VIPA System 300V

SM | Manual

HB130E_SM | Rev. 11/32

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VIPA art of automation

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Note

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CE Conformity

Hereby, VIPA GmbH declares that the products and systems are in compliance with the essential requirements and other relevant provisions of the following directives:

- 2004/108/EC Electromagnetic Compatibility Directive
- 2006/95/EC Low Voltage Directive

Conformity is indicated by the CE marking affixed to the product.

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Contents

About this Manual

This manual describes the operation of the System 300V and the according available signal modules (SM). A short overview over the range of products is followed by a detailed description of the single modules. You will get information for connecting and operating the System 300V and the additional SM modules.

Overview

Chapter 1: Basics

This introduction includes recommendations on the handling of the modules of the VIPA System 300V and introduces you to central res. decentral automation systems.

Chapter 2: Installation and assembly guide lines

All information that you need for installation and cabling of a PLC with components of the System 300V may be found in this chapter.

Chapter 3-5: Digital in-/output modules

These chapters introduce you to the digital peripheral modules of the System 300V from VIPA and contain all information that you will need for installation. Chapter 3 contains information about the digital input modules, chapter 4 describes the digital output modules and chapter 5 concerns to the combined input/output modules.

Chapter 6-8: Analog in-/output modules

Content of these chapters is the description of the analog peripheral modules of the System 300V from VIPA. Chapter 6 gives you all necessary information about the analog input, chapter 7 informs about the analog output and chapter 8 about the analog input/output modules.

Objective and contents

This manual describes the signal modules (SM) that can be used with the System 300. It contains a description of construction, project implementation and application of the products as well as the technical data.

Target audience

The manual is targeted at users who have a background in automation technology.

Structure of the manual

The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document

The following guides are available in the manual:

- an overall table of contents at the beginning of the manual
- an overview of the topics for every chapter

Availability

The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

Icons Headings

Important passages in the text are highlighted by following icons and headings:

Danger!
Immediate or likely danger.
Personal injury is possible.

Attention!
Damages to property is likely if these warnings are not heeded.

Note!
Supplementary information and useful tips.

Safety information

Applications conforming with specifications

The modules of the System 300V are constructed and produced for:

- all VIPA System 300 components
- communication and process control
- general control and automation applications
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

Danger!

This device is not certified for applications in

- in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

The following conditions must be met before using or commissioning the components described in this manual:

- Modification to the process control system should only be carried out when the system has been disconnected from power!
- Installation and modifications only by properly trained personnel
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

National rules and regulations apply to the disposal of the unit!

Chapter 1 Basics

Outline

Main theme of this chapter is to give you an overview about the System 300V from VIPA. We will outline the possibilities of the installation of central res. decentral systems.

This chapter also contains general information about the System 300V like measurements, hints for installation and the environmental conditions.

Inhalt

Safety Information for Users

Handling of electrostatically sensitive modules

VIPA modules make use of highly integrated components in MOS-Technology. These components are extremely sensitive to over-voltages that can occur during electrostatic discharges.

The following symbol is attached to modules that can be destroyed by electrostatic discharges.

The symbol is located on the module, the module rack or on packing material and it indicates the presence of electrostatically sensitive equipment.

It is possible that electrostatically sensitive equipment is destroyed by energies and voltages that are far less than the human threshold of perception. These voltages can occur where persons do not discharge themselves before handling electrostatically sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable. Modules, damaged in this way, are normally not immediately recognized. The according error may occur only after a while of operation.

Modules that have been damaged by electrostatic discharges can fail after a temperature change, mechanical shock or changes in the electrical load.

Only the consequent implementation of protection devices and meticulous attention to the applicable rules and regulations for handling the respective equipment can prevent failures of electrostatically sensitive modules.

Shipping of modules

Modules must be shipped in the original packing material.

Measurements and alterations on electrostatically sensitive modules

When you are conducting measurements on electrostatically sensitive modules you should take the following precautions:

- Floating instruments must be discharged before use.
- Instruments must be grounded.

Modifying electrostatically sensitive modules you should only use soldering irons with grounded tips.

Attention!

Personnel and instruments should be grounded when working on electrostatically sensitive modules.

General description of the System 300V

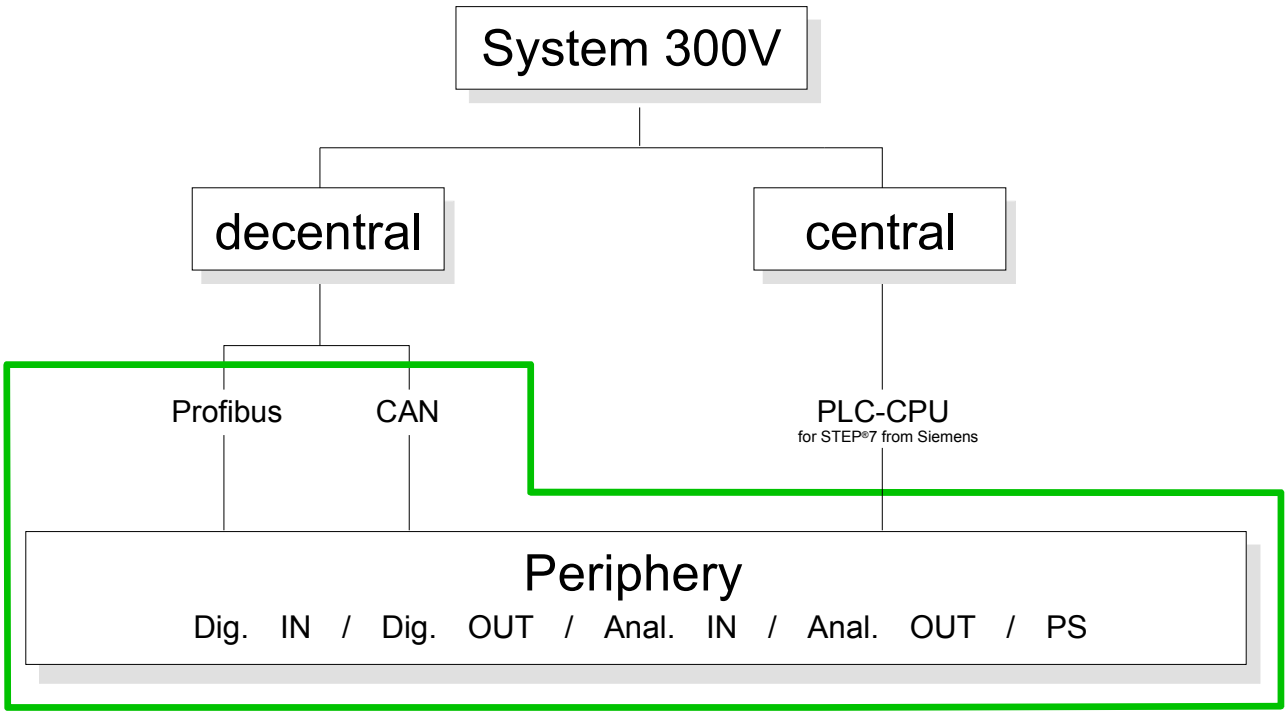
The System 300V

The System 300V is a modular automation system for middle and high performance needs, that you can use either distributed or non-distributed. The single modules are directly clipped to a 530 mm backplane and are connected together with the help of bus clips at the backside.

The single modules of the VIPA System 300V are design compatible to Siemens. Due to the compatible backplane bus it is no problem to mix the modules from VIPA and Siemens.

The CPUs of the System 300V are instruction set compatible to S7-300 from Siemens. The CPUs are programmed via the VIPA programming software WinPLC7 or the SIMATIC manager from Siemens or other available programming tools.

The following picture illustrates the performance range of the System 300V:



Components

Central system

The System 200V series consists of a number of PLC-CPUs. These are programmed in STEP®7 from Siemens. Herefore you may use WinPLC7 from VIPA or the SIMATIC manager from Siemens.

CPUs with integrated Ethernet interfaces or additional serial interfaces simplify the integration of the PLC into an existing network or the connection of additional peripheral equipment.

The application program is saved in Flash or an additional plug-in memory module.

Because of the automatic addressing, up to 32 peripheral modules can be called by the System 300V CPUs.

Decentral system

In combination with a Profibus DP master and slave the PLC-CPUs or the PC-CPU form the basis for a Profibus-DP network in accordance with DIN 19245-3.

The DP network can be configured with the hardware configurator from Siemens. Together with the hardware configuration you transfer your project into the CPU via MPI. Another component of the decentral system is the CAN-Slave. It allows the link-up to the fieldbus system CANopen.

Peripheral modules

A large number of peripheral modules are available from VIPA, for example digital as well as analog inputs/outputs.

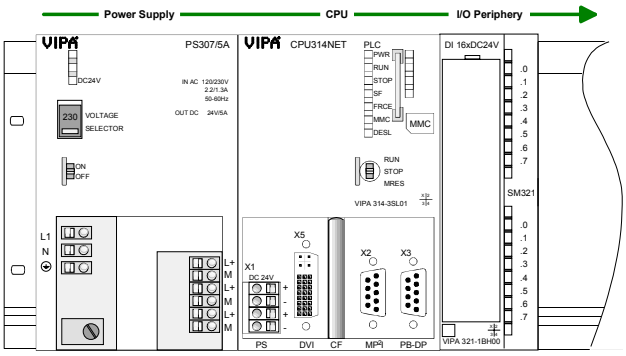
These peripheral modules can be deployed central as well as decentral.

Dimensions/ Weight

- Profile rail 530mm
- Peripheral modules with recessed labeling
- Dimensions of the basic enclosure:
  1tier width: (WxHxD) in mm: 40x125x120
  2tier width: (WxHxD) in mm: 80x125x120
  3tier width: (WxHxD) in mm: 120x125x120

Installation

Please regard that the power supply and header modules like CPUs and couplers may only plugged-in at the left side.



Reliability

- Wiring by means of spring pressure connections (CageClamps) at the front connector
- Core cross-section 0.08...2.5mm^2 or 1.5 mm^2
- Total isolation of the wiring at module change
- Potential separation of all modules to the backplane bus
- Burst/ESD acc. IEC 61000-4-2/IEC 61000-4-4 (up to level 3)
- Shock resistance acc. IEC 60068-2-6 / IEC 60068-2-27 (1G/12G)

Environmental conditions

- Operating temperature: 0 ... +60°C
- Storage temperature: -25 ... +70°C
- Relative humidity: 5...95% without condensation
- Ventilation by means of a fan is not required

Green Cable for project engineering

For project engineering of your DP slave you may transfer your projects from your PC to the CPU serial via MPI by using the "Green Cable". Please also regard the hints to the Green Cable in this chapter!

Integrated power supply

Every Profibus slave has an internal power supply. This power supply requires DC 24V. In addition to the electronics on the bus coupler, the supply voltage is also used to power any modules connected to the backplane bus. Please note that the maximum current that the integrated power supply can deliver to the backplane bus is 3.5A.

The power supply is protected against reverse polarity and overcurrent.

Compatibility

The digital in-/output modules of the System 300V from VIPA are pin and function compatible to Siemens.

The project engineering happens in the SIMATIC manager from Siemens.

Note!

For programming of a System 300V CPU from VIPA please use always the **CPU 315-2DP (6ES7 315-2AF03 V1.2)** from Siemens in the hardware catalog.

Please note the Profibus address 1 of the CPU 31x is system dependent reserved.

For the project engineering, a thorough knowledge of the Siemens SIMATIC manager and the hardware configurator is required!

Chapter 2 Assembly and installation guidelines

Outline

In this chapter you will find all information, required for the installation and the cabling of a process control with the components of the System 300V.

Inhalt

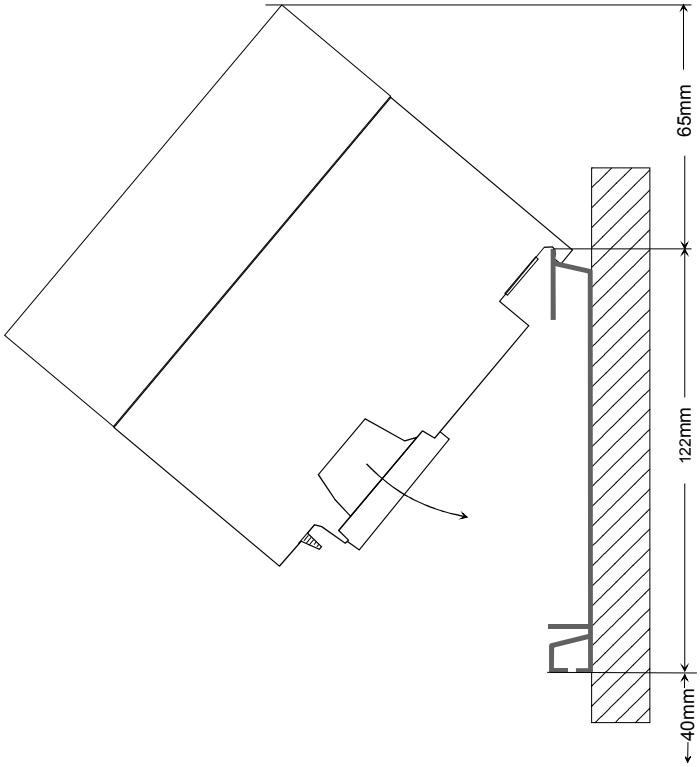
Installation dimensions

Overview Here follows all the important dimensions of the System 300V.

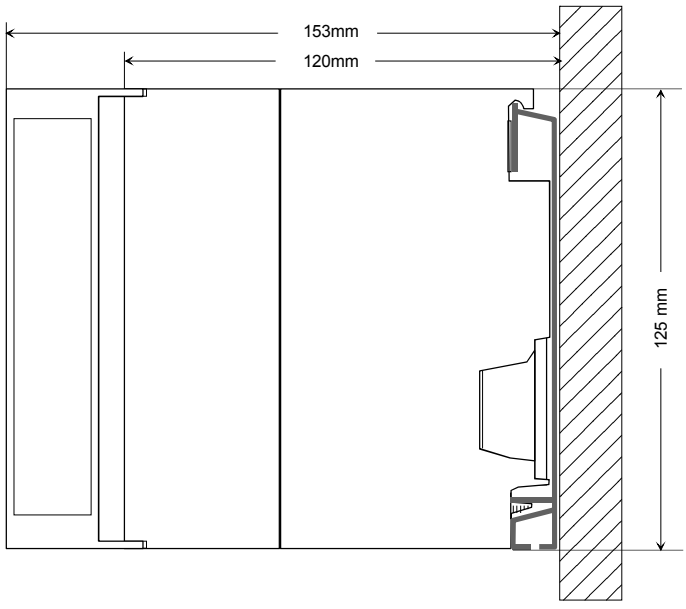
Dimensions Basic enclosure

1tier width (WxHxD) in mm: 40 x 125 x 120
2tier width (WxHxD) in mm: 80 x 125 x 120
3tier width (WxHxD) in mm: 120 x 125 x 120

Dimensions



Installation dimensions



Assembly

General

The single modules are directly installed on a profile rail and connected via the backplane bus connector. Before installing the modules you have to clip the backplane bus connector to the module from the backside.

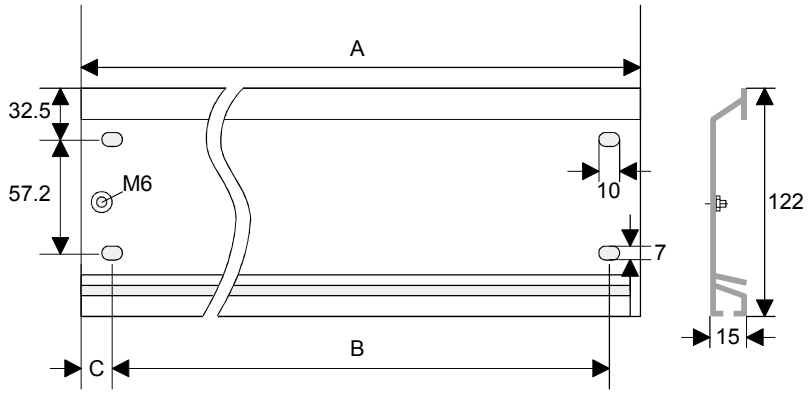
The backplane bus connector is delivered together with the peripheral modules.

Profile rail

Order number	A	B	C
VIPA 390-1AB60	160	140	10
VIPA 390-1AE80	482	466	8.3
VIPA 390-1AF30	530	500	15
VIPA 390-1AJ30	830	800	15
VIPA 390-9BC00*	2000	Drillings only left	15

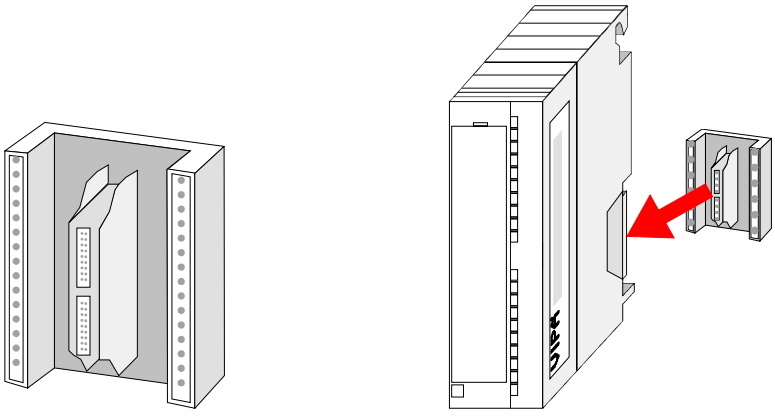
* Unit pack: 10 pieces

Measures in mm



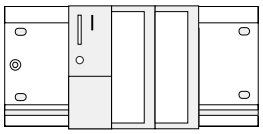
Bus connector

For the communication between the modules the System 300 uses a backplane bus connector. The backplane bus connector are included in the delivering of the peripheral modules and are clipped at the module from behind before installing it to the profile rail.

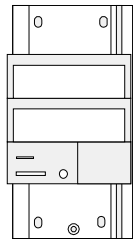


Assembly possibilities

horizontal assembly



vertical assembly

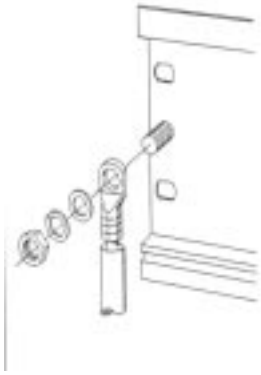


lying assembly

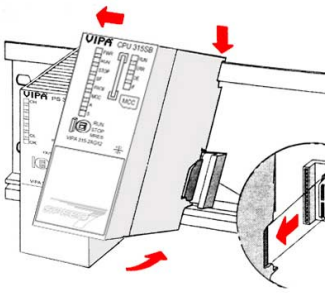
Please regard the allowed environment temperatures:

- horizontal assembly: from 0 to 60°C
- vertical assembly: from 0 to 40°C
- lying assembly: from 0 to 40°C

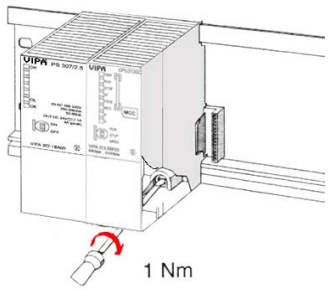
Approach



- Bolt the profile rail with the background (screw size: M6), so that you still have minimum 65mm space above and 40mm below the profile rail.
- If the background is a grounded metal or device plate, please look for a low-impedance connection between profile rail and background.
- Connect the profile rail with the protected earth conductor. For this purpose there is a bolt with M6-thread.
- The minimum cross-section of the cable to the protected earth conductor has to be 10mm^2.



