducer to electrically isolated AI

Wiring non-isolated transducer to a non-isolated AI

Always operate the CPU / IM 153 in grounded mode if you connect non-isolated transducers to non-isolated modules.

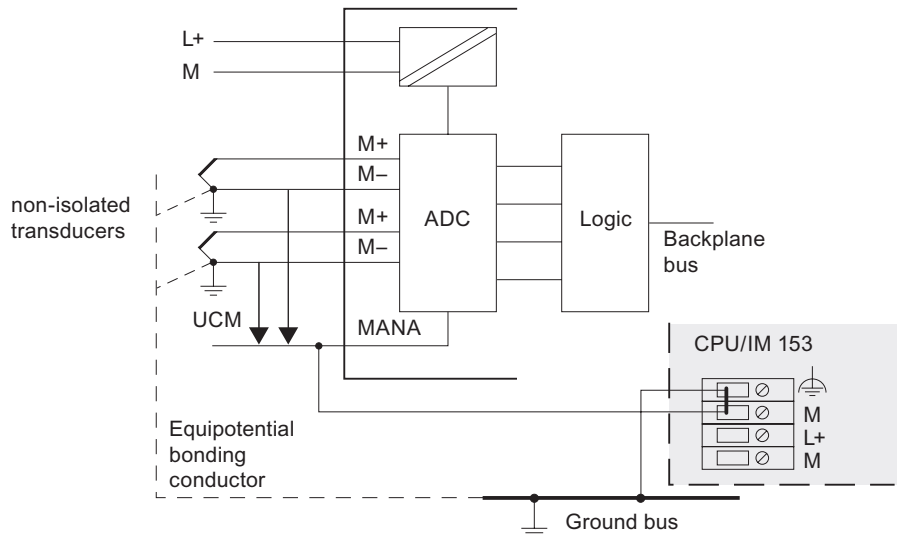


Figure 4-4 Wiring non-isolated transducer to a non-isolated AI

Note

You may not wire non-isolated 2-wire transducers/resistive transducers to non-isolated analog inputs!

4.3 Connecting voltage transducers

Introduction

This chapter contains a description of wiring voltage transducers and points to which particular attention must be paid.

Connection of voltage transducers

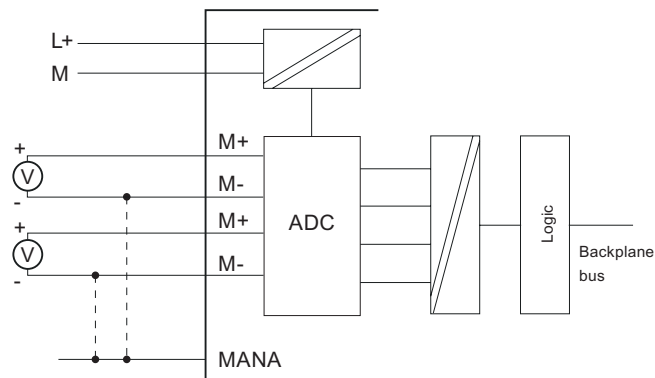


Figure 4-5 Connecting voltage transducers to electrically isolated analog inputs

4.4 Connecting current transducers

Introduction

This chapter contains a description of wiring current transducers and points to which particular attention must be paid.

Current transducers which can be wired up

- As 2-wire transducer
- As 4-wire transducer

Wire 2-wire transducer with supply via module

The 2-wire transducer is wired to a short circuit-proof supply voltage at the terminals of the analog input module.

This transducer converts the measured variable into a current. 2-wire transducers must be electrically isolated.

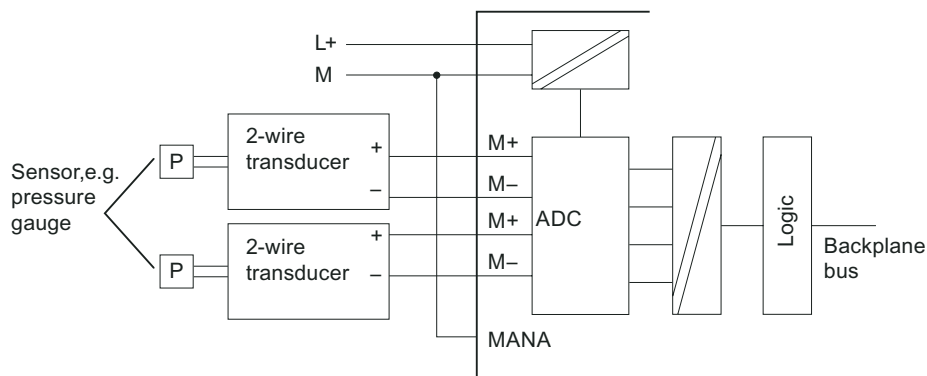


Figure 4-6 Wire 2-wire transducers to electrically isolated AI

Wire 2-wire transducer with supply from L +

When the supply voltage L+ is fed from the module, configure the 2-wire as a 4-wire transducer in *STEP 7*.

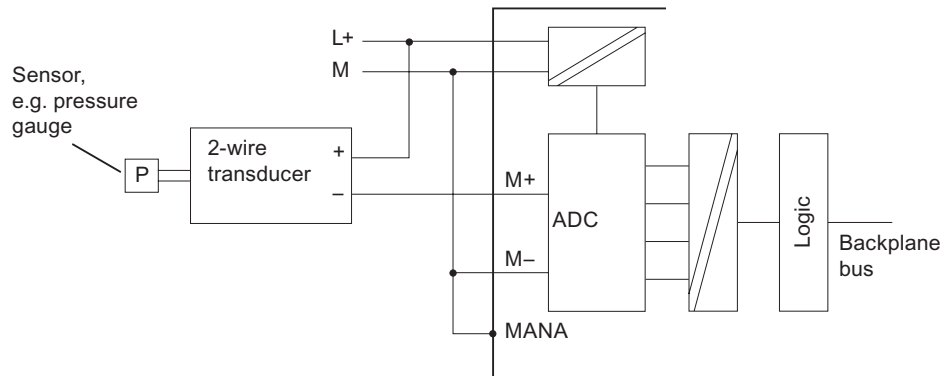


Figure 4-7 Wire 2-wire transducers with supply from L + to electrically isolated AI

Wire 4-wire transducer

4-wire transducers are supplied separately with power.

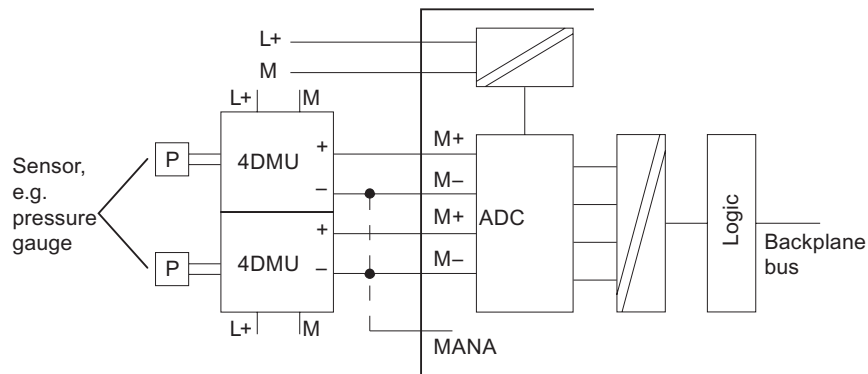


Figure 4-8 Wire 4-wire transducers to electrically isolated AI

4.5 Wiring resistance thermometers and resistors

Introduction

This chapter contains a description of wiring resistance thermometers and resistors and points to which particular attention must be paid.

Signal transducers for measuring resistance which can be wired

- With 4-wire connection
- With 3-wire connection
- With 2-wire connection

Wiring resistance thermometers and resistors

During a resistance measurement, the module supplies a constant current through terminals I_{C+} and I_{C-} . The constant current is fed to the resistor to be measured and then measured as voltage drop. It is imperative to wire the constant current cables directly to the resistance thermometer/resistor.

Measurements with programmed 4-or 3-wire connection parameters compensate for line resistance and therefore deliver considerably better accuracy than that gained from the measurement with a 2-wire connection.

Measurements with a programmed 2-wire connection also record the line resistance in addition to their own resistance.

4-wire connection of a resistance thermometer

The voltage generated at the resistance thermometer is measured via the $M+$ and $M-$ terminals. Watch out for the polarity when you wire the cable (wire (I_{C+} and $M+$, and I_{C-} and $M-$ at the resistance thermometer.)

Always wire the I_{C+} , $M+$, I_{C-} and $M-$ cables directly to the resistance thermometer.

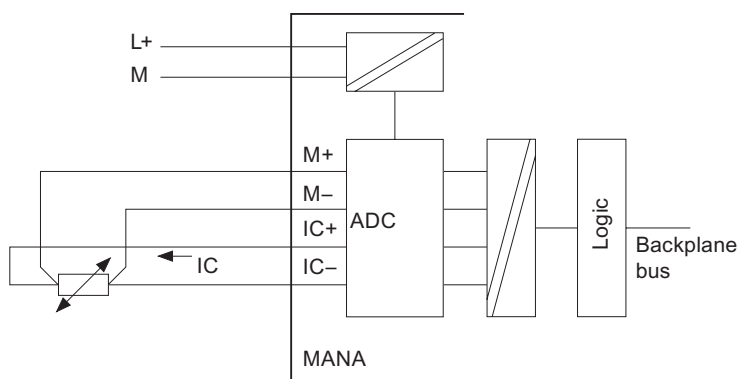


Figure 4-9 4-wire connection of resistance thermometers to an electrically isolated analog input

3-wire connection of a resistance thermometer

When terminating 3-wire cables at modules equipped with four terminals, you should generally **bridge M- and IC-**. Always wire the connected **IC+** and **M+** cables directly to the resistance thermometer.

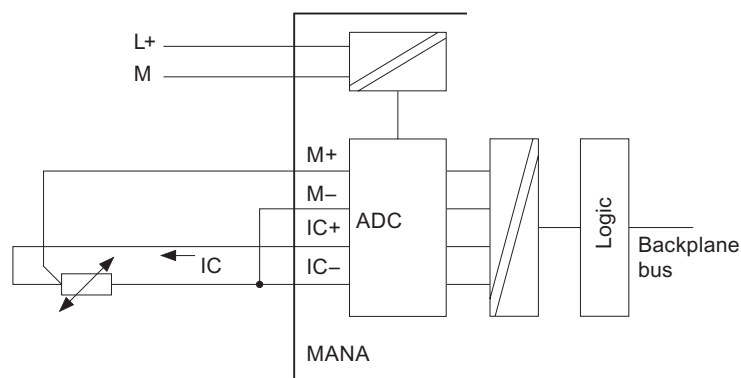


Figure 4-10 3-wire connection of resistance thermometers to an electrically isolated analog input

2-wire connection of a resistance thermometer

For 2-wire connections, bridge the **M+** and **IC+**, and the **M-** and **IC-** terminals of the module. The line resistance is measured at the same time.

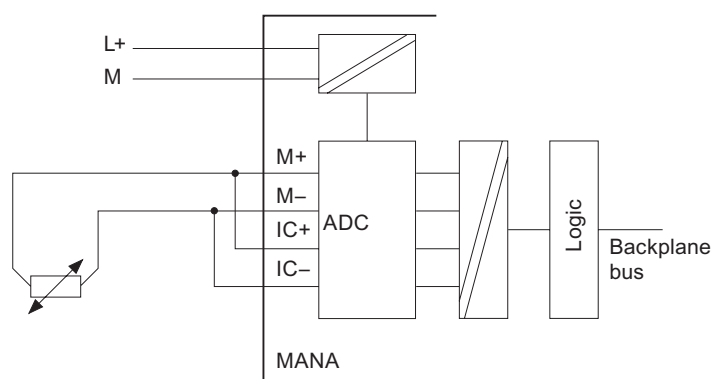


Figure 4-11 2-wire connection of resistance thermometers to an electrically isolated analog input

4.6 Wiring thermocouples

Introduction

This chapter contains a description of wiring thermocouples and points to which particular attention must be paid.

Thermocouples which can be wired (depending on module)

- B; C; E; J; K; L; N; R; S; T; U;
- TXK / XKL GOST

Thermocouple selection

The figure below shows several thermocouples and their temperature ranges.

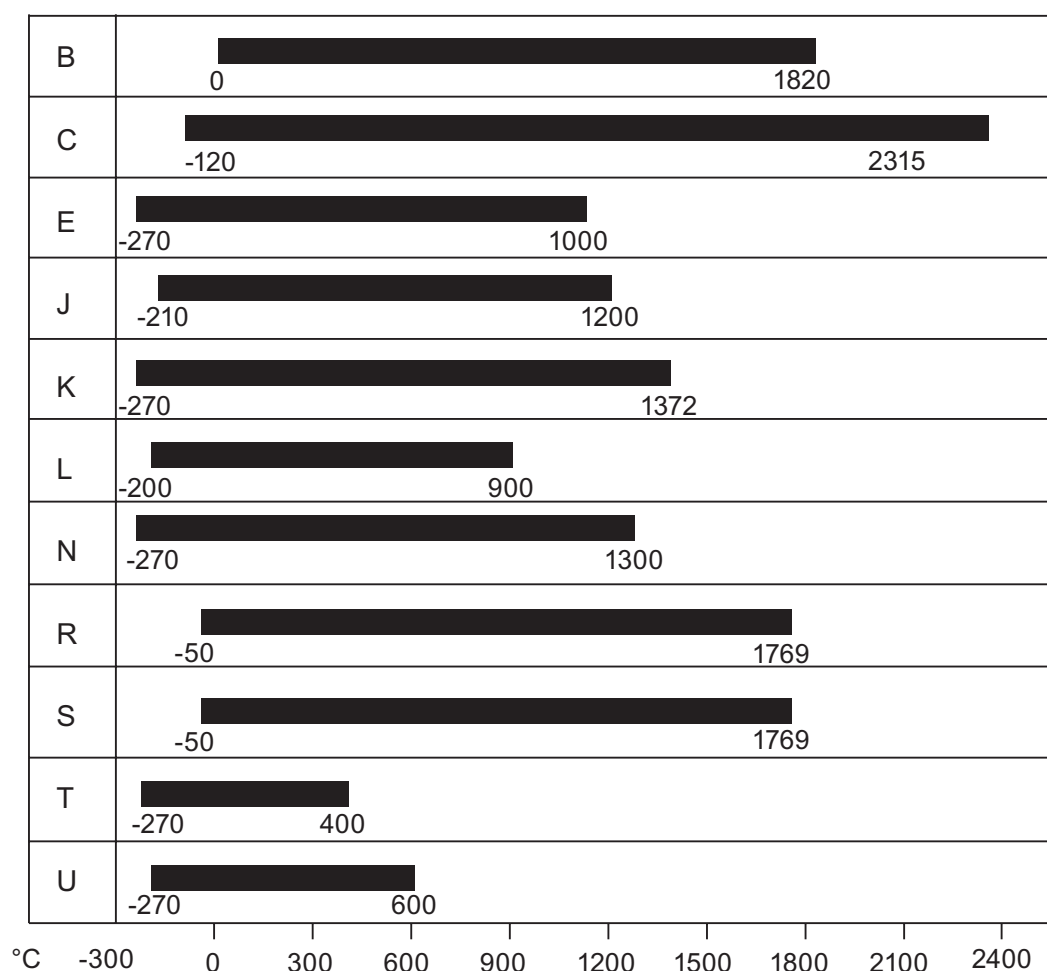


Figure 4-12 Thermocouples and their ranges

Thermocouple structure

Thermocouples consist of a pair of thermal probes, and all necessary installation and connecting parts. The thermocouple consists of two wires made of different metals, or of metal alloys soldered or welded together at their ends.

The different thermocouple types, for example, K, J or N, are derived from diverse material compositions. The measuring principle of all thermocouples is the same, irrespective of their type.

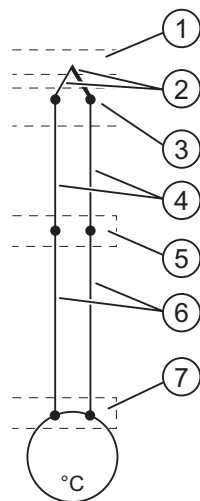


Figure 4-13 Figure 4-22 Thermocouple structure

- ① Measurement point
- ② Thermocouple with positive and negative thermo sidepieces
- ③ Wiring point
- ④ Compensating line
- ⑤ Reference junction
- ⑥ Supply line
- ⑦ Point for recording thermo voltage

Operating principle of thermocouples

Any temperature difference between the measuring point and the free ends of the thermocouple (point of connection) induces a thermoelectric voltage which is tapped at the terminating ends. The thermoelectric voltage induced on the thermocouple is a function of the temperature difference between the measuring point and the free ends, and is also determined by the material factor.

Thermocouples always sense a temperature difference. It is therefore essential to hold the free ends at the known temperature of a reference junction, in order to be able to determine the temperature at the measuring junction.

The thermocouples can be extended from their point of connection to the reference junction by means of compensating cables. These compensating wires are made of the same materials as the thermocouple wires. The supply lines between the reference junction and module are made of copper.

Note

Make sure of the correct polarity, for the device will otherwise return significant measuring errors.

Compensation of the reference junction temperature

You can compensate for the influence of temperature fluctuation at the reference junction by means of a compensating circuit.

You have several options of measuring the reference junction temperature, in order to calculate the absolute temperature value as a function of the temperature difference between the reference and measuring junction.

You can use either an internal or an external compensating circuit, depending on the required location of the reference junction.

Options of compensating the reference junction temperature

Table 4-1 Options of compensating the reference junction temperature

Option	Explanations
No compensation	To record only the temperature difference between the measuring point and reference junction.
Internal compensation (for the wiring, see <i>Connecting thermocouples with internal compensation box to electrically isolated analog inputs</i>)	The internal compensation is based on a comparison using the internal temperature (thermocouple internal comparison) of the module.
External compensation with compensation box in the feed lines of each thermocouple (the wiring is shown in the figure <i>Connecting thermocouples with compensation box to electrically isolated analog inputs</i> and <i>connecting thermocouples with reference junction (order no. M72166-xxx00) to electrically isolated analog inputs</i>)	You have already measured and compensated the reference junction temperature (thermocouple external comparison) using an interconnected compensating box in the feed lines of each thermocouple. Further processing at the module is not required.
Only for SM 331; AI 8 x TC: External compensation with resistance thermometer for recording temperature at reference junction	You can measure the reference temperature using a (platinum or nickel) resistance thermometer, and compute it in the module for any thermocouple.

See also

Connecting thermocouples with internal compensation (Page 4-15)

Connecting thermocouples with external compensation (Page 4-16)

Sensors which can be connected to analog inputs (Page 4-1)

4.6.1 Connecting thermocouples with internal compensation

Function principle of internal compensation

Internal compensation allows you to form the reference point at the terminals of the analog input module. In this case, route the compensating lines directly to the analog module. The internal temperature sensor measures the module's temperature and returns a compensation voltage.

Please note: internal compensation is not as accurate as external compensation.

Connecting thermocouples with internal compensation

Wire the thermocouples either directly to the inputs of the module, or indirectly via compensating lines. Each channel group can use any type of thermocouple supported by the analog module, independently of other channel groups.

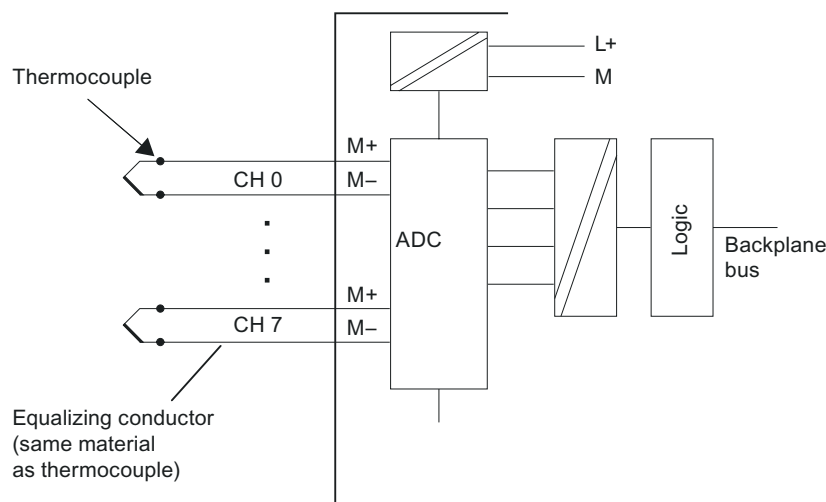


Figure 4-14 Connecting thermocouples with internal compensation to electrically isolated analog inputs

4.6.2 Connecting thermocouples with external compensation

Function principle of external compensation with compensating box

With external compensation, the temperature at the reference junction of the thermocouples is evaluated using a compensating box.

The compensating box contains a bridge circuit which is calibrated to a defined reference junction temperature /calibrating temperature.) The reference junction is formed by the connecting ends of the thermocouple's equalizing conductor.

The resistance of the temperature-sensitive bridge changes as a function of the difference between the actual reference temperature and calibrating temperature. This difference induces a positive or negative compensating voltage, which is added to the thermoelectrical voltage.

Wiring the compensating box

Terminate the compensating box at the COMP terminals of the module; the compensating box must be installed at the reference junction of the thermocouples. The compensating box be supplied with an electrically isolated voltage. The power supply module must provide adequate noise filtering, for example, by means of grounded cable shielding.

The thermocouple terminals on the compensation box are not required, and should be short-circuited (as an example, see the figure *Connecting thermocouples with reference junction (order no. M72166-xxx00) to electrically isolated analog inputs.*)

Restrictions:

- The channel group parameters always apply to the all its channels (for example, input voltage, integrating time etc.)
- For external compensation with connection of the compensating box to the module's COMP terminals, all thermocouples must be of the same type, and all channels operating with external compensation must use the same type.

Connecting thermocouples via compensating box

If all thermocouples connected to the module's inputs share a common reference junction, compensate the circuit as follows:

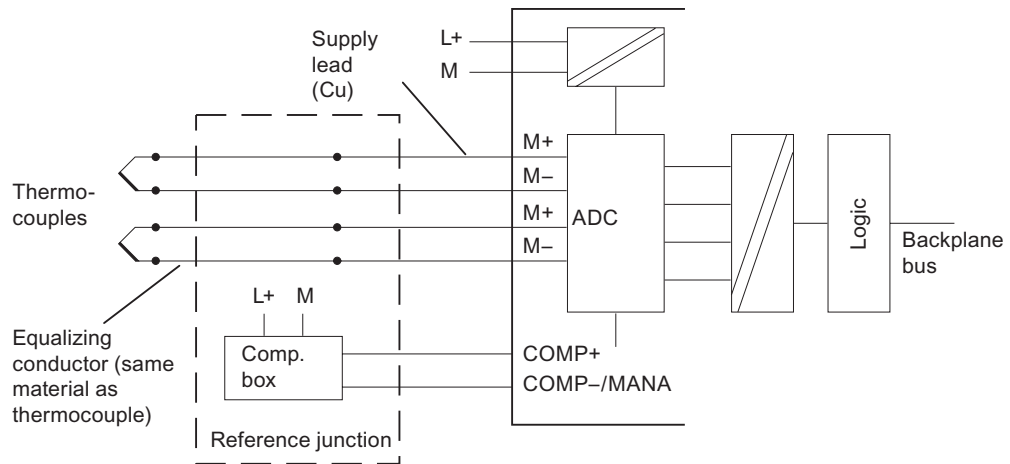


Figure 4-15 Connecting thermocouples to electrically isolated analog inputs via compensation box

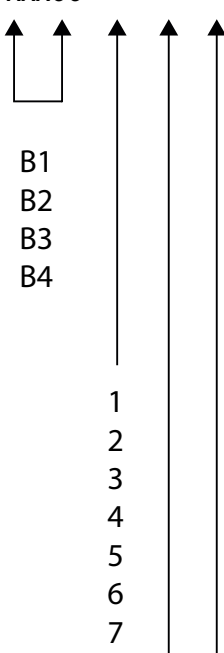
Note

To compensate the analog input modules, always use compensation boxes with a **reference junction temperature of 0 °C**.

Recommended compensating box

We recommend the use of a SIEMENS reference junction with integrated power supply unit as a compensating box. The table below shows the relevant ordering data.

Table 4-2 Ordering data of the reference junction

Recommended compensating box			Order number			
Reference junction with integrated power supply unit, for rail mounting			M72166-xxx00			
Auxiliary power	220 VAC					
	24 VAC					
	24 VDC					
	110 VAC					
Wiring to thermocouple						
	Fe-CuNi	Type L				
	Fe/Cu Ni	Type J				
	Ni Cr/Ni	Type K				
	Pt 10% Rh/Pt	Type S				
	Pt 13% Rh/Pt	Type R				
	Cu/Cu Ni	Type U				
	Cu/Cu Ni	Type T				
Reference temperature 0 °C						

Connecting to the reference junction (order no. M72166-xxx00)

If all thermocouples connected to the module's inputs share a common reference junction, compensate the circuit as follows:

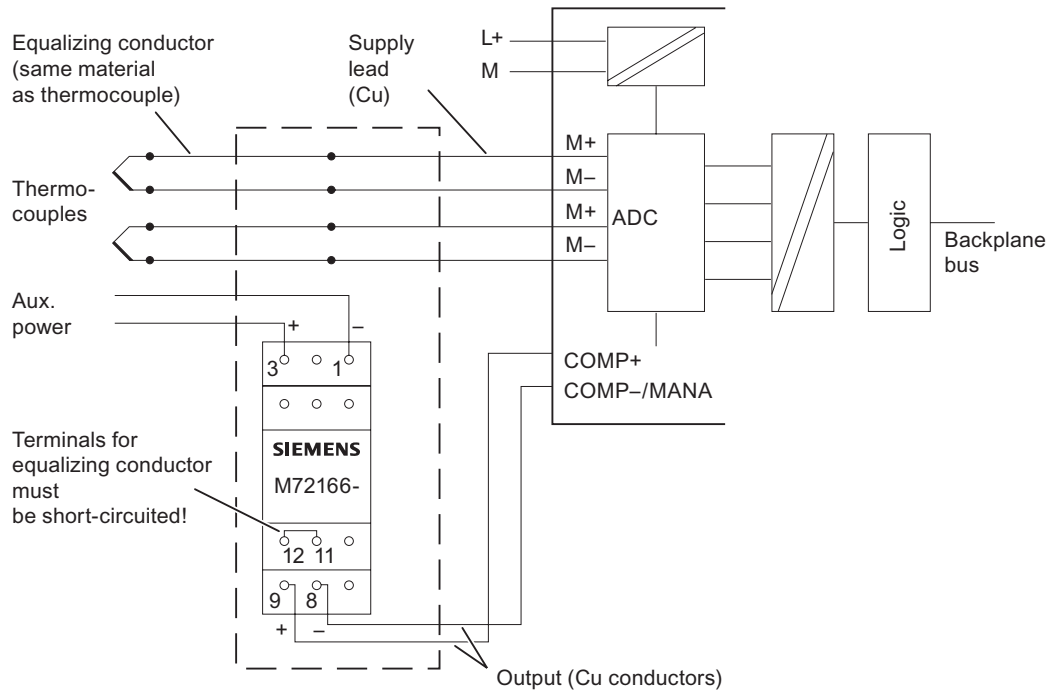


Figure 4-16 Connecting thermocouples to the reference junction (order no. M72166-xxx00)

4.7 Connecting loads/actuators to analog outputs

Connecting loads/actuators to analog outputs

The analog output modules can be used to supply power to loads and actuators.

Cables for analog signals

Always use shielded twisted-pair cables to wire analog signals. Form two twisted pairs of the Q_V and S_+ , and M and S_- signals in order to reduce interference. Connect both ends of the analog cable shield to ground.

Any potential difference between the cable ends may cause an equipotential current on the shield, and thus disturbance on analog signals. To avoid this situation, you should ground the shield only at one end of the cable.

Electrically isolated analog output modules

When using electrically isolated analog output modules, the reference point of measuring circuit M_{ANA} and the CPU's M terminal are not galvanically interconnected.

Always use electrically isolated analog input modules if there is a risk of a potential difference V_{iso} developing between the reference point of measuring circuit M_{ANA} and the M terminal of the CPU. Use an equipotential bonding conductor to interconnect the M_{ANA} terminal and the M terminal of the CPU, in order to prevent V_{iso} from exceeding the permitted value.

Non-isolated analog output modules

When using on-isolated analog output modules, always interconnect the reference point M_{ANA} of the of measuring circuit with terminal M of the CPU. Wire the M_{ANA} terminal to the M terminal of the CPU. Any potential difference between M_{ANA} and the M terminal of the CPU could otherwise corrupt the analog signal.

4.7.1 Connecting loads/actuators to voltage outputs

Connecting loads to a voltage output

Basically, you may choose between the 2-wire and 4-wire technique to connect loads to voltage outputs. However, certain analog output modules do not support both connections.

4-wire connection of loads to a voltage output of an electrically isolated module

You can use the 4-wire technique to achieve a high accuracy at the load, by wiring the S- and S+ sensor lines directly to the load. This results direct measurement and correction of the voltage at the load.

Disturbance or voltage drops may lead to a potential difference between sensor line S- and the reference circuit of analog circuit M_{ANA} . This potential difference may not exceed the permissible value. A negative influence on the accuracy of the analog signal is otherwise inevitable.

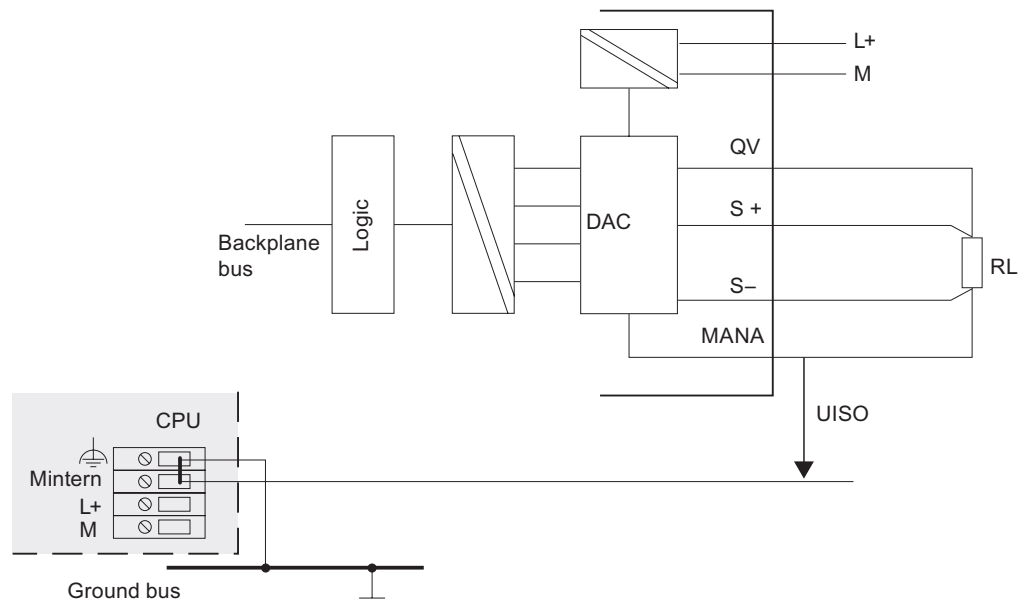


Figure 4-17 4-wire connection of loads to a voltage output of an electrically isolated analog output module

2-wire connection of loads to a voltage output of a non-isolated module

Wire the loads to the Q_V terminals and to the reference point of measuring circuit M_{ANA} . Connect terminal $S+$ to Q_V and terminal S to M_{ANA} in the front connector.

On the 2-conductor connection, the line resistances are not compensated.

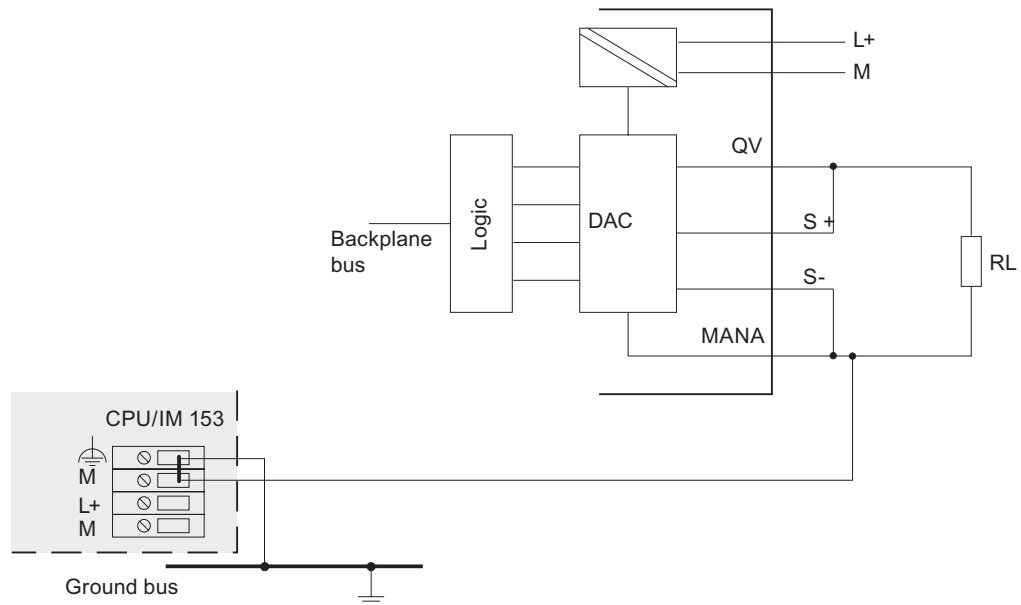


Figure 4-18 2-wire connection of loads to the voltage output of a non-isolated analog module

See also

Connecting loads/actuators to analog outputs (Page 4-20)

4.7.2 Connecting loads/actuators to current outputs

Connecting loads to current outputs

Always connect loads to Q_I and to the reference point of analog circuit M_{ANA} of a current output.

Connecting loads to a current output of an electrically isolated analog output module

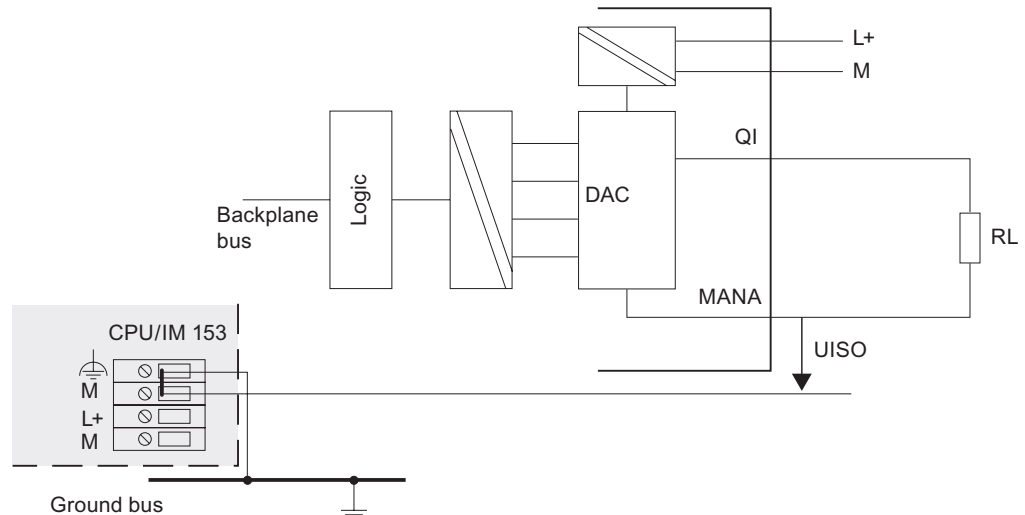


Figure 4-19 Connecting loads to a current output of an electrically isolated analog output module

Connecting loads to a current output of a non-isolated analog output module

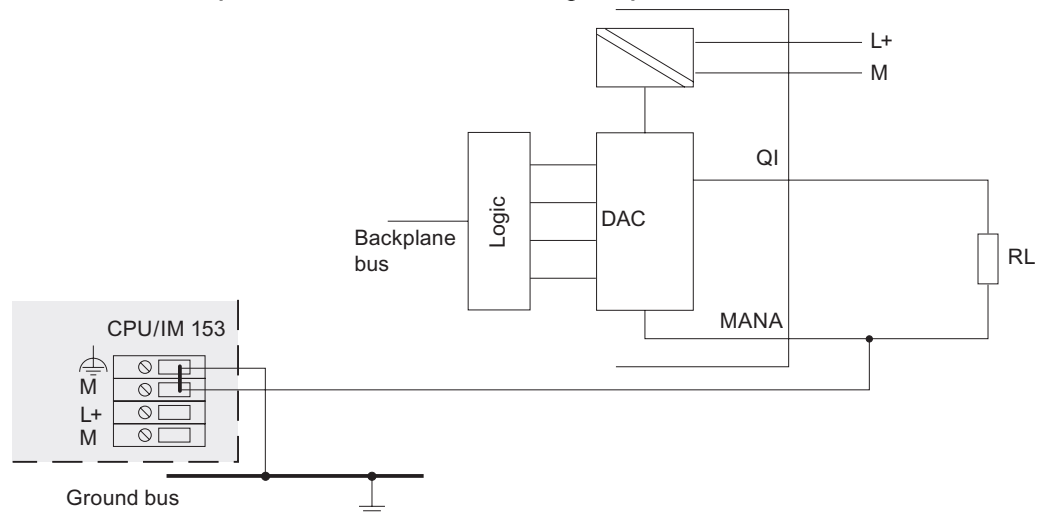


Figure 4-20 Connecting loads to a current output of a non-isolated analog output module

See also

Connecting loads/actuators to analog outputs (Page 4-20)

Representation of the analog values of analog modules

5

Introduction

This chapter describes the analog values for all measuring or output ranges supported by the analog modules.

Analog to digital conversion

The CPU only processes the analog values in binary format.

Analog input modules convert the analog process signal to a digital format.

Analog output modules convert digital output values to analog signals.

Representation of analog values at a resolution of 16 bits

The digitized analog value applies to input and output values of the same nominal range. Analog values are output as real numbers in two's complement. The resultant assignment:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit values	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Sign

The sign of the analog value is always set at bit 15:

- "0" → +
- "1" → -

Resolution < 16 bits

On analog modules with a resolution of < 16 bits, the analog value is stored left-aligned. The unused least significant bit positions are padded with zeros ("0".)

Example

The example below demonstrates the zero padding of unused bit positions for low resolution values.

Table 5-1 Example: Bit pattern of a 16-bit and 13-bit analog value

Resolution	Analog value															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16-bit analog value	0	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1
13-bit analog value	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0

5.1 Representation of the analog values of analog input channels

Measured value resolution

The resolution of the analog values may differ, based on the analog module and module parameters. At resolutions < 15 bits, all bits identified by "x" are set to "0".

Note

This resolution does not apply to temperature values. Converted temperature values are the result of a conversion in the analog module.

Table 5-2 Supported analog value resolutions

Resolution in bits (+ sign)	Units		Analog value	
	dec	hex	high byte	low byte
8	128	80 _H	Sign 0 0 0 0 0 0 0	1 x x x x x x x
9	64	40 _H	Sign 0 0 0 0 0 0 0	0 1 x x x x x x
10	32	20 _H	Sign 0 0 0 0 0 0 0	0 0 1 x x x x x
11	16	10 _H	Sign 0 0 0 0 0 0 0	0 0 0 1 x x x x
12	8	8 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13	4	4 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
14	2	2 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
15	1	1 _H	Sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

Binary representation of input ranges

Table 5-3 Bipolar input ranges

Units	Measured value in %	Data word																Range
		2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
32767	>118.515	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	>100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	Undershoot range
-27649	≤-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Underflow
-32768	≤-117.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 5-4 Unipolar input ranges

Units	Measured value in %	Data word																Range
		2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
32767	≥118.515	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	≥100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Undershoot range
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-4864	-17.593	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	Underflow
-32768	≤-17.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Representation of analog values in voltage measuring ranges

Table 5-5 Representation of analog values in the ± 1 V to ± 10 V voltage measuring range

System		Voltage measuring range				
dec	hex	± 10 V	± 5 V	± 2.5 V	± 1 V	
32767	7FFF	11.851 V	5.926 V	2.963 V	1.185 V	Overflow
32512	7F00					
32511	7EFF	11.759 V	5.879 V	2.940 V	1.176 V	Overshoot range
27649	6C01					
27648	6C00	10 V	5 V	2.5 V	1 V	Nominal range
20736	5100	7.5 V	3.75 V	1.875 V	0.75 V	
1	1	361.7 μ V	180.8 μ V	90.4 μ V	36.17 μ V	
0	0	0 V	0 V	0 V	0 V	
-1	FFFF					
-20736	AF00	-7.5 V	-3.75 V	-1.875 V	-0.75 V	
-27648	9400	-10 V	-5 V	-2.5 V	-1 V	
-27649	93FF					Undershoot range
-32512	8100	-11.759 V	-5.879 V	-2.940 V	-1.176 V	Underflow
-32513	80FF					
-32768	8000	-11.851 V	-5.926 V	-2.963 V	-1.185 V	

Table 5-6 Representation of analog values in the ± 80 mV to ± 500 mV voltage measuring ranges

System		Voltage measuring range				
dec	hex	± 500 mV	± 250 mV	± 80 mV		
32767	7FFF	592.6 mV	296.3 mV	94.8 mV	Overflow	
32512	7F00					
32511	7EFF	587.9 mV	294.0 mV	94.1 mV	Overshoot range	
27649	6C01					
27648	6C00	500 mV	250 mV	80 mV	Nominal range	
20736	5100	375 mV	187.5 mV	60 mV		
1	1	18.08 μ V	9.04 μ V	2.89 μ V		
0	0	0 mV	0 mV	0 mV		
-1	FFFF					
-20736	AF00	-375 mV	-187.5 mV	-60 mV		
-27648	9400	-500 mV	-250 mV	-80 mV		
-27649	93FF				Undershoot range	
-32512	8100	-587.9 mV	-294.0 mV	-94.1 mV		
-32513	80FF				Underflow	
-32768	8000	-592.6 mV	-296.3 mV	-94.8 mV		

Table 5-7 Representation of analog values in the 1 V to 5 V and 0 V to 10 V voltage measuring ranges

System		Voltage measuring range		
dec	hex	1 to 5 V	0 to 10 V	
32767	7FFF	5.741 V	11.852 V	Overflow
32512	7F00			
32511	7EFF	5.704 V	11.759 V	Overshoot range
27649	6C01			
27648	6C00	5 V	10 V	Nominal range
20736	5100	4 V	7.5 V	
1	1	1 V + 144.7 μ V	0 V + 361.7 μ V	
0	0	1 V	0 V	
-1	FFFF		Negative values are not supported	Undershoot range
-4864	ED00	0.296 V		Underflow
-4865	ECFF			
-32768	8000			

Representation of analog values in the current measuring ranges

Table 5-8 Representation of analog values in the ± 3.2 mA to ± 20 mA current measuring ranges

System		Current measuring range			
dec	hex	± 20 mA	± 10 mA	± 3.2 mA	
32767	7FFF	23.70 mA	11.85 mA	3.79 mA	Overflow
32512	7F00				
32511	7EFF	23.52 mA	11.76 mA	3.76 mA	Overshoot range
27649	6C01				
27648	6C00	20 mA	10 mA	3.2 mA	Nominal range
20736	5100	15 mA	7.5 mA	2.4 mA	
1	1	723.4 nA	361.7 nA	115.7 nA	
0	0	0 mA	0 mA	0 mA	
-1	FFFF				
-20736	AF00	-15 mA	-7.5 mA	-2.4 mA	
-27648	9400	-20 mA	-10 mA	-3.2 mA	
-27649	93FF				Undershoot range
-32512	8100	-23.52 mA	-11.76 mA	-3.76 mA	
-32513	80FF				Underflow
-32768	8000	-23.70 mA	-11.85 mA	-3.79 mA	

Representation of the analog values of analog modules

5.1 Representation of the analog values of analog input channels

Table 5-9 Representation of analog values in the 0 mA to 20 mA and 4 mA to 20 mA current measuring ranges

System		Current measuring range		
dec	hex	0 mA to 20 mA	4 mA to 20 mA	
32767	7FFF	23.70 mA	22.96 mA	Overflow
32512	7F00			
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Nominal range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4 mA	
-1	FFFF			Undershoot range
-4864	ED00	-3.52 mA	1.185 mA	
-4865	ECFF			Underflow
-32768	8000			

Representation of the analog values of resistive transducers

Table 5-10 Representation of the analog values of 6 k Ω ; 10 k Ω and from 150 Ω to 600 Ω resistive transducers

System		Resistive transducer range					
dec	hex	6k Ω	10 k Ω	150 Ω	300 Ω	600 Ω	
32767	7FFF	7.111 k Ω	11.852 k Ω	177.77 Ω	355.54 Ω	711.09 Ω	Overflow
32512	7F00			150.01 Ω	300.01 Ω	600.02 Ω	
32511	7EFF	7.055 k Ω	11.759 k Ω	176.38 Ω	352.77 Ω	705.53 Ω	Overshoot range
27649	6C01						
27648	6C00	6.0 k Ω	10 k Ω	150 Ω	300 Ω	600 Ω	Nominal range
20736	5100	4.5 k Ω	7.5 k Ω	112.5 Ω	225 Ω	450 Ω	
1	1	217.0 m Ω	361.7 m Ω	5.43 m Ω	10.85 m Ω	21.70 m Ω	
0	0	0 Ω	0 Ω	0 Ω	0 Ω	0 Ω	
		(negative values are physically impossible)					Undershoot range

Presentation of analog values for resistance thermometers Pt x00 and Pt x00 GOST (0.003850) standard

Table 5-11 Presentation of analog values for resistance thermometers PT 100, 200, 500, 1000 and PT 10, 50, 100, 500 GOST (0.003850) standard

Pt x00 Standard / GOST in °C (1 digit = 0.1°C)	Units		Pt x00 Standard/ GOST in °F (1 digit = 0.1 °F)	Units		Pt x00 Standard/ GOST in K (1 digit = 0.1 K)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal		dec	hexa- decimal	
> 1000.0	32767	7FFF _H	> 1832.0	32767	7FFF _H	> 1273.2	32767	7FFF _H	Overflow
1000.0	10000	2710 _H	1832.0	18320	4790 _H	1273.2	12732	31BC _H	Overshoot range
:	:	:	:	:	:	:	:	:	
850.1	8501	2135 _H	1562.1	15621	3D05 _H	1123.3	11233	2BE1 _H	Nominal range
850.0	8500	2134 _H	1562.0	15620	3D04 _H	1123.2	11232	2BE0 _H	
:	:	:	:	:	:	:	:	:	Underflow range
-200.0	-2000	F830 _H	-328.0	-3280	F330 _H	73.2	732	2DC _H	
-200.1	-2001	F82F _H	-328.1	-3281	F32F _H	73.1	731	2DB _H	Underflow range
:	:	:	:	:	:	:	:	:	
-243.0	-2430	F682 _H	-405.4	-4054	F02A _H	30.2	302	12E _H	Underflow
< - 243.0	-32768	8000 _H	< - 405.4	-32768	8000 _H	< 30.2	32768	8000 _H	

Representation of the analog values of Pt x00 GOST (0.003910) standard resistance thermometers

Table 5-12 Representation of the analog values of Pt 10, 50, 100, 500 GOST (0.003910) standard resistance thermometers

Pt x00 GOST Standard in °C (1 digit = 0.1°C)	Units		Pt x00 GOST Standard in °F (1 digit = 0.1 °F)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal	
> 1295.0	32767	7FFF _H	> 2363.0	32767	7FFF _H	Overflow
1295.0	12950	3296 _H	2363.0	23630	5CE4 _H	Overshoot range
:	:	:	:	:	:	
1100.1	11001	2AF9 _H	2012.1	20121	4E99 _H	Nominal range
1100.0	11000	2AF8 _H	2012.0	20120	4E98 _H	
:	:	:	:	:	:	Undershoot range
-260.0	-2600	F5D8 _H	-436.0	-4360	EEF8 _H	
-260.1	-2601	F5D7 _H	-436.1	-4361	EEF7 _H	Undershoot range
:	:	:	:	:	:	
-273.2	-2732	F554 _H	-459.7	-4597	EE0B _H	Underflow
< - 273.2	-32768	8000 _H	< - 459.7	-32768	8000 _H	

Presentation of analog values for resistance thermometers Pt x00 and Pt x0 GOST (0.003850) standard

Table 5-13 Presentation of analog values for resistance thermometers Pt 100, 200, 500, 1000 und Pt 10, 50, 100, 500 GOST (0.003850) Klima

Pt x00 Klima/ GOST in °C (1 digit = 0.01°C)	Units		Pt x00 Klima/ GOST in °F (1 digit = 0.01 °F)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal	
> 155.00	32767	7FFF _H	> 311.00	32767	7FFF _H	Overflow
155.00	15500	3C8C _H	311.00	31100	797C _H	Overshoot range
:	:	:	:	:	:	
130.01	13001	32C9 _H	266.01	26601	67E9 _H	
130.00	13000	32C8 _H	266.00	26600	67E8 _H	Nominal range
:	:	:	:	:	:	
-120.00	-12000	D120 _H	-184.00	-18400	B820 _H	
-120.01	-12001	D11F _H	-184.01	-18401	B81F _H	Undershoot range
:	:	:	:	:	:	
-145.00	-14500	C75C _H	-229.00	-22900	A68C _H	
< - 145.00	-32768	8000 _H	< - 229.00	-32768	8000 _H	Underflow

Representation of the analog values of Ni x00 Standard resistance thermometers

Table 5-14 Representation of the analog values of Ni100, 120, 200, 500, 1000 and LG-Ni 1000 resistance thermometers

Ni x00 Standard in °C (1 digit = 0.1°C)	Units		Ni x00 Standard in °F (1 digit = 0.1 °F)	Units		Ni x00 standard in K (1 digit = 0.1 K)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal		dec	hexa- decimal	
> 295.0	32767	7FFF _H	> 563.0	32767	7FFF _H	> 568.2	32767	7FFF _H	Overflow
295.0	2950	B86 _H	563.0	5630	15FE _H	568.2	5682	1632 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
250.1	2501	9C5 _H	482.1	4821	12D5 _H	523.3	5233	1471 _H	
250.0	2500	9C4 _H	482.0	4820	12D4 _H	523.2	5232	1470 _H	Nominal range
:	:	:	:	:	:	:	:	:	
-60.0	-600	FDA8 _H	-76.0	-760	FD08 _H	213.2	2132	854 _H	
-60.1	-601	FDA7 _H	-76.1	-761	FD07 _H	213.1	2131	853 _H	Underflow range
:	:	:	:	:	:	:	:	:	
-105.0	-1050	FBE6 _H	-157.0	-1570	F9DE _H	168.2	1682	692 _H	
< -105.0	-32768	8000 _H	< -157.0	-32768	8000 _H	< 168.2	32768	8000 _H	Underflow

Representation of the analog values of Ni x00 climate resistance thermometers

Table 5-15 Representation of the analog values of Ni 100, 120, 200, 500, 1000 and LG-Ni 1000 resistance thermometers

Ni x00 climate in °C (1 digit = 0.01°C)	Units		Ni x00 climate in °F (1 digit = 0.01 °F)	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 295.00	32767	7FFF _H	> 325.11	32767	7FFF _H	Overflow
295.00	29500	733C _H	327.66	32766	7FFE _H	Overshoot range
:	:	:	:	:	:	
250.01	25001	61A9 _H	280.01	28001	6D61 _H	
250.00	25000	61A8 _H	280.00	28000	6D60 _H	Nominal range
:	:	:	:	:	:	
-60.00	-6000	E890 _H	-76.00	-7600	E250 _H	
-60.01	-6001	E88F _H	-76.01	-7601	E24F _H	Undershoot range
:	:	:	:	:	:	
-105.00	-10500	D6FC _H	-157.00	-15700	C2AC _H	
< - 105.00	-32768	8000 _H	< - 157.00	-32768	8000 _H	Underflow

Representation of the analog values of Ni 100 GOST Standard resistance thermometers

Table 5-16 Representation of the analog values of Ni 100 GOST Standard resistance thermometers

Ni 100 GOST Standard in °C (1 digit = 0.1°C)	Units		Ni 100 GOST Standard in °F (1 digit = 0.1 °F)	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 212.4	32767	7FFF _H	> 414.3	32767	7FFF _H	Overflow
212.4	2124	084C _H	414.3	4143	102F _H	Overshoot range
:	:	:	:	:	:	
180.1	1801	0709 _H	356.1	3561	0DE9 _H	
180.0	1800	0708 _H	356.0	3560	0DE8 _H	Nominal range
:	:	:	:	:	:	
-60.0	-600	FDA8 _H	-76.0	-760	FD08 _H	
-60.1	-601	FDA7 _H	-76.1	-761	FD07 _H	Undershoot range
:	:	:	:	:	:	
-105.0	-1050	FBE6 _H	-157.0	-1570	F9DE _H	
< - 105.0	-32768	8000 _H	< - 157.0	-32768	8000 _H	Underflow

Representation of the analog values of Ni 100 GOST Klima resistance thermometers

Table 5-17 Representation of the analog values of Ni 100 GOST Klima resistance thermometers

Ni 100 GOST Klima in °C (1 digit = 0.1°C)	Units		Ni 100 GOST Klima in °F (1 digit = 0.1 °F)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal	
> 212.40	32767	7FFF _H	> 414.30	32767	7FFF _H	Overflow
212.40	2124	084C _H	414.30	41430	A1D6 _H	Overshoot range
:	:	:	:	:	:	
180.1	1801	0709 _H	356.10	35610	8B1A _H	
180.0	1800	0708 _H	356.00	35600	8B10 _H	Nominal range
:	:	:	:	:	:	
-60.0	-600	FDA8 _H	-76.00	-7600	E250 _H	
-60.1	-601	FDA7 _H	-76.10	-7610	E246 _H	Undershoot range
:	:	:	:	:	:	
-105.0	-1050	FBE6 _H	-157.00	-15700	C2AC _H	
< - 105.0	-32768	8000 _H	< - 157.00	-32768	8000 _H	Underflow

Representation of the analog values of Cu 10 Standard resistance thermometers

Table 5-18 Representation of the analog values of Cu 10 resistance thermometers

Cu 10 Standard in °C (1 digit = 0.01°C)	Units		Cu 10 Standard in °F (1 digit = 0.01 °F)	Units		Cu 10 Standard in K (1 digit = 0.01 K)	Units		Range
	dec	hexa- decimal		dec	hexa- decimal		dec	hexa- decimal	
> 312.0	32767	7FFF _H	> 593.6	32767	7FFF _H	> 585.2	32767	7FFF _H	Overflow
312.0	3120	C30 _H	593.6	5936	1730 _H	585.2	5852	16DC _H	Overshoot range
:	:	:	:	:	:	:	:	:	
260.1	2601	A29 _H	500.1	5001	12D5 _H	533.3	5333	14D5 _H	
260.0	2600	A28 _H	500.0	5000	1389 _H	533.2	5332	14D4 _H	Nominal range
:	:	:	:	:	:	:	:	:	
-200.0	-2000	F830 _H	-328.0	-3280	F330 _H	73.2	732	2DC _H	
-200.1	-2001	F82F _H	-328.1	-3281	F32F _H	73.1	731	2DB _H	Underflow range
:	:	:	:	:	:	:	:	:	
-240.0	-2400	F6A0 _H	-400.0	-4000	F060 _H	33.2	332	14C _H	
< - 240.0	-32768	8000 _H	< - 400.0	-32768	8000 _H	< 33.2	32768	8000 _H	Underflow

Representation of the analog values of Cu 10 climate resistance thermometers

Table 5-19 Representation of the analog values of Cu 10 resistance thermometers

Cu 10 climate in °C (1 digit = 0.01°C)	Units		Cu 10 climate in °F (1 digit = 0.01 °F)	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 180.00	32767	7FFF _H	> 325.11	32767	7FFF _H	Overflow
180.00	18000	4650 _H	327.66	32766	7FFE _H	Overshoot range
:	:	:	:	:	:	
150.01	15001	3A99 _H	280.01	28001	6D61A _H	Nominal range
150.00	15000	3A98 _H	280.00	28000	6D60 _H	
:	:	:	:	:	:	Undershoot range
-50.00	-5000	EC78 _H	-58.00	-5800	E958 _H	
-50.01	-5001	EC77 _H	-58.01	-5801	E957 _H	
:	:	:	:	:	:	
-60.00	-6000	E890 _H	-76.00	-7600	E250 _H	
< - 60.00	-32768	8000 _H	< - 76.00	-32768	8000 _H	Underflow

Representation of the analog values of Cu 10, 50, 100, 500 GOST (0.00426) GOST Standard resistance thermometers

Table 5-20 Representation of the analog values of Cu 10, 50, 100, 500 GOST Standard resistance thermometers

Cu x0 Standard in °C (1 digit = 0.1°C)	Units		Cu x0 Standard in °F (1 digit = -0.01 °F)	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 240.0	32767	7FFF _H	> 325.11	32767	7FFF _H	Overflow
240.0	2400	4650 _H	327.66	32766	7FFE _H	Overshoot range
:	:	:	:	:	:	
200.1	15001	3A99 _H	280.01	28001	6D61A _H	Nominal range
200.0	15000	3A98 _H	280.00	28000	6D60 _H	
:	:	:	:	:	:	Undershoot range
-50.0	-5000	EC78 _H	-58.00	-5800	E958 _H	
-50.1	-5001	EC77 _H	-58.01	-5801	E957 _H	
:	:	:	:	:	:	
-60.0	-6000	E890 _H	-76.00	-7600	E250 _H	
< - 60.00	-32768	8000 _H	< - 76.00	-32768	8000 _H	Underflow

Representation of the analog values of Cu 10, 50, 100, 500 GOST Standard (0.00428) resistance thermometers

Table 5-21 Representation of the analog values of Cu 10, 50, 100, 500 GOST Standard resistance thermometers

Cu 10 climate in °C (1 digit = 0.01°C)	Units		Cu 10 climate in °F (1 digit = 0.01 °F)	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 180.00	32767	7FFF _H	> 325.11	32767	7FFF _H	Overflow
180.00	18000	4650 _H	327.66	32766	7FFE _H	Overshoot range
:	:	:	:	:	:	
150.01	15001	3A99 _H	280.01	28001	6D61A _H	Nominal range
150.00	15000	3A98 _H	280.00	28000	6D60 _H	
:	:	:	:	:	:	Undershoot range
-50.00	-5000	EC78 _H	-58.00	-5800	E958 _H	
-50.01	-5001	EC77 _H	-58.01	-5801	E957 _H	Undershoot range
:	:	:	:	:	:	
-60.00	-6000	E890 _H	-76.00	-7600	E250 _H	Underflow
< - 60.00	-32768	8000 _H	< - 76.00	-32768	8000 _H	

Representation of the analog values of thermocouples type B

Table 5-22 Representation of the analog values of thermocouples type B

Type B in °C	Units		Type B in °F	Units		Type B in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 2070.0	32767	7FFF _H	> 3276.6	32767	7FFF _H	> 2343.2	32767	7FFF _H	Overflow
2070.0	20700	50DC _H	3276.6	32766	7FFE _H	2343.2	23432	5B88 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1821.0	18210	4722 _H	2786.6	27866	6CDA _H	2094.2	20942	51CE _H	Nominal range
1820.0	18200	4718 _H	2786.5	27865	6CD9 _H	2093.2	20932	51C4 _H	
:	:	:	:	:	:	:	:	:	Underflow range
0.0	0	0000 _H	32.0	320	0140 _H	273.2	2732	0AAC _H	
:	:	:	:	:	:	:	:	:	Underflow range
-120.0	-1200	FB50 _H	-184.0	-1840	F8D0 _H	153.2	1532	05FC _H	
< -120.0	-32768	8000 _H	< -184.0	-32768	8000 _H	< 153.2	32768	8000 _H	Underflow

Representation of the analog values of thermocouples type C

Table 5-23 Representation of the analog values of thermocouples type C

Type C in °C	Units		Type C in °F	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 2500.0	32767	7FFF _H	> 3276.6	32767	7FFF _H	Overflow
2500.0	25000	61A8 _H	3276.6	32766	7FFE _H	Overshoot range
:	:	:	:	:	:	
2315.1	23151	5A6F _H	2786.6	27866	6CDA _H	
2315.0	23150	5A6E _H	2786.5	27865	6CD9 _H	Nominal range
:	:	:	:	:	:	
0.0	0	0000 _H	32.0	320	0140 _H	
0.1	-1	FFFF _H	31.9	319	013F _H	Undershoot range
:	:	:	:	:	:	
-120.0	-1200	FB50 _H	-184.0	-1840	F8D0 _H	
< -120.0	-32768	8000 _H	< -184.0	-32768	8000 _H	Underflow

Representation of the analog values of thermocouples type E

Table 5-24 Representation of the analog values of thermocouples type E

Type E in °C	Units		Type E in °F	Units		Type E in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 1200.0	32767	7FFF _H	> 2192.0	32767	7FFF _H	> 1473.2	32767	7FFF _H	Overflow
1200.0	12000	2EE0 _H	2192.0	21920	55A0 _H	1473.2	14732	398C _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1000.1	10001	2711 _H	1833.8	18338	47A2 _H	1274.2	12742	31C6 _H	
1000.0	10000	2710 _H	1832.0	18320	4790 _H	1273.2	12732	31BC _H	Nominal range
:	:	:	:	:	:	:	:	:	
-270.0	-2700	F574 _H	-454.0	-4540	EE44 _H	0	0	0000 _H	
< -270.0	< -2700	< F574 _H	< -454.0	< -4540	< EE44 _H	< 0	< 0	< 0000 _H	Underflow
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F0C4 _H , and to output 8000 _H .			... FB70 _H , and to output 8000 _H .			... E5D4 _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type J

Table 5-25 Representation of the analog values of thermocouples type J

Type J in °C	Units		Type J in °F	Units		Type J in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 1450.0	32767	7FFF _H	> 2642.0	32767	7FFF _H	> 1723.2	32767	7FFF _H	Overflow
1450.0	14500	38A4 _H	2642.0	26420	6734 _H	1723.2	17232	4350 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1201.0	12010	2EEA _H	2193.8	21938	55B2 _H	1474.2	14742	3996 _H	Nominal range
1200.0	12000	2EE0 _H	2192.0	21920	55A0 _H	1473.2	14732	398C _H	
:	:	:	:	:	:	:	:	:	Underflow
-210.0	-2100	F7CC _H	-346.0	-3460	F27C _H	63.2	632	0278 _H	
< -210.0	< -2100	<F7CC _H	< -346.0	< -3460	<F27C _H	< 63.2	< 632	< 0278 _H	Underflow
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F31C _H , and to output 8000 _H .			... EA0C _H , and to output 8000 _H .			... FDC8 _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type K

Table 5-26 Representation of the analog values of thermocouples type K

Type K in °C	Units		Type K in °F	Units		Type K in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 1622.0	32767	7FFF _H	> 2951.6	32767	7FFF _H	> 1895.2	32767	7FFF _H	Overflow
1622.0	16220	3F5C _H	2951.6	29516	734C _H	1895.2	18952	4A08 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1373.0	13730	35A2 _H	2503.4	25034	61CA _H	1646.2	16462	404E _H	Nominal range
1372.0	13720	3598 _H	2501.6	25061	61B8 _H	1645.2	16452	4044 _H	
:	:	:	:	:	:	:	:	:	Underflow
-270.0	-2700	F574 _H	-454.0	-4540	EE44 _H	0	0	0000 _H	
< -270.0	< -2700	< F574 _H	< -454.0	< -4540	< EE44 _H	< 0	< 0	< 0000 _H	Underflow
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F0C4 _H , and to output 8000 _H .			... E5D4 _H , and to output 8000 _H .			... FB70 _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type L

Table 5-27 Representation of the analog values of thermocouples type L

Type L in °C	Units		Type L in °F	Units		Type L in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 1150.0	32767	7FFF _H	> 2102.0	32767	7FFF _H	> 1423.2	32767	7FFF _H	Overflow
1150.0	11500	2CEC _H	2102.0	21020	521C _H	1423.2	14232	3798 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
901.0	9010	2332 _H	1653.8	16538	409A _H	1174.2	11742	2DDE _H	Nominal range
900.0	9000	2328 _H	1652.0	16520	4088 _H	1173.2	11732	2DD4 _H	
:	:	:	:	:	:	:	:	:	
-200.0	-2000	F830 _H	-328.0	-3280	F330 _H	73.2	732	02DC _H	Underflow
< -200.0	< -2000	< F830 _H	< -328.0	< -3280	< F330 _H	< 73.2	< 732	< 02DC _H	
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F380 _H , and to output 8000 _H .			... EAC0 _H , and to output 8000 _H .			... FE2C _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type N

Table 5-28 Representation of the analog values of thermocouples type N

Type N in °C	Units		Type N in °F	Units		Type N in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 1550.0	32767	7FFF _H	> 2822.0	32767	7FFF _H	> 1823.2	32767	7FFF _H	Overflow
1550.0	15500	3C8C _H	2822.0	28220	6E3C _H	1823.2	18232	4738 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1300.1	13001	32C9 _H	2373.8	23738	5CBA _H	1574.2	15742	3D7E _H	Nominal range
1300.0	13000	32C8 _H	2372.0	23720	5CA8 _H	1573.2	15732	3D74 _H	
:	:	:	:	:	:	:	:	:	
-270.0	-2700	F574 _H	-454.0	-4540	EE44 _H	0	0	0000 _H	Underflow
< -270.0	< -2700	< F574 _H	< -454.0	< -4540	< EE44 _H	< 0	< 0	< 0000 _H	
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F0C4 _H , and to output 8000 _H .			... E5D4 _H , and to output 8000 _H .			... FB70 _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type R, S

Table 5-29 Representation of the analog values of thermocouples type R, S

Type R, S in °C	Units		Type R, S in °F	Units		Types R, S in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 2019.0	32767	7FFF _H	> 3276.6	32767	7FFF _H	> 2292.2	32767	7FFF _H	Overflow
2019.0	20190	4EDE _H	3276.6	32766	7FFE _H	2292.2	22922	598A _H	Overshoot range
:	:	:	:	:	:	:	:	:	
1770.0	17770	4524 _H	3218.0	32180	7DB4 _H	2043.2	20432	4FD0 _H	
1769.0	17690	451A _H	3216.2	32162	7DA2 _H	2042.2	20422	4FC6 _H	Nominal range
:	:	:	:	:	:	:	:	:	
-50.0	-500	FE0C _H	-58.0	-580	FDBC _H	223.2	2232	08B8 _H	
-51.0	-510	FE02 _H	-59.8	-598	FDAA _H	222.2	2222	08AE _H	Underflow range
:	:	:	:	:	:	:	:	:	
-170.0	-1700	F95C _H	-274.0	-2740	F54C _H	103.2	1032	0408 _H	
< -170.0	-32768	8000 _H	< -274.0	-32768	8000 _H	< 103.2	< 1032	8000 _H	Underflow

Representation of the analog values of thermocouples type T

Table 5-30 Representation of the analog values of thermocouples type T

Type T in °C	Units		Type T in °F	Units		Type T in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 540.0	32767	7FFF _H	> 1004.0	32767	7FFF _H	> 813.2	32767	7FFF _H	Overflow
540.0	5400	1518 _H	1004.0	10040	2738 _H	813.2	8132	1FC4 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
401.0	4010	0FAA _H							
400.0	4000	0FA0 _H	752.0	7520	1D60 _H	673.2	6732	1AAC _H	Nominal range
:	:	:	:	:	:	:	:	:	
-270.0	-2700	F574 _H	-454.0	-4540	EE44 _H	3.2	32	0020 _H	
< -270.0	< -2700	< F574 _H	< -454.0	< -4540	< EE44 _H	< 3.2	< 32	< 0020 _H	Underflow
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F0C4 _H , and to output 8000 _H .			... E5D4 _H , and to output 8000 _H .			... FB70 _H , and to output 8000 _H .			

Representation of the analog values of thermocouples type U

Table 5-31 Representation of the analog values of thermocouples type U

Type U in °C	Units		Type U in °F	Units		Type U in K	Units		Range
	dec	hexa-decimal		dec	hexa-decimal		dec	hexa-decimal	
> 850.0	32767	7FFF _H	> 1562.0	32767	7FFF _H	> 1123.2	32767	7FFF _H	Overflow
850.0	8500	2134 _H	1562.0	15620	2738.0 _H	1123.2	11232	2BE0 _H	Overshoot range
:	:	:	:	:	:	:	:	:	
601.0	6010	177A _H	1113.8	11138	2B82 _H	874.2	8742	2226 _H	
600.0	6000	1770 _H	1112.0	11120	2B70 _H	873.2	8732	221C _H	Nominal range
:	:	:	:	:	:	:	:	:	
-200.0	-2000	F830 _H	-328.0	-3280	F330 _H	73.2	732	02DC _H	
< -200.0	< -2000	< F830 _H	< -328.0	< -3280	< F330 _H	< 73.2	< 732	< 02DC _H	Underflow
Faulty wiring (polarity reversal, or open inputs, for example), or transducer error in the negative range (wrong type of thermocouple, for example) will cause the analog input module to signal underflow, starting at ...									
... F380 _H , and to output 8000 _H .			... EAC0 _H , and to output 8000 _H .			... FE2C _H , and to output 8000 _H .			

Presentation of analogue values for type TXK/XKL GOST thermocouple

Table 5-32 Presentation of analogue values for type TXK/XKL GOST thermocouple

Type TXK/XKL in °C	Units		Type TXK/XKL in °F	Units		Range
	dec	hexa-decimal		dec	hexa-decimal	
> 1050.0	32767	7FFF _H	> 1922.0	32767	7FFF _H	Overflow
1050.0	8500	2904 _H	1922.0	19220	4B14 _H	Overshoot range
:	:	:	:	:	:	
800.1	8001	1F41 _H	1472.1	14721	3981 _H	
800.0	8000	1F40 _H	1472.0	14720	3980 _H	Nominal range
:	:	:	:	:	:	
0.0	0	0000 _H	32.0	320	0140 _H	
:	:	:	:	:	:	
-200.0	-2000	F830 _H	-328.0	-3280	F330 _H	
< -200.0	<-32768	< F8000 _H	< -328.0	<-32768	8000 _H	Underflow

5.2 Representation of the analog values of analog output channels

Binary representation of output ranges

Table 5-33 Bipolar output ranges

Units	Output value in %	Data word																Range
		2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
≥32512	0 %	0	1	1	1	1	1	1	1	x	x	x	x	x	x	x	x	Overflow
32511	117,589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	≥100,004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100,000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0,003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0,003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100,000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	Undershoot range
-27649	≤100,004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	
-32512	-117,593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Undershoot range
≤32513	0 %	1	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x	Underflow

Table 5-34 Unipolar output ranges

Units	Output value in %	Data word																Range
		2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	
≥32512	0 %	0	1	1	1	1	1	1	1	x	x	x	x	x	x	x	x	Overflow
32511	117,589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overshoot range
27649	≥100,004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100,000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nominal range
1	0,003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	0,000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-32512		1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	limited to the low limit of the rated range, 0 V or 0 mA
≤32513	0 %	1	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x	Underflow

Representation of analog values in the voltage output ranges

Table 5-35 Representation of analog values in the ± 10 V output range

System			Voltage output range	
	dec	hex	± 10 V	
118,5149 %	32767	7FFF	0.00 V	Overflow, off power
	32512	7F00		
117,589 %	32511	7EFF	11.76 V	Overshoot range
	27649	6C01		
100 %	27648	6C00	10 V	Nominal range
75 %	20736	5100	7.5 V	
0,003617 %	1	1	361.7 μ V	
0 %	0	0	0 V	
	-1	FFFF	-361.7 μ V	
-75 %	-20736	AF00	-7.5 V	Undershoot range
-100 %	-27648	9400	-10 V	
	-27649	93FF		
-117,593 %	-32512	8100	-11.76 V	Underflow, idle state
	-32513	80FF		
-118,519 %	-32768	8000	0.00 V	

Table 5-36 Representation of analog values in the 0 V to 10 V and 1 V to 5 V output ranges

System			Voltage output range		
	dec	hex	0 V to 10 V	1 V to 5 V	
118,5149 %	32767	7FFF	0.00 V	0.00 V	Overflow, off power
	32512	7F00			
117,589 %	32511	7EFF	11.76 V	5.70 V	Overshoot range
	27649	6C01			
100 %	27648	6C00	10 V	5 V	Nominal range
75 %	20736	5100	7.5 V	3.75 V	
0,003617 %	1	1	361.7 μ V	1 V +144.7 μ V	
0 %	0	0	0 V	1 V	
	-1	FFFF			
-25 %	-6912	E500		0 V	Undershoot range
	-6913	E4FF			
-117,593 %	-32512	8100			Underflow, idle state
	-32513	80FF			
-118,519 %	-32768	8000	0.00 V	0.00 V	

Representation of analog values in the current output ranges

Table 5-37 Representation of analog values in the ± 20 mA output range

System			Current output range	
	dec	hex	± 20 mA	
118,5149 %	32767	7FFF	0.00 mA	Overflow, off power
	32512	7F00		
117,589 %	32511	7EFF	23.52 mA	Overshoot range
	27649	6C01		
100 %	27648	6C00	20 mA	Nominal range
75 %	20736	5100	15 mA	
0,003617 %	1	1	723.4 nA	
0 %	0	0	0 mA	
	-1	FFFF	-723.4 nA	
-75 %	-20736	AF00	-15 mA	Undershoot range
-100 %	-27648	9400	-20 mA	
	-27649	93FF		
-117,593 %	-32512	8100	-23.52 mA	Underflow, idle state
	-32513	80FF		
-118,519 %	-32768	8000	0.00 mA	

Table 5-38 Representation of analog values in the 0 mA to 20 mA and 4 mA to 20 mA output ranges

System			Current output range		
	dec	hex	0 mA to 20 mA	4 mA to 20 mA	
118,5149 %	32767	7FFF	0.00 mA	0.00 mA	Overflow, off power
	32512	7F00			
117,589 %	32511	7EFF	23.52 mA	22.81 mA	Overshoot range
	27649	6C01			
100 %	27648	6C00	20 mA	20 mA	Nominal range
75 %	20736	5100	15 mA	15 mA	
0,003617 %	1	1	723.4 nA	4 mA + 578.7 nA	
0 %	0	0	0 mA	4 mA	
	-1	FFFF			Undershoot range
-25 %	-6912	E500		0 mA	
	-6913	E4FF			Not possible. Output value limited to 0 mA.
-117,593 %	-32512	8100			
	-32513	80FF			Underflow, idle state
-118,519 %	-32768	8000	0.00 mA	0.00 mA	

5.3 Setting the measuring method and ranges of analog input channels

Two procedures

There are two methods of setting the measuring method and ranges of analog input channels at analog modules:

- using a measuring range module and *STEP 7*
- hardwiring the analog input channel, and programming in STEP 7

The method to use for the various analog modules is module-specific, and described in detail in the relevant module chapters.

The next chapter shows how to set the measuring method and range using measuring range modules.

Setting the measuring method and range using measuring range module

Analog modules are supplied with measuring range modules as required.

Reposition the measuring range modules to suit the measuring method and range.

Note

The measuring range modules are attached to the side of the analog input module.

Before you install the analog input module, check the measuring method and range of the measuring range modules, and adapt these as required.

Optional settings of the measuring range modules

Optional settings of the measuring range modules are: "A", "B", "C" and "D".

For detailed information on specific measuring method and range settings, refer to the relevant module chapter.

The settings for the various measuring methods and ranges are also shown on the printed label of the analog module.

Reconnecting measuring range modules

To reconnect a measuring range module:

1. Use a screwdriver to lever the measuring range module out of the analog input module.

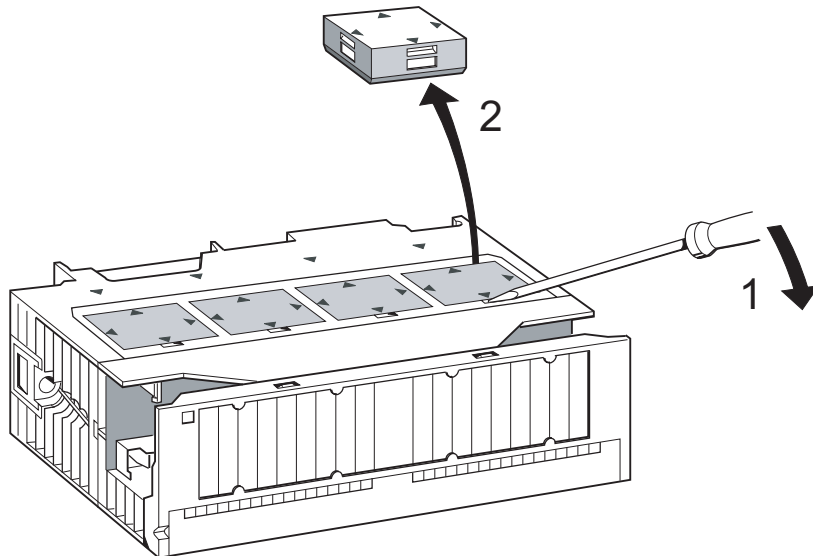


Figure 5-1 Levering the measuring range modules out of the analog input module

2. Insert the measuring range module into the required slot (1) of the analog input module.
The measuring range selected is the one that points to the marker on the module (2).

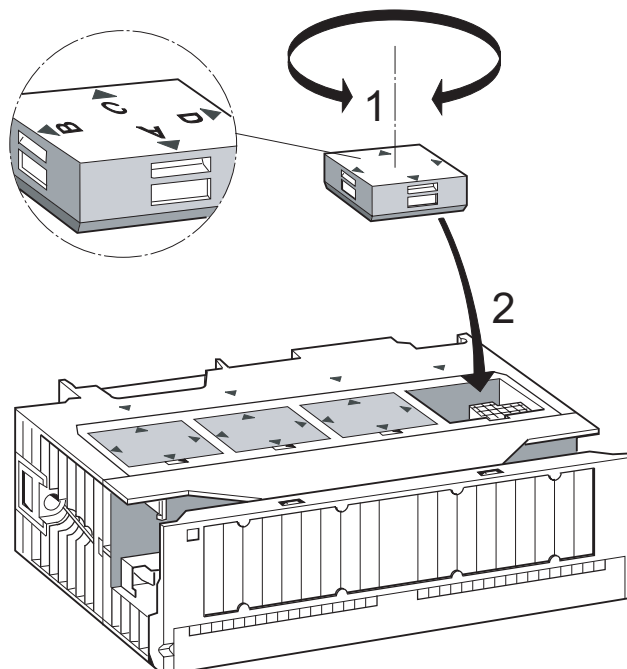


Figure 5-2 Inserting measuring range modules into the analog input module

Continue with the insertion of all other measuring range modules.

You can now install the module.



Caution

Faulty measuring range module settings may lead to the destruction of the module.

Always make sure the measuring range module is in the correct position before you connect any encoders to the module.

5.4 Reactions of the analog modules

This chapter

This chapter describes:

- the dependency of analog input and output values on CPU operating states and on the supply voltage of the analog module
- the reaction of analog modules, based on the actual analog value within the relevant range of values
- the influence of the operational limits of analog modules on analog IO values, as illustrated by an example

5.4.1 Influence of the supply voltage and operating mode

Introduction

This chapter describes:

- the dependency of analog IO values on CPU operating states, and on the supply voltage of the analog module
- the reaction of analog modules, based on the actual analog value within the relevant range of values
- the influence of the operational limits of analog modules on analog IO values, as illustrated by an example

Influence of the supply voltage and operating state on the modules

The IO values of analog modules are determined by the CPU operating state and the module's supply voltage.

Table 5-39 Dependencies of the analog IO values on the CPU's operating State and on the L+ supply voltage

CPU operating state		Supply voltage L+ at the analog module	Input value of the analog input module	Output value of the analog output module
POWER ON	RUN	L+ present	Measured value	CPU values
			7FFF _H , until the first conversion after POWER ON is completed, or when the module has been programmed.	Until the first conversion... - after POWER ON, the module outputs a 0 mA or 0 V signal. - after programming is successfully completed, it outputs the previous value.
		L+ missing	Overflow value	0 mA / 0 V
POWER ON	STOP	L+ present	Measured value	Substitution value / last value (default: 0 mA / 0 V)
			7FFF _H , until the first conversion after POWER ON is completed, or when the module has been programmed.	
		L+ missing	Overflow value	0 mA / 0 V
POWER OFF	-	L+ present	-	0 mA / 0 V
		L+ missing	-	0 mA / 0 V

Reaction to power failure

Power failure at analog modules is always indicated by their relevant SF LED. This information is also available on the module (in diagnostic buffer data.)

Diagnostics interrupt triggering is based on parameter settings.

See also

Programming analog modules (Page 5-31)

5.4.2 Influence of the range of analog values

Influence of errors on analog modules with diagnostics functions

Errors may lead to an entry in the diagnostics buffer and trigger a diagnostic interrupt at analog modules with diagnostics function and corresponding parameter settings.

Influence of the range of values on the analog input module

The reaction of analog modules is determined by the actual input values within the range of values.

Table 5-40 Reaction of analog input modules as a function of the actual analog value within the range of values

Measured value within	Input value	SF LED	Diagnostics	Interrupt
Nominal range	Measured value	-	-	-
Overshoot/undershoot range	Measured value	-	-	-
Overflow	7FFF _H	lit ¹	Entry is made ¹	Diagnostics interrupt ¹
Underflow	8000 _H	lit ¹	Entry is made ¹	Diagnostics interrupt ¹
beyond programmed limit	Measured value	-	-	Hardware interrupt ¹
¹⁾ , only supported by modules with diagnostics function, and depending on parameter settings				

Influence of the range of values on the analog output module

The reaction of analog modules is determined by the actual output values within the value range.

Table 5-41 Reaction of analog output modules as a function of the actual analog value within the range of values

Output value within	Output value	SF LED	Diagnostics	Interrupt
Nominal range	CPU value	-	-	-
Overshoot/undershoot range	CPU value	-	-	-
Overflow	0 signal	-	-	-
Underflow	0 signal	-	-	-

5.4.3 Influence of operational limits and basic error limits

Operational limit

The operational limit represents the total measuring/output error of an analog module within the permissible temperature range, based on the module's rating.

Basic error limit

The basic error limit represents the total measuring/output error at 25 °C, based on the module's rating.

Note

The percentile values of operational and basic error limits in the module's technical data always refer to the **highest possible** input and output value within the nominal range of the module.

Example of the determination of the output error of a module

An analog output module SM 332; AO 4 x 12 Bit is being used for voltage output. An output range of "0 to 10 V" is set. The module is operating at an ambient temperature of 30 °C, i.e. the operational limit applies. The technical data of the module state:

- Operational limit for voltage output: $\pm 0,5 \%$

Hence, an output error of $\pm 0.05 \text{ V}$ ($\pm 0.5 \%$ of 10 V) across the nominal range of the module must be expected.

At an actual voltage of 1 V, for example, the module will then output a value in the range from 0.95 V to 1.05 V. The relative error is $\pm 5 \%$ in this case.

For the example, the figure below shows how the relative error decreases as the output value approaches the end of the 10-V range.

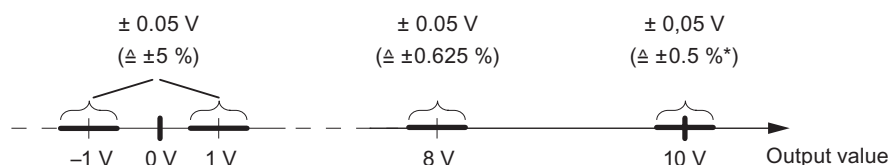


Figure 5-3 Example of the relative error of an analog output module

5.5 Conversion and cycle times of analog modules

Conversion time of analog input channels

The conversion time is the total of the basic conversion time plus additional processing times of the module for:

- Resistance measurement
- Wirebreak monitoring

The basic conversion time depends directly on the conversion method of the analog input channel (integrating method, actual value conversion.)

The integration time of integrating conversions has a direct influence on conversion times. The integration time depends on the interference frequency suppression you set in *STEP 7*.

