SIEMENS

SIMATIC

S7-300 Automation System Module Data

Manual

The following supplement is part of this documentation:

No.	Product Information	Drawing number	Edition
1	Reparameterization steps in RUN mode	A5E00201782-03	12/2004
2	Use of subassemblies/modules in a Zone 2 Hazardous Area	A5E00352937-03	12/2006

This description forms part of the documentation package with the order number: S7-300 Automation System: 6ES7398-8FA10-8BA0.

02/2007
A5E00105505-05

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.

Trademarks

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.

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

A5E00105505-05
℗ 04/2007

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.

Refer to the relevant S7-300 or ET 200M manuals to find out how to assemble and wire the modules.for system installation.

Basic knowledge required

This manual presumes 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 to include 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:

- 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/en/ and the relevant article ID.

Name of the manual	Description
Manual CPU 31xC and CPU 31x, technical data Contribution ID: 12996906	Control and display elements, communication, memory concept, cycle and reaction times, technical data.
Operating Instructions 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 description of PROFINET: Network components, data exchange and communication, PROFINET IO, Component-based Automation, application example of PROFINET IO and Component-based Automation.
Programming Manual Migration from PROFIBUS DP to PROFINET IO Contribution ID: 19289930	Guideline for migration from PROFIBUS DP to PROFINET IO.
Manual • CPU 31xC: Technological functions Contribution ID: 12429336 • CD containing examples	Description of the technological functions: positioning, counting, point-to-point coupling, loop control. The CD contains examples of the technological functions.
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	Using concrete examples, 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.
Configuring Manual ET 200M signal modules for process automation Contribution ID: 7215812	Description of 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 configuration, 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

Since the S7-300 components only contain low levels of harmful substances, they are 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

Standards and approvals (Page 13)

Table of contents

General technical data 1

1.1 Standards and approvals

Introduction

Contents of general technical data:

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

CE approval

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/EC "Equipment and protective systems intended for use in potentially explosive atmospheres" (Explosion Protection Directive)

The EC declaration of conformity is held on file available to competent authorities at:

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

UL approval

Underwriters Laboratories Inc. complying with

- UL 508 (Industrial Control Equipment)

CSA approval

Canadian Standards Association to

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

or

Underwriters Laboratories Inc. complying with

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

or

HAZ. LOC.

Underwriters Laboratories Inc. complying with

- 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 approvals can be found on the rating plate of the relevant module.

FM approval

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

ATEX approval

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 approval

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 industrial environments

SIMATIC products are designed for industrial applications.

Table 1-1 Use in industrial environments

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.

The following measures are recommended to ensure the interference complies with limit value class B:

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

Warning

Personal injury and damage to property may occur.

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 *S7-300 Automation System, Hardware and Installation,* 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 climatic environmental 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 ≤ f ≤ 58 Hz, constant amplitude 0.075 mm 58 Hz ≤ f ≤ 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 Severity of shock: 15 g peak value, 11 ms duration Direction of shock: 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 Severity of shock: 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_2S: < 0.1 ppm; RH < 60 %, no condensation	Test: 10 ppm; 4 days Test: 1 ppm; 4 days

1.5 Specification of dielectric tests, protection class, degree of protection, and rated voltage of 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_e 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 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	--- 6ES7 307-1EA00-0AA0
IM 153-1	6AG1 153-1AA03-2XB0	6ES7 153-1AA03-0XB0
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	6ES7 312-5BD00-0AB0 6ES7 313-5BE00-0AB0 6ES7 314-1AF10-0AB0 6ES7 315-2AG10-0AB0
IM 365	6AG1365-0BA01-2AA0	6ES7 365-0BA01-0AA0

	SIPLUS S7-300 modules for the use under extended environmental conditions	"Standard" modules
Digital input module		
SM 321; DI 16 x DC 24V	6AG1 321-1BH02-2AA0	6ES7 321-1BH02-0AA0
SM 321; DI 32 x DC 24V	6AG1 321-1BL00-2AA0	6ES7 321-1BL00-0AA0
SM 321; DI 16 x DC 24V	6AG1 321-7BH01-2AB0	6ES7 321-7BH01-0AB0
SM 321; DI 16 x DC 24 V-125 V	6AG1 321-1CH20-2AA0	6ES7 321-1CH20-0AA0
SM 321; DI 8 x AC 120/230V	6AG1 321-1FF01-2AA0	6ES7 321-1FF01-0AA0
Digital output module		
SM 322; DO 16 x DC 24V/0.5A	6AG1 322-1BH01-2AA0	6ES7 322-1BH01-0AA0
SM 322; DO 8 x Rel. AC 230V/5A	6AG1 322-1HF10-2AA0	6ES7 322-1HF10-0AA0
SM 322, DO 8 x DC 48-125 V/1.5 A	6AG1 322-1CF00-2AA0	6ES7 322-1CF00-0AA0
SM 322; DO 8 x AC 120/230V/2A	6AG1 322-1FF01-2AA0	6ES7 322-1FF01-0AA0
SM 322; DO 8 x DC 24V/0.5A	6AG1 322-8BF00-2AB0	6ES7 322-8BF00-0AB0
Digital I/O module SM 323; DI8/DO8 x DC 24V/0.5A	6AG1 323-1BH01-2AA0	6ES7 323-1BH01-0AA0
Analog input module SM 331; AI 2 x 12Bit	6AG1 331-7KB02-2AB0	6ES7 331-7KB02-0AB0
Analog output module SM 332; AO 2 x 12Bit	6AG1 332-5HB01-2AB0	6ES7 332-5HB01-0AB0
Analog IO module SM 334; AI4/AO 2 x 12Bit	6AG1 334-0KE00-2AB0	6ES7 334-0KE00-0AB0

1.8 Mechanical and climatic environmental conditions for the operation of 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_2S: < 0.1ppm; Relative humidity < 60%	Test: 10 ppm; 4 days 1 ppm; 4 days

2 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; (6AG1 305-1BA80-0AA0)

Order number "SIPLUS S7-300 module"

6AG1 305-1BA80-0AA0

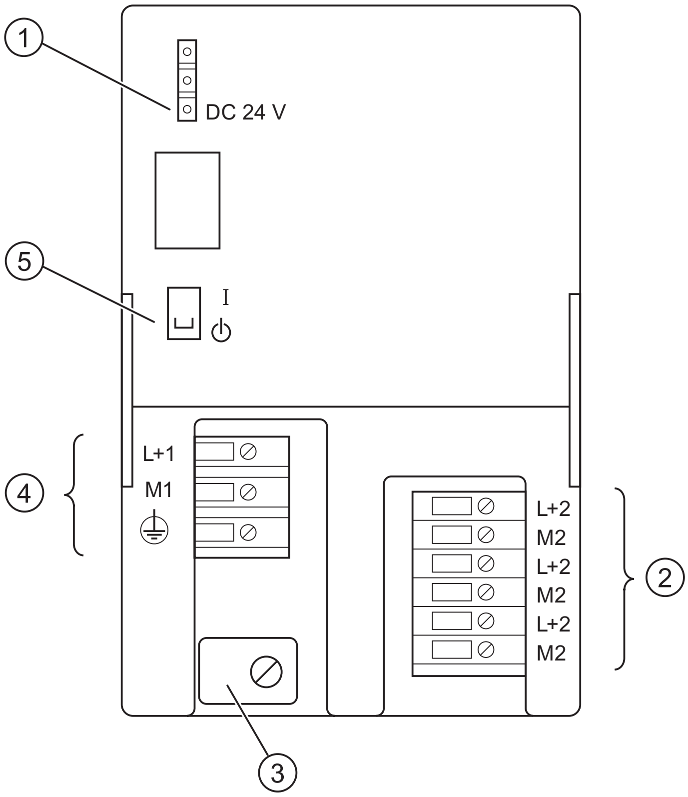
Properties

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

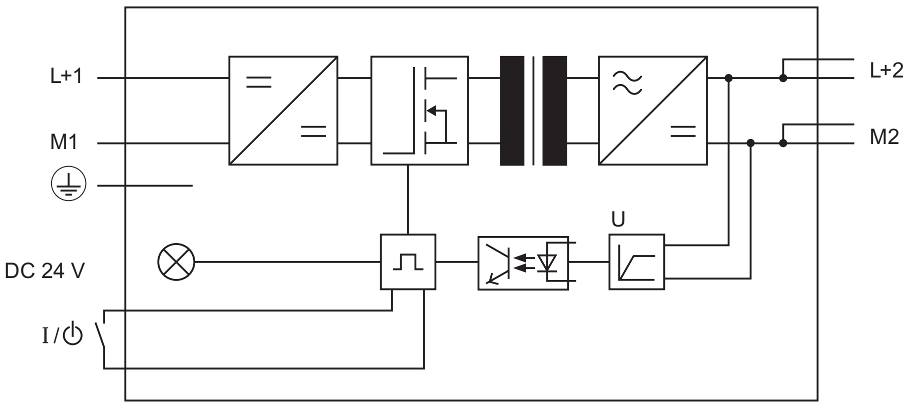


Figure 2-1 Block diagram of power supply module PS 305; 2 A

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 A (dynamic) • 3 A < I ≤ 3.9 A (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	Flashing
... 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 the PS 305; 2 A (6AG1 305-1BA80-0AA0)

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^2s
Output parameters	
Output voltage • Rated value • Permissible range	 24 VDC 24 V ± 3 %, open circuit-proof
• Rampup time	max. 3 s
Output current • Rated value	2 A; [1)] 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; (6ES7 307-1BA00-0AA0)

Order number

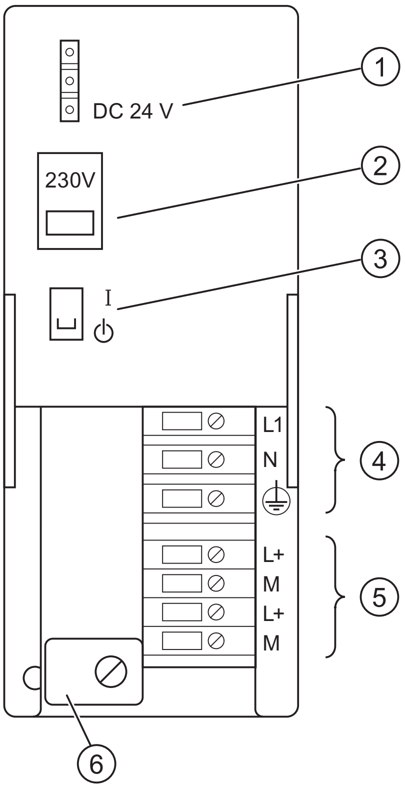
6ES7 307-1BA00-0AA0

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

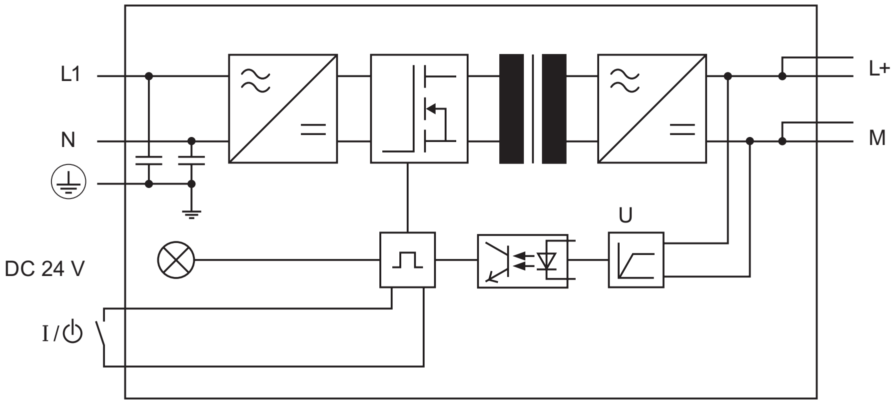


Figure 2-2 Block diagram of power supply module PS 307; 2 A

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 A (dynamic) • 2 A < I ≤ 2.6 A (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	Flashing
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 (6ES7 307-1BA00-0AA0)

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 • Rated value Mains frequency • Rated value • Permissible range	 AC 120 V/230 V 50 Hz or 60 Hz 47 Hz to 63 Hz
Rated input current • at 230 V • at 120 V	 0.5 A 0.8 A
Inrush current (at 25 °C)	20 A
I^2t (at inrush current)	1 A^2s
Output parameters	
Output voltage • Rated value • Permissible range • Rampup time	 24 VDC 24 V ± 5 %, open circuit-proof max. 2.5 s
Output current • Rated value	 2 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 insulation voltage (24 V to L1) • Test voltage	 AC 250 V DC 2800 V
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V) • Repeat rate	min. 20 ms min 1 s
Efficiency	83 %
Power consumption	58 W
Power loss	typ. 10 W
Diagnostics	
"Output voltage present" display	yes, green LED

2.3 Power supply module PS 307; 5 A; (6ES7 307-1EAx0-0AA0)

Order number: "Standard module

6ES7 307-1EA00-0AA0

Order number "SIPLUS S7 module"

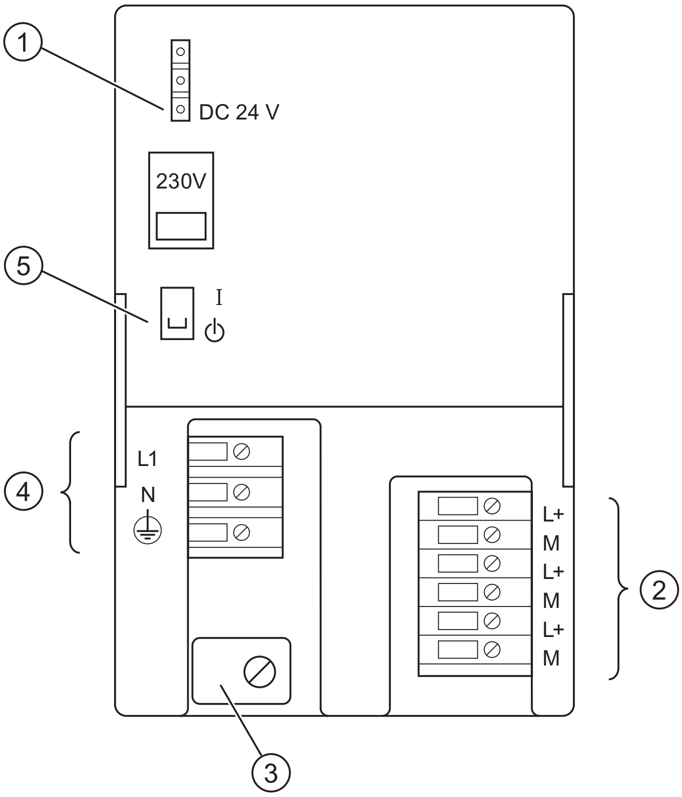
6AG1 307-1EA80-0AA0

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

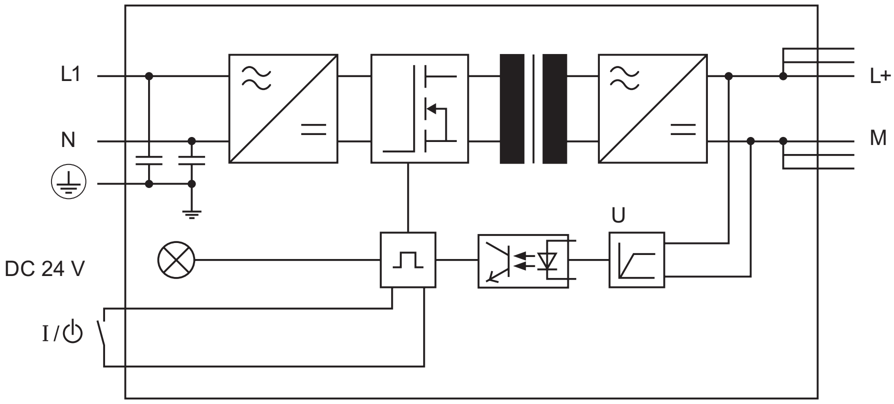


Figure 2-3 Block diagram of the PS 307; 5A

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 A (dynamic) • 5 A < I ≤ 6.5 A (static)	Voltage dip, automatic voltage recovery Voltage drop, reduction of service life	Flashing
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 (6ES7 307-1EA00-0AA0)

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 • Permissible range	 50 Hz or 60 Hz 47 Hz to 63 Hz
Rated input current • at 120 V • at 230 V	 2 A 1 A
Inrush current (at 25 °C)	45 A
I^2t (at inrush current)	1.2 A^2s
Output parameters	
Output voltage • Rated value • Permissible range	 24 VDC 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) • Repeat rate	min. 20 ms 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 (6AG1 307-1EA80-0AA0)

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 • Permissible range	 50 Hz or 60 Hz 47 Hz to 63 Hz
Rated input current • at 120 V • at 230 V	 2.1 A 1.2 A
Inrush current (at 25 °C)	45 A
I^2t (at inrush current)	1.8 A^2s
Output parameters	
Output voltage • Rated value • Permissible range • Rampup time	 DC 24 V 24 ± V 3 % 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) • Test voltage	 AC 250 V DC 2800 V
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V) • Repeat rate	min. 20 ms min. 1 s
Efficiency	84 %
Power consumption	143 W
Power loss	23 W
Diagnostics	
"Output voltage present" display	yes, green LED

2.4 Power supply module PS 307; 10 A; (6ES7 307-1KA00-0AA0)

Order number

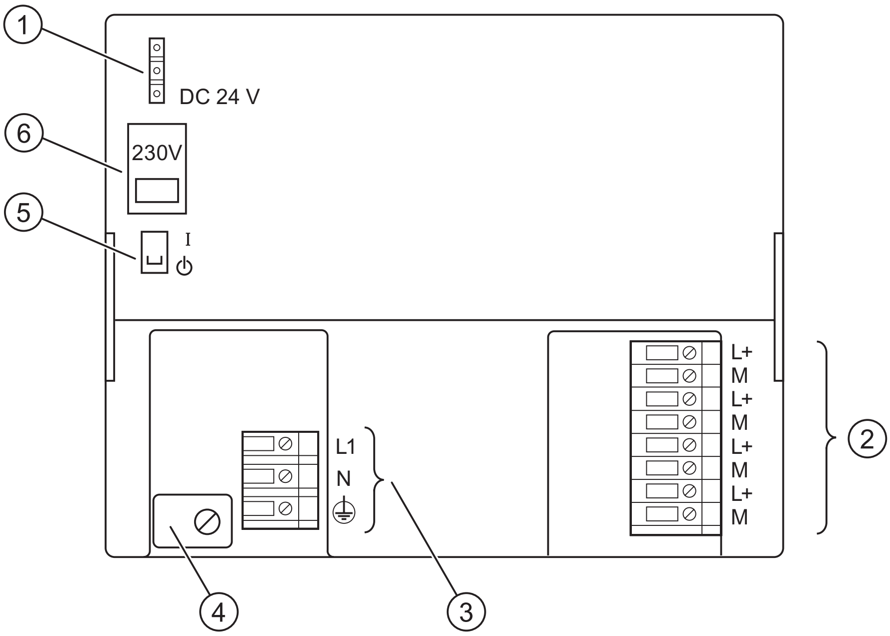
6ES7 307-1KA00-0AA0

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

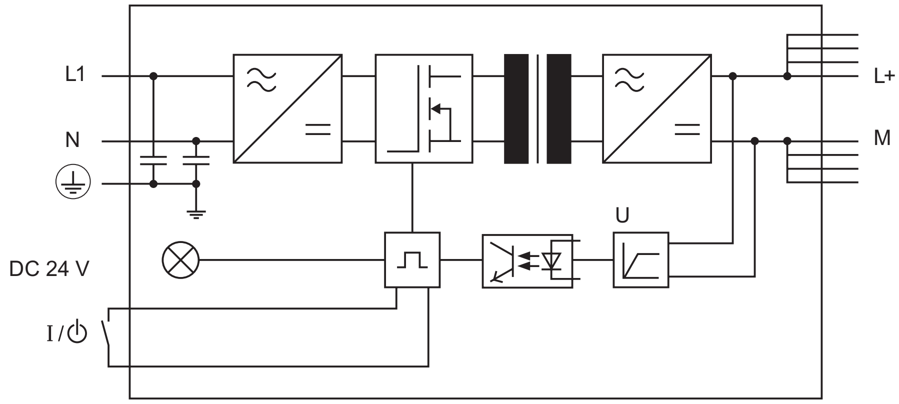


Figure 2-4 Block diagram of the PS 307; 10A power supply module

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 A (dynamic) • 10 A < I ≤ 13 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 (6ES7 307-1KA00-0AA0)

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 • Permissible range	 50 Hz or 60 Hz 47 Hz to 63 Hz
Rated input current • at 230 V • at 120 V	 1.7 A 3.5 A
Inrush current (at 25 °C)	55 A
I^2t (at inrush current)	9 A^2s
Output parameters	
Output voltage • Rated value • Permissible range • Rampup time	 24 VDC 24 V ± 5 %, open circuit-proof 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) • Test voltage	 AC 250 V DC 2800 V
Safety isolation	SELV circuit
Buffering of power supply failure (at 93 V or 187 V) • Repeat rate	min. 20 ms min 1 s
Efficiency	89 %
Power consumption	270 W
Power loss	typ. 30 W
Diagnostics	
"Output voltage present" display	yes, green LED

Digital modules 3

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/en/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 415)

Evaluating diagnostic data of signal modules in the user program (Page 459)

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 UC 24/48V (-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 AC 120/230 V 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/en/7215812.

Overview of properties

The table below shows the 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	no	no	no	no	yes	no
Diagnostics interrupt	no	no	no	no	yes	no
Substitute 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 diagnostics 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

	Module					
Rated load voltage	24 VDC	24 VDC	24 VDC	48 VDC to 125 VDC	120/230 VAC	120/230 VAC
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	yes	no	yes	no	no	yes
Diagnostics interrupt	yes	no	yes	no	no	yes
Substitute 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	-

* This module is described in the ET 200M Signal Modules for Process Automation manual. You can download this manual from the Internet at: http://support.automation.siemens.com/WW/view/en/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
Diagnostics 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
Diagnostics interrupt	no	no	no
Edge-triggered process interrupt	no	no	no
Programmable input delay	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.

You do not strictly have to adhere to this suggested sequence, that is, you can complete other tasks such as installing or commissioning other modules, or program the module at an earlier or later time.

Step sequence

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

Step	Procedure	See...
1.	Selecting the module	*Modules overview* and the specific module chapter
2.	Installing the module in the SIMATIC S7 system	*Installation* chapter in the relevant AS 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	*Diagnostics of the digital modules*
4.	Commission the configuration	*Commissioning* chapter in the relevant installation manual:of the AS used: • S7-300 Automation System, Hardware and Installation, or S7-400 / M7-400 Automation System, Hardware and Installation or • ET 200M distributed I/O device
5.	Analysis the configuration if commissioning was not successful.	Chapter *Diagnostics of digital modules*

See also

Module overview (Page 44)

Programming digital modules (Page 50)

Diagnostics of digital modules (Page 51)

Parameters of digital output modules (Page 418)

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 diagnostics interrupts, isochronous; (6ES7 321-7BH01-0AB0)
- Digital output module SM 322; DO 8 x DC 24 V/0.5 A, with diagnostics interrupt; (6ES7 322-8BF00-0AB0)
- Digital output module SM 322; DO 8 x AC120/230 V /2A ISOL (6ES7 322-5FF00-0AB0)
- Relay output module SM 322; DO 8 x Rel. AC230V /5A (6ES7 322-5HF00-0AB0)
- Digital IO module SM 327; DI 8/DX 8 x DC 24 V/0.5 A (6ES7 327-1BH00-0AB0)

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	programmable using	CPU operating state
static	PG (STEP 7 HW CONFIG)	STOP
dynamic	PG (STEP 7 HW CONFIG)	STOP
	SFC55 in the user program	RUN

Parameters of digital modules

Information on programmable parameters is available in the module-specific chapter.

See also

Parameters of digital IO modules (Page 416)

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 diagnostics interrupts, isochronous; (6ES7 321-7BH01-0AB0)
- Digital output module SM 322; DO 16 × UC 24/48 V (6ES7 322-5GH00-0AB0)
- Digital output module SM 322; DO 8 x DC 24 V/0.5 A, with diagnostics interrupt; (6ES7 322-8BF00-0AB0)
- Digital output module SM 322; DO 8 x AC120/230 V /2A ISOL (6ES7 322-5FF00-0AB0)
- Relay output module SM 322; DO 8 x Rel. AC230V /5A (6ES7 322-5HF00-0AB0)

Programmable and non-programmable diagnostics messages

We distinguish between programmable and non-programmable diagnostics messages.

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

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

Reactions to diagnostics message in STEP 7

Actions initiated by diagnostics messages:

- The diagnostics 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 Diagnostics Interrupt" is set in STEP 7, the system triggers a diagnostics interrupt and calls OB82.

Reading diagnostics messages

You can read detailed diagnostics messages using SFCs in the user program (refer to the appendix "Diagnostics 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.)

Diagnostics 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 diagnostics message. It goes dark after all error states are cleared.

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

Diagnostics messages and interrupt processing of digital modules

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

3.5 How to protect digital modules from inductive overvoltage

Inductive overvoltage

Overvoltage occurs when an inductance 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

Inductances 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.

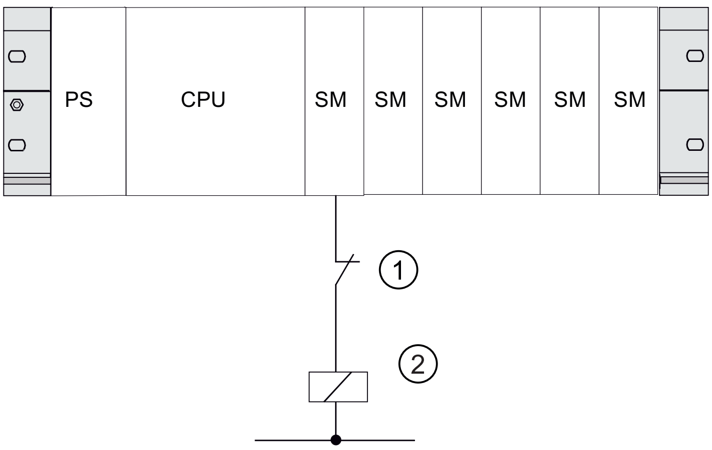


Figure 3-1 Relay contact for emergency stop in output current circuit

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.

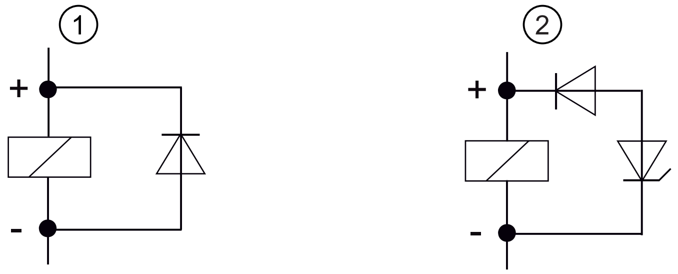


Figure 3-2 Configuration of coils operated with direct current

① with diode
② with Z diode

Properties of the diode/Z diode circuit:

- Cut-off currents can be avoided. Z diode withstands a higher cut-off voltage.
- High cut-off delay (6 to 9 times higher compared to non-protective cid´rcuits).

Faster cut-off of the Zener diode compared to the diode circuit.

Connection of AC-operated coils

The operation of AC coils with varistors or RC elements is shown in the diagram.

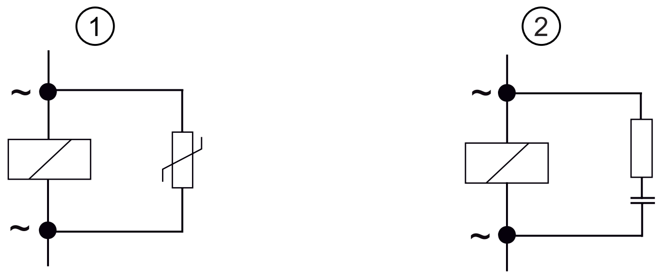


Figure 3-3 Connection of AC-operated coils

① with varistor
② with RC element

Properties of a circuit with varistor:

- The amplitude of the cut-off current is limited but not attenuated.
- The steepness of the overvoltage remains the same.
- Low cut-off delay.

Properties of acircuit with RC elements:

- Reduction of the amplitude and steepness of the cut-off current.
- Low cut-off delay.

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

Order number: "Standard module"

6ES7 321-1BL00-0AA0

Order number: "SIPLUS S7-300 module"

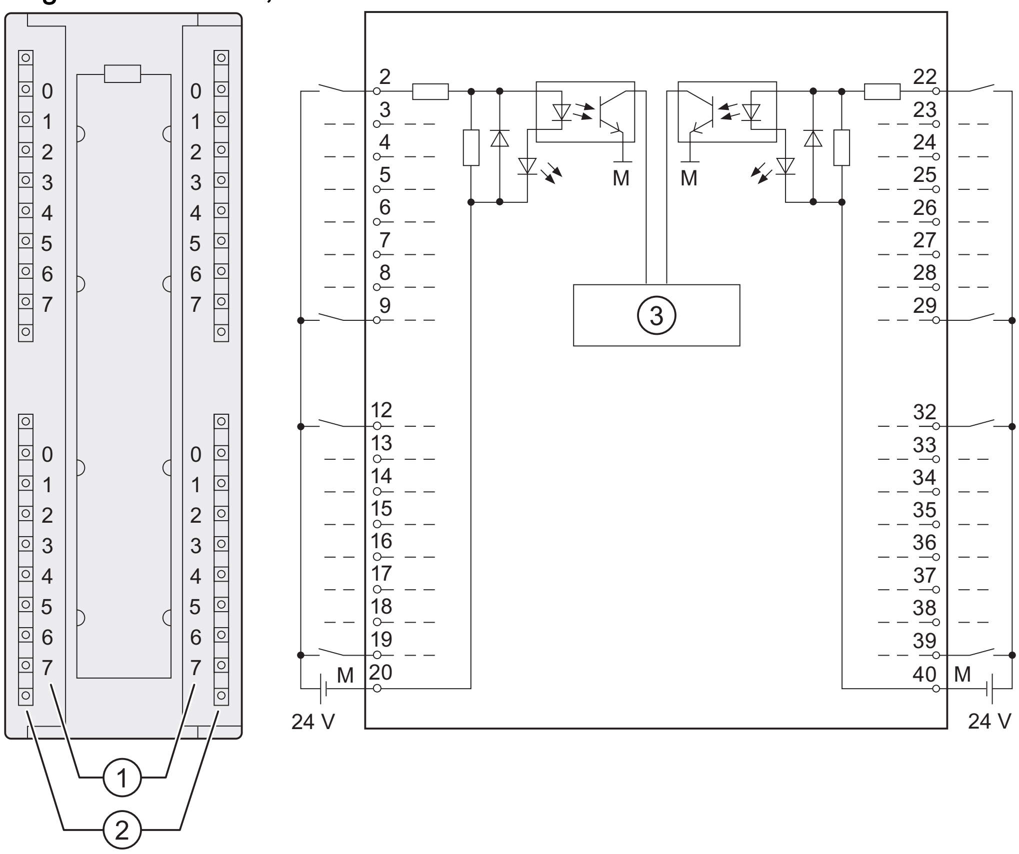
6AG1 321-1BL00-2AA0

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)

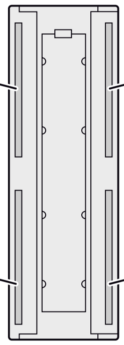
Wiring and block diagrams of SM 321; DI 32 x DC 24 V



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 • shielded	 max. 600 m max. 1000 m
Front connector	40-pin
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs • horizontal mounting position to 40 °C to 60 °C • vertical mounting position to 40 °C	 32 16 32
Electrical isolation • between channels and the backplane bus • between channels – in groups of	 yes yes 16
Maximum potential difference • between different circuits	 75 VDC / 60 VAC

Technical data	
Isolation test voltage	500 VDC
Current consumption • from the backplane bus	 max. 15 mA
Power loss of the module	typ. 6.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	none
Diagnostics functions	none
Transducer selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 13 V to 30 V - 30 V to + 5 V
Input current • "1" signal	 typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 the signal transducers	using a 40pin front connector

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

Order number

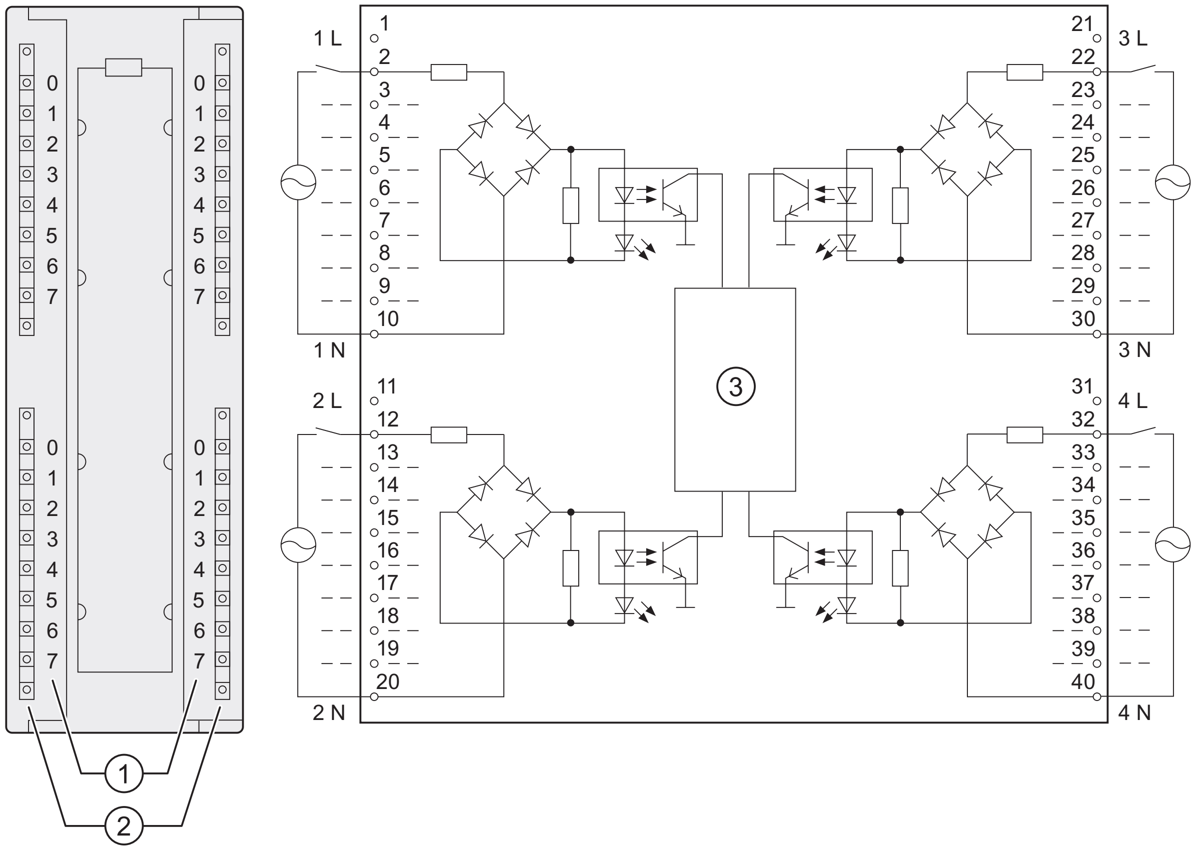
6ES7 321-1EL00-0AA0

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



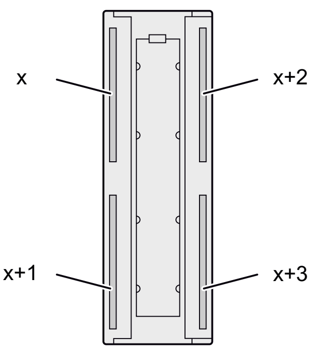
① Channel number

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 • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
• horizontal mounting position to 40 °C to 60 °C	 32 24
• vertical mounting position to 40 °C	 32
Electrical isolation • between channels and the backplane bus	 yes
• between channels in groups of	yes 8
Maximum 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 • "1" signal • "0" signal • Frequency band	 120 VAC 74 V to 132 V 0 V to 20 V 47 Hz to 63 Hz
Input current • "1" signal	 typ. 21 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 max. 15 ms max. 25 ms
Input characteristics	to IEC 61131, type 2
Connection of 2-wire BEROs • Permissible quiescent current	supported max. 4 mA
Wiring the signal transducers	using a 40pin front connector

3.8 Digital input module SM 321; DI 16 x DC 24 V; (6ES7321-1BH02-0AA0)

Order number: "Standard module"

6ES7 321-1BH02-0AA0

Order number: "SIPLUS S7-300 module"

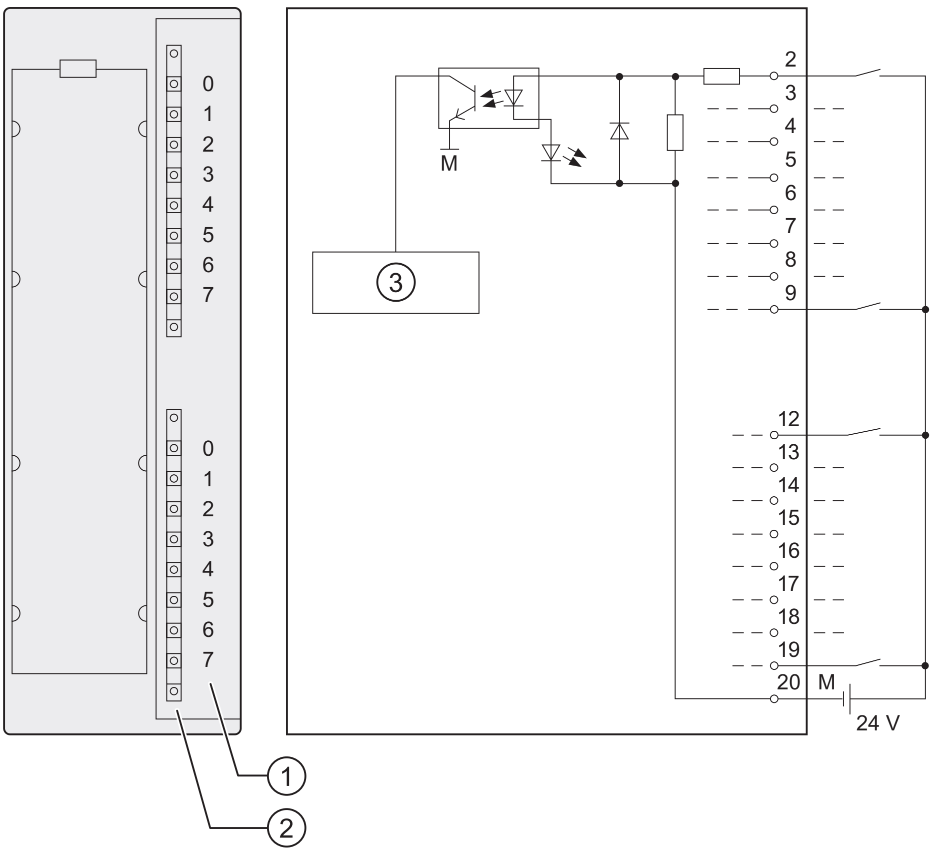
6AG1 321-1BH02-2AA0

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 to 60 °C • vertical mounting position to 40 °C	 16 16
Electrical isolation • between channels and the backplane bus • between channels • in groups of	 yes yes 16
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 13 V to 30 V - 30 V to + 5 V
Input current • "1" signal	 typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 the signal transducers	using a 20-pin front connector

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

Order number:

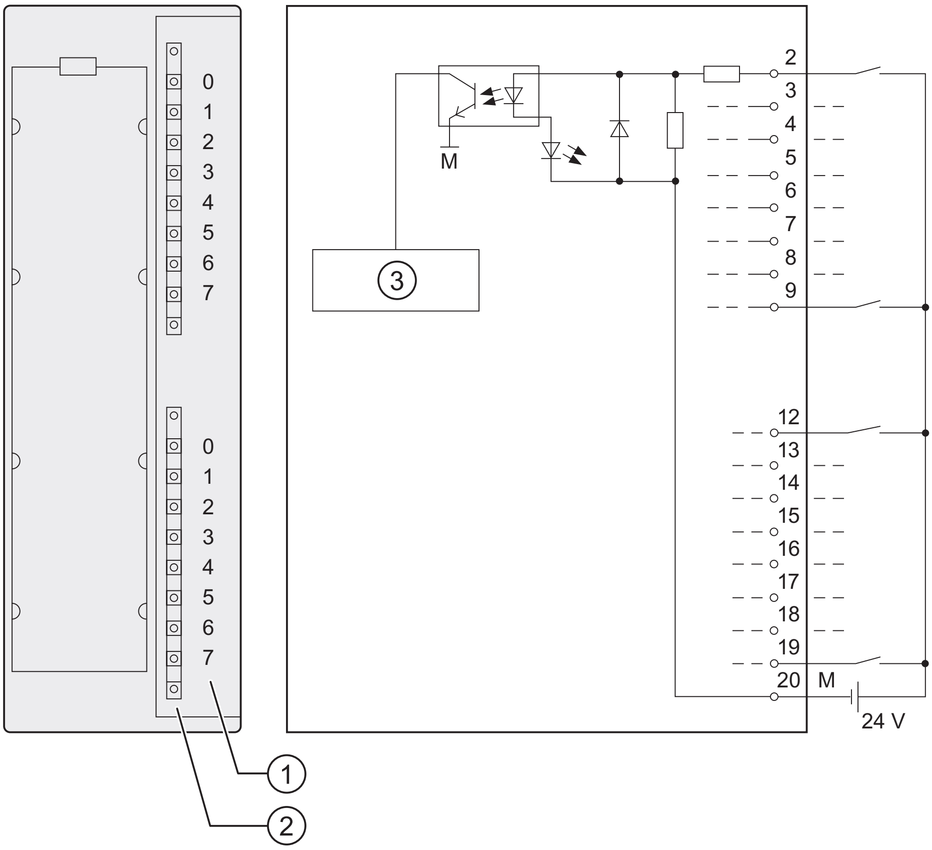
6ES7 321-1BH10-0AA0

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



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

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 to 60 °C • vertical mounting position to 40 °C	 16 16
Electrical isolation • between channels and the backplane bus	 yes
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 13 V to 30 V - 30 V to + 5 V
Input current • "1" signal	 typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 of the signal sensors	using a 20-pin front connector

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

Order number: "Standard module"

6ES7 321-7BH01-0AB0

Order number: "SIPLUS S7-300 module"

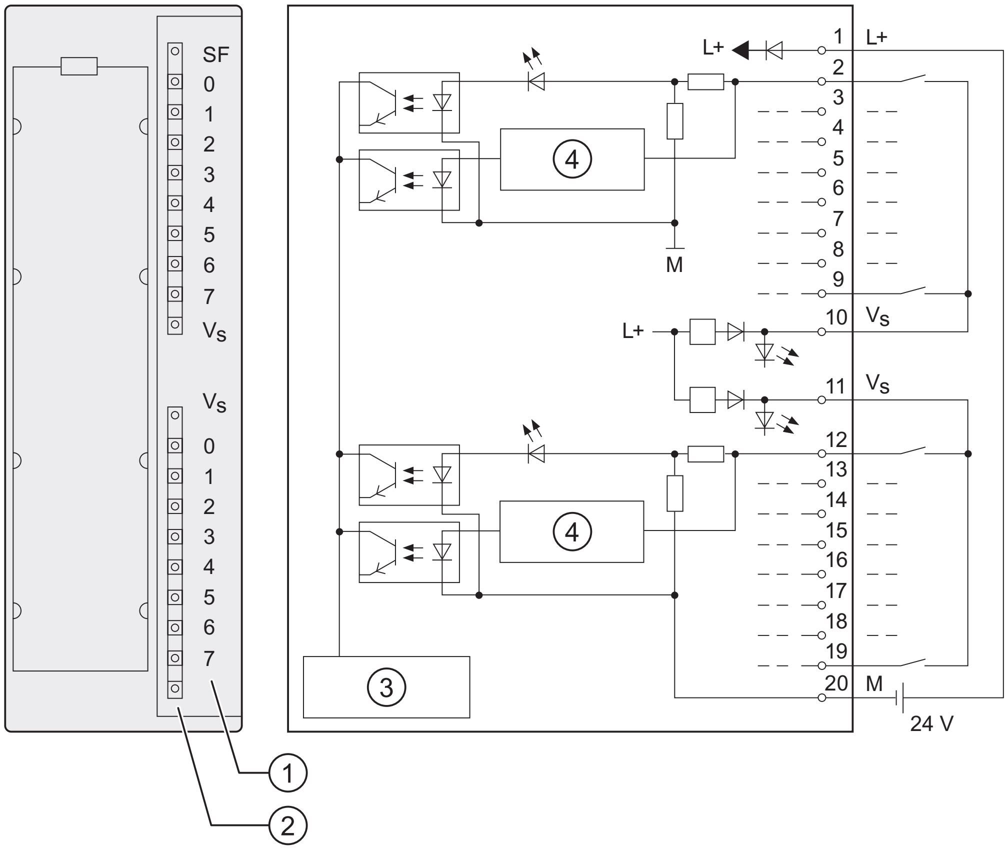
6AG1 321-7BH01-2AB0

Properties

Properties of SM 321; DI 16 x 24 VDC with hardware and diagnostics 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 sensor supplies for each group of 8 channels
- external redundant sensor supply is supported
- "Sensor supply (Vs)" status display
- Group error display (SF)
- Supports isochronous mode
- Supports the "CiR" function
- Programmable diagnostics
- Programmable diagnostics interrupt
- Programmable process 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
Sensor supply V_S -green
③ Backplane bus interface
④ Wire-break detection

Wiring diagram of the redundant sensor supply

The figure below shows how an additional redundant voltage source can be used to power sensors using Vs.

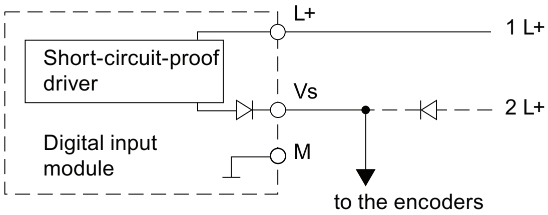


Figure 3-4 Wiring diagram of the redundant supply of sensors of SM 321; DI 16 x DC 24 V

Wiring diagram of the shunt circuit of the sensors

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

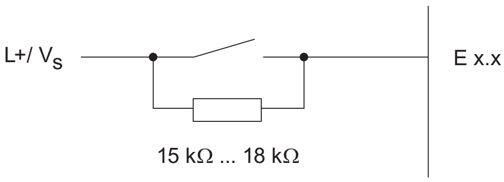


Figure 3-5 Wiring diagram of the shunt circuit of transducers of SM 321; DI 16 x DC 24 V

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
• Response 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 the electronic system and sensors	24 VDC
• Reverse polarity protection	yes

Technical data	
Number of simultaneously controlled inputs	
• horizontal mounting position to 60 °C	16
• vertical mounting position to 40 °C	16
Electrical isolation • between channels and the backplane bus • between channels – in groups of	 yes 16
Maximum 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 sensor supply V_S)	max. 90 mA
Power loss of the module	typ. 4 W
Status, interrupts, diagnostics	
Status display • Inputs	 green LED per channel
• Sensor supplies (Vs)	green LED per output
Interrupts • Process interrupt • Diagnostics interrupt	 programmable programmable
Diagnostics functions	programmable
• Group error display	red LED (SF)
• Reading diagnostics information	supported
Monitoring for • wirebreak	 yes, sensing I < 1 mA
Sensor 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

Technical data	
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 13 V to 30 V -30 V to + 5 V
Input current • "1" signal	 typ. 7 mA
Input characteristics	to IEC 61131, type 2
Connection of 2-wire BEROs • Permissible quiescent current	supported max. 2 mA
Wiring the signal transducers	using a 20-pin front connector
Shunt circuit of the sensor for wire-break detection	10 kohms to 18 kohms
Time/frequency	
Internal preparation time for status processing (non-synchronous operation) • Enabling of process and diagnostics interrupts	 max. 40 ms
Input delay • programmable • Rated value	 yes 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:

- Independent user program cycle. The length of the cycle time may vary due to non-cyclic 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 mode

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 TWE applies, irrespective of the enable status of diagnostics)	255 µs to 345 µs
includes an input delay time of	100 µs
T_{DPmin}	2.5 ms
Diagnostics interrupt	max. 4 x T_{DP}

Note

In "isochronous" mode, the input delay is automatically set to 100 µs, 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.

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

Programming

For general information on programming digital modules, refer to the chapter *Programming 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 • Diagnostics interrupt • Process 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 • Sensor supply missing • Wirebreak	 yes/no yes/no	 no no	 static	 Channel group
Process interrupt trigger • Positive edge • Negative edge	 yes/no yes/no	 no no	 dynamic	 Channel group

Allocating the sensor supplies to channel groups

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

Assigning interrupt parameters to channel groups

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

The channel group number is required to program 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...	Programmable in the following channel groups	Channel group number
Process interrupt (triggered at the positive, negative, or both edges)	0 and 1 2 and 3 4 and 5 6 and 7 8 and 9 10 and 11 12 and 13 14 and 15	0 1 2 3 4 5 6 7
Diagnostics interrupt for missing sensor supply	0 to 7 8 to 15	-
Diagnostics interrupt for wire-break	0 and 1 2 and 3	0 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 μs to 140 μs
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 50)

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

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

The table below shows an overview of the diagnostics 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
Sensor 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 fault	SF	Module	
RAM fault	SF	Module	
Process interrupt lost	SF	Module	

Note

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

Causes of error and troubleshooting

Table 3-12 Diagnostics 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
Sensor supply missing	Overload at sensor supply	Eliminate overload
	Short-circuit to M at sensor 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 timeout	Infrequent high electromagnetic interference	Eliminate the interference
	Module defective	Replace the module

Diagnostics message	Possible cause of error	To correct or avoid error
EPROM fault	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
	Module defective	Replace the module
RAM fault	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
	Module defective	Replace the module
Process 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 SM 321; DI 16 x DC 24 V - Behavior

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	-

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 sensor 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 sensor supply, but rather the failure of the internal and/or external auxiliary voltage, and/or a blown fuse.

Short-circuit at the sensor supply Vs

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

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

Introduction

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

- Diagnostics interrupt
- Process 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*).

Diagnostics interrupt

When diagnostics 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 in order to process diagnostics interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to view detailed diagnostics data output by the module.

Diagnostics data remain consistent until the program exits OB82. The module acknowledges the diagnostics interrupt when the program exits OB82.

Process interrupt

SM 321; DI 16 x DC 24 V can trigger a process 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.)

Active process interrupts trigger process interrupt processing in the CPU (OB40) and interrupt execution of the user program or of object classes with lower priority in the CPU.

You can define the response of the AS to signal edge transitions in the user program of process interrupt OB40. The module acknowledges the process interrupt when the program exits the process interrupt OB.

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

Process interrupt lost

A "Process interrupt lost" diagnostics interrupt is generated if a successive interrupt is triggered at the channel previously saved to the stack and which has not yet been processed by the CPU.

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

Interrupt-triggering channels

The relevant process interrupt-triggering channel is logged in the OB40_POINT_ADDR variable of the start information of OB40. The figure shows the bit assignments of DWORD 8 in the local data.

Byte	Variable	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

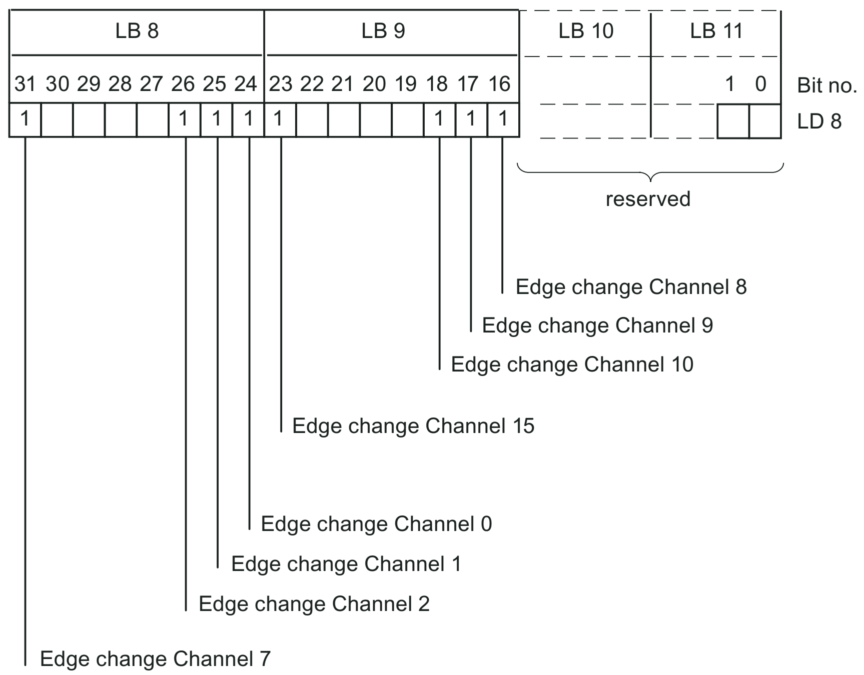


Figure 3-6 Start Information of OB40: which event has triggered the process interrupt

See also

SM 321; DI 16 x DC 24 V - Parameters (Page 69)

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

Order number

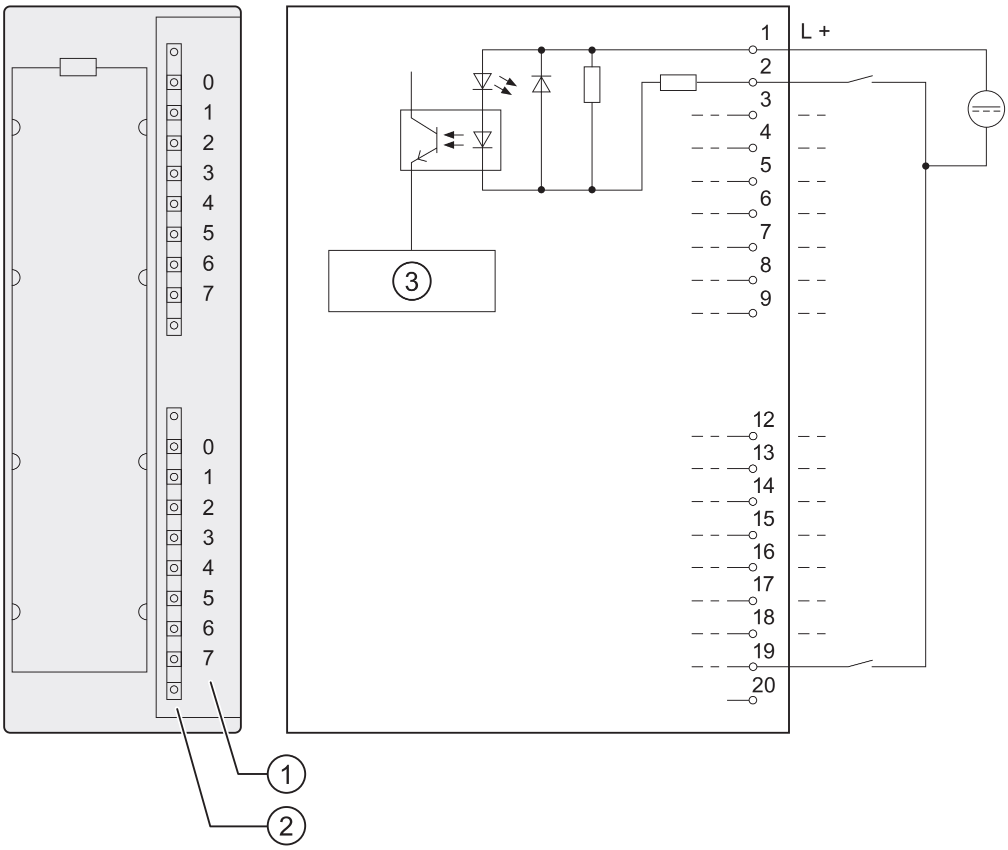
6ES7 321-1BH50-0AA0

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 diagram of SM 321; DI 16 x DC 24 V



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

SM 321; DI 16 x DC 24 V - 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	
Supports isochronous mode	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 to 60 °C	16
• vertical mounting position to 40 °C	16
Electrical isolation • between channels and the backplane bus	 yes
• between channels in groups of	yes 16
Maximum 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
Sensor selection data	
Input voltage (reference potential L+)	
• Rated value • "1" signal • "0" signal	24 VDC -13 V to -30 V +30 V to -5 V
Input current • "1" signal	 typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 of the signal sensors	using a 20-pin front connector

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

Order number

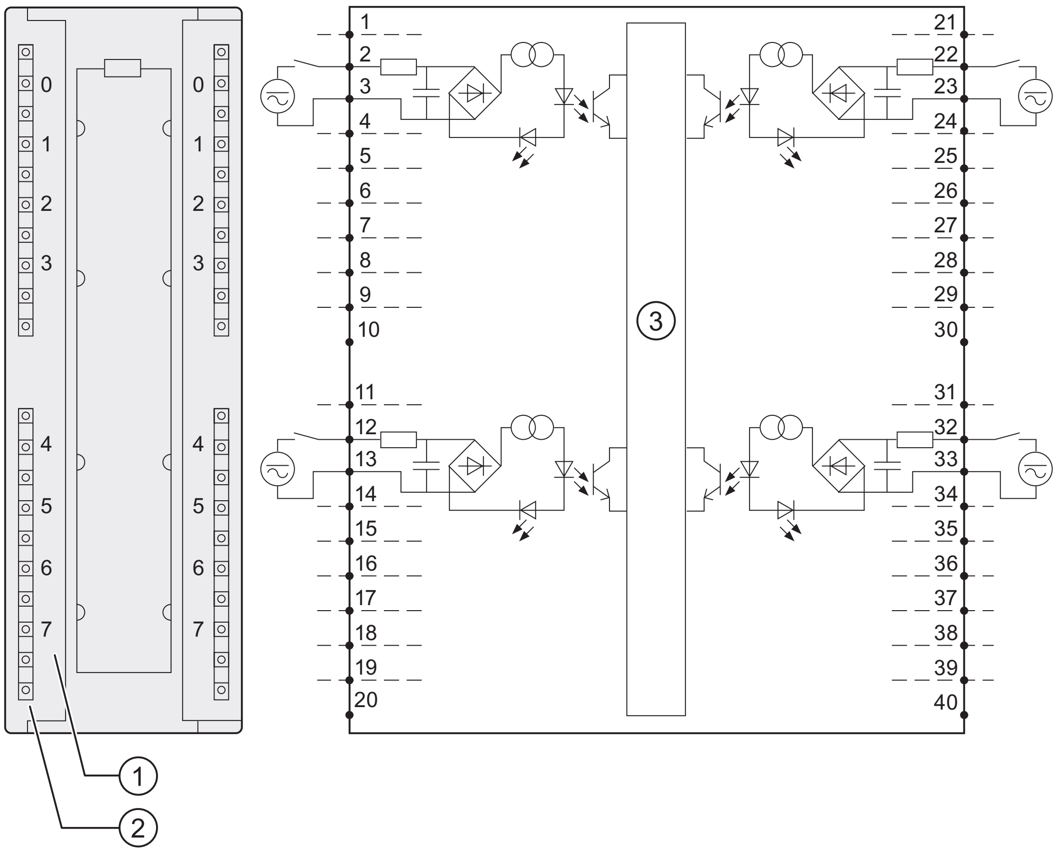
6ES7 321-1CH00-0AA0

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 autarkic and can be wired to suit any configuration

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



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

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

Technical data	
Dimensions and weight	
Dimensions W x H x D	40 x 125 x 117
Weight	approx. 260 g
Module-specific data	
Supports isochronous mode	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
• other mounting positions up to 40 °C	16
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 1
Maximum 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	100 mA max.
Power loss of the module	
• Operation with 24 V • Operation with 48 V	typ. 1.5 W typ. 2.8 W
Status, interrupts, diagnostics	
Status display Interrupts Diagnostics functions	green LED per channel none none
Sensor selection data	
Input voltage • Rated value	 24 VDC/VAC or 48 VDC/VAC
• "1" signal • "0" signal • Frequency band	14 V to 60 V -5 V to 5 V 0 Hz to 63 Hz
Input current	
• "1" signal • "0" signal	typ. 2.7 mA -1 mA to +1 mA

Technical data	
Input delay	
• "0" to "1" transition • "1" to "0" transition	max. 16 ms max. 16 ms
Input characteristics	to IEC 61131, type 1
Connection of 2-wire BEROs	supported
• Permissible quiescent current	max. 1 mA
Wiring of the signal sensors	using a 40-pin front connector

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

Order number: "Standard module"

6ES7 321-1CH20-0AA0

Order number: "SIPLUS S7-300 module"

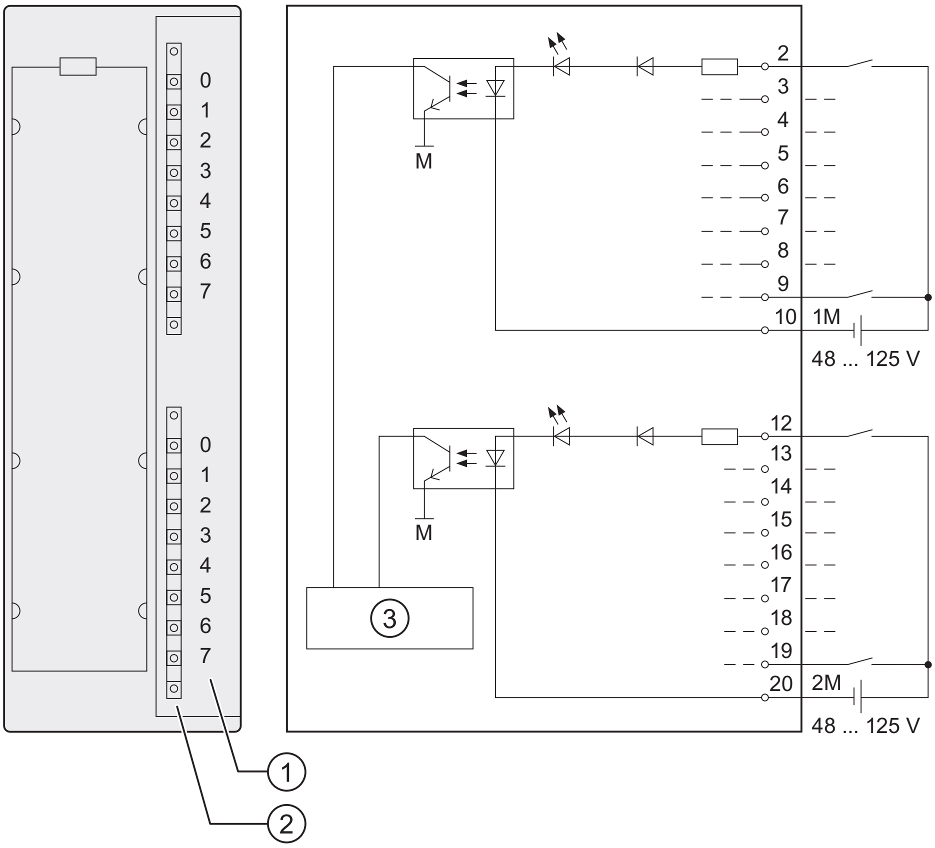
6AG1 321-1CH20-2AA0

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



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

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

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

Technical data		
Voltages, currents, electrical potentials		
Number of simultaneously controlled input at V_I	to 60 V	to 146 V
• horizontal mounting position to 50 °C to 60 °C	 8 8	 8 6
• vertical mounting position to 40 °C	8	8
Electrical isolation		
• between channels and the backplane bus	yes	
• between channels in groups of	yes 8	
Maximum 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	
Sensor selection data		
Input voltage		
• Rated value	48 VDC to 125 VDC	
• "1" signal	30 V to 146 V	
• "0" signal	-146 V to 15 V	
Input current • "1" signal	 typ. 3.5 mA	
Input delay • "0" to "1" transition • "1" to "0" transition	 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 the signal transducers	using a 20-pin front connector	

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

Order number

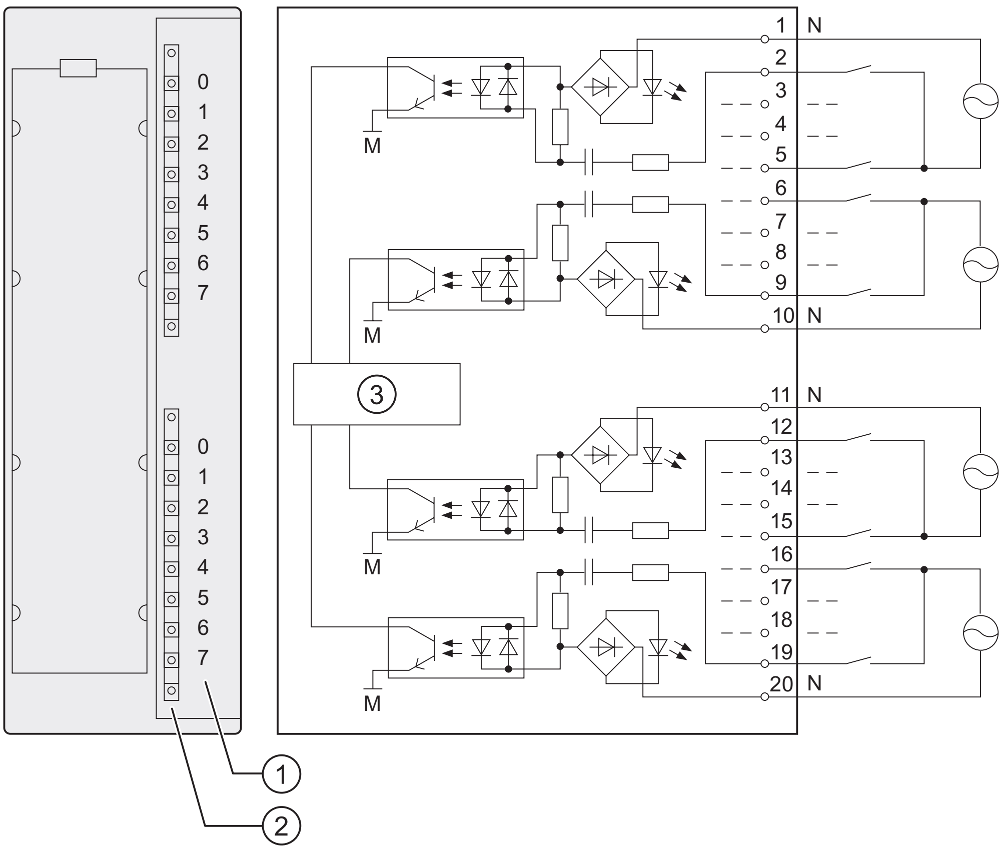
6ES7 321-1FH00-0AA0

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

SM 321; DI 16 x AC 120/230 V- Technical data

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 • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1 All load voltages must be connected to a common phase	120/230 V
Number of simultaneously controlled inputs	
• Horizontal mounting position to 60 °C	16
• Vertical mounting position to 40 °C	16
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 4
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal • Frequency band	 120/230 VAC 79 V to 264 V 0 V to 40 V 47 Hz to 63 Hz
Input current • "1" signal 120 V, 60 Hz 230 V, 50 Hz	 typ. 6.5 mA typ. 16.0 mA

Technical data	
Input delay • "0" to "1" transition • "0" to "1" transition	 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 the signal transducers	using a 20-pin front connector

3.15 Digital input module SM 321; DI 8 x AC 120/230 V; (6ES7321-1FF01-0AA0)

Order number: "Standard module"

6ES7 321-1FF01-0AA0

Order number: "SIPLUS S7-300 module"

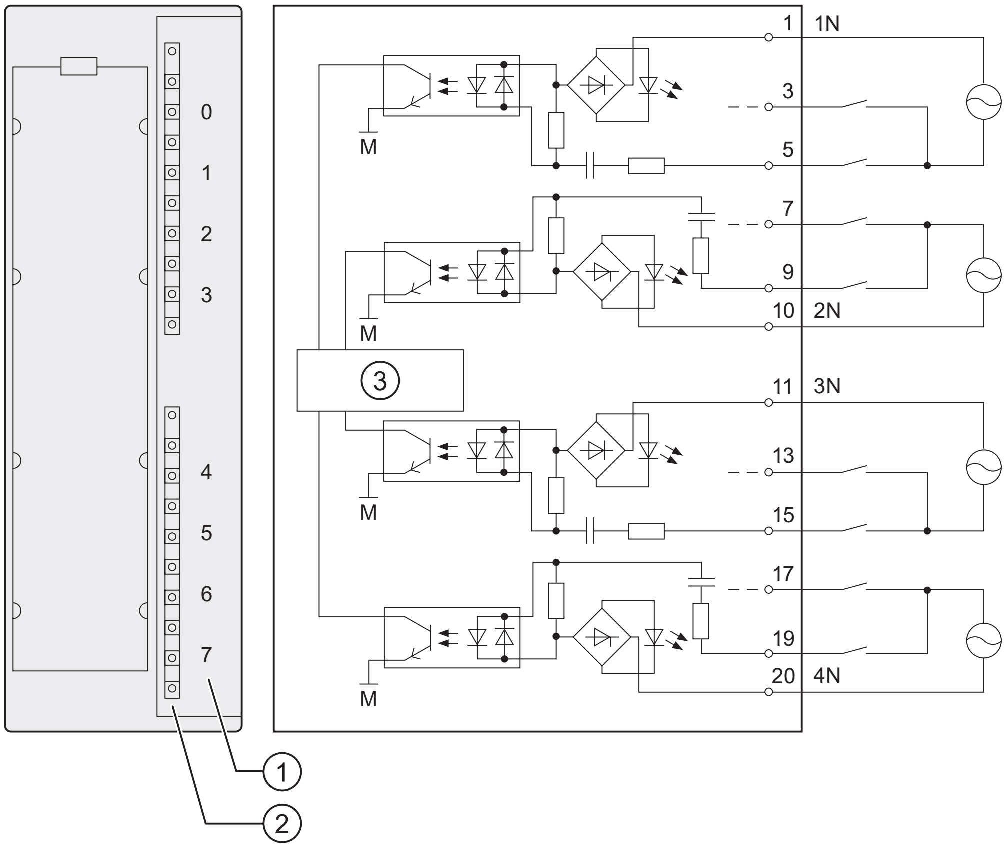
6AG1 321-1FF01-2AA0

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



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

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

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Number of simultaneously controlled inputs	
• horizontal mounting position to 60 °C	8
• vertical mounting position to 40 °C	8
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 2
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal • Frequency band	 120/230 VAC 79 V to 264 V 0 V to 40 V 47 Hz to 63 Hz
Input current • "1" signal 120 V, 60 Hz 230 V, 50 Hz	 typ. 6.5 mA typ. 11 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 of the signal transducers	using a 20-pin front connector

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

Order number

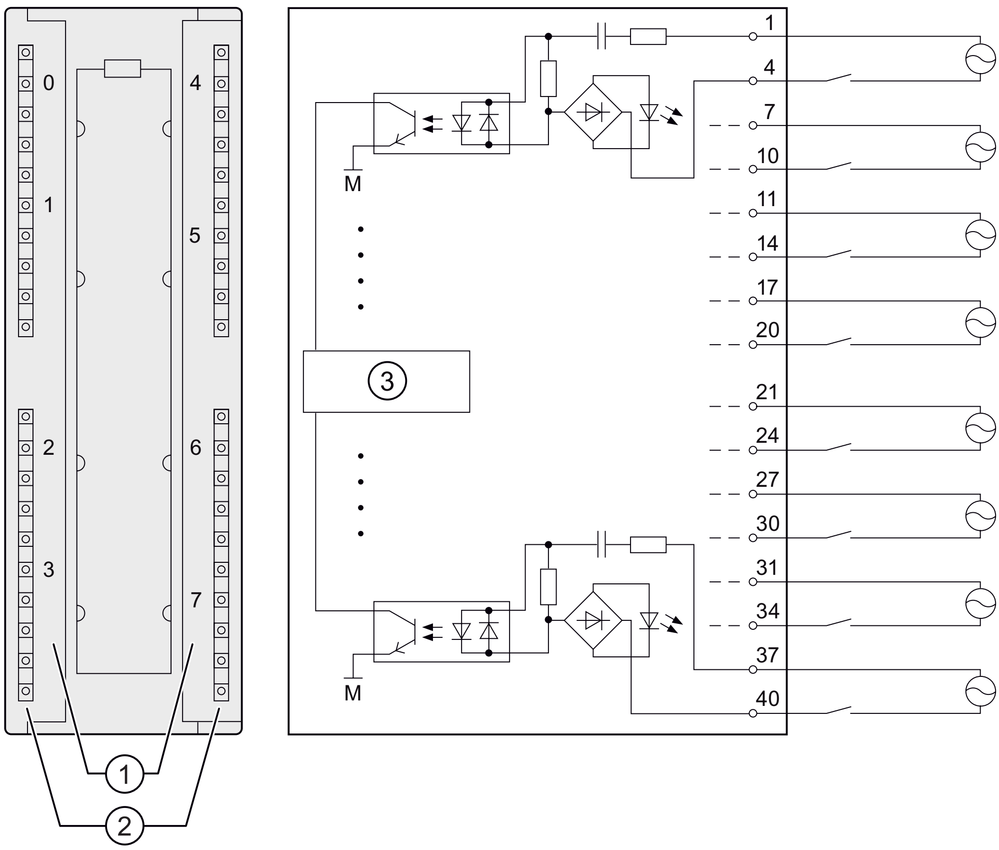
6ES7 321-1FF10-0AA0

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
- Rated input voltage 120/230 VAC
- 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

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

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 • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1 All load voltages must be connected to a common phase	120/230 VAC
Number of simultaneously controlled inputs	
• Horizontal mounting position to 60 °C	8
• Vertical mounting position to 40 °C	8
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 1
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal • Frequency band	 120/230 VAC 79 V to 264 V 0 V to 40 V 47 Hz to 63 Hz

Technical data	
Input current • "1" signal 120 V, 60 Hz 230 V, 50 Hz	 typ. 7.5 mA typ. 17.3 mA
Input delay • "0" to "1" transition • "0" to "1" transition	 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 of the signal sensors	using a 40-pin front connector

3.17 Digital output module SM 322; DO 32 x DC 24 V/ 0,5 A; (6ES7322-1BL00-0AA0)

Order number

6ES7 322-1BL00-0AA0

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

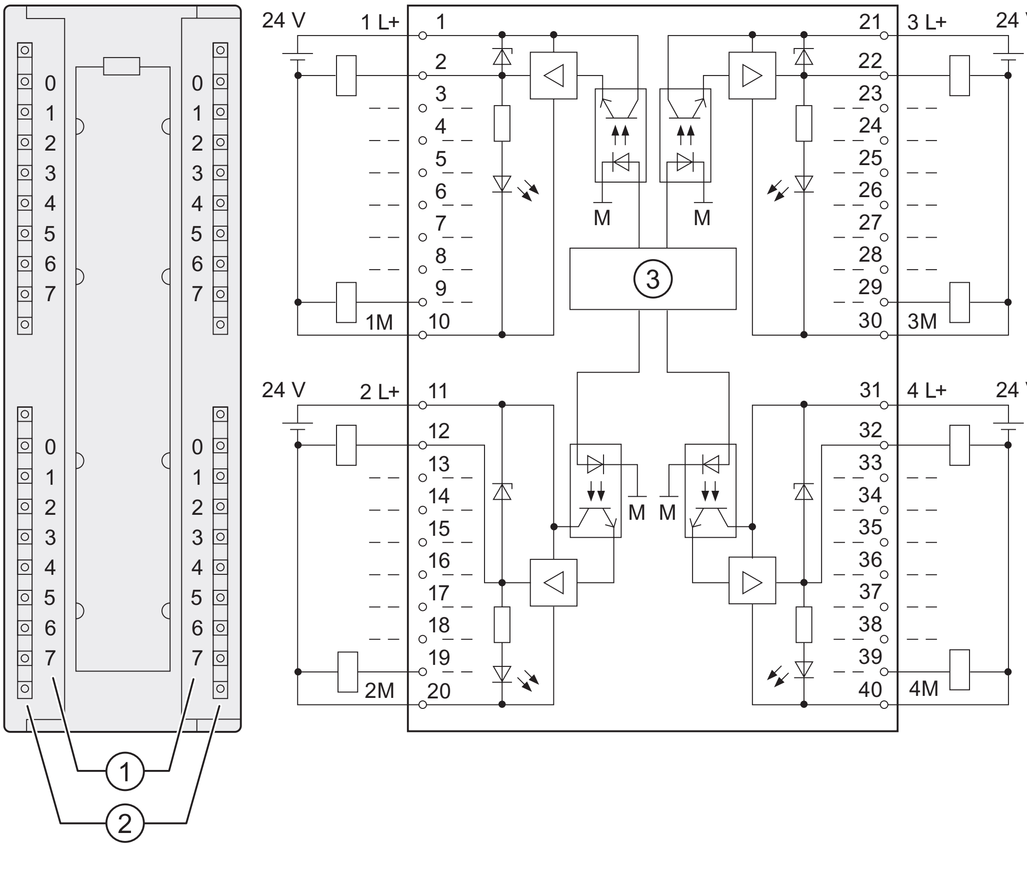
Use of the module with high-speed counters

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 diagram of SM 322; DO 32 x DC 24 V/ 0,5 A



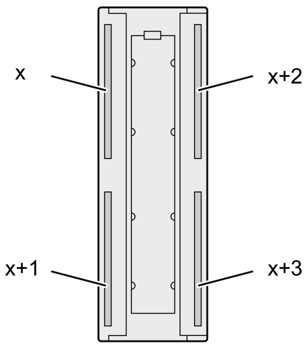
① Channel number

② Status display - green

③ Backplane bus interface

Terminal assignment

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



SM 322; DO 32 x DC 24 V/ 0,5 A - Technical data

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 • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 3 A
• vertical mounting position to 40 °C	max. 2 A
Electrical isolation • between channels and the backplane bus	 yes
• between channels in groups of	yes 8
Maximum 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. 110 mA 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 • "1" signal	 min. L+ (-0.8 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA

Technical data	
Output delay (resistive load)	
• "0" to "1" transition	max. 100 μs
• "1" to "0" transition	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 of the actuators	using a 40-pin front connector

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

Order number

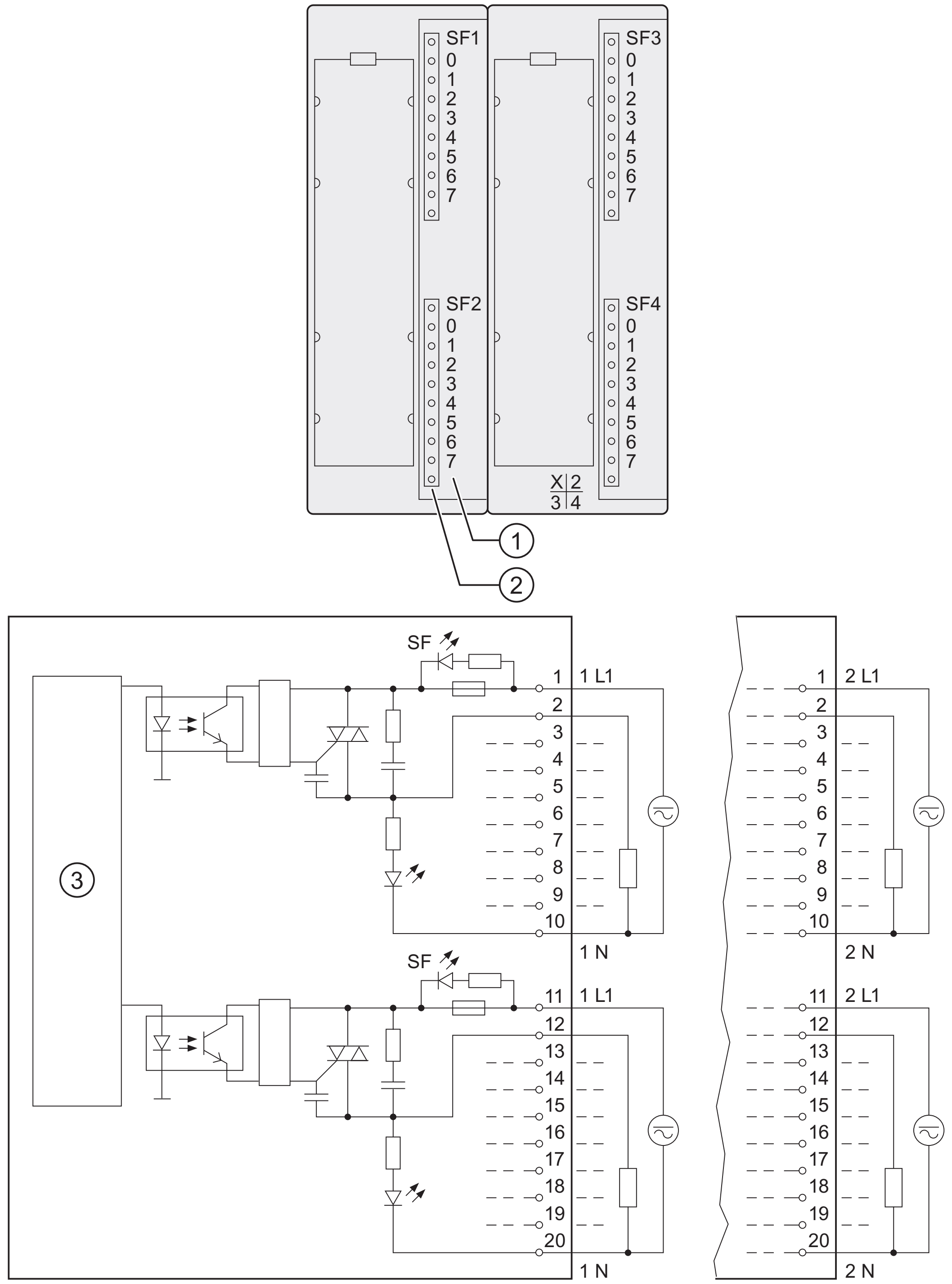
6ES7 322-1FL00-0AA0

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



① Channel numbers

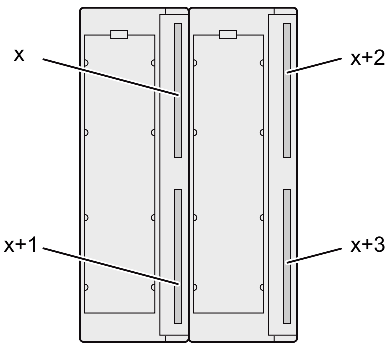
② Status display - green

Error LED - red

③ Backplane bus interface

Terminal assignment

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



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

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 • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
• Maximum frequency range	47 Hz to 63 Hz
Cumulative current of outputs (per group)	
• horizontal mounting position to 60 °C to 40 °C	 max. 3 A max. 4 A
• vertical mounting position • to 40 °C	 max. 4 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 8
Maximum potential difference	
• between $M_{internal}$ and outputs	250 VAC
• between outputs of different groups	250 VAC