- Stick the power supply to the profile rail and pull it to the left side to the grounding bolt of the profile rail.
- Fix the power supply by screwing.
- Take a backplane bus connector and click it at the CPU from the backside like shown in the picture.
- Stick the CPU to the profile rail right from the power supply and pull it to the power supply.



- Click the CPU downwards and bolt it like shown.
- Repeat this procedure with the peripheral modules, by clicking a backplane bus connector, stick the module right from the modules you've already fixed, click it downwards and connect it with the backplane bus connector of the last module and bolt it.

Danger!

- The power supplies must be released before installation and repair tasks, i.e. before handling with the power supply or with the cabling you must disconnect current/voltage (pull plug, at fixed connection switch off the concerning fuse)!
- Installation and modifications only by properly trained personnel!

Cabling

Overview

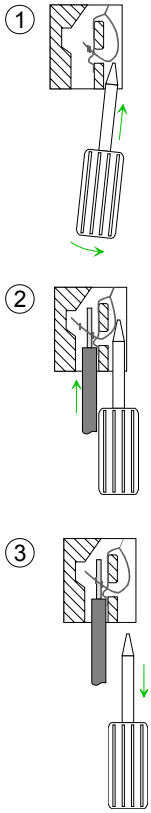
The power supplies and CPUs are exclusively delivered with CageClamp contacts. For the signal modules the front connectors are available from VIPA with screw contacts. In the following all connecting types of the power supplies, CPUs and input/output modules are described.

Danger!

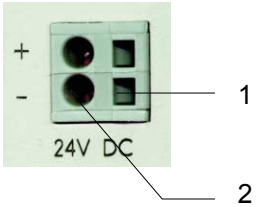
- Before installation or overhauling, the power supplies must be disconnected from voltage (pull the plug or remove the fuse)!
- Installation and modifications only by properly trained personnel!

CageClamp technology (gray)

For the cabling of power supplies, bus couplers and parts of the CPU, gray connectors with CageClamp technology are used.



You may connect wires with a cross-section of 0.08mm^2 to 2.5mm^2. You can use flexible wires without end case as well as stiff wires.



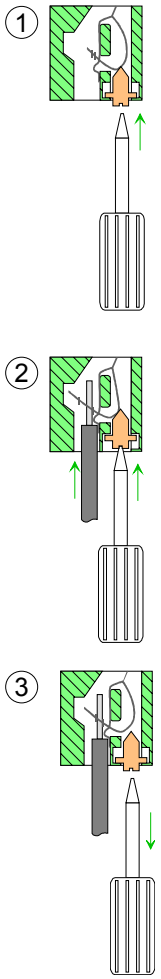
[1] Rectangular opening for screwdriver
[2] Round opening for wires

The picture on the left side shows the cabling step by step from top view.

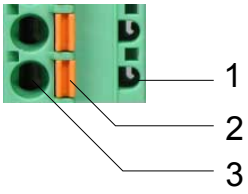
- To conduct a wire you plug a fitting screwdriver obliquely into the rectangular opening like shown in the picture.
- To open the contact spring you have to push the screwdriver in the opposite direction and hold it.
- Insert the insulation striped wire into the round opening. You may use wires with a cross-section from 0.08mm^2 to 2.5mm^2.
- By removing the screwdriver the wire is connected safely with the plug connector via a spring.

CageClamp technology (green)

For the cabling of e.g. the power supply of a CPU, green plugs with CageClamp technology are deployed.



Here also you may connect wires with a cross-section of 0.08mm^2 to 2.5mm^2. You can use flexible wires without end case as well as stiff wires.



[1] Test point for 2mm test tip
[2] Locking (orange) for screwdriver
[3] Round opening for wires

The picture on the left side shows the cabling step by step from top view.

- For cabling you push the locking vertical to the inside with a suiting screwdriver and hold the screwdriver in this position.
- Insert the insulation striped wire into the round opening. You may use wires with a cross-section from 0.08mm^2 to 2.5mm^2.
- By removing the screwdriver the wire is connected safely with the plug connector via a spring.

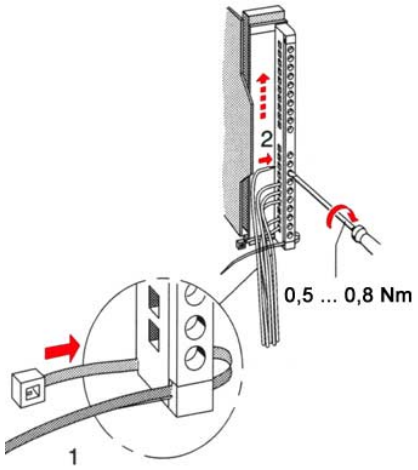
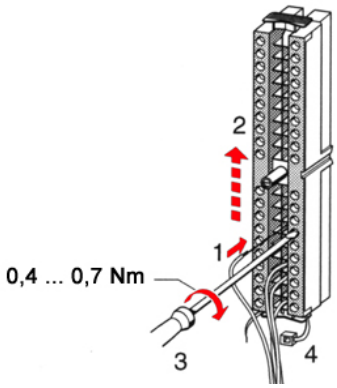
Note!

In opposite to the gray connection clamp from above, the green connection clamp is realized as plug that can be clipped off carefully even if it is still cabled.

Front connectors of the in-/output modules

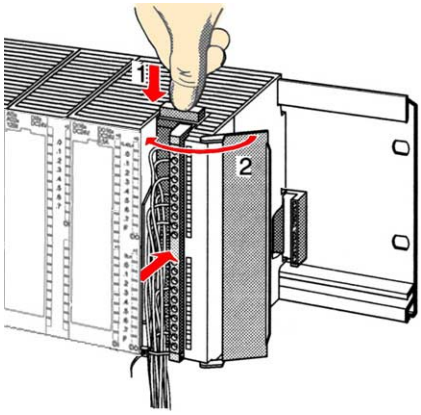
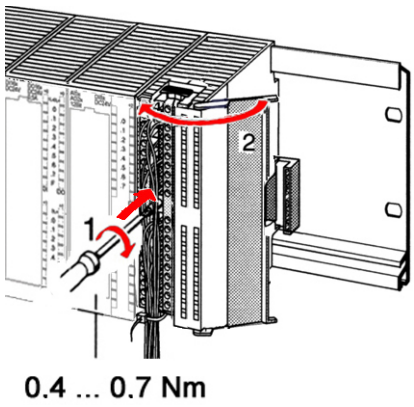
In the following the cabling of the three variants of the front-facing connector is shown:

For the I/O modules the following plugs are available at VIPA:

<table>
<tr><th>20pole screw connection
VIPA 392-1AJ00</th><th>40pole screw connection
VIPA 392-1AM00</th></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Open the front flap of your I/O module.</td></tr>
<tr><td colspan="2">Bring the front connector in cabling position.
Herefore you plug the front connector on the module until it locks. In this position the front connector juts out of the module and has no contact yet.</td></tr>
<tr><td colspan="2">Deisolate your wires. If needed, use core end cases.</td></tr>
<tr><td>Thread the included cable binder into the front connector.</td><td></td></tr>
<tr><td colspan="2">If you want to lead out your cables from the bottom of the module, start with the cabling from bottom to top, res. from top to bottom, if the cables should be led out at the top.</td></tr>
<tr><td colspan="2">Bolt also the connection screws of not cabled screw clamps.</td></tr>
<tr><td> 
</td><td>Put the included cable binder around the cable bundle and the front connector.
 
</td></tr>
<tr><td colspan="2">Fix the cable binder for the cable bundle.</td></tr>
</table>

continued ...

... continue

<table>
<tr><th>20pole screw connection</th><th>40pole screw connection</th></tr>
<tr><td>Push the release key at the front connector on the upper side of the module and at the same time push the front connector into the module until it locks.
  </td><td>Bolt the fixing screw of the front connector.
  </td></tr>
<tr><td colspan="2">Now the front connector is electrically connected with your module.</td></tr>
<tr><td colspan="2">Close the front flap.</td></tr>
<tr><td colspan="2">Fill out the labeling strip to mark the single channels and push the strip into the front flap.</td></tr>
</table>

Installation guidelines

General

The installation guidelines contain information about the interference free deployment of System 300 systems. There is the description of the ways, interference may occur in your control, how you can make sure the electromagnetic digestibility (EMC), and how you manage the isolation.

What means EMC?

Electromagnetic digestibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interferenced res. without interferencing the environment.

All System 300 components are developed for the deployment in hard industrial environments and fulfill high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

- Fields
- I/O signal conductors
- Bus system
- Current supply
- Protected earth conductor

Depending on the spreading medium (lead bound or lead free) and the distance to the interference cause, interferences to your control occur by means of different coupling mechanisms.

One differs:

- galvanic coupling
- capacitive coupling
- inductive coupling
- radiant coupling

Basic rules for EMC

In the most times it is enough to take care of some elementary rules to guarantee the EMC. Please regard the following basic rules when installing your PLC.

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Install a central connection between the ground and the protected earth conductor system.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminum parts. Aluminum is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal res. data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated.
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favorable.
  - Lay the line isolation extensively on an isolation/protected earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metalized plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Wire all inductivities with erase links, which are not addressed by the System 300V modules.
  - For lightening cabinets you should prefer incandescent lamps and avoid luminescent lamps.
- Create a homogeneous reference potential and ground all electrical operating supplies when possible.
  - Please take care for the targeted employment of the grounding actions. The grounding of the PLC is a protection and functionality activity.
  - Connect installation parts and cabinets with the System 300V in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If potential differences between installation parts and cabinets occur, lay sufficiently dimensioned potential compensation lines.

Isolation of conductors

Electrical, magnetically and electromagnetic interference fields are weakened by means of an isolation, one talks of absorption.

Via the isolation rail, that is connected conductive with the rack, interference currents are shunt via cable isolation to the ground. Hereby you have to make sure, that the connection to the protected earth conductor is impedance-low, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area.

  Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible
  - analog signals (some mV res. µA) are transferred
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metalized plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to the System 300V module and **don't** lay it on there again!

Please regard at installation!

At potential differences between the grounding points, there may be a compensation current via the isolation connected at both sides.

Remedy: Potential compensation line

Chapter 3 Digital Input Modules

Outline

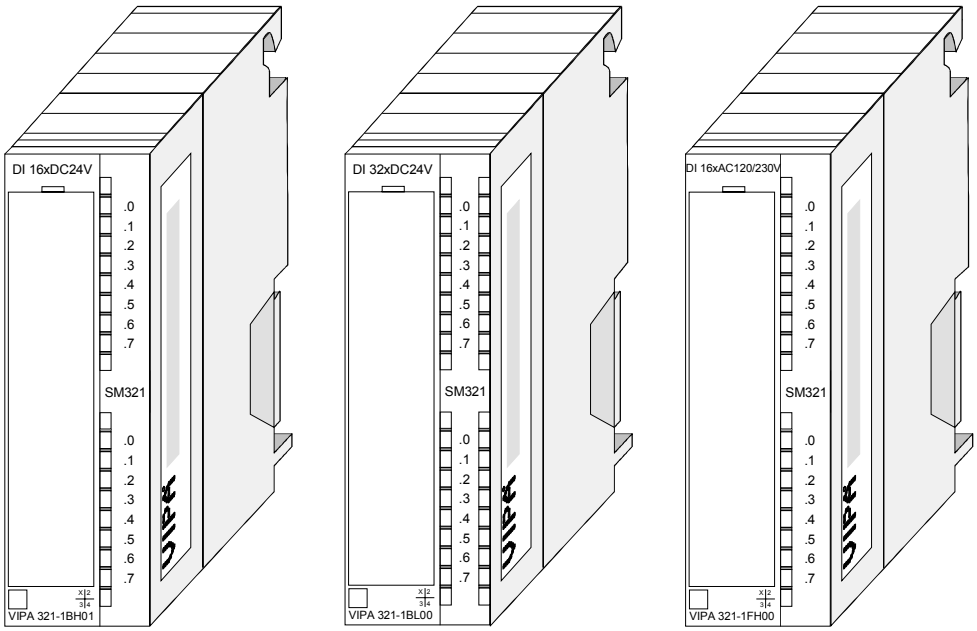
This chapter contains a description of the structure and the operation of the VIPA digital input modules.

Content

System overview

Input Modules SM 321

In the following you find an overview over the digital input modules that are available at VIPA:



Order data Input modules

Type	Order number	Page
DI 16xDC 24V	VIPA 321-1BH01	3-3
DI 32xDC 24V	VIPA 321-1BL00	3-6
DI 16xAC 120/230V	VIPA 321-1FH00	3-9

321-1BH01 - DI 16xDC 24V

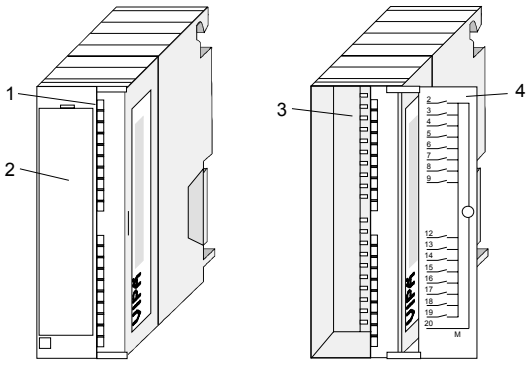
Order data DI 16xDC 24V VIPA 321-1BH01

Description The digital input module collects the binary control signals from the process level and transmits them isolated to the superordinated bus system. It has 16 channels and their status is monitored via LEDs.

Properties

- 16 inputs, isolated to the backplane bus
- Nominal input voltage DC 24V
- Useable for switches and approximate switches
- Status monitoring of the channels via LED

Structure



[1] LEDs

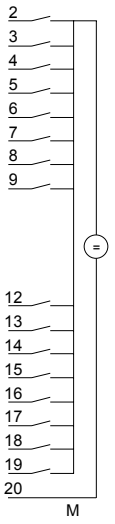
[2] flap with labeling strip

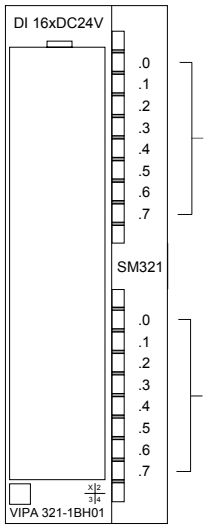
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

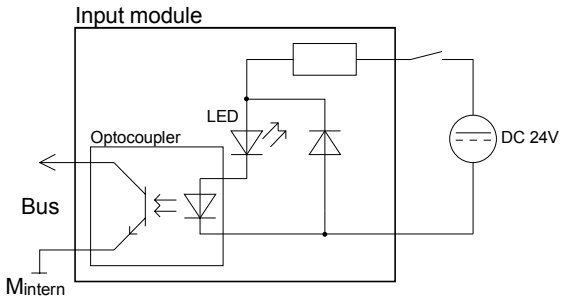
Pin	Assignment
1	not used
2	Input I+0.0
.	.
.	.
.	.
9	Input I+0.7
12	Input I+1.0
.	.
.	.
.	.
19	Input I+1.7
20	Ground





LED	Description
.0 7	LEDs (green) I+0.0 to I+1.7 from ca. 15V on, the signal is recognized as "1" and the according LED is activated

Schematic diagram



Technical Data

Order number	**321-1BH01**
Type	SM 321
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	25 mA
Power loss	3.5 W
Technical data digital inputs	
Number of inputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysterese	-
Frequency range	-
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	16
Number of simultaneously utilizable inputs vertical configuration	16
Input characteristic curve	IEC 61131, type 1
Initial data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	16
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	220 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

321-1BL00 - DI 32xDC 24V

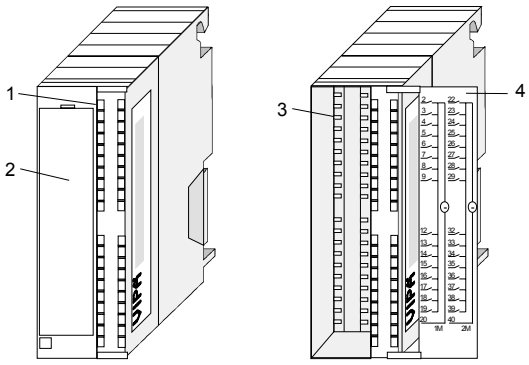
Order data DI 32xDC 24V VIPA 321-1BL00

Description The digital input module collects the binary control signals from the process level and transmits them isolated to the superordinated bus system. It has 32 channels and their status is monitored via LEDs.

Properties

- 32 inputs, isolated to the backplane bus
- Nominal input voltage DC 24V
- Useable for switches and approximate switches
- Status monitoring of the channels via LED

Structure



[1] LEDs

[2] flap with labeling strip

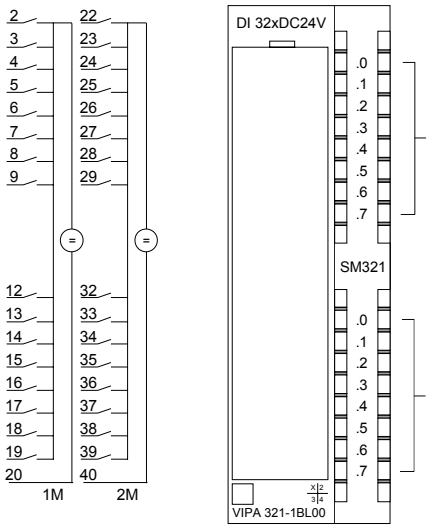
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

Pin	Assignment
1	not used
2...9	Input I+0.0...I+0.7
12...19	Input I+1.0...I+1.7
20	Ground
21	not used
22...29	Input I+2.0...I+2.7
32...39	Input I+3.0...I+3.7
40	Ground

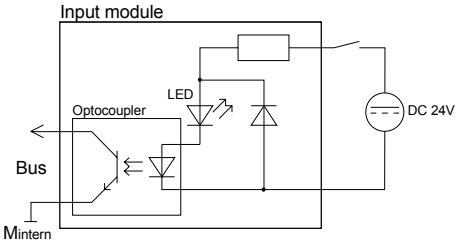
Circuit diagram



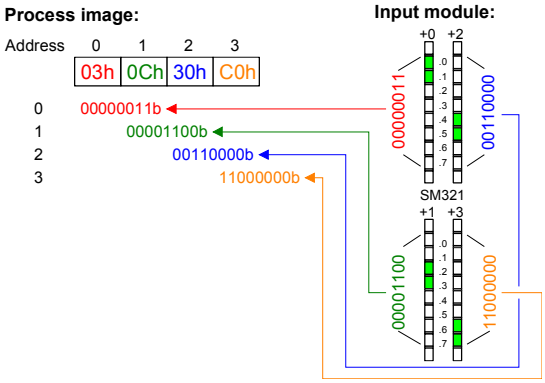
LED	Description
.0 7	LEDs (green) I+0.0 to I+3.7 from ca. 15V on, the signal is recognized as "1" and the according LED is activated

Schematic diagram
Numeric representation

Schematic diagram



Numeric representation



Technical Data

Order number	321-1BL00
Type	SM 321
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	35 mA
Power loss	5.5 W
Technical data digital inputs	
Number of inputs	32
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysterese	-
Frequency range	-
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	32
Number of simultaneously utilizable inputs vertical configuration	32
Input characteristic curve	IEC 61131, type 1
Initial data size	4 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	16
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	240 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

321-1FH00 - DI 16xAC120/230V

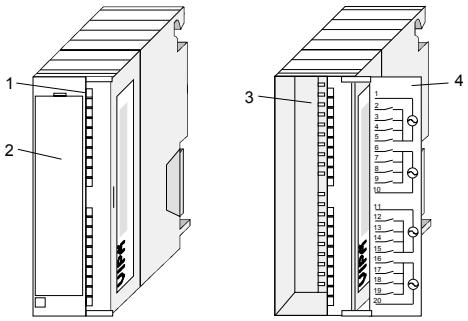
Order data DI 16xAC 120/230V VIPA 321-1FH00

Description The digital input module collects the binary control signals from the process level and transmits them isolated to the superordinated bus system.
It has 16 channels and their status is monitored via LEDs.