For information on basic conversion times and additional processing times of the various analog modules, refer to the technical data of the relevant module.

Cycle time of analog input channels

Analog-to-digital conversion, and the transfer of digitized measured values to memory and/or to the backplane bus, are carried out sequentially, i.e. the analog input channels are converted in successive order. The cycle time, i.e. the time expiring until an analog input value is converted again, represents the accumulated conversion time of all activated analog input channels of the analog input module.

The figure below provides an overview of the cycle time elements for an n-channel analog module.

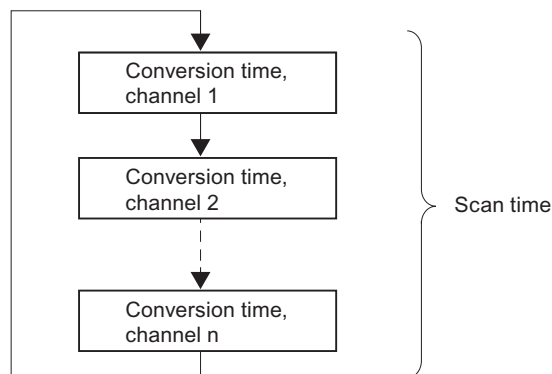


Figure 5-4 Cycle time of an analog input or output module

Conversion and cycle times for analog input channels in channel groups

Make allowances for the accumulated channel conversion time when the analog input channels are joined to form channel groups.

Example

Two analog input channels of the SM 331; AI 2 x 12 Bit analog input module form a channel group. You must therefore grade the cycle time in steps of 2.

Setting smoothing of analog values

Certain analog input modules allow you to set smoothing of analog values in *STEP 7*.

Using smoothing

Smoothed analog values provide a reliable analog signal for further processing.

It is useful to smooth the analog values with slow variations of measured values, for example, when measuring temperature.

Smoothing principle

The measured values are smoothed by digital filtering. Smoothing is accomplished by the module calculating mean values, derived from a defined number of converted (digitized) analog values.

The user configures up to four grades of smoothing (none, low, average, high). The grade determines the number of analog signals used for averaging.

A higher smoothing provides a more reliable analog value, and prolongs the time it takes to apply a smoothed analog signal following a step response (see the example below.)

Example

The figure below shows the number of cycles a module requires to apply a close to 100% analog value after a step response, based on the smoothing function settings. The figure applies to all signal changes at the analog input.

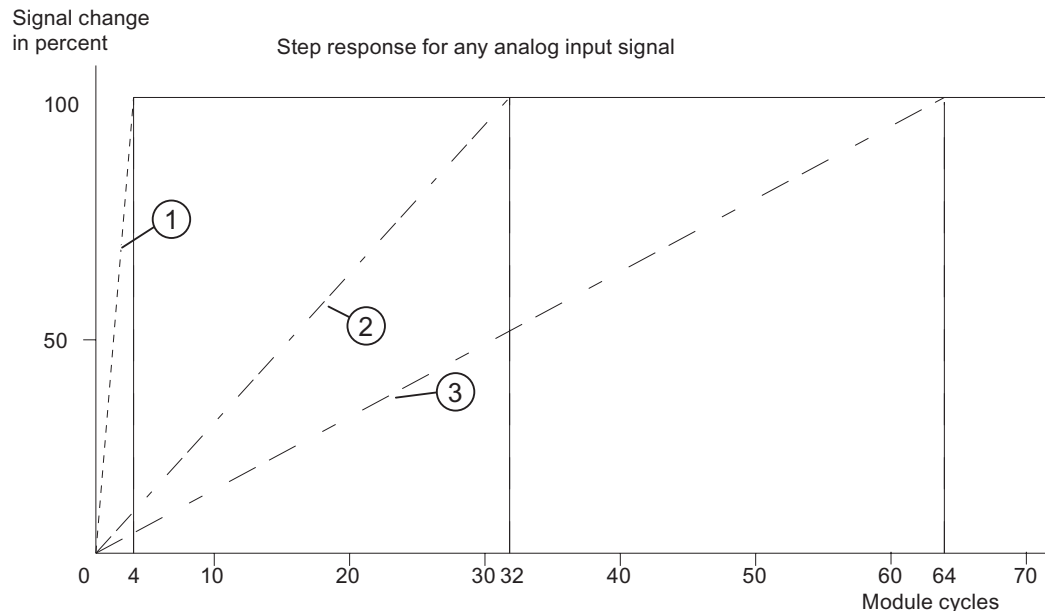


Figure 5-5 Example of impact of smoothing on the jump response with the AI 8 x 14 bit

- ① Low smoothing grade
- ② Medium smoothing grade
- ③ High smoothing grade

Further information on smoothing

For information showing whether a specific module supports smoothing functions, and special features to observe, refer to the chapter dealing with the analog input module.

Conversion time of the analog output channels

The conversion time of the analog output channels includes the transfer of digitized output values from internal memory, and their digital-to-analog conversion.

Cycle time of analog output channels

Analog output channels are converted sequentially, i.e. successively.

The cycle time, i.e. the time expiring until an analog output value is converted again, is equivalent to the accumulated conversion times of all activated analog output channels. Refer to the figure *Cycle time of an analog IO channel*.

Tip

You should disable all unused analog channels in **STEP 7** in order to reduce cycle times.

5.6 Settling and response times of analog output channels

Settling time

The settling time (t_2 to t_3), i.e. the time expiring until a converted value has gained a specified level at an analog output, is load-dependent. We therefore distinguish between resistive, capacitive and inductive load.

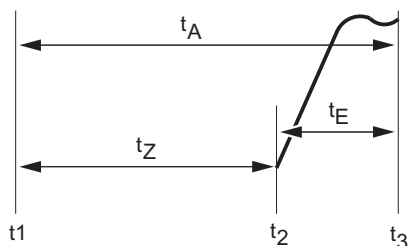
For information on settling times as a function of load at the various analog output modules, refer to the technical data of the relevant module.

Response time

The worst case response time (t_1 to t_3), i.e. the time expiring between the input of digital output values to internal memory, and the signal settling time at the analog output, may be equivalent to the total of cycle time plus settling time.

The worst case scenario is given, when the analog channel has been converted immediately before a new output value is transferred, and is not converted again until all other channels have been converted (cycle time.)

Overview of the settling time and response time of analog output modules



- t_A Response time
- t_C t_C = cycle time, corresponds to $n \times$ conversion time (n = activated channels)
- t_S Settling time
- t_1 a new digitized output value is available
- t_2 Output value accepted and converted
- t_3 the specified job value will be reached

5.7 Programming analog modules

Introduction

The properties of analog modules may differ. The module properties can be programmed.

Programming tools

You program analog modules in *STEP 7*. Always program the module while the CPU is in STOP mode.

After you defined all parameters, download these from your PG to the CPU. The CPU transfers the parameters to the relevant analog modules at the STOP → RUN transition.

Also, position the measuring range modules of the module as required.

Static and dynamic parameters

Parameters are organized by static and dynamic properties.

Set the static parameters while the CPU is in STOP, as described earlier.

You can also modify dynamic parameters in the active user program using SFCs. However, the parameters set in *STEP 7* will be applied again after a RUN → STOP, STOP → RUN transition of the CPU.

Parameters	configurable using	CPU operating state
static	PG (STEP 7 HW CONFIG)	STOP
dynamic	PG (STEP 7 HW CONFIG)	STOP
	SFC 55 in the user program	RUN

5.7.1 Parameters of analog input modules

Parameters of analog input modules

For information on parameters supported by specific analog modules, refer to the chapter dealing with the relevant module.

The defaults apply if you have not set any parameters in **STEP 7**.

5.8 Diagnostics functions of analog modules

Programmable and non-programmable diagnostic messages

We distinguish between programmable and non-programmable diagnostic messages.

You only obtain programmable diagnostic messages if you have enabled diagnostics at the relevant parameters. Program these functions in the "Diagnostics" parameter block in *STEP 7*.

The analog module always provides non-programmable diagnostic messages, irrespective of the enable state of diagnostics functions.

Reactions to a diagnostic message in *STEP 7*

Actions initiated by diagnostic messages:

- The diagnostic message is written to the diagnostics buffer of the analog module, and is then passed to the CPU.
- The error LED on the analog module is lit.
- When "Enable Diagnostic Interrupt" is set in *STEP 7*, the system triggers a diagnostic interrupt and calls OB82.

Reading diagnostic messages

You can read detailed diagnostics messages in the user program using SFCs.

Viewing the cause of error

You can view the cause of the error in the module diagnostics data in *STEP 7* (refer to the *STEP 7* Online Help.)

Diagnostics message included in the measured value of analog input modules

All analog input modules return the measured value 7FFF_H as a reaction to errors, irrespective of parameter settings. This measured value indicates either overflow, error, or a disabled channel.

Diagnostic message using the SF LED

All analog modules indicate errors at their SF LED (group error LED.) The SF LED lights up when the analog module triggers a diagnostic message. It goes dark after all error states are cleared.

See also

Programming analog modules (Page 5-31)

5.8.1 Diagnostic messages of analog input modules

Overview of the diagnostic messages of analog input modules

The table below provides an overview of the diagnostic messages of analog input modules.

Table 5-42 Diagnostic messages of analog input modules

Diagnostics message	LED	Scope of diagnostics	programmable
External load voltage missing	SF	Module	No
Configuration / programming error	SF	Channel	Yes
Common-mode error	SF	Channel	Yes
Wirebreak	SF	Channel	Yes
Underflow	SF	Channel	Yes
Overflow	SF	Channel	Yes

5.8.2 Diagnostics messages of analog output modules

Overview of the diagnostic messages of analog output modules

The table below provides an overview of the diagnostic messages of analog output modules.

Table 5-43 Diagnostics messages of analog output modules

Diagnostics message	LED	Scope of diagnostics	programmable
External load voltage missing	SF	Module	No
Configuration / programming error	SF	Channel	Yes
Short-circuit to M	SF	Channel	Yes
Wirebreak	SF	Channel	Yes

Note

Prerequisite for the detection of errors indicated by programmable diagnostic messages is an appropriate configuration of the analog module in *STEP 7*.

5.8.3 Causes of error and troubleshooting at analog input modules

Overview of the causes of error and troubleshooting at analog input modules

Table 5-44 Diagnostics messages of analog input modules, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid error
External load voltage missing	Load voltage L+ of module missing	Connect supply L+
Configuration / programming error	Faulty parameters transferred to module	Check the measuring range module Program the module
Common-mode error	Excess potential difference C_{MV} between inputs M- and the reference potential of measuring circuit (M_{ANA})	Connect M- with M_{ANA}
Wirebreak	Resistance of transducer circuit too high	Use a different type of transducer, or modify the wiring, for example, using a larger conductor cross-section.
	Open circuit between module and sensor	Connect the cable
	Channel not connected (open)	Disable the channel group ("measuring method" parameter)
		Wire the channel
Underflow	Input value below undershoot range; possible cause of error: wrong measuring range setting	set another measuring range
	at the measuring ranges 4 to 20 mA and 1 to 5 V, the sensor may be connected revers polarity	Check the connections
Overflow	Input value exceeds overshoot range	set another measuring range

5.8.4 Causes of error and troubleshooting at analog output modules

Overview of the causes of error and troubleshooting routines at analog input modules

Table 5-45 Diagnostics messages of analog output modules, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid error
External load voltage missing	Load voltage L+ of module missing	Connect supply L+
Configuration / programming error	Faulty parameters transferred to module	Program the module
Short-circuit to M	Overload at output	Eliminate overload
	Short-circuit of output Q_V to M_{ANA}	Eliminate the short-circuit
Wirebreak	Actuator resistance too high	Use a different type of actuator, or modify the wiring using cables with a larger conductor cross-section
	Wire-break between the module and actuator	Connect the cable
	Channel not used (open)	Disable channel group ("output type" parameter)

5.9 Interrupts of analog modules

Introduction

This section describes the interrupt reaction of analog modules. We distinguish the following interrupts:

- Diagnostic interrupt
- Hardware interrupt

Note: certain analog modules do not support interrupts, or can only partially "handle" the interrupts described below. For information on modules supporting interrupt functions, refer to their technical data.

Description of the *STEP 7* blocks

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if not set accordingly. Program the interrupt enable parameter in *STEP 7*.

Diagnostic interrupt

When diagnostic interrupts are enabled, incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of an interrupt.

The CPU interrupts user program execution, and executes diagnostic interrupt OB82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

Hardware interrupt with "high or low limit exceeded" trigger

Define a working range by setting a high and low limit. If the process signal (for example, the temperature) overshoots this working range, the module triggers a hardware interrupt, provided the interrupt is enabled.

As a result, the CPU interrupts execution of the user program and executes hardware interrupt OB 40.

In the user program of OB 40, you can define the reaction of the automation system to the violation of limits.

The module acknowledges the hardware interrupt when the program exits OB 40.

Note

Note: the system does not generate a hardware interrupt if your limit setting exceeds the overshoot or undershoot range.

Structure of the start information tag OB40_POINT_ADDR of OB 40

The information showing which channel has violated which limit is entered in the OB40_POINT_ADDR tag of the OB 40 start information. The figure below shows the assignment of bits in DWORD 8 of local data.

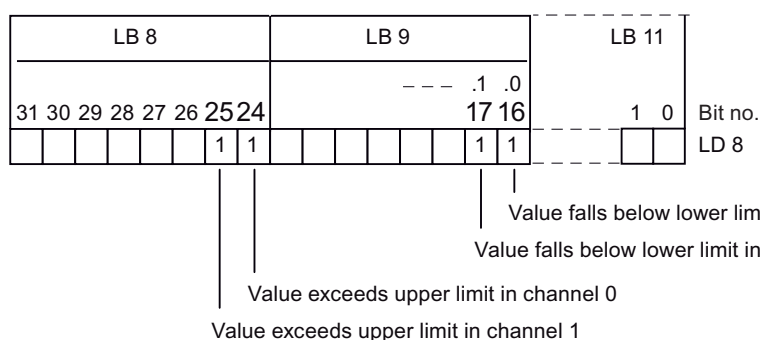


Figure 5-6 Start Information of OB 40: Which event has violated limits and triggered a hardware interrupt

Hardware interrupt triggered by "Reached end of scan cycle"

A hardware interrupt programmed to be triggered at the end of scan cycles allows you to synchronize a process with the scan cycle of the analog input module.

A scan cycle includes the conversion of the measured values of all active channels of the analog input module. The module processes the channels in succession. When all measured values are successfully converted, the module reports the existence of new measurement data at its channels to the CPU by means of interrupt.

You can always use this interrupt to load the actual, converted analog values.

Analog modules

Introduction

This chapter describes:

1. Steps from the selection of analog modules to commissioning
2. Overview of essential module properties
3. Modules which are available (properties, connection and block diagrams, technical data and additional information on the module):
 - a) for analog input modules
 - b) for analog output modules
 - c) for analog IO modules

STEP 7 blocks for analog functions

You can use FC105 "SCALE" (scale values) and FC106 "UNSCALE" (unscale values) blocks to read and output analog values in *STEP 7*. Those FCs are available in the *STEP 7* standard library, in the "TI-S7-Converting Blocks" subfolder.

Description of *STEP 7* blocks for analog functions

For information on FCs 105 and 106, refer to the *STEP 7* Online Help.

Further information

You should be familiar with the structure of the parameter sets (data records 0, 1 and 128) in system data before you edit module parameters in the *STEP 7* user program.

You should be familiar with the structure of diagnostics data (data records 0, 1) in system data before you edit any diagnostics data of the module in the *STEP 7* user program.

See also

Principles of programming signal modules in the user program (Page A-1)

Evaluating diagnostic data of signal modules in the user program (Page B-1)

6.1 Steps from the selection of analog modules to commissioning

Introduction

The table below contains the steps required to successfully complete commissioning of analog modules.

Although this sequence is suggested, you may nonetheless carry out specific steps, or install or commission other modules, at your own time (for example, assigning parameters to the module).

Steps from the selection of analog modules to commissioning

1. Selecting the module
2. For certain analog input modules: Set the measuring type and range using the measuring range module
3. Installing the module in the SIMATIC S7 system
4. Assigning module parameters
5. Connect the measuring transducers or loads to the module
6. Commission the configuration
7. Analyze the configuration if commissioning failed

More information on installation and commissioning

See the "Installation" and "Commissioning" chapter in the Installation Manual for your automation system:

- S7-300 Automation System, Installation or
- S7-400 Automation System, Installation or
- Distributed I/O Device ET 200M

You will find the documentation online at:
<http://support.automation.siemens.com/WW/view/de/>

6.2 Module overview

Introduction

The tables below summarize the essential properties of the analog modules. This overview supports you in selecting a module to suit your requirements.

6.2.1 Analog input modules:

Overview of properties

The table below shows essential properties of the analog input modules

Table 6-1 Analog input modules: Overview of properties

Properties	Module			
	SM 331; AI 8 x 16 Bit (-7NF00-)	SM 331; AI 8 x 16 Bit (-7NF10-)	SM 331; AI 8 x 14 Bit High Speed (-7HF0x-)	SM 331; AI 8 x 13 Bit (-1KF01-)
Number of inputs	8 inputs in 4 channel groups	8 inputs in 4 channel groups	8 inputs in 4 channel groups	8 inputs in 8 channel groups
Resolution	adjustable for each channel group: • 15 bits+sign	adjustable for each channel group: • 15 bits+sign	adjustable for each channel group: • 13 bits+sign	adjustable for each channel group: • 12 bits+sign
Measuring method	adjustable for each channel group: • Voltage • Current	adjustable for each channel group: • Voltage • Current	adjustable for each channel group: • Voltage • Current	configurable per channel: • Voltage • Current • Resistance • Temperature
Measuring range selection	any, per channel group	any, per channel group	any, per channel group	any, per channel
Supports isochronous mode	No	No	Yes	No
Programmable diagnostics	Yes	Yes	Yes	No
Diagnostic interrupt	adjustable	adjustable	adjustable	No
Limit value monitoring	adjustable for 2 channels	adjustable for 8 channels	adjustable for 2 channels	No
Hardware interrupt when limit exceeded	adjustable	adjustable	adjustable	No
Hardware interrupt at end of cycle	No	Yes	No	No

Properties	Module			
	SM 331; AI 8 x 16 Bit (-7NF00-)	SM 331; AI 8 x 16 Bit (-7NF10-)	SM 331; AI 8 x 14 Bit High Speed (-7HF0x-)	SM 331; AI 8 x 13 Bit (-1KF01-)
Potential ratios	electrically isolated to: the backplane bus interface	electrically isolated to: the backplane bus interface	electrically isolated to: - the backplane bus interface - load voltage (not applicable to 2-DMU)	electrically isolated to: the backplane bus interface
permissible potential difference between inputs (ICM)	50 VDC	60 VDC	11 VDC	2.0 VDC
Special features	-	-	-	-
Sign 2-DMU 2-wire measuring transducer				

Table 6-2 Analog input modules: Overview of properties (continued)

Properties	Module				
	SM 331; AI 8 x 12 bit (-7KF02-)	SM 331; AI 2 x 12 bit (-7KB02-)	SM 331; AI 8 x TC (-7PF11-)	SM 331; AI 8 x RTD (-7PF01-)	SM 331; AI 8 x 0/4...20 mA HART (-7TF00-)*
Number of inputs	8 inputs in 4 channel groups	2 inputs in 1 channel group	8 inputs in 4 channel groups	8 inputs in 4 channel groups	8 inputs in 1 channel group
Resolution	adjustable for each channel group: 9 bits+sign 12 bits+sign 14 bits+sign	adjustable for each channel group: 9 bits+sign 12 bits+sign 14 bits+sign	adjustable for each channel group: 15 bits+sign	adjustable for each channel group: 15 bits+sign	adjustable for each channel group: 15 bits+sign
Measuring method	adjustable for each channel group: - Voltage - Current - Resistance - Temperature	adjustable for each channel group: - Voltage - Current - Resistance - Temperature	adjustable for each channel group: Temperature	adjustable for each channel group: - Resistance - Temperature	adjustable for each channel group: - Voltage - Current - Resistance - Temperature
Measuring range selection	any, per channel group	any, per channel group	any, per channel group	any, per channel group	any, per channel group
Programmable diagnostics	Yes	Yes	Yes	Yes	Yes
Supports isochronous mode	No	No	No	No	No

Properties	Module				
	SM 331; AI 8 x 12 bit (-7KF02-)	SM 331; AI 2 x 12 bit (-7KB02-)	SM 331; AI 8 x TC (-7PF11-)	SM 331; AI 8 x RTD (-7PF01-)	SM 331; AI 8 x 0/4...20 mA HART (-7TF00-)*
Diagnostic interrupt	adjustable	adjustable	adjustable	adjustable	adjustable
Limit value monitoring	adjustable for 2 channels	adjustable for 1 channel	adjustable for 8 channels	adjustable for 8 channels	adjustable for 8 channels
Hardware interrupt when limit exceeded	adjustable	adjustable	adjustable	adjustable	adjustable
Hardware interrupt at end of cycle	No	No	adjustable	adjustable	adjustable
Potential ratios	electrically isolated to: - the CPU - load voltage (not applicable to 2-DMU)	electrically isolated to: - the CPU - load voltage (not applicable to 2-DMU)	electrically isolated to: the CPU	electrically isolated to: the CPU	electrically isolated to: - the CPU - load voltage (not applicable to 2-DMU)
permissible potential difference between inputs (ICM)	≤ DC 2.3 V	≤ DC 2.3 V	60 VAC / 75 VDC	60 VAC / 75 VDC	60 VAC / 75 VDC
Special features	-	-	-	-	-
Sign 2-DMU 2-wire measuring transducer					

* A description of this module can be found in the manual Distributed I/O Device ET 200M HART analog modules. You will find this manual online at:
<http://support.automation.siemens.com/WW/view/de/22063748>.

6.2.2 Analog output modules:

Overview of properties

The table below shows essential properties of the analog output modules

Table 6-3 Analog output modules: Overview of properties

Properties	Modules				
	SM 332; AO 8 x 12 Bit (-5HF00-)	SM 332; AO 4 x 16 Bit (-7ND02-)	SM 332; AO 4 x 12 Bit (-5HD01-)	SM 332; AO 2 x 12 Bit (-5HB01-)	SM 332; AO 8 x 0/4...20mA HART (-8TF00-) *
Number of outputs	8 output channels	4 outputs in 4 channel groups	4 output channels	2 output channels	8 output channels
Resolution	12 bits	16 bits	12 bits	12 bits	15 bits (0...20mA) 15 bits +VZ (4...20mA)
Output type	each separate channel: • Voltage • Current	each separate channel: • Voltage • Current	each separate channel: • Voltage • Current	each separate channel: • Voltage • Current	each separate channel: • Voltage • Current
Supports isochronous mode	No	Yes	No	No	No
Programmable diagnostics	Yes	Yes	Yes	Yes	Yes
Diagnostic interrupt	adjustable	adjustable	adjustable	adjustable	adjustable
Substitution value output	No	adjustable	adjustable	adjustable	adjustable
Potential ratios	electrical isolation between: • the backplane bus interface • load voltage	electrical isolation between: • backplane bus interface and channel • channels • output and L+, M • CPU and L+, M	electrically isolated to: • the backplane bus interface • load voltage	electrically isolated to: • the backplane bus interface • load voltage	electrically isolated to: • the backplane bus interface • load voltage
Special features	-	-	-	-	-

VZ = sign

* A description of this module can be found in Manual Distributed I/O Device ET 200M HART analog modules. You will find this manual online at:
<http://support.automation.siemens.com/WW/view/de/22063748>.

6.2.3 Analog IO modules:

Overview of properties

The table below shows the essential properties of analog IO modules

Table 6-4 Analog IO modules: Overview of properties

Properties	SM 334; AI 4/AO 2 x 8/8 bits (-0CE01-)	SM 334; AI 4/AO 2 x 12 bits (-0KE00-)
Number of inputs	4 inputs in 1 channel group	4 inputs in 2 channel groups
Number of outputs	2 outputs in 1 channel group	2 outputs in 1 channel group
Resolution	8 bits	12 bits + sign
Measuring method	adjustable for each channel group: • Voltage • Current	adjustable for each channel group: • Voltage • Resistance • Temperature
Output type	each separate channel: • Voltage • Current	each separate channel: • Voltage
Supports isochronous mode	No	No
Programmable diagnostics	No	No
Diagnostic interrupt	No	No
Limit value monitoring	No	No
Hardware interrupt when limit exceeded	No	No
Hardware interrupt at end of cycle	No	No
Substitution value output	No	No
Potential ratios	• electrically interconnected to backplane bus interface • electrically isolated to load voltage	electrically isolated to: • backplane bus interface • load voltage
Special features	Not programmable, measurement and output type defined by hardwiring	-

6.3 Analog input module SM 331; AI 8 x 16 Bit; (6ES7331-7NF00-0AB0)

Order number

6ES7331-7NF00-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group
 - Voltage
 - Current
- Resolution adjustable per channel group (15 bits + sign)
- Any measuring range selection per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 2 channels
- Hardware interrupt can be set when limit exceeded
- High-speed refreshing of measured values
- Electrically isolated to the CPU

Resolution

The measured value's resolution is not dependent on the integration time selected.

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set the hardware interrupts of channel groups 0 and 1 in *STEP 7*. However, always set a hardware interrupt only for the first channel of a channel group, i.e. either at channel 0, or at channel 2

High-speed refreshing of measured values

In high-speed refresh mode, the measured values at two channels of a group occur are refreshed three times faster than those at multiple active channel groups.

Example: Channels 0 and 1 are active with 2 ms filtering. Refreshed data are thus available at intervals of 10 ms to the PLC at both channels. (For other settings, the refresh rate is equivalent to the filter setting.)

A high-speed update of measured values is only possible if both channels of channel group 0 and 1 are active, i.e. the "measuring method" parameter is set. However, only one of the two channel groups 0 or 1 may be active (not concurrently active.)

Terminal assignment

The following diagrams show different possible forms of wiring

Wiring: Voltage and current measurement

For current measurements, wire the channel's voltage inputs with relevant current measuring resistor in parallel. Do so by bridging the channel's input terminals to the adjacent terminals of the connector.

Example: Set up channel 0 for current measurements by bridging terminals 22 and 2, and terminals 23 to 3.

At the channel configured for current measurements, connect the current measuring resistor to the adjacent channel terminals in order to achieve the specified accuracy.

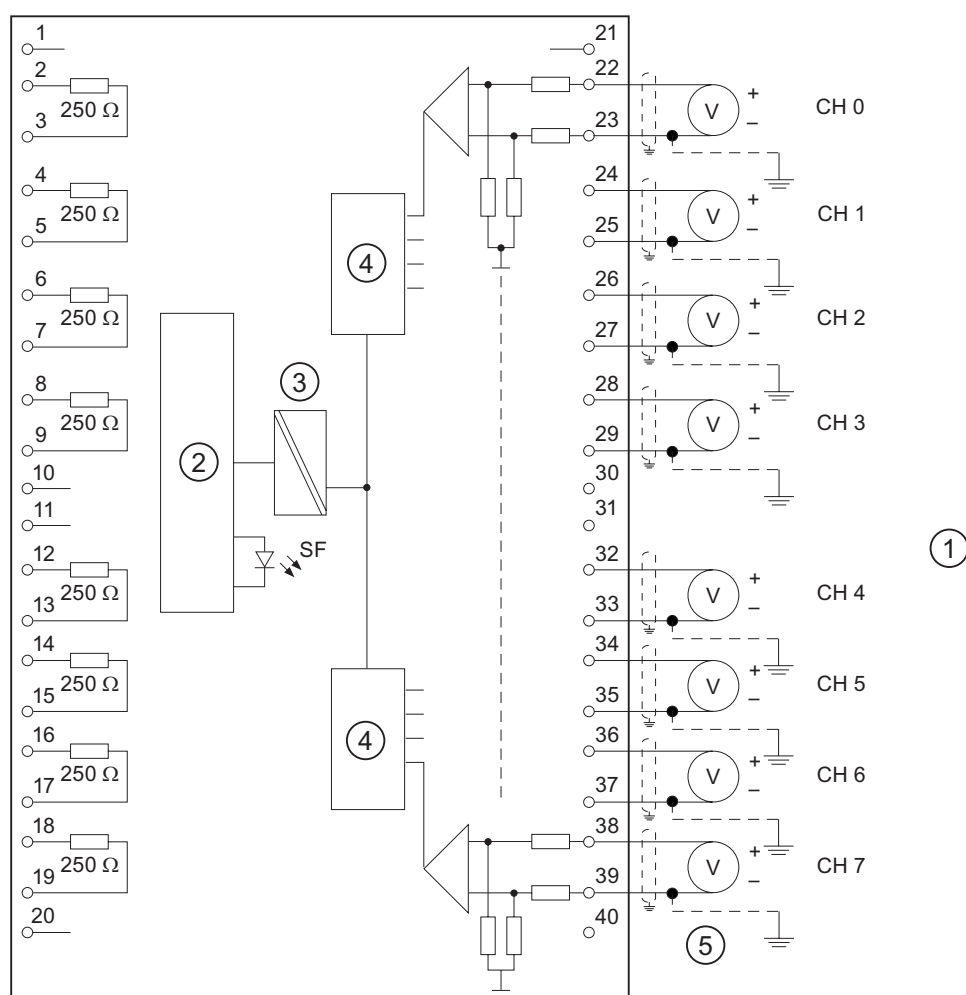


Figure 6-1 Wiring and block diagrams

- ① Voltage measurement
- ② Backplane bus interface
- ③ Electrical isolation
- ④ Analog-to-Digital Converter (ADC)
- ⑤ Potential compensation

Wiring: 2 and 4-wire measuring transducer

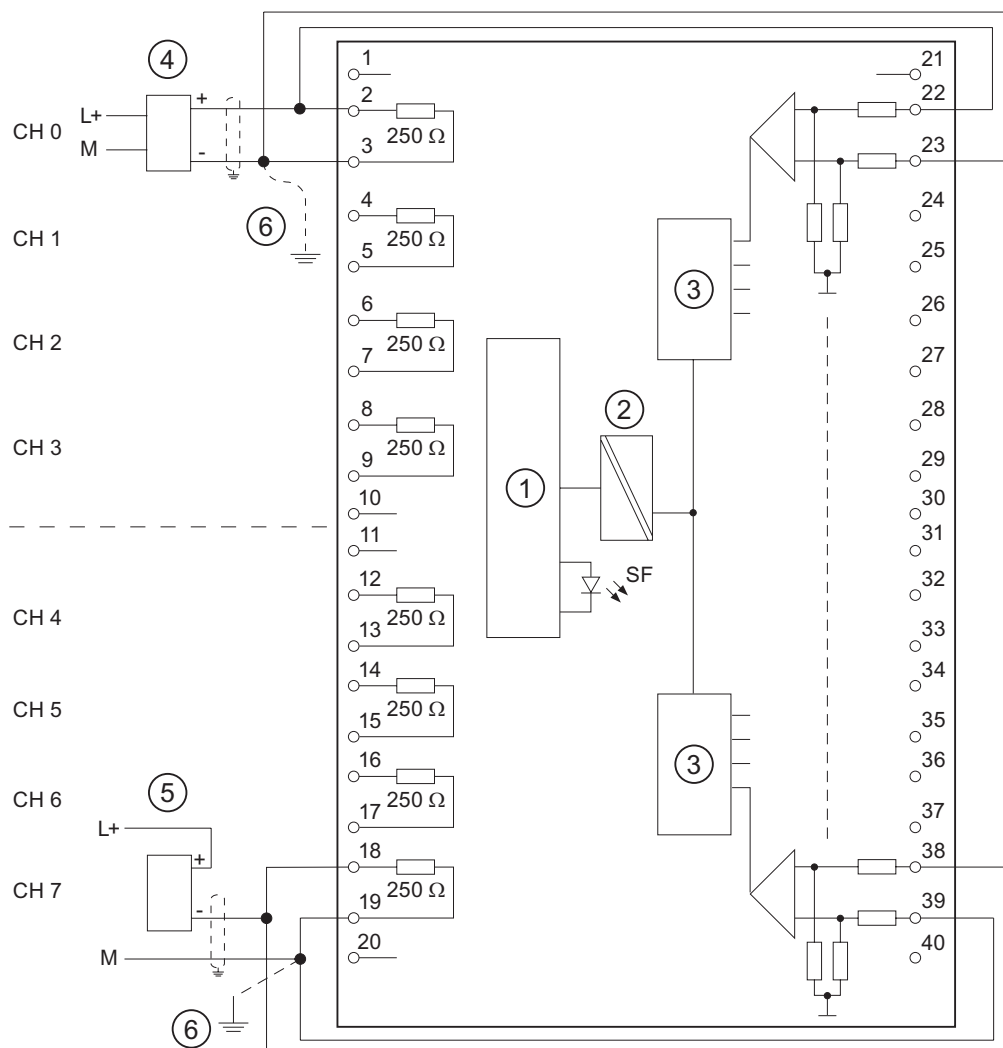


Figure 6-2 Wiring and block diagrams

- ① Backplane bus interface
- ② Electrical isolation
- ③ Analog-to-Digital Converter (ADC)
- ④ Channel 0 for 4-wire transducer
- ⑤ Channel 7 for 2-wire transducer (with external supply)
- ⑥ Potential compensation

Technical data

Technical data					
Dimensions and weight					
Dimensions W x H x D (mm)		40 x 125 x 117			
Weight		approx. 272 g			
Module-specific data					
Isochronous mode supported		No			
Number of inputs		8			
Cable length shielded		max. 200 m			
Voltages, currents, electrical potentials					
Electrical isolation between channels and the backplane bus		Yes			
Permissible potential difference - between inputs (CMV) - Between the inputs and M_{internal} (V_{iso})		AC 35 V / DC 50 V, 60 VAC / 75 VDC			
Isolation test voltage		500 VDC			
Current consumption from the backplane bus		max. 130 mA			
Power loss of the module		typ. 0.6 W			
Formation of analog values					
Measuring principle		Integrating			
Integration/conversion time/resolution (per channel)					
programmable		Yes			
Integration time in ms		10	16,7	20	100
Basic conversion time per channel group with more than one active channel		35	55	65	305
Channel conversion time per channel group, only with active channel group 0 or 1		10	16,7	20	100
Channel integration time (1/f1) in ms		10	16,7	20	100
Resolution (including overshoot range)		15 bits + sign			
Noise suppression at interference frequency f1 in Hz		100	60	50	10
Basic execution time of the module, in ms (all channels enabled)		140	220	260	1220
Noise suppression, error limits					
Noise suppression at $f = n$ (f_1 1%), (f_1 = interference frequency); $n = 1, 2, \dots$					
- Common-mode noise ($V_{\text{cm}} < 50$ V) - Series mode interference (peak value of disturbance < rated input range)		> 100 dB > 90 dB			
Crosstalk between inputs		> 100 dB			
Operational limit (across temperature range, relative to input range)		$C_{MV} = 0$ / $C_{MV} = \pm 50$ V			
- Voltage input - Current input		$\pm 0,1\%$ / $\pm 0,7\%$ $\pm 0,3\%$ / $\pm 0,9\%$			

Technical data		
Basic error limit (operational error limit at 25 °C relative to input range)		
- Voltage input - Current input	±0,05%	
Temperature error (relative to input range)	±0.005%/K	
Linearity error (relative to input range)	±0,03%	
Repetition accuracy (in transient state at 25 °C, relative to input range)	±0,025%	
Status, interrupts, diagnostics		
Interrupts - Hardware interrupt when limit has been exceeded - Diagnostic interrupt	programmable Channels 0 and 2 programmable	
Diagnostics functions - Group error display - Reading diagnostics information	programmable red LED (SF) supported	
Transducer selection data		
Input ranges (rated values) / input impedance		
Voltage	± 5 V 1 to 5 V ± 10 V	/ 2 MΩ / 2 MΩ / 2 MΩ
Current	0 mA to 20 mA ± 20 mA 4 mA to 20 mA	/ 250 Ω / 250 Ω / 250 Ω
Permissible voltage at voltage input (destruction limit)	max. 50 V, continuous	
Permissible current at current input (destruction limit)	max. 32 mA	
Wiring signal transducers	with 40-pin front connector	
- for voltage measurement - for current measurement as 2-wire transducer as 4-wire transducer - Load of the 2-wire transducer	supported possible, with separate transducer supply supported max. 820 Ω	

6.3.1 Measuring methods and ranges

Introduction

Use the "measuring range" parameter in *STEP 7* to set the measuring method and measuring ranges.

The "voltage" measuring method and "± 10V" measuring range are set by default at the module. You can use those default settings without having to program the SM 331; AI 8 x 16 Bit in *STEP 7*.

Measuring methods and ranges

Table 6-5 Measuring methods and ranges

Selected measuring method	Measuring range
V voltage:	±5 V 1 V to 5 V ±10 V
Current	0 mA to 20 mA ±20 mA 4 mA to 20 mA

6.3.2 Adjustable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-6 Overview of parameters of SM 331; AI 8 x 16 Bit

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt when limit exceeded	Yes/no Yes/no	No No	Dynamic	Module
Hardware interrupt trigger - High limit - Low limit	May be restricted by the measuring range. from 32511 to - 32512 from - 32512 to 32511	-	Dynamic	Channel
Diagnostics - Group diagnostics - with wirebreak monitoring	Yes/no Yes/no	No No	static	Channel group

Parameters	Range of values	Default	Parameter type	Scope
Measurement				
• Measuring method	disabled V voltage 4DMU current (4-wire transducer)	V	Dynamic	Channel group
• Measuring range	See table <i>Measuring methods and ranges</i>	± 10 V		
• Noise suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

Channel groups

The channels of SM 331; AI 8 x 16 Bit are arranged in four groups of two channels. You always assign parameters to a channel group.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-7 Assignment of SM 331; AI 8 x 16 Bit channels to channel groups

Channels ...	... form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.3.3 Additional information on SM 331; AI 8 x 16 bit

Unused channels

For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

Certain inputs of the channel group configuration may remain unused. To be able to use diagnostic functions at the used channels, note the special features of those inputs outlined below:

- **Measuring range 1 V to 5 V:** wire the used and unused inputs of the same channel group in parallel.
- **Current measurement, 4 to 20 mA:** wire the unused inputs of the same channel group in series. Connect a shunt resistor to each programmed and unused channel.
- **Other measuring ranges:** Short-circuit the plus and minus inputs of the channel.

Wirebreak monitoring

The wire-break check is available for the 1 V to 5 V range, and for the 4 mA to 20 mA range.

Applicable to both measuring ranges:

When the wire-break check is **enabled**, the module logs the wire-break in its diagnostics buffer when the current drops below 3.6 mA (0.9 V.)

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

When wire-break check is **disabled**, and diagnostic interrupts are enabled, the module triggers a diagnostic interrupt when the underflow value is reached.

Special features in programming high and low limits

The programmable limits (hardware interrupt triggers) of SM 331; AI 8 x 16 Bit differ from the range of value shown in the *Overview of parameters of SM 331; AI 8 x 16 Bit* table.

Reason: in certain situations, the calculation methods of the module software used to evaluate the process tags do not return values up to 32511. The process value triggering a hardware interrupt at underflow or overflow limits is based on the calibration factors of the relevant channel, and may vary between the low limits shown in the Table below and 32511 (7EFF_H).

Limits may not be set higher than the minimum limits to be expected as shown in the table below.

Table 6-8 Minimum high and low limits of SM 331; AI 8 x 16 Bit

Measuring range	Minimum high limit	Minimum low limit
$\pm 10 \text{ V}$	11.368 V 31430 7AC6 _H	-11.369 V -31433 8537 _H
$\pm 5 \text{ V}$	5.684 V 31430 7AC6 _H	-5.684 V -31430 853A _H
1 to 5 V	5.684 V 32376 7E78 _H	0.296 V -4864 ED00 _H
0 mA to 20 mA	22.737 mA 31432 7AC8 _H	-3.519 mA -4864 ED00 _H
4 mA to 20 mA	22.737 mA 32378 7E7A _H	1.185 mA -4864 ED00 _H
$\pm 20 \text{ mA}$	22.737 mA 31432 7AC8 _H	-22.737 mA -31432 8538 _H

Measuring errors as a result of CMV

SM 331; AI 8 x 16 Bit is capable of taking measurements, irrespective of the presence of AC or DC CMV.

With **AC CMV** values of a multiple of filter frequency settings, noise is suppressed as a result of ADC integration time and common mode suppression at the input amplifiers. With AC CMV < 35 V_{rms}, the noise suppression of > 100 dB results in negligible measurement errors.

The influence of **DC CMV** can only be reduced to minimum using the noise suppression function of the input amplifier unit. A certain degradation of measuring accuracy in proportion to CMV must be expected. The worst case error is generated at 50 VDC between one channel and the remaining seven channels. The calculated worst case error is 0.7% at 0 °C to 60 °C, while the measured error usually lies at ≤ 0.1% at 25 °C.

6.4 Analog input module SM 331; AI 8 x 16 Bit; (6ES7331-7NF10-0AB0)

Order number

6ES7331-7NF10-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group
 - Voltage
 - Current
- Resolution adjustable per channel group (15 bits + sign)
- Any measuring range selection per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 8 channels
- Hardware interrupt can be set for limit monitoring
- Hardware interrupt parameters can be set at the end of cycle interrupt
- High-speed refresh of measured values at up to 4 channels
- Electrically isolated to the CPU

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Terminal assignment

The following diagrams show different possible forms of wiring

Wiring: Voltage and current measurement

Connection possible at both ends at channels 0 to channel 7

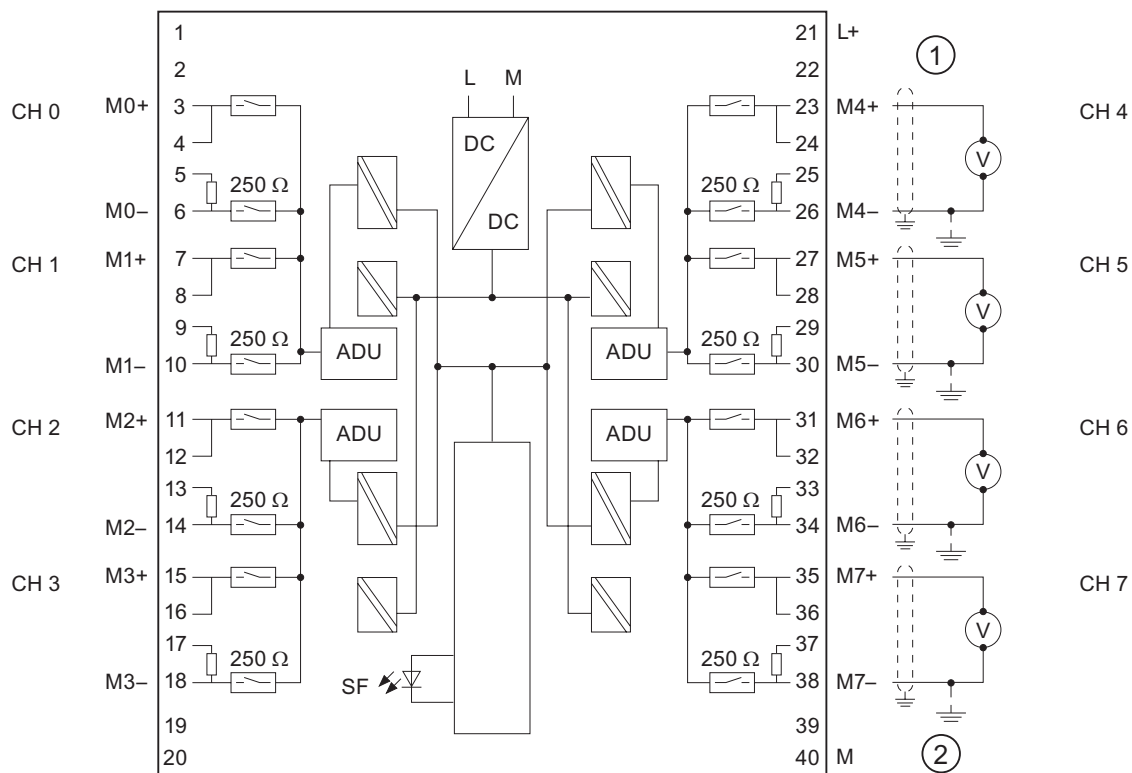


Figure 6-3 Wiring and block diagrams

- ① Connection for voltage measurement
- ② Potential compensation

Wiring: 2 and 4-wire measuring transducer

Wiring possible at both ends at channel 0 to channel 7

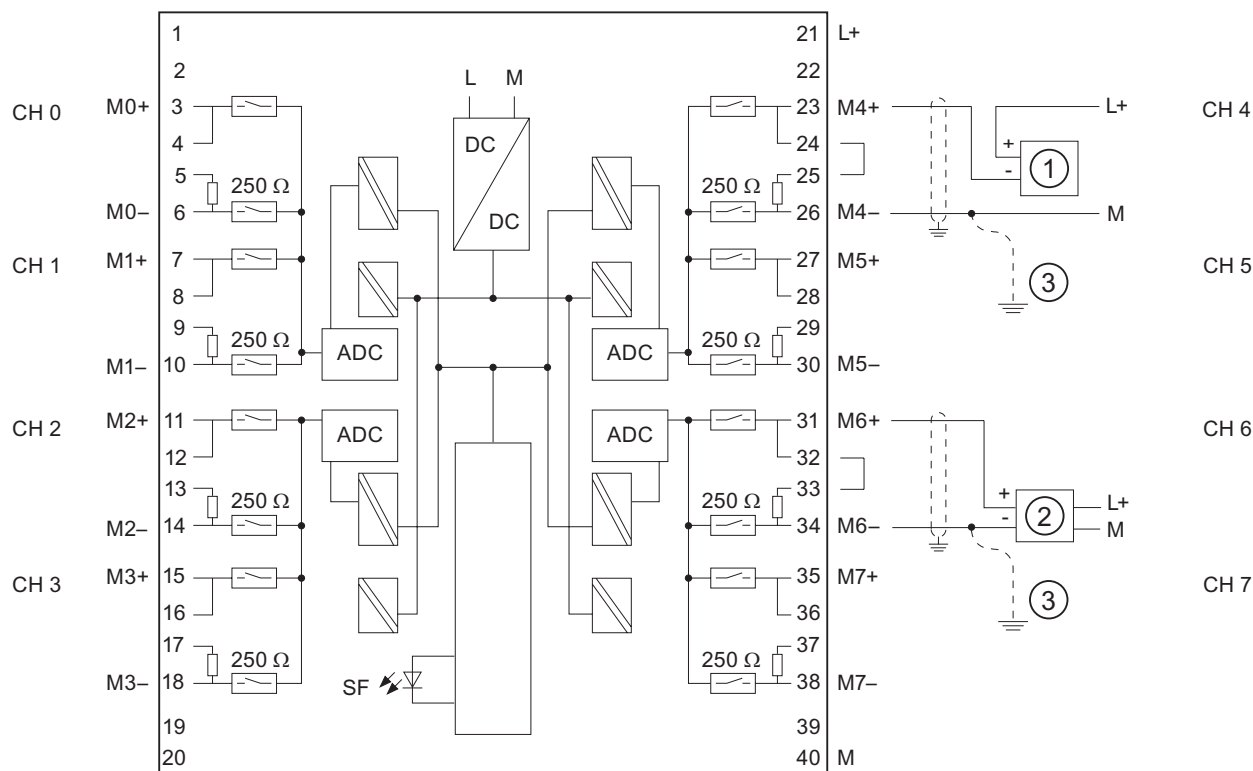


Figure 6-4 Wiring and block diagrams

- ① 2-wire transducer
- ② 4-wire transducer
- ③ Potential compensation

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 272 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Cable length	
• shielded	max. 200 m
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
• Reverse polarity protection	Yes

Technical data	
Electrical isolation	
- between channels and the backplane bus - between channels and electronics power supply - between channels in groups of	Yes Yes Yes 2
Permissible potential difference	
between inputs (CMV)	60 VAC / 75 VDC
Between the inputs and M_{internal} (V_{iso})	60 VAC / 75 VDC
Isolation test voltage	500 VAC
Current consumption	
- from the backplane bus - from power supply L+	max. 100 mA max. 200 mA
Power loss of the module	typ. 3.0 W
Formation of analog values	
Measuring principle	Integrating
Integration/conversion time/resolution (per channel)	
- programmable - Basic conversion time in ms (8-channel mode) - Basic conversion time in ms (4-channel mode) - Resolution, including sign - Noise suppression at frequency f_1 in Hz	Yes 95/83/72/23 10 ¹⁾ 4) 16 bits All ²⁾ /50/60/400
Measured value smoothing	None / low/ average/ high
Basic execution time of the module, in ms (8-channel-mode)	190/166/144//46
Basic execution time of the module, in ms (4-channel-mode)	10 ¹⁾
Noise suppression, error limits	
Noise suppression at $F = n \times (f_1 \pm 1\%)$ (f_1 = interference frequency, $n = 1, 2, \dots$)	
- Common-mode interference ($V_{\text{CM}} < \text{AC } 60 \text{ V}$) - Series mode interference (peak value of disturbance $<$ rated input range)	> 100 dB > 90 dB ³⁾
Crosstalk between inputs	> 100 dB
Operational limit (across temperature range, relative to input range)	
- Input voltage - Input current	$\pm 0,1\%$ $\pm 0,1\%$
Basic error limit (operational error limit at 25 °C, relative to input range)	
- Voltage input - Current input	$\pm 0,05\%$ $\pm 0,05\%$
Temperature error (relative to input range)	$\pm 0.005\%/K$
Linearity error (relative to input range)	$\pm 0,01\%$
Repetition accuracy (in transient state at 25 °C, relative to input range)	$\pm 0,01\%$

Technical data	
Status, interrupts, diagnostics	
Interrupts	
- Hardware interrupt when limit value is exceeded - Hardware interrupt at end of cycle - Diagnostic interrupt	Programmable channels 0 - 7 programmable programmable
Diagnostics functions	programmable
- Group error display - Reading diagnostics information	red LED (SF) supported
Transducer selection data	
Input range (rated values) / input impedance	
Voltage	$\pm 5 \text{ V} / 2 \text{ M}\Omega$ $1 \text{ V to } 5 \text{ V} / 2 \text{ M}\Omega$ $\pm 10 \text{ V} / 2 \text{ M}\Omega$
Current	$0 \text{ mA to } 20 \text{ mA} / 250 \Omega$ $4 \text{ mA to } 20 \text{ mA} / 250 \Omega$ $\pm 20 \text{ mA} / 250 \Omega$
Permissible voltage at voltage input (destruction limit)	35 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)
Permissible current at current input (destruction limit)	40 mA
Wiring signal transducers	with 40-pin front connector
- for voltage measurement - for current measurement as 2-wire transducer as 4-wire transducer	supported possible, with separate transducer supply supported

1) Interference frequency for 4-channel mode is "All"

2) Interference frequencies 50/60/400 Hz are designated as "All"

3) Series-mode rejection for 8-channel mode is reduced as follows:

50 Hz > 70 dB

60 Hz > 70 dB

400 Hz > 80 dB

50/60/400 Hz > 90 dB

4) In 4-channel mode, the converted value tunes to 100% within 80 ms. The value established in this process is set every max. 10 ms.

6.4.1 Measuring methods and ranges

Introduction

Use the "measuring method" parameter in *STEP 7* to set the measuring method and measuring range.

Table 6-9 Measuring methods and ranges

Selected measuring method	Output range
V voltage:	$\pm 5\text{ V}$, from 1 V to 5 V, $\pm 10\text{ V}$
Current (4-wire transducer) 4DMU	0 mA bis 20 mA 4 mA bis 20 mA $\pm 20\text{ mA}$

Channel groups

The channels of SM 331; AI 8 x 16 bits are arranged in four groups of two channels. You always assign parameters to a group. The interrupt limits form the exception.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-10 Assignment of SM 331; AI 8 x 16 Bit channels to channel groups

Channels ...	...form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

6.4.2 Adjustable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-11 Overview of parameters of SM 331; AI 8 x 16 Bit

Parameters	Range of values	Defaults	Parameter type	Scope
Enable				
• Hardware interrupt when limit value is exceeded	yes/no	no	dynamic	Module
• Hardware interrupt at end of cycle	yes/no	no	dynamic	
• Diagnostic interrupt	Yes/no	no	dynamic	
Hardware interrupt trigger				
• High limit	32511 to -32512	-	Dynamic	Channel
• Low limit	-32512 to 32511	-	Dynamic	Channel
Diagnostics				
• Group diagnostics	Yes/no	No	static	Channel
• Wirebreak monitoring	Yes/no	No		Channel
Measurement				
• Module operating mode	8 channels 4 channels	Yes No	Dynamic	Module Channel group
• Noise suppression	50 Hz 60 Hz 400 Hz 50/60/400 Hz	50/60/400 Hz		
• Smoothing	- None - Low - Average - High	None	Dynamic	Channel group
• Measuring method	• Measuring range		Dynamic	Channel group
Disabled				
Voltage	± 5 V 1 to 5 V ± 10 V	± 10 V		
Current (4-wire transducer)	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	4 mA to 20 mA		

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.4.3 Additional information to SM 331; AI 8 x 16 Bit

Modes of operation

Operating modes of the SM 331; AI 8 x 16 Bit:

- 8-channel mode
- 4-channel mode

8-channel operating mode

In this mode, the module does not toggle between the two channels of each group. The four analog-to-digital converters (ADC) of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, then those with the odd numbers 1, 3, 5 and 7 (see the figure below.)

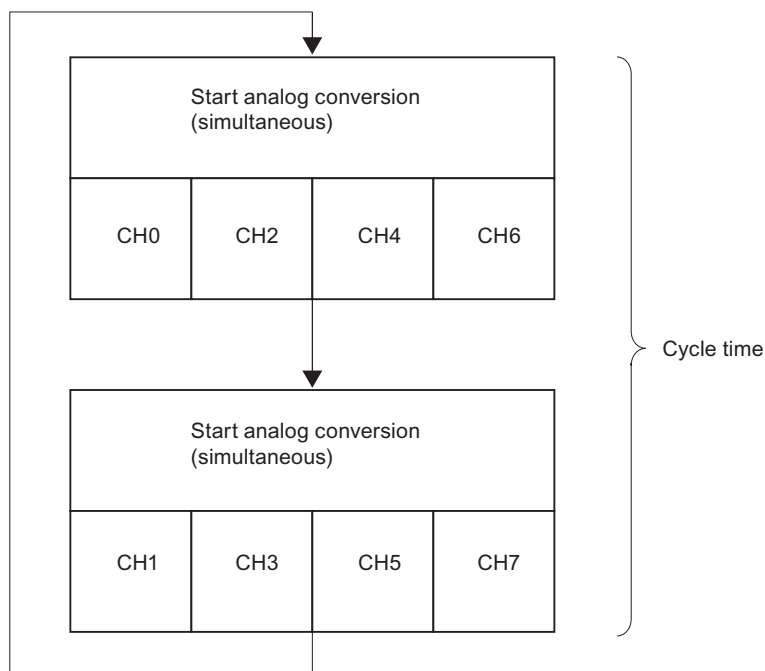


Figure 6-5 8-channel mode cycle time

Cycle time of module in 8-channel mode

However, the channel conversion time is oriented on the programmed noise suppression. At a set interference frequency of 50 Hz, the channel conversion time is 76 ms, including communication time. At a set an interference frequency of 60 Hz, the channel conversion time is 65 ms. You can reduce channel conversion times to 16 ms by setting an interference frequency of 400 Hz. When you set an interference frequency "All", the channel conversion time amounts to 88 ms. The module then has to toggle to the channel of the group via Opto-MOS relay. Opto-MOS relays require switching and settling times of 7 ms. The table below shows this relationship.

Table 6-12 Cycle times in 8-channel mode

Interference frequency (Hz)	Channel cycle time (ms)	Module cycle time (all channels)
50	83	166
60	72	144
400	23	46
50/60/400	95	190

4-channel mode operating mode

In this mode, the module does not toggle between the channels of the various groups. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6.

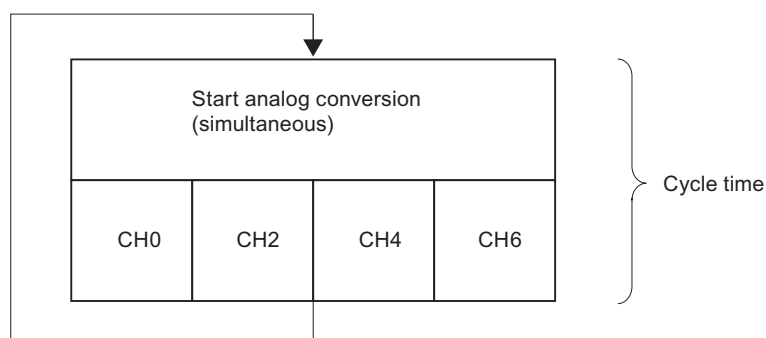


Figure 6-6 4-channel mode cycle time

Module cycle time

In 4-channel mode, the converted value tunes to 100% within 80 ms and is updated every 10 ms. The channel and module cycle time are always identical, because the module does toggle between the channels of a group: 10 ms.

Channel conversion time = channel cycle time = module cycle time = 10 ms

Unused channels

For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

Certain inputs of the channel group configuration may remain unused. To enable diagnostic functions at the used channels, note the special features of those inputs outlined below:

- **Measuring range 1 V to 5 V:** wire the used and unused inputs of the same channel group in parallel.
- **Current measurement, 4 mA to 20 mA:** wire the unused inputs of the same channel group in series. Connect a shunt resistor to each programmed and unused channel.
- **Other measuring ranges:** Short-circuit the plus and minus inputs of the channel.

Wirebreak monitoring

The wire-break check is available for the voltage measuring ranges, and for the 4 mA to 20 mA current measuring range.

If you configured a measuring range of $\pm 5V$, 1 to 5 V, $\pm 10 V$, 4 to 20 mA, and **enabled** wire-break check, the analog input module logs a wire-break event in diagnostics data when the underflow (32768) is reached.

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

If you configured a measuring range of 4 mA to 20 mA, **disabled** wire-break check, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

Short-circuit to M or L

If you short-circuit an input channel to M or L, the module does not suffer any damage. The channel continues to output valid data and does not report a diagnostics event.

Overflow, underflow and hardware interrupt limits

The limits in diagnostics reaction to overflow and underflow in certain measuring ranges differ compared to the listed ranges starting at the chapter *Analog value representation for analog input channels* of the manual. In certain situations the numerical methods of the module software used to evaluate the process tags do not return values up to 32511.

Do not set any hardware interrupt limits higher than the lowest possible overflow or underflow response limits. End of cycle interrupt starting at the chapter *Analog value representation for analog input channels*.

End of cycle interrupt

You can synchronize a process with the conversion cycle of the module by enabling the end of cycle interrupt. The interrupt is set when enabled channels have been converted.

The following table shows the content of the 4 bytes of additional OB40 information during hardware or end of cycle interrupts.

Content of the 4 bytes of additional information		27	26	25	24	23	2 ²	2 ¹	2 ⁰	Byte
Special analog flags	2 bits per channel to identify the range									
	High limit exceeded at channel	7	6	5	4	3	2	1	0	0
	Low limit exceeded at channel	7	6	5	4	3	2	1	0	1
	End of cycle event						X			2
	Free bit									3

Operation of the module on the ET 200M Distributed IO devices

Operation of SM 331; AI 8 x 16 bits on ET 200M requires one of the following IM 153 x:

- IM 153-1; as of 6ES7153-1AA03-0XB0; E 01
- IM 153-2; as of 6ES7153-2AA02-0XB0; E 05
- IM 153-2; as of 6ES7153-2AB01-0XB0; E 04

Programming restrictions when operating SM 331; AI 8 x 16 Bit on PROFIBUS masters which only support DPV0

Certain parameters are not supported when operating an electrically isolated SM 331; AI 8 16 bits analog input module on an ET200M PROFIBUS slave system in combination with a PROFIBUS master which is not an S7 master. Non-S7 masters do not support hardware interrupts. All parameters associated with those functions are thus disabled. This includes hardware interrupt enable, hardware restrictions and end of cycle interrupt enable. All other parameters are permitted.

6.5 Analog input module SM 331; AI 8 x 14 Bit High Speed; synchronous; (6ES7331-7HF0x-0AB0)

Order number

6ES7331-7HF00-0AB0 or 6ES7331-7HF01-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group:
 - Voltage
 - Current
- Resolution adjustable per channel group (13 bits + sign)
- Measuring range selection any, per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 2 channels
- Hardware interrupt can be set when limit exceeded
- High-speed refreshing of measured values
- Isochronous mode supported
- Electrically isolated to the CPU
- Electrically isolated to load voltage (not for 2-wire transducers)

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set the hardware interrupts of channel groups 0 and 1 in STEP 7. However, always set a hardware interrupt only for the first channel of a channel group, i.e. either at channel 0, or at channel 2

Terminal assignment

The following diagrams show different possible forms of wiring.

Wiring: Voltage measurement

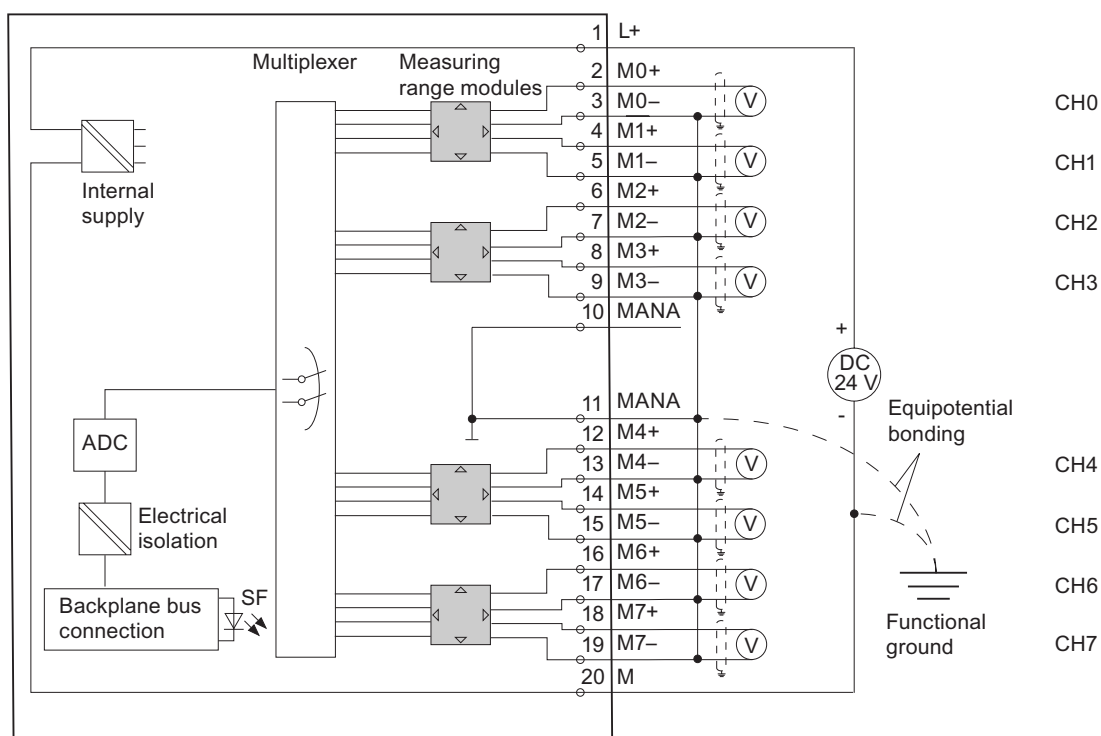


Figure 6-7 Block diagram and wiring diagram

Measuring range module settings

Measuring range	Measuring range module setting
$\pm 1V$	A
$\pm 5V$	B
$\pm 10V$	B (Default)
1...5V	B

Wiring: 2 and 4-wire measuring transducer for current measurement

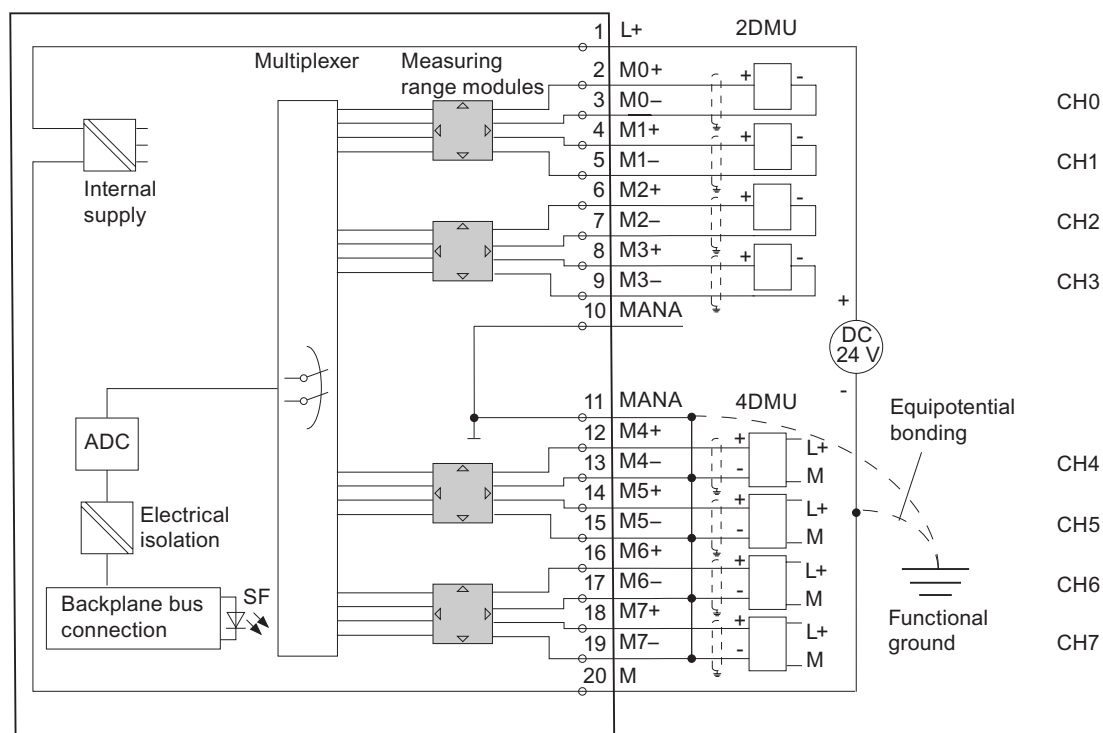


Figure 6-8 Block diagram and wiring diagram

Measuring range module settings

Measuring range		Measuring range module setting
2-wire transducer	4...20mA	D
4-wire transducer	± 20mA 0...20mA 4...20mA	C

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 230 g
Module-specific data	
Isochronous mode supported	Yes
Number of inputs	8
Cable length	
• shielded	max. 200 m

6.5 Analog input module SM 331; AI 8 x 14 Bit High Speed; synchronous; (6ES7331-7HF0x-0AB0)

Technical data				
Voltages, currents, electrical potentials				
Rated electronics supply voltage L + Reverse polarity protection	24 VDC Yes			
Transducer power supply				
- Supply current - short circuit-proof	max. 30 mA (per channel) Yes			
Electrical isolation				
- between channels and the backplane bus - between channels - between channels and electronics power supply	Yes No Yes			
Permissible potential difference - between inputs and M_{ANA} (CMV) - at signal = 0 V - not for 2-wire transducers - between inputs (CMV) - between M_{ANA} and M_{internal} (V_{iso})	11 VDC / 8 VAC 11 VDC / 8 VAC 75 VDC / 60 VAC			
Isolation test voltage Channels to backplane bus and load voltage L +	500 VDC			
Current consumption - from the backplane bus - from load voltage L + (without 2-wire transducer)	max. 100 mA max. 50 mA			
Power loss of the module	typ. 1.5 W			
Formation of analog values				
Measuring principle	Actual value conversion			
Integration/conversion time/resolution (per channel)				
programmable	Yes			
Basic conversion time per channel	52 µs			
Resolution (including overshoot range)	14 bits			
Noise suppression at interference frequency f1 in Hz	None	400	60	50
Basic execution time of the module (independent of the number of enabled channels)	0.42 ms	2.5 ms	16.7 ms	20 ms
Noise suppression, error limits				
Noise suppression at f = n (f1 ± 1 %), (f1 = interference frequency) n=1.2...				
- Common-mode interference (CMV < 11 Vpp) - Seriesmode interference (peak value of disturbance < rated input range)	> 80 dB > 40 dB			
Crosstalk between inputs	> 65 dB			

Technical data		
Operational limit (across temperature range, relative to input range)		
• Voltage input	± 1 V ± 5 V ± 10 V 1 to 5 V	± 0,3 % ± 0,4 % ± 0,3 % ± 0,4 %
• Current input	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	± 0,3 % ± 0,3 % ± 0,3 %
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	± 1 V ± 5 V ± 10 V 1 to 5 V	± 0,2 % ± 0,25 % ± 0,2 % ± 0,25 %
• Current input	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	± 0,2 % ± 0,2 % ± 0,2 %
Temperature error (relative to input range)	± 0.004 %/K	
Linearity error (relative to input range)	± 0,03 %	
Repetition accuracy (in transient state at 25 °C, relative to input range)	± 0,1 %	
Status, interrupts, diagnostics		
Interrupts		
• Hardware interrupt	programmable	
• Diagnostic interrupt	programmable	
Diagnostics functions		
• Group error display	red LED (SF)	
• Reading diagnostics information	supported	
Transducer selection data		
Input ranges (rated values) / input impedance		
• Voltage	± 1 V ± 5 V ± 10 V 1 to 5 V	10 MΩ 100 kΩ 100 kΩ 100 kΩ
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	50 Ω 50 Ω 50 Ω
Permissible voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20)	
Permissible current at current input (destruction limit)	40 mA	
Wiring signal transducers	with 20-pin front connector	
• for voltage measurement	supported	
• for current measurement		
as 2-wire transducer	supported	
as 4-wire transducer	supported	
• Load of the 2-wire transducer at L+ = DC 24 V	max. 820 Ω	
Characteristic linearization	None	

6.5.1 Measuring methods and ranges

Introduction

The analog input module has measuring range modules. Use the measuring range module and the "measuring range" parameter in *STEP 7* to set the measuring method and measuring ranges.

The "voltage" measuring method and the "" 10 V" measuring range of the module are set by default in *STEP 7*. You can use those default settings without having to program the SM 331; AI 8 x 14 Bit High Speed in *STEP 7*.

Measuring range modules

Reposition the measuring range modules to suit the measuring method and range. See table *Setting measuring methods and ranges of analog input channels*.

Measuring methods and ranges

Table 6-13 Measuring methods and ranges

Selected measuring method	Measuring range (type of sensor)	Measuring range module settings
V: Voltage	$\pm 1\text{ V}$	A
	$\pm 5\text{ V}$	B
	1 V to 5 V	
	$\pm 10\text{ V}$	
4DMU: Current (4-wire transducer)	0 mA to 20 mA	C
	4 mA to 20 mA	
	$\pm 20\text{ mA}$	
2DMU: Current (2-wire transducer)	4 mA to 20 mA	D

Channel groups

The channels of SM 331; AI 8 x 14 Bit High Speed are arranged in four groups of two channels. You always assign parameters to a channel group.

SM 331; AI 8 x 14 bits High Speed is equipped with one measuring range module per channel group.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-14 Assignment of SM 331; AI 8 x 14 bits High Speed channels to channel groups

Channels ...	... form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

6.5.2 Adjustable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-15 Overview of parameters for SM 331; AI 8 x 14 Bit High Speed

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt when limit exceeded	Yes/no Yes/no	No No	Dynamic	Module
Fast Mode (can only be set if the 331-7HF01 was registered for synchronous operation in the DP slave properties)	Yes/no	No	static	Module
Hardware interrupt trigger - High limit - Low limit	May be restricted by the measuring range. from 32511 to - 32512 from - 32512 to 32511	-	Dynamic	Channel
Diagnostics Group diagnostics	Yes/no	No	static	Channel group
Measurement Measuring method	disabled V voltage 4DMU current (4-wire transducer) 2DMU current (2-wire transducer)	V	Dynamic	Channel or channel group
• Measuring range	See table <i>Measuring methods and ranges</i>	± 10 V		
• Noise suppression	none; 400 Hz; 60 Hz; 50 Hz	50 Hz		

See also

Programming analog modules (Page 5-31)

6.5.3 Isochronous mode

Properties

Reproducible reaction times (i.e. of the same length) are achieved in a SIMATIC system by means of a constant DP bus cycle, and synchronization of the single cyclic processes outlined below:

- Cyclic user program execution. The length of the cycle time may vary due to acyclic program branching.
- Independent and variable DP cycle on the PROFIBUS subnet
- Cyclic operation of the backplane bus of the DP slave.
- Cyclic signal conditioning and conversion at the electronic modules of the DP slave.

The constant DP cycle runs in synchronism and at the same length. The CPU run levels (OB61 to OB64) and isochronous IO are synchronized with this cycle. I/O data are therefore transferred at defined and constant intervals (isochronous mode.)

Requirements

- The DP master and slave must support isochronous mode. You require *STEP 7* V5.2 or higher.

Mode of operation: Isochronous mode

Table 6-16 Conditions of isochronous mode:

Default mode	
Filtering and processing time T_{WE} between reading actual values and writing these to the transfer buffer (the value defined for T_{WE} applies, irrespective of the enable status of diagnostics)	max. 625 μ s
including an input delay time of	10 μ s
T_{DPmin}	3.5 ms
Diagnostic interrupt	max. 4 x T_{DP}
Fast Mode (only possible with 6ES7331-7HF01-0AB0)	
Filter and processing time T_{WE} between reading actual value and writing the results to the transfer buffer (diagnosis not selectable)	max. 625 μ s
including an input delay time of	10 μ s
T_{DPmin}	1 ms

Note

You can accelerate the cycle of your DP system by setting "Fast Mode." However, this is at the expense of diagnostics: Diagnostics functions will be disabled in this operating mode.

The minimum T_i value you can set in *HW Konfig* is derived from the defined T_{WE} value plus calculation and transfer times required by the IM 153.

The specified T_{DPmin} value is determined by the size of the DP slave/IM 153 configuration: Of the diverse installed modules, the slowest always determines the time T_{DPmin} .

Note

When operated in "synchronous" mode, the modules automatically sets "Integration time: none/interference frequency", irrespective of parameter settings in *STEP 7*. none / interference frequency". "Hardware interrupt" functionality is not available in "synchronous" mode.

Calculation of filter and processing times

The same time conditions always apply, regardless of the number of configured channels. The time relative to the clock signal for reading a specific channel is calculated according to the formula:

$$T_{WE\_CH} = (\text{channel number} + 1) \times 52 \mu\text{s} + t_v; t_v = 119 \text{ to } 209 \mu\text{s}$$

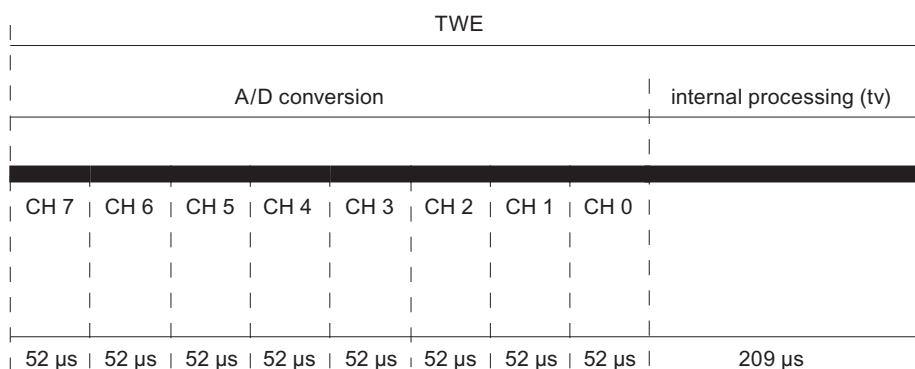


Figure 6-9 Calculation of filter and processing times

Definition of isochronous mode

The module starts with the analog-to-digital conversion of channel 7, and saves the result internally. Next, it converts channels 6...0 sequentially at intervals of 52 ms and in the same way. After an additional internal processing time, it outputs the result of all converted channels to the backplane bus interface where it can be fetched by the CPU.

Further information

For further information on synchronous mode, refer to the *STEP 7*, Online Help, and in the *ET 200M Distributed IO System* and *Synchronicity* manuals.

6.5.4 Additional information on SM 331; AI 8 x 14 Bit High Speed, isochronous

Unused channels

You should wire unused channels as shown in the following table. This optimizes interference immunity of the analog input module.

Measuring range	M+/ M-	M_ana
Voltage	short-circuit	link with M-
Current / 4-wire transducer	leave open	link with M-
Current / 2-wire transducer	leave open	link with M

Certain inputs of the channel group configuration may remain unused. To enable diagnostic functions at the used channels, note the special features of those inputs outlined below:

- **Measuring range 1 V to 5 V:** wire the used and unused inputs of the same channel group in parallel.
- **Current measurement, 2-wire transducer:** There are two options of wiring the channel circuit.
 - a) Open unused input; channel group diagnostics disabled. If you were to enable diagnostics, the analog module would trigger a single diagnostic interrupt, and light up its SF LED.
 - b) Loading the unused input using a 1.5 k Ω to 3.3 k Ω resistor. This allows you to enable diagnostics for this channel group.
- **Current measurement 4 mA to 20 mA, 4-wire transducer:** wire the unused inputs of the same channel group in series.

Wire-break check function in the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and **enabled wire-break check**, the analog input module logs a wire-break event in diagnostics data when the current drops below 1,185 mA.

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

If you configured a measuring range of 4 mA to 20 mA, **disabled wire-break check**, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

6.6 Analog input module SM 331; AI 8 x 13 Bit;(6ES7331-1KF01-0AB0)

Order number

6ES7331-1KF01-0AB0

Properties

- 8 inputs in 8 channel groups
- Resolution adjustable per channel group (12 bits + sign)
- Measuring method adjustable per channel group:
 - Voltage
 - Current
 - Resistance
 - Temperature
- Any measuring range selection per channel

Terminal assignment

The following diagrams show wiring examples. Basically, these connection examples apply to all channels (channel 0 to 7).

Note

When connecting voltage and current transducers, make sure the maximum permitted common-mode voltage C_{MV} of 2 V is not exceeded between the inputs. To prevent measuring errors, interconnect the various M- terminals.