Technical data	
Isolation test voltage	4000 VDC
Current consumption • from the backplane bus • from load voltage L1 (no-load)	 max. 190 mA max. 10 mA
Power loss of the module	typ. 25 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	no
Diagnostics functions • Group error display	yes red LED (SF)
Actuator selection data	
Output voltage • "1" signal	 min. L1 (-0.8 V)
Output current • "1" signal Rated value Permissible range Maximum inrush current (per group)	 1 A 10 mA to 1 A 10 A (for two AC cycles)
• "0" signal (residual current)	max. 2 mA
Output delay (resistive load)	
• "0" to "1" transition	1 AC cycle
• "1" to "0" transition	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 • with inductive load to IEC 947-5-1, AC 15 • with lamp load	 max. 10 Hz max. 0.5 Hz 1 Hz
Short circuit-proof output	no
Wiring of the actuators	using a 20-pin* front connector

*Requires two front connectors of this version

3.19 Digital output module SM 322; DO 16 x DC 24 V/ 0,5 A; (6ES7322-1BH01-0AA0)

Order number: "Standard module"

6ES7 322-1BH01-0AA0

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

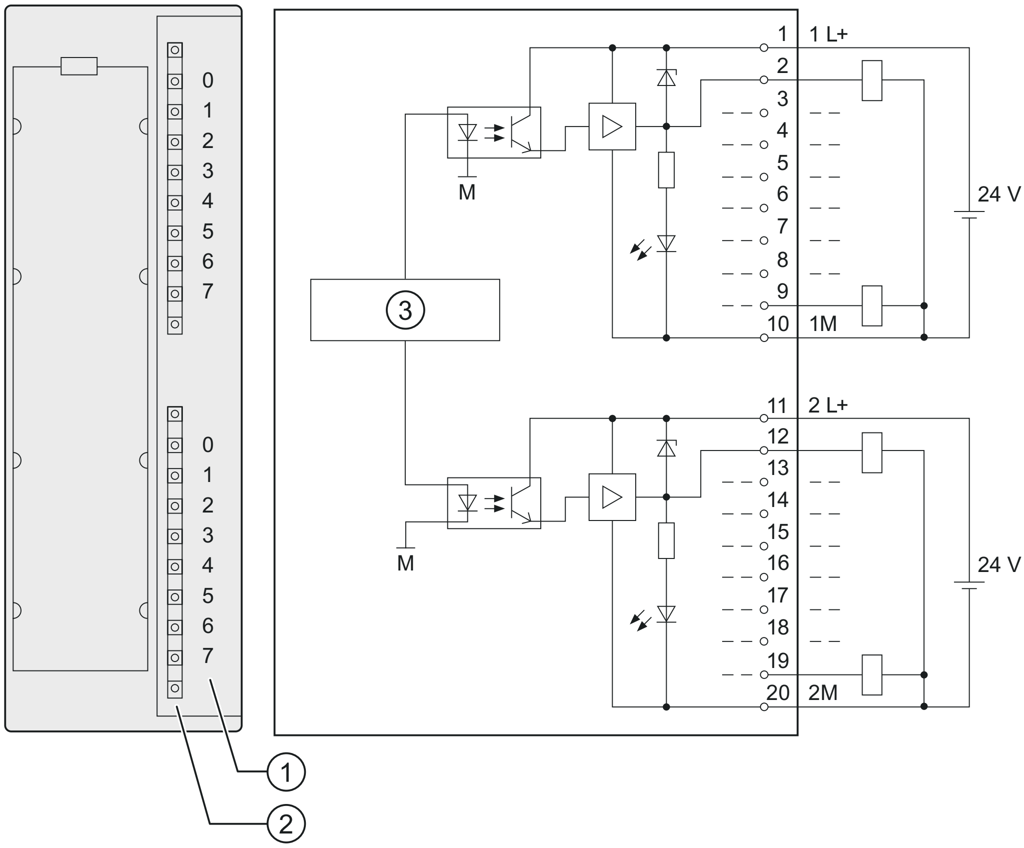
Use of the module with high-speed counters

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



① Channel number

② Status display - green

③ Backplane bus interface

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

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 3 A
• vertical mounting position to 40 °C	 max. 2 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 8
Maximum 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 • "1" signal	min. L+ (-0.8 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• "0" to "1" transition	max. 100 μs
• "1" to "0" transition	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 of the actuators	using a 20-pin front connector

3.20 Digital output module SM 322; DO 16 x DC 24 V/0,5 A High Speed; (6ES7322-1BH10-0AA0)

Order number:

6ES7 322-1BH10-0AA0

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
- Supports isochronous mode

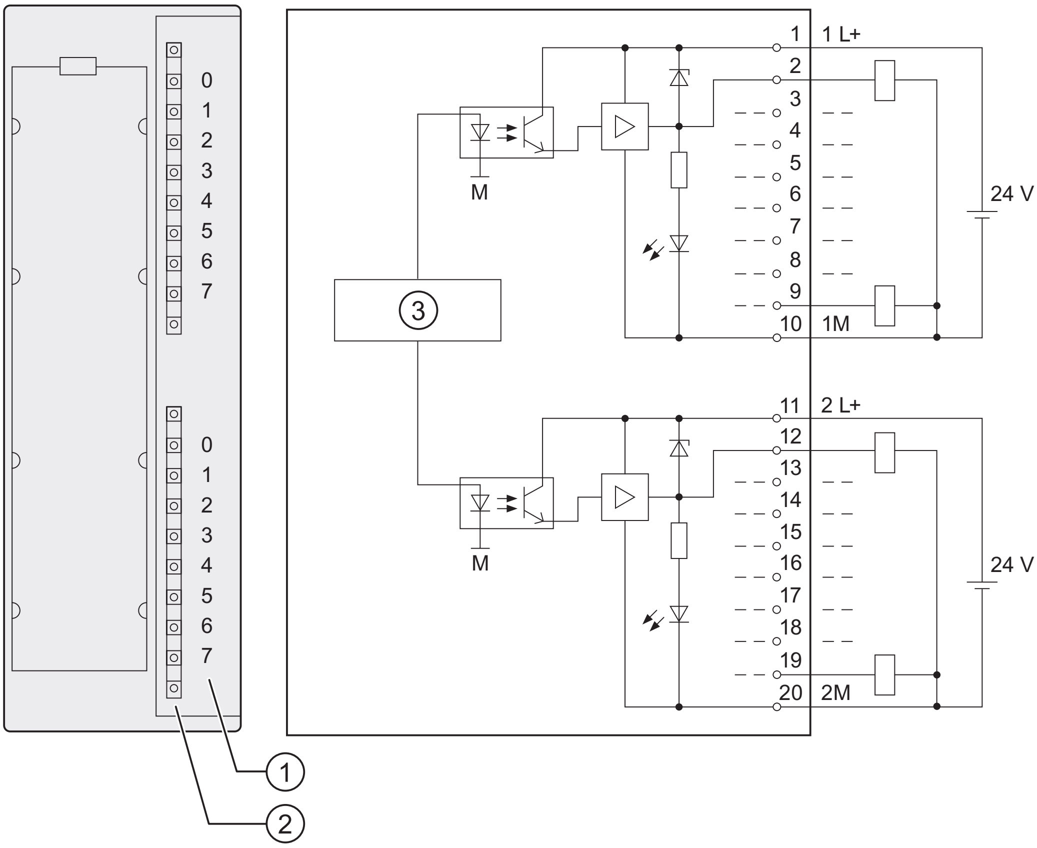
Use of the module with high-speed counters

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 3 A
• vertical mounting position to 40 °C	max. 2 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 8
Maximum 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 • "1" signal	min. L+ (-0.8 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• "0" to "1" transition	max. 100 µs
• "1" to "0" transition	max. 200 µs
Internal module cycle time between the backplane bus and the output driver input	
• "0" to "1" transition	0.1 µs to 20 µs
• "1" to "0" transition	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 of the actuators	using a 20-pin front connector

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

Order number

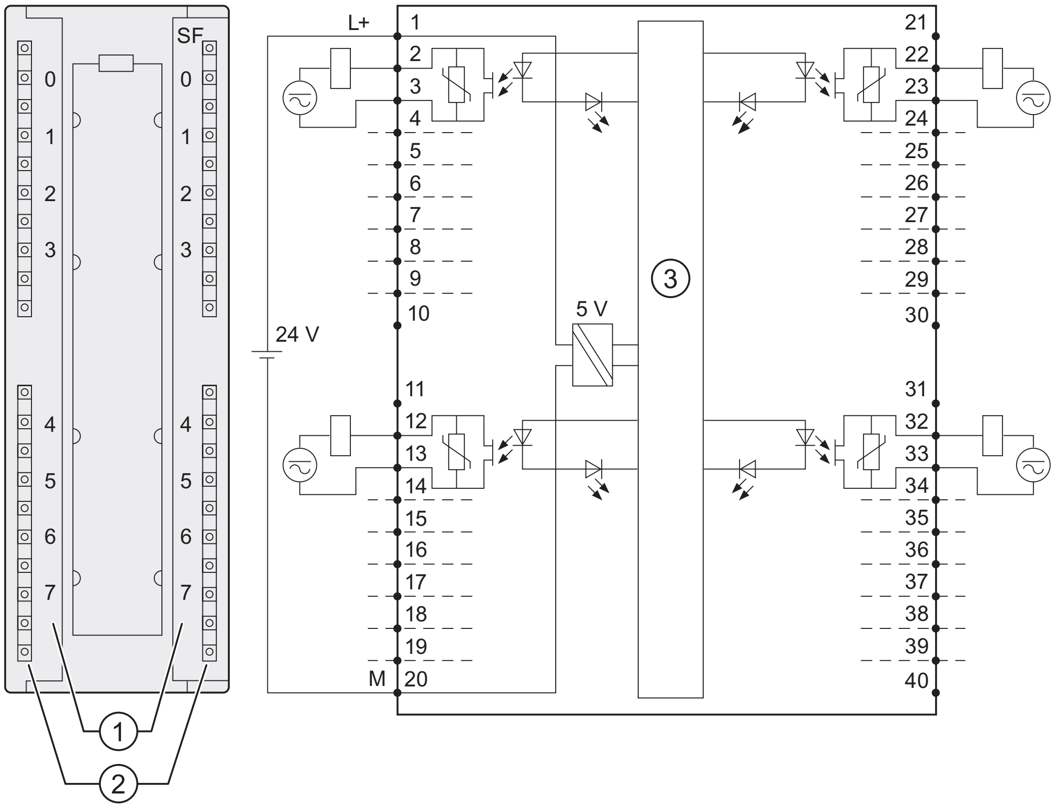
6ES7322-5GH00-0AB0

Properties

Performance features 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



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

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 • shielded	 max. 600 m 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 to 40 °C	max. 0.5 A
Cumulated current of outputs (per module)	
• horizontal mounting position to 60 °C	max. 8 A
• other mounting positions 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
Maximum 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 LED per channel
Diagnostics functions	
• Group error display	red LED (SF)
Interrupts	
• Diagnostics interrupt • Reading diagnostics information	programmable supported
Actuator selection data	
Output voltage	
• "1" signal	min. L+ (-0.25 V)
Output current	
• Rated inrush current (per group) with "1" signal • "0" signal (residual current)	0.5 A, max. 1.5 A (max. 50 ms) max. 10 μA

Dimensions and weight	
Output delay (resistive load)	
• "0" to "1" transition • "1" to "0" transition	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	max. 10 Hz
• with inductive load to IEC 947-5-1; DC 12 AC/12	max. 0.5 Hz
• with lamp load	max. 0.5 Hz
Wiring of the actuators	using a 40pin front connector

* Outputs must be protected by a 250 V fast-blow fuse (recommended fuses: Wickman 194-1100 1.1 A and Littlefuse 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 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	
Substitute value output	
Substitute value	
Substitute 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

Diagnostics 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 fault	yes
D1:	Internal fault	yes
D2:	External fault	yes
D3:	Channel fault	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:	Diagnostics interrupt from substitute	no
D7:	Reserve	

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 timeout	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 fault	yes
D3:	RAM fault	yes
D4:	DAC error	no
D5:	Fuse blown	no
D6:	Process interrupt lost	no
D7:	Reserve	
Channel-specific diagnostics byte		
D0:	Programming error	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

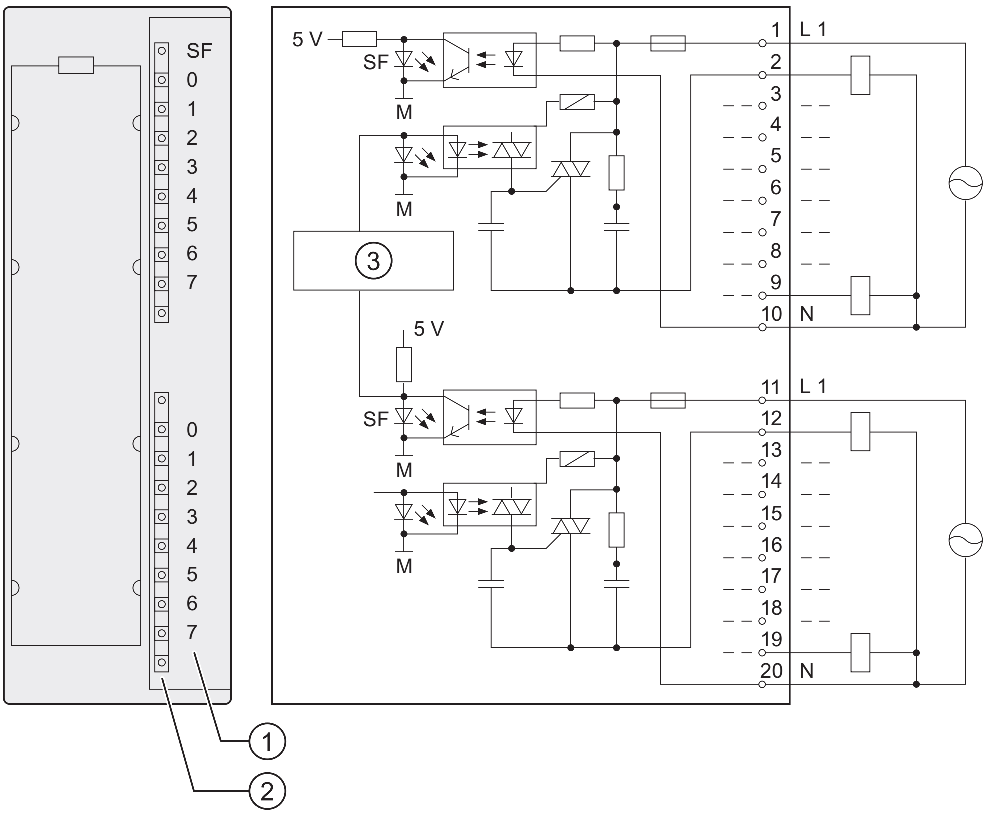
6ES7 322-1FH00-0AA0

Properties

Properties of 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 diagram 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

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

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 • shielded	 max. 600 m 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 to 40 °C to 60 °C	 max. 4 A max. 2 A
• vertical mounting position to 40 °C	max. 2 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 8
Maximum 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 • from load voltage L+ (no-load)	 max. 200 mA max. 2 mA
Power loss of the module	typ. 8.6 W
Status, interrupts, diagnostics	
Status display	green LED for each channel
Interrupts • Diagnostics interrupt	 no
Diagnostics functions • Group error display	red LED (SF) (fuse or no L1/N)
Actuator selection data	
Output voltage • "1" signal – At maximum current – At minimum current	 min. L 1 (- 1.5 V) min. L 1 (- 8,5 V)

Technical data	
Output current	
• "1" signal Rated value Permissible range at 0 °C to 40 °C Permissible range at 0°C to 60°C Maximum inrush current (per group)	 1 A 10 mA to 1 A 10 mA to 0.5 A 20 A (two 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 increasing power	no
Control of a digital input	supported
Switching frequency	
• with resistive load • with inductive load to IEC 947-5-1, AC 15	max. 10 Hz max. 0.5 Hz
• with lamp load	max. 1 Hz
Short-circuit protection of the 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 • Schurter • Littlefuse	19 194-8 A SP001.1014 217.008
Fuse holder	
• Wickman	19 653
Wiring of the actuators	using a 20-pin front connector

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

Order number

6ES7 322-1BF01-0AA0

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

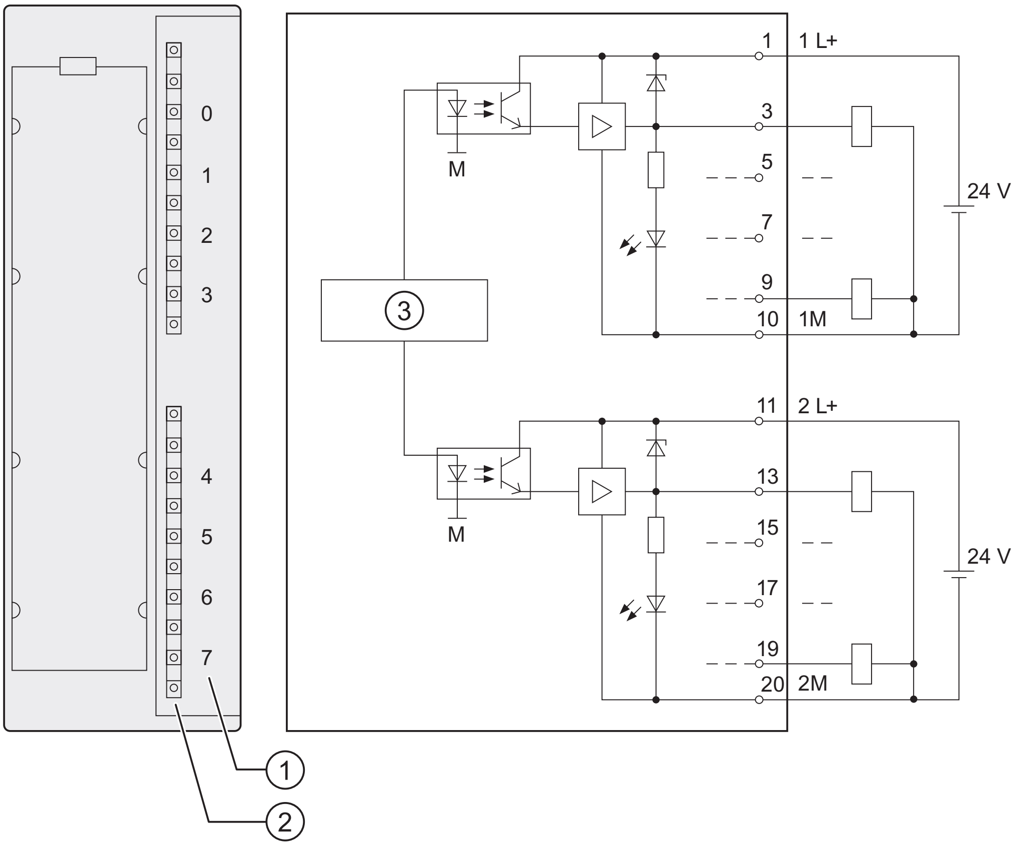
Use of the module with high-speed counters

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, the module outputs will carry a "1" signal for the duration of approx. 50 μs due to the circuit structure.

Wiring and block diagram of SM 322; DO 8 x DC 24 V/2 A



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

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

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

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current of outputs (per group)	
• horizontal mounting position to 60 °C	max. 4 A
• vertical mounting position to 40 °C	max. 4 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 4
Maximum 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. 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 • "1" signal	min. L+ (-1.6 V)
Output current	
• "1" signal Rated value Permissible range	 2 A 5 mA to 2.4 A
• with "0" signal (residual current)	max. 0.5 mA
Output delay (with resistance load)	
• "0" to "1" transition	max. 100 μs
• "1" to "0" transition	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 increasing power	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 + (-48 V)
Short-circuit protection of the output	yes, electronic
• Threshold	typ. 3 A
Wiring of the actuators	using a 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"

6ES7 322-8BF00-0AB0

Order number: "SIPLUS S7-300 module"

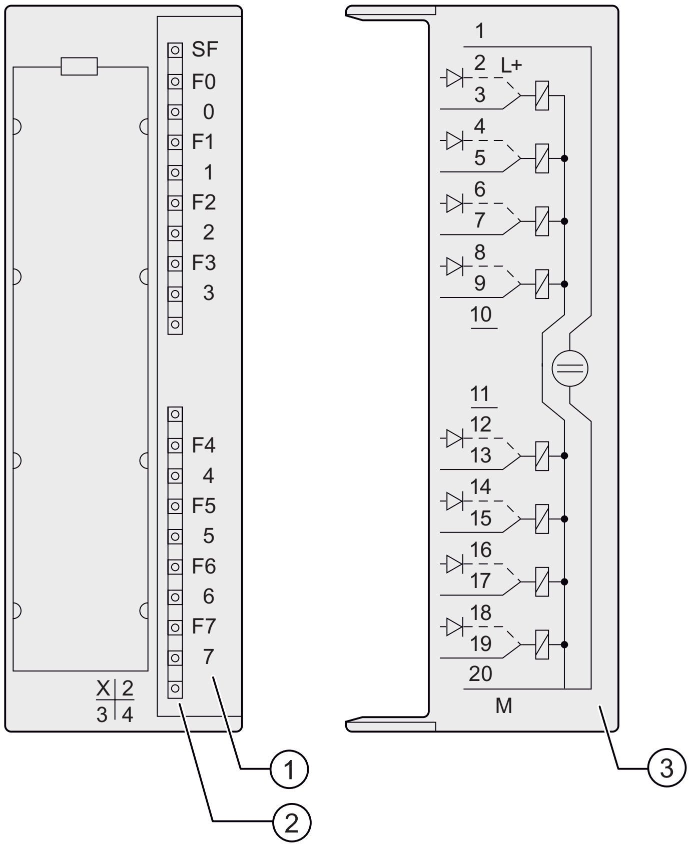
6AG1 322-8BF00-2AB0

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 diagnostics interrupt
- Programmable substitute value output

Wiring and block diagram of SM 322; DO 8 x DC 24 V/ 0.5 A



① Channel number, channel error (F)

② Status display - green

Error LED - red

③ Wiring diagram

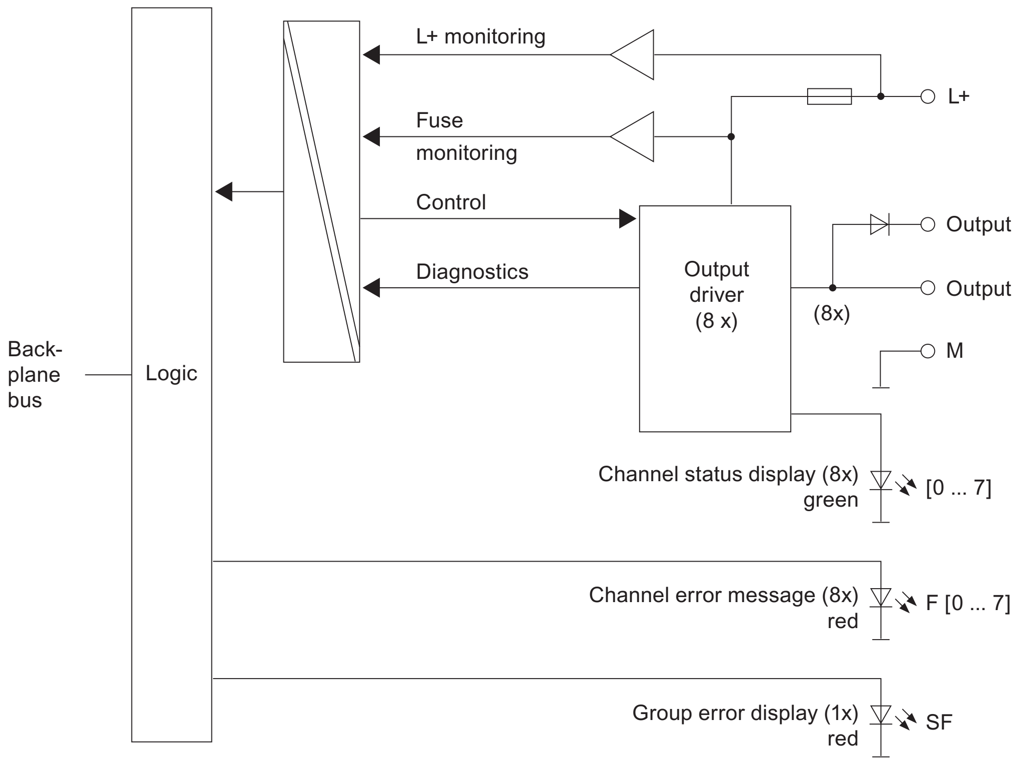


Figure 3-7 Block diagram of SM 322; DO 8 x DC 24 V/0.5 A

Redundant load control

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.

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

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Cumulative current (per group) of outputs without series diode	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 3 A
• vertical mounting position to 40 °C	max. 4 A
Cumulative current of outputs (per group) with series diode	
• horizontal mounting position to 40 °C to 60 °C	 max. 3 A max. 2 A
• vertical mounting position to 40 °C	max. 3 A
Electrical isolation • between channels and the backplane bus	 yes
• between channels in groups of	yes 8
Maximum 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. 90 mA
Power loss of the module	typ. 5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts • Diagnostics interrupt	programmable
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 • "1" signal without series diode with series diode	 min. L + (- 0.8 V) min. L+ (-1.6 V)

Technical data	
Output current	
• "1" signal Rated value Permissible range	 0.5 A 10 mA to 0.6 A 1)
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load) • "0" to "1" transition • "1" to "0" transition	 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 of the actuators	using a 20-pin front connector

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

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

Programming

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

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

The table below lists the programmable 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 • Diagnostics interrupt	yes/no	no	dynamic	Module
Reaction to CPU STOP	Set substitute value (SSV) Hold last value (HLV)	SSV		
Diagnostics • Wirebreak • Load voltage L+ missing • Short-circuit to M • Short-circuit to L+	 yes/no yes/no yes/no yes/no	 no no no no	static	Channel
Set substitute value "1"	yes/no	no	dynamic	Channel

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

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 fault	SF	Module	no
RAM fault	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 "wire-break diagnostics" parameter for the channel in *STEP 7*
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 timeout	generally	Infrequent high electromagnetic interference	Eliminate the interference
		Defective module	Replace the module
EPROM fault	generally	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
		Defective module	Replace the module
RAM fault	generally	Infrequent high electromagnetic interference	Eliminate interference and cycle the power supply of CPU off/on.
		Defective module	Replace the module

3.24.3 SM 322; DO 8 x DC 24 V/0.5 A - Behavior

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	Substitute 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

SM 322; DO 8 x DC 24 V/0.5 A - Parameters (Page 120)

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

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**.

Diagnostics interrupt

Incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of diagnostics interrupt, if this interrupt is enabled.

The CPU interrupts user program execution in order to process diagnostics interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to view detailed diagnostics data output by the module.

Diagnostics data remain consistent until the program exits OB82. The module acknowledges the diagnostics interrupt when the program exits OB82.

See also

SM 322; DO 8 x DC 24 V/0.5 A - Parameters (Page 120)

3.25 Digital output module SM 322; DO 8 x DC 48-125 V/1,5 A; (6ES7322-1CF00-0AA0)

Order number: "Standard module"

6ES7 322-1CF00-0AA0

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)

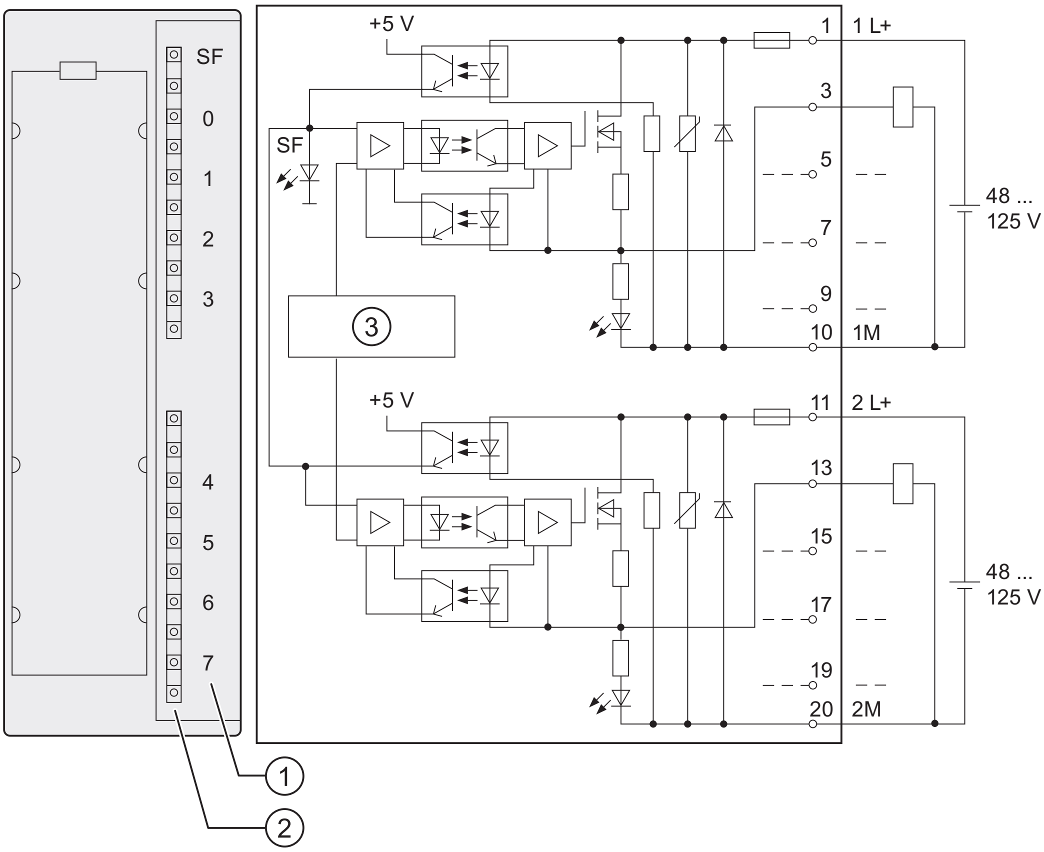
Use of the module with high-speed counters

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



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

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 • shielded	 max. 600 m 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 to 40 °C to 50 °C to 60 °C	 max. 6 A max. 4 A max. 3 A
• vertical mounting position to 40 °C	max. 4 A
Electrical isolation • between channels and the backplane bus	yes
• between channels in groups of	yes 4
Maximum potential difference • between different circuits	 146 VDC / 132 VAC
Isolation test voltage	1500 VAC
Current consumption • from the backplane bus • from load voltage L+ (no-load)	 max. 100 mA 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 • "1" signal	 min. L+ (-1.2 V)
Output current • "1" signal Rated value Permissible range	 1.5 A 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)	
• "0" to "1" transition • "1" to "0" transition	max. 2 ms max. 15 ms
Lamp load	max. 15 W at 48 V max. 40 W at 125 V

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 • with inductive load • with lamp load	 max. 25 Hz max. 0.5 Hz max. 10 Hz
Internal limiting of the inductive shutdown voltage to	typ. M (-1V)
Short circuit-proof output • Threshold	yes, electronic3) typ. 4.4 A
Replacement fuses	Fuse 6.3 A/250 V, fast-blow, 5 x 20 mm
• Schurter • Wickman	SP0001.1012 194-1630-0
Fuse holder • Wickman	 653 0000 040
Wiring of the actuators	using a 20-pin front connector

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

2) Possible errors:

- no load voltage
- fuse defective
- output overload

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"

6ES7 322-1FF01-0AA0

Order number: "SIPLUS S7-300 module"

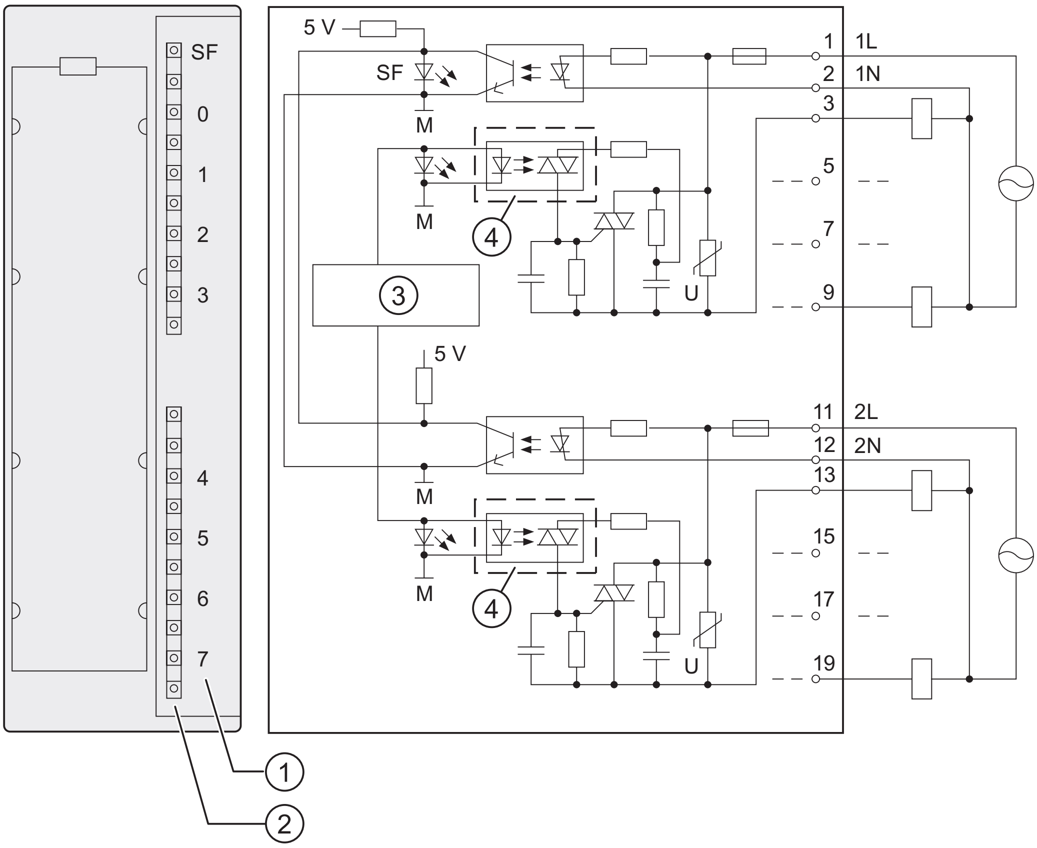
6AG1 322-1FF01-2AA0

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 diagram 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

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

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L1 • Maximum frequency range	120/230 VAC 47 Hz to 63 Hz
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 2 A
• vertical mounting position to 40 °C	 max. 2 A
Electrical isolation • between channels and the backplane bus • between channels in groups of	 yes yes 4
Maximum 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 • 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	none
Diagnostics functions • Group error display	yes red LED (SF) 2)
Actuator selection data	
Output voltage • "1" signal – At maximum current – At minimum current	 min. L1 (-1.5 V) min. L1 (-8.5 V)
Output current • "1" signal Rated value permissible range at 0 °C to 40 °C permissible range at 40 °C to 60 °C Maximum inrush current (per group)	 AC 2 A1) 10 mA to 2 A 10 mA to 1 A max. 20 A (max. 1 AC cycle)
• "0" signal (residual current)	max. 2 mA
Output delay (resistive load)	
• "0" to "1" transition	max. 1 AC cycle
• "1" to "0" transition	max. 1 AC cycle

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 • with inductive load to IEC 947-5-1, AC 15 • with lamp load	 max. 10 Hz max. 0.5 Hz 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 • Wickman • Schurter • Littlefuse	8 A fuse/fast-blow 194-1800-0 SP001.1013 217.008
Fuse holder • Wickman	 653 07
Wiring of the actuators	using a 20-pin front connector

1) The load current must not be half-wave

2) Possible errors:

- no load voltage
- defective fuse

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

Order number

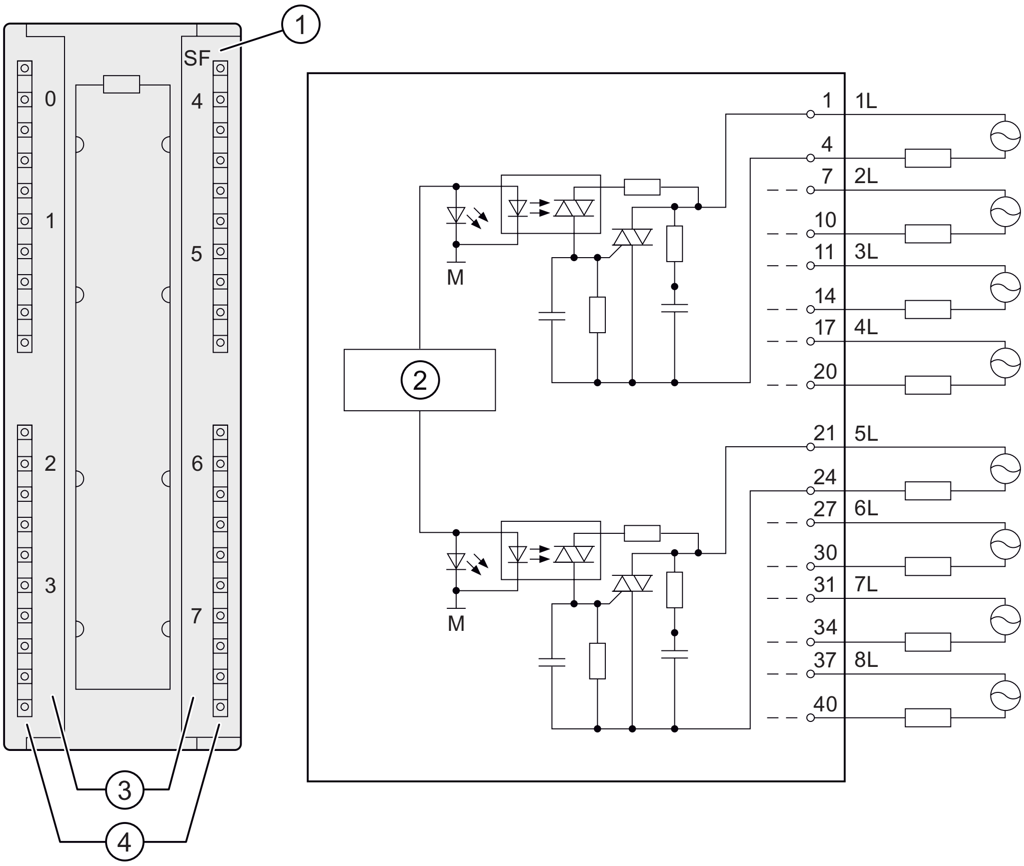
6ES7 322-5FF00-0AB0

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 diagnostics interrupt
- Programmable substitute 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

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

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L1	120/230 VAC
Cumulative current of outputs (module)	
• Horizontal mounting position to 40 °C to 60 °C	 max. 8 A max. 4 A
• vertical mounting position to 40 °C	max. 4 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 1
Maximum 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 • Diagnostics interrupt	 programmable
Diagnostics functions • Group error display	 red LED (SF)
Actuator selection data	
Output voltage • "1" signal – At maximum current – At minimum current	 min. L1 (-1.5 V) min L1 (-8.5 V)
Output current	
• "1" signal Rated value permissible range at 0 °C to 40 °C permissible range at 40 °C to 60 °C Maximum inrush current (per group)	 2 A 10 mA to 2 A 10 mA to 1 A 20 A (with two half-waves)
• "0" signal (residual current)	max. 2 mA
Zero transition	max. 60 V
Size of the motor starter	max. size 5 to NEMA

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 of the actuators	using a 20-pin front connector

Note

The outputs must be protected by a high-speed, fast-blow 3.15 A 250 VAC fuse. Hazardous areas to National Electric Code must be determined safe before you remove/replace the fuse. Removal and replacement may only be possible using 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 substitute value (SSV) Hold last value (HLV)	SSV	dynamic	Channel
Set substitute 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 418)

Programming digital modules (Page 50)

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

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 timeout	SF	Module	no
EPROM fault	SF	Module	no
RAM fault	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 timeout	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Defective module	Replace the module
EPROM fault	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Defective module	Replace the module
RAM fault	Always	Transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Defective module	Replace the module

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

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.

Diagnostics 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 in order to process diagnostics interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to obtain detailed diagnostics data from the module.

Diagnostics data remain consistent until the program exits OB82. 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

SM 322; DO 8 x DC 24 V/0.5 A - Parameters (Page 120)

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

Order number

6ES7 322-1HH01-0AA0

Properties

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

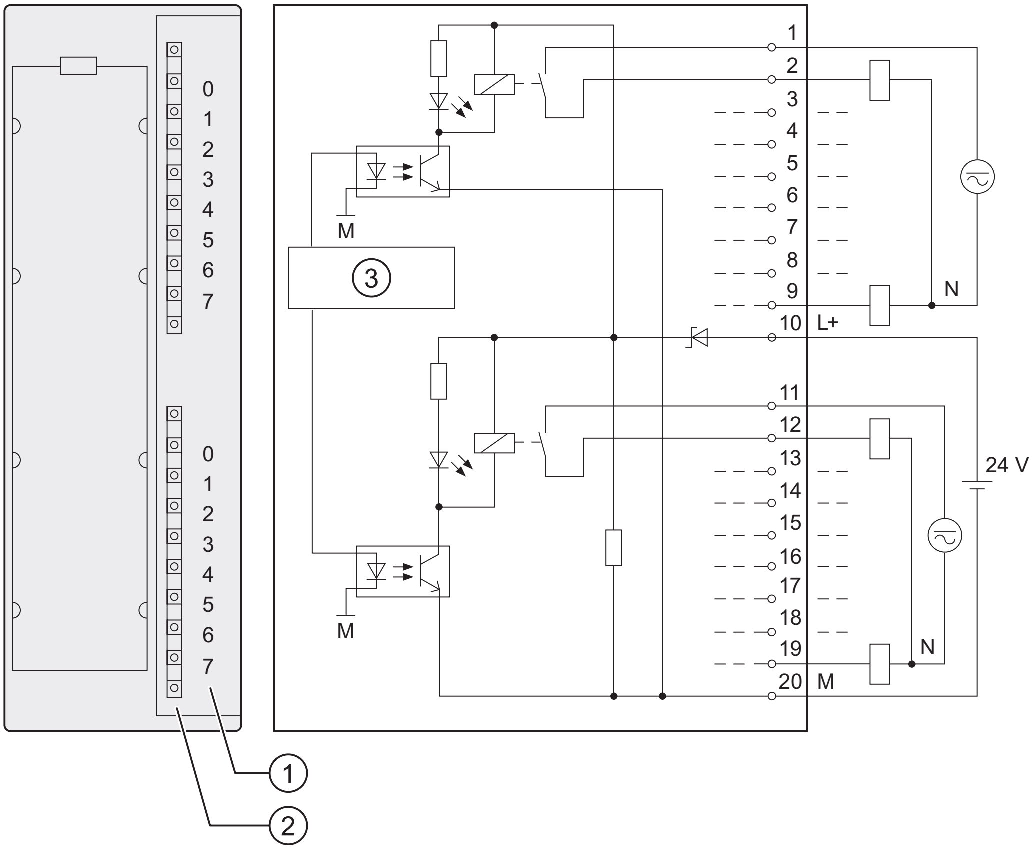
- 16 outputs, electrically isolated in groups of 8
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

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



① Channel number

② Status display - green

③ Backplane bus interface

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	
Maximum 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 / 230 VAC 5 W / 24 VDC	
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 of the actuators	using a 20-pin front connector	

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

Order number

6ES7 322-1HF01-0AA0

Properties

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

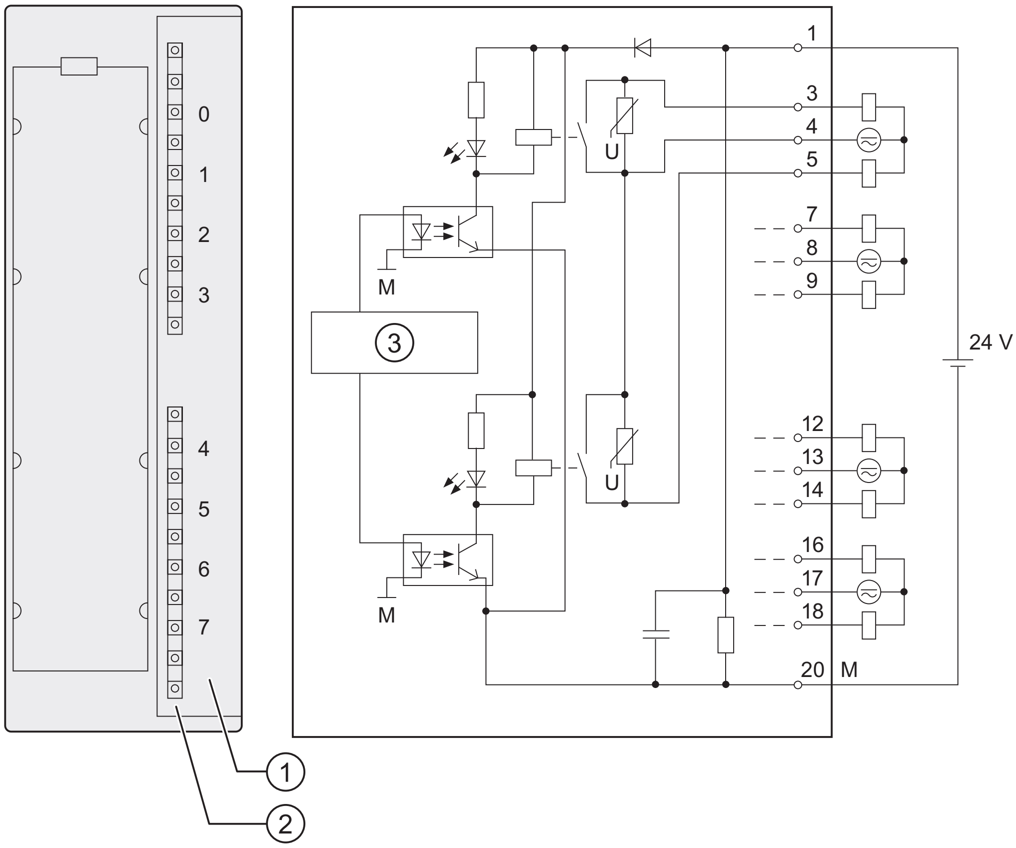
- 8 outputs, electrically isolated in groups of 2
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

Reaction to a shutdown of the power supply

Note

Rule for SM 322; DO 8 x Rel. VAC release version 1: The internal backup capacitor provides power for the duration of approx. 200 ms. This backup time is sufficient to briefly control the relay in the user program.

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

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

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 • shielded	 max. 600 m max. 1000 m

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	
Maximum 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 • from power supply L+	 max. 40 mA 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 useful 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
60 VDC	0.5 A	1.6 million
120 VDC	0.2 A	1.6 million
48 VAC	2.0 A	1.6 million
60 VAC	2.0 A	1.2 million
120 VAC	2.0 A	0.5 million [2)]
	1.0 A	0.7 million [2)]
	0.5 A	1.5 million [2)]
230 VAC	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
60 VDC	0.5 A	0.5 million
	0.2 A	0.3 million [2)]
120 VDC	1.5 A	1 million
48 VAC	1.5 A	1 million
60 VAC	2.0 A	0.2 million
120 VAC	1.0 A	0.7 million
	0.7 A	1 million
	0.5 A	2.0 million
230 VAC	2.0 A	0.3 million [2)]
	1.0 A	0.7 million [2)]
	0.5 A	2 million [2)]
Contact protection (internal)	Varistor SIOV-CU4032 K275 G	
An external protective circuit extends the useful 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 58W	25000
Fluorescent lamps, conventionally compensated [2)]	1 x 58 W	25000
Fluorescent lamps, non-compensated [2)]	10 x 58 W	25000

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 of the actuators	using a 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

6ES7 322-5HF00-0AB0

Properties

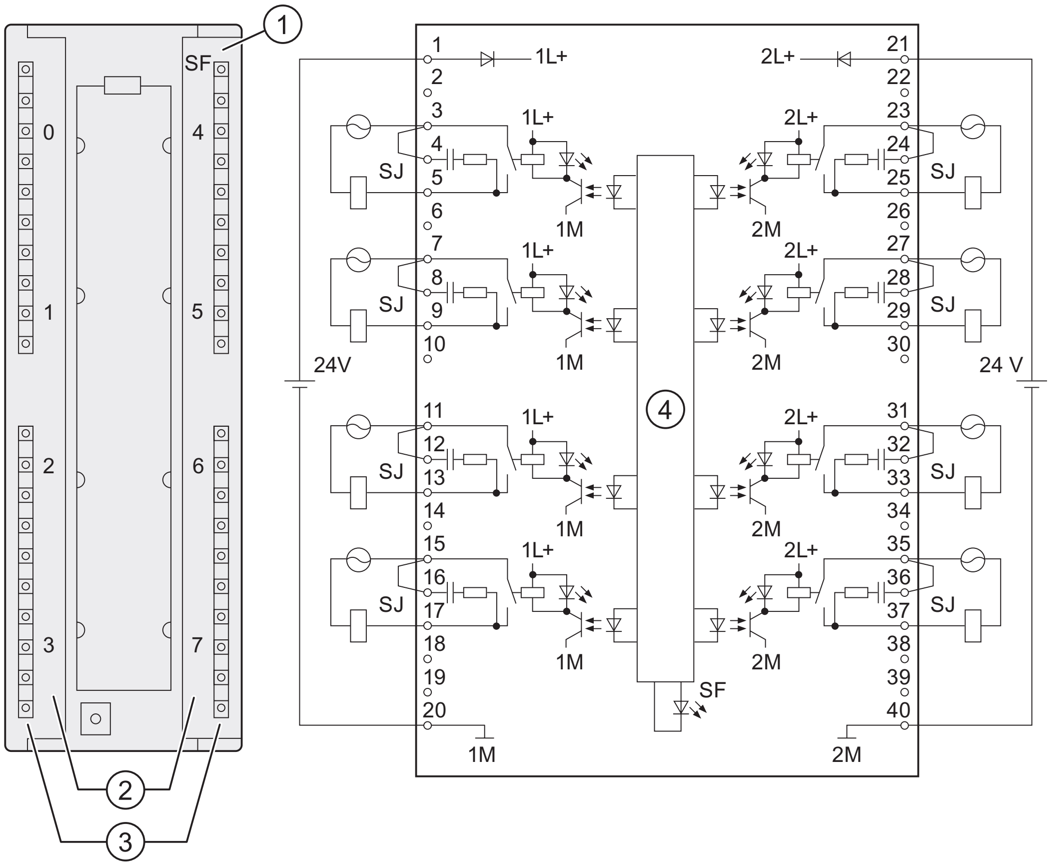
Properties of relay output module SM 322; DO 8 x Rel. AC 230V/5A:

- 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
- Channel-specific status displays
- Programmable diagnostic interrupt
- Programmable substitute 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. (see the diagram below).

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



① Error LED - red

② Channel number

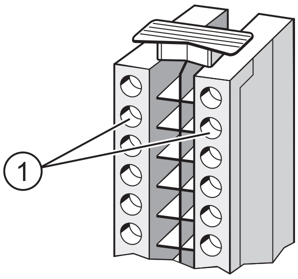
③ Status display - green

④ Backplane bus interface

Operation on safety extra-low voltage (SELV)

Make allowances for the special feature outlined below when operating the 6ES7 322-5HF00-0AB0 relay output module on SELV:

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



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	
Supports isochronous mode	no
Number of outputs	8
Cable length • unshielded • shielded	 max. 600 m 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 in groups of	yes 1

Technical data		
Maximum 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 • from power supply L+	 max. 100 mA max. 160 mA	
Power loss of the module	typ. 3.5 W	
Status, interrupts, diagnostics		
Status display	green LED for each channel	
Interrupts		
• Diagnostics 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 useful 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
• with inductive load		

Technical data		
Voltage	Current	Number of switching cycles (typ.)
24 VDC 24 VDC 24 VDC 24 VDC 24 VDC 120 VDC 230 VAC 230 VAC 230 VAC 230 VAC 230 VAC	5.0 A 2.5 A 1.0 A 0.2 A 0.1 A 0.1 A 5.0 A 2.5 A 1.0 A 0.2 A 0.1 A	0.1 million 0.25 million 0.5 million 1 million 1.2 million 1.2 million 0.1 million 0.25 million 0.5 million 1 million 1.2 million
An RC quenching element (jumper "SJ" inserted) or an external protection circuit extend 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 1500 W	25000 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	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 increasing power	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 of the actuators	using a 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 fault.

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 (SSV) Hold last value (HLV)	SSV	Dynamic	Channel
Set substitution value "1"	yes/no	no	Dynamic	Channel

See also

Programming digital modules (Page 50)

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

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
		Defective module	Replace the module
EPROM error	generally	infrequent high level of electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Defective module	Replace the module
RAM error	generally	transient high electromagnetic interference	Eliminate interference and cycle the CPU power supply off and on
		Defective module	Replace the module

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

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

Incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of diagnostics interrupt, if this interrupt is enabled.

The CPU interrupts user program execution in order to process diagnostics interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to obtain detailed diagnostics data from the module.

Diagnostics data remain consistent until the program exits OB82. The module acknowledges the diagnostics interrupt when the program exits OB82.

See also

SM 322; DO 8 x DC 24 V/0.5 A - Parameters (Page 120)

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

Order number: "Standard module"

6ES7 322-1HF10-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 322-1HF10-2AA0

Properties

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

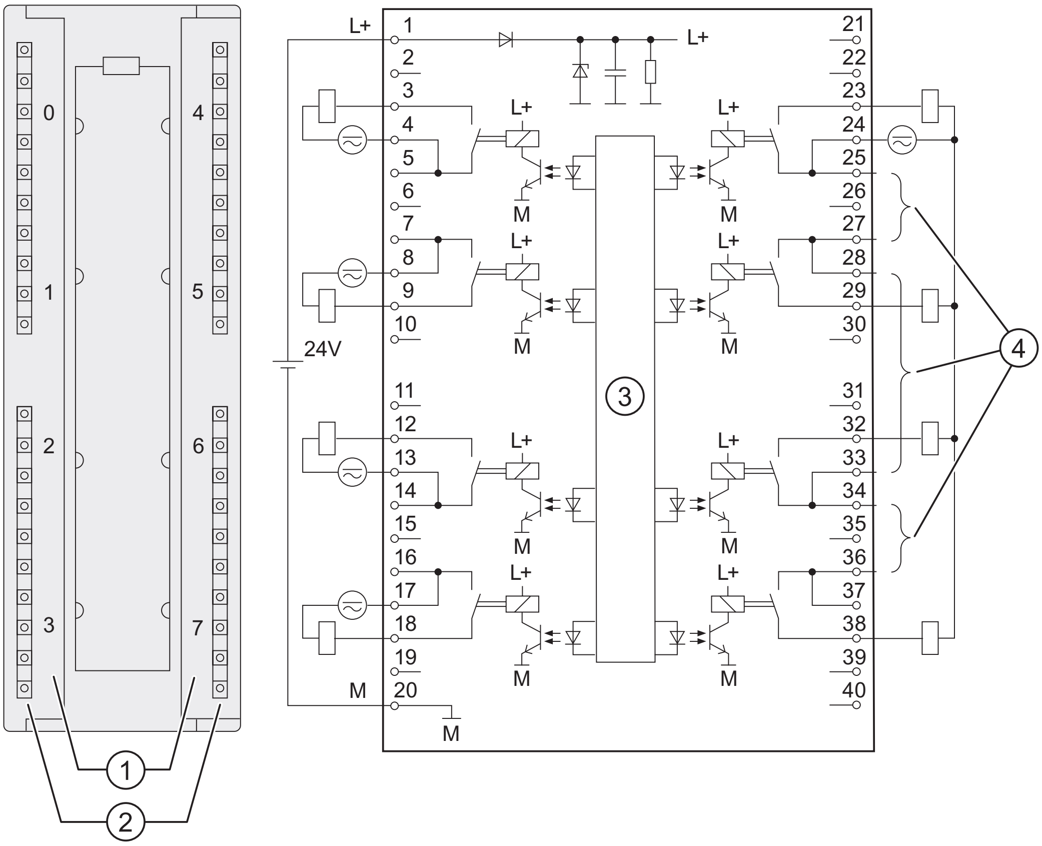
- 8 outputs, electrically isolated in groups of 1
- Rated load voltage 24 VDC to 120 VDC, 48 VAC to 230 VAC
- Suitable for AC/DC solenoid valves, contactors, motor starters, FHP motors and signal lamps.

Measures to take for switching currents > 3 A

Note

Always use connecting cables with a cross-section of 1.5 mm^2 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

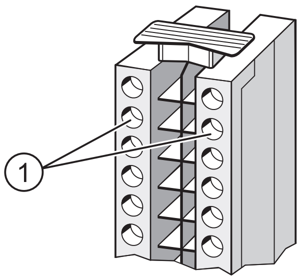
$I_{Accumulated\ current} \leqq 8$ A at $T_U \leqq 30$ °C

$I_{Accumulated\ current} \leqq 5$ A at $T_U \leqq 60$ °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. The creepage distances and air gaps of the 40-pin front connector do not meet SIMATIC requirements in terms of safe electrical separation if operated with voltages above 120 VUC.



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

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

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 • 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)	
• horizontal mounting position to 30 °C to 60 °C • vertical mounting position to 40 °C	 max. 8 A max. 5 A max. 5 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels in groups of	yes 1

Technical data		
Maximum 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 • from power supply L+	 max. 40 mA max. 125 mA	
Power loss of the module	typ. 4.2 W	
Status, interrupts, diagnostics		
Status display Interrupt Diagnostics functions	green LED per channel none 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 useful life of contacts		
• with resistive load		
Voltage	Current	Number of switching cycles (typ.)
24 VDC	8.0 A 4.0 A 2.0 A 0.5 A	0.1 million 0.3 million 0.7 million 4.0 million
60 VDC	0.5 A	4 million
120 VDC	0.2 A	1.6 million
48 VAC	8.0 A 2.0 A	0.1 million 1.6 million
60 VAC	8.0 A 2.0 A	0.1 million 1.2 million
120 VAC	8.0 A 4.0 A 2.0 A 1.0 A 0.5 A	0.1 million 0.3 million 0.5 million 0.7 million 1.5 million
230 VAC	8.0 A 4.0 A 2.0 A 1.0 A 0.5 A	0.1 million 0.3 million 0.5 million 0.7 million 1.5 million

Technical data		
Switching capacity and useful 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 1.0 A 0.5 A	0.3 million 0.5 million 1 million
60 VDC	0.5 A 0.3 A	0.5 million 1 million
120 VDC	0.2 A	0.5 million
48 VAC	3.0 A 1.5 A	0.5 million 1 million
60 VAC	3.0 A 1.5A	0.3 million 1 million
120 VAC	3.0 A 2.0 A 1.0 A 0.5 A	0.2 million 0.3 million 0.7 million 2 million
230 VAC	3.0 A 2.0 A 1.0 A 0.5 A	0.1 million 0.3 million 0.7 million 2.0 million
• Aux. contactors Size 0 (3TH28)		30 million
An external protective circuit extends the useful life of contacts.		
	Power	Number of switching cycles (typ.)
Lamp load (230 VAC)	1000 W 1500 W	25000 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 load control	supported	
• for increasing power	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 of the actuators	using a 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

6ES7 323-1BL00-0AA0

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 capable of driving solenoid valves, DC contactors and indicator lights

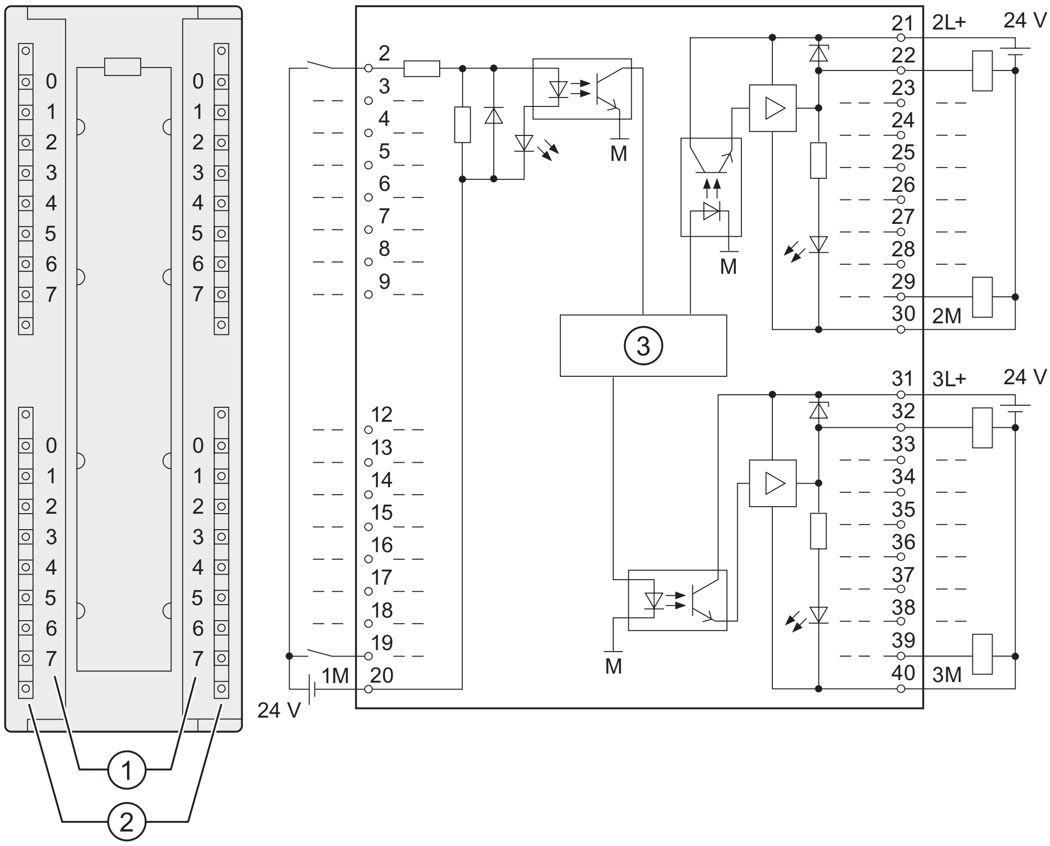
Use of the module with high-speed counters

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.

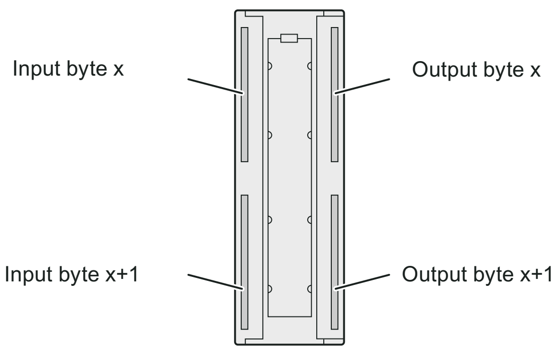
Wiring and block diagram of SM 323; DI 16/DO 16 x DC 24 V/0.5 A



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

Terminal assignment

The diagram below shows the IO addressing of channels.



SM 323; DI 16/DO 16 x DC 24 V/0,5 A - Technical data

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	no
Number of inputs	16
Number of outputs	16
Cable length • unshielded • shielded	 max. 600 m max. 1000 m
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
• horizontal mounting position to 40 °C to 60 °C	 16 8
• vertical mounting position to 40 °C	16
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C	 max. 4 A max. 3 A
• vertical mounting position to 40 °C	max. 2 A
Electrical isolation • between channels and the backplane bus	 yes
• between channels Inputs in groups of Outputs in groups of	yes 16 8
Maximum 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. 6.5 W
Status, interrupts, diagnostics	
Status display	green LED per channel
Interrupts	none
Diagnostics functions	none

Technical data	
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 13 V to 30 V - 30 V to + 5 V
Input current • "1" signal	 typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 of the signal transducers	using a 40-pin front connector
Actuator selection data	
Output voltage • "1" signal	 min. L + (- 0.8 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• "0" to "1" transition • "1" to "0" transition	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	supported (only outputs of the same group)
• for increasing power	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	yes, electronic
• Threshold	typ. 1 A
Wiring of the actuators	using a 40-pin front connector

3.33 Digital IO module SM 323; DI 8/DO 8 x DC 24 V/0.5 A; (6ES7323-1BH01-0AA0)

Order number: "Standard module"

6ES7 323-1BH01-0AA0

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 capable of driving solenoid valves, DC contactors and indicator lights

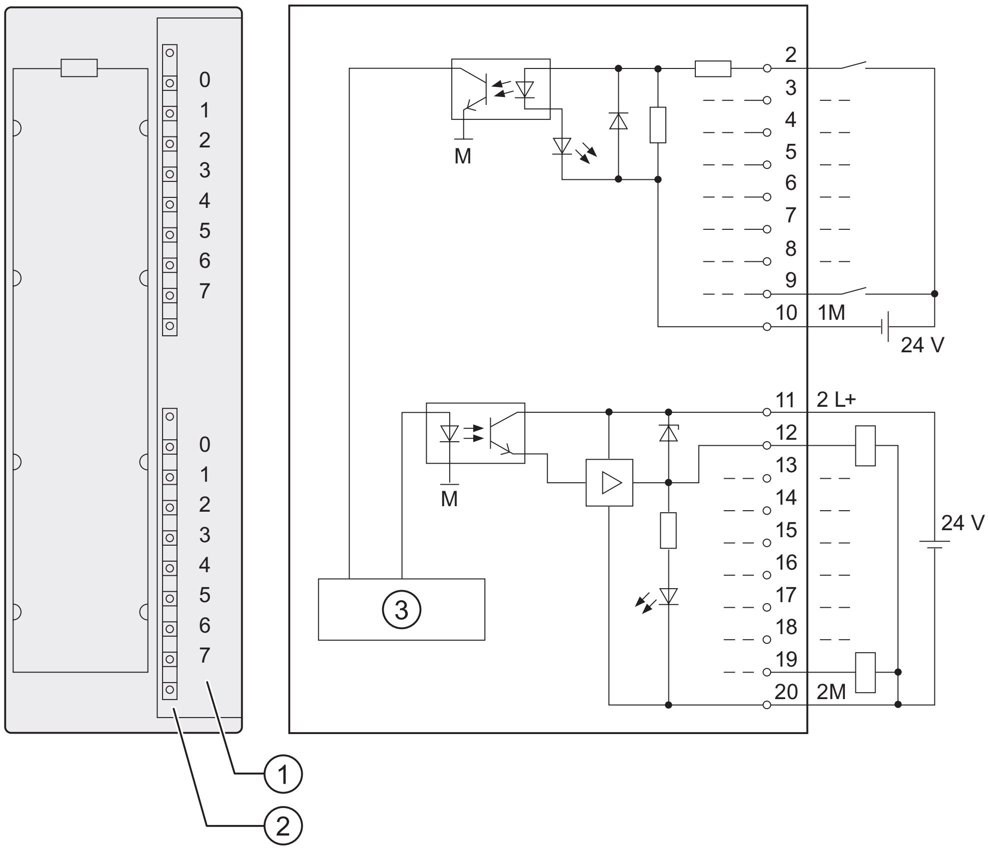
Use of the module with high-speed counters

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

SM 323; DI 8/DO 8 x DC 24 V/0.5 A - 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	8
Number of outputs	8
Cable length • unshielded • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
• horizontal mounting position to 60 °C • vertical mounting position to 40 °C	8 8
Cumulative current of outputs (per group)	
• horizontal mounting position to 60 °C • vertical mounting position to 40 °C	max. 4 A max. 4 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels Inputs in groups of Outputs in groups of	yes 8 8
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	24 VDC 13 V to 30 V - 30 V to + 5 V
Input current • "1" signal	typ. 7 mA
Input delay • "0" to "1" transition • "1" to "0" transition	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 of the signal sensors	using a 20-pin front connector

Technical data	
Actuator selection data	
Output voltage • "1" signal	 min. L + (- 0.8 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• "0" to "1" transition • "1" to "0" transition	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	supported (only outputs of the same group)
• for performance increase	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	yes, electronic
• Threshold	typ. 1 A
Wiring of the actuators	using a 20-pin front connector

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

Order number

6ES7 327-1BH00-0AB0

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 capable of driving solenoid valves, DC contactors and indicator lights
- Dynamic change of parameters in RUN (CiR-compatible), separately at each channel.
- Readback of outputs.

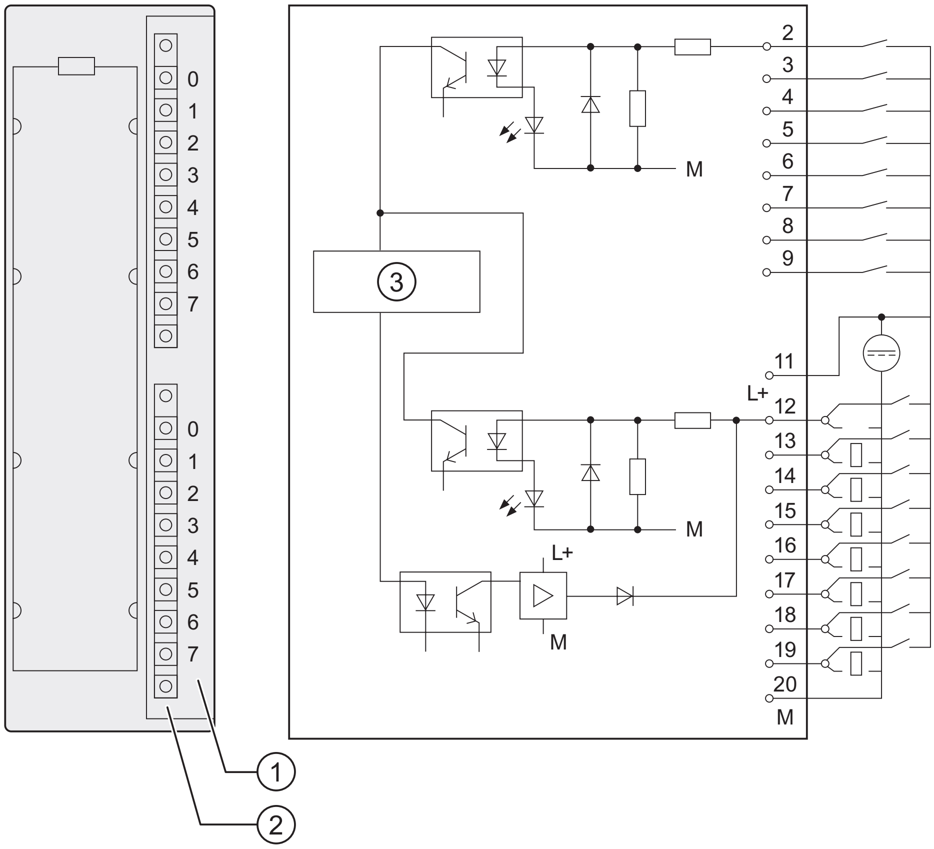
Use of the module with high-speed counters

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 • shielded	 max. 600 m max. 1000 m

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+	24 VDC
Number of simultaneously controlled inputs	
• horizontal mounting position to 60 °C • vertical mounting position to 40 °C	 16 16
Cumulative current of outputs (per group)	
• horizontal mounting position to 40 °C to 60 °C • vertical mounting position to 40 °C	 max. 4 A max. 3 A max. 2 A
Electrical isolation	
• between channels and the backplane bus	yes
• between channels	no
Maximum 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
Sensor selection data	
Input voltage • Rated value • "1" signal • "0" signal	 24 VDC 15 V to 30 V - 30 V to + 5 V
Input current • "1" signal	 typ. 6 mA
Input delay • "0" to "1" transition • "1" to "0" transition	 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 of the signal transducers	using a 40pin front connector

Technical data	
Actuator selection data	
Output voltage • "1" signal	 min. L+ (-1.5 V)
Output current	
• "1" signal Rated value Permissible range	 0.5 A 5 mA to 0.6 A
• "0" signal (residual current)	max. 0.5 mA
Output delay (resistive load)	
• "0" to "1" transition • "1" to "0" transition	max. 350 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	supported
• for increasing power	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 + (-54 V)
Short circuit-proof output	yes, electronic
• Threshold	typ. 1 A
Wiring of the actuators	using a 40pin front connector

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

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 lists the programmable parameters of SM 327; DO 8 x DC 24 V/0.5 A, including defaults.

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

The comparison illustrates the parameters you can edit:

- in*STEP 7*
- using SFC55 "WR_PARM"
- using SFB53 "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	Default	Parameter type	Scope	Data record number	Programmable using ...	
						SFC55, SFB53	PG
Digital output	yes/no	no	dynamic	Channel	1	yes	yes

See also

SM 322; DO 8 x DC 24 V/0.5 A - Parameters (Page 120)

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.

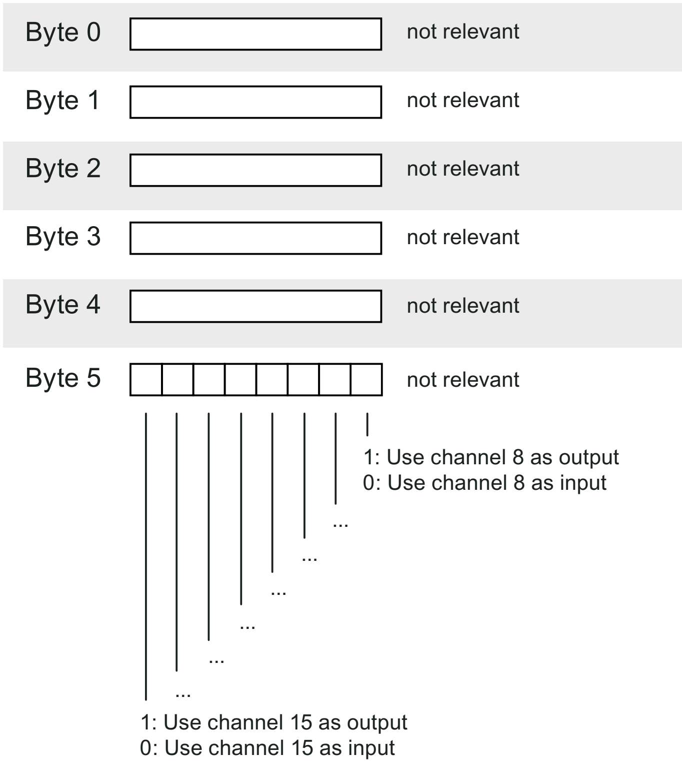


Figure 3-8 Structure of data record 1 of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Readback of outputs

The readback function is a simple form of diagnostics. You can use this to determine whether the information output 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 at I11.3. See the figure below

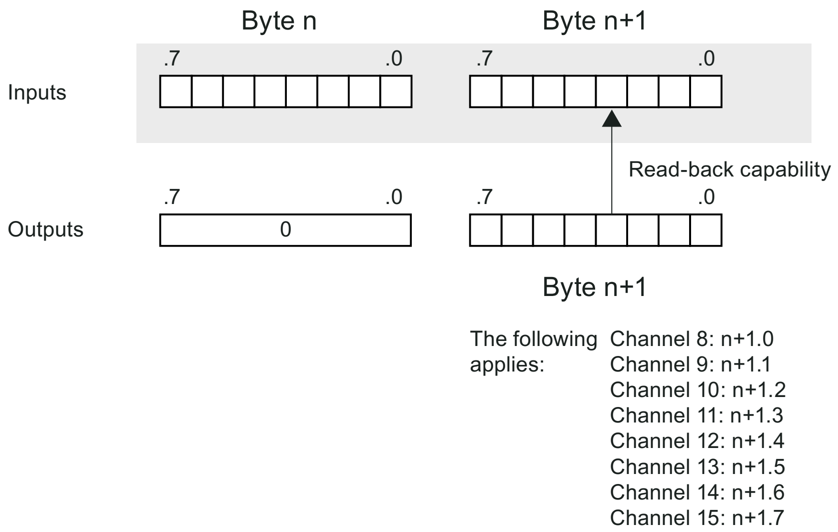


Figure 3-9 Readback of the outputs of SM 327; DI 8/DO 8 x DC 24 V/0.5 A

Principles of analog value processing 4

4.1 Overview

Introduction

This chapter describes the basic procedure in wiring and connecting signal sensors to analog inputs and analog outputs and corresponding items to observe.

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

Always adhere to the general information on sensor wiring and connecting.

Special wiring and connecting options are described in the corresponding module data.

Installation and wiring

For information on installation and wiring, refer to the S7-300, CPU 31xC, and CPU 31x Operating Instructions: Installation On the Internet at: http://support.automation.siemens.com/WW/view/en/13008499.

4.2 Wiring and connecting transducers to analog inputs

Transducers which can be wired and connected to analog inputs

You can wire and connect the following transducers to the analog input modules, depending on the 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 disturbance on analog signals. Avoid this effect by means of low-impedance equipotential bonding. Ground only one end of the shielding.

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 any risk of potential difference V_{ISO} developing between the reference point of measuring circuit (MANA and/or M-) and the M terminal of the CPU/IM153 .

You can prevent the potential difference V_{ISO} from exceeding limits by means of equipotential interconnection of terminals M_{ANA} and M of the CPU/IM153.

Non-isolated analog input modules

Non-isolated analog input modules require a low-impedance connection between the reference point of measuring circuit M_{ANA} and the M terminal of the CPU or interface module IM 153. Interconnect terminals M_{ANA} with M of the CPU or interface module IM 153. Any potential difference between M_{ANA} and M of the CPU or interface module IM 153 may corrupt the analog signal.

Limited potential difference CMV

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

- the measurement inputs (M+ / M-) and the reference potential of measuring circuit M_{ANA}
- between the measuring inputs.

The following diagrams show the measures to be taken when wiring transducers.

4.2.1 Wiring and connecting electrically isolated transducers

Electrically isolated transducers

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

Potential differences may develop between electrically isolated sensors. These potential differences may be caused by interference, 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

At modules where $V_{CM} \leq 2.5$ V, interconnect M- and M_{ANA} (see the diagrams below).

Wiring and connecting electrically isolated transducesr to an electrically isolated AI

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

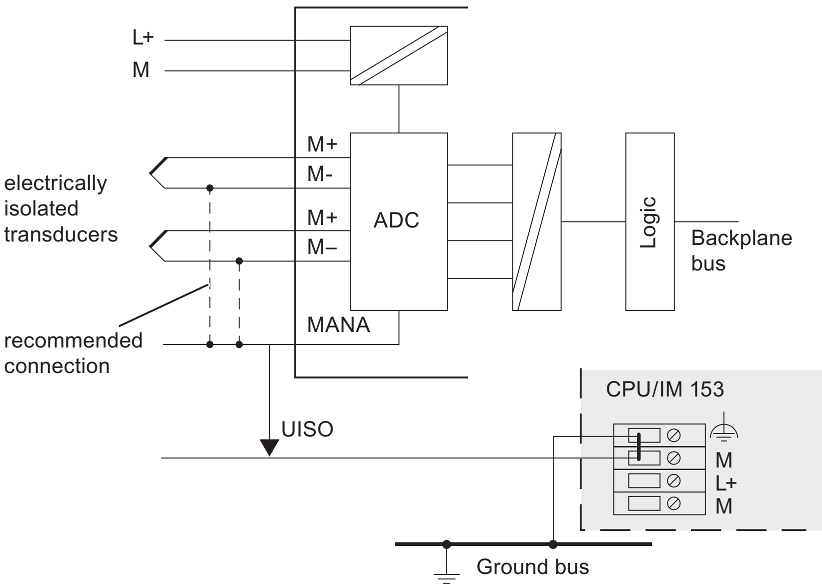


Figure 4-1 Wiring and connecting electrically isolated transducers to electrically isolated AI

Wiring and connecting electrically isolated transducers to a non-isolated AI

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

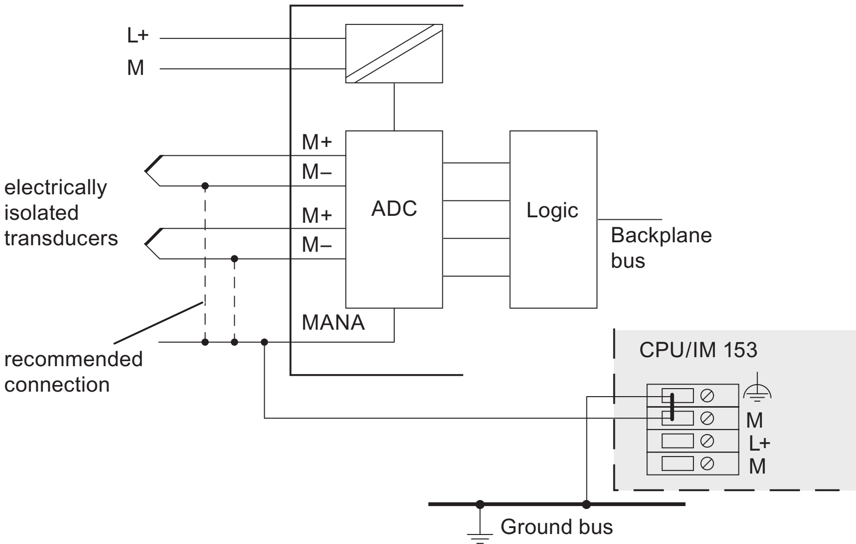


Figure 4-2 Wiring and connecting electrically isolated transducers to a non-isolated AI

Note

Do not interconnect M- with M_{ANA} when wiring and connecting 2-wire transducers and resistance transducers. An equalization current develops at the interconnection of M- with M_{ANA} and corrupts the measured value. This also applies to unused inputs which are programmed accordingly.