Properties

- 16 inputs, isolated in groups of 4
- Rated input voltage AC 120/230V
- Useable for switches
- Status monitoring of the channels via LED

Structure



[1] LEDs

[2] flap with labeling strip

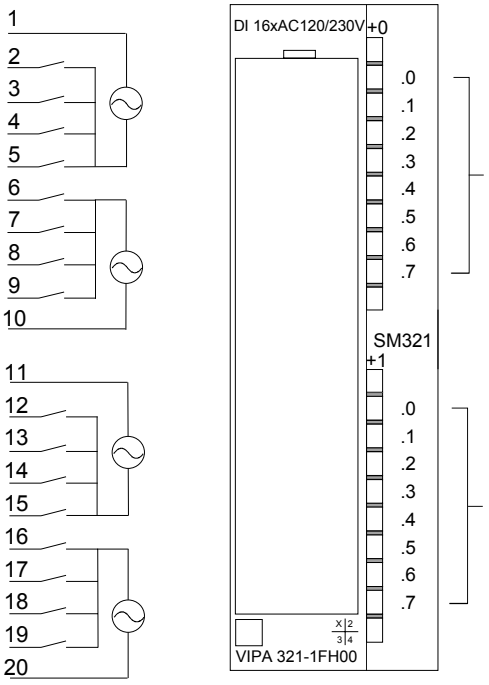
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

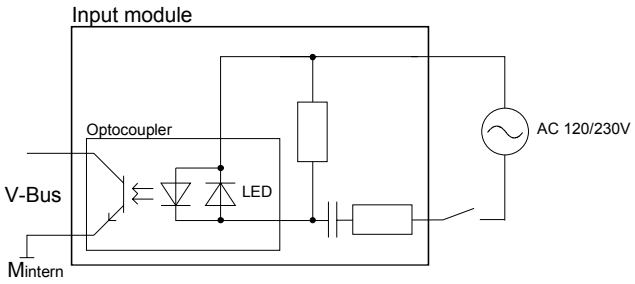
Pin	Assignment
1	Neutral conductor
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Neutral conductor
11	Neutral conductor
12	Input I+1.0
13	Input I+1.1
14	Input I+1.2
15	Input I+1.3
16	Input I+1.4
17	Input I+1.5
18	Input I+1.6
19	Input I+1.7
20	Neutral conductor

Circuit diagram



LED	Description
.0 7	LEDs (green) I+0.0 to I+0.7 I+1.0 to I+1.7 from ca. AC 79V on, the signal is recognized as "1" and the according LED is activated

Schematic diagram



Technical Data

Order number	**321-1FH00**
Type	SM 321
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	35 mA
Power loss	5 W
Technical data digital inputs	
Number of inputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	AC 120/230 V
Current consumption from load voltage L+ (without load)	-
Rated value	AC 120/230 V
Input voltage for signal "0"	AC 0...40 V
Input voltage for signal "1"	AC 79...264 V
Input voltage hysterese	-
Frequency range	47...63 Hz
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	25 ms
Input delay of "1" to "0"	25 ms
Number of simultaneously utilizable inputs horizontal configuration	16
Number of simultaneously utilizable inputs vertical configuration	16
Input characteristic curve	-
Initial data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	4
Between channels and backplane bus	✓
Insulation tested with	DC 4000 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	240 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Chapter 4 Digital Output Modules

Outline

This chapter contains a description of the structure and the operation of the VIPA digital output modules.

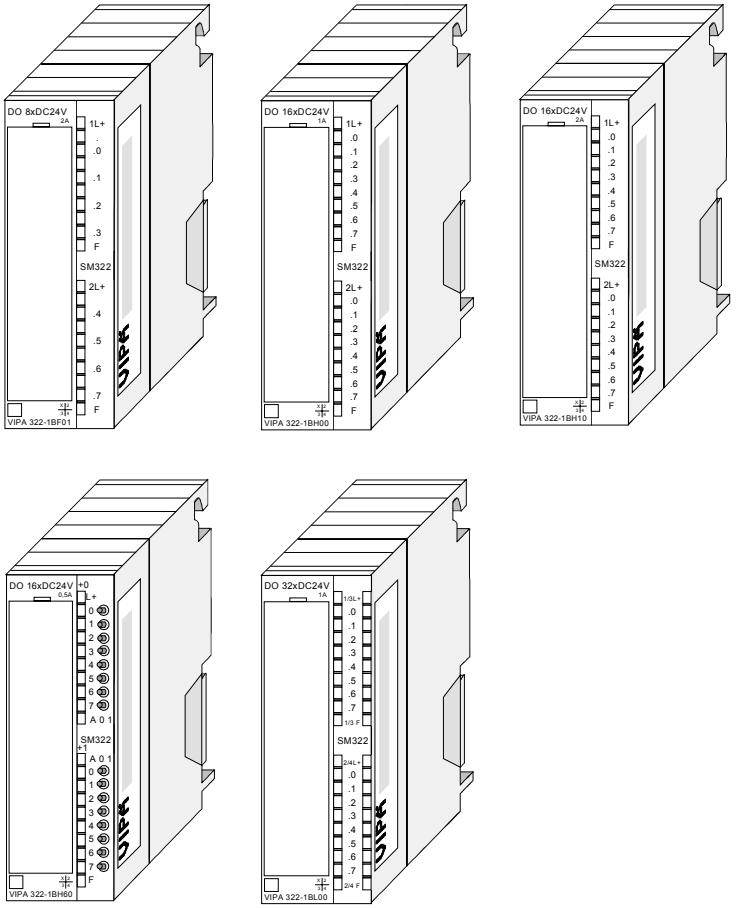
Content

System overview

Output modules SM 322

In the following you will get an overview over the digital output modules that are available at VIPA:

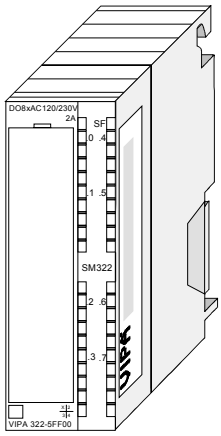
DC 24V output modules



Order data DC 24V output modules

Type	Order No.	Page
DO 8xDC 24V 2A	VIPA 322-1BF01	4-4
DO 16xDC 24V 1A	VIPA 322-1BH01	4-7
DO 16xDC 24V 2A	VIPA 322-1BH41	4-10
DO 16xDC24V 0.5A for manual operation	VIPA 322-1BH60	4-13
DO 32xDC 24V 1A	VIPA 322-1BL00	4-17

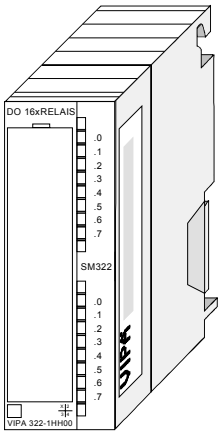
AC 120/230V Output module



Order data AC 120/230V output modul

Type	Order No.	Page
DO 8xAC 120/230V 2A	VIPA 322-5FF00	4-21

Relay output module



Order data relay output module

Type	Order No.	Page
DO 16xRelay	VIPA 322-1HH00	4-26

322-1BF01 - DO 8xDC 24V 2A

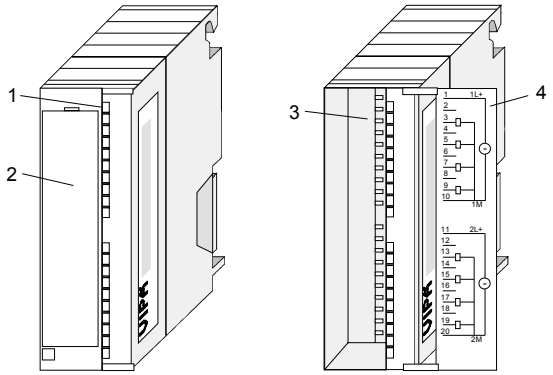
Order data DO 8xDC 24V 2A VIPA 322-1BF01

Description The digital output module collects the binary control signals from the superordinated bus system and transmits them isolated to the process level. The module has to be provided with 24V via the front slot. It has 8 channels and their status is monitored via LEDs.

Properties

- 8 outputs, potential separated to the back panel bus
- supply voltage DC 24V, output voltage 2A
- useable for magnetic valve and DC contactor
- LEDs for supply voltage and error messages
- Status monitoring of the channels via LED

Structure



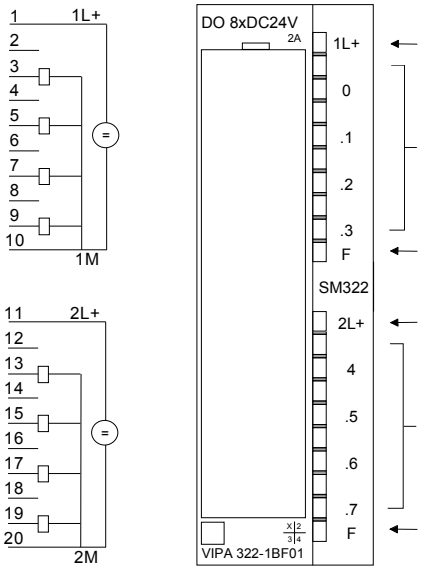
[1] LEDs

[2] flap with labeling strip

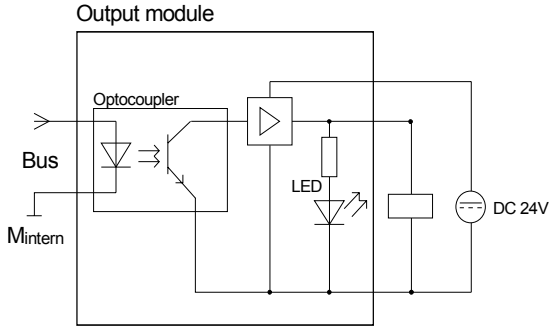
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

Pin	Assignment	Circuit diagram	LED	Description
1	Supply voltage DC 24V		1L+, 2L+	LED (green) supply voltage is on
3	Output Q+0.0		.0 7	LEDs (green) Q+0.0 to Q+0.7
5	Output Q+0.1			As soon as an output is active, the according LED is activated
7	Output Q+0.2			
9	Output Q+0.3			
10	Ground 1			
11	Supply voltage DC 24V		F	LED (red) Error when overload or short circuits
13	Output Q+0.4			
15	Output Q+0.5			
17	Output Q+0.6			
19	Output Q+0.7			
20	Ground 2			

Schematic diagram



Technical data

Order number	322-1BF01
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	7.5 W
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	68 mA
Output current at signal "1", rated value	2 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	possible (only outputs group)
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 1 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	3 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	1 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	4
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	240 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

322-1BH01 - DO 16xDC 24V 1A

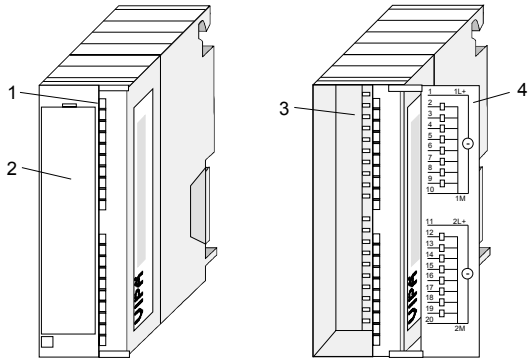
Order data DO 16xDC 24V 1A VIPA 322-1BH01

Description The digital output module collects the binary control signals from the superordinated bus system and transmits them isolated to the process level. The module has to be provided with 24V via the front slot. It has 16 channels and their status is monitored via LEDs.

Properties

- 16 outputs, potential separated to the back panel bus
- supply voltage DC 24V, output voltage 1A
- useable for magnetic valve and DC contactor
- LEDs for supply voltage and error messages
- Status monitoring of the channels via LED

Structure



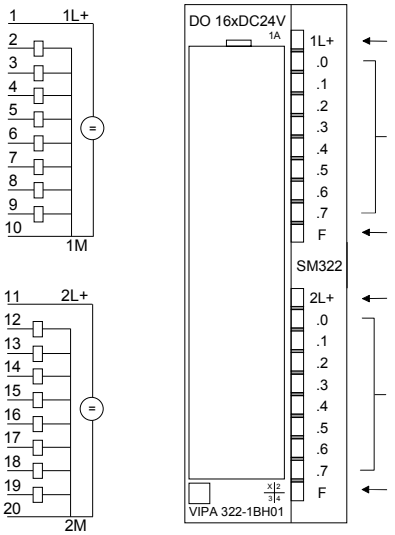
[1] LEDs

[2] flap with labeling strip

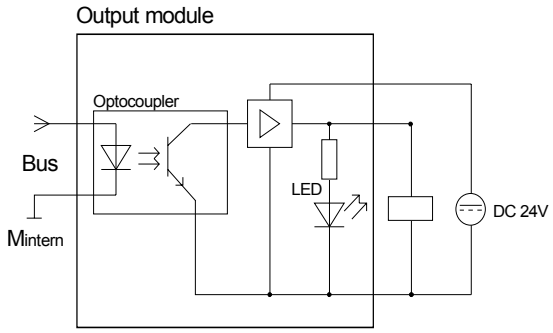
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

Pin	Assignment	Circuit diagram	LED	Description
1	Supply voltage DC 24V		1L+, 2L+	LED (green) supply voltage is on
2	Output Q+0.0		.0 7	LEDs (green) Q+0.0 to Q+1.7
.	.			As soon as an output is active, the according LED is activated
.	.			
9	Output Q+0.7			
10	Ground 1			
11	Supply voltage DC 24V		F	LED (red) Error when overload or short circuits
12	Output Q+1.0			
.	.			
.	.			
19	Output Q+1.7			
20	Ground 2			

Schematic diagram



Technical Data

Artikelnummer	**322-1BH01**
Bezeichnung	SM 322
SPEED-Bus	-
Stromaufnahme/Verlustleistung	
Stromaufnahme aus Rückwandbus	110 mA
Verlustleistung	4 W
Technische Daten digitale Ausgänge	
Anzahl Ausgänge	16
Leitungslänge geschirmt	1000 m
Leitungslänge ungeschirmt	600 m
Lastnennspannung	DC 24 V
Stromaufnahme aus Lastspannung L+ (ohne Last)	30 mA
Ausgangsstrom bei "1"-Signal, Nennwert	1 A
Ausgangsverzögerung von "0" nach "1"	150 µs
Ausgangsverzögerung von "1" nach "0"	100 µs
Mindestlaststrom	-
Lampenlast	5 W
Parallelschalten von Ausgängen zur redundanten Ansteuerung	möglich (nur Ausgänge der gleichen Gruppe)
Parallelschalten von Ausgängen zur Leistungserhöhung	möglich (nur Ausgänge der gleichen Gruppe)
Ansteuern eines Digitaleingangs	✓
Schaltfrequenz bei ohmscher Last	max. 1000 Hz
Schaltfrequenz bei induktiver Last	max. 0,5 Hz
Schaltfrequenz bei Lampenlast	max. 1 Hz
Begrenzung (intern) der induktiven Abschaltspannung	L+ (-52 V)
Kurzschlussschutz des Ausgangs	ja, elektronisch
Ansprechschwelle des Schutzes	1,5 A
Anzahl Schaltspiele der Relaisausgänge	-
Schaltvermögen der Relaiskontakte	-
Ausgangsdatengröße	2 Byte
Status, Alarm, Diagnosen	
Statusanzeige	grüne LED pro Kanal
Alarme	nein
Prozessalarm	nein
Diagnosealarm	nein
Diagnosefunktion	nein
Diagnoseinformation auslesbar	keine
Versorgungsspannungsanzeige	grüne LED pro Gruppe
Sammelfehleranzeige	rote SF-LED
Kanalfehleranzeige	keine
Potenzialtrennung	
zwischen den Kanälen	✓
zwischen den Kanälen in Gruppen zu	8
zwischen Kanälen und Rückwandbus	✓
Isolierung geprüft mit	DC 500 V
Mechanische Daten	
Abmessungen (BxHxT)	40 x 125 x 120 mm
Gewicht	230 g
Umgebungsbedingungen	
Betriebstemperatur	0 °C bis 60 °C
Lagertemperatur	-25 °C bis 70 °C
Zertifizierungen	
Zertifizierung nach UL508	ja

322-1BH41 - DO 16xDC 24V 2A

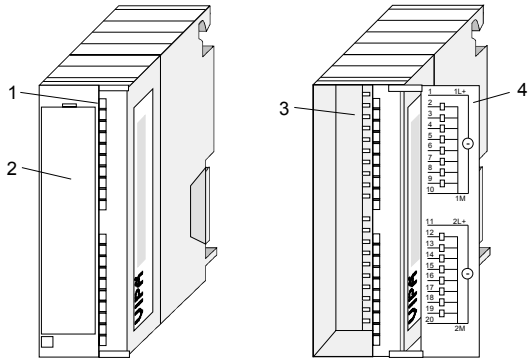
Order data DO 16xDC 24V 2A VIPA 322-1BH41

Description The digital output module collects the binary control signals from the superordinated bus system and transmits them isolated to the process level. The module has to be provided with 24V via the front slot. It has 16 channels and their status is monitored via LEDs.

Properties

- 16 outputs, potential separated to the back panel bus
- supply voltage DC 24V, output voltage 2A
- useable for magnetic valve and DC contactor
- LEDs for supply voltage and error messages
- Status monitoring of the channels via LED

Structure



[1] LEDs

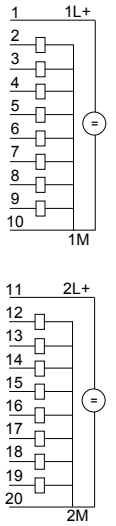
[2] flap with labeling strip

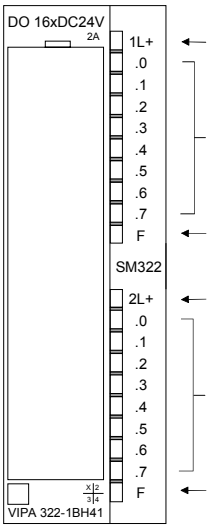
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

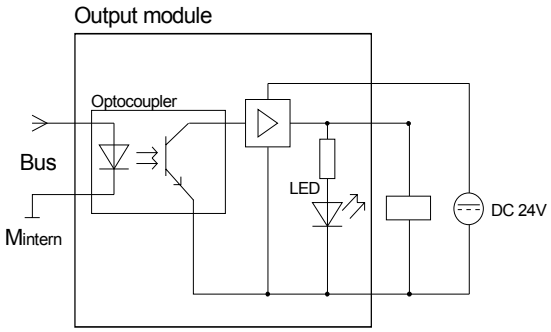
Pin	Assignment
1	Supply voltage DC 24V
2	Output Q+0.0
.	.
.	.
9	Output Q+0.7
10	Ground 1
11	Supply voltage DC 24V
12	Output Q+1.0
.	.
.	.
19	Output Q+1.7
20	Ground 2





LED	Description
1L+, 2L+	LED (green) supply voltage is on
.0 7	LEDs (green) Q+0.0 to Q+1.7 As soon as an output is active, the according LED is turned on
F	LED (red) Error when overload or short circuits

Schematic diagram



Project engineering

Note!
Project engineering as 322-1BH01!