Wiring: Voltage measurement

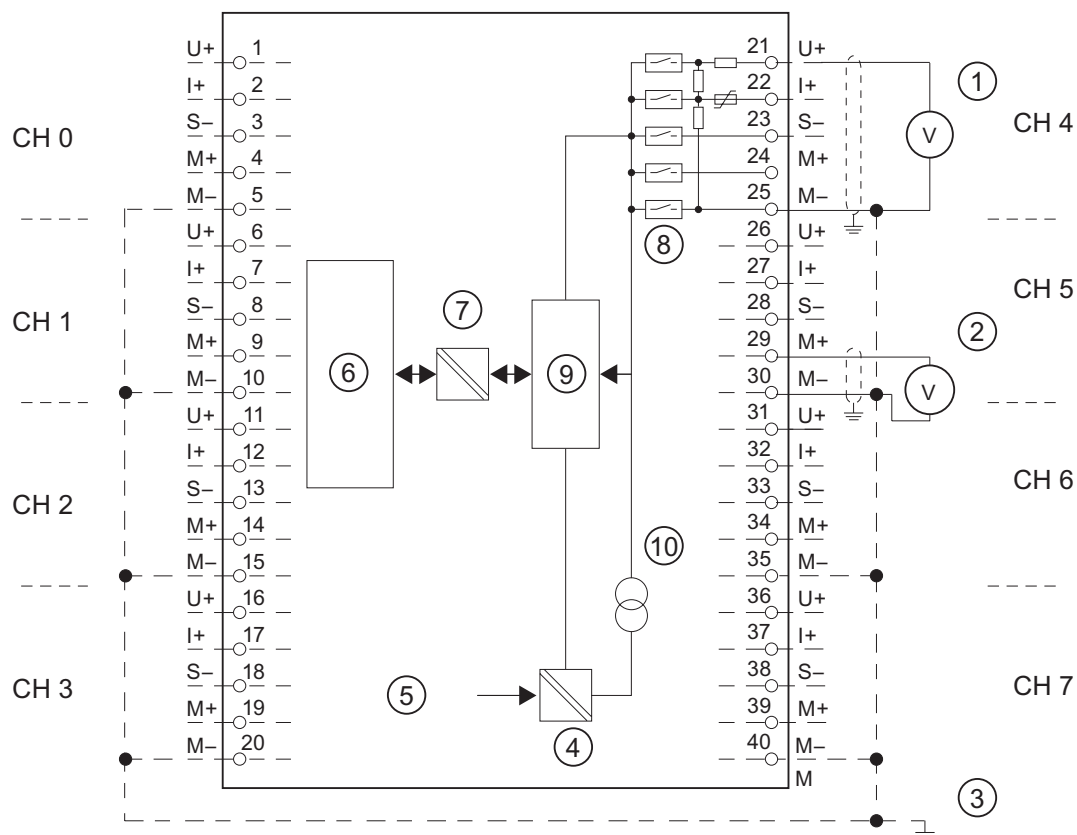


Figure 6-10 Block diagram and wiring diagram

- ① Voltage measurement ($\pm 5V$, $10V$, $1...5V$, $0...10V$)
- ② Voltage measurement ($\pm 50\text{ mV}$, $\pm 500\text{ mV}$, $\pm 1\text{ V}$)
- ③ Potential compensation
- ④ Internal supply
- ⑤ + 5V from backplane bus
- ⑥ Logic and backplane bus interface
- ⑦ Electrical isolation
- ⑧ Multiplexer
- ⑨ Analog to Digital Converter (ADC)
- ⑩ Source of current

Principle

Wiring: Voltage measurement (0...10 V, 1..5 V, ± 5 V, ± 10 V)

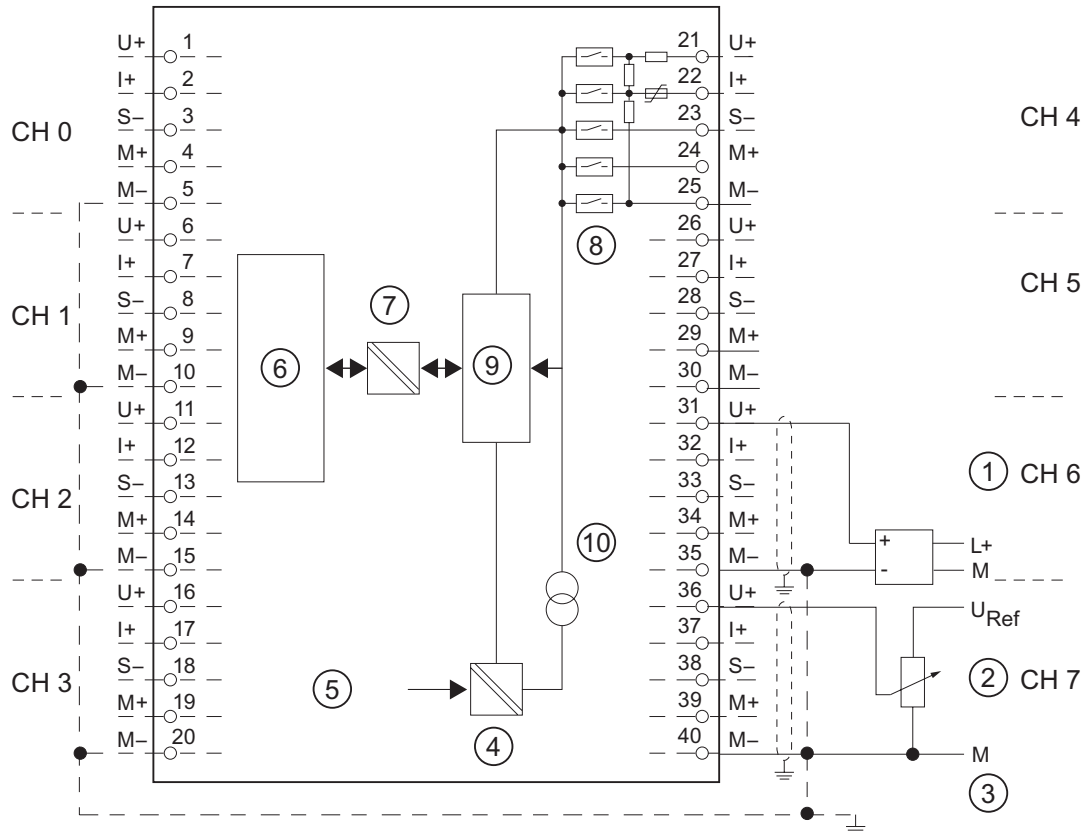


Figure 6-11 Block diagram and wiring diagram

- ① Transducer with voltage output (0...10 V, 1..5 V, ± 5 V, ± 10 V)
- ② Voltage measurement (note input impedance in the Technical data)
- ③ Potential compensation
- ④ Internal supply
- ⑤ + 5V from backplane bus
- ⑥ Logic and backplane bus interface
- ⑦ Electrical isolation
- ⑧ Multiplexer
- ⑨ Analog to Digital Converter (ADC)
- ⑩ Source of current

Wiring: 2 and 4-wire measuring transducer for current measurement

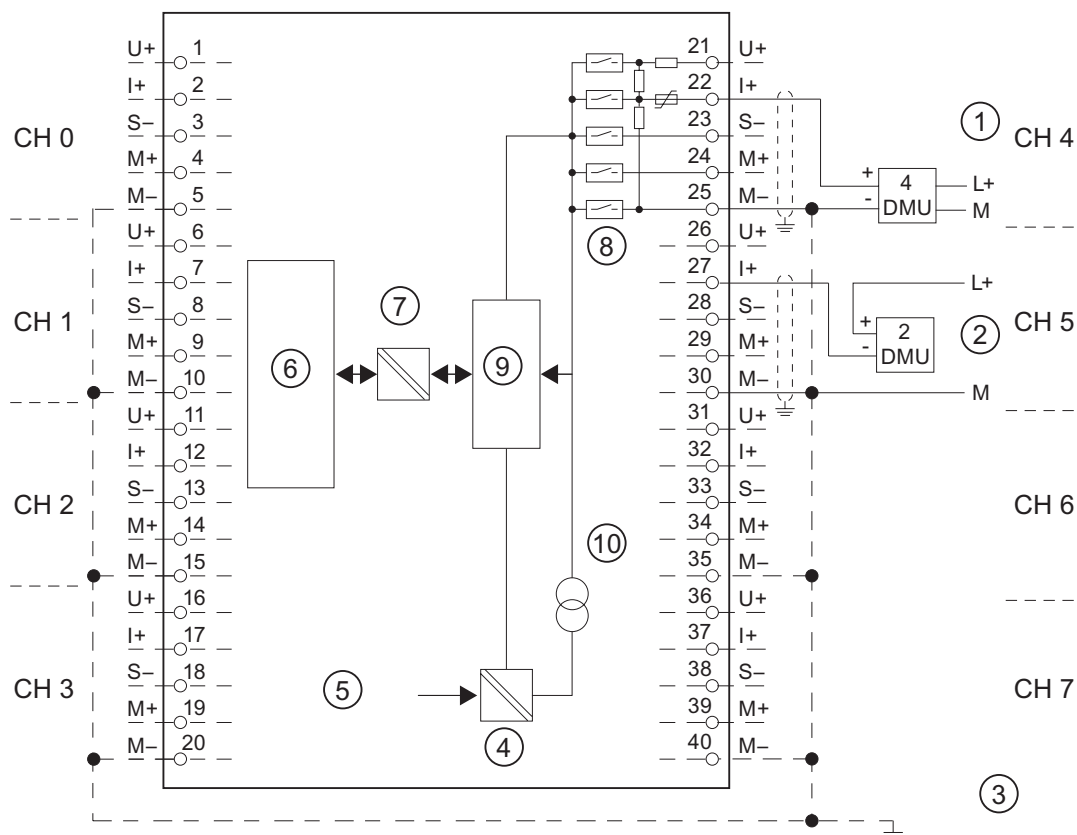


Figure 6-12 Block diagram and wiring diagram

- ① 4-wire transducer (0/4...20 mA or ± 20 mA)
- ② 2-wire transducer (4...20 mA)
- ③ Potential compensation
- ④ Internal supply
- ⑤ + 5V from backplane bus
- ⑥ Logic and backplane bus interface
- ⑦ Electrical isolation
- ⑧ Multiplexer
- ⑨ Analog to Digital Converter (ADC)
- ⑩ Source of current

Resistance measurement with 2, 3 and 4-wire connection

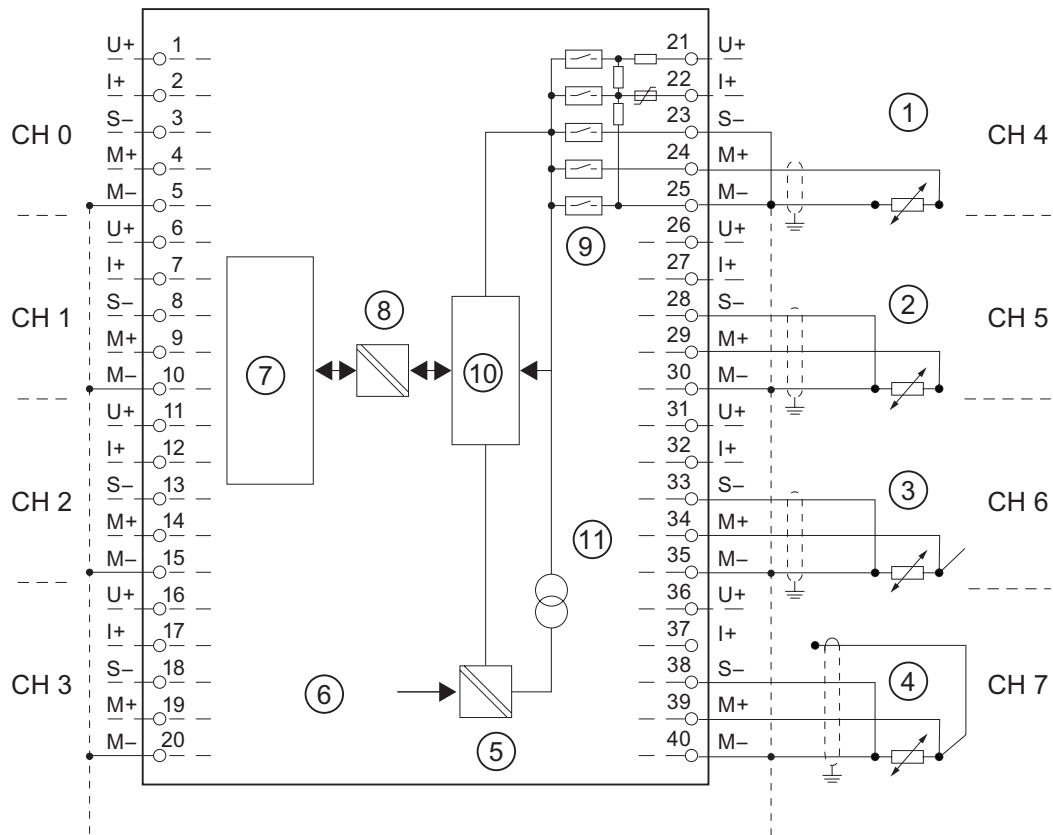


Figure 6-13 Block diagram and wiring diagram

- ① 2-wire connection. A bridge must be produced between M and S (without line resistance compensation).
- ② 3-wire connection
- ③ 4-wire connection. The fourth line must not be wired (line remains unused)
- ④ 4-wire connection. The fourth line is routed to the terminal strip in the cabinet but is not wired.
- ⑤ Internal supply
- ⑥ + 5V from backplane bus
- ⑦ Logic and backplane bus interface
- ⑧ Electrical isolation
- ⑨ Multiplexer
- ⑩ Analog to Digital Converter (ADC)
- ⑪ Source of current

Note

It is not necessary to interconnect the M- terminals when measuring resistances and resistance thermometers. A connection between the M- terminals can however increase the interference resistance.

Technical data

Technical data		
Dimensions and weight		
Dimensions W x H x D (mm)	40 x 125 x 117	
Weight	Approx. 250 g	
Module-specific data		
Isochronous mode supported	No	
Number of inputs	8	
• with resistive transducers	8	
Cable length		
• Shielded	max. 200 m max. 50 m at 50 mV	
Voltages, currents, electrical potentials		
Constant current for resistive transducers		
• Resistance thermometer and resistance measurements 0 ... 600 Ω	max. 0,83 mA	
• Resistance measurement 0 ... 6 kΩ	max. 0,25 mA	
Electrical isolation		
• between channels and the backplane bus	Yes	
• between channels	No	
Permissible potential difference		
• between inputs (C _{MV})	2,0 VDC	
• Between the inputs and M _{internal} (V _{iso})	75 VDC / 60 VAC	
Insulation test voltage	500 VDC	
Current consumption		
• from the backplane bus	max. 90 mA	
Power loss of the module	typ. 0.4 W	
Formation of analog values		
Measuring principle	Integrating	
Integration/conversion time/resolution (per channel)		
• programmable	Yes	
• Noise suppression at interference frequency f1 in Hz	50	60
• Integration time in ms	60	50
• Basic conversion time, including the integration time in ms	66	55
Additional conversion time for resistance measurements in ms	66	55
• Resolution in bits (including overshoot range)	13 bits	13 bits
Noise suppression, error limits		
Noise suppression at f = n (f1 ± 1 %), (f1 = interference frequency) n=1.2...		
• Common-mode noise (CMV < 2 V)	> 86 dB	
• Seriesmode interference (peak value of disturbance < rated input range)	> 40 dB	
Crosstalk between inputs	> 50 dB	

Technical data		
Operational limit (across temperature range, relative to input range)		
• Voltage input	± 5 V	± 0,6 %
	± 10 V	± 0,5 %
	1 V to 5 V	
	0 V to 10 V	
	± 50 mV ± 500 mV ± 1 V	
• Current input	± 20 mA	± 0,5 %
	0 mA to 20 mA	
	4 mA to 20 mA	
• Resistance	0 kΩ to 6 kΩ	± 0,5 %
	0 Ω to 600 Ω	± 0,5 %
• Resistance thermometers	Pt 100 Ni 100 Standard	± 1,2 K
	Pt 100 Ni 100 Klima	± 1 K
	Ni 1000, LG-Ni 1000 Standard	± 1 K
	Ni 1000 LG-Ni 1000 Klima	± 1 K
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	± 5 V	± 0,4 %
	± 10 V	
	1 V to 5 V	
	0 V to 10 V	± 0,3 %
	± 50 mV ± 500 mV ± 1 V	
• Current input	± 20 mA	± 0,3 %
	0 mA to 20 mA	
	4 mA to 20 mA	
• Resistance	0 kΩ to 6 kΩ	± 0,3 %
	0 Ω to 600 Ω	± 0,3 %
• Resistance thermometers	Pt 100 Ni 100 Standard	± 1 K
	Pt 100 Ni 100 Klima	± 0,8 K
	Ni 1000 LG-Ni 1000 Standard	± 0,8 K
	Ni 1000 LG-Ni 1000 Klima	± 0,8 K

6.6 Analog input module SM 331; AI 8 x 13 Bit;(6ES7331-1KF01-0AB0)

Technical data		
Temperature error (relative to input range)	± 0.006 %/K / 0.006 K/K	
Linearity error (relative to input range)	± 0.1 % / 0.1 K	
Repetition accuracy (in transient state at 25 °C, relative to input range)	± 0.1 % / ± 0.1 K	
Status, interrupts, diagnostics		
Interrupts	None	
Diagnostics functions	None	
Transducer selection data		
Input ranges (rated values) / input impedance		
• Voltage	± 50 mV ± 500 mV ± 1 V ± 5 V ± 10 V 1 V to 5 V 0 V to 10 V	100 kΩ
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	50 Ω
• Resistance	0 kΩ to 6 kΩ 0 Ω to 600 Ω	100 MΩ
• Resistance thermometers	Pt 100 Ni 100 Ni 1000 LG-Ni 1000 Standard / Klima	100 MΩ
Permissible voltage at voltage input U+ (destruction limit)	max. 30 V, continuous	
Permissible input voltage at voltage inputs M+, M-, S- (destruction limit)	max. 12 V continuous; 30 V for a duration of max. 1 s	
Permissible current at current input I+ (destruction limit)	max. 40 mA	
Wiring signal transducers	with 40-pin front connector	
• for voltage measurement	supported	
• for current measurement	supported, with external supply	
– as 2-wire transducer	supported	
– as 4-wire transducer		
• for resistance measurement		
with 2-wire connection	supported	
with 3-wire connection	supported	
with 4-wire connection	supported	
Characteristic linearization	programmable	
• for resistance thermometers	Pt 100 Standard / Klima Ni 100 Standard / Klima Ni 1000 Standard / Klima LG-Ni 1000 Standard / Klima	
• Technical unit of temperature measurements	Degrees Centigrade, degrees Fahrenheit, Kelvin	

6.6.1 Measuring methods and ranges

Introduction

Use the "measuring method" parameter in *STEP 7* to set the measuring method and measuring range.

Selected measuring method	Measuring range
Voltage V	$\pm 50 \text{ mV}$ $\pm 500 \text{ mV}$ $\pm 1 \text{ V}$ $\pm 5 \text{ V}$ $1 \text{ V to } 5 \text{ V}$ $0 \text{ V to } 10 \text{ V}$ $\pm 10 \text{ V}$
Current I	$0 \text{ mA to } 20 \text{ mA}$ $4 \text{ mA to } 20 \text{ mA}$ $\pm 20 \text{ mA}$
resistance (4-wire connection) R-4L	6Ω 600Ω
Thermal resistance RTD-4L (linear, 4-wire connection) (temperature measurement)	Pt 100 Klima / Standard Ni 100 Klima / Standard Ni 1000 Klima / Standard LG-Ni 1000 Klima / Standard

6.6.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-17 Parameters of SM 331; AI 8 x 13 Bit

Parameters	Range of values	Default	Parameter type	Scope
Measurement Measuring method	disabled V voltage I current R resistance RTD thermoelectric resistance	V	Dynamic	Channel
Measuring range	Voltage ± 50 mV; ± 500 mV; ±1 V; 1 V to 5 V ± 5 V; 0 to 10 V; ± 10 V	± 10 V		
	Current 0 mA to 20 mA; 4 mA to 20 mA; ± 20 mA	± 20 mA		
	Resistance 0 Ω to 600 Ω; 0 kΩ to 6 kΩ	600 Ω		
	Thermoelectric resistance (linear) Pt 100 Klima / Standard Ni 100 Klima / Standard Ni 1000 Klima / Standard LG-Ni 1000 Klima / Standard	Pt 100 standard		
Temperature coefficient	Pt 100 0.003850 Ω/Ω/ °C (IST-90) Ni 100 / Ni 1000 0,006180 Ω/Ω/ °C LG-Ni 1000 0.005000 Ω/Ω/ °C	0,003850		
Noise suppression	50 Hz; 60 Hz	50 Hz		Module
Temperature unit	Degrees Centigrade, degrees Fahrenheit, Kelvin*	Degrees Centigrade		
* only Pt 100 Standard, Ni 100 Standard, Ni 1000 Standard, LG-Ni 1000 Standard				

See also

Programming analog modules (Page 5-31)

6.6.3 Additional information to SM 331; AI 8 x 13 Bit

Unused channels

For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

Link the M- terminals of the unused channels with one another.

6.7 Analog input module SM 331; AI 8 x 12 Bit;(6ES7331-7KF02-0AB0)

Order number

6ES7331-7KF02-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group
 - Voltage
 - Current
 - Resistance
 - Temperature
- Resolution adjustable per channel group (9/12/14 bits + sign)
- Measuring range selection any, per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 2 channels
- Hardware interrupt can be set when limit exceeded
- Electrically isolated to CPU and load voltage (not for 2-wire transducers)

Resolution

The measured value resolution is directly proportional to the selected integration time, i.e. the measured value resolution increases in proportion to the increase in the length of the integration time at the analog input channel.

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set the hardware interrupts of channel groups 0 and 1 in *STEP 7*. However, always set a hardware interrupt only for the first channel of a channel group, i.e. either at channel 0, or at channel 2

Terminal assignment

The following diagrams show different possible forms of wiring. The input impedance is determined by the measuring range module setting, see table *Measuring methods and ranges*.

Wiring: Voltage measurement

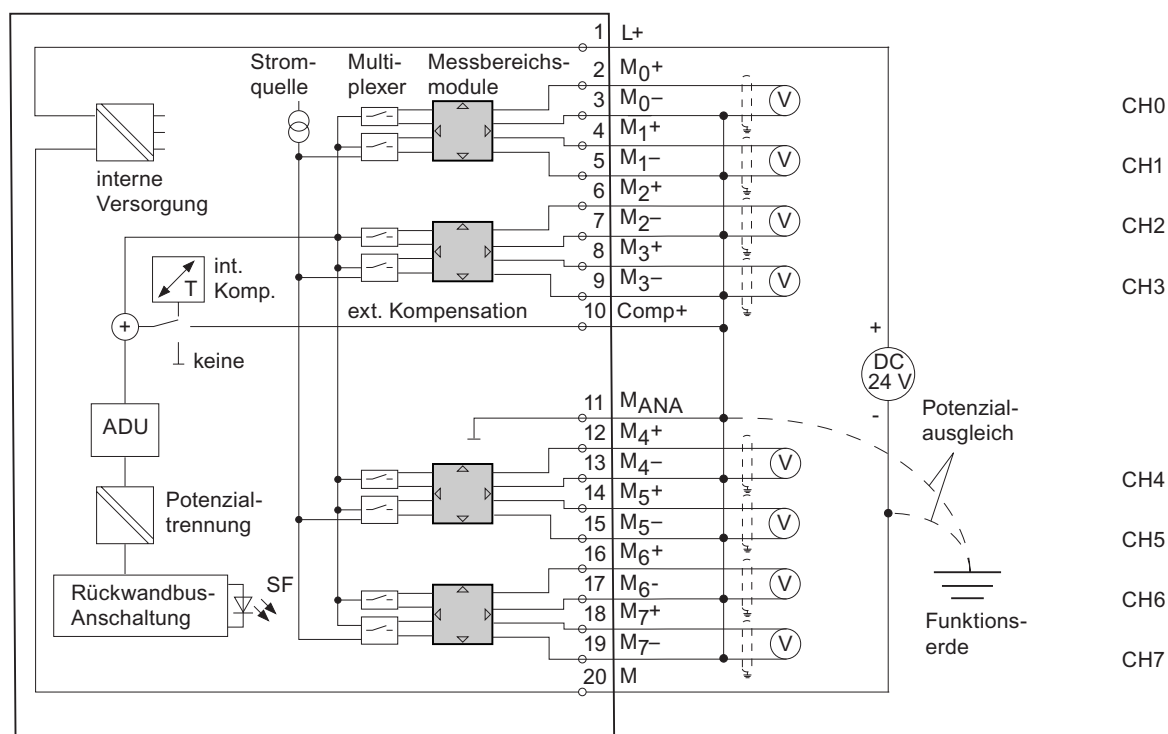


Figure 6-14 Block diagram and wiring diagram

Measuring range module settings

Measuring range	Measuring range module setting
$\pm 80 \text{ mV}$ $\pm 250 \text{ mV}$ $\pm 500 \text{ mV}$ $\pm 1000 \text{ mV}$	A
$\pm 2.5 \text{ V}$ $\pm 5 \text{ V}$ $1 \text{ V to } 5 \text{ V}$ $\pm 10 \text{ V}$	B

Wiring: 2 and 4-wire measuring transducer for current measurement

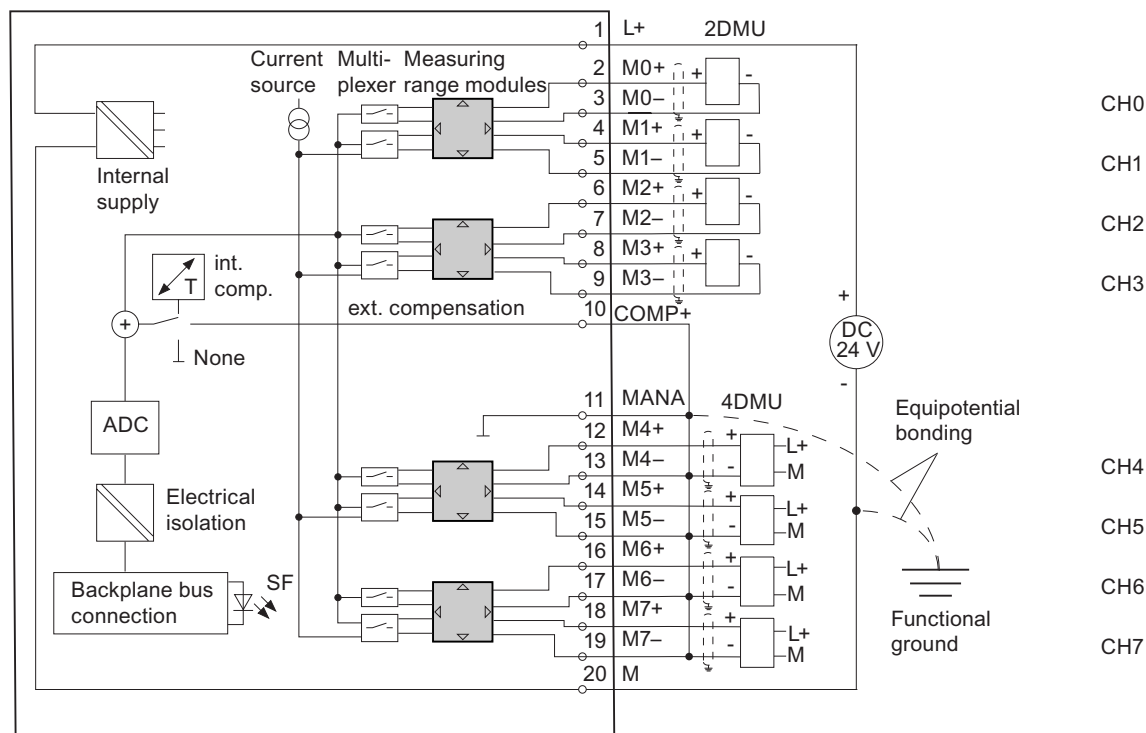


Figure 6-15 Block diagram and wiring diagram

Note

The connection between M_{ANA} and $M-$ (terminals 11, 13, 15, 17, 19) is not needed for grounded 4-wire transducers with a non-electrically isolated supply.

Measuring range module settings

Measuring range		Measuring range module setting
2-wire transducer	4 mA to 20 mA	D
4-wire transducer	± 3.2 mA	C
	± 10 mA	
	0 mA to 20 mA	
	4 mA to 20 mA	
	± 20 mA	

Caution

If you have set the measuring range module to the "current" setting and voltage is being interrogated, the module is destroyed.

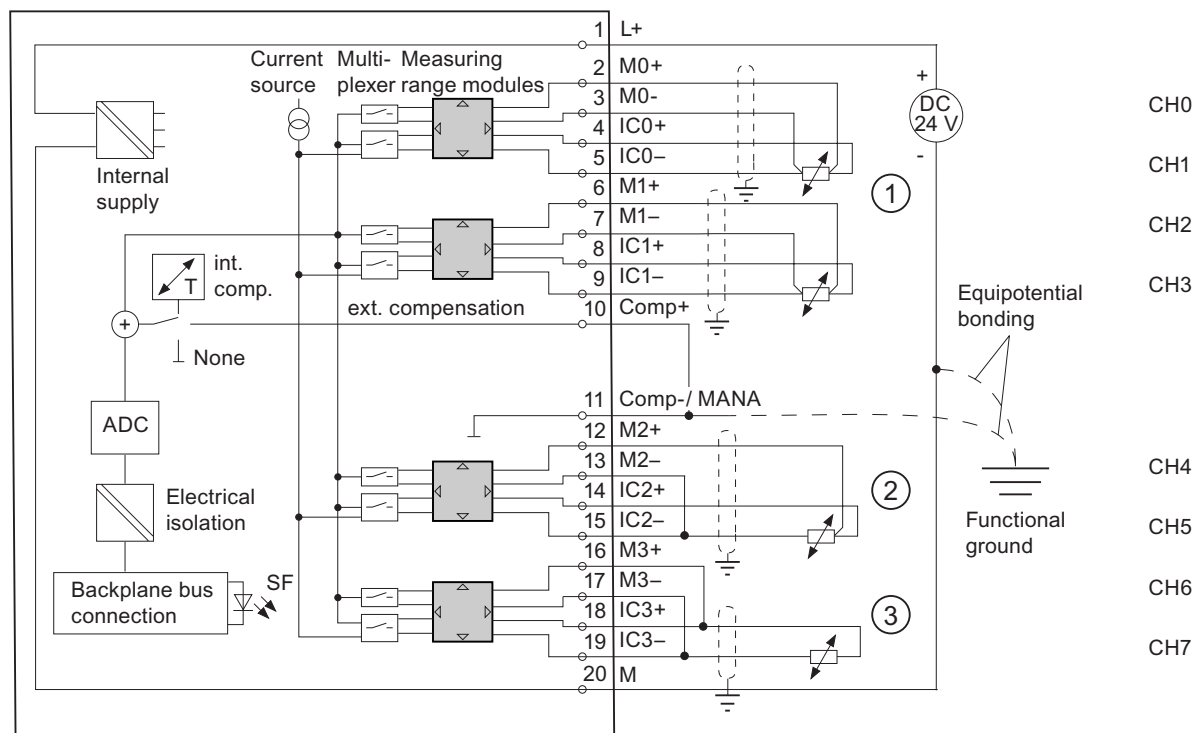
Wiring: 2, 3 and 4-wire connection of resistive transducers or thermoresistors

Figure 6-16 Block diagram and wiring diagram

- ① 4-wire connection
- ② 3-wire connection
- ③ 2-wire connection

Measuring range module settings

Measuring range		Measuring range module setting
150 Ω 300 Ω 600 Ω		A
Thermoresistor (linear, 4-wire connection) (temperature measurement) RTD-4L	Pt 100 Klima Ni 100 Klima Pt 100 standard Ni 100 Standard	A

Note

- "Resistance measurement" is only available at one channel per group. The "2nd" channel of the group is used accordingly for current impression (I_C). The "1st" channel of the group returns the measured value. The "2nd" channel of the group has the default overflow value "7FFF_H."
- There is no performance resistors compensation with "2- and 3-wire connections".

Wiring: Thermocouples with external compensation

With internal compensation, there must be a bridge between Comp+ and M_{ANA}.

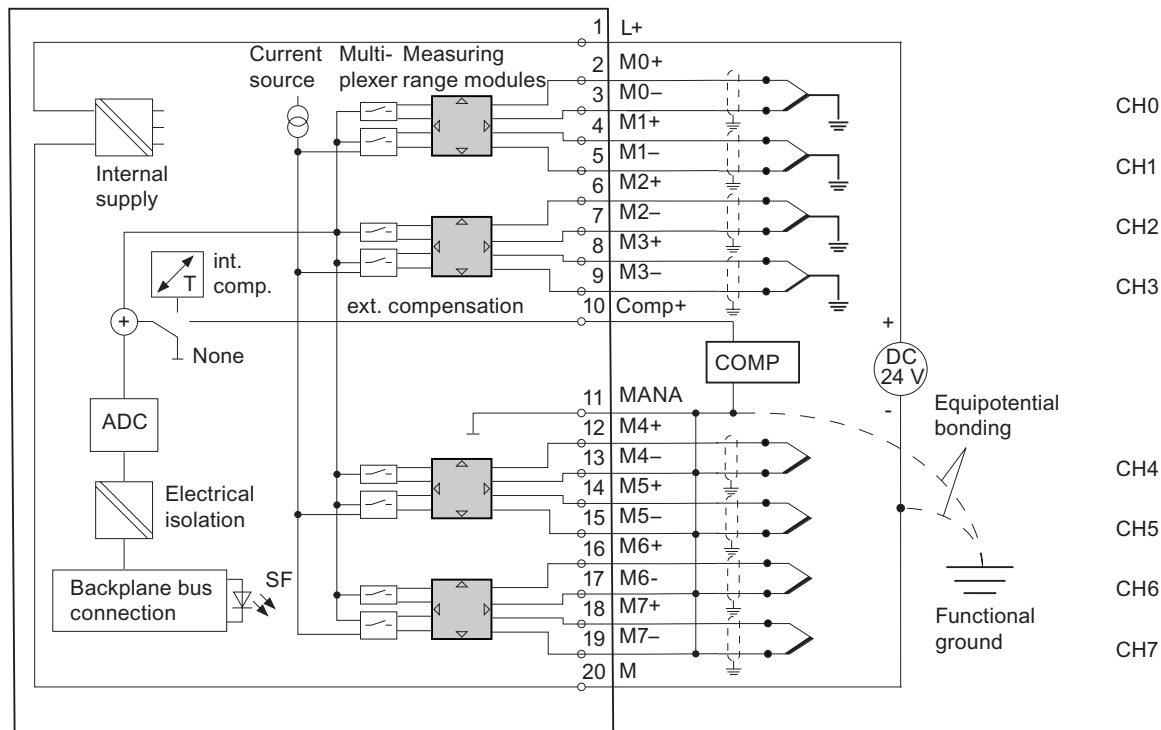


Figure 6-17 Block diagram and wiring diagram

Measuring range module settings

Measuring range		Measuring range module setting
Thermocouple TC-I (internal comparison) (thermal voltage measurement) Linearization is not taken into account	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
Thermocouple TC-E (external comparison) (thermovoltage measurement) Linearization is not taken into account		
Thermocouple (linear, internal comparator) (temperature measurement) TC-IL	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
Thermocouple (linear, external comparator) (temperature measurement) TC-EL		

Note

- With grounded thermocouples, you must not establish a connection between M- and M_{ANA}
- With non-grounded thermocouples, you must establish a connection between M- and M_{ANA}

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	Approx. 250 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
• with resistive transducers	4
Cable length	max. 200 m
• Shielded	max. 50 m at 80 mV and with thermocouples
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
• Reverse polarity protection	Yes

Technical data				
Transducer power supply				
- Supply current - short circuit-proof	max. 60 mA (per channel) Yes			
Constant current for resistive transducers	typ. 1.67 mA			
Electrical isolation				
- between channels and the backplane bus - Between channels and electronics power supply - not for 2-wire transducers	Yes Yes			
Permissible potential difference				
- between inputs and M_{ANA} (CMV) - at signal = 0 V - between inputs (C_{MV}) - between M_{ANA} and M_{internal} (V_{iso})	typ. DC 2.5 V (> DC 2.3V) typ. DC 2.5 V (> DC 2.3V) 75 VDC / 60 VAC			
Insulation test voltage	500 VDC			
Current consumption				
- from the backplane bus - from load voltage L+	max. 50 mA max. 30 mA (without 2-wire transducer)			
Power loss of the module	typ. 1 W			
Formation of analog values				
Measuring principle	Integrating			
Integration/conversion time/resolution (per channel)				
programmable	Yes			
Integration time in ms	2,5	16 ² / ₃	20	100
Basic conversion time, including the integration time in ms	3	17	22	102
Additional conversion time for resistance measurement, in ms or	1	1	1	1
additional conversion time for wire-break monitoring, in ms or	10	10	10	10
additional conversion time for resistance measurements and wire-break monitoring in ms	16	16	16	16
Resolution in bits (including overshoot range)	9 bits	12 bits	12 bits	14 bits
Noise cuppression at interference frequency f1 in Hz	400	60	50	10
Basic execution time of the module, in ms (all channels enabled)	24	136	176	816
Measured value smoothing	None			
Noise suppression, error limits				
Noise suppression at F = n (f1 ± 1 %), (f1 = interference frequency)				
- Common-mode noise (CMV < 2.5 V) - Seriesmode interference (peak value of disturbance < rated input range)	> 70 dB > 40 dB			
Crosstalk between inputs	> 50 dB			

Technical data		
Operational limit (across temperature range, relative to input range)		
• Voltage input	80 mV	± 1 %
	250 mV to 1000 mV	± 0,6 %
	2.5 V to 10 V	± 0,8 %
• Current input	3.2 mA to 20 mA	± 0,7 %
• Resistance	150 Ω; 300 Ω; 600 Ω	± 0,7 %
• Thermocouple	Types E, N, J, K, L	± 1,1 %
• Resistance thermometers	Pt 100/Ni 100	± 0,7 %
	Pt 100 Klima	± 0,8 %
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	80 mV	± 0,7 %
	250 mV to 1000 mV	± 0,4 %
	2.5 V to 10 V	± 0,6 %
• Current input	3.2 mA to 20 mA	± 0,5 %
• Resistance	150 Ω; 300 Ω; 600 Ω	± 0,5 %
• Thermocouple	Types E, N, J, K, L	± 0,7 %
• Resistance thermometers	Pt 100/Ni 100	± 0,5 %
	Pt 100 Klima	± 0,6 %
Temperature error (relative to input range)		± 0.005 %/K
Linearity error (relative to input range)		± 0,05 %
Repetition accuracy (in transient state at 25 °C, relative to input range)		± 0,05 %
Temperature error of internal compensation		± 1 %
Status, interrupts, diagnostics		
Interrupts	programmable	
• Hardware interrupt when limit has been exceeded	Channels 0 and 2	
• Diagnostic interrupt	programmable	
Diagnostics functions	programmable	
• Group error display	red LED (SF)	
• Reading diagnostics information	supported	

Technical data		
Transducer selection data		
Input ranges (rated values) / input impedance		
• Voltage	$\pm 80 \text{ mV}$ $\pm 250 \text{ mV}$ $\pm 500 \text{ mV}$ $\pm 1000 \text{ mV}$ $\pm 2.5 \text{ V}$ $\pm 5 \text{ V}$ $1 \text{ V to } 5 \text{ V}$ $\pm 10 \text{ V}$	$10 \text{ M}\Omega$ $10 \text{ M}\Omega$ $10 \text{ M}\Omega$ $10 \text{ M}\Omega$ $/100 \text{ k}\Omega$ $/100 \text{ k}\Omega$ $/100 \text{ k}\Omega$ $/100 \text{ k}\Omega$
• Current	$\pm 3.2 \text{ mA}$ $\pm 10 \text{ mA}$ $\pm 20 \text{ mA}$ $0 \text{ mA to } 20 \text{ mA}$ $4 \text{ mA to } 20 \text{ mA}$	$25 \text{ }\Omega$ $25 \text{ }\Omega$ $25 \text{ }\Omega$ $25 \text{ }\Omega$ $25 \text{ }\Omega$
• Resistance	$150 \text{ }\Omega$ $300 \text{ }\Omega$ $600 \text{ }\Omega$	$/10 \text{ M}\Omega$ $/10 \text{ M}\Omega$ $/10 \text{ M}\Omega$
• Thermocouples	Types E, N, J, K, L	$/10 \text{ M}\Omega$
• Resistance thermometers	Pt 100, Ni 100	$/10 \text{ M}\Omega$
Permissible voltage at voltage input (destruction limit)	max. 20 V, continuous 75 V for the duration of max. 1 s (duty factor 1:20)	
Permissible current at current input (destruction limit)	max. 40 mA	
Wiring signal transducers	with 20-pin front connector	
• for voltage measurement	supported	
• for current measurement		
as 2-wire transducer	supported	
as 4-wire transducer	supported	
• for resistance measurement		
with 2-wire connection	possible, no compensation for line resistor	
with 3-wire connection	supported	
with 4-wire connection	supported	
• Load of the 2-wire transducer	max. 820 Ω	
Characteristic linearization	programmable	
• for thermocouples	Types E, N, J, K, L	
• for resistance thermometers	Pt 100 (Standard and Klima range) Ni 100 (Standard and Klima range)	
Temperature compensation	programmable	
• Internal temperature compensation	supported	
• External temperature compensation with compensating box	supported	
• Compensation for 0 °C reference junction temperature	supported	
• Technical unit of temperature measurements	Degrees Centigrade	

6.7.1 Measuring methods and ranges

Introduction

Module SM 331; AI 8 x 12 Bit has measuring range modules

Use the measuring range module and the "measuring range" parameter in *STEP 7* to set the measuring methods and measuring ranges.

The "voltage" measuring method and " ± 10 V" measuring range are set by default at the module. You can use those default settings without having to program the SM 331; AI 8 x 12 Bit in *STEP 7*.

Measuring range modules

Reposition the measuring range modules to suit the measuring method and range (see chapter *Setting measuring methods and ranges of analog input channels*). The necessary settings are also available on the module's imprint.

Measuring methods and ranges

Table 6-18 Measuring methods and ranges

Selected measuring method	Measuring range (type of sensor)	Measuring range module settings
V voltage	± 80 mV ± 250 mV ± 500 mV ± 1000 mV	A
	± 2.5 V ± 5 V 1 V to 5 V ± 10 V	B
Thermocouple TC-I (internal comparison) (thermal voltage measurement) Linearization is not taken into account	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
Thermocouple TC-E (external comparison) (thermoelectric measurement) Linearization is not taken into account		
Thermocouple (linear, internal comparator) (temperature measurement) TC-IL	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
Thermocouple (linear, external comparator) (temperature measurement) TC-EL		

Selected measuring method	Measuring range (type of sensor)	Measuring range module settings
Current (2-wire transducer) 2DMU	4 mA to 20 mA	D
Current (4-wire transducer) 4DMU	± 3.2 mA ± 10 mA 0 mA to 20 mA 4 mA to 20 mA ± 20 mA	C
Resistance (4-wire connection) R-4L	150 Ω 300 Ω 600 Ω	A
Thermoresistor (linear, 4-wire connection) (temperature measurement) RTD-4L	Pt 100 Klima Ni 100 Klima Pt 100 Standard Ni 100 Standard	A

Channel groups

The channels of SM 331; AI 8 x 12 Bit are arranged in four groups of two channels. You always assign parameters to a channel group.

The analog input module SM 331; AI 8 x 12 Bit is equipped with one measuring range module per channel group.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-19 Assignment of SM 331; AI 8x12 bit channels to channel groups

Channels ...	...form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.7.2 Adjustable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-20 Overview of parameters for SM 331; AI 8 x 12 bit

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt when limit exceeded	Yes/no Yes/no	No No	Dynamic	Module
Hardware interrupt trigger - High limit - Low limit	May be restricted by the measuring range from 32511 to - 32512 from - 32512 to 32511	-	Dynamic	Channel
Diagnostics - Group diagnostics - with wirebreak monitoring	Yes/no Yes/no	No No	static	Channel group
Measurement Measuring method	disabled V voltage 4DMU current (4-wire transducer) 2DMU current (2-wire transducer) R-4L resistance (4-wire connection) RTD-4L thermoelectric resistance (linear, 4-wire connection) TC-I thermocouple (internal comparator) TC-E thermocouple (external comparison) TC-IL thermocouple (linear, internal comparator) TC-EL thermocouple (linear, external comparison)	V	Dynamic	Channel or channel group
Measuring range	See table <i>Measuring methods and ranges</i>	$\pm 10\text{ V}$		
Noise suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

6.7.3 Additional information to SM 331; AI 8 x 12 Bit

Unused channels

Certain inputs of the channel group configuration may remain unused. To enable diagnostic functions at the used channels, note the special features of those inputs outlined below:

- **Current measurement (other than 1 to 5V)** and for thermocouples: You must short-circuit unused channels and connect them to M_{ANA} . This optimizes interference immunity of the analog input module. For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time. If not used, short-circuit the COMP input.
- **Measuring range 1 V to 5 V:** wire the used and unused inputs of the same channel group in parallel.
- **Current measurement, 2-wire transducer:** There are two options of wiring the channel circuit.
 - a) Open unused input; channel group diagnostics disabled. If you were to enable diagnostics, the analog module would trigger a single diagnostic interrupt, and light up its SF LED.
 - b) Loading the unused input using a 1.5 k Ω to 3.3 k Ω resistor. This allows you to enable diagnostics for this channel group.
- **Current measurement 4 mA to 20 mA, 4-wire transducer:** wire the unused inputs of the same channel group in series.

All channels deactivated

If you disable **all** input channels of the module and enable diagnostics you configure the SM 331; AI 8 x 12 Bit analog input modul, the module does **not** indicate "external auxiliary voltage missing."

Wire-break check function in the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and **enabled wire-break check**, the analog input module logs a wire-break event in diagnostics data when the current drops below 3.6 mA.

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

If you configured a measuring range of 4 mA to 20 mA, **disabled wire-break check**, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

Wirebreak monitoring

The wire-break check function is designed only for temperature measurements (thermocouples and thermoresistors.)

See also

Representation of the analog values of analog input channels (Page 5-2)

6.8 Analog input module SM 331; AI 2 x 12 bit; (6ES7331-7KB02-0AB0)

Order number: : "Standard module"

6ES7331-7KB02-0AB0

Order number: "SIPLUS S7-300 module"

6AG1331-7KB02-2AB0

Properties

- Two inputs in one channel group
- Measuring method adjustable per channel group
 - Voltage
 - Current
 - Resistance
 - Temperature
- Resolution adjustable per channel group (9/12/14 bits + sign)
- Measuring range selection any, per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 2 channels
- Hardware interrupt can be set with limit alarm
- Electrically isolated to CPU and load voltage (not for 2-wire transducers)

Resolution

The measured value resolution is directly proportional to the selected integration time, i.e. the measured value resolution increases in proportion to the increase in the length of the integration time at the analog input channel (see Technical data.)

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set a hardware interrupt for the channel group in *STEP 7*. However, you always have to set the hardware interrupt at channel 0.

Terminal assignment

The following diagrams show different possible forms of wiring. The input impedance is determined by the set measuring range.

Wiring: Voltage measurement

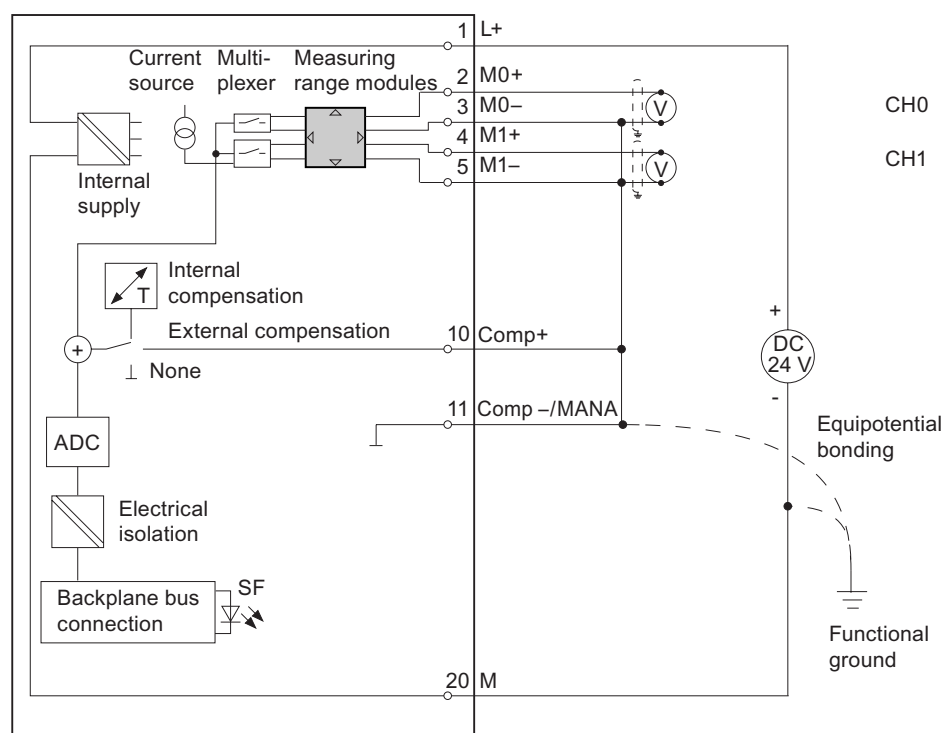


Figure 6-18 Wiring and block diagrams

Measuring range module settings

Measuring range	Measuring range module setting
$\pm 80 \text{ mV}$ $\pm 250 \text{ mV}$ $\pm 500 \text{ mV}$ $\pm 1000 \text{ mV}$	A
$\pm 2.5 \text{ V}$ $\pm 5 \text{ V}$ $1 \text{ V to } 5 \text{ V}$ $\pm 10 \text{ V}$	B

Wiring: Thermocouple with external compensation

With internal compensation, there must be a bridge between Comp+ and M_{ANA}

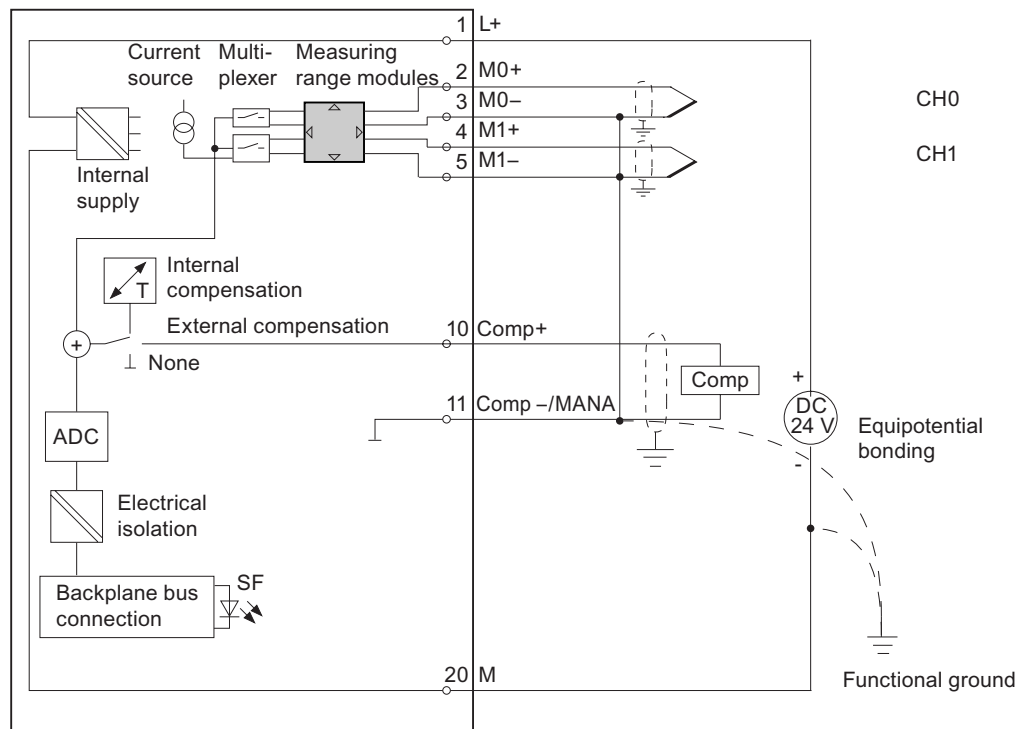


Figure 6-19 Wiring and block diagrams

Measuring range module settings

Measuring range		Measuring range module setting
TC-I: Thermocouple (internal comparison) (thermal voltage measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi]	A
TC-E: Thermocouples (external comparison) (thermal voltage measurement)	Type K [NiCr-Ni] Type L [Fe-CuNi]	
TC-IL: Thermocouples (linear, internal comparison) (temperature measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
TC-EL: Thermocouples (linear, external comparison) (temperature measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A

Wiring: 2, 3, 4-wire connection of resistors or thermoresistors

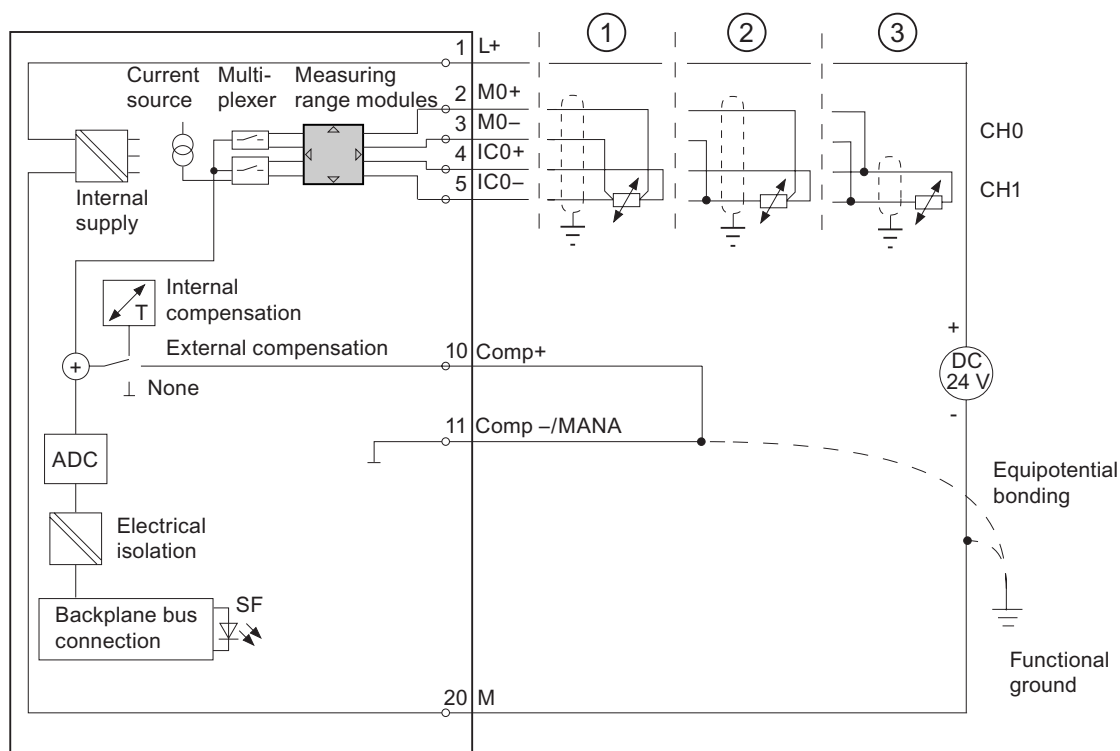


Figure 6-20 Wiring and block diagrams

- ① 4-wire connection, no compensation for line resistors
- ② 3-wire connection, no compensation for line resistors
- ③ 2-wire connection

Measuring range module settings

Measuring range		Measuring range module setting
150 Ω		A
300 Ω		
600 Ω		
RTD-4L: Thermal resistance (linear, 4-wire connection) (temperature measurement)	Pt 100 Klima Ni 100 Klima Pt 100 Standard Ni 100 Standard	A

Note

Resistance measurements are only available at one channel of the analog input module. The "2nd" channel is used for current impression (I_C).

The "1st" returns the measured value. The "2nd" channel is assigned the default overflow value "7FFF_H."

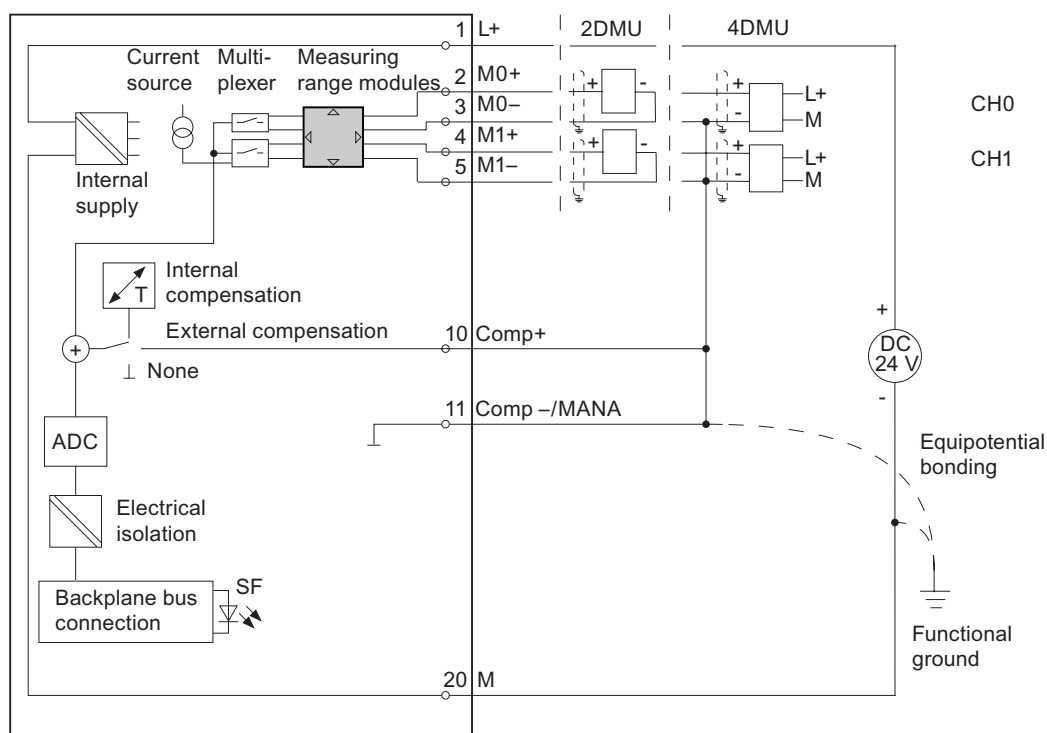
Wiring: 2 and 4-wire measuring transducer for current measurement

Figure 6-21 Wiring and block diagrams

Measuring range module settings

Measuring range		Measuring range module setting
2-wire transducer	4 mA to 20 mA	D
4-wire transducer	± 3.2 mA	C
	± 10 mA	
	0 mA to 20 mA	
	4 mA to 20 mA	
	± 20 mA	

Caution

If you have set the measuring range module to the "current" setting and voltage is being interrogated, the module is destroyed!

Technical data

Technical data				
Dimensions and weight				
Dimensions W x H x D (mm)		40 x 125 x 117		
Weight		approx. 250 g		
Module-specific data				
Isochronous mode supported		No		
Number of inputs		2		
• with resistive transducers		1		
Cable length		max. 200 m		
• shielded		max. 50 m at 80 mV and with thermocouples		
Voltages, currents, electrical potentials				
Rated electronics supply voltage L +		24 VDC		
• Reverse polarity protection		Yes		
Transducer power supply				
• Supply current		max. 60 mA (per channel)		
• short circuit-proof		Yes		
Constant current for resistive transducers		typ. 1.67 mA		
Electrical isolation				
• between channels and the backplane bus		Yes		
• between channels and electronics power supply		Yes		
– not for 2-wire transducers				
Permissible potential difference				
• between inputs and M _{ANA} (C _{MV})		typ. DC 2.5 V (> DC 2.3V)		
– at signal = 0 V		typ. DC 2.5V (> DC 2.3V)		
• between inputs (C _{MV})		75 VDC / 60 VAC		
• between M _{ANA} and M _{internal} (V _{iso})				
Isolation test voltage		500 VDC		
Current consumption				
• from the backplane bus		max. 50 mA		
• from load voltage L+		max. 30 mA (without 2-wire transducer)		
Power loss of the module		typ. 1.3 W		
Formation of analog values				
Measuring principle		Integrating		
Integration/conversion time/resolution (per channel)				
• programmable		Yes		
• Integration time in ms		2,5	16 ² / ₃	20
• Basic conversion time, including the integration time in ms		6	34	44
				100
				204

Technical data				
Additional conversion time for resistance measurement, in ms or	1	1	1	1
additional conversion time for wire-break monitoring in ms or	10	10	10	10
additional conversion time for resistance measurements and wire-break monitoring in ms	16	16	16	16
• Resolution in bits (including overshoot range)	9 bits	12 bits	12 bits	14 bits
• Noise suppression at interference frequency f1 in Hz	400	60	50	10
• Basic execution time of the module, in ms (all channels enabled)	12	68	88	408
Measured value smoothing	None			
Noise suppression, error limits				
Noise suppression at f = n (f1 " 1 %), (f1 = interference frequency) n=1.2...				
• Common-mode noise (CMV < 2.5 V)	> 70 dB			
• Seriesmode interference (peak value of disturbance < rated input range)	> 40 dB			
Crosstalk between inputs	> 50 dB			
Operational limit (across temperature range, relative to input range)				
• Voltage input	80 mV 250 mV to 1000 mV 2.5 to 10 V	± 1 % ± 0,6 % ± 0,8 %		
• Current input	3.2 mA to 20 mA	± 0,7 %		
• Resistance	150 Ω; 300 Ω; 600 Ω	± 0,7 %		
• Thermocouple	Types E, N, J, K, L	± 1, 1 %		
• Resistance thermometer	Pt 100/Ni 100	± 0,7 %		
	Pt 100 Klima	± 0,8 %		
Basic error limit (operational error limit at 25 °C, relative to input range)				
• Voltage input	80 mV 250 mV to 1000 mV 2.5 to 10 V	± 0,6 % ± 0,4 % ± 0,6 %		
• Current input	3.2 mA to 20 mA	± 0,5 %		
• Resistance	150 Ω; 300 Ω; 600 Ω	± 0,5 %		
• Thermocouple	Types E, N, J, K, L	± 0,7 %		
• Resistance thermometer	Pt 100/Ni 100	± 0,5 %		
	Pt 100 Klima	± 0,6 %		
Temperature error (relative to input range)		± 0.005 %/K		
Linearity error (relative to input range)		± 0,05 %		
Repetition accuracy (in transient state at 25 °C, relative to input range)		± 0,05 %		
Temperature error of internal compensation		± 1 %		
Status, interrupts, diagnostics				
Interrupts	programmable			
• Hardware interrupt when limit has been exceeded	Channels 0			
• Diagnostic interrupt	programmable			

Technical data		
Diagnostics functions - Group error display - Reading diagnostics information	programmable red LED (SF) supported	
Transducer selection data		
Input ranges (rated values) / input impedance		
Voltage	± 80 mV ± 250 mV ± 500 mV ± 1000 mV ± 2.5 V ± 5 V 1 V to 5 V ± 10 V	10 MΩ 10 MΩ 10 MΩ 10 MΩ 100kΩ 100kΩ 100kΩ 100kΩ
Current	± 3.2 mA ± 10 mA ± 20 mA 0 mA to 20 mA 4 mA to 20 mA	25 Ω 25 Ω 25 Ω 25 Ω 25 Ω
Resistance	150 Ω 300 Ω 600 Ω	10 MΩ 10 MΩ 10 MΩ
Thermocouples	Types E, N, J, K, L	10 MΩ
Resistance thermometer	Pt 100, Ni 100	10 MΩ
Permissible voltage at voltage input (destruction limit)	max. 20 V continuous; 30 V for the duration of max. 1 s (duty factor 1:20)	
Permissible current at current input (destruction limit)	40 mA	
Wiring signal transducers	with 20-pin front connector	
for voltage measurement	supported	
for current measurement as 2-wire transducer as 4-wire transducer	supported supported	
for resistance measurement with 2-wire connection with 3-wire connection with 4-wire connection	supported supported supported	
Load of the 2-wire transducer	max. 820 Ω	
Characteristic linearization - for thermocouples - of resistance thermometers	programmable Types E, N, J, K, L Pt 100 (Standard and Klima range) Ni 100 (Standard and Klima range)	
Temperature compensation - Internal temperature compensation - External temperature compensation with compensating box - Compensation for 0 °C reference junction temperature - Technical unit of temperature measurements	programmable supported supported supported Degrees Centigrade	

6.8.1 Measuring methods and ranges

Introduction

Module SM 331; AI 2 x 12 Bit has a measuring range module. Use the measuring range module and the "measuring method" parameter in *STEP 7* to set the measuring methods and measuring ranges. The "voltage" measuring method and "± 10V" measuring range are set by default at the module. You can those default settings without having to program the SM 331; AI 2 x 12 Bit in *STEP 7*.

Measuring range module

Reposition the measuring range module to suit the measuring method and range (see the chapter *Setting measuring methods and ranges of analog input channels*). The necessary settings are also available on the module's imprint.

Table 6-21 Measuring methods and ranges

Selected measuring method	Measuring range (type of sensor)	Measuring range module settings
V: Voltage	± 80 mV ± 250 mV ± 500 mV ± 1000 mV	A
	± 2.5 V ± 5 V 1 to 5 V ± 10 V	B
TC-I: Thermocouple (internal comparison) (thermal voltage measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi]	A
TC-E: Thermocouples (external comparison) (thermal voltage measurement)	Type K [NiCr-Ni] Type L [Fe-CuNi]	
2DMU: Current (2-wire transducer)	4 mA to 20 mA	D
4DMU: Current (4-wire transducer)	± 3.2 mA ± 10 mA 0 mA to 20 mA 4 mA to 20 mA ± 20 mA	C
R-4L: Resistance (4-wire connection)	150 Ω 300 Ω 600 Ω	A

Selected measuring method	Measuring range (type of sensor)	Measuring range module settings
TC-IL: Thermocouples (linear, internal comparison) (temperature measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
TC-EL: Thermocouples (linear, external comparison) (temperature measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
RTD-4L: Thermal resistance (linear, 4-wire connection) (temperature measurement)	Pt 100 Klima Ni 100 Klima Pt 100 Standard Ni 100 Standard	A

Channel groups

Two channels of SM 331; AI 2 x 12 Bit form a channel group. You can only assign parameters to the channel group.

SM 331; AI 2 x 12 Bit is equipped with a measuring range module for channel group 0.

Wirebreak monitoring

The wire-break check function is designed only for temperature measurements (thermocouples and thermoresistors.)

Special features of the wire-break check function in the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and **enabled wire-break check**, the analog input module logs a wire-break event in diagnostics data when the current drops below 3.6 mA.

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

If you configured a measuring range of 4 mA to 20 mA, **disabled wire-break check**, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

6.8.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-22 Overview of parameters of SM 331; AI 2 x 12 Bit

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt when limit exceeded	Yes/no Yes/no	No No	Dynamic	Module
Hardware interrupt trigger - High limit - Low limit	32511 to -32512 from - 32512 to 32511	-	Dynamic	Channel
Diagnostics - Group diagnostics - with wirebreak monitoring	Yes/no Yes/no	No No	static	Channel group
Measurement Measuring method	disabled V voltage 4DMU current (4-wire transducer) 2DMU current (2-wire transducer) R-4L resistance (4-wire connection) RTD-4L thermoelectric resistance (linear, 4-wire connection) TC-I thermocouple (internal comparator) TC-E thermocouple (external comparison) TC-IL thermocouple (linear, internal comparator) TC-EL thermocouple (linear, external comparison)	V	Dynamic	Channel or channel group
Measuring range	Refer to the chapter <i>Measuring methods and ranges</i> for the adjustable measuring ranges of the input channels	$\pm 10\text{ V}$		
Noise suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.8.3 Additional information to SM 331; AI 2 x 12 bit

Unused channels

You must short-circuit unused channels and connect them to M_{ANA} . This optimizes interference immunity of the analog input module. For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

If not used, short-circuit the COMP input.

Certain inputs of the channel group configuration may remain unused. To enable diagnostic functions at the used channels, note the special features of those inputs outlined below:

- **Measuring range 1 V to 5 V:** wire the used and unused inputs of the same channel group in parallel.
- **Current measurement, 2-wire transmitter:** There are two ways to wire the channel circuit:
 - a) Open unused input; channel group diagnostics disabled. If you were to enable diagnostics, the analog module would trigger a single diagnostic interrupt, and light up its SF LED.
 - b) Terminating the unused input using a 1.5 k Ω to 3.3 k Ω resistor. This allows you to enable diagnostics for this channel group.
- **Current measurement 4 mA to 20 mA, 4-wire transducer:** wire the unused inputs of the same channel group in series.

Wirebreak monitoring

The wire-break check function is designed only for temperature measurements (thermocouples and thermoresistors.)

Special features of the wire-break check function in the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and **enabled wire-break check**, the analog input module logs a wire-break event in diagnostics data when the current drops below 3.6 mA.

The module also triggers a diagnostic interrupt if you enabled diagnostics interrupts in the program.

The lit SF LED is otherwise the only indication of the wire-break, and you must evaluate the diagnostic bytes in the user program.

If you configured a measuring range of 4 mA to 20 mA, **disabled wire-break check**, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

6.9 Analog input module SM 331; AI 8 x RTD; (6ES7331-7PF01-0AB0)

Order number

6ES7331-7PF01-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group
 - Resistance
 - Temperature
- Resolution adjustable per channel group (15 bits + sign)
- Measuring range selection any, per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 8 channels
- Hardware interrupt can be set when limit exceeded
- High-speed refresh of measured values for 4 channels
- Hardware interrupt can be set at end of cycle
- Electrically isolated to the CPU

Resolution

The measured value's resolution is not dependent on the integration time selected.

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set the hardware interrupts of channel groups 0 and 1 in STEP 7. However, always set a hardware interrupt only for the first channel of a channel group, i.e. either at channel 0, or at channel 2

Terminal assignment

The following diagrams show different possible forms of wiring. These connection examples apply to all channels (channel 0 to 7).



Caution

Any faulty wiring of 3-wire connections may cause unforeseeable module states and hazardous plant states.

Wiring: 2, 3 and 4-wire connection for resistor and thermoresistor measurement

Wiring possible at both ends at channel 0 to channel 7

Note

The module's product status 02 must be configured with an unused channel of an active group of channels in order to avoid incorrect measurements.

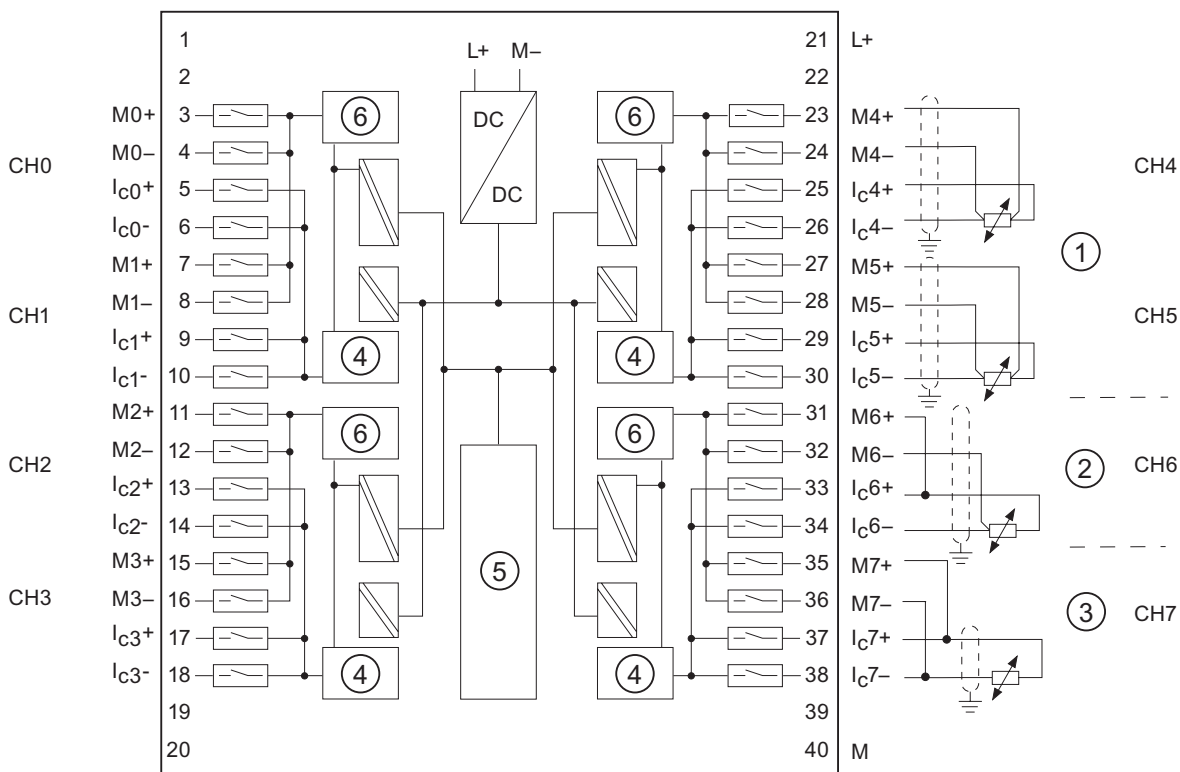


Figure 6-22 Wiring and block diagrams

- ① 4-wire connection
- ② 3-wire connection
- ③ 2-wire connection
- ④ Digital-to-Analog Converter
- ⑤ Backplane bus interface
- ⑥ Analog-to-Digital Converter (ADC)

**Caution**

Any faulty wiring of 3-wire connections may cause unforeseeable module states and hazardous plant states.

Wiring: 3-wire connection

For 3-wire connections to SM 331; AI 8 x RTD, **bridge M+ and I_{C+}**.

Always wire the connected I_{C-} **and** M- cables directly to the resistance thermometer.

Wiring: 2-wire connection

For 3-wire connections to SM 331; AI 8 x RTD, **bridge M+ and I_{C+}** as well as M- and I_{C-}.

On the 2-conductor connection, there is no compensation for line resistors. The line resistors are measured at the same time!

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	Approx. 272 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Cable length	
• shielded	max. 200 m
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
• Reverse polarity protection	Yes
Constant measuring current for resistive transducers	max. 5 mA
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels and electronics power supply	Yes
• between channels	Yes
in groups of	2
Permissible potential difference	
• between channels (U _{CM})	60 VAC / 75 VDC
• Between the channels and M _{internal} (V _{iso})	60 VAC / 75 VDC

Technical data	
Isolation test voltage	500 VDC
Current consumption - from the backplane bus - from power supply L+	max. 100 mA max. 240 mA
Power loss of the module	typ. 4.6 W
Formation of analog values	
Measuring principle	Integrating
Mode of operation	8-channel mode (hardware filter)
Integration/conversion time/resolution (per channel) - programmable - Basic conversion time in ms - Additional conversion time for resistance measurement in ms - Additional conversion time for wire-break monitoring in ms - Resolution (including overshoot range) - Noise suppression at interference frequency f1 in Hz	Yes 80 100* 0 16 bits (including sign) 400 / 60 / 50
Measured value smoothing	None / low/ average/ high
Conversion time (per channel)	100 ms
Basic execution time of the module (all channels enabled)	200 ms
Mode of operation	8-channel mode (software filter)
Integration/conversion time/resolution (per channel) - programmable - Basic conversion time in ms - Additional conversion time for resistance measurement in ms - Additional conversion time for wire-break monitoring in ms - Resolution (including overshoot range) - Noise suppression at interference frequency f1 in Hz	Yes 8 / 25 / 30 25/ 43/ 48* 0 16 bits (including sign) 400 / 60 / 50
Measured value smoothing	None / low/ average/ high
Conversion time (per channel)	25 ms/ 43 ms/ 48 ms
Basic execution time of the module (all channels enabled)	50 ms/ 86 ms/ 96 ms
Mode of operation	4-channel mode (hardware filter)
Integration/conversion time/resolution (per channel) - programmable - Basic conversion time in ms - Additional conversion time for resistance measurement in ms - Additional conversion time for wire-break monitoring in ms - Resolution (including overshoot range) - Noise suppression at interference frequency f1 in Hz	Yes 3,3**** 100* 100** 16 bits (including sign) 400 / 60 / 50
Measured value smoothing	None / low/ average/ high
Basic execution time of the module (all channels enabled)	10 ms

Technical data	
Noise suppression, error limits	
Noise suppression at $f = n$ ($f_1 \pm 1\%$), (f_1 = interference frequency) $n=1,2, \dots$	
- Common-mode noise (CMV < 60 V) - Seriesmode interference (peak value of disturbance < rated input range)	> 100 dB > 90 dB
Crosstalk between inputs	> 100 dB
Operational limit (across temperature range, relative to 0 °C to 60 °C input range)	
- Resistance thermometer - Pt 50, Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, LG-Ni 1000, Cu 50, Cu 100, - Pt 10, Cu 10 - Resistance	± 1.0 °C ± 2.0 °C ± 0,1 %
Basic error limit (operational error limit at 25 °C, relative to input range)	
- Resistance thermometer - Pt 50, Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, LG-Ni 1000, Cu 50, Cu 100, - Pt 10, Cu 10 - Resistance	± 0.5 °C ± 1.0 °C ± 0,05 %
Temperature error (relative to input range)	
- Resistance thermometer - Resistance	± 0.015 °C/K ± 0.005 °%/K
Linearity error (relative to input range)	
- Resistance thermometer - Resistance	± 0.2 °C ± 0,02 %
Repetition accuracy (in transient state at 25 °C, relative to input range)	
- Resistance thermometer - Resistance	± 0.2 °C ± 0.01 %
Status, interrupts, diagnostics	
Interrupts	
- Hardware interrupt - Diagnostic interrupt	Programmable (channels 0-7) programmable
Diagnostics function	programmable
- Group error display - Diagnostic information readable	red LED (SF) supported
Transducer selection data	
Input range (rated values) input resistance	
- Resistance thermometer - Resistance	Pt 10, Pt 50, Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, LG-Ni 1000, Cu 10, Cu 50, Cu 100 (standard and Klima range) 150 Ω, 300 Ω, 600 Ω
Permissible voltage at voltage input (destruction limit)	35 V DC continuous 75 V DC for max. 1 s (duty ratio 1 : 20)

Technical data	
Wiring signal transducers for resistance measurement with 2-wire connection with 3-wire connection with 4-wire connection	with 40-pin front connector supported supported*** supported
Characteristic linearization - Resistance thermometer - Technical unit of temperature measurements	Pt 10, Pt 50, Pt 100, Pt 200, Pt 500, Pt 1000, Ni 100, Ni 120, Ni 200, Ni 500, Ni 1000, LG-Ni 1000, Cu 10, Cu 50, Cu 100 (standard and Klima range) Degrees Centigrade; degrees Fahrenheit

* With 3-wire connections, resistance measurements to compensate for line resistors at intervals of five minutes.

** Wire-break monitoring in 4-channel mode (hardware filter) at intervals of three seconds.

*** The maximum line resistor for 3-wire transducer measurements for the RTD elements PT 10 and Cu 10 is 10 Ω . The maximum line resistor for all other RTD elements during 3-wire transducer measurements is 20 Ω .

**** In 4-channel mode, the converted value tunes to 100 % within 80 ms. The value established in this process is set every typ. 3.3 ms (max. 10 ms).

6.9.1 Measuring methods and ranges

Introduction

Use the "measuring method" parameter in *STEP 7* to set the measuring method and measuring range.

Table 6-23 Measuring methods and ranges

Selected measuring method	Measuring range
Resistance: (3-/4-wire connection)	150 Ω 300 Ω 600 Ω
RTD resistance and linearization: (3-/4-wire connection)	Pt 100 Klima Pt 200 Klima Pt 500 Klima Pt 1000 Klima Ni 100 Klima Ni 120 Klima Ni 200 Klima Ni 500 Klima Ni 1000 Klima* LG-Ni 1000 Klima Cu 10 Klima Pt 100 Standard Pt 200 Standard Pt 500 Standard Pt 1000 Standard Ni 100 Standard Ni 120 Standard Ni 200 Standard Ni 500 Standard Ni 1000 Standard* LG-Ni 1000 Standard Cu 10 Standard Pt 10 GOST Klima Pt 10 GOST Standard Pt 50 GOST Klima Pt 50 GOST Standard Pt 100 GOST Klima Pt 100 GOST Standard Pt 500 GOST Klima Pt 500 GOST Standard Cu 10 GOST Klima Cu 10 GOST Standard Cu 50 GOST Klima Cu 50 GOST Standard Cu 100 GOST Klima Cu 100 GOST Standard Ni 100 GOST Klima Ni 100 GOST Standard

* Δ LG-Ni 1000 mit Temperaturkoeffizient 0,00618 oder 0,00672

Channel groups

The channels of SM 331; AI 8 x RTD are arranged in four groups of two channels. You always assign parameters to a channel group.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-24 Assignment of SM 331; AI 8 x RTD channels to channel groups

Channels ...	... form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

6.9.2 Einstellbare Parameter

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

Eine Übersicht über die einstellbaren Parameter mit deren Voreinstellungen finden Sie in der folgenden Tabelle.

Parameters

Table 6-25 Übersicht Parameter der SM 331; AI 8 x RTD

Parameters	Range of values	Default	Parameter type	Scope
Enable				
• Diagnostic interrupt	Yes/no	No	Dynamic	Module
• Hardware interrupt when limit exceeded	Yes/No	No		
• Hardware interrupt at end of cycle	Yes/no	No		
Hardware interrupt trigger				
• High limit	32511 to -32512	32767	Dynamic	Channel
• Low limit	von - 32512 bis 32511	-32768		
Diagnostics				
• Group diagnostics	Yes/no	No	static	Channel group
• with wirebreak monitoring	Yes/no	No		

Parameters	Range of values	Default	Parameter type	Scope
Measurement				
• Measuring method	disabled R-4L resistance (4-wire connection) R-3L resistance (3-wire connection) RTD-4L thermoelectric resistance (linear, 4-wire connection) RTD-3L thermoelectric resistance (linear, 3-wire connection)	RTD-4L	Dynamic	Channel group
• Measuring range	Siehe Tabelle <i>Messarten und Messbereiche</i>	Pt 100 Klima 0.003850 (IPTS-68)		
• Temperature unit	Degrees Centigrade; degrees Fahrenheit	Degrees Centigrade	Dynamic	Module
• Mode of operation	8 Kanal-Modus (Hardwarefilter) 8 Kanal-Modus (Softwarefilter) 4 Kanal-Modus (Hardwarefilter)	8 Kanal-Modus HW-Filter	Dynamic	Module
• Temperature coefficient for temperature measurement with thermoelectric resistance (RTD)	Platinum (Pt) 0,003850 $\Omega/\Omega/^\circ\text{C}$ (IPTS-68) 0.003916 $\Omega/\Omega/^\circ\text{C}$ 0.003902 $\Omega/\Omega/^\circ\text{C}$ 0.003920 $\Omega/\Omega/^\circ\text{C}$ 0.003850 $\Omega/\Omega/^\circ\text{C}$ (ITS-90) 0,003910 $\Omega/\Omega/^\circ\text{C}$ Nickel (Ni) 0,006170 $\Omega/\Omega/^\circ\text{C}$ 0.006180 $\Omega/\Omega/^\circ\text{C}$ 0.006720 $\Omega/\Omega/^\circ\text{C}$ 0,005000 $\Omega/\Omega/^\circ\text{C}$ (LG Ni 1000) Copper (Cu) 0,004260 $\Omega/\Omega/^\circ\text{C}$ 0,004270 $\Omega/\Omega/^\circ\text{C}$ 0,004280 $\Omega/\Omega/^\circ\text{C}$	0,003850	Dynamic	Channel group
• Noise suppression*	50/60/400 Hz; 400 Hz; 60 Hz; 50 Hz	50/60/400 Hz	Dynamic	Channel group
• Smoothing	None Low Average High	None	Dynamic	Channel group
* 50/60/400 Hz only programmable for 8-channel mode (hardware filter) and 4-channel mode (hardware filter); 50 Hz, 60 Hz or 400 Hz only programmable for 8-channel mode (software filter)				

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.9.3 Additional information to SM 331; AI 8 x 16 RTD

Modes of operation

Operating modes of the SM 331; AI 8 x RTD:

- 8-channel mode (hardware filter)
- 8-channel mode (software filter)
- 4-channel mode (hardware filter)

The operating mode influences the module cycle time.

8-channel mode (hardware filter)

In this mode, the module does not toggle between the two channels of each group. The four analog-to-digital converters (ADC) of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, then those with the odd numbers 1, 3, 5 and 7 (see the figure below.)

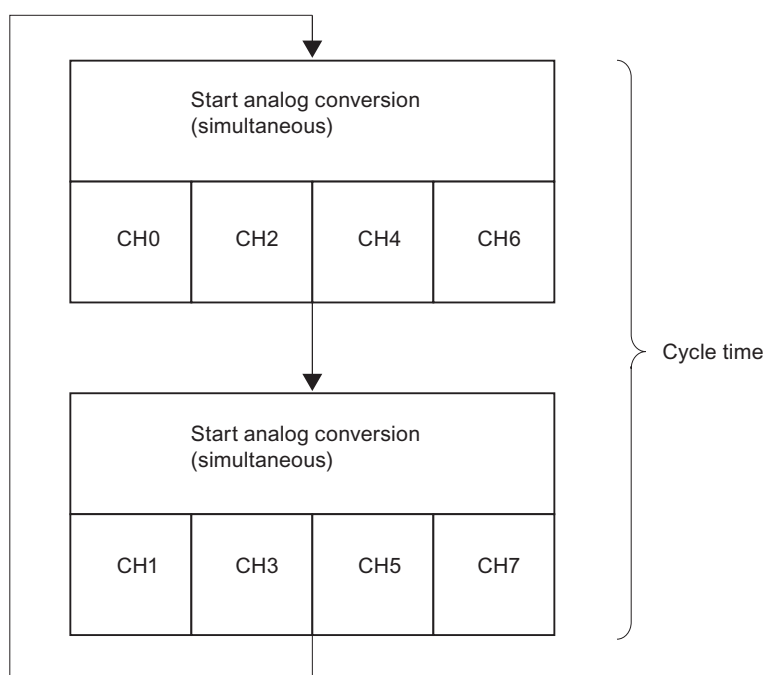


Figure 6-23 8-channel mode cycle time (hardware filter)

Cycle time of module in 8-channel mode

The channel conversion time, including module communication time, is 84 ms. After this cycle, the module has to change over to the second channel of the group using OptoMOS relays. Opto-MOS relays require switching and settling times of 12 ms. Each channel requires a time of 97 ms, i.e. the total cycle time equals 194 ms.

$$\text{Cycle time} = (t_k + t_u) \times 2$$

$$\text{Cycle time} = (84 \text{ ms} + 16 \text{ ms}) \times 2$$

$$\text{Total cycle time} = 200 \text{ ms}$$

t_k : Conversion time for one channel

t_u : Channel changeover time within the channel group

8-channel mode (software filter)

Analog-to-digital conversion in this mode is identical to the conversion in 8-channel mode (hardware filter). The four analog-to-digital converters (ADC) of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, then those with the odd numbers 1, 3, 5 and 7 (see the figure below.)

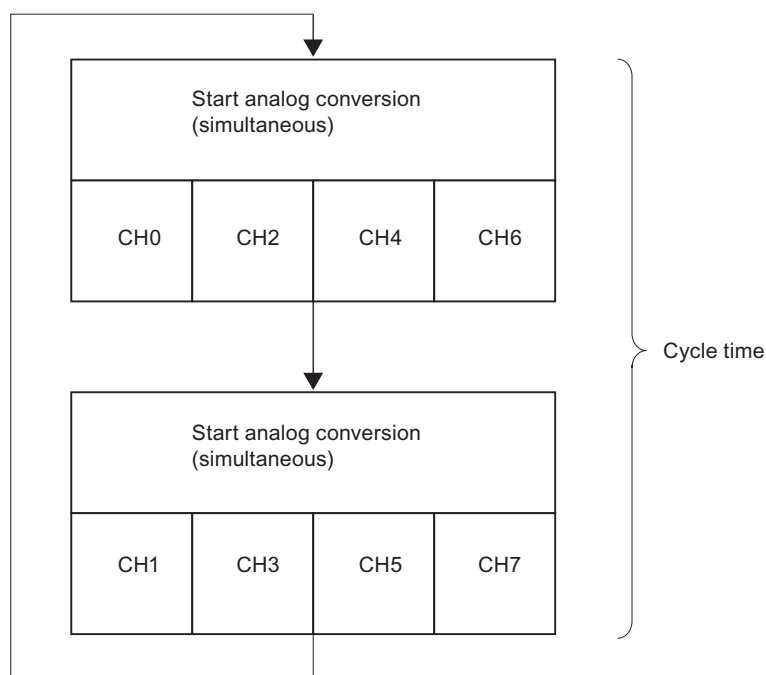


Figure 6-24 8-channel mode cycle time (software filter)

Cycle time of module in 8-channel mode (software filter)

However, the channel conversion time is oriented on the programmed noise suppression. At a set interference frequency of 50 Hz, the channel conversion time is 32 ms, including communication time. At a set an interference frequency of 60 Hz, the channel conversion time is 27 ms. You can reduce channel conversion times to 9 ms by setting an interference frequency of 400 Hz. As in "hardware filter, 8channel" mode, the module has to toggle to the second channel of the group within a changeover time of 16 ms using the Opto-MOS relays. The table below shows this relationship.