4.2.2 Wiring non-isolated transducers

Non-isolated transducer

Non-isolated transducers are interconnected with local ground potential. Always interconnect M_{ANA} with local ground when using non-isolated transducers.

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

Wiring non-isolated transducer to electrically isolated AI

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

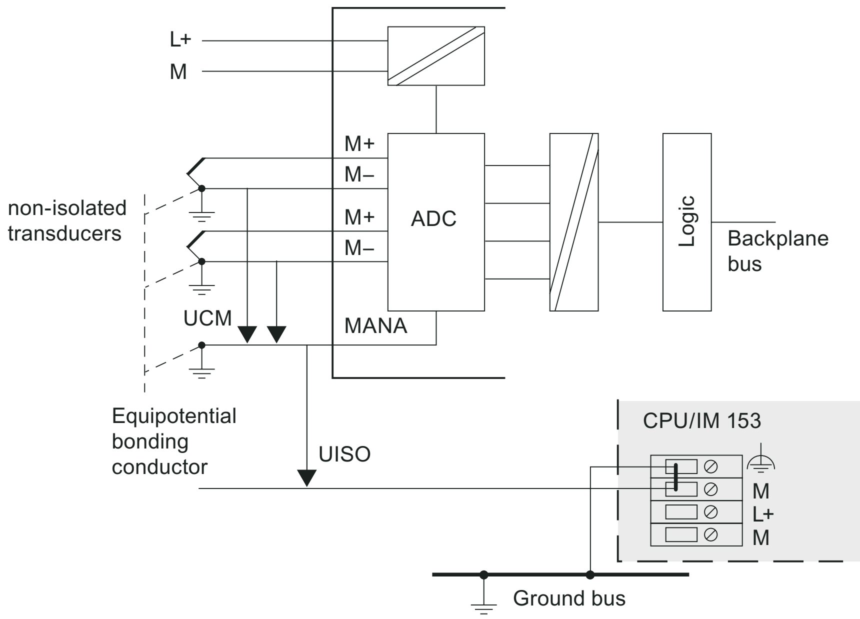


Figure 4-3 Wiring non-isolated transducer to electrically isolated AI

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.

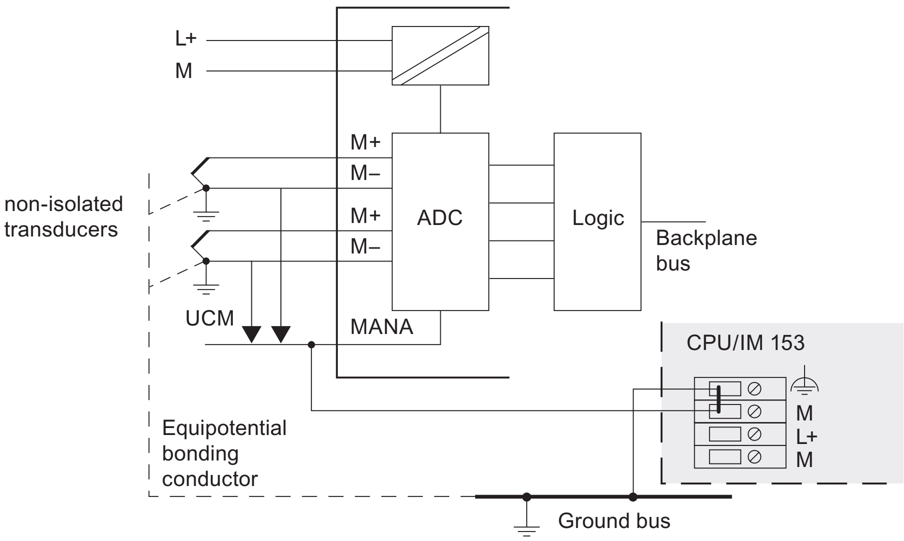


Figure 4-4 Wiring non-isolated transducers to a non-isolated AI

Note

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

4.3 Wiring and connecting voltage transducers

Introduction

This chapter describes how to wire and connect voltage transducers and and the corresponding items to be observed.

Wiring and connecting voltage transducers

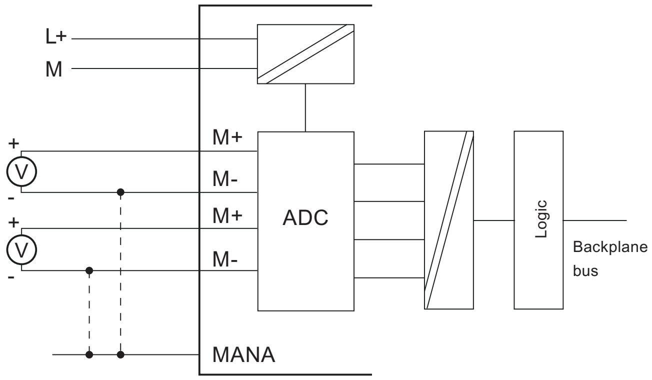


Figure 4-5 Wiring and connecting voltage transducers to electrically isolated AI

4.4 Wiring and connecting current transducers

Introduction

This chapter describes the wiring and connecting of current transducers and rules to be observed.

Supported current transducers

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

Wiring and connecting 2-wire transducers with power supply from the module

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

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

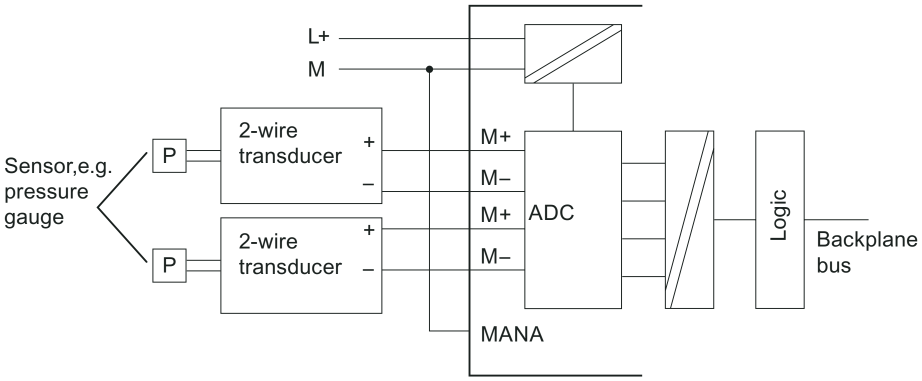


Figure 4-6 Wiring and connecting 2-wire transducers to electrically isolated AI

Wiring and connecting 2-wire transducers with power supply from L+

Configure the 2-wire as a 4-wire transducer in *STEP 7* if it is connected to supply voltage L+.

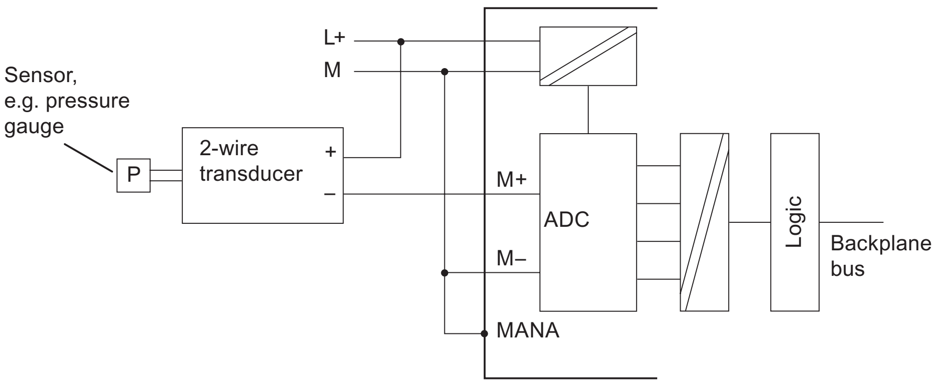


Figure 4-7 Wiring and connecting a 2-wire transducer with supply from L + to an electrically isolated AI

Wiring and connecting 4-wire transducers

4-wire transducers are connected to a separately power supply.

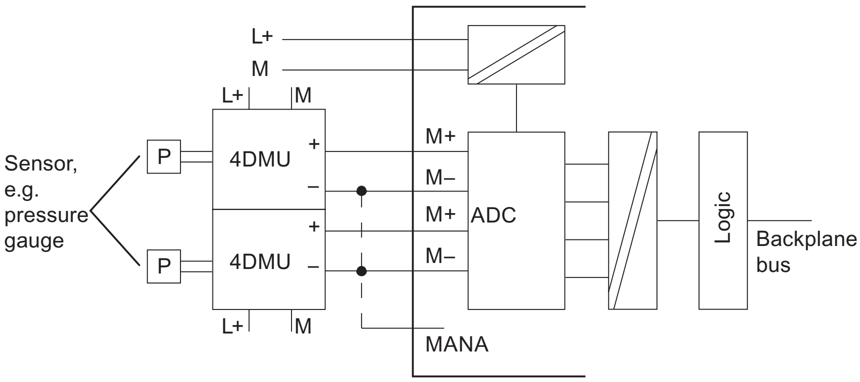


Figure 4-8 Wiring and connecting 4-wire transducers to electrically isolated AI

4.5 Wiring and connecting resistance thermometers and resistors

Introduction

This chapter describes the wiring and connecting of resistance thermometers and resistors and rules to be observed.

Supported resistance transducers

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

Wiring and connecting resistance thermometers and resistors

The module provides a constant current at terminals I_{C+} and I_{C-} for current measurements. The constant current is fed to the resistance for measuring its voltage potential. The constant current cables must be wired directly to the resistance thermometer/resistor.

Measurements programmed for 4-or 3-wire connections compensate for line resistance and return considerably higher precision compared to 2-wire connections.

Measurements with programmed 2-wire connections also record line impedance in addition to their internal resistance.

4-wire connection of a resistance thermometer

The voltage generated at the resistance thermometer is measured across the M_+ and M_- terminals. Observe the correct polarity when wiring and connecting the devices (I_{C+} and M_+, and I_{C-} and M- at the resistance thermometer).

Always wire and connect the I_C**+, M+**, I_C**- and M-** lines directly to the resistance thermometer.

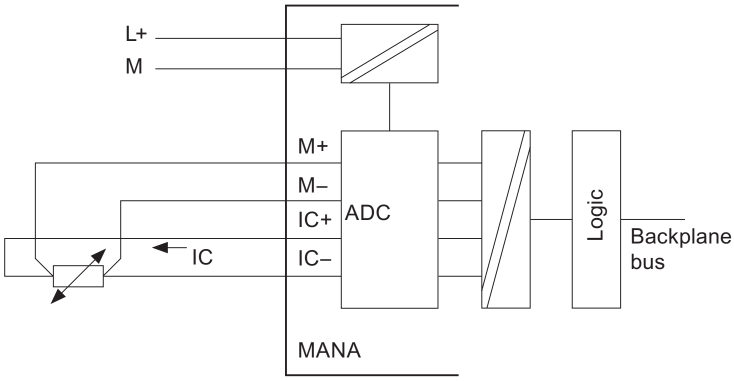


Figure 4-9 4-wire connection of resistance thermometers to an electrically isolated analog input

3-wire connection of a resistance thermometer

When connecting 3-wire devices to modules equipped with four terminals, you should generally **bridge M- and** I_C**-**. Always wire and connect the connected $_C$+ and M+ lines directly to the resistance thermometer.

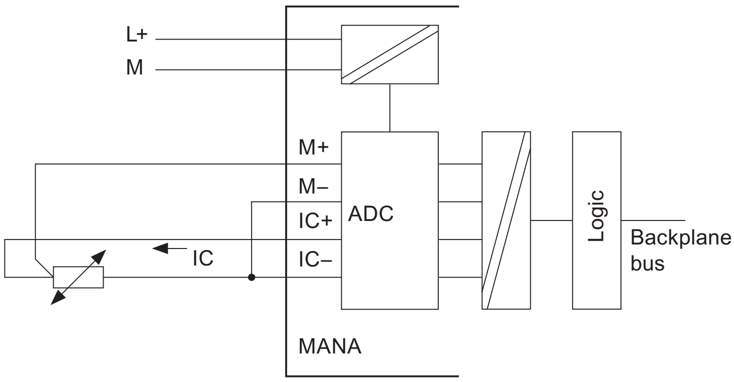


Figure 4-10 3-wire connection of resistance thermometers to an electrically isolated analog input

2-wire connection of a resistance thermometer

For 2-wire connections, insert a bridge between the M_+ and I_{C+} and between the M- and I_{C-} terminals of the module. The line impedance is included in the measurement.

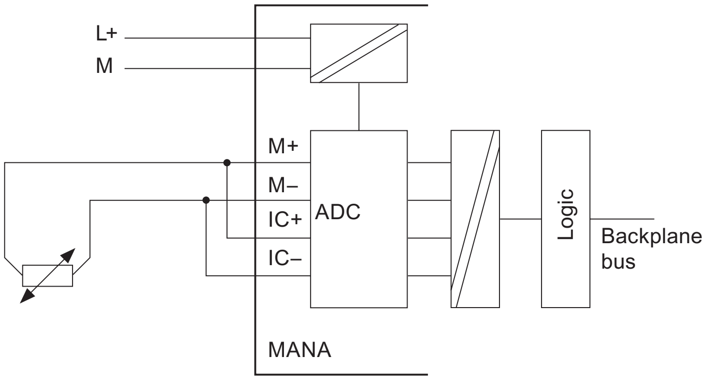


Figure 4-11 2-wire connection of resistance thermometers to an electrically isolated analog input

4.6 Wiring and connecting thermocouples

Introduction

This chapter describes the wiring and connecting of thermocouples and corresponding rules to be observed.

Supported thermocouples (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.

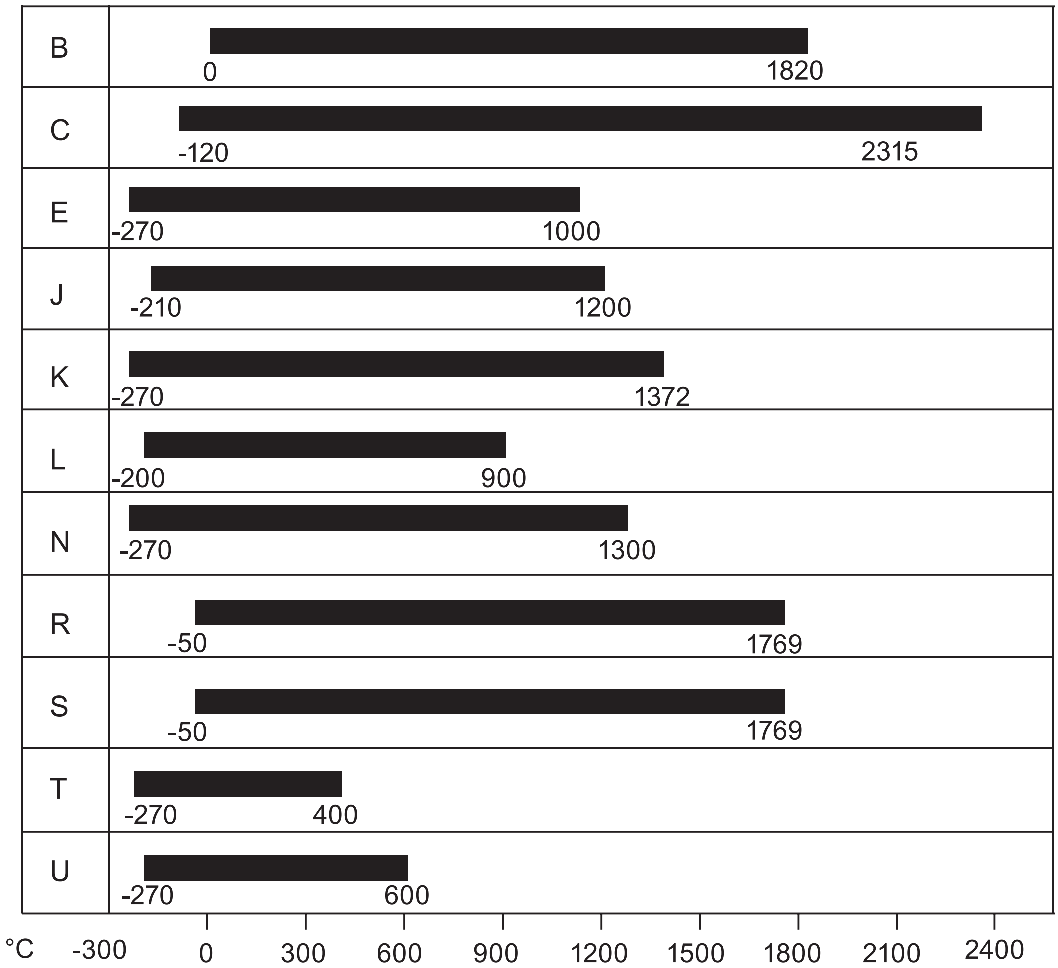


Figure 4-12 Thermocouples and their ranges

Thermocouple structure

Thermocouples consist of a pair of thermal probes and all necessary installation and connecting parts. The thermocouple pair 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 different material compositions. The measuring principle of all thermocouples is the same, irrespective of their type.

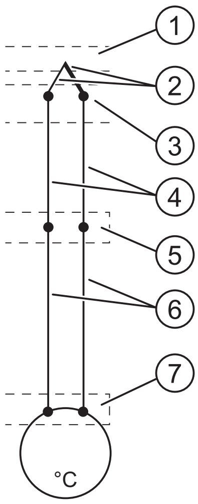


Figure 4-13 Fig. 4-22 Structure of thermocouples

①	Measurement point
②	Thermocouple with positive and negative thermal elements
③	Terminal
④	Compensating line
⑤	Reference junction
⑥	Supply line
⑦	Thermal voltage acquisition point

Operating principle of thermocouples

Any temperature difference between the measuring point and the free ends of the thermocouple (point of connection) generates a thermoelectric voltage. The thermoelectric voltage is a function of the temperature difference between the measuring point and the free ends, and is also determined by the material composition of the thermal elements.

As thermocouples always sense temperature differences, it is essential to maintain the free ends at the known temperature of a reference junction in order to be able to determine the temperature at the measuring point.

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

Note

Make sure of the correct polarity in order to avoid serious measuring errors.

Compensation for 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 obtain an absolute temperature value as a function of the temperature difference between the reference junction and the measuring point.

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

Options of compensating for the reference junction temperature

Table 4-1 Options of compensating for the reference junction temperature

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

See also

Wiring and connecting thermocouples with internal compensation (Page 187)

Wiring and connecting thermocouples with external compensation (Page 187)

Wiring and connecting transducers to analog inputs (Page 173)

4.6.1 Wiring and 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.

Note that internal compensation is not as accurate as external compensation.

Wiring and 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.

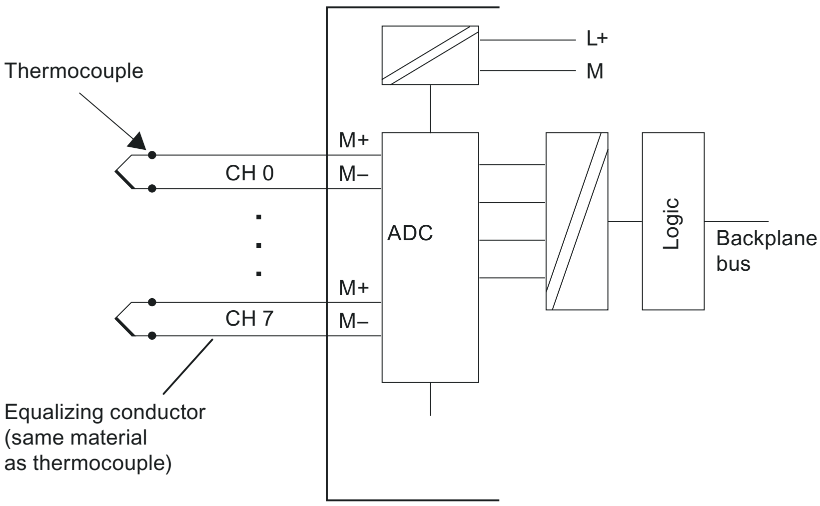


Figure 4-14 Wiring and connecting thermocouples with internal compensation to electrically isolated analog inputs

4.6.2 Wiring and 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 and connecting 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 *Wiring and connecting thermocouples with reference junction (order no. M72166-xxx00).*

Restrictions:

- The channel group parameters always apply to the all its channels (for example, input voltage, integrating time etc.)
- For external compensation with wiring and connecting 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.

Wiring and connecting thermocouples via compensating box

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

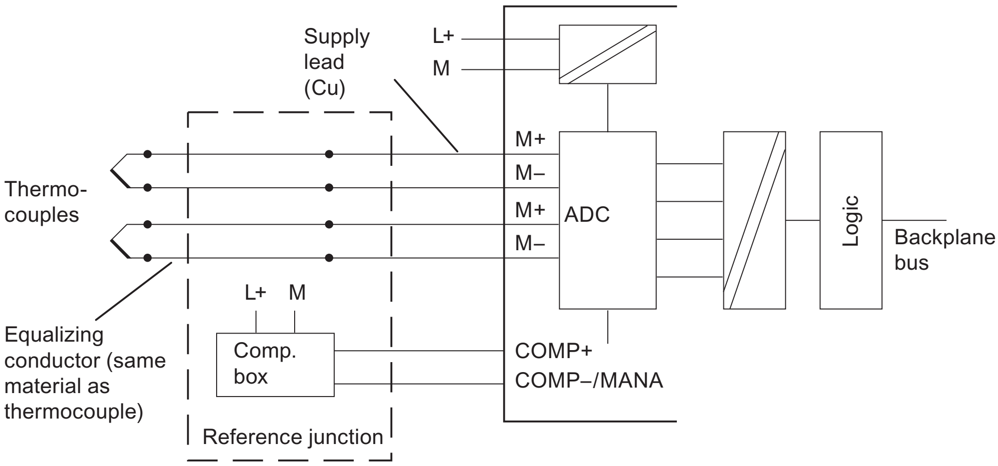


Figure 4-15 Wiring and connecting thermocouples to electrically isolated analog inputs via compensation box

---

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		B1
	24 VAC		B2
	24 VDC		B3
	110 VAC		B4
Wiring and connecting to thermocouple			
	Fe-CuNi	Type L	1
	Fe/Cu Ni	Type J	2
	Ni Cr/Ni	Type K	3
	Pt 10% Rh/Pt	Type S	4
	Pt 13% Rh/Pt	Type R	5
	Cu/Cu Ni	Type U	6
	Cu/Cu Ni	Type T	7
Reference temperature 0 °C			

Wiring and 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:

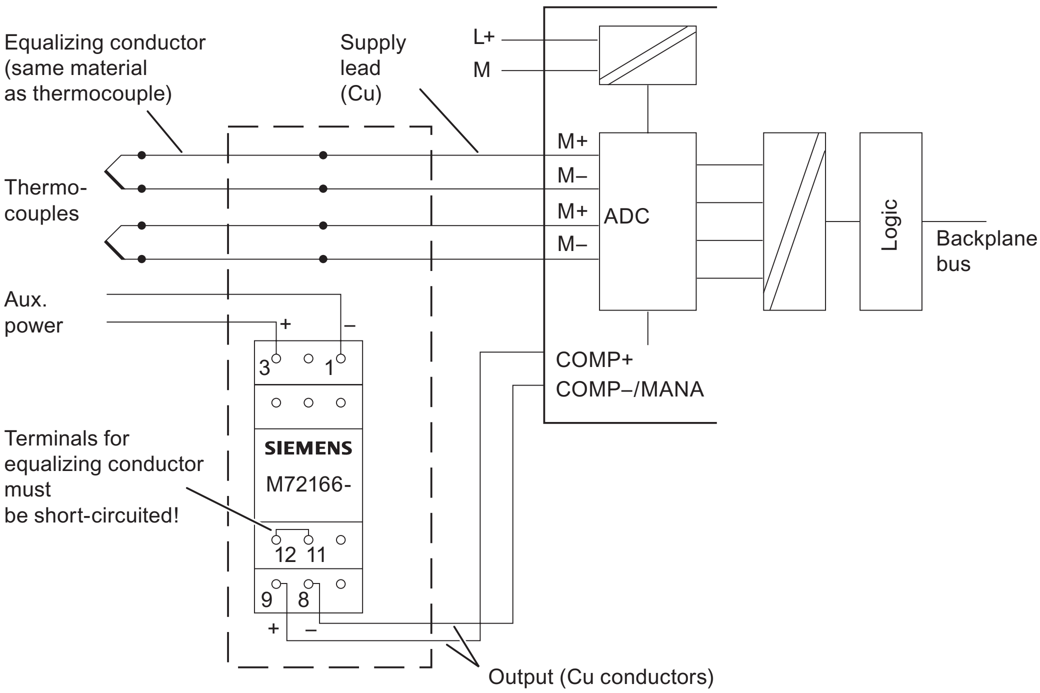


Figure 4-16 Wiring and connecting thermocouples with reference junction (order no. M72166-xxx00)

4.7 Wiring and connecting loads/actuators to analog outputs

Wiring and connecting loads/actuators to analog outputs

The analog output modules can be used as current or voltage source for 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 disturbance on analog signals. Avoid this situation by grounding only one end of the shielding.

Electrically isolated analog output modules

Electrically isolated analog output modules do not have a galvanic interconnection between the reference point of measuring circuit M_{ANA} and the CPU's M terminal.

Always use electrically isolated analog input modules if there is any risk of 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 Wiring and connecting loads/actuators to voltage outputs

Wiring and connecting loads to a voltage output

The voltage outptus support the wiring and connecting of 2-wire and 4-wire loads. Certain analog output modules, however, do not support both types of wiring and connecting.

Wiring 4-wire loads to the voltage output of an electrically isolated module

The 4-wire load circuit returns high precision. Wiring and connecting the S- and S+ sense lines directly to the load. This allows direct measurement and correction of the load voltage.

Interference or voltage dips may lead to potential differences between the sense line S- and the reference loop of analog circuit M_{ANA}. This potential difference may not exceed set limits. Any potential difference above limits has a negative impact on analog signal precision.

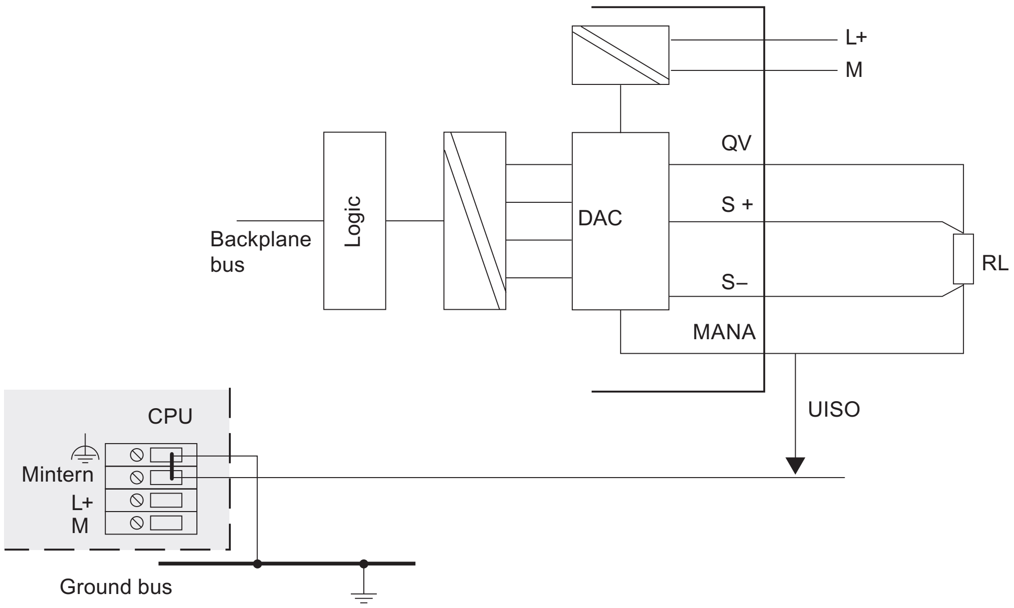


Figure 4-17 4-wire connection of loads to the voltage output of an electrically isolated analog output module

Wiring 2-wire loads to the voltage output of non-isolated module

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

A 2-wire circuit does not provide for compensation of line impedance.

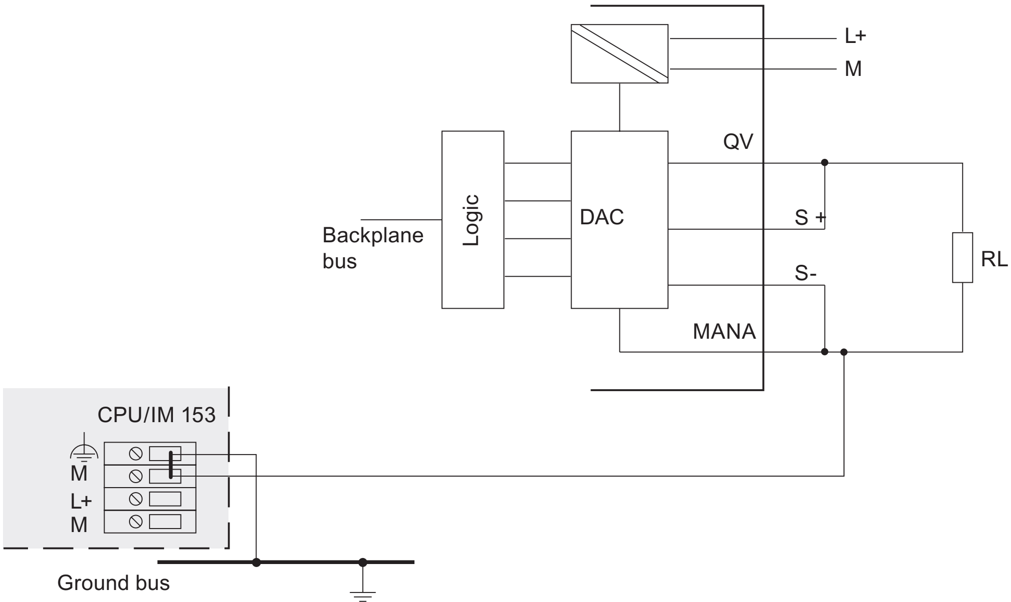


Figure 4-18 2-wire connection of loads to the voltage output of a non-isolated analog module

See also

Wiring and connecting loads/actuators to analog outputs (Page 190)

4.7.2 Wiring and connecting loads/actuators to current outputs

Wiring and connecting loads to a current output

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

Wiring and connecting loads to a current output of an electrically isolated module

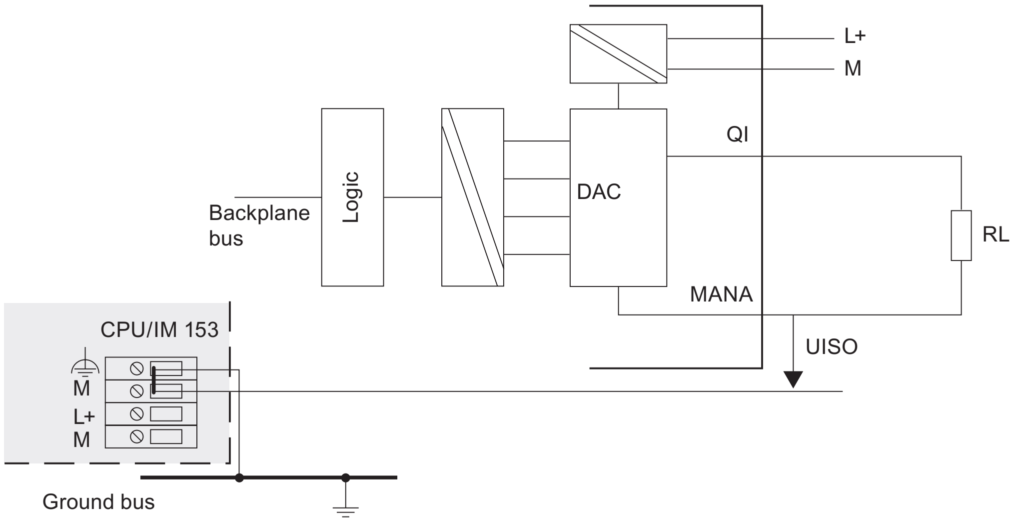


Figure 4-19 Wiring and connecting loads to a current output of an electrically isolated analog output module

Wiring and connecting loads to a current output of a non-isolated analog output module

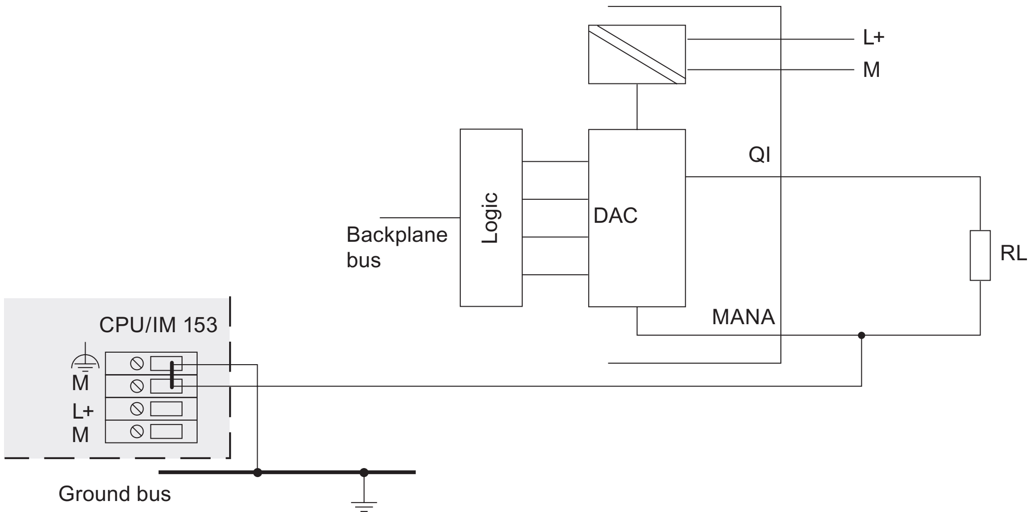


Figure 4-20 Wiring and connecting loads to a current output of a non-isolated analog output module

See also

Wiring and connecting loads/actuators to analog outputs (Page 190)

5 Representation of the analog values of analog modules

Introduction

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

Analog value conversion

The CPU always 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 rated range. Analog values are output as fixed point numbers with 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 values for 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	Rated range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	≤-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Undershoot range
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
-32768	≤-117.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

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 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	
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Rated range
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	Undershoot range range
-4864	-17.593	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	
-32768	≤-17.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

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	Rated range
20736	5100	7.5 V	3.75 V	1.875 V	0.75 V	
1	1	361.7 µV	180.8 µV	90.4 µV	36.17 µV	
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	
-32513	80FF					Underflow
-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	Rated range
20736	5100	375 mV	187.5 mV	60 mV	
1	1	18.08 µV	9.04 µV	2.89 µV	
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	Rated range
20736	5100	4 V	7.5 V	
1	1	1 V + 144.7 µV	0 V + 361.7 µV	
0	0	1 V	0 V	
-1	FFFF		Negative values are not supported	Undershoot range
-4864	ED00	0.296 V		
-4865	ECFF			Underflow
-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	Rated 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	

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	Rated 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 kΩ; 10 kΩ and from 150 Ω to 600 Ω resistive transducers

System		Resistive transducer range					
dec	hex	6kΩ	10 kΩ	150 Ω	300 Ω	600 Ω	
32767	7FFF	7.111 kΩ	11.852 kΩ	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 kΩ	11.759 kΩ	176.38 Ω	352.77 Ω	705.53 Ω	Overshoot range
27649	6C01						
27648	6C00	6.0 kΩ	10 kΩ	150 Ω	300 Ω	600 Ω	Rated range
20736	5100	4.5 kΩ	7.5 kΩ	112.5 Ω	225 Ω	450 Ω	
1	1	217.0 mΩ	361.7 mΩ	5.43 mΩ	10.85 mΩ	21.70 mΩ	
0	0	0 Ω	0 Ω	0 Ω	0 Ω	0 Ω	
		(negative values are physically impossible)					Undershoot range

Representation of analog values for resistance thermometers Pt x00 and Pt x00 GOST (0.003850) standard

Table 5-11 Representation 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	hex		dec	hex		dec	hex	
> 1000,0	32767	7FFF$_H$	> 1832,0	32767	7FFF$_H$	> 1273,2	32767	7FFF$_H$	Overflow
1000,0 : 850,1	10000 : 8501	2710$_H$: 2135$_H$	1832,0 : 1562,1	18320 : 15621	4790$_H$: 3D05$_H$	1273,2 : 1123,3	12732 : 11233	31BC$_H$: 2BE1$_H$	Overshoot range
850,0 : -200,0	8500 : -2000	2134$_H$: F830$_H$	1562,0 : -328,0	15620 : -3280	3D04$_H$: F330$_H$	1123,2 : 73,2	11232 : 732	2BE0$_H$: 2DC$_H$	Rated range
-200,1 : -243,0	-2001 : -2430	F82F$_H$: F682$_H$	-328,1 : -405,4	-3281 : -4054	F32F$_H$: F02A$_H$	73,1 : 30,2	731 : 302	2DB$_H$: 12E$_H$	Undershoot range
< - 243,0	-32768	8000$_H$	< - 405,4	-32768	8000$_H$	< 30,2	32768	8000$_H$	Underflow

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	hex		dec	hex	
> 1295,0	32767	7FFF$_H$	> 2363,0	32767	7FFF$_H$	Overflow
1295,0 : 1100,1	12950 : 11001	3296$_H$: 2AF9$_H$	2363,0 : 2012,1	23630 : 20121	5CE4$_H$: 4E99$_H$	Overshoot range
1100,0 : -260,0	11000 : -2600	2AF8$_H$: F5D8$_H$	2012,0 : -436,0	20120 : -4360	4E98$_H$: EEF8$_H$	Rated range
-260,1 : -273,2	-2601 : -2732	F5D7$_H$: F554$_H$	-436,1 : -459,7	-4361 : -4597	EEF7$_H$: EE0B$_H$	Undershoot range
< - 273,2	-32768	8000$_H$	< - 459,7	-32768	8000$_H$	Underflow

Representation of analog values for resistance thermometers Pt x00 and Pt x0 GOST (0.003850) standard

Table 5-13 Representation of analog values for resistance thermometers Pt 100, 200, 500,1000 and 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	hex		dec	hex	
> 155,00	32767	7FFF$_H$	> 311,00	32767	7FFF$_H$	Overflow
155,00 : 130,01	15500 : 13001	3C8C$_H$: 32C9$_H$	311,00 : 266,01	31100 : 26601	797C$_H$: 67E9$_H$	Overshoot range
130,00 : -120,00	13000 : -12000	32C8$_H$: D120$_H$	266,00 : -184,00	26600 : -18400	67E8$_H$: B820$_H$	Rated range
-120,01 : -145,00	-12001 : -14500	D11F$_H$: C75C$_H$	-184,01 : -229,00	-18401 : -22900	B81F$_H$: A68C$_H$	Undershoot range
< - 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	hex		dec	hex		dec	hex	
> 295.0	32767	7FFF$_H$	> 563.0	32767	7FFF$_H$	> 568.2	32767	7FFF$_H$	Overflow
295.0 : 250.1	2950 : 2501	B86$_H$: 9C5$_H$	563.0 : 482.1	5630 : 4821	15FE$_H$: 12D5$_H$	568.2 : 523.3	5682 : 5233	1632$_H$: 1471$_H$	Overshoot range
250.0 : -60.0	2500 : -600	9C4$_H$: FDA8$_H$	482.0 : -76.0	4820 : -760	12D4$_H$: FD08$_H$	523.2 : 213.2	5232 : 2132	1470$_H$: 854$_H$	Rated range
-60.1 : -105.0	-601 : -1050	FDA7$_H$: FBE6$_H$	-76.1 : -157.0	-761 : -1570	FD07$_H$: F9DE$_H$	213.1 : 168.2	2131 : 1682	853$_H$: 692$_H$	Undershoot range
< -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	hex		dec	hex	
> 295.00	32767	$7FFF_H$	> 325.11	32767	$7FFF_H$	Overflow
295.00 : 250.01	29500 : 25001	$733C_H$: $61A9_H$	327.66 : 280.01	32766 : 28001	$7FFE_H$: $6D61_H$	Overshoot range
250.00 : -60.00	25000 : -6000	$61A8_H$: $E890_H$	280.00 : -76.00	28000 : -7600	$6D60_H$: $E250_H$	Rated range
-60.01 : -105.00	-6001 : -10500	$E88F_H$: $D6FC_H$	-76.01 : -157.00	-7601 : -15700	$E24F_H$: $C2AC_H$	Undershoot range
< - 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	hex		dec	hex	
> 212.4	32767	$7FFF_H$	> 414.3	32767	$7FFF_H$	Overflow
212.4 : 180.1	2124 : 1801	$084C_H$: 0709_H	414.3 : 356.1	4143 : 3561	$102F_H$: $0DE9_H$	Overshoot range
180.0 : -60.0	1800 : -600	0708_H : $FDA8_H$	356.0 : -76.0	3560 : -760	$0DE8_H$: $FD08_H$	Rated range
-60.1 : -105.0	-601 : -1050	$FDA7_H$: $FBE6_H$	-76.1 : -157.0	-761 : -1570	$FD07_H$: $F9DE_H$	Undershoot range
< - 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	hex		dec	hex	
> 212.40	32767	7FFF$_H$	> 414.30	32767	7FFF$_H$	Overflow
212.40 : 180.1	2124 : 1801	084C$_H$: 0709$_H$	414.30 : 356.10	41430 : 35610	A1D6$_H$: 8B1A$_H$	Overshoot range
180.0 : -60.0	1800 : -600	0708$_H$: FDA8$_H$	356.00 : -76.00	35600 : -7600	8B10$_H$: E250$_H$	Rated range
-60.1 : -105.0	-601 : -1050	FDA7$_H$: FBE6$_H$	-76.10 : -157.00	-7610 : -15700	E246$_H$: C2AC$_H$	Undershoot range
< - 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	hex		dec	hex		dec	hex	
> 312.0	32767	7FFF$_H$	> 593.6	32767	7FFF$_H$	> 585.2	32767	7FFF$_H$	Overflow
312.0 : 260.1	3120 : 2601	C30$_H$: A29$_H$	593.6 : 500.1	5936 : 5001	1730$_H$: 12D5$_H$	585.2 : 533.3	5852 : 5333	16DC$_H$: 14D5$_H$	Overshoot range
260.0 : -200.0	2600 : -2000	A28$_H$: F830$_H$	500.0 : -328.0	5000 : -3280	1389$_H$: F330$_H$	533.2 : 73.2	5332 : 732	14D4$_H$: 2DC$_H$	Rated range
-200.1 : -240.0	-2001 : -2400	F82F$_H$: F6A0$_H$	-328.1 : -400.0	-3281 : -4000	F32F$_H$: F060$_H$	73.1 : 33.2	731 : 332	2DB$_H$: 14C$_H$	Undershoot range
< - 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	hex		dec	hex	
> 180.00	32767	$7FFF_H$	> 325.11	32767	$7FFF_H$	Overflow
180.00 : 150.01	18000 : 15001	4650_H : $3A99_H$	327.66 : 280.01	32766 : 28001	$7FFE_H$: $6D61A_H$	Overshoot range
150.00 : -50.00	15000 : -5000	$3A98_H$: $EC78_H$	280.00 : -5.,00	28000 : -5800	$6D60_H$: $E958_H$	Rated range
-50.01 : -60.00	-5001 : -6000	$EC77_H$: $E890_H$	-58.01 : -76.00	-5801 : -7600	$E957_H$: $E250_H$	Undershoot range
< - 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	hex		dec	hex	
> 240.0	32767	$7FFF_H$	> 325.11	32767	$7FFF_H$	Overflow
240.0 : 200.1	2400 : 15001	4650_H : $3A99_H$	327.66 : 28.01	32766 : 28001	$7FFE_H$: $6D61A_H$	Overshoot range
200.0 : -50.0	15000 : -5000	$3A98_H$: $EC78_H$	280.00 : -58.00	28000 : -5800	$6D60_H$: $E958_H$	Rated range
-50.1 : -60.0	-5001 : -6000	$EC77_H$: $E890_H$	-58.01 : -76.00	-5801 : -7600	$E957_H$: $E250_H$	Undershoot range
< - 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	hex		dec	hex	
> 180.00	32767	$7FFF_H$	> 325.11	32767	$7FFF_H$	Overflow
180,00 : 150.01	18000 : 15001	4650_H : $3A99_H$	327.66 : 280,01	32766 : 28001	$7FFE_H$: $6D61A_H$	Overshoot range
150.00 : -50.00	15000 : -5000	$3A98_H$: $EC78_H$	280.00 : -58.00	28000 : -5800	$6D60_H$: $E958_H$	Rated range
-50.01 : -60.00	-5001 : -6000	$EC77_H$: $E890_H$	-58.01 : -76.00	-5801 : -7600	$E957_H$: $E250_H$	Undershoot range
< - 60.00	-32768	8000_H	< - 76.00	-32768	8000_H	Underflow

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	hex		dec	hex		dec	hex	
> 2070.0	32767	$7FFF_H$	> 3276.6	32767	$7FFF_H$	> 2343.2	32767	$7FFF_H$	Overflow
2070.0 : 1821.0	20700 : 18210	$50DC_H$: 4722_H	3276.6 : 2786.6	32766 : 27866	$7FFE_H$: $6CDA_H$	2343.2 : 2094.2	23432 : 20942	$5B88_H$: $51CE_H$	Overshoot range
1820.0 : 0.0	18200 : 0	4718_H : 0000_H	2786.5 : 32.0	27865 : 320	$6CD9_H$: 0140_H	2093.2 : 273.2	20932 : 2732	$51C4_H$: $0AAC_H$	Rated range
: -120.0	: -1200	: $FB50_H$	: -184.0	: -1840	: $F8D0_H$	: 153.2	: 1532	: $05FC_H$	Undershoot range
< -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	hex		dec	hex	
> 2500.0	32767	$7FFF_H$	> 3276.6	32767	$7FFF_H$	Overflow
2500.0 : 2315.1	25000 : 23151	$61A8_H$: $5A6F_H$	3276.6 : 2786.6	32766 : 27866	$7FFE_H$: $6CDA_H$	Overshoot range
2315.0 : 0.0	23150 : 0	$5A6E_H$: 0000_H	2786.5 : 32.0	27865 : 320	$6CD9_H$: 0140_H	Rated range
0.1 : -120.0	-1 : -1200	$FFFF_H$: $FB50_H$	31.9 : -184.0	319 : -1840	$013F_H$: $F8D0_H$	Undershoot range
< -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	hex		dec	hex		dec	hex	
> 1200.0	32767	$7FFF_H$	> 2192.0	32767	$7FFF_H$	> 1473.2	32767	$7FFF_H$	Overflow
1200.0 : 1000.1	12000 : 10001	$2EE0_H$: 2711_H	2192.0 : 1833.8	21920 : 18338	$55A0_H$: $47A2_H$	1473.2 : 1274.2	14732 : 12742	$398C_H$: $31C6_H$	Overshoot range
1000.0 : -270.0	10000 : -2700	2710_H : $F574_H$	1832.0 : -454.0	18320 : -4540	4790_H : $EE44_H$	1273.2 : 0	12732 : 0	$31BC_H$: 0000_H	Rated range
< -270.0	< -2700	< $F574_H$	< -454.0	< -4540	< $EE44_H$	<0	<0	< 0000_H	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... $F0C4_H$ and outputs the value 8000_H.			... $FB70_H$ and outputs the value 8000_H.			... $E5D4_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 1450.0	32767	7FFF$_H$	> 2642.0	32767	7FFF$_H$	> 1723.2	32767	7FFF$_H$	Overflow
1450.0 : 1201.0	14500 : 12010	38A4$_H$: 2EEA$_H$	2642.0 : 2193.8	26420 : 21938	6734$_H$: 55B2$_H$	1723.2 : 1474.2	17232 : 14742	4350$_H$: 3996$_H$	Overshoot range
1200.0 : -210.0	12000 : -2100	2EE0$_H$: F7CC$_H$	2192.0 : -346.0	21920 : -3460	55A0$_H$: F27C$_H$	1473.2 : 63.2	14732 : 632	398C$_H$: 0278$_H$	Rated range
< -210.0	< -2100	<F7CC$_H$	< -346,0	< -3460	<F27C$_H$	< 63.2	< 632	< 0278$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F31C$_H$ and outputs the value 8000$_H$.			... EA0C$_H$ and outputs the value 8000$_H$.			... FDC8$_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 1622.0	32767	7FFF$_H$	> 2951.6	32767	7FFF$_H$	> 1895.2	32767	7FFF$_H$	Overflow
1622.0 : 1373.0	16220 : 13730	3F5C$_H$: 35A2$_H$	2951.6 : 2503.4	29516 : 25034	734C$_H$: 61CA$_H$	1895.2 : 1646.2	18952 : 16462	4A08$_H$: 404E$_H$	Overshoot range
1372.0 : -270.0	13720 : -2700	3598$_H$: F574$_H$	2501.6 : -454.0	25061 : -4540	61B8$_H$: EE44$_H$	1645.2 : 0	16452 : 0	4044$_H$: 0000$_H$	Rated range
< -270.0	< -2700	< F574$_H$	< -454.0	< -4540	<EE44$_H$	< 0	< 0	< 0000$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F0C4$_H$ and outputs the value 8000$_H$.			... E5D4$_H$ and outputs the value 8000$_H$.			... FB70$_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 1150.0	32767	7FFF$_H$	> 2102.0	32767	7FFF$_H$	> 1423.2	32767	7FFF$_H$	Overflow
1150.0 : 901.0	11500 : 9010	2CEC$_H$: 2332$_H$	2102.0 : 1653.8	21020 : 16538	521C$_H$: 409A$_H$	1423.2 : 1174.2	14232 : 11742	3798$_H$: 2DDE$_H$	Overshoot range
900.0 : -200.0	9000 : -2000	2328$_H$: F830$_H$	1652.0 : -328.0	16520 : -3280	4088$_H$: F330$_H$	1173.2 : 73.2	11732 : 732	2DD4$_H$: 02DC$_H$	Rated range
< -200.0	< -2000	< F830$_H$	< -328.0	< -3280	< F330$_H$	< 73.2	< 732	<02DC$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F380$_H$ and outputs the value 8000$_H$.			... EAC0$_H$ and outputs the value 8000$_H$.			... FE2C$_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 1550.0	32767	7FFF$_H$	> 2822.0	32767	7FFF$_H$	> 1823.2	32767	7FFF$_H$	Overflow
1550.0 : 1300.1	15500 : 13001	3C8C$_H$: 32C9$_H$	2822.0 : 2373.8	28220 : 23738	6E3C$_H$: 5CBA$_H$	1823.2 : 1574.2	18232 : 15742	4738$_H$: 3D7E$_H$	Overshoot range
1300.0 : -270.0	13000 : -2700	32C8$_H$: F574$_H$	2372.0 : -454.0	23720 : -4540	5CA8$_H$: EE44$_H$	1573.2 : 0	15732 : 0	3D74$_H$: 0000$_H$	Rated range
< -270.0	< -2700	< F574$_H$	< -454.0	< -4540	<EE44$_H$	< 0	< 0	< 0000$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F0C4$_H$ and outputs the value 8000$_H$.			... E5D4$_H$ and outputs the value 8000$_H$.			... FB70$_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 2019.0	32767	7FFF$_H$	> 3276.6	32767	7FFF$_H$	> 2292.2	32767	7FFF$_H$	Overflow
2019.0 : 1770.0	20190 : 17770	4EDE$_H$: 4524$_H$	3276.6 : 3218.0	32766 : 32180	7FFE$_H$: 7DB4$_H$	2292.2 : 2043.2	22922 : 20432	598A$_H$: 4FD0$_H$	Overshoot range
1769.0 : -50.0	17690 : -500	451A$_H$: FE0C$_H$	3216.2 : -58.0	32162 : -580	7DA2$_H$: FDBC$_H$	2042.2 : 223.2	20422 : 2232	4FC6$_H$: 08B8$_H$	Rated range
-51.0 : -170.0	-510 : -1700	FE02$_H$: F95C$_H$	-59.8 : -274.0	-598 : -2740	FDAA$_H$: F54C$_H$	222.2 : 103.2	2222 : 1032	08AE$_H$: 0408$_H$	Undershoot range
< -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	hex		dec	hex		dec	hex	
> 540.0	32767	7FFF$_H$	> 1004.0	32767	7FFF$_H$	> 813.2	32767	7FFF$_H$	Overflow
540.0 : 401.0	5400 : 4010	1518$_H$: 0FAA$_H$	1004.0	10040	2738$_H$	813.2	8132	1FC4$_H$	Overshoot range
400.0 : -270.0	4000 : -2700	0FA0$_H$: F574$_H$	752.0 : -454.0	7520 : -4540	1D60$_H$: EE44$_H$	673.2 : 3.2	6732 : 32	1AAC$_H$: 0020$_H$	Rated range
< -270.0	< -2700	< F574$_H$	< -454.0	< -4540	<EE44$_H$	< 3.2	< 32	< 0020$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F0C4$_H$ and outputs the value 8000$_H$.			... E5D4$_H$ and outputs the value 8000$_H$.			... FB70$_H$ and outputs the value 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	hex		dec	hex		dec	hex	
> 850.0	32767	7FFF$_H$	> 1562.0	32767	7FFF$_H$	> 1123.2	32767	7FFF$_H$	Overflow
850.0 : 601.0	8500 : 6010	2134$_H$: 177A$_H$	1562.0 : 1113.8	15620 : 11138	2738.0$_H$: 2B82$_H$	1123.2 : 874.2	11232 : 8742	2BE0$_H$: 2226$_H$	Overshoot range
600.0 : -200.0	6000 : -2000	1770$_H$: F830$_H$	1112.0 : -328.0	11120 : -3280	2B70$_H$: F330$_H$	873.2 : 73.2	8732 : 732	221C$_H$: 02DC$_H$	Rated range
< -200.0	< -2000	< F830$_H$	< -328.0	< -3280	< F330$_H$	< 73.2	< 732	<02DC$_H$	Underflow
If the wiring is incorrect (polarity reversal, or open inputs, for example), or if a fault is generated at the transducer in the negative range (wrong type of thermocouple, for example), the analog input module reports an underflow when it detects a value below...									
... F380$_H$ and outputs the value 8000$_H$.			... EAC0$_H$ and outputs the value 8000$_H$.			... FE2C$_H$ and outputs the value 8000$_H$.			

Representation of analog values for type TXK/XKL GOST thermocouple

Table 5-32 Representation of analog values for type TXK/XKL GOST thermocouple

Type TXK/XKL in °C	Units		Type TXK/XKL in °F	Units		Range
	dec	hex		dec	hex	
> 1050.0	32767	7FFF$_H$	> 1922.0	32767	7FFF$_H$	Overflow
1050.0 : 800.1	8500 : 8001	2904$_H$: 1F41$_H$	1922.0 : 1472.1	19220 : 14721	4B14$_H$: 3981$_H$	Overshoot range
800.0 : 0.0 : -200.0	8000 : 0 : -2000	1F40$_H$: 0000$_H$: F830$_H$	1472.0 : 32.0 : -328.0	14720 : 320 : -3280	3980$_H$: 0140$_H$: F330$_H$	Rated range
< -200.0	<-32768	< F8000$_H$	< -328.0	<-32768	8000$_H$	Underflow

5.2 Representation of analog values for analog output channels

Binary representation of output ranges

Table 5-33 Bipolar output ranges

		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	Rated range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	≤100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Undershoot range
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
≤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	Rated 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	limited to the low limit of the rated range, 0 V or 0 mA
-32512		1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
≤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	Rated range
75 %	20736	5100	7.5 V	
0.003617 %	1	1	361.7 µV	
0 %	0	0	0 V	
	-1	FFFF	-361.7 µV	
-75 %	-20736	AF00	-7.5 V	
-100 %	-27648	9400	-10 V	
	-27649	93FF		Undershoot range
-117.593 %	-32512	8100	-11.76 V	
	-32513	80FF		Underflow, off power
-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	Rated range
75 %	20736	5100	7.5 V	3.75 V	
0.003617 %	1	1	361.7 µV	1 V +144.7 µV	
0 %	0	0	0 V	1 V	
	-1	FFFF			Undershoot range
-25 %	-6912	E500		0 V	
	-6913	E4FF			Not possible. Output value limited to 0 V.
-117.593 %	-32512	8100			
	-32513	80FF			Underflow, off power
-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	
75 %	20736	5100	15 mA	Rated range
0.003617 %	1	1	723.4 nA	
0 %	0	0	0 mA	
	-1	FFFF	-723.4 nA	
-75 %	-20736	AF00	-15 mA	
-100 %	-27648	9400	-20 mA	
	-27649	93FF		Undershoot range
-117.593 %	-32512	8100	-23.52 mA	
	-32513	80FF		Underflow, off power
-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	Rated 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 supported. Output value limited to 0 mA.
-117.593 %	-32512	8100			
	-32513	80FF			Underflow, off power
-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 of the analog input channel and STEP 7

The method to use for the various analog modules is module-specific and is described in detail in the special module chapters.

This section describes how to set up the type and range of measurement using measuring range modules.

Setting the measurement type and ranges using measuring range modules

The analog modules are supplied with corresponding measuring range modules as required.

You may have to change the position of the measuring range module to suit the measurement type and range.

Note

Note that the measuring range modules are installed on the side of the analog input module.

Always check whether the measuring range modules needs to be set up for a different measurement type and range **before** you install the analog input module.

Optional settings of the measuring range modules

Optional settings of the measuring range modules: "A", "B", "C" and "D".

For detailed information on settings to be made for a specific measurement type and range, refer to the special module chapter.

The settings for the different measurement types and ranges are also printed onto the analog module.

Changing the positioning of measuring range modules

To insert the measuring range module into a different slot:

1. Remove the measuring range module from the slot of the analog input module by lifting it out with a screwdriver.

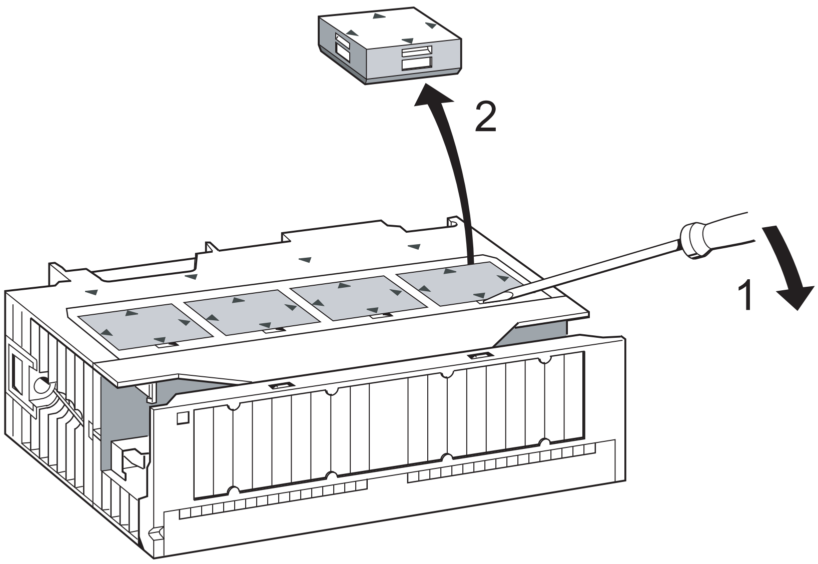


Figure 5-1 Removing the measuring range module from a slot of the analog input module

2. Insert the measuring range module into the required slot (1) of the analog input module.

   The indicator of the selected measuring range must be in line with the marker on the module (2).

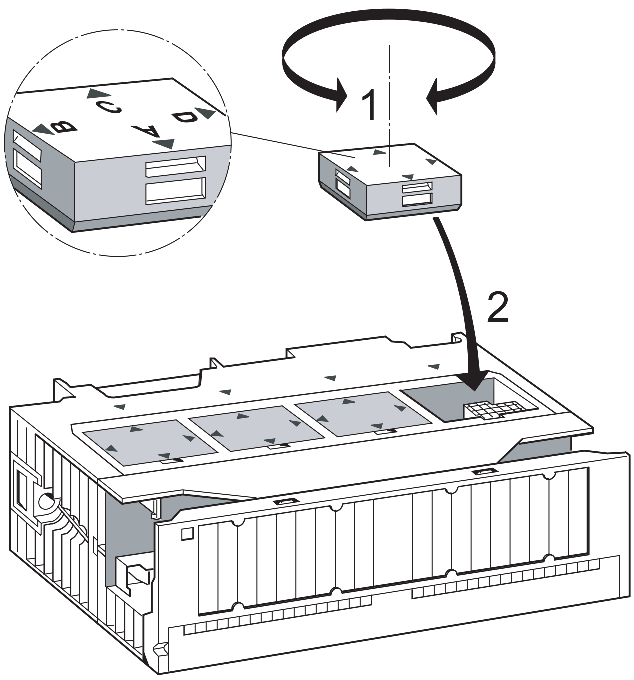


Figure 5-2 Inserting the measuring range module into the analog input module

Proceed likewise with any other measuring range modules.

You can now install the module.

> **Caution**
>
> Incorrect settings of the measuring range modules may lead to the destruction of the module.
>
> Always make sure that the measuring range module is in the correct position before you connect a sensor to the module.

5.4 Response 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 power supply and operating state

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 diagnostics buffer data.)

Diagnostics interrupt triggering is based on parameter settings.

See also

Programming analog modules (Page 225)

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 diagnostics 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
Rated 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	-	-	Process 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
Rated range	CPU value	-	-	-
Overshoot/undershoot range	CPU value	-	-	-
Overflow	0 signal	-	-	-
Underflow	0 signal	-	-	-

5.4.3 Influence of the operational 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: ±0,5 %

Hence, an output error of ±0.05 V (±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 ±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.

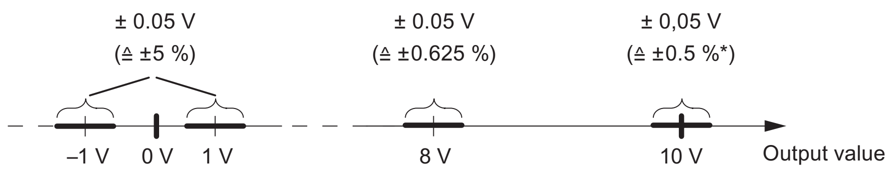


Figure 5-3 Example of the relative error of an analog output module

5.5 Conversion / cycle time 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.

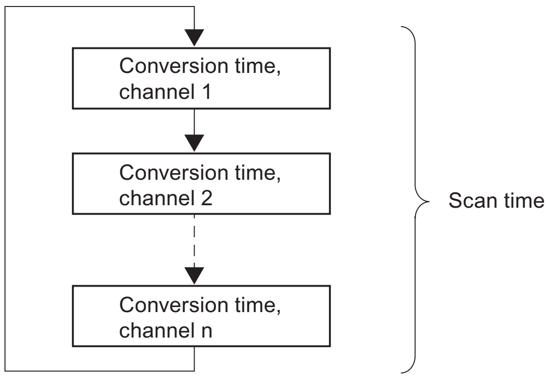


Figure 5-4 Cycle time of an analog input or output module

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.

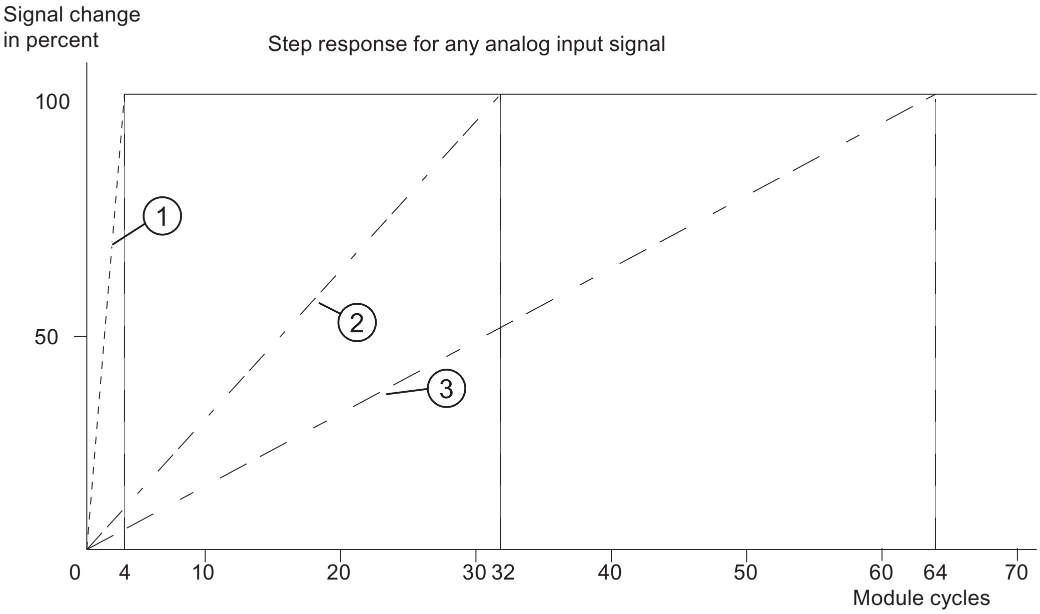


Figure 5-5 Example of impact of smoothing on the jump response with the AI 8 x 14 bit

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.

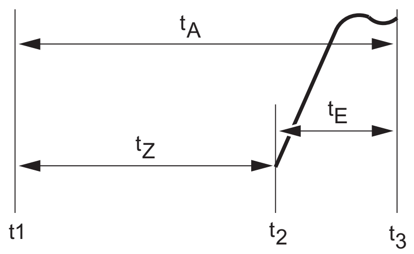
For information on settling times as a function of load at the various analog output modules, refer to the technical data of the relevant module.

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	tC = Cycle time, equivalent to n x conversion time (n = active channels)
t_S	Settling time
t_1	new digital output value is set
t_2	Output value is applied and converted
t_3	specified output value is 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 of analog modules

Programmable and non-programmable diagnostics messages

We distinguish between programmable and non-programmable diagnostics messages.

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

The the analog module always provides non-programmable diagnostics messages, irrespective of the enable state of diagnostics functions.

Reactions to a diagnostics message in *STEP 7*

Actions initiated by diagnostics messages:

- The diagnostics 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 Diagnostics Interrupt" is set in STEP 7, the system triggers a diagnostics interrupt and calls OB82.

Reading diagnostics 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.

Diagnostics 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 has generated a diagnostics message. It goes dark after all error states are cleared.

See also

Programming analog modules (Page 225)

5.8.1 Diagnostics messages of analog input modules

Overview of the diagnostics messages of analog input modules

The table below provides an overview of the diagnostics messages of analog input modules.

Table 5-42 Diagnostics 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 diagnostics messages of analog output modules

The table below provides an overview of the diagnostics 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

The detection of errors which are indicated in programmable diagnostics messages requires 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 errors
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	Potential difference C_{MV} between inputs M- and the reference potential of measuring circuit (M_{ANA} out of limits)	Connect M- with M_{ANA}
Wirebreak	Resistance of transducer circuit too high	Use a different type of sensor, 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	program a different measuring range
	polarity reversal of the sensor wiring in the measuring ranges 4 to 20 mA and 1 to 5 V	Check the connections
Overflow	Input value exceeds overshoot range	program a different 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 output 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 errors
External load voltage missing	Load voltage L+ of module missing	Connect supply L+
Configuration / programming error	Faulty parameters transferred to module	Assign new module parameters
Short-circuit to M	Overload at output	Eliminate overload
	Short-circuit at output Q_V to M_{ANA}	Eliminate the short-circuit
Wirebreak	Actuator impedance 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 the channel group ("output type" parameter)

5.9 Interrupts of analog modules

Introduction

This section describes the interrupt response of analog modules. Always distinguish between the following interrupts:

- Diagnostics interrupt
- Process interrupt

Note that certain analog modules do not support interrupts, or are only partially capable of "handling" the interrupts described below. For information on modules which support interrupt functionality, 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 are no default interrupt settings, that is, interrupts are disabled if not set accordingly. Program the interrupt enable parameter in *STEP 7*.

Diagnostics interrupt

Incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of diagnostics interrupt, if this interrupt is enabled.

The CPU interrupts user program execution in order to process diagnostics interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to view details of diagnostics data output by the module.

Diagnostics data remain consistent until the program exits OB82. The program acknowledges the diagnostics interrupt at the module when it exits OB82.

Process 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 process interrupt, provided the interrupt is enabled.

The CPU interrupts user program execution in order to execute process interrupt OB40.

In the user program of OB 40, you can define the reaction of the automation system to the violation of limits.

The program acknowledges the diagnostics interrupt at the module when it exits OB40.

Note

Note: the system does not generate a process interrupt if your limit setting exceeds the overshoot or undershoot range.

Structure of the start information variable OB40_POINT_ADDR of OB 40

The channel at which a specific limit is exceeded is logged to the OB40_POINT_ADDR variable in the start information of OB40. The diagram below shows the bit assignment of DWORD 8 in local data.

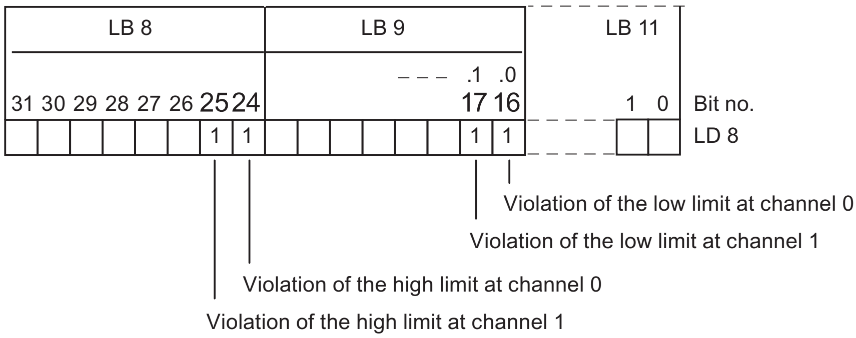


Figure 5-6 Start information of OB40: which limits event has triggered a process interrupt

Process interrupt triggered by "End of cycle reached"

You can synchronize a process with the cycle of the analog input module by programming a process interrupt trigger at the end of the cycle.

One cycle comprises the conversion of the measured values of all active channels of the analog input module. The module processes the channels in successive order. After all measured values were successfully converted, the module outputs an interrupt to the CPU in order to report new measured values at its channels.

You can always use this interrupt to download the actual converted analog values.

Analog modules 6

Introduction

This chapter describes:

1. Analog module selection and commissioning sequence
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 415)

Evaluating diagnostic data of signal modules in the user program (Page 459)

6.1 Analog module selection and commissioning sequence

Introduction

The table below contains the steps required to successfully complete commissioning of analog modules.

You do not strictly have to adhere to this suggested sequence, that is, you can complete other tasks such as installing or commissioning other modules, or program the module at an earlier or later time.

Analog module selection and commissioning sequence

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/en/

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	programmable for each channel group: • 15 bits+sign	programmable for each channel group: • 15 bits+sign	programmable for each channel group: • 13 bits+sign	programmable for each channel group: • 12 bits+sign
Measurement type	programmable for each channel group: • Voltage • Current	programmable for each channel group: • Voltage • Current	programmable for each channel group: • Voltage • Current	programmable 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
Diagnostics interrupt	programmable	programmable	programmable	no
Limit value monitoring	programmable for 2 channels	programmable for 8 channels	programmable for 2 channels	no
Process interrupt when limit exceeded	programmable	programmable	programmable	no
Process interrupt at end of cycle	no	yes	no	no

	Module			
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 for 2DMU)	electrically isolated to: • the backplane bus interface
maximum potential difference between inputs (ICM)	50 VDC	60 VDC	11 VDC	2.0 VDC
Special features	-	-	-	-
Sign 2DMU 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	programmable for each channel group: • 9 bits+sign • 12 bits+sign • 14 bits+sign	programmable for each channel group: • 9 bits+sign • 12 bits+sign • 14 bits+sign	programmable for each channel group: • 15 bits+sign	programmable for each channel group: • 15 bits+sign	programmable for each channel group: 15 bits+sign
Measurement type	programmable for each channel group: • Voltage • Current • Resistance • Temperature	programmable for each channel group: • Voltage • Current • Resistance • Temperature	programmable for each channel group: • Temperature	programmable for each channel group: • Resistance • Temperature	programmable 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
Diagnostics interrupt	programmable	programmable	programmable	programmable	programmable
Limit value monitoring	programmable for 2 channels	programmable for 1 channel	programmable for 8 channels	programmable for 8 channels	programmable for 8 channels

	Module				
Process interrupt when limit exceeded	programmable	programmable	programmable	programmable	programmable
Process interrupt at end of cycle	no	no	programmable	programmable	programmable
Potential ratios	electrically isolated to: • the CPU • load voltage (not for 2DMU)	electrically isolated to: • the CPU • load voltage (not for 2DMU)	electrically isolated to: • the CPU	electrically isolated to: • the CPU	electrically isolated to: • the CPU • load voltage (not for 2DMU)
maximum 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 2DMU 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 can download this manual from the Internet at: http://support.automation.siemens.com/WW/view/en/22063748.

6.2.2 Analog output modules

Overview of properties

The table below shows the analog output modules based on their essential properties

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 mA to 20mA) 15 bits +sign (4 mA to 20mA)
Output type	per channel: • Voltage • Current	per channel: • Voltage • Current	per channel: • Voltage • Current	per channel: • Voltage • Current	per channel: • Voltage • Current
Supports isochronous mode	no	yes	no	no	no
Programmable diagnostics	yes	yes	yes	yes	yes
Diagnostics interrupt	programmable	programmable	programmable	programmable	programmable
Substitution value output	no	programmable	programmable	programmable	programmable
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 can download this manual from the Internet at: http://support.automation.siemens.com/WW/view/en/22063748.

6.2.3 Analog I/O modules

Overview of properties

The table below shows the analog IO modules based on their essential properties

Table 6-4 Analog IO modules: Overview of properties

Properties	Modules	
	SM 334; AI 4/AO 2 x 8/8 Bit (-0CE01-)	SM 334; AI 4/AO 2 x 12 Bit (-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
Measurement type	programmable for each channel group: • Voltage • Current	programmable for each channel group: • Voltage • Resistance • Temperature
Output type	per channel: • Voltage • Current	per channel: • Voltage
Supports isochronous mode	no	no
Programmable diagnostics	no	no
Diagnostics interrupt	no	no
Limit value monitoring	no	no
Process interrupt when limit is exceeded	no	no
Process interrupt at end of cycle	no	no
Substitute value output	no	no
Potential ratios	• connected to potential of the 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
- Programmable measurement type at each channel group
  - Voltage
  - Current
- Programmable resolution per channel group (15 bits + sign)
- Any measuring range per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 2 channels
- Programmable process interrupt when limit is exceeded
- High-speed measured value update
- Electrically isolated to the CPU

Resolution

The resolution of measured values is independent of the selected integration time.

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups 0 and 1 can be programmed in *STEP 7*. However, set a process interrupt only for the first channel of a channel group, that is, either at channel 0, or at channel 2

High-speed update of measured values

A high-speed update of measured values at two channels of a channel group is three times compared to the activation of several channel groups.

Example: When channels 0 and 1 are active with 2.5 ms filtering, both channels return new measured values to the PLC at intervals of 10 ms. (with other settings, the refresh rate is equivalent to the filter setting.)

High-speed update of measured values is only possible if both channels of channel group 0 and 1 are active, that is, 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 diagrams below show various wiring options

Wiring: Voltage and current measurement

Wire the voltage inputs of the channel voltage in parallel using the corresponding shunt resistor when measuring current. Bridge the channel input terminals with the adjacent connector terminals.

Example: You configure channel 0 for current measurement by bridging terminals 22 and 2, and terminals 23 to 3.

At the channel configured for current measurements, connect the shunt resistor to the adjacent channel terminals in order to achieve the specified precision.

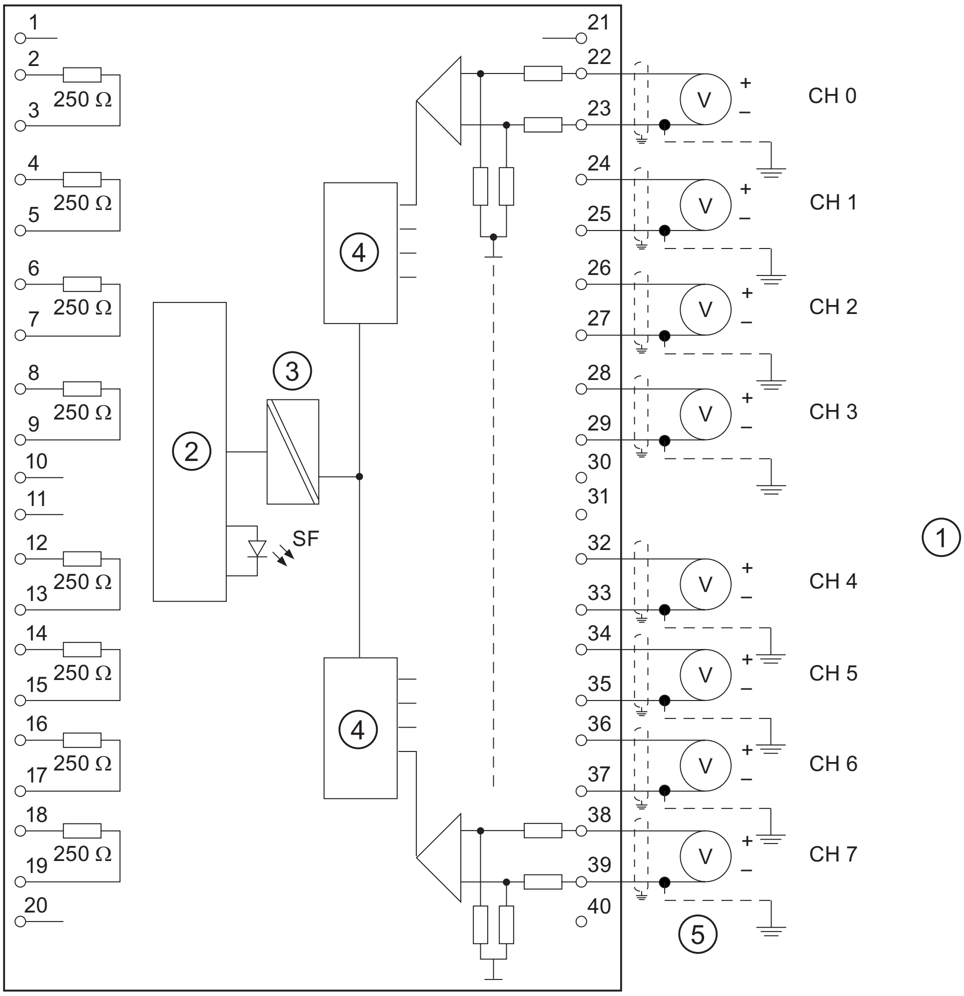


Figure 6-1 Wiring and block diagrams

① Voltage measurement
② Backplane bus interface
③ Electrical isolation
④ Analog-to-Digital Converter (ADC)
⑤ Equipotential bonding

Wiring: 2-wire and 4-wire transducer

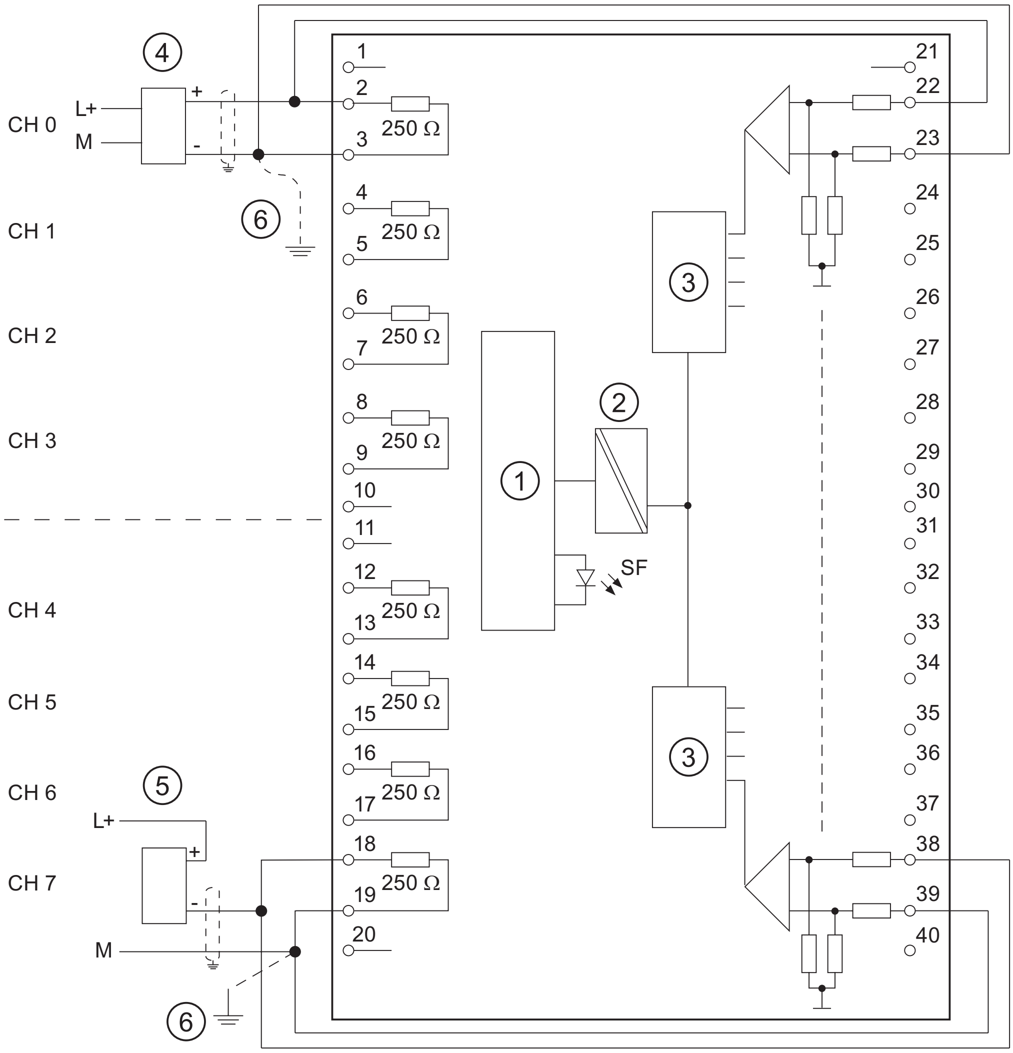


Figure 6-2 Wiring and block diagrams

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	Equipotential bonding

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			
Maximum 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			
Generation 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 and error limits				
Noise suppression at f = n (f1 1%), (f1 = interference frequency); n= 1, 2, ...				
• Common-mode noise (CMV < 50 V) • Series mode interference (peak value of interference < rated input range)	> 100 dB > 90 dB			
Crosstalk between inputs	> 100 dB			
Operational error limit (across temperature range, relative to input range)	C_{MV} = 0 / CMV = ±50 V			
• Voltage input • Current input	±0,1% / ± 0,7% ±0,3% / ± 0,9%			

Technical data		
Basic error limit (operational error limit at 25 °C relative to input range)		
• Voltage input • Current input	±0,05% ±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 • Limit interrupt • Diagnostics interrupt	 programmable Channels 0 and 2 programmable	
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported	
Sensor selection data		
Input ranges (rated values) / input impedance		
• Voltage	± 5 V 1 V 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
Maximum voltage at voltage input (destruction limit)	max. 50 V, continuous	
Maximum current at current input (destruction limit)	max. 32 mA	
Wiring of the signal transducers	using a 40pin 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 Measurement types and ranges

Introduction

The measurement type and range is configured at the "measuring range" parameter in *STEP 7*.