Technical Data

Order number	322-1BH41
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	110 mA
Power loss	4 W
Technical data digital outputs	
Number of outputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Output current at signal "1", rated value	2 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	possible (only outputs group)
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 1 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	3 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	8
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

322-1BH60 - DO 16xDC 24V 0.5A for manual operation

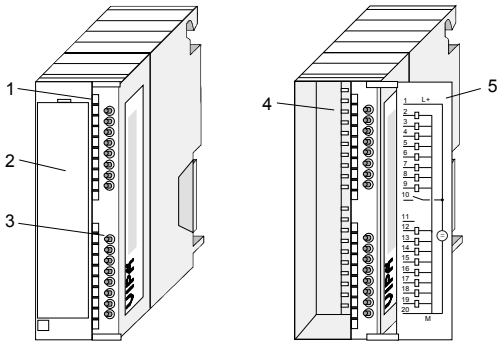
Order data DO 16xDC 24V 0.5A HB VIPA 322-1BH60

Description The module is configured as in-/output module. It has 16 channels and their status is monitored via LEDs. Besides of the LEDs the frontside provides a row of switches for manual res. Automatic operation, i.e. every output has a 3 setting switch with the positions automatic, manual 0 and manual 1.

Properties

- 16 outputs, potential separated to the back panel bus
- 1 input, potential separated, for activation of all outputs
- 3 setting switch per channel (automatic, manual 0 and manual 1)
- 16 inputs, switch status via input word
- supply voltage DC 24V, output voltage 0.5A
- LEDs for supply voltage and error messages
- Status monitoring of the channels via LED

Structure



[1] LEDs

[2] flap with labeling strip

[3] switch bar

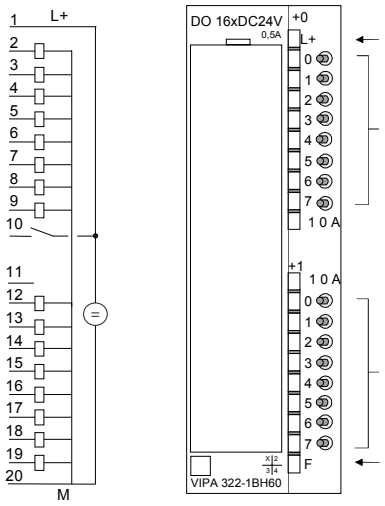
[4] contact bar

[5] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

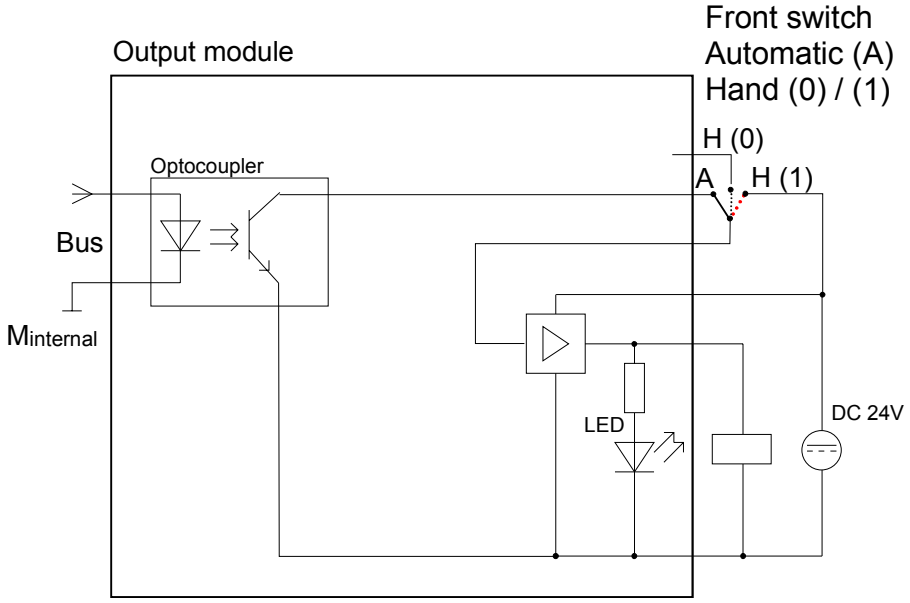
Pin	Assignment
1	Supply voltage DC 24V
2	Output Q+0.0
.	.
.	.
9	Output Q+0.7
10	Input for Q.x="1"
11	n.c.
12	Output Q+1.0
.	.
.	.
19	Output O+1.7
20	Ground

Circuit diagram



LED	Description
L+	LED (green) supply voltage is on
.0 7	LEDs (green) Q+0.0 to Q+1.7 As soon as an output is active, the according LED is turned on
F	LED (red) Error when overload or short circuits

Schematic diagram



Deployment

Please regard that the module is installed as 323-1BL00. You are allowed to request the switch position of the according channel via the input word.
For this is valid:

triple switch	input word	Description
	I.x=0	Manual 1: output channel always activated
	I.x=0	Manual 0: output channel always de-activated
	I.x=1	Automatic: control via PLC application

The control of the outputs happens via output word.

Note!
By connecting DC 24V at the input (Pin 10), all outputs are set to "1".
This input cannot be evaluated by the PLC user program.

Project engineering

Note!
Project engineering as 323-1BL00!

Technical Data

Order number	322-1BH60
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Power loss	6 W
Technical data digital outputs	
Number of outputs	16
Cable length, shielded	-
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	140 mA
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	max. 100 µs
Output delay of "1" to "0"	max. 500 µs
Minimum load current	-
Lamp load	5 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	16
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

322-1BL00 - DO 32xDC 24V 1A

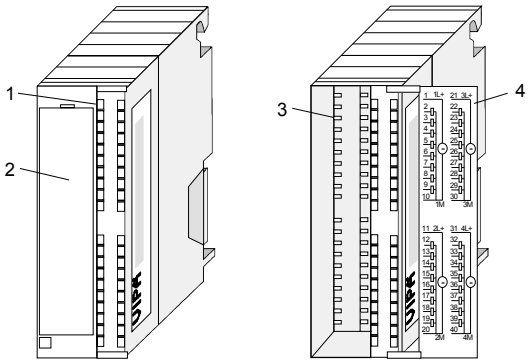
Order data DO 32xDC 24V 1A VIPA 322-1BL00

Description The digital output module collects the binary control signals from the superordinated bus system and transmits them isolated to the process level. The module has to be provided with 24V via the front slot. It has 16 channels and their status is monitored via LEDs.

Properties

- 32 outputs, potential separated to the back panel bus
- Supply voltage DC 24V
- Output voltage 1A per channel
- Useable for magnetic valve and DC contactor
- LEDs for supply voltage and error messages
- Activity LED per channel

Structure



[1] LEDs

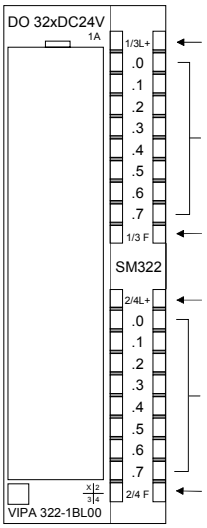
[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

Pin assignment
Status monitor

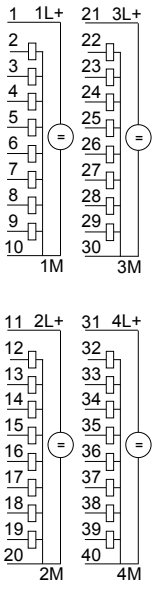
Pin	Assignment
1	Supply voltage 1L+
2	Output Q+0.0
...	...
9	Output Q+0.7
10	Ground 1
11	Supply voltage 2L+
12	Output Q+1.0
...	...
19	Output Q+1.7
20	Ground 2
21	Supply voltage 3L+
22	Output Q+2.0
...	...
29	Output Q+2.7
30	Ground 3
31	Supply voltage 4L+
32	Output Q+3.0
...	...
39	Output Q+3.7
40	Ground 4



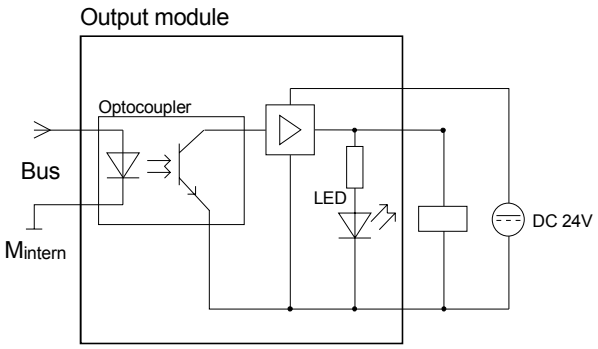
LED	Description
1/3L+, 2/4L+	LED (green) supply voltage is on
.0 7	LEDs (green) Q+0.0 to Q+3.7 As soon as an output is active, the according LED is turned on
1/3F, 2/4F	LED (red) Error when overload or short circuits

Circuit diagram
Schematic diagram

Circuit diagram



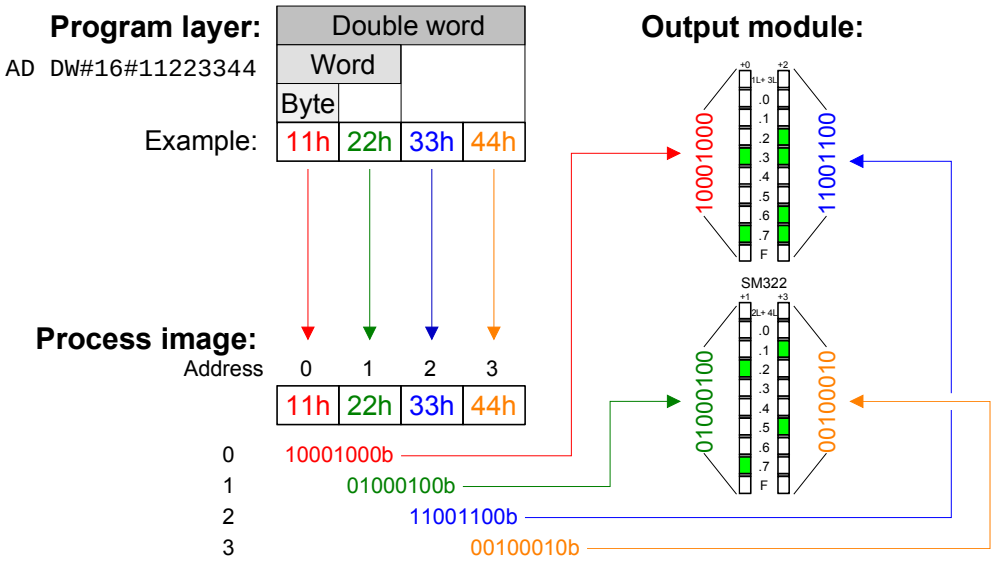
Schematic diagram



Numeric representation

From the application level to the hardware level the data is stored in Motorola-Format, i.e. "ready for reading".

The following picture shows the output of the number 287454020dez res. 11223344hex on the outputs of the 32pin output modules



Technical Data

Order number	322-1BL00
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	200 mA
Power loss	5 W
Technical data digital outputs	
Number of outputs	32
Cable length, shielded	-
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Output current at signal "1", rated value	1 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	6 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 1 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1.5 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	8
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	260 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

322-5FF00 - DO 8xAC 120/230V 2A

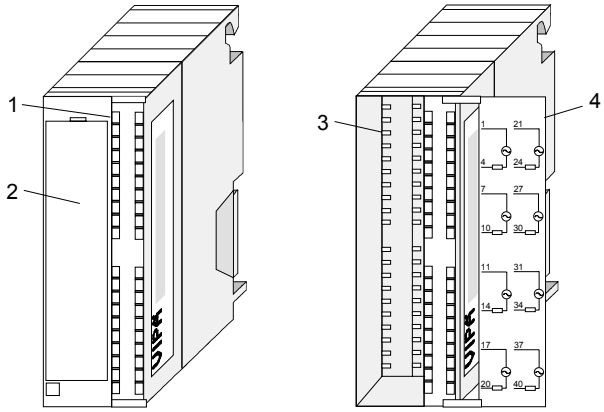
Order data DO 8xAC 120/230V 2A VIPA 322-5FF00

Description The digital output module collects the binary control signals from the superordinated bus system and transmits them isolated to the process level. It has 8 channels and their status is monitored via LEDs.

Properties

- 8 outputs, isolated between the channels and to the back plane bus
- Rated load voltage AC 120/230V
- Output current per channel 2A
- Suitable for AC solenoid valves, contactors, motor starters, fractional h.p. motors and indicator lights
- Group error display
- Channel-specific status LEDs
- Programmable substitute value output

Structure



[1] LEDs

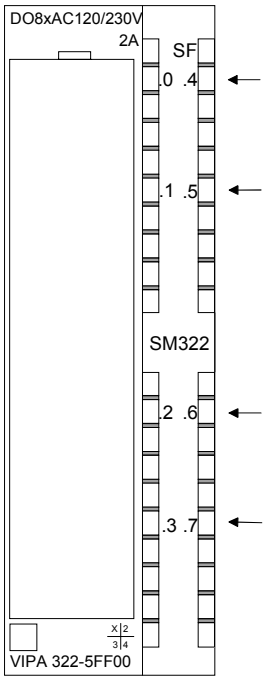
[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

Pin assignment
Status monitor

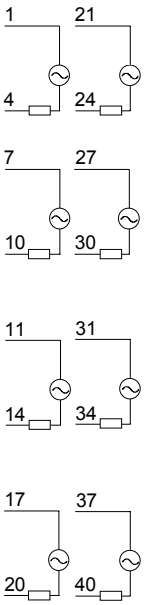
Pin	Assignment
1	Rated load voltage 1L
4	Q+0.0
7	Rated load voltage 2L
10	Q+0.1
11	Rated load voltage 3L
14	Q+0.2
17	Rated load voltage 4L
20	Q+0.3
21	Rated load voltage 5L
24	Q+0.4
27	Rated load voltage 6L
30	Q+0.5
31	Rated load voltage 7L
34	Q+0.6
37	Rated load voltage 8L
40	Q+0.7



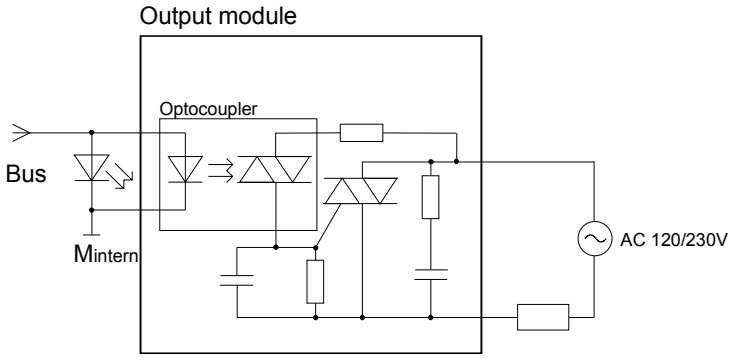
LED	Description
SF	LED (red) Group errror LED, error if module is not supplied with parameters by the CPU
.0 7	LED (green) Q+0.0 to Q+0.7 As soon as an output is active, the according LED is turned on

Circuit diagram
Schematic diagram

Circuit diagram



Schematic diagram



Caution!
The outputs must be protected by a fast-acting 3.15A, AC 250V fuse. When mounted in a hazardous area, the fuse may only be removed by a tool.

Parameterization

Overview

There are the following possibilities for parameterization:

- Parameterization by WinPLC7 from VIPA or by hardware configuration of Siemens SIMATIC manager.
- Parameterization during run time by means of SFCs

Parameterization by hardware configuration

To be compatible to the Siemens SIMATIC manager the following steps are to be accomplished:

- Start the hardware configurator from Siemens.
- Create a new project.
- Configure your CPU.
- Link-up your System 300V modules in the plugged-in sequence starting with slot 4. Here the digital output modules of VIPA are to be projected as digital output modules of Siemens in accordance with the following rules:

  VIPA 322-5FF00 to be configured as **6ES7 322-5FF00-0AB0**

  The digital output modules can be found at the hardware catalog at *Simatic 300 > SM-300.*

- If needed parameterize the CPU respectively the modules. The parameter window appears as soon as you double click on the according module. At this window the according parameter can be changed.
- Save your project, switch the CPU to STOP and transfer your project to the CPU. As soon as the CPU is switched to RUN the parameters are transferred to the connected modules.

Parameters

The following parameters can be adjusted at the digital output modules:

- Reaction at CPU-STOP
- Switch substitute value "1"

More description of the parameters may be found at the following pages.

Parameterization during run time by means of SFCs

If the module gets parameters, which are not supported by the module, for example a current module is to be configured as a voltage module, these parameters are interpreted as wrong parameters and an error is initialized.
At the parameterization, a 4byte long parameter area is set in the record set 1. Deploying the SFCs 56, 57 and the SFB 53, you may alter parameters during run time and transfer them to the module.

Parameter Record set 1

Record set 1 (Byte 0 to 3):		Default value
Byte	Bit 7 ... Bit 0	
0	Reaction to CPU Stop Bit 0: Keep last valid value Bit 1: Substitute a value Bit 6: reserved Bit 7: reserved	00h
1	Substitute value Bit 0: Substitute value "1" on channel 0 Bit 1: Substitute value "1" on channel 1 Bit 2: Substitute value "1" on channel 2 Bit 3: Substitute value "1" on channel 3 Bit 4: Substitute value "1" on channel 4 Bit 5: Substitute value "1" on channel 5 Bit 5: Substitute value "1" on channel 6 Bit 7: Substitute value "1" on channel 7	00h
2	not relevant	00h
3	not relevant	00h

Note!
You should only enable the parameters in byte 0, "Hold last valid value" and "Enable substitute value" as an alternative.

Reaction to CPU-Stop

Here the module reaction at CPU-STOP may be set. There are the following possibilities:

- Keep last valid value
  The value of each channel is freezed when the CPU is stopped
- Substitute a value
  At CPU-STOP each channel is substituded by a value which may be assigned by byte 1.

Technical Data

Order number	**322-5FF00**
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Power loss	8.6 W
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	AC 120/230 V
Current consumption from load voltage L+ (without load)	2 mA
Output current at signal "1", rated value	2 A
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-
Lamp load	50 W
Parallel switching of outputs for redundant control of a load	possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 10 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 1 Hz
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	Fuse 3.15 A /250 V, quick response
Trigger level	3.15 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	1 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	1
Between channels and backplane bus	✓
Insulation tested with	AC 1500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	330 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

322-1HH00 - DO 16xRelay

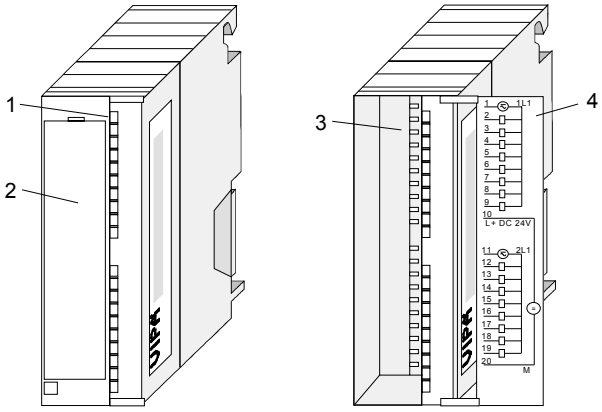
Order data DO 16xRelais VIPA 322-1HH00

Description The relay output module collects the binary control signals from the superordinated bus system and transmits them via relay outputs to the process level. The module electronics are provided via the back panel bus. It has 16 channels working as switches, and their status is monitored via LEDs.