Table 6-26 Cycle times in "8-channel mode (software filter)"

Interference frequency	Channel cycle time*	Module cycle time (all channels)
50 Hz	48 ms	96 ms
60 Hz	43 ms	86 ms
400 Hz	25 ms	50 ms
* Channel cycle time = channel conversion time + 12 ms channel changeover time within the group		

4-channel mode (hardware filter)

In this mode, the module does not toggle between the channels of the various groups. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6.

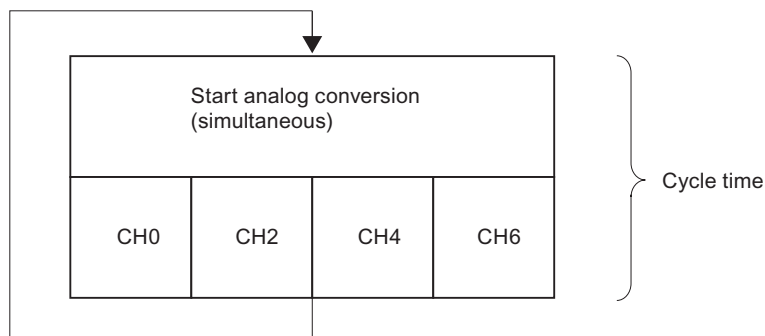


Figure 6-25 4-channel mode cycle time (hardware filter)

Cycle time of module in 4-channel mode (hardware filter)

In 4-channel mode, the converted value tunes to 100% within 80 ms and is updated every 10 ms. The channel and module cycle time are always identical, because the module does toggle between the channels of a group: 10 ms.

Channel conversion time = channel cycle time = module cycle time = **10 ms**

Cycle time extension due to wire-break monitoring

The wire-break monitoring software function of the module is available in all operating modes.

The cycle time of the module is doubled **in 8-channel mode (hardware or software filter)**, irrespective of the number of channels at which wire-break monitoring is enabled.

In 4-channel mode (hardware filter), the module interrupts processing of input data for the duration of 100 ms to perform a wire-break check, i.e. each wire-break check extends the module cycle time by 100 ms.

Unused channels

In order to avoid incorrect measurements, the module's product version 02 must be configured with an unused channel of an active group of channels. To suppress a diagnosis error in the unused channel, the configuration should include a resistor of the nominal range.

For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

Short-circuit to M or L

If you short-circuit an input channel to M or L, the module does not suffer any damage. The channel continues to output valid data and does not report a diagnostics event.

End of cycle interrupt

You can synchronize a process with the conversion cycle of the module by enabling the end of cycle interrupt. The interrupt occurs when the conversion of all the enabled channels is complete.

The following table shows the content of the 4 bytes of additional OB40 information during hardware or end of cycle interrupts.

Content of the 4 bytes of additional information		2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	Byte
Special analog flags	2 bits per channel to identify the range									
	High limit exceeded at channel	7	6	5	4	3	2	1	0	0
	Low limit exceeded at channel	7	6	5	4	3	2	1	0	1
	End of cycle event						X			2
	Free bit									3

Programming restrictions when operating SM 331; AI 8 x RTD with PROFIBUS masters which only support DPV0.

When operating the SM 331; AI 8 x RTD analog input module on an ET 200M PROFIBUS slave system and the PROFIBUS master is not an S7 master, certain parameters are not permitted. Non-S7 masters do not support hardware interrupts. All parameters associated with those functions are thus disabled. This includes hardware interrupt enable, hardware restrictions and end of cycle interrupt enable. All other parameters are permitted.

Operation of the module on the ET 200M Distributed IO Device

Operation of SM 331; AI 8 x RTD on ET 200M requires one of the following IM 153 x:

- IM 153-1; as of 6ES7153-1AA03-0XB0, V 01
- IM 153-2; as of 6ES7153-2AA02-0XB0, V 05
- IM 153-2; as of 6ES7153-2BA00-0XA0; V 01
- IM 153-2; as of 6ES7153-2AA01-0XB0, V 04

6.10 Analog input module SM 331; AI 8 x TC; (6ES7331-7PF11-0AB0)

Order number

6ES7331-7PF11-0AB0

Properties

- 8 inputs in 4 channel groups
- Measuring method adjustable per channel group
 - Temperature
- Resolution adjustable per channel group (15 bits + sign)
- Measuring range selection any, per channel group
- Programmable diagnostics and diagnostic interrupt
- Limit value monitoring adjustable for 8 channels
- Hardware interrupt can be set when limit exceeded
- High-speed refresh of measured values at up to 4 channels
- Hardware interrupt can be set at end of cycle interrupt
- Electrically isolated to the CPU

Resolution

The measured value's resolution is not dependent on the integration time selected.

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Hardware interrupts

You can set the hardware interrupts of channel groups 0 and 1 in *STEP 7*. However, always set a hardware interrupt only for the first channel of a channel group, i.e. either at channel 0, or at channel 2

Terminal assignment

The following diagrams show wiring examples. These connection examples apply to all channels (channel 0 to 7).

Wiring: Thermocouple via reference junction

All 8 inputs are available as measurement channels if thermocouples are wired via reference junctions which are regulated to 0 °C or 50 °C.

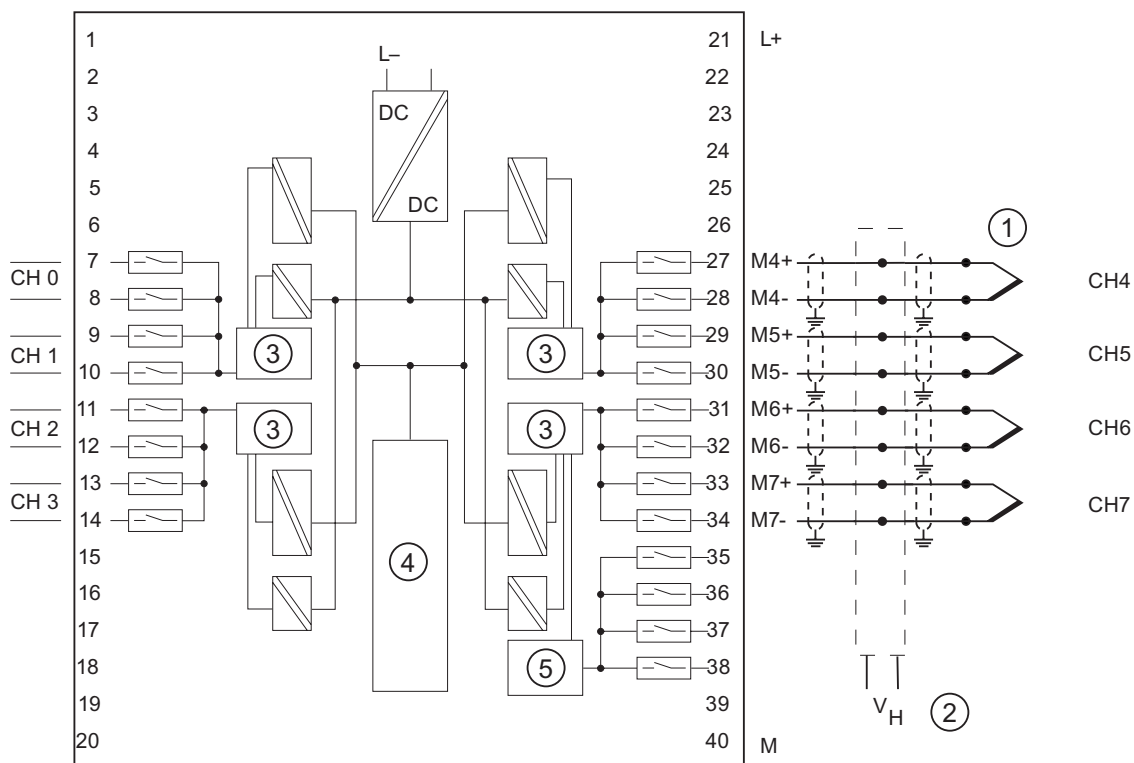


Figure 6-26 Wiring and block diagrams

- ① Thermocouple via reference junction
- ② Reference junction regulated to 0 °C or 50 °C
e.g. compensation box (per channel) or thermostat
- ③ Analog-to-Digital Converter (ADC)
- ④ Backplane bus interface
- ⑤ External cold spot comparison

Wiring: Thermocouple with external compensation

With this form of compensation, the temperature of the terminals at the reference junction is established using a resistor thermometer Pt100 with a temperature range of -25 °C to 85 °C (see terminals 35 to 38).

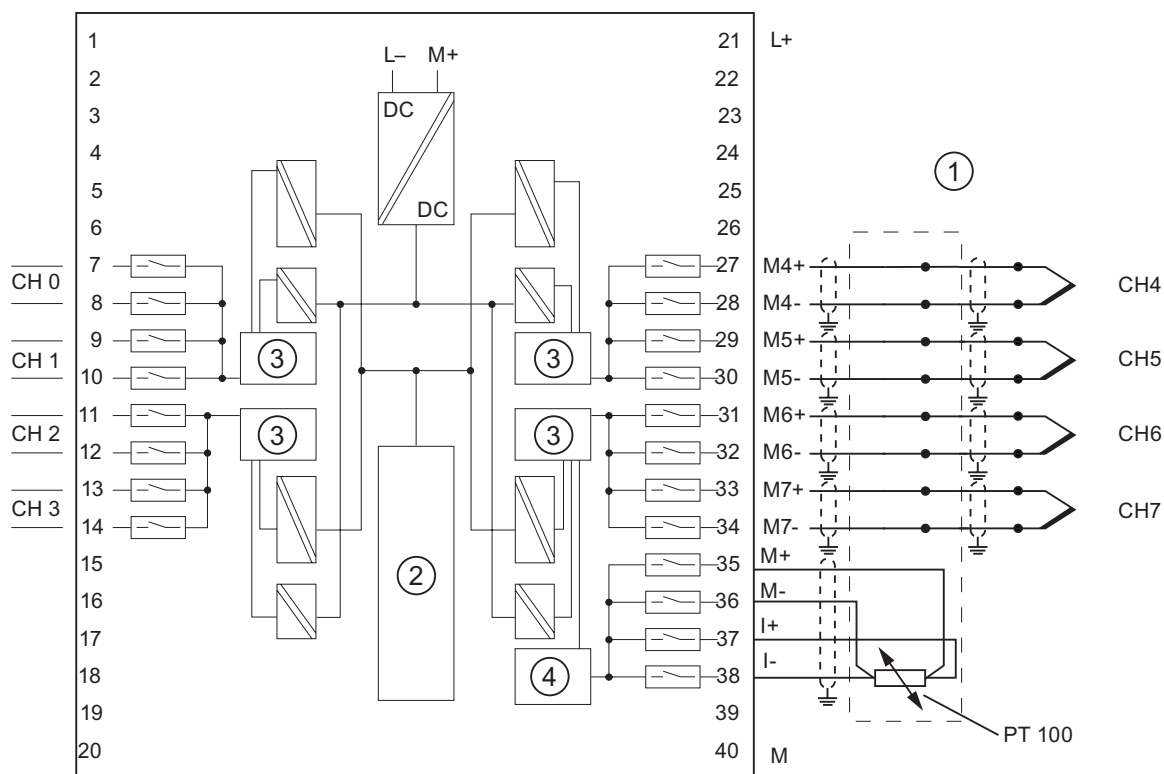


Figure 6-27 Wiring and block diagrams

- ① Thermocouple with external temperature compensation
- ② Backplane bus interface
- ③ Analog-to-Digital Converter (ADC)
- ④ External cold spot comparison

Wiring: Thermocouple with internal compensation

With this kind of compensation, temperature in the connector reference junction is recorded by the module.

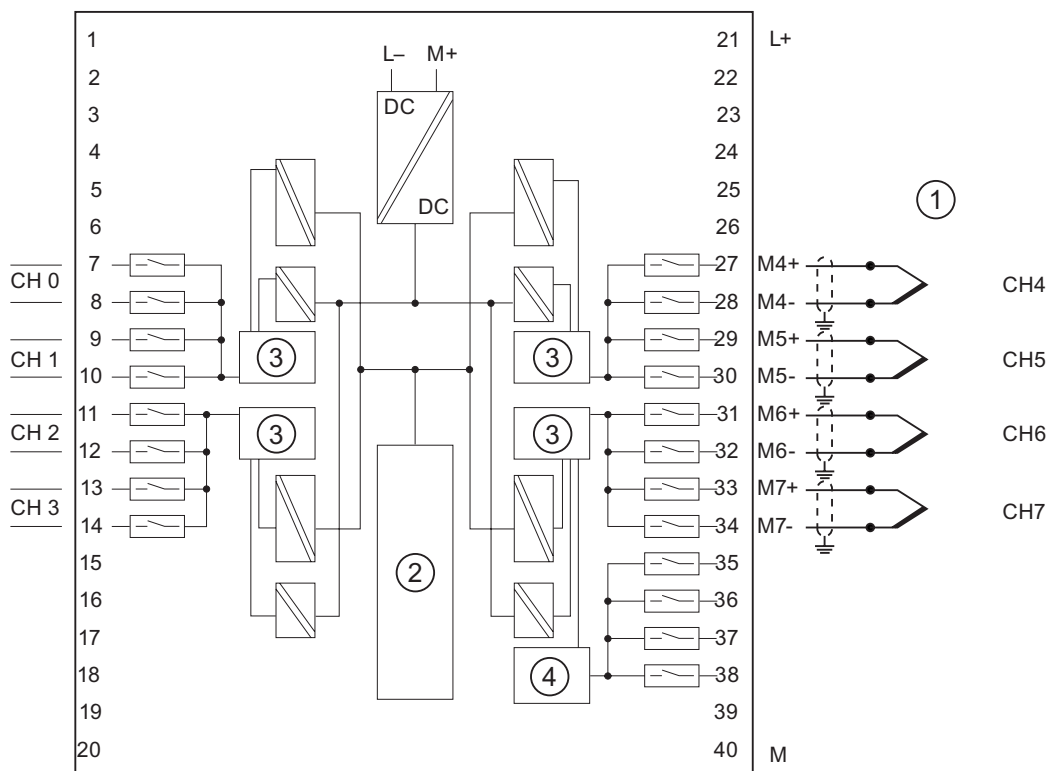


Figure 6-28 Wiring and block diagrams

- ① Thermocouple with equalizing conductor up to front connector
- ② Backplane bus interface
- ③ Analog-to-Digital Converter (ADC)
- ④ External cold spot comparison

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 272 g
Module-specific data	
Isochronous mode supported	No
Cable length	
• shielded	max. 100 m

Technical data	
Voltages, currents, electrical potentials	
Rated electronics supply voltage L + • Reverse polarity protection	24 VDC Yes
Constant measuring current for resistive transducers	typ. 0.7 mA
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels in groups of	Yes Yes Yes 2
Permissible potential difference • between channels (U_{CM}) • Between the channels and $M_{internal}$ (V_{iso})	60 VAC / 75 VDC 60 VAC / 75 VDC
Isolation test voltage	500 VDC
Current consumption • from the backplane bus • from power supply L+	max. 100 mA max. 240 mA
Power loss of the module	typ. 3.0 W
Formation of analog values	
Measuring principle	Integrating
Mode of operation	8-channel mode (hardware filter)
Integration/conversion time/resolution (per channel) • programmable • Basic conversion time in ms • additional conversion time for wire-break monitoring in ms • Resolution (including overshoot range) • Noise suppression at interference frequency f1 in Hz	Yes 95 4 16 bits (including sign) 400/60/50
Measured value smoothing	None / low/ average/ high
Basic execution time of the module (all channels enabled)	196 ms
Mode of operation	8-channel mode (software filter)
Integration/conversion time/resolution (per channel) • programmable • Basic conversion time in ms • additional conversion time for wire-break monitoring in ms • Resolution (including overshoot range) • Noise suppression at interference frequency f1 in Hz	Yes 23/72/83 4 16 bits (including sign) 400/60/50
Measured value smoothing	None / low/ average/ high
Basic execution time of the module (all channels enabled)	46 ms/ 144 ms/ 166 ms
Measuring principle	Integrating
Mode of operation	4-channel mode (hardware filter)

6.10 Analog input module SM 331; AI 8 x TC; (6ES7331-7PF11-0AB0)

Technical data			
Integration/conversion time/resolution (per channel)			
- programmable - Basic conversion time in ms		Yes 3.3 ms *****	
additional conversion time for wire-break monitoring in ms		93 *	
- Resolution (including overshoot range) - Noise suppression at interference frequency f1 in Hz		16 bits (including sign) 400/60/50	
Measured value smoothing		None / low/ average/ high	
Basic execution time of the module (all channels enabled)		10 ms	
Noise suppression, error limits			
Noise suppression at f = n (f1 1 %), (f1 = interference frequency) n = 1.2, etc.			
- Common-mode interference (U_{CM} < 60 V AC) - Series mode interference (peak value of disturbance < rated input range)		> 100 dB > 90 dB **	
Crosstalk between inputs		> 100 dB	
Operational limit (across temperature range, relative to 0 °C to 60 °C input range). Note: This limit does not cover the cold junction error ³⁾ .			
Thermocouple			
Type T	-200 °C to	+400 °C	± 0.7 °C
	-230 °C to	-200 °C	± 1.5 °C
Type U	-150 °C to	+600 °C	± 0.9 °C
	-200 °C to	-150 °C	± 1.2 °C
Type E	-200 °C to	+1000 °C	± 1.2 °C
	-230 °C to	-200 °C	± 1.5 °C
Type J	-150 °C to	+1200 °C	± 1.4 °C
	-210 °C to	-150 °C	± 1.7 °C
Type L	-150 °C to	+900 °C	± 1.5 °C
	-200 °C to	-150 °C	± 1.8 °C
Type K	-150 °C to	+1372 °C	± 2.1 °C
	-220 °C to	-150 °C	± 2.9 °C
Type N	-150 °C to	+1300 °C	± 2.2 °C
	-220 °C to	-150 °C	± 3.0 °C
Type R	+100 °C to	+1769 °C	± 1.5 °C
	-50 °C to	+100 °C	± 1.8 °C
Type S	+100 °C to	+1769 °C	± 1.7 °C
	-50 °C to	+100 °C	± 2.0 °C
Type B *****	+800 °C to	+1820 °C	± 2.3 °C
	+200 °C	+800 °C	± 2.5 °C
Type C	+100 °C to	+2315 °C	± 2.3 °C
	0 °C	+100 °C	± 2.5 °C
Txk/xk(L)	-200 ° C	-150 ° C	± 1.5 °C

Technical data			
Basic error limit (operational error limit at 25 °C, relative to input range)			
• Thermocouple			
Type T	-200 °C to	+400 °C	± 0.5 °C
	-230 °C to	-200 °C	± 1.0 °C
Type U	-150 °C to	+600 °C	± 0.5 °C
	-200 °C to	-150 °C	± 1.0 °C
Type E	-200 °C to	+1000 °C	± 0.5 °C
	-230 °C to	-200 °C	± 1.0 °C
Type J	-150 °C to	+1200 °C	± 0.5 °C
	-210 °C to	-150 °C	± 1.0 °C
Type L	-150 °C to	+900 °C	± 0.5 °C
	-200 °C to	-150 °C	± 1.0 °C
Type K	-150 °C to	+1372 °C	± 0.5 °C
	-220 °C to	-150 °C	± 1.0 °C
Type N	-150 °C to	+1300 °C	± 0.5 °C
	-200 °C to	-150 °C	± 1.0 °C
Type R	+100 °C to	+1769 °C	± 0.5 °C
	-50 °C to	+100 °C	± 0.5 °C
Type S	+100 °C to	+1769 °C	± 0.5 °C
	-50 °C to	+100 °C	± 1.0 °C
Type B ****	+800 °C to	+1820 °C	± 1.0 °C
	+200 °C to	+800 °C	± 2.0 °C
Type C	+100 °C to	+2315 °C	± 0.5 °C
	0 °C	+100 °C	± 1.0 °C
Txk/xk(L)	-200 ° C	-150 ° C	± 1.0 °C
Temperature error (relative to input range)		± 0.005%/K	
Linearity error (relative to input range)		±0,02%	
Repeat accuracy (in transient state at 25 °C, relative to input range) ***		±0,01%	
Status, interrupts, diagnostics			
Interrupts			
• Hardware interrupt		programmable	
		(channels 0 to 7)	
• Diagnostic interrupt		programmable	
Diagnostics functions		programmable	
• Group error display		red LED (SF)	
• Reading diagnostics information		supported	
Transducer selection data			
Input ranges (rated values) / input impedance			
• Thermocouples		Type B, C, N, E, R, S, J, L, T, K, U, TxK/ xK (L)	
Permissible voltage at voltage input (destruction limit)		20 VDC continuous; 75 VDC for the duration of max. 1 s (duty factor 1:20)	
Characteristic linearization		programmable	

Technical data	
Temperature compensation	programmable
• Internal temperature compensation	supported
• External temperature compensation with Pt 100 (0.003850)	supported
• Compensation for 0 °C reference junction temperature	supported
• Compensation for 50 °C reference junction temperature	supported
• Technical unit of temperature measurements	Degrees Centigrade / degrees Fahrenheit
Wiring signal transducers	with 40-pin front connector

** Wire-break monitoring in 4-channel mode (hardware filter) at intervals of three seconds.

** In 8-channel software mode (software filter), series-mode rejection is reduced as follows:

50 Hz > 70 dB

60 Hz > 70 dB

400 Hz > 80 dB

*** The operational limit comprises only the basic error of the analog input at $T_a = 25\text{ °C}$ and the total temperature error. The total error must include the error or the compensation of the cold reference junction. Internal compensation of reference junction = max. 1.5 °C

External compensation of reference junction = precision of external RTD employed $\pm 0.1\text{ °C}$.

External compensation of reference junction which maintains the reference junction at 0 °C or 50 °C = accuracy of temperature control for the reference junction.

**** Because of the slight rise over the range of approx. 0 °C to 85 °C , the lack of compensation of the reference junction temperature only has a negligible effect on a type B thermocouple. If there is no compensation, and the measuring method "Compensation to 0 °C " is set, the deviation at the type B thermocouple during temperature measurement is: 200 °C to $1802\text{ °C} < 0.5\text{ °C}$

***** In 4-channel mode, the converted value tunes to 100 % within 80 ms. The value established in this process is set every type. 3.3 ms (max. 10 ms).

6.10.1 Measuring methods and ranges

Introduction

Use the "measuring method" parameter in *STEP 7* to set the measuring method and measuring range.

Table 6-27 Measuring methods and ranges

Selected measuring method	Measuring range
TC-L00C: (thermocouple, linear, 0 °C reference temperature)	Type B
	Type C
TC-L50C: (thermocouple, linear, 50 °C reference temperature)	Type E
	Type J
TC-IL: (thermocouple, linear, internal comparator)	Type K
	Type L
TC-EL: (thermocouple, linear, external comparison)	Type N
	Type R
	Type S
	Type T
	Type U
	Type Txk / xk (L)

Channel groups

The channels of SM 331; AI 8 x TC are arranged in four groups of two channels. You always assign parameters to a channel group.

The table below shows the relevant configuration of channel groups. You will need the channel group number to set the SFC parameters in the user program.

Table 6-28 Assignment of SM 331; AI 8 x TC channels to channel groups

Channels ...	... form one channel group each
Channel 0	Channel group 0
Channel 1	
Channel 2	Channel group 1
Channel 3	
Channel 4	Channel group 2
Channel 5	
Channel 6	Channel group 3
Channel 7	

6.10.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-29 Parameters of SM 331; AI 8 x TC

Parameters	Range of values	Default	Parameter type	Scope
Enable - Diagnostic interrupt - Hardware interrupt when limit exceeded - Hardware interrupt at end of cycle	Yes/no Yes/no Yes/no	No No No	Dynamic	Module
Hardware interrupt trigger - High limit - Low limit	32511 to -32512 from - 32512 to 32511	32767 -32768	Dynamic	Channel
Diagnostics - Group diagnostics - with wirebreak monitoring	Yes/no Yes/no	No No	static	Channel group
Measurement Measuring method	disabled TC-IL thermocouple (linear, internal comparator) TC-EL thermocouple (linear, external comparison) TC-L00C thermocouple (linear, ref. temp. 0 °C) TC-L50C thermocouple (linear, ref. temp. 50 °C)	TC-IL	Dynamic	Channel group
• Measuring range	See table <i>Measuring methods and ranges</i>	Type K		
• Reaction to open thermocouple	Overflow; underflow	Overflow		
• Temperature unit	Degrees Centigrade; degrees Fahrenheit	Degrees Centigrade	Dynamic	Module
• Mode of operation	8-channel mode (hardware filter) 8-channel mode (software filter) 4-channel mode (hardware filter)	8 channels, hardware filter	Dynamic	Module
• Noise suppression*	50/60/400 Hz; 400 Hz; 60 Hz; 50 Hz;	50/60/400 Hz	Dynamic	Channel group
• Smoothing	None Low Average High	None	Dynamic	Channel group

* 50/60/400 Hz only programmable for 8-channel mode (hardware filter) and 4-channel mode (hardware filter); 50 Hz, 60 Hz or 400 Hz only programmable for 8-channel mode (software filter)

See also

Programming analog modules (Page 5-31)

Diagnostic messages of analog input modules (Page 5-33)

6.10.3 Additional information on SM 331; AI 8 x TC

Modes of operation

Operating modes of the SM 331; AI 8 x TC:

- 8-channel mode (hardware filter)
- 8-channel mode (software filter)
- 4-channel mode (hardware filter)

The operating mode influences the module cycle time.

8-channel mode (hardware filter)

In this mode, the module does not toggle between the two channels of each group. The four analog-to-digital converters (ADC) of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, then those with the odd numbers 1, 3, 5 and 7 (see the figure below.)

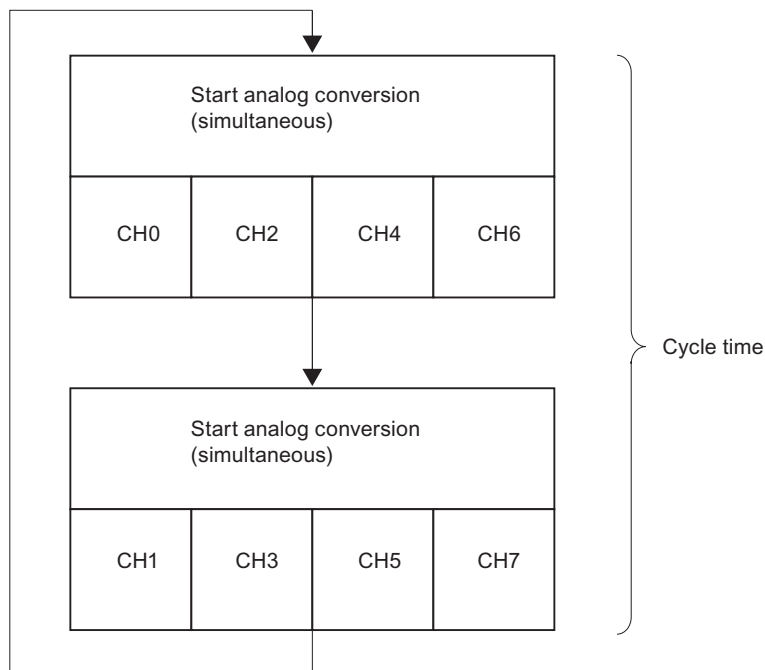


Figure 6-29 8-channel mode cycle time (hardware filter)

Cycle time of module in 8-channel mode (hardware filter)

The channel conversion time, including module communication time, is 91 ms. After this cycle, the module has to change over to the second channel of the group using OptoMOS relays. Opto-MOS relays require switching and settling times of 7 ms. Each channel requires a time of 98 ms, i.e. the total cycle time equals 196 ms.

$$\text{Cycle time} = (t_k + t_U) \times 2$$

$$\text{Cycle time} = (91 \text{ ms} + 7 \text{ ms}) \times 2$$

$$\text{Cycle time} = \mathbf{196 \text{ ms}}$$

t_k : Conversion time for one channel

t_U : Time for changing over to the other channel in a channel group

8-channel mode (software filter)

Analog-to-digital conversion in this mode is identical to the conversion in 8-channel mode (hardware filter). The four analog-to-digital converters (ADC) of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, then those with the odd numbers 1, 3, 5 and 7 (see the figure below.)

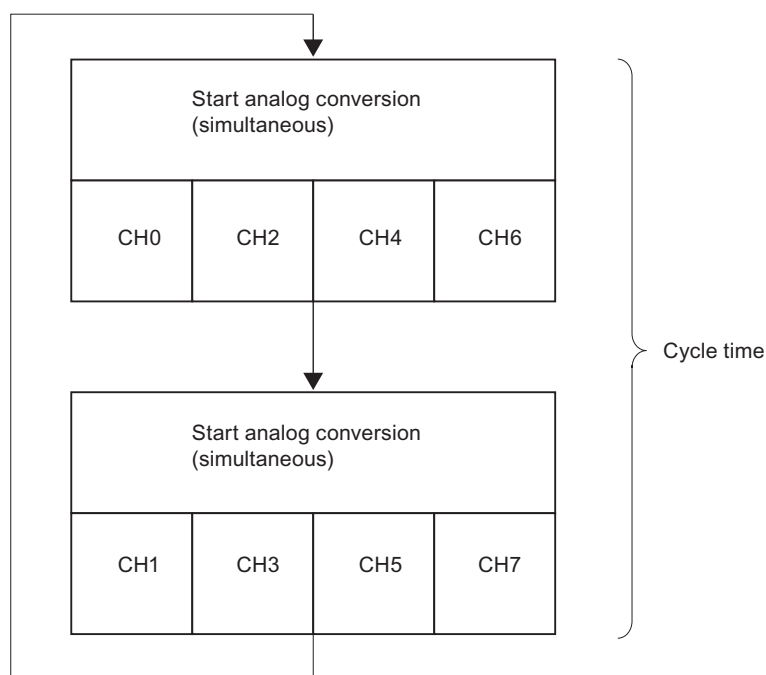


Figure 6-30 8-channel mode cycle time (software filter)

Cycle time of module in 8-channel mode (software filter)

However, the channel conversion time is oriented on the programmed noise suppression. At a set interference frequency of 50 Hz, the channel conversion time is 76 ms, including communication time. At a set an interference frequency of 60 Hz, the channel conversion time is 65 ms. You can reduce channel conversion times to 16 ms by setting an interference frequency of 400 Hz. As in "hardware filter, 8channel" mode, the module has to toggle to the second channel of the group within a changeover time of 7 ms using the Opto-MOS relays. The table below shows this relationship.

Table 6-30 Cycle times in 8-channel mode (software filter)

Programmed noise suppression	Channel cycle time*	Module cycle time (all channels)
50 Hz	83 ms	166 ms
60 Hz	72 ms	144 ms
400 Hz	23 ms	46 ms
* Channel cycle time = channel conversion time + 7 ms channel changeover time within the group		

4-channel mode (hardware filter)

In this mode, the module does not toggle between the channels of the various groups. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6.

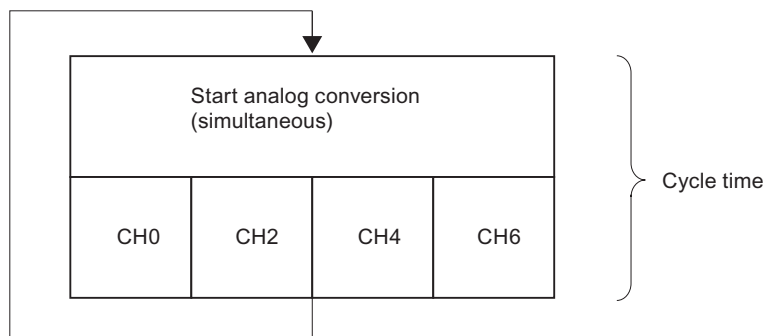


Figure 6-31 4-channel mode cycle time (hardware filter)

Cycle time of module in 4-channel mode (hardware filter)

In 4-channel mode, the converted value tunes to 100 % within 80 ms and is updated every 10 ms. The channel and module cycle time are always identical, because the module does toggle between the channels of a group: 10 ms.

Channel conversion time = channel cycle time = module cycle time = **10 ms**

Cycle time extension due to wire-break monitoring

The wire-break monitoring software function of the module is available in all operating modes.

The 8-channel mode (hardware or software filter modes) extends module cycle times by 4 ms, irrespective of the number of channels at which wire-break monitoring is enabled.

In 4-channel mode (hardware filter), the module interrupts processing of input data for the duration of 170 ms to perform a wire-break check, i.e. each wire-break check extends the module cycle time by 93 ms.

Unused channels

For unused channels, set the "disabled" instruction at the "measuring method" parameter. This reduces the module's cycle time.

You need to terminate any non-switched channels in an enabled group, i.e. you short circuit the positive input and negative input of that channel.

This action enables you to achieve the following outcome:

- this prevents measurement errors on the channels used within a group
- Diagnosis messages from the unused channel in a group are suppressed

Short-circuit to M or L

If you short-circuit an input channel to M or L, the module does not suffer any damage. The channel continues to output valid data and does not report a diagnostics event.

Special features of channel groups with respect to hardware interrupts upon limit violation

You can set the high and low limits triggering hardware interrupts separately for each channel in *STEP 7*.

End of cycle interrupt

You can synchronize a process with the conversion cycle of the module by enabling the end of cycle interrupt. The interrupt occurs when the conversion of all the enabled channels is complete.

Table 6-31 Content of the 4 bytes of additional OB40 information during hardware or end of cycle interrupts

Content of the 4 bytes of additional information		2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	Byte
Special analog flags	2 bits per channel to identify the range									
	High limit exceeded at channel	7	6	5	4	3	2	1	0	0
	Low limit exceeded at channel	7	6	5	4	3	2	1	0	1
	End of cycle event						X			2
	Free byte									3

Programming restrictions when operating SM 331; AI 8 x TC with PROFIBUS masters which only support DPV0.

When operating the SM 331; AI 8 x TC analog input module on an ET 200M PROFIBUS slave system and the PROFIBUS master is not an S7 master, certain parameters are not permitted. Non-S7 masters do not support hardware interrupts. All parameters associated with those functions are thus disabled. This includes hardware interrupt enable, hardware restrictions and end of cycle interrupt enable. All other parameters are permitted.

Operation of the module on the ET 200M Distributed IO Device

Operation of SM 331; AI 8 x TC on ET 200M requires one of the following IM 153 x:

- IM 153-1; as of 6ES7153-1AA03-0XB0, E 01
- IM 153-2; as of 6ES7153-2AA02-0XB0, E 05
- IM 153-2; as of 6ES7153-2AB01-0XB0, E 04

6.11 Analog output module SM 332; AO 8 x 12 Bit; (6ES7332-5HF00-0AB0)

Order number

6ES7332-5HF00-0AB0

Properties

- 8 outputs in one group
- The output can be selected by individual channel
 - Voltage output
 - Current output
- Resolution 12 bits
- Programmable diagnostics and diagnostic interrupt
- Programmable diagnostic alarm
- electrically isolated to the backplane bus interface and load voltage

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The following diagrams show wiring examples. These connection examples apply to all channels (channel 0 to 7).

Note

When you switch the rated load voltage (L+) off and on, the output may carry incorrect interim values for the duration of for approx. 10 ms.

Wiring: 2 and 4-wire measuring transducer for current measurement

The following image depicts:

- 2-wire connection, no compensation for line resistors and
- 4-wire connection with compensation for line resistors

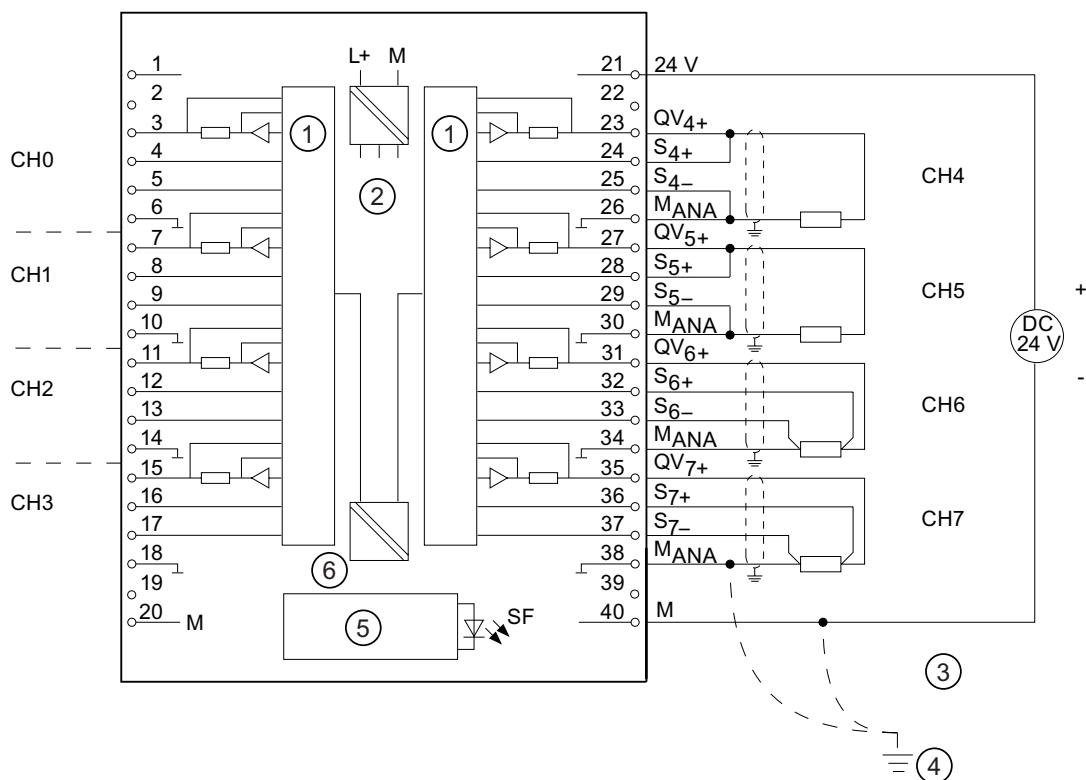


Figure 6-32 Wiring and block diagrams

Numeral	Description
①	DAC
②	Internal supply
③	Potential compensation
④	Function ground/earth
⑤	Backplane bus interface
⑥	Electrical isolation

[illegible]

Numeral	Description
①	DAC
②	Internal supply
③	Potential compensation
④	Function ground/earth
⑤	Backplane bus interface
⑥	Electrical isolation

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 272 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	8
Cable length • shielded	max. 200 m

6.11 Analog output module SM 332; AO 8 x 12 Bit; (6ES7332-5HF00-0AB0)

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
• Reverse polarity protection	Yes
• Electrical isolation	Yes
• between channels and the backplane bus	Yes
• between channels and electronics power supply	Yes
• between channels	No
• between channels and load voltage L+	Yes
Permissible potential difference	
• between S- and M _{ANA} (CMV)	3 VDC
• between M _{ANA} and M _{internal} (V _{ISO})	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 100 mA
• from supply voltage L+ (no load)	max. 340 mA
Power loss of the module	typ. 6.0 W
Formation of analog values	
• Resolution, including sign	
• ± 10 V; ± 20 mA; 4 mA to 20 mA; 1 V to 5 V	11 bits + sign
• 0 V to 10 V; 0 mA to 20 mA;	12 bits max. 0.8 ms
• Conversion time (per channel)	
Settling time	
• with resistive load	0.2 ms
• with capacitive load	3.3 ms
• with inductive load	0.5 ms (1 mH)
	3.3 ms (10 mH)
Noise suppression, error limits	
• Crosstalk between outputs	> 40 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output	$\pm 0,5$ %
• Current output	$\pm 0,6$ %
Basic error limit (operational error limit at 25 °C, relative to output range)	
• Output voltage	$\pm 0,4$ %
• Output current	$\pm 0,5$ %
• Temperature error (relative to output range)	± 0.002 %/K
• Linearity error (relative to output range)	+ 0,05 %
• Repetition accuracy (in transient state at 25 °C, relative to output range)	$\pm 0,05$ %
• Output ripple; bandwidth 0 kHz to 50 kHz (relative to output range)	$\pm 0,05$ %
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	programmable

Technical data	
Diagnostics functions - Group error display - Reading diagnostics information	programmable red LED (SF) supported
Actuator selection data	
Output ranges (rated values)	
Voltage	$\pm 10 \text{ V}$ 0 V to 10 V 1 V to 5 V
Current	$\pm 20 \text{ mA}$ 0 mA to 20 mA 4 mA to 20 mA
Load impedance (in the rated output range)	
- For voltage outputs - capacitive load	min. 1 k Ω max. 1 μF
- For current outputs - at CMV < 1 V - with inductive load	max. 500 Ω max. 600 Ω max. 10 mH
Voltage output - Short-circuit protection - Short-circuit current	Yes max. 25 mA
Current output Noload voltage	max. 18 V
- Destruction limit against external voltages/currents - Voltage at outputs to M_{ANA} - Current	max. 18 V continuous; 75 V for a duration of max. 1 s (duty factor 1:20) max. 50 mA d.c.
Wiring the actuators - for voltage output 4-wire connection - for current output 2-wire connection	with 40-pin front connector supported supported

6.11.1 Output ranges SM 332; AO 8 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable them. You configure the outputs at the "output type" parameter in *STEP 7*.

The output type "Voltage" and output range " ± 10 V" are set by default at the module. You can always use this combination of output type and range without having to program the SM 332; AO 8 x 12 Bit in *STEP 7*.

Table 6-32 Output ranges

Selected type of output	Output range
Voltage	1 V to 5 V 0 V to 10 V ± 10 V
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA

See also

Representation of the analog values of analog output channels (Page 5-18)

6.11.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides an overview of configurable parameters, including defaults:

Table 6-33 Summary of parameters SM 332; AO 8 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable					
• Diagnostic interrupt	Yes/no		No	Dynamic	Module
Diagnostics					
• Group diagnostics	Yes/no		No	static	Channel
Output	disabled		V	Dynamic	Channel
• Output type	Voltage		± 10 V		
	Current				
• Output range	See table of <i>output ranges</i>				
Reaction to CPU STOP	ASS	Outputs zero current/voltage	ASS	Dynamic	Channel
	HLV	Hold last value			
	SSV	Set substitution value			

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 8 x 12 Bit. You can thus assign individual parameters to each output channel.

Assign the parameters you set at the SFCs in your user program to channel groups. Each output channel of SM 332; AO 8 x 12 Bit is thus assigned to a channel group, i.e. output channel 0 > channel group 0, for example.

Note

The output may carry incorrect interim values if you modify output ranges while SM 332; AO 8 x 12 Bit is in RUN.

See also

Programming analog modules (Page 5-31)

Diagnostics messages of analog output modules (Page 5-33)

6.11.3 Additional information to SM 332; AO 8 x 12 Bit

Unused channels

To take unused output channels of SM 332; AO 8 x 12 Bit off power, set the "disabled" argument at the "output type" parameter. Disabled channels can be left unused.

Wirebreak monitoring

SM 332; AO 8 x 12 Bit only monitors wire-break at current outputs.

In output ranges 0...20mA and ± 20 mA, no "safe" wire break inspection can be carried out at output values of -20s...+200 μ A.

Short-circuit monitoring

SM 332; AO 8 x 12 Bit only monitors short-circuit at voltage outputs.

6.12 Analog output module SM 332; AO 4 x 16 bit; isochronous; (6ES7332-7ND02-0AB0)

Order number

6ES7332-7ND02-0AB0

Properties

- 4 outputs in 4 channel groups
- The output channels can be programmed as
 - Voltage output
 - Current output
- Resolution 16 bits
- Isochronous mode supported
- Supports the "CiR" function
- Programmable diagnostics and diagnostic interrupt
- electrical isolation between:
 - backplane bus interface and analog output channel
 - analog output channels
 - analog output and L+, M
 - Backplane bus circuit and L+, M

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The following diagrams show wiring examples.

Note

When you switch the rated load voltage (L+) off and on, the output may carry incorrect interim values for the duration of for approx. 10 ms.

Wiring: 4-wire connection

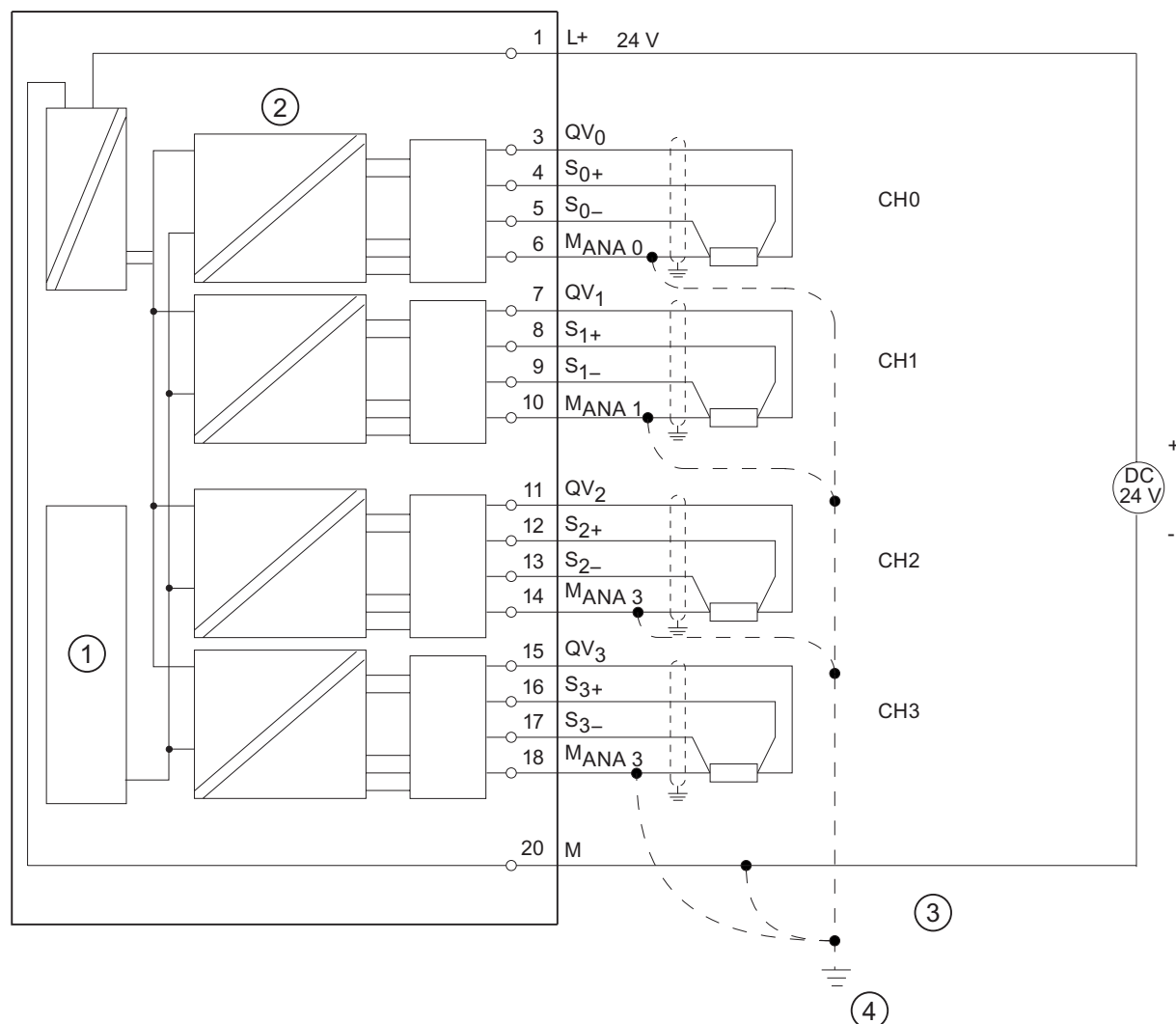


Figure 6-34 Wiring and block diagrams

- ① Backplane bus interface
- ② Electrical isolation
- ③ Potential compensation
- ④ Function ground/earth

Wiring: 2-wire connection

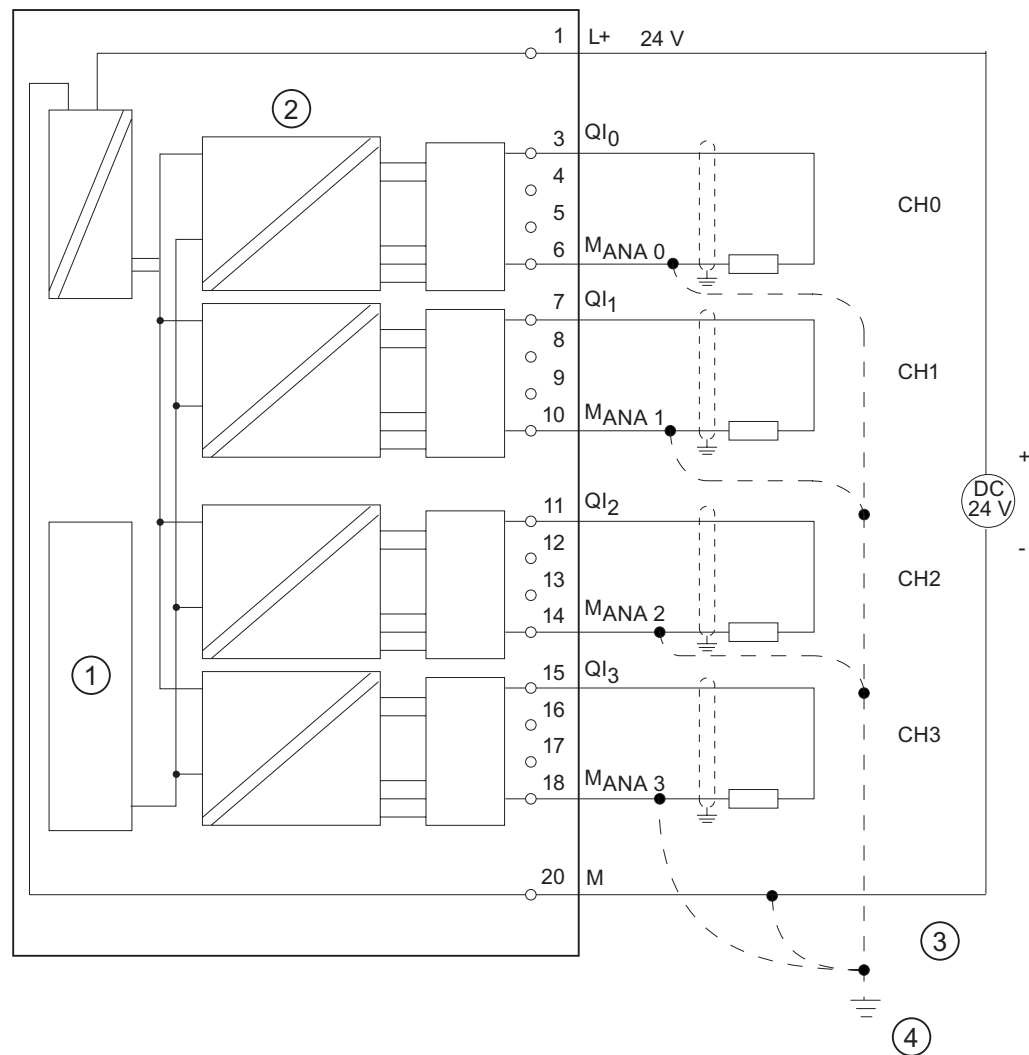


Figure 6-35 Wiring and block diagrams

- ① Backplane bus interface
- ② Electrical isolation
- ③ Potential compensation
- ④ Function ground/earth

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 220 g
Module-specific data	
Isochronous mode supported	Yes
Support of CiR	Yes
Reaction of non-programmed outputs	return the last valid output value before the parameterization
Number of outputs	4
Cable length shielded	max. 200 m
Voltages, currents and potentials	
Rated load voltage L+	24 VDC
Reverse polarity protection	Yes
Electrical isolation	
between channels and the backplane bus	Yes
between channels and electronics power supply	Yes
between channels	Yes
Permissible potential difference	
Between outputs (ECM)	200 VDC / 120 VAC
between M_{ANA} and M_{internal} (V_{ISO})	200 VDC / 120 VAC
Isolation test voltage	1500 VDC
Current consumption	
from the backplane bus	max. 120 mA
from load voltage L+ (no-load)	max. 290 mA
Power loss of the module	typ. 3 W
Formation of analog values	
Resolution (including sign)	
± 10 V	16 bits
0 V to 10 V	15 bits
1 V to 5 V	14 bits
± 20 mA	16 bits
0 mA to 20 mA	15 bits
4 mA to 20 mA	15 bits
Conversion time (per channel)	
in standard operation	<200 µs
in isochronous mode	640 µs
Basic execution time of the module (independent of the number of enabled channels)	
in standard operation	<800 µs
in isochronous mode	750 µs

6.12 Analog output module SM 332; AO 4 x 16 bit; isochronous; (6ES7332-7ND02-0AB0)

Technical data	
Settling time	
• with resistive load	0.2 ms
• with capacitive load	3.3 ms
• with inductive load	0.5 ms (1 mH) / 3.3 ms (10 mH)
Noise suppression, error limits	
Crosstalk between outputs	> 100 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output	±0,12%
• Current output	±0,18%
Basic error limit (operational error limit at 25°, relative to output range)	
• Voltage output ± 10 V 0 V to 10 V 1 V to 5 V	±0,02% ±0,02% ±0,04%
• Current output ± 20 mA 0 mA to 20 mA 4 mA to 20 mA	±0,02% ±0,02% ±0,04%
Temperature error (relative to output range)	
• Voltage output	± 0.0025%/K
• Current output	± 0.004%/K
Linearity error (relative to output range)	±0,004%
Repeat accuracy (in transient state at 25 °C, relative to output range)	±0,002 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	±0,05 %
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	programmable
Diagnostics functions	programmable
• Group error display	red LED (SF)
• Reading diagnostics information	supported
Injection of substitution values	Yes, programmable
Actuator selection data	
Output ranges (rated values)	
• Voltage	± 10 V 0 V to 10 V 1 V to 5 V
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA
Load impedance (in the rated range of the output)	
• For voltage outputs – capacitive load	min. 1 kΩ max. 1 µF
• For current outputs – inductive load	max. 500 Ω max. 1 mH

Technical data	
Voltage output - Short-circuit protection - Short-circuit current	Yes max. 40 mA
Current output Noload voltage	max. 18 V
Destruction limit against external voltages/currents - Voltage at outputs to M_{ANA} - Current	max. 15 V, continuous 75 V for the duration of max. 1 s (duty factor 1:20) 20) max. 50 mA d.c.
Wiring the actuators - For voltage output 4-wire connection (measuring lead) - For current output 2-wire connection	with 20-pin front connector supported supported

6.12.1 Output ranges SM 332; AO 4 x 16 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable these. You configure the output circuits at the "output type" parameter in *STEP 7*.

The output type "Voltage" and output range " ± 10 V" are set by default at the module. You can always use this combination of output type and range without having to program the SM 332; AO 4 x 16 Bit in *STEP 7*.

Output ranges

You program the output ranges for voltage and current outputs in *STEP 7*.

Table 6-34 Output ranges SM 332; AO 4 x 16 Bit

Selected type of output	Output range
Voltage	1 V to 5 V 0 V to 10 V ± 10 V
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA

6.12.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides overview of configurable parameters and defaults.

Table 6-35 Summary of parameters SM 332; AO 8 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable					
• Diagnostic interrupt	Yes/no		No	Dynamic	Module
Diagnostics					
• Group diagnostics	Yes/no		No	static	Channel
Output	disabled		V	Dynamic	Channel
• Output type	Voltage		$\pm 10\text{ V}$		
	Current				
• Output range	See table of <i>Output ranges for SM 332; AO 4 x 16 bit</i>				
Reaction to CPU STOP	ASS	Outputs zero current/voltage	ASS	Dynamic	Channel
	HLV	Hold last value			

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 4 x 16 Bit. You can thus assign individual parameters to each output channel.

Assign the parameters you set at the SFCs in your user program to channel groups. Each output channel of SM 332; AO 4 x 16 Bit is thus assigned to a channel group, i.e. output channel 0 > channel group 0, for example.

Note

The output may carry incorrect interim values if you modify output ranges while SM 332; AO 4 x 16 Bit is in RUN.

See also

Programming analog modules (Page 5-31)

Diagnostics messages of analog output modules (Page 5-33)

6.12.3 Isochronous mode

Properties

Reproducible reaction times (i.e. of the same length) are achieved in a SIMATIC system by means of a constant DP bus cycle, and synchronization of the single cyclic processes outlined below:

- Cyclic user program execution. The length of the cycle time may vary due to acyclic program branching.
- Independent and variable DP cycle on the PROFIBUS subnet
- Cyclic operation of the backplane bus of the DP slave.
- Cyclic signal conditioning and conversion at the electronic modules of the DP slave.

The constant DP cycle runs in synchronism and at the same length. The CPU run levels (OB61 to OB64) and isochronous IO are synchronized with this cycle. I/O data are therefore transferred at defined and constant intervals (isochronous mode.) Maximum oscillation of $\pm 50 \mu\text{s}$.

Requirements

- The DP master and slave must support isochronous mode. You require *STEP 7* V5.2 or higher.

Mode of operation: Isochronous

Conditions of isochronous mode:

Processing and activation time T_{WA} between reading the output value to the transfer buffer and loading it into the D/A converter for output	750 μs
T_{DPmin}	1100 μs
Diagnostic interrupt	max. 4 x T_{DP}

Calculation of filter and processing times

The same time conditions always apply, regardless of the number of configured channels.

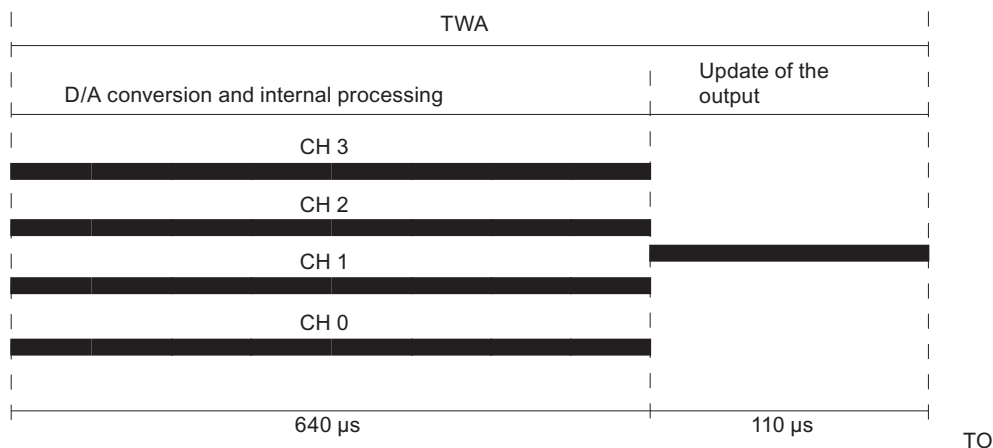


Figure 6-36 Calculation of the processing time and refresh time of the output

Definition of isochronous mode

Within the time $T_O - T_{WA}$, the module reads the output data and saves these internally. After the internal processing time of each channel, the results are written to the various DACs.

Further information

For further information on isochronous mode, refer to the *STEP 7* Online Help, and to the *Distributed I/O Device ET 200M* and *Isochrone mode* manuals.

6.12.4 Additional information to SM 332; AO 4 x 16 Bit

Unused channels

To take unused output channels of SM 332; AO 4 x 16 Bit off power, set the "disabled" argument at the "output type" parameter, and leave the terminal open.

Substitution values

You can configure the SM 332; AO 4 x 16 Bit for CPU STOP mode as follows: Outputs off power, hold last value or inject substitution values. Injected substitution values must be within the output range.

6.13 Analog output module SM 332; AO 4 x 12 Bit; (6ES7332-5HD01-0AB0)

Order number

6ES7332-5HD01-0AB0

Properties

- 4 outputs in one group
- The output can be selected by individual channel
 - Voltage output
 - Current output
- Resolution 12 bits
- Programmable diagnostics and diagnostic interrupt
- Electrically isolated to backplane bus interface and load voltage

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The following diagrams show wiring examples.

Note

When you switch the rated load voltage (L+) off and on, the output may carry incorrect interim values for the duration of approx. 10 ms.

Wiring: 2 and 4-wire measuring transducer for current measurement

The following Fig. represents the 2-wire connection with no compensation for line resistors and the 4-wire connection with compensation for line resistors.

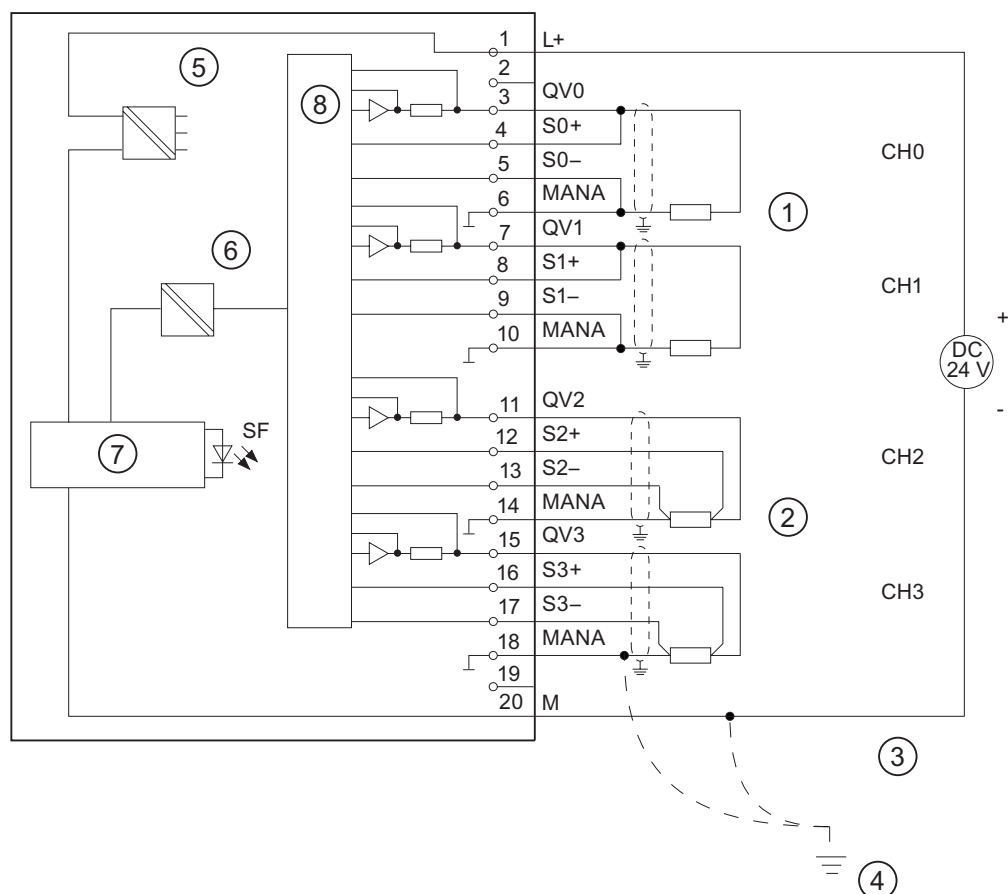


Figure 6-37 Wiring and block diagrams

- ① 2-wire connection, no compensation for line resistors
- ② 4-wire connection, with compensation for line resistors
- ③ Potential compensation
- ④ Function ground/earth
- ⑤ Internal supply
- ⑥ Electrical isolation
- ⑦ Backplane bus interface
- ⑧ Analog-to-Digital Converter (ADC)

Wiring: Current output

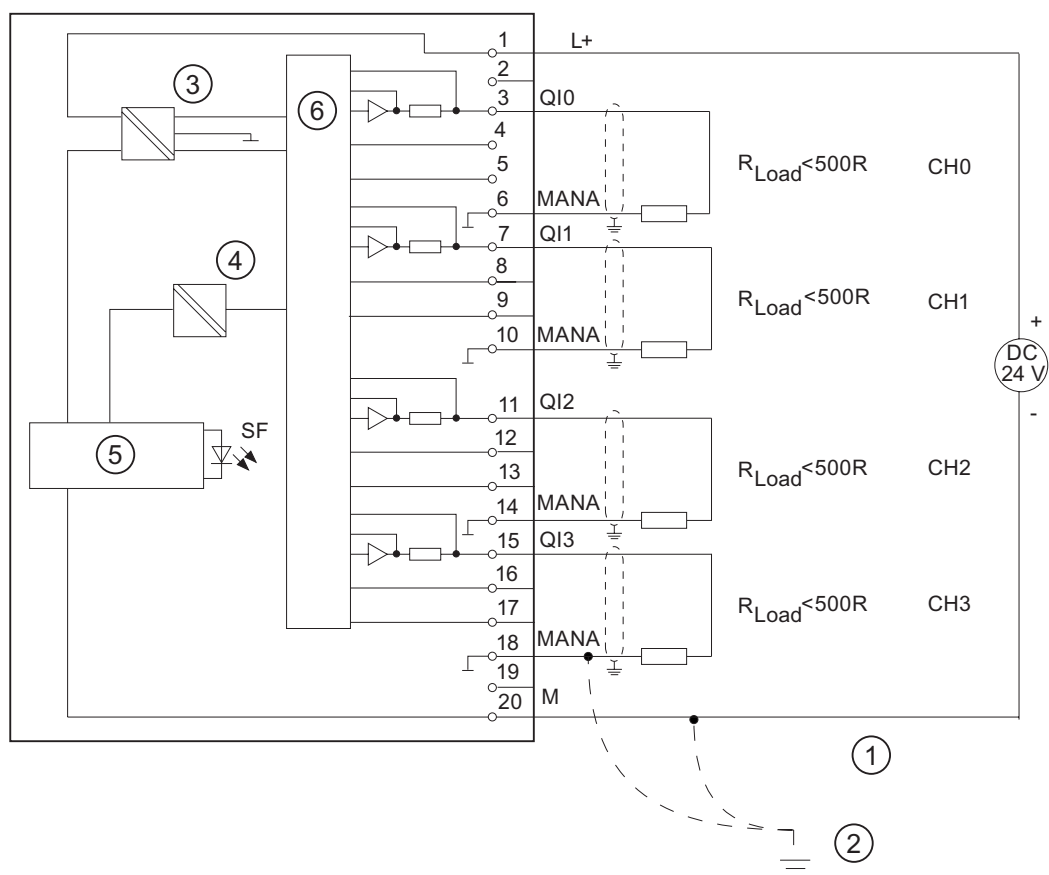


Figure 6-38 Wiring and block diagrams

- ① Potential compensation
- ② Function ground/earth
- ③ Internal supply
- ④ Electrical isolation
- ⑤ Backplane bus interface
- ⑥ Analog-to-Digital Converter (ADC)

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 220 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	4

6.13 Analog output module SM 332; AO 4 x 12 Bit; (6ES7332-5HD01-0AB0)

Technical data	
Cable length	
• shielded	max. 200 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
• Reverse polarity protection	Yes
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels and electronics power supply	Yes
• between channels	No
• between channels and load voltage L+	Yes
Permissible potential difference	
• between S- and M _{ANA} (CMV)	3 VDC
• between M _{ANA} and M _{internal} (V _{ISO})	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 60 mA
• from load voltage L+ (no-load)	max. 240 mA
Power loss of the module	typ. 3 W
Formation of analog values	
Resolution (including overshoot range)	
• ± 10 V; ± 20 mA;	11 bits + sign
• 4 mA to 20 mA; 1 V to 5 V	
• 0 V to 10 V; 0 mA to 20 mA	12 bits
Conversion time (per channel)	max. 0.8 ms
Settling time	
• with resistive load	0.2 ms
• with capacitive load	3.3 ms
• with inductive load	0.5 ms (1 mH)
	3.3 ms (10 mH)
Noise suppression, error limits	
Crosstalk between outputs	> 40 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output	$\pm 0,5$ %
• Current output	$\pm 0,6$ %
Basic error limit (operational error limit at 25°, relative to output range)	
• Voltage output	$\pm 0,4$ %
• Current output	$\pm 0,5$ %
Temperature error (relative to output range)	± 0.002 %/K
Linearity error (relative to output range)	$\pm 0,05$ %
Repetition accuracy (in transient state at 25 °C, relative to output range)	$\pm 0,05$ %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	$\pm 0,05$ %

Technical data	
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	programmable
Diagnostics functions	programmable
• Group error display	red LED (SF)
• Reading diagnostics information	supported
Injection of substitution values	Yes, programmable
Actuator selection data	
Output ranges (rated values)	
• Voltage	± 10 V 0 V to 10 V 1 V to 5 V
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA
Load impedance (in the rated range of the output)	
• For voltage outputs – capacitive load	min. 1 kΩ max. 1 μF
• For current outputs – at CMV < 1 V – inductive load	max. 500 Ω max. 600 Ω max. 10 mH
Voltage output	
• Short-circuit protection	Yes
• Short-circuit current	max. 25 mA
Current output	
• Noload voltage	max. 18 V
Destruction limit against external voltages/currents	
• Voltage at outputs to M _{ANA}	max. 18 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20)
• Current	max. 50 mA d.c.
Wiring the actuators	with 20-pin front connector
• For voltage output – 4-wire connection (measuring lead)	supported
• For current output – 2-wire connection	supported

6.13.1 Output ranges SM 332; AO 4 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable these. You configure the outputs at the "output type" parameter in *STEP 7*.

The output type "Voltage" and output range " ± 10 V" are set by default at the module. You can always use this combination of output type and range without having to program the SM 332; AO 4 x 12 bit in *STEP 7*.

Output ranges

You program the output ranges for voltage and current outputs in *STEP 7*.

Table 6-36 Output ranges SM 332; AO 4 x 12 Bit

Selected type of output	Output range
Voltage	1 V to 5 V 0 V to 10 V ± 10 V
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA

6.13.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides overview of configurable parameters and defaults.

Table 6-37 Summary of parameters SM 332; AO 4 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable					
• Diagnostic interrupt	Yes/no		No	Dynamic	Module
Diagnostics					
• Group diagnostics	Yes/no		No	static	Channel
Output	disabled		V	Dynamic	Channel
• Output type	Voltage		± 10 V		
	Current				
• Output range	See table of <i>Output ranges for SM 332; AO 4 x 12 Bit</i>				
Reaction to CPU STOP	ASS	Outputs zero current/voltage	ASS	Dynamic	Channel
	HLV	Hold last value			
	SSV	Set substitution value			

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 4 x 12 Bit. You can thus assign individual parameters to each output channel.

Assign the parameters you set at the SFCs in your user program to channel groups. Each output channel of SM 332; AO 4 x 12 Bit is thus assigned to a channel group, i.e. output channel 0 > channel group 0, for example.

Note

The output may carry incorrect interim values if you modify output ranges while SM 332; AO 4 x 12 Bit is in RUN.

See also

Programming analog modules (Page 5-31)

Diagnostics messages of analog output modules (Page 5-33)

6.13.3 Additional information to SM 332; AO 4 x 12 Bit

Unused channels

To take unused output channels of SM 332; AO 4 x 12 Bit off power, set the "disabled" argument at the "output type" parameter. Disabled channels can be left unused.

Wirebreak monitoring

SM 332; AO 4 x 12 Bit only monitors wire-break at current outputs.

In output ranges 0...20mA and ± 20 mA, no "safe" wire break inspection can be carried out at output values of -20s...+200 μ A.

Short-circuit monitoring

SM 332; AO 4 x 12 Bit only monitors short-circuit at voltage outputs.

Substitution values

You can configure the SM 332; AO 4 x 12 Bit for CPU STOP mode as follows: Outputs off power, hold last value or inject substitution values. Injected substitution values must be within the output range.

6.14 Analog output module SM 332; AO 2 x 12 Bit; (6ES7332-5HB01-0AB0)

Order number: : "Standard module"

6ES7332-5HB01-0AB0

Order number: "SIPLUS S7-300 module"

6AG1332-5HB01-2AB0

Properties

- 2 outputs in one group
- The outputs can be selected by individual channel
 - Voltage output
 - Current output
- Resolution 12 bits
- Programmable diagnostics and diagnostic interrupt
- Electrically isolated to backplane bus interface and load voltage

Diagnostics

For information on diagnostics message consolidated at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The following diagrams show wiring examples.

Note

When you switch the rated load voltage (L+) off and on, the output may carry incorrect interim values for the duration of for approx. 10 ms.

Wiring: 2 and 4-wire measuring transducer for current measurement

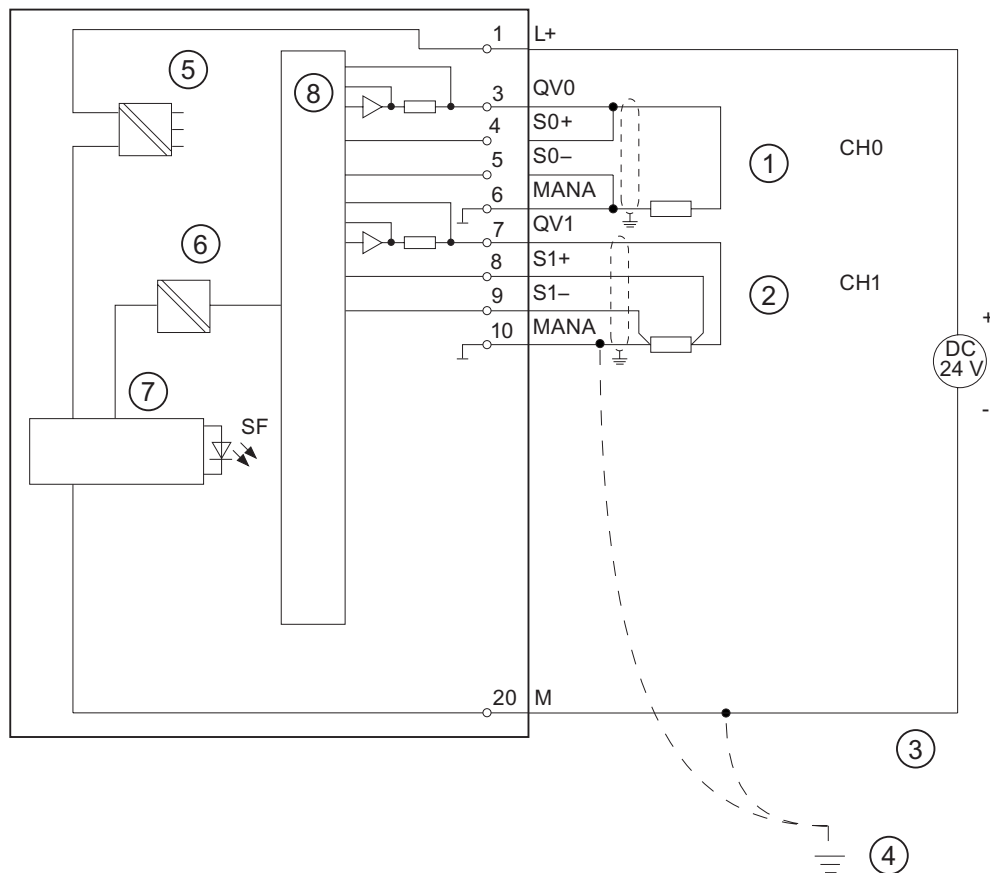


Figure 6-39 Wiring and block diagrams

- ① 2-wire connection: without compensation for the line resistors
- ② 4-wire connection: with compensation for the line resistors
- ③ Potential compensation
- ④ Function ground/earth
- ⑤ Internal supply
- ⑥ Electrical isolation
- ⑦ Backplane bus interface
- ⑧ Analog-to-Digital Converter (ADC)

Connection for current output

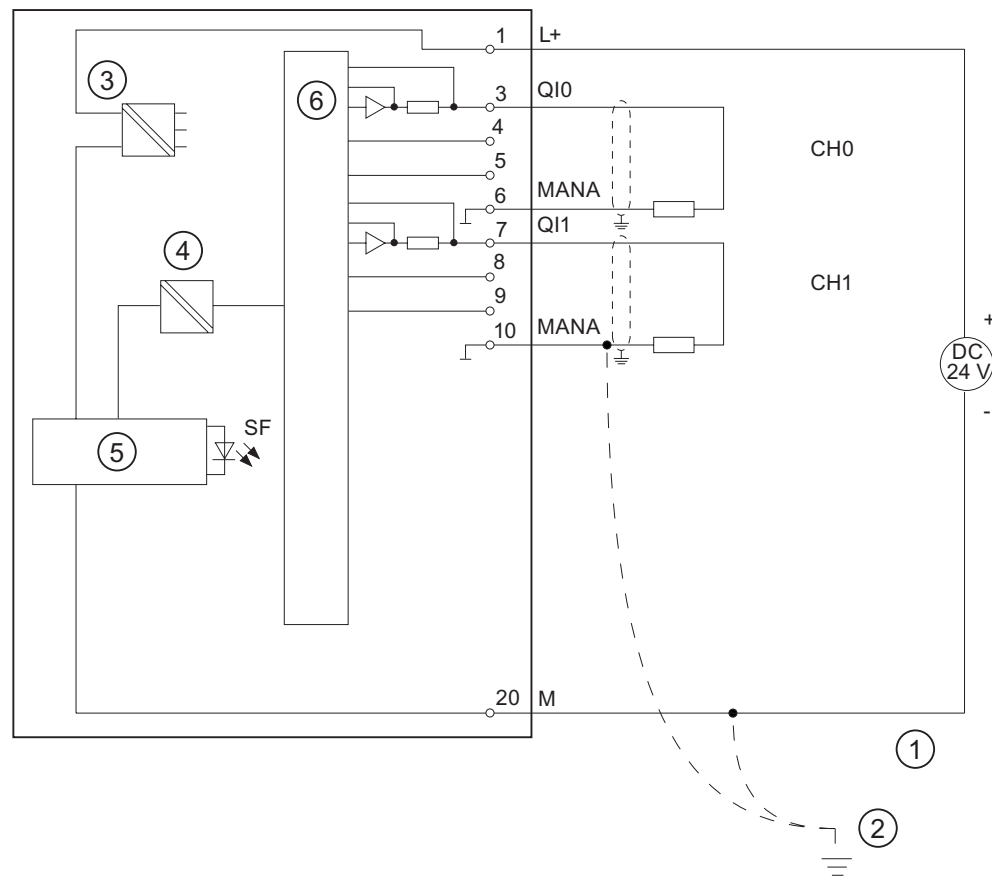


Figure 6-40 Wiring and block diagrams

- ① Potential compensation
- ② Function ground/earth
- ③ Internal supply
- ④ Electrical isolation
- ⑤ Backplane bus interface
- ⑥ Analog-to-Digital Converter (ADC)

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 220 g
Module-specific data	
Isochronous mode supported	No

Technical data	
Number of outputs	2
Cable length	
• shielded	max. 200 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
• Reverse polarity protection	Yes
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels and electronics power supply	Yes
• between channels	No
• between channels and load voltage L+	Yes
Permissible potential difference	
• between S- and M _{ANA} (CMV)	3 VDC
• between M _{ANA} and M _{internal} (V _{iso})	75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption	
• from the backplane bus	max. 60 mA
• from load voltage L+ (no-load)	max. 135 mA
Power loss of the module	typ. 3 W
Formation of analog values	
Resolution (including overshoot range)	
• ± 10 V; ± 20 mA;	11 bits + sign
• 4 mA to 20 mA; 1 V to 5 V	
• 0 V to 10 V; 0 mA to 20 mA	12 bits
Conversion time (per channel)	max. 0.8 ms
Settling time	
• with resistive load	0.2 ms
• with capacitive load	3.3 ms
• with inductive load	0.5 ms (1 mH)
	3.3 ms (10 mH)
Noise suppression, error limits	
Crosstalk between outputs	> 40 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output	$\pm 0,5$ %
• Current output	$\pm 0,6$ %
Basic error limit (operational error limit at 25°, relative to output range)	
• Voltage output	$\pm 0,4$ %
• Current output	$\pm 0,5$ %
Temperature error (relative to output range)	± 0.002 %/K
Linearity error (relative to output range)	$\pm 0,05$ %
Repetition accuracy (in transient state at 25 °C, relative to output range)	$\pm 0,05$ %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	$\pm 0,05$ %

Technical data	
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	programmable
Diagnostics functions	programmable
• Group error display	red LED (SF)
• Reading diagnostics information	supported
Injection of substitution values	Yes, programmable
Actuator selection data	
Output ranges (rated values)	
• Voltage	± 10 V 0 V to 10 V 1 V to 5 V
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA
Load impedance (in the rated range of the output)	
• For voltage outputs – capacitive load	min. 1 kΩ max. 1 μF
• For current outputs – at CMV < 1 V – inductive load	max. 500 Ω max. 600 Ω max. 10 mH
Voltage output	
• Short-circuit protection	Yes
• Short-circuit current	max. 25 mA
Current output	
• No-load voltage	max. 18 V
Destruction limit against external voltages/currents	
• Voltage at outputs to M _{ANA}	max. 18 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20)
• Current	max. 50 mA d.c.
• Wiring the actuators	with 20-pin front connector
• For voltage output – 2-wire connection – 4-wire connection (measuring line)	supported supported
• For current output – 2-wire connection	supported

6.14.1 Output ranges SM 332; AO 2 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable these. You configure the outputs at the "output type" parameter in *STEP 7*.

The output type "Voltage" and output range " ± 10 V" are set by default at the module. You can always use this combination of output type and range without having to program the SM 332; AO 2 x 12 Bit in *STEP 7*.

Output ranges

You program the output ranges for voltage and current outputs in *STEP 7*.

Table 6-38 Output ranges SM 332; AO 2 x 12 Bit

Selected type of output	Output range
Voltage	1 V to 5 V 0 V to 10 V ± 10 V
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA

6.14.2 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides an overview of configurable parameters, including defaults:

Table 6-39 Summary of parameters SM 332; AO 2 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable Diagnostic interrupt	Yes/no		No	Dynamic	Module
Diagnostics Group diagnostics	Yes/no		No	static	Channel
Output Output type	disabled Voltage Current		V ± 10 V	Dynamic	Channel
Output range	See table of <i>Output ranges for SM 332; AO 2 x 12 Bit</i>				
Reaction to CPU STOP	ASS HLV SSV	Outputs zero current/voltage Hold last value Set substitution value	ASS	Dynamic	Channel

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 2 x 12 Bit. You can thus assign individual parameters to each output channel.

Assign the parameters you set at the SFCs in your user program to channel groups. Each output channel of SM 332; AO 2 x 12 Bit is thus assigned to a channel group, i.e. output channel 0 > channel group 0, for example.

Note

The output may carry incorrect interim values if you modify output ranges while SM 332; AO 2 x 12 Bit is in RUN.

See also

Diagnostics messages of analog output modules (Page 5-33)

Programming analog modules (Page 5-31)

6.14.3 Additional information to SM 332; AO 2 x 12 Bit

Unused channels

To take unused output channels of SM 332; AO 2 x 12 Bit off power, set the "disabled" argument at the "output type" parameter. Disabled channels can be left unused.

Wirebreak monitoring

SM 332; AO 2 x 12 Bit only monitors wire-break at current outputs.

In output ranges 0...20mA and ± 20 mA, no "safe" wire break inspection can be carried out at output values of -20s...+200 μ A.

Short-circuit monitoring

SM 332; AO 2 x 12 Bit only monitors short-circuit at voltage outputs.

Substitution values

You can configure the SM 332; AO 2 x 12 Bit for CPU STOP mode as follows: Outputs off power, hold last value or inject substitution values. Injected substitution values must be within the output range.

6.15 Analog IO module SM 334; AI 4/AO 2 x 8/8 Bit; (6ES7334-0CE01-0AA0)

Order number

6ES7334-0CE01-0AA0

Properties

- 4 inputs in one group and 2 outputs in one group
- Resolution 8 bits
- Measuring method adjustable per channel group
 - Voltage
 - Current
- Not programmable, measurement and output type defined by hardwiring
- Non-isolated to the backplane bus interface
- Electrically isolated to load voltage

Terminal assignment

The following diagrams show wiring examples.