The default setting of the module is "voltage" measurement with "± 10V" range. You can use these default settings without having to program the SM 331; AI 8 x 16 Bit in *STEP 7*.

Measurement types and ranges

Table 6-5 Measurement types and ranges

Selected type of measurement	Measuring range
Voltage V:	± 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 Programmable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-6 Overview of the parameters of SM 331; AI 8 x 16 Bit

Parameters	Range of values	Default	Parameter type	Scope
Enable • Diagnostics interrupt • Process interrupt when limit exceeded	 yes/no yes/no	 no no	dynamic	Module
Process 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 line continuity check	 yes/no yes/no	 no no	static	Channel group
Measurement • Measurement type	disabled Voltage V: 4DMU current (4-wire transducer)	V	dynamic	Channel group
• Measuring range	See the table *Measurement types and ranges*	± 10 V		
• Noise suppression	100 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 can assign parameters only to one channel group.

The table below shows the relevant configuration of channel groups. The channel group number is required to program 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 225)

Diagnostics messages of analog input modules (Page 227)

6.3.3 Additional information on SM 331; AI 8 x 16 Bit

Unused channels

Set the "disabled" value at the "measuring method" parameter for unused channels. This setting reduces module cycle times.

As certain programmed inputs may remain unused due to the channel group configuration, make allowances for the special features of those inputs outlined below in order to be able to use the diagnostics functions at these used channels:

- 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.

Line continuity check

The line continuity check is available for the 1 V to 5 V and 4 mA to 20 mA ranges.

Rule for both measuring ranges:

When the line continuity check is **enabled**, the module logs the wire-break to diagnostics data when the current drops below 3.6 mA (0.9 V.)

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

When line continuity check is **disabled** and diagnostic interrupts are enabled, the module triggers a diagnostics interrupt when underflow is detected.

Special features in programming high and low limits

The programmable limits (process 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: The calculation methods deployed in the module software to evaluate the process variables do not allow the reporting of values up to 32511 in certain situations. The process value triggering a process 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 the value 32511 ($7EFF_H$).

You may not define any limits which exceed the minimum limits specified 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
± 10 V	11.368 V 31430 $7AC6_H$	-11.369 V -31433 8537_H
± 5 V	5.684 V 31430 $7AC6_H$	-5.684 V -31430 $853A_H$
1 V 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 $ED00_H$
± 20 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 any CMV in the AC or DC range.

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
- Programmable measurement type at each channel group
  - Voltage
  - Current
- Programmable resolution per channel group (15 bits + sign)
- Any measuring range selection per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 8 channels
- Programmable process interrupt when limit is exceeded
- Programmable process interrupt at end of cycle
- High-speed update of measured values at up to 4 channels
- Electrical isolation to the CPU

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Terminal assignment

The diagrams below show various wiring options

Wiring: Voltage and current measurement

Connection possible at both sides at channels 0 to 7

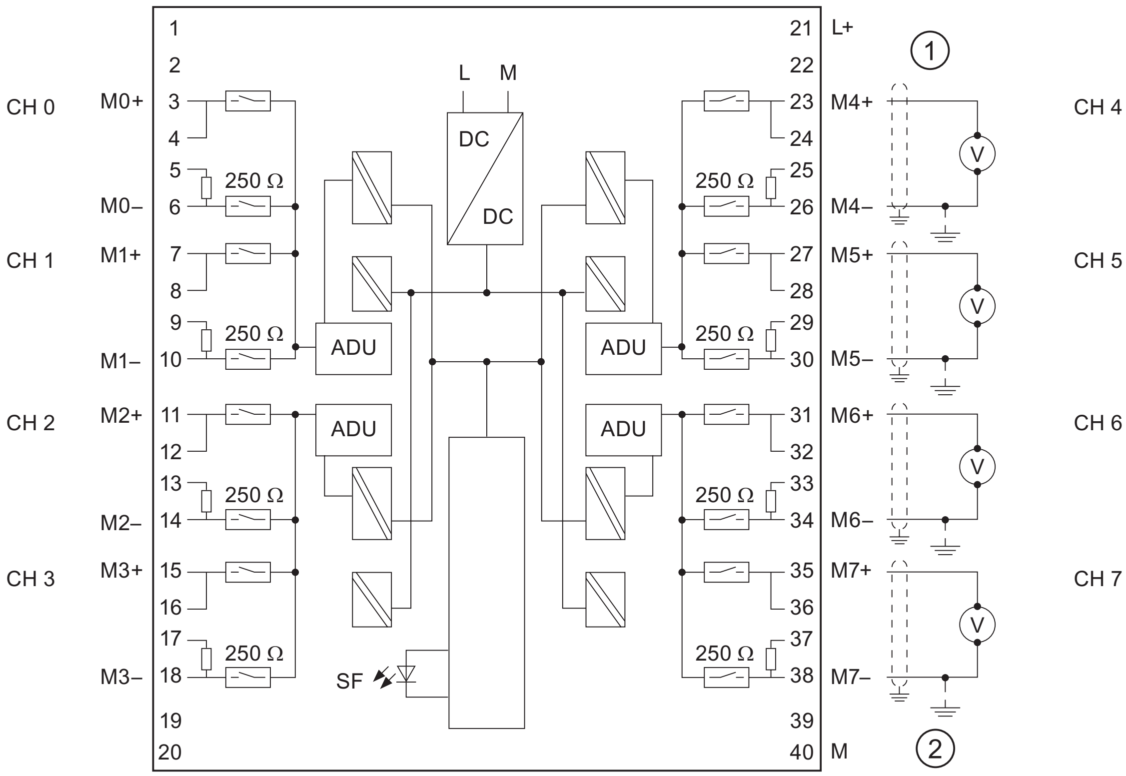


Figure 6-3 Wiring and block diagrams

① Connection for voltage measurement
② Equipotential bonding

Wiring: 2-wire and 4-wire transducer

Connection possible at both sides at channels 0 to 7

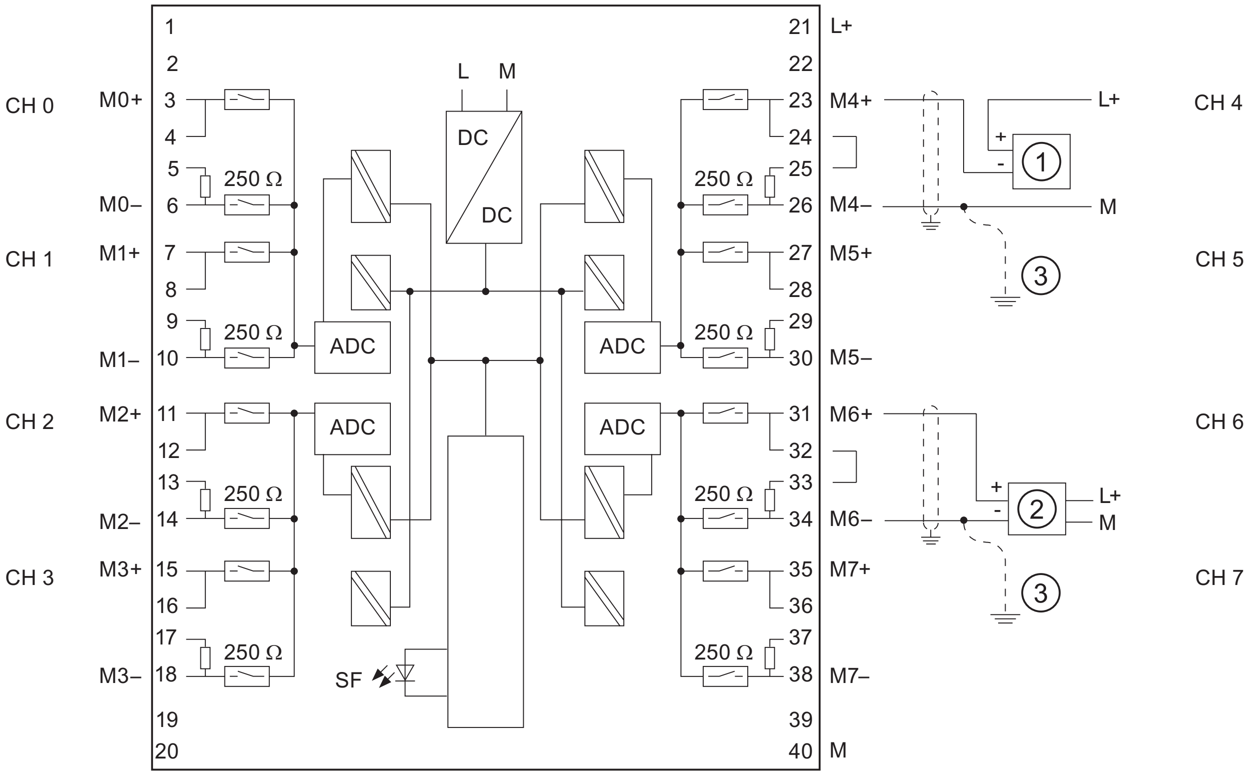


Figure 6-4 Wiring and block diagrams

① 2-wire transducer
② 4-wire transducer
③ Equipotential bonding

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

Technical data	
Voltages, currents, electrical potentials	
Rated electronics supply voltage L +	24 VDC
• Reverse polarity protection	yes
Electrical isolation	
• between channels and the backplane bus • between channels and electronics power supply • between channels in groups of	yes yes yes 2
Maximum 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
Generation 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 f1 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 x (f1 1%)(f1 = interference frequency, n = 1, 2, ...)	
• Common-mode interference (VCM < AC 60 V) • Series mode interference (peak value of disturbance < rated input range)	> 100 dB > 90 dB [3)]
Crosstalk between inputs	> 100 dB
Operational error limit (across temperature range, relative to input range)	
• Input voltage • Input current	±0,1% ±0,1%
Basic error limit (operational error limit at 25 °C, relative to input range)	
• Voltage input • Current input	±0,05% ±0,05%
Temperature error (relative to input range)	± 0.005%/K
Linearity error (relative to input range)	±0,01%
Repetition accuracy (in transient state at 25 °C, relative to input range)	±0,01%

Technical data	
Status, interrupts, diagnostics	
Interrupts	
• Process interrupt when limit value is exceeded • Process interrupt at end of cycle • Diagnostics interrupt	Programmable channels 0 to 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	± 5 V / 2 MΩ 1 V to 5 V / 2 MΩ ± 10 V / 2 MΩ
• Current	0 mA to 20 mA / 250 Ω 4 mA to 20 mA / 250 Ω ± 20 mA / 250 Ω
Maximum voltage at voltage input (destruction limit)	35 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)
Maximum current at current input (destruction limit)	40 mA
Wiring of the signal transducers	using a 40pin 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 settles to 100% within 80 ms. The value determined in this process is returned at intervals of max. 10 ms.

6.4.1 Measurement types and ranges

Introduction

The measurement type and range is configured at the "measuring range" parameter in *STEP 7*.

Table 6-9 Measurement types and ranges

Selected type of measurement	Output range
Voltage V:	± 5 V, from 1 V to 5 V, ± 10 V
Current (4-wire transducer) 4DMU	0 mA to 20 mA 4 mA to 20 mA ± 20 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. The channel group number is required to program 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 Programmable 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 • Process interrupt when limit value is exceeded • Process interrupt at end of cycle • Diagnostics interrupt	 yes/no yes/no yes/no	 no no no	 dynamic dynamic dynamic	 Module
Process interrupt trigger • High limit • Low limit	 32511 to -32512 -32512 to 32511	 - -	 dynamic dynamic	 Channel Channel
Diagnostics • Group diagnostics • Line continuity check	 yes/no yes/no	 no no	 static	 Channel Channel
Measurement • Module operating mode • Noise suppression	 • 8 channels • 4 channels 50 Hz 60 Hz 400 Hz 50/60/400 Hz	 yes no 50/60/400 Hz	 dynamic	 Module Channel group
• Smoothing	• none • weak • medium • strong	none	dynamic	Channel group
• Measurement type	• Measuring range:		dynamic	Channel group
disabled				
Voltage	• ± 5 V • 1 V 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 225)

Diagnostics messages of analog input modules (Page 227)

6.4.3 Additional information for SM 331; AI 8 x 16 Bit

Modes of operation

Operating modes of SM 331; AI 8 x 16 Bit:

- 8-channel mode
- 4-channel mode

8-channel operating mode

In this mode, the module changes between the two channels of each group. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, and then the channels with the odd numbers 1, 3, 5 and 7 (see the figure below.)

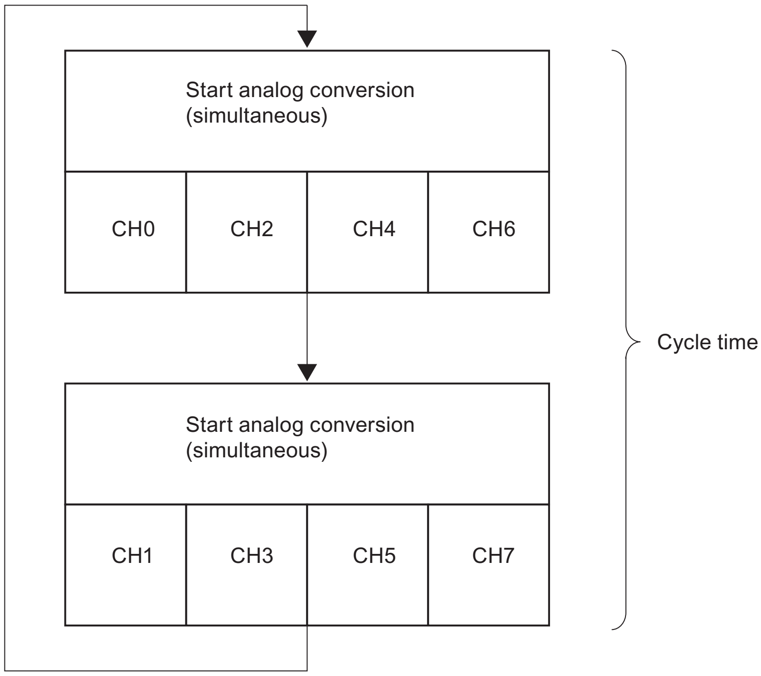


Figure 6-5 8-channel mode cycle time

Cycle time of module in 8-channel mode

The channel conversion time is based on the programmed noise suppression. The channel conversion time is 76 ms, including communication time, at a set interference frequency of 50 Hz. The channel conversion time is 65 ms when you set an interference frequency of 60 Hz. You can reduce channel conversion times to 16 ms by setting an interference frequency of 400 Hz. When you set 50, 60 and 400 Hz , the channel conversion time amounts to 88 ms. The module then has to switch to a different channel of the group by means of the Opto-MOS relay. Opto-MOS relays require 7 ms for switching and settling. The table below shows this correlation.

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 operating mode

In this mode, the module does not change between the channels of the groups. The four ADCs of the module simultaneously convert the channels 0, 2, 4 and 6.

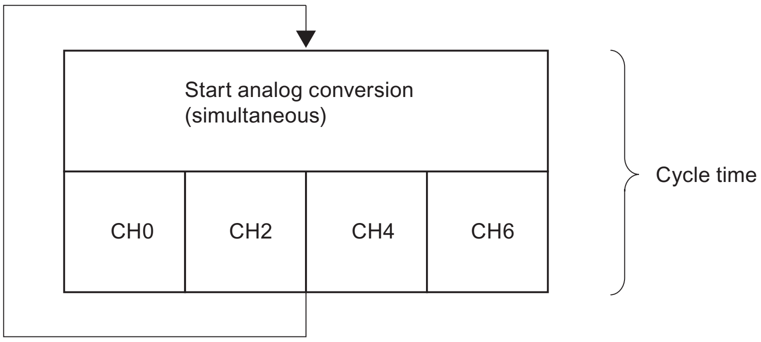


Figure 6-6 4-channel mode cycle time

Module cycle time

The converted value settles to 100% within 80 ms and is updated every 10 ms when 4-channel mode is set. The channel and module cycle times are always identical, because the module does not change between the channels of a group: 10 ms.

Channel conversion time = channel cycle time = module cycle time = 10 ms

Unused channels

Set the "disabled" value at the "measuring method" parameter for unused channels. This setting reduces module cycle times.

As certain programmed inputs may remain unused due to the channel group configuration, make allowances for the special features of these inputs outlined below in order to be able to use the diagnostics functions at these used channels:

- 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. A shunt resistor must be connected for each programmed and unused channel.
- Other measuring ranges: Short-circuit the plus and minus inputs of the channel.

Line continuity check

The line continuity 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 ± 5V, 1 V to 5 V, ± 10 V, 4 mA to 20 mA, and enabled the line continuity check, the analog input module logs a wire-break event in diagnostics data when the underflow (32768) is reached.

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

If you configured a measuring range of 4 mA to 20 mA, disabled the line continuity check, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

Short-circuit to M or L

The module does not suffer any damage if you short-circuit an input channel to M or L.. The channel continues to output valid data and does not report a diagnostics event.

Overflow, underflow and process interrupt limits

The limits in diagnostics response 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 variables do not return values up to 32511.

Do not set any process 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 table below shows the contents of the 4 bytes of additional OB40 information during process 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 6ES7 153-1AA03-0XB0, E 01
- IM 153-2; as of 6ES7 153-2AA02-0XB0; E 05
- IM 153-2; as of 6ES7 153-2AB01-0XB0; 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 Bit 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 process interrupts. All parameters associated with these functions are disabled for this reason. This includes process interrupt enable, hardware restrictions and end the enabling of cycle interrupts. All other parameters are allowed.

6.5 Analog input module SM 331; AI 8 x 14 Bit High Speed; isochrone; (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
- Programmable resolution at each channel group (13 bits + sign)
- Any measuring range per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 2 channels
- Programmable process interrupt when limit is exceeded
- High-speed update of measured values
- Isochronous mode supported
- Electrical isolation to the CPU
- Electrically isolated to load voltage (not for 2-wire transducers)

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups 0 and 1 can be programmed in STEP 7. However, set a process interrupt only for the first channel of a channel group, that is, either at channel 0, or at channel 2

Terminal assignment

The diagrams below show the various wiring options.

Wiring: Voltage measurement

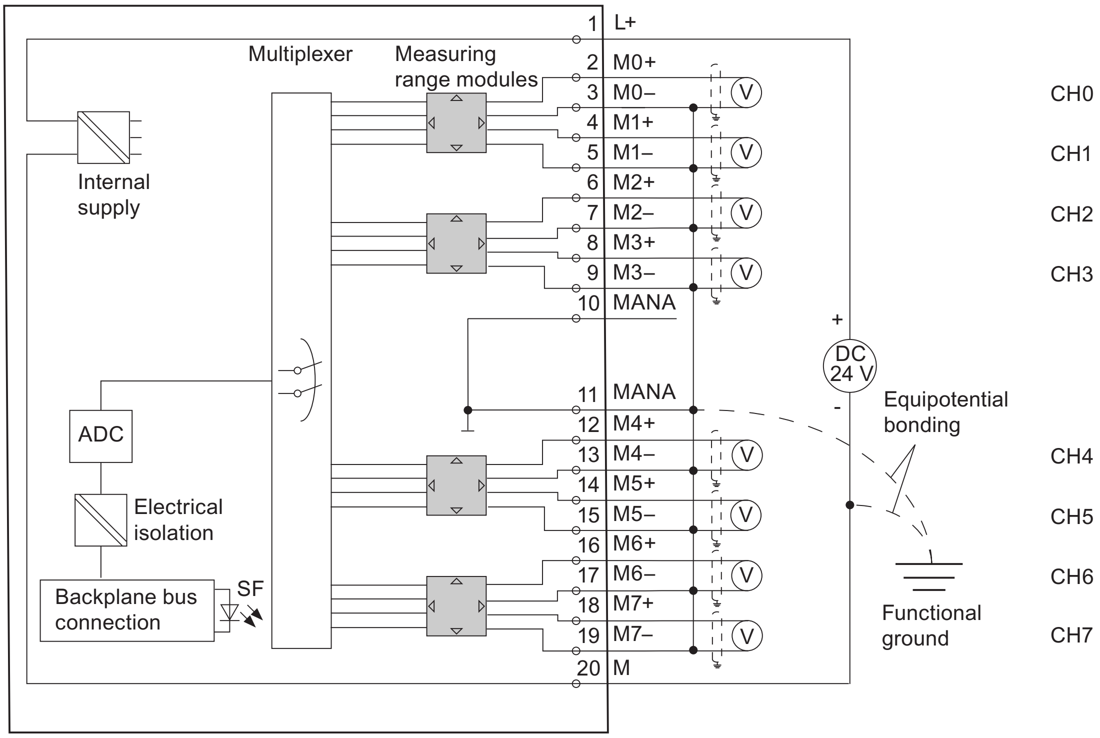


Figure 6-7 Block diagram and wiring diagram

Measuring range module settings

Measuring range	Measuring range module setting
± 1V	A
± 5V	B
± 10V	B (Default)
1 V to 5V	B

Wiring: 2-wire and 4-wire transducers for current measurement

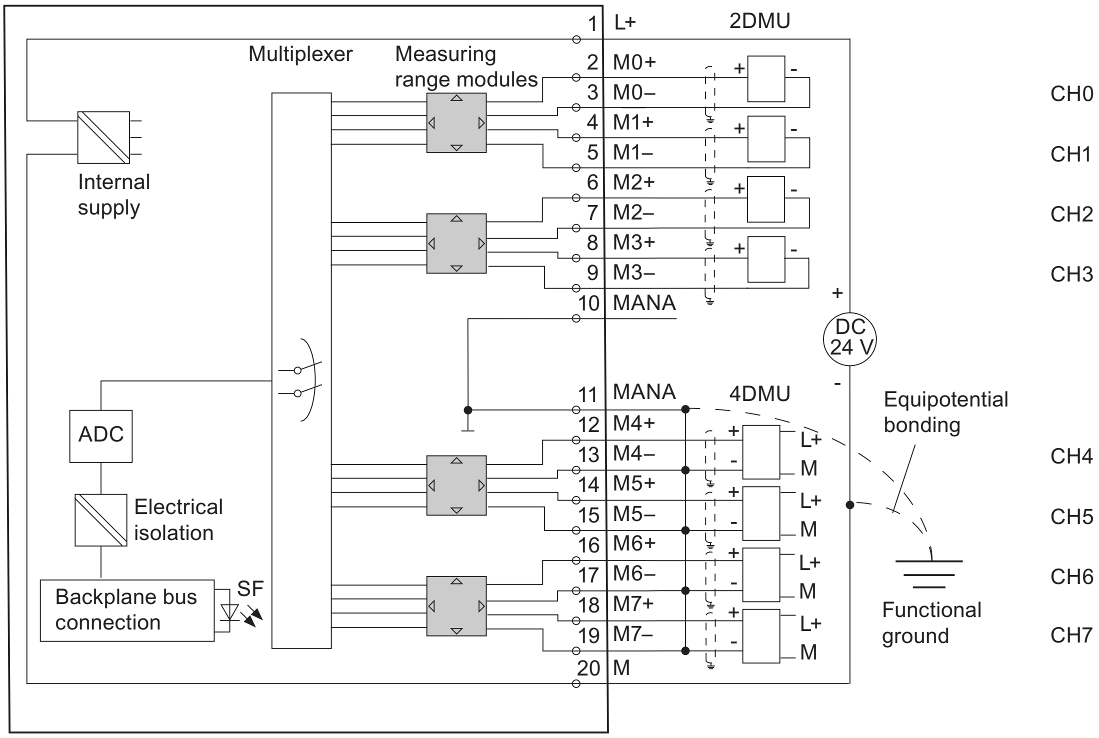


Figure 6-8 Block diagram and wiring diagram

Measuring range module settings

Measuring range		Measuring range module setting
2-wire transducer	4 mA to 20mA	D
4-wire transducer	± 20mA 0 mA to 20mA 4 mA to 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

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			
Maximum 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			
Generation 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 < rated input range)	> 80 dB > 40 dB			
Crosstalk between inputs	> 65 dB			
Operational error limit (across temperature range, relative to input range)				
• Voltage input	± 1 V ± 5 V ± 10 V 1 V 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 %	

Technical data		
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	± 1 V ± 5 V ± 10 V 1 V 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 • Process interrupt • Diagnostics interrupt	 programmable programmable	
Diagnostics functions • Group error display • Reading diagnostics information	 red LED (SF) supported	
Sensor selection data		
Input ranges (rated values) / input impedance		
• Voltage	± 1 V ± 5 V ± 10 V 1 V 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
Maximum voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20)	
Maximum current at current input (destruction limit)	40 mA	
Wiring of the signal sensors • for voltage measurement • for current measurement as 2-wire transducer as 4-wire transducer • Load of the 2-wire transducer at L+ = DC 24 V	with 20pin front connector supported supported supported max. 820 Ω	
Characteristics linearization	none	

6.5.1 Measurement types and ranges

Introduction

The analog input module has measuring range modules. The measurement type and range is configured at the "measuring range" parameter in *STEP 7*.

The default setting of the module *STEP 7* is "voltage" measurement with "± 10V" range. 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

You may have to change the position of the measuring range module to suit the measurement type and range. See table *Setting measuring methods and ranges of analog input channels*. The settings are also printed on the module. Mark the position of the measuring range module on the front door (see figure).

Range:

A	B
C	D

Measurement types and ranges

Table 6-13 Measurement types and ranges

Selected type of measurement	Measuring range (type of sensor)	Measuring range module settings
V: Voltage	± 1 V	A
	± 5 V 1 V to 5 V ± 10 V	B
4DMU: Current (4-wire transducer)	0 mA to 20 mA 4 mA to 20 mA ± 20 mA	C
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 can assign parameters only to one 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. The channel group number is required to program 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 Programmable 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 • Diagnostics interrupt • Process interrupt when limit exceeded	 yes/no yes/no	 no no	 dynamic	 Module
Fast Mode (can only be set if the 331-7HF01 is included for isochronous operation in the DP slave properties)	yes/no	no	static	Module
Process interrupt trigger • High limit • Low limit	May be restricted by the measuring range. from 32511 to - 32512 from - 32512 to 32511	-	dynamic	Channel

Parameters	Range of values	Default	Parameter type	Scope
Diagnostics • Group diagnostics	yes/no	no	static	Channel group
Measurement • Measurement type	disabled Voltage V 4DMU current (4-wire transducer) 2DMU current (2-wire transducer)	V	dynamic	Channel or channel group
• Measuring range	See the table *Measurement types and ranges*	± 10 V		
• Noise suppression	none; 400 Hz; 60 Hz; 50 Hz	50 Hz		

See also

Programming analog modules (Page 225)

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:

- Independent user program cycle. The length of the cycle time may vary due to non-cyclic program branching.
- Independent and variable DP cycle on the PROFIBUS subnet
- Cyclic operation of the backplane bus of the DP slave.
- Cyclic signal preparation 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:

Standard Mode	
Filtering and processing time T_{WE} between reading actual values and writing these to the transfer buffer(the value defined for TWE applies, irrespective of the enable status of diagnostics)	max. 625 µs
including an input delay time of	10 µs
T_{DPmin}	3.5 ms
Diagnostics interrupt	max. 4 x T_{DP}
Fast Mode (only possible with 6ES7 331-7HF01-0AB0)	
Filter and processing time T_{WE} between reading actual value and writing the results to the transfer buffer (diagnosis not selectable)	max. 625 µs
including an input delay time of	10 µs
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 Config* 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 "isochronous" mode, the modules automatically sets "Integration time: none/interference frequency", irrespective of parameter settings in *STEP 7*. none / interference frequency". "Process interrupt" functionality is not available in "isochronous" 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 = (channel number +1) x 52 µs + tv; tv = 119 to 209 µs

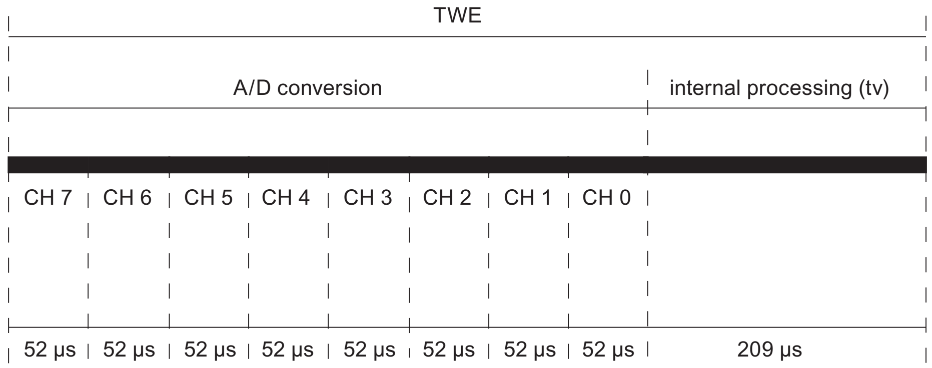


Figure 6-9 Calculation of filter and processing times

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 isochronous 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, isochrone

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	connect with M-
Current / 4-wire transducer	leave open	connect with M-
Current / 2-wire transducer	leave open	connect with M

As certain programmed inputs may remain unused due to the channel group configuration, make allowances for the special features of these inputs outlined below in order to be able to use the diagnostics functions at these used channels:

- 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 inputs; 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 kΩ to 3.3 kΩ 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.

Line continuity check for the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and enabled the line continuity check, the analog input module logs a wire-break event to diagnostics data when the current drops below 1.185 mA.

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

If you configured a measuring range of 4 mA to 20 mA, disabled the line continuity 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; (6ES7 331-1KF01-0AB0)

Order number

6ES7331-1KF01-0AB0

Properties

- 8 inputs in 8 channel groups
- Programmable resolution at each channel group (12 bits + sign)
- Programmable measurement type per channel group:
  - Voltage
  - Current
  - Resistance
  - Temperature
- Any measuring range per channel

Terminal assignment

The diagrams below show various wiring options. These examples apply to all channels (channel 0 to 7).

Note

When connecting voltage and current transducers, make sure that the maximum permitted common-mode voltage C_{MV} of 2 V is not exceeded between the inputs. Prevent measuring errors by interconnecting the corresponding M- terminals.

Wiring: Voltage measurement

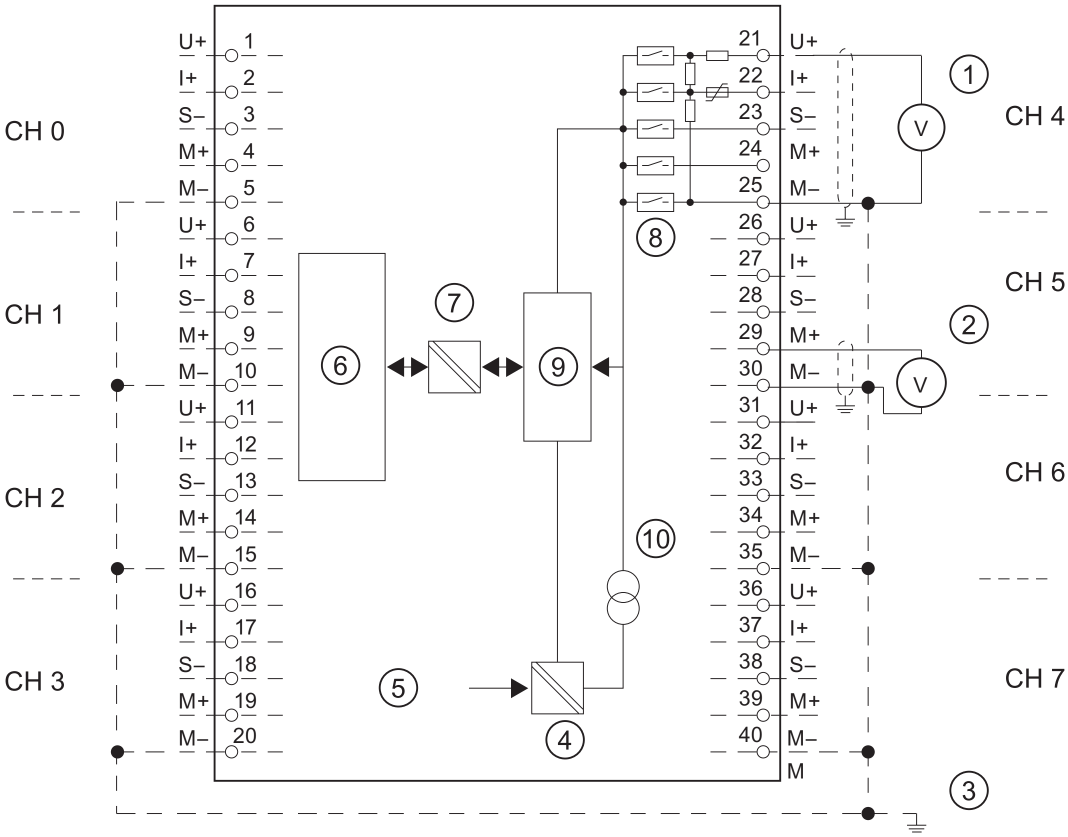


Figure 6-10 Block diagram and wiring diagram

① Voltage measurement (± 5 V, 10 V, 1 V to 5 V, 0 V to 10 V)
② Voltage measurement (± 50 mV, ± 500 mV, ± 1 V)
③ Equipotential bonding
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 Current source

Wiring: Voltage measurement (0 V to 10 V, 1 V to 5 V, ± 5 V, ± 10 V)

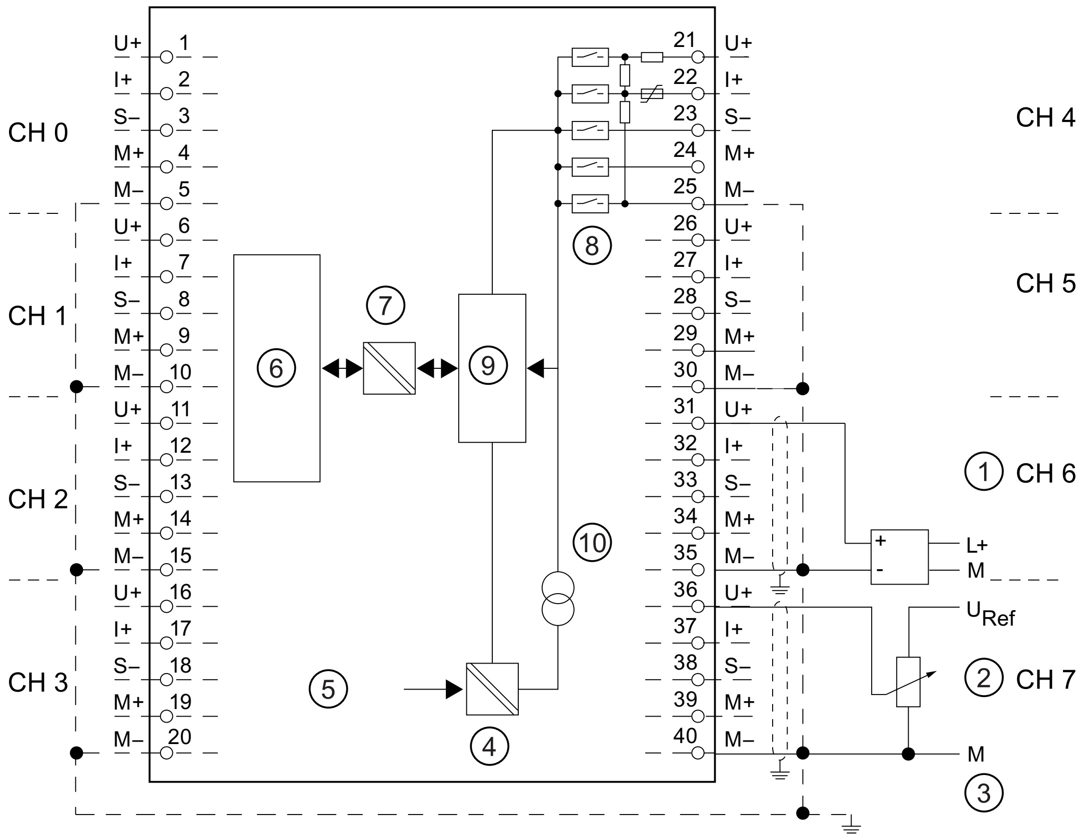


Figure 6-11 Block diagram and wiring diagram

①	Transducer with voltage output (0 V to 10 V, 1 V to 5 V, ± 5 V, ± 10 V)
②	Voltage measurement (note the input impedance defined in technical data)
③	Equipotential bonding
④	Internal supply
⑤	+ 5 V from backplane bus
⑥	Logic and backplane bus interface
⑦	Electrical isolation
⑧	Multiplexer
⑨	Analog to Digital Converter (ADC)
⑩	Current source

Wiring: 2-wire and 4-wire transducers for current measurement

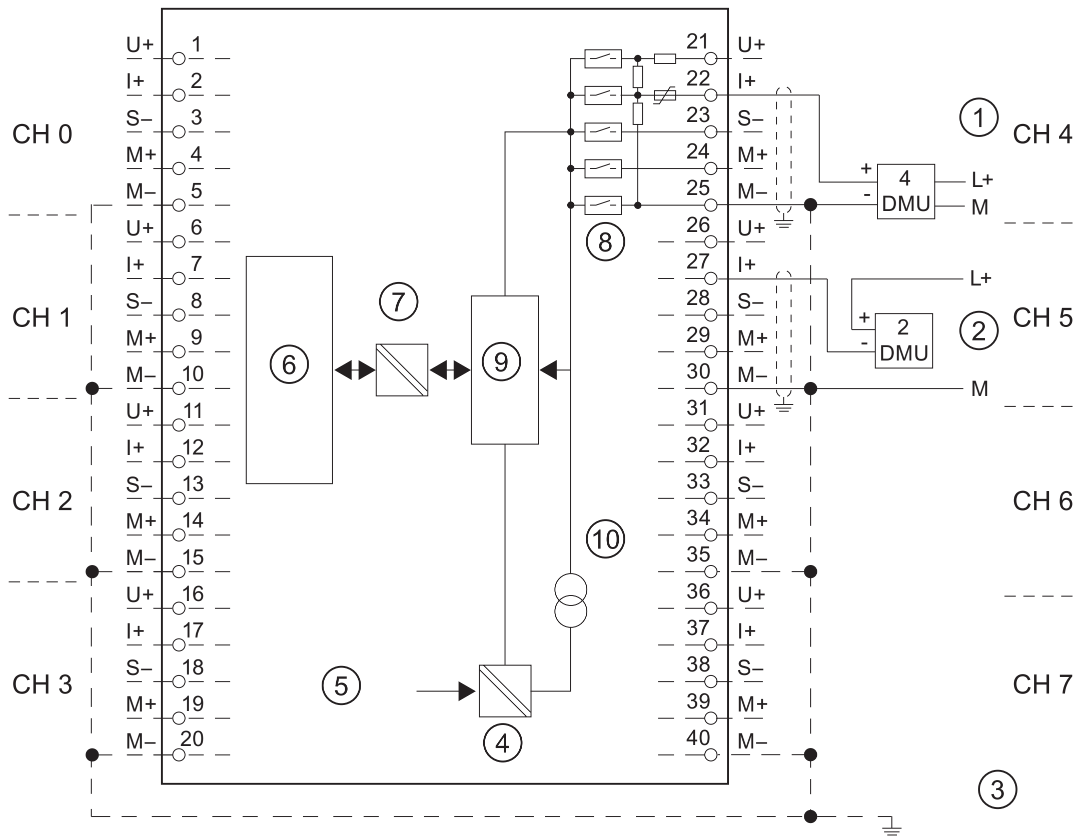


Figure 6-12 Block diagram and wiring diagram

① 4-wire transducer (0/4 mA to 20 mA or ± 20 mA)
② 2-wire transducer (4 mA to 20 mA)
③ Equipotential bonding
④ Internal supply
⑤ + 5 V from backplane bus
⑥ Logic and backplane bus interface
⑦ Electrical isolation
⑧ Multiplexer
⑨ Analog to Digital Converter (ADC)
⑩ Current source

Resistance measurement with 2-, 3- and 4-wire connection

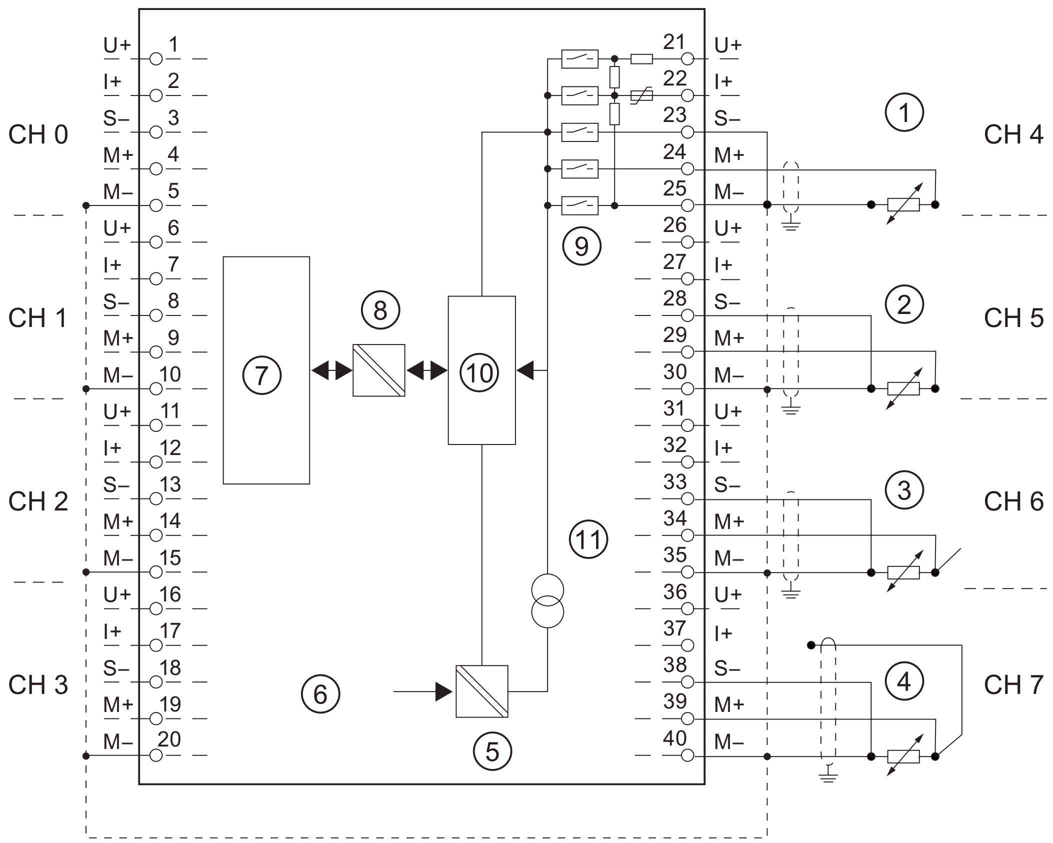


Figure 6-13 Block diagram and wiring diagram

- ① 2-wire connection. Insert a bridge between M and S (no line resistance compensation).
- ② 3-wire connection
- ③ 4-wire connection. The fourth line may not be wired (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 + 5 V from backplane bus
- ⑦ Logic and backplane bus interface
- ⑧ Electrical isolation
- ⑨ Multiplexer
- ⑩ Analog to Digital Converter (ADC)
- ⑪ Current source

Note

It is not necessary to interconnect the M- terminals when measuring resistances and resistance thermometers. However, interconnection of the M- terminals may enhance interference immunity.

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 • with resistive transducers	8 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 Ω to 600 Ω • Resistance measurement 0 kΩ to 6 kΩ	 0.83 mA (pulsed) 0.25 mA (pulsed)	
Electrical isolation • between channels and the backplane bus • between channels	 yes no	
Maximum potential difference • between inputs (CMV) • Between the inputs and $M_{internal}$ (V_{iso})	 2.0 VDC 75 VDC / 60 VAC	
Isolation test voltage	500 VDC	
Current consumption • from the backplane bus	 max. 90 mA	
Power loss of the module	typ. 0.4 W	
Generation 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		
• Series-mode interference (CMV < 2 V) • Seriesmode interference (peak value < rated input range)	> 86 dB > 40 dB	
Crosstalk between inputs	> 50 dB	

Technical data		
Operational error limit (across temperature range, relative to input range)		
• Voltage input	± 5 V	± 0.6 %
	± 10 V 1 V to 5 V 0 V to 10 V ± 50 mV ± 500 mV ± 1 V	± 0.5 %
• Current input	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	± 0.5 %
• Resistance	0 kΩ to 6 kΩ 0 Ω to 600 Ω	± 0.5 % ± 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 ± 50 mV ± 500 mV ± 1 V	± 0.3 %
• Current input	± 20 mA 0 mA to 20 mA 4 mA to 20 mA	± 0.3 %
• Resistance	0 kΩ to 6 kΩ 0 Ω to 600 Ω	± 0.3 % ± 0.3 %

Technical data		
• 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
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	
Sensor 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
Maximum voltage at voltage input U+ (destruction limit)	max. 30 V, continuous	
Maximum voltage at voltage inputs M+, M-, S- (destruction limit)	max. 12 V continuous; 30 V for a duration of max. 1 s	
Maximum current at current input I+ (destruction limit)	40 mA	

Technical data	
Wiring of the signal sensors	using a 40pin front connector
• for voltage measurement • for current measurement – as 2-wire transducer – as 4-wire transducer	supported supported, with external supply supported
• for resistance measurement with 2-wire connection with 3-wire connection with 4-wire connection	 supported supported supported
Characteristics 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 measurement	Degrees Centigrade, degrees Fahrenheit, Kelvin

6.6.1 Measurement types and ranges

Introduction

The measurement type and range is configured at the "measuring range" parameter in *STEP 7*.

Selected type of measurement	Measuring range
Voltage V:	± 50 mV ± 500 mV ± 1 V ± 5 V 1 V to 5 V 0 V to 10 V ± 10 V
Current I	0 mA to 20 mA 4 mA to 20 mA ± 20 mA
resistance (4-wire connection) R-4L	6 Ω 600 Ω
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 Programmable 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 • Measurement type	disabled Voltage V Current I Resistance R RTD thermoelectric resistance	V	dynamic	Channel
• Measuring range	Voltage ± 50 mV; ± 500 mV; ±1 V; 1 V to 5 V ± 5 V; 0 V 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 225)

6.6.3 Additional information on SM 331; AI 8 x 13 Bit

Unused channels

Set the "disabled" value at the "measurement type" parameter for unused channels. This setting reduces module cycle times.

Interconnect the M- terminals of unused channels.

6.7 Analog input module SM 331; AI 8 x 12 bit; (6ES7 331-7KF02-0AB0)

Order number

6ES7331-7KF02-0AB0

Properties

- 8 inputs in 4 channel groups
- Programmable measurement type at each channel group
  - Voltage
  - Current
  - Resistance
  - Temperature
- Programmable resolution at each channel group (9/12/14 bits + sign)
- Any measuring range selection per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 2 channels
- Programmable process interrupt when limit is 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, that is, the measured value resolution increases in proportion to length of the integration time at the analog input channel.

Diagnostics

For information on diagnostics messages consolidated in the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups 0 and 1 can be programmed in *STEP 7*. However, set a process interrupt only for the first channel of a channel group, that is, either at channel 0, or at channel 2

Terminal assignment

The diagrams below show various wiring options The input impedance depends on the setting of the measuring range module, see table *Measurement types and ranges*.

Wiring: Voltage measurement

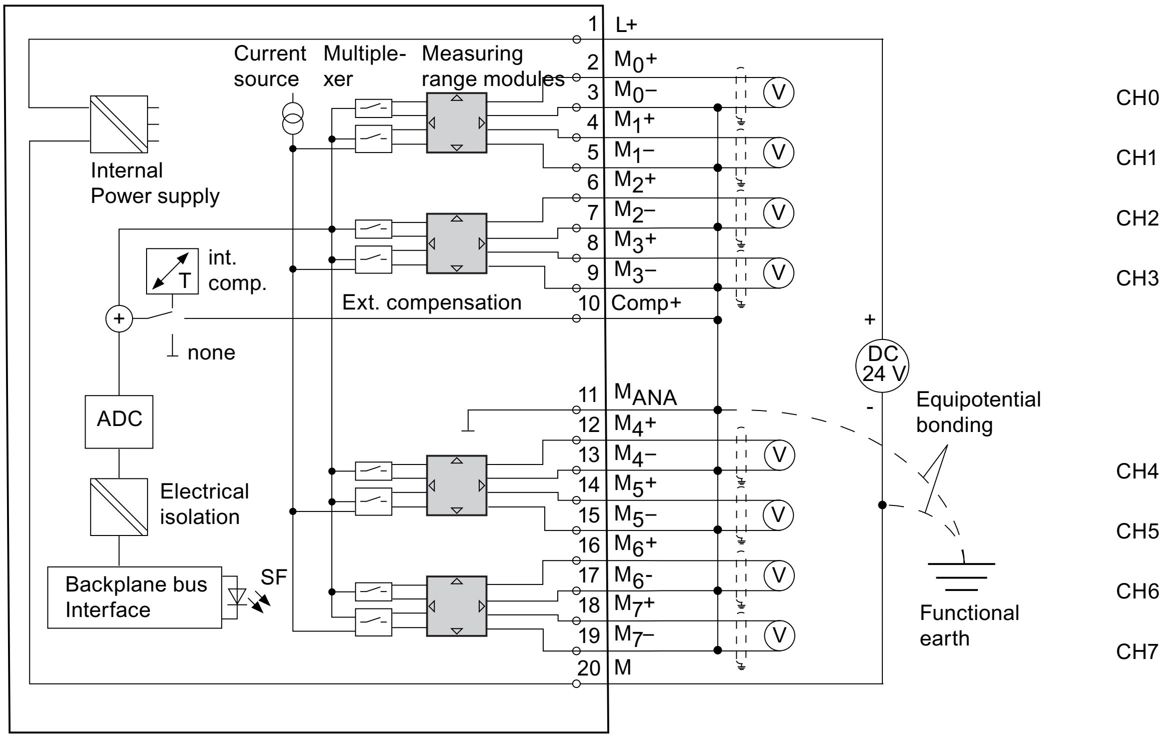


Figure 6-14 Block diagram and wiring diagram

Measuring range module settings

Measuring range	Measuring range module setting
± 80 mV ± 250 mV ± 500 mV ± 1000 mV	A
± 2.5 V ± 5 V 1 V to 5 V ± 10 V	B

Wiring: 2-wire and 4-wire transducers for current measurement

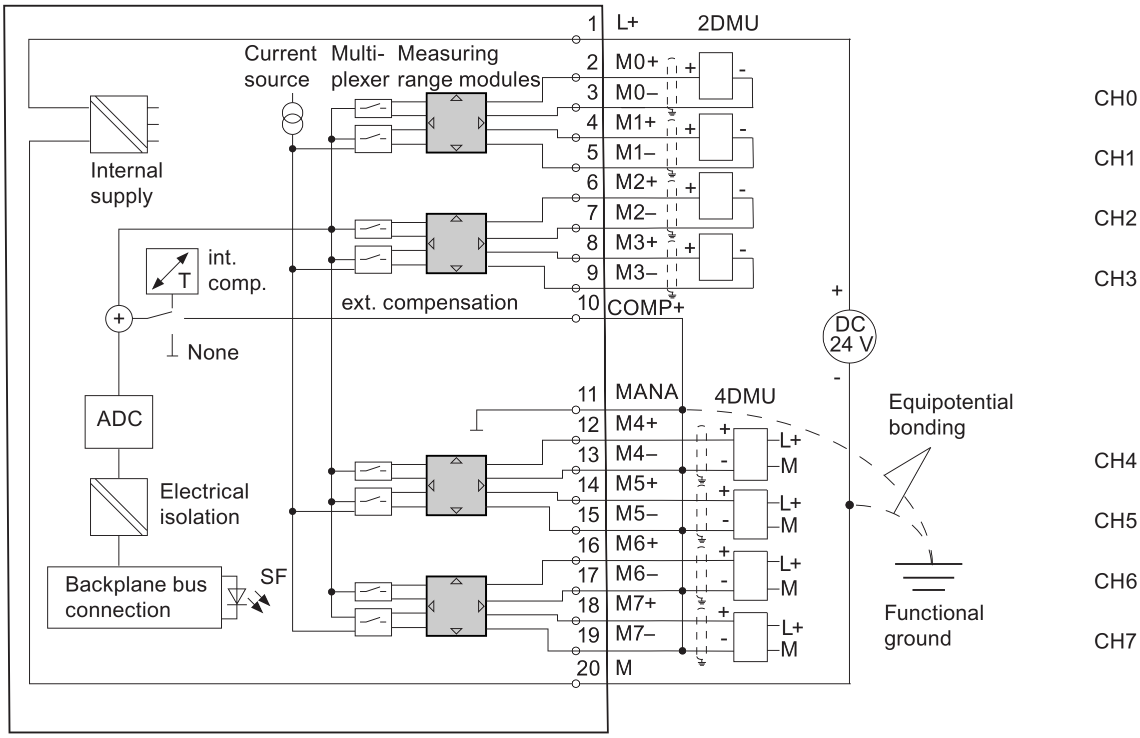


Figure 6-15 Block diagram and wiring diagram

Note

The interconnection between M_{ANA} and M- (terminals 11, 13, 15, 17, 19) is not required when using grounded 4-wire transducers with non-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 ± 10 mA 0 mA to 20 mA 4 mA to 20 mA ± 20 mA	C

Caution

Any voltage measurement will destroy the measuring range module if "current" measuring mode is set.

Wiring: 2-, 3- and 4-wire connection of resistance transducers or thermoresistors

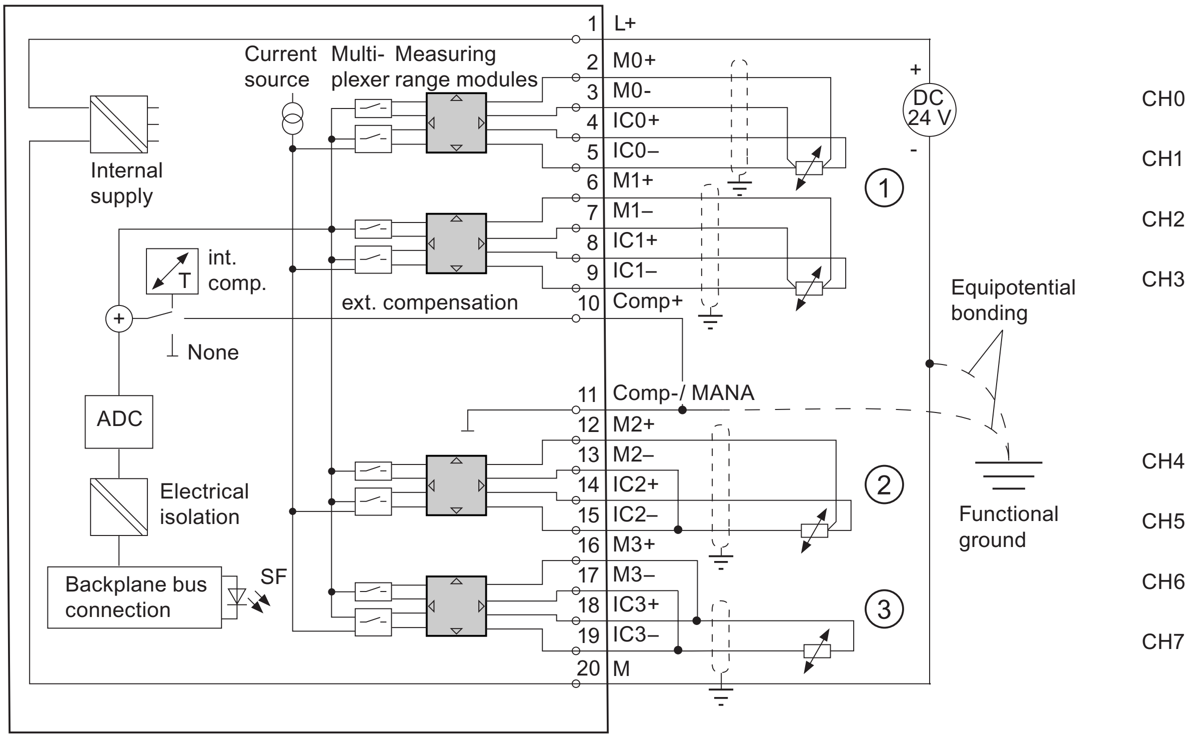


Figure 6-16 Block diagram and wiring diagram

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 measuring mode (I_C). The "1st" channel of the group returns the measured value. The "2nd" channel of the group is assigned the default overflow value "$7FFF_H$."
- There is no compensation for power resistors for "2- and 3-wire connections".

Wiring: Thermocouples with external compensation

Insert a bridge between Comp+ and M_{ANA} when using the internal compensation.

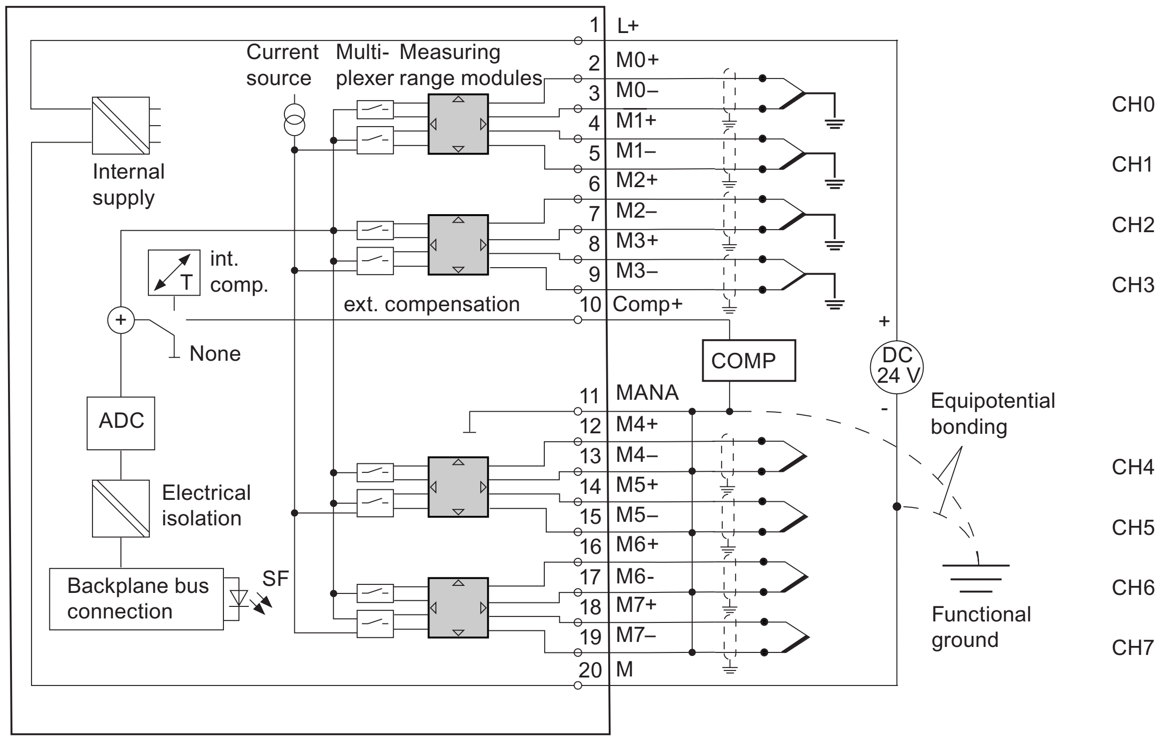


Figure 6-17 Block diagram and wiring diagram

Measuring range module settings

Measuring range		Measuring range module setting
Thermocouple TC-I (internal comparison) (thermal voltage measurement) Linearization is ignored	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 ignored		
Thermocouple (linear, internal comparison) (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 comparison) (temperature measurement) TC-EL		

Note
- An interconnection of M- and M_{ANA} is not required when using grounded thermocouples.
- Interconnect M- and M_{ANA} when using non-grounded thermocouples

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 • with resistive transducers	8 4
Cable length • shielded	max. 200 m max. 50 m at 80 mV and with thermocouples
Voltages, currents, electrical potentials	
Rated electronics supply voltage L + • Reverse polarity protection	24 VDC yes
Transducer power supply • Supply current • short circuit-proof	 max. 60 mA (per channel) yes
Constant current for resistive transducers	typ. 1.67 mA (pulsed)

Technical data				
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply – not for 2-wire transducers	yes yes			
Maximum potential difference • between inputs and M_{ANA} (CMV) – at signal = 0 V • between inputs (CMV) • 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			
Isolation 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			
Generation 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 suppression 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)				
• Series-mode interference (CMV < 2.5 V) • Seriesmode interference (peak value < rated input range)	> 70 dB > 40 dB			
Crosstalk between inputs	> 50 dB			
Operational error limit (across temperature range, relative to input range)				
• Voltage input	80 mV 250 mV to 1000 mV 2.5 V 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 %	

Technical data		
Basic error limit (operational error limit at 25 °C, relative to input range)		
• Voltage input	80 mV 250 mV to 1000 mV 2.5 V to 10 V	± 0.7 % ± 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 • Limit interrupt • Diagnostics interrupt	programmable Channels 0 and 2 programmable	
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported	
Sensor 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 /100 kΩ 100 kΩ 100 kΩ 100 kΩ
• 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 thermometers	Pt 100, Ni 100	10 MΩ
Maximum voltage at voltage input (destruction limit)	max. 20 V, continuous 75 V for the duration of max. 1 s (duty factor 1:20)	

Technical data	
Maximum current at current input (destruction limit)	40 mA
Wiring of the signal sensors	using a 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	 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
Characteristics linearization • for thermocouples	programmable Types E, N, J, K, L
• for resistance thermometers	Pt 100 (Standard and Klima range) Ni 100 (Standard and Klima range)
Temperature compensation • Internal temperature compensation	programmable supported
• External temperature compensation with compensating box	supported
• Compensation for 0 °C reference junction temperature	supported
• Technical unit of temperature measurement	degrees Centigrade

6.7.1 Measurement types and ranges

Introduction

Module SM 331; AI 8 x 12 Bit has measuring range modules

The measurement type and range is configured at the "measuring range" parameter in *STEP 7*.

The default setting of the module is "voltage" measurement with "± 10V" range. You can use these default settings without having to program the SM 331; AI 8 x 12 Bit in *STEP 7*.

Measuring range modules

You may have to change the position of the measuring range modules to suit the measurement type and range (see the chapter *Setting the measuring types and ranges of analog input channels*). The necessary settings are also available on the module's imprint. Mark the position of the measuring range module on the front door (see figure).

Range:

A	B
C	D

Measurement types and ranges

Table 6-18 Measurement types and ranges

Selected type of measurement	Measuring range (type of sensor)	Measuring range module settings
Voltage V	± 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 ignored	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 ignored		
Thermocouple (linear, internal comparison) (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 comparison) (temperature measurement) TC-EL		
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 can assign parameters only to one channel group.

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. The channel group number is required to program 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 225)

Diagnostics messages of analog input modules (Page 227)

6.7.2 Programmable parameters

Introduction

For information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-20 Overview of the parameters for SM 331; AI 8 x 12 Bit

Parameters	Range of values	Default	Parameter type	Scope
Enable • Diagnostics interrupt • Process interrupt when limit exceeded	 yes/no yes/no	 no no	dynamic	Module
Process 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 line continuity check	 yes/no yes/no	 no no	static	Channel group
Measurement • Measurement type	 disabled Voltage V 4DMU current (4-wire transducer) 2DMU current (2-wire transducer) R-4L resistance (4-wire connection) RTD-4L thermoresistor (linear, 4-wire connection) TC-I thermocouple (internal comparison) TC-E thermocouple (external comparison) TC-IL thermocouple (internal comparison) TC-EL thermocouple (linear, external comparison)	 V	dynamic	Channel or channel group
• Measuring range	See the table *Measurement types and ranges*	± 10 V		
• Noise suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

6.7.3 Additional information on SM 331; AI 8 x 12 Bit

Unused channels

As certain programmed inputs may remain unused due to the channel group configuration, make allowances for the special features of these inputs outlined below in order to be able to use the diagnostics functions at these used channels:

- Voltage measurement (except 1 V to 5V) and for thermocouples: Short-circuit unused channels and connect these with M_{ANA}. This optimizes interference immunity of the analog input module. Set the "disabled" value at the "measurement type" parameter for unused channels. This setting reduces module cycle times. Also short-circuit the COMP input if this is not used.
- 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 kΩ to 3.3 kΩ 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 at the parameters of SM 331; AI 8 x 12 Bit, the module does **not** report "external auxiliary voltage missing."

Line continuity check for the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and **enabled the line continuity check**, the analog input module logs a wire-break event to diagnostics data when the current drops below 3,6 mA.

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

If you configured a measuring range of 4 mA to 20 mA, **disabled** the line continuity check, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

Line continuity check

The line continuity check is designed only for temperature measurements (thermocouples and thermoresistors.)

See also

Representation of the values for analog input channels (Page 196)

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
- Programmable measurement type for each channel group
  - Voltage
  - Current
  - Resistance
  - Temperature
- Programmable resolution at each channel group (9/12/14 bits + sign)
- Any measuring range per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for one channel
- Programmable process interrupt when limit is exceeded
- Electrically isolated to CPU and load voltage (not for 2DMU)

Resolution

The measured value resolution is directly proportional to the selected integration time, that is, the measured value resolution increases in proportion to length of the integration time at the analog input channel.

Diagnostics

For information on diagnostics messages consolidated in the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups can be programmed in *STEP 7*. However, set a process interrupt only for the first channel of a channel group, that is channel 0.

Terminal assignment

The diagrams below show various wiring options The input impedance depends on programmed measuring range.

Wiring: Voltage measurement

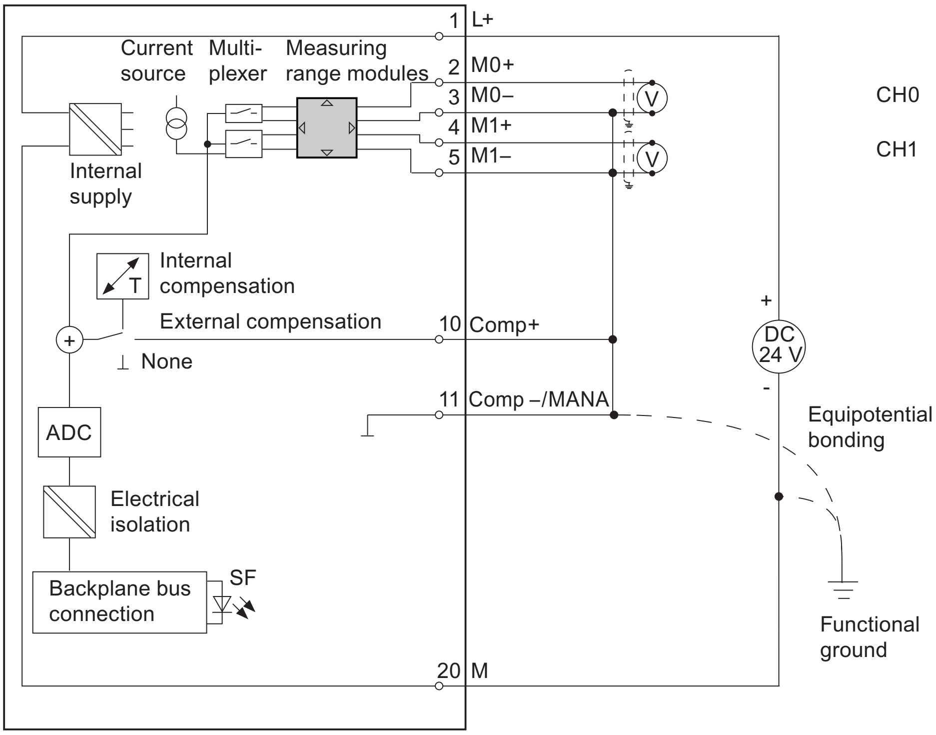


Figure 6-18 Wiring and block diagrams

Measuring range module settings

Measuring range	Measuring range module setting
± 80 mV ± 250 mV ± 500 mV ± 1000 mV	A
± 2.5 V ± 5 V 1 V to 5 V ± 10 V	B

Wiring: Thermocouple with external compensation

Insert a bridge between Comp+ and M_{ANA} when using the internal compensation.

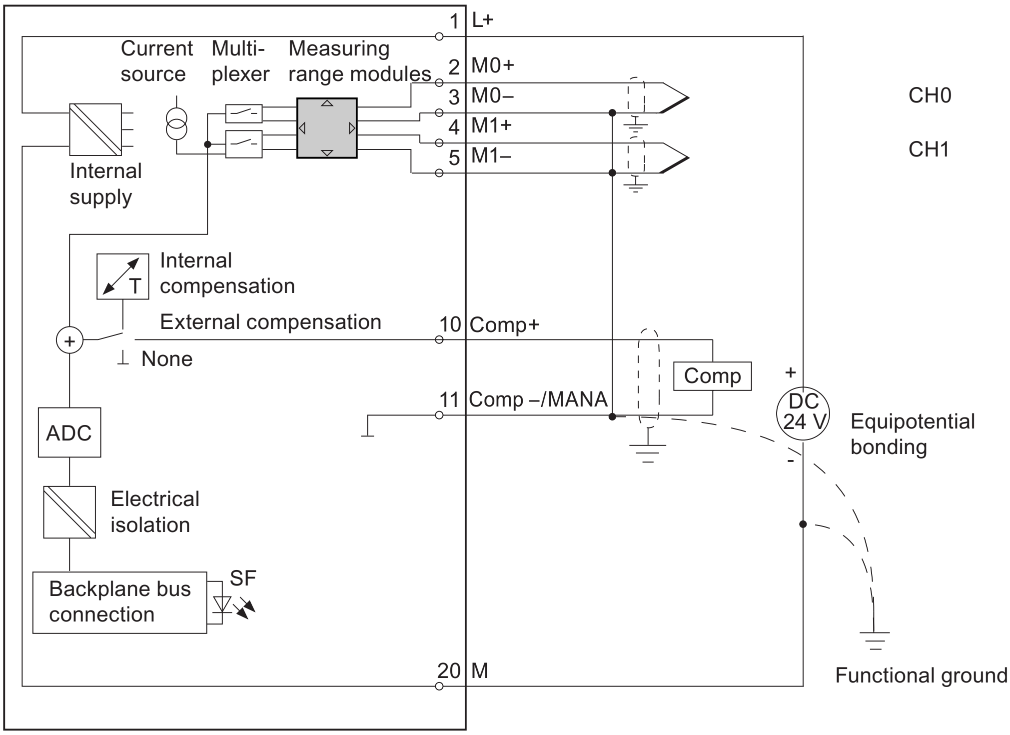


Figure 6-19 Wiring and block diagrams

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] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
TC-E: Thermocouples (external comparison) (thermal voltage measurement)		
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- and 4-wire connection of resistance transducers or thermoresistors

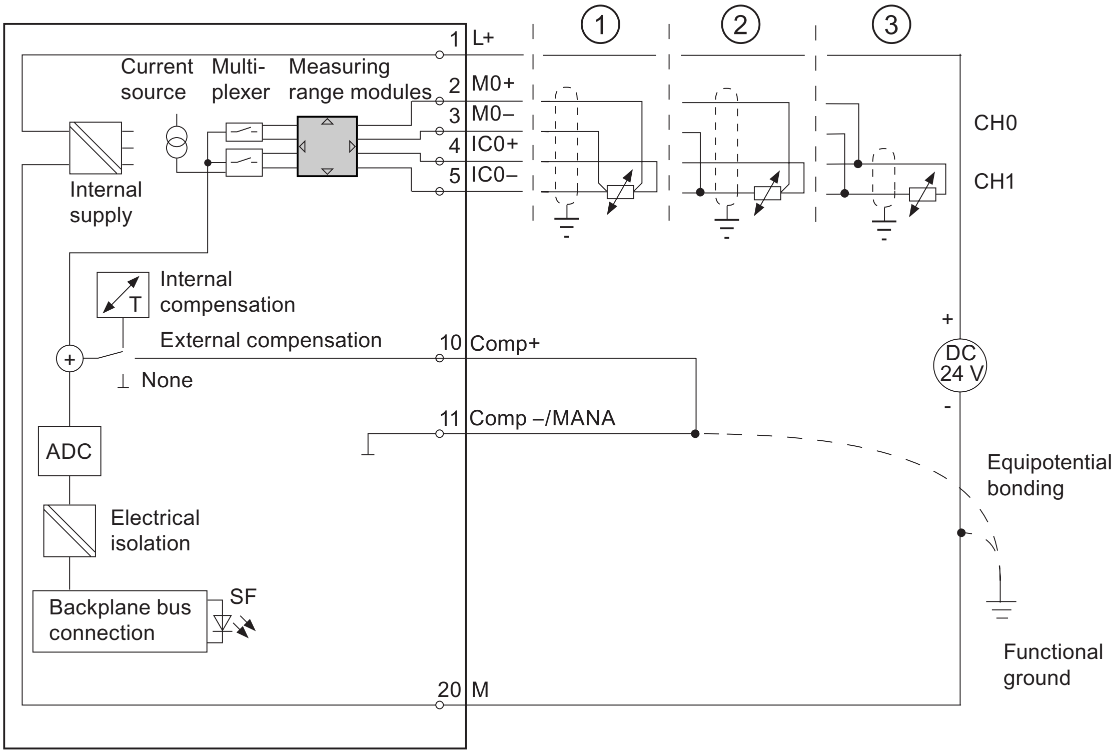


Figure 6-20 Wiring and block diagrams

① 4-wire connection, no compensation for line impedance
② 3-wire connection, no compensation for line impedance
③ 2-wire connection

Measuring range module settings

Measuring range		Measuring range module setting
150 Ω 300 Ω 600 Ω		A
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 measurement" is only available at one channel per group. The "2nd" channel of the group is used accordingly for current measuring mode (I_C).

The "1st" returns the measured value. The "2nd" channel of the group is assigned the default overflow value "$7FFF_H$."

Wiring: 2-wire and 4-wire transducers for current measurement

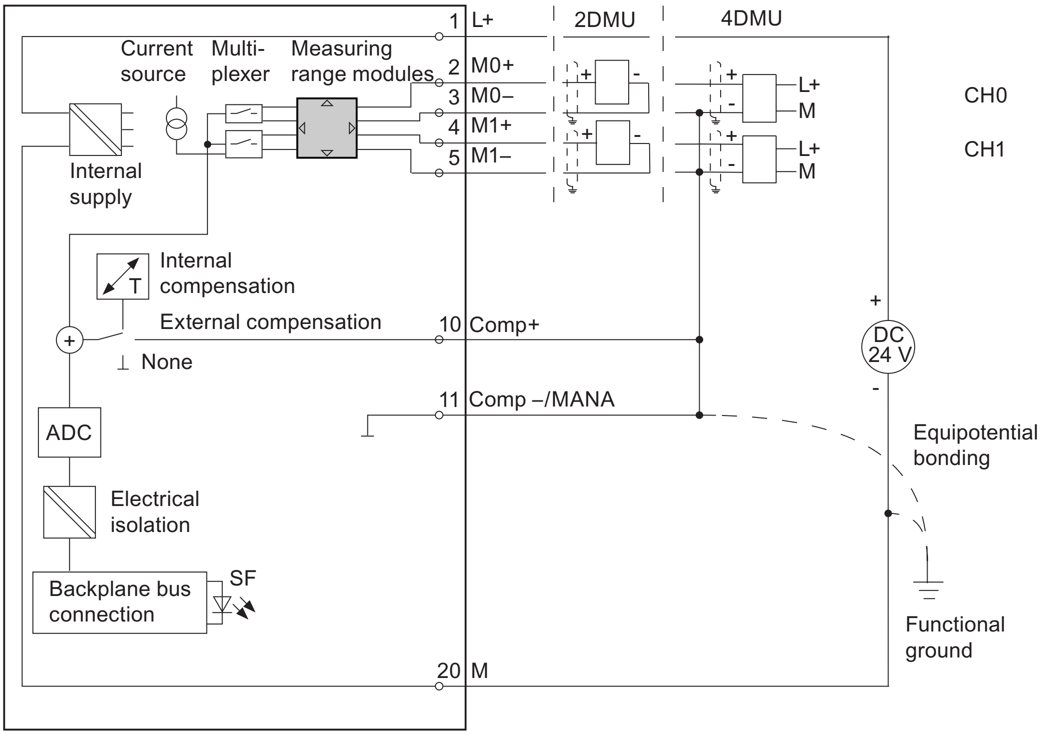


Figure 6-21 Wiring and block diagrams

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 ± 10 mA 0 mA to 20 mA 4 mA to 20 mA ± 20 mA	C

Caution
Any voltage measurement will destroy the measuring range module if "current" measuring mode is set at this module!

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 • with resistive transducers	2 1			
Cable length • shielded	max. 200 m max. 50 m at 80 mV and with thermocouples			
Voltages, currents, electrical potentials				
Rated electronics supply voltage L + • Reverse polarity protection	24 VDC yes			
Transducer power supply • Supply current • short circuit-proof	 max. 60 mA (per channel) yes			
Constant current for resistive transducers	typ. 1.67 mA (pulsed)			
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply – not for 2-wire transducers	 yes yes			
Maximum potential difference • between inputs and M_{ANA} (CMV) – at signal = 0 V • between inputs (CMV) • between M_{ANA} and $M_{internal}$ (V_{iso})	 typ. DC 2.5 V (> DC 2.3V) typ. DC 2.5V (> DC 2.3V) 75 VDC / 60 VAC			
Isolation 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. 1.3 W			
Generation 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	6	34	44	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...				
• Series-mode interference (CMV < 2.5 V) • Seriesmode interference (peak value < rated input range)	> 70 dB > 40 dB			
Crosstalk between inputs	> 50 dB			
Operational error limit (across temperature range, relative to input range)				
• Voltage input	80 mV 250 mV to 1000 mV 2.5 V 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 V 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 • Limit interrupt • Diagnostics interrupt	programmable Channels 0 programmable			

Technical data		
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported	
Sensor 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 100 kΩ 100 kΩ 100 kΩ 100 kΩ
• 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
Maximum voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20)	
Maximum current at current input (destruction limit)	40 mA	
Wiring of the signal sensors	using a 20-pin front connector	
• for voltage measurement	supported	
• for current measurement as 2-ire 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	
Characteristics linearization • for thermocouples • for 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 measurement	programmable supported supported supported degrees Centigrade	

6.8.1 Measurement types and ranges

Introduction

SM 331; AI 2 x 12 Bit is equipped with a measuring range module. The measurement type and range is configured at the "measuring range" parameter in *STEP 7*. You can use the default "voltage" measurement type and "± 10 V range without having to program the SM 331; AI 2 x 12 Bit in *STEP 7*.

Measuring range module

Change the position of the measuring range module to set the measurement type and range (see the chapter *Setting the measurement types and ranges of analog input channels*). The necessary settings are also available on the module's imprint. Mark the position of the measuring range module on the front door (see figure).

Range:

A	B
C	D

Table 6-21 Measurement types and ranges

Selected type of measurement	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
TC-I: Thermocouple (internal comparison) (thermal voltage measurement)	Type N [NiCrSi-NiSi] Type E [NiCr-CuNi] Type J [Fe-CuNi] Type K [NiCr-Ni] Type L [Fe-CuNi]	A
TC-E: Thermocouples (external comparison) (thermal voltage measurement)		
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 type of measurement	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

The two channels of SM 331; AI 2 x 12 Bit form a channel group. You can assign parameters only to one channel group.

SM 331; AI 2 x 12 Bit is equipped with a measuring range module for channel group 0.

Line continuity check

The line continuity check is designed only for temperature measurements (thermocouples and thermoresistors.)

Special features of the line continuity check for the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and enabled the line continuity check, the analog input module logs a wire-break event to diagnostics data when the current drops below 3.6 mA.

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

If you configured a measuring range of 4 mA to 20 mA, disabled the line continuity check, and enabled diagnostic interrupts, the module triggers a diagnostic interrupt when the underflow value is reached.