Properties

- 16 relay outputs in groups of 8
- Power supply via back panel bus
- Load capacity voltage AC 230V / DC 30V
- Maximal contact rating per channel 5A
- useable for small motors, lamps, magnetic valve and DC contactors
- Activity LED per channel

Structure



[1] LEDs

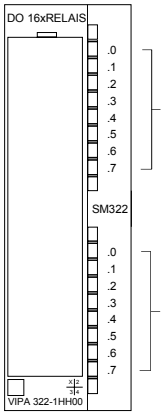
[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

Pin assignment
Status monitor

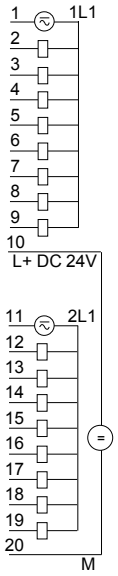
Pin	Assignment
1	1L1
2	Relay-Output Q+0.0
...	...
9	Relay-Output Q+0.7
10	L+DC24V
11	2L1
12	Relay-Output Q+1.0
...	...
19	Relay-Output Q+1.7
20	Ground



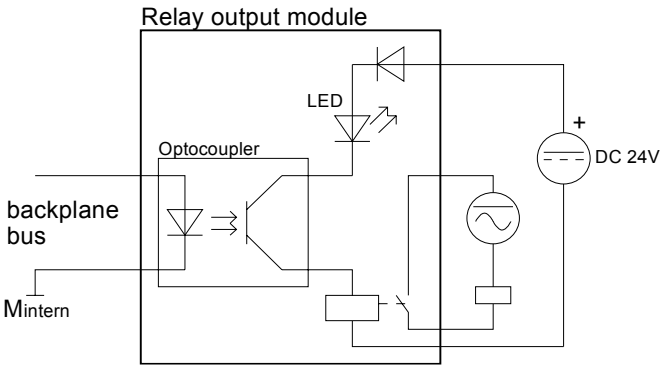
LED	Description
.0... .7	LED (green) Q+0.0 to Q+1.7 As soon as an output is active, the according LED is turned on

Circuit diagram
Schematic diagram

Circuit diagram

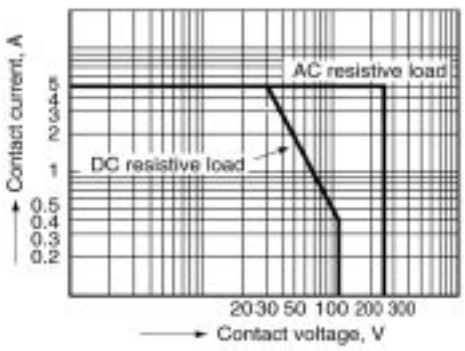


Schematic diagram

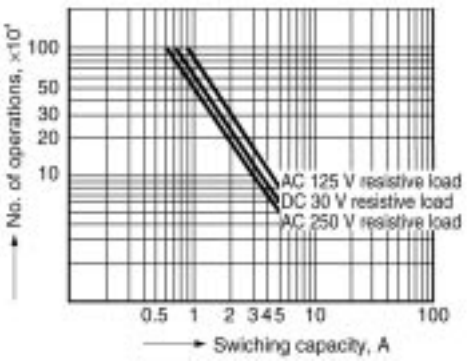


Note: When using inductive load please take an suitable protector!

Maximum toggle capacity



Life Time



Technical Data

Order number	322-1HH00
Type	SM 322
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	4 W
Technical data digital outputs	
Number of outputs	16
Cable length, shielded	-
Cable length, unshielded	600 m
Rated load voltage	DC 30 V/ AC 230 V
Current consumption from load voltage L+ (without load)	-
Output current at signal "1", rated value	4 A
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-
Lamp load	6 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	-
Switching frequency with inductive load	-
Switching frequency on lamp load	-
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	-
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	8
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	290 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Chapter 5 Digital Input/Output Modules

Outline

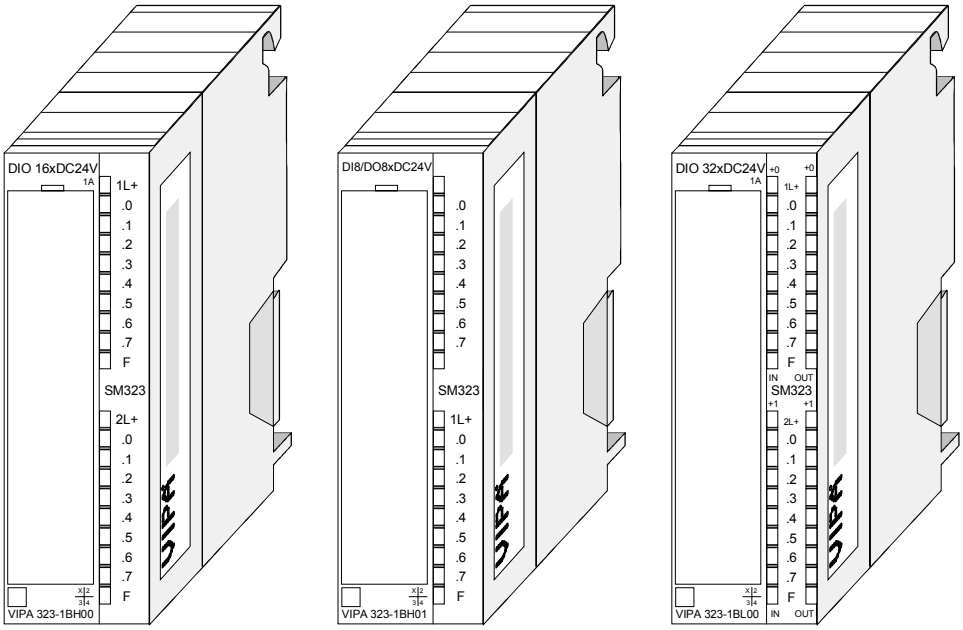
This chapter contains a description of the structure and the operation of the VIPA digital in-/output modules.

Content

System overview

I/O modules SM 323

In the following you will get an overview over the digital input/output modules that are available at VIPA:



Order data I/O modules

Type	Order No.	Page
DIO 16xDC 24V 1A	VIPA 323-1BH00	5-3
DI 8xDC 24V, DO 8xDC 24V 1A	VIPA 323-1BH01	5-7
DI 16xDC 24V, DO 16xDC 24V 1A	VIPA 323-1BL00	5-11

Security hints for DIO modules

Attention!

Please regard that the voltage applied to an output channel must be ≤ the voltage supply applied to L+.

Due to the parallel connection of in- and output channel per group, a set output channel may be supplied via an applied input signal.

Thus, a set output remains active even at power-off of the voltage supply with the applied input signal.

Non-observance may cause module demolition.

323-1BH00 - DIO 16xDC 24V 1A

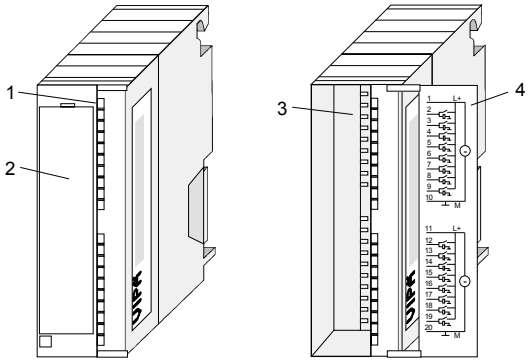
Order Data DIO 16xDC 24V 1A VIPA 323-1BH00

Description The module is a combined module. It has 16 channels that can be used either as inputs or outputs. Every channel supports a diagnostic function, i.e. as soon as an output is active, the according input is set. If there is a short circuit at the load, the according input is reset and the error may be recognized by analyzing the input.

Properties

- 16 channels, isolated to the backplane bus (as input or output)
- Diagnostic function
- Nominal input voltage DC 24V / supply voltage DC 24V
- Output current 1A
- LED for error message at overload, overheat or short circuit
- Activity monitoring of the channels via LED

Structure



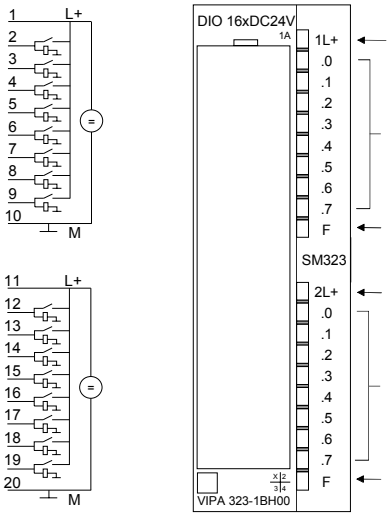
[1] LEDs

[2] flap with labeling strip

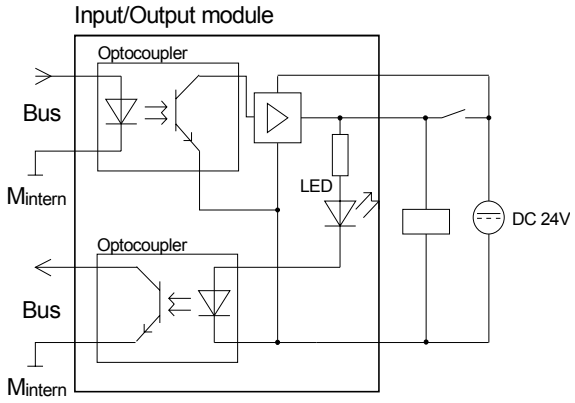
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

Pin	Assignment	Circuit diagram	LED	Description
1	Supply voltage +DC 24V		1L+, 2L+	LED (green) supply voltage is on
2	In-/Output I/Q+0.0		.0 7	LED (green) per Byte
...	...			As soon as an input signal "1" or an active output is recognized, the according LED is activated
9	In-/Output I/Q+0.7			
10	Ground			
11	Supply voltage +DC 24V			
12	In-/Output I/Q+1.0			
...	...		F	LED (red)
19	In-/Output I/Q+1.7			error at overload or short circuit
20	Ground			

Schematic diagram



Project Engineering

Note!
Project Engineering as 323-1BL00!

Technical Data

Order number	**323-1BH00**
Type	SM 323
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	130 mA
Power loss	4 W
Technical data digital inputs	
Number of inputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	16
Number of simultaneously utilizable inputs vertical configuration	16
Input characteristic curve	IEC 61131, type 1
Initial data size	2 Byte
Technical data digital outputs	
Number of outputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	30 mA
Output current at signal "1", rated value	1 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	5 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel

Order number	323-1BH00
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

323-1BH01 - DI 8xDC 24V, DO 8xDC 24V 1A

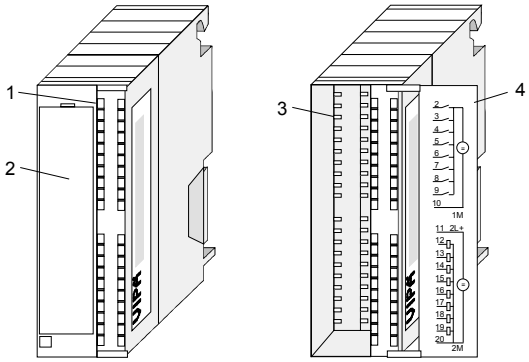
Order Data DI 8xDC 24V, DO 8xDC 24V 1A VIPA 323-1BH01

Description The module has 16 channels, isolated to the back panel bus, where 8 working as inputs and the 8 working as outputs. The status of the channels is shown via LEDs.

Properties

- 16 channels, from this 8 inputs and 8 outputs
- Nominal input voltage DC 24V
- Supply voltage DC 24V (external) for outputs
- Output current 1A per channel
- LED for error message at overload, overheat or short circuit
- Activity monitoring of the channels via LED

Structure



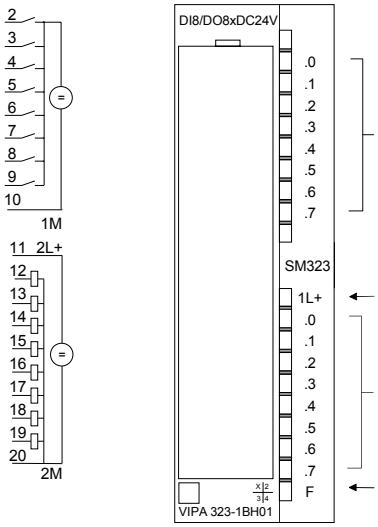
[1] LEDs

[2] flap with labeling strip

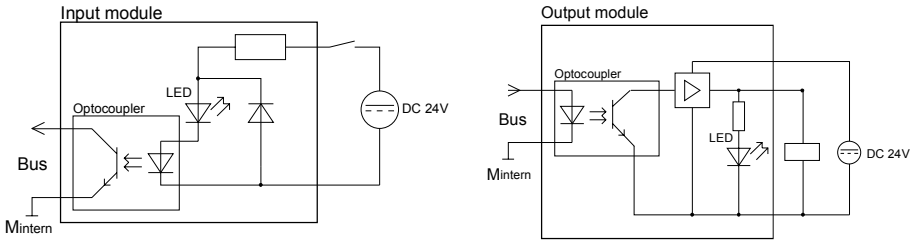
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

Pin	Assignment	Circuit diagram	LED	Description
1	Not used		1L+	LED (green)
2	Input I+0.0			supply voltage is on
...	...			
9	Input I+0.7		.0 7	LED (green)
10	Ground 1M inputs			I+0.0 ... I+0.7
11	Supply voltage DC +24V			Q+0.0 ... Q+0.7
12	Output Q+0.0			At signal "1" (input) res. active output, the according LED is activated
...	...			
19	Output Q+0.7			
20	Ground 2M outputs		F	LED (red) error at overload, short circuit

Schematic diagram



Technical Data

Order number	**323-1BH01**
Type	SM 323
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	4 W
Technical data digital inputs	
Number of inputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysterese	-
Frequency range	-
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	8
Number of simultaneously utilizable inputs vertical configuration	8
Input characteristic curve	IEC 61131, type 1
Initial data size	1 Byte
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	15 mA
Output current at signal "1", rated value	1 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	5 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	1 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel

Order number	323-1BH01
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	8
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	240 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

323-1BL00 - DI 16xDC 24V, DO 16xDC 24V 1A

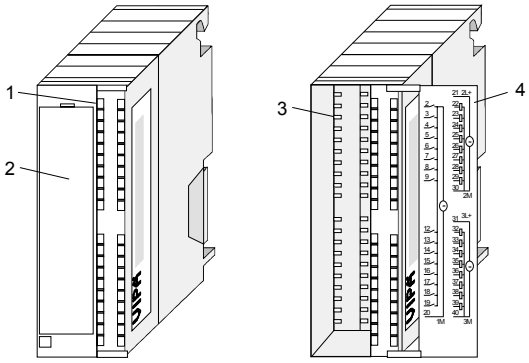
Order Data DI 16xDC24V, DO 16xDC24V 1A VIPA 323-1BL00

Description The module has 32 channels, isolated to the back plane bus, with 16 inputs and 16 outputs. The status of the channels is shown via LEDs.

Properties

- 32 channels, 16 inputs and 16 outputs
- Nominal input voltage DC 24V
- Supply voltage DC 24V (external) for outputs
- Output current 1A per channel
- LED for error message at overload, overheat or short circuit
- Activity monitoring of the channels via LED

Structure



[1] LEDs

[2] flap with labeling strip

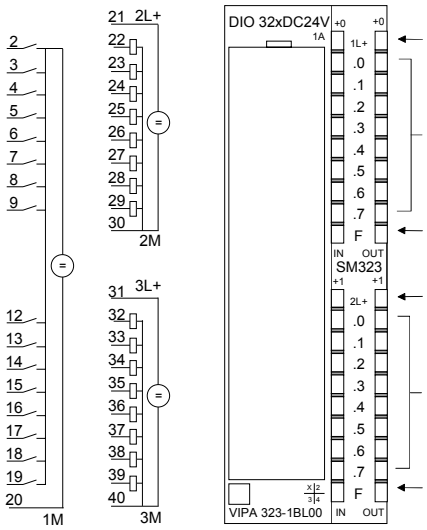
[3] contact bar

[4] flap opened with inner label

Pin assignment
Circuit diagram
Status monitor

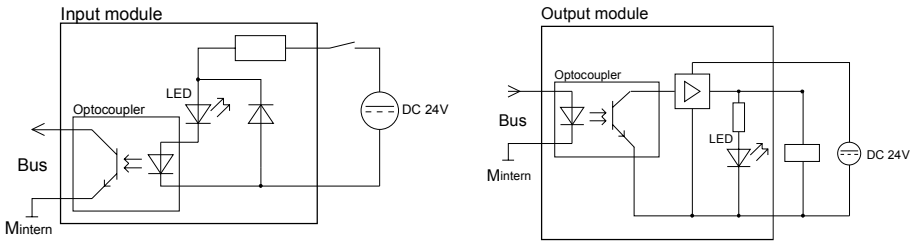
Pin	Assignment
1	Not used
2	Input I+0.0
...	...
19	Input I+1.7
20	Ground 1M inputs
21, 31	Supply voltage DC +24V
22	Output Q+0.0
...	...
39	Output Q+1.7
30	Ground 2M outputs
40	Ground 3M outputs

Circuit diagram



LED	Description
1L+, 2L+	LED (green) supply voltage is on
.0 7	LED (green) I+0.0 ... I+1.7 Q+0.0 ... Q+1.7 At signal "1" (input) res. active output, the according LED is activated
F	LED (red) error at overload, short circuit

Schematic diagram



Technical Data

Order number	**323-1BL00**
Type	SM 323
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	130 mA
Power loss	5.8 W
Technical data digital inputs	
Number of inputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysterese	-
Frequency range	-
Input resistance	-
Input current for signal "1"	7 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	16
Number of simultaneously utilizable inputs vertical configuration	16
Input characteristic curve	IEC 61131, type 1
Initial data size	2 Byte
Technical data digital outputs	
Number of outputs	16
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	30 mA
Output current at signal "1", rated value	1 A
Output delay of "0" to "1"	150 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	5 W
Parallel switching of outputs for redundant control of a load	possible (only outputs group)
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel

Order number	323-1BL00
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	green LED per group
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	8
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	260 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Chapter 6 Analog Input Modules

Outline

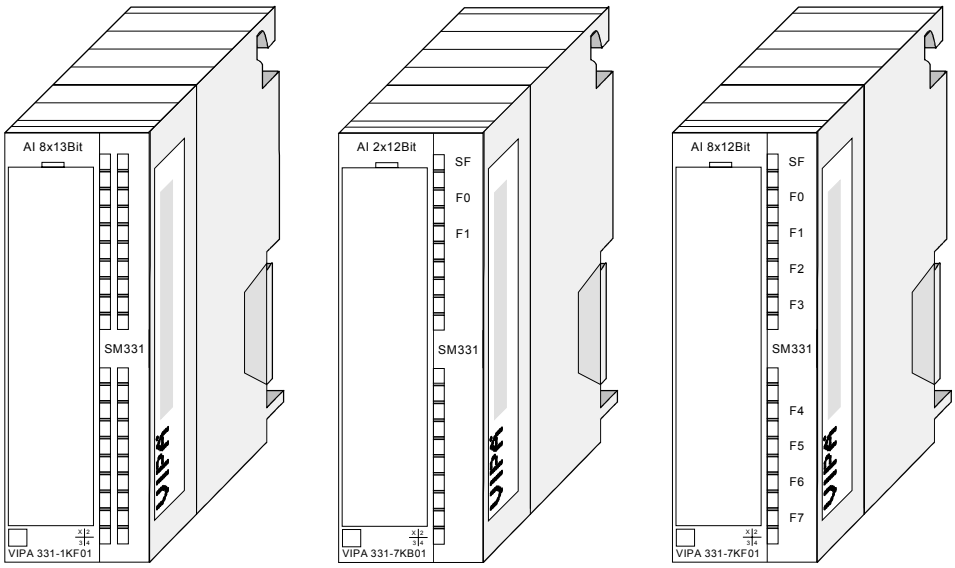
This chapter contains a description of the structure and the operation of the VIPA analog input modules.