Note

Note when wiring the SM 334:

- analog ground **M_{ANA}** (terminal 15 or 18) is connected to chassis ground **M** of the CPU or interface module **IM**. Use a cable with a conductor cross-section of at least 1 mm².
The module will shut down if the ground connection between M_{ANA} and M is missing. Inputs are read with 7FFF_H, and outputs return a value of 0. The module may be destroyed if operated without ground over a longer period of time.
 - the **supply voltage for the CPU and/or the interface module (IM) may not be connected with reversed polarity**. Reverse polarity will inevitably lead to the destruction of the module, because M_{ANA} develops an impermissible high potential (+24 V.)
-

Wiring: Current measurement and current output

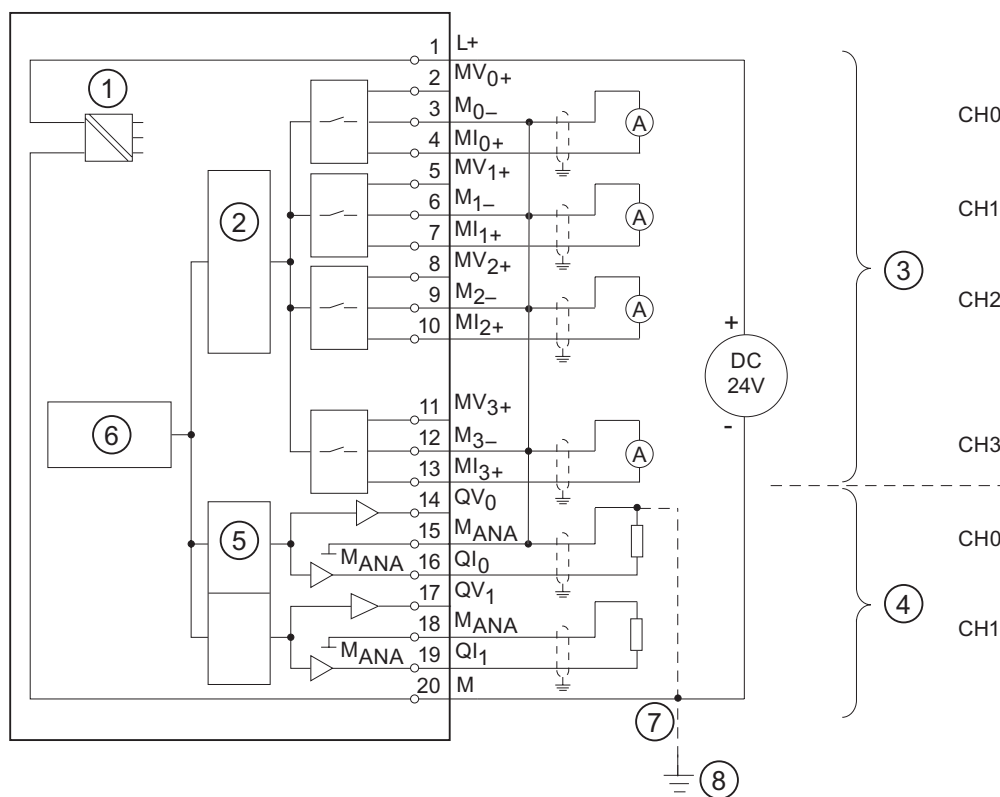


Figure 6-41 Wiring and block diagrams

- ① Internal supply
- ② Analog-to-Digital Converter (ADC)
- ③ Inputs: Current measurement
- ④ Outputs: Current output
- ⑤ Digital-to-Analog Converter (DAC)
- ⑥ Backplane bus interface
- ⑦ Potential compensation
- ⑧ Function ground/earth

Wiring: Voltage measurement and voltage output

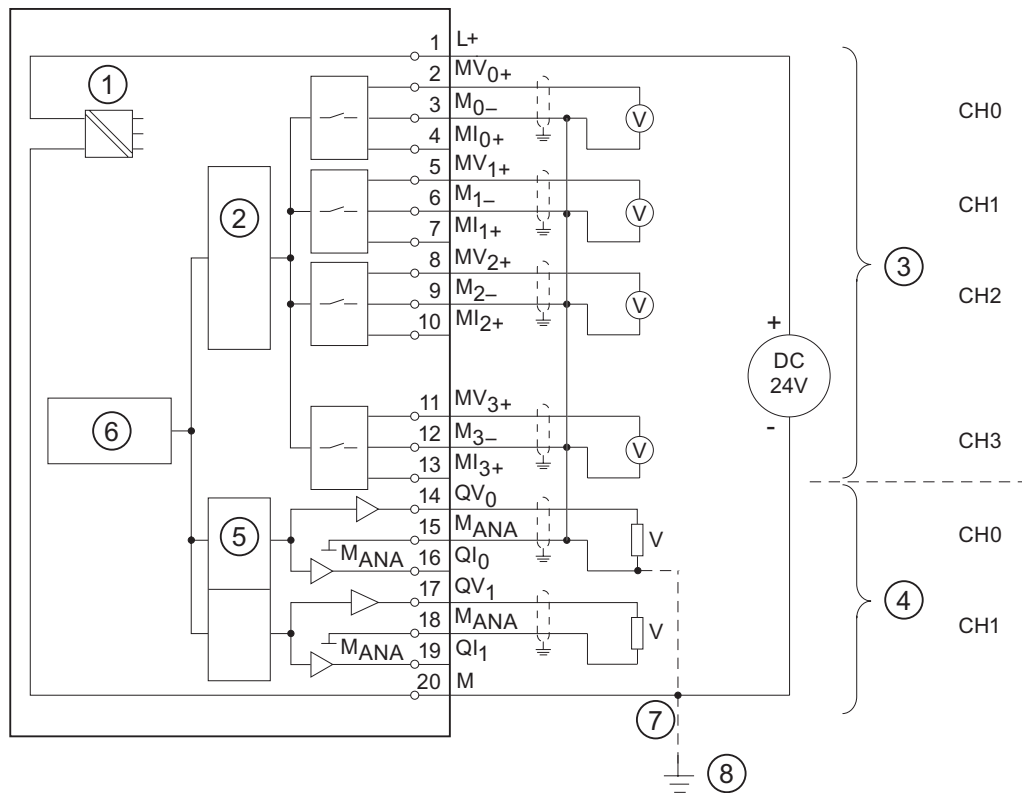


Figure 6-42 Wiring and block diagrams

- ① Internal supply
- ② Analog-to-Digital Converter (ADC)
- ③ Inputs: Voltage measurement
- ④ Outputs: Voltage output
- ⑤ Digital-to-Analog Converter (DAC)
- ⑥ Backplane bus interface
- ⑦ Potential compensation
- ⑧ Function ground/earth

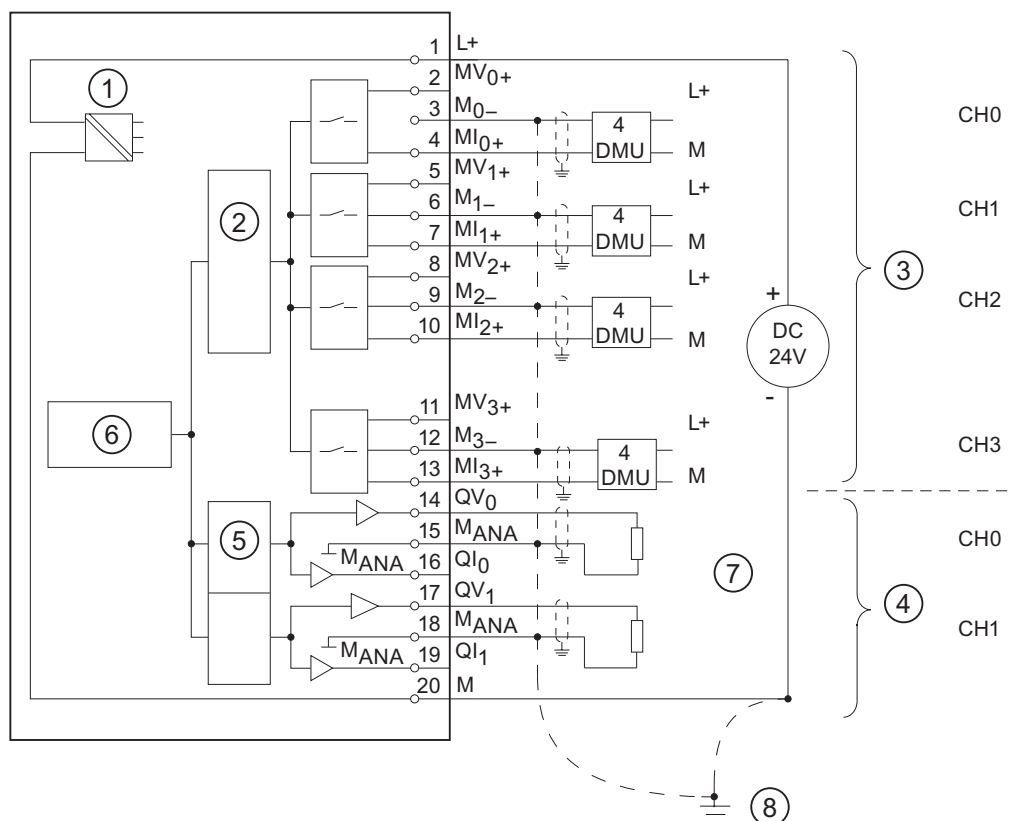
Wiring: 4-wire measuring converter for current measurement and voltage output

Figure 6-43 Wiring and block diagrams

- ① Internal supply
- ② Analog-to-Digital Converter (ADC)
- ③ Inputs: Current measurement with 4-wire measuring converter
- ④ Outputs: Voltage output
- ⑤ Digital-to-Analog Converter (DAC)
- ⑥ Backplane bus interface
- ⑦ Potential compensation
- ⑧ Function ground/earth

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 285 g
Module-specific data	
Isochronous mode supported	No

Technical data	
Number of inputs	4
Number of outputs	2
Cable length shielded	max. 200 m
Voltages, currents, electrical potentials	
Rated supply voltage of the rated electronics and load voltage L+	24 VDC
Electrical isolation - between channels and the backplane bus - between channels and electronics power supply	No Yes
between channels	No
Permissible potential difference - between inputs and M_{ANA} (CMV) - between inputs (CMV)	1 VDC 1 VDC
Isolation test voltage	500 VDC
Current consumption - from the backplane bus - from supply and load voltage L+ (no load)	max. 55 mA max. 110 mA
Power loss of the module	typ. 3 W
Generation of analog input values	
Measuring principle	Actual value conversion
Integration/conversion time (per channel) - programmable - Integration time in μs - Basic conversion time, including the integration time in μs - Resolution (including overshoot range)	No 500 100 8 bits
Time constant of the input filter	0.8 ms
Basic execution time of the module (all channels enabled)	max. 5 ms
Generation of analog output values	
Resolution (including overshoot range)	8 bits
Conversion time (per channel)	max. 500 μs
Settling time - with resistive load - with capacitive load - with inductive load	0.3 ms 3.0 ms 0.3 ms
Noise suppression, error limits for inputs	
Noise suppression at F = n (f1 ± 1 %) (f1 = interference frequency)	
Common-mode noise (V_{pp} < 1 V)	> 60 dB
Crosstalk between outputs	> 50 dB
Operational limit (across temperature range, relative to input range)	
- Voltage input - Current input	± 0,9 % ± 0,8 %

Technical data	
Basic error limit (operational error limit at 25 °C, relative to input range)	
• Voltage input	± 0,7 %
• Current input	± 0,6 %
Temperature error (relative to input range)	± 0.005 %/K
Linearity error (relative to input range)	± 0,05 %
Repetition accuracy (in transient state at 25 °C, relative to input range)	± 0,05 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	± 0,05 %
Noise suppression, error limits of outputs	
Crosstalk between outputs	> 40 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output	± 0,6 %
• Current output	± 1,0 %
Basic error limit (operational error limit at 25 °C, relative to output range)	
• Voltage output	± 0,5 %
• Current output	± 0,5 %
Temperature error (relative to output range)	± 0.02 %/K
Linearity error (relative to output range)	± 0,05 %
Repetition accuracy (in transient state at 25 °C, relative to output range)	± 0,05 %
Output ripple (bandwidth relative to output range)	± 0,05 %
Status, interrupts, diagnostics	
Interrupts	None
Diagnostics functions	None
Transducer selection data	
Input ranges (rated values) / input impedance	
• Voltage	0 V to 10 V/100 k Ω
• Current	0 mA to 20 mA/50 Ω
Permissible voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)
Permissible current at current input (destruction limit)	40 mA
Wiring signal transducers	with 20-pin front connector supported
• for voltage measurement	
• for current measurement as 2-wire transducer	supported with external supply
as 4-wire transducer	
Actuator selection data	
Output ranges (rated values)	
• Voltage	0 V to 10 V
• Current	0 mA to 20 mA

Technical data	
Load impedance (in the rated output range)	
- For voltage outputs – capacitive load - For current outputs – inductive load	min. 5 k Ω max. 1 μ F max. 300 Ω max. 1 mH
Voltage output - Short-circuit protection - Short-circuit current	Yes max. 11 mA
Current output Noload voltage	max. 15 V
Destruction limit against external voltages/currents - Voltage at outputs to MANA - Current	max. 15 V, continuous max. 50 mA d.c.
Wiring the actuators - for voltage output 2-wire connection 4-wire connection (measuring line)	with 20-pin front connector supported not supported

6.15.1 Operating principle of SM 334; AI 4/AO 2 x 8/8 Bit

Introduction

SM 334; AI 4/AO 2 x 8/8 bit is a non-isolated analog IO module. SM 334; AI 4/AO 2 x 8/8 Bit is not programmable.

Addressing

The inputs and outputs of the module are addressed beginning at the module start address. The address of a channel is derived from the module start address and an address offset.

Input addresses

Addresses applicable to the inputs:

Channel	Address
0	Module start address
1	Module start address + 2 bytes address offset
2	Module start address + 4 bytes address offset
3	Module start address + 6 bytes address offset

Output addresses

Addresses applicable to the module outputs:

Channel	Address
0	Module start address
1	Module start address + 2 bytes address offset

6.15.2 Measuring method/output type of SM 334; AI 4/AO 2 x 8/8 bit

Introduction

SM 334; AI 4/AO 2 x 8/8 Bit is not programmable.

Defining the measuring method and output type

Set the measuring method (voltage, current) by hardwiring the input channel.

Set the output type (voltage, current) by hardwiring the output channel.

See also

Representation of the analog values of analog input channels (Page 5-2)

Representation of the analog values of analog output channels (Page 5-18)

6.15.3 Measuring and output ranges of SM 334; AI 4/ AO 2 x 8/8 bit

Measuring ranges

SM 334; AI 4/AO 2 x 8/8 bits operates in the 0 V to 10 V and 0 mA to 20 mA measuring ranges.

Compared to the other analog modules, the SM 334 has a lower resolution and no negative measuring ranges. Make allowances for this feature when reading the measured value tables *Analog value representation in the ± 1 V to ± 10 V measuring ranges* and *Analog value representation in the 0 mA to 20 mA and 4 mA to 20 mA measuring ranges*.

Output ranges

SM 334; AI 4/AO 2 x 8/8 Bit operates in the 0 V to 10 V and 0 mA to 20 mA measuring ranges.

Compared to the other analog modules, the SM 334 has a lower resolution, and its analog outputs do not have any undershoot ranges. Make allowances for this feature when reading the tables *Analog value representation in the 0 V to 10 V and 1 V to 5 V output ranges* and *Analog value representation in the 0 mA to 20 mA and 4 mA to 20 mA output ranges*.

6.15.4 Additional information to SM 334; AI 4/AO2 x 8/8 bit

Unused channels

Always short-circuit unused input channels, and connect these to M_{ANA} . This optimizes noise immunity of the analog module.

Leave unused output channels open.

6.16 Analog IO module SM 334; AI 4/AO 2 x 12 bit; (6ES7334-0KE00-0AB0)

Order number: : "Standard module"

6ES7334-0KE00-0AB0

Order number: "SIPLUS S7-300 module"

6AG1334-0KE00-2AB0

Properties

- 4 inputs in 2 groups and 2 outputs in one group
- Resolution of 12 bits + sign
- Measuring method adjustable per channel group:
 - Voltage
 - Resistance
 - Temperature
- Electrically isolated to the backplane bus interface
- Electrically isolated to load voltage

Terminal assignment

The following diagrams show wiring examples.

Note

When you switch the rated load voltage supply on/off, the output may assume incorrect interim values below the rated load voltage.

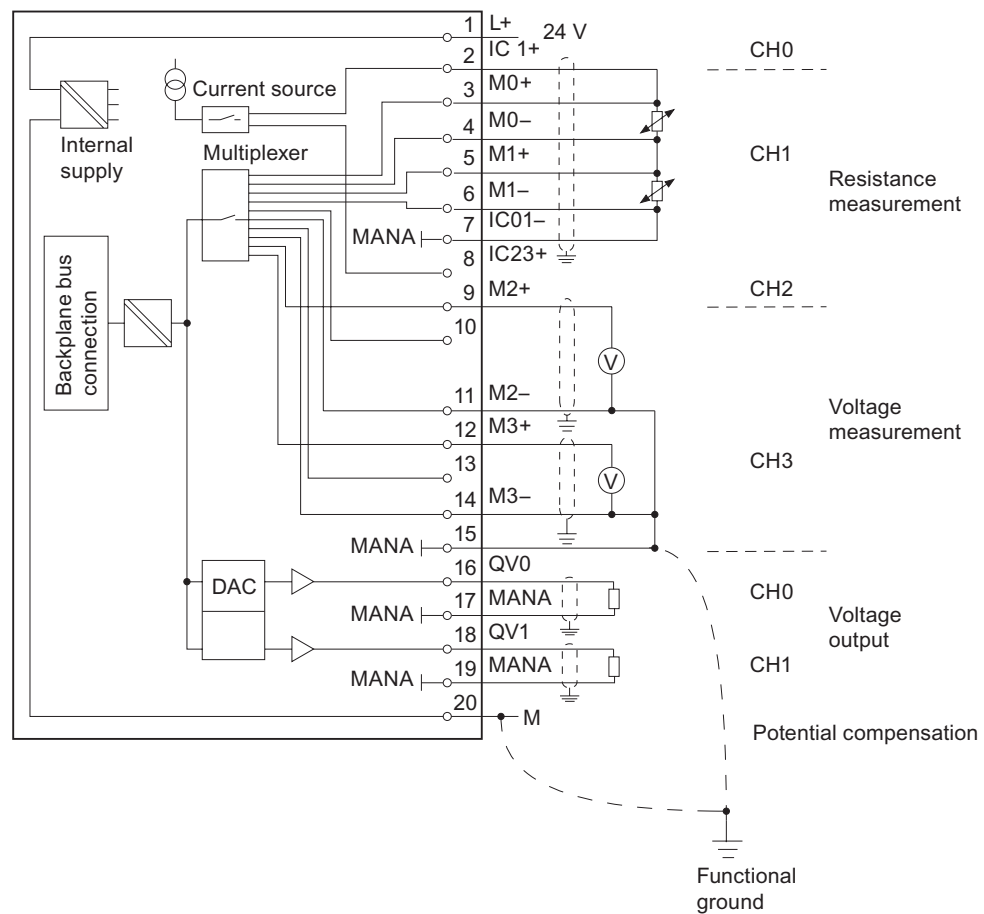
Wiring: Resistance measurement, voltage measurement and voltage output

Figure 6-44 Wiring and block diagrams

Wiring: Resistance measurement and voltage output

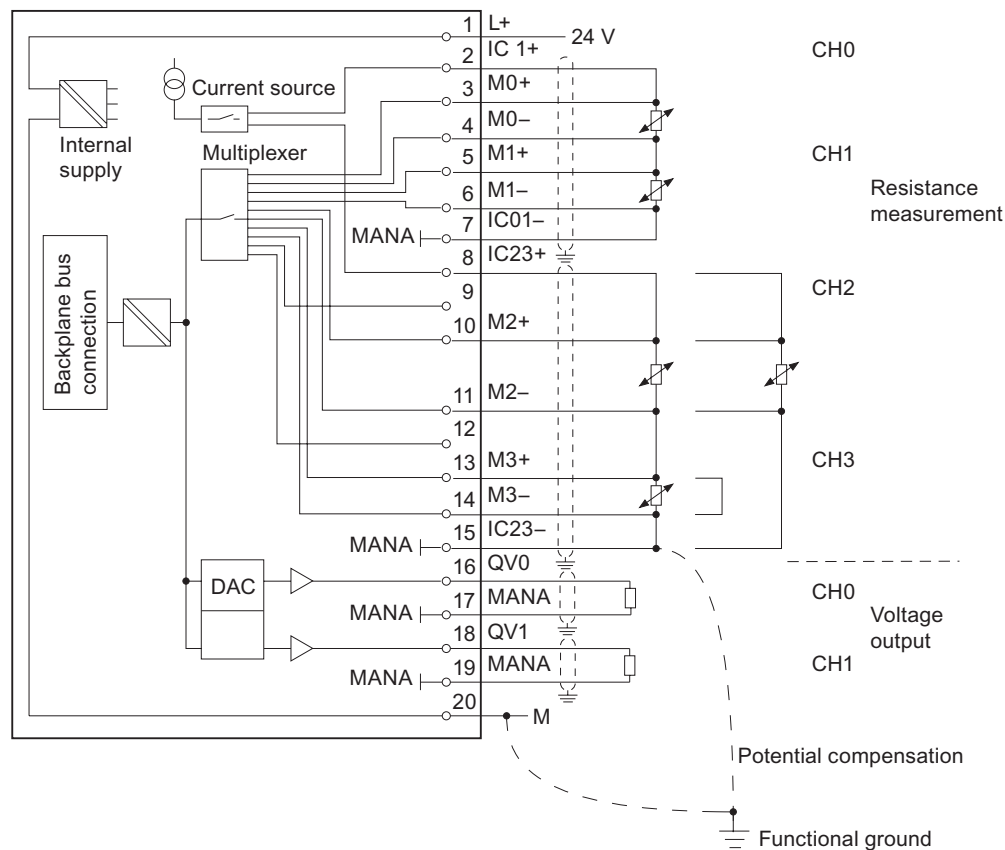


Figure 6-45 Wiring and block diagrams

Technical data

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	approx. 200 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	4
• with resistive transducers	4
Number of outputs	2
Shielded cable length	max. 100 m
Voltages, currents, electrical potentials	
Supply voltage of the rated electronics and load voltage L+	24 VDC
• Reverse polarity protection	Yes

6.16 Analog IO module SM 334; AI 4/AO 2 x 12 bit; (6ES7334-0KE00-0AB0)

Technical data		
Constant measuring current for resistive transducers (pulsed) - For PT 100 - at 10 kΩ	typ. 490 μA typ. 105 μA	
Electrical isolation - between channels and the backplane bus - between channels and electronics power supply	Yes Yes	
between channels	No	
Permissible potential difference - between inputs and M_{ANA} (CMV) - between inputs (CMV) - between M_{ANA} and M_{internal} (V_{iso})	1 V 1 V 75 VDC / 60 VAC	
Isolation test voltage	500 VDC	
Current consumption - from the backplane bus - from supply and load voltage L+ (no load)	max. 60 mA max. 80 mA	
Power loss of the module	typ. 2 W	
Generation of analog input values		
Measuring principle	Integrating	
Integration/conversion time (per channel)		
programmable	Yes	
Integration time in ms	16 ² / ₃	20
Basic conversion time, including the integration time in ms	72	85
Additional conversion time for resistance measurements in ms	72	85
Resolution in bits (including overshoot range)	12 bits	12 bits
Noise suppression at interference frequency f1 in Hz	60	50
Measured value smoothing	programmable, in 2 stages	
Time constant of the input filter	0.9 ms	
Basic execution time of the module (all channels enabled)	350 ms	
Generation of analog output values		
Resolution (including overshoot range)	12 bits	
Conversion time (per channel)	500 μs	
Settling time - with resistive load - with capacitive load	0.8 ms 0.8 ms	
Noise suppression, error limits for inputs		
Noise suppression at F = n (f1 ± 1 %) (f1 = interference frequency)		
- Common-mode noise (V_{pp} < 1 V) - Seriesmode interference (peak value of disturbance < rated input range)	> 38 dB > 36 dB	
Crosstalk between inputs	> 88 dB	

Technical data		
Operational limit (across temperature range, relative to input range)		
• Voltage input	0 V to 10 V	± 0,7 %
• Resistance input	10 kΩ	± 3,5 %
• Temperature input	Pt 100	± 1 %
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	0 V to 10 V	± 0,5 %
• Resistance input	10 kΩ	± 2,8 %
• Temperature input	Pt 100	± 0,8 %
Temperature error (relative to input range)	± 0.01 %/K	
Linearity error (relative to input range)	± 0,05 %	
Repetition accuracy (in transient state at 25 °C, relative to input range)	± 0,05 %	
Noise suppression, error limits of outputs		
Crosstalk between outputs	> 88 dB	
Operational limit (across the temperature range, relative to output range)		
• Voltage output	± 1,0 %	
Basic error limit (operational error limit at 25 °C, relative to output range)		
• Voltage output	± 0,85 %	
Temperature error (relative to output range)	± 0.01 %/K	
Linearity error (relative to output range)	± 0,01 %	
Repetition accuracy (in transient state at 25 °C, relative to output range)	± 0,01 %	
Output ripple; range 0 Hz to 50 kHz (relative to output range)	± 0,1 %	
Status, interrupts, diagnostics		
Interrupts	None	
Diagnostics function	None	
Transducer selection data		
Input ranges (rated values) / input impedance		
• Voltage	0 V to 10 V	100 kΩ
• Resistance	10 kΩ	10 MΩ
• Temperature	Pt 100	10 MΩ
Permissible voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)	
Wiring signal transducers		
• for voltage measurement	supported	
• for resistance measurement		
with 2-wire connection	supported	
with 3-wire connection	supported	
with 4-wire connection	supported	
Characteristic linearization	programmable	
• of resistance thermometers	PT 100 (Klima range)	
Technical unit of data formats	Degrees Centigrade	

Technical data	
Actuator selection data	
Output range (rated value)	
• Voltage	0 V to 10 V
Load impedance (in the rated output range)	
• For voltage outputs – capacitive load	min. 2.5 kΩ max. 1.0 μF
Voltage output	
• Short-circuit protection	Yes
• Short-circuit current	max. 30 mA
Destruction limit against external voltages/currents	
• Voltage at outputs to MANA	max. 15 V, continuous
Wiring the actuators	
• for voltage output 2-wire connection 4-wire connection (measuring line)	with 20-pin front connector supported not supported

6.16.1 Adjustable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides an overview of configurable parameters, including defaults:

Table 6-40 Summary of parameters SM 334; AI 4/AO 2 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Input					
Measurement					
• Measuring method	disabled		RTD-4L		
	V R-4L RTD-4L	Voltage Resistance (4-wire connection) Thermal resistance (linear, 4-wire connection)		Dynamic	Channel
• Measuring range	0 V to 10 V 10000 Ω Pt 100 Klima		Pt 100 Klima		
Output					
• Output type	disabled Voltage 0 V to 10 V		V 0 V to 10 V	Dynamic	Channel
• Output range					

See also

Programming analog modules (Page 5-31)

6.16.2 Measuring methods and ranges

Introduction

You can wire the inputs for voltage, resistance or temperature measurements, or disable the inputs.

You can wire the outputs as voltage outputs, or disable them.

Configure the IO circuits at "measuring method" and "output method" parameters in *STEP 7*.

Input defaults

The "thermoelectric resistance (linear, 4-wire connection)" measuring method and "Pt 100 Klima" measuring range are set by default at the module. You can use those default settings without having to program the SM 334; AI 4/AO 2 x12 Bit in *STEP 7*.

Options of wiring the input channels

You can wire the input channels of SM 334; AI 4/AO 2 x 12 Bit in the following combinations:

Channel	Wiring versions
Channels 0 and 1	• 2 x temperature or • 2 x resistance
Channels 2 and 3	• 2 x voltage, • 2 x resistance, • 2 x temperature, • 1 x temperature and 1 x voltage, or • 1 x resistance and 1 x voltage

Note

Wiring both a temperature sensor and a resistor to channels 0 and 1 or 2 and 3 is not allowed.

Reason: Common current source for both channels.

Measuring ranges

Program the measuring ranges in *STEP 7*.

Table 6-41 Measuring methods and ranges

Selected measuring method	Measuring range
V: Voltage	0 V to 10 V
R-4L: resistance (4-wire connection)	10 k Ω
RTD-4L: Thermoelectric resistance (linear, 4-wire connection) (temperature measurement)	Pt 100 Klima

Output ranges of SM 334; AI 4/ AO 2 x 12 bit

The "voltage" output type and "0 V to 10 V" output range are set by default at the module. You can always use this combination of the output type and range without having to program the SM 334; AO 4 x 2 Bit in *STEP 7*.

Table 6-42 Output ranges

Selected type of output	Output range
Voltage	0 V to 10 V

See also

Representation of the analog values of analog output channels (Page 5-18)

6.16.3 Additional information to SM 334; AI 4/ AO 2 x 12 bit

Unused channels

Set the "disabled" argument at the "measuring method" parameter for unused input channels. This reduces the module's cycle time.

Always short-circuit unused input channels, and connect these to M_{ANA}. This optimizes interference immunity of the analog input module.

To take the unused output channels of SM 334; AI 4/AO 2 x 12 Bit off power, always set "disabled" argument at the "output type" parameter, and leave the connection open.

Other signal modules

Signal modules

This chapter describes the technical data and properties of the S7-300 signal modules.

7.1 Module overview

Introduction

The table below summarizes the essential features of the signal modules described in this chapter. This overview supports you in selecting a module to suit your requirements.

Table 7-1 Special signal modules: Overview of properties

Properties	Simulator module SM 374; IN/OUT 16	Dummy module DM 370	Position decoder module SM 338; POS-INPUT
Number of inputs/outputs	max. 16 inputs or outputs	1 slot reserved for one non-programmed module	3 inputs for the connection of absolute value encoders (SSI) 2 digital inputs for freezing encoder values
Suitable for...	Simulation of: 16 inputs or 16 outputs or 8 inputs and 8 outputs	Dummy for: - Interface modules - non-programmed signal modules - Modules which occupy 2 slots	Position detection with up to 3 absolute value encoders (SSI) Encoder types: Absolute value encoder (SSI) with 13-bit, 21-bit or 25-bit frame lengths Data format: Gray code or binary code
Isochronous mode supported	No	No	Yes
Programmable diagnostics	No	No	No
Diagnostic interrupt	No	No	adjustable
Special features	Function adjustable with screwdriver	When replacing DM 370 with another module, the mechanical assembly and address assignment/addressing of the entire system remain unchanged	SM 338 does not support absolute value encoders with a monoflop time greater than 64 ms

7.2 Simulator module SM 374; IN/OUT 16; (6ES7374-2XH01-0AA0)

Order number

6ES7374-2XH01-0AA0

Properties

Properties of simulator module SM 374; IN/OUT 16:

- Simulation of:
 - 16 inputs or
 - 16 outputs or
 - 8 inputs and 8 outputs (each with the same start addresses!)
- Status displays for the simulation of inputs and outputs
- Function adjustable with screwdriver

Note

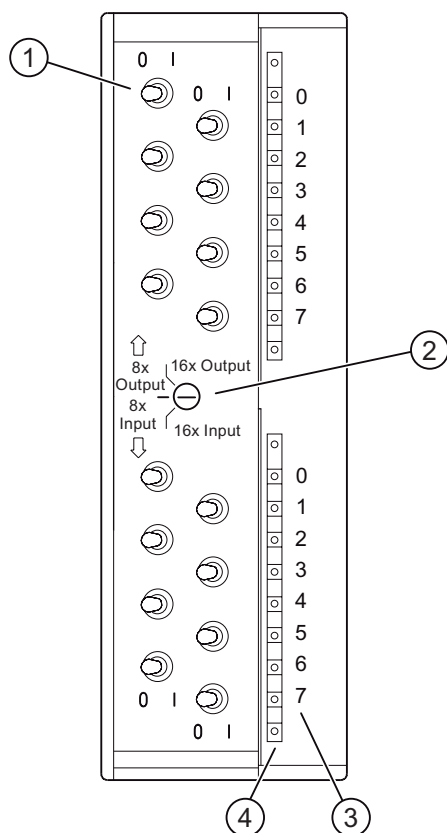
Do not operate the function selection switch in RUN!

Configuration in STEP 7

The simulator module SM 374; IN/OUT 16 is not included in the *STEP 7* module catalog. *STEP 7* therefore does not recognize the SM 374 order number. "Simulate" the simulator module function required for your configuration as follows:

- To use the SM 374 **with 16 inputs**, define the order number of a digital input module with 16 inputs in *STEP 7*,
for example: 6ES7321-1BH02-0AA0
- To use the SM 374 **with 16 outputs**, define the order number of a digital output module with 16 outputs in *STEP 7*,
for example: 6ES7322-1BH01-0AA0
- To use the SM 374 **with 8 inputs and 8 outputs**, define the order number of a digital input/output module with 8 inputs and 8 outputs in *STEP 7*,
for example: 6ES7323-1BH00-0AA0

Module view (without front panel door)



- ① Input status selector switch
- ② Function selector switch
- ③ Channel number
- ④ Status displays - green

Technical data of SM 374; IN/OUT 16

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 110
Weight	approx. 190 g
Module-specific data	
Optional simulation of	16 inputs 16 outputs 8 inputs and 8 outputs
Voltages, currents, electrical potentials	
Current consumption from the backplane bus	max. 80 mA
Power loss of the module	typ. 0.35 W
Status, interrupts, diagnostics	
Status display	yes, green LED for each channel
Interrupts	No
Diagnostics functions	No

7.3 Dummy module DM 370; (6ES7370-0AA01-0AA0)

Order number

6ES7370-0AA01-0AA0

Properties

The dummy module DM 370 reserves a slot for a non-configured module. It can be used as dummy module for:

- Interface modules (without reservation of address space)
- Non-configured signal modules (with reservation of address space)
- Modules which occupy 2 slots (with reservation of address space)

When replacing the dummy module with another S7-300 module, the mechanical assembly and address assignment/addressing of the entire configuration remain unchanged.

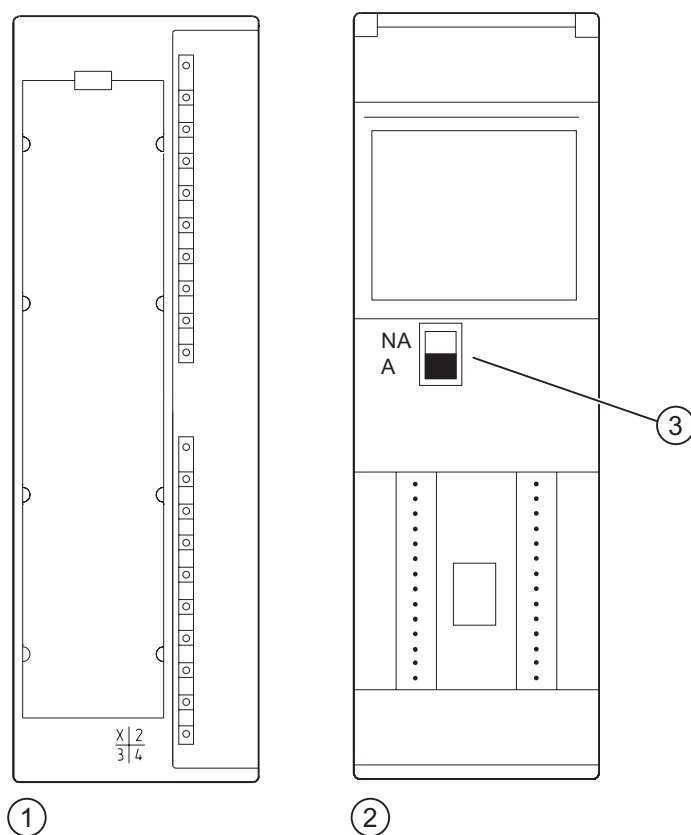
Configuration in *STEP 7*

Configure the DM 370 dummy module in *STEP 7* only if you module for a programmed signal module. If the module reserves the slot for an interface module, you can discard module configuration in *STEP 7*.

Modules which occupy 2 slots

Install two dummy modules for modules which occupy 2 slots. You only reserve the address space using the dummy module in slot "x", rather than the dummy module in slot "x + 1". For details of the procedure, see the table below.

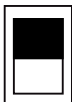
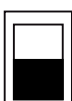
The rack can receive up to 8 modules (SM/FM/CP.) When using two dummy modules to reserve a slot for a module of 80 mm width, you may still install 7 further modules (SM/FM/CP) because the dummy module only uses the address space for one module.

Module view

Switch settings for addressing

The table below shows how to set the switch on the rear panel of the module, according to the module type.

Table 7-2 Meaning of the switch settings of dummy module DM 370

Switch setting	Meaning	Use
NA A 	The dummy module reserves one slot. The module will not be configured, and does not use any address space.	- Without active backplane bus: For configurations where a single slot is physically reserved, with electrical connection to the S7-300 bus. - With active backplane bus: No
NA A 	The dummy module reserves one slot. The module must be configured and occupies 1 byte in the input address space (system default: not in the process image.)	For configurations where an addressed slot is reserved.

Technical data of DM 370

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 180 g
Voltages, currents, electrical potentials	
Current consumption from the backplane bus	approx. 5 mA
Power loss	typ. 0.03 W

7.4 Position decoder module SM 338; POS-INPUT; (6ES7338-4BC01-0AB0)

Order number

6ES7338-4BC01-0AB0

Properties

Properties of position decoder module SM 338; POS-INPUT:

- 3 inputs for the connection of up to three absolute value encoders (SSI), and 2 digital inputs to freeze encoder values
- Allows direct reaction to encoder values in motion systems
- Processing of encoder values recorded by SM 338 in the user program
- Isochronous mode supported
- Selectable encoder value acquisition mode:
 - cyclic
 - isochronous
- Rated input voltage 24 VDC
- Nonisolated to the CPU
- Fast Mode selectable; with faster transducer action and compressed feedback interface. The Fast Mode is available from firmware version V2.0.0 in SM 338; POS-INPUT and can be selected from STEP 7 V5.3+SP2.

Supported encoder types

Encoder types supported by SM 338; POS-INPUT:

- Absolute value encoder (SSI), frame length 13 bit
- Absolute value encoder (SSI), frame length 21 bit
- Absolute value encoder (SSI), frame length 25 bit

Supported data formats

SM 338; POS-INPUT supports gray code and binary code.

Firmware update

To extend functions and for troubleshooting, it is possible with the help of STEP 7 HW-Config to load firmware updates in the operating system memory of the SM 338; POS-INPUT.

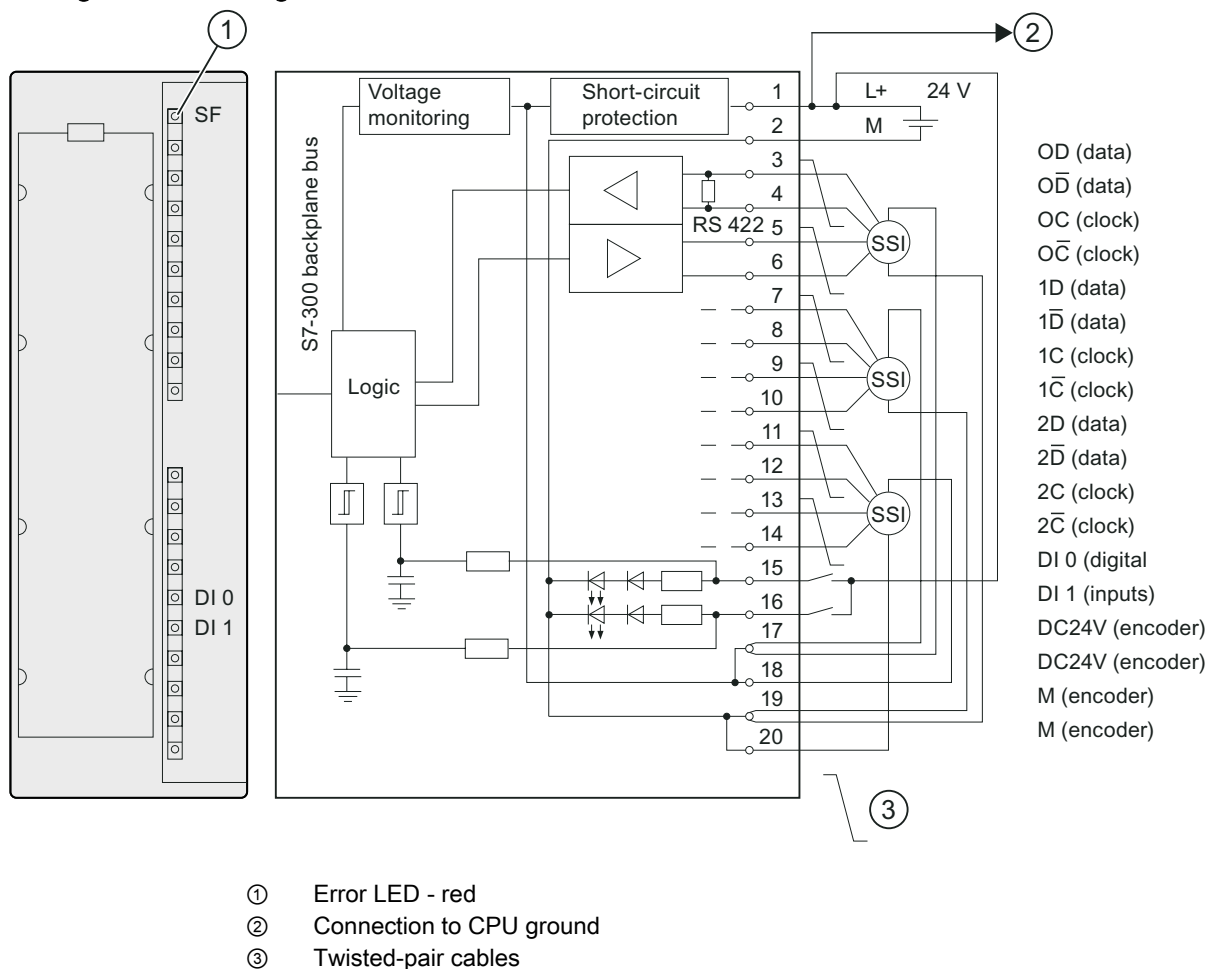
Notice

When you boot the firmware update, the old firmware is deleted. If the firmware update is interrupted or terminated for some reason, thereafter the SM 338; POS-INPUT ceases to function properly. Reboot the firmware update and wait until this has completed successfully.

Note

The firmware update is only possible in remote operation if the header assembly (slave circuit) employed supports the system services required for this.

Wiring and block diagrams



Wiring rules

Important rules to observe wiring the module:

- Ground of the encoder supply is connected to CPU ground potential. Thus, establish a low impedance connection between pin 2 of SM 338 (M) and CPU ground.
- Always use shielded twisted-pair cable to wire encoder signals (pins 3 to 14.) Connect both ends of the shielding. Use the shield connection element to terminate the shielding on SM 338 (order number 6ES7390-5AA00-0AA0.)
- Connect an external power supply if the maximum output current (900 mA) of the encoder supply is exceeded.

Technical data of SM 338; POS-INPUT

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 235 g
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
• Range	20.4 ... 28.8 V
• Reverse polarity protection	No
Electrical isolation	no, only to shield
Permissible potential difference	
• between the input (M terminal) and CPU grounding busbar	1 VDC
Encoder supply	
• Output voltage	L+ -0.8 V
• Output current	max. 900 mA, short circuit-proof
Current consumption	
• from the backplane bus	max. 160 mA
• from load voltage L+ (no load)	max. 10 mA
Power loss of the module	typ. 3 W
Encoder inputs POS-INPUT 0 to 2	
Position detection	absolute
Difference signals for SSI data and SSI clock	to RS422 standard
Data transfer rate and cable (twisted-pair and shielded) length of absolute value encoders	• 125 kHz max. 320 m • 250 kHz max. 160 m • 500 kHz max. 60 m • 1 MHz max. 20 m
SSI frame transfer rate	13 bits 21 bits 25 bits 112 µs 176 µs 208 µs 56 µs 88 µs 104 µs 28 µs 44 µs 52 µs 14 µs 22 µs 26 µs
Monoflop time ²	16 µs, 32 µs, 48 µs, 64 µs

Technical data	
Digital inputs DI 0, DI 1	
Electrical isolation	no, only to shield
Input voltage	0 signal -3 V ... 5 V 1 signal 11 V ... 30.2 V
Input current	0 signal ≤ 2 mA (standby current) 1 signal 9 mA (typ.)
Input delay	0 > 1: max. 300 μ s 1 > 0: max. 300 μ s
Maximum repetition rate	1 kHz
Connection of a two-wire BEROs, type 2	supported
Shielded cable length	600 m
Unshielded cable length	32 m
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	programmable
Status display for digital inputs	LED (green)
Group error	LED (red)
Inaccuracy of the encoder value	
Cyclic encoder value acquisition	
• maximum age ¹	(2 × frame transfer rate) + monoflop time + 580 μ s
• minimum age ¹	Frame transfer rate + 130 μ s
• Jitter	Frame transfer rate + monoflop time + 450 μ s
Refresh rate	Frame evaluation at intervals of 450 μ s
Inaccuracy of the frozen encoder value (Freeze)	
Free-running transducer capture (Fast Mode)	
• maximum age ¹	(2 × frame transfer rate) + monoflop time + 400 μ s
• minimum age ¹	Frame transfer rate + 100 μ s
• Jitter	Frame transfer rate + monoflop time + 360 μ s
Refresh rate	Frame evaluation at intervals of 360 μ s
Isochronous encoder value acquisition	
• Age	Encoder value at time T_i of the current PROFIBUS DP cycle
Inaccuracy of the frozen encoder value (Freeze)	
Free-running transducer capture (Standard Mode)	
• maximum age ¹	(2 × frame transfer rate) + monoflop time + 580 μ s
• minimum age ¹	Frame transfer rate + 130 μ s
• Jitter	Frame transfer rate + monoflop time + 450 μ s
Isochronous encoder value acquisition	
• Jitter	Max. (frame transfer rate $_n$ + programmed Monoflop time $_n$) $n=0, 1, 2$, (channel)

Technical data	
Isochronous times for the module	
In Standard Mode	TWE 850 µs TWE 620 µs ToiMin 90 µs TDPMIn 1620 µs
In Fast Mode	TWE 700 µs TWE 0 µs ToiMin 0 µs TDPMIn 900 µs

¹ age of the encoder values determined by the transfer process and the processing

² Restriction of the monoflop time of the absolute value encoder:
 $(1 / \text{transmission rate}) < \text{monoflop of the absolute value encoder} < 64 \mu\text{s} + 2 \times (1 / \text{transmission rate})$:

7.4.1 Isochronous mode

Introduction

Note

The basics of isochronous operation are described in a separate manual.

Hardware requirements

To operate SM 338 in isochronous mode, you need:

- a CPU which supports isochronous mode
- a DP master which supports the constant bus cycle
- a slave interface (IM 153-x) which supports isochronous mode

Properties

SM 338 operates in non-isochronous or isochronous mode, depending on system parameters.

In isochronous mode, data are exchanged between the DP master and SM 338 in synchronism to the PROFIBUS DP cycle.

In isochronous mode, all 16 bytes of the feedback interface are consistent.

If synchronism is lost due to disturbance or failure/delay of Global Control (GC), the SM 338 resumes isochronous mode at the next cycle without error reaction.

If synchronism is lost, the feedback interface is not updated.

7.4.2 Functions of SM 338; POS-INPUT; encoder value acquisition

The absolute value encoder transfers its values in frames to the SM 338. The SM 338 initiates the frame transfer.

- In non-isochronous mode, the encoder values are acquired cyclically.
- In isochronous mode, the encoder values are acquired in synchronism with the PROFIBUS DP cycle at each T_i .

Cyclic encoder value acquisition

The SM 338 always initiates a frame transfer at the end of the programmed monoflop time.

Asynchronously to those cyclic frames, the SM 338 processes the acquired encoder values cyclically, based on its refresh rate (see Technical data.)

Thus, cyclic acquisition returns encoder values of different ages. The difference between the min./max. age represents the jitter (see Technical data.)

Isochronous encoder value acquisition

Isochronous encoder values acquisition is automatically set when the DP master system operates with active constant bus cycle, and the DP slave is in synchronism with the DP cycle.

SM 338 initiates a frame transfer in each PROFIBUS DP cycle, at the time T_i .

The SM 338 processes the transferred encoder values in synchronism with the PROFIBUS DP cycle.

7.4.2.1 Gray code/binary code converter

When Gray code is set, the Gray code value returned by the absolute value encoder is converted into binary code. When binary code is set, the values returned by the encoder remain unchanged.

Note

When you set Gray code, the SM 338 always converts the entire encoder value (13, 21, 25 bits). As a result, any leading special bits will influence the encoder value, and the appended bits may be corrupted.

7.4.2.2 Transferred encoder value and scaling

Transducer value and standardization

The transferred encoder value contains the encoder position of the absolute value encoder. In addition to the encoder position, the encoder transfers additional bits located before and after the encoder position, depending on the encoder used.

The SM 338 determines the encoder position based on the following settings:

- Scaling, places (0..12), or
- scaling, units / revolution

Scaling, places

Scaling determines the position of the encoder value at the feedback interface.

- "Places" = 1, 2....12 indicates that appended irrelevant bits in the encoder value are shifted out, and the encoder value is right-aligned in the address area (see the example below.)
- "Places" = 0 determines that appended bits are retained and available for evaluation. This may be useful when the absolute value encoder used transfers information in the appended bits (see manufacturer specifications) which you want to evaluate (also refer to the chapter *Gray code/binary code converter*.)

Steps per revolution parameter

Up to 13 bits are available for the steps per revolution parameter. The resultant number of steps per revolution is displayed automatically according to the "Places" setting.

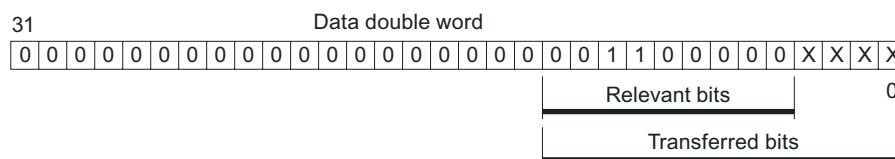
Example of encoder value scaling

You are using a single-turn encoder with
 2^9 steps = 512 steps per revolution (resolution/360°.)

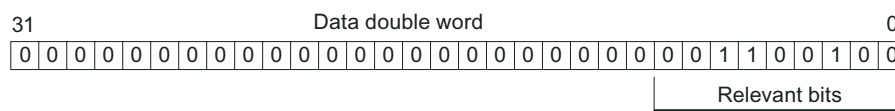
Your configuration in *STEP 7*:

- Absolute encoder: 13 bits
- Scaling: 4 places
- Steps per revolution: 512

Prior to normalizing: cyclically measured encoder value 100



After normalizing: Encoder value 100



Result: bits 0 to 3 (4 digits, marked with "x") were omitted.

7.4.2.3 Freeze function

The freeze function "freezes" the actual encoder values of SM 338. The freeze function is coupled to the digital inputs DI 0 and DI 1 of SM 338.

The freeze function is triggered by a signal transition (positive edge) a DI 0 or DI 1. Bit 31 = 1 (output address) identifies a frozen encoder value. You can freeze one, two or three encoder values using one digital input.

Enable the freeze function by setting the corresponding parameters in *STEP 7*.

To allow their event-triggered evaluation, the encoder values are retained until the freeze function is terminated.

Terminating the freeze function

The freeze function must be terminated separately at each encoder input. You acknowledge the function in the user program by setting bit 0, 1 or 2 of the relevant channel by setting the *STEP 7* operation T PAB "xyz."

The acknowledgement resets bit 31 of the corresponding encoder value, and initiates a refresh of the encoder values. You can freeze the encoder values again after you cleared the ACK bit at the output address of the module.

In isochronous mode, the acknowledgement is processed at the time T_0 . From this point on, you can freeze the encoder values again by setting the digital inputs.

Note

The Freeze function is acknowledged automatically when you assign new parameters with different arguments to the relevant channel.

The freeze function remains unaffected if you set parameters with identical arguments.

See also

SM 338; POS-INPUT addressing (Page 7-16)

SM 338; POS-INPUT programming (Page 7-15)

7.4.3 SM 338; POS-INPUT programming**Programming**

You program the SM 338; POS-INPUT in *STEP 7*. Always program the module while the CPU is in STOP mode.

After you completed the parameter declaration, download the parameters from the PG to the CPU. At its next STOP → RUN transition, the CPU transfers the parameters to the SM 338.

New parameters can not be assigned by the user program.

Parameters of SM 338; POS-INPUT

The table below provides an overview of configurable parameters and defaults for the SM 338.

The defaults apply if you have not set any parameters in *STEP 7* (default setting bold).

Table 7-3 Parameters of SM 338; POS-INPUT

Parameters	Range of values	Note
Enable		Enable parameter.
• Fast-Mode	Yes / no	Applies to all 3 channels.
Enable		Enable parameter.
• Diagnostic interrupt	Yes / no	Applies to all 3 channels.
Absolute value encoder (SSI) 1)	none; 13 bits ; 21 bits; 25 bits	none: The encoder input is switched off.
Code type 1)	Gray ; Binary	Code returned by the encoder.
Transmission rate 1),3)	125 kHz ; 250 kHz; 500 kHz; 1 MHz	Data transfer rate of the SSI position detection. Observe the relationship between cable lengths and the transmission rate (see Technical data)

Parameters	Range of values	Note
Monoflop time ^{1),2),3)}	16 µs; 32 µs; 48 µs; 64 µs	The monoflop time represents the minimum interval between two SSI frames. The configured monoflop time must be greater than the monoflop time of the absolute value encoder.
Scaling - Places - Steps per revolution ⁴	0 to 12 2 to 8192	Scaling right-aligns the encoder value in the address space; irrelevant places are discarded.
Enabling the Freeze function	off ; 0; 1	Definition of the digital input that initiates freezing of the encoder value at the positive edge.
¹ See the technical data of the absolute value encoder ² The monoflop time is equivalent to the interval between two SSI frames. The configured monoflop time must be greater than the monoflop time of the absolute value encoder (see the technical data of the manufacturer). The time $2 \times (1 / \text{transmission rate})$ is added to the value set in HW Config. A transmission rate of 125 kHz and configured monoflop time of 16 ms sets an effective monoflop time of 32 ms. ³ Restriction of the monoflop time of the absolute value encoder: $(1 / \text{transmission rate}) < \text{monoflop of the absolute value encoder} < 64 \mu\text{s} + 2 \times (1 / \text{transmission rate})$ ⁴ to powers of two		

Note

Please note that in asynchronous mode, the transmission rate and monoflop time affect the accuracy and update quality of the encoder values. In isochronous mode, the transmission rate and monoflop time have an influence on the accuracy of the freeze function.

7.4.4 SM 338; POS-INPUT addressing

Data areas for encoder values

The SM 338 inputs and outputs are addressed beginning at the module start address. The input and output address is determined in your configuration of SM 338 in *STEP 7*.

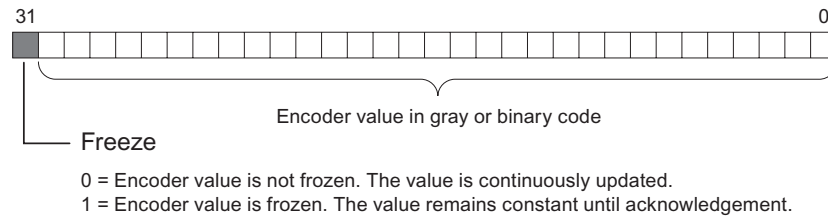
Input addresses

Table 7-4 Table 5-4 SM 338; POS-INPUT: Input addresses

Encoder input	Input address (derived from configuration) + address offset
0	"Module start address"
1	"Module start address" + 4 byte address offset
2	"Module start address" +8 byte address offset

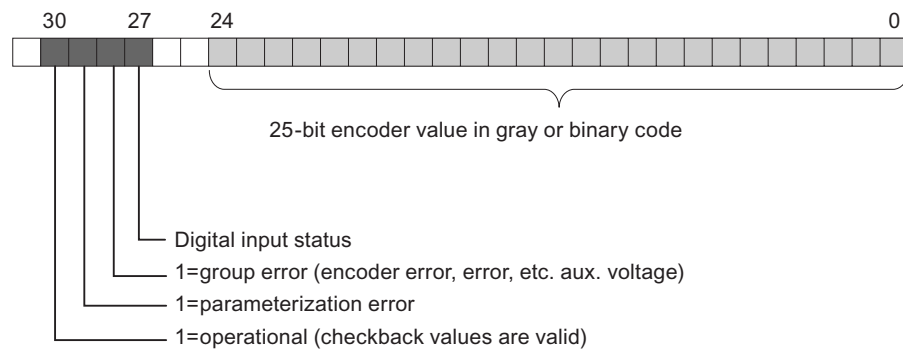
Structure of double data word in Standard Mode

Double data word structure of the encoder inputs:



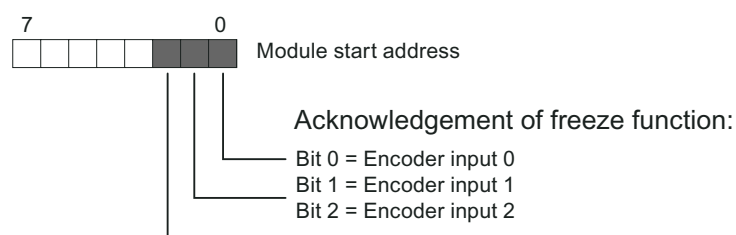
Structure of double data word in Fast Mode

Double data word structure of the encoder inputs:



In the double data word from channel 0, the status of digital input IO is reported to bit 27 (digital input status) and the double data word from channel 1 is reported to digital input I1. In the double data word from channel 2, the bit is always = 0.

Output address in Standard Mode



No output data are supported in Fast Mode.

Reading data areas

You can read the data areas in your user program using the *STEP 7* operation L PED "xyz."

Example of access to encoder values and use of the freeze function

You want to read and evaluate the values at the encoder inputs. The module start address is 256.

STL				Explanation
L	PED	256	//	Read encoder value in the address area for encoder input 0
T	MD	100	//	Save encoder value to memory double word
V	M	100.7	//	Freeze state for subsequent acknowledgement
=	M	99.0	//	determine and save
L	PED	230	//	Read encoder value in the address area for encoder input 1
T	MD	104	//	Save encoder value to memory double word
V	M	104.7	//	Freeze state for subsequent acknowledgement
=	M	99.1	//	determine and save
L	PED	264	//	Read encoder value in the address area for encoder input 2
T	MD	108	//	Save encoder value to memory double word
V	M	108.7	//	Freeze state for subsequent acknowledgement
=	M	99.2	//	determine and save
L	MB	99	//	Load freeze state and
T	POB	256	//	acknowledge (SM 338: output address 256)

You can then process the encoder values from the bit memory address areas MD 100, MD 104 and MD 108. The encoder value is set in bits 0 to 30 of the memory double word.

7.4.5 Diagnostics of SM 338; POS-INPUT

Introduction

The SM 338 provides diagnostics messages, i.e. it always provides all diagnostics messages without user intervention.

Reactions to a diagnostic message in *STEP 7*

Actions initiated by diagnostic messages:

- The diagnostic message is entered in the diagnosis of the module and forwarded to the CPU.
- The SF LED on the module is lit.
- If you have set "Enable Diagnostic Interrupt" in *STEP 7*, the system triggers a diagnostic interrupt and calls OB 82.

Reading diagnostic messages

You can read detailed diagnostic messages using SFCs in the user program (refer to the appendix "Diagnostic data of signal modules").

You can view the cause of the error in the module diagnostics data in *STEP 7* (refer to the *STEP 7* Online Help.)

Diagnostic message using the SF LED

The SM 338 indicates errors at its SF LED (group error LED.) The SF LED lights up when the SM 338 generates a diagnostic message. It goes dark after all error states are cleared.

The SF LED also lights up to indicate external errors (short-circuit at the encoder supply), regardless of the CPU operating state (at POWER ON.)

The SF LED lights up temporarily at startup, during the self test of SM 338.

Diagnostic messages of SM338; POS-INPUT

The table below provides an overview of the diagnostic messages of SM 338; POS-INPUT.

Table 7-5 Diagnostic messages of SM 338; POS INPUT

Diagnostics message	LED	Scope of diagnostics
Module error	SF	Module
Internal error	SF	Module
External error	SF	Module
Channel error	SF	Module
External auxiliary voltage missing	SF	Module
Module not programmed	SF	Module
Incorrect parameters	SF	Module

Diagnostics message	LED	Scope of diagnostics
Channel information available	SF	Module
Watchdog time-out	SF	Module
Channel error	SF	Channel (encoder input)
Configuration / programming error	SF	Channel (encoder input)
External channel error (encoder error)	SF	Channel (encoder input)

Causes of error and troubleshooting

Table 7-6 Diagnostics messages of SM 338, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid error
Module error	Any, the module has detected an error.	
Internal error	Module has detected an error within the automation system.	
External error	Module has detected an error outside of the automation system.	
Channel error	Indicates that only specific channels are faulty.	
External auxiliary voltage missing	Supply voltage L+ of the module is missing	Connect supply L+
Module not programmed	Module requires information whether it should operate with default system parameters or user parameters.	Message present after power on, until the CPU has completed the transfer of parameters; configure the module as required.
Incorrect parameters	One parameter, or the combination of parameters, is not plausible	Program the module
Channel information available	Channel error; module can provide additional channel information.	
Watchdog time-out	Infrequent high electromagnetic interference	Eliminate interference
Channel error	Any, the module has detected an error at the encoder input.	
Configuration / programming error	Illegal parameter transferred to module	Program the module
External channel error (encoder error)	Wire-break at encoder cable, encoder cable not connected, or encoder defective.	Check connected encoder

7.4.6 Interrupts of SM 338; POS-INPUT

Introduction

This chapter describes the interrupt reaction of SM 338; POS-INPUT. The SM 338 can trigger diagnostic interrupts.

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There is no default interrupt setting, i.e. interrupts are disabled if not set accordingly. Program the interrupt enable parameter in *STEP 7*.

Diagnostic interrupt

If you have enabled diagnostic interrupts, the incoming error events (initial occurrence of the error) and outgoing error events (message after troubleshooting) are reported by means of interrupts.

The CPU interrupts user program execution, and executes diagnostic interrupt OB82.

You can call SFC 51 or 59 in OB82 in the user program to view detailed diagnostic data output by the module.

Diagnostics data remain consistent until the program exits OB 82. The module acknowledges the diagnostic interrupt when the program exits OB82.

See also

SM 338; POS-INPUT programming (Page 7-15)

Interface modules

Interface modules

This chapter describes the technical data and properties of the S7-300 interface modules.

8.1 Module overview

Introduction

The table below summarizes the essential features of the interface modules described in this chapter. This overview supports you in selecting a module to suit your requirements.

Table 8-1 Table 6-1 Interface modules: Overview of properties

Properties	Interface module IM 360	Interface module IM 361	Interface module IM 365
Suitable for installation in S7-300 racks	0	1 to 3	0 and 1
Data transfer	from IM 360 to IM 361 via connecting cable 386	from IM 360 to IM 361, or from IM 361 to IM 361, via connecting cable 386	from IM 365 to IM 365 via connecting cable 386
Distance between...	max. 10 m	max. 10 m	1 m, permanently connected
Special features	---	---	- Preassembled module pair - Rack 1 supports only signal modules - IM 365 does not route the communication bus to rack 1

8.2 Interface module IM 360; (6ES7360-3AA01-0AA0)

Order number

6ES7360-3AA01-0AA0

Properties

Special features of interface module IM 360:

- Interface for rack 0 of the S7-300
- Data transfer from IM 360 to IM 361 via connecting cable 368
- Maximum distance between IM 360 and IM 361 is 10 m

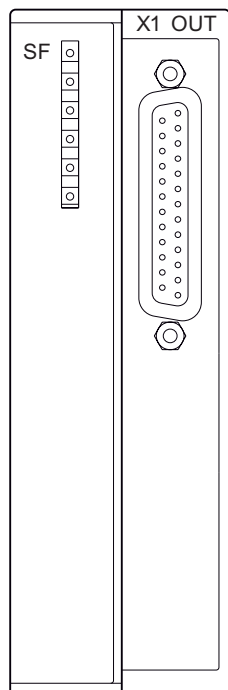
Status and error LEDs

Interface module IM 360 is equipped with the following status and error LEDs.

Display element	Meaning	Explanations
SF	Group error	The LED lights up if • the connecting cable is missing. • IM 361 is switched off.

Front view

The figure below shows the front view of interface module IM 360



Technical data

The overview below shows the technical data of interface module IM 360.

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 250 g
Module-specific data	
Cable length	
• Maximum length to next IM	10 m
Current consumption	
• from the backplane bus	350 mA
Power loss	typ. 2 W
Status and error LEDs	Yes

8.3 Interface module IM 361; (6ES7361-3CA01-0AA0)

Order number

6ES7361 3CA01-0AA0

Properties

Special features of interface module IM 361:

- 24 VDC power supply
- Interface for racks 1 to 3 of the S7-300
- Current output via the S7-300 backplane bus: max. 0.8 A
- Data transfer from IM 360 to IM 361, or from IM 361 to IM 361 via connecting cable 368
- Maximum distance between IM 360 and IM 361 is 10 m
- Maximum distance between IM 361 and IM 361 is 10 m

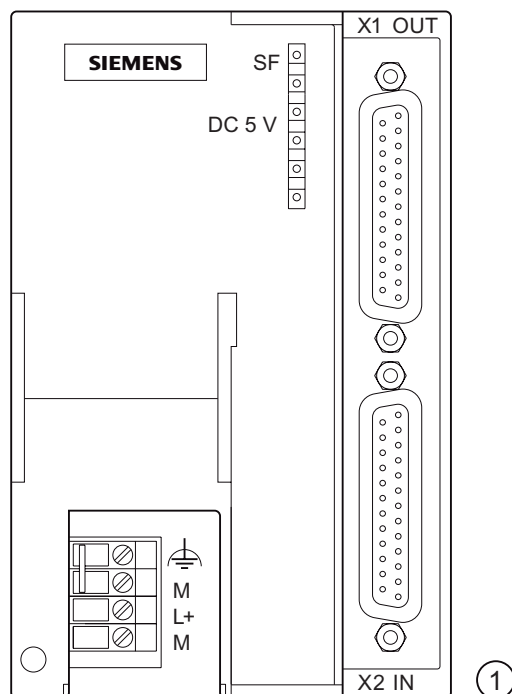
Status and error LEDs

Interface module IM 361 is equipped with the following status and error LEDs.

Display element	Meaning	Explanations
SF	Group error	The LED lights up if • the connecting cable is missing • the IM 361 connected in series is switched off • the CPU is in POWER OFF state
5 VDC	5 VDC supply for the S7-300 backplane bus	-

Front view

The figure below shows the front view of interface module IM 361



① Front view

Technical data

The overview below shows the technical data of interface module IM 361.

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm)	80 x 125 x 120
Weight	505 g
Module-specific data	
Cable length	
Maximum length to next IM	10 m
Current consumption	
from 24 VDC	0.5 A
Power loss	typ. 5 W
Current sinking at backplane bus	0.8 A
Status and error LEDs	Yes

See also

Spare parts (Page D-1)

8.4 Interface module IM 365; (6ES7365-0BA01-0AA0)

Order number: "Standard module"

6ES7365-0BA01-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 365-0BA01-2AA0

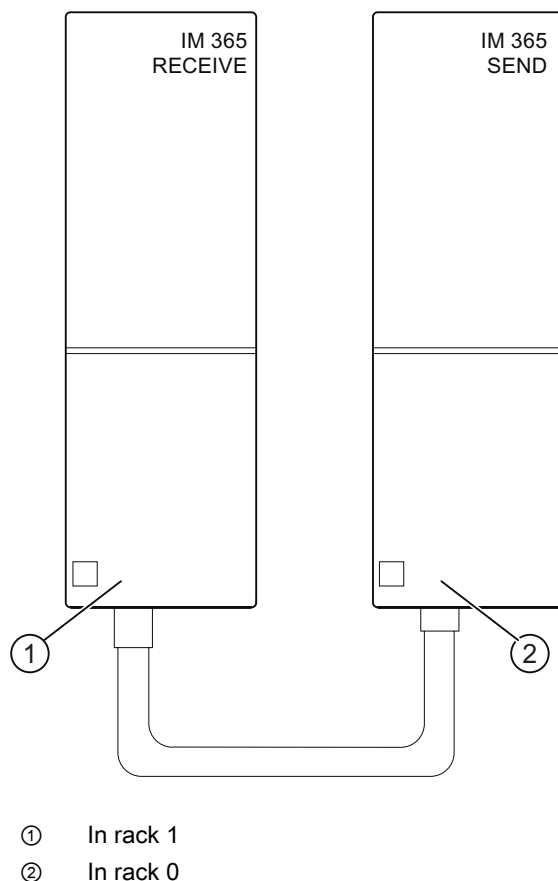
Properties

Special features of interface module IM 365:

- Preassembled pair of modules for rack 0 and rack 1
- Total power supply of 1.2 A, of which up to 0.8 A may be used per rack.
- Connecting cable with a length of 1 m already permanently connected
- Install only signal modules in rack 1
- IM 365 does **not** route the communication bus to rack 1, i.e. you cannot install FMs with communication bus function in rack 1.

Front view

The figure below shows the front view of interface module IM 365



Technical data

The overview below shows the technical data of interface module IM 365.

Technical data	
Dimensions and weight	
Dimensions W x H x D (mm) per module	40 x 125 x 120
Total weight	580 g
Module-specific data	
Cable length	
Maximum length to next IM	1 m
Current consumption from the backplane bus	100 mA
Power loss	typ. 0.5 W
Current sinking per module	max. 1.2 A 0.8 A
Status and error LEDs	No

RS 485 Repeater

This chapter

This chapter describes the RS 485 Repeater in detail.

This includes:

- the purpose of the RS 485 Repeater
- The maximum cable lengths between two RS 485 Repeaters
- functions of the various operating elements and terminals
- information about grounded and nongrounded operation
- technical data and the block diagram

Further information

For further information on the RS 485 Repeater, refer to the chapter "Configuring an MPI or PROFIBUS DP network" in the **CPU Data, Installation** manual.

Diagnostic Repeater

Compared to the RS 485 repeater, the Diagnostic Repeater has new characteristics: Diagnostic function and modeling as the DP slave. For further information, refer to the *Diagnostics Repeater for PROFIBUS DP* manual on the Internet at this address:
<http://support.automation.siemens.com/WW/view/de/7915183>

9.1 Fields of application and properties; (6ES7972-0AA01-0XA0)

Order number

6ES7972-0AA01-0XA0

Definition of the RS 485 Repeater

The RS 485 Repeater amplifies data signals on bus lines and couples bus segments.

Application of the RS 485 Repeater

You need an RS 485 Repeater if:

- more than 32 nodes are connected to the bus
- bus segments are operated ungrounded on the bus, or
- the maximum cable length of a segment is exceeded (see the table below.)

Table 9-1 Maximum cable length of a segment

Transmission rate	Max. cable length of a segment (in m)
9.6 to 187.5 kbps	1000
500 kbps	400
1.5 Mbps	200
3 to 12 Mbps	100

Rules

If you install the bus using RS 485 Repeaters:

- Up to nine RS 485 Repeaters may be connected in series.
- The maximum cable length between two nodes with RS 485 Repeater may not exceed the values listed in the table below.

Table 9-2 Maximum cable length between two RS 485 Repeaters

Transmission rate	Maximum cable length between 2 nodes (in m) with RS 485 Repeater (6ES7972-0AA01-0XA0)
9.6 to 187.5 kbps	10000
500 kbps	4000
1.5 Mbps	2000
3 to 12 Mbps	1000

9.2 Design of the RS 485 Repeater; (6ES7972-0AA01-0XA0)

The table below shows the design and functions of the RS 485 Repeater.

Table 9-3 Description and functions of the RS 485 Repeater

Repeater design	No.	Function
	①	LED 24 V supply voltage
	②	Terminal for the RS 485 Repeater power supply (pin "M5.2" is reference ground, if you want to measure voltage between terminals "A2" and "B2".)
	③	Shield clamp for the strain relief and grounding of the bus cable of bus segments 1 or 2
	④	Terminals for the bus cable of bus segment 1
	⑤	Terminating resistance for bus segment 1
	⑥	LED for bus segment 1
	⑦	OFF switch (= isolate bus segments from each other, for example, for commissioning)
	⑧	LED for bus segment 2
	⑨	Terminating resistance for bus segment 2
	⑩	Terminals for the bus cable of bus segment 2
	⑪	Slide for mounting and removing the RS 485 Repeater on the DIN rail
	⑫	Interface for PG/OP on bus segment 1

9.3 RS 485 Repeater in ungrounded and grounded operation

Grounded or ungrounded

The RS 485 Repeater is ...

- Grounded, if all other nodes on the segment are also operated on ground potential
- ungrounded, if all other nodes in the segment are operated on ungrounded potential

Note

Bus segment 1 is grounded if you connect a PG to the PG/OP socket of the RS 485 Repeater. The segment is grounded, because the MPI in the PG is grounded, and the PG/OP socket of the RS 485 Repeater is connected internally with bus segment 1.

Grounded operation of the RS 485 Repeater

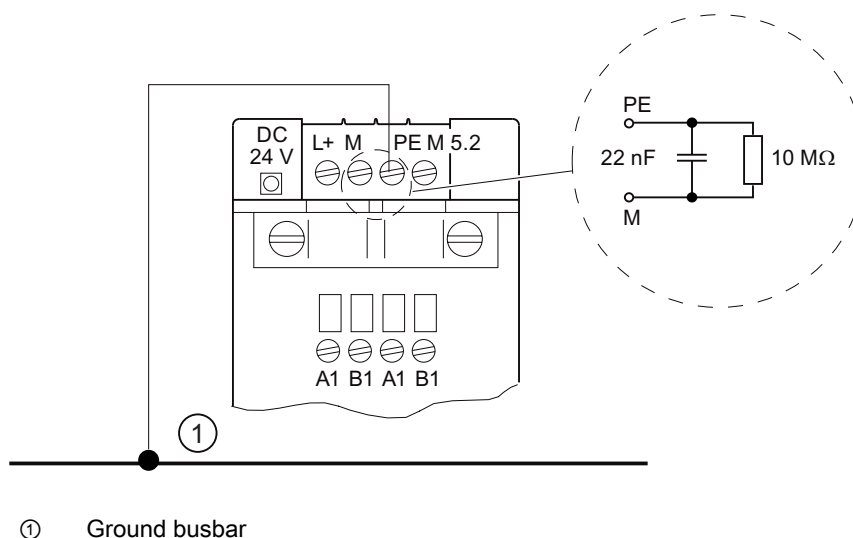
For grounded operation of the RS 485 Repeater, you must bridge terminals "M" and "PE" on the top of the RS 485 Repeater.

Ungrounded operation of the RS 485 Repeater

For ungrounded operation of the RS 485 Repeater, do not interconnect "M" and "PE" on the top of the RS 485 Repeater. In addition, the supply voltage to the RS 485 Repeater must be ungrounded.

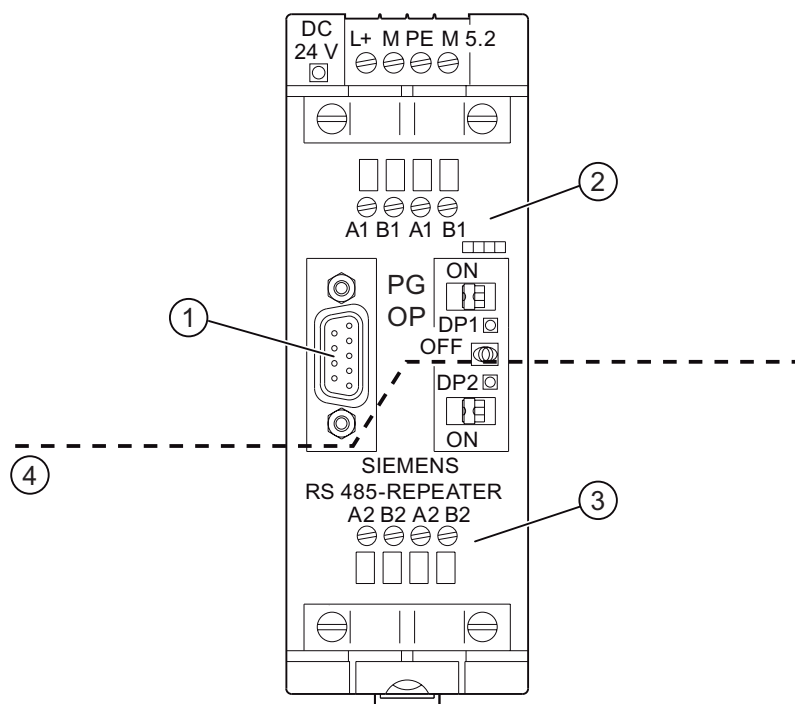
Wiring diagram

In a repeater configuration with ungrounded reference potential (ungrounded operation), any interference currents and static charges are discharged to the protective conductor by means of an RC network integrated in the repeater (refer to the figure below).



Electrical isolation between bus segments

Bus segments 1 and 2 are electrically isolated. The PG/OP interface is connected internally to the port for bus segment 1. The figure below shows the front panel of the RS 485 Repeater.



- ① PG/OP interface
- ② Terminals for bus segment 1
- ③ Terminals for bus segment 2
- ④ Electrical isolation

Amplification of bus signals

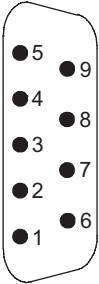
The amplification of the bus signals takes place between the port for bus segment 1 or the PG/OP interface and the port for bus segment 2.

9.4 Technical data

Technical data the RS 485 Repeater

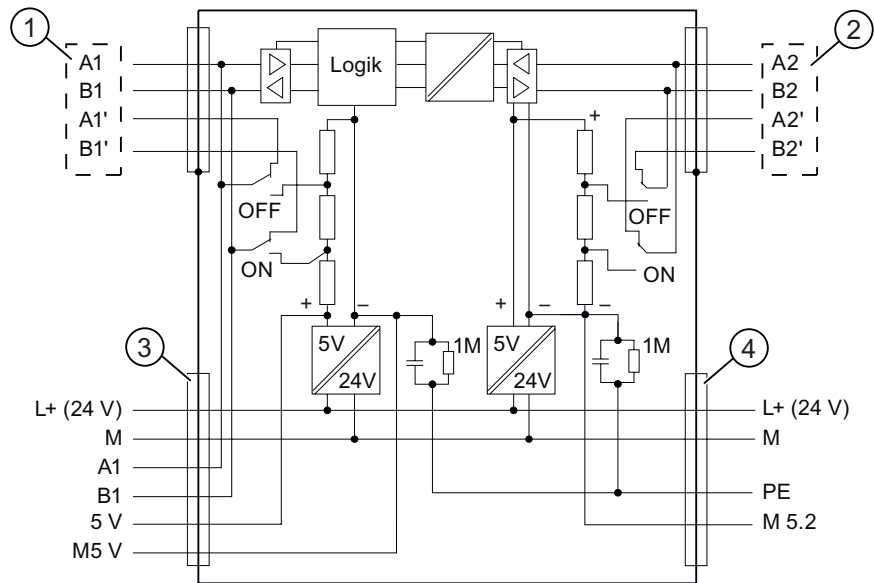
Technical data	
Power supply	
- Rated voltage - Ripple	24 VDC 20.4 VDC to 28.8 VDC
Current consumption at rated voltage	
- without load on PG/OP socket - Load on PG/OP socket (5 V/90 mA) - Load on PG/OP socket (24 V/100 mA)	100 mA 130 mA 200 mA
Electrical isolation	Yes, 500 VAC
Connection of fiber-optic conductors	Yes, via repeater adapters
Redundancy mode	No
Transmission rate (automatically detected by the repeater)	9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps, 3 Mbps, 6 Mbps, 12 Mbps
Degree of protection	IP 20
Dimensions W x H x D (mm)	45 x 128 x 67
Weight (includes packaging)	350 g

Pin assignment of the sub-D connector (PG/OP socket)

View	Pin No.	Signal name	Designation
	1	-	-
	2	M24V	Ground 24 V
	3	RxD/TxD-P	Data line B
	4	RTS	Request To Send
	5	M5V2	Data reference potential (from station)
	6	P5V2	Supply plus (from station)
	7	P24V	24 V
	8	RxD/TxD-N	Data line A
	9	-	-

Block diagram of the RS 485 Repeater

- Bus segments 1 and 2 are electrically isolated.
- Bus segment 2 and the PG/OP socket are electrically isolated.
- Signals are amplified
 - between bus segments 1 and 2
 - between PG/OP socket and bus segment 2



- ① Segment 1
- ② Segment 2
- ③ PG/OP socket
- ④ PG/OP socket

Parameter sets of signal modules

A.1 Principles of programming signal modules in the user program

Parameter assignment in the user program

You have programmed the modules in *STEP 7*.

In the user program, you can use a SFC:

- to assign new parameters to the module, and
- transfer the parameters from the CPU to the addressed signal module

Parameters are stored in data records

The signal module parameters are written to data records 0 and 1; for certain analog input modules, these are also written to data record 128.

Editable parameters

You can edit the parameters of data record 1, and then transfer these to the signal module using SFC55. The CPU parameters are not changed by this action!

You cannot modify any parameters of data record 0 in the user program.

SFCs for programming

SFCs available for programming signal modules in the user program:

Table A-1 SFCs for programming signal modules

SFC no.	Identifier	Application
55	WR_PARM	Transfer modifiable parameters (data record 1 and 28) to the addressed signal module.
56	WR_DPARM	Transfer parameters (data record 0, 1 or 128) from the CPU to the addressed signal module.
57	PARM_MOD	Transfer all parameters (data record 0, 1 and 128) from the CPU to the addressed signal module.

Description of the parameters

The next chapters describe all modifiable parameters of the various module classes. For information on signal module parameters, refer to:

- the *STEP 7* Online Help
- to this Reference Manual

The chapters dealing with the various signal modules also show you the corresponding configurable parameters.

Further references

For detailed information on programming signal modules in the user program and on corresponding SFCs, refer to the *STEP 7* manuals.

A.2 Parameters of digital input modules

Parameters

The table below lists the parameters you can set for digital input modules.

Note

For details on parameters of programmable digital IO modules, see the chapter dealing with the relevant module.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"
- using SFB 53 "WRREC" (for GSD, for example).

Parameters set in *STEP 7* may also be transferred to the module using SFCs 56 and 57, and SFB 53 (refer to the *STEP 7* Online Help).

Table A-2 Parameters of digital IO modules

Parameters	Data record number	Programmable, using ...	
		... SFC 55, SFB 53	... PG
Input delay	0	No	Yes
Diagnostics of missing encoder supply		No	Yes
Wire-break diagnostics		No	Yes
Hardware interrupt enable	1	Yes	Yes
Diagnostics interrupt enable		Yes	Yes
Hardware interrupt at positive edge		Yes	Yes
Hardware interrupt at negative edge		Yes	Yes

Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of digital input modules.