6.8.2 Programmable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

Parameters

Table 6-22 Overview of the parameters of SM 331; AI 2 x 12 Bit

Parameters	Range of values	Default	Parameter type	Scope
Enable • Diagnostics interrupt • Process interrupt when limit exceeded	 yes/no yes/no	 no no	 dynamic	 Module
Process interrupt trigger • High limit • Low limit	 32511 to -32512 from - 32512 to 32511	-	dynamic	Channel
Diagnostics • Group diagnostics • with line continuity check	 yes/no yes/no	 no no	static	Channel group
Measurement • Measurement type	 disabled Voltage V 4DMU current (4-wire transducer) 2DMU current (2-wire transducer) R-4L resistance (4-wire connection) RTD-4L thermoresistor (linear, 4-wire connection) TC-I thermocouple (internal comparison) TC-E thermocouple (external comparison) TC-IL thermocouple (internal comparison) TC-EL thermocouple (linear, external comparison)	 V	dynamic	Channel or channel group
• Measuring range	Refer to the chapter *Measuring methods and ranges* for the adjustable measuring ranges of the input channels	± 10 V		
• Noise suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

See also

Programming analog modules (Page 225)

Diagnostics messages of analog input modules (Page 227)

6.8.3 Additional information on SM 331; AI 2 x 12 Bit

Unused channels

Short-circuit unused channels and connect these with M_{ANA}. This optimizes interference immunity of the analog input module. Set the "disabled" value at the "measurement type" parameter for unused channels. This setting reduces module cycle times.

Also short-circuit the COMP input if this is not used.

As certain programmed inputs may remain unused due to the channel group configuration, make allowances for the special features of these inputs outlined below in order to be able to use the diagnostics functions at these used channels:

- 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 setting up the channel circuit:

  a) Open unused input; channel group diagnostics disabled. The analog module would trigger a single diagnostics interrupt and set its SF LED if diagnostics is enabled.

  b) Terminating the unused input using a 1.5 kΩ to 3.3 kΩ 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.

Line continuity check

The line continuity check is designed only for temperature measurements (thermocouples and thermoresistors.)

Special features of the line continuity check for the 4 mA to 20 mA measuring range

If you configured a measuring range of 4 mA to 20 mA, and enabled the line continuity check, the analog input module logs a wire-break event to diagnostics data when the current drops below 3.6 mA.

The module also triggers a diagnostics interrupt if this function is enabled in the program.

A wire break can only be signaled by means of the lit SF LED and the diagnostic bytes must be evaluated in the user program if diagnostics interrupts are disabled.

If you configured a measuring range of 4 mA to 20 mA, disabled the line continuity 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
- Programmable measurement type at each channel group
  - Resistance
  - Temperature
- Programmable resolution at each channel group (15 bits + sign)
- Any measuring range per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 8 channels
- Programmable process interrupt when limit is exceeded
- High-speed update of measured values at up to 4 channels
- Programmable process interrupt at end of cycle
- Electrical isolation to the CPU

Resolution

The resolution of measured values is independent of the selected integration time.

Diagnostics

For information on diagnostics messages consolidated in the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups 0 and 1 can be programmed in STEP 7. However, set a process interrupt only for the first channel of a channel group, that is, either at channel 0, or at channel 2

Terminal assignment

The diagrams below show the various wiring options. These examples apply to all channels (channel 0 to 7).

> **⚠ Caution**
>
> Any faulty wiring of the 3-wire connections may cause unexpected module states and hazardous plant states.

Wiring: 2, 3 and 4-wire connection for resistance and thermoresistor measurement

Connection possible at both sides at channels 0 to 7

Note

Up to product version 02 of the module, an unused channel of an active channel group has to be interconnected in order to avoid incorrect measurements.

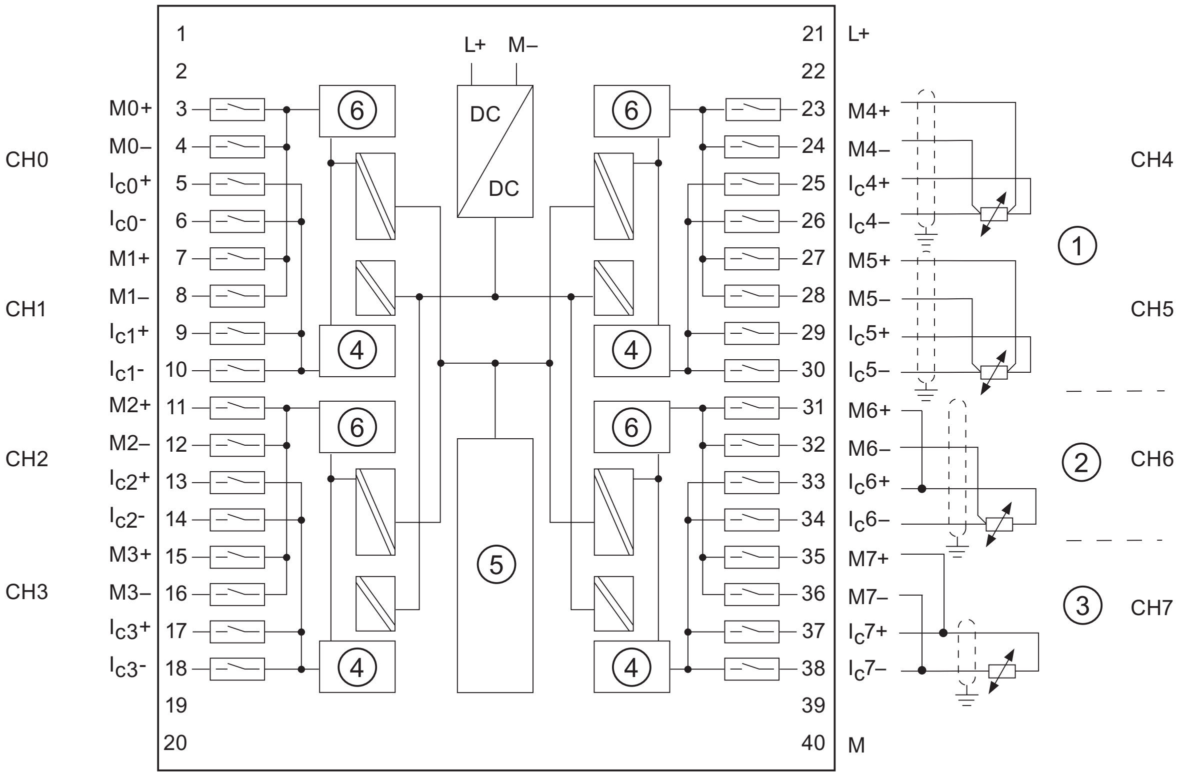


Figure 6-22 Wiring and block diagrams

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 the 3-wire connections may cause unexpected 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 I_{C-} **and** M_- cables directly to the resistance thermometer.

Wiring: 2-wire connection

For 2-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 impedance. The line impedance is included in the measurement!

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 + • Reverse polarity protection	24 VDC yes
Constant measuring current for resistive transducers	typ. 5 mA (pulsed)
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels in groups of	 yes yes yes 2
Maximum 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. 4.6 W
Generation of analog values	
Measuring principle	Integrating
Mode of operation	**8-channel mode (hardware filter)**

Technical data	
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
Noise suppression, error limits	
Noise suppression at f = n (f1 ± 1%), (f1 = interference frequency) n=1.2, ...	
• Common-mode interference (CMV < 60 V) • Seriesmode interference (peak value < rated input range)	> 100 dB > 90 dB
Crosstalk between inputs	> 100 dB
Operational error limit (across temperature range, relative to input range 0 to 60°C)	
• Resistance thermometers – 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 thermometers – 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 thermometers • Resistance	 ± 0.015 °C/K ± 0.005 °%/K

Technical data	
Linearity error (relative to input range) • Resistance thermometers • 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 • Process interrupt • Diagnostics interrupt	 Programmable (channels 0-7) programmable
Diagnostics function • Group error display • Reading diagnostics information	programmable red LED (SF) supported
Sensor 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
Maximum voltage at voltage input (destruction limit)	35 V DC continuous; 75 V DC for max. duration of 1 s (duty factor 1:20) 20)
Wiring of the signal sensors • for resistance measurement with 2-wire connection with 3-wire connection with 4-wire connection	using a 40-pin front connector supported supported*** supported
Characteristics linearization • Resistance thermometer • Technical unit of temperature measurement	 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 impedance at intervals of five minutes.

** Wire-break monitoring in 4-channel mode (hardware filter) at intervals of three seconds.

*** Maximum line impedance for 3-wire transducer measurements for the RTD elements PT 10 and Cu 10: 10 Ω. Maximum line impedance for all other RTD elements during 3-wire transducer measurements: 20 Ω.

**** In 4-channel mode, the converted value settles to 100 % within 80 ms. The value determined in this process is set at intervals of 3.3 ms (max. 10 ms).

6.9.1 Measurement types and ranges

Introduction

The measurement type and range is configured at the "measurement type" parameter in *STEP 7*.

Table 6-23 Measurement types and ranges

Selected type of measurement	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

* ≙ LG-Ni 1000 with temperature coefficient 0.00618 or 0.00672

Channel groups

The channels of SM 331; AI 8 x RTD are arranged in four groups of two channels. You can assign parameters only to one channel group.

The table below shows the relevant configuration of channel groups. The channel group number is required to program 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 Programmable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides an overview of programmable parameters and of their defaults:

Parameters

Table 6-25 Overview of SM 331; AI 8 x RTD parameters

Parameters	Range of values	Default	Parameter type	Scope
Enable • Diagnostics interrupt • Process interrupt when limit exceeded • Process interrupt at end of cycle	 yes/no yes/no yes/no	 no no no	dynamic	Module
Process interrupt trigger • High limit • Low limit	 32511 to -32512 from - 32512 to 32511	 32767 -32768	dynamic	Channel
Diagnostics • Group diagnostics • with line continuity check	 yes/no yes/no	 no no	static	Channel group

Parameters	Range of values	Default	Parameter type	Scope
Measurement • Measurement type	disabled R-4L resistance (4-wire connection) R-3L resistance (3-wire connection) RTD-4L thermoresistor (linear, 4-wire connection) RTD-3L thermoresistor (linear, 3-wire connection)	RTD-4L	dynamic	Channel group
• Measuring range	See the table *Measurement types and ranges*	Pt 100 Klima 0.003850 (IPTS-68)		
• 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-channel mode, hardware filter	dynamic	Module
• Temperature coefficient for temperature measurement with thermoresistor (RTD)	Platinum (Pt) 0.003850 Ω/Ω/ °C (IPTS-68) 0.003916 Ω/Ω/ °C 0.003902 Ω/Ω/ °C 0.003920 Ω/Ω/ °C 0.003850 Ω/Ω/ °C (ITS-90) 0,003910 Ω/Ω/ °C Nickel (Ni) 0,006170 Ω/Ω/ °C 0.006180 Ω/Ω/ °C 0.006720 Ω/Ω/ °C 0.005000 Ω/Ω/ °C (LG Ni 1000) Copper (Cu) 0,004260 Ω/Ω/ °C 0,004270 Ω/Ω/ °C 0,004280 Ω/Ω/ °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 weak medium strong	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 225)

Diagnostics messages of analog input modules (Page 227)

6.9.3 Additional information on SM 331; AI 8 x RTD

Modes of operation

Operating modes of 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 changes between the two channels of each group. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, and then the channels with the odd numbers 1, 3, 5 and 7 (see the figure below.)

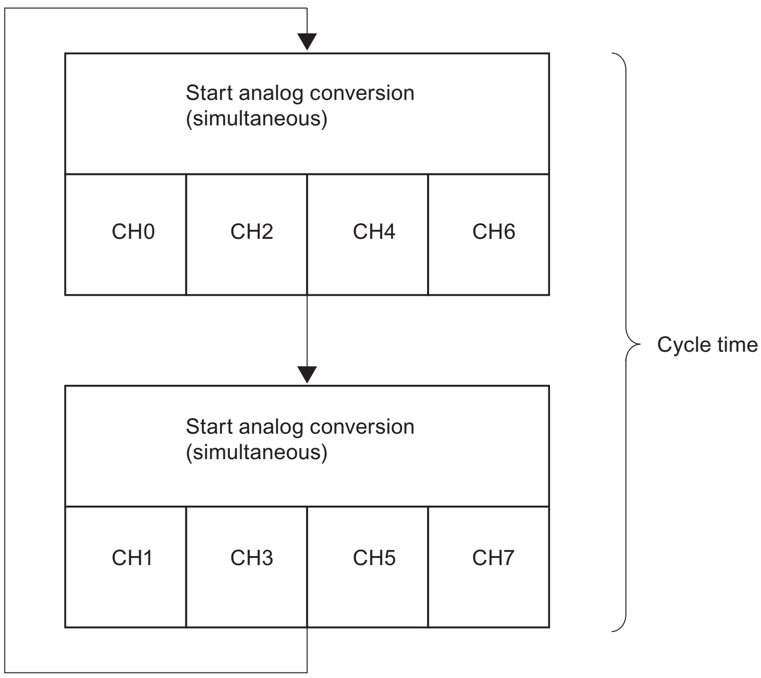


Figure 6-23 8-channel mode cycle time (hardware filter)

Cycle time of module in 8-channel mode

The channel conversion time, including module communication time, is 84 ms. The module must change to the second channel of the group using OptoMOS relays when conversion is completed. Opto-MOS relays require 12 ms for switching and settling. Each channel requires a time of 97 ms, i.e. the total cycle time equals 194 ms.

Cycle time = (t_K + t_U) x 2

Cycle time = (84 ms + 16 ms) x 2

Cycle time = 200 ms

t_C: Conversion time for one channel
t_C: 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 ADCs of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, and then the channels with the odd numbers 1, 3, 5 and 7 (see the figure below.)

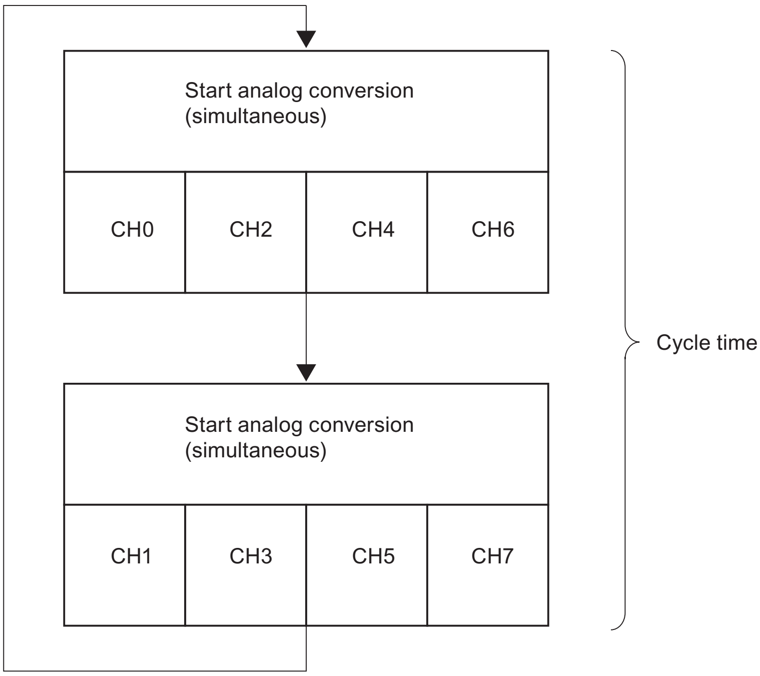


Figure 6-24 8-channel mode cycle time (software filter)

Cycle time of module in 8-channel mode (software filter)

The channel conversion time is based on the programmed interference frequency. The channel conversion time is 32 ms, including communication time, when you set an interference frequency of 50 Hz. The channel conversion time is 27 ms when you set an interference frequency of 60 Hz. 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 correlation.

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 change between the channels of the groups. The four ADCs of the module simultaneously convert the channels 0, 2, 4 and 6.

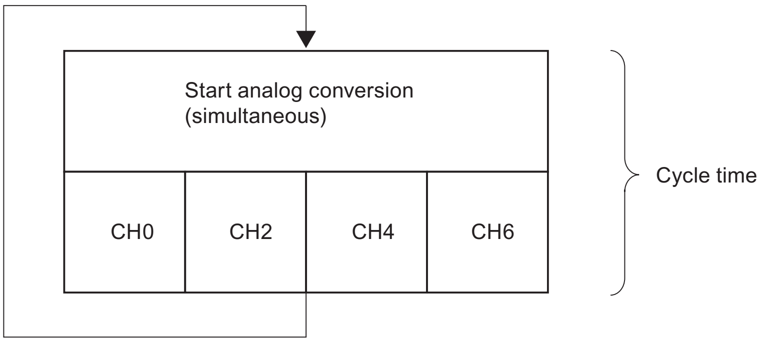


Figure 6-25 4-channel mode cycle time (hardware filter)

Cycle time of the module in 4-channel mode (hardware filter)

The converted value settles to 100% within 80 ms and is updated at intervals of 10 ms when 4-channel mode is set. The channel and module cycle times are always identical, as the module does not change 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 and performs a line continuity check. That is, each line continuity check extends the module cycle time by 100 ms.

Unused channels

In order to avoid incorrect measurements, the module's product up to version 02 must be configured with an unused channel of an active group of channels. Connect a resistor of the nominal range to the unused channel in order to suppress diagnostics errors.

Set the "disabled" value at the "measurement type" parameter for unused channels. This setting reduces module cycle times.

Short-circuit to M or L

The module does not suffer any damage if you short-circuit an input channel to M or L.. 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 is set when all active channels have been converted.

The table below shows the contents of the 4 bytes of additional OB40 information during process or end of cycle interrupts.

Content of the 4 bytes with 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.

Certain parameters are not allowed 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.. Non-S7 masters do not support process interrupts. All parameters associated with these functions are disabled for this reason. This includes process interrupt enable, hardware restrictions and end the enabling of cycle interrupts. All other parameters are allowed.

Operating the submodule 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
- Programmable measurement type at each channel group
  - Temperature
- Programmable resolution at each channel group (15 bits + sign)
- Any measuring range per channel group
- Programmable diagnostics and diagnostics interrupt
- Programmable limit value monitoring for 8 channels
- Programmable process interrupt when limit is exceeded
- High-speed update of measured values at up to 4 channels
- Programmable process interrupt at end of cycle
- Electrical isolation to the CPU

Resolution

The resolution of measured values is independent of the selected integration time.

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog input modules*.

Process interrupts

Process interrupts for channel groups 0 and 1 can be programmed in *STEP 7*. However, set a process interrupt only for the first channel of a channel group, that is, either at channel 0, or at channel 2

Terminal assignment

The diagrams below show various wiring options. These 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.

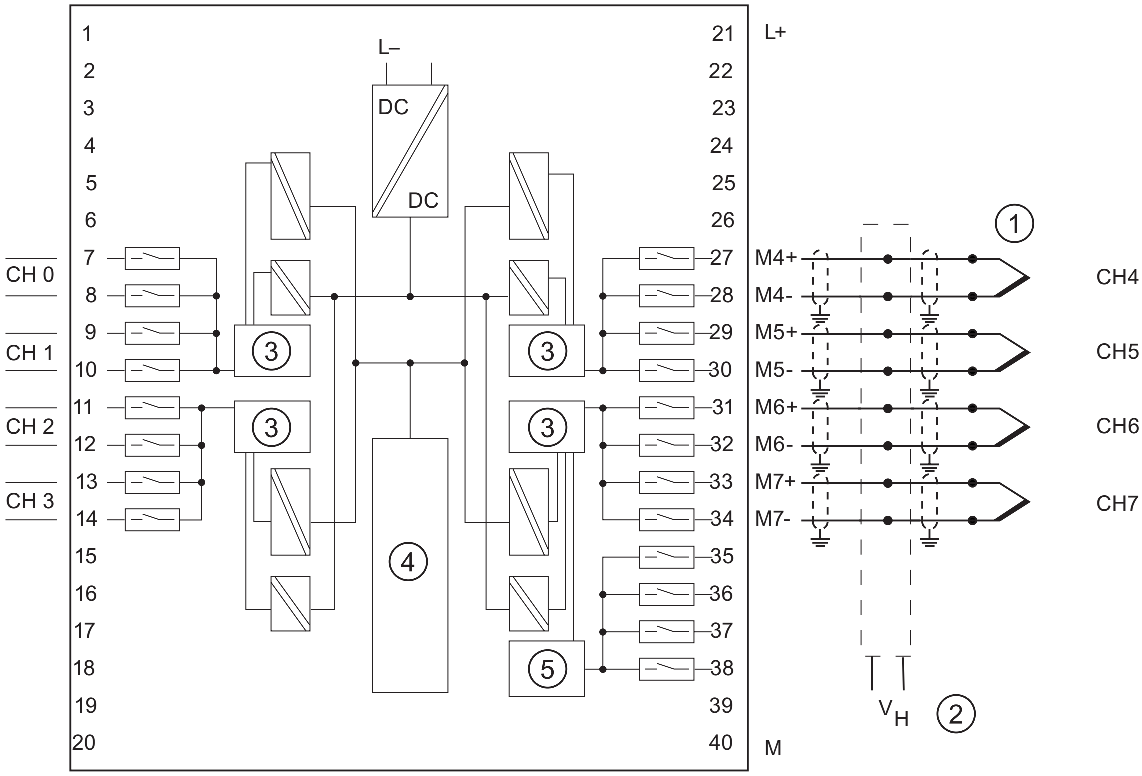


Figure 6-26 Wiring and block diagrams

① Thermocouple via reference junction

② Reference junction regulated to 0 °C or 50 °C
for example, 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 type of compensation, the temperature of the terminals at the reference junction is established using a resistance thermometer Pt100 with a temperature range of -25 °C to 85 °C (see terminals 35 to 38).

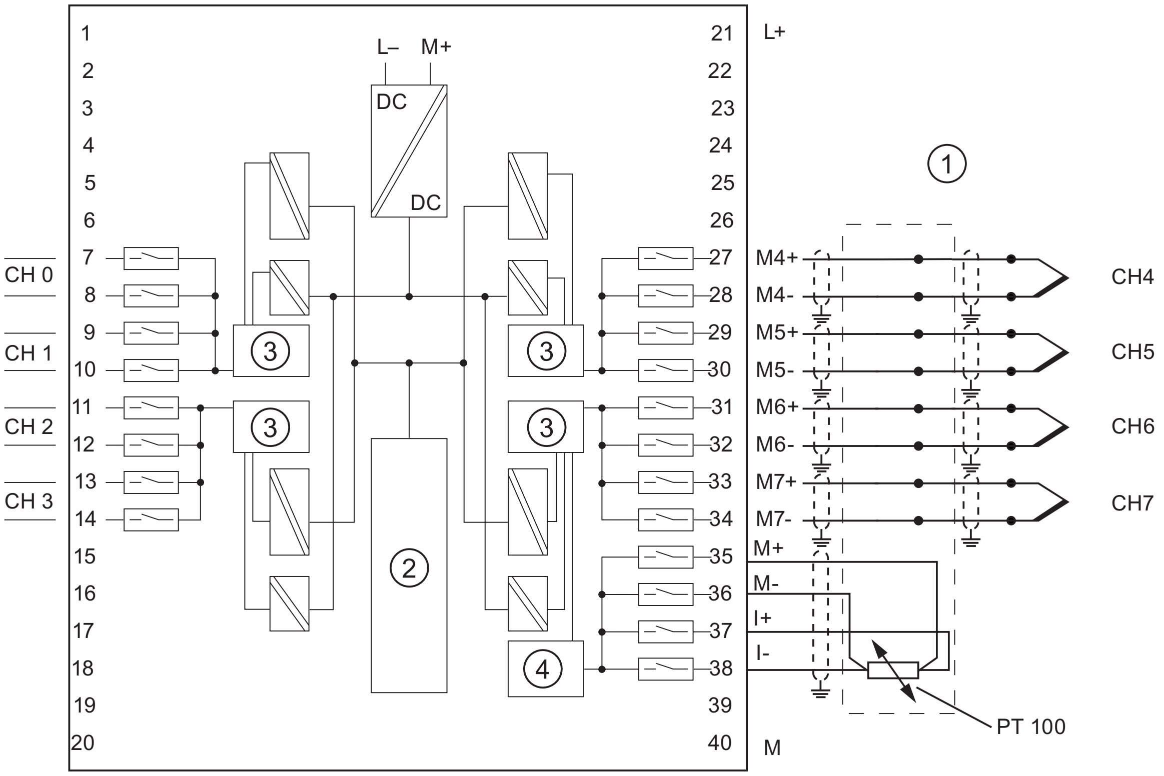


Figure 6-27 Wiring and block diagrams

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, the module registers the temperature at the reference junction in the connector.

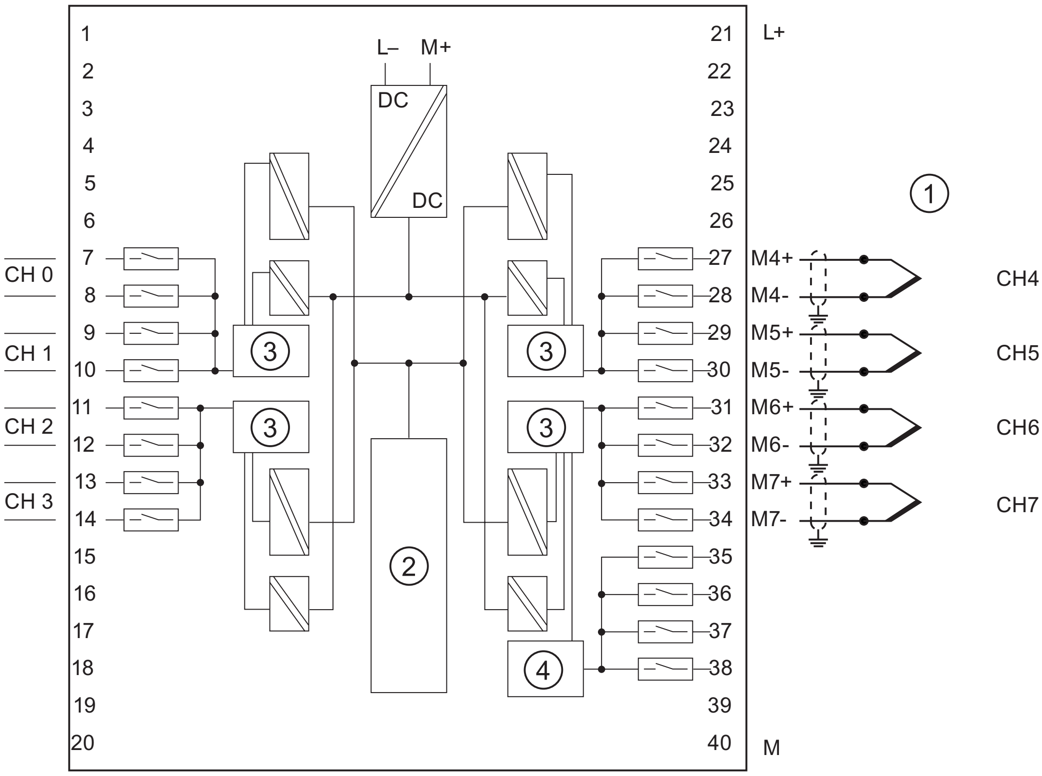


Figure 6-28 Wiring and block diagrams

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 x117
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
Maximum 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
Generation 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/weak/medium/strong
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/weak/medium/strong
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)**

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/weak/medium/strong	
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 error limit (across temperature range, relative to input range) 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%	
Repetition accuracy (in transient state at 25 °C, relative to input range)***		±0.01%	
Status, interrupts, diagnostics			
Interrupts • Process interrupt • Diagnostics interrupt		 programmable (channels 0 to 7) programmable	
Diagnostics functions • Group error display • Reading diagnostics information		programmable red LED (SF) supported	
Sensor selection data			
Input ranges (rated values) / input impedance • Thermocouples		 Type B, C, N, E, R, S, J, L, T, K, U, TxK/ xK (L)	
Maximum voltage at voltage input (destruction limit)		20 VDC continuous; 75 VDC for the duration of max. 1 s (duty factor 1:20)	
Characteristics linearization		programmable	

Technical data	
Temperature compensation • Internal temperature compensation • External temperature compensation with Pt 100 (0.003850) • Compensation for 0 °C reference junction temperature • Compensation for 50 °C reference junction temperature • Technical unit of temperature measurement	programmable supported supported supported supported Degrees Centigrade / degrees Fahrenheit
Wiring of the signal sensors	using a 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 error limit comprises only the basic error of the analog input at Ta = 25 °C and the total temperature error. The total error must include the compensation error of the cold reference junction. Internal compensation of the reference junction = max. 1.5 °C
External compensation of the reference junction = precision of external RTD employed ± 0.1 °C.
External compensation of the reference junction which maintains the reference junction at 0 °C or 50 °C = precision of temperature control for the reference junction.

**** Because of the slight rise within the range of approx. 0 °C to 85 °C, the lack of compensation for the reference junction temperature only has a negligible effect on a type B thermocouple. If there is no compensation, and the measurement type "Compensation to 0 °C" is set, the deviation at the type B thermocouple during temperature measurement is: 200 °C to 1802 °C < 0.5 °C

***** In 4-channel mode, the converted value settles to 100 % within 80 ms. The value determined in this process is set at intervals of 3.3 ms (max. 10 ms).

6.10.1 Measurement types and ranges

Introduction

The measurement type and range are configured at the "measurement type" parameter in *STEP 7*.

Table 6-27 Measurement types and ranges

Selected type of measurement	Measuring range
TC-L00C: (thermocouple, linear, 0 °C reference temperature) TC-L50C: (thermocouple, linear, 50 °C reference temperature) TC-IL: (thermocouple, linear, internal comparator) TC-EL: (thermocouple, linear, external comparison)	Type B Type C Type E Type J Type K Type L 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 can assign parameters only to one channel group.

The table below shows the relevant configuration of channel groups. The channel group number is required to program 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 Programmable 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 • Diagnostics interrupt • Process interrupt when limit exceeded • Process interrupt at end of cycle	 yes/no yes/no yes/no	 no no no	dynamic	Module
Process interrupt trigger • High limit • Low limit	32511 to -32512 from - 32512 to 32511	32767 -32768	dynamic	Channel
Diagnostics • Group diagnostics • with line continuity check	 yes/no yes/no	 no no	static	Channel group
Measurement • Measurement type	disabled TC-IL thermocouple (linear, internal comparison) 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 the table *Measurement types and ranges*	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

Parameters	Range of values	Default	Parameter type	Scope
• Smoothing	none weak medium strong	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 225)

Diagnostics messages of analog input modules (Page 227)

6.10.3 Additional information on SM 331; AI 8 x TC

Modes of operation

Operating modes of 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 changes between the two channels of each group. The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, and then the channels with the odd numbers 1, 3, 5 and 7 (see the figure below.)

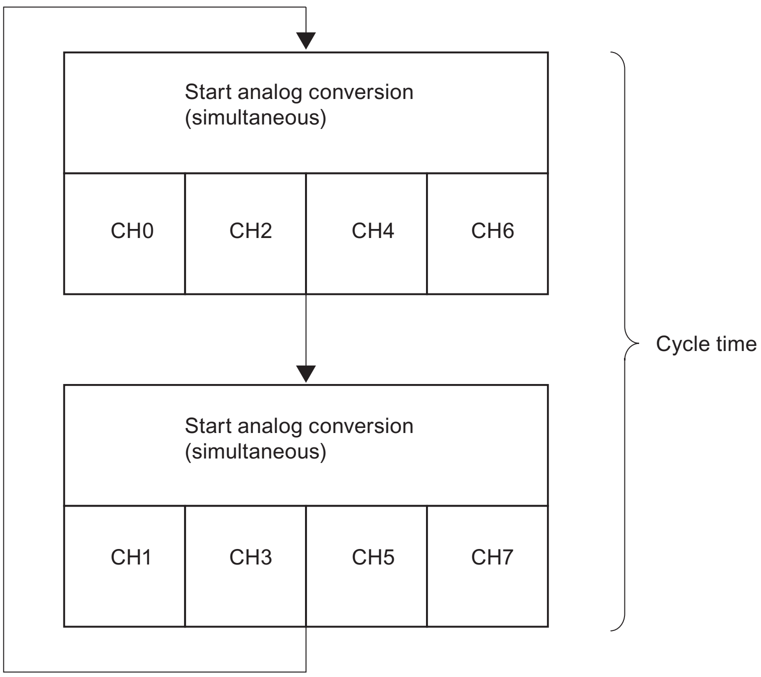


Figure 6-29 8-channel mode cycle time (hardware filter)

Cycle time of the module in 8-channel mode (hardware filter)

The channel conversion time, including module communication time, is 91 ms. The module must change to the second channel of the group using OptoMOS relays when conversion is completed. Opto-MOS relays require 7 ms for switching and settling. Each channel requires a time of 98 ms, i.e. the total cycle time equals 196 ms.

Cycle time = (t_K + t_U) x 2

Cycle time = (91 ms + 7 ms) x 2

Cycle time = **196 ms**

t_C: Conversion time for one channel
t_C: 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 similar to conversion in 8-channel mode (hardware filter). The four ADCs of the module simultaneously convert channels 0, 2, 4 and 6. The ADCs first convert the channels with even numbers, and then the channels with the odd numbers 1, 3, 5 and 7 (see the figure below.)

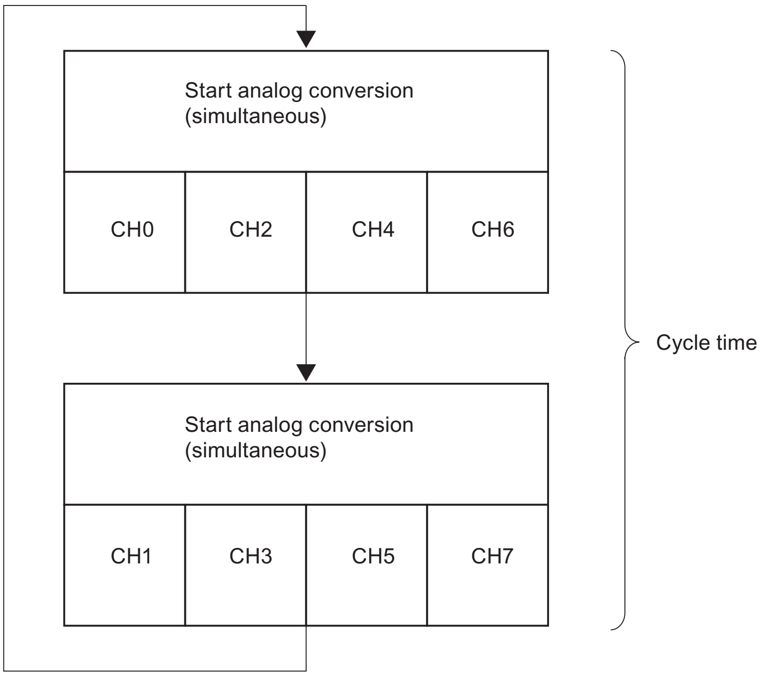


Figure 6-30 8-channel mode cycle time (software filter)

Cycle time of module in 8-channel mode (software filter)

However, the channel conversion time is oriented on the programmed noise suppression. The channel conversion time is 76 ms, including communication time, when you set an interference frequency of 50 Hz. The channel conversion time is 65 ms when you set an interference frequency of 60 Hz. 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 change to the second channel of the group within a changeover time of 7 ms using the Opto-MOS relays. The table below shows this correlation.

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 change between the channels of the groups. The four ADCs of the module simultaneously convert the channels 0, 2, 4 and 6.

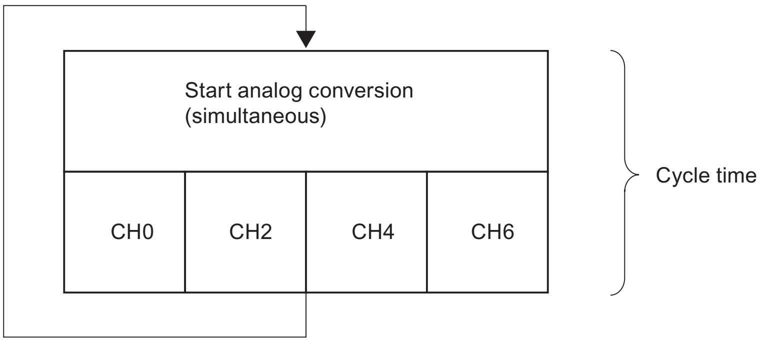


Figure 6-31 4-channel mode cycle time (hardware filter)

Cycle time of the module in 4-channel mode (hardware filter)

The converted value settles to 100 % within 80 ms and is updated every 10 ms when 4-channel mode is set. The channel and module cycle times are always identical, as the module does not change 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 and performs a line continuity check. That is, each line continuity check extends the module cycle time by 93 ms.

Unused channels

Set the "disabled" value at the "measurement type" parameter for unused channels. This setting reduces module cycle times.

Terminate all unused channels of an active group, that is, you short-circuit the positive and negative inputs of these channels.

Effect of this measure:

- Measurement errors at the channels used of a group are avoided
- Diagnostics messages from the unused channel in a group are suppressed

Short-circuit to M or L

The module does not suffer any damage if you short-circuit an input channel to M or L.. 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 is set when all active channels have been converted.

Table 6-31 The table below shows the contents of the 4 bytes of additional OB40 information during process or end of cycle interrupts.

Content of the 4 bytes with 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 xTC 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 process interrupts. All parameters associated with these functions are disabled for this reason. This includes process interrupt enable, hardware restrictions and end of cycle interrupt enable. All other parameters are allowed.

Operating the submodule 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 diagnostics interrupt
- Programmable diagnostics interrupt
- Electrically isolated from the backplane bus interface and load voltage

Diagnostics

For information on diagnostics messages consolidated in the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The diagrams below show various wiring options. These 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 connection for voltage output

The following image depicts:

- 2-wire connection, no compensation for line impedance and
- 4-wire connection with compensation for line impedance

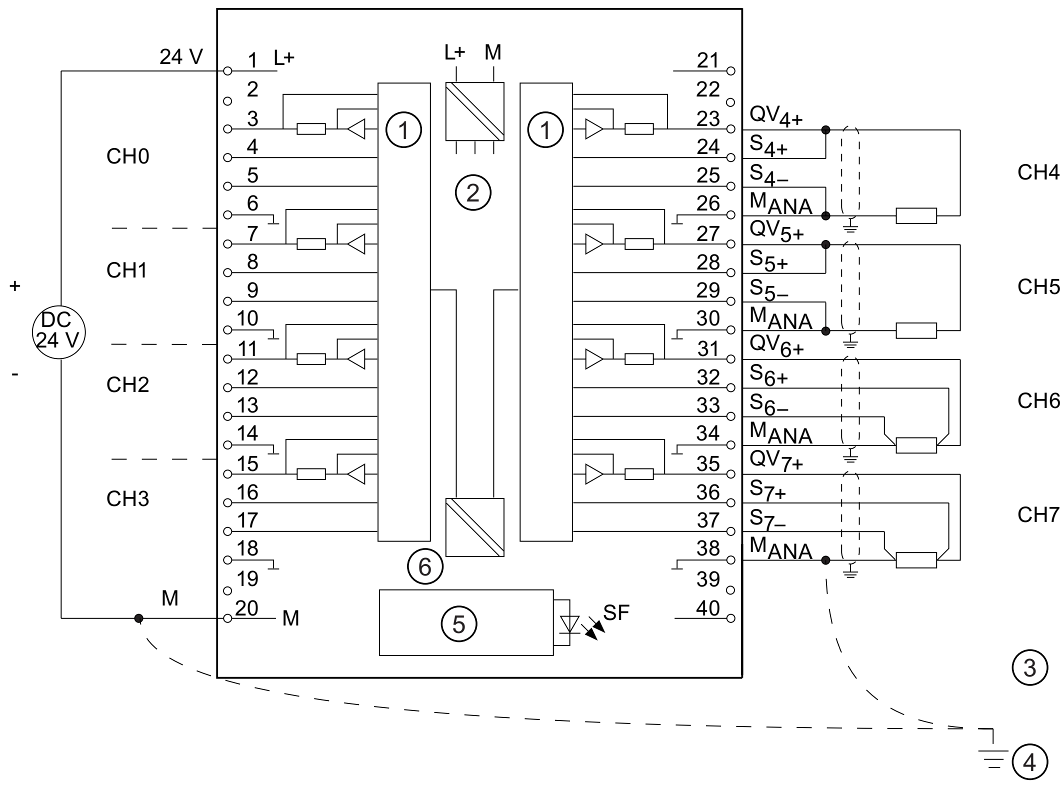


Figure 6-32 Wiring and block diagrams

Numeral	Description
①	DAC
②	Internal supply
③	Equipotential bonding
④	Functional earth
⑤	Backplane bus interface
⑥	Electrical isolation

Wiring: Current output

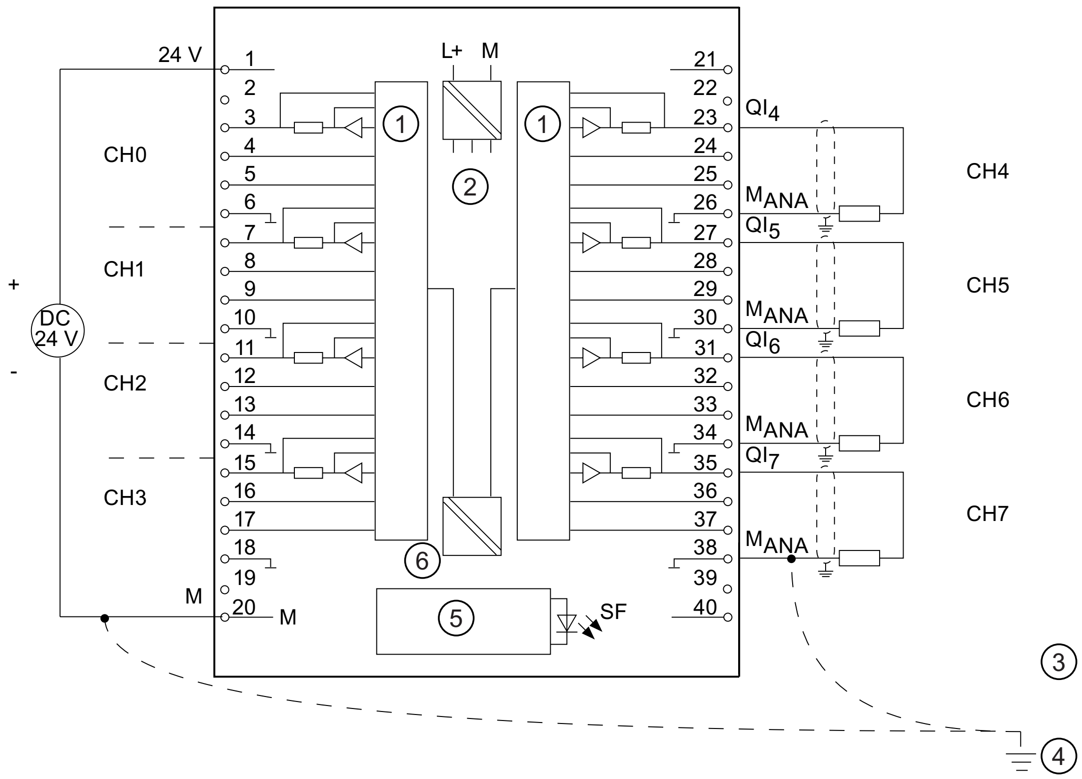


Figure 6-33 Wiring and block diagrams

Numeral	Description
①	DAC
②	Internal supply
③	Equipotential bonding
④	Functional earth
⑤	Backplane bus interface
⑥	Electrical isolation

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

Technical data	
Voltages, currents, electrical potentials	
Rated load voltage L+ • Reverse polarity protection	24 VDC yes
• Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels • between channels and load voltage L+	 yes yes no yes
Maximum potential difference • between S- and M_{ANA} (CMV) • between M_{ANA} and $M_{internal}$ (V_{ISO})	 3 VDC 75 VDC / 60 VAC
Isolation test voltage	500 VDC
Current consumption • from the backplane bus • from supply voltage L+ (no load)	 max. 100 mA max. 340 mA
Power loss of the module	typ. 6.0 W
Generation of analog values	
• Resolution, including sign	
• ± 10 V; ± 20 mA; 4 mA to 20 mA; 1 V to 5 V • 0 V to 10 V; 0 mA to 20 mA; • Conversion time (per channel)	11 bits + sign 12 bits max. 0.8 ms
Settling time • with resistive load • with capacitive load • with inductive load	 0.2 ms 3.3 ms 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 • Current output	± 0.5 % ± 0.6 %
Basic error limit (operational error limit at 25 °C, relative to output range)	
• Output voltage • Output current • Temperature error (relative to output range) • Linearity error (relative to output range) • Repetition accuracy (in transient state at 25 °C, relative to output range) • Output ripple; bandwidth 0 kHz to 50 kHz (relative to output range)	± 0.4 % ± 0.5 % ± 0.002 %/K + 0.05 % ± 0.05 % ± 0.05 %
Status, interrupts, diagnostics	
Interrupts • Diagnostics 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	± 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 output range)	
• For voltage outputs – capacitive load	min. 1 kΩ 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 of the actuators • for voltage output 4–wire connection • for current output 2–wire connection	using a 40-pin front connector supported supported

6.11.1 SM 332; AO 8 x 12 Bit - Output ranges

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable them. You program the outputs at the "output type" parameter in *STEP 7*.

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 analog values for analog output channels (Page 212)

6.11.2 Programmable 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 Overview of the parameters of SM 332; AO 8 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable • Diagnostics interrupt	yes/no		no	dynamic	Module
Diagnostics • Group diagnostics	yes/no		no	static	Channel
Output • Output type • Output range	disabled Voltage Current See table of *output ranges*		V ± 10 V	dynamic	Channel
Reaction to CPU STOP	ASS HLV SSV	Outputs zero current/voltage Hold last value Set substitute value	ASS	dynamic	Channel

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 8 x 12 Bit. You can assign separate parameters to each output channel.

Assign the parameters you set at the SFCs in the user program to the 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 225)

Diagnostics messages of analog output modules (Page 227)

6.11.3 Additional information on 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 do not have to be wired.

Line continuity check

SM 332; AO 8 x 12 Bit only performs a line continuity check at the current outputs.

In output ranges 0 mA to 20mA and ±20mA, a "reliable" line continuity check is not possible for output values of -20s...+200μA.

Short-circuit test

SM 332; AO 8 x 12 Bit only performs a short-circuit test at the voltage outputs.

6.12 Analog output module SM 332; AO 4 x 16 bit; isochrone; (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 diagnostics 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 messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The diagrams below show various wiring options.

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

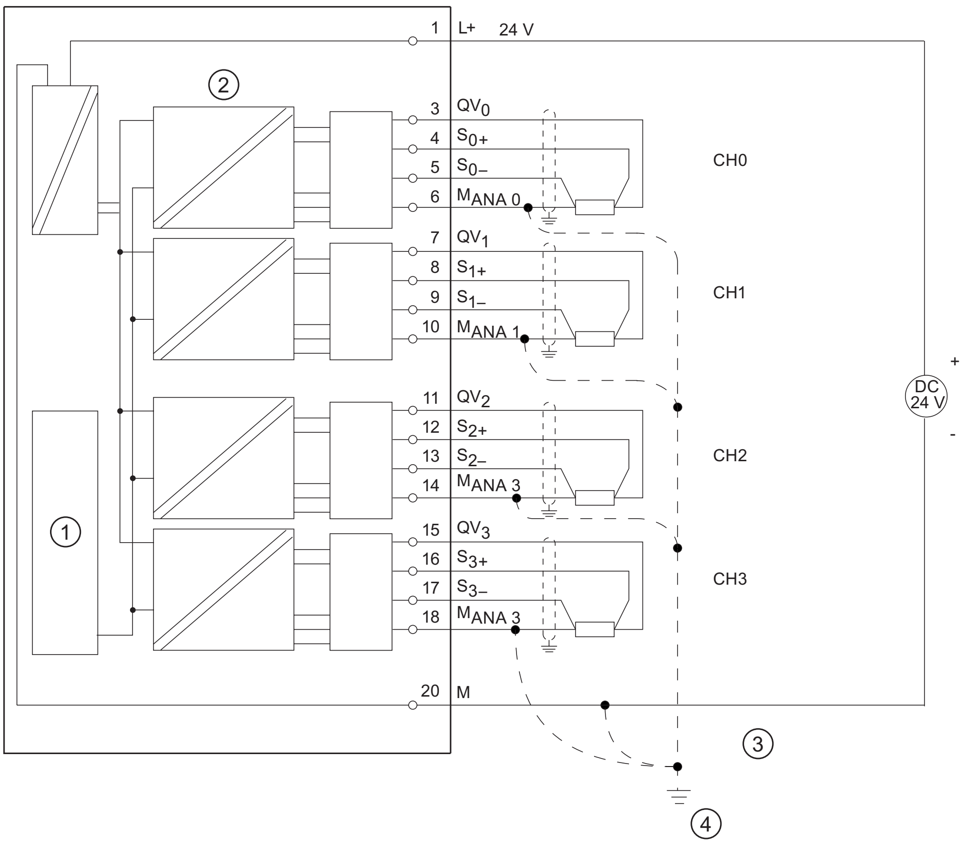


Figure 6-34 Wiring and block diagrams

① Backplane bus interface
② Electrical isolation
③ Equipotential bonding
④ Functional earth

Wiring: 2-wire connection

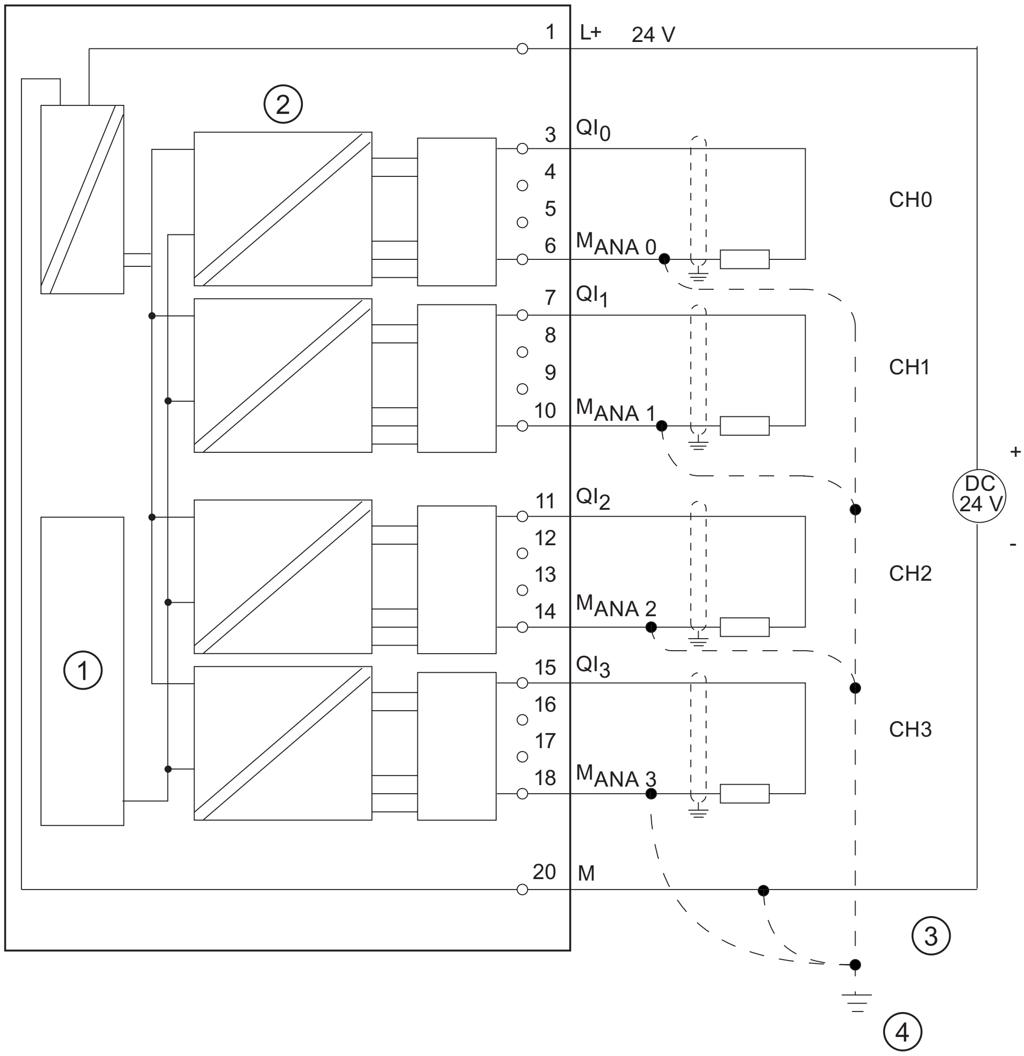


Figure 6-35 Wiring and block diagrams

① Backplane bus interface
② Electrical isolation
③ Equipotential bonding
④ Functional 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 • Reaction of non-programmed outputs	yes return the output value which was valid before the parameterization
Number of outputs	4
Cable length • shielded	max. 200 m
Voltages, currents and potentials	
Rated load voltage L+ • Reverse polarity protection	24 VDC yes
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels	 yes yes yes
Maximum potential difference • between outputs (ECM) • between M_{ANA} and $M_{internal}$ (V_{ISO})	 200 VDC / 120 VAC 200 VDC / 120 VAC
Isolation test voltage	1500 VDC
Current consumption • from the backplane bus • from load voltage L+ (no-load)	 max. 120 mA max. 290 mA
Power loss of the module	typ. 3 W
Generation of analog values	
Resolution (including sign) • ± 10 V • 0 V to 10 V • 1 V to 5 V • ± 20 mA • 0 mA to 20 mA • 4 mA to 20 mA	 16 bits 15 bits 14 bits 16 bits 15 bits 15 bits
Conversion time (per channel) • in standard mode • in isochronous mode	 <200 µs 640 µs
Basic execution time of the module (independent of the number of enabled channels) • in standard mode • in isochronous mode	 <800 µs 750 µs

Technical data	
Settling time • with resistive load • with capacitive load • with inductive load	 0.2 ms 3.3 ms 0.5 ms (1 mH) / 3.3 ms (10 mH)
Noise suppression and error limits	
Crosstalk between outputs	> 100 dB
Operational limit (across the temperature range, relative to output range)	
• Voltage output • Current output	±0.12% ±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 • Current output	 ± 0.0025%/K ± 0.004%/K
Linearity error (relative to output range)	±0.004%
Repetition accuracy (in transient state at 25°, relative to output range)	±0.002 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	±0.05 %
Status, interrupts, diagnostics	
Interrupts • Diagnostics interrupt	 programmable
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported
Set substitute 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

Technical data	
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
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 of the actuators • for voltage output – 4-wire connection (measuring lead) • for current output – 2-wire connection	using a 20-pin front connector supported supported

6.12.1 SM 332; AO 4 x 16 Bit - Output ranges

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable these. You program 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 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 Programmable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides overview of programmable parameters and of their defaults.

Table 6-35 Overview of the parameters of SM 332; AO 8 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable • Diagnostics interrupt	yes/no		no	dynamic	Module
Diagnostics • Group diagnostics	yes/no		no	static	Channel
Output • Output type • Output range	disabled Voltage Current See table of *Output ranges for SM 332; AO 4 x 16 bit*		V ± 10 V	dynamic	Channel
Reaction to CPU STOP	ASS HLV	Outputs zero current/voltage Hold last value	ASS	dynamic	Channel

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 4 x 16 Bit. You can assign separate parameters to each output channel.

Assign the parameters you set at the SFCs in the user program to the 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 225)

Diagnostics messages of analog output modules (Page 227)

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:

- Independent user program cycle. The length of the cycle time may vary due to non-cyclic program branching.
- Independent and variable DP cycle on the PROFIBUS subnet
- Cyclic operation of the backplane bus of the DP slave.
- Cyclic signal preparation 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 flutter: ±50 μs.

Requirements

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

Mode of operation: Isochronous mode

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
Diagnostics 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.

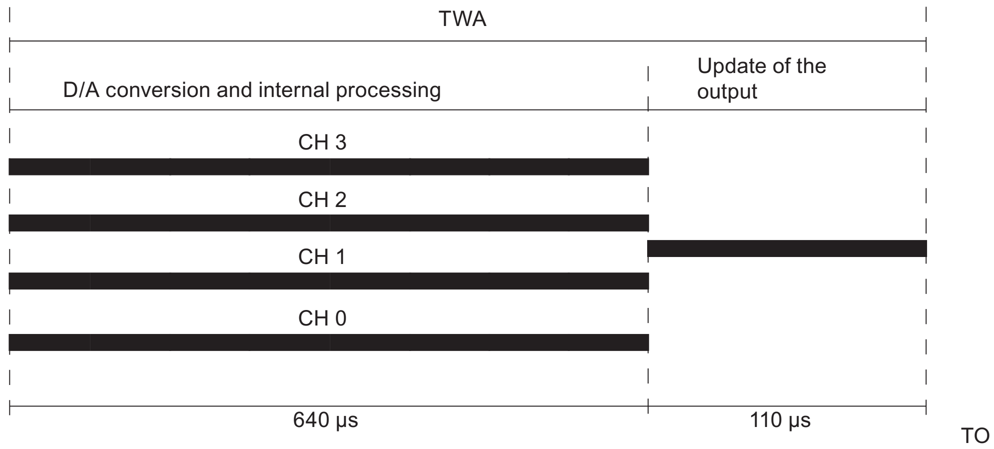


Figure 6-36 Calculation of the processing time and refresh time of the output

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 *ET 200M Distributed IO System* and *Synchronicity* manuals.

6.12.4 Additional information on 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.

Substitute 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 set substitute values. The set substitute values must lie 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 diagnostics interrupt
- Electrically isolated to backplane bus interface and load voltage

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The diagrams below show various wiring options.

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 connection for voltage output

The following Fig. represents the 2-wire connection with no compensation for line resistors and the 4-wire connection with compensation for line resistors.

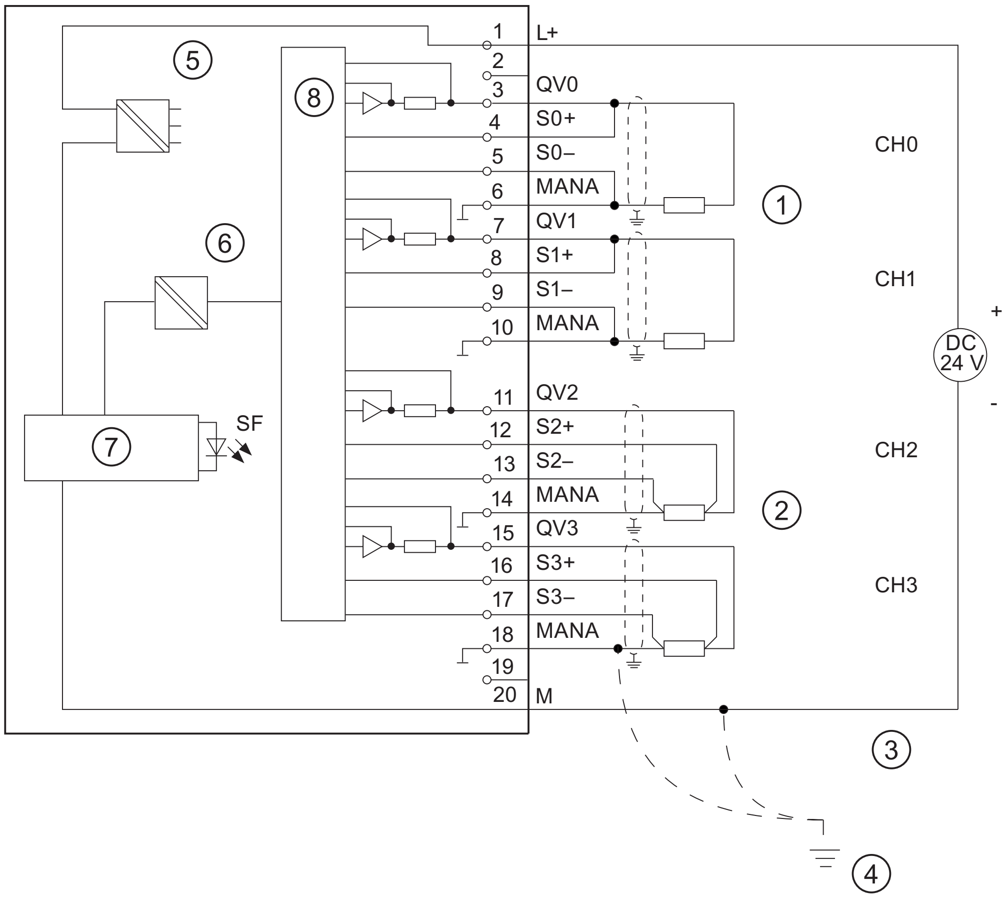


Figure 6-37 Wiring and block diagrams

①	2-wire connection, no compensation for line resistors
②	4-wire connection, with compensation for line resistors
③	Equipotential bonding
④	Functional earth
⑤	Internal supply
⑥	Electrical isolation
⑦	Backplane bus interface
⑧	Analog-to-Digital Converter (ADC)

Wiring: Current output

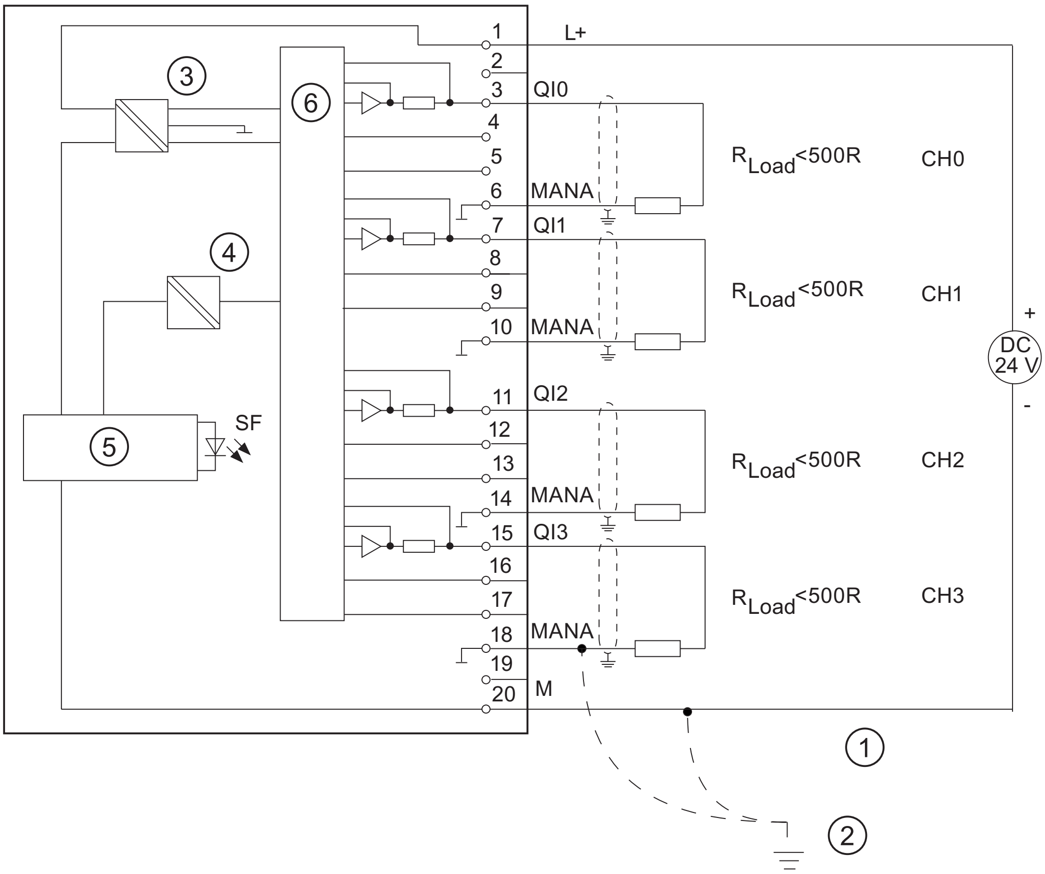


Figure 6-38 Wiring and block diagrams

①	Equipotential bonding
②	Functional 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

Technical data	
Cable length • shielded	 max. 200 m
Voltages, currents, electrical potentials	
Rated load voltage L+ • Reverse polarity protection	24 VDC yes
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels • between channels and load voltage L+	 yes yes no yes
Maximum potential difference • between S- and M_{ANA} (CMV) • between M_{ANA} and $M_{internal}$ (V_{ISO})	 3 VDC 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. 240 mA
Power loss of the module	typ. 3 W
Generation of analog values	
Resolution (including overshoot range) • ± 10 V; ± 20 mA; • 4 mA to 20 mA; 1 V to 5 V • 0 V to 10 V; 0 mA to 20 mA	 11 bits + sign 12 bits
Conversion time (per channel)	max. 0.8 ms
Settling time • with resistive load • with capacitive load • with inductive load	 0.2 ms 3.3 ms 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 • Current output	± 0.5 % ± 0.6 %
Basic error limit (operational error limit at 25°, relative to output range)	
• Voltage output • Current output	± 0.4 % ± 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)	± 0.05 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	± 0.05 %

Technical data	
Status, interrupts, diagnostics	
Interrupts • Diagnostics interrupt	 programmable
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported
Set substitute 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 • 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 the duration of max. 1 s (duty factor 1:20) max. 50 mA d.c.
Wiring of the actuators • for voltage output – 4-wire connection (measuring lead) • for current output – 2-wire connection	using a 20-pin front connector supported supported

6.13.1 Output ranges of SM 332; AO 4 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable them. You program 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

Program the voltage and current output ranges in *STEP 7*.

Table 6-36 Output ranges of 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 Programmable parameters

Introduction

For general information on programming analog modules, refer to the chapter *Programming analog modules*.

The table below provides overview of programmable parameters and of their defaults.

Table 6-37 Overview of the parameters of SM 332; AO 4 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable • Diagnostics interrupt	yes/no		no	dynamic	Module
Diagnostics • Group diagnostics	yes/no		no	static	Channel
Output • Output type • Output range	disabled Voltage Current See table of *Output ranges for SM 332; AO 4 x 12 Bit*		V ± 10 V	dynamic	Channel
Reaction to CPU STOP	ASS HLV SSV	Outputs zero current/voltage Hold last value Set substitute value	ASS	dynamic	Channel

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 4 x 12 Bit. You can assign separate parameters to each output channel.

Assign the parameters you set at the SFCs in the user program to the 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 225)

Diagnostics messages of analog output modules (Page 227)

6.13.3 Additional information on 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 do not have to be wired.

Line continuity check

SM 332; AO 4 x 12 Bit only performs a line continuity check at the current outputs.

A "reliable" line continuity check is not possible for output values of -20s...+200μA within the output ranges 0 mA to 20mA and ±20mA.

Short-circuit test

SM 332; AO 4 x 12 Bit only performs a short-circuit test at the voltage outputs.

Substitute 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 set substitute values. The set substitute values must lie 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 set separately as
  - voltage output
  - current output
- Resolution 12 bits
- Programmable diagnostics and diagnostics interrupt
- Electrically isolated to backplane bus interface and load voltage

Diagnostics

For information on diagnostics messages at the "group diagnostics" parameter, refer to the table *Diagnostics messages of analog output modules*.

Terminal assignment

The diagrams below show various wiring options.

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 connection for voltage output

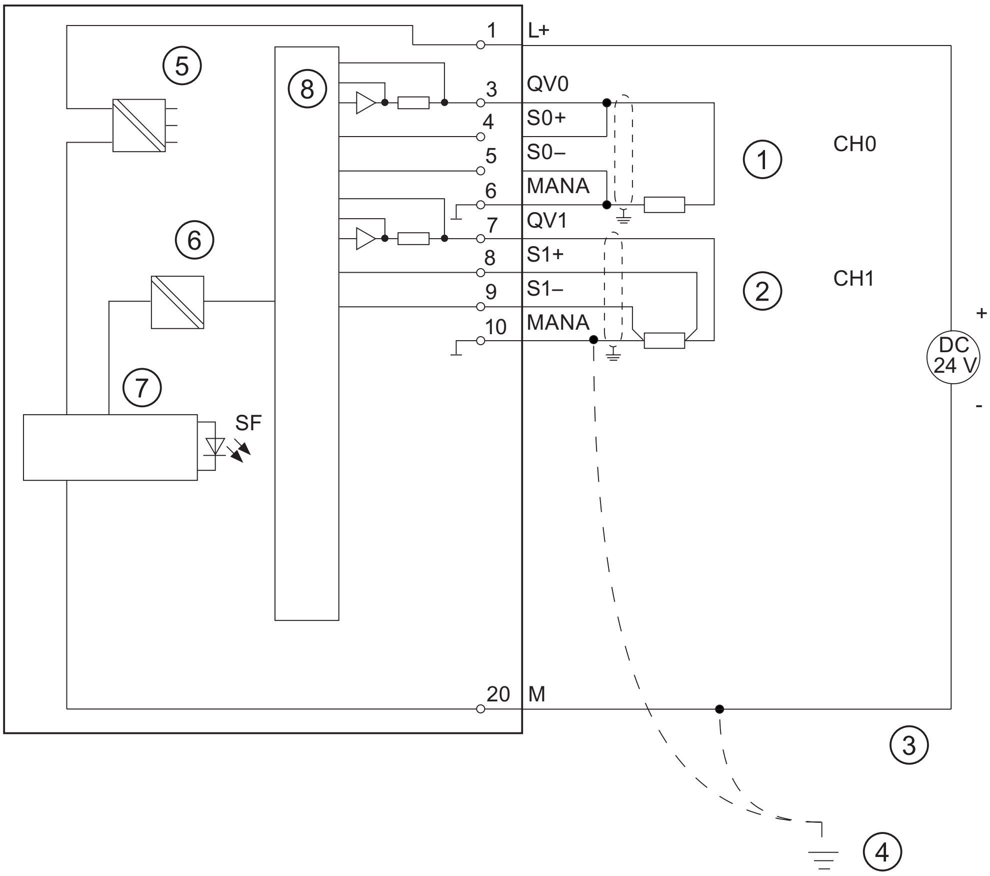


Figure 6-39 Wiring and block diagrams

①	2-wire connection: no compensation for line impedance
②	4-wire connection: with compensation for line impedance
③	Equipotential bonding
④	Functional earth
⑤	Internal supply
⑥	Electrical isolation
⑦	Backplane bus interface
⑧	Analog-to-Digital Converter (ADC)

Wiring for current output

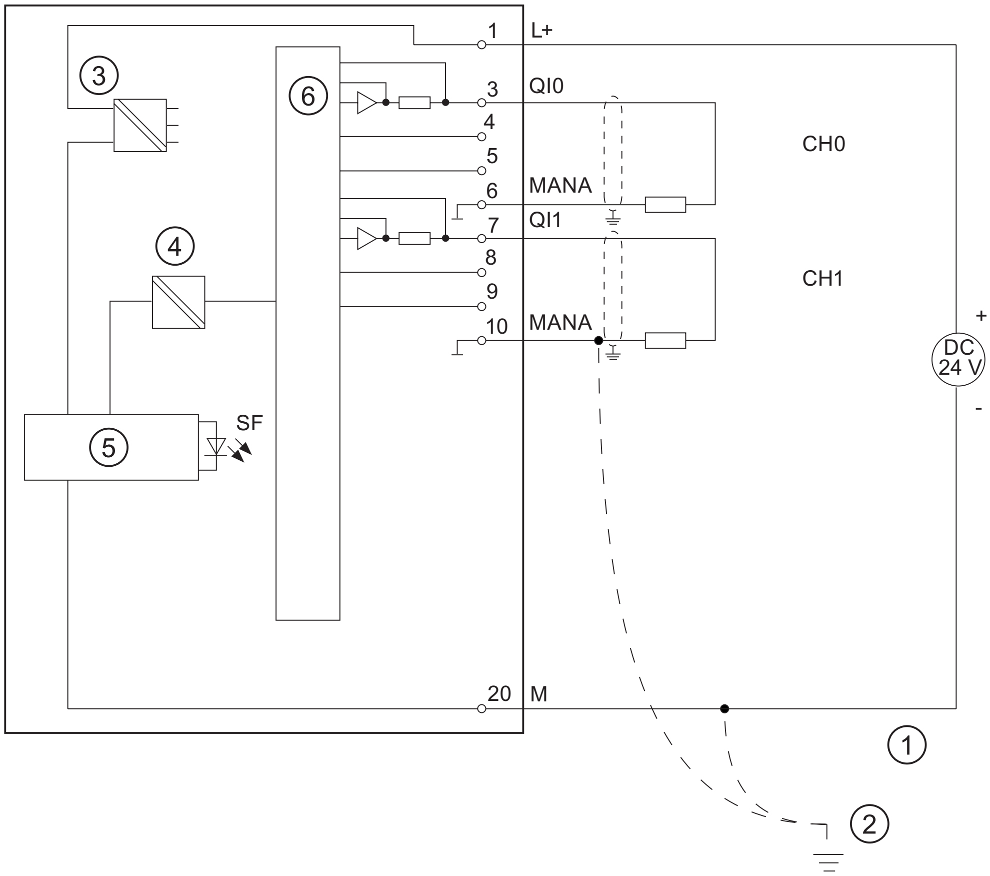


Figure 6-40 Wiring and block diagrams

①	Equipotential bonding
②	Functional 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+ • Reverse polarity protection	24 VDC yes
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels • between channels and load voltage L+	 yes yes no yes
Maximum potential difference • between S- and M_{ANA} (CMV) • between M_{ANA} and $M_{internal}$ (V_{iso})	 3 VDC 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. 135 mA
Power loss of the module	typ. 3 W
Generation of analog values	
Resolution (including overshoot range) • ± 10 V; ± 20 mA; • 4 mA to 20 mA; 1 V to 5 V • 0 V to 10 V; 0 mA to 20 mA	 11 bits + sign 12 bits
Conversion time (per channel)	max. 0.8 ms
Settling time • with resistive load • with capacitive load • with inductive load	 0.2 ms 3.3 ms 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 • Current output	± 0.5 % ± 0.6 %
Basic error limit (operational error limit at 25°, relative to output range)	
• Voltage output • Current output	± 0.4 % ± 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)	± 0.05 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	± 0.05 %

Technical data	
Status, interrupts, diagnostics	
Interrupts • Diagnostics interrupt	 programmable
Diagnostics functions • Group error display • Reading diagnostics information	programmable red LED (SF) supported
Set substitute 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 • 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 the duration of max. 1 s (duty factor 1:20) max. 50 mA d.c.
• Wiring of the actuators • for voltage output – 2-wire connection – 4-wire connection (measuring line) • for current output – 2-wire connection	using a 20-pin front connector supported supported supported

6.14.1 Output ranges of SM 332; AO 2 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable them. You program the outputs at the "output type" parameter in *STEP 7*.

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

Program the voltage and current output ranges in *STEP 7*.

Table 6-38 Output ranges of 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 Programmable 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 Overview of the parameters of SM 332; AO 2 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable • Diagnostics interrupt	yes/no		no	dynamic	Module
Diagnostics • Group diagnostics	yes/no		no	static	Channel
Output • Output type • Output range	disabled Voltage Current See table of *Output ranges for SM 332; AO 2 x 12 Bit*		V ± 10 V	dynamic	Channel
Reaction to CPU STOP	ASS HLV SSV	Outputs zero current/voltage Hold last value Set substitute 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 assign separate parameters to each output channel.

Assign the parameters you set at the SFCs in the user program to the 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 227)

Programming analog modules (Page 225)

6.14.3 Additional information on 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 do not have to be wired.

Line continuity check

SM 332; AO 2 x 12 Bit only performs a line continuity check at the current outputs.

A "reliable" line continuity check is not possible for output values of -20s...+200µA within the output ranges 0 mA to 20mA and ±20mA.

Short-circuit test

SM 332; AO 2 x 12 Bit only performs a short-circuit test at the voltage outputs.

Substitute 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 set substitute values. The set substitute values must lie 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
- Programmable measurement type at each channel group
  - Voltage
  - Current
- Not programmable, measurement and output type defined by hardwiring
- Connected to potential of the backplane bus interface
- Electrically isolated to load voltage

Terminal assignment

The diagrams below show various wiring options.

Note

Note when wiring the SM 334:

- analog ground M_{ANA}**(terminal 15 or 18) is interconnected with chassis ground M of the CPU or interface module IM.** Use a cable with a conductor cross-section of at least 1 mm^2.

  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

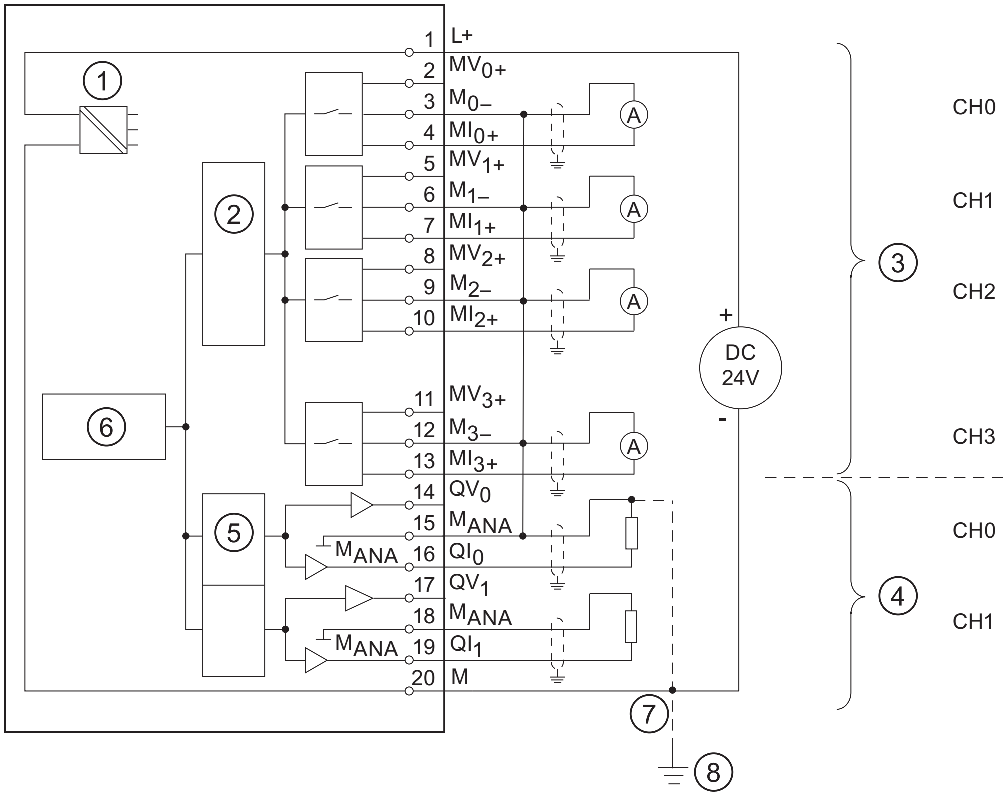


Figure 6-41 Wiring and block diagrams

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 Equipotential bonding
⑧ Functional earth

Wiring: Voltage measurement and voltage output

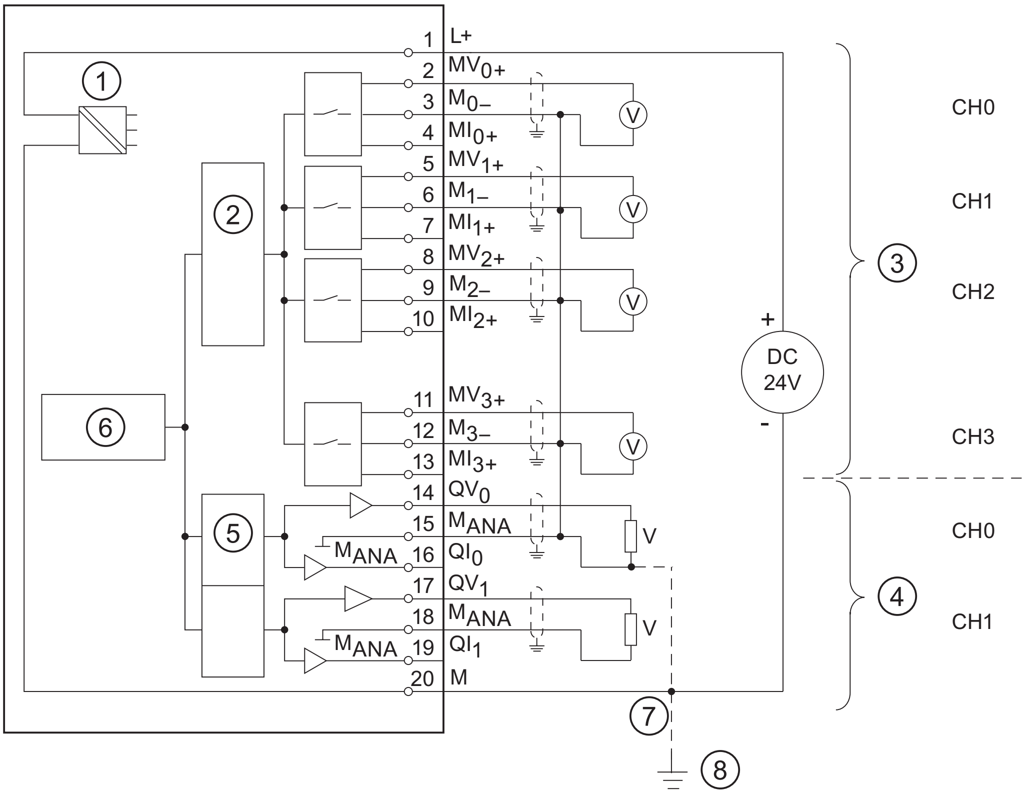


Figure 6-42 Wiring and block diagrams

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 Equipotential bonding
⑧ Functional earth

Wiring: 4-wire transducers for current measurement and voltage output

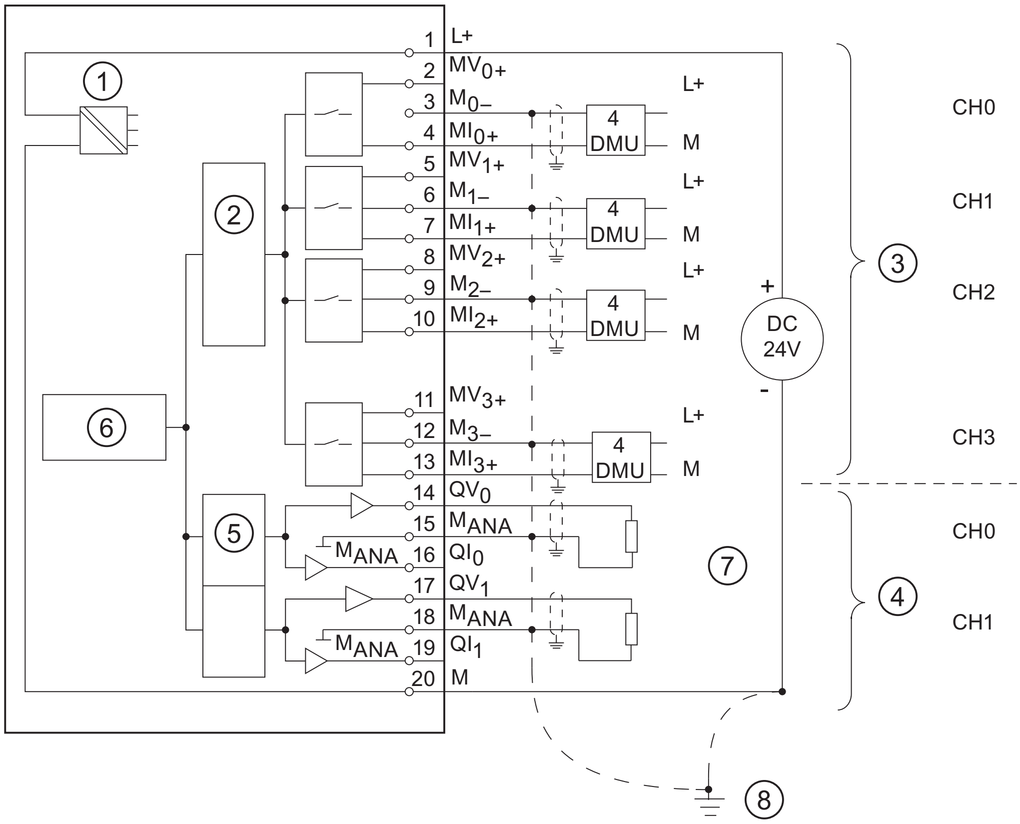


Figure 6-43 Wiring and block diagrams

① Internal supply
② Analog-to-Digital Converter (ADC)
③ Inputs: Current measurement with 4-wire transducer
④ Outputs: Voltage output
⑤ Digital-to-Analog Converter (DAC)
⑥ Backplane bus interface
⑦ Equipotential bonding
⑧ Functional 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
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
Maximum 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 • Resolution (including overshoot range)	Actual value conversion 8 bits
Integration/conversion time (per channel) • programmable • Integration time in µs	 no <500
Basic execution time of inputs	max. 5 ms
Time constant of the input filter	0.8 ms
Generation of analog output values	
• Resolution (including overshoot range)	8 bits
Conversion time (per channel) • programmable • Conversion time in µs	 no <500
Basic execution time of outputs	max. 5 ms
Settling time • with resistive load • with capacitive load • with inductive load	 0.3 ms 3.0 ms 0.3 ms

Technical data	
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 error limit (across temperature range, relative to input range)	
• Voltage input • Current input	± 0.9 % ± 0.8 %
Basic error limit (operational error limit at 25 °C, relative to input range)	
• Voltage input • Current input	± 0.7 % ± 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 • Current output	± 0.6 % ± 1.0 %
Basic error limit (operational error limit at 25 °C, relative to output range)	
• Voltage output • Current output	± 0.5 % ± 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
Sensor selection data	
Input ranges (rated values) / input impedance • Voltage • Current	 0 V to 10 V/100 k Ω 0 mA to 20 mA/50 Ω
Maximum voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)
Maximum current at current input (destruction limit)	40 mA
Wiring of the signal sensors • for voltage measurement • for current measurement as 2-wire transducer as 4-wire transducer	using a 20-pin front connector supported supported with external supply

Technical data	
Actuator selection data	
Output ranges (rated values) • Voltage • Current	 0 V to 10 V 0 mA to 20 mA
Load impedance (in the rated output range)	
• For voltage outputs – capacitive load • For current outputs – inductive load	min. 5 kΩ max. 1 µF 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 of the actuators • for voltage output 2-wire connection 4-wire connection (measuring line)	using a 20-pin front connector supported not supported

6.15.1 SM 334; AI 4/AO 2 x 8/8 Bit - Function principle

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 I/O 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

Valid input addresses:

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

Valid output addresses:

Channel	Address
0	Module start address
1	Module start address + 2 bytes address offset

6.15.2 Measurement and 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 measurement and output type

Set the measurement type (voltage, current) by hardwiring the input channel.