Content

System overview

Input modules SM 331

The following gives you an overview of the analog input modules of the System 300V available from VIPA:



Order Data Analog input modules

Type	Order number	Page
AI 8x13Bit, U, I, R, Thermo, Pt/Ni100, Ni1000	VIPA 331-1KF01	6-7
AI 2x12Bit, U, I, R, Thermo, Pt/Ni100	VIPA 331-7KB01	6-16
AI 8x12Bit, U, I, R, Thermo, Pt/Ni100	VIPA 331-7KF01	6-16

Security hint

Attention!

Please regard that the modules described here do not have hardware precautions against wrong parameterization res. wrong wiring. The setting of the according measuring range is exclusively at the project engineering.

For example, the modules may get a defect if you connect a voltage at parameterized current measuring.

At the project engineering you should be very careful.

Please regard also that disconnecting res. connecting during operation is not possible!

Principles

Cables for analog signals

For analog signals you have to use isolated cables to reduce interference. The cable screening should be grounded at both ends. If there are differences in the potential between the cable ends, there may occur a potential compensating current that could disturb the analog signals. In this case you should ground the cable screening only at one end.

Connecting test probes

The analog input modules provide variant connecting possibilities for:

- Current sensor
- Voltage senor
- Resistance thermometer
- Thermocouple
- Resistors

Note!

Please take care of the correct polarity when installing the measuring transducer! Please install short circuits at non-used inputs by connecting the positive contact with the channel ground of the according channel.

Parameterization

The analog input modules from VIPA do not have any measuring range plug.

The modules are parameterized via the hardware configurator or during runtime via SFCs.

Diagnostic functions

The modules that are described in this chapter except the 331-1KF01 offer diagnostics functions.

The following errors may cause diagnostics:

- Error in the project engineering res. parameterization
- Wire break at current measuring
- Measuring range overstep
- Measuring range shortfall
- Common Mode Error
- Lost process interrupt
- Failure of the external power supply

For diagnostic evaluation during runtime, you may use the SFCs 51 and 59. They allow you to request detailed diagnostic information and to react to it.

Parameterization - Basics

Overview

The analog input modules from VIPA do not have any measuring range plug, so the measuring range is to be set by configuration.

There are the following possibilities for parameterization:

- Parameterization by hardware configuration of Siemens SIMATIC manager or with WinPLC7 from VIPA.
- Parameterization during run time by means of SFCs.

Parameterization by hardware configuration

To be compatible to the Siemens SIMATIC manager the following steps are to be accomplished:

- Start the hardware configurator from Siemens
- Create a new project
- Configure your CPU.
- Link-up your System 300V modules in the plugged-in sequence starting with slot 4. Here the analog input modules of VIPA are to be projected as analog input modules of Siemens:

  The analog input modules can be found at the hardware catalog at *SIMATIC 300 > SM-300.*

- If needed parameterize the CPU respectively the modules. The parameter window appears as soon as you double click on the according module. At this window the according parameter can be changed.
- Save your project, switch the CPU to STOP and transfer your project to the CPU. As soon as the CPU is switched to RUN the parameters are transferred to the connected modules.

Parameters

The following parameters can be adjusted at the analog input modules:

- Starting address of the input data
- Measuring range, measuring type and integration time
- Diagnostics and interrupt reaction (only 331-7Kx01)

Parameterization during runtime

By using the SFCs 55, 56 and 57 you may change the parameters of the analog modules during runtime via the CPU. The time needed until the new parameterization is valid can last up to a few ms. During this time the measuring value 7FFFh is issued.

The following example shows the assignment of record set 1 to the module 331-7Kx01 during run time.

Example

```
Var
  rec1        array  [0...13] of BYTE
  retval      INT
  busy        BOOL

Set Record set 1:
  L     B#16#0     //Diagnostic disabled
  T     #rec1[0]
  L     B#16#AA    //Interference freq. suppression
  T     #rec1[1]
  L     B#16#D4    //Meas. range Type S: 0100b
  T     #rec1[2]   //Meas. type: Thermocouple
  T     #rec1[3]   //Compensation internal: 1101b
  T     #rec1[4]   //for all channels
  T     #rec1[5]
  L     B#16#7F    //Upper limit value
  T     #rec1[6]   //channel 0: 7FFFh
  L     B#16#FF
  T     #rec1[7]
        :
  L     B#16#80    //Upper limit value
  T     #rec1[10]  //channel 2: 8000h
  L     B#16#00
  T     #rec1[11]
```

Record set 1 from module 331-7Kx01:

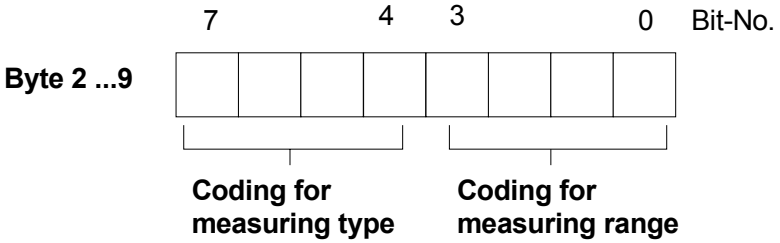
Byte	Bit 7 ... Bit 0
0	Bit 5 ... 0: reserved Bit 6: Diagnosis interrupt release Bit 7: Proc. interrupt release
1	Interference freq. suppression Bit 0, 1: Channel 0/1 Bit 2, 3: Channel 2/3 Bit 4, 5: Channel 4/5 Bit 6, 7: Channel 6/7
2	Mode Channel 0/1 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
3	Mode Channel 2/3 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
4	Mode Channel 4/5 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
5	Mode Channel 6/7 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
6, 7	Upper limit value Channel 0
8, 9	Lower limit value Channel 0
10, 11	Upper limit value Channel 2
12, 13	Lower limit value Channel 2

Transfer with SFC 55 "WR_PARM" Record set 1to Module:

```
Call     "WR_PARM"              //call SFC 55
  REQ      :=TRUE               //write request
  IOID     :=B#16#54            //identifier for the address space: peripheral input
  LADDR    :=W#16#100           //logical base address: 100
  RECNUM   :=B#16#1             //record number 1
  RECORD   :=#rec1              //record for Record set 1
  RET_VAL  :=#retval            //return value (0: no error >0: error code)
  BUSY     :=#busy              //BUSY = 1: the write operation has not been completed
```

Get mode

As shown in the following illustration the parameter *mode* is made up of the coding of the *measuring range* and *measuring type* during run time parameterization each channel respectively channel group.



The corresponding codes can be found at *parameterization* of each module.

The table is divided into *measuring type* like voltage, current, resistance measuring... . Here the corresponding binary code of the *measuring type* may be found.

Within the *measuring types* there are the *measuring ranges*, for which a binary *measuring range code* is to be specified in each case.

Example

Referring to the example specified above the mode is determined in the following:

Given: Measuring type: Thermocouple, compensation internal, linear
Measuring range: Type S

For the module 331-7Kx01 results from the table in the case of "Thermocouple with compensation internal, linear" the binary coding for measuring type: 1101b.

For Measuring range "Type S" the binary measuring range coding results as: 0100b.

By joining the two binary values you receive the following byte as *mode*: 1101 0100b = D4h.

331-1KF01 - AI 8x13Bit

Order data AI 8x13Bit VIPA 331-1KF01

Description

The analog input module transforms analog signals from the process into digital signals for the internal processing.

The module is pin and function compatible to the known module from Siemens. Plugging and unplugging during operation, is not supported.

Voltage and current encoders, resistors and resistor thermometers may be connected as sensors

Properties

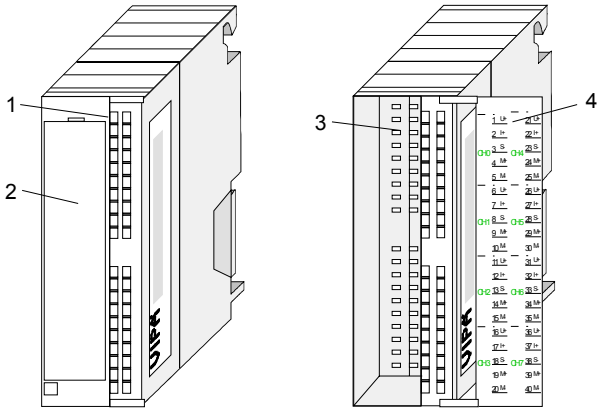
- 8 inputs
- Measuring value resolution 12bit + sign
- Isolated to the backplane bus

Default configuration

After Power ON the module has the following default configuration. These can be changed by hardware configuration.

- measuring range: ±10V for all channels
- integration time: 60ms

Structure



[1] LEDs (not active)

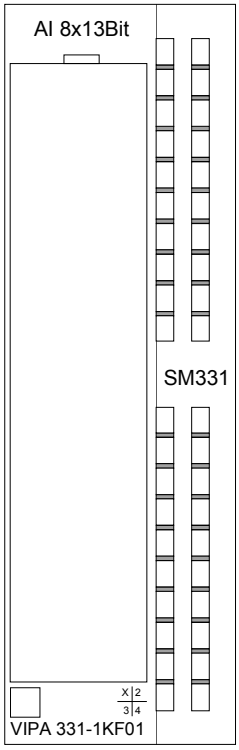
[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

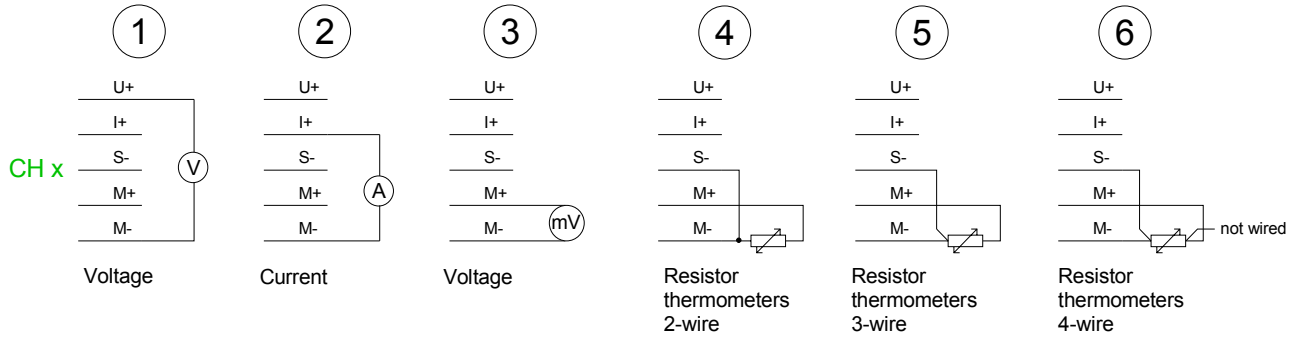
Pin assignment

Pin	Assignment	Connection		
1	U+ channel 0		1	U+
2	I+ channel 0		2	I+
3	S- channel 0	CH 0	3	S-
4	M+ channel 0		4	M+
5	M- channel 0		5	M-
6	U+ channel 1		6	U+
7	I+ channel 1		7	I+
8	S- channel 1	CH 1	8	S-
9	M+ channel 1		9	M+
10	M- channel 1		10	M-
11	U+ channel 2		11	U+
12	I+ channel 2		12	I+
13	S- channel 2	CH 2	13	S-
14	M+ channel 2		14	M+
15	M- channel 2		15	M-
16	U+ channel 3		16	U+
17	I+ channel 3		17	I+
18	S- channel 3	CH 3	18	S-
19	M+ channel 3		19	M+
20	M- channel 3		20	M-
21	U+ channel 4		21	U+
22	I+ channel 4		22	I+
23	S- channel 4	CH 4	23	S-
24	M+ channel 4		24	M+
25	M- channel 4		25	M-
26	U+ channel 5		26	U+
27	I+ channel 5		27	I+
28	S- channel 5	CH 5	28	S-
29	M+ channel 5		29	M+
30	M- channel 5		30	M-
31	U+ channel 6		31	U+
32	I+ channel 6		32	I+
33	S- channel 6	CH 6	33	S-
34	M+ channel 6		34	M+
35	M- channel 6		35	M-
36	U+ channel 7		36	U+
37	I+ channel 7		37	I+
38	S- channel 7	CH 7	38	S-
39	M+ channel 7		39	M+
40	M- channel 7		40	M-



Wiring diagrams

The following illustration shows the connection options for the different measuring ranges. The assignment to the measuring ranges is to find in the column "Conn." of the table "Measuring" on the next pages.



Note!

Please take care that the maximum permissible common-mode voltage of 2V between the inputs at connection of voltage and current giver is not exceeded. To avoid wrong measurements you connect the individual connections M- with each other.

At measuring of resistances and resistance thermometers a connection of the M- connections is not required.

Temporarily not used inputs with activated channel must be connected with the concerning ground. When not used channels are deactivated this is not necessary.

Representation of analog values

Analog values are exclusively processed by the CPU in a binary format. For this the analog module transforms every process signal into a digital and transfers this as word to the CPU.

At similar nominal range, the digitalized analog value for in- and output is identical.

Resolution

Because the resolution of the module is 12Bit plus sign-Bit, the not used low value positions (3 Bit) are filled with "0".

For the sign Bit is valid:

Bit 15 = "0" → positive value

Bit 15 = "1" → negative value

Resolution	Analog value															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	SG	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}
12bit + sign	SG	Measuring value												0	0	0

331-1KF01 - AI 8x13Bit - Parameterization

Overview

After Power ON the module is set to ±10V for all channels with an integration time of 60ms.

Via a hardware configuration you may parameterize the channels individually.

Place module

- Start the hardware configurator with the project the analog modules are to be configured.
- To place the analog module open the hardware catalog. There the module can be found at SIMATIC 300/SM-300/AI-300, order no.: 6ES7 331-1KF01-0AB0.
- Choose the according module and drag & drop it to the concerning slot in the hardware configurator.

Parameterize the module

Via double click on the wanted module in the hardware configurator you open the concerning parameter window.

You may alter the following parameters:

- Start address of the data of the module stored in the CPU
- Measuring range, measuring type and integration times for all of the 8 channels

Save and transfer project

- Save and compile your project
- Set your CPU to STOP
- Transfer your project into the CPU

As soon as you switch the CPU into RUN, the parameters are transmitted to the analog input module.

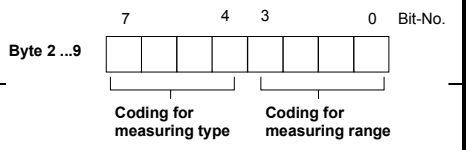
More detailed information about the parameters can be found on the following pages.

Structure of parameter byte (Record set 1)

At the parameterization, a parameter area of 14byte length is stored in the record set 1. Under deploying the SFCs 55, 56 and 57, you may alter the parameters during run time and transfer them to your analog module.

Record set 1 (Byte 0 to 13):

Byte	Bit 7 ... Bit 0
0	Temperature measuring: 0000 0000b: Grad Celsius 0000 1000b: Grad Fahrenheit 0001 0000b: Kelvin
1	Interference frequency suppression: 0000 0001b: *60Hz (50ms Integration time)* 0000 0010b: *50Hz (60ms Integration time)*
2	Mode channel 0 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
3	Mode channel 1 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
4	Mode channel 2 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
5	Mode channel 3 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
6	Mode channel 4 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
7	Mode channel 5 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
8	Mode channel 6 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
9	Mode channel 7 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type
10	Temperature coefficient: Bit 3 ... 0: channel 1 Bit 7 ... 4: channel 0
11	Temperature coefficient: Bit 3 ... 0: channel 3 Bit 7 ... 4: channel 2
12	Temperature coefficient: Bit 3 ... 0: channel 5 Bit 7 ... 4: channel 4
13	Temperature coefficient: Bit 3 ... 0: channel 7 Bit 7 ... 4: channel 6



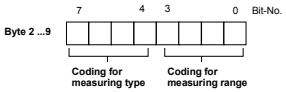
The according coding of measuring range and measuring type is described on the following pages.

To deactivate a channel the code 0000 0000 is used.

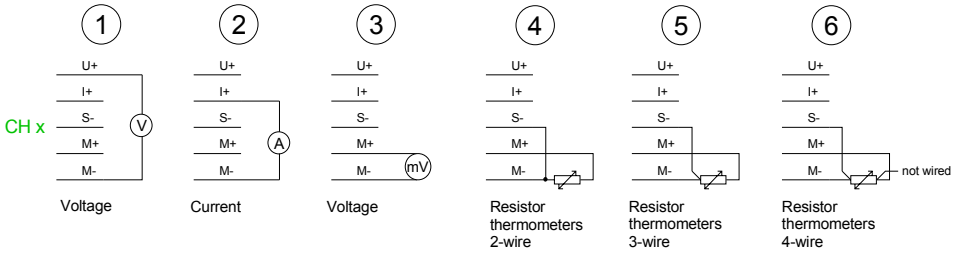
At temperature measurement a temperature coefficient is required. The table shows the according coefficient:

Measurem. range	Temperature coefficient	Coding each channel
Pt 100	Pt 0.003850Ω/Ω/°C (ITS-90)	0100b
Ni100 Ni1000	Ni 0.006180Ω/Ω/°C	1000b
LG-Ni 1000	Ni 0.005000Ω/Ω/°C	1010b

Mode per Channel



The following section shows an overview of all measuring types and ranges plus binary coding for the parameterization. Additionally, the wiring diagram assigned to the measuring range is shown in brackets.