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

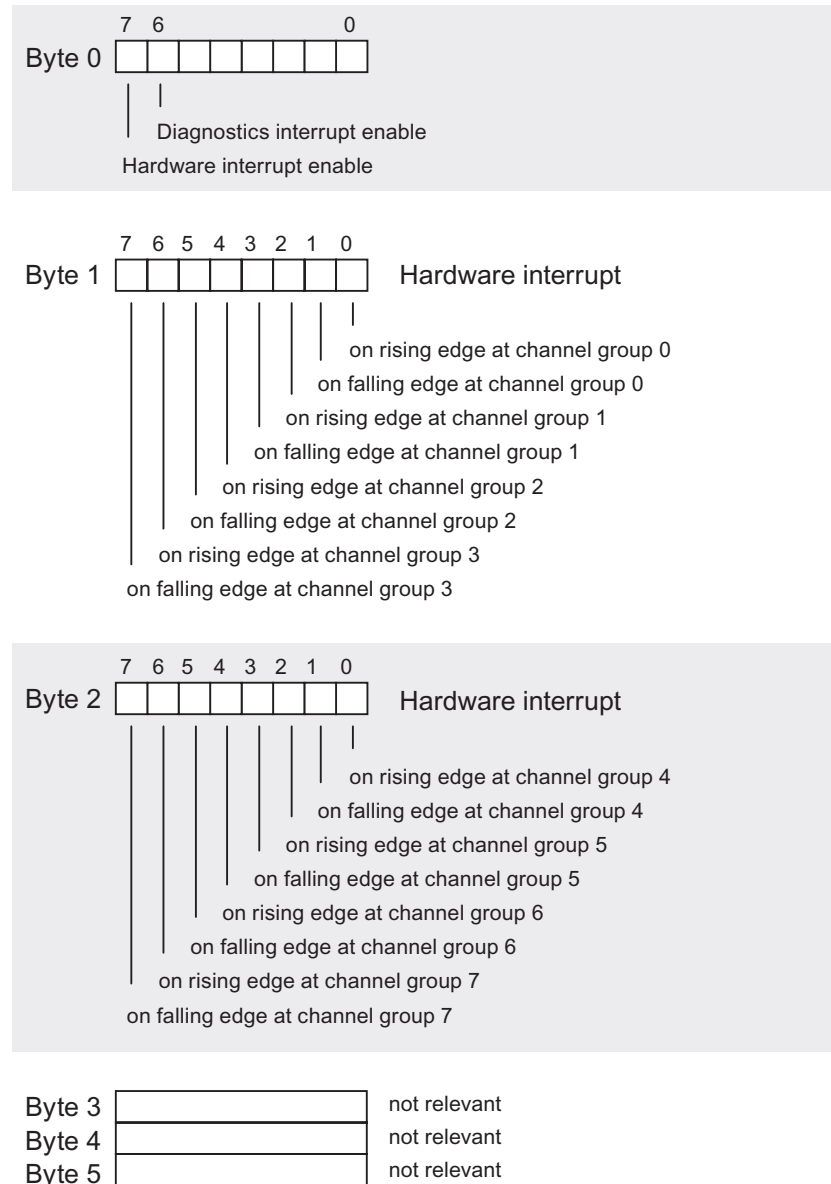


Figure A-1 Data record 1 for parameters of digital input modules

See also

Diagnostics of digital modules (Page 3-9)

A.3 Parameters of digital output modules

Parameters

The table below contains all parameters you can set for digital output modules.

Note

For details on the parameters of programmable digital IO modules, see the chapter dealing with the relevant module.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"
- using SFB 53 "WRREC" (for GSD, for example).

Parameters set in *STEP 7* may also be transferred to the module using SFCs 56 and 57, and SFB 53 (refer to the *STEP 7* Online Help).

Table A-3 Parameters of digital output modules

Parameters	Data record number	Programmable, using ...	
		... SFC 55, SFB 53	... PG
Diagnostics of missing load voltage L+	0	No	Yes
Wire-break diagnostics		No	Yes
Diagnostics of short-circuit to M		No	Yes
Diagnosis of short-circuit to L+		No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Reaction to CPU STOP		Yes	Yes
Set substitution value "1"		Yes	Yes

Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of digital output modules.

You enable a parameter by setting a logic "1" at the corresponding bit of byte 0.

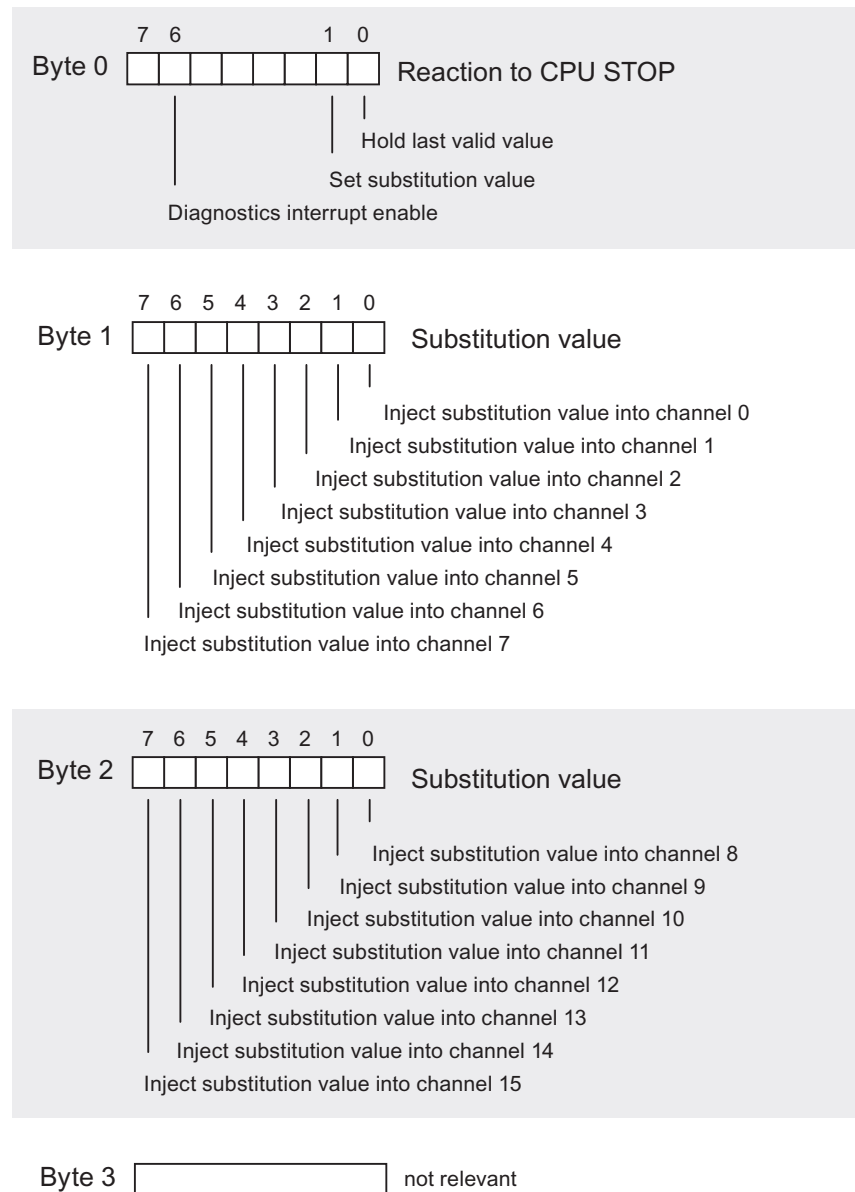


Figure A-2 Data record 1 for parameters of digital output modules

Note

The "hold last valid value" and "set substitution value" parameters should only be enabled at byte 0 as an alternative.

A.4 Parameters of analog input modules

Parameters

The table below lists all parameters you can set for analog input modules.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57 (refer to the *STEP 7* manuals).

Table A-4 Parameters of analog input modules

Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics: with wirebreak monitoring		No	Yes
Temperature unit		No	Yes
Temperature coefficient		No	Yes
Smoothing		No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Hardware interrupt when limit exceeded		Yes	Yes
End of cycle interrupt enable		Yes	Yes
Noise suppression		Yes	Yes
Measuring method		Yes	Yes
Measuring range		Yes	Yes
High limit		Yes	Yes
Low limit		Yes	Yes

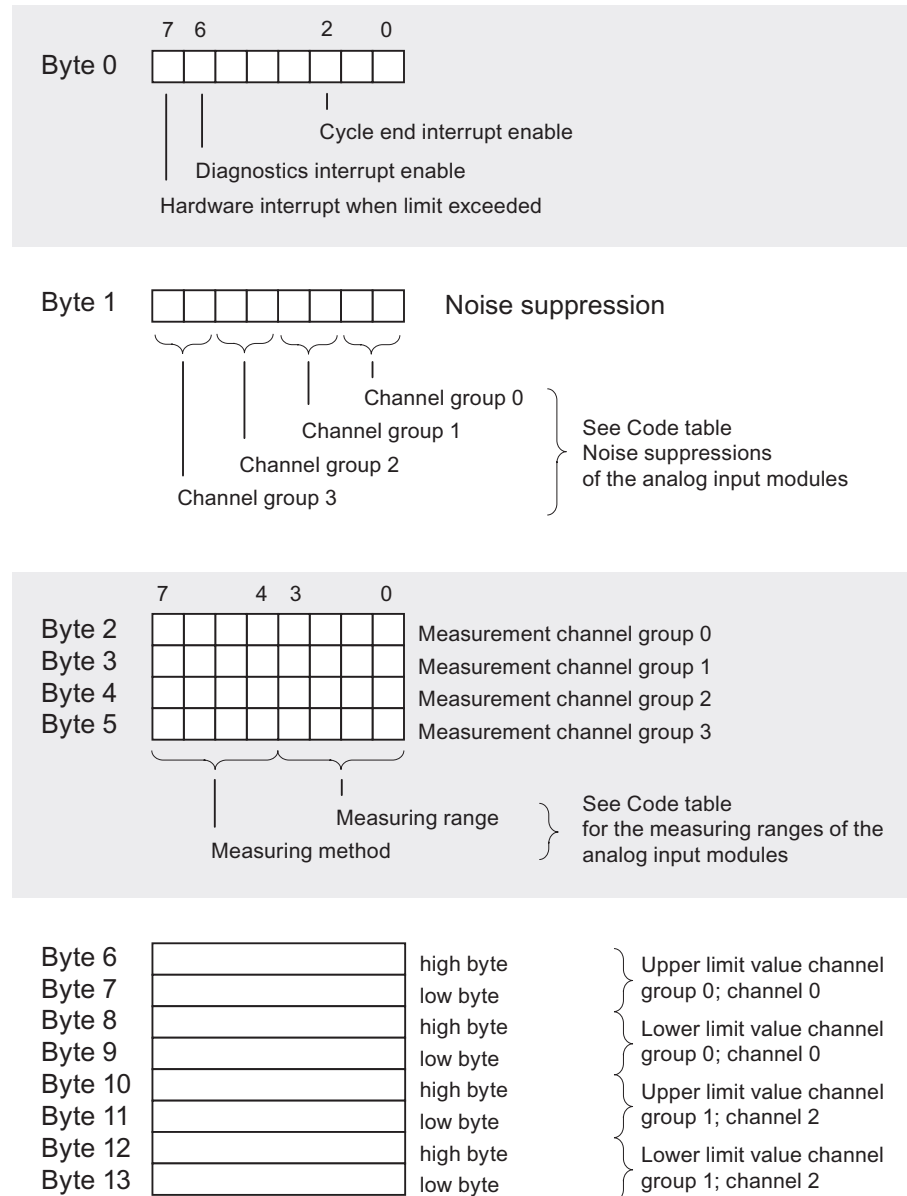
Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of analog input modules.

You enable a parameter by setting a logic "1" at the corresponding bit of byte 0.



Note: For the channel groups, only one limit value for the respective first channel is set.

Figure A-3 Data record 1 for the parameters of analog input modules

Note

The representation of limits matches the analog value representation (see chapter 4.)
Observe range limits when setting the limit values.

Noise suppression

The table below contains the coding at byte 1 of data record 1 for the various frequencies (see the previous figure.) Make allowances for the resultant integration time at each channel!

Table A-5 Noise suppression codes of analog input modules

Noise suppression	Integration time	Code
400 Hz	2.5 ms	2#00
60 Hz	16.7 ms	2#01
50 Hz	20 ms	2#10
10 Hz	100 ms	2#11

Measuring methods and ranges

The table below shows all measuring methods and ranges of the analog input module, including their codes. Enter these codes at bytes 2 to 5 in data record 1 (refer to the previous figure.)

Note

You may have to reposition a measuring range module of the analog input module to suit the measuring range.

Table A-6 Measuring range codes of analog input modules

Measuring method	Code	Measuring range	Code
disabled	2#0000	disabled	2#0000
Voltage	2#0001	± 80 mV	2#0001
		± 250 mV	2#0010
		± 500 mV	2#0011
		± 1 V	2#0100
		± 2.5 V	2#0101
		± 5 V	2#0110
		1 V to 5 V	2#0111
		0 V to 10 V	2#1000
		± 10 V	2#1001
		± 25 mV	2#1010
		± 50 mV	2#1011
4-wire transducer	2#0010	± 3.2 mA	2#0000
		± 10 mA	2#0001
		0 mA to 20 mA	2#0010
		4 mA to 20 mA	2#0011
		± 20 mA	2#0100
		± 5 mA	2#0101
2-wire transducer	2#0011	4 mA to 20 mA	2#0011

Measuring method	Code	Measuring range	Code
Resistance (4-wire connection)	2#0100	150 Ω 300 Ω 600 Ω 10 k Ω	2#0010 2#0100 2#0110 2#1001
Resistance 4-wire connection; 100 Ω compensation	2#0110	52 Ω to 148 Ω 250 Ω 400 Ω 700 Ω	2#0001 2#0011 2#0101 2#0111
Thermal resistance + linearization 4-wire connection	2#1000	Pt 100 Klima Ni 100 Klima Pt 100 Standard range Pt 200 Standard range Pt 500 Standard range Pt 1000 Standard range Ni 1000 Standard range Pt 200 Klima Pt 500 Klima Pt 1000 Klima Ni 1000 Klima Ni 100 Standard range	2#0000 2#0001 2#0010 2#0011 2#0100 2#0101 2#0110 2#0111 2#1000 2#1001 2#1001 2#1011
Thermocouples with internal comparator	2#1010	Type B [PtRh - PtRh] Type N [NiCrSi-NiSi]	2#0000 2#0001
Thermocouples with external comparison	2#1011	Type E [NiCr-CuNi] Type R [PtRh -Pt]	2#0010 2#0011
Thermocouples + linearization internal comparison	2#1101	Type S [PtRh -Pt] Type J [Fe - CuNi IEC]	2#0100 2#0101
Thermocouples + linearization external comparison	2#1110	Type L [Fe-CuNi] Type T [Cu - CuNi] Type K [NiCr-Ni] Type U [Cu -Cu Ni]	2#0110 2#0111 2#1000 2#1001

See also

Analog modules (Page 6-1)

A.5 Parameters of analog input module SM 331; AI 8 x RTD

Parameters

The table below shows all parameters you can set at analog input module SM 331; AI 8 x RTD.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57 (refer to the *STEP 7* manuals).

Table A-7 Parameters of SM 331; AI 8 x RTD

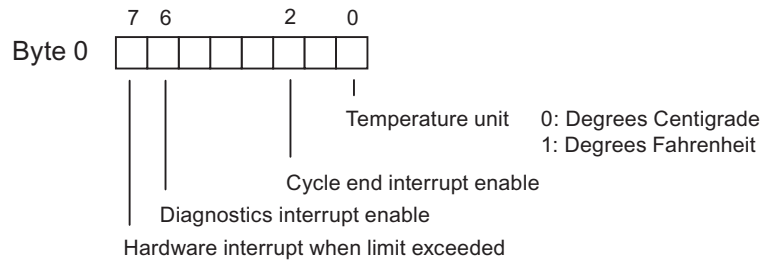
Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics: with wirebreak monitoring		No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Hardware interrupt when limit exceeded		Yes	Yes
End of cycle interrupt enable		Yes	Yes
Temperature unit		Yes	Yes
Measuring method	128	Yes	Yes
Measuring range		Yes	Yes
Mode of operation		Yes	Yes
Temperature coefficient		Yes	Yes
Noise suppression		Yes	Yes
Smoothing		Yes	Yes
High limit		Yes	Yes
Low limit		Yes	Yes

Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 of SM 331; AI 8 x RTD. You enable a parameter by setting a logical "1" at the corresponding bit.



Bytes 1 to 13 are not assigned

Figure A-4 Data record 1 for the parameters of SM 331; AI 8 RTD

Structure of data record 128

The figure below shows the structure of data record 128 of SM 331; AI 8 x RTD.

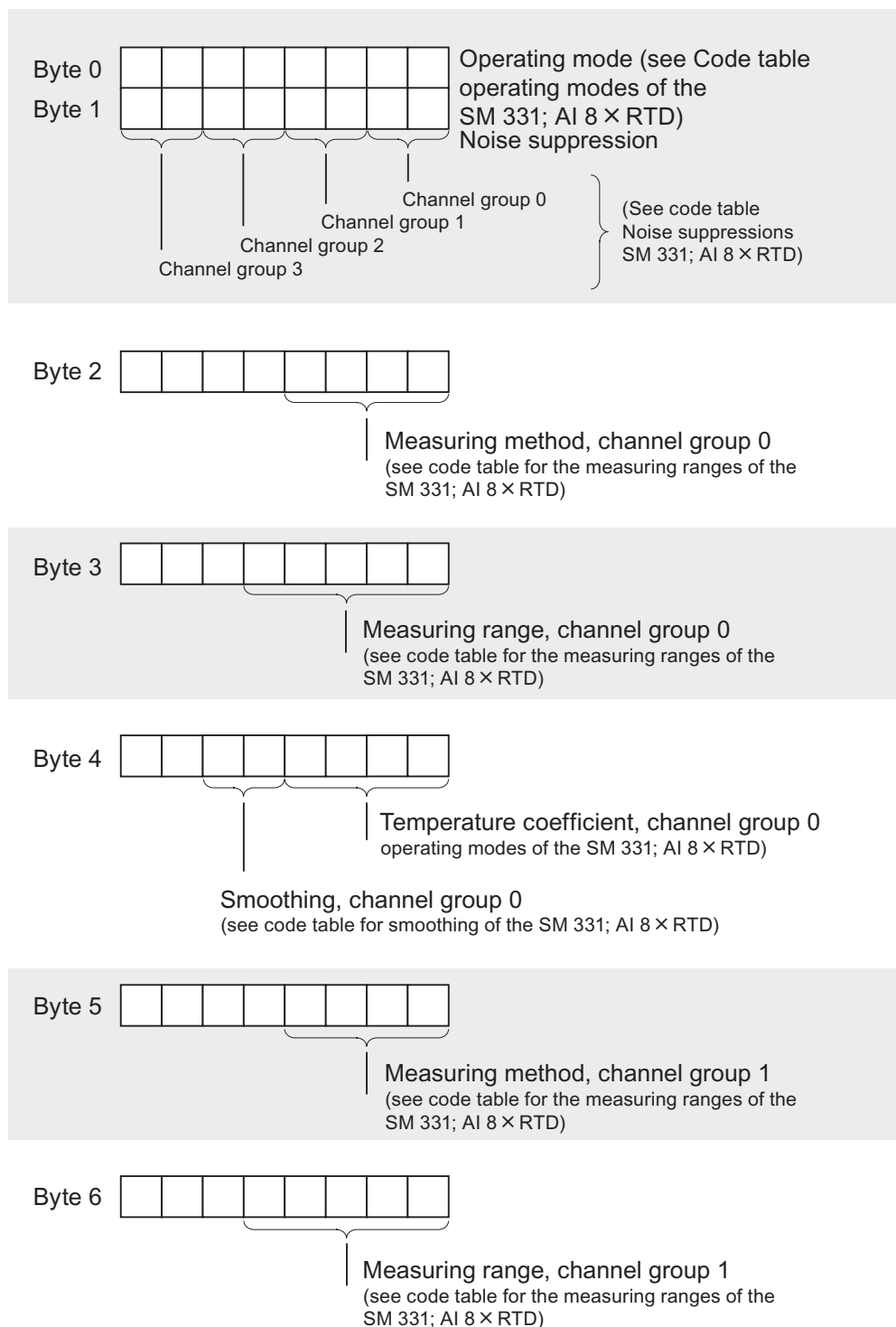


Figure A-5 Data record 128 of SM 331; AI 8 x RTD

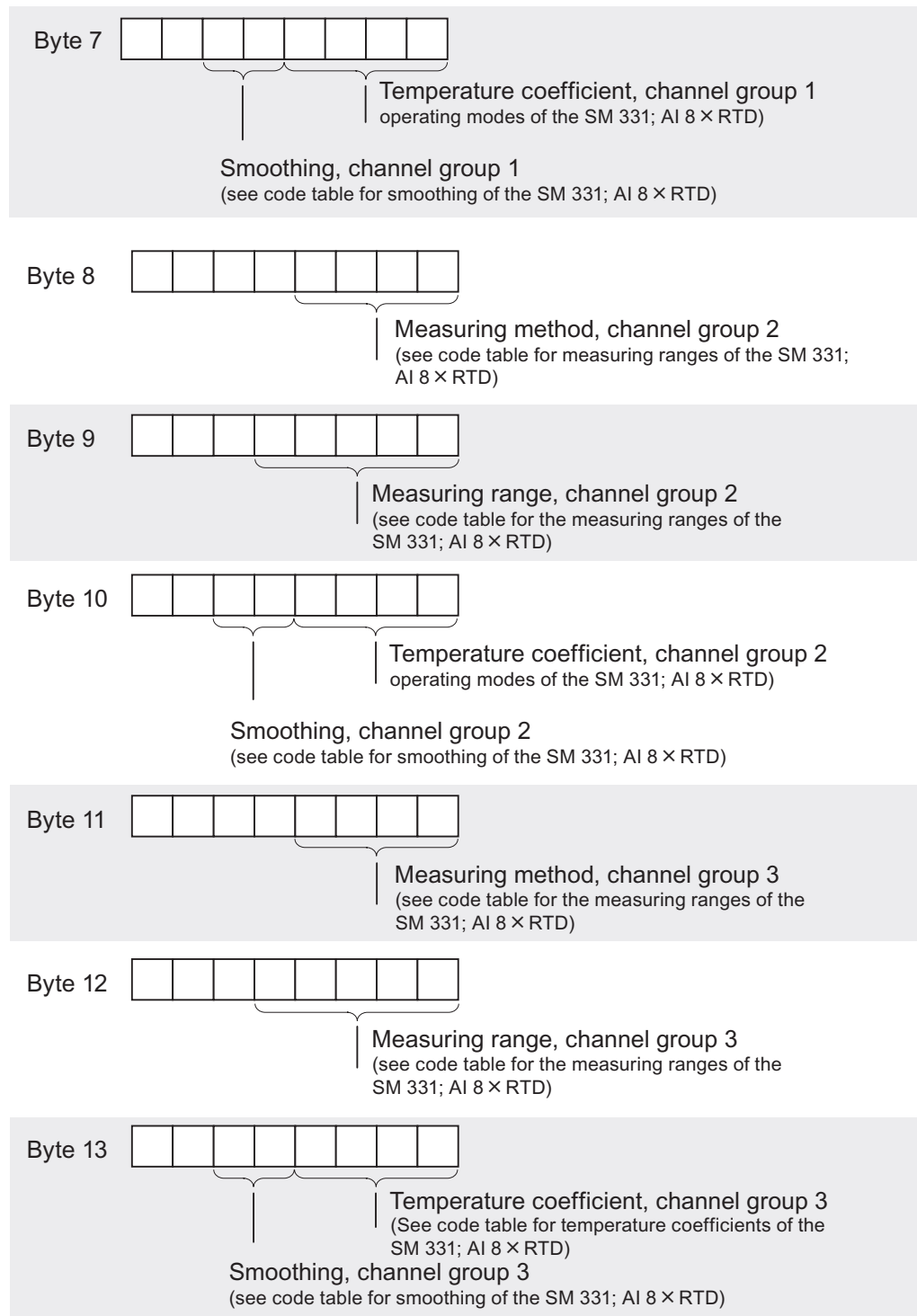


Figure A-6 Data record 128 of SM 331; AI 8 x RTD (continued)

Byte 14								High Byte	}	Upper limit value channel group 0; channel 0
Byte 15								Low Byte		
Byte 16								High Byte	}	Lower limit value channel group 0; channel 0
Byte 17								Low Byte		

Byte 18								High Byte	}	Upper limit value channel group 0; channel 1
Byte 19								Low Byte		
Byte 20								High Byte	}	Lower limit value channel group 0; channel
Byte 21								Low Byte		

Byte 22								High Byte	}	Upper limit value channel group 1; channel 2
Byte 23								Low Byte		
Byte 24								High Byte	}	Lower limit value channel group 1; channel 2
Byte 25								Low Byte		

Byte 26								High Byte	}	Upper limit value channel group 1; channel 3
Byte 27								Low Byte		
Byte 28								High Byte	}	Lower limit value channel group 1; channel 3
Byte 29								Low Byte		

Byte 30								High Byte	}	Upper limit value channel group 2; channel 4
Byte 31								Low Byte		
Byte 32								High Byte	}	Lower limit value channel group 2; channel 4
Byte 33								Low Byte		

Byte 34								High Byte	}	Upper limit value channel group 2 channel 5
Byte 35								Low Byte		
Byte 36								High Byte	}	Lower limit value channel group 2; channel 5
Byte 37								Low Byte		

Figure A-7 Data record 128 of SM 331; AI 8 x RTD (continued)

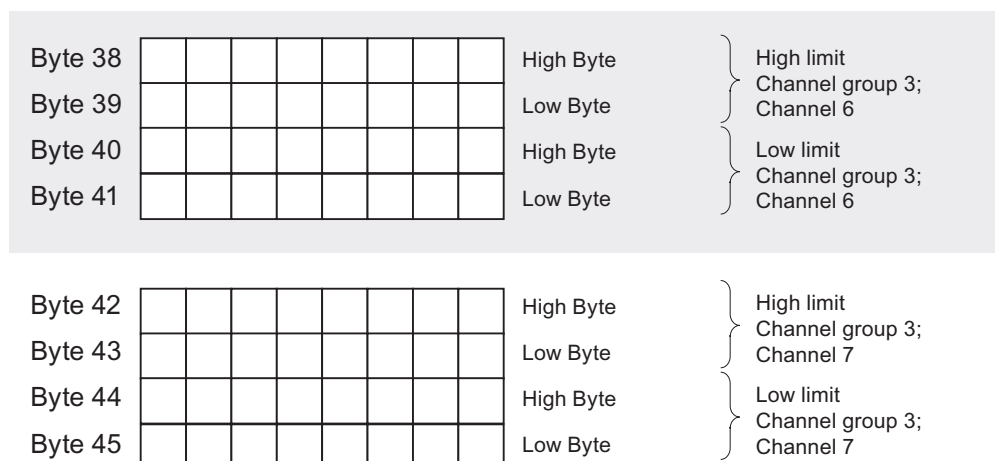


Figure A-8 Data record 128 of SM 331; AI 8 x RTD (continued)

Note

The representation of limits matches the analog value representation. Observe range limits when setting the limit values.

Modes of operation of SM 331; AI 8 x RTD

The table below contains the coding at byte 0 of data record 128 for the various modes of operation (see the previous figure.)

Table A-8 Operating mode codes of SM 331; AI 8 x RTD

Mode of operation	Code
8 channels, hardware filter	2#00000000
8 channels, software filter	2#00000001
4 channels, hardware filter	2#00000010

Noise suppression of SM 331; AI 8 x RTD

The table below contains the frequency codes to be entered at byte 1 of data record 128 (see the previous figure.) The 50 Hz, 60 Hz and 400 Hz only apply to 8channel software filter mode. The 50 Hz, 60 Hz and 400 Hz settings only apply to 4- and 8-channel hardware filter mode.

Table A-9 Noise suppression codes of SM 331; AI 8 x RTD

Noise suppression	Code
400 Hz	2#00
60 Hz	2#01
50 Hz	2#10
50/60/400 Hz	2#11

Measuring methods and ranges of SM 331; AI 8 x RTD

The table below shows all measuring methods and ranges of the module, including their codes. Enter these codes at the corresponding bytes of data record 128 (see the figure *Data record 1 for the parameters of analog input modules*).

Table A-10 Measuring range codes of SM 331; AI 8 x RTD

Measuring method	Code	Measuring range	Code
disabled	2#0000	disabled	2#0000
Resistance (4-wire connection)	2#0100	150 Ω 300 Ω 600 Ω	2#0010 2#0100 2#0110
Resistance (3-wire connection)	2#0101	150 Ω 300 Ω 600 Ω	2#0010 2#0100 2#0110
Thermal resistance + linearization 4-wire connection	2#1000	Pt 100 Klima Ni 100 Klima Pt 100 Standard Ni 100 Standard Pt 500 Standard Pt 1000 Standard Ni 1000 Standard Pt 200 Klima Pt 500 Klima Pt 1000 Klima Ni 1000 Klima Pt 200 Standard Ni 120 Standard Ni 120 Klima Cu 10 Klima Cu 10 Standard Ni 200 Standard Ni 200 Klima Ni 500 Standard Ni 500 Klima Pt 10 GOST climatic Pt 10 GOST Standard Pt 50 GOST climatic Pt 50 GOST climatic Pt 100 GOST climatic Pt 100 GOST Standard Pt 500 GOST climatic Pt 500 GOST Standard Cu 10 GOST climatic Cu 10 GOST Standard Cu 50 GOST climatic Cu 50 GOST Standard Cu 100 GOST climatic Cu 100 GOST Standard Ni 100 GOST climatic Ni 100 GOST Standard	2#00000000 2#00000001 2#00000010 2#00000011 2#00000100 2#00000101 2#00000110 2#00000111 2#00001000 2#00001001 2#00001010 2#00001011 2#00001100 2#00001101 2#00001110 2#00001111 2#00010000 2#00010001 2#00010010 2#00010011 0x14 0x15 0x16 0x17 0x18 0x19 0x1A 0x1B 0xC 0xD 0xE 0xF 0x20 0x30 0x22 0x23

Measuring method	Code	Measuring range	Code
Thermal resistance + linearization 3-wire connection	2#1001	Pt 100 Klima	2#00000000
		Ni 100 Klima	2#00000001
		Pt 100 Standard	2#00000010
		Ni 100 Standard	2#00000011
		Pt 500 Standard	2#00000100
		Pt 1000 Standard	2#00000101
		Ni 1000 Standard	2#00000110
		Pt 200 Klima	2#00000111
		Pt 500 Klima	2#00001000
		Pt 1000 Klima	2#00001001
		Ni 1000 Klima	2#00001010
		Pt 200 Standard	2#00001011
		Ni 120 Standard	2#00001100
		Ni 120 Klima	2#00001101
		Cu 10 Klima	2#00001110
		Cu 10 Standard	2#00001111
		Ni 200 Standard	2#00010000
		Ni 200 Klima	2#00010001
		Ni 500 Standard	2#00010010
		Ni 500 Klima	2#00010011
		Pt 10 GOST climatic	0x14
		Pt 10 GOST Standard	0x15
		Pt 50 GOST climatic	0x16
		Pt 50 GOST climatic	0x17
		Pt 100 GOST climatic	0x18
		Pt 100 GOST Standard	0x19
		Pt 500 GOST climatic	0x1A
		Pt 500 GOST Standard	0x1B
		Cu 10 GOST climatic	0xC
		Cu 10 GOST Standard	0xD
		Cu 50 GOST climatic	0xE
		Cu 50 GOST Standard	0xF
		Cu 100 GOST climatic	0x20
		Cu 100 GOST Standard	0x30
		Ni 100 GOST climatic	0x22
		Ni 100 GOST Standard	0x23

Temperature coefficient of SM 331; AI 8 x RTD

The table below contains the temperature coefficient codes to be entered at the corresponding byte of data record 128 (refer to the previous figure.)

Table A-11 Temperature coefficient codes of SM 331; AI 8 x RTD

Temperature coefficient	Code
Pt 0.003850 $\Omega/\Omega/^{\circ}\text{C}$ (IPTS-68)	2#0000
Pt 0.003916 $\Omega/\Omega/^{\circ}\text{C}$	2#0001
Pt 0.003902 $\Omega/\Omega/^{\circ}\text{C}$	2#0010
Pt 0.003920 $\Omega/\Omega/^{\circ}\text{C}$	2#0011
Pt 0.003850 $\Omega/\Omega/^{\circ}\text{C}$ (ITS-90)	2#0100
Pt 0.003910 $\Omega/\Omega/^{\circ}\text{C}$	2#0101
Pt 0.006170 $\Omega/\Omega/^{\circ}\text{C}$	2#0111

Temperature coefficient	Code
Ni 0.006180 $\Omega/\Omega/^{\circ}\text{C}$	2#1000
Ni 0.006720 $\Omega/\Omega/^{\circ}\text{C}$	2#1001
0.005000 $\Omega/\Omega/^{\circ}\text{C}$ (LG Ni 1000)	2#1010
Cu 0.004260 $\Omega/\Omega/^{\circ}\text{C}$	2#1011
Cu 0.004270 $\Omega/\Omega/^{\circ}\text{C}$	2#1100
Cu 0.004280 $\Omega/\Omega/^{\circ}\text{C}$	2#1101

Smoothing function of SM 331; AI 8 x RTD

The table below lists all smoothing codes to be entered at the corresponding byte of data record 128 (refer to the previous figure.)

Table A-12 Smoothing codes of SM 331; AI 8 x RTD

Smoothing	Code
None	2#00
Low	2#01
Average	2#10
High	2#11

See also

Analog modules (Page 6-1)

Parameters of analog input modules (Page A-6)

A.6 Parameters of analog input module SM 331; AI 8 x TC

Parameters

The table below shows all parameters you can set at analog input module SM 331; AI 8 x TC.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57 (refer to the *STEP 7* manuals).

Table A-13 Parameters of SM 331; AI 8 TC

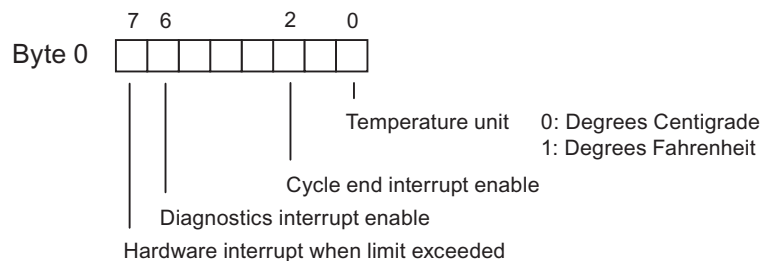
Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics: with wirebreak monitoring		No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Hardware interrupt when limit exceeded		Yes	Yes
End of cycle interrupt enable		Yes	Yes
Temperature unit		Yes	Yes
Measuring method	128	Yes	Yes
Measuring range		Yes	Yes
Mode of operation		Yes	Yes
Reaction to open thermocouple		Yes	Yes
Noise suppression		Yes	Yes
Smoothing		Yes	Yes
High limit		Yes	Yes
Low limit		Yes	Yes

Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 of SM 331; AI 8 x TC. You enable a parameter by setting a logical "1" at the corresponding bit.



Bytes 1 to 13 are not assigned

Figure A-9 Data record 1 for the parameters of SM 331; AI 8 x TC

Structure of data record 128

The figure below shows the structure of data record 128 of SM 331; AI 8 x TC.

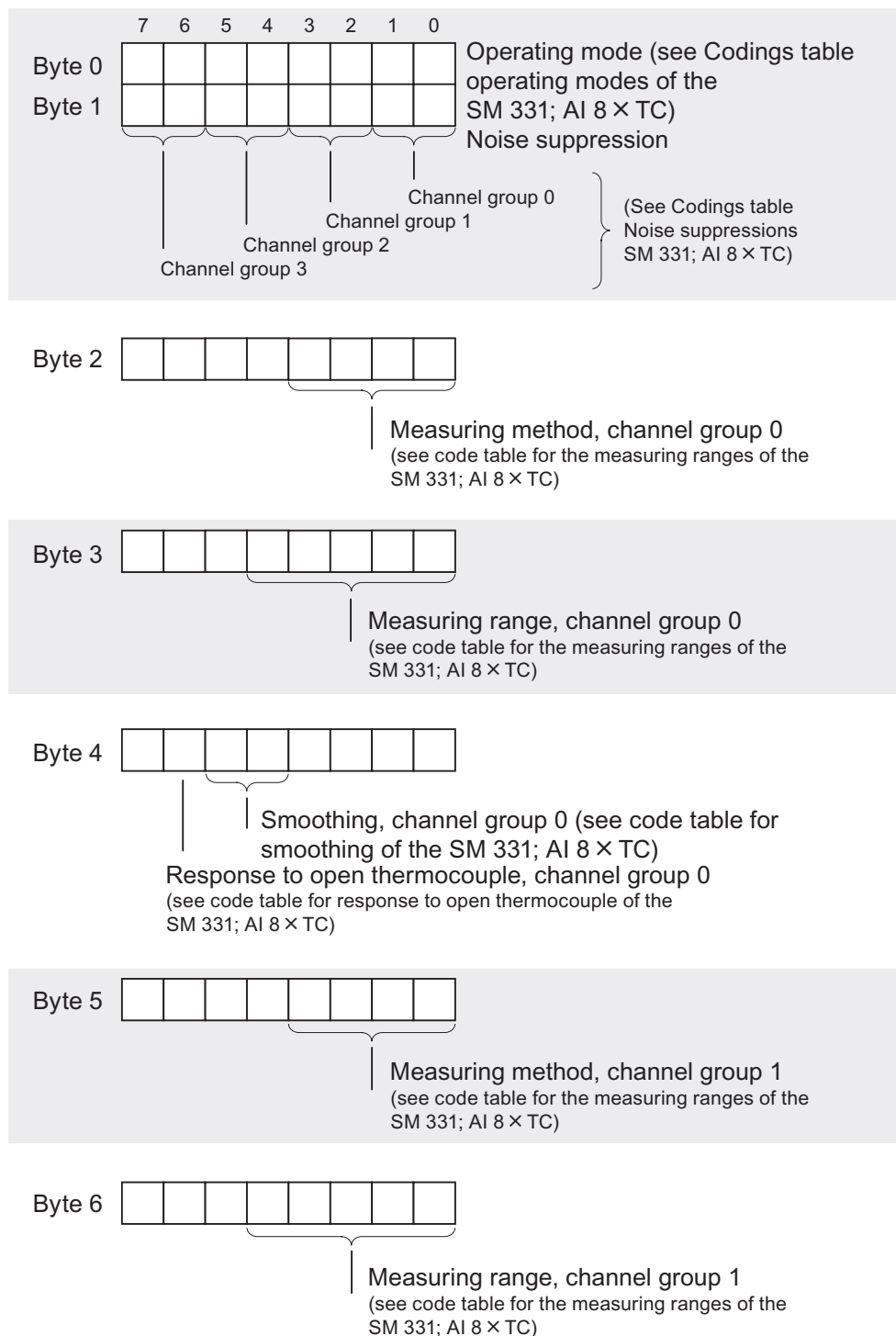


Figure A-10 Fig. A-10 Data record 128 of SM 331; AI 8 x TC (continued)

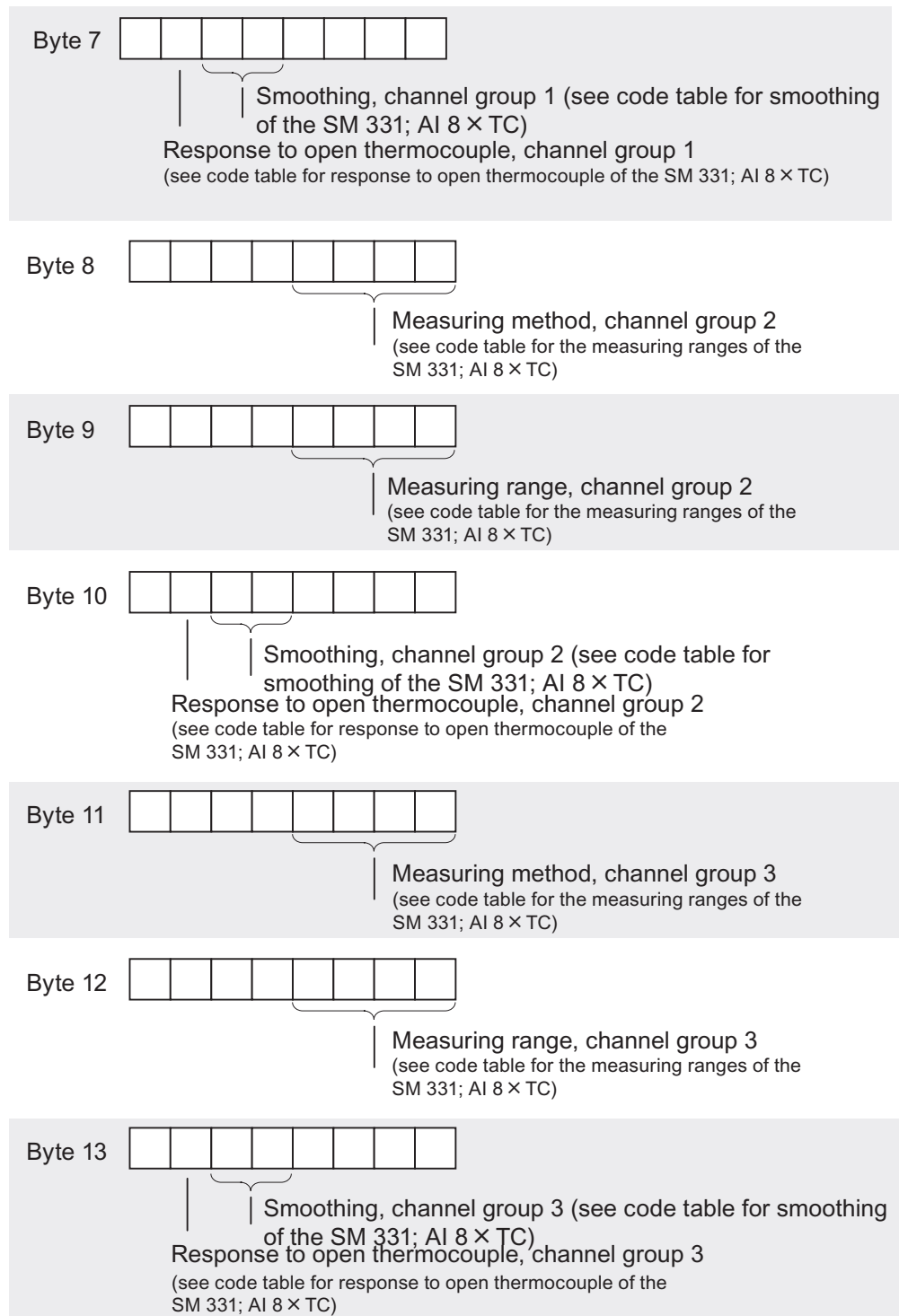


Figure A-11 Data record 128 of SM 331; AI 8 TC (continued)

Byte 14								High Byte	}	High limit
Byte 15								Low Byte		Channel group 0;
Byte 16								High Byte	}	Low limit
Byte 17								Low Byte		Channel group 0;
										Channel 0

Byte 18								High Byte	}	High limit
Byte 19								Low Byte		Channel group 0;
Byte 20								High Byte	}	Low limit
Byte 21								Low Byte		Channel group 0;
										Channel 1

Byte 22								High Byte	}	High limit
Byte 23								Low Byte		Channel group 1;
Byte 24								High Byte	}	Low limit
Byte 25								Low Byte		Channel group 1;
										Channel 2

Byte 26								High Byte	}	High limit
Byte 27								Low Byte		Channel group 1;
Byte 28								High Byte	}	Low limit
Byte 29								Low Byte		Channel group 1;
										Channel 3

Byte 30								High Byte	}	High limit
Byte 31								Low Byte		Channel group 2;
Byte 32								High Byte	}	Low limit
Byte 33								Low Byte		Channel group 2;
										Channel 4

Byte 34								High Byte	}	High limit
Byte 35								Low Byte		Channel group 2;
Byte 36								High Byte	}	Low limit
Byte 37								Low Byte		Channel group 2;
										Channel 5

Figure A-12 Data record 128 of SM 331; AI 8 TC (continued)

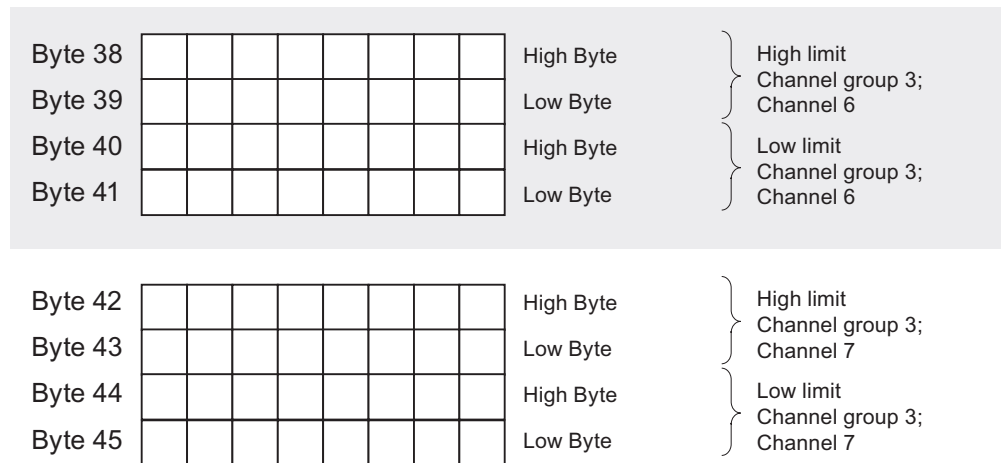


Figure A-13 Data record 128 of SM 331; AI 8 TC (continued)

Note

The representation of limits matches the analog value representation. Observe range limits when setting the limit values.

Modes of operation of SM 331; AI 8 x TC

The table below contains the coding at byte 0 of data record 128 for the various modes of operation (see the previous figure.)

Table A-14 Operating mode codes of SM 331; AI 8 x TC

Mode of operation	Code
8 channels, hardware filter	2#00000000
8 channels, software filter	2#00000001
4 channels, hardware filter	2#00000010

Noise suppression of SM 331; AI 8 x TC

The table below contains the frequency codes to be entered at byte 1 of data record 128 (see the previous figure.) The 400 Hz, 60 Hz and 50 Hz settings only apply to 8-channel software filter mode. The 50 Hz, 60 Hz and 400 Hz settings only apply to 4- and 8-channel hardware filter mode.

Table A-15 Noise suppression codes of SM 331; AI 8 x TC

Noise suppression	Code
400 Hz	2#00
60 Hz	2#01
50 Hz	2#10
50/60/400 Hz	2#11

Measuring methods and ranges of SM 331; AI 8 x TC

The table below shows all measuring methods and ranges of the module, including their codes. Enter these codes at the corresponding bytes of data record 128 (see the figure *Data record 1 for the parameters of analog input modules*).

Table A-16 Measuring range codes of SM 331; AI 8 x TC

Measuring method	Code	Measuring range	Code
disabled	2#0000	disabled	2#0000
(thermocouple, linear, 0 °C reference temperature)	2#1010	B N E R S J L T K U C TXK/XK(L)	2#0000 2#0001 2#0010 2#0011 2#0100 2#0101 2#0110 2#0111 2#1000 2#1001 2#1010 2#1011
(thermocouple, linear, 50 °C reference temperature)	2#1011	B N E R S J L T K U C TXK/XK(L)	2#0000 2#0001 2#0010 2#0011 2#0100 2#0101 2#0110 2#0111 2#1000 2#1001 2#1010 2#1011

Measuring method	Code	Measuring range	Code
Thermocouple, linear, internal comparison	2#1101	B	2#0000
		N	2#0001
		E	2#0010
		R	2#0011
		S	2#0100
		J	2#0101
		L	2#0110
		T	2#0111
		K	2#1000
		U	2#1001
		C	2#1010
		TXK/XK(L)	2#1011
Thermocouple, linear, external comparison	2#1110	B	2#0000
		N	2#0001
		E	2#0010
		R	2#0011
		S	2#0100
		J	2#0101
		L	2#0110
		T	2#0111
		K	2#1000
		U	2#1001
		C	2#1010
		TXK/XK(L)	2#1011

Reaction to open thermocouple of SM 331; AI 8 x TC

The table below lists the codes for the reaction to an open thermocouple to enter at the corresponding byte of data record 128 (refer the previous figure.)

Table A-17 Codes of the reaction to open thermocouple of SM 331; AI 8 x TC

Reaction to open thermocouple	Code
Overflow	2#0
Underflow	2#1

Smoothing of SM 331; AI 8 x TC

The table below lists all smoothing codes to be entered at the corresponding byte of data record 128 (refer to the previous figure.)

Table A-18 Smoothing codes of SM 331; AI 8 x TC

Smoothing	Code
None	2#00
Low	2#01
Average	2#10
High	2#11

See also

Analog modules (Page 6-1)

Parameters of analog input modules (Page A-6)

A.7 Parameters of analog input module SM 331; AI 8 x 13 Bit

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of the analog input module.

You enable a parameter by setting a logical "1" at the corresponding bit in byte 0.

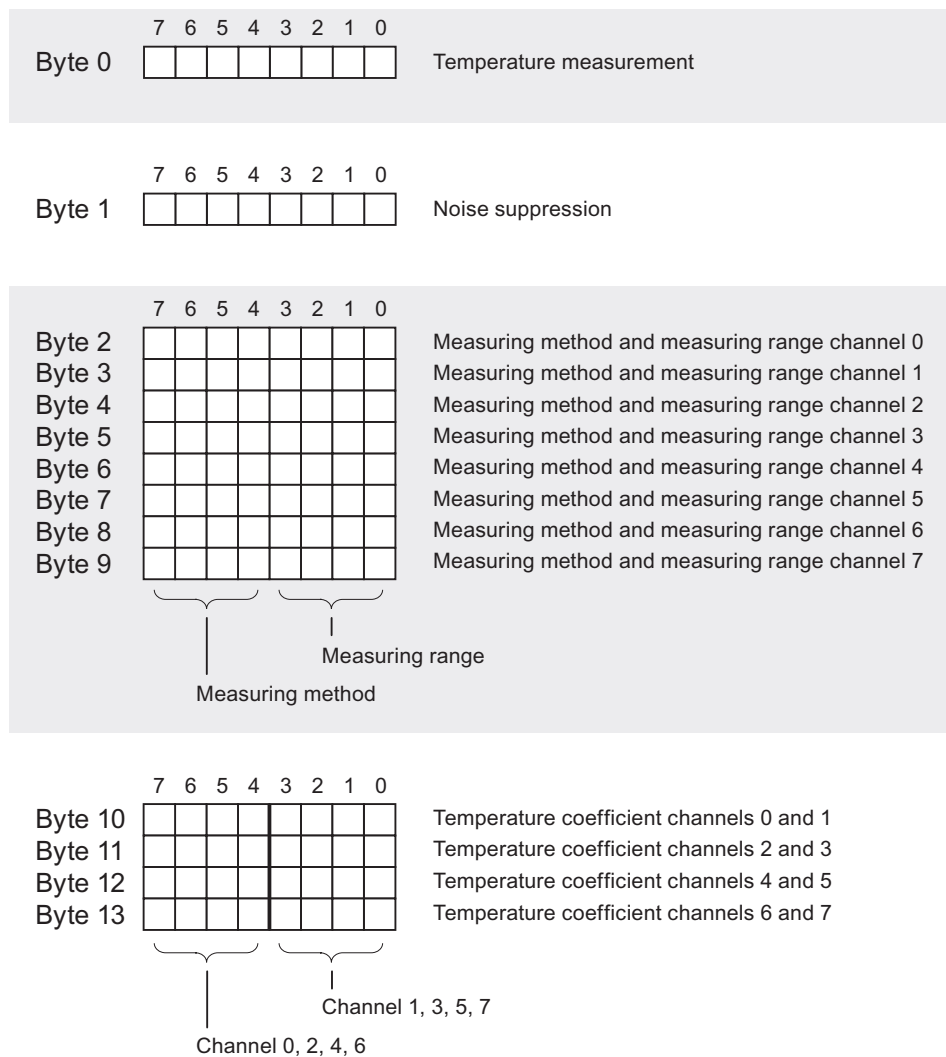


Figure A-14 Data record 1 for the parameters of analog input modules

Temperature measurement

The table below lists the temperature measurement codes to be entered at byte 0 of data record 1 (see the previous figure.)

Table A-19 Temperature measurement codes of the analog input module

Temperature unit for linearization	Code
Degrees Centigrade	2#0000 0000
Degrees Fahrenheit	2#0000 1000
Kelvin	2#0001 0000

Noise suppression

The table below contains the frequency codes to be entered at byte 1 of data record 1 (see the previous figure.) Make allowances for the resultant integration time at each module!

Table A-20 Noise suppression codes of the analog input module

Noise suppression	Integration time	Code
60 Hz	50 ms	2#01
50 Hz	60 ms	2#10

Measuring methods and ranges

The table below contains all the measuring methods and ranges of the analog input module, including their codes. Enter these codes at bytes 2 to 13 in data record 1 (refer to the previous figure.)

Note

The front connector of the analog input module must be wired in accordance with the measuring range!

Table A-21 Measuring ranges codes of the analog input module

Measuring method	Code	Measuring range	Code
disabled	2#0000	disabled	2#0000
Voltage	2#0001	± 50 mV ± 500 mV ± 1 V ± 5 V 1 V to 5 V 0 V to 10 V ± 10 V	2#1011 2#0011 2#0100 2# 0110 2#0111 2#1000 2#1001
Current	2#0010	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	2#0010 2#0011 2#0100
Resistance	2#0101	600 Ω 6 kΩ	2#0110 2#1000
Thermoelectric resistance (linear)	2#1001	Pt 100 Klima Pt 100 Standard Ni 100 Klima Ni 100 Standard Ni 1000 / LG-Ni 1000 Klima Ni 1000 / LG-Ni 1000 Standard	2#0000 2#0010 2#0001 2#0011 2#1010 2#0110

Temperature coefficient

The table below lists the temperature coefficient codes to be entered at bytes 10 to 13 of data record (refer to previous figure.)

Table A-22 Temperature measurement codes of the analog input module

Temperature coefficient	Measuring range	Code
Pt 0.003850 Ω/Ω/°C (ITS-90)	Pt 100	2#0100
Ni 0.006180 Ω/Ω/°C	Ni 100 / Ni 1000	2#1000
Ni 0.005000 Ω/Ω/°C	LG-Ni 1000	2#1010

A.8 Parameters of analog input module SM 331; AI 8 x 16 Bit

Parameters

The table below shows all parameters you can set for electrically isolated analog input module SM 331; AI 8 x Bit. This comparison shows which specific method you can use to configure the various parameters:

- SFC 55 "WR_PARM"
- *STEP 7* programming device

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 or SFC 57.

Table A-23 Parameters for the electrically isolated analog input module SM 331; AI 8 x 16 Bit

Parameters	Data record no.	Configurable using...	
		...SFC 55	...Programming device
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics: with wirebreak monitoring		No	Yes
Hardware interrupt when limit exceeded	1	Yes	Yes
Diagnostics interrupt enable		Yes	Yes
End-of-cycle alarm enable		Yes	Yes
Module operating mode	128	Yes	Yes
Noise suppression		Yes	Yes
Measuring method		Yes	Yes
Measuring range		Yes	Yes
Smoothing		Yes	Yes
High limit		Yes	Yes
Low limit		Yes	Yes

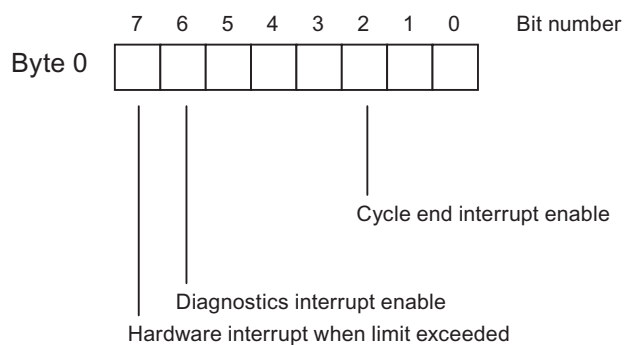
Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of the electrically isolated analog input module SM 331; AI 8 x 16 bit.

You enable a parameter by setting a logical "1" at the corresponding bit in byte 0.



Bytes 1 to 13 are not assigned

Figure A-15 Data record 1 for parameters of SM 331; AI 8 x 16 Bit

Structure of data record 128

The figure below shows the structure of data record 128 for the parameters of the electrically isolated analog input module SM 331; AI 8 x 16 bit.

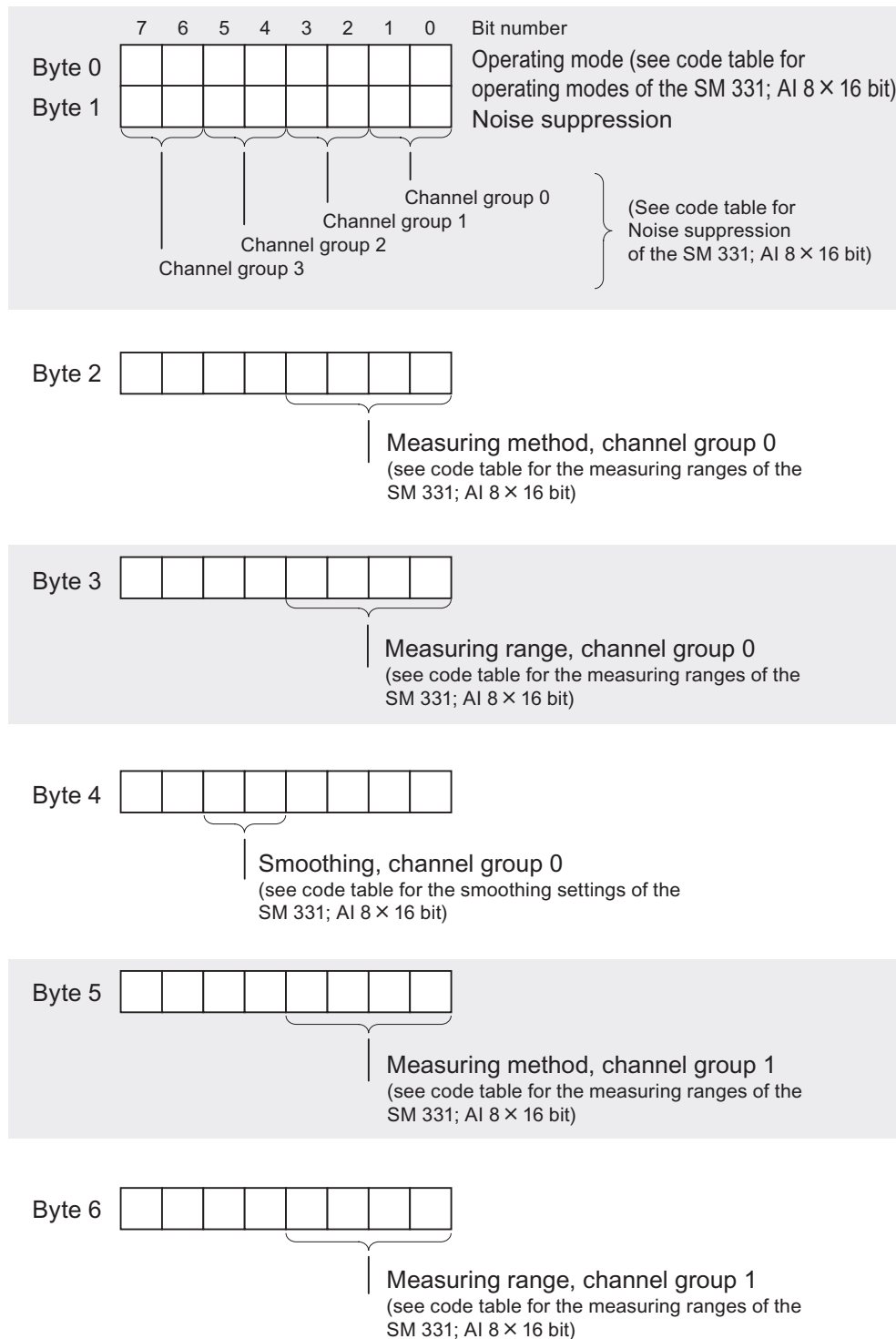


Figure A-16 Data record 128 for parameters of SM 331; AI 8 x 16 Bit

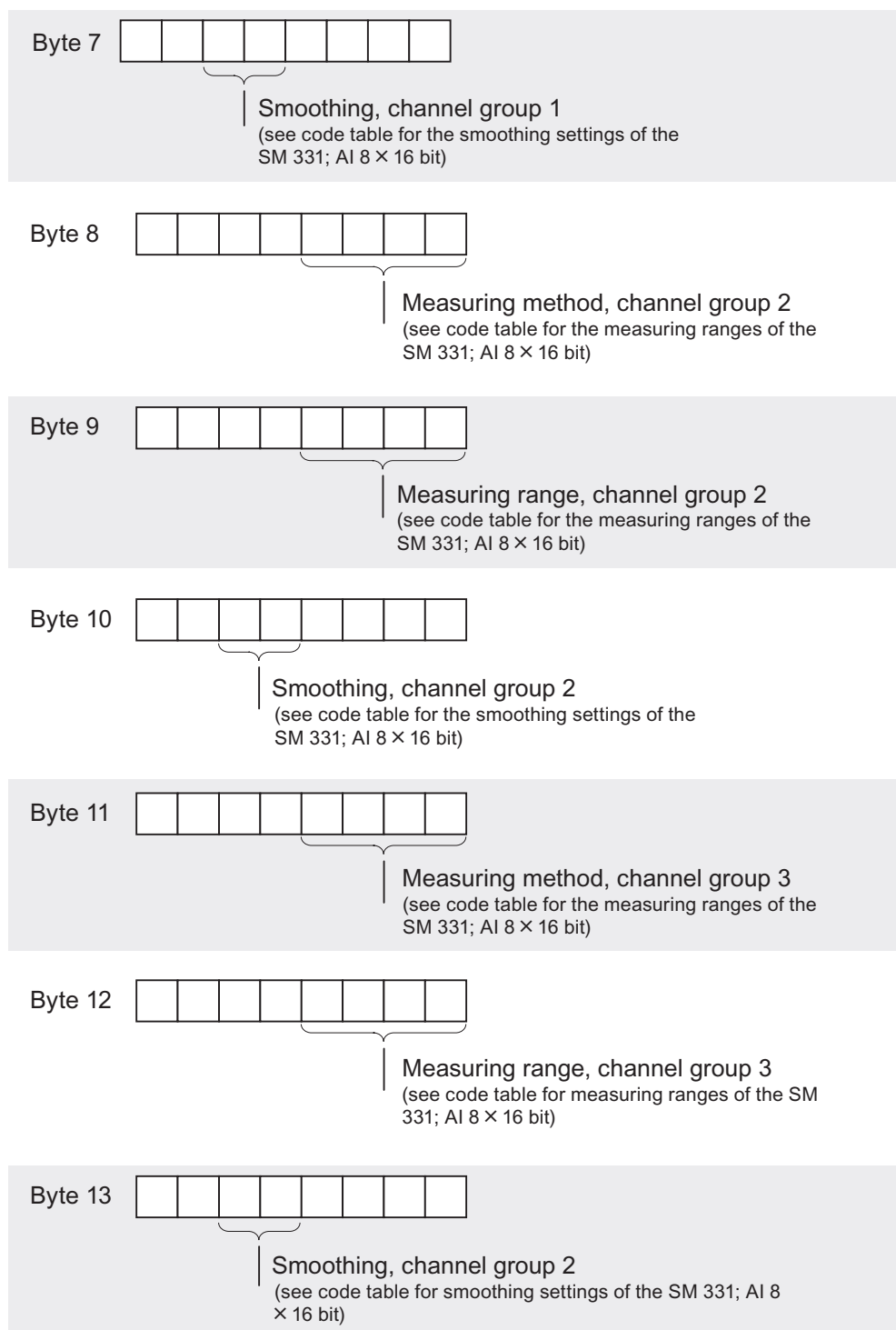


Figure A-17 Data record 128 for parameters of SM 331; AI 8 x 16 Bit (continued)

A.8 Parameters of analog input module SM 331; AI 8 x 16 Bit

Byte 14								High Byte	}	High limit Channel group 0; Channel 0
Byte 15								Low Byte		
Byte 16								High Byte	}	Low limit Channel group 0; Channel 0
Byte 17								Low Byte		
Byte 18								High Byte	}	High limit Channel group 0; Channel 1
Byte 19								Low Byte		
Byte 20								High Byte	}	Low limit Channel group 0; Channel 1
Byte 21								Low Byte		
Byte 22								High Byte	}	High limit Channel group 1; Channel 2
Byte 23								Low Byte		
Byte 24								High Byte	}	Low limit Channel group 1; Channel 2
Byte 25								Low Byte		
Byte 26								High Byte	}	High limit Channel group 1; Channel 3
Byte 27								Low Byte		
Byte 28								High Byte	}	Low limit Channel group 1; Channel 3
Byte 29								Low Byte		
Byte 30								High Byte	}	High limit Channel group 2; Channel 4
Byte 31								Low Byte		
Byte 32								High Byte	}	Low limit Channel group 2; Channel 4
Byte 33								Low Byte		
Byte 34								High Byte	}	High limit Channel group 2; Channel 5
Byte 35								Low Byte		
Byte 36								High Byte	}	Low limit Channel group 2; Channel 5
Byte 37								Low Byte		

Figure A-18 Data record 128 for parameters of SM 331; AI 8 x 16 Bit (continued)

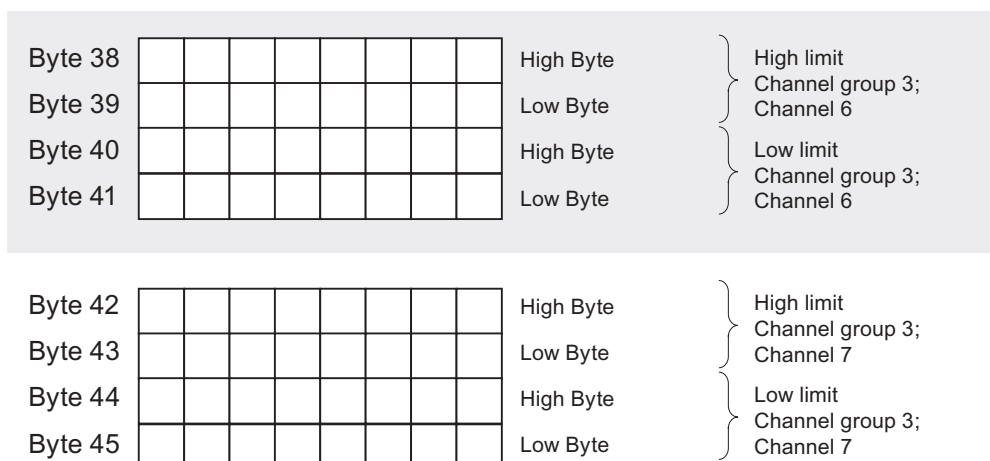


Figure A-19 Data record 128 for parameters of SM 331; AI 8 x 16 Bit (continued)

Note

The representation of limits matches the analog value representation. Observe range limits when setting the limit values.

Module operating modes

The table below lists the operating mode codes to be entered at byte 0 of data record 128 (see the previous figure.)

Table A-24 Operating mode codes of SM 331; AI 8 x 16 Bit

Module operating mode	Code
8 channels	2#00000000
4 channels	2#00000001

Noise suppression

The table below lists the frequency codes to be entered at byte 1 of data record 128 (see the previous figure.) 4-channel mode only works if 50 Hz, 60 Hz and 400 Hz noise suppression is set.

Table A-25 Noise suppression codes of SM 331; AI 8 x 16 Bit

Noise suppression	Code
400 Hz	2#00
60 Hz	2#01
50 Hz	2#10
50 Hz, 60 Hz and 400 Hz	2#11

Measuring methods and ranges

The table below lists the measuring ranges of the electrically isolated analog input module SM 331; AI 8 x 16 bit. The table below shows the measuring method and range codes. Enter these codes according to the required measuring range at the relevant byte of data record 128 (see previous figure.)

Table A-26 Measuring range codes of SM 331; AI 8 x 16 Bit

Measuring method	Code	Measuring range	Code
Disabled	2#0000	Disabled	2#0000
Voltage	2#0001	± 5 V 1 V to 5 V ± 10 V	2#0110 2#0111 2#1001
Current (4-wire transducer)	2#0010	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	2#0010 2#0011 2#0100

Settings of input smoothing

The table below lists the smoothing settings of the electrically isolated analog input module SM 331; AI 8 x 16 Bit. Enter these codes according to the required smoothing at the relevant byte of data record 128 (see previous figure.)

Table A-27 Smoothing codes of SM 331; AI 8 x 16 Bit

Smoothing settings	Code
None	2#00
Low	2#01
Average	2#10
High	2#11

See also

Analog modules (Page 6-1)

A.9 Parameters of analog output modules

Parameters

The table below lists all parameters you can set for analog output modules. The comparison shows:

- which parameters you can edit in *STEP 7*, and
- which parameters you can change using SFC 55 "WR_PARM".

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57.

Table A-28 Parameters of analog output modules

Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Reaction to CPU STOP		Yes	Yes
Output type		Yes	Yes
Output range		Yes	Yes
Substitution value		Yes	Yes

Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of analog output modules.

You enable diagnostics interrupts by setting a logic "1" at the corresponding bit of byte 0.

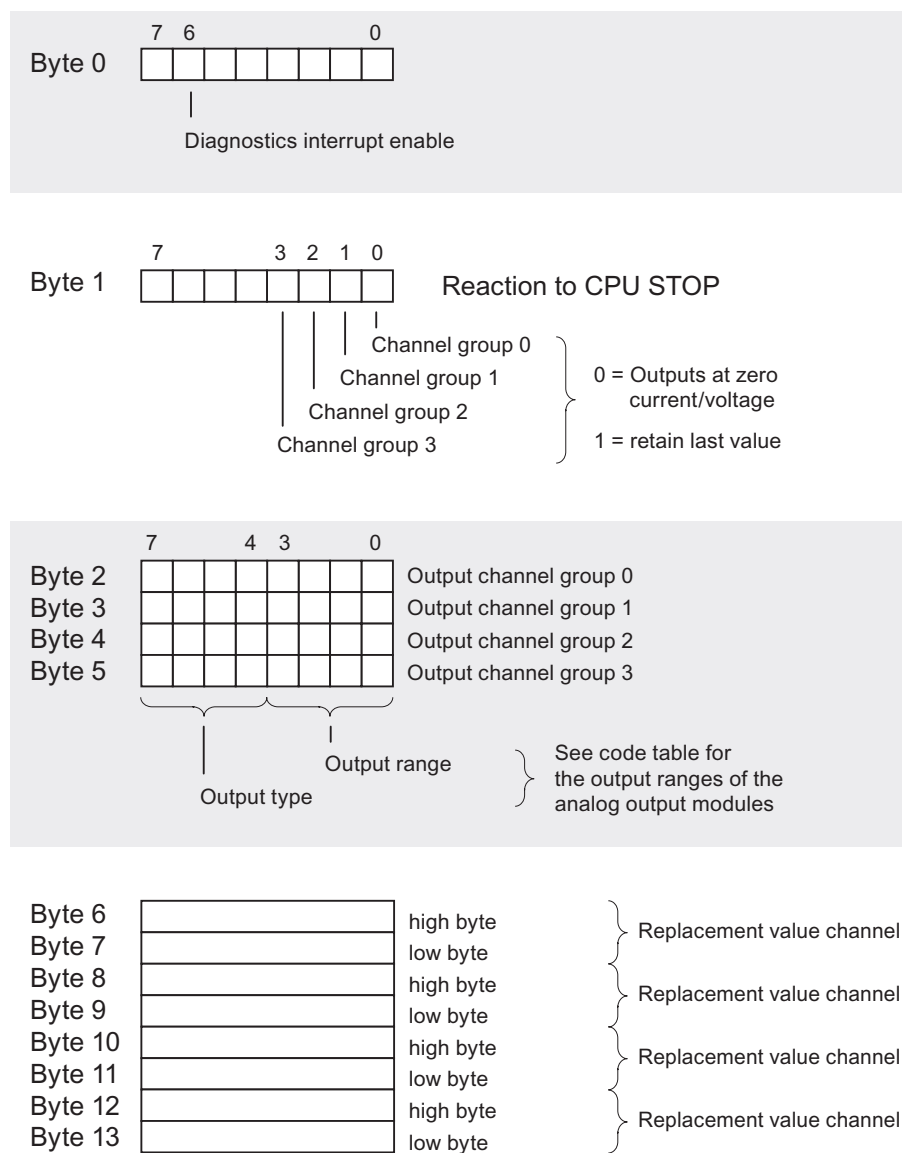


Figure A-20 Data record 1 for the parameters of analog output modules

Output types and output ranges

The table below lists all output types/ranges of the analog output modules, including their codes. Enter these codes at bytes 2 to 5 in data record 1 (refer to the previous figure.)

Table A-29 Output range codes of analog output modules

Output type	Code	Output range	Code
disabled	2#0000	disabled	2#0000
Voltage	2#0001	1 V to 5 V 0 V to 10 V ± 10 V	2#0111 2#1000 2#1001
Current	2#0010	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	2#0010 2#0011 2#0100

See also

Analog modules (Page 6-1)

A.10 Parameters of analog output module SM 332; AO 8 x 12 Bit

Parameters

The table below shows all parameters you can set at analog output module SM 332; AO 8 x 12 Bit. The comparison shows:

- which parameters you can edit in *STEP 7*, and
- which parameters you can change using SFC 55 "WR_PARM".

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57.

Table A-30 Parameters of SM 332; AO 8 x 12 Bit

Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Diagnostics: Group diagnostics	0	No	Yes
Diagnostics interrupt enable	1	Yes	Yes
Reaction to CPU STOP		Yes	Yes
Output type		Yes	Yes
Output range		Yes	Yes

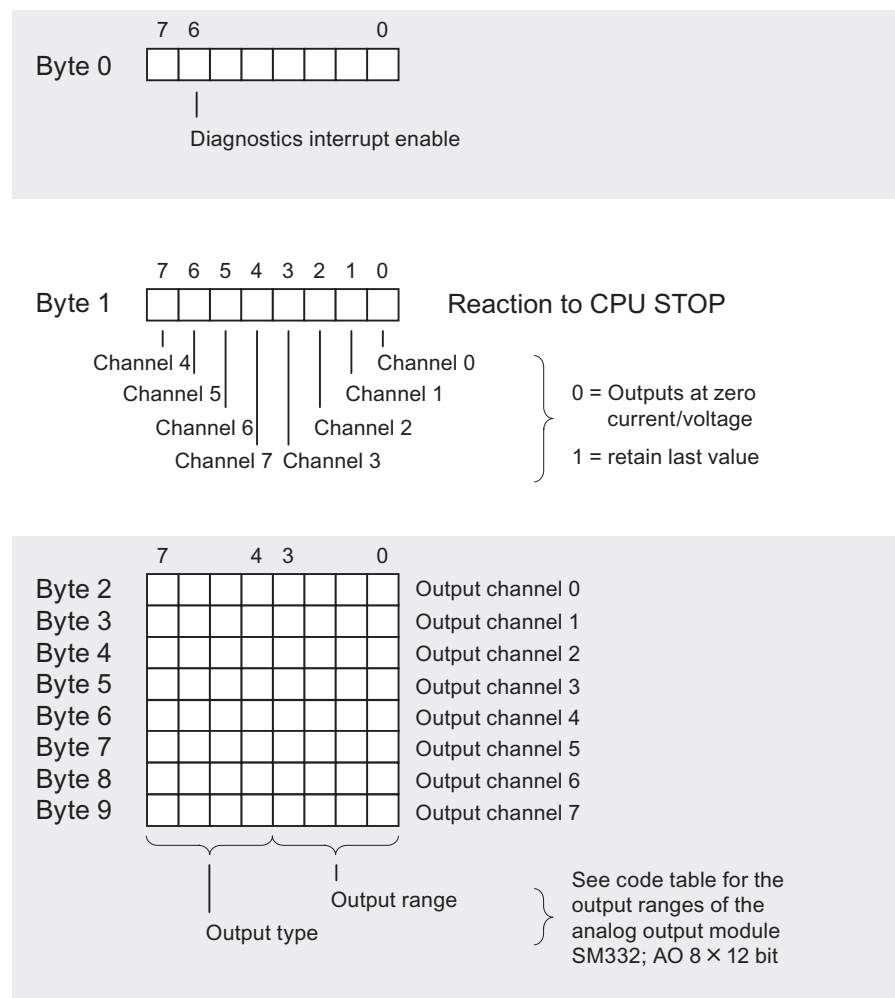
Note

To enable diagnostic interrupts in the user program at data record 1, you first need to enable diagnostics at data record 0 in *STEP 7*.

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of SM 332; AO 8 x 12 Bit.

You enable diagnostics interrupts by setting a logic "1" at the corresponding bit of byte 0.



Bytes 10 to 13 are not assigned

Figure A-21 Data record 1 for the parameters of analog output modules

Output type and output range

The table lists the output types/ranges of SM 332; AO 8 x 12 Bit, including their codes. Enter these codes at bytes 2 to 9 in data record 1 (refer to the previous figure.)

Table A-31 Output range codes of analog output module SM 332; AO 8 x 12 Bit

Output type	Code	Output range	Code
Disabled	2#0000	Disabled	2#0000
Voltage	2#0001	1 V to 5 V 0 V to 10 V ± 10 V	2#0111 2#1000 2#1001
Current	2#0010	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	2#0010 2#0011 2#0100

A.11 Parameters of analog IO modules

Parameters

The table below lists all parameters you can set for analog IO modules.

The comparison illustrates the editable parameters:

- in *STEP 7*
- using SFC 55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC 56 and SFC 57 (refer to the *STEP 7* manuals).

Table A-32 Parameters of analog IO modules

Parameters	Data record number	Programmable, using ...	
		... SFC 55	... PG
Measuring method	1	Yes	Yes
Measuring range		Yes	Yes
Integration time		Yes	Yes
Output type		Yes	Yes
Output range		Yes	Yes

Structure of data record 1

The figure below shows the structure of data record 1 for the parameters of analog IO modules.

You enable a parameter by setting a logic "1" at the corresponding bit of byte 0.

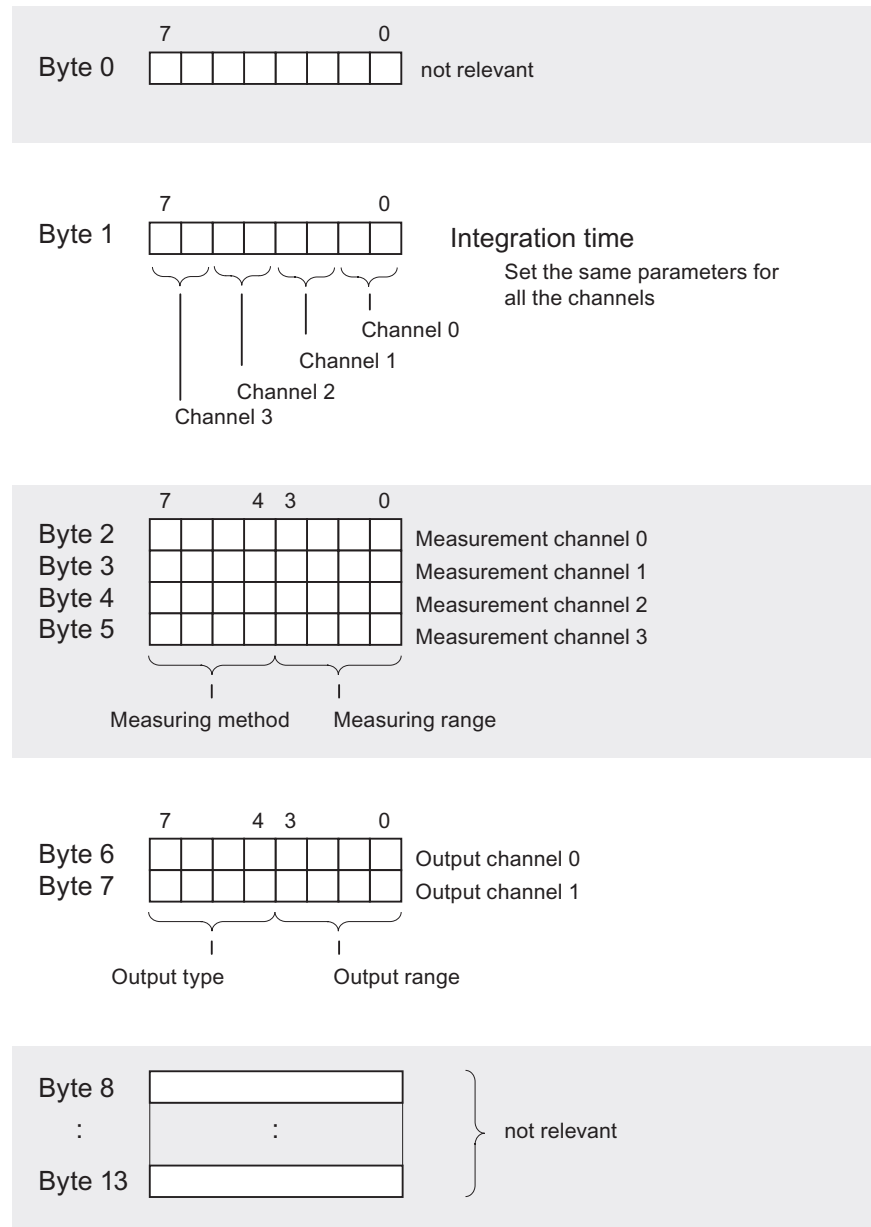


Figure A-22 Data record 1 for the parameters of analog IO modules

Measuring methods and ranges

The table below lists all measuring methods/ranges of analog IO modules, including their codes. Enter these codes at bytes 2 to 5 in data record 1 (refer to the previous figure.)

Table A-33 Measuring range codes of analog IO modules

Measuring method	Code	Measuring range	Code
disabled	2#0000	disabled	2#0000
Voltage	2#0001	0 V to 10 V	2#1000
Resistance (4-wire connection)	2#0100	10 k Ω	2#1001
Thermal resistance + linearization 4-wire connection	2#1000	Pt 100 Klima	2#0000

Output types and output ranges

The table below lists all output types/ranges of analog IO modules, including their codes. Enter these codes at bytes 6 and 7 of data record 1 (refer to the previous figure.)

Table A-34 Output range codes of analog IO modules

Output type	Code	Output range	Code
disabled	2#0000	disabled	2#0000
Voltage	2#0001	0 V to 10 V	2#1000

Diagnostics data of signal modules

B.1 Evaluating diagnostic data of signal modules in the user program

Introduction

This appendix describes the diagnostic data structure in system data. You should be sufficiently familiar with this structure if you want to evaluate the diagnostics data of the signal module in the *STEP 7* user program.

Diagnostic data are stored in data records

Module diagnostics data may have a length of max. 16 bytes, and are contained in data records 0 and 1:

- Data record 0 contains 4 bytes of diagnostic data describing the current state of an automation system.
- Data record 1 shares the same four bytes of diagnostics with data record 0, **and** contains up to 12 bytes of module-specific diagnostics data.

Further references

For detailed information on the principles of evaluating diagnostics data of signal modules in the user program, and on SFCs you may use in this context, refer to the *STEP 7* manuals.

B.2 Structure and content of diagnostics data bytes 0 to 7

Introduction

The section below describes the structure and content of the various bytes in diagnostics data. General rule: An error is indicated by a logic "1" at the relevant bit.