Set the output type (voltage, current) by hardwiring the output channel.

See also

Representation of the values for analog input channels (Page 196)

Representation of analog values for analog output channels (Page 212)

6.15.3 Measurement 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 Bit provides the 0 V to 10 V and 0 mA to 20 mA measuring ranges.

By contrast 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 provides the 0 V to 10 V and 0 mA to 20 mA output ranges.

Compared to the other analog modules, the SM 334 has a lower resolution, and its analog outputs do not have any overshoot 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 on 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 interference immunity of the analog input 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
- Programmable measurement type per channel group:
  - Voltage
  - Resistance
  - Temperature
- Electrically isolated to the backplane bus interface
- Electrically isolated to load voltage

Terminal assignment

The diagrams below show various wiring options.

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

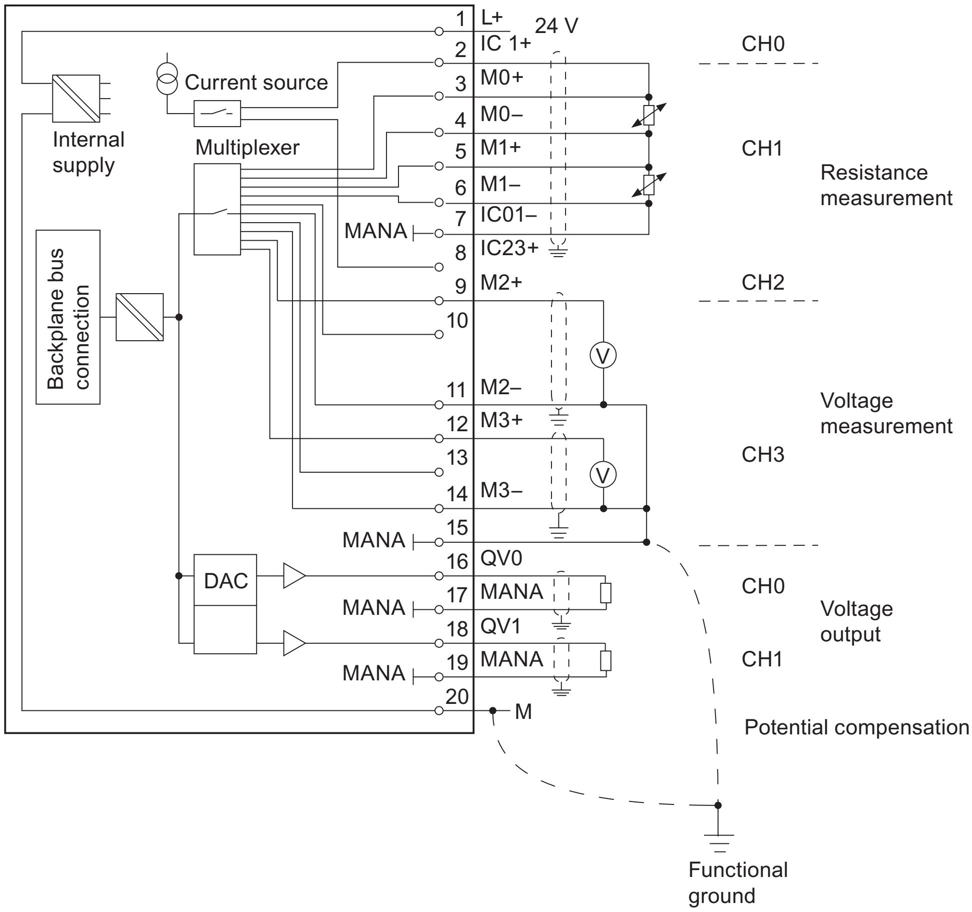


Figure 6-44 Wiring and block diagrams

Wiring: Resistance measurement and voltage output

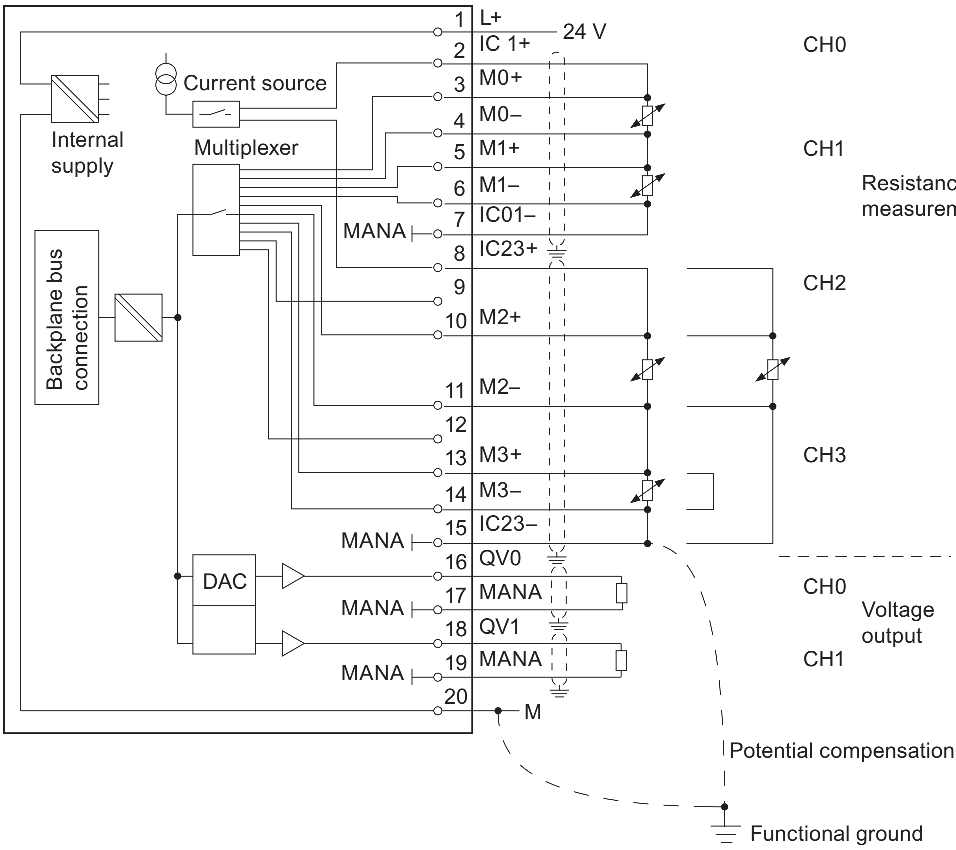


Figure 6-45 Wiring and block diagrams

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 • with resistive transducers	4 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+ • Reverse polarity protection	24 VDC yes

Technical data		
Constant measuring current for resistive transducers (pulsed) • For PT 100 • at 10 kΩ	typ. 490 µA; from product version 06: 1.5 mA typ. 105 µA	
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply	yes yes	
between channels	no	
Maximum 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 < rated input range)	> 38 dB > 36 dB	
Crosstalk between inputs	> 88 dB	
Operational error 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 %

Technical data		
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	
Sensor 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
Maximum voltage at voltage input (destruction limit)	max. 20 V continuous; 75 V for max. duration of 1 s (duty factor 1:20)	
Wiring of the signal sensors • for voltage measurement • for resistance measurement with 2-wire connection with 3-wire connection with 4-wire connection	 supported supported supported supported	
Characteristics linearization • for resistance thermometers	programmable Pt 100 (Climatic range)	
Technical unit of data formats	degrees Centigrade	
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	

Technical data	
Voltage output • Short-circuit protection • Short-circuit current	 yes max. 30 mA
Destruction limit against external voltages/currents • Voltage at outputs to MANA	 max. 15 V, continuous
Wiring of the actuators • for voltage output 2-wire connection 4-wire connection (measuring line)	using a 20-pin front connector supported not supported

* the error limits specified for the outputs are only valid when there is a high-ohm connection. In the entire load resistance range, an additional error of <0.9 % can result.

6.16.1 Programmable 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 • Measurement type	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 • Output range	disabled Voltage 0 V to 10 V		V 0 V to 10 V	dynamic	Channel

See also

Programming analog modules (Page 225)

6.16.2 Measurement types and ranges

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable these.

You can wire the outputs as voltage outputs, or disable these.

Program the outputs at the "measurement type" AND output type" parameters in *STEP 7*.

Input defaults

The "thermoelectric resistance (linear, 4-wire connection)" measurement type and "Pt 100 Klima" measuring range are set by default at the module. You can use these 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 Measurement types and ranges

Selected type of measurement	Measuring range
V: Voltage	0 V to 10 V
R-4L: resistance (4-wire connection)	10 kΩ
RTD-4L: Thermoresistor (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 analog values for analog output channels (Page 212)

6.16.3 Additional information on SM 334; AI 4/ AO 2 x 12 bit

Unused channels

Set the "disabled" argument at the "measurement type" parameter for unused input channels. This setting reduces module cycle times.

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.

7 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 non-programmable module	• 3 inputs for absolute 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-programmable signal modules • modules which occupy 2 slots	Position detection using up to three absolute encoders (SSI) Encoder types: Absolute encoder (SSI), message frame length 13 bits, 21 bits or 25 bits Data formats: Gray code or binary code
Isochronous mode supported	no	no	yes
Programmable diagnostics	no	no	no
Diagnostics interrupt	no	no	programmable
Special features	Function adjustable with screwdriver	the mechanical structure and addressing of the overall configuration remains unchanged when DM 370 is replaced with a different module.	SM 338 does not support absolute encoders with a monoflop time > 64 μs

7.2 Simulator module SM 374; IN/OUT 16; (6ES7 374-2XH01-0AA0)

Order number

6ES7 374-2XH01-0AA0

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:

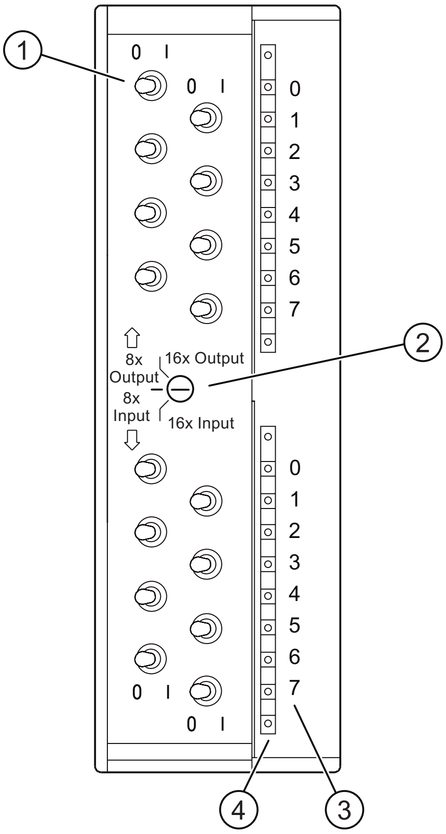
- To use the SM 374 **with 16 inputs**, define the order number of a digital input module with 16 inputs in *STEP 7*,

  for example: 6ES7 321-1BH02-0AA0
- 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: 6ES7 322-1BH01-0AA0
- 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: 6ES7 323-1BH00-0AA0

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

Technical data	
Status, interrupts, diagnostics	
Status display	yes, green LED for each channel
Interrupts	no
Diagnostics functions	no

7.3 Dummy module DM 370; (6ES7 370-0AA01-0AA0)

Order number

6ES7 370-0AA01-0AA0

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*

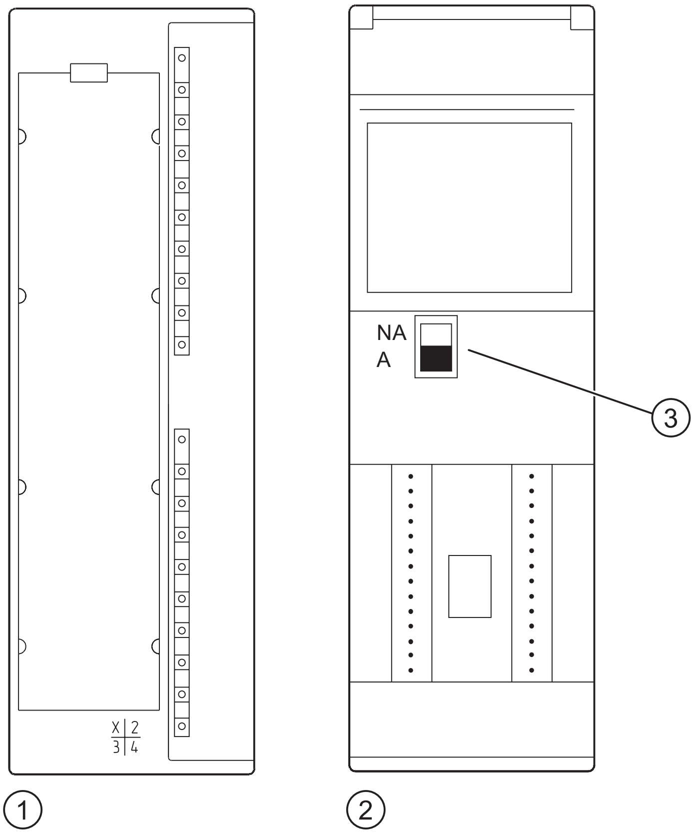
Configure the DM 370 dummy module in *STEP 7* only if you module for a programmed signal module. If the module reserves the slot for an interface module, you can discard module configuration in *STEP 7*.

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

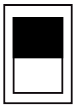
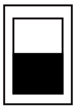


① Front view
② Rear view
③ Address selector switch

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 detection module SM 338; POS-INPUT; (6ES7 338-4BC01-0AB0)

Order number

6ES7 338-4BC01-0AB0

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

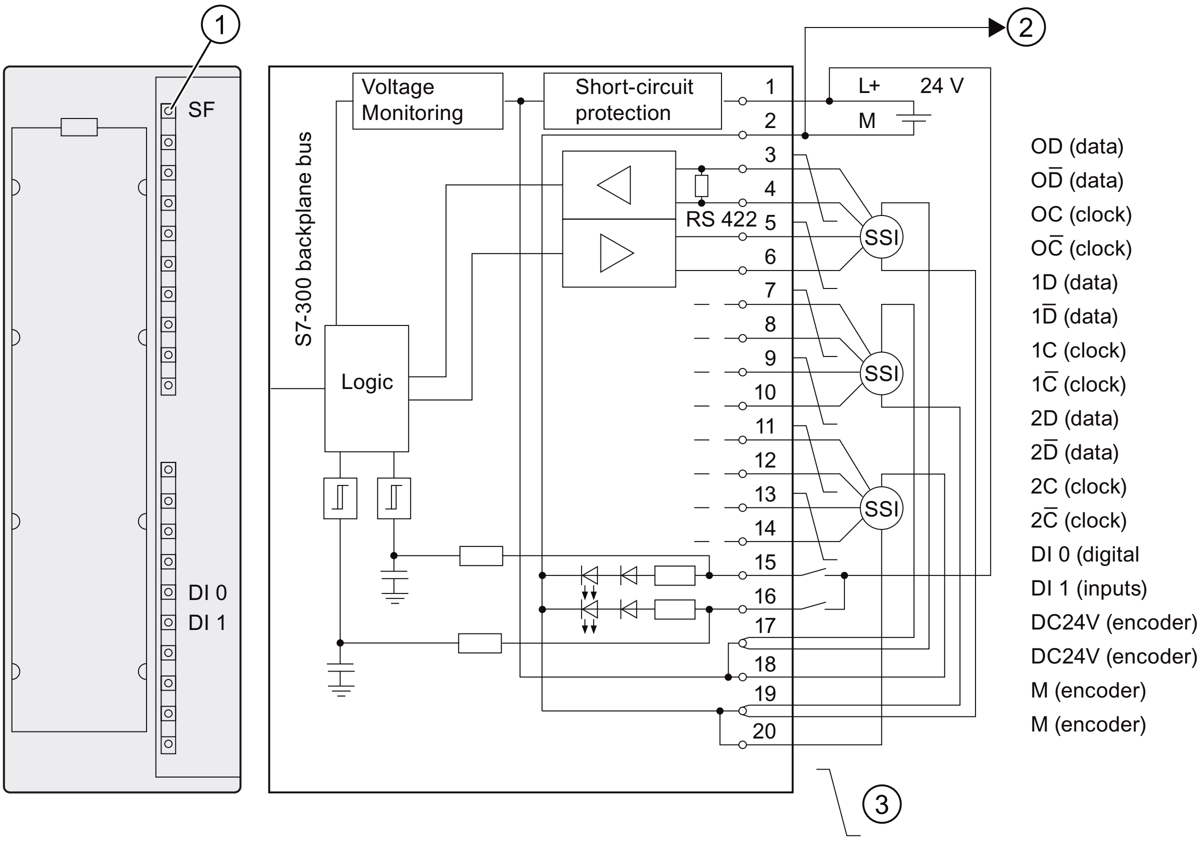
To extend functions and for troubleshooting, it is possible with the help of STEP 7 HW-Config to load firmware updates in the operating system memory of the SM 338; POS-INPUT.

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



① Error LED - red

② Connection to CPU ground

③ Twisted-pair cables

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 6ES7 390-5AA00-0AA0.)
- 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+ • Range • Reverse polarity protection	24 VDC 20.4 ... 28.8 V no
Electrical isolation	no, only to shield
Maximum potential difference • between the input (M terminal) and CPU grounding busbar	 1 VDC
Encoder supply • Output voltage • Output current	 L+ -0.8 V max. 900 mA, short circuit-proof
Current consumption • from the backplane bus • from load voltage L+ (no load)	 max. 160 mA 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 • 125 kHz • 250 kHz • 500 kHz • 1 MHz	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 μs 1 > 0: max. 300 μs
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 • Diagnostics interrupt	 programmable
Status display for digital inputs Group error	LED (green) LED (red)
Inaccuracy of the encoder value	
Cyclic encoder value acquisition	
• maximum age [1] • minimum age [1] • Jitter	(2 × frame transfer rate) + monoflop time + 580 μs Frame transfer rate + 130 μs Frame transfer rate + monoflop time + 450 μs
Refresh rate	Frame evaluation at intervals of 450 μs
Inaccuracy of the frozen encoder value (Freeze)	
Free-running transducer capture (Fast Mode)	
• maximum age [1] • minimum age [1] • Jitter	(2 × frame transfer rate) + monoflop time + 400 μs Frame transfer rate + 100 μs Frame transfer rate + monoflop time + 360 μs
Refresh rate	Frame evaluation at intervals of 360 μs
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] • minimum age [1] • Jitter	(2 × frame transfer rate) + monoflop time + 580 μs Frame transfer rate + 130 μs Frame transfer rate + monoflop time + 450 μs
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 / transmission rate) < monoflop of the absolute value encoder < 64 µs + 2 x (1 / 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.

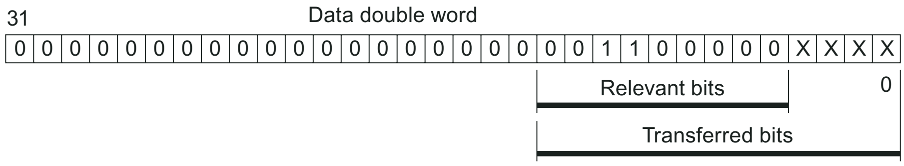
Example of encoder value scaling

You are using a single-turn encoder with
2^9 steps = 512 steps per revolution (resolution/360°.)

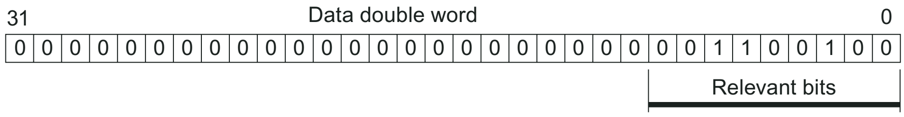
Your configuration in *STEP 7*:

- 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 allows 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_o. 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

Addressing SM 338 POS-INPUT (Page 392)

Programming SM 338 POS-INPUT (Page 391)

7.4.3 Programming SM 338 POS-INPUT

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 • Fast-Mode	yes / **no**	Enable parameter. Applies to all 3 channels.
Enable • Diagnostic interrupt	yes / **no**	Enable parameter. 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 (1 / 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 / transmission rate) < monoflop of the absolute value encoder < 64 μs + 2 x (1 / 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 Addressing SM 338 POS-INPUT

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*.

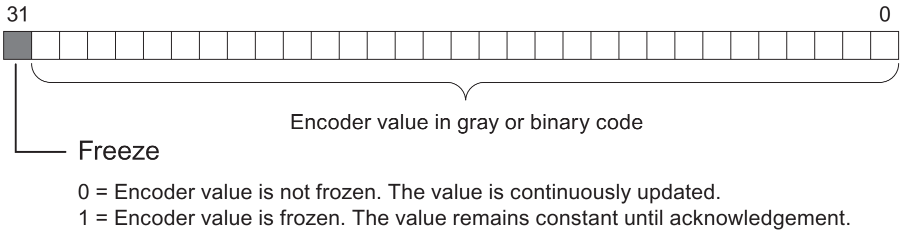
Input addresses

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

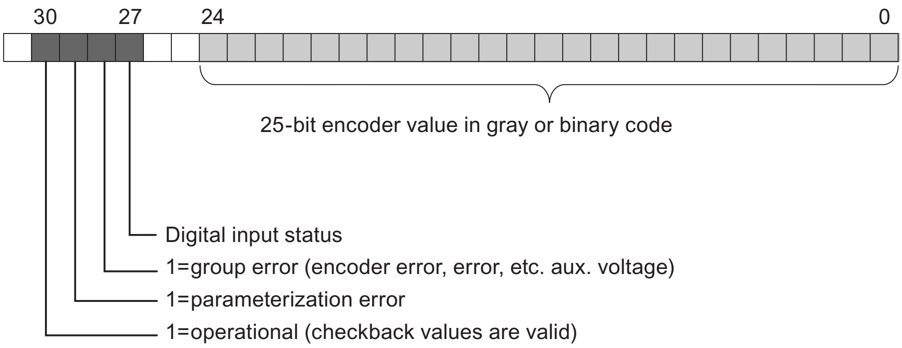
Structure of double data word in Standard Mode

Double data word structure of the encoder inputs:



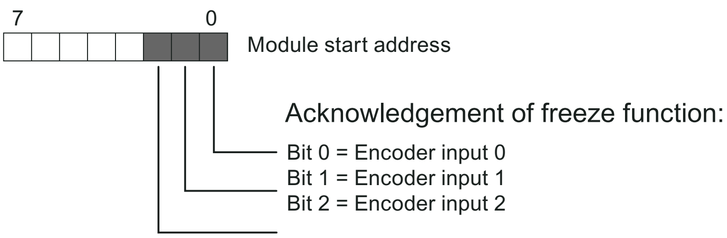
Structure of double data word in Fast Mode

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 SM 338; POS-INPUT - Diagnostics

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
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 SM 338; POS INPUT - Interrupts

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

Programming SM 338 POS-INPUT (Page 391)

Interface modules 8

Interface modules

This chapter described 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 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; (6ES7 360-3AA01-0AA0)

Order number

6ES7 360-3AA01-0AA0

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

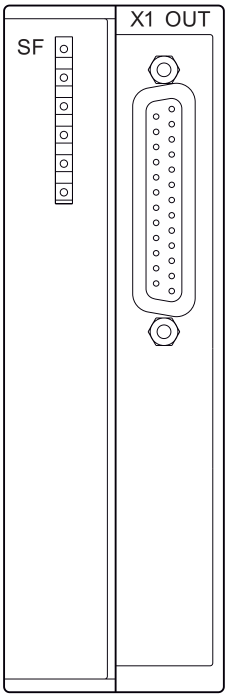
Status and error LEDs

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; (6ES7 361-3CA01-0AA0)

Order number

6ES7 361 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

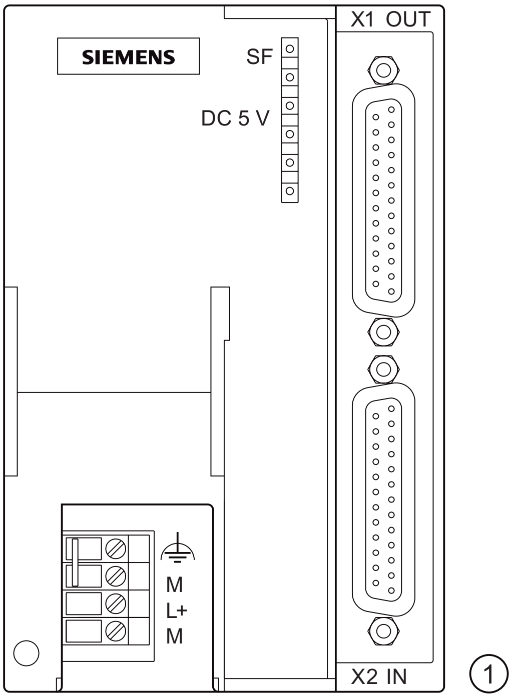
Status and error LEDs

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 Power loss	 0.5 A typ. 5 W
Current sinking at backplane bus	0.8 A
Status and error LEDs	yes

See also

Spare parts and accessories for S7-300 modules (Page 483)

8.4 Interface module IM 365; (6ES7 365-0BA01-0AA0)

Order number: "Standard module"

6ES7 365-0BA01-0AA0

Order number: "SIPLUS S7-300 module"

6AG1 365-0BA01-2AA0

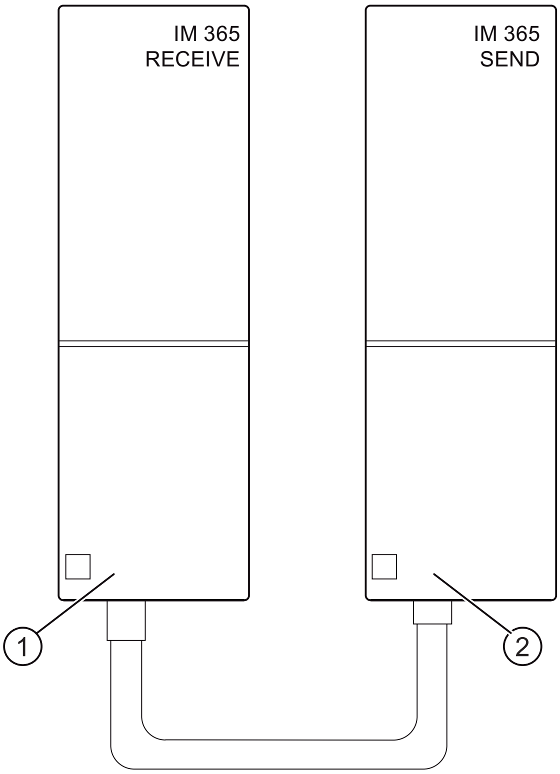
Properties

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



① In rack 1
② In rack 0

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 Power loss	 100 mA typ. 0.5 W
Current sinking per module	max. 1.2 A 0.8 A
Status and error LEDs	no

RS 485 Repeater 9

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/en/7915183

9.1 Fields of application and properties; (6ES7 972-0AA01-0XA0)

Order number

6ES7 972-0AA01-0XA0

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.

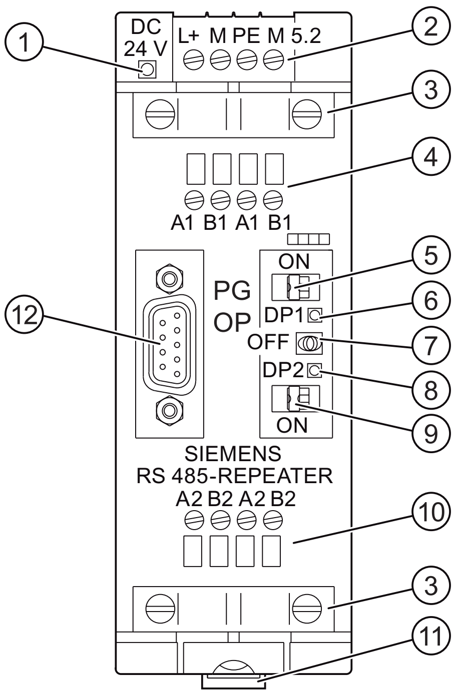
Table 9-2 Maximum cable length between two RS 485 Repeaters

Transmission rate	Maximum cable length between 2 nodes (in m) with RS 485 Repeater (6ES7 972-0AA01-0XA0)
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; (6ES7 972-0AA01-0XA0)

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 (use pin "M5.2" is reference ground when measuring the 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 operation in ungrounded and grounded mode

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 referenced to ground 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

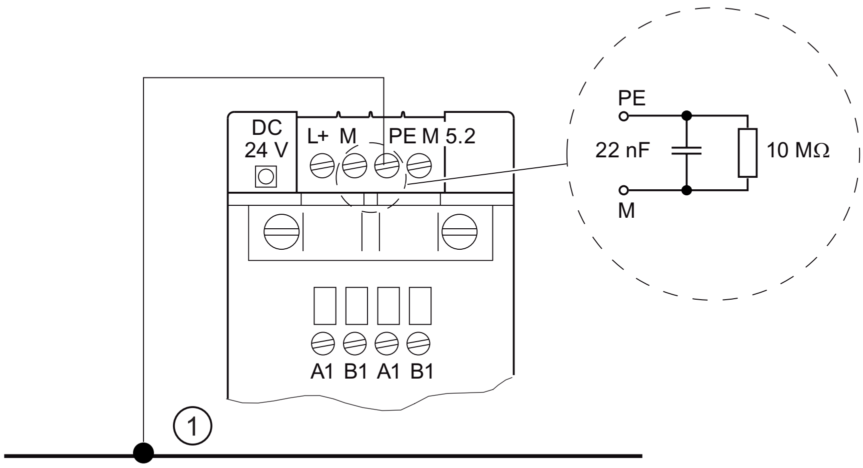
For grounded operation of the RS 485 Repeater, you must bridge terminals "M" and "PE" on the top of the RS 485 Repeater.

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

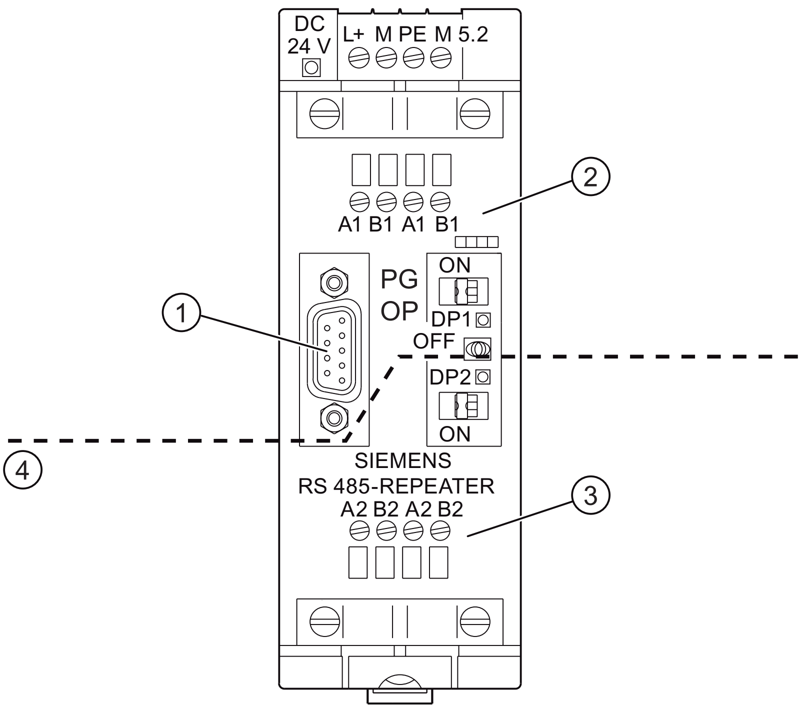
In a repeater configuration with ungrounded reference potential (ungrounded operation), any interference currents and static charges are discharged to the protective conductor by means of an RC network integrated in the repeater (refer to the figure below).



① Ground busbar

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

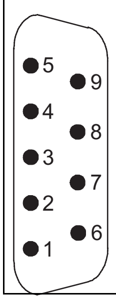
The amplification of the bus signals takes place between the port for bus segment 1 or the PG/OP interface and the port for bus segment 2.

9.4 Technical data

Technical data the RS 485 Repeater

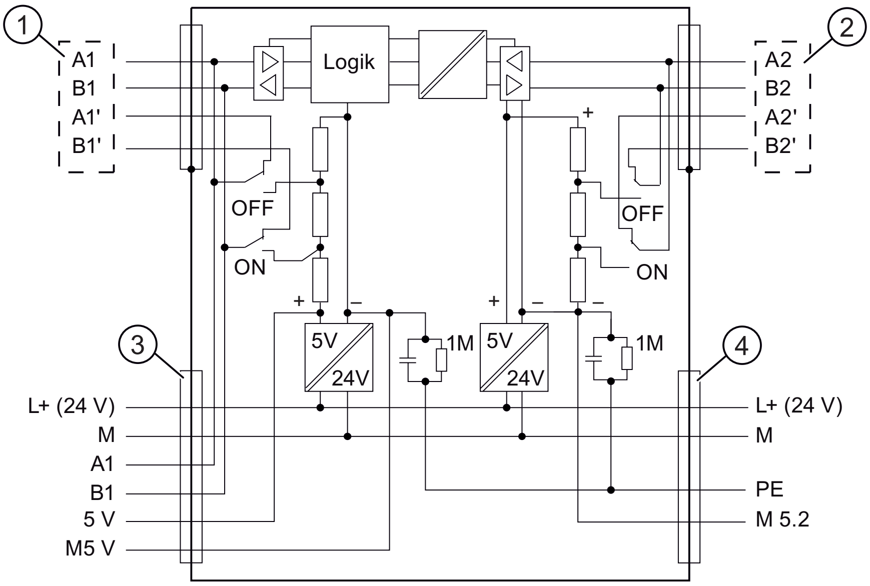
Technical data	
Power supply • Rated voltage • Ripple	 24 VDC 20.4 VDC to 28.8 VDC
Current consumption at rated voltage • without load on PG/OP socket • Load on PG/OP socket (5 V/90 mA) • Load on PG/OP socket (24 V/100 mA)	 100 mA 130 mA 200 mA
Electrical isolation	yes, 500 VAC
Connection of fiber-optic 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

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 the programmable parameters (data record 1 and 28) to the addressed signal module.
56	WR_DPARM	Transfer the 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 IO 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 parameters you can edit:

- in *STEP 7*
- using SFC55 "WR_PARM"
- using SFB53 "WRREC" (for GSD, for example).

Parameters set in *STEP 7* may also be transferred to the module using SFCs 56 and 57, and SFB53 (refer to the *STEP 7*) Online Help).

Table A-2 Parameters of digital IO modules

Parameters	Data record number	Programmable, using ...	
		... SFC55, SFB53	... 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.

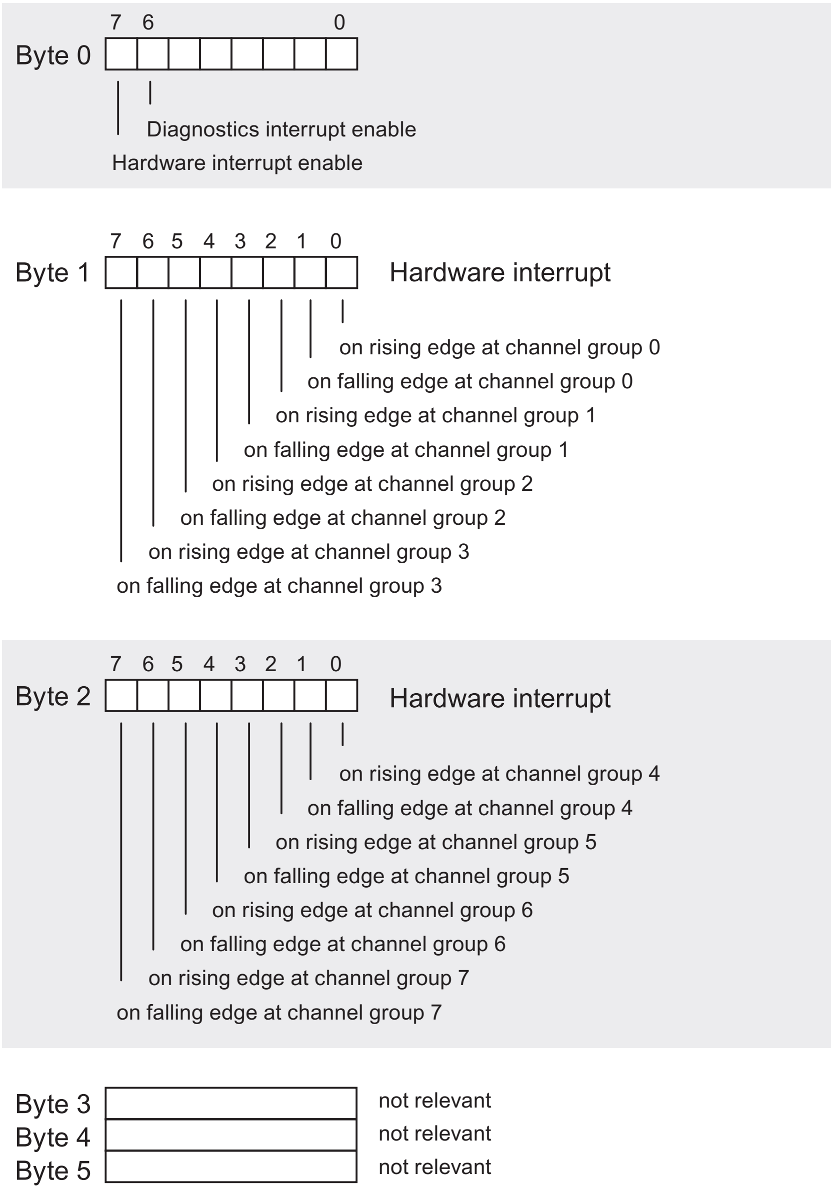


Figure A-1 Data record 1 for parameters of digital input modules

See also

Diagnostics of digital modules (Page 51)

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 parameters you can edit:

- in *STEP 7*
- using SFC55 "WR_PARM"
- using SFB53 "WRREC" (for GSD, for example).

Parameters set in *STEP 7* may also be transferred to the module using SFCs 56 and 57, and SFB53 (refer to the *STEP 7*) Online Help).

Table A-3 Parameters of digital output modules

Parameters	Data record number	Programmable, using ...	
		... SFC55, SFB53	... 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 substitute 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.

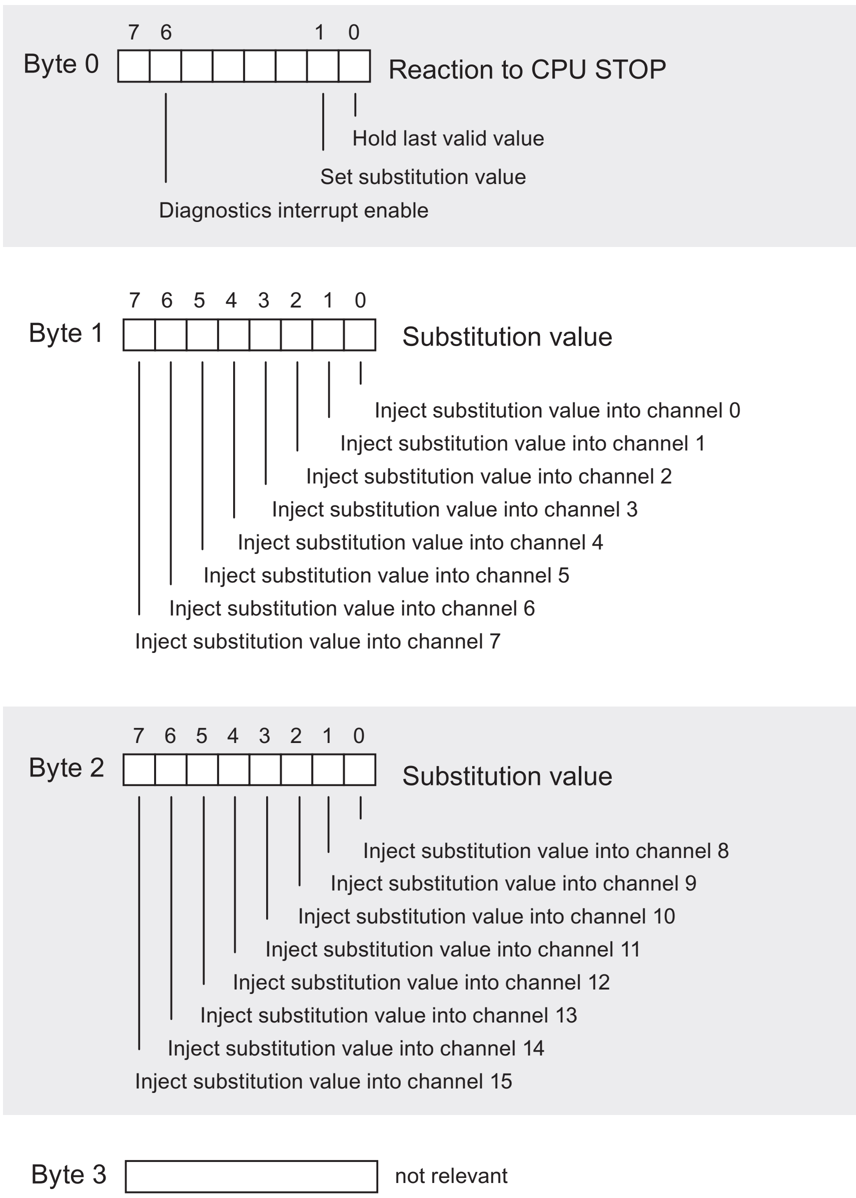


Figure A-2 Data record 1 for parameters of digital output modules

---

Note

The "hold last valid value" and "set substitute 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 parameters you can edit:

- in *STEP 7*
- using SFC55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC56 and SFC57 (refer to the *STEP 7* manuals).

Table A-4 Parameters of analog input modules

Parameters	Data record number	Programmable, using ...	
		... SFC55	... 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.

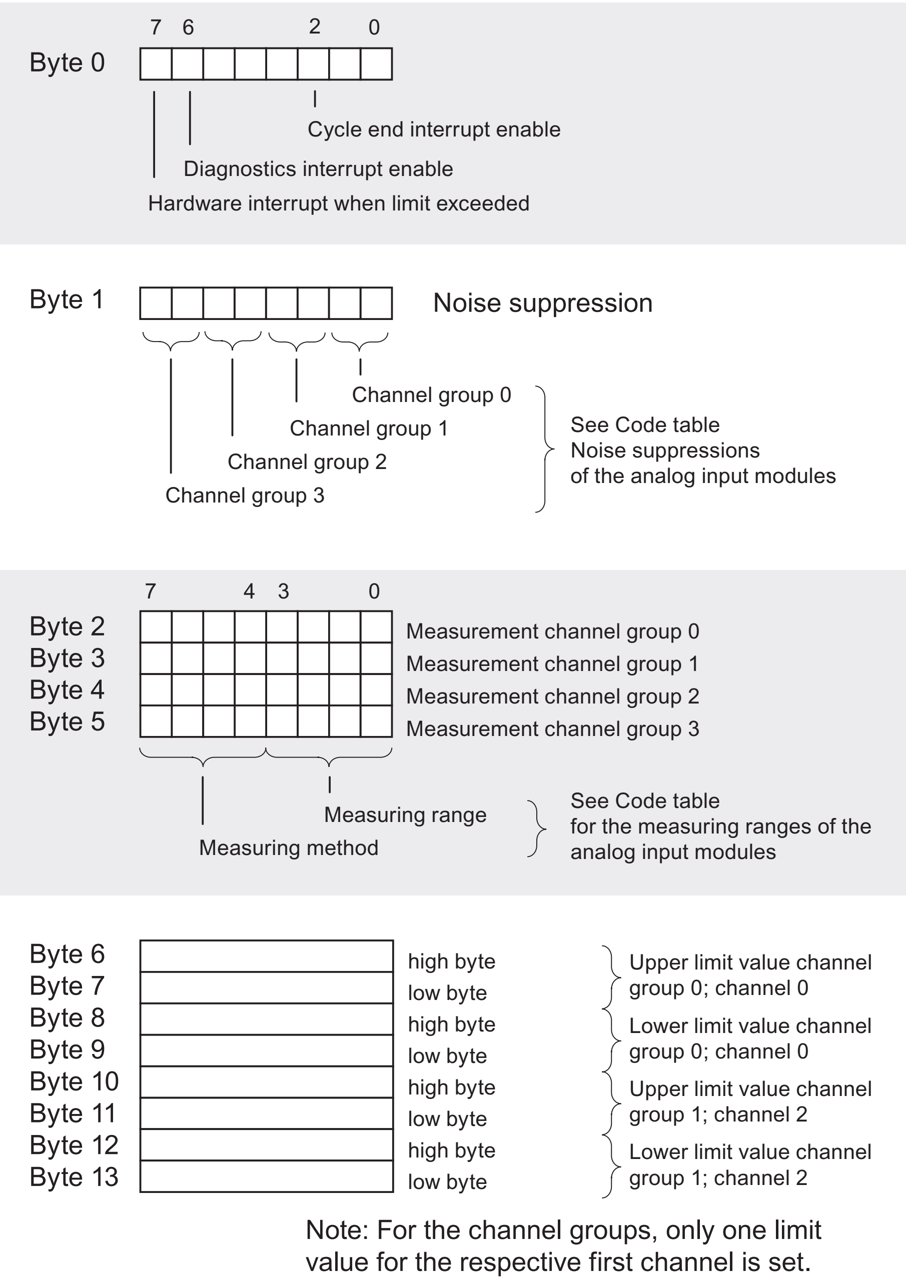


Figure A-3 Data record 1 for the parameters of analog input modules

---

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 0 V to 10 V	2#0111 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 to 20 mA	2#0010
		4 to 20 mA	2#0011
		±20 mA	2#0100
		±5 mA	2#0101
2-wire transducer	2#0011	4 to 20 mA	2#0011

Measuring method	Code	Measuring range	Code
Resistance (4-wire connection)	2#0100	150 Ω	2#0010
		300 Ω	2#0100
		600 Ω	2#0110
		10 k Ω	2#1001
Resistance 4-wire connection; 100 Ω compensation	2#0110	52 Ω to 148 Ω	2#0001
		250 Ω	2#0011
		400 Ω	2#0101
		700 Ω	2#0111
Thermal resistance + linearization 4-wire connection	2#1000	Pt 100 Klima	2#0000
		Ni 100 Klima	2#0001
		Pt 100 Standard range	2#0010
		Pt 200 Standard range	2#0011
		Pt 500 Standard range	2#0100
		Pt 1000 Standard range	2#0101
		Ni 1000 standard range	2#0110
		Pt 200 Klima	2#0111
		Pt 500 Klima	2#1000
		Pt 1000 Klima	2#1001
		Ni 1000 Klima	2#1001
		Ni 100 standard range	2#1011
Thermocouples with internal comparator	2#1010	Type B [PtRh - PtRh]	2#0000
		Type N [NiCrSi-NiSi]	2#0001
Thermocouples with external comparison	2#1011	Type E [NiCr-CuNi]	2#0010
		Type R [PtRh -Pt]	2#0011
Thermocouples + linearization internal comparison	2#1101	Type S [PtRh -Pt]	2#0100
		Type J [Fe - CuNi IEC]	2#0101
Thermocouples + linearization external comparison	2#1110	Type L [Fe-CuNi]	2#0110
		Type T [Cu - CuNi]	2#0111
		Type K [NiCr-Ni]	2#1000
		Type U [Cu -Cu Ni]	2#1001

See also

Analog modules (Page 231)

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 parameters you can edit:

- in *STEP 7*
- using SFC55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC56 and SFC57 (refer to the *STEP 7* manuals).

Table A-7 Parameters of SM 331; AI 8 x RTD

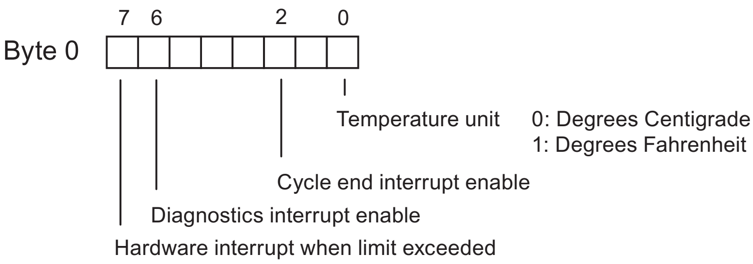
Parameters	Data record number	Programmable, using ...	
		... SFC55	... PG
Diagnostics: Group diagnostics	0	no	yes
Diagnostics: with wirebreak monitoring		no	yes
Diagnostics interrupt enable	1	yes	yes
Hardware interrupt when limit exceeded		yes	yes
End of cycle interrupt enable		yes	yes
Temperature unit		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 diagram 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 diagram below shows the structure of data record 128 of SM 331; AI 8 x RTD.

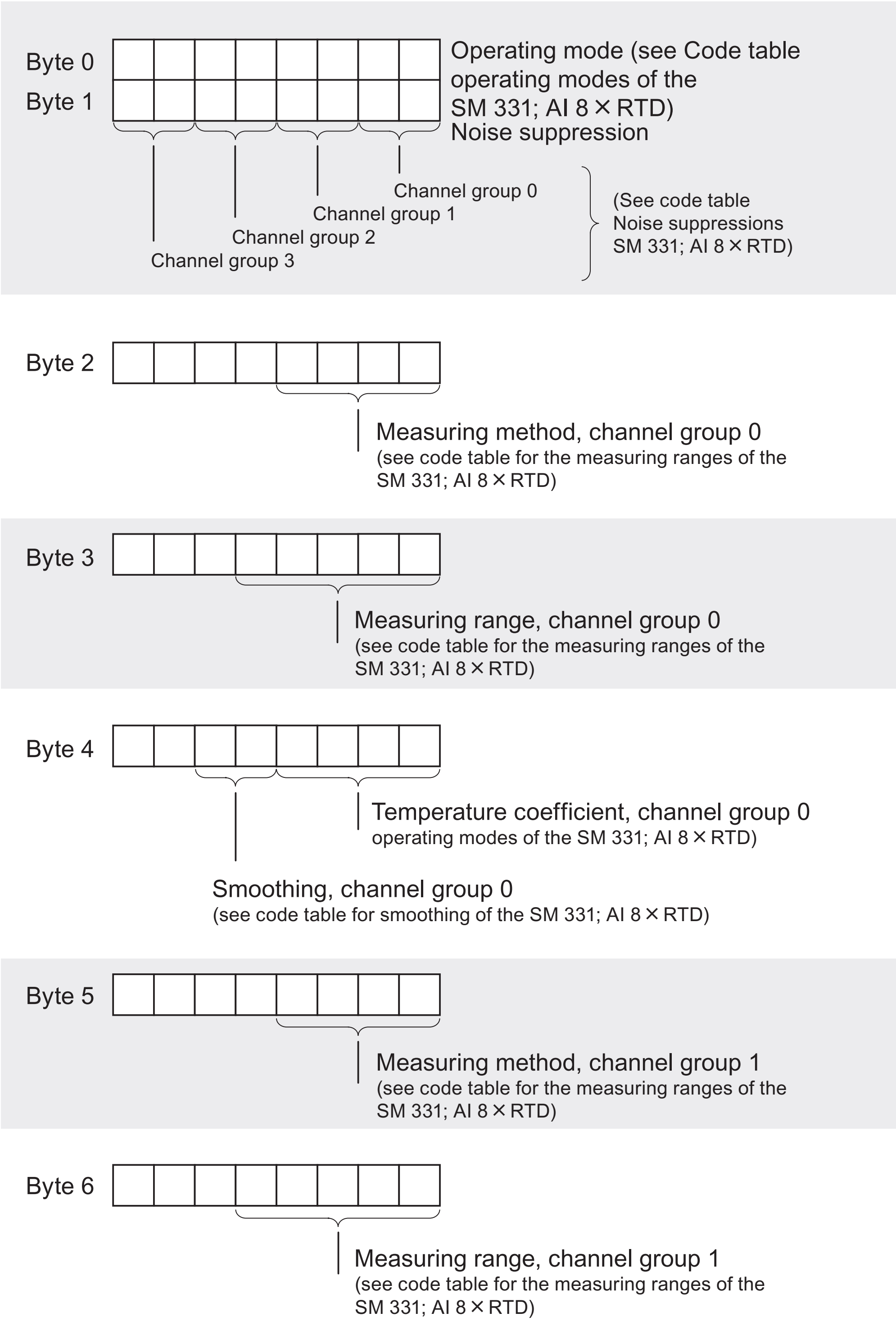


Figure A-5 Data record 128 of SM 331; AI 8 x RTD

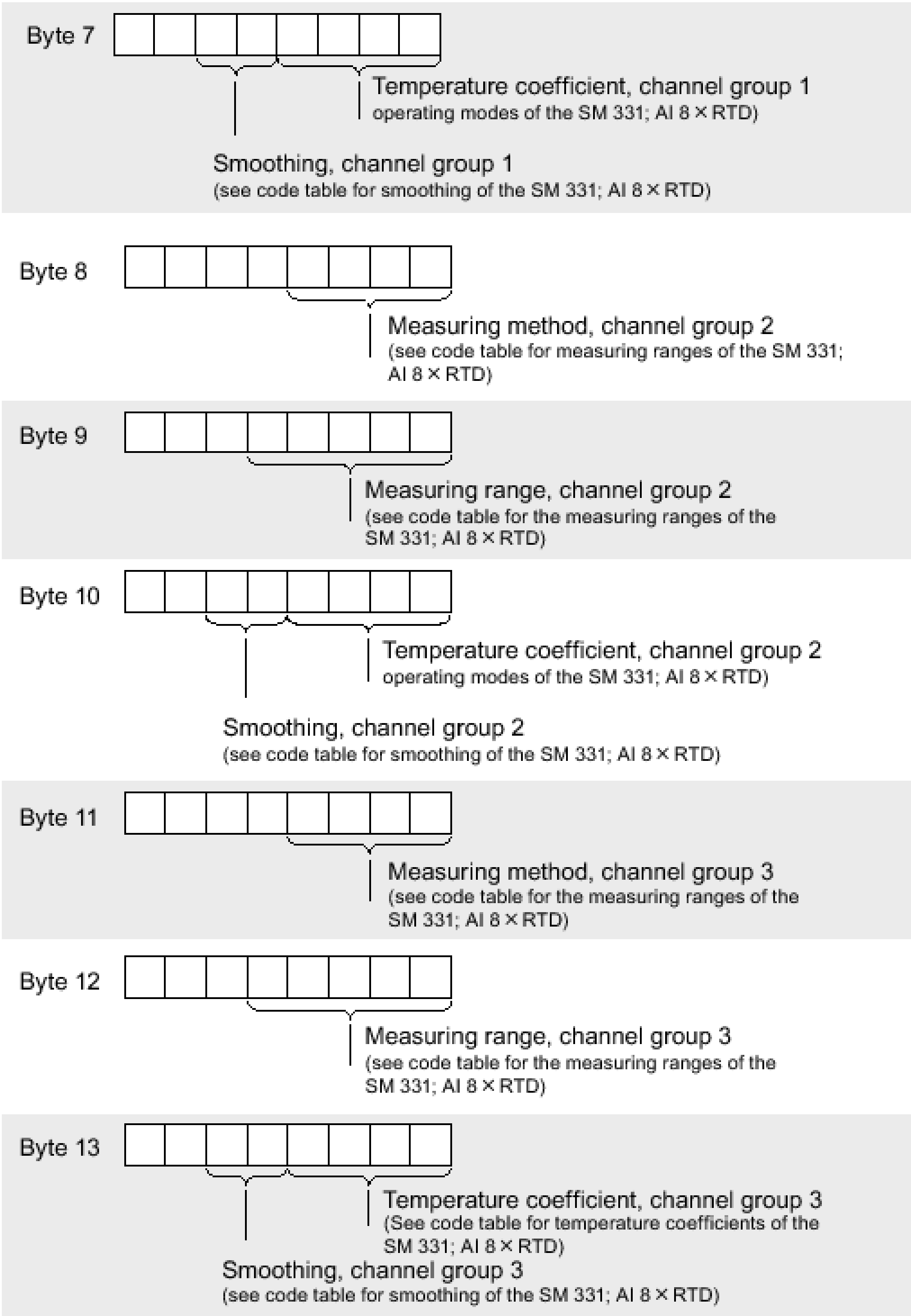


Figure A-6 Data record 128 of SM 331; AI 8 x RTD (continued)

Byte 14	High Byte	Hi limit value Channel group 0; Channel 0
Byte 15	Low Byte	
Byte 16	High Byte	Lo limit value Channel group 0; Channel 0
Byte 17	Low Byte	
Byte 18	High Byte	Hi limit value Channel group 0; Channel 1
Byte 19	Low Byte	
Byte 20	High Byte	Lo limit value Channel group 0; Channel 1
Byte 21	Low Byte	
Byte 22	High Byte	Hi limit value Channel group 1; Channel 2
Byte 23	Low Byte	
Byte 24	High Byte	Lo limit value Channel group 1; Channel 2
Byte 25	Low Byte	
Byte 26	High Byte	Hi limit value Channel group 1; Channel 3
Byte 27	Low Byte	
Byte 28	High Byte	Lo limit value Channel group 1; Channel 3
Byte 29	Low Byte	
Byte 30	High Byte	Hi limit value Channel group 2; Channel 4
Byte 31	Low Byte	
Byte 32	High Byte	Lo limit value Channel group 2; Channel 4
Byte 33	Low Byte	
Byte 34	High Byte	Hi limit value Channel group 2; Channel 5
Byte 35	Low Byte	
Byte 36	High Byte	Lo 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)

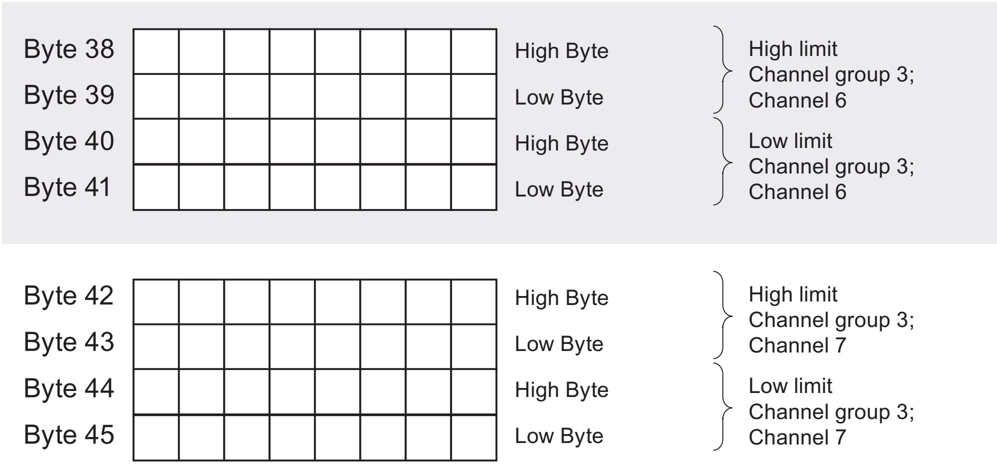


Figure A-8 Data record 128 of SM 331; AI 8 x RTD (continued)

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 coding of SM 331; AI 8 x RTD

Mode of operation	Coding
8 channels, hardware filter	2#00000000
8 channels, software filter	2#00000001
4 channels, hardware filter	2#00000010

Interference frequency suppression at 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 Interference suppression coding 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 Climatic Ni 100 Climatic Pt 100 Standard Ni 100 Standard Pt 500 Standard Pt 1000 Standard Ni 1000 Standard Pt 200 Climatic Pt 500 Climatic Pt 1000 Climatic Ni 1000 Climatic Pt 200 Standard Ni 120 Standard Ni 120 Climatic Cu 10 Climatic Cu 10 Standard Ni 200 Standard Ni 200 Climatic Ni 500 Standard Ni 500 Climatic 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 Climatic	2#00000000
		Ni 100 Climatic	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 Climatic	2#00000111
		Pt 500 Climatic	2#00001000
		Pt 1000 Climatic	2#00001001
		Ni 1000 Climatic	2#00001010
		Pt 200 Standard	2#00001011
		Ni 120 Standard	2#00001100
		Ni 120 Climatic	2#00001101
		Cu 10 Climatic	2#00001110
		Cu 10 Standard	2#00001111
		Ni 200 Standard	2#00010000
		Ni 200 Climatic	2#00010001
		Ni 500 Standard	2#00010010
		Ni 500 Climatic	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 Ω/Ω/°C (IPTS-68)	2#0000
Pt 0,003916 Ω/Ω/°C	2#0001
Pt 0,003902 Ω/Ω/°C	2#0010
Pt 0,003920 Ω/Ω/°C	2#0011
Pt 0.003850 Ω/Ω/°C (ITS-90)	2#0100
Pt 0,003910 Ω/Ω/°C	2#0101
Pt 0.006170 Ω/Ω/°C	2#0111
Ni 0,006180 Ω/Ω/°C	2#1000
Ni 0,006720 Ω/Ω/°C	2#1001
0.005000 Ω/Ω/ °C (LG Ni 1000)	2#1010
Cu 0,004260 Ω/Ω/°C	2#1011
Cu 0,004270 Ω/Ω/°C	2#1100
Cu 0.004280 Ω/Ω/°C	2#1101

Smoothing function at 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 at 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 231)

Parameters of analog input modules (Page 420)

A.6 Parameters of SM 331; AI 8 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 parameters you can edit:

- in *STEP 7*
- using SFC55 "WR_PARM"

Parameters set in *STEP 7* can also be transferred to the module using SFC56 and SFC57 (refer to the *STEP 7* manuals).

Table A-13 Parameters of SM 331; AI 8 TC

Parameters	Data record number	Programmable, using ...	
		... SFC55	... 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.

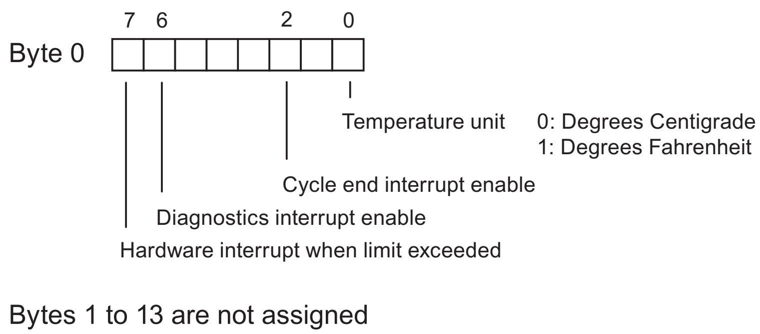


Figure A-9 Data record 1 for the parameters of SM 331; AI 8 x TC

Structure of data record 128

The figure below shows the structure of data record 128 of SM 331; AI 8 x TC.

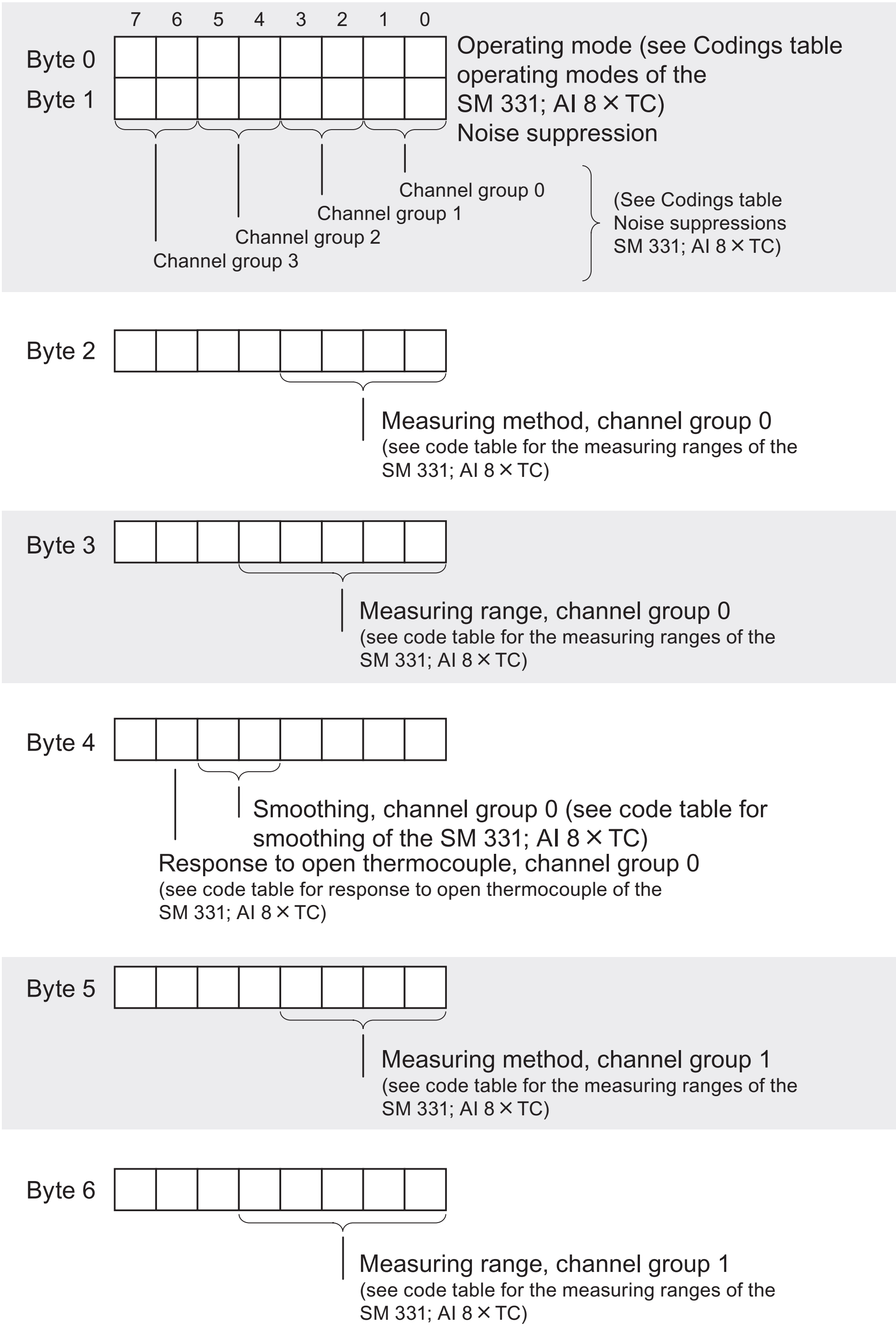


Figure A-10 Fig. A-10 Data record 128 of SM 331; AI 8 x TC (continued)

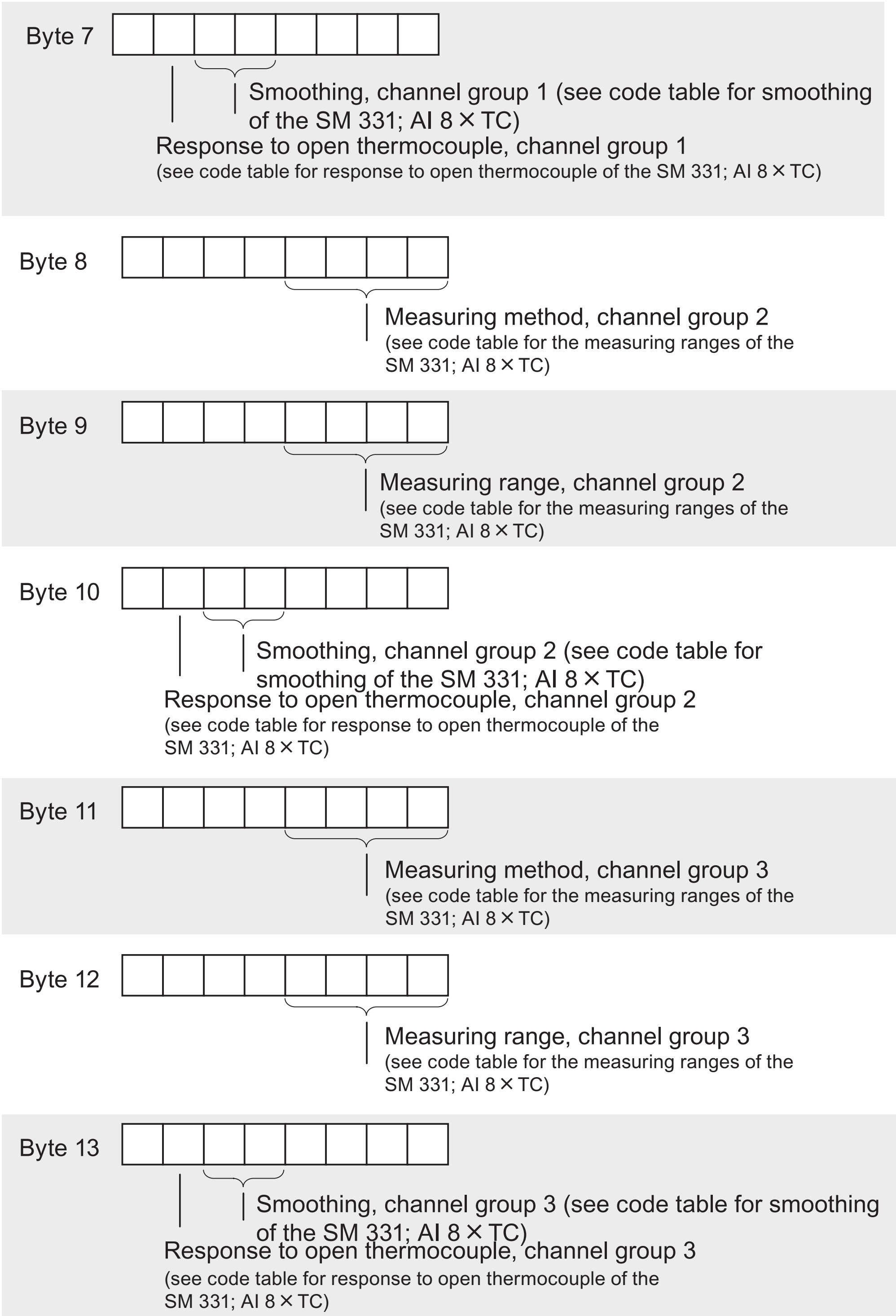


Figure A-11 Data record 128 of SM 331; AI 8 TC (continued)

Byte		Meaning
Byte 14	High Byte	High limit Channel group 0; Channel 0
Byte 15	Low Byte	High limit Channel group 0; Channel 0
Byte 16	High Byte	Low limit Channel group 0; Channel 0
Byte 17	Low Byte	Low limit Channel group 0; Channel 0
Byte 18	High Byte	High limit Channel group 0; Channel 1
Byte 19	Low Byte	High limit Channel group 0; Channel 1
Byte 20	High Byte	Low limit Channel group 0; Channel 1
Byte 21	Low Byte	Low limit Channel group 0; Channel 1
Byte 22	High Byte	High limit Channel group 1; Channel 2
Byte 23	Low Byte	High limit Channel group 1; Channel 2
Byte 24	High Byte	Low limit Channel group 1; Channel 2
Byte 25	Low Byte	Low limit Channel group 1; Channel 2
Byte 26	High Byte	High limit Channel group 1; Channel 3
Byte 27	Low Byte	High limit Channel group 1; Channel 3
Byte 28	High Byte	Low limit Channel group 1; Channel 3
Byte 29	Low Byte	Low limit Channel group 1; Channel 3
Byte 30	High Byte	High limit Channel group 2; Channel 4
Byte 31	Low Byte	High limit Channel group 2; Channel 4
Byte 32	High Byte	Low limit Channel group 2; Channel 4
Byte 33	Low Byte	Low limit Channel group 2; Channel 4
Byte 34	High Byte	High limit Channel group 2; Channel 5
Byte 35	Low Byte	High limit Channel group 2; Channel 5
Byte 36	High Byte	Low limit Channel group 2; Channel 5
Byte 37	Low Byte	Low limit Channel group 2; Channel 5

Figure A-12 Data record 128 of SM 331; AI 8 TC (continued)

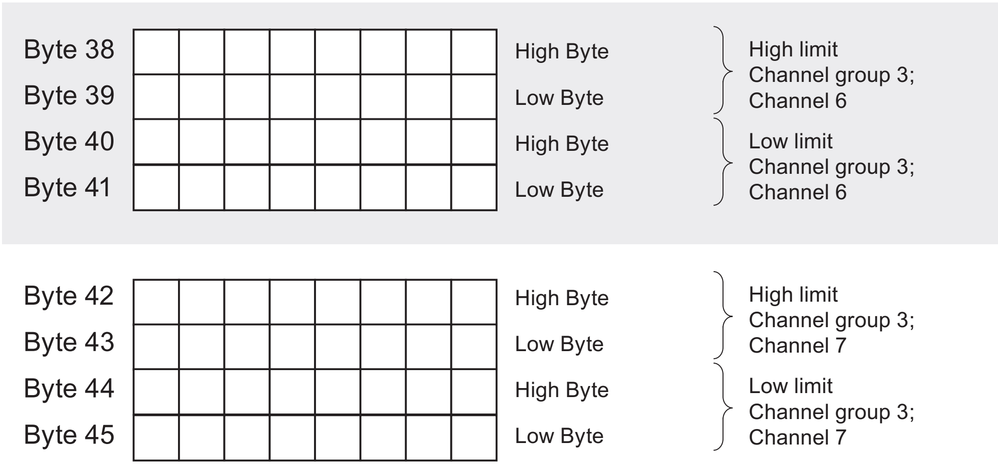


Figure A-13 Data record 128 of SM 331; AI 8 TC (continued)

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

Operating mode	Coding
8 channels, hardware filter	2#00000000
8 channels, software filter	2#00000001
4 channels, hardware filter	2#00000010

Interference frequency suppression at 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 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-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 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, external comparison	2#1110	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

Reaction to open thermocouple at 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 previoius 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 at 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 231)

Parameters of analog input modules (Page 420)

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.

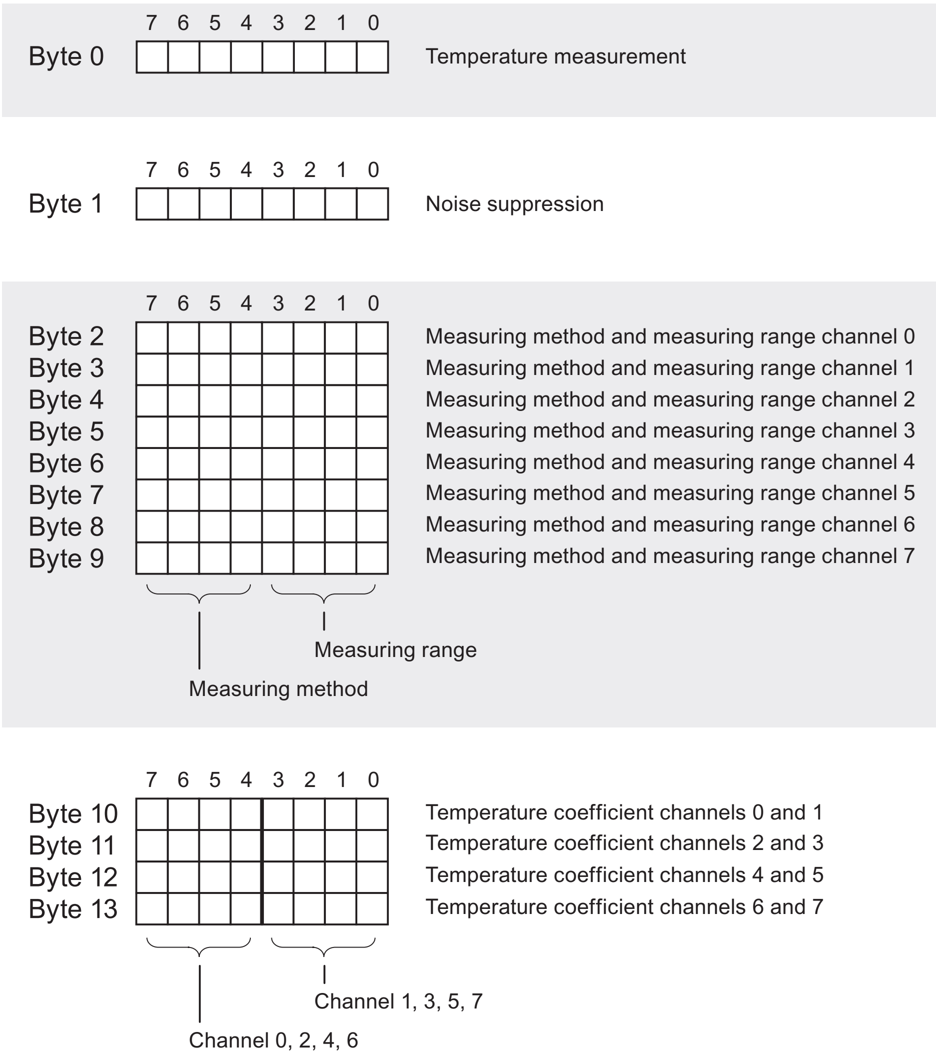


Figure A-14 Data record 1 for the parameters of analog input modules

Temperature measurement

The table below lists the temperature measurement codes to be enterd 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	2#1011
		± 500 mV	2#0011
		± 1 V	2#0100
		± 5 V	2# 0110
		1 V to 5 V	2#0111
		0 V to 10 V	2#1000
		± 10 V	2#1001
Current	2#0010	0 mA to 20 mA	2#0010
		4 mA to 20 mA	2#0011
		± 20 mA	2#0100
Resistance	2#0101	600 Ω	2#0110
		6 kΩ	2#1000
Thermoelectric resistance (linear)	2#1001	Pt 100 Klima	2#0000
		Pt 100 Standard	2#0010
		Ni 100 Klima	2#0001
		Ni 100 Standard	2#0011
		Ni 1000 / LG-Ni 1000 Klima	2#1010
		Ni 1000 / LG-Ni 1000 Standard	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:

- SFC55 "WR_PARM"
- *STEP 7* programming device

Parameters set in *STEP 7* can also be transferred to the module using SFC56 or SFC57.