*Measuring type Voltage measuring (**Measuring type coding: 0001b**)*

Measuring range (Connection)	Measuring range / Representation			Measuring range coding
+/- 50mV (Connection 3)	58.79mV - 50...50mV - 58.79mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0001b
+/- 500mV (Connection 3)	587.9mV - 500...500mV - 587.9mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0011b
+/- 1V (Connection 3)	1.176V - 1...1V - 1.175V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0100b
+/- 5V (Connection 1)	5.879V - 5...5V - 5.879V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0110b
1... 5V (Connection 1)	5.704V 1...5V 0.296V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (- 4864)	0111b
0 ... 10V (Connection 1)	11.759V 0...10V -1.759V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (- 4864)	1000b
+/- 10V (Connection 1)	11.759V - 10...10V - 11.759V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	1001b

*Measuring type Current measuring (**Measuring type coding: 0010b**)*

Measuring range (Connection)	Measuring range / Representation			Measuring range coding
0... 20mA (Connection 2)	23.52mA 0...20mA - 3.52mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (-4864)	0010b
4... 20mA (Connection 2)	22.81mA 4...20mA 1.185mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (-4864)	0011b
+/- 20mA (Connection 2)	23.52mA - 20...20mA - 23.52mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0100b

*Measuring type Resistance measuring (**Measuring type coding: 0101b**)*

Measuring range (Connection)	Measuring range / Representation			Measuring range coding
600 Ohm (Connect. 4, 5, 6)	705.53 Ohm 0...600 Ohm negative values physically not possible	= End Overdrive region = Nominal range	(32511) (0...27648)	0110b
6000 Ohm (Connect. 4, 5, 6)	7055.3 Ohm 0...6000 Ohm negative values physically not possible	= End Overdrive region = Nominal range	(32511) (0...27648)	1000b

*Measuring type Thermo resistance measuring (**Measuring type coding: 1001b)**, wiring diagram (Conn.: 4, 5, 6)*

Meas. range	°C (0.1°C/digit)	Unit dec.	°F (0.1°F/digit)	Unit dec.	K (0.1K/digit)	Unit dec.	Range	Range coding
Pt100 Standard	1000.0	10000	1832.0	18320	1273.2	12732	End Overdrive region	0010b
	850.0 ... -200.0	8500 ... -2000	1562 ... -328.0	15620 ... -3280	1123.2 ... 73.2	11232 ... 732	Nominal range	
	-243.0	-2430	-405.4	-4054	30.2	302	End Under-drive region	
Meas. range	°C (0.01°C/digit)	Unit dec.	°F (0.01°F/digit)	Unit dec.			Range	Range coding
Pt100 Climate	155.00	15500	311.00	31100	-	-	End Overdrive region	0000b
	130.00 ... -120.00	13000 ... -12000	266.00 ... -184.00	26600 ... -18400	-	-	Nominal range	
	-145.00	-14500	-229.00	-22900	-	-	End Under-drive region	
Meas. range	°C (0.1°C/digit)	Unit dec.	°F (0.1°F/digit)	Unit dec.	K (0.1K/digit)	Unit dec.	Range	Range coding
Ni100 Standard	295.0	2950	563.0	5630	568.2	5682	End Overdrive region	0011b
	250.0 ... -60.0	2500 ... -600	482..0 ... -76.0	4820 ... -760	523.2 ... 213.2	5232 ... 2132	Nominal range	
	-105.0	-1050	-157.0	-1570	168.2	1682	End Under-drive region	
Meas. range	°C (0.01°C/digit)	Unit dec.	°F (0.01°F/digit)	Unit dec.			Range	Range coding
Ni100 Climate	295.00	29500	327.66	32766	-	-	End Overdrive region	0001b
	250.00 ... -60.00	25000 ... -6000	280.00 ... -76.00	28000 ... 7600	-	-	Nominal range	
	-105.00	-10500	-157.00	-15700	-	-	End Under-drive region	
Meas. range	°C (0.1°C/digit)	Unit dec.	°F (0.1°F/digit)	Unit dec.	K (0.1K/digit)	Unit dec.	Range	Range coding
Ni 1000 / LG-Ni 1000 Standard	295.0	2950	563.0	5630	568.2	5682	End Overdrive region	0110b
	250.0 ... -60.0	2500 ... -600	482.0 ... -76.0	4820 ... -760	523.2 ... 213.2	5232 ... 2132	Nominal range	
	-105.0	-1050	-157.0	-1570	168.2	1682	End Under-drive region	
Meas. range	°C (0.01°C/digit)	Unit dec.	°F (0.01°F/digit)	Unit dec.			Range	Range coding
Ni 1000 / LG-Ni 1000 Climate	295.00	29500	327.66	32766	-	-	End Overdrive region	1010b
	250.00 ... -60.00	25000 ... -6000	280.00 ... -76.00	28000 ... 7600	-	-	Nominal range	
	-105.00	-10500	-157.00	-15700	-	-	End Under-drive region	

When exceeding the overdrive region 32767 (7FFFh) is issued, falling below the underdrive region -32768 (8000h) is issued.

331-1KF01 - AI 8x13Bit - Technical Data

Order number	331-1KF01
Type	SM 331
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	255 mA
Power loss	1.3 W
Technical data analog inputs	
Number of inputs	8
Cable length, shielded	200m / 50m at measuring range ±50mV
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	-50 mV ... +50 mV -500 mV ... +500 mV -1 V ... +1 V -5 V ... +5 V 0 V ... +10 V -10 V ... +10 V +1 V ... +5 V
Operational limit of voltage ranges	+/-0.5% ... +/-0.6%
Basic error limit voltage ranges with SFU	+/-0.3% ... +/-0.4%
Current inputs	✓
Min. input resistance (current range)	100 Ω
Input current ranges	-20 mA ... +20 mA 0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.5%
Basic error limit current ranges with SFU	+/-0.3%
Resistance inputs	✓
Resistance ranges	0 ... 600 Ohm 0 ... 6000 Ohm
Operational limit of resistor ranges	+/-0.5%
Basic error limit	+/-0.3%
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100 Ni100 Ni1000
Operational limit of resistance thermometer ranges	+/-1K ... +/-1.2K
Basic error limit thermoresistor ranges	+/-0.8K
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	13
Measurement principle	Sigma-Delta
Basic conversion time	61 ms/51 ms / channel
Noise suppression for frequency	50 Hz/60 Hz
Initial data size	16 Byte

Order number	**331-1KF01**
Status information, alarms, diagnostics	
Status display	none
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	260 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

331-7Kx01 - AI 8(2)x12Bit

Order data

AI 8x12Bit	VIPA 331-7KF01
AI 2x12Bit	VIPA 331-7KB01

Description

The analog input modules transform analog signals from the process into digital signals for the internal processing. The modules are pin and function compatible to the modules from Siemens with the same name.

Please regard that contrary to the Siemens modules the modules specified here do not have any measuring range plug. The attitude of the designated measuring range exclusively takes place during software project engineering. Plugging and unplugging during operation, is not supported. Voltage and current sensors, thermocouples, resistors and resistance thermometers may be connected.

Properties

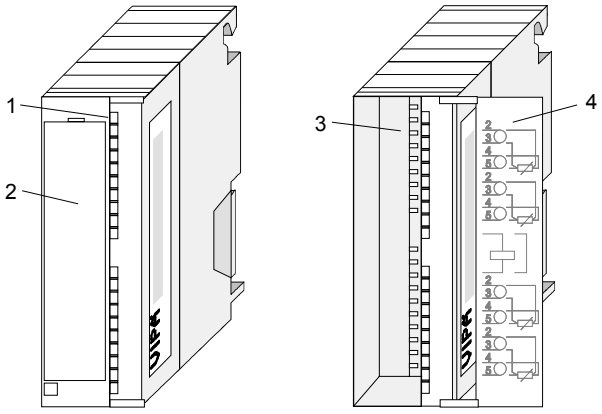
- 8 inputs in 4 channel group (331-7KF01)
- 2 inputs in 1 channel group (331-7KB01)
- Measuring value resolution 14Bit + sign
- Configurable diagnostic and process interrupt
- Isolated to the backplane bus

Measuring range after Power ON

After Power ON both modules have the following default configuration. These can be changed by hardware configuration:

- measuring range: ±10V for all channels
- integration time: 20ms
- Interrupts deactivated

Structure



[1] LEDs

[2] flap with labeling strip

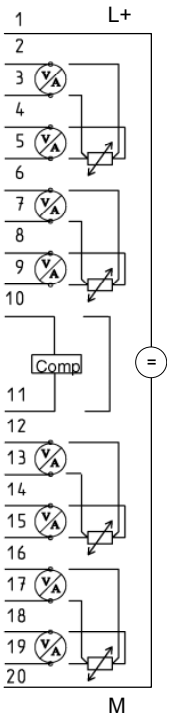
[3] contact bar

[4] flap opened with inner label

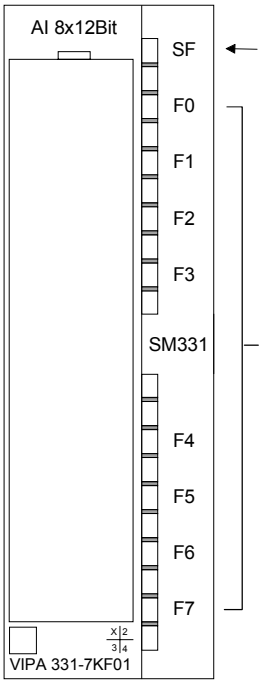
Pin assignment status monitor

Pin	Assignment
1	Power supply DC 24V
2	+ Channel 0
3	Ground Channel 0
4	+ Channel 1
5	Ground Channel 1
6	+ Channel 2
7	Ground Channel 2
8	+ Channel 3
9	Ground Channel 3
10	+ Compensation slot
11	Ground Compens. slot
12	+ Channel 4
13	Ground Channel 4
14	+ Channel 5
15	Ground Channel 5
16	+ Channel 6
17	Ground Channel 6
18	+ Channel 7
19	Ground Channel 7
20	Ground

Connection



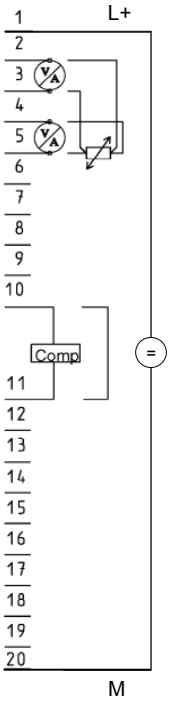
331-7KF01



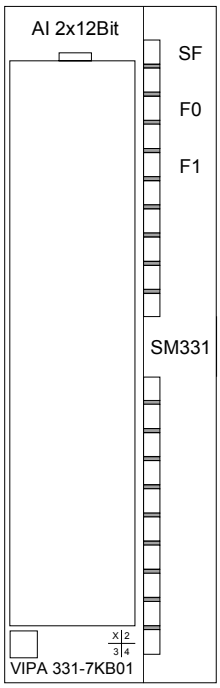
LED	Description
SF	LED (red) Group error, ON as soon as a diagnostic entry is present respectively during missing external voltage supply
F0...7	LED (red) Channel error, ON together with SF if error respectively overflow measuring range per channel

Pin	Assignment
1	Power supply DC 24V
2	+ Channel 0
3	Ground Channel 0
4	+ Channel 1
5	Ground Channel 1
6	n.c.
.	.
.	.
.	.
9	n.c.
10	+ Compensation slot
11	Ground Compens. slot
12	n.c.
.	.
.	.
.	.
19	n.c.
20	Ground

Connection



331-7KB01



LED	Description
SF	LED (red) Group error, ON as soon as a diagnostic entry is present respectively during missing external voltage supply
F0 F1	LED (red) Channel error, ON together with SF if error respectively overflow measuring range per channel

Connection of sensors

Regarding the fact, that parameterized inputs can be left unused due to the building of channel groups, you have to connect the unused inputs with the associated ground.

If you want to use the internal compensation when deploying thermo-couples, the 2 COMP inputs have to be bridged too.

In the following all connection types of sensors for a pair of channels are specified.

Installation of current sensors

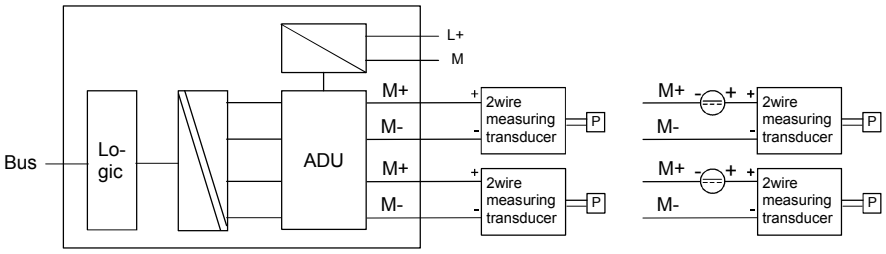
Current sensors as 2wire or 4wire measuring transducer

The 2wire measuring transducer gets the supply voltage (13V at 30mA) short-circuit resistant via the clamps of the analog input module. The 2wire measuring transducer transduces the measuring value into a current.

With use of 2wire measuring transducer with a voltage >13V you may connect in line an external power supply. But here you have to deactivate the internal power supply, by selecting 4wire operation during hardware configuration.

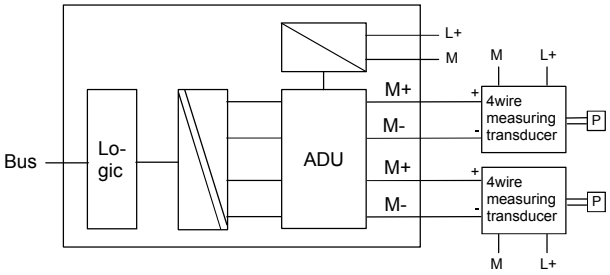
2wire measuring transducer

The following picture illustrates the connection of 2wire measuring transducers with internal respectively external power supply:



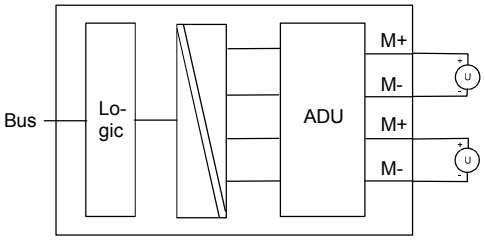
4wire measuring transducer

Please regard that the 4wire measuring transducers have to be provided external.



Installation of voltage sensors

The following picture shows the installation of voltage sensors at a channel pair of a potential separated analog input module:



M+: measuring line (positive)
M-: measuring line (negative)

Installation of thermocouples AI 8(2)x12Bit

The thermo pair consists of two wires of different metals or metal alloys which are soldered or welded together at the ends. The different combinations of metals cause different thermocouple types, e.g. K, J, N.

Operating basics

Independent from the type of the thermocouple the principle of measuring is identical for all types:

When the measuring point has another temperature than the free ends of the thermo pair (connection point), a voltage occurs between the free ends, the thermo voltage.

The amount of the thermo voltage depends on the difference between the temperature at the measuring point and the temperature at the free ends. For a thermo pair always records a temperature difference, the free ends have to be set on a comparison point with known temperature, to determine the temperature at the measuring point.

Extension to a comparison point

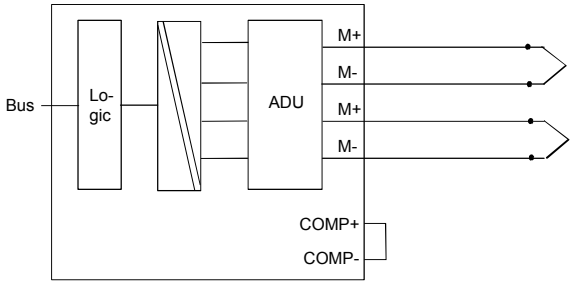
The thermo pairs may be extended from your connecting point to a point with known temperature (comparison point) via compensating lines.

The compensating lines have the same material as the wires of the thermocouple. The leads are out of copper. In this case you should use the external compensation. Please regard pole correct installation, for this may cause enormous measuring errors.

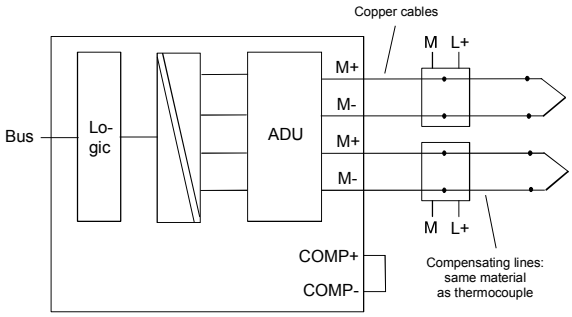
Installation variants

The following pictures show the different installation possibilities of thermocouple with and without compensation slot.

Thermocouples without compensation slot and internal compensation



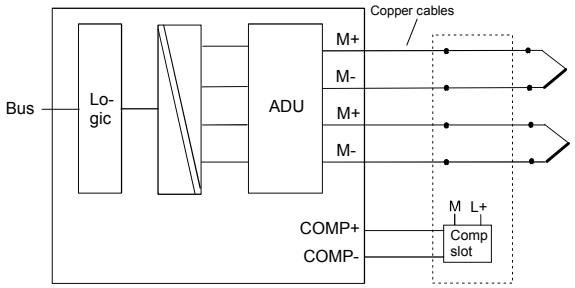
Thermocouples without compensation slot and external compensation



M+: measuring line (positive)
M-: measuring line (negative)
COMP+: Compensation connection (positive)
COMP-: Compensation connection (negative)

When connecting thermocouples without compensation slot and parameterized internal compensation, the temperature compensation happens via a temperature sensor in the module per channel pair. At external compensation, thermocouples with integrated compensation have to be used.

Thermocouples with compensation slot

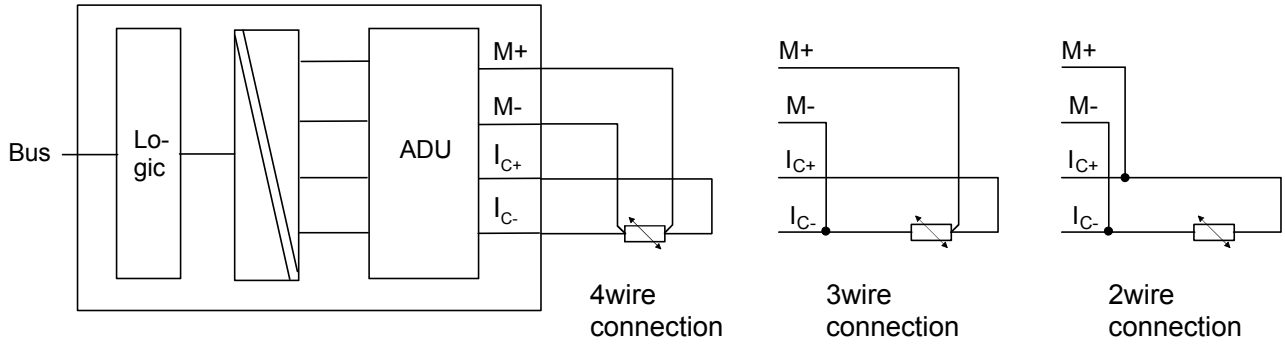


When connecting thermocouples with one compensation slot, you have to regard that the thermocouples have the same type.

The compensation slot is to be connected at COMP+ and COMP- and is to be supplied external.

Installation of resistance thermometers and resistors

The installation of resistance thermometers/resistors needs 4wires. Via the connections I_{C+} and I_{C-} the resistance thermometer/resistor gets a constant current. The voltage occurring at the resistor thermometer/resistor is measured via the connections M+ and M-.



M+: measuring line (positive)
M-: measuring line (negative)
I_{C+}: constant current line (positive)
I_{C-}: constant current line (negative)

By appropriate bridges on the module between M+ and I_{C+} respectively M- and I_{C-} you can attach also resistance thermometers in 2- and 3wire technique. Due to the not considered conduit length you have to count on losses of accuracy with the result of the measurement.

Channel allocation

At "resistance thermometers-/resistors measuring" the whole channel group (both channels) are used. The measured value can be found at the area of the 1. channel of the group. The 2. channel of the group is predefined with the overflow value "7FFFh".

Thermocouples with Pt100 reference junction (since firmware V1.3.8)

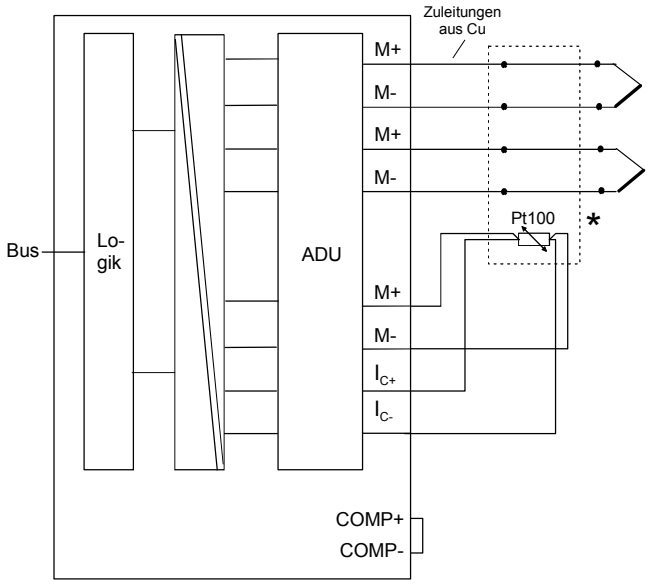
Starting with firmware version 1.3.8 of the analog module, there is the possibility to connect a Pt100 reference junction for compensation.