Bytes 0 and 1

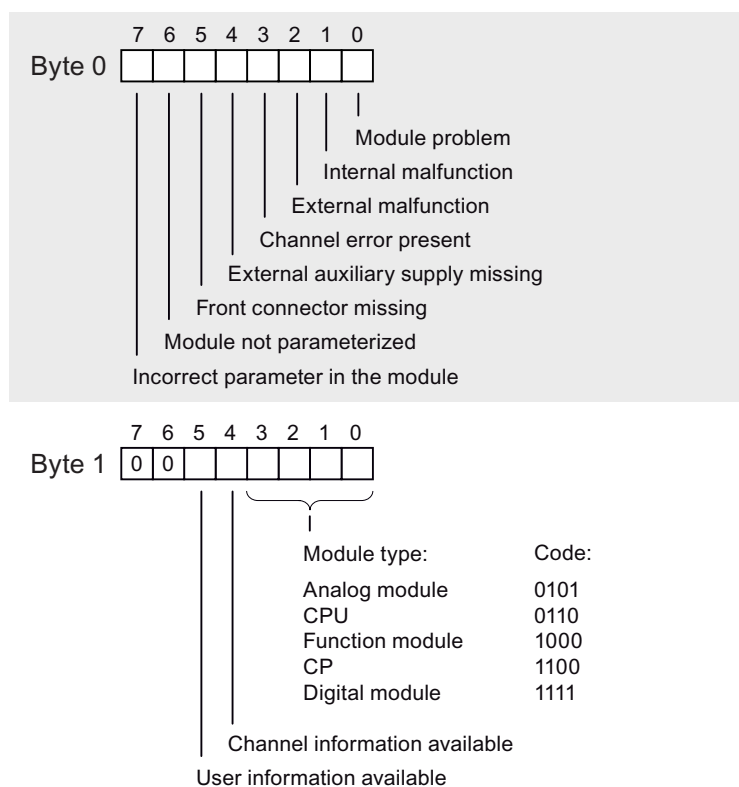


Figure B-1 Bytes 0 and 1 of diagnostics data

Module classes

The table below lists the module class IDs (bits 0 to 3 in byte 1.)

Table B-1 Module class IDs

ID	Module class
0101	Analog module
0110	CPU
1000	Function module
1100	CP
1111	Digital module

Bytes 2 and 3

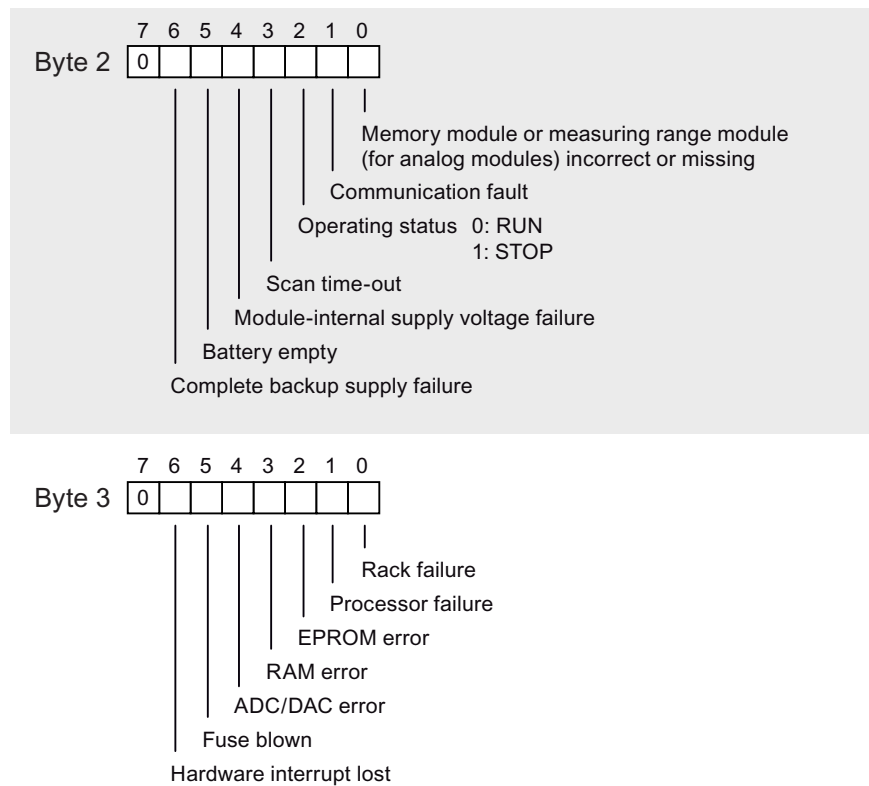


Figure B-2 Bytes 2 and 3 of diagnostics data

Bytes 4 to 7

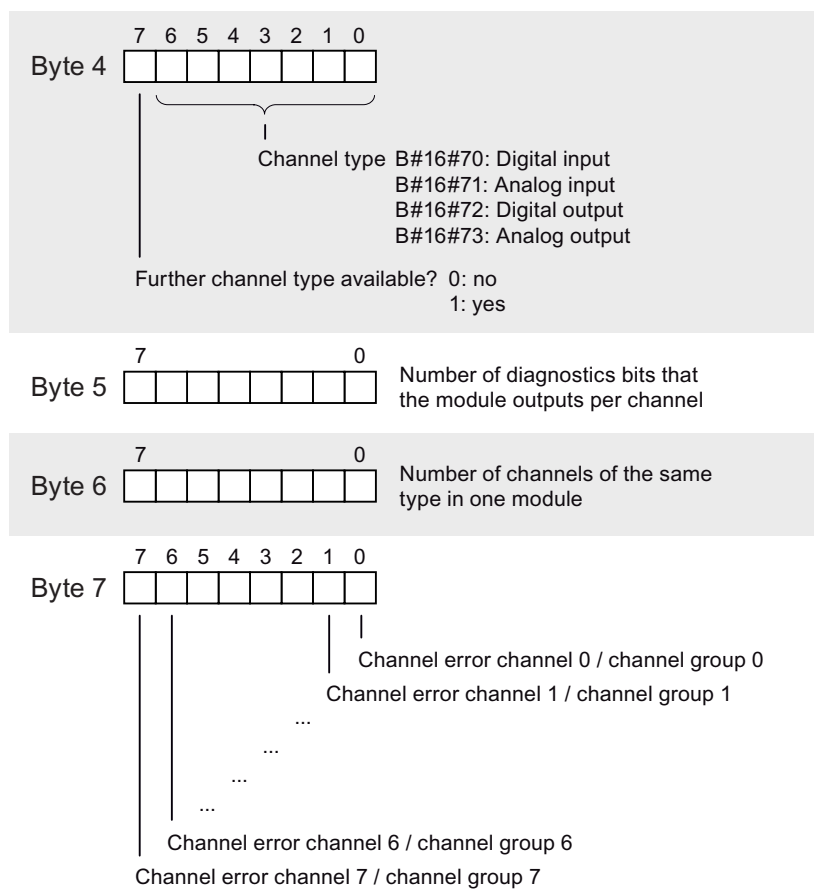


Figure B-3 Bytes 4 to 7 of diagnostics data

B.3 Channel-specific diagnostics data, starting at byte 8

Introduction

Data record 1 contains the channel-specific diagnostic data, starting at bytes 8 to 15. The figures below show the assignment of the diagnostics byte of a module-specific channel or channel group. General rule: An error is indicated by a logic "1" at the relevant bit.

For information on possible error causes and troubleshooting routines, refer to the chapter "Module diagnostics."

Digital input channel of SM 321; DI 16 x DC 24 V; with hardware/diagnostics interrupts

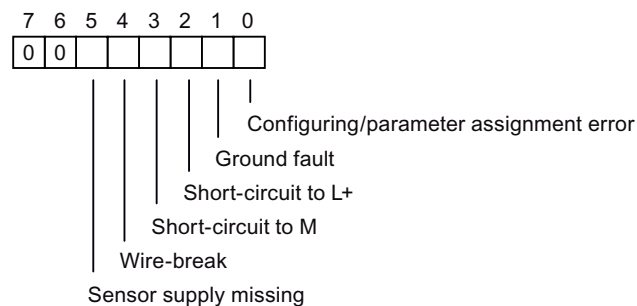


Figure B-4 Diagnostics byte for a digital input channel of SM 321; DI 16 x DC 24 V

Digital output channel of SM 322; DO 8 x DC 24 V/0.5 A; with diagnostics interrupt

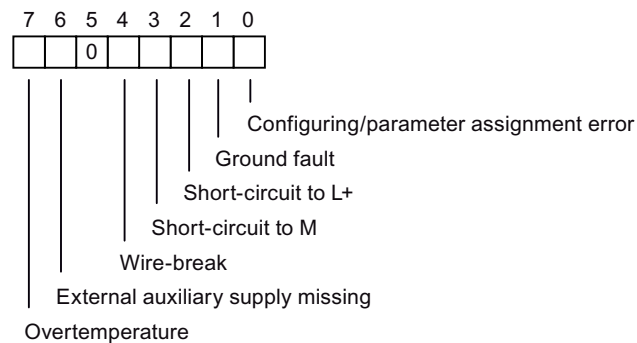


Figure B-5 Diagnostics byte for a digital output channel of SM 322; DO 8 x DC 24 V/0.5 A

Analog input channel of SM 331 modules with diagnostics functions

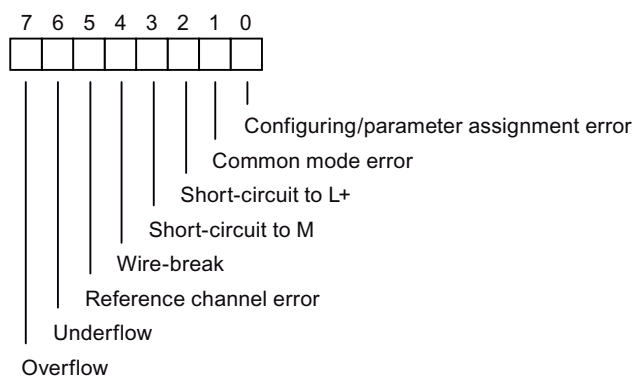


Figure B-6 Diagnostics byte for an analog input channel of SM 331 modules with diagnostics functions

Analog output channel of SM 332 modules with diagnostics functions

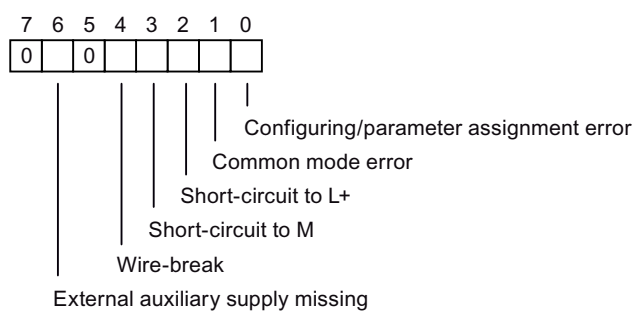


Figure B-7 Diagnostics byte for an analog input channel of SM 332 modules with diagnostics functions

B.4 Diagnostics data of SM 338; POS-INPUT

Introduction

The next section describes the structure and contents of the various bytes in diagnostic data of the position detection module SM 338; POS-INPUT. General rule: An error is indicated by a logic "1" at the relevant bit.

For information on possible error causes and troubleshooting routines, refer to the chapter *Position detection module SM 338; POS-INPUT*.

Bytes 0 and 1

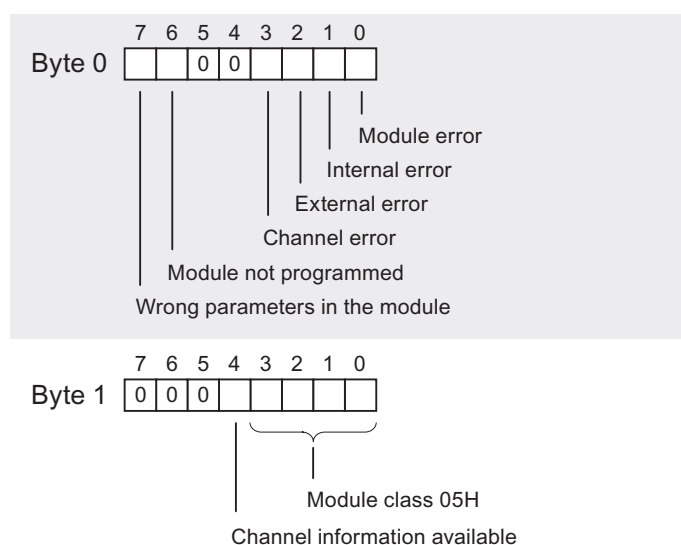


Figure B-8 Bytes 0 and 1 in diagnostics data of SM 338; POS-INPUT

Bytes 2 to 7

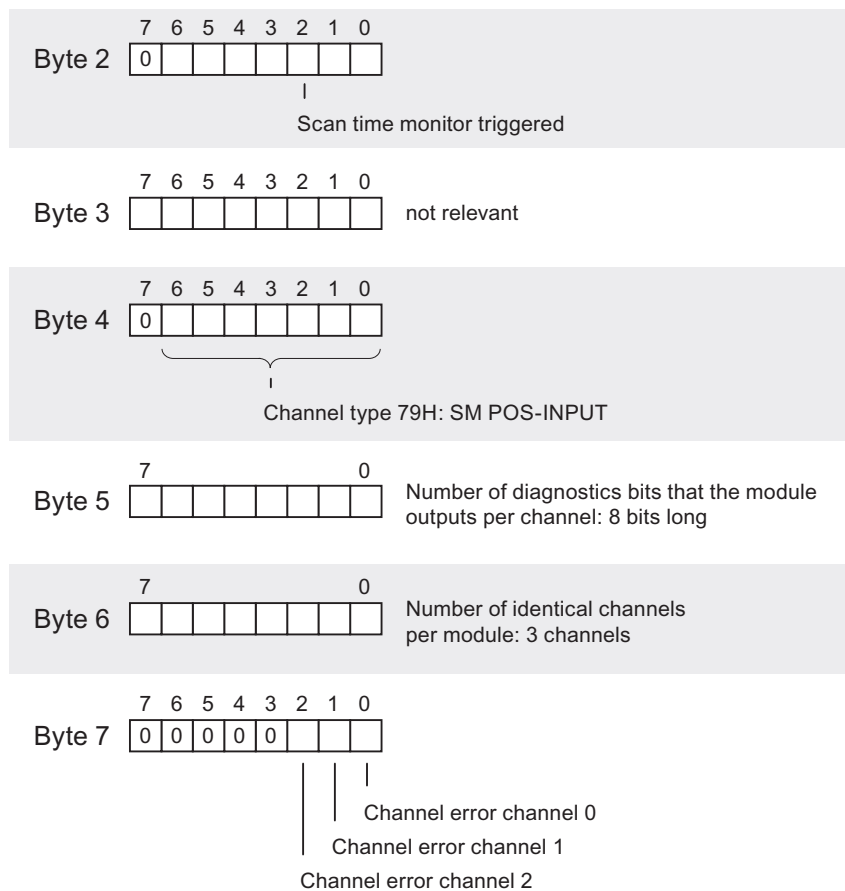


Figure B-9 Bytes 2 and 7 in diagnostics data of SM 338; POS-INPUT

Bytes 8 to 10

Data record 1 contains the channel-specific diagnostic data, starting at bytes 8 to 10. The figure below shows the assignment of the diagnostic byte for a channel of SM 338; POS-INPUT.

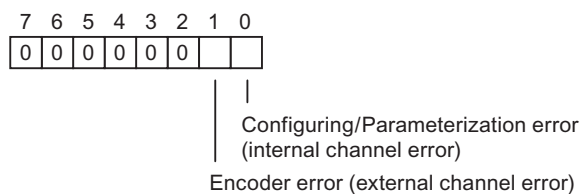


Figure B-10 Diagnostics byte for a channel of SM 338; POS-INPUT

See also

Order number (Page 7-7)

Dimensional drawings

Introduction

This appendix contains the dimensional drawings of the most important components of an S7-300. The specified dimensions are required to determine the dimensions of an S7-300 configuration. Make allowances for the dimensions of an S7-300 configuration when you install the system in cabinets, control rooms, etc. This appendix does not include the dimensional drawings of S7-300 or M7-300 CPUs, or of IM 153-1. These are included in the relevant manuals.

Contents

This appendix contains the dimensional drawings of the S7-300 components listed below.

- Mounting rails
- Power supply modules
- Interface modules
- Signal modules
- Accessories

C.1 Dimensional drawings of the mounting rails

483 mm standard rail

The figure below shows the dimensional drawing of the 483 mm standard rail.

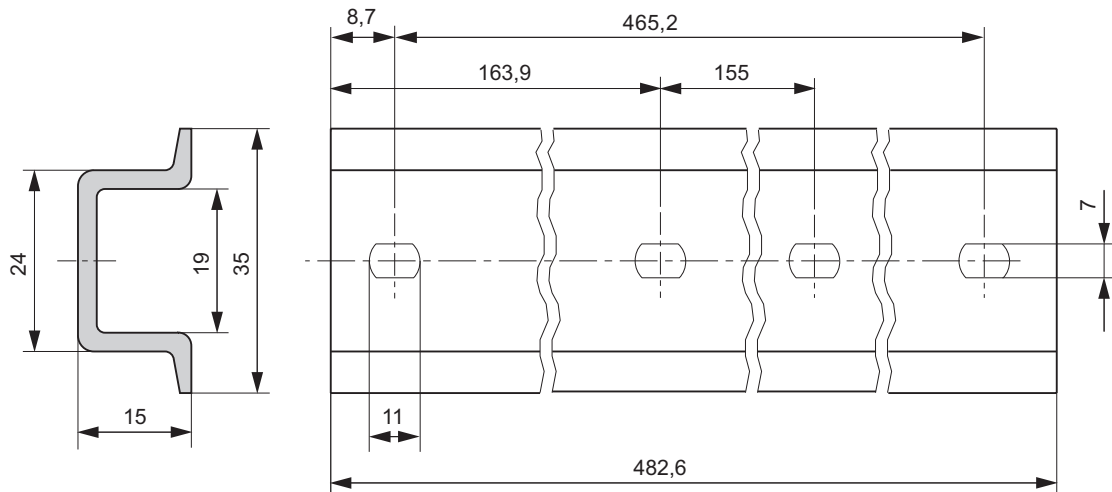


Figure C-1 Dimensional drawing of the 483 mm standard rail

Standard mounting rail 530 mm

The figure below shows the dimensional drawing of the 530 mm standard rail.

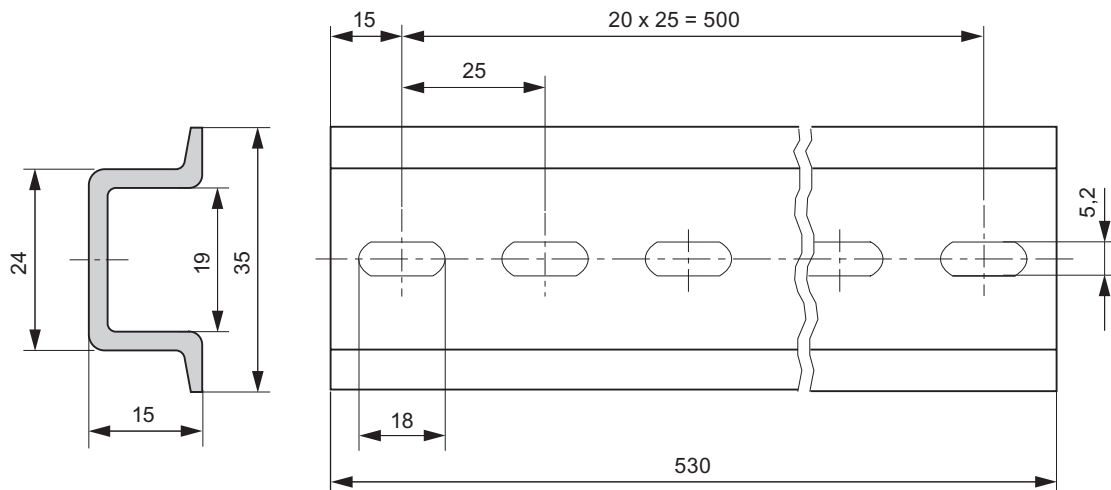


Figure C-2 Dimensional drawing of the 530 mm standard rail

Standard mounting rail 830 mm

The figure below shows the dimensional drawing of the 830 mm standard rail.

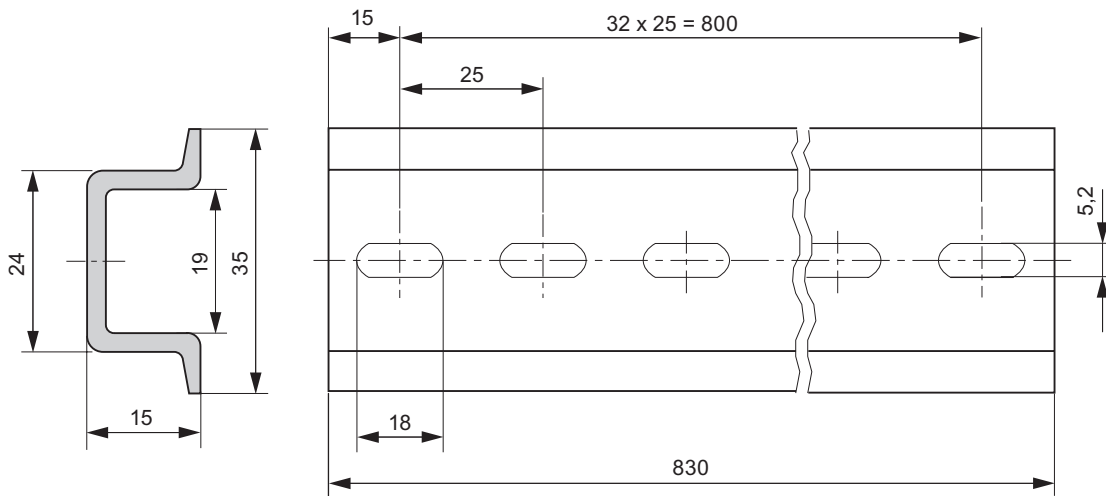


Figure C-3 Dimensional drawing of the 830 mm standard rail

Standard mounting rail 2000 mm

The figure below shows the dimensional drawing of the 2000 mm standard rail.

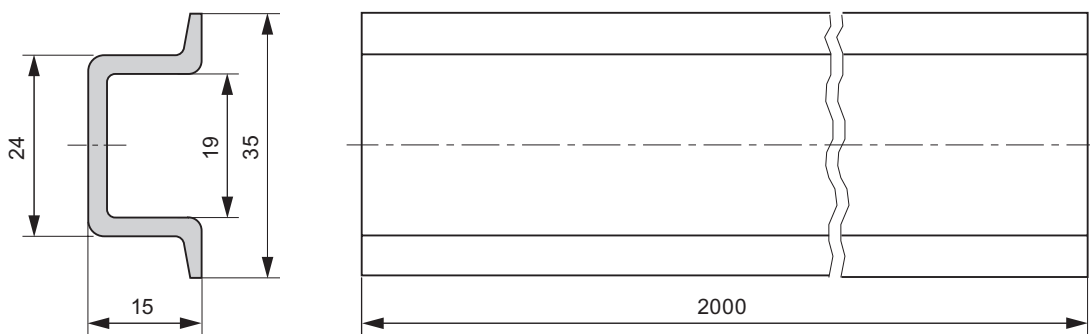


Figure C-4 Dimensional drawing of the 2000 mm standard rail

Mounting rail 160 mm

The figure below shows the dimensional drawing of the 160 mm mounting rail.

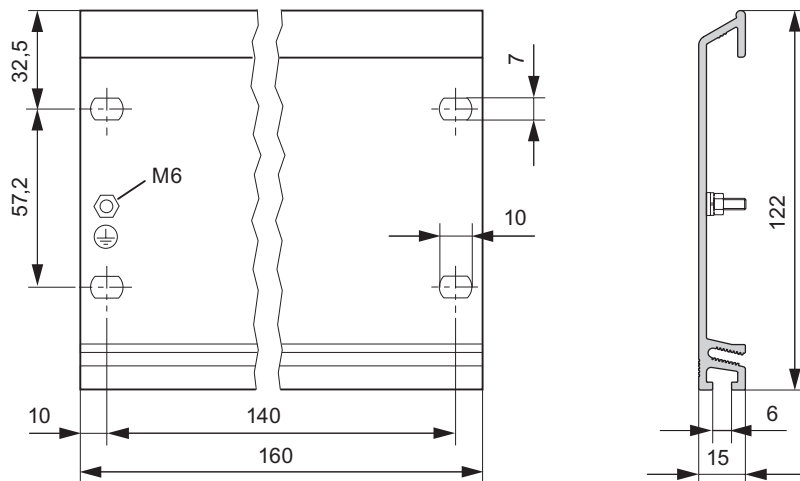


Figure C-5 Dimensional drawing of the mounting rail with standard width of 160 mm.

Mounting rail 482.6 mm

The figure below shows the dimensional drawing of the 482.6 mm mounting rail.

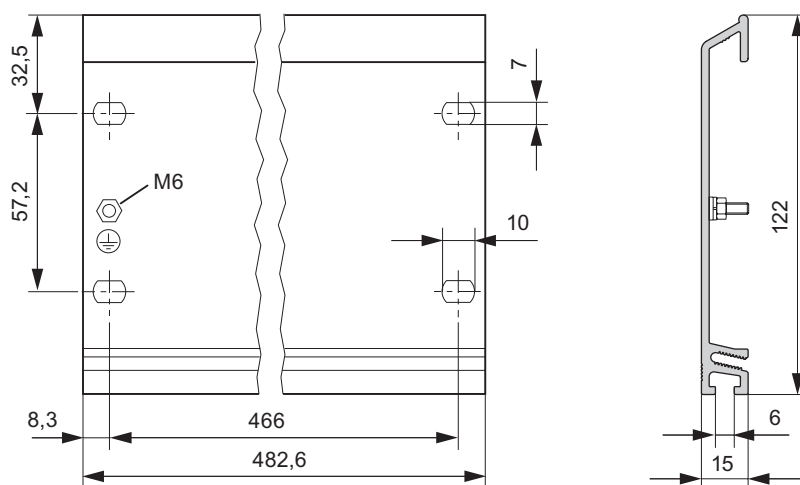


Figure C-6 Dimensional drawing of the mounting rail with standard width of 482.6 mm.

Mounting rail 530 mm

The figure below shows the dimensional drawing of the 530 mm mounting rail.

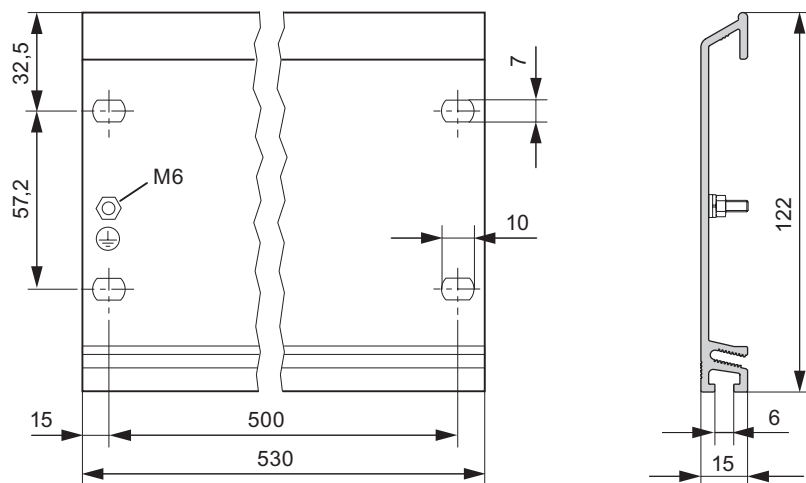


Figure C-7 Dimensional drawing of the mounting rail with standard width of 530 mm.

Mounting rail 830 mm

The figure below shows the dimensional drawing of the 830 mm mounting rail.

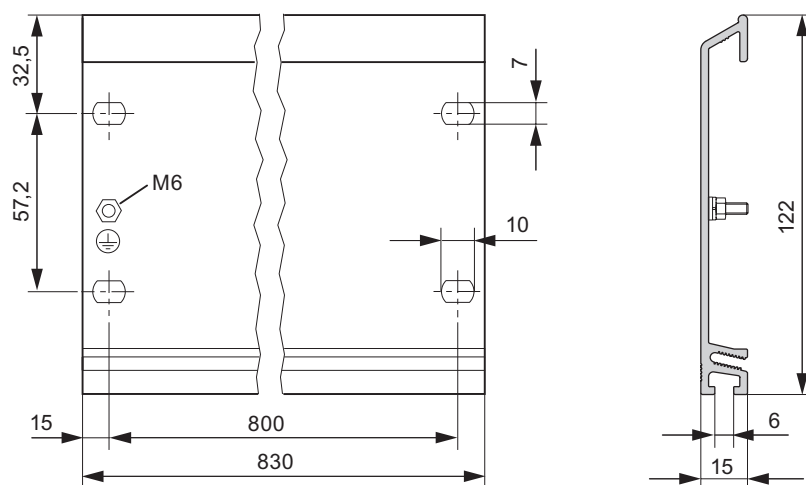


Figure C-8 Dimensional drawing of the mounting rail with standard width of 830 mm.

Mounting rail 2000 mm

The figure below shows the dimensional drawing of the 2000 mm mounting rail.

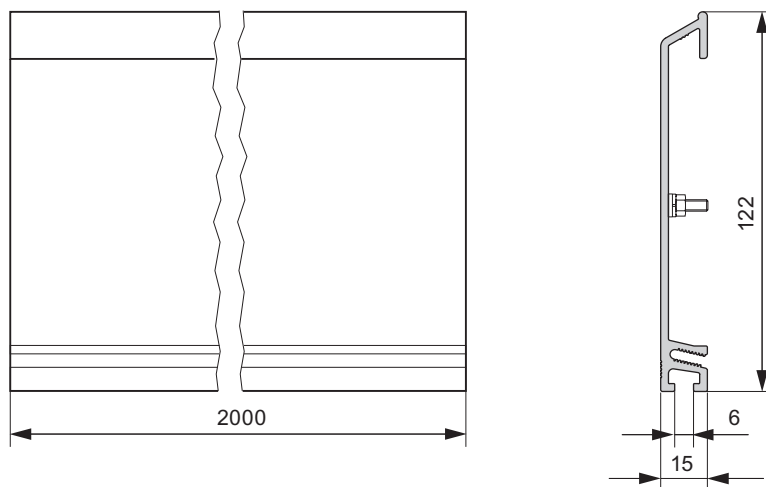
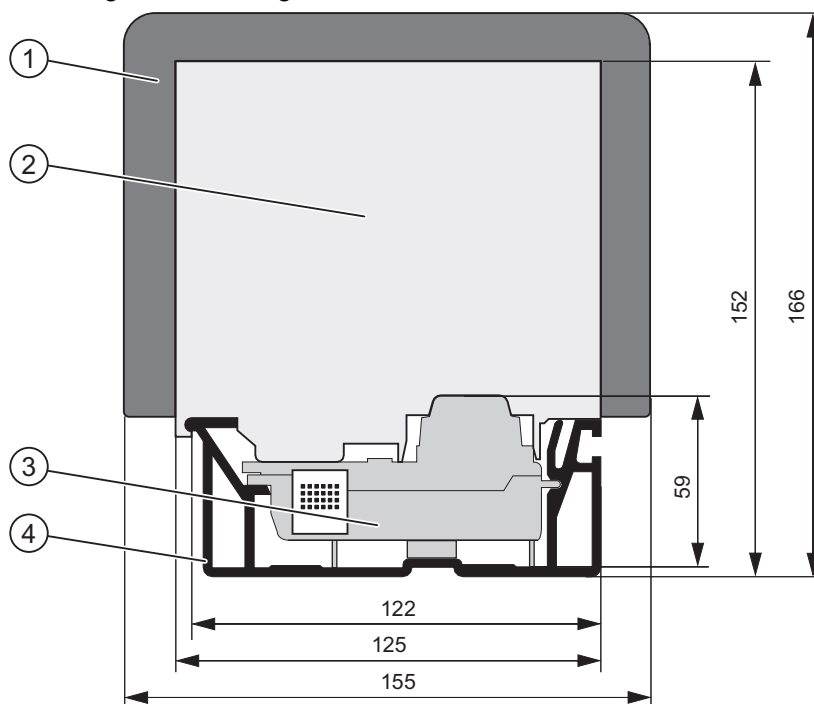


Figure C-9 Dimensional drawing of the 2000 mm mounting rail

Mounting rail for the "Insertion and Removal" function

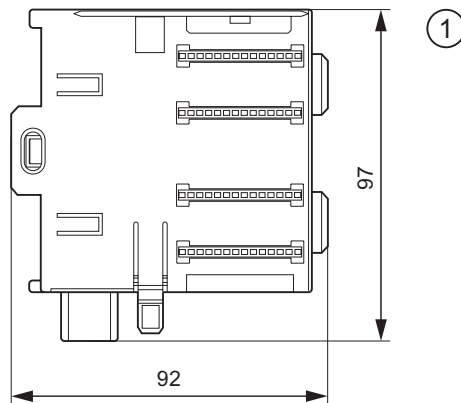
The figure below shows the dimensional drawing of the mounting rail for the "Insertion and Removal" function with active bus module, S7-300 module and explosion-proof partition. The mounting rail has a length of 482.6 mm or 530 mm.



- ① Explosion-proof partition
- ② S7-300 module
- ③ active bus module
- ④ Mounting rail for the "Insertion and Removal" function

C.1.1 Bus modules

The figure below shows the dimension drawing of the active bus module for the "Insertion and Removal" function.



- ① Bus modules
BM PS/IM (...7HA)
BM IM/IM (...7HD)
BM 2 x 40 (...7HB)
BM 1 x 80 (...7HC)

C.2 Dimensional drawings of the power supply modules

PS 307; 2 A

The figure below shows the dimensional drawing of the PS 307; 2 A power supply module.

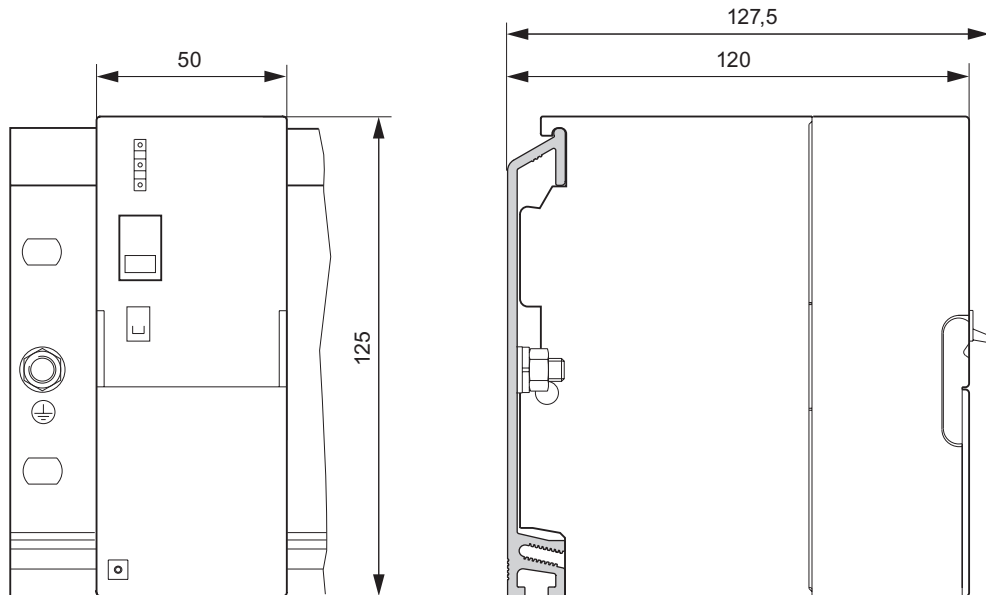


Figure C-10 Power supply module PS 307; 2 A

PS 307; 5A

The figure below shows the dimensional drawing of the PS 307; 5 A power supply module.

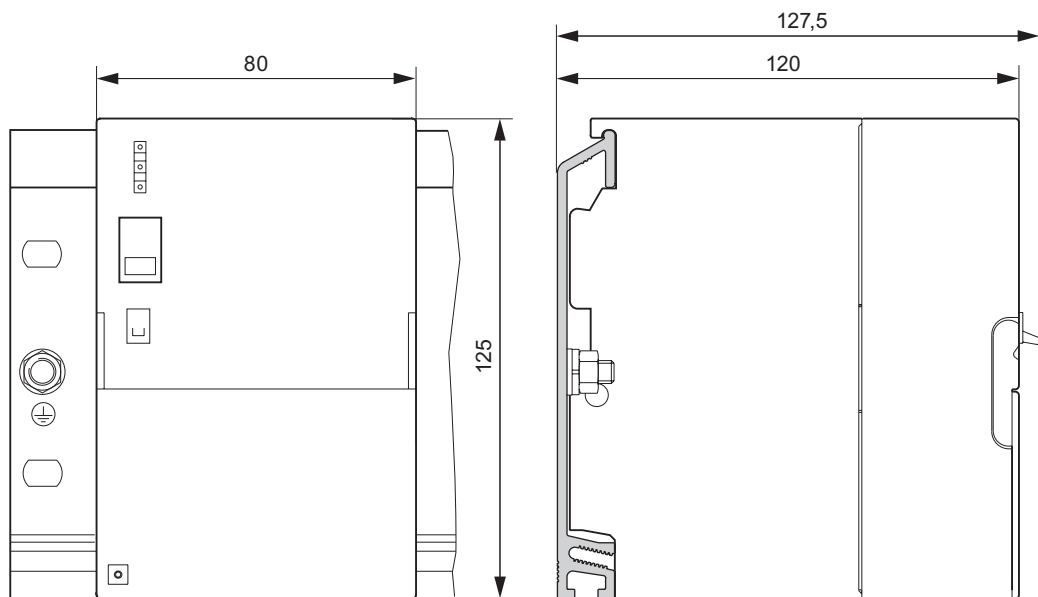


Figure C-11 Power supply module PS 307; 5 A

PS 307; 10 A

The figure below shows the dimensional drawing of the PS 307; 10 A power supply module.

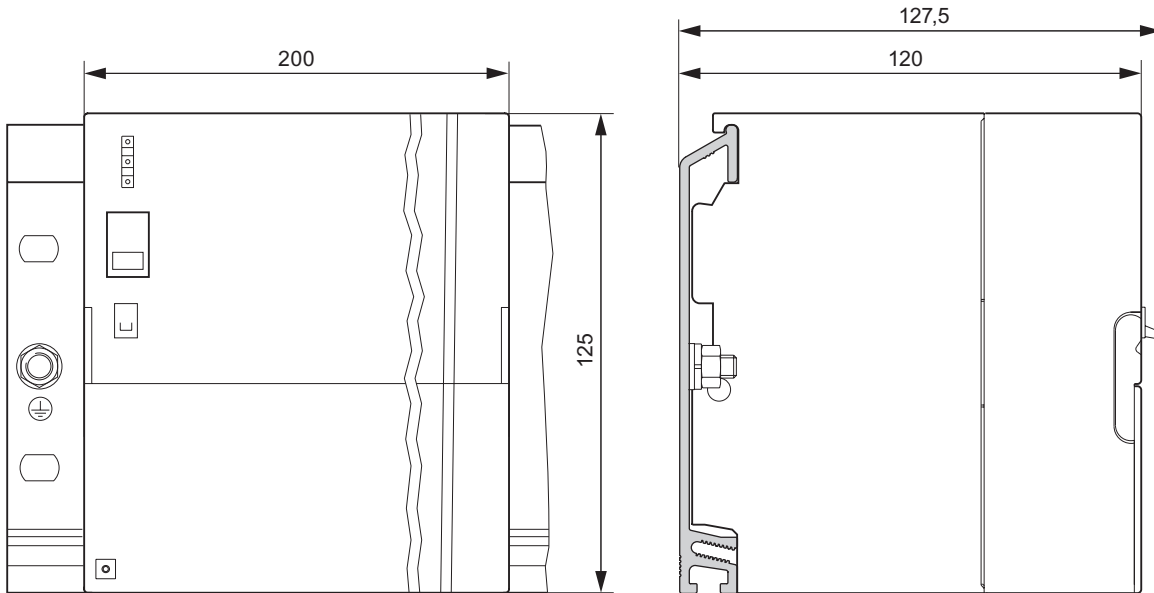


Figure C-12 Power supply module PS 307; 10 A

PS 307; 5 A with 313/314/315/ 315-2 DP CPU

The figures below show the dimensional drawings of a configuration consisting of a power supply module PS 307; 5 A and a 313/314/315/315-2 DP CPU. Observe the dimensions derived from the use of a power connector when wiring the PS 307; 5 A to the CPU.

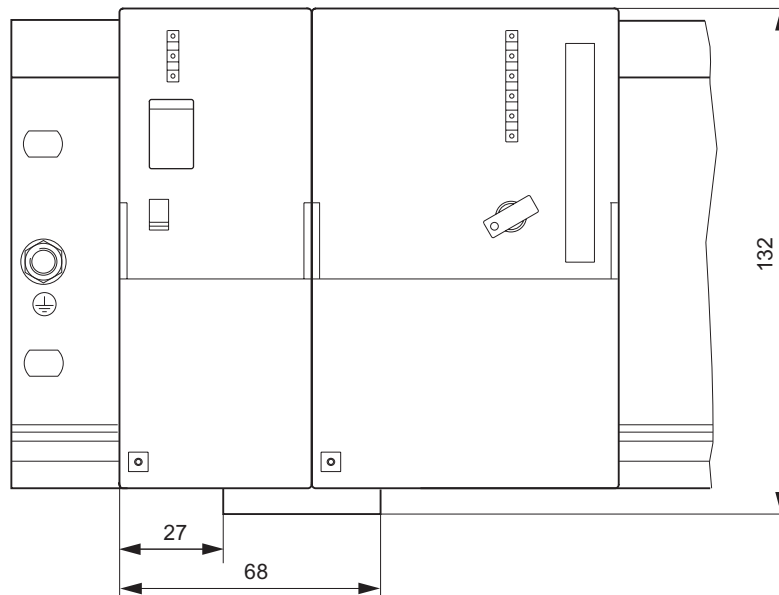


Figure C-13 Dimensional drawing of power supply module PS 307; 5 A with CPU 313/314/315/315-2 DP, front view

PS 307; 5 A with 313/314/315/ 315-2 DP CPU

The figure below shows the dimensional drawing of power supply module PS 307; 5 A with 313/314/315/315-2 DP CPU in the side view.

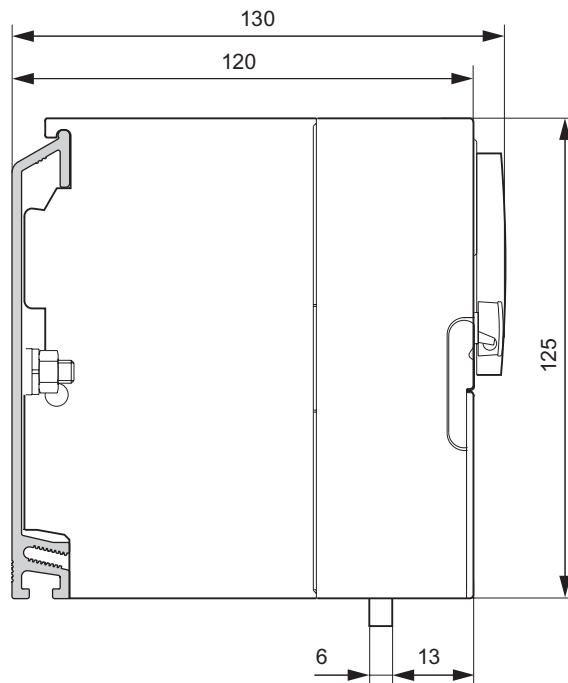


Figure C-14 Dimensional drawing power supply module PS 307; 5 A with CPU 313/314/315/315-2 DP, side view

C.3 Dimensional drawings of the interface modules

IM 360

The figure below shows the dimensional drawing of interface module IM 360.

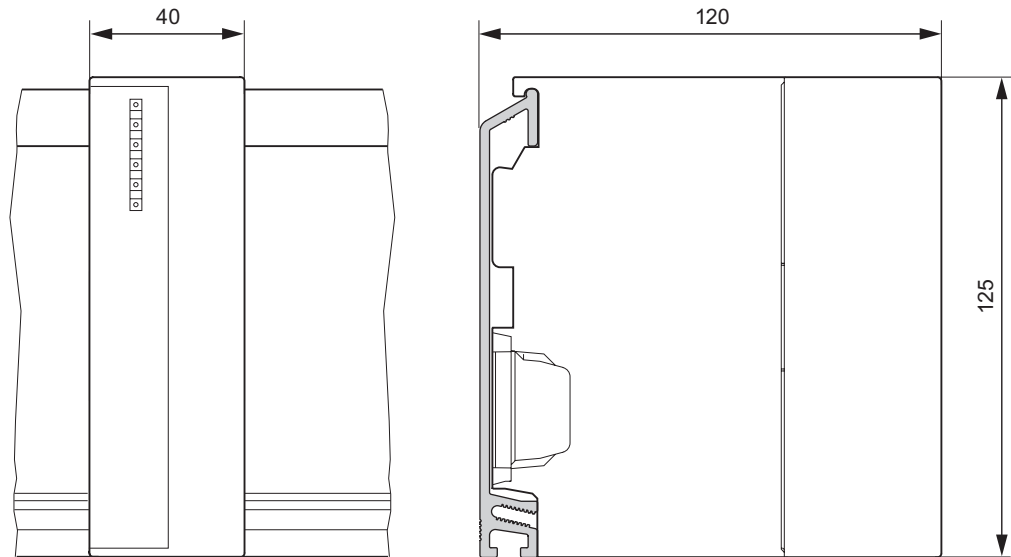


Figure C-15 Interface module IM 360

IM 361

The figure below shows the dimensional drawing of interface module IM 361.

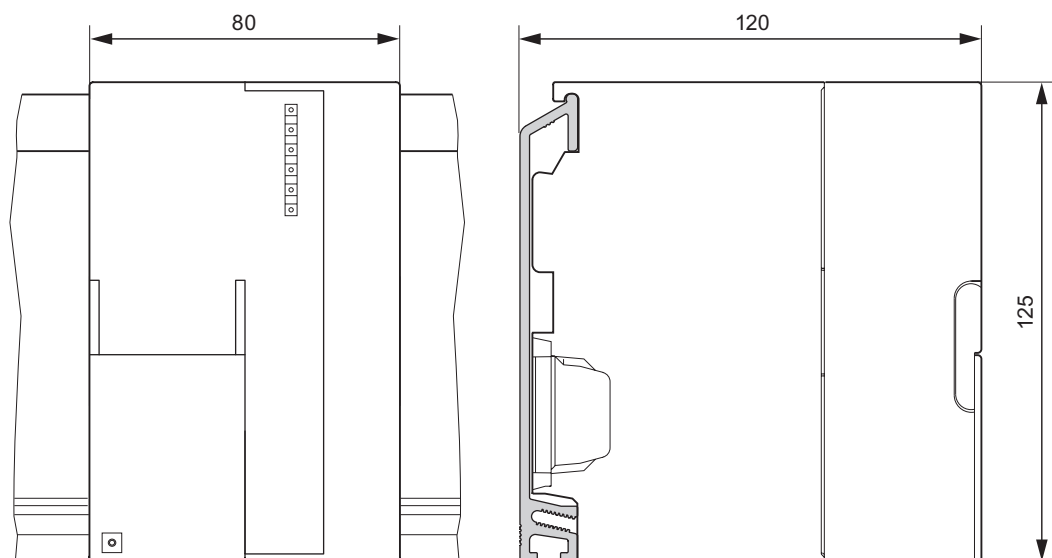


Figure C-16 Interface module IM 361

IM 365

The figure below shows the dimensional drawing of interface module IM 365.

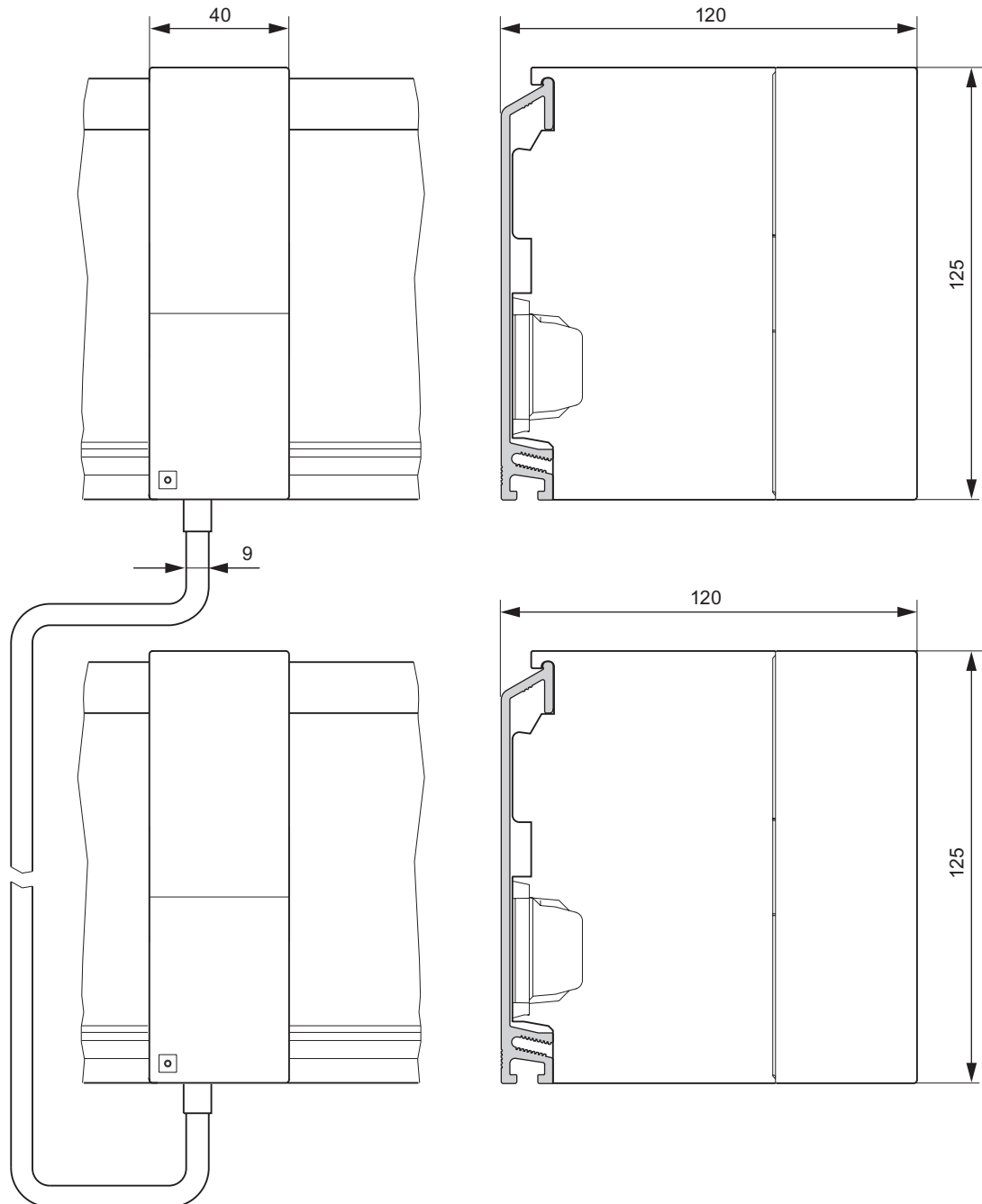


Figure C-17 Interface module IM 365

C.4 Dimensional drawings of the signal modules

Signal module

The figure below shows the dimensional drawing of the signal module.
The signal module design may differ. However, dimensions are always the same.

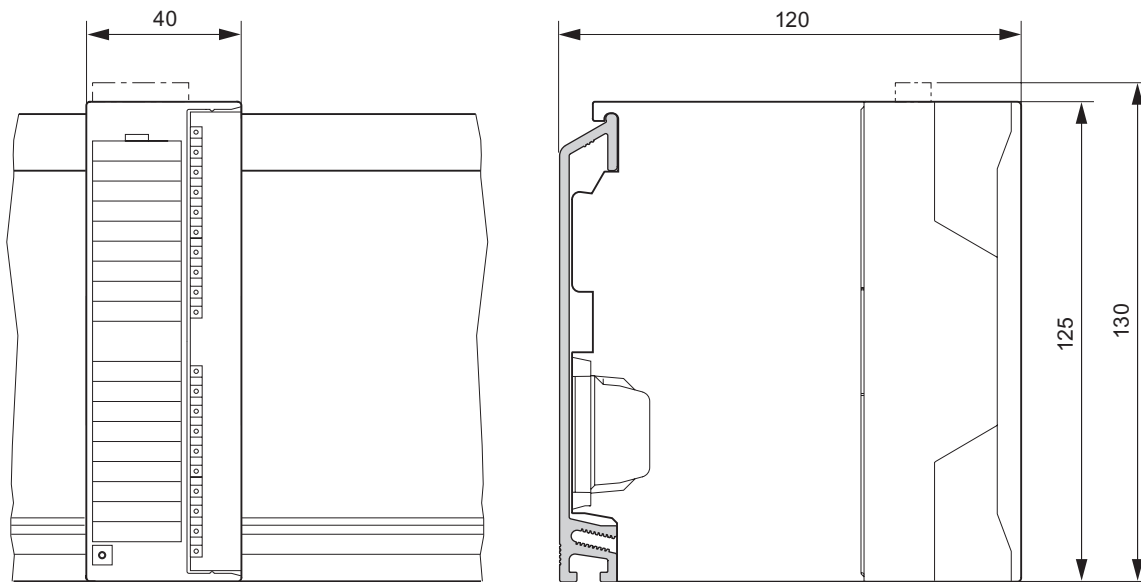


Figure C-18 Signal module

C.5 Dimensional drawings of accessories

Shield connecting element

The figure below shows the dimensional drawing of the shield connecting element used two signal modules.

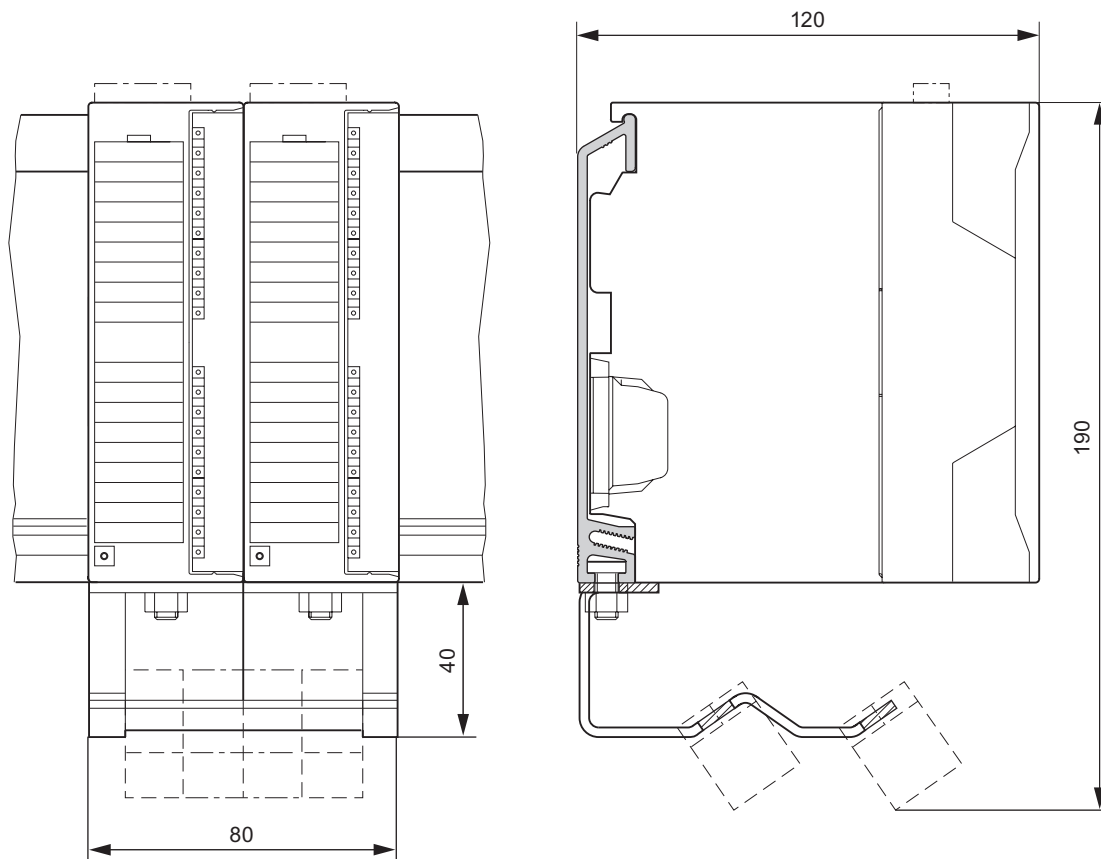


Figure C-19 2 signal modules with shield connecting element

RS 485 Repeater on standard rail

The figure below shows the dimensional drawing of the RS 485 Repeater mounted on the standard rail.

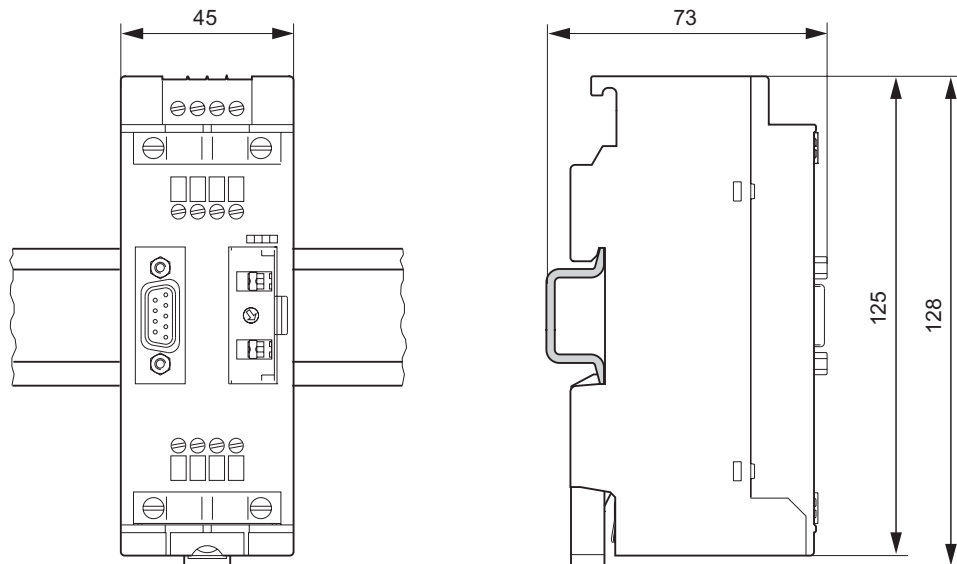


Figure C-20 RS 485 Repeater on standard rail

RS 485 Repeater on standard rail

The figure below shows the dimensional drawing of the RS 485 Repeater on an S7-300 mounting rail.

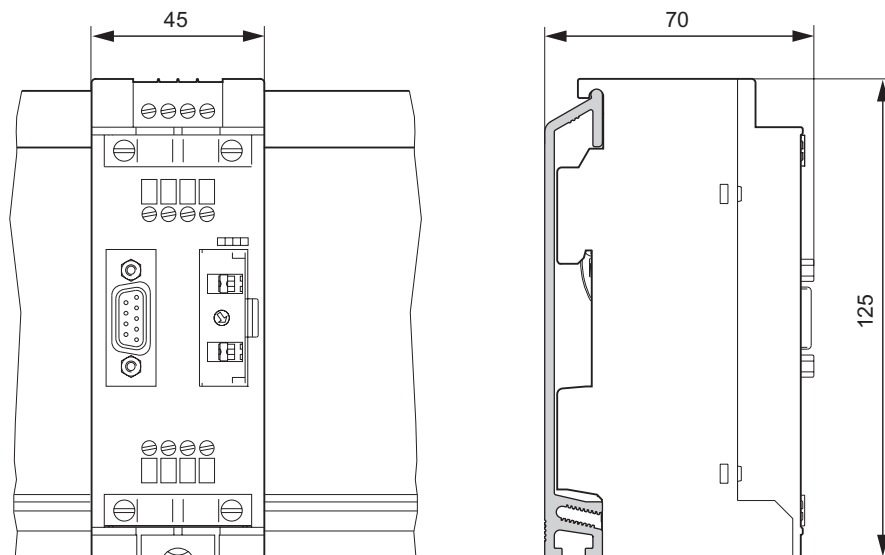


Figure C-21 RS 485 Repeater on standard rail

Spare parts and accessories for S7-300 modules

Spare parts

The table below lists the S7-300 parts you can order separately or later.

Table D-1 Accessories and spare parts

S7-300 parts	Order number
Bus connector	6ES7390-0AA00-0AA0
Power connector between power supply unit and CPU	6ES7390-7BA00-0AA0
Labeling strip (10 items)	
• for 8-/16channel modules	6ES7392-2XX00-0AA0
• for 32channel modules	6ES7392-2XX10-0AA0
Labeling strips for printing	
• for 16-channel modules (petrol)	6ES7392-2AX00-0AA0
(light-beige)	6ES7392-2BX00-0AA0
(yellow)	6ES7392-2CX00-0AA0
(red)	6ES7392-2DX00-0AA0
• for 32-channel modules (petrol)	6ES7392-2AX10-0AA0
(light-beige)	6ES7392-2BX10-0AA0
(yellow)	6ES7392-2CX10-0AA0
(red)	6ES7392-2DX10-0AA0
• Instructions for printing labeling strips using print templates	http://www.siemens.de/automation/csi/product Contribution ID: 11978022
Slot number plate	6ES7912-0AA00-0AA0
Front connector 20-pin	
• Screw technology (1 unit)	6ES7392-1AJ00-0AA0
• Screw technology (100 unit)	6ES7392-1AJ00-1AB0
• Spring clamp technology (1 unit)	6ES7392-1BJ00-0AA0
• Spring clamp technology (100 unit)	6ES7392-1BJ00-1AB0
Front connector 40-pin	
• Screw technology (1 unit)	6ES7392-1AM00-0AA0
• Screw technology (100 unit)	6ES7392-1AM00-1AB0
• Spring clamp technology (1 unit)	6ES7392-1BM01-0AA0
• Spring clamp technology (100 unit)	6ES7392-1BM01-1AB0
Front connector for 2 ribbon cable connections	
• screw terminal technology	6ES7921-3AB00-0AA0
• cageclamp technology	6ES7921-3AA00-0AA0

S7-300 parts	Order number
Front connector for 4 ribbon cable connections cageclamp technology	6ES7921-3AA20-0AA0
Round-sheath ribbon cable (16-pole) - Unshielded 30 m - Unshielded 60 m - Shielded 30 m - Shielded 60 m	6ES7923-0CD00-0AA0 6ES7923-0CG00-0AA0 6ES7923-0CD00-0BA0 6ES7923-0CG00-0BA0
Connectors, 16-pin, set of 8 (insulation displacement terminals)	6ES7921-3BE10-0AA0
Shield connecting element	6ES7390-5AA00-0AA0
Shield terminal element for 2 cables, each with a shield diameter of 2 to 6 mm 1 cable with a shield diameter of 3 to 8 mm 1 cable with a shield diameter of 4 to 13 mm	6ES7390-5AB00-0AA0 6ES7390-5BA00-0AA0 6ES7390-5CA00-0AA0
Measuring range module for analog modules	6ES7974-0AA00-0AA0
Fuse set for digital output modules - 6ES7322-1FF01-0AA0 - 6ES7322-1FH00-0AA0 (contains 10 fuses and 2 fuse holders)	6ES7973-1HD00-0AA0
Fuse set for digital output module - 6ES7322-1CF00-0AA0 (contains 10 fuses)	6ES7973-1GC00-0AA0
Connecting cable for IM 360 and IM 361, or IM 361 and IM 361 1 m 2.5 m 5 m 10 m	6ES7368-3BB01-0AA0 6ES7368-3BC51-0AA0 6ES7368-3BF01-0AA0 6ES7368-3CB01-0AA0

Directive on handling Electrostatic-Sensitive Devices (ESD)

Introduction

In this appendix, we explain

- the meaning of "electrostatic-sensitive devices"
- the precautions you must take when handling and working with electrostatic sensitive modules.

E.1 Definition of ESD

Definition

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

These **E**lectrostatic **S**ensitive **D**evices/**M**odules are commonly abbreviated **ESD**. The common international designation **ESD** stands for **E**lectrostatic **S**ensitive **D**evice.

Electrostatic sensitive devices are labeled with the following symbol:



Caution

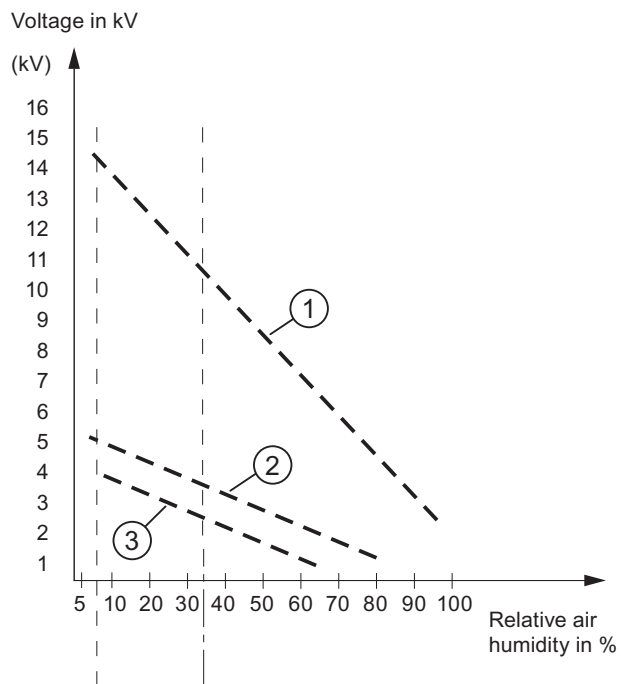
Electrostatic sensitive devices may be destroyed by voltages far below the level perceived by human beings. These voltages are generated when you touch a component or electrical connections of a module without having discharged your body. In most cases, the damage caused by overvoltage is not evident immediately, and results in damage only after a prolonged period of operation.

E.2 Electrostatic charging of the body

Electrostatic charging

Any person with a non-conductive connection to the electrical potential of its surroundings may be exposed to electrostatic charge.

The figure below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials indicated. These values correspond to IEC 801-2 specifications.



- ① Synthetic material
- ② Wool
- ③ antistatic materials, such as wood or concrete

E.3 Basic protective measures against electrostatic discharge

Ensure sufficient grounding

Make sure all persons, workplaces and packaging are sufficiently grounded when handling ESD components. This prevents electrostatic charge.

Avoid direct contact

You should only touch ESD components if unavoidable (for example, during maintenance work). Handle the modules without touching any chip pins or PCB traces. In this way, the discharged energy can not affect the sensitive devices.

Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

Support & Service

SIMATIC Technical Support

You can contact Technical Support for all A&D products:

- via the Internet using the **Support Request**:
<http://www.siemens.com/automation/support-request>
- E-mail: adsupport@siemens.com
- Phone: +49 (0) 180 5050 222
- Fax: +49 (0) 180 5050 223

Further information about our technical support is available in the Internet at
<http://www.siemens.com/automation/service>

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

<http://www.siemens.com/automation/service&support>

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- A Knowledge Manager to find the right documents for you.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- your local contact partner for Automation & Drives in our Partner Database
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have any questions about the products described in this manual and do not find the right answers.

Find your contact partner at:

<http://www.siemens.com/automation/partner>

A signpost to the documentation of the various SIMATIC products and systems is available at:

<http://www.siemens.de/simatic-tech-doku-portal>

Training center

SIEMENS offers a range of courses to help you to get started with your S7-300 Automation System. Please contact your local Training Center, or the Central Training Center in Nuremberg, D -90327 Germany.

Telephone: +49 (911) 895-3200

<http://www.sitrain.com>

List of abbreviations

G.1 List of abbreviations

Abbreviations	Explanations
AC	Alternating current
ADC	Analog-to-Digital Converter
AI	Analog input
AO	Analog output
AS	Automation system
COMP+ / -	Compensation line (positive / negative)
CP	Communications processor
CPU	Central Processing Unit of the PLC
DAC	Digital-to-Analog Converter
DB	Data block
DC	Direct current
DI	Digital input
DO	Digital output
ESD	Electrostatic sensitive devices
EMC	Electromagnetic Compatibility
EPROM	Erasable Programmable Read-Only Memory
SSV	Set substitution value
FB	Function block
FC	Function
FEPRM	Flash Erasable Programmable Read-Only Memory
ES	Encoder supply
I+	Measuring line for current input
I _c + / -	Constant current line (positive negative)
KV+ / -	Cold spot comparison (positive / negative)
L+	Power supply 24 VDC
HLV	Hold last valid value
FOC	Fiber-optic conductor
M	Ground
M+ / -	Measuring line (positive / negative)

List of abbreviations

G.1 List of abbreviations

Abbreviations	Explanations
M _{ANA}	Reference potential of the analog measuring circuit
MPI	Multipoint interface
OB	Organization block
OP	Operator panel
OS	Operator system
P5V	Power supply for module logic
PIO	Process Image of Outputs
PII	Process Image of Inputs
PG	Programming device
PS	Power supply
Q _I :	Analog output current
Q _V :	Analog output voltage
RAM	Random Access Memory
R _L :	Load impedance
S + / -	Sensor line (positive / negative)
SF	"Group error" LED
SFB	System function block
SFC	System function
SM	Signal module
PLC	Programmable logic controller
SSI	Synchronous serial interface
TD	HMI (Text Display)
U+	Measuring line for voltage input
CMV	Common Mode Voltage
Viso	Potential difference between M _{ANA} and local ground
sign	Sign

Glossary

2-/3-/4-wire connection

Methods of connecting resistance thermometers / resistances to the front connector of the module, or loads to the voltage output of an analog input module.

2-wire transducer (passive sensor) / 4-wire transducer (active sensor)

Type of transducer (2-wire transducers: power supply via terminals of the analog input module; 4-wire transducers: power supply via separate terminals of the transducer.)

Absolute encoder

Determines the distance traveled by reading a numerical value: When using absolute encoders with serial interface (SSI), the path information is transferred synchronously and serially according to the SSI protocol (synchronous serial interface).

Address

Represents the identifier of a specific address or address range. Examples: input I 12.1; flag word MW 25; data block DB 3.

Backplane bus

Serial data bus for module intercommunication, and power distribution to the modules. Bus connectors interconnect the modules.

Basic conversion time

Time required for the actual coding of a channel (integration time, plus all times required by the internal control, i.e. the channel is fully processed when this time has expired.

Basic error limit

Represents the operational limit at 25 °C, relative the module's rated range.

Basic execution time

Cycle time of an analog IO module when all of its channels are enabled. Equivalent to "number of channels x basic conversion time."

Bus

A transfer medium that interconnects several nodes. Data may be transferred in serial or parallel mode, using electrical or fiber-optic conductors.

Bus segment

Self-contained part of a bus system. Bus segments are coupled by means of → Repeater.

CiR

Plant changes in RUN (Configuration in RUN)

Common mode voltage (CMV)

The voltage common to all terminals of a group, measured between this group and any reference point (usually ground potential.)

Communications processor

Programmable S7 communications module, used for networking, PtP coupling, for example.

Compensating box

Can be used for temperature measurements using thermocouples connected to analog input modules. Represents a compensation circuit used to compensate temperature fluctuation at the → Reference junction.

Configuring

Refers to the selection and assembly of automation system components, or to software installation and adaptation to a specific process (by programming the modules, for example.)

CP

→ Communications processor

CPU

Central Processing Unit of the → Automation System. A CPU stores and executes the user program. It contains the operating system, memory, processing unit and communications interfaces.

Cumulative current

Cumulative current of all output channels of a digital output module.

Cycle time

Denotes the time a → CPU requires for a single execution of the → user program.

Default setting

A useful setting which is used whenever the user does not enter a different value.

Destruction limit

Permissible limit of the input voltage / output current. The accuracy of measurements may deteriorate if this limit is violated. If the destruction limit is considerably exceeded, this may destroy the internal measuring circuit.

Diagnostic interrupt

Module diagnostics function report errors to the → CPU by means of diagnostics interrupts. The CPU operating system calls OB 82 when a diagnostics interrupt is generated.

Diagnostics

Generic term for → System diagnostics, hardware error diagnostics, and user-specific diagnostics.

Diagnostics buffer

The diagnostics buffer represents a backup memory in the CPU, used to store diagnostics events in their order of occurrence.

In STEP 7 (PLC → Module status), the user can read data from the diagnostics buffer to determine the precise cause of error.

Diagnostics data

All diagnostics events are logged at the CPU and entered in → Diagnostics buffer. If an error OB exists, the buffer is started.

Direct access

Denotes access of the CPU to a module via the → backplane bus, while bypassing the → Process image.

electrically disconnected

The reference potential of the control and load voltage circuits at electrically isolated IO modules are isolated galvanically, for example, using optocouplers, relay contacts or transformers. IO circuits can be connected to a common reference potential.

electrically interconnected

The reference potential of the control and load voltage circuits of non-isolated IO modules are electrically interconnected.

FREEZE

STEP 7 parameter for the SM 338; POS-INPUT position detection module. FREEZE is a control command (function), used to freeze actual encoder values of SM 338.

Ground

The conductive earth whose electrical potential can be set equal to zero at any point.

Ground potential may be different from zero in the area of grounding electrodes. The term "reference ground" is frequently used to describe this situation.

grounding

Grounding means, to connect an electrically conductive component via an equipotential grounding system to a grounding electrode (one or several conductive components with low impedance contact to earth.)

Hardware interrupt

Function initiated by interrupt-triggering modules, based on specific events in the process (high or low limit violated, module has completed cyclic conversion of channels.)

The hardware interrupt is reported to the CPU, The CPU executes the assigned → Organization block according to interrupt priority.

Hold last value (HLV)

The module retains the last value output before the CPU went into STOP.

Input delay

STEP 7 parameter for digital input modules. The input delay function is used to suppress coupled disturbance. This includes pulse-shaped disturbance within the range from 0 ms to the set input delay

The input delay tolerance is defined in the technical data of the module. The length of suppressed pulse-shaped disturbance is determined by the length of the input delay.

The permissible input delay is determined by the line length between the encoder and the module. Unshielded encoder supply lines of a greater length (more than 100 m) require a long delay setting.

Integration time

STEP 7 parameter for analog input modules. The integration time is equivalent to the inverse value of the → noise suppression frequency in ms.

Interface, multi-point

→ MPI

Interrupt

SIMATIC S7 knows 28 different priority classes which control user program execution. Those priority classes also include hardware interrupts, for example. When an interrupt is generated, the operating system automatically calls an assigned OB which the user can program to trigger a specific action (at an FB for example.)

Interrupt, diagnostics

Diagnostics interrupt

Interrupt, end of cycle

→ hardware interrupt

Interrupt, hardware

→ hardware interrupt

Linearity error

Denotes the maximum deviation of the measured/output value from the ideal linear relationship between the measured/output signal and the digital value. Defined as a percentage, relative to the rated range of the analog module.

Logic block

A SIMATIC S7 logic block contains elements of the *STEP 7* user program. In contrast, a data block only contains data. Available logic blocks: Organization Blocks (OBs), Function Blocks (FBs), Functions (FCs), System Function Blocks (SFBs), System Functions (SFCs).

Measuring range module

Modules installed on analog input modules for the adaptation to different measuring ranges.

Mode of operation

Definition of this term:

1. selection of a CPU operating state using the mode selector switch or a PG
2. the type of program execution at the CPU
3. an analog input module parameter in *STEP 7*

Monoflop time

STEP 7 parameter for the SM 338; POS-INPUT position detection module. The monoflop time is equivalent to interval between two SSI message frames (→ Absolute encoder.)

MPI

Multi-Point Interface. SIMATIC S7 interface for programming devices. Allows central access to remote programmable modules (CPUs, CPs), Text Displays und Operator Panels. MPI nodes can intercommunicate.

Noise suppression

STEP 7 parameter for analog input modules. The frequency of AC mains may corrupt measured values, in particular in the low voltage ranges, and when thermocouples are being used. At this parameter, the user defines the mains frequency prevailing on his system.

OB

→ Organization Block

Operating state

Operating states known to SIMATIC S7 automation systems: STOP, → STARTUP, RUN and STOP.

Operational limit

Represents the measuring/output error of an analog module across the entire permissible temperature range, based on the module's rating.

Organization block

OBs form the interface between the CPU operating system and the user program. The sequential order of user program execution is defined in the organization blocks.

Parameter

1. Tag of a → Code block
2. Tag used to set one or several properties of a module. Each module is supplied with default parameters which users may edit in *STEP 7*.

PG

→ Programming device

Potential compensation

Electrical connection (equipotential conductor) of electrical equipment and external conductive objects to the same or near to same potential, in order to prevent the development of disturbance and dangerous potentials between those objects.

Process image

The CPU saves the signal states of analog IO modules to a process image.

We distinguish between the process image of inputs (PII) and outputs (PIO). The input modules read the process image of inputs (PII) before the operating system executes the user program. The operating system transfers the process image of outputs (PIO) to the output modules at the end of program execution.

Product version

Differentiates products of the same order number. The product version is incremented in the case of upwards compatible enhancements of functionality, production-specific changes (use of new components/parts), and fixes.

Programming device

A programming device (PG) is a special compact PC (Personal Computer) suitable for use in industry. A PG is fully equipped for programming SIMATIC automation systems.

Reaction to open thermocouple

STEP 7 parameter for analog input modules operating with thermocouples. This parameter defines whether the module outputs an "Overflow" (7FFFH) or "Underflow" (8000H) value when it detects an open thermocouple.

Reference junction

When operating thermocouples on analog input modules: point of known temperature (for example, → compensating box.)

Reference potential

Potential from which the voltages of participating circuits are derived and measured.

Repeatability

Denotes the maximum deviation between measured/output values, if the same input or output signal is repeatedly set. Repeatability refers to the rated range of the module, and applies to its settled temperature state.

Repeater

Equipment used to amplify bus signals, and couple → bus segments across greater distances

Resolution

Number of bits representing the value of analog modules in binary format. The resolution is module-specific. It is also determined by the → integration time of analog input modules. The precision of the measured value resolution increases with the length of the integration time. The maximum resolution is 16 bits + sign.

Restart

At its restart (initiated by setting the mode selector switch from STOP to RUN, or after POWER ON), the CPU first executes restart OB 100, and then continues with cyclic program execution (OB1.)

During its restart, the CPU reads the → Process image of inputs (PIO), and then executes the STEP 7 user program, starting at the first statement in OB1.

Retentivity

Data areas in data blocks (DBs), timers, counters and flags are considered retentive if their content is not lost as a result of restart or power off.

Scaling

STEP 7 parameter for the SM 338; POS-INPUT position detection module. Scaling right-aligns the → Absolute encoder value in the address space; irrelevant places are discarded.

Segment

→ Bus segment

SFC

→ System Function

Signal module

Signal modules (SMs) form the interface between the process and the automation system. These are available as digital and analog input/output and IO modules.

Smoothing

STEP 7 parameter for analog input modules. The measured values are smoothed by digital filtering. Users can select module-specific filter properties, i.e. none, low, medium or high. The time constant of the digital filter increases in proportion to the degree of smoothing.

STARTUP

STARTUP mode initiates the transition from STOP to RUN mode. STARTUP can be triggered by setting the → mode selector, by power on, or by an operator action on the programming device. S7-300 performs a → restart.

Substitution value

Values output by faulty signal output modules to the process, or used to substitute a process value of a faulty signal input module in the user program.

Substitution values are configurable in STEP 7 (hold last value, substitution value 0 or 1.) Those values must be set at the outputs when the CPU goes into STOP.

System diagnostics

Denotes the detection, evaluation and reporting of error events within the automation system. Examples of such errors are: program errors, or module failure. System errors may be indicated by LED displays, or in *STEP 7*.

System Function

A System Function (SFC) is an integral function of the CPU operating system, and can be called in the STEP 7 user program as required.

Temperature coefficient

STEP 7 parameter for analog input modules, for temperature measurements taken with resistance thermometers (RTD.) The selected temperature coefficient is specific to the resistance thermometer being used (to DIN standard.)

Temperature error

Denotes the drift of measured/output values, caused by fluctuation of the ambient temperature at an analog module. It is defined in % per Kelvin, relative to the rated range of the analog module.

Temperature error of internal compensation

Only applies to the measurement of thermocouples. Defines the error to add to the actual temperature error, when "internal comparison" mode is selected. The error is defined either as a percentile value relative to the physical rated range of the analog module, or as an absolute value in °C.

ungrounded

no galvanic connection to ground potential

User program

Contains statements, tags and data for processing signals which can control a plant or process. It is assigned to a programmable module (CPU, FM, for example) and can be organized in smaller units (blocks).

Wirebreak

Parameter in *STEP 7*. A wirebreak check is used to monitor line continuity between the encoder and input, or between the actuator and output. The module detects a wirebreak based on a current flow at the appropriately programmed input/output.

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Product Information on the Manual

Edition 12.2004

- **S7-300 Programmable Controller; Module Specifications, as of Edition 02/2004 (A5E00105505)**
 - **ET 200M Distributed I/O Device Signal Modules for Process Automation, as of Edition 10/2004 (A5E00085262)**
 - **S7-300, ET 200M Programmable Controller, Modules with Intrinsically-Safe Signals, as of Edition 08/2003 (A5E00172008)**
-

Introduction

Parameterizable signal modules of the S7-300 product family mentioned in this product information document can be reparameterized online using STEP7 *HWCONFIG* in RUN mode of the CPU.

In other words, the module parameters can be changed without switching the CPU to STOP mode or affecting other modules.

The following prerequisites must be met in order to use this function:

- STEP7 as of Version 5.2
- Distributed use of the S7-300 modules described in the S7-400 programmable controller (CPUs as of V3.1 or CP 443-5 extended as of V5.0).
- Use of the ET 200M with the IM 153-2 as of 6ES7153-2BA00-0XB0 or 6ES7153-2BB00-0XB0
- Use of the IM 157 as of 6ES7157-0AA82-0XA00

You will find a detailed description of the prerequisites and principles of operation in the manual *Modifying the System during Operation via CiR* (visit <http://www.siemens.com/automation/service&support> and enter the entry ID: 14044916).

Reparameterization steps in RUN mode

Observe the reparameterization steps described in the above manual.

Note the peculiarities of certain modules described in the table.

Example 1:

To change a measuring range for modules, proceed as follows:

1. Change the user program so that the channel to be reparameterized is no longer evaluated, and download it to the CPU.
2. Change the measuring range for the module in HWCONFIG, and download the changed configuration to the CPU.
3. Adapt the user program to the changed channel, and download it to the CPU.

Example 2:

When reparameterizing certain modules (see the table), you should ensure that there is no pending diagnostic event (e.g. a wire break message) before carrying out reparameterization, since otherwise it may happen in some cases that outgoing diagnostic events are no longer reported. As a result, the SF LEDs on the CPU, IM, or module will continue to shine, for example, although the reparameterized module is working correctly. If such a situation does arise, however, the module must be removed and then plugged in again.

Notes on the table

There is a separate table for each manual that describes the technical specifications of the signal modules of the S7-300 product family.

The “Behavior of the Inputs/Outputs” column indicates the behavior of the inputs/outputs when reparameterization is carried out in RUN mode, provided they are not affected by reparameterization.