Table A-23 Parameters for the electrically isolated analog input module SM 331; AI 8 x 16 Bit

Parameters	Data record no.	Configurable using...	
		... SFC55	...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

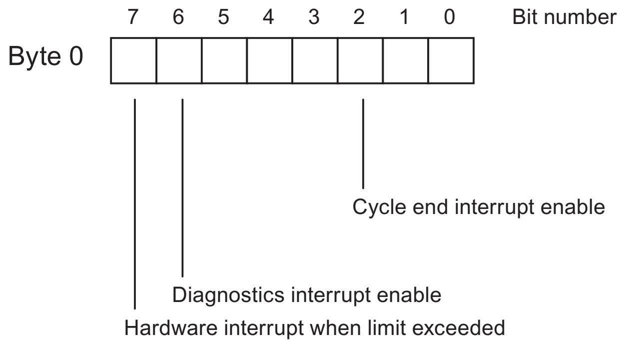
Note

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.

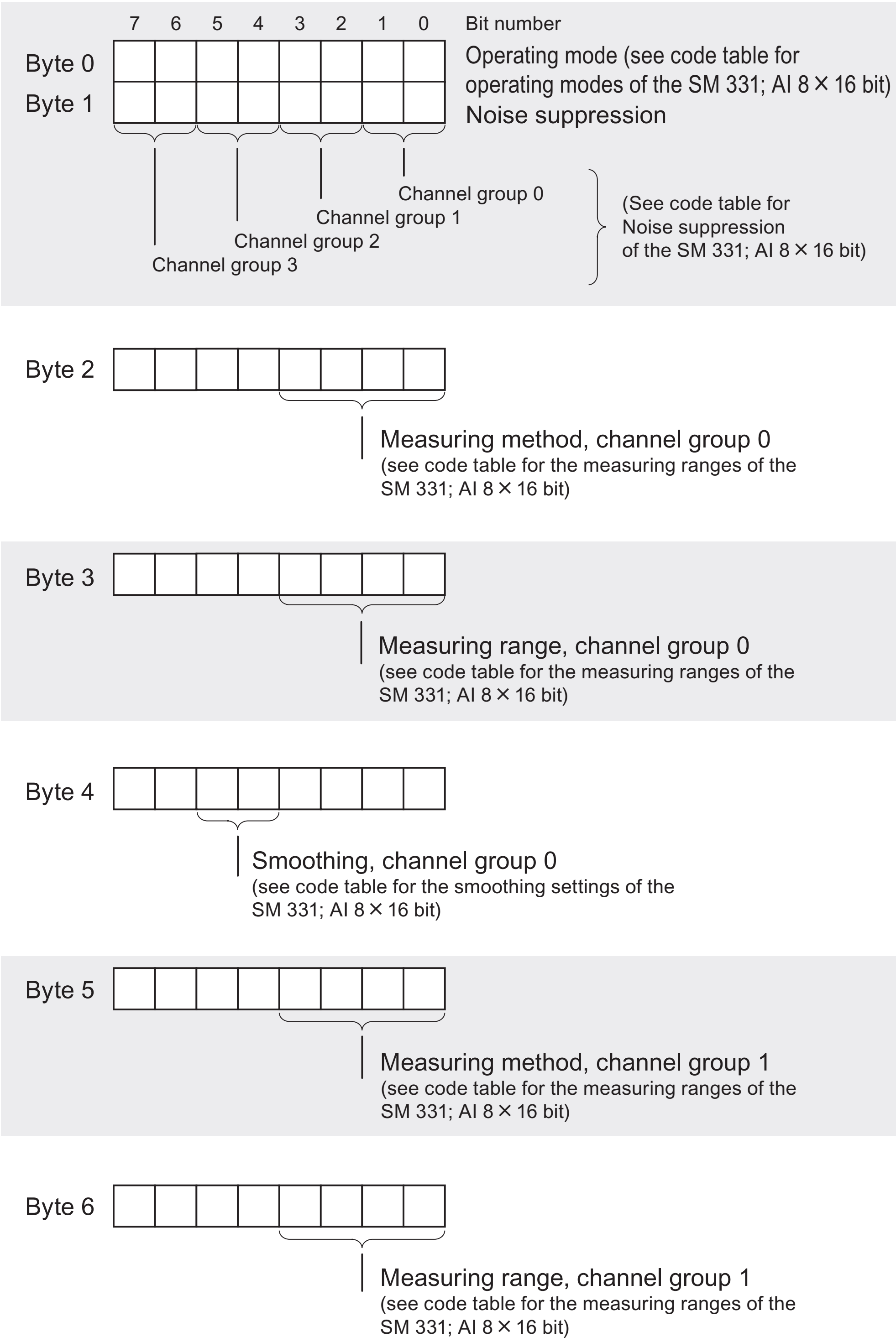


Figure A-16 Data record 128 for parameters of SM 331; AI 8 x 16 Bit

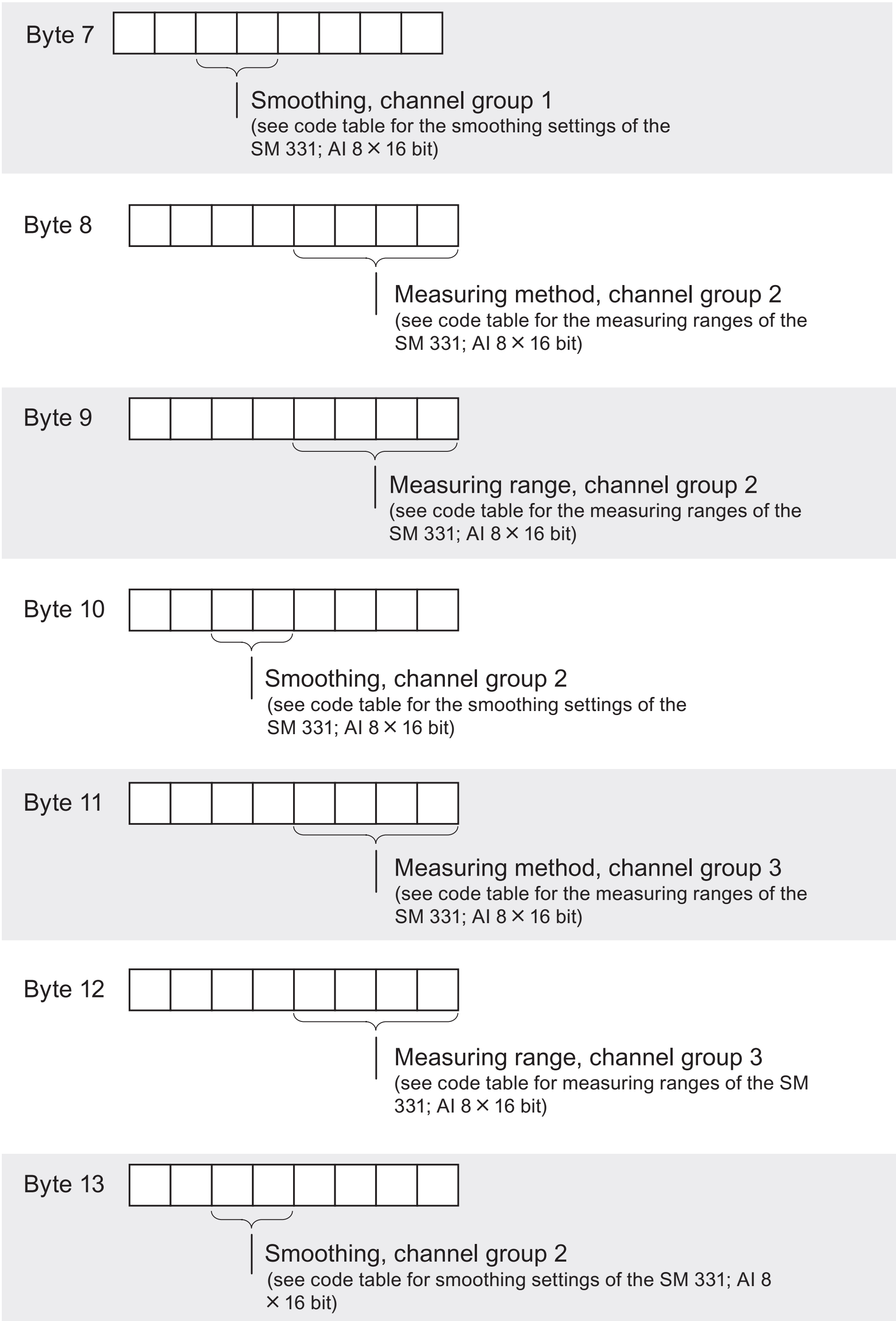


Figure A-17 Data record 128 for parameters of SM 331; AI 8 x 16 Bit (continued)

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)

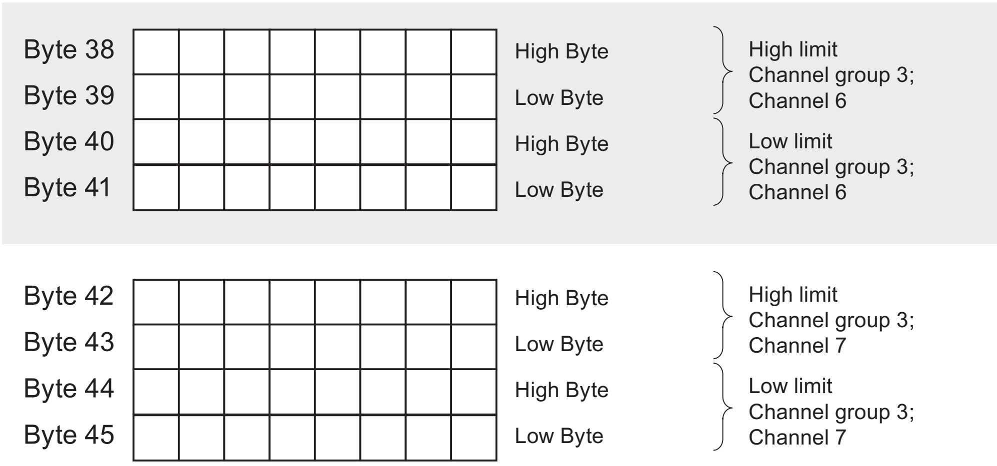


Figure A-19 Data record 128 for parameters of SM 331; AI 8 x 16 Bit (continued)

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 231)

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 SFC55 "WR_PARM".

Parameters set in *STEP 7* can also be transferred to the module using SFC56 and SFC57.

Table A-28 Parameters of analog output modules

Parameters	Data record number	Programmable, using ...	
		... SFC55	... 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
Substitute 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.

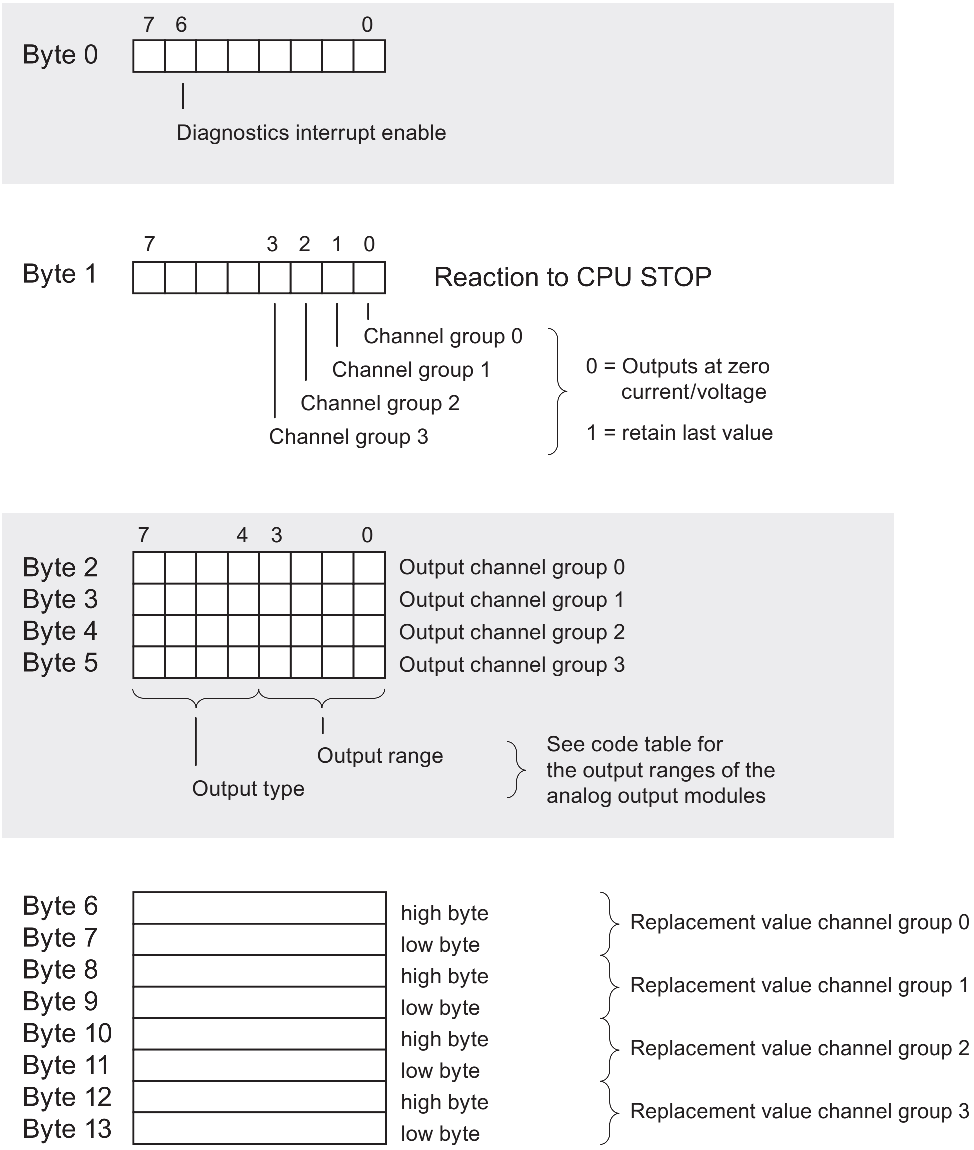


Figure A-20 Data record 1 for the parameters of analog output modules

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 231)

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

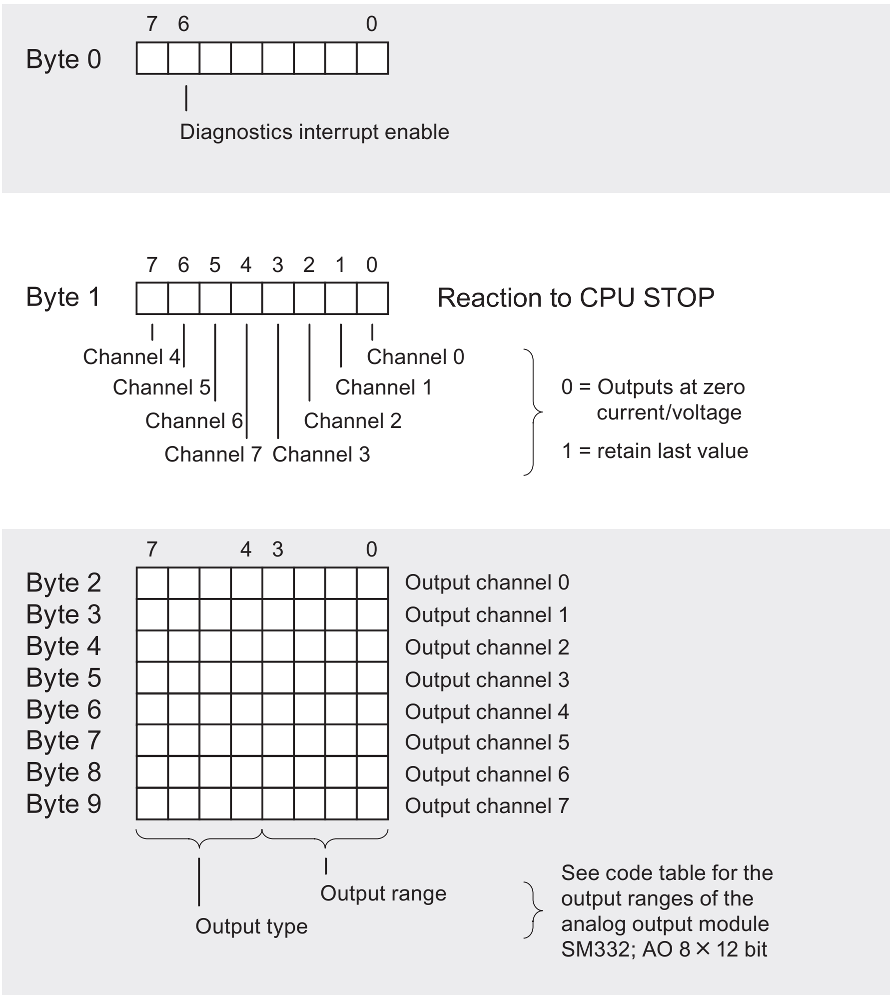
Note

To enable diagnostics 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 parameters you can edit:

- 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.

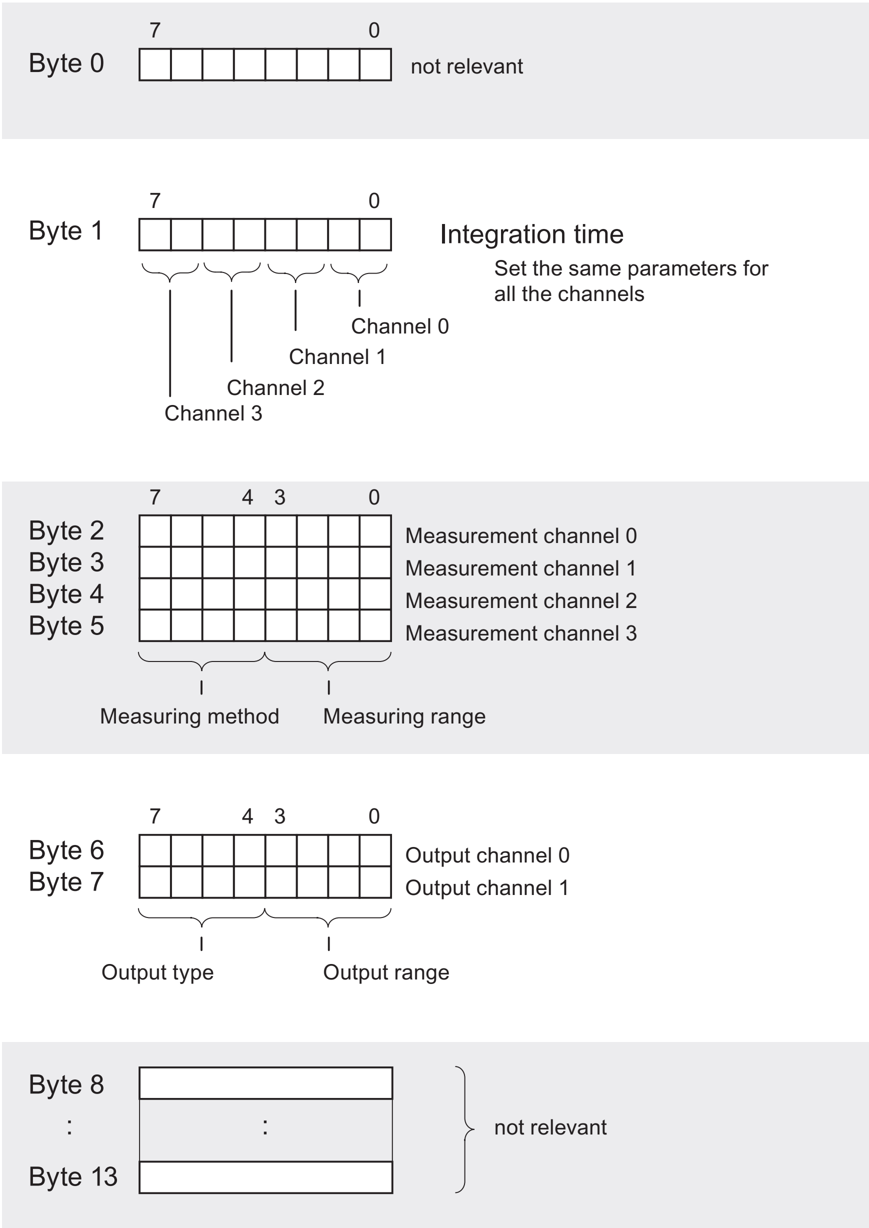


Figure A-22 Data record 1 for the parameters of analog IO modules

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 kΩ	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

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.

Diagnostics data are saved to data records

Module diagnostic data may have a maximum length of 16 bytes and are stored in data records 0 and 1:

- Data record 0 (DS0) contains 4 bytes of diagnostics data describing the current state of an automation system.
- Data record 1 contains the 4 bytes of diagnostic data which are also available in data record 0 **and** up to 12 bytes of module-specific diagnostics data.

Further references

For detailed information on the evaluation of the diagnostics data of signal modules in the user program and on corresponding SFCs, 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

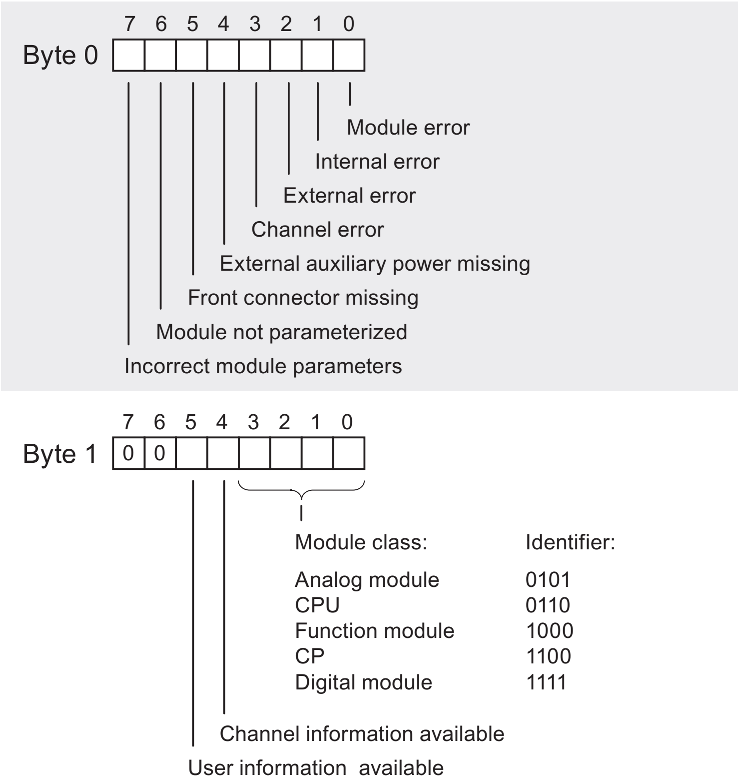


Figure B-1 Bytes 0 and 1 of diagnostics data

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

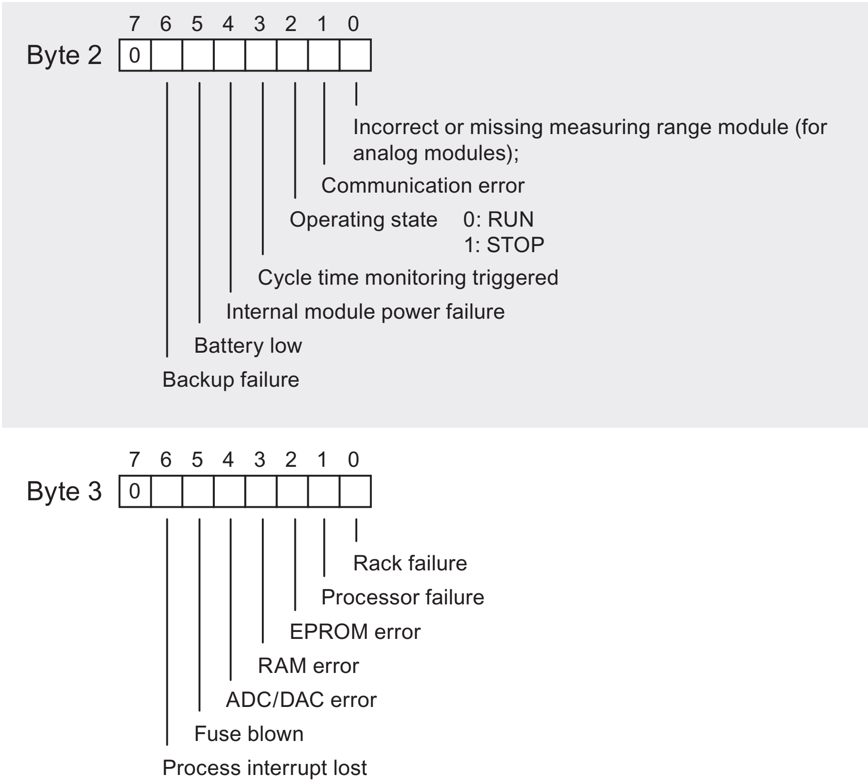


Figure B-2 Bytes 2 and 3 of diagnostics data

Bytes 4 to 7

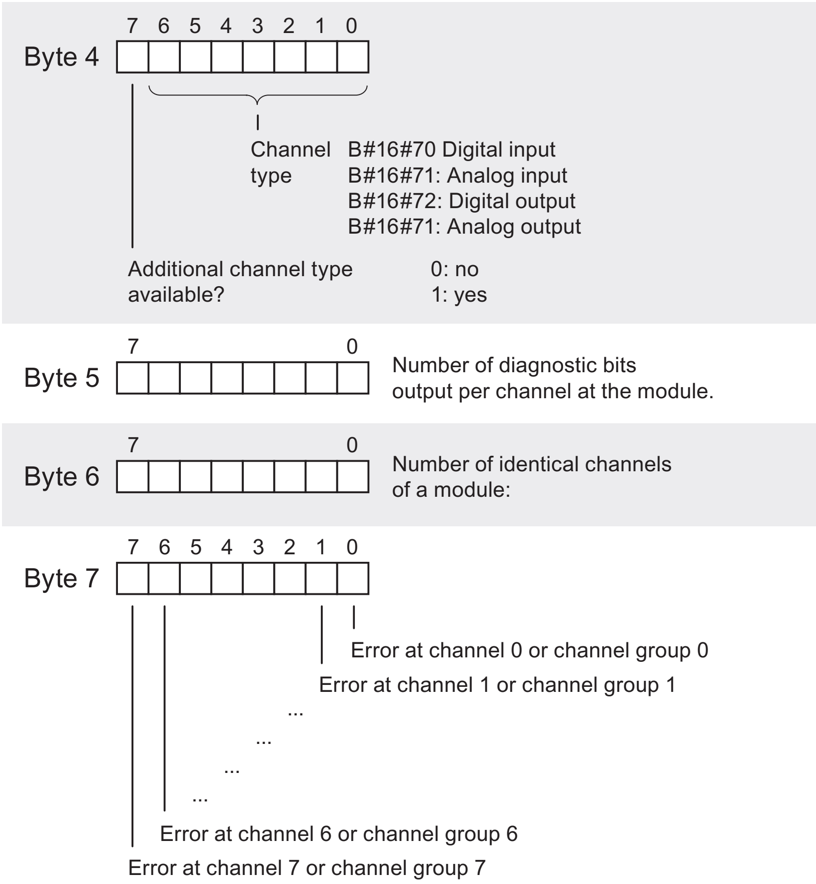


Figure B-3 Bytes 4 to 7 of diagnostics data

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 process and diagnostics interrupt

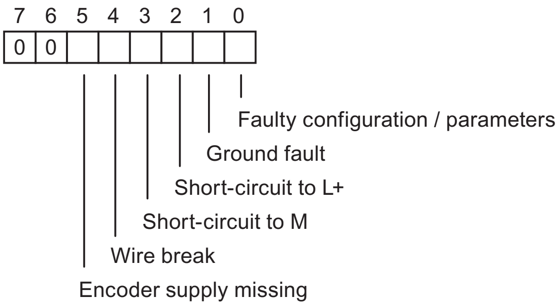


Figure B-4 Diagnostics byte for a digital input channel of SM 321; DI 16 x DC 24 V

Digital output channel of SM 322; DO 8 x DC 24 V/0.5 A; with diagnostics interrupt

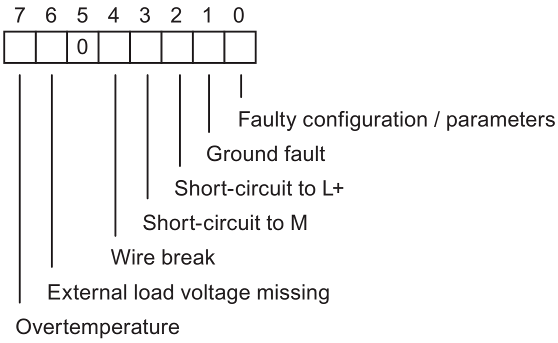


Figure B-5 Diagnostics byte for a digital output channel of SM 322; DO 8 x DC 24 V/0,5 A

Analog input channel of SM 331 modules with diagnostics functions

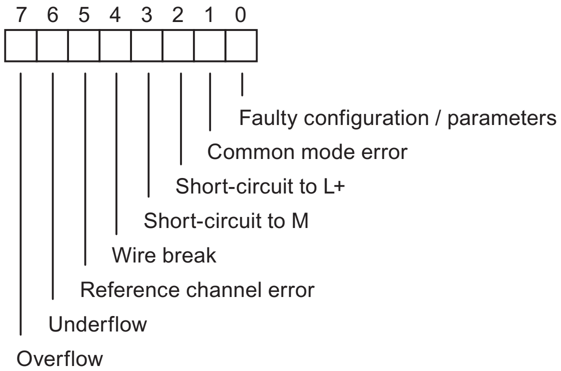


Figure B-6 Diagnostics byte of an analog input channel of an SM 331 module with diagnostics functions

Analog input channel of the SM 332 module with diagnostics functions

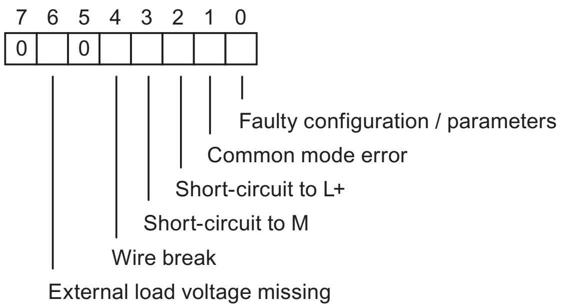


Figure B-7 Diagnostics byte of an analog input channel of an SM 332 module with diagnostics functions

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

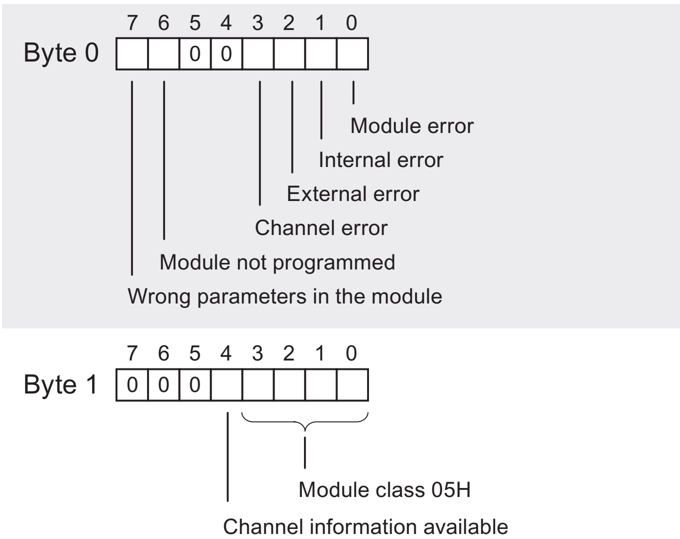


Figure B-8 Bytes 0 and 1 in diagnostics data of SM 338; POS-INPUT

Bytes 2 to 7

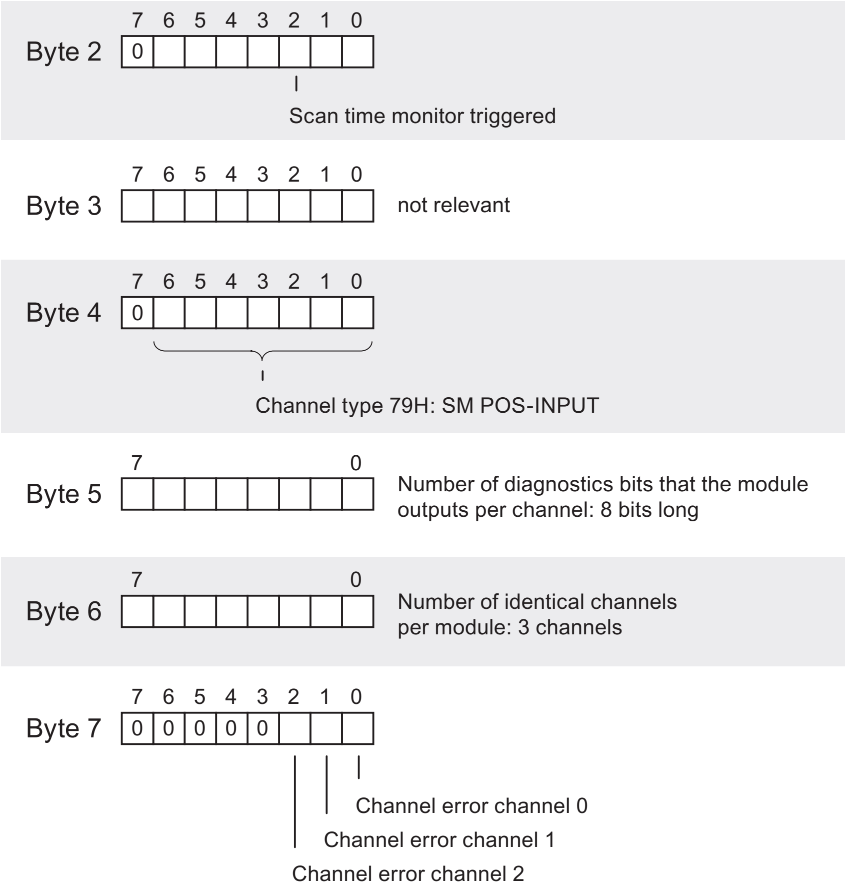


Figure B-9 Bytes 2 and 7 in diagnostics data of SM 338; POS-INPUT

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.

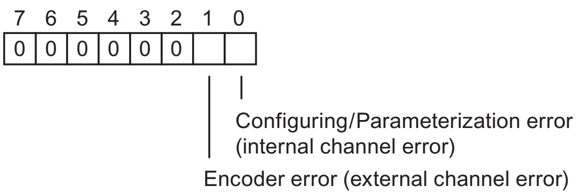


Figure B-10 Diagnostics byte for a channel of SM 338; POS-INPUT

See also

Position detection module SM 338; POS-INPUT;(6ES7 338-4BC01-0AB0) (Page 383)

Dimensional drawings C

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

Standard mounting rail 483 mm

The figure below shows the dimensional drawing of the 483 mm standard rail.

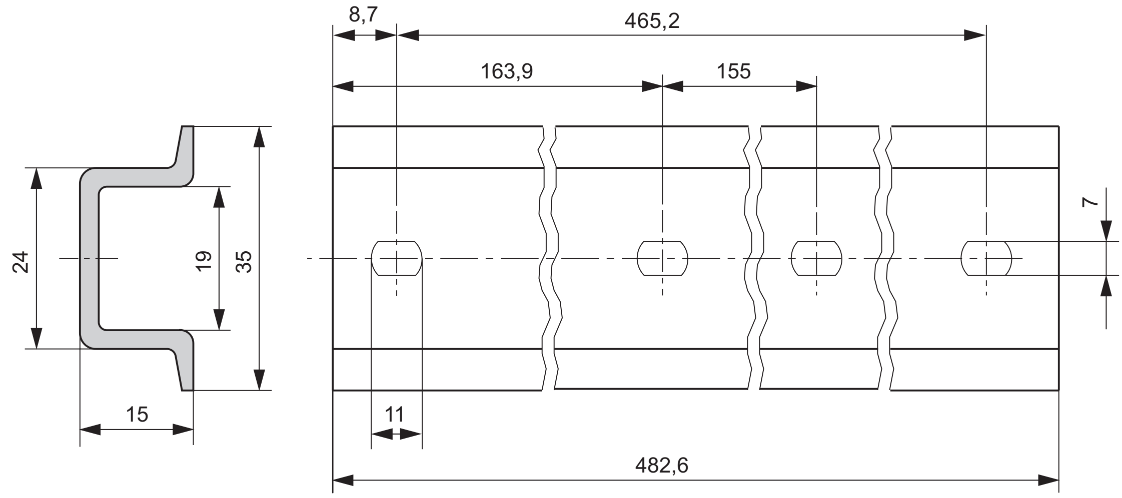


Figure C-1 Dimensional drawing of the 483 mm standard rail

Standard mounting rail 530 mm

The figure below shows the dimensional drawing of the 530 mm standard rail.

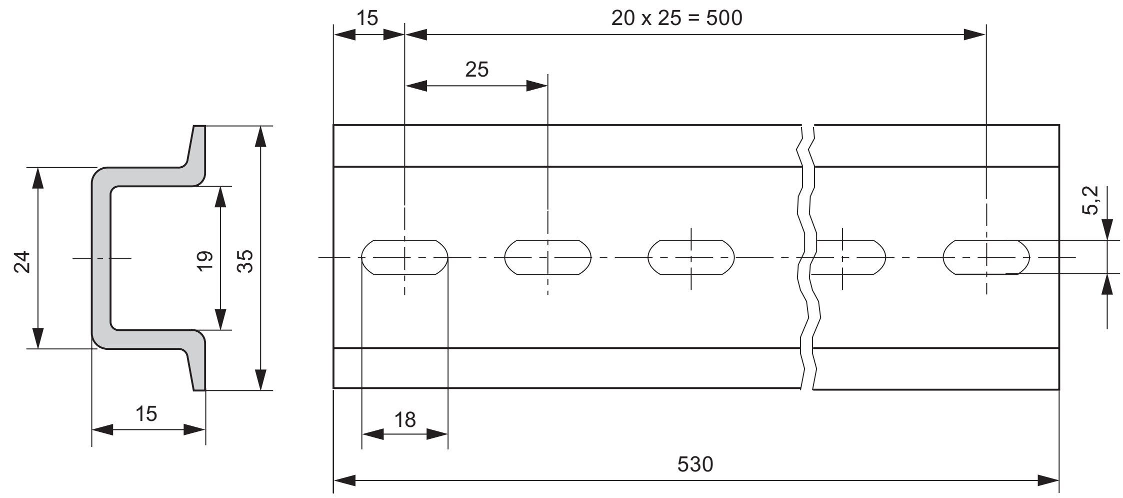


Figure C-2 Dimensional drawing of the 530 mm standard rail

Standard mounting rail 830 mm

The figure below shows the dimensional drawing of the 830 mm standard rail.

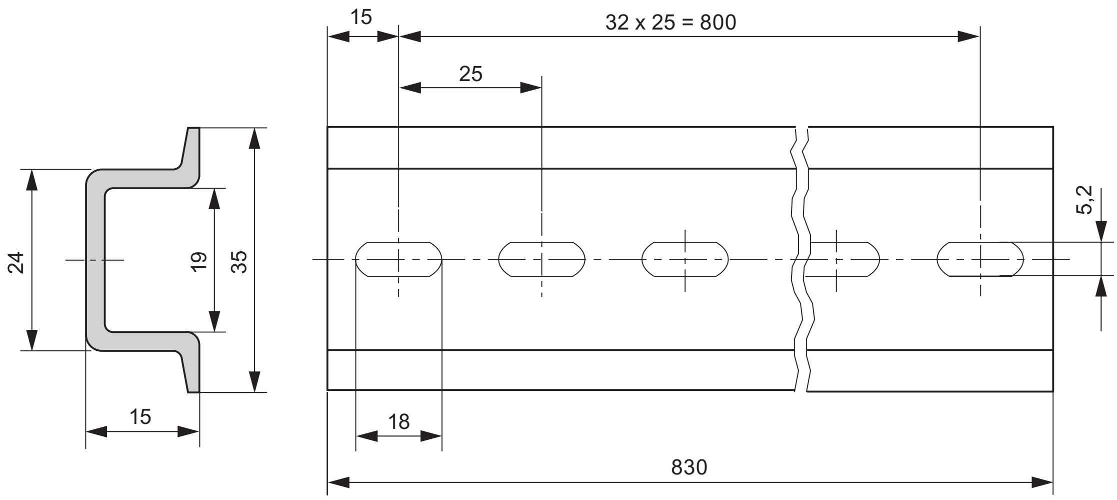


Figure C-3 Dimensional drawing of the 830 mm standard rail

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.

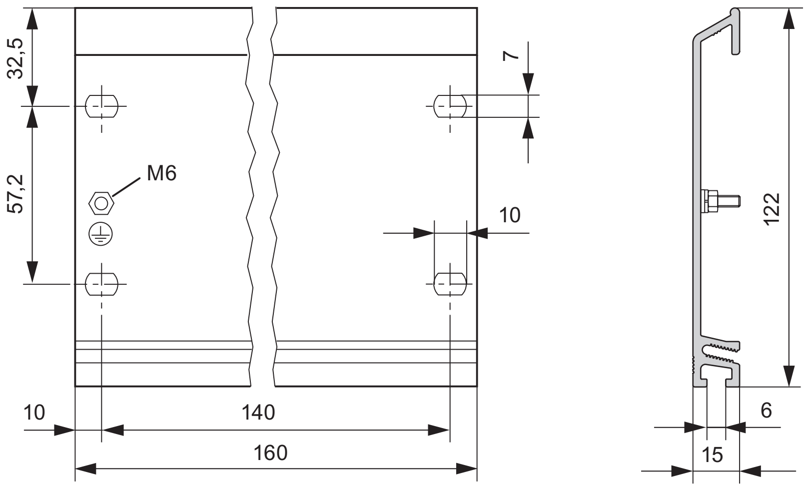


Figure C-5 Dimensional drawing of the mounting rail with standard width of 160 mm.

Mounting rail 482.6 mm

The figure below shows the dimensional drawing of the 482.6 mm mounting rail.

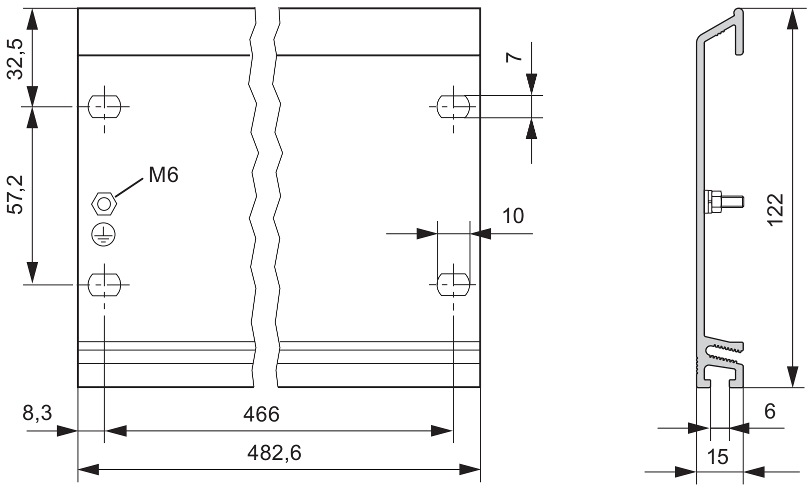


Figure C-6 Dimensional drawing of the mounting rail with standard width of 482.6 mm.

Mounting rail 530 mm

The figure below shows the dimensional drawing of the 530 mm mounting rail.

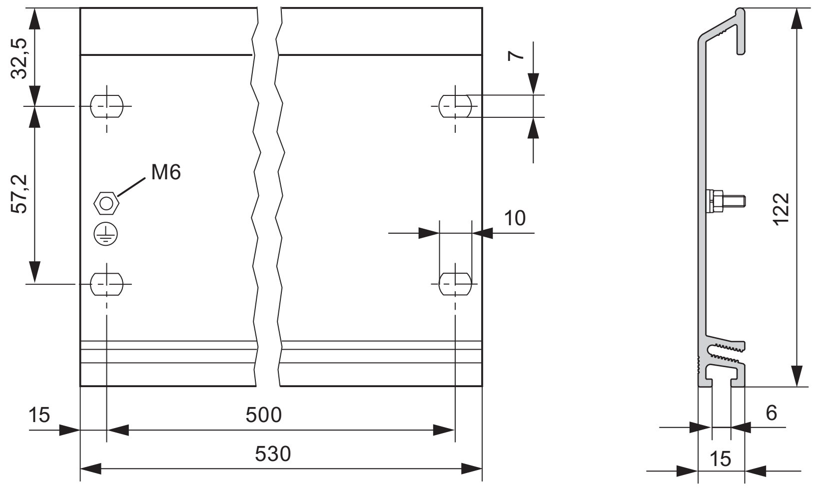


Figure C-7 Dimensional drawing of the mounting rail with standard width of 530 mm.

Mounting rail 830 mm

The figure below shows the dimensional drawing of the 830 mm mounting rail.

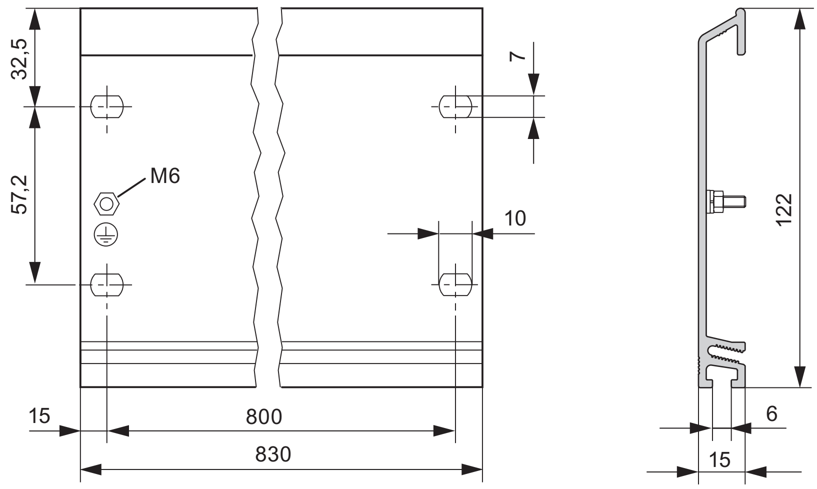


Figure C-8 Dimensional drawing of the mounting rail with standard width of 830 mm.

Mounting rail 2000 mm

The figure below shows the dimensional drawing of the 2000 mm mounting rail.

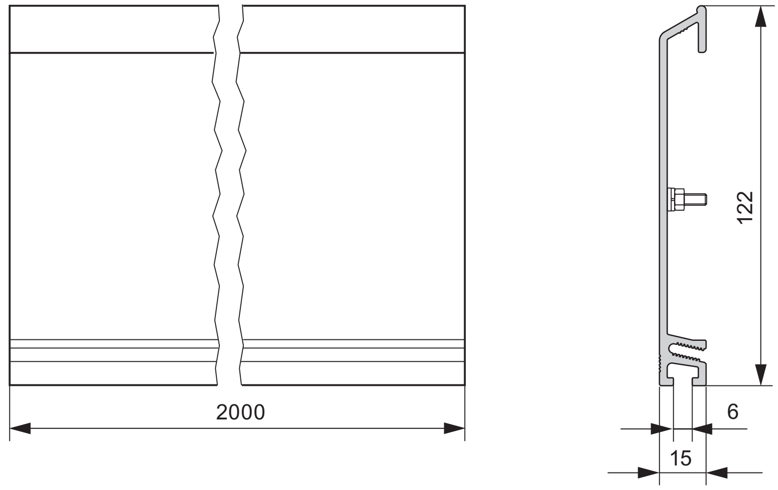
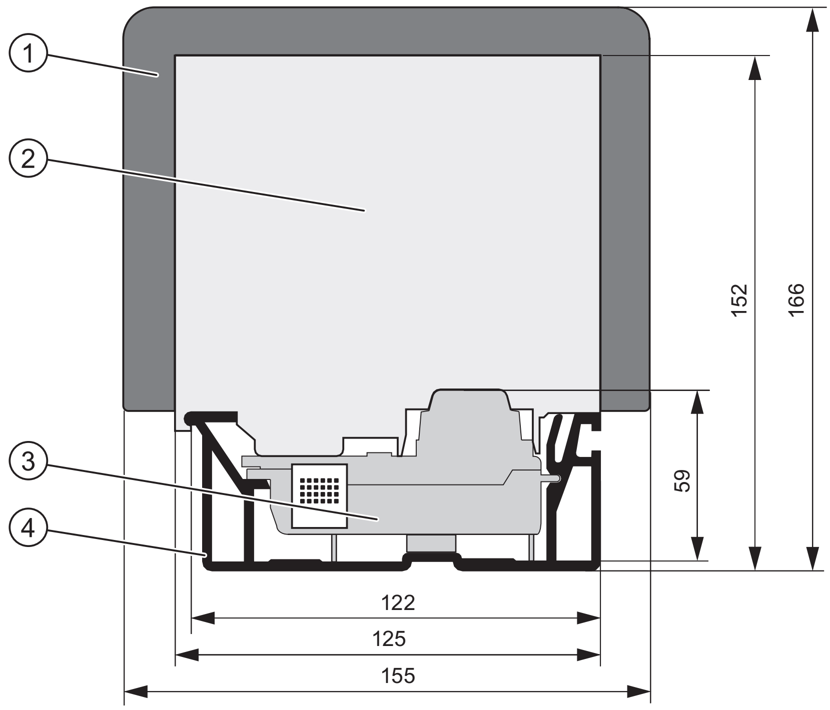


Figure C-9 Dimensional drawing of the 2000 mm mounting rail

Mounting rail for the "Insertion and Removal" function

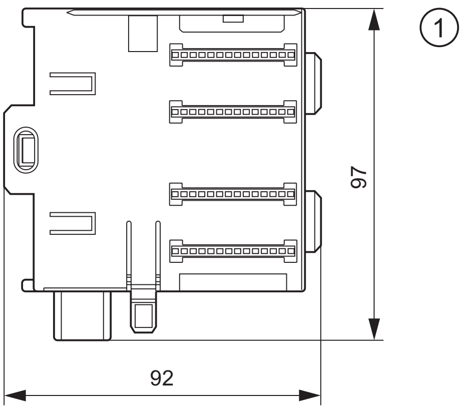
The figure below shows the dimensional drawing of the mounting rail for the "Insertion and Removal" function with active bus module, S7-300 module and explosion-proof partition. The mounting rail has a length of 482.6 mm or 530 mm.



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 drawing below shows the dimensions of power supply module PS 307; 2 A.

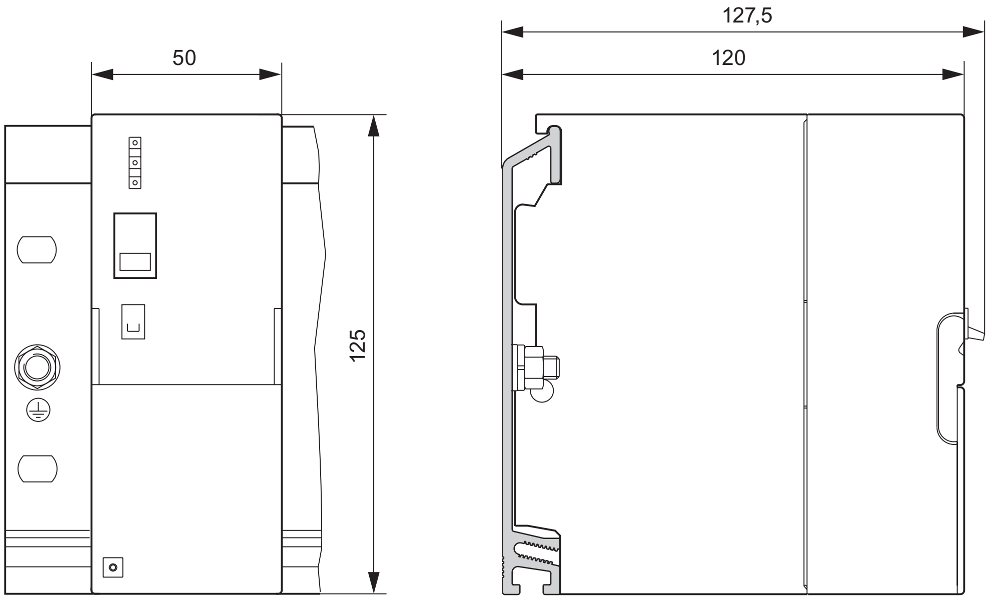


Figure C-10 Power supply module PS 307; 2 A

PS 307; 5A

The drawing below shows the dimensions of power supply module PS 307; 5 A.

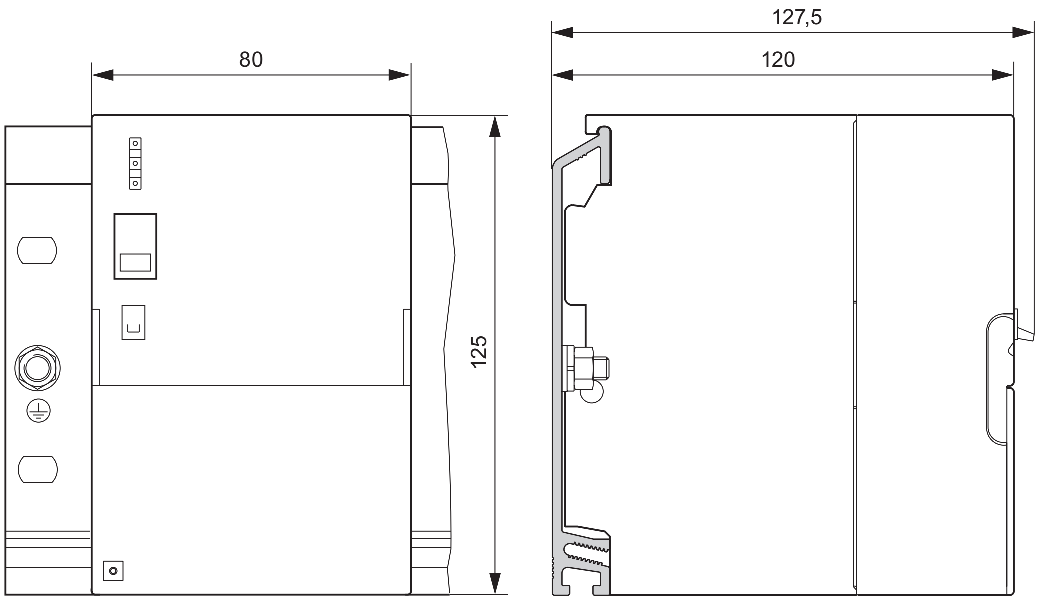


Figure C-11 Power supply module PS 307; 5 A

PS 307; 10 A

The drawing below shows the dimensions of power supply module PS 307; 10 A.

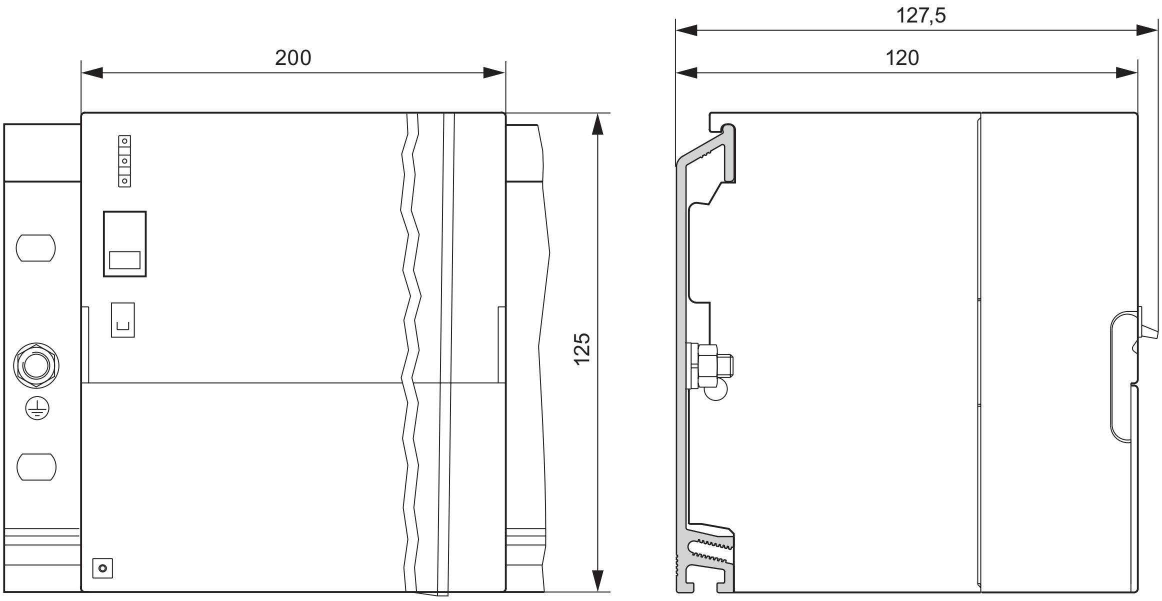


Figure C-12 Power supply module PS 307; 10 A

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.

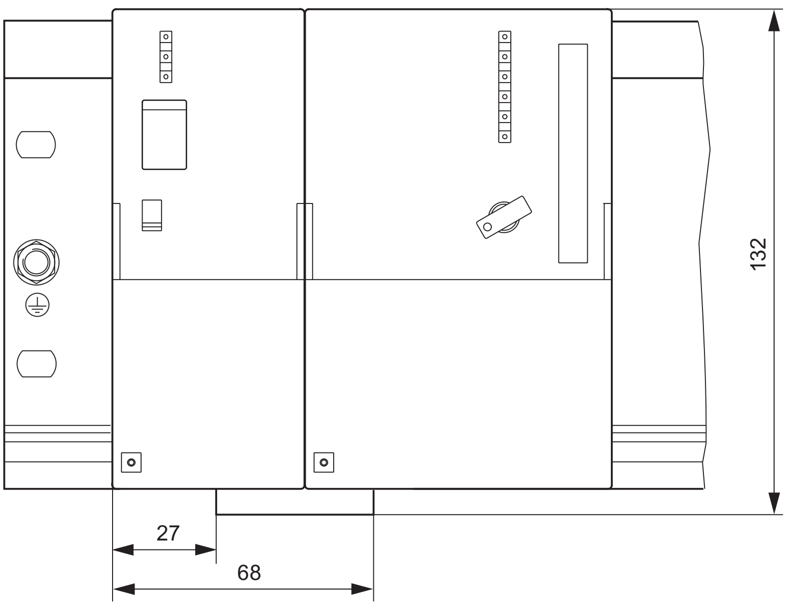


Figure C-13 Dimensional drawing of power supply module PS 307; 5 A with CPU 313/314/315/315-2 DP, front view

PS 307; 5 A with 313/314/315/ 315-2 DP CPU

The side view drawing below shows the dimensions of power supply module PS 307; 5 A with 313/314/315/315-2 DP CPU.

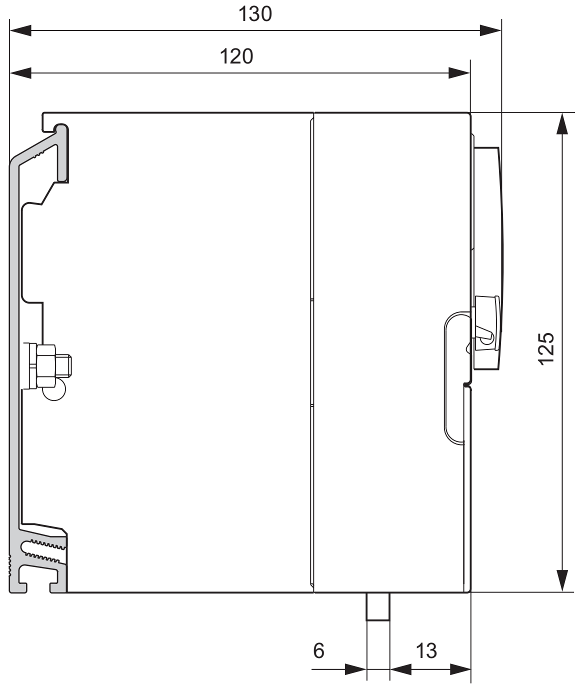


Figure C-14 Dimensional drawing power supply module PS 307; 5 A with CPU 313/314/315/315-2 DP, side view

C.3 Dimensional drawings of the interface modules

IM 360

The figure below shows the dimensional drawing of interface module IM 360.

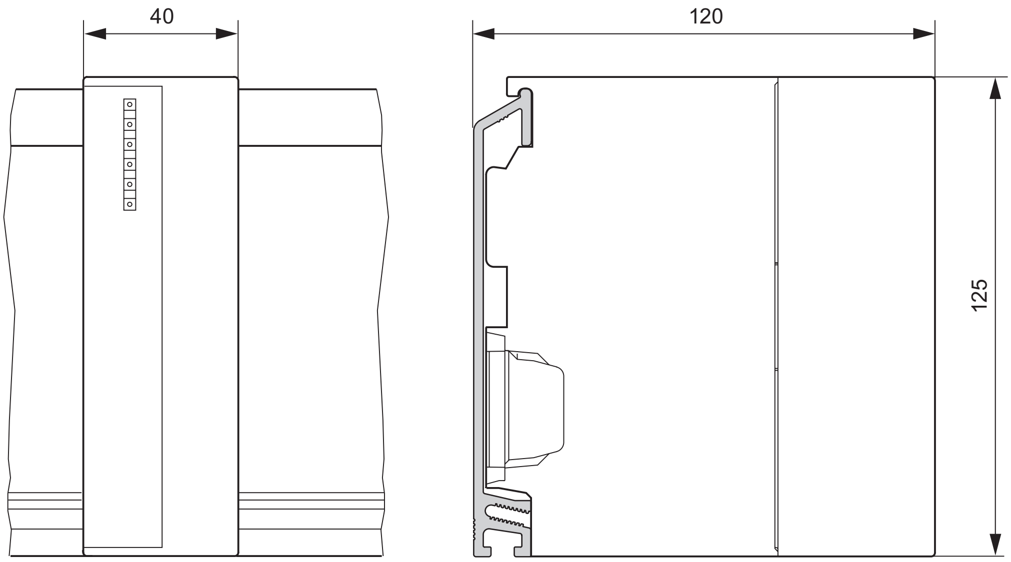


Figure C-15 Interface module IM 360

IM 361

The figure below shows the dimensional drawing of interface module IM 361.

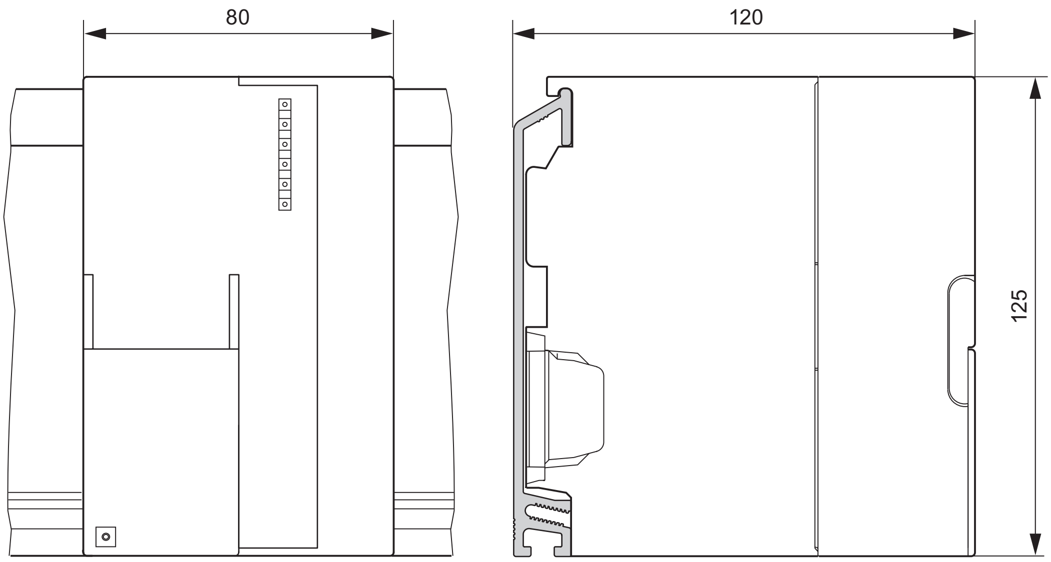


Figure C-16 Interface module IM 361

IM 365

The figure below shows the dimensional drawing of interface module IM 365.

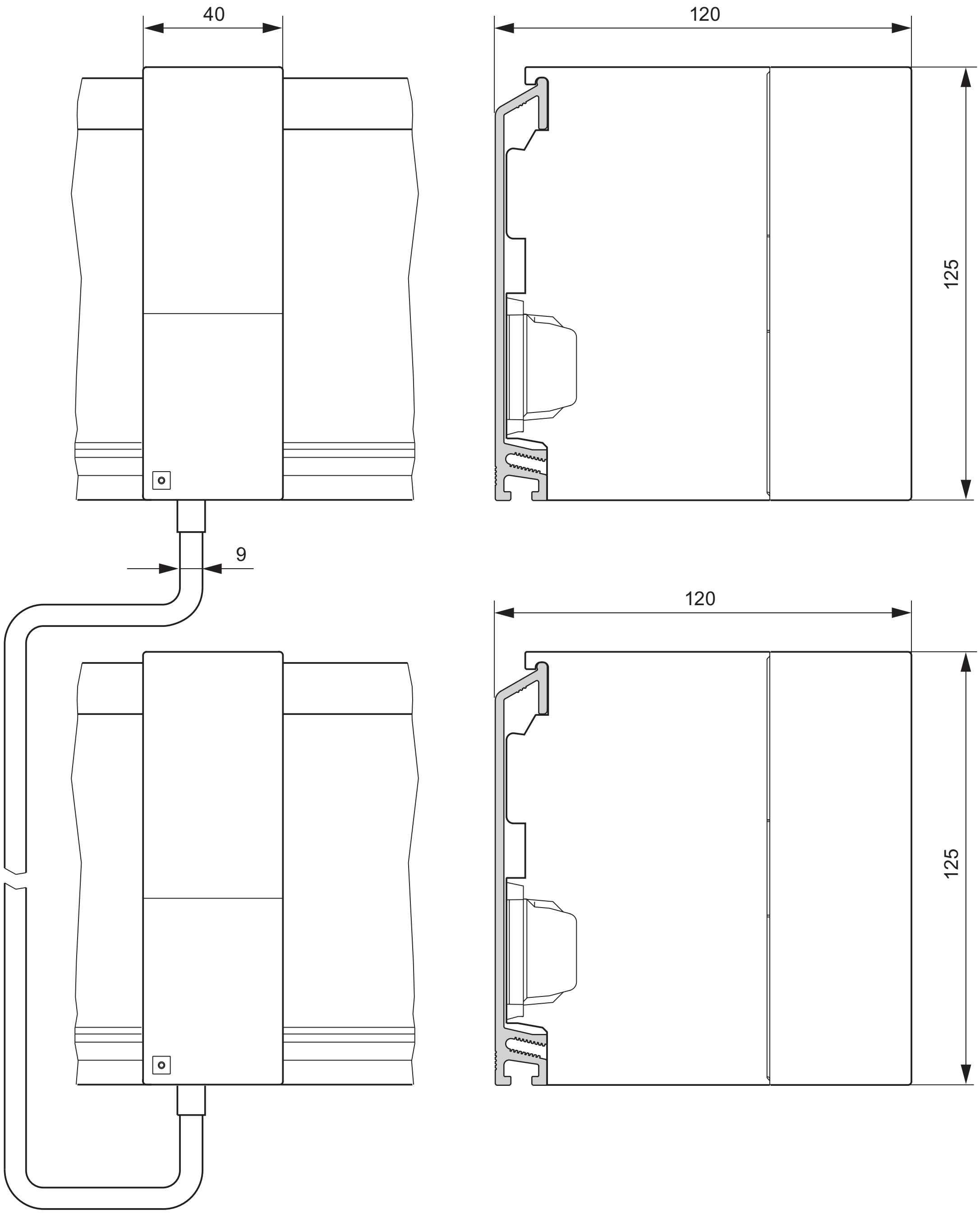


Figure C-17 Interface module IM 365

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. The specified dimensions are always the same.

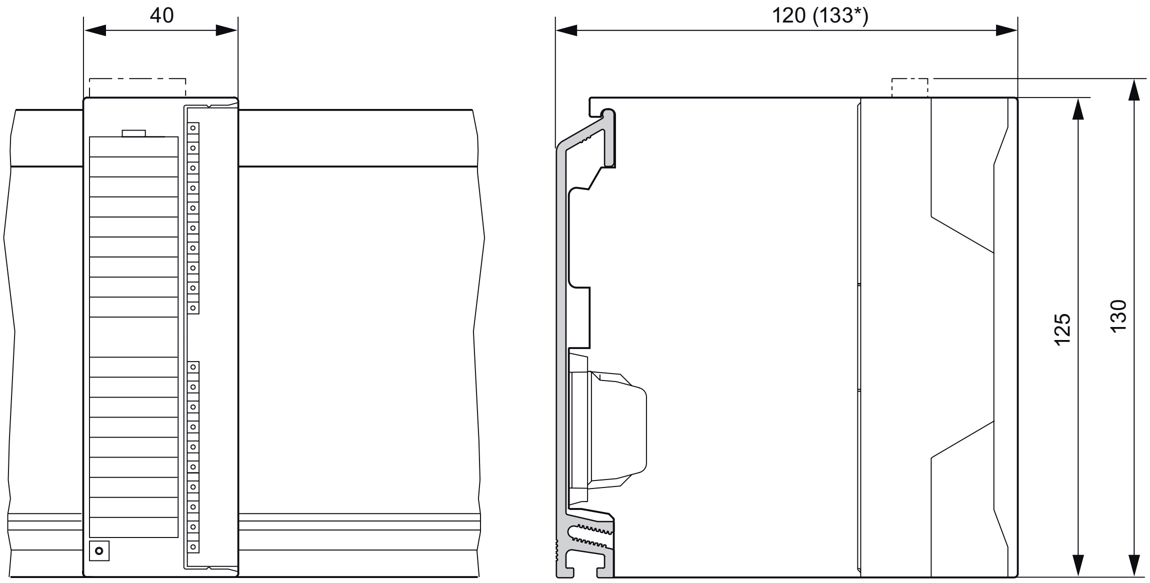


Figure C-18 Signal module

* With front door, elevated design

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.

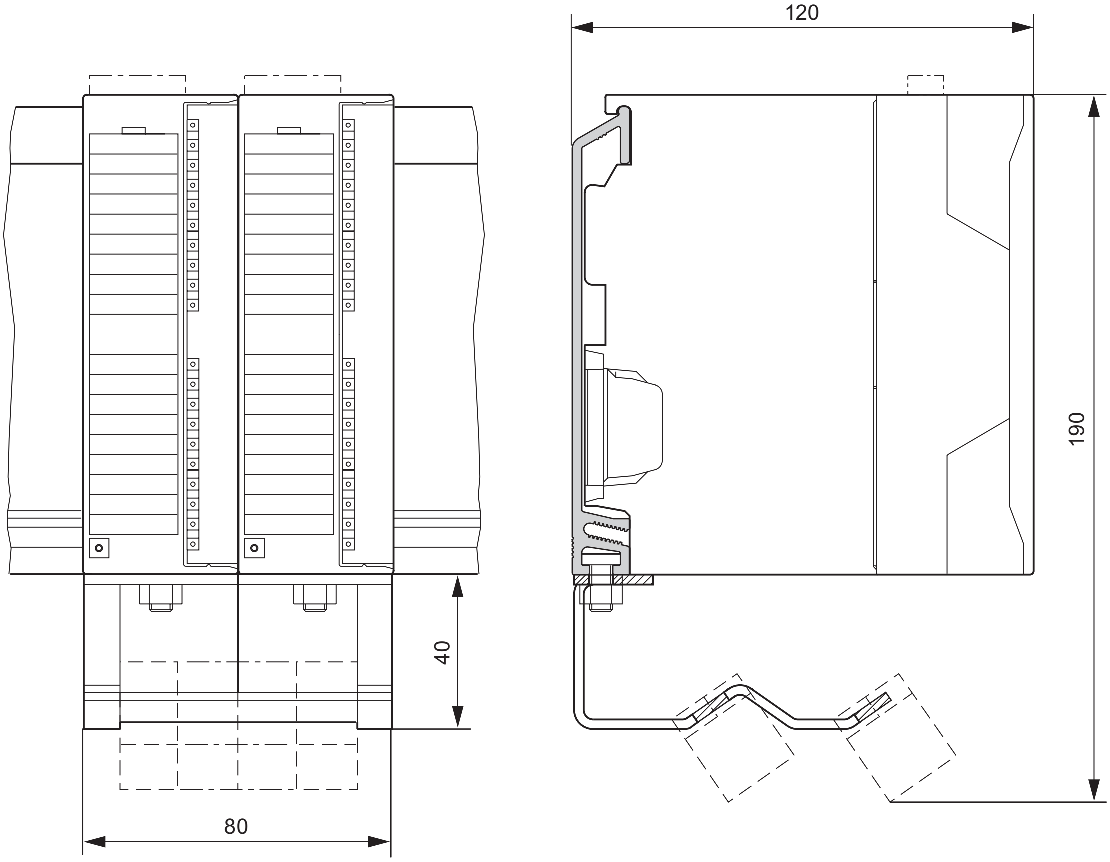


Figure C-19 2 signal modules with shield connecting element

RS 485 Repeater on standard rail

The figure below shows the dimensional drawing of the RS 485 Repeater mounted on the standard rail.

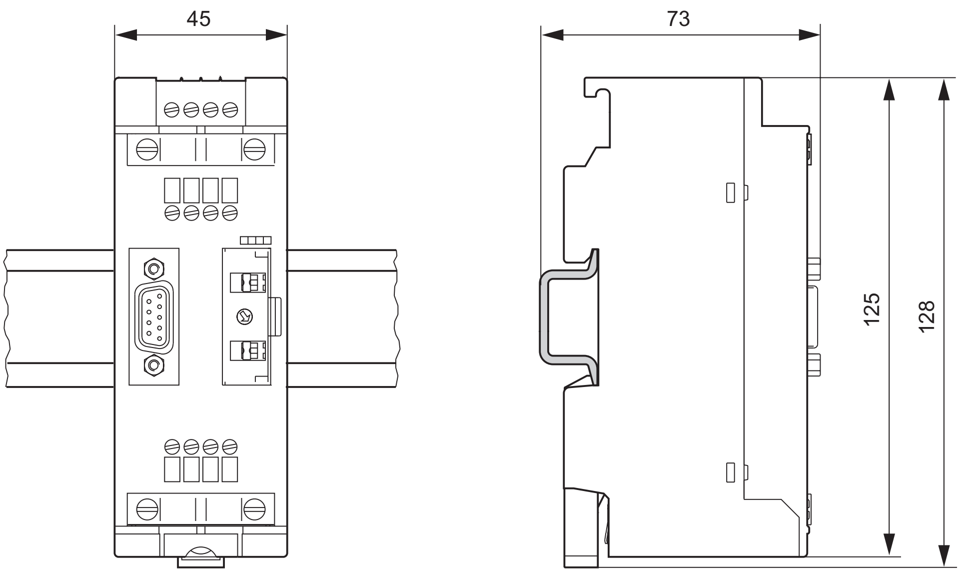


Figure C-20 RS 485 Repeater on standard rail

RS 485 Repeater on standard rail

The figure below shows the dimensional drawing of the RS 485 Repeater on an S7-300 mounting rail.

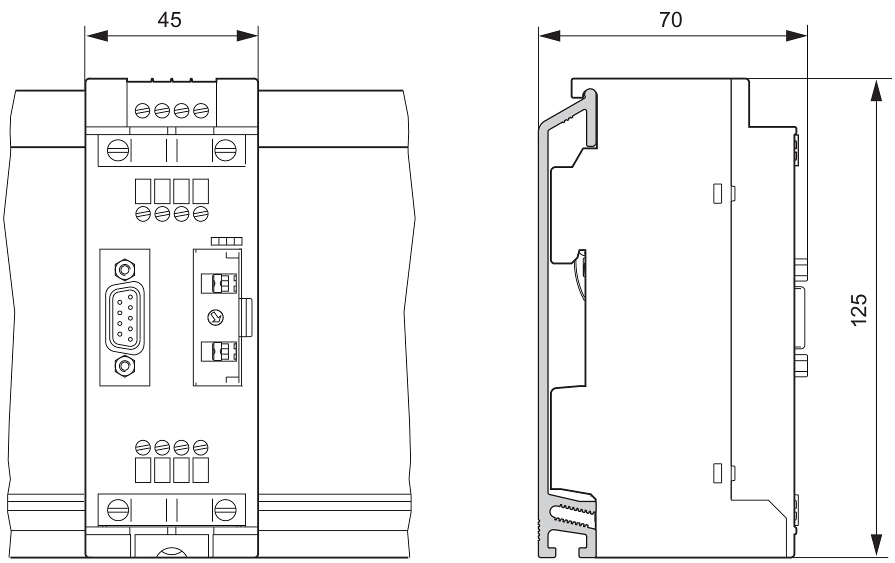


Figure C-21 RS 485 Repeater on standard rail

Spare parts and accessories for S7-300 modules D

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	6ES7 390-0AA00-0AA0
Power connector between power supply unit and CPU	6ES7 390-7BA00-0AA0
Labeling strip (10 items) • for 8-/16channel modules • for 32channel modules	 6ES7 392-2XX00-0AA0 6ES7 392-2XX10-0AA0
Labeling strips for printing • for 16-channel modules (petrol) (light-beige) (yellow) (red) • for 32-channel modules (petrol) (light-beige) (yellow) (red)	 6ES7 392-2AX00-0AA0 6ES7 392-2BX00-0AA0 6ES7 392-2CX00-0AA0 6ES7 392-2DX00-0AA0 6ES7 392-2AX10-0AA0 6ES7 392-2BX10-0AA0 6ES7 392-2CX10-0AA0 6ES7 392-2DX10-0AA0
• Instructions for printing labeling strips using print templates	www.siemens.de/automation/csi/product Contribution ID: 11978022
Slot number plate	6ES7 912-0AA00-0AA0
Front connector 20-pin • Screw technology (1 unit) • Screw technology (100 unit) • Spring clamp technology (1 unit) • Spring clamp technology (100 unit)	 6ES7 392-1AJ00-0AA0 6ES7 392-1AJ00-1AB0 6ES7 392-1BJ00-0AA0 6ES7 392-1BJ00-1AB0
Front connector 40-pin • Screw technology (1 unit) • Screw technology (100 unit) • Spring clamp technology (1 unit) • Spring clamp technology (100 unit)	 6ES7 392-1AM00-0AA0 6ES7 392-1AM00-1AB0 6ES7 392-1BM01-0AA0 6ES7 392-1BM01-1AB0
Front connector for 2 ribbon cable connections • screw terminal technology • cageclamp technology	 6ES7 921-3AB00-0AA0 6ES7 921-3AA00-0AA0

S7-300 parts	Order number
Front connector for 4 ribbon cable connections • cageclamp technology	 6ES7 921-3AA20-0AA0
Round-sheath ribbon cable (16-pole) • Unshielded 30 m • Unshielded 60 m • Shielded 30 m • Shielded 60 m	 6ES7 923-0CD00-0AA0 6ES7 923-0CG00-0AA0 6ES7 923-0CD00-0BA0 6ES7 923-0CG00-0BA0
Connectors, 16-pin, set of 8 (insulation displacement terminals)	6ES7 921-3BE10-0AA0
Shield connecting element	6ES7 390-5AA00-0AA0
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	 6ES7 390-5AB00-0AA0 6ES7 390-5BA00-0AA0 6ES7 390-5CA00-0AA0
Measuring range module for analog modules	6ES7 974-0AA00-0AA0
Fuse set for digital output modules - 6ES7 322-1FF01-0AA0 - 6ES7 322-1FH00-0AA0 (contains 10 fuses and 2 fuse holders)	6ES7 973-1HD00-0AA0
Fuse set for digital output module - 6ES7 322-1CF00-0AA0 (contains 10 fuses)	6ES7 973-1GC00-0AA0
Connecting cable for IM 360 and IM 361, or IM 361 and IM 361 • 1 m • 2.5 m • 5 m • 10 m	 6ES7 368-3BB01-0AA0 6ES7 368-3BC51-0AA0 6ES7 368-3BF01-0AA0 6ES7 368-3CB01-0AA0
Front door, elevated design for 32-channel modules	6ES7 328-0AA00-7AA0

Directive on handling Electrostatic-Sensitive Devices (ESD)

E

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**devices/**M**odules are commonly abbreviated **ESD**. The common international designation **ESD** stands for **E**lectrostatic **S**ensitive **D**evice.

ESD modules are identified by the following symbol:

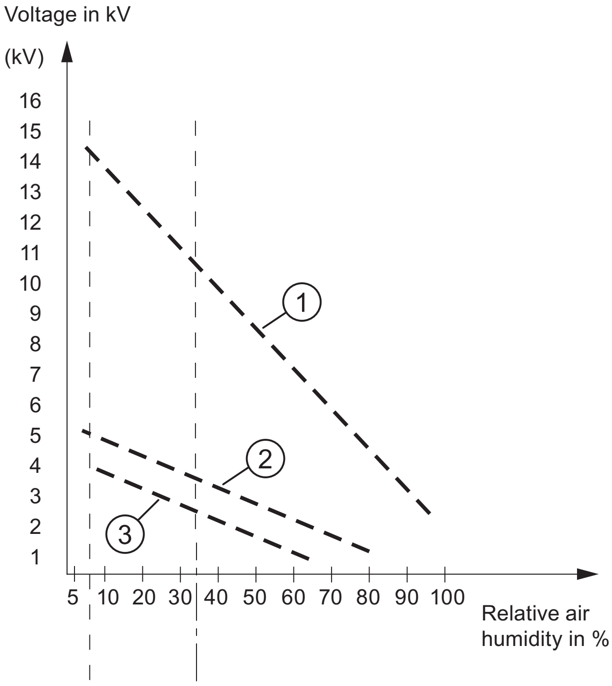
Caution
ESD devices can be destroyed by voltages well below the threshold of human perception. These static voltages develop when you touch a component or electrical connection of a device without having drained the static charges present on your body. The electrostatic discharge current may lead to latent failure of a module, that is, this damage may not be significant immediately, but in operation may cause malfunction.

E.2 Electrostatic charge 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.

F 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 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.

Phone: +49 (911) 895-3200

http://www.sitrain.com

List of abbreviations

G

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
FEPROM	Flash Erasable Programmable Read-Only Memory
ES	Encoder supply
I+	Measuring line for current input
I_C+ / -	Constantcurrent 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)
M_{ANA}	Reference potential of the analog measuring circuit
MPI	Multipoint interface

Abbreviations	Explanations
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 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.

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.

Diagnostics 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.

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.

Equipotential bonding

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.

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 grater 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.

Parameters

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

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.

Users can program the substitute values 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.

Index

B

C

D

L

M

N

O

P

R

T

U

V

W

SIEMENS

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).

A5E00201782-03

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		

<table>
<tr><th>Module</th><th>Behavior of the inputs/outputs</th><th>Peculiarities when reparameterizing</th></tr>
<tr><td>6ES7 332-5HD01-0AB0
SM 332; AO 4 × 12 Bit</td><td rowspan="4">Output the last valid output value before parameterization</td><td rowspan="2">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</td></tr>
<tr><td>6ES7 332-5HB01-0AB0
6ES7 332-5HB81-0AB0
SM 332; AO 2 × 12 Bit</td></tr>
<tr><td>6ES7 332-5HF00-0AB0
SM 332; AO 8 × 12 Bit</td><td>---</td></tr>
<tr><td>6ES7 332-7ND00-0AB0
6ES7 332-7ND01-0AB0
SM 332; AO 4 × 16 Bit</td><td>---</td></tr>
</table>

<table>
<tr><th>Module</th><th>Behavior of the inputs/outputs</th><th>Peculiarities when reparameterizing</th></tr>
<tr><td colspan="3">ET 200M signal modules for process automation (PCS7)</td></tr>
<tr><td>6ES7 321-7TH00-0AB0
SM 321; DI 16 × NAMUR</td><td>Supply the last valid process value (including the value status) before parameterization</td><td rowspan="2">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</td></tr>
<tr><td>6ES7 322-8BH00-0AB0
SM 322; DO 16 × DC 24 V/0,5A</td><td>Output the last valid output value before parameterization</td></tr>
</table>

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		---

SIEMENS

SIMATIC

Product Information

12/2006

Use of subassemblies/modules in a Zone 2 Hazardous Area

Einsatz der Baugruppen/Module im explosions- gefährdeten Bereich Zone 2

Zugelassene Baugruppen/Module

Nachfolgend finden Sie wichtige Hinweise für die Installation der Baugruppen/Module im explosionsgefährdeten Bereich.

Die Liste mit den zugelassenen Baugruppen/Module finden Sie im Internet:

http://support.automation.siemens.com/WW/view/de/

Geben Sie auf dieser Webseite (im Suchfenster) die dazugehörige Beitrags-ID ein, *siehe Tabelle.*

Fertigungsort / Zulassung

Ex **II 3 G** **EEx nA II T3 .. T6** nach EN 60079-15 : 2003

Prüfnummer: *siehe Tabelle*

Fertigungsort	Baugruppen/Module	Prüfnummer	Beitrags-ID
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Fehlersichere Module	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Buskopplung DP/PA Diagnoserepeater S7-300 Fehlersichere Baugruppen	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-Busanschlussstecker	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Hinweis

Baugruppen/Module mit der Zulassung Ex 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 für:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Baugruppen/Module müssen in ein geeignetes Gehäuse eingebaut werden. Dieses Gehäuse muss 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 60079-15).
2. Wenn am Kabel bzw. an der Kabeleinführung dieses Gehäuses unter Betriebsbedingungen eine Temperatur > 70 °C erreicht wird oder wenn unter Betriebsbedingungen die Temperatur an der Aderverzweigung > 80 °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 6.2 (gemäß EN 60079-15) entsprechen.
4. Es müssen Maßnahmen getroffen werden, dass die Nennspannung durch Transienten um nicht mehr als 40 % überschritten werden kann.

Besondere Bedingungen für KEMA 04 ATEX 1151X

1. Die PROFIBUS-Busanschlussstecker müssen so installiert werden, dass sie vor mechanischer Gefahr geschützt sind.
2. Wenn das Eindringen von Feuchtigkeit und Staub nicht auszuschließen ist, sind die PROFIBUS-Busanschlussstecker Serie 6ES7972-... in ein geeignetes Gehäuse einzubauen. Dieses Gehäuse muss mindestens die Schutzart IP 54 (nach EN 60529) gewährleisten.
3. Die PROFIBUS-Busanschlussstecker müssen mit den mitgelieferten Schrauben vorschriftsgemäß befestigt werden.
4. Das Anschließen bzw. Trennen von spannungsführenden Leitern oder der Betätigung Geräteschalter, z.B Installations- oder Wartungszwecken, ist nur erlaubt wenn sichergestellt ist, dass der Bereich nicht explosionsgefährdet ist.

Besondere Bedingungen für KEMA 05 ATEX 1137X

1. Baugruppen/Module müssen in ein geeignetes Gehäuse eingebaut werden. Dieses Gehäuse muss 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 60079-15).
2. Wenn am Kabel bzw. an der Kabeleinführung dieses Gehäuses unter Betriebsbedingungen eine Temperatur > 70 °C erreicht wird oder wenn unter Betriebsbedingungen die Temperatur an der Aderverzweigung > 80 °C sein kann, müssen die Temperatureigenschaften der Kabel mit den tatsächlich gemessenen Temperaturen übereinstimmen.
3. Es müssen Maßnahmen getroffen werden, dass die Nennspannung durch Transienten um nicht mehr als 40 % überschritten werden kann.

Weitere Informationen

Weitere Informationen zu den Baugruppen/Modulen finden Sie im dazugehörigen Handbuch.

Use of subassemblies/modules in a Zone 2 Hazardous Area

Approved devices/modules

Below you will find important information on the installation of the subassemblies/modules in a hazardous area.

You can find the list of approved devices/modules on the Internet:

http://support.automation.siemens.com/WW/view/en/

Enter the associated article ID in the search window on this website, see table.

Production Location / Certification

II 3 G **EEx nA II T3 .. T6** to EN 60079-15 : 2003

Test number: *see table below*

Production Location	Subassemblies/Modules	Test Number	Article ID
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET-200S ET 200S fault-tolerant modules	KEMA 01 ATEX 1238X	24037700
	S7-300 ET-200M DP/PA bus interface Diagnostics repeater S7-300 fault-tolerant modules	KEMA 02 ATEX 1096X	24038475
	PROFIBUS Bus Connector Plug	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 for:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Subassemblies/modules must be installed in an adequate housing. This must comply with the IP 54 degree of protection (according to EN 60529) 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 60079-15).
2. If a temperature of > 70 °C is reached in the cable or at the cable entry of this housing under operating conditions, or if a temperature of > 80 °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 6.2 (in accordance with EN 60079-15).
4. Steps must be taken to ensure that the rated voltage through transients cannot be exceeded by more than 40 %.

Special Conditions for KEMA 04 ATEX 1151X

1. The PROFIBUS bus connector plugs must be installed so that they are protected from mechanical hazards.
2. If the ingress of moisture and dust cannot be ruled out, the PROFIBUS bus connection plugs series 6ES7972 ... are to be installed in a suitable housing. This housing must guarantee at least the protection type IP 54 (according to EN 60529).
3. The PROFIBUS bus connection plugs must be attached according to instructions using the supplied screws.
4. The connecting or disconnecting of live conductors or operation of device switches, e.g. for installation or servicing purposes is only allowed when it has been ensured that the area is not explosive.

Special Conditions for KEMA 05 ATEX 1137X

1. Subassemblies/modules must be installed in an adequate housing. This must comply with the IP 54 degree of protection (according to EN 60529) 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 60079-15).
2. If a temperature of > 70 °C is reached in the cable or at the cable entry of this housing under operating conditions, or if a temperature of > 80 °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. Steps must be taken to ensure that the rated voltage through transients cannot be exceeded by more than 40 %.

Further Information

You can find further information on devices/modules in the associated handbook.

Utilisation des modules / coupleurs dans la zone à risque d'explosion 2

Les modules de construction agréés

Vous trouverez ci-après des informations importantes pour l'installation de la station de périphérie décentralisée des modules / coupleurs dans la zone à risque d'explosion.
Vous trouverez une liste de modules de construction agréés sur internet
http://support.automation.siemens.com/WW/view/fr/

Entrez sur le site internet (dans la fenêtre de recherche), le numéro d'identification correspondant de l'article, voir tableau.

Lieu de fabrication / Homologation

Ex **II 3 G** **EEx nA II T3 .. T6** selon EN 60079-15 : 2003

Numéro de contrôle : *voir tableau*

Lieu de fabrication	Modules de construction	Numéro de contrôle	Numéro d'ident. de l'article
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Fehlersichere Module	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Buskopplung DP/PA Diagnoserepeater S7-300 Modules de sécurité anti-erreurs	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-connecteur de bus	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Note

Les modules / coupleurs homologués ⟨Ex⟩ 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 pour :

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Les modules / coupleurs doivent être installés dans un boîtier approprié. Celui-ci doit assurer au moins l'indice de protection IP 54 (selon EN 60529). 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 60079-15).
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 corespondre aux températures effectivement mesurées.
3. Les entrées de câbles utilisées doivent avoir le niveau de protection IP exigé et être conformes au paragraphe 6.2 (selon EN 60079-15).
4. Il faut prendre des mesures pour que la tension nominale ne puisse pas être dépassée de plus de 40% sous l'influence de transitoires.

Conditions particulières pour KEMA 04 ATEX 1151X

1. Les connecteurs de bus PROFIBUS doivent être installés de manière à ce qu'ils soient protégés contre les dangers d'ordre mécanique.
2. Lorsqu'on ne peut éviter l'infiltration de l'humidité et de la poussière, il est indispensable de monter les connecteurs de bus PROFIBUS Série 6ES7972-... dans un boîtier approprié. Ce boîtier doit au moins répondre aux exigences du type de protection IP 54 (d'après la norme EN 60529).
3. Les connecteurs de bus PROFIBUS doivent être fixés de manière conforme, avec leurs vis correspondantes, disponibles lors de la livraison des produits.
4. la connexion ou la séparation des conducteurs sous tension électrique ou l'actionnement de commutateurs d'appareils comme par exemple lors des installations ou des maintenances n'est permise que lorsqu'on s'est assuré que la zone n'est pas sujette à des risques d'explosion.

Conditions particulières pour KEMA 05 ATEX 1137X

1. Les modules / coupleurs doivent être installés dans un boîtier approprié. Celui-ci doit assurer au moins l'indice de protection IP 54 (selon EN 60529). 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 60079-15).
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 corespondre aux températures effectivement mesurées.
3. Il faut prendre des mesures pour que la tension nominale ne puisse pas être dépassée de plus de 40% sous l’influence de transitoires.

Informations supplémentaires

Vous trouverez des informations supplémentaires sur les modules de construction dans le manuel correspondant.

Aplicación de los módulos / tarjetas en áreas con peligro de explosión, zona 2

Grupos / Módulos permitidos

A continuación encontrará importantes informaciones para la instalación de los módulos / tarjetas en áreas con peligro de explosión.

Podrá encontrar la lista con los grupos y módulos en Internet:

http://support.automation.siemens.com/WW/view/es/

Indique en esta página Web (en la ventana de búsqueda) el ID del artículo correspondiente, *véase tabla.*

Lugar de fabricación / Homologación

II 3 G **EEx nA II T3 .. T6** según la norma EN 60079-15 : 2003

Número de comprobación: *véase tabla*

Lugar de fabricación	Módulos / tarjetas	Número de comprobación	ID del artículo
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 1238X	24037700
	S7-300 ET 200M Acoplamiento de bus DP/PA Repetidor de diagnóstico Grupos S7-300 a prueba de fallos	KEMA 02 ATEX 1096X	24038475
	Clavija de conexión de PROFIBUS	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II Adaptador TS IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Nota

Los grupos y módulos con la autorización II 3 G EEx nA II T3 . T6 sólo podrán emplearse en sistemas SIMATIC de la categoría de equipos 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 para:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Los módulos / tarjetas se han de montar en una carcasa apropiada. Esta carcasa debe 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 60079-15).
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 6.2 (conforme a EN 60079-15).
4. Es necesario adoptar las medidas necesarias para evitar que la tensión nominal pueda rebasar en más del 40 % debido a efectos transitorios.

Condiciones especiales para KEMA 04 ATEX 1151X

1. Las clavijas de conexión del PROFIBUS deberán instalarse de tal modo que queden protegidas de cualquier peligro mecánico.
2. Cuando no se pueda excluir la posibilidad de que la humedad y el polvo penetren en la clavija de conexión del PROFIBUS serie 6ES7972-... deberá montarla en una carcasa adecuada. Esta carcasa deberá garantizar como mínimo el tipo de protección IP 54 (según EN 60529).
3. Las clavijas de conexión del PROFIBUS deberán fijarse con los tornillos incluidos según lo previsto.
4. La conexión o la desconexión de conductores con energía aplicada o la activación de interruptores del aparato, p. ej., con fines de instalación o mantenimiento, sólo se permite si se garantiza que el área no sea potencialmente explosiva.

Condiciones especiales para KEMA 05 ATEX 1137X

1. Los módulos / tarjetas se han de montar en una carcasa apropiada. Esta carcasa debe 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 60079-15).
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. Es necesario adoptar las medidas necesarias para evitar que la tensión nominal pueda rebasar en más del 40 % debido a efectos transitorios.

Otras informaciones

Encontrará otras informaciones relativas a los grupos y módulos en el manual correspondiente.

Impiego di unità/moduli nell'area a pericolo di esplosione zona 2

Unità/moduli omologati

Qui di seguito sono riportate delle avvertenze importanti per l'installazione delle unità/moduli nell'area a pericolo di esplosione.

L'elenco di unità/moduli omologati è reperibile in Internet:

http://support/automation.siemens.com/WW/view/it/

In questa pagina web (nella maschera di ricerca), inserire il relativo codice articolo, *vedi tabella*.

Luogo di produzione / Omologazione

II 3 G EEx nA II T3 .. T6 secondo EN 60079-15 : 2003

Numero di controllo: *vedi tabella*

Luogo di produzione	Unità/moduli	Numero di controllo	Codice articolo
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	24037700
	S7-300 ET 200M Accoppiamento di bus DP/PA Repeater di diagnostica Unità ad elevata sicurezza S7-300	KEMA 02 ATEX 1096X	24038475
	Connettore bus PROFIBUS	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 per:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Le unità/i moduli devono essere montati in un contenitore adatto. Questo contenitore deve 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 60079-15).
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 6.2 (secondo EN 60079-15).
4. Devono essere prese delle misure per evitare che la tensione nominale possa essere superata per più del 40% da parte di transienti.

Condizioni particolari per KEMA 04 ATEX 1151X

1. I connettori bus PROFIBUS devono essere installati in modo tale da non essere esposti a pericolo meccanico.
2. Se è impossibile escludere la penetrazione di umidità e polvere, i connettori bus PROFIBUS della serie 6ES7972-… devono essere installati in un contenitore adatto. Questo contenitore deve essere conforme almeno al tipo di protezione IP 54 (secondo EN 60529).
3. I connettori bus PROFIBUS devono essere assicurati mediante le viti allegate e secondo le disposizioni.
4. La connessione o l’interruzione di conduttori in tensione oppure l’azionamento di interruttori, per es. per eseguire l’installazione o la manutenzione, sono consentiti solo previa verifica dell'assenza del pericolo di esplosione nell’area.

Condizioni particolari per KEMA 05 ATEX 1137X

1. Le unità/i moduli devono essere montati in un contenitore adatto. Questo contenitore deve assicurare almeno il tipo di protezione IP 54 (secondo EN 60529). 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 60079-15).
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. Devono essere prese delle misure per evitare che la tensione nominale possa essere superata per più del 40% da parte di transienti.

Ulteriori informazioni

Ulteriori informazioni relative a unità/moduli sono reperibili nel relativo manuale.

Gebruik van de componenten/modulen in het explosief gebied zone 2

Toegelaten componenten/modulen

Hierna vindt u belangrijke aanwijzingen voor de installatie van de componenten/modulen in het explosief gebied.

De lijst met de toegelaten componenten/modulens vindt u in het internet:

http://support.automation.siemens.com/WW/view/en/

Voer op deze website (in het zoekvenster) de bijhorende bijdrage-ID in, *zie tabel.*

Productieplaats / Vergunning

II 3 G **EEx nA II T3 .. T6** conform EN 60079-15 : 2003

Keuringsnummer: *zie tabel*

Productieplaats	Componenten/modulen	Keuringsnummer	Bijdrage-ID
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	24037700
	S7-300 ET 200 M Buskoppeling DP/PA Diagnoserepeater S7-300 tegen fouten beveiligde componenten	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-busaansluitstekker	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 voor:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Componenten/modulen moeten worden ingebouwd in een geschikte behuizing. Deze behuizing moet 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 60079-15).
2. Als aan de kabel of aan de kabelinvoering van deze behuizing onder bedrijfsomstandigheden een temperatuur wordt bereikt > 70 °C of als onder bedrijfsomstandigheden de temperatuur aan de adervertakking > 80 °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 6.2 (volgens EN 60079-15).
4. Er dienen maatregelen te worden getroffen, zodat de nominale spanning door transiënten met niet meer dan 40 % kan worden overschreden.

Bijzondere voorwaarden voor KEMA 04 ATEX 1151X

1. De PROFIBUS-aansluitstekkers moeten dusdanig worden geïnstalleerd, dat zij tegen mechanisch gevaar beschermd zijn.
2. Als het binnendringen van vocht en stof niet kan worden uitgesloten, dienen de PROFIBUS-busaansluitstekkers van de serie 6ES7972-... in een geschikte behuizing te worden gemonteerd. Deze behuizing moet minstens de veiligheidsgraad IP 54 (volgens EN 60529) waarborgen.
3. De PROFIBUS-busaansluitstekkers moeten met de meegeleverde schroeven zoals voorgeschreven worden bevestigd.
4. Het aansluiten of scheiden van spanningvoerende geleiders of het activeren van apparaatschakelaars, bijv.voor installatie- of onderhoudsdoeleinden, is slechts toegestaan als kan worden gegarandeerd dat het gebied niet explosief is.

Bijzondere voorwaarden voor KEMA 05 ATEX 1137X

1. Componenten/modulen moeten worden ingebouwd in een geschikte behuizing. Deze behuizing moet 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 60079-15).
2. Als aan de kabel of aan de kabelinvoering van deze behuizing onder bedrijfsomstandigheden een temperatuur wordt bereikt > 70 °C of als onder bedrijfsomstandigheden de temperatuur aan de adervertakking > 80 °C kan zijn, moeten de temperatuureigenschappen van de kabel overeenstemmen met de werkelijk gemeten temperaturen.
3. Er dienen maatregelen te worden getroffen, zodat de nominale spanning door transiënten met niet meer dan 40 % kan worden overschreden.

Verdere informatie

Verdere informatie over de componenten/modulen vindt u in het bijhorende handboek.

Brug af komponenter/moduler i det eksplosionsfarlige område zone 2

Tilladte komponenter/moduler

I det følgende findes vigtige henvisninger vedr. installation af komponenter/moduler i det eksplosionsfarlige område.

En liste med de tilladte komponenter/moduler findes på internettet:

http://support.automation.siemens.com/WW/view/en/

Indtast på denne webside (i søgevinduet) det pågældende bidrags-ID, *se tabel.*

Produktionssted / Godkendelse

Ex **II 3 G** **EEx nA II T3 .. T6** efter EN 60079-15 : 2003

Kontrolnummer: *se tabel*

Produktionssted	Komponenter/moduler	Kontrolnummer	Bidrags-ID
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S fejlsikre komponenter	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Buskobling DP/PA Diagnoserepeater S7-300 fejlsikre komponenter	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-busadapterstik	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Bemærk

Komponenter/moduler med godkendelsen Ex 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 for:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Komponenterne/modulerne skal monteres i et egnet kabinet. Dette kabinet skal mindst kunne sikre beskyttelsesklasse IP 54 (efter EN 60529). 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 60079-15).
2. Hvis kablet eller kabelindføringen på dette kabinet når op på en temperatur på > 70 °C under driftsbetingelser eller hvis temperaturen på åreforegreningen kan være > 80 °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 afsnit 6.2 (iht. EN 60079-15).
4. Der skal træffes foranstaltninger, der sørger for, at den nominelle spænding via transienter ikke kan overskrides mere end 40 %.

Særlige betingelser for KEMA 04 ATEX 1151X

1. PROFIBUS-busadapterstik skal installeres således, at de er sikret mod mekanisk fare.
2. Hvis indtrængen af fugtighed og støv ikke kan udelukkes, skal PROFIBUS-busadapterstik serie 6ES7972-... monteres i et egnet kabinet. Dette kabinet skal mindst kunne sikre beskyttelsesklasse IP 54 (efter EN 60529).
3. PROFIBUS-busadapterstik skal fastgøres korrekt med de medleverede skruer.
4. Tilslutning eller afbrydelse af spændingsførende ledere eller betjening af apparatkontakter, f.eks. ved installation eller vedligeholdelse, er kun tilladt, hvis det kan sikres, at området ikke er eksplosionsfarligt.

Besondere Bedingungen für KEMA 05 ATEX 1137X

1. Komponenterne/modulerne skal monteres i et egnet kabinet. Dette kabinet skal mindst kunne sikre beskyttelsesklasse IP 54 (efter EN 60529). 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 60079-15).
2. Hvis kablet eller kabelindføringen på dette kabinet når op på en temperatur på > 70 °C under driftsbetingelser eller hvis temperaturen på åreforegreningen kan være > 80 °C under driftsbetingelser, skal kablernes temperaturegenskaber stemme overens med de temperaturer, der rent faktisk måles.
3. Der skal træffes foranstaltninger, der sørger for, at den nominelle spænding via transienter ikke kan overskrides mere end 40 %.

Yderligere informationer

Yderligere informationer om komponenterne/modulerne findes i den pågældende manual.

Rakenneryhmien/moduulien käyttö räjähdysvaarannetuilla alueilla, vyöhyke 2

Sallitut rakenneryhmät/moduulit

Seuraavasta löydätte tärkeitä ohjeita rakenneryhmien/moduulien asennukseen räjähdysvaarannetuilla alueilla.

Uusi: Luettelo sallituista rakenneryhmistä/moduuleista on Internetissä:

http://support.automation.siemens.com/WW/view/en/

Syötä tällä Internet-sivulla (hakuikkunassa) kyseinen käyttäjätunnus (ks. taulukko).

Valmistuspaikka / Hyväksyntä

II 3 G EEx nA II T3 - T6 EN 60079-15 : 2003 -standardin mukaan

Tarkastusnumero: *katso taulukko*

Valmistuspaikka	Rakenneryhmät/ moduulit	Tarkastusnumero	Käyttäjä-tunnus
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S läpi-iskuvarmat rakenneryhmät	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Väyläkytkin DP/PA Dignoositoistin S7-300 läpi-iskuvarmat rakenneryhmät	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-väyläliitäntäpistoke		24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies		24193554

Ohje

Rakenneryhmiä/moduuleja hyväksynnän II 3 G EEx nA II T3 - T6 kanssa saa käyttää ainoastaan laitekategorian 3 SIMATIC-järjestelmissä.

Kunnossapito

Korjausta varten täytyy kyseinen rakenneryhmä/moduuli lähettää valmistuspaikkaan. Korjaus voidaan suorittaa ainoastaan siellä.

Erityiset vaatimukset:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Rakenneryhmät/moduulit täytyy asentaa sopivaan koteloon. Tämän kotelon täytyy olla vähintään kotelointiluokan IP 54 mukaisia. Tällöin on huomioitava ympäristöolosuhteet, johon laite asennetaan. Kotelolle täytyy olla valmistajaselvitys vyöhykettä 2 varten (EN 60079-15 mukaan).
2. Kun johdolla tai tämän kotelon johdon sisäänviennillä saavutetaan > 70 °C lämpötila tai kun käyttöolosuhteissa lämpötila voi piuhajaotuksella olla > 80 °C, täytyy johdon lämpötilaominaisuuksien vastata todellisesti mitattuja lämpötiloja.
3. Käytettyjen johtojen sisäänohjauksien täytyy olla vaaditun IP-kotelointiluokan ja kohdan 6.2 (EN 60079-15 mukaan) mukaisia.
4. Toimenpiteet täytyy suorittaa, ettei nimellisjännite voi transienttien kautta ylittyä enemmän kuin 40 %.

Erityiset vaatimukset rakenneryhmille KEMA 04 ATEX 1151X

1. PROFIBUS-väyläliitäntäpistokkeet on asennettava niin, että ne on suojattu mekaaniselta vaaralta.
2. Mikäli kosteuden ja pölyn pääsyä laitteen sisään ei voida poissulkea, sarjan 6ES7972 PROFIBUS-väyläliitäntäpistokkeet on asennettava sopivaan koteloon. Tämän kotelon on oltava vähintään kotelointiluokan IP 54 (EN 60529) mukainen.
3. PROFIBUS-väyläliitäntäpistokkeet on kiinnitettävä määräysten mukaisesti mukana toimitetuilla ruuveilla.
4. Jännitettä johtavien johdinten liittäminen ja irrottaminen tai laitekytkinten käyttäminen esimerkiksi asennus- tai huoltotarkoituksiin on sallittu ainoastaan silloin, kun on varmistettu, että alue ei ole räjähdysherkkä.

Erityiset vaatimukset rakenneryhmille KEMA 05 ATEX 1137X

1. Rakenneryhmät/moduulit täytyy asentaa sopivaan koteloon. Tämän kotelon täytyy olla vähintään kotelointiluokan IP 54 mukaisia. Tällöin on huomioitava ympäristöolosuhteet, johon laite asennetaan. Kotelolle täytyy olla valmistajaselvitys vyöhykettä 2 varten (EN 60079-15 mukaan).
2. Kun johdolla tai tämän kotelon johdon sisäänviennillä saavutetaan > 70 °C lämpötila tai kun käyttöolosuhteissa lämpötila voi piuhajaotuksella olla > 80 °C, täytyy johdon lämpötilaominaisuuksien vastata todellisesti mitattuja lämpötiloja.
3. Toimenpiteet täytyy suorittaa, ettei nimellisjännite voi transienttien kautta ylittyä enemmän kuin 40 %.

Lisätietoja

Lisätietoja rakenneryhmistä/moduuleista on asianomaisessa käsikirjassa.

Användning av komponentgrupperna/modulerna i explosionsriskområde zon 2

Tillåtna komponentergrupper/moduler

Nedan följer viktiga anvisningar om installationen av komponentgrupperna/modulerna i ett explosionsriskområde.

En lista över de tillåtna komponentgrupperna/modulerna finns på internet:

http://support.automation.siemens.com/WW/view/en/

Ange aktuellt bidrags-ID på webbplatsen (i sökfönstret), *se tabell.*

Tillverkningsort / Godkännande

II 3 G **EEx nA II T3 .. T6** enligt EN 60079 : 2003

Kontrollnummer: *se tabell*

Tillverkningsort	Komponentgrupper/ moduler	Kontroll-nummer	Bidrags-ID
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Felsäkra moduler	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Busskoppling DP/PA Diagnosrepeater S7-300 Felsäkra komponentgrupper	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-bussanslutningskontakt	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Kontrollerade termineringsenheter	KEMA 05 ATEX 1137X	24193554

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 för:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Komponentgrupperna/modulerna måste monteras i ett lämpligt hus. Huset måste minst vara av skyddsklass IP 54 (enligt EN 60529). Därvid ska omgivningsvillkoren där enheten installeras beaktas. För kåpan måste en tillverkardeklaration för zon 2 föreligga (enligt EN 60079-15).
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 verkligen uppmätta temperaturen.
3. De använda kabelinföringarna måste uppfylla kraven i det krävda IP-skyddsutförandet och i avsnitt 6.2 (enligt EN 60079-15).
4. Åtgärder måste vidtas så, att märkspänningen ej kan överskridas med mer än 40 % genom transienter.

Särskilda villkor för KEMA 04 ATEX 1151X

1. PROFIBUS-bussanslutningskontakten ska installeras så att den är skyddad mot mekaniska faror.
2. Om det inte går att utesluta att fukt och damm kan tränga in ska PROFIBUS-bussanslutningskontakten serie 6ES7972-... monteras i ett lämpligt hus. Huset måste vara av minst skyddsklass IP 54 (enligt EN 60529).
3. PROFIBUS-bussanslutningskontakten måste fästas enligt anvisningarna med de bifogade skruvarna.
4. Anslutning och frånskiljning av spänningsförande ledare eller aktivering av enhetsbrytare vid t.ex. installation eller underhåll får endast utföras om det är säkerställt att det inte föreligger explosionsrisk i området.

Särskilda villkor för KEMA 05 ATEX 1137X

1. Komponentgrupperna/modulerna måste monteras i ett lämpligt hus. Huset måste minst vara av skyddsklass IP 54 (enligt EN 60529). Därvid ska omgivningsvillkoren där enheten installeras beaktas. För kåpan måste en tillverkardeklaration för zon 2 föreligga (enligt EN 60079-15).
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 verkligen uppmätta temperaturen.
3. Åtgärder måste vidtas så, att märkspänningen ej kan överskridas med mer än 40 % genom transienter.

Ytterligare information

Ytterligare information om komponentgrupperna/modulerna finns i tillhörande handbok.

Uso de grupos construtivos/módulos em área exposta ao perigo de explosão 2

Grupos construtivos/módulos permitidos

A seguir, o encontrará avisos importantes para a instalação de grupos construtivos/ módulos em área exposta ao perigo de explosão.

A lista com os grupos construtivos/módulos autorizados encontram-se na Internet:

http://support.automation.siemens.com/WW/view/en/

Insira nesta página de web (na jenal de busca) o respectivo número de ID, *veja a tabela*.

Local de produção / Licença

II 3 G **EEx nA II T3 .. T6** seg. EN 60079-15 : 2003

Número de ensaio: *veja a tabela*

Local de produção	Grupos construtivos/módulos	N° de ensaio	N° de ID
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	24037700
	S7-300 ET 200M Acoplador bus DP/PA Repetidor de diagnóstico S7-300 Grupos construtivos protegidos contra erro	KEMA 02 ATEX 1096X	24038475
	Ficha de conexão do bus PROFIBUS	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Alemanha	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 efectuado o reparo.

Condições especiais para:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Os grupos construtivos/módulos devem ser montados em uma caixa adequada. Esta caixa deve garantir no mínimo o tipo de protecção IP 54 (seg. EN 60529). 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 60079-15).
2. Caso no cabo ou na entrada do cabo desta carcaça sob as condições operacionais seja atingida uma temperatura de > 70 °C, ou caso sob condições operacionais a temperatura na ramificação do fio poderá atingir > 80 °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 secção 6.2 (de acordo com o EN 60079-15).
4. Precisam ser tomadas medidas para que a tensão nominal através de transitórios não possa ser ultrapassada em mais que 40 %.

Condições especiais para KEMA 04 ATEX 1151X

1. As fichas de conexão do bus PROFIBUS devem ser instaladas de modo que fiquem protegidas contra perigo mecânico.
2. Se a entrada de humidade e poeira não puder ser excluída, as fichas de conexão de bus PROFIBUS série 6ES7972-... devem ser montadas em uma caixa adequada. Esta caixa deve garantir a protecção mínima IP 54 (seg. EN 60529).
3. As fichas de conexão de bus PROFIBUS deve ser fixadas com os parafusos fornecidos, de acordo com as prescrições.
4. A conexão ou separação de condutores de tensão ou o accionamento de interruptores de aparelhos, p. ex. para fins de reparação ou instalação, só é permitida quando se pode garantir que a área não está exposta ao risco de explosão.

Condições especiais para KEMA 05 ATEX 1137X

1. Os grupos construtivos/módulos devem ser montados numa caixa adequada. Esta caixa deve garantir a protecção mínima IP 54 (seg. EN 60529). Para isso, as condições de ambiente, nas quais o aparelho é instalado, devem ser consideradas. Para a caixa, deve haver uma declaração do fabricante para a zona 2 (seg. EN 60079-15).
2. Se no cabo ou condutor do cabo desta caixa, sob condições de serviço, uma temperatura de > 70 °C for alcançada ou se, sob condições de serviço, a temperatura da derivação do condutor puder ser de > 80 °C, as características de temperatura dos cabos devem coincidir com as temperaturas reais medidas.
3. Precisam ser tomadas medidas para que a tensão nominal através de transitórios não possa ser ultrapassada em mais que 40 %.

Outras informações

Outras informações sobre os grupos construtivos/módulos podem ser encontradas no respectivo manual.

Χρήση των δομικών συγκροτημάτων/μονάδων σε επικίνδυνη για έκρηξη περιοχή, ζώνη 2

Επιτρεπόμενα δομικά συγκρότημα/μονάδες

Στη συνέχεια θα βρείτε σημαντικές υποδείξεις για την εγκατάσταση των δομικών συγκροτημάτων/μονάδων σε επικίνδυνη για έκρηξη περιοχή.

Νέο: Τη λίστα με τα επιτρεπόμενα δομικά συγκροτήματα/μονάδες θα τη βρείτε στο διαδίκτυο (Internet):

http://support.automation.siemens.com/WW/view/en/

Εισάγετε σε αυτή την ιστοσελίδα (στο παράθυρο αναζήτησης) το αντίστοιχο ID άρθρου, *βλέπε πίνακα.*

Τόπος κατασκευής / Άδεια

II 3 G EEx nA II T3 .. T6 σύμφωνα με το πρότυπο EN 60079-15 : 2003

Αριθμός ελέγχου: *βλέπε πίνακα*

Τόπος κατασκευής	Δομικά συγκροτήματα/μονάδες	Αιθμ. ελέγχου	ID άρθρου
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	24037700
	S7-300 ET 200M Σύζευξη διαύλου DP/PA Επαναλήπτης διάγνωσης S7-300 Ασφαλή σε περίπτωση βλάβης δομικά συγκροτήματα	KEMA 02 ATEX 1096X	24038475
	Φις σύνδεσης του διαύλου PROFIBUS	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS προσαρμογέας II TS προσαρμογέας IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Υπόδειξη

Δομικά συγκροτήματα/μονάδες με την έγκριση Ⓔx II 3 G EEx nA II T3 .. T6 επιτρέπεται να χρησιμοποιούνται μόνο σε συστήματα 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 για:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Τα δομικά συγκροτήματα/μονάδες πρέπει να ενσωματωθούν σε ένα γειωμένο περίβλημα. Αυτό το περίβλημα πρέπει να εξασφαλίζει 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 60079-15).
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 εισόδοι καλωδίων πρέπει να συμμορφώνονται με το βαθμό προστασίας IP 54 στην ενότητα 6.2 (σύμφωνα με το πρότυπο EN 60079-15).
4. Πρέπει να ληφθούν μέτρα, να μην μπορεί να γίνει υπέρβαση της ονομαστικής τάσης μέσω αιφνίδιας μεταβολής της τάσης πάνω από 40 %.

Ιδιαίτερες προϋποθέσεις για KEMA 04 ATEX 1151X

1. Τα φις σύνδεσης του διαύλου PROFIBUS πρέπει να εγκατασταθούν έτσι, ώστε να προστατεύονται από μηχανικό κίνδυνο.
2. Όταν η είσοδος υγρασίας και σκόνης δεν μπορεί να αποκλειστεί, τότε πρέπει τα φις σύνδεσης του διαύλου PROFIBUS σειρά 6ES7972-... να τοποθετηθούν σε ένα κατάλληλο περίβλημα. Αυτό το περίβλημα πρέπει να εξασφαλίζει το ελάχιστο το βαθμός προστασίας IP 54 (σύμφωνα με το πρότυπο EN 60529).
3. Τα φις σύνδεσης του διαύλου PROFIBUS πρέπει να στερεωθούν με τις συνημμένες βίδες σύμφωνα με τις προδιαγραφές.
4. Η σύνδεση ή η αποσύνδεση ηλεκτροφόρων αγωγών ή ο χειρισμός του διακόπτη της συσκευής, π.χ. για λόγους εγκατάστασης ή συντήρησης, επιτρέπεται μόνο, όταν είναι εξασφαλισμένο, ότι η περιοχή δεν είναι μια επικίνδυνη για έκρηξ περιοχή.

Ιδιαίτερες προϋποθέσεις για KEMA 05 ATEX 1137X

1. Τα δομικά συγκροτήματα/μονάδες πρέπει να ενσωματωθούν σε ένα γειωμένο περίβλημα. Αυτό το περίβλημα πρέπει να εξασφαλίζει 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 60079-15).
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. Πρέπει να ληφθούν μέτρα, να μην μπορεί να γίνει υπέρβαση της ονομαστικής τάσης μέσω αιφνίδιας μεταβολής της τάσης πάνω από 40 %.

Περισσότερες πληροφορίες

Περαιτέρω πληροφορίες για τα δομικά συγκροτήματα/μονάδες θα βρείτε στο αντίτοιχο εγχειρίδιο.

Použití konstrukčních skupin / modulů v prostředí s nebezpečím výbuchu Zóna 2

Schválené konstrukční skupiny/moduly

Dále naleznete důležité pokyny pro instalaci konstrukčních skupin/modulů v oblastech s nebezpečím výbuchu.

Seznam schválených konstrukčních skupin/modulů naleznete na internetu:

http://support.automation.siemens.com/WW/view/en/

Na této internetové stránce zadejte do vyhledávacího okna příslušné identifikační číslo příspěvku. *Viz tabulka.*

Místo výroby / Registrace

II 3 G **EEx nA II T3 .. T6** dle EN 60079-15 : 2003

Zkušební číslo: *viz tabulka*

Místo výroby	Konstrukční skupiny/Moduly	Kontrolní číslo	ID příspěvku
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	24037700
	S7-300 ET 200M Spojka sběrnice DP/PA Diagnostické translační relé S7-300 Konstrukční skupiny odolné proti chybám	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-Busanschlussstecker	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Upozornění

Konstrukční skupiny/Moduly s osvědčením 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 pro:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Konstrukční skupiny/moduly musí být zabudovány ve vhodném krytu. Tento kryt musí zajišťovat minimálně 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 60079-15).
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 přívody musí odpovídat požadovanému druhu krytí IP a odstavci 6.2 (dle EN 60079-15).
4. Musí být provedena opatření k zamezení přechodného překročení jmenovitého napětí, nepřesahující více než 40 %.

Zvláštní podmínky pro KEMA 04 ATEX 1151X

1. Přípojné konektory sběrnice PROFIBUS musí být nainstalovány tak, aby byly chráněny před mechanickým rizikem.
2. Pokud není možno zabránit průniku vlhkosti a prachu, je nutno přípojné konektory sběrnice PROFIBUS série 6ES7972-... zabudovat do vhodného krytu. Tento kryt musí zajišťovat minimálně druh krytí IP 54 (podle EN 60529).
3. Přípojné konektory sběrnice PROFIBUS musí být předpisově upevněny pomocí dodaných šroubů.
4. Připojení, popř. odpojení vodičů pod napětím nebo sepnutí spínačů přístrojů, např. za účelem instalace nebo údržby, je povoleno pouze tehdy, pokud je zajištěno, že oblast není ohrožena explozí.

Zvláštní podmínky pro KEMA 05 ATEX 1137X

1. Konstrukční skupiny/moduly musí být zabudovány ve vhodném krytu. Tento kryt musí zajišťovat minimálně druh krytí IP 54 (podle 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 60079-15).
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. Musí být provedena opatření k zamezení přechodného překročení jmenovitého napětí, nepřesahující více než 40 %.

Další informace

Další informace ke konstrukčním skupinám/modulům naleznete v příslušné příručce.

Sõlmede/moodulite kasutamine plahvatusohtliku piirkonna tsoonis 2

Lubatud sõlmed/moodulid

Järgnevalt leiate Te olulisi juhiseid sõlmede/moodulite paigaldamiseks plahvatusohtlikus piirkonnas.

Üksikasjaliku teabe lubatud sõlmede/moodulite kohta leiate Internetist:
http://support.automation.siemens.com/WW/view/en/

Sisestage sellel veebilehel (otsinguaknasse) vastav kood, vt tabelit.

Valmistamiskoht / Kasutusluba

II 3 G **EEx nA II T3 .. T6** vastavalt standardile 60079-15 : 2003

Katsetusnumber: *vaadake tabelit*

Valmistamiskoht	Sõlmed/moodulid	Katsetusnumber	Kood
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S rikkekindlad moodulid	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M siiniühendus DP/PA diagnostikarepiiter S7-300 rikkekindlad sõlmed	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-siiniühenduse pistik	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken- straße 50, 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS adapter II TS adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M juhitavad klemmliideste sõlmed	KEMA 05 ATEX 1137X	24193554

Juhis

Sõlmi/mooduleid 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. Parandustöid tohib teha ainult seal.

Eritingimused

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

kohta:

1. Sõlmed/moodulid tuleb monteerida sobivasse metallkorpusesse. Korpus peab 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 60079-15).
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 6.2 toodud nõuetele (vastavalt standardile EN 60079-15).
4. Peab rakendama abinõusid, et nimipinget üleminekute tõttu ei saaks ületada üle 40 %.

Eritingimused KEMA 04 ATEX 1151X kohta

1. PROFIBUS-siiniühenduse pistik tuleb paigaldada selliselt, et see oleks kaitstud mehaanilise ohu eest.
2. Juhul kui niiskuse ja tolmu sissetungimist ei saa vältida, tuleb 6ES7972-... seeria PROFIBUS-siiniühenduse pistikud paigaldada sobivasse korpusesse. See korpus peab tagama vähemalt kaitseklassile IP 54 (vastavalt standardile EN 60529).
3. PROFIBUS-siiniühenduse pistikud tuleb kinnitada ettenähtud viisil kaasasolevate kruvidega.
4. Pinget juhtivate juhtide ühendamine või eemaldamine või seadme lüliti käivitamine, nt paigaldus- ja hoolduseesmärkidel, on lubatud ainult juhul, kui piirkond ei ole plahvatusohtlik.

Eritingimused KEMA 05 ATEX 1137X kohta

1. Sõlmed/moodulid tuleb monteerida sobivasse metallkorpusesse. Korpus peab 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 60079-15).
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. Peab rakendama abinõusid, et nimipinget üleminekute tõttu ei saaks ületada üle 40 %.

Täpsem teave

Täpsemat teavet sõlmede/moodulite kohta leiate kaasasolevast käsiraamatust.

Ierīču/moduļu pielietojums sprādzienbīstamas teritorijas zonā 2

Pieļaujamās ierīces/moduļi

Turpmāk atrodamas svarīgas norādes par ierīču/moduļu uzstādīšanu sprādzienbīstamajā zonā.

Sarakstu ar pieļaujamajām ierīcēm/moduļiem Jūs atradīsiet internetā:

http://support.automation.siemens.com/WW/view/en/

Ievadiet šajā mājas lapā (meklēšanas logā) attiecīgo lietotāja ID, *skatīt tabulu*

Izgatavošanas vieta / Atļauja

II 3 G **EEx nA II T3 .. T6** saskaņā ar EN 60079-15 : 2003

Pārbaudes numurs: *skatīt tabulu*

Izgatavošanas vieta	Ierīces/moduļi	Pārbaudes numurs	Lietotāja ID
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Fehlersichere Module	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Kopnes savienotājs DP/PA Diagnostikas atkārtotājs S7-300 Pret kļūdām aizsargātas ierīces	KEMA 02 ATEX 1096X	24038475
	PROFIBUS slēdzis	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Norāde

Ierīces/moduļi ar atļauju ⟨Ex⟩ 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 priekš

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Ierīces/moduļi jāiebūvē piemērotā 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 60079-15).
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 6.2 (saskaņā ar EN 60079-15).
4. Nepieciešams veikt pasākumus, lai pārejas spriegums nepārsniegtu nominālo spriegumu vairāk kā par 40 %.

Īpašie noteikumi KEMA 04 ATEX 1151X

1. PROFIBUS slēdžus ir jāinstalē tā, lai tie būtu aizsargāti no mehāniskām briesmām
2. Ja nav iespējams izvairīties no šķidrumu un putekļu iekļūšanas, tad PROFIBUS slēdžus no sērijas 6ES7972-... ir jāiebūvē piemērotā korpusā. Šim korpusam ir jāatbalsta vismaz drošības veids IP 54 (pēc E N 60529).
3. PROFIBUS slēdžus ir jāpiestiprina ar komplektā ietilpstošajām skrūvēm.
4. Spriegumu vadošu vadu pieslēgšana vai atslēgšana vai ierīces slēdža lietošana, piemēram, uzstādīšanas vai tehniskās apkopes dēļ, ir atļauta tikai tad, kad ir noskaidrots vai zonā nepastāv eksplodēšanas iespējamība.

Īpaši noteikumi KEMA 05 ATEX 1137X

1. Ierīces/moduļi ir jāiebūvē piemērotā korpusā. Šiem korpusiem ir jāatbalsta vismaz drošības veids IP 54 (pēc E N 60529). Pie tam ir jāņem vērā apkārtnes faktori, kādā ierīce tiks uzstādīta. Korpusam jāatbilst ražotāja 2. zonas deklarācijai (saskaņā ar EN 60079-15).
2. Ja šī korpusa kabelis, respektīvi, kabeļa ievade darba laikā sasniedz > 70 °C vai, ja darba laikā vadu sazarojums ir sasniedzis > 80 °C, tad kabeļa temperatūras īpašībām ir jāatbilst izmērītajām temperatūrām.
3. Ir jāveic pasākumi, lai nominālais spriegums caur pārejām nepārsniegtu 40%

Papildus informācija

Papildus informāciju par ierīcēm/moduļiem Jūs atradīsiet pievienotajā rokasgrāmatā.

Konstrukcinių grupių / modulių panaudojimas sprogioje 2 zonos aplinkoje

Leistinos konstrukcinės grupės / moduliai

Toliau pateikiama svarbi informacija apie konstrukcinių grupių ir modulių montavimą sprogioje aplinkoje.

Leistinų konstrukcinių grupių / modulių sąrašą rasite interneto svetainėje:

http://support.automation.siemens.com/WW/view/en/

Įveskite šioje svetainėje (į ieškos laukelį) atitinkamą kodą, *žr. lentelę.*

Pagaminimo vieta / Saugos reikalavimai

Ex **II 3 G** **EEx nA II T3 .. T6** pagal EN 60079-15 : 2003

Patikros numeris: *žr. lentelėje*

Pagaminimo vieta	Konstrukcinės grupės / moduliai	Patikros numeris	Kodas
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	24037700
	S7-300 ET 200M Magistralinė jungtis DP/PA Diagnozės retransliatorius S7-300 nuo trukdžių apsaugotos konstrukcinės grupės	KEMA 02 ATEX 1096X	24038475
	PROFIBUS magistralinės jungties kištukas	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Vokietija	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Nuoroda

Konstrukcines grupes / modulius, kurių leidimas eksploatuoti yra Ex II 3 G EEx nA II T3 .. T6, galima naudoti tik 3 kategorijos sistemose „SIMATIC“.

Priežiūra

Sugedusią konstrukcinę grupę / modulį išsiųskite gamintojui. Tik jis gali kvalifikuotai suremontuoti įtaisą.

Specialiosios sąlygos, taikomos

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Konstrukcinės grupės / moduliai turi būti įrengiami tik tinkamuose korpusuose. Šio korpuso saugos klasė turi būti mažiausiai „IP 54“ (pagal EN 60529). Būtina atsižvelgti į kitas aplinkos, kurioje įrengtas įtaisas, sąlygas. Norint korpusą eksploatuoti zonoje 2, būtinas gamintojo pažymėjimas (pagal EN 60079-15).
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 6.2 skyriaus (pagal EN 60079-15) reikalavimus.
4. Būtina imtis priemonių, kad pereinamųjų grandžių nominali įtampa neviršytų 40 %.

Specialiosios sąlygos, taikomos KEMA 04 ATEX 1151X

1. PROFIBUS magistralinės jungties kištukas turi būti įmontuotas taip, kad būtų apsaugotas nuo mechaninių pažeidimų.
2. Jeigu galimas drėgmės ir dulkių poveikis, 6ES7972-... serijos PROFIBUS magistralinės jungties kištukas įmontuojamas specialiame korpuse. Šio korpuso saugos klasė turi būti mažiausiai „IP 54“ (pagal EN 60529).
3. PROFIBUS magistralinės jungties kištukas turi būti tvirtinamas pagal instrukciją, naudojant kartu pateikiamus varžtus.
4. Prijungti arba atjungti įtampos linijas arba naudotis prietaiso jungikliu, pvz., instaliavimo arba priežiūros darbų metu, leidžiama tik įsitikinus, kad aplinka nėra sprogi.

Specialiosios sąlygos, taikomos KEMA 05 ATEX 1137X

1. Konstrukcinės grupės / moduliai turi būti įrengiami tik tinkamuose korpusuose. Šio korpuso saugos klasė turi būti mažiausiai „IP 54“ (pagal EN 60529). Būtina atsižvelgti į kitas aplinkos, kurioje įrengtas įtaisas, sąlygas. Norint korpusą eksploatuoti zonoje 2, būtinas gamintojo pažymėjimas (pagal EN 60079-15).
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. Būtina imtis priemonių, kad pereinamųjų grandžių nominali įtampa neviršytų 40 %.

Papildoma informacija

Papildomos informacijos apie konstrukcines grupes / modulius rasite eksploatacijos vadove.

A főegységek/modulok alkalmazása a 2. zóna robbanásveszélyes környezetben

Engedélyezett főegységek/modulok

A következőkben fontos utasításokat talál a főegységek/modulok telepítéséhez a robbanásveszélyes környezetbe.

Az engedélyezett főegységek/modulok jegyzékét megtalálja az Interneten:

http://support.automation.siemens.com/WW/view/en/

Ezen a web-oldalon írja be a kereső ablakba a hozzá tartozó bejegyzés ID-t, *ld. a táblázatban.*

Gyártási hely / Engedélyezés

II 3 G **EEx nA II T3 .. T6** az EN 60079-15 : 2003 szerint

Ellenőrző szám: *lásd a táblázatot*

Gyártási hely	Főegységek/modulok	Bevizsgálás száma	Bejegyzés száma
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S hibabiztos főegységek	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M DP/PA buszcsatoló Diagnózisrepeater S7-300 hibabiztos főegységek	KEMA 02 ATEX 1096X	24038475
	PROFIBUS- busz csatlakozó dugó	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Utasítás

Csak a II 3 G EEx nA II T3 .. T6 engedélyezéssel rendelkező főegységeket/modulokat használhatja a 3. felszerelés-kategóriába tartozó SIMATIC rendszerekbe.

Karbantartás

Javításra küldje az érintett főegységeket/modulokat a gyártási helyre. Csak itt hajthatják végre a javítást.

Különleges feltételek a következők számára:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. A főegységeket/modulokat egy erre alkalmas házba kell beszerelni. Ez a ház rendelkezzen legalább az IP 54 védettségi fokozattal (EN 60529 szerint). Itt figyelembe kell venni azokat a környezeti feltételeket, amelyek a készülék telepítésekor fellépnek. A ház rendelkezzen a 2. zónára vonatkozó gyártói nyilatkozat (az EN 60079-15 szerint).
2. Ha az adott ház kábelén ill. kábelvezetésen üzemi körülmények között a hőmérséklet > 70 °C, vagy ha az üzemi körülmények között az érelágazásokon a hőmérséklet > 80 °C, akkor a kábel hőmérsékleti tulajdonságai egyezzenek meg a ténylegesen mért hőmérsékletekkel.
3. Az alkalmazott kábelvezetések feleljenek meg az előírt IP védettségi fokozatnak és a 6.2. bekezdésnek (EN 60079-15 szerint).
4. Gondoskodjon róla, hogy a tranziensek a névleges feszültséget ne lépjék túl több mint 40 %-al.

Különleges feltételek a KEMA 04 ATEX 1151X-hez

1. A PROFIBUS busz csatlakozó dugót úgy kell beszerelni, hogy mechanikai veszélyeztetéstől védett legyen.
2. Ha por és nedvesség behatolását nem lehet kizárni, a 6ES7972-... sorozatú PROFIBUS busz csatlakozó dugót kell egy alkalmas házba beépíteni. Ez a ház rendelkezzen az IP 54 védettségi fokozattal (EN 60529 szerint).
3. A PROFIBUS busz csatlakozó dugót a vele szállított csavarokkal óvatosan kell rögzíteni.
4. A feszültséget vezető vezetékek bekötése vagy leválasztása, vagy készülék kapcsolók működtetése (pl. szerelési- vagy gondozási célokból) csak akkor szabad, ha biztosították, hogy a terület ne legyen robbanásveszélyes.

Különleges feltételek a KEMA 05 ATEX 1137X-hez

1. A főegységeket/modulokat egy erre alkalmas házba kell beszerelni. Ez a ház rendelkezzen legalább az IP 54 védettségi fokozattal (EN 60529 szerint). Itt figyelembe kell venni azokat a környezeti feltételeket, amelyek a készülék telepítésekor fellépnek. A ház rendelkezzen a 2. zónára vonatkozó gyártói nyilatkozat (az EN 60079-15 szerint).
2. Ha a jelen ház kábelén ill. kábelvezetésen üzemi körülmények között a hőmérséklet > 70 °C, vagy ha az üzemi körülmények között az érelágazásokon a hőmérséklet > 80 °C, akkor a kábel hőmérsékleti tulajdonságai legyen azonosak a ténylegesen mért hőmérsékletekkel.
3. Gondoskodjon róla, hogy a tranziensek ne lépjék túl több mint 40 %-al a névleges feszültséget.

További információk

A főegységek/modulokról további információkat talál a hozzá tartozó kézikönyvben.

Tqegħid tal-Komponenti / *Modules* fiż-Żona 2, fejn hemm Riskju ta' Splużjoni

Komponenti/Moduli approvati

Hawn taħt għandek issib indikazzjonijiet importanti għall-installazzjoni ta' komponenti / *modules* f'żona fejn hemm riskju ta' splużjoni.

Ġdid: Tista' tara l-lista ta' komponenti/modules approvati fuq l-internet:

http://support.automation.siemens.com/WW/view/en/

Daħħal fis-*search window* ta' din il-websajt l-ID rispettiv ta' l-oġġett, *ara t-tabella.*

Post ta' Manifattura / Approvazzjoni

II 3 G **EEx nA II T3 .. T6** b'mod konformi ma' EN 60079-15 : 2003

Numru taċ-Ċertifikat: ara t-tabella

Post ta' Manifattura	Komponenti / Modules	Numru taċ-Ċertifikat	Numru taċ-Ċertifikat
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Il-Ġermanja	ET 200S *Modules* ET 200S *fail-safe*	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M *bus coupling* DP/PA Ripetitur ta' dijanjosi *Modules* S7-300 *fail-safe*	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-Bus Connector Plug	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Il-Ġermanja	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter TS Adaptor IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Terminal Assemblies	KEMA 05 ATEX 1137X	24193554

Nota

Komponenti / *modules* approvati II 3 G EEx nA II T3 .. T6 jistgħu jintużaw biss f'sistemi SIMATIC li jappartienu għal appart ta' kategorija 3.

Manutenzjoni

Fil-każ li jkollhom bżonn tiswija, il-komponenti / *modules* ikkonċernati għandhom jintbagħtu fil-post ta' manifattura. It-tiswijiet jistgħu jsiru biss f'dan il-post.

Kundizzjonijiet Speċjali għal:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Komponenti / *modules* għandhom jiġu mmontati ġewwa lqugħ addattat. Dan l-ilqugħ għandu jiggarantixxi protezzjoni li tkun mill-inqas tat-tip IP 54 (skond EN 60529). Inti u tagħmel hekk, trid taħseb għall-kundizzjonijiet ambjentali ta' waqt l-installazzjoni ta' l-apparat. Għall-ilqugħ, irid ikun hemm dikjarazzjoni tal-fabbrikant li tgħid li dan huwa tajjeb għaż-żona 2 (skond EN 60079-15).
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 hemm temperatura ogħla minn 80 °C, il-kejbil irid ikollu karatteristiċi li jifilħu għal dawn it-temperaturi.
3. Id-daħliet għall-kejbil li jintużaw iridu jikkonformaw mat-tip ta' protezzjoni IP mitluba u mat-taqsima 6.2 (skond EN 60079-15).
4. Iridu jittieħdu miżuri biex il-vultaġġ nominali ma jinqabiżx b'aktar minn 40%.

Kundizzjonijiet speċjali għal KEMA 04 ATEX 1151X

1. Il-plugs tat-tip PROFIBUS-Bus Connector jeħtieġu jiġu installati b'mod li jiżgura protezzjoni kontra kull periklu mekkaniku.
2. Jekk id-dħul ta' l-umdità jew tat-trab ma jistax jiġi eskluż, jeħtieġu jiġu installati plugs tat-tip PROFIBUS-Bus Connector tan-Numru Serjali 6ES7972-... f'ilqugħ adegwat. Dan l-ilqugħ jeħtieġ jissodisfa l-klassi ta' protezzjoni IP 54 (b'mod konformi ma' EN 60529) bħala standard minimu.
3. Il-plugs tat-tip PROFIBUS-Connector jeħtieġu jiġu installati skond l-istruzzjonijiet u bil-viti pprovduti.
4. It-tqabbid u/jew skonnettjar ta' wajers bil-kurrent fihom u l-użu ta' swiċċijiet, jiġifieri għal għanijiet ta' installazzjoni jew manutenzjoni huwa permess biss jekk iż-żona m'hijiex waħda li fiha riskju ta' splużjoni.

Kundizzjonijiet speċjali għal KEMA 05 ATEX 1137X

1. Komponenti / *modules* għandhom jiġu mmontati ġewwa lqugħ addattat. Dan l-ilqugħ għandu jiggarantixxi protezzjoni li tkun mill-inqas tat-tip IP 54 (skond EN 60529). Inti u tagħmel hekk, trid taħseb għall-kundizzjonijiet ambjentali ta' waqt l-installazzjoni ta’ l-apparat. Għall-ilqugħ, irid ikun hemm dikjarazzjoni tal-fabbrikant li tgħid li dan huwa tajjeb għaż-żona 2 (skond EN 60079-15).
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 hemm temperatura ogħla minn 80 °C, il-kejbil irid ikollu karatteristiċi li jifilħu għal dawn it-temperaturi.
3. Iridu jittieħdu miżuri biex il-vultaġġ nominali ma jinqabiżx b'aktar minn 40%.

Aktar informazzjoni

Għal iktar informazzjoni dwar il-komponenti/moduli, jekk jogħġbok irreferi għall-manwal rispettiv.

Zastosowanie grup konstrukcyjnych / modułów w 2 strefie zagrożenia wybuchem

Dopuszczone grupy konstrukcyjne/moduły

Poniżej znajdują się ważne informacje dotyczące instalacji grup konstrukcyjnych modułów w strefie zagrożenia wybuchem.

Lista dopuszczonych grup konstrukcyjnych/modułów znajduje się w Internecie pod adresem http://support.automation.siemens.com/WW/view/en/

Na tej stronie należy wprowadzić odpowiedni ID udziału, patrz tabela.

Miejsce produkcji / Rejestracja

II 3 G **EEx nA II T3 .. T6** stosownie do EN 60079-15 : 2003

Nr testu: *zobacz tabela*

Miejsce produkcji	Grupy konstrukcyjne/moduły	Nr testu	ID udziału
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Niemcy	ET 200S ET 200S moduły odporne na uszkodzenia	KEMA 01 ATEX 1238X	24037700
	S7-300 ET 200M Zbierające łącze sprzężające DP/PA Powtarzacz diagnozy S7-300 grupy odporne na uszkodzenia	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-szynowy wtyk przyłączeniowy	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Niemcy	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 dla:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Grupy konstrukcyjne / moduły muszą zostać zamontowane do odpowiedniej puszki ochronnej. Puszki muszą 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 60079-15).
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 6.2 (stosownie do EN 60079-15).
4. Muszą zostać spełnione takie warunki, aby napięcie miana w przejściach nie mogło przekroczyć więcej niż 40 %.

Warunki szczególne dla KEMA 04 ATEX 1151X

1. Wtyki przyłączeniowe PROFIBUS muszą być zamontowane w sposób chroniący przed uszkodzeniami mechanicznymi.
2. Jeżeli nie można wykluczyć wnikania wilgoci i kurzu wtyki przyłączeniowe PROFIBUS serii 6ES7972… należy zamontować w odpowiedniej puszce. Puszki muszą spełniać wymagania co najmniej stopnia IP 54 (stosownie do EN 60529).
3. Wtyki przyłączeniowe PROFIBUS muszą być unieruchomione zgodnie z przepisami przy pomocy załączonych śrub.
4. Podłączanie lub rozłączanie przewodów będących pod napięciem lub uruchamianie przełączników urządzenia np. do prac instalacyjno - konserwacyjnych jest dozwolone wyłącznie po upewnieniu się, że obszar nie jest zagrożony wybuchem.

Warunki szczególne dla KEMA 05 ATEX 1137X

1. Grupy konstrukcyjne / moduły muszą zostać zamontowane do odpowiedniej puszki ochronnej. Puszki muszą 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 60079-15).
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. Muszą zostać spełnione takie warunki, aby napięcie miana w przejściach nie mogło przekroczyć więcej niż 40 %.

Pozostałe informacje

Pozostałe informacje dotyczące grup konstrukcyjnych/modułów znajdują się w stosownych podręcznikach.

Použitie konštrukčných skupín / modulov v prostredí s nebezpečenstvom výbuchu zóny 2

Schválené konštrukčné skupiny / moduly

Ďalej nájdete dôležité pokyny pre inštaláciu konštrukčných skupín / modulov v prostredí s nebezpečenstvom výbuchu.

Zoznam schválených konštrukčných skupín / modulov nájdete na internete:

http://support.automation.siemens.com/WW/view/en/

Na tejto Web-stránke (v okienku vyhľadávania) zadajte príslušné identifikačné číslo danej položky, *pozri Tabuľku*.

Miesto vyhotovenia / Osvedčenie

II 3 G **EEx nA II T3 .. T6** podľa EN 60079-15 : 2003

Číslo skúšky : *pozri tabuľka*

Miesto vyhotovenia	Konštrukčné skupiny / moduly	Číslo skúšky	Identifikačné číslo položky
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	24037700
	S7-300 ET 200M Zbernicový väzbový člen DP/PA opakovač diagnózy S7-300 konštrukčné skupiny odolné voči poruchám	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-Zbernicová ukončovacia prípojka	KEMA 04 ATEX 1151X	24028800
Siemens AG, divízia A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Nemecko	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

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 pre:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Konštrukčné skupiny / moduly sa musia vmontovať do vhodnej schránky. Táto schránka musí 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 60079-15).
2. V prípade, že na kábli, prípadne na káblovom prívode tohto puzdra presiahne teplota pri prevádzkových podmienkach hodnotu > 70 °C, alebo ak na vetve žily môže byť pri prevádzkových podmienkach teplota > 80 °C, musia tepelné vlastnosti kábla vyhovovať skutočne nameraným hodnotám.
3. Všetky použité káblové prívody musia zodpovedať požadovanému druhu ochrany IP a odseku 6.2 (podľa EN 60079-15).
4. Musia sa vykonať také opatrenia, aby sa menovité napätie cez prechody nemohlo prekročiť o viac ako 40 %.

Špeciálne podmienky pre KEMA 04 ATEX 1151X:

1. Zbernicové ukončovacie prípojky musia byť namontované tak, aby boli chránené pred mechanickým poškodením.
2. Ak nie je úplne vylúčený prienik vlhkosti a prachu, zbernicové ukončovacie prípojky PROFIBUS série 6ES7972-... je potrebné zabudovať do vhodnej schránky. Táto schránka musí zabezpečovať druh ochrany minimálne IP 54 (podľa EN 60529).
3. Zbernicové ukončovacie prípojky PROFIBUS musia byť pripevnené s dodanými skrutkami podľa predpisov.
4. Pripojenie resp. odpojenie vodičov pod napätím alebo uvedenie prístrojového spínača do prevádzky, napr. na účely inštalácie alebo údržby je povolené len potom, ako bolo preverené, že v prostredí nehrozí nebezpečenstvo výbuchu.

Špeciálne podmienky pre KEMA 05 ATEX 1137X

1. Konštrukčné skupiny / moduly sa musia vmontovať do vhodnej schránky. Táto schránka musí 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 60079-15).
2. V prípade, že na kábli, prípadne na káblovom prívode tohto puzdra presiahne teplota pri prevádzkových podmienkach hodnotu > 70 °C, alebo ak na vetve žily môže byť pri prevádzkových podmienkach teplota > 80 °C, musia tepelné vlastnosti kábla vyhovovať skutočne nameraným hodnotám.
3. Musia sa vykonať také opatrenia, aby sa menovité napätie cez prechody nemohlo prekročiť o viac ako 40 %.

Ďalšie informácie

Ďalšie o konštrukčných skupinách / moduloch nájdete v príslušnej príručke.

Uporaba sklopov/modulov v eksplozivno ogroženem območju cone 2

Dovoljeni sestavni sklopi / moduli

Sledijo pomembni napotki o inštalaciji sestavnih sklopov/modulov v eksplozivno ogroženem območju.

Seznami z dovoljenimi sestavnimi sklopi / moduli boste našli v medmrežju:

http://support.automation.siemens.com/WW/view/en/

Na tej spletni strani vnesite (v iskalnem okencu) pripadajoč ID prispevka,

glejte preglednico.

Mesto izdelave / Dovoljenje - Atest

II 3 G **EEx nA II T3 .. T6** po EN 60079-15 : 2003

kontrolna številka: *glej tabelo*

Mesto izdelave	Sklopi/moduli	Kontrolna številka	ID prispevka
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	24037700
	S7-300 ET 200M vezava vodila DP/PA Diagnozni repeater S7-300 Sklopi varovani proti okvari	KEMA 02 ATEX 1096X	24038475
	VODILO PROFI Priključni vtič vodila	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adapter II TS Adapter IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Opozorilo

Sestavni sklopi/moduli z dovoljenjem II 3 G EEx nA II T3 .. T6 se lahko uporabijo samo v SIMATIC-Sistemih kategorije naprav 3 .

Vzdrževanje

V primeru popravila pošljete sklope/module na kraj izdelave. Popravila lahko izvajajo samo na tem naslovu!

Posebni pogoji za:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Sestavni sklopi/moduli se morajo vgraditi v ustrezno ohišje. To ohišje mora zagotoviti najmanj vrsto zaščite 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 60079-15).
2. Če na kablu oz. uvodnici tega ohišja v režimu obratovanja temperatura doseže vrednost > 70 °C ali če doseže na razcepih vodnikov v obratovanju temperatura vrednost > 80 °C, se morajo temperaturne lastnosti kablov skladati z dejansko namerjenimi.
3. Uporabljene uvodnice morajo ustrezati predpisani IP zaščiti in poglavju 6.2 (po EN 60079-15).
4. Sprejeti je potrebno ukrepe, da nazivna napetost zaradi tranzientov ne bo prekoračena za več kot 40%.

Posebni pogoji za KEMA 04 ATEX 1151X

1. Priključni vtiči vodila VODILO PROFI morajo biti nameščeni tako, da so zaščiteni pred mehansko nevarnostjo..
2. Če ni mogoče izključiti vdiranje vlage in prahu, je priključne vtiče vodila VODILO PROFI serije 6ES7972-... vgraditi v primerno ohišje. To ohišje mora zagotavljati najmanj vrsto zaščite IP 54 (po EN 60529).
3. Priključni vtiči vodila VODILO PROFI morajo biti pritrjeni s priloženimi vijaki.
4. Priklop oz. ločevanje vodov pod napetostjo ali vklop stikala naprave, npr. zaradi instalacije ali vzdrževanja je dovoljeno, če je zagotovljeno, da območje ni eksplozijsko ogroženo.

Posebni pogoji za KEMA 05 ATEX 1137X

1. Sestavni sklopi/moduli se morajo vgraditi v ustrezno ohišje. To ohišje mora zagotoviti najmanj vrsto zaščite 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 60079-15).
2. Če na kablu oz. uvodnici tega ohišja v režimu obratovanja temperatura doseže vrednost > 70 °C ali če doseže na razcepih vodnikov v obratovanju temperatura vrednost > 80 °C, se morajo temperaturne lastnosti kablov skladati z dejansko namerjenimi.
3. Sprejeti je potrebno ukrepe, da nazivna napetost zaradi tranzientov ne bo prekoračena za več kot 40%.

Ostale informacije

Ostale informacije o sestavnih sklopih / modulih boste našli v ustreznem priročniku.

Patlama tehlikesi olan Alan 2 bölgesinde ünite gruplarının/modüllerin kullanılması

İzin verilen Ünite grupları/Modüller

Aşağıda, ünite gruplarının/modüllerin patlama tehlikesi olan bölgelerde kurulması için önemli bilgiler bulacaksınız.

İzin verilmiş olan ünite gruplarının/modüllerin listesi için internete bakınız:

http://support.automation.siemens.com/WW/view/en/

Bu web sitesinde (arama penceresinde) ilgili doküman ID'sini giriniz, *bakınız Tablo.*

İmalat yeri / Lisans

II 3 G **EEx nA II T3 .. T6** EN 60079-15 : 2003 standardına göre

Test numarası: *Bakınız tablo*

İmalat yeri	Ünite grupları/Modüller	Kontrol numarası	Doküman-ID
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	24037700
	S7-300 ET 200M Bus kuplajı DP/PA Diyagnoz repeater ünitesi S7-300 Hataya karşı emniyetli ünite grupları	KEMA 02 ATEX 1096X	24038475
	PROFIBUS-Bus bağlantı fişi	KEMA 04 ATEX 1151X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS Adaptör II TS Adaptör IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137X	24193554

Bilgi

II 3 G EEx nA II T3 .. T6 lisanslı ünite grupları/modüller sadece 3 numaralı cihaz kategorisine ait SIMATIC sistemlerinde kullanılabilir.

Bakım

Bir onarım gerekli olması halinde, ilgili ünite grupları/modüller imalat yerine gönderilmelidir. Onarım sadece orada yapılabilir ve yapılmalıdır.

Özel koşullar:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Ünite grupları/modüller uygun bir kasa içine monte edilmelidir. Bu kasa, en az IP 54 (EN 60529 standardına göre) koruma türüne sahip olmalıdır. Burada, cihazın kurulduğu çevre koşulları dikkate alınmalıdır. Kullanılacak kasa için, alan 2 için geçerli bir üretici beyanı mevcut olmalıdır (EN 60079-15 standardına göre).
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 6.2 (EN 60079-15 standardına göre) dahilindeki taleplere uygun olmalıdır.
4. Nominal gerilimin transiyentlerden (hatlardaki dalgalanmalardan dolayı ani gerilim ve akım değişiklikleri) dolayı azami %40 aşılması için gerekli önlemler alınmalıdır.

KEMA 04 ATEX 1151X için özel koşullar:

1. PROFIBUS Bus bağlantı fişleri, mekanik tehlikeye karşı korunaklı olacak şekilde monte edilmelidir.
2. İçine toz ve nemin girmesi önlenemediğinde, 6ES7972-... serisi PROFIBUS Bus bağlantı fişleri uygun bir kasa içine monte edilmelidir. Bu kasa, en az IP 54 (EN 60529 standardına göre) koruma türüne sahip olmalıdır.
3. PROFIBUS Bus bağlantı fişleri birlikte verilen cıvatalarla talimatlara uygun olarak sabitlenmelidir.
4. Montaj veya bakım çalışmaları için elektrik ileten kabloların bağlanması veya sökülmesi ya da cihaz şalterine basılması işlemlerine, yalnızca ilgili sahada patlama tehlikesi bulunmadığı tespit edildiğinde izin verilir.

KEMA 05 ATEX 1137X için özel koşullar:

1. Ünite grupları/modüller uygun bir kasa içine monte edilmelidir. Bu kasa, en az IP 54 (EN 60529 standardına göre) koruma türüne sahip olmalıdır. Burada, cihazın kurulduğu çevre koşulları dikkate alınmalıdır. Kullanılacak kasa için, alan 2 için geçerli bir üretici beyanı mevcut olmalıdır (EN 60079-15 standardına göre).
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. Nominal gerilimin transiyentlerden (hatlardaki dalgalanmalardan dolayı ani gerilim ve akım değişiklikleri) dolayı azami %40 aşılması için gerekli önlemler alınmalıdır.

Daha başka bilgiler

Ünite grupları/modüller hakkında daha fazla bilgi için ilgili kılavuza bakınız.

Използване на електронни блокове/модули във взривоопасната област Зона 2

Допуснати до експлоатация електронни блокове/модули

По-нататък ще намерите важни указания за инсталирането на електронни блокове/модули във взривоопасната област.

Списъкът на допуснатите до експлоатация електронни блокове/модули ще намерите в интернет:

http://support.automation.siemens.com/WW/view/en/

В този уеб сайт въведете (в прозореца за търсене) съответния идентификационен номер, *вижте таблицата.*

Място на производство / Удостоверение за допускане в експлоатация

II 3 G **EEx nA II T3 .. T6** съгласно EN 60079-15 : 2003

Номер на изпитване: *вижте таблицата*

Място на производство	Електронни блокове/модули	Номер на изпитване	Идентификационен номер
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S модули, защитени по отношение на възникване на грешки	KEMA 01 ATEX 1238 X	24037700
	S7-300 ET 200M шинна връзка DP/PA повторител на диагнозата S7-300 електронни блокове, защитени по отношение на възникване на грешки	KEMA 02 ATEX 1096 X	24038475
	PROFIBUS- съединителен шинен щекер	KEMA 04 ATEX 1151 X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS адаптер II TS адаптер IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Модулно разпределени входно-изходни системи	KEMA 05 ATEX 1137 X	24193554

Указание

Електронни блокове/модули с разрешение за допускане в експлоатация ⟨Ex⟩ II 3 G EEx nA II T3 .. T6 могат да се използват само в системи SIMATIC с категория на уреда 3.

Поддържане в изправност

За ремонт съответните електронни блокове/модули трябва да се изпратят до мястото на производство. Ремонтът може да се извърши само там.

Особени условия за:

KEMA 01 ATEX 1238X

KEMA 02 ATEX 1096X

KEMA 03 ATEX 1125X, ATEX 1226X, ATEX 1228X

1. Електронните блокове/модулите трябва да се монтират в подходящ корпус. Този корпус трябва да осигурява степен на защита най-малко IP 54 (съгласно EN 60529). При това трябва да се имат предвид условията на околната среда, в които се инсталира устройството. За корпуса трябва да има разяснение на производителя за зона 2 (съгласно EN 60079-15).
2. Когато на кабела или на кабелния вход на този корпус при работни условия се достигне температура > 70 °C, или когато при работни условия температурата на разклонението на жилата може да е > 80 °C, температурните свойства на кабелите трябва да се съгласуват с действително измерените температури.
3. Използваните кабелни входове трябва да съответстват на исканата степен на защита IP и на раздел 6.2 (съгласно EN 60079-15).
4. Трябва да се предприемат мерки номиналното напрежение да не се надхвърля с повече от 40 % чрез преходни процеси.

Особени условия за KEMA 04 ATEX 1151X

1. Съединителните шинни щекери PROFIBUS трябва да се инсталират така, че да са защитени от опасност за механични повреди.
2. Когато не може да се изключи проникването на влага и прах, съединителните шинни щекери PROFIBUS от серия 6ES7972 трябва да се монтират в подходящ корпус. Този корпус трябва да осигурява степен на защита най-малко IP 54 (съгласно EN 60529).
3. Съединителните шинни щекери PROFIBUS трябва да се закрепват с доставените винтове съгласно инструкцията.
4. Свързването или разделянето на токопроводящи жила, или на задействането на превключватели на устройствата, например за инсталационни цели или заради поддръжката, е разрешено, само ако е гарантирано, че областта не е взривоопасна.

Особени условия за KEMA 05 ATEX 1137X

1. Електронните блокове/модулите трябва да се монтират в подходящ корпус. Този корпус трябва да осигурява степен на защита най-малко IP 54 (съгласно EN 60529). При това трябва да се имат предвид условията на околната среда, в които се инсталира устройството. За корпуса трябва да има разяснение на производителя за зона 2 (съгласно EN 60079-15).
2. Когато на кабела или на кабелния вход на този корпус при работни условия се достигне температура > 70 °C, или когато при работни условия температурата на разклонението на жилата може да е > 80 °C, температурните свойства на кабелите трябва да се съгласуват с действително измерените температури.
3. Трябва да се предприемат мерки номиналното напрежение да не се надхвърля с повече от 40 % чрез преходни процеси.

Подробна информация

Подробна информация за електронните блокове/модулите ще намерите в съответния справочник.

Utilizarea unităților constructive/modulelor în domeniul cu potențial exploziv din zona 2

Unități constructive/module aprobate

În continuare veți găsi indicații importante pentru instalarea grupelor constructive/modulelor în domeniul cu potențial exploziv.

Lista cu unitățile constructive/modulele se află pe internet:

http://support.automation.siemens.com/WW/view/en/

Pe această pagină web (în fereastra de căutare) introduceți ID-ul articolului, *vezi tabelul.*

Locul de fabricație / aprobarea

II 3 G **EEx nA II T3 .. T6** conform EN 60079-15 : 2003

Număr verificare: *vezi tabelul*

Locul de fabricație	Unități constructive/module	Număr verificare	ID articol
Siemens AG, Bereich A&D Werner-von-Siemens-Straße 50 92224 Amberg Germany	ET 200S ET 200S Module de siguranță	KEMA 01 ATEX 1238 X	24037700
	S7-300 ET 200M Cuplaj magistrală DP/PA Repetor diagnoză S7-300 unități constructive de siguranță	KEMA 02 ATEX 1096 X	24038475
	Ştecher racord magistrală PROFIBUSr	KEMA 04 ATEX 1151 X	24028800
Siemens AG, Bereich A&D Östliche Rheinbrücken-straße 50 76187 Karlsruhe Germany	S7-400	KEMA 03 ATEX 1125X	21479867
	S7-300 CP TS adaptor II TS adaptor IE	KEMA 03 ATEX 1228X	21497622
	SIMATIC NET	KEMA 03 ATEX 1226X	21089482
	ET 200M Marshalled Termination Assemblies	KEMA 05 ATEX 1137 X	24193554

Indicație

Unitățile constructive/modulele cu aprobarea II 3 G EEx nA II T3 .. T6 se pot utiliza numai în sisteme SIMATIC din categoria de aparate 3.

Mentenanță

Pentru reparație, unitățile constructive/modulele respective se vor trimite la locul de fabricație. Reparația se poate efectua numai acolo.

Condiții speciale pentru:

KEMA 01	**ATEX 1238X**
KEMA 02	**ATEX 1096X**
KEMA 03	**ATEX 1125X, ATEX 1226X, ATEX 1228X**

1. Unitățile constructive/modulele se vor monta într-o carcasă adecvată. Această carcasă va garanta cel puțin tipul de protecție IP 54 (conform EN 60529). La aceasta se vor respecta condițiile de mediu în care se instalează dispozitivul. Pentru carcasă va fi disponibilă declarația producătorului pentru zona 2 (conform EN 60079-15).
2. Dacă la cablu, respectiv la intrarea cablului acestei carcase, în condiții de funcționare, este atinsă o temperatură > 70 °C sau dacă în condiții de funcționare, la derivația conductorilor poate fi o temperatură > 80 °C, caracteristicile de temperatură ale cablurilor trebuie să corespundă temperaturilor reale măsurate.
3. Intrările de cablu utilizate vor corespunde tipului de protecție IP şi secțiunii 6.2 (conform EN 60079-15).
4. Se vor lua măsuri pentru ca tensiunea nominală prin fenomene tranzitorii să nu depăşească mai mult cu 40 %.

Condiții speciale pentru KEMA 04 ATEX 1151X

1. Ştecherele de conectare pentru magistrală PROFIBUS se vor instala astfel încât să fie protejate contra pericolelor mecanice.
2. Dacă nu se poate evita pătrunderea umezelii şi a prafului, ştecherele de conectare pentru magistrală PROFIBUS, seria 6ES7972-... se vor monta într-o carcasă adecvată. Această carcasă va garanta cel puțin tipul de protecție IP 54 (conform EN 60529).
3. Ştecherele de conectare pentru magistrală PROFIBUS se vor fixa corespunzător cu şuruburile livrate.
4. Conectarea, resp. separarea firelor conducătoare de tensiune sau la acționarea comutatorului aparatului, de exemplu în scopuri de instalare sau întreținere, este permisă numai dacă se garantează că zona nu prezintă potențial exploziv.

Condiții speciale pentru KEMA 05 ATEX 1137X

1. Unitățile constructive/modulele se vor monta într-o carcasă adecvată. Această carcasă va garanta cel puțin tipul de protecție IP 54 (conform EN 60529). La aceasta se vor respecta condițiile de mediu în care se instalează dispozitivul. Pentru carcasă va fi disponibilă declarația producătorului pentru zona 2 (conform EN 60079-15).
2. Dacă la cablu, respectiv la intrarea cablului acestei carcase, în condiții de funcționare, este atinsă o temperatură > 70 °C sau dacă în condiții de funcționare, la derivația conductorilor poate fi o temperatură > 80 °C, caracteristicile de temperatură ale cablurilor trebuie să corespundă temperaturilor reale măsurate.
3. Se vor lua măsuri pentru ca tensiunea nominală prin fenomene tranzitorii să nu depăşească mai mult cu 40 %.

Informații suplimentare

Informații suplimentare cu privire la grupele constructive/module se află în manualul aferent.