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
S7-300 module specifications		
6ES7 321-7BH00-0AB0 6ES7 321-7BH80-0AB0 SM 321; DI 16 × DC 24 V; with hardware interrupt and diagnostic interrupt	Supply the last valid process value before parameterization	---
6ES7 321-7BH01-0AB0 SM 321; DI 16 × DC 24 V; with hardware interrupt and diagnostic interrupt, clocked		
6ES7 322-8BF00-0AB0 6ES7 322-8BF80-0AB0 SM 322; DO 8 × DC 24 V/ 0.5 A; with diagnostic interrupt	Output the last valid output value before parameterization	---
6ES7 322-5FF00-0AB0 SM 322; DO 8 × AC 120/230V/ 2A ISOL		
6ES7 322-5GH00-0AB0 SM 322; DO 16 × UC 24/48V		
6ES7 322-5HF00-0AB0 SM 322; DO 8 × Rel. AC 230V/5A		
6ES7 331-7NF00-0AB0 SM 331; AI 8 × 16 Bit	Supply the last valid process value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 331-7NF10-0AB0 SM 331; AI 8 × 16 Bit		
6ES7 331-7PF00-0AB0 SM 331; AI 8 × RTD		
6ES7 331-7PF10-0AB0 SM 331; AI 8 × TC		

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
6ES7 332-5HD01-0AB0 SM 332; AO 4 × 12 Bit	Output the last valid output value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: - Only reparameterize when there is no pending diagnosis on the module, or - Remove the module, and then plug it in again
6ES7 332-5HB01-0AB0 6ES7 332-5HB81-0AB0 SM 332; AO 2 × 12 Bit		
6ES7 332-5HF00-0AB0 SM 332; AO 8 × 12 Bit		---
6ES7 332-7ND00-0AB0 6ES7 332-7ND01-0AB0 SM 332; AO 4 × 16 Bit		---

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
ET 200M signal modules for process automation (PCS7)		
6ES7 321-7TH00-0AB0 SM 321; DI 16 × NAMUR	Supply the last valid process value (including the value status) before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: - Only reparameterize when there is no pending diagnosis on the module, or - Remove the module, and then plug it in again
6ES7 322-8BH00-0AB0 SM 322; DO 16 × DC 24 V/0,5A	Output the last valid output value before parameterization	

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
S7-300, ET 200, I/O modules with intrinsically-safe signals		
6ES7 321-7RD00-0AB0 SM 321; DI 4 × NAMUR	Supply the last valid process value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: - Only reparameterize when there is no pending diagnosis on the module, or - Remove the module, and then plug it in again
6ES7 322 5RD00-0AB0 SM 322; DO 4 × 15V/20mA	Output the last valid output value before parameterization	---
6ES7 322-5SD00-0AB0 SM 322; DO 4 × 24V/10mA		
6ES7 331-7RD00-0AB0 SM 331; AI 4 × 0/4...20mA	Supply the last valid process value before parameterization	---
6ES7 331-7SF00-0AB0 SM 331; AI 8 × TC/4 × RTD		---
6ES7 331-7TB00-0AB0 SM 331; AI 2 × 0/4...20mA HART		---
6ES7 332-5RD00-0AB0 SM 332; AO 4 × 0/4...20mA	Output the last valid output value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: - Only reparameterize when there is no pending diagnosis on the module, or - Remove the module, and then plug it in again
6ES7 332-5TB00-0AB0 SM 332; AO 2 × 0/4...20mA HART		---

Use of subassemblies/modules in a Zone 2 Hazardous Area

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English	Use of subassemblies/modules in a Zone 2 Hazardous Area	5
Français	Utilisation des modules / coupleurs dans la zone à risque d'explosion 2	7
Español	Aplicación de los módulos / tarjetas en áreas con peligro de explosión, zona 2	9
Italiano	Impiego delle unità/moduli nell'area a pericolo di esplosione zona 2	11
Nederlands	Gebruik van de componenten/modulen in het explosief gebied zone 2	13
Dansk	Brug af komponenter/moduler i det eksplosionsfarlige område zone 2	15
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Ελληνικά	Χρήση των δομικών συγκροτημάτων/μονάδων σε επικίνδυνη για έκρηξη περιοχή, ζώνη 2	23
Česky	Použití konstrukčních skupin / modulů v prostředí s nebezpečím výbuchu Zóna 2	25
Estnisch	Sõlmede/modulite kasutamine plahvatusohtliku piirkonna tsoonis 2	27
Latviski	Ierīču/moduļu pielietojums sprādzienbīstamas teritorijas zonā 2	29
Lietuviška	Konstrukcinių grupių/modulių panaudojimas sprogioje 2 zonos aplinkoje	31
Magya	A főegységek/modulok alkalmazása a 2. zóna robbanásveszélyes környezetben	33
Malti	Tqegħid tal-Komponenti / Modules fiż-Zona 2, fejn hemm Riskju ta' Splużjoni	35
Polski	Zastosowanie grup konstrukcyjnych / modułów w 2 strefie zagrożenia wybuchem	37
Slovensky	Použitie konštrukčných skupín / modulov v prostredí s nebezpečenstvom výbuchu zóny 2	39
Slovensko	Uporaba sklopov/modulov v eksplozivno ogroženem območju cone 2	41
Türkçe	Patlama tehlikesi olan Alan 2 bölgesinde ünite gruplarının/modüllerin kullanılması	43

Einsatz der Baugruppen/Module im explosionsgefährdeten Bereich Zone 2

Zone 2

Explosionsgefährdete Bereiche werden in Zonen eingeteilt. Die Zonen werden nach der Wahrscheinlichkeit des Vorhandenseins einer explosionsfähigen Atmosphäre unterschieden.

Zone	Explosionsgefahr	Beispiel
2	explosive Gasatmosphäre tritt nur selten und kurzzeitig auf	Bereiche um Flanschverbindungen mit Flachdichtungen bei Rohrleitungen in geschlossenen Räumen
sicherer Bereich	nein	- außerhalb der Zone 2 - Standardanwendungen von dezentraler Peripherie

Nachfolgend finden Sie wichtige Hinweise für die Installation der Baugruppen/Module im explosionsgefährdeten Bereich.

Weitere Informationen

Weitere Informationen zu den Baugruppen/Modulen finden Sie im dazugehörigen Handbuch.

Fertigungsort / Zulassung



II 3 G

EEx nA II T3 .. T6

nach EN 50021 : 1999

Prüfnummer: siehe Tabelle

Fertigungsort	Baugruppen/Module	Prüfnummer
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S	KEMA 01
	ET 200S Fehlersichere Module	ATEX 1238X
	S7-300	KEMA 02
	ET 200M Buskopplung DP/PA Diagnoserepeater S7-300 Fehlersichere Baugruppen	ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03
	S7-300 CP TS Adapter II	ATEX 1125X
	SIMATIC NET	KEMA 03 ATEX 1228X
		KEMA 03 ATEX 1226X

Hinweis

Baugruppen/Module mit der Zulassung II 3 G EEx nA II T3 .. T6 dürfen nur in SIMATIC-Systemen der Gerätekategorie 3 eingesetzt werden.

Instandhaltung

Für eine Reparatur müssen die betroffene Baugruppen/Module an den Fertigungsort geschickt werden. Nur dort darf die Reparatur durchgeführt werden.

Besondere Bedingungen

1. Baugruppen/Module müssen in einen Schaltschrank oder ein metallisches Gehäuse eingebaut werden. Diese müssen mindestens die Schutzart IP 54 (nach EN 60529) gewährleisten. Dabei sind die Umgebungsbedingungen zu berücksichtigen, in denen das Gerät installiert wird. Für das Gehäuse muss eine Herstellererklärung für Zone 2 vorliegen (gemäß EN 50021).
2. Wenn am Kabel bzw. an der Kabeleinführung dieses Gehäuses unter Betriebsbedingungen eine Temperatur $> 70\text{ °C}$ erreicht wird oder wenn unter Betriebsbedingungen die Temperatur an der Aderverzweigung $> 80\text{ °C}$ sein kann, müssen die Temperatureigenschaften der Kabel mit den tatsächlich gemessenen Temperaturen übereinstimmen.
3. Die eingesetzten Kabeleinführungen müssen der geforderten IP-Schutzart und dem Abschnitt 7.2 (gemäß EN 50021) entsprechen.
4. Alle Geräte, einschließlich Schalter etc., die an den Ein- und Ausgängen von SIMATIC-Systemen angeschlossen werden, müssen für den Explosionsschutz Typ EEx nA oder EEx nC genehmigt sein.
5. Es müssen Maßnahmen getroffen werden, dass die Nennspannung durch Transienten um nicht mehr als 40 % überschritten werden kann.
6. Umgebungstemperaturbereich: 0 °C bis 60 °C
7. Innerhalb des Gehäuses ist an einem nach dem Öffnen gut sichtbaren Platz ein Schild mit folgender Warnung anzubringen:



Warnung

Das Gehäuse darf nur kurze Zeit geöffnet werden, z. B. für visuelle Diagnose. Betätigen Sie dabei keine Schalter, ziehen oder stecken keine Baugruppen und trennen keine elektrischen Leitungen (Steckverbindungen). Diese Warnung kann unberücksichtigt bleiben, wenn bekannt ist, dass keine explosionsgefährdete Atmosphäre herrscht.

Liste der zugelassenen Baugruppen/Module

Die Liste mit den zugelassenen Baugruppen/Module finden Sie im Internet:

<http://www4.ad.siemens.de/view/cs/>

unter der Beitrags-ID 13702947.

Use of subassemblies/modules in a Zone 2 Hazardous Area

Zone 2

Hazardous areas are divided up into zones. The zones are distinguished according to the probability of the existence of an explosive atmosphere.

Zone	Explosion Hazard	Example
2	Explosive gas atmosphere occurs only seldom and for a short time	Areas around flange joints with flat gaskets in pipes in enclosed spaces
Safe area	No	• Outside zone 2 • Standard distributed I/O applications

Below you will find important information on the installation of the subassemblies/modules in a hazardous area.

Further Information

You will find further information on the subassemblies/modules in the corresponding manual.

Production Location / Certification



II 3 G

EEx nA II T3 .. T6

to EN 50021 : 1999

Test number: *see table below*

Production Location	Subassemblies/Modules	Test Number
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET-200S ET 200S fault-tolerant modules	KEMA 01 ATEX 1238X
	S7-300 ET-200M DP/PA bus interface Diagnostics repeater S7-300 fault-tolerant modules	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Note

Subassemblies/modules with II 3 G EEx nA II T3 .. T6 certification can only be used in SIMATIC systems rated as category 3 equipment.

Maintenance

If repair is necessary, the affected subassemblies/modules must be sent to the production location. Repairs can only be carried out there.

Special Conditions

1. Subassemblies/modules must be installed in a cabinet or metal housing. These must comply with the IP 54 degree of protection as a minimum. The environmental conditions under which the equipment is installed must be taken into account. There must be a manufacturer's declaration for zone 2 available for the housing (in accordance with EN 50021).
2. If a temperature of $> 70^{\circ}\text{C}$ is reached in the cable or at the cable entry of this housing under operating conditions, or if a temperature of $> 80^{\circ}\text{C}$ can be reached at the junction of the conductors under operating conditions, the temperature-related properties of the cables must correspond to the temperatures actually measured.
3. The cable entries used must comply with the required IP degree of protection and Section 7.2 (in accordance with EN 50021).
4. All devices (including switches, etc.) that are connected to the inputs and outputs of SIMATIC systems must be approved for EEx nA or EEx nC explosion protection.
5. Steps must be taken to ensure that the rated voltage through transients cannot be exceeded by more than 40 %.
6. Ambient temperature range: 0°C to 60°C
7. A sign containing the following warning must be put up inside the housing in an easily visible position when the housing is opened:



Warning

The housing can only be opened for a short time (e.g. for visual diagnostics). If you do this, do not operate any switches, remove or install any modules or disconnect any electrical cables (plug-in connections). You can disregard this warning if you know that the atmosphere is not hazardous (i.e. there is no risk of explosion).

List of Approved Subassemblies/Modules

You will find the list of approved subassemblies/modules under the ID 13702947 on the Internet:

<http://www4.ad.siemens.de/view/cs/>.

Utilisation des modules / coupleurs dans la zone à risque d'explosion 2

Zone 2

Les environnements à risque d'explosion sont répartis en zones. Les zones se distinguent par la probabilité de présence d'une atmosphère explosive.

Zone	Risque d'explosion	Exemple
2	Formation rare et brève d'une atmosphère gazeuse explosive	Environnement de raccords à joints plats dans le cas de conduites dans des locaux fermés
Zone sûre	Non	• A l'extérieur de la zone 2 • Utilisation standard de périphérie décentralisée

Vous trouverez ci-après des remarques importantes pour l'installation de la station de périphérie décentralisée des modules / coupleurs dans la zone à risque d'explosion.

Informations complémentaires

Des informations complémentaires sur les modules / cartouches se trouvent dans le manuel correspondant.

Lieu de fabrication / Homologation



II 3 G

EEx nA II T3 .. T6

selon EN 50021 : 1999

Numéro de contrôle : voir tableau

Lieu de fabrication	Modules / coupleurs	Numéro de contrôle
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S Modules à sécurité intrinsèque ET 200S	KEMA 01 ATEX 1238X
	S7-300 ET 200M Couplage de bus DP/PA Répéteur de diagnostic Modules à sécurité intrinsèque S7-300	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Nota

Les modules / coupleurs homologués  II 3 G EEx nA II T3 .. T6 ne peuvent être utilisés que dans des systèmes SIMATIC de catégorie 3.

Entretien

Si une réparation est nécessaire, le module / coupleur concerné doit être expédié au lieu de production. La réparation ne doit être effectuée qu'en ce lieu.

Conditions particulières

1. Les modules / coupleurs doivent être installés dans une armoire ou un boîtier métallique. Ceux-ci doivent assurer au moins l'indice de protection IP 54. Il faut alors tenir compte des conditions d'environnement dans lesquelles l'appareil est installé. Le boîtier doit faire l'objet d'une déclaration de conformité du fabricant pour la zone 2 (selon EN 50021).
2. Si dans les conditions d'exploitation, une température > 70 °C est atteinte au niveau du câble ou de l'entrée du câble dans ce boîtier, ou bien si la température au niveau de la dérivation des conducteurs peut être > 80 °C, les capacités de résistance thermique des câbles doivent correspondre aux températures effectivement mesurées.
3. Les entrées de câbles utilisées doivent avoir le niveau de protection IP exigé et être conformes au paragraphe 7.2 (selon EN 50021).
4. Tous les appareillages (y compris les interrupteurs, etc.) raccordés aux entrées et sorties de systèmes SIMATIC doivent être homologués pour la protection antidéflagrante type EEx nA ou EEx nC.
5. Il faut prendre des mesures pour que la tension nominale ne puisse pas être dépassée de plus de 40% sous l'influence de transitoires.
6. Plage de température ambiante : 0° C à 60° C
7. A l'intérieur du boîtier, il faut placer, à un endroit bien visible après ouverture, une plaquette comportant l'avertissement suivant :



Avertissement

Ouvrir le boîtier le moins longtemps possible, par exemple pour effectuer un diagnostic visuel. Ce faisant, n'actionnez aucun commutateur, ne déconnectez aucun module et ne débranchez pas de câbles électriques (connexions). Le respect de cet avertissement n'est pas impératif s'il est certain que l'environnement ne présente pas de risque d'explosion.

Liste des modules / coupleurs homologués

Vous trouverez sur Internet la liste des modules / coupleurs homologués :

<http://www4.ad.siemens.de/view/cs/>

référence ID 13702947.

Aplicación de los módulos / tarjetas en áreas con peligro de explosión, zona 2

Zona 2

Las áreas con peligro de explosión se clasifican en zonas. Las zonas se diferencian según la probabilidad de la existencia de una atmósfera capaz de sufrir una explosión.

Zona	Peligro de explosión	Ejemplo
2	La atmósfera explosiva de gas sólo se presenta rara vez y muy brevemente	Áreas alrededor de uniones abridadas con juntas planas en tuberías en locales cerrados
Área segura	no	- fuera de la zona 2 - Aplicaciones estándar de la periferia descentralizada

A continuación encontrará importantes informaciones para la instalación de los módulos / tarjetas en áreas con peligro de explosión.

Otras informaciones

Encontrará otras informaciones relativas a los módulos / tarjetas en el Manual correspondiente.

Lugar de fabricación / Homologación



II 3 G

EEx nA II T3 .. T6

según norma EN 50021 : 1999

Número de comprobación: véase *tabla*

Lugar de fabricación	Módulos / tarjetas	Número de comprobación
Siemens AG, Bereich A&D Werner-von-Siemens- Straße 50 92224 Amberg Germany	ET 200S Grupos ET 200S a prueba de fallos	KEMA 01 ATEX 1238 X
	S7-300 ET 200M Acoplamiento de bus DP/PA Repetidor de diagnóstico Grupos S7-300 a prueba de fallos	KEMA 02 ATEX 1096 X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125 X
	S7-300 CP TS Adapter	KEMA 03 ATEX 1228 X
	SIMATIC NET	KEMA 03 ATEX 1226 X

Nota

Los módulos / tarjetas con la homologación  II 3 G EEx nA II T3 .. T6 pueden utilizarse únicamente en los sistemas SIMATIC de la categoría de equipo 3.

Mantenimiento

Para una reparación se ha de remitir el módulo / tarjeta afectado al lugar de fabricación. Sólo allí se puede realizar la reparación.

Condiciones especiales

1. Los módulos / tarjetas se han de montar en un armario eléctrico de distribución o en una carcasa metálica. Éstos deben garantizar como mínimo el grado de protección IP 54 (conforme a EN 60529). Para ello se han de tener en cuenta las condiciones ambientales, en las cuales se instala el equipo. La caja deberá contar con una declaración del fabricante para la zona 2 (conforme a EN 50021).
2. Si durante la operación se alcanzara una temperatura > 70° C en el cable o la entrada de cables de esta caja o bien una temperatura > 80° C en la bifurcación de hilos, deberán adaptarse las propiedades térmicas de los cables a las temperaturas medidas efectivamente.
3. Las entradas de cable utilizadas deben cumplir el grado de protección IP exigido y lo expuesto en el apartado 7.2 (conforme a EN 50021).
4. Todos los dispositivos –inclusive interruptores, etc.– conectados a las entradas y salidas de sistemas SIMATIC deben estar homologados para la protección contra explosiones del tipo EEx nA o EEx nC.
5. Es necesario adoptar las medidas necesarias para evitar que la tensión nominal pueda rebasar en más del 40 % debido a efectos transitorios.
6. Margen de temperatura ambiente: 0° C hasta 60° C
7. Dentro de la caja deberá colocarse en un lugar perfectamente visible tras su apertura un rótulo con la siguiente advertencia:



Precaución

Abrir la caja sólo brevemente, p.ej. para el diagnóstico visual. Durante este tiempo Ud. no deberá activar ningún interruptor, desenchufar o enchufar módulos ni separar conductores eléctricos (conexiones enchufables). Esta advertencia puede ignorarse si Ud. sabe que en la atmósfera existente no hay peligro de explosión.

Lista de los módulos / tarjetas homologados

En la internet hallará Ud. una lista con los módulos / tarjetas homologados:

<http://www4.ad.siemens.de/view/cs/>

bajo el ID de asignación 13702947.

Impiego delle unità/moduli nell'area a pericolo di esplosione zona 2

Zona 2

Le aree a pericolo di esplosione vengono suddivise in zone. Le zone vengono distinte secondo la probabilità della presenza di un'atmosfera esplosiva.

Zona	Pericolo di esplosione	Esempio
2	L'atmosfera esplosiva si presenta solo raramente e brevemente	Aree intorno a collegamenti a flange con guarnizioni piatte nelle condotte in ambienti chiusi
Area sicura	No	- Al di fuori della zona 2 - Applicazioni standard di periferia decentrata

Qui di seguito sono riportate delle avvertenze importanti per l'installazione delle unità/moduli nell'area a pericolo di esplosione.

Ulteriori informazioni

Ulteriori informazioni sulle unità/moduli si trovano nel corrispondente manuale.

Luogo di produzione / Omologazione



II 3 G

EEx nA II T3 .. T6

secondo EN 50021 : 1999

Numero di controllo: vedi tabella

Luogo di produzione	Unità/moduli	Numero di controllo
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S Unità ad elevata sicurezza ET 200S	KEMA 01 ATEX 1238X
	S7-300 ET 200M Accoppiamento di bus DP/PA Repeater di diagnostica Unità ad elevata sicurezza S7-300	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Avvertenza

Le unità/moduli con l'omologazione  II 3 G EEx nA II T3 .. T6 possono essere impiegati solo nei sistemi SIMATIC della categoria di apparecchiature 3.

Manutenzione

Per una riparazione, le unità/i moduli interessati devono essere inviati al luogo di produzione. La riparazione può essere effettuata solo lì.

Condizioni particolari

1. Le unità/i moduli devono essere montati in un armadio elettrico o in un contenitore metallico. Questi devono assicurare almeno il tipo di protezione IP 54. In questo caso bisogna tenere conto delle condizioni ambientali nelle quali l'apparecchiatura viene installata. Per il contenitore deve essere presente una dichiarazione del costruttore per la zona 2 (secondo EN 50021).
2. Se nei cavi o nel loro punto di ingresso in questo contenitore viene raggiunta in condizioni di esercizio una temperatura > 70 °C o se in condizioni di esercizio la temperatura nella derivazione dei fili può essere > 80 °C, le caratteristiche di temperatura dei cavi devono essere conformi alla temperatura effettivamente misurata.
3. Gli ingressi dei cavi usati devono essere conformi al tipo di protezione richiesto e alla sezione 7.2 (secondo EN 50021).
4. Tutte le apparecchiature, inclusi interruttori, ecc. che vengono collegati agli ingressi/uscite di sistemi SIMATIC, devono essere stati omologati per la protezione da esplosione tipo EEx nA o EEx nC.
5. Devono essere prese delle misure per evitare che la tensione nominale possa essere superata per più del 40% da parte di transienti.
6. Campo termico ambientale: da 0° C a 60° C
7. All'interno del contenitore va apportata, in un luogo ben visibile dopo l'apertura, una targhetta con il seguente avvertimento:



Attenzione

Il contenitore può rimanere aperto solo per breve tempo, ad esempio per una diagnostica a vista. In tal caso non azionare alcun interruttore, non disinnestare o innestare unità e non staccare connessioni elettriche (connettori). Non è necessario tenere conto di questo avvertimento se è noto che non c'è un'atmosfera a rischio di esplosione

Elenco delle unità/moduli omologati

L'elenco con le unità/moduli omologati si trova in Internet al sito:

<http://www4.ad.siemens.de/view/cs/>

all'ID di voce 13702947.

Gebruik van de componenten/modulen in het explosief gebied zone 2

Zone 2

Explosieve gebieden worden ingedeeld in zones. Bij de zones wordt onderscheiden volgens de waarschijnlijkheid van de aanwezigheid van een explosieve atmosfeer.

Zone	Explosiegevaar	Voorbeeld
2	Een explosieve gasatmosfeer treedt maar zelden op en voor korte duur	Gebieden rond flensverbindingen met pakkingen bij buisleidingen in gesloten vertrekken
Veilig gebied	neen	- Buiten de zone 2 - Standaardtoepassingen van decentrale periferie

Hierna vindt u belangrijke aanwijzingen voor de installatie van de componenten/modulen in het explosief gebied.

Verdere informatie

In het bijhorende handboek vindt u verdere informatie over de componenten/modulen

Productieplaats / Vergunning



II 3 G

EEx nA II T3 .. T6

conform EN 50021 : 1999

Keuringsnummer: zie tabel

Productieplaats	Componenten/modulen	Keuringsnummer
Siemens AG, Bereich A&D Werner-von-Siemens- Strasse 50 92224 Amberg Germany	ET 200S ET 200S tegen fouten beveiligde componenten	KEMA 01 ATEX 1238X
	S7-300 ET 200 M Buskoppeling DP/PA Diagnoserepeater S7-300 tegen fouten beveiligde componenten	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Opmerking

Componenten/modulen met de vergunning  II 3 G EEx nA II T3 .. T6 mogen slechts worden gebruikt in SIMATIC-systemen van de apparaatcategorie 3.

Instandhouding

Voor een reparatie moeten de betreffende componenten/modulen naar de plaats van vervaardiging worden gestuurd. Alleen daar mag de reparatie worden uitgevoerd.

Speciale voorwaarden

1. Componenten/modulen moeten worden ingebouwd in een schakelkast of in een behuizing van metaal. Deze moeten minstens de veiligheidsgraad IP 54 waarborgen. Hierbij dient rekening te worden gehouden met de omgevingsvoorwaarden waarin het apparaat wordt geïnstalleerd. Voor de behuizing dient een verklaring van de fabrikant voor zone 2 te worden ingediend (volgens EN 50021).
2. Als aan de kabel of aan de kabelinvoering van deze behuizing onder bedrijfsomstandigheden een temperatuur wordt bereikt $> 70^{\circ}\text{C}$ of als onder bedrijfsomstandigheden de temperatuur aan de adervertakking $> 80^{\circ}\text{C}$ kan zijn, moeten de temperatuureigenschappen van de kabel overeenstemmen met de werkelijk gemeten temperaturen.
3. De aangebrachte kabelinvoeringen moeten de vereiste IP-veiligheidsgraad hebben en in overeenstemming zijn met alinea 7.2 (volgens EN 50021).
4. Alle apparaten, schakelaars enz. inbegrepen, die worden aangesloten op de in- en uitgangen van SIMATIC-systemen, moeten zijn goedgekeurd voor de explosiebeveiliging type EEx nA of EEx nC.
5. Er dienen maatregelen te worden getroffen, zodat de nominale spanning door transiënten met niet meer dan 40 % kan worden overschreden.
6. Omgevingstemperatuurbereik: 0°C tot 60°C
7. Binnen de behuizing dient op een na het openen goed zichtbare plaats een bord te worden aangebracht met de volgende waarschuwing:



Waarschuwing

De behuizing mag slechts voor korte tijd worden geopend, bijv. voor een visuele diagnose. Bedien hierbij geen schakelaar, trek of steek geen modulen en ontkoppel geen elektrische leidingen (steekverbindingen). Deze waarschuwing kan buiten beschouwing blijven, indien bekend is dat er geen explosieve atmosfeer heerst.

Lijst van de toegelaten componenten/modulen

De lijst met de toegelaten componenten/modulen vindt u in het internet:

<http://www4.ad.siemens.de/view/cs/>

onder de bijdrage-ID 13702947.

Brug af komponenter/moduler i det eksplosionsfarlige område zone 2

Zone 2

Eksplodingsfarlige områder inddeles i zoner. Zonerne adskiller sig indbyrdes efter hvor sandsynligt det er, at der er en eksplosiv atmosfære.

Zone	Eksplodingsfare	Eksempel
2	Ekspløsiv gasatmosfære optræder kun sjældent og varer kort	Områder rundt om flangeforbindelser med flade pakninger ved rørledninger i lukkede rum
Sikkert område	Nej	• Uden for zone 2 • Standardanvendelser decentral periferi

I det følgende findes vigtige henvisninger vedr. installation af komponenter/moduler i det eksplosionsfarlige område.

Yderligere informationer

Yderligere informationer om komponenterne/modulerne findes i den pågældende manual.

Produktionssted / Godkendelse



II 3 G

EEx nA II T3 .. T6

efter EN 50021 : 1999

Kontrolnummer: se tabel

Produktionssted	Komponenter/moduler	Kontrolnummer
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S fejlsikre komponenter	KEMA 01 ATEX 1238X
	S7-300 ET 200M Buskobling DP/PA Diagnoserepeater S7-300 fejlsikre komponenter	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Bemærk

Komponenter/moduler med godkendelsen II 3 G EEx nA II T3 .. T6 må kun monteres i SIMATIC-systemer for udstyrskategori 3.

Vedligeholdelse

Hvis de pågældende komponenter/moduler skal repareres, bedes De sende dem til produktionsstedet. Reparation må kun udføres der.

Særlige betingelser

1. Komponenterne/modulerne skal monteres i et kontrolskab eller et metalkabinet. Disse skal mindst kunne sikre beskyttelsesklasse IP 54. I denne forbindelse skal der tages højde for de omgivelsestemperaturer, i hvilke udstyret er installeret. Der skal være udarbejdet en erklæring fra fabrikanten for kabinettet for zone 2 (iht. EN 50021).
2. Hvis kablet eller kabelindføringen på dette hus når op på en temperatur på $> 70^{\circ}\text{C}$ under driftsbetingelser eller hvis temperaturen på åreforegningen kan være $> 80^{\circ}\text{C}$ under driftsbetingelser, skal kablernes temperaturegenskaber stemme overens med de temperaturer, der rent faktisk måles.
3. De benyttede kabelindføringer skal være i overensstemmelse med den krævede IP-beskyttelsestype og afsnittet 7.2 (iht. EN 50021).
4. Alle apparater, inkl. kontakter osv., der forbindes med ind- og udgangene til SIMATIC-systemerne, skal være godkendt til eksplosionsbeskyttelse af type EEx nA eller EEx nC.
5. Der skal træffes foranstaltninger, der sørger for, at den nominelle spænding via transienter ikke kan overskrides mere end 40 %.
6. Omgivelsestemperaturområde: 0°C til 60°C
7. I kabinettet skal der anbringes et skilt, der skal kunne ses, når kabinettet åbnes. Dette skilt skal have følgende advarsel:



Advarsel

Kabinettet må kun åbnes i kort tid, f.eks. til visuel diagnose. Tryk i denne forbindelse ikke på kontakter, træk eller isæt ikke komponenter og afbryd ikke elektriske ledninger (stikforbindelser). Der skal ikke tages højde for denne advarsel, hvis man ved, at der ikke er nogen eksplosionsfarlig atmosfære.

Liste over godkendte komponenter/moduler

Listen med de godkendte komponenter/moduler findes på internettet:

<http://www4.ad.siemens.de/view/cs/>

under bidrags-ID 13702947.

Rakenneryhmien/moduulien käyttö räjähdysvaarannetuilla alueilla, vyöhyke 2

Vyöhyke 2

Räjähdysvaarannetut alueet jaetaan vyöhykkeisiin. Vyöhykkeet erotellaan räjähdyskelpoisen ilmakehän olemassa olon todennäköisyyden mukaan.

Vyöhyke	Räjähdysvaara	Esimerkki
2	Räjähtävä kaasuilmakehä ilmaantuu vain harvoin ja lyhytaikaisesti	Alueet putkistojen lattatiivisteillä varustuilla laippaliitoksilla suljetuissa tiloissa
turvallinen alue	ei	- vyöhykkeen 2 ulkopuolella - Hajautetun ulkopiirin vakiosovellukset

Seuraavasta löydätte tärkeitä ohjeita rakenneryhmien/moduulien asennukseen räjähdysvaarannetuilla alueilla.

Lisätietoja

Lisätietoja rakenneryhmiin/moduuleihin löydätte niihin kuuluvista ohjekirjasta.

Valmistuspaikka / Hyväksyntä



II 3 G

EEx nA II T3 .. T6

EN 50021 mukaan: 1999

Tarkastusnumero: katso taulukko

Valmistuspaikka	Rakenneryhmät/moduulit	Tarkastusnumero
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S läpi-iskuvarmat rakenneryhmät	KEMA 01 ATEX 1238X
	S7-300 ET 200M Väyläkytkin DP/PA Dignositoistin S7-300 läpi-iskuvarmat rakenneryhmät	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Ohje

Rakenneryhmät/moduulit hyväksynnän II 3 G EEx nA II T3 .. T6 kanssa saadaan käyttää ainoastaan laitekategorian 3 SIMATIC-järjestelmissä.

Kunnossapito

Korjausta varten täytyy kyseinen rakenneryhmä/moduuli lähettää valmistuspaikkaan. Korjaus voidaan suorittaa ainoastaan siellä.

Erityiset vaatimukset

1. Rakenneryhmät/moduulit täytyy asentaa kytkentäkaappiin tai metalliseen koteloon. Näiden täytyy olla vähintään kotelointiluokan IP 54 mukaisia. Tällöin on huomioitava ympäristöolosuhteet, johon laite asennetaan. Kotelolle täytyy olla valmistajaselvitys vyöhykettä 2 varten (EN 50021 mukaan).
2. Kun johdolla tai tämän kotelon johdon sisäänviennillä saavutetaan $> 70^{\circ}\text{C}$ lämpötila tai kun käyttöolosuhteissa lämpötila voi pihuhajaotuksella olla $> 80^{\circ}\text{C}$, täytyy johdon lämpötilaominaisuuksien vastata todellisesti mitattuja lämpötiloja.
3. Käytettyjen johtojen sisäänohjauksien täytyy olla vaaditun IP-kotelointiluokan ja kohdan 7.2 (EN 50021 mukaan) mukaisia.
4. Kaikkien laitteiden, kytkimet jne. mukaan lukien, jotka liitetään SIMATIC-järjestelmien tuloille ja lähdöille, täytyy olla hyväksyttyjä tyyppin EEx nA tai EEx nC räjähdysuojausta varten.
5. Toimenpiteet täytyy suorittaa, ettei nimellisjännite voi transienttien kautta ylittyä enemmän kuin 40 %.
6. Ympäristölämpötila-alue: $0^{\circ}\text{C} \dots 60^{\circ}\text{C}$
7. Kotelon sisälle, avauksen jälkeen näkyvälle paikalle, on kiinnitettävä kilpi, jossa on seuraava varoitus:



Varoitus

Kotelo saadaan avata ainoastaan lyhyeksi ajaksi, esim. visuaalista diagnoosia varten. Älä tällöin käytä mitään kytkimiä, vedä tai liitä mitään rakenneryhmiä, äläkä erota mitään sähköjohtoja (pistoliittimiä). Tätä varoitusta ei tarvitse huomioida, kun on tiedossa, että minkäänlaista räjähdysvaarannettua ilmakehää ei ole olemassa.

Hyväksytyjen rakenneryhmien/moduulien lista

Lista hyväksytyistä rakennesarjoista/moduuleista löytyy internetistä osoitteesta:

<http://www4.ad.siemens.de/view/cs/>

käyttäjätunnuksella 13702947.

Användning av komponentgrupperna/modulerna i explosionsriskområde zon 2

Zon 2

Explosionsriskområden delas in i zoner. Zonerna delas in enligt sannolikheten att en atmosfär med explosionsfara föreligger.

Zon	Explosionsfara	Exempel
2	Explosiv gasatmosfär uppstår endast sällan eller kortvarigt	Områden kring flänsförbindelser med packningar vid rörledningar i slutna utrymmen
Säkert område	Nej	• Utanför zon 2 • Standardanvändning av decentral periferi

Nedan följer viktiga anvisningar om installationen av komponentgrupperna/modulerna i ett explosionsriskområde.

Ytterligare information

Ytterligare information om komponentgrupperna/modulerna finner du i tillhörande handbok.

Tillverkningsort / Godkännande



II 3 G

EEx nA II T3 .. T6

enligt EN 50021 : 1999

Kontrollnummer: se tabell

Tillverkningsort	Komponentgrupper/ moduler	Kontrollnummer
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Felsäkra komponentgrupper	KEMA 01 ATEX 1238X
	S7-300 ET 200M Busskoppling DP/PA Diagnosrepeater S7-300 Felsäkra komponentgrupper	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Anvisning

Komponentgrupper/moduler med godkännande  II 3 G EEx nA II T3 .. T6 får endast användas i SIMATIC-system i apparatgrupp 3.

Underhåll

Vid reparation måste den aktuella komponentgrupperna/modulerna insändas till tillverkaren. Reparationer får endast genomföras där.

Särskilda villkor

1. Komponentgrupperna/modulerna måste monteras i ett kopplingsskåp eller metallhus. Dessa måste minst vara av skyddsklass IP 54. Därvid ska omgivningsvillkoren där enheten installeras beaktas. För kåpan måste en tillverkardeklaration för zon 2 föreligga (enligt EN 50021).
2. Om en temperatur på > 70°C uppnås vid husets kabel resp kabelinföring under driftvillkor eller om temperaturen vid trådförgreningen kan vara > 80°C under driftvillkor, måste kabelns temperaturegenskaper överensstämma med den verkliga uppmätta temperaturen.
3. De använda kabelinföringarna måste uppfylla kraven i det krävda IP-skyddsutförandet och i avsnitt 7.2 (enligt EN 50021).
4. Alla apparater, inklusive brytare osv, som ansluts till in- och utgångarna på SIMATIC-system, måste vara godkända för explosionsskydd av typ EEx nA eller EEx nC.
5. Åtgärder måste vidtas så, att märkspänningen ej kan överskridas med mer än 40 % genom transienter.
6. Omgivningstemperatur: 0° C till 60° C
7. När huset öppnats ska en skylt med följande varning monteras på ett tydligt synligt ställe huset:



Varning

Huset får endast öppnas under kort tid, t ex för visuell diagnos. Använd därvid inga brytare, lossa eller anslut inga enheter och frånskilj inga elektriska ledningar (insticksanslutningar).

Ingen hänsyn måste tas till denna varning om det är säkert att det inte råder någon explosionsfarlig atmosfär.

Lista över godkända komponentgrupper/moduler

Lista över godkända komponentgrupper/moduler finns på Internetadressen:

<http://www4.ad.siemens.de/view/cs/>

under bidrags-ID 13702947.

Uso de grupos construtivos/módulos em área exposta ao perigo de explosão 2

Zona 2

As áreas expostas ao perigo de explosão são divididas em zonas. As zonas são diferenciadas de acordo com a probabilidade da existência de uma atmosfera explosiva.

Zona	Perigo de explosão	Exemplo
2	Só raramente e por um breve período de tempo surgem atmosferas explosivas	Áreas em torno de ligações flangeadas com vedações chatas em tubulações em recintos fechados
Área segura	não	• fora da zona 2 • Aplicações descentralizadas de periferia descentralizada

A seguir, o encontrará avisos importantes para a instalação de grupos construtivos/ módulos em área exposta ao perigo de explosão.

Mais informações

Para obter mais informações sobre grupos construtivos/módulos, consulte o respectivo manual.

Local de produção / Licença



II 3 G

EEx nA II T3 .. T6

seg. EN 50021 : 1999

Número de ensaio: veja a tabela

Local de produção	Grupos construtivos/módulos	Nº de ensaio
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Alemanha	ET 200S ET 200S Grupos construtivos protegidos contra erro	KEMA 01 ATEX 1238X
	S7-300 ET 200M Acoplador bus DP/PA Repetidor de diagnóstico S7-300 Grupos construtivos protegidos contra erro	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Alemanha	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Aviso

Os grupos construtivos/módulos com a licença  II 3 G EEx nA II T3 .. T6 só podem ser aplicados em sistemas SIMATIC da categoria de aparelho 3.

Reparo

Os grupos construtivos/módulos em questão devem ser remetidos para o local de produção a fim de que seja realizado o reparo. Apenas lá deve ser efetuado o reparo.

Condições especiais

1. Os grupos construtivos/módulos devem ser montados em um armário de distribuição ou em uma caixa metálica. Estes devem garantir no mínimo o tipo de protecção IP 54. Durante este trabalho deverão ser levados em consideração as condições locais, nas quais o aparelho será instalado. Para a caixa deverá ser apresentada uma declaração do fabricante para a zona 2 (de acordo com EN 50021).
2. Caso no cabo ou na entrada do cabo desta carcaça sob as condições operacionais seja atingida uma temperatura de $> 70^{\circ}\text{C}$, ou caso sob condições operacionais a temperatura na ramificação do fio poderá atingir $> 80^{\circ}\text{C}$, as características de temperatura deverão corresponder às temperaturas realmente medidas.
3. As entradas de cabo utilizadas devem corresponder ao tipo exigido de protecção IP e à seção 7.2 (de acordo com o EN 50021).
4. Todos os aparelhos, inclusive as chaves, etc., que estejam conectadas em entradas e saídas dos sistemas SIMATIC devem possuir a licença para a protecção de explosão do tipo EEx nA ou EEx nC.
5. Precisam ser tomadas medidas para que a tensão nominal através de transitórios não possa ser ultrapassada em mais que 40 %.
6. Área de temperatura ambiente: 0°C até 60°C
7. No âmbito da carcaça deve ser colocada, após a abertura, em um ponto bem visível uma placa com a seguinte advertência:



Advertência

A carcaça deve ser aberta apenas por um breve período de tempo, por ex. para diagnóstico visual. Não acione nenhum interruptor, não retire ou conecte nenhum módulo e não separe nenhum fio elétrico (ligações de tomada). Esta advertência poderá ser ignorada caso se saiba que não há nenhuma atmosfera sujeita ao perigo de explosão.

Lista dos grupos construtivos/módulos autorizados

A lista com os grupos construtivos/módulos autorizados encontram-se na Internet:

<http://www4.ad.siemens.de/view/cs/>

sob o número de ID 13702947.

Χρήση των δομικών συγκροτημάτων/μονάδων σε επικίνδυνα για έκρηξη περιοχή, ζώνη 2

Ζώνη 2

Οι επικίνδυνες για έκρηξη περιοχές χωρίζονται σε ζώνες. Οι ζώνες διαφέρουν σύμφωνα με την πιθανότητα ύπαρξης ενός ικανού για έκρηξη περιβάλλοντος.

Ζώνη	Κίνδυνος έκρηξης	Παράδειγμα
2	Εκρηκτικό περιβάλλον αερίου παρουσιάζεται μόνο σπάνια και για σύντομο χρονικό διάστημα	Περιοχές γύρω από φλαντζωτές συνδέσεις με τσιμούχες σε σωληνώσεις σε κλειστούς χώρους
Ασφαλής περιοχή	όχι	- Εκτός της ζώνης 2 - Τυπικές εφαρμογές αποκεντρωμένης περιφέρειας

Στη συνέχεια θα βρείτε σημαντικές υποδείξεις για την εγκατάσταση των δομικών συγκροτημάτων/μονάδων σε επικίνδυνα για έκρηξη περιοχή.

Επιπλέον πληροφορίες

Επιπλέον πληροφορίες για τα δομικά συγκροτήματα/μονάδες θα βρείτε στο αντίστοιχο εγχειρίδιο.

Τόπος κατασκευής / Άδεια



II 3 G

EEx nA II T3 .. T6

σύμφωνα με το πρότυπο

EN 50021 : 1999

Αριθμός ελέγχου: βλέπε πίνακα

Τόπος κατασκευής	Δομικά συγκροτήματα/μονάδες	Αιθμ. ελέγχου
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Ασφαλή σε περίπτωση βλάβης δομικά συγκροτήματα	KEMA 01 ATEX 1238X
	S7-300 ET 200M Σύζευξη διαύλου DP/PA Επαναλήπτης διάγνωσης S7-300 Ασφαλή σε περίπτωση βλάβης δομικά συγκροτήματα	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Υπόδειξη

Τα δομικά συγκροτήματα/οι μονάδες με την άδεια  II 3 G EEx nA II T3 .. T6 επιτρέπεται να τοποθετηθούν μόνο σε συστήματα αυτοματισμού SIMATIC της κατηγορίας συσκευής 3.

Συντήρηση

Για μια επισκευή πρέπει να σταλθούν τα αντίστοιχα δομικά συγκροτήματα/μονάδες στον τόπο κατασκευής. Μόνο εκεί επιτρέπεται να γίνει η επισκευή.

Ιδιαίτερες προϋποθέσεις

1. Τα δομικά συγκροτήματα/μονάδες πρέπει να ενσωματωθούν σε ένα ερμάριο ζεύξης ή σε ένα μεταλλικό περίβλημα. Αυτά πρέπει να εξασφαλίζουν το λιγότερο το βαθμό προστασίας IP 54 (κατά EN 60529). Σε αυτήν την περίπτωση πρέπει να ληφθούν υπόψη οι περιβαλλοντικές συνθήκες, στις οποίες θα εγκατασταθεί η συσκευή. Για το περίβλημα πρέπει να προβλέπεται δήλωση του κατασκευαστή για τη ζώνη 2 (σύμφωνα με το πρότυπο EN 50021).
2. Εάν στο καλώδιο ή στην είσοδο του καλωδίου αυτού του περιβλήματος κάτω από συνθήκες λειτουργίας η θερμοκρασία ξεπεράσει τους 70 °C ή όταν κάτω από συνθήκες λειτουργίας η θερμοκρασία στη διακλάδωση του σύρματος μπορεί να είναι μεγαλύτερη από 80 °C, πρέπει οι θερμοκρασιακές ιδιότητες των καλωδίων να ταυτίζονται με τις πραγματικά μετρημένες θερμοκρασίες.
3. Οι χρησιμοποιούμενες εισόδους καλωδίων πρέπει να συμμορφώνονται με το βαθμό προστασίας IP 54 στην ενότητα 7.2 (σύμφωνα με το πρότυπο EN 50021).
4. Όλες οι συσκευές, συμπεριλαμβανομένων διακοπών κ.α., που συνδέονται στις εισόδους και εξόδους των συστημάτων SIMATIC, πρέπει να φέρουν εγκεκριμένη προστασία κατά έκρηξης τύπου EEx nA ή EEx nC.
5. Πρέπει να ληφθούν μέτρα, να μην μπορεί να γίνει υπέρβαση της ονομαστικής τάσης μέσω αιφνίδιας μεταβολής της τάσης πάνω από 40 %.
6. Περιοχή θερμοκρασίας περιβάλλοντος: 0° C έως 60° C
7. Πρέπει να τοποθετηθεί μέσα στο περίβλημα σε ευδιάκριτο σημείο μετά το άνοιγμα μία πινακίδα με την ακόλουθη προειδοποίηση:



Προειδοποίηση

Το περίβλημα επιτρέπεται να ανοίγει μόνο για μικρό χρονικό διάστημα, π.χ. για τη διενέργεια οπτικής διάγνωσης. Μην κάνετε χρήση διακοπών, μην τραβάτε ή εμβυσματώνετε δομικά συγκροτήματα και μη διαχωρίζετε ηλεκτροφόρους αγωγούς (εμβυσματώσιμες συνδέσεις).

Η προειδοποίηση αυτή δε χρειάζεται να ληφθεί υπ' όψιν, εάν είναι γνωστό ότι δεν υφίσταται ατμόσφαιρα παρουσιάζουσα κίνδυνο έκρηξης.

Κατάλογος των εγκεκριμένων δομικών συγκροτημάτων/μονάδων

Η λίστα με τα εγκεκριμένα δομικά συγκροτήματα/μονάδες υπάρχει στο διαδίκτυο:

<http://www4.ad.siemens.de/view/cs/>

με τον κωδικό συνδρομής 13702947.

Použití konstrukčních skupin / modulů v prostředí s nebezpečím výbuchu Zóna 2

Zóna 2

Oblasti s nebezpečím výbuchu jsou rozděleny do zón. Zóny jsou rozlišeny podle pravděpodobnosti výskytu explosivní atmosféry.

Zóna	Nebezpečí exploze	Příklad
2	Explosivní plynová atmosféra se vyskytuje pouze zřídka a krátkodobě	Oblasti kolem přírubových spojů s plochým těsněním u potrubí v uzavřených prostorech
Bezpečná oblast	není	- Mimo zónu 2 - Standardní aplikace necentrálních periferií

Dále naleznete důležité pokyny pro instalaci konstrukčních skupin/modulů v oblastech s nebezpečím výbuchu.

Další informace

Další informace ke konstrukčním skupinám/modulům naleznete v příslušné příručce.

Místo výroby / Registrace



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dle EN 50021 : 1999

Zkušební číslo: viz tabulka

Místo výroby	Konstrukční skupiny/Moduly	Kontrolní číslo
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Konstrukční skupiny odolné proti chybám	KEMA 01 ATEX 1238X
	S7-300 ET 200M Spojka sběrnice DP/PA Diagnostické translační relé S7-300 Konstrukční skupiny odolné proti chybám	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Upozornění

Konstrukční skupiny/Moduly s osvědčením (Ex) II 3 G EEx nA II T3 .. T6 smějí být použity pouze v systémech SIMATIC, přístrojové kategorie 3.

Údržba

K opravě musí být příslušné konstrukční skupiny/moduly zaslány do výrobního místa. Oprava smí být provedena pouze zde.

Zvláštní podmínky

1. Konstrukční skupiny/moduly musí být zabudovány v rozvaděči nebo kovovém krytu. Ty musí minimálně zajišťovat druh ochrany IP 54 (dle EN 60529). Přitom je nutno respektovat okolní podmínky, v nichž je přístroj instalován. Pro kryt musí být k dispozici prohlášení výrobce pro zónu 2 (dle EN 50021).
2. Pokud je na kabelu popř. kabelovém vedení tohoto krytu dosaženo za provozních podmínek teploty > 70 °C, nebo když za provozních podmínek může být na kabelových větvích teplota > 80 °C, musí teplotní vlastnosti kabelu souhlasit se skutečně naměřenými teplotami.
3. Použité kabelové příводы musí odpovídat požadovanému druhu ochrany IP a odstavci 7.2 (dle EN 50021).
4. Všechny přístroje, včetně spínačů atd. napojených na vstupy a výstupy systémů SIMATIC, musí mít osvědčení vůči výbuchu typu EEx nA nebo EEx nC.
5. Musí být provedena opatření k zamezení přechodného překročení jmenovitého napětí, nepřesahující více než 40 %.
6. Rozsah teploty okolí: 0° C do 60° C
7. Uvnitř krytu je nutno na dobře viditelném místě po otevření připevnit štítek s následujícím varováním:



Varování

Kryt smí být otevřen pouze krátce, např. pro vizuální diagnostiku. Nepoužívejte přitom žádný spínač, nevytahujte ani nezasunujte žádné konstrukční skupiny a neoddělujte žádná elektrická vedení (konektorové spoje). Toto varování nemusíte respektovat, pokud je známo, že se na místě nevyskytuje explozivní atmosféra.

Seznam konstrukčních skupin/modulů s osvědčením

Seznam konstrukčních skupin/modulů s osvědčením naleznete na Internetu:

<http://www4.ad.siemens.de/view/cs/>

pod identifikací příspěvku ID 13702947.

Sõlmede/moodulite kasutamine plahvatusohtliku piirkonna tsoonis 2

Tsoon 2

Plahvatusohtlikud piirkonnad jagatakse tsoonideks. Tsoone eristatakse vastavalt plahvatusohtliku keskkonna esinemise tõenäosusele.

Tsoon	Plahvatusoht	Näide
2	üldine plahvatav keskkond esineb ainult harva ja lühiajaliselt	Piirkonnad lamedate rõngastihenditega torustike äärikliidete ümbruses suletud ruumides
ohutu piirkond	ei	- väljaspool tsooni 2 - Mittstsentralse välisseadme standardsed rakendused

Järgnevalt leiate Te olulisi juhiseid sõlmede/moodulite paigaldamiseks plahvatusohtlikus piirkonnas.

Täiendav info

Üksikasjalik info sõlmede/moodulite kohta on toodud seadme juurde kuuluvas käsiraamatus.

Valmistamiskoht / Kasutusluba



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vastavalt standardile EN 50021 : 1999

Katsetusnumber: vaadake tabelit

Valmistamiskoht	Sõlmed/moodulid	Katsetusnumber
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Rikkekindlad sõlmed	KEMA 01 ATEX 1238X
	S7-300 ET 200M Siinühendus DP/PA Diagnostikarepiiter S7-300 Rikkekindlad sõlmed	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Juhis

Sõlmi/moduleid kasutusloaga II 3 G EEx nA II T3 .. T6 tohib kasutada ainult SIMATIC-süsteemides, mille seadmeklass on 3.

Korrashoid

Parandamiseks tuleb sõlmed/moodulid saata valmistamiskohta. Parandustõid tohib teha ainult seal.

Eritingimused

1. Sõlmed/moodulid tuleb monteerida jaotuskarpi või metallkorpusesse. Need peavad tagama kaitseastme vähemalt IP 54 (vastavalt standardile EN 60529). Seejuures peab arvesse võtma seadme paigaldamise keskkonna tingimusi. Korpuse jaoks peab tsooni 2 jaoks olema tootja juhis (vastavalt standardile EN 50021).
2. Kui selle korpuse kaabli juures või kaabelvaheliku (kaabelsisestuse) juures töötingimustes saavutatakse temperatuur > 70 °C või, kui töötingimustes temperatuur soone hargnemiskoha juures võib olla > 80 °C, peavad kaabli termilised omadused olema vastavuses tegelikult mõõdetud temperatuuridega.
3. Kasutatavad kaabelvahelikud (kaabelsisestused) peavad vastama nõutud IP-kaitseastmele ja osas 7.2 toodud nõuetele (vastavalt standardile EN 50021).
4. Kõik seadmed, kaasa arvatud lülitid, jt., mis SIMATIC-süsteemide sisendite ja väljundite külge ühendatakse, peavad võimaldama plahvatuskaitse tüüpi EEx nA või EEx nC.
5. Peab rakendama abinõusid, et nimipinget üleminekute tõttu ei saaks ületatada üle 40 %.
6. Ümbritseva keskkonna temperatuurivahemik: 0° C kuni 60° C
7. Korpuse sisse tuleb sellisesse kohta, mis pärast avamist on hästi nähtav, panna silt järgmise hoiatusega:



Ettevaatust

Korpust tohib avada ainult lühikeseks ajaks, näiteks visuaalse diagnostika jaoks. Seejuures ärge kasutage ühtegi lülitit ega võtke välja ega pange sisse ühtegi sõlme ega lahutage ühtegi elektrijuhet (pistikühendused). Seda hoiatust võib mitte arvesse võtta, kui on teada, et ei esine mingit plahvatusohtlikku keskkonda.

Lubatud sõlmede/moodulite loetelu

Lubatud sõlmede/modulite loetelu leiate Te internetist:

<http://www4.ad.siemens.de/view/cs/>

lisas-ID 13702947.

Ierīču/moduļu pielietojums sprādzienbīstamas teritorijas zonā 2

Zona 2

Sprādzienbīstamās teritorijas ir sadalītas zonās. Šīs zonas atšķir pēc sprādzienbīstamas atmosfēras pastāvēšanas iespējamības.

Zona	Sprādzienbīstamība	Piemērs
2	eksplozīva gāzes atmosfēra izveidojas reti un uz īsu laiku	Teritorijas ap atloku savienojumiem ar plakaniem blīvējumiem uz cauruļvadiem slēgtās telpās
droša teritorija	nē	- Ārpus zonas 2 - Decentralizētas perifērijas ierīces standartlietojumi

Turpmāk atrodamas svarīgas norādes par ierīču/moduļu uzstādīšanu sprādzienbīstamajā zonā.

Turpmāka informācija

Turpmāka informācija par ierīcēm/moduļiem ir atrodama attiecīgajā rokasgrāmatā.

Izgatavošanas vieta / Atļauja



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saskaņā ar EN 50021 : 1999

Pārbaudes numurs: skatīt tabulu

Izgatavošanas vieta	Ierīces/moduļi	Pārbaudes numurs
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S	KEMA 01 ATEX 1238X
	S7-300 ET 200M Kopnes savienotājs DP/PA Diagnosticas atkārtotājs S7-300 Pret kļūdām aizsargātas ierīces	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Norāde

Ierīces/moduļi ar atļauju  II 3 G EEx nA II T3 .. T6 var tikt pielietotas tikai 3.kategorijas SIMATIC sistēmās.

Tehniskā apkope

Attiecīgu ierīču/moduļu remontam tie ir jānosūta ražotājam. Remontu drīkst veikt tikai tur.

Īpaši apstākļi

1. Ierīces/moduļi jāiebūvē sadales skapī vai metāla korpusā. Tiem jānodrošina aizsardzības līmenis ne mazāks kā IP 54 (saskaņā ar EN 60529). Turklāt, ierīces uzstādīšanā jāievēro apkārtējas vides apstākļi. Korpusam ir nepieciešams izgatavotāja apliecinājums zonai 2 (saskaņā ar EN 50021).
2. Ja uz kabeļa vai šī korpusa kabeļu ievades ekspluatācijas apstākļos tiek sasniegta temperatūra > 70 °C vai ja ekspluatācijas apstākļos uz kabeļa atzariem var būt temperatūra > 80 °C, kabeļu temperatūras īpašībām jāatbilst faktiski nomērītām temperatūrām.
3. Pielietojamām kabeļu ievadēm jāatbilst nepieciešamajam aizsardzības veidam IP un sadaļai 7.2 (saskaņā ar EN 50021).
4. Visām ierīcēm, ieskaitot pārslēgus utt., kas tiek pieslēgti pie SIMATIC sistēmu ievadēm un izvadēm, jābūt atļaujām EEx nA vai EEx nC tipa sprādzienaizsardzībai.
5. Nepieciešams veikt pasākumus, lai pārejas spriegums nepārsniegtu nominālo spriegumu vairāk kā par 40 %.
6. Apkārtējas temperatūras diapazons: 0° C līdz 60° C
7. Korpusa iekšpusē, vietā, kas ir labi redzama, atverot to, ir jāizvieto plāksne ar sekojošo brīdinājumu:

**Brīdinājums**

Korpusu var atvērt tikai īslaicīgi, piemēram, vizuālai diagnostikai. Pie tam nenospiediet nekādus slēdžus, neievietojiet un neizņemiet nekādas ierīces un nepārtrauciet elektriskās līnijas (spraudsavienojumus). Šis brīdinājums var tikt ņemts vērā, ja ir zināms, ka nepastāv sprādzienbīstama atmosfēra.

Pieļaujamo ierīču/moduļu saraksts

Pieļaujamo ierīču/moduļu saraksts ir atrodams Internetā:

<http://www4.ad.siemens.de/view/cs/>

zem datu ID 13702947.

Konstruktinių grupių/modulių panaudojimas sprogioje 2 zonos aplinkoje

Zona 2

Sprogi aplinka yra apibūdinama keliomis zonomis. Zonos skirstomos pagal galimos sprogios terpės atsiradimo tikimybę.

Zona	Sprogimo pavojus	Pavyzdys
2	sprogi atmosfera būna retai ir trumpai	Uždary patalpų vamzdynuose - flanšo su tarpikliais sujungimų vietose
saugioji sritis	nėra	- ne zonoje 2 - Standartinė periferinė sistema

Toliau pateikiama informacija apie konstrukcinių grupių ir modulių montavimą sprogioje aplinkoje.

Papildoma informacija

Papildomos informacijos apie konstrukcines grupes/modulius rasite eksploatacijos vadove.

Pagaminimo vieta / Saugos reikalavimai



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pagal EN 50021 : 1999

Patikros numeris: žiūr. lentelėje

Pagaminimo vieta	Konstruktinės grupės/moduliai	Patikros numeris
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Ambergas Vokietija	ET 200S ET 200S nuo trukdžių apsaugotos konstrukcinės grupės	KEMA 01 ATEX 1238X
	S7-300 ET 200M Magistralinė jungtis DP/PA Diagnozės retransliatorius S7-300 nuo trukdžių apsaugotos konstrukcinės grupės	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Vokietija	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Nuoroda

Konstruktines grupes/modulius, kurių leidimas eksploatuoti yra  II 3 G EEx nA II T3 .. T6 galima naudoti tik 3 kategorijos sistemose "SIMATIC".

Priežiūra

Esant gedimams, konstrukcinę grupę/modulį išsiųskite gamintojui. Tik jis gali kvalifikuotai suremontuoti įtaisą.

Specialiosios sąlygos

1. Konstrukcines grupes/modulius montuokite jungimo spintoje arba metaliniame korpuse. Korpuso ar jungimo spintos saugos klasė turi būti mažiausiai "IP 54" (pagal EN 60529). Būtina atsižvelgti į kitas aplinkos sąlygas. Norint korpusą eksploatuoti zonoje 2, būtinas gamintojo pažymėjimas (pagal EN 50021).
2. Jei korpuso kabelio arba kabelio prijungimo temperatūra pakyla daugiau nei 70 °C arba laidų atšakoje temperatūra padidėja daugiau nei 80 °C, reikia naudoti kabelius, kurių terminės savybės atitinka išmatuotas temperatūros vertes.
3. Kabelių sujungimai turi būti saugos klasės IP ir atitikti 7.2 skyriaus (pagal EN 50021) reikalavimus.
4. Visi prietaisai, įskaitant ir jungiklius, jungiami sistemų "SIMATIC" įeigose ir išeigose, turi būti tipo "EEx nA" arba "EEx nC" - apsaugoti nuo sprogių.
5. Būtina imtis priemonių, kad pereinamųjų grandžių vardinė įtampa neviršytų 40 %.
6. Leistina aplinkos temperatūra: 0° C iki 60° C
7. Atidarę korpusą, jo viduje gerai matomoje vietoje, įtaisykite lentelę su įspėjimu:

**Įspėjimas**

Korpusą atidaryti tik trumpam laikui, pvz., patikrai. Neliesti jungiklių, konstrukcinių grupių neištraukti ir nekišti, neatjungti elektrinių sujungimų (kištukinių sujungimų).

Šio įspėjimo galima nepaisyti, kai yra žinoma, jog darbinė aplinka yra nesprogi.

Leistinių konstrukcinių grupių/modulių sąrašas

Leistinių konstrukcinių grupių/modulių sąrašą rasite interneto puslapyje:

<http://www4.ad.siemens.de/view/cs/>

įvedę kodą 13702947.

A főegységek/modulok alkalmazása a 2. zóna robbanásveszélyes környezetben

2. zóna

A robbanásveszélyes környezeteket zónákba sorolják be. A robbanásveszélyes légkör előfordulásának valószínűsége alapján különböztetik meg a zónákat.

Zóna	Robbanásveszély	Példa
2	robbanásveszélyes gázt tartalmazó légkör csak ritkán és rövid ideig lép fel	zárt helyiségekben elhelyezett csővezetékeknél a lapos tömítéssel rendelkező karimás kötések környezetében
biztonságos környezet	nem	- a 2. zónán kívül - a decentralis periféria készülékek standard alkalmazásai

A következőkben fontos utasításokat talál a főegységek/modulok telepítéséhez a robbanásveszélyes környezetbe.

További információk

A további információkat a főegységekhez/modulokhoz megtalálja a hozzátartozó kézikönyvben.

Gyártási hely / Engedélyezés



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az EN 50021 : 1999 szerint

Ellenőrző szám: lásd a táblázatot

Gyártási hely	Főegységek/modulok	Ellenőrző szám
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S hibabiztos főegységek	KEMA 01 ATEX 1238X
	S7-300 ET 200M DP/PA buszcsatló Diagnózisrepeater S7-300 hibabiztos főegységek	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Utasítás

 Az II 3 G EEx nA II T3 .. T6 engedélyezéssel rendelkező főegységeket/modulokat alkalmazhatja csak a 3. felszerelés-kategóriába tartozó SIMATIC rendszerekbe.

Karbantartás

Javítás esetén küldje az érintett főegységeket/modulokat a gyártási helyre. Csak itt hajthatják végre a javítást.

Különleges feltételek

1. A főegységeket/modulokat egy kapcsolószekrénybe vagy egy fém házba kell beszerelni. Ezeknek kell biztosítaniuk legalább az IP 54 védeettségi fokozatot (EN 60529 szerint). Itt figyelembe kell venni azokat a környezeti feltételeket, amelyek fellépnek a készülék telepítésekor. A házhoz meg kell legyen a gyártói nyilatkozat a 2. zónához (az EN 50021 szerint).
2. Ha a jelen ház kábelén ill. kábelvezetésen üzemi feltételek mellett a hőmérséklet > 70 °C, vagy ha az üzemi feltételek mellett a hőmérséklet > 80 °C az érelágazásokon, akkor meg kell egyezzenek a kábel hőmérsékleti tulajdonságai a ténylegesen mért hőmérsékletekkel.
3. Az alkalmazott kábelvezetések meg kell feleljenek a követelt IP védeettségi fokozatnak és a 7.2. bekezdésnek (EN 50021 szerint).
4. Minden készülék, kapcsolót stb. beleértve, amelyeket a SIMATIC rendszerek be- és kimeneteire csatlakoztattak, engedélyezve kell legyen az EEx nA vagy EEx nC típusú robbanásvédelemhez.
5. Intézkedéseket kell hozni, hogy a tranziensek ne lépják túl a névleges feszültséget több mint 40 %-al.
6. Környezeti hőmérséklet tartomány: 0° C ... 60° C
7. A házban belül -a nyitáskor jól látható helyen- helyezzen el egy táblát a következő figyelmeztetéssel:



Figyelmeztetés

A házat csak rövid ideig szabad nyitani, pl. optikai diagnózishoz. Eközben ne működtessen egy kapcsolót sem, ne húzzon ki vagy dugjon be egy főegységet sem és ne válasszon le villamos vezetékeket (dugós csatlakozók). Ez a figyelmeztetés mellőzhető, ha tudott, hogy nem áll fenn robbanásveszélyes légkör.

A megengedett főegységek/modulok listája

A megengedett főegységek/modulok listáját megtalálja az interneten:

<http://www4.ad.siemens.de/view/cs/>

a 13702947 cikk azonosító szám alatt.

Tqegħid tal-Komponenti / Modules fiż-Żona 2, fejn hemm Riskju ta' Splużjoni

Żona 2

Sezzjonijiet fejn hemm riskju ta' splużjoni jitqassmu f'żoni. Tagħmel distinzjoni bejn żona u oħra skond il-probabbiltà li jkun hemm ambjent li jista' jwassal għal splużjoni.

Żona	Periklu ta' Splużjoni	Eżempju
2	ambjent gassuż li jista' jisplodi jfeġġ rament u għal żmien qasir	Żoni madwar flanġ ġojnts b'gaskits ċatti f'kanni ġewwa spazji magħluqin
żona ż-żgura	le	- barra miż-żona 2 - użu normali ta' <i>devices</i> periferali decentralizzati

Issib hawn taħt indikazzjonijiet importanti għall-installazzjoni ta' komponenti / *modules* fiż-żona fejn hemm riskju ta' splużjoni.

Aktar Tagħrif

Aktar tagħrif fuq il-komponenti / *modules* jinstab fil-manwal ikkonċernat.

Post ta' Manifattura / Approvazzjoni



II 3 G

EEx nA II T3 .. T6

skond EN 50021 : 1999

Numru tač-Ċertifikat: ara t-tabella

Post ta' Manifattura	Komponenti / Modules	Numru tač-Ċertifikat
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S <i>modules</i> ma jistgħux ifallu	KEMA 01 ATEX 1238X
	S7-300 ET 200M <i>bus coupling</i> DP/PA Ripetitur ta' dijanjosi S7-300 <i>modules</i> ma jistgħux ifallu	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Nota

Komponenti / *modules* bl-approvazzjoni II 3 G EEx nA II T3 .. T6 jistgħu jintużaw biss ġewwa sistemi SIMATIC tal-kategorija 3.

Manutenzjoni

Fil-każ li jkun hemm bżonn ta' tiswija, il-komponenti / *modules* ikkonċernati għandhom jintbagħtu fil-post ta' manifattura. It-tiswijiet jistgħu jsiru biss f'dan il-post.

Kundizzjonijiet Speċjali

1. Komponenti / *modules* għandhom jiġu mmontati ġewwa swiċċ kabinett jew kaxxa tal-metall. Dawn iridu jggarantixxu protezzjoni mill-inqas tat-tip IP 54 (skond EN 60529). Inti u tagħmel hekk, trid taħseb għall-kundizzjonijiet ambjentali ta' waqt l-installazzjoni tad-*device*. Irid ikun hemm dikjarazzjoni tal-manifatturier għall-kaxxa għaž-żona 2 (skond EN 50021).
2. Jekk fil-kejbil, jew fil-kaxxa mad-daħla għall-kejbil, tintlaħaq temperatura ta' aktar minn 70 °C taħt kundizzjonijiet ta' ħidma, jew jekk fil-post fejn jinfirdu l-wajers jista' jkun li hemm temperatura ta' aktar minn 80 °C, il-kejbil irid ikollu proprjetajiet ta' temperatura xierqa għat-temperaturi tabilhaqq imkejlin.
3. Id-daħliet għall-kejbil li jintużaw iridu jikkonformaw mat-tip ta' protezzjoni IP mitlub u t-taqsima 7.2 (skond EN 50021).
4. Id-*devices* kollha, swiċċijiet etc. inkluzi, li jitqabbd u ma' l-*inputs* u l-*outputs* ta' sistemi SIMATIC, iridu jkunu approvati għal protezzjoni kontra splużjoni tat-tip EEx nA jew EEx nC.
5. Iridu jittieħdu miżuri biex il-vultaġġ nominali ma jitqabbiżx b'aktar minn 40% minħabba transitorji.
6. Varjazzjoni tat-temperatura ambjentali: 0° C sa 60° C
7. Għandha titqiegħed tabella bit-twissija li ġejja ġewwa l-kaxxa, f'post li jidher sew wara li tinfetaħ il-kaxxa:



Twissija

Il-kaxxa tista' tinfetaħ biss għal żmien qasir, per eżempju għal dijanjosi viżwali. Inti u tagħmel hekk, ma tista' tmiss l-ebda swiċċ, ddaħħal jew tneħħi l-ebda *module* u tneħħi l-ebda kejbil elettriku (konnessjonijiet li tipplaggjahom). Tista' ma tagħtix każ ta' din it-twissija meta taf li m'hemmx riskju ta' splużjoni fl-ambjent.

Lista ta' Komponenti / *Modules* Approvati

Issib il-lista ta' komponenti / *modules* approvati fl-internet:

<http://www4.ad.siemens.de/view/cs/>

bin-numru ta' identifikazzjoni 13702947.

Zastosowanie grup konstrukcyjnych / modułów w 2 strefie zagrożenia wybuchem

Strefa 2

Otoczenie zagrożone wybuchem dzielone jest na strefy. Strefy dzielą się ze względu na stopień prawdopodobieństwa powstania atmosfery stwarzającej możliwość powstania wybuchu.

Strefa	Niebezpieczeństwo eksplozji	Przykład
2	atmosfera gazowa z zagrożeniem wybuchem występuje rzadko i na krótki okres czasu	miejsca wokół łącz w kanałach technicznych z opaskami przy przewodach instalacyjnych w pomieszczeniach zamkniętych
obszar bezpieczny	nie	- poza 2 strefą - standardowe zastosowanie decentralnych urządzeń peryferyjnych

Dalej znajdą Państwo informacje dotyczące instalacji grup konstrukcyjnych / modułów w otoczeniu zagrożonym wybuchem.

Pozostałe informacje

Dalsze informacje dotyczące grup konstrukcyjnych / modułów znajdą państwo w odpowiedniej instrukcji.

Miejsce produkcji / Rejestracja



II 3 G

EEx nA II T3 .. T6

stosownie do EN 50021 : 1999

Nr testu: zobacz tabela

Miejsce produkcji	Grupy konstrukcyjne / moduły	Nr testu
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Niemcy	ET 200S ET 200S grupy konstrukcyjne odporne na uszkodzenia	KEMA 01 ATEX 1238X
	S7-300 ET 200M Zbierające łącze sprzężające DP/PA powtarzacz diagnozy S7-300 grupy konstrukcyjne odporne na uszkodzenia	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Niemcy	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Uwaga

Grupy konstrukcyjne / moduły zarejestrowane jako  II 3 G EEx nA II T3 .. T6 wolno stosować jedynie w systemach SIMATIC o 3 kategorii urządzenia.

Konserwacja

W celu naprawy należy odpowiednie grupy konstrukcyjne / moduły przesłać do miejsca produkcji. Jedynie serwis producenta jest upoważniony do dokonywania napraw.

Warunki szczególne

1. Grupy konstrukcyjne / moduły muszą zostać zamontowane do skrzynki ochronnej lub metalowej puszki ochronnej. Muszą one spełniać wymagania co najmniej stopnia IP 54 (stosownie do EN 60529). Należy brać pod uwagę warunki otoczenia, w którym urządzenie będzie instalowane. Należy posiadać oświadczenie producenta dopuszczające puszkę do użytku w strefie 2 (stosownie do EN 50021).
2. W przypadku, gdyby na przewodzie tej puszki podczas pracy temperatura mogła przekroczyć > 70 °C, lub żyła przewodu mogłaby osiągnąć temperaturę > 80 °C, właściwości cieplne przewodu muszą zostać dobrane do takich wartości.
3. Wszystkie stosowane przewody muszą odpowiadać właściwemu stopniowi ochrony IP oraz warunkom określonym w punkcie 7.2 (stosownie do EN 50021).
4. Wszystkie urządzenia włączając w to przełączniki itp., które podłączane są do wejść lub wyjść systemów SIMATIC muszą być dopuszczone do ochrony przeciw wybuchom typu EEx nA lub EEx nC.
5. Muszą zostać spełnione takie warunki, aby napięcie miana w przejściach nie mogło przekroczyć więcej niż 40 %.
6. Temperatura otoczenia: od 0° C do 60° C
7. W puszcze w dobrze widocznym po otwarciu miejscu należy umieścić ostrzeżenie następującej treści:

**Uwaga**

Puszkę wolno otworzyć jedynie na krótki okres czasu na przykład w celu kontroli optycznej. Nie wolno przy tym naciskać na żaden z przełączników, nie wolno wyciągać ani montować żadnej grupy konstrukcyjnej ani też odłączać żadnych przewodów elektrycznych (łącza wsuwkowe). Powyższego ostrzeżenia nie trzeba przestrzegać jeśli wiadomo jest, iż na miejscu nie ma zagrożenia wybuchem.

Lista dopuszczonych grup konstrukcyjnych / modułów

Wykaz dopuszczonych grup konstrukcyjnych / modułów znajduje się na stronie internetowej:

<http://www4.ad.siemens.de/view/cs/>

w części ID 13702947.

Použitie konštrukčných skupín / modulov v prostredí s nebezpečenstvom výbuchu zóny 2

Zóna 2

Prostredia s nebezpečenstvom výbuchu sa rozdeľujú do zón. Zóny sa rozlišujú podľa pravdepodobnosti prítomnosti atmosféry so schopnosťou výbuchu.

Zóna	Nebezpečenstvo explózie	Príklad
2	plynová atmosféra s nebezpečenstvom výbuchu sa vyskytuje len zriedka a krátkodobo	priestory okolo prírubových spojov s plochými tesneniami pri potrubných vedeniach v uzavretých priestoroch
bezpečná oblasť	nie	• mimo zóny 2 • štandardné použitia decentralnej periferie

Ďalej nájdete dôležité pokyny pre inštaláciu konštrukčných skupín / modulov v prostredí s nebezpečenstvom výbuchu.

Ďalšie informácie

Ďalšie informácie ku konštrukčným skupinám / modulom nájdete v príslušnej príručke.

Miesto vyhotovenia / Osvedčenie



II 3 G

EEx nA II T3 .. T6

podľa EN 50021 : 1999

Číslo skúšky : pozri tabuľka

Miesto vyhotovenia	Konštrukčné skupiny / moduly	Číslo skúšky
Siemens AG, divízia A&D Werner-von-Siemens-Straße 50 92224 Amberg Nemecko	ET 200S ET 200S konštrukčné skupiny odolné voči poruchám	KEMA 01 ATEX 1238X
	S7-300 ET 200M Zbernicový väzbový člen DP/PA opakovač diagnózy S7-300 konštrukčné skupiny odolné voči poruchám	KEMA 02 ATEX 1096X
Siemens AG, divízia A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Nemecko	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Upozornenie

Konštrukčné skupiny / moduly s osvedčením  II 3 G EEx nA II T3 .. T6 sa smú používať len v systémoch SIMATIC kategórie zariadenia 3.

Údržba

Za účelom opravy sa musia príslušné konštrukčné skupiny / moduly zaslať na miesto vyhotovenia. Oprava sa smie vykonávať len na tomto mieste !

Špeciálne podmienky

1. Konštrukčné skupiny / moduly sa musia vmontovať do spínacej skrine alebo do kovového puzdra schránky. Tie musia zabezpečovať druh ochrany minimálne IP 54 (podľa EN 60529). Pritom je potrebné zohľadniť podmienky prostredia, do ktorého sa bude zariadenie inštalovať. V prípade puzdra musí existovať vyhlásenie výrobcu pre zónu 2 (podľa EN 50021).
2. V prípade, že na kábli, prípadne na káblovom prívode tohto puzdra presiahne teplota pri prevádzkových podmienkach hodnotu $> 70^{\circ}\text{C}$, alebo ak na vetve žily môže byť pri prevádzkových podmienkach teplota $> 80^{\circ}\text{C}$, musia tepelné vlastnosti kábla vyhovovať skutočne nameraným hodnotám.
3. Všetky použité káblové prívody musia zodpovedať požadovanému druhu ochrany IP a odseku 7.2 (podľa EN 50021).
4. Všetky zariadenia, vrátane prepínača, atď., ktoré sa pripoja na vstupy a výstupy systémov SIMATIC, musia byť schválené pre ochranu voči výbuchu typu EEx nA alebo EEx nC.
5. Musia sa splniť také opatrenia, aby sa menovité napätie cez prechody nemohlo prekročiť o viac ako 40 %.
6. Rozsah okolitých teplôt: 0°C až 60°C
7. V puzdre je na dobre viditeľné miesto po otvorení potrebné umiestniť štítok s nasledovnou výstrahou:

**Výstraha**

Puzdro sa môže otvoriť len počas krátkej doby, napríklad pre vizuálnu diagnózu. Nestlačte pritom žiadny prepínač, nevyťahujte alebo nezasuňte žiadnu konštrukčnú skupinu a neoddeľte žiadne elektrické vedenia (zástrčkové spojenia).

Túto výstrahu si nemusíte všímať v takom prípade, ak je známe, že sa na mieste nevyskytuje atmosféra s nebezpečenstvom výbuchu.

Zoznam dovolených konštrukčných skupín / modulov

Zoznam dovolených konštrukčných skupín / modulov sa nachádza na internete :

<http://www4.ad.siemens.de/view/cs/>

v článku ID 13702947.

Uporaba sklopov/modulov v eksplozivno ogroženem območju cone 2

Cona 2

Eksplozivno ogrožena območja se delijo na cone. Cone se ločijo po verjetnosti prisotnosti eksplozivne atmosfere.

Cona	Nevarnost eksplozije	Primer
2	eksplozivna zmes plinov v atmosferi je redka in traja le kratko.	Območja okoli prirobnih spojev z ploskimi tesnili pri cevni napeljavah v zaprtih prostorih.
sigurno območje	ne	- izven cone 2 - Standardna uporaba decentralne periferije.

Sledijo pomembni napotki o inštalaciji sklopov/modulov v eksplozivno ogroženem območju.

Nadaljnje informacije

Nadaljnje informacije o sklopih/modulih najdete v priloženem priročniku.

Mesto izdelave / Dovoljenje - Atest



II 3 G

EEx nA II T3 .. T6

po EN 50021 : 1999

kontrolna številka: *glej tabelo*

Mesto izdelave	Sklopi/moduli	kontrolna številka:
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Sklopi varovani proti okvari	KEMA 01 ATEX 1238X
	S7-300 ET 200M bus vezava DP/PA Diagnostni repeater S7-300 Sklopi varovani proti okvari	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Opozorilo

Sklopi/moduli z dovoljenjem II 3 G EEx nA II T3 .. T6 se lahko uporabijo samo v SIMATIC-Sistemih kategorije 3 .

Vzdrževanje

V primeru popravila pošljete sklope/module na kraj izdelave. Popravila lahko izvajajo samo na tem naslovu!

Posebni pogoji

1. Sklopi/moduli se morajo vgraditi v elektro omaro ali metalno ohišje. Omara/ohišje mora zadostiti varovanju IP 54 (po EN 60529). Pri tem je potrebno upoštevati tudi pogoje okolice, v kateri se naprava nahaja. Ohišje mora imeti izjavo (atest) proizvajalca za uporabo v coni 2 (po EN 50021).
2. Če na kablu oz. uvodnici tega ohišja v režimu obratovanja temperatura doseže vrednost $> 70^{\circ}\text{C}$ ali če doseže na razcepih vodnikov v obratovanju temperatura vrednost $> 80^{\circ}\text{C}$, se morajo temperaturne lastnosti kablov skladati z dejansko namerjenimi.
3. Uporabljene uvodnice morajo ustrezati predpisani IP zaščiti in poglavju 7.2 (po EN 50021).
4. Vse naprave, vključno s stikali itd., ki so priklopljene na vhodih oz. izhodih sistemov SIMATIC, morajo biti odobrene za zaščito proti eksplozijam tipa EEx nA ali EEx nC.
5. Zagotoviti se mora, da nazivna napetost ne prekorači več kot 40% pri tranziencah (preklopih, vklopih,...).
6. Temperaturno območje okolice: 0°C do 60°C
7. V notranjosti ohišja, na odprtem dobro vidljivem mestu, se pritrdi napis z naslednjim opozorilom:



Opozorilo

Ohišje se lahko odpre samo za kratek čas, npr. za vizualno diagnozo. Pri tem ne vklaplajte/izklaplajte stikal, sklopov ali električnih vodnikov (vtičnih spojev). Opozorilo ne velja, kadar je znano, da ni eksplozivne atmosfere.

Seznam dovoljenih sklopov/modulov

Seznam dovoljenih sklopov/modulov najdete na internetu na spletni strani:

<http://www4.ad.siemens.de/view/cs/>

pod ID prispevka 13702947.

Patlama tehlikesi olan Alan 2 bölgesinde ünite gruplarının/modüllerin kullanılması

Alan 2

Patlama tehlikesi olan bölgeler alanlara ayrılır. Alanlar, patlayabilecek atmosfere sahip ortam ihtimaline göre farklı derecelere ayrılır.

Alan	Patlama tehlikesi	Örnek
2	Patlayıcı gaz atmosferi sadece nadir ve kısa bir süre için söz konusu	Kapalı alanlardaki boru bağlantılarında yassı contalı flanş bağlantıları civarındaki bölgeler
Güvenli bölge	hayır	- Alan 2 haricinde - Merkezi olmayan periferi standart uygulamaları

Aşağıda, ünite gruplarının/modüllerin patlama tehlikesi olan bölgelerde kurulması için önemli bilgiler bulacaksınız.

Daha başka bilgiler

Ünite grupları/modüller hakkında daha fazla bilgi için ilgili kılavuza bakınız.

İmalat yeri / Lisans



II 3 G

EEx nA II T3 .. T6

EN 50021 standartına göre: 1999

Test numarası: bkz. Tablo

İmalat yeri	Ünite grupları/Modüller	Kontrol numarası
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Hataya karşı emniyetli ünite grupları	KEMA 01 ATEX 1238X
	S7-300 ET 200M Bus kuplajı DP/PA Diyagnoz repeater ünitesi S7-300 Hataya karşı emniyetli ünite grupları	KEMA 02 ATEX 1096X
Siemens AG, Bereich A&D Östliche Rheinbrückenstr. 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X
	S7-300 CP TS Adapter II	KEMA 03 ATEX 1228X
	SIMATIC NET	KEMA 03 ATEX 1226X

Bilgi

⚠ II 3 G EEx nA II T3 .. T6 lisanslı ünite grupları/modüller sadece 3 numaralı cihaz kategorisine ait SIMATIC sistemlerine kullanılabilir.

Bakım ve koruma

Bir onarım gerekli olması halinde, ilgili ünite grupları/modüller imalat yerine gönderilmelidir. Onarım sadece orada yapılabilir ve yapılmalıdır.

Özel koşullar

1. Ünite grupları/modüller bir şalter dolabı içine veya metal kasa içine monte edilmelidir. Bu kasalar en az IP 54 (EN 60529 standartına göre) koruma türüne ait olmalıdır. Burada, cihazın kurulduğu çevre koşulları dikkate alınmalıdır. Kullanılacak kasa için, alan 2 için geçerli bir üretici beyanı mevcut olmalıdır (EN 50021 standartına istinaden).
2. Kabloda ya da bu kasanın kablo girişindeki işletme koşullarında sıcaklık > 70 °C oluyorsa veya işletme koşullarında kablo telleri (damarları) ayrılma noktasında sıcaklık > 80 °C olma ihtimali varsa, kablonun sıcaklık ile ilgili özellikleri, gerçekten ölçülmüş sıcaklıklara uygun olmalıdır.
3. Kullanılmış olan kablo girişleri, talep edilen IP koruma türüne ve bölüm 7.2 (EN 50021 standartına göre) dahilindeki taleplere uygun olmalıdır.
4. SIMATIC sistemlerinin giriş ve çıkışlarına bağlanan tüm cihazlar (şalterler vs. dahil) için, EEx nA veya EEx nC patlamaya karşı koruma tipine istinaden izin alınmış olmalıdır.
5. Nominal gerilimin transiyentlerden (hatlardaki dalgalanmalardan dolayı ani gerilim ve akım değişiklikleri) dolayı azami %40 aşılması için gerekli önlemler alınmalıdır.
6. Çevre sıcaklığı aralığı: 0° C ile 60° C arasında
7. Kasa dahilinde, açıldıktan sonra iyi görülebilen bir yere aşağıdaki uyarı takılmalıdır:

**İkaz**

Kasa sadece kısa bir süre açılmalıdır, örn. görsel diyagnoz için. Herhangi bir şaltere basmayınız, herhangi bir ünite grubunu çekip çıkarmayınız veya takmayınız, elektrik hatlarını (soket bağlantıları) ayırmayınız. Eğer patlama tehlikesi söz konusu olan bir atmosfer olmadığı biliniyorsa, işbu ikaz göz ardı edilebilir.

İzin verilmiş olan ünite gruplarının/modüllerin listesi

İzin verilmiş olan ünite gruplarının/modüllerin listesi için internete bakınız:

<http://www4.ad.siemens.de/view/cs/>

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