With this connection variant the temperature of the reference junction is evaluated by means of a Pt100 resistance thermometer. For this the channel group tied up to Pt100 reference junction is to be parameterized as "Pt100 reference junction". Only one channel group may be parameterized as "Pt100 reference junction".

Every channel, which is parameterized on "thermocouple with external compensation", uses the temperature of the Pt100 reference junction for evaluation.

Compared to the compensating box there is the possibility to use thermocouples of different type at the same time. The temperature evaluation is more exactly than internal compensation, too.

Since this variant is not supported by the Siemens SIMATIC manager, the parameterization only takes place exclusively at run time.



M+: measuring line (positive)
M-: measuring line (negative)
I_{C+}: constant current line (positive)
I_{C-}: constant current line (negative)

*) With a wire break at the Pt100 reference junction for evaluation, the 1. channel of one group shows the value 7FFFh.

Connection Pt100 reference junction

The installation of the Pt100 reference junction needs 4 wires. By appropriate bridges on the module between M+ and I_{C+} respectively M- and I_{C-} you also may attach Pt100 in 2- and 3wire technique. Due to the not considered conduit length you have to count on losses of accuracy with the result of the measurement.

Here via the connections I_{C+} and I_{C-} the Pt resistance thermometer gets a constant current. The voltage occurring at the Pt100 resistor thermometer is measured via the connections M+ and M-.

Channel allocation

At Pt100 reference junction the whole channel group (both channels) are used. The measured value can be found at the area of the 1. channel of the group. The 2. channel of the group is predefined with the overflow value "7FFFh".

Every channel, which is parameterized on "thermocouple with external compensation", uses this measuring value for evaluation even in a case of a wire break it contains the value 7FFFh.

Analog value representation

The analog values are only processed by the CPU in binary representation. Hereby the process signals are transformed into digital format in the analog module and passed on to the CPU as word variable.

The digitized analog value is the same for input and output values at the same nominal range.

Resolution

The resolution of an analog value is 14 Bit plus sign Bit. Bit 15 serves as sign bit (SG) with the meaning:

Bit 15 = "0" → positive value

Bit 15 = "1" → negative value

Depending upon parameterized interference frequency (integration time) the modules offers different resolutions. The not used low byte bits are set to "0".

Resolution	Analog value															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	SG	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}
14bit + sign	SG	Measuring value (interference frequency 10Hz)														0
12bit + sign	SG	Measuring value (interference frequency 50, 60Hz)												0	0	0
9bit + sign	SG	Measuring value (interference frequency 400Hz)									0	0	0	0	0	0

Note!

This resolution does not apply to temperature levels. The converted temperature levels are the result of a conversion of the analog module.

Behavior at over- and underflow

As soon as a measured value exceeds the overdrive region and/or falls below the underdrive region, the following value is issued:

Measuring value > end of overdrive region: 32767 (7FFFh)

Measuring value < end of underdrive region: -32768 (8000h)

331-7Kx01 - AI 8(2)x12Bit - Parameterization

Overview

After power ON every channel of the modules is adjusted to ±10V with an interference frequency of 50Hz. The diagnostic function is deactivated.

At the parameterization, a record set of 16byte length is transferred to both modules. Here the AI 2x12Bit (331-7KB01) uses the parameters for the channel group 0/1 the parameters for further channel groups are ignored.

Note!

Parameters which are not supported by the Siemens hardware configurator may only be changed during run time by means of SFCs.

Install module

- Start the hardware configurator and load your project for the analog module.
- Open the hardware catalog to install the analog input module.
  In the hardware catalog the analog modules with the order-no.:
  6ES7 331-7KB01 (2x12Bit) and 6ES7 331-7KF01 (8x12Bit) can be found at SIMATIC 300/SM-300/AI-300.
- Choose the according module and drag & drop this module to the concerning slot in the hardware configurator.

Parameterize the module

Via double click on the wanted module in the hardware configurator you open the concerning parameter window.

You can change the following module parameters:

- Starting address for CPU mapping
- Measuring ranges, measuring type and integration times for channel pairs
- Process interrupt at limit value overflow for channel 0 and channel 2
- Limit value action at overflow
- Diagnosis and group diagnosis for each channel pair at wire break or measuring range over-/underflow.

Save and transfer your project

- Save and translate your project
- Switch your CPU in STOP
- Transfer your project into the CPU

As soon as you switch the CPU into RUN, the parameters are transmitted to the analog input module.

More information about the parameters can be found at the following pages.

Structure of the parameter bytes Record set 0, Record set 1

At the parameterization, a parameter area of 16byte length is stored in the record sets 0 and 1. Here the data irrelevant for the module AI 2x12Bit (331-7KB01) are ignored.
Using the SFCs 55, 56 and 57 you can only change parameters at record set 1 and transfer during runtime to the analog module. On this way parameters may be transferred which are not supported by the Siemens SIMATIC manager, as e.g. setting of high temperature measuring ranges.

Parameter Record set 0
(not parameterizable via SFC)

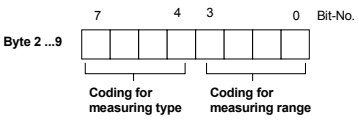
Record set 0 (Byte 0 to 1):

Byte	Bit 7 ... Bit 0	Default
0	Group diagnosis bit coded Bit 0: Channel 0/1 Bit 1: Channel 2/3 Bit 2: Channel 4/5 Bit 3: Channel 6/7 Bit 7 ... 4: reserved	00h
1	Wire break test bit coded Bit 0: Channel 0/1 Bit 1: Channel 2/3 Bit 2: Channel 4/5 Bit 3: Channel 6/7 Bit 7 ... 4: reserved	00h

Parameter Record set 1
(parameterizable via SFC)

Record set 1 (Byte 0 to 13):

Byte	Bit 7 ... Bit 0	Default
0	Bit 5 ... 0: reserved Bit 6: Diagnostic interrupt release Bit 7: Process interrupt release	00h
1	Interference frequency suppression Bit 0, 1: Channel 0/1 Bit 2, 3: Channel 2/3 Bit 4, 5: Channel 4/5 Bit 6, 7: Channel 6/7 00: 400Hz (2.5ms) 01: 60Hz (16.6ms) 10: 50Hz (20ms) 11: 10Hz (100ms)	AAh
2	Mode Channel 0/1 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	19h (+/-10V)
3	Mode Channel 2/3 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	19h (+/-10V)
4	Mode Channel 4/5 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	19h (+/-10V)
5	Mode Channel 6/7 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	19h (+/-10V)
6, 7	Upper limit value Channel 0	7FFFh
8, 9	Lower limit value Channel 0	8000h
10, 11	Upper limit value Channel 2	7FFFh
12, 13	Lower limit value Channel 2	8000h



For the according coding of measuring range and measuring type see "Modus per channel" at the following pages.

Note for deactivating a channel group!
With the Coding 0000 0000 a channel group may be deactivated.

Modus per channel pair

The following section shows an overview of all measuring types and ranges plus binary coding for the parameterization.

*Measuring type Voltage measuring (**Measuring type coding: 0001b**)*

Measuring range	Range / Representation			Range coding
+/- 80mV	94.071mV - 80...80mV - 94.074mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0001b
+/- 250mV	293.97mV - 250...250mV - 293.98mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0010b
+/- 500mV	587.94mV - 500...500mV - 587.96mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0011b
+/- 1V	1.175V - 1...1V - 1.175V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0100b
+/- 2.5V	2.939V - 2.5...2.5V - 2.933V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0101b
+/- 5V	5.879V - 5...5V - 5.879V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0110b
+/- 10V	11.758V - 10...10V - 11.759V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	1001b
1... 5V	5.703V 1...5V 0.296V	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (- 4864)	0111b

*Measuring type 4wire Current measuring (**Measuring type coding: 0010b**)*

Measuring range	Range / Representation			Range coding
+/- 3.2mA	3.762mA - 3.2...3.2mA - 3.762mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0000b
+/- 10mA	11.758mA - 10...10mA - 11.758mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0001b
+/- 20mA	23.515mA - 20...20mA - 23.515mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	0100b
0... 20mA	23.515mA 0...20mA - 3.518mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (-4864)	0010b
4... 20mA	22.810mA 4...20mA 1.185mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (-4864)	0011b

*Measuring type 2wire Current measuring (**Measuring type coding: 0011b**)*

Measuring range	Range / Representation			Range coding
4... 20mA	22.810mA 4...20mA 1.185mA	= End Overdrive region = Nominal range = End Underdrive region	(32511) (0...27648) (-4864)	0011b

*Measuring type 4wire Resistance measuring (**Measuring type coding: 0100b**)*

Measuring range	Range / Representation		Range coding
150 Ohm	176.383 Ohm = End Overdrive region 0...150 Ohm = Nominal range negative values physically not possible	(32511) (0...27648)	0010b
300 Ohm	352.767 Ohm = End Overdrive region 0...300 Ohm = Nominal range negative values physically not possible	(32511) (0...27648)	0100b
600 Ohm	705.534 Ohm = End Overdrive region 0...600 Ohm = Nominal range negative values physically not possible	(32511) (0...27648)	0110b

*Measuring type 4wire Thermo resistance (**Measuring type coding: 1000b**)*

Measuring range	Range / Representation		Range coding
Pt100 Standard	1000°C = End Overdrive region - 200...850°C = Nominal range - 243°C = End Underdrive region (0.1°C/digit)	(10000) (-2000...8500) (-2430)	0010b
Pt100 Climate	155°C = End Overdrive region - 120...130°C = Nominal range - 145°C = End Underdrive region (0.01°C/digit)	(15500) (-12000...13000) (-14500)	0000b
Pt 100 reference junction	1000 = End Overdrive region -100...200 = Nominal range -243 = End Underdrive region (0.1°C/Digit)	(10000) (-1000...2000) (-2430)	1101b[2)]
Ni100 Standard	295°C = End Overdrive region - 60...250°C = Nominal range - 105°C = End Underdrive region (0.1°C/digit)	(2950) (-600...2500) (-1050)	0011b [1)]
Ni100 Climate	295°C = End Overdrive region - 60...250°C = Nominal range - 105°C = End Underdrive region (0.01°C/digit)	(29500) (-6000...25000) (-10500)	0001b

1) Please use up to the firmware version V.1.2.6 of the analog module the coding 1011b.
The current firmware version may be found at the front flap beneath the label strip.

2) The measuring range Pt100 reference junction is available starting with firmware version V. 1.3.8. Since this measuring range is not supported by the Siemens SIMATIC manager, the parameterization only takes place exclusively at run time.

Measuring type Thermocouple:

*compensation external, linear (**Measuring type coding: 1110b**)*
*compensation internal, linear (**Measuring type coding: 1101b**)*

Measuring range	Range / Representation in °C (0.1°C/digit)			Range coding
Type J [Fe-Cu-Ni IEC]	1450°C -210...1200°C -210°C	= End Overdrive region = Nominal range = End Underdrive region	(14500) (-2100... 12000) (-2100)	0101b
Type K [Ni-Cr-Ni]	1622°C -270... 1372°C -270°C	= End Overdrive region = Nominal range = End Underdrive region	(16220) (-2700... 13720) (-2700)	1000b
Type N [Ni-Cr-Si]	1550°C -270...1300°C -270°C	= End Overdrive region = Nominal range = End Underdrive region	(15500) (-2700...13000) (-2700)	0001b
Type E [Ni-Cr - Cu-Ni]	1200°C -270...1000°C -270°C	= End Overdrive region = Nominal range = End Underdrive region	(12000) (-2700...10000) (-2700)	0010b
Type L [Fe-Cu-Ni]	1150°C -200...900°C -200°C	= End Overdrive region = Nominal range = End Underdrive region	(11500) (-2000...9000) (-2000)	0110b
Type T [Cu-Cu-Ni]	540 -270...400 -270	= End Overdrive region = Nominal range = End Underdrive region	(5400) (-2700...4000) (-2700)	0111b[1)]
Type R [PtRh-Pt]	2019 -50...1769 -170	= End Overdrive region = Nominal range = End Underdrive region	(20190) (-500...17690) (-1700)	0011b[1)]
Type S [PtRh-Pt]	2019 -50...1769 -170	= End Overdrive region = Nominal range = End Underdrive region	(20190) (-500...17690) (-1700)	0100b[1)]
Type B [PtRh-PtRh]	2070 0...1820 -120	= End Overdrive region = Nominal range = End Underdrive region	(20700) (0...18200) (-1200)	0000b[1)]
Type C [WRe5-WRe26]	2500 0...2315 -120	= End Overdrive region = Nominal range = End Underdrive region	(25000) (0...23150) (-1200)	1010b[1)]

Measuring type Thermocouple:

*compensation external (**Measuring type coding: 1011b**)*
*compensation internal (**Measuring type coding: 1010b**)*

The evaluated thermo electromotive force is added to the force of the internal or external reference junction and is mapped to the 80mV measuring range.

Measuring range	Range / Representation			Range coding
Type J [Fe-Cu-Ni IEC]				0101b
Type K [Ni-Cr-Ni]				1000b
... and so on (see above)	94.071mV - 80...80mV - 94.074mV	= End Overdrive region = Nominal range = End Underdrive region	(32511) (-27648...27648) (-32512)	. . .
Type C [WRe5-WRe26]				1010b[1)]

[1)] The measuring range is available starting with firmware version V. 1.3.8. Since this measuring range is not supported by the Siemens SIMATIC manager, the parameterization only takes place exclusively at run time.

331-7Kx01 - AI 8(2)x12Bit - Diagnostics

Diagnostics

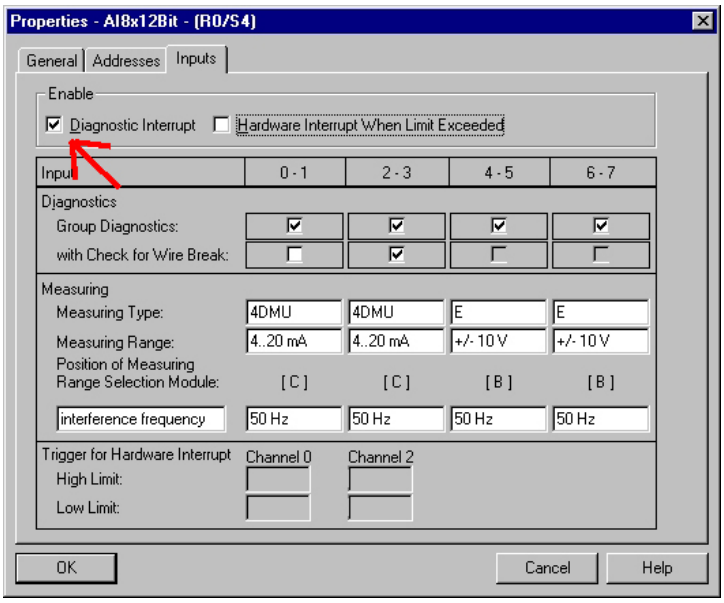
As soon as an error occurs, like "wire break" or "measuring value out of range", an entry is made in the diagnostic area that can be evaluated by means of the user application.

If you have released the diagnostic interrupts at the parameterization, incoming and outgoing error events are signaled by interrupts and monitored on the according analog input module via LED.

At a diagnostic interrupt the CPU interrupts the user application and works off the OB 82. For more detailed diagnostic information you may call the SFC 51 res. SFC 59 in the OB 82. The diagnostic data is consistent until you leave the OB 82.

Starting the diagnosis

When an error occurs and after error correction, the diagnosis is started. Via the parameterization you fix the diagnosis behavior at error:



A diagnostic interrupt is only transmitted to the CPU, if you activate the diagnostic interrupt in the parameterization window.

The following errors may initialize a diagnosis:

- Error in project engineering res. parameterization
- Wire break at current measuring
- Measuring range overflow
- Measuring range underflow
- Common mode error
- Lost process interrupt
- Failure of the external voltage supply

Error indication via measuring value and LEDs

Every analog input module sends, independent from the parameterization, the measuring value 7FFFh at overflow and 8000h at underflow when recognizing an error.

At activated *group diagnosis* the group diagnosis-LED (SF) and the error-LED that is assigned to that channel are blinking.

If you additionally activated the *wire break diagnosis* at current measuring, a wire break is shown via the error LED assigned to this channel.

Evaluating the diagnosis

At a diagnosis event the CPU interrupts the user program and branches into OB 82. This OB allows you via according programming to request detailed diagnostic information by means of the SFCs 51 and 59 and react to it.

After processing of the OB 82, the processing of the user application is continued. The diagnostic data are consistent until leaving the OB 82.

As soon as you have activated the diagnostic interrupt release, *record set 0* is transferred to the superordinated system in cause of an error. The *record set 0* has a fixed content and a length of 4byte. The content of *record set 0* may be monitored in plain text in the diagnosis window of the CPU.

For the extended diagnosis during run time, you may also evaluate the *record set 1* of 16byte length via SFCs 51 and 59.

Record set 0 and 1 have the following structure:

Diagnosis record set 0

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Error in module Bit 1: reserved Bit 2: External error Bit 3: Channel error Bit 4: external voltage supply missing Bit 6, 5: reserved Bit 7: Wrong parameters in module	00h
1	Bit 3 ... 0: Module class 0101 Analog module Bit 4: Channel information present Bit 7 ... 5: reserved	15h
2	reserved	00h
3	Bit 5 ... 0: reserved Bit 6: Process interrupt lost Bit 7: reserved	00h

Diagnostics record set 1

Byte 0 to 15:

The record set 1 contains the 4byte of record set 0 and additionally 12byte module specific diagnostic data.

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 15):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	Content record set 0 (see page before)	-
4	Bit 6 ... 0: Channel type 70h: Digital input 71h: Analog input 72h: Digital output 73h: Analog output 74h: Analog in-/output Bit 7: More channel types present 0: no 1: yes	71h
5	Bit 7 ... 0: Number of diagnostic bits, that the module throws per channel	08h
6	Bit 7 ... 0: Number of similar channels of a module	04h
7	Bit 0: Channel error Channel 0 ... Bit 7: Channel error Channel 7	00h
8	Bit 0: Project engineering/Parameterization error Channel 0 Bit 1: Common mode error Bit 3 ... 2: reserved Bit 4: Wire break Channel 0 Bit 5: reserved Bit 6: Underflow Channel 0 Bit 7: Overflow Channel 0	00h
...	...	
15	Bit 0: Project engineering/Parameterization error Channel 7 Bit 1: Common mode error Bit 3 ... 2: reserved Bit 4: Wire break Channel 7 Bit 5: reserved Bit 6: Underflow Channel 7 Bit 7: Overflow Channel 7	00h

Note!

Please note that the AI 2x12Bit (331-7KB01) exclusively supplies diagnostic data of the channel group 0/1!

Error cause and remedy

Message	Possible error cause	Remedial
Project engineering/ Parameterization error	Parameterization at run time: Wrong function code in record set	Proof the parameterization during run time
Wire break	Sensor allocation is too high-impedance	install another sensor type or cable with a higher cross-section
	Interruption of the conductor between module and sensor	Install conductor connection
	Channel is not wired (open)	Deactivate the channel group (parameter measuring type)
		Wire the channel
Measuring range underflow	Input value is under the underdrive region, error causes may be: • at measuring range 4 ... 20mA, 1 ... 5V - sensor connection polarity inversion - wrong measuring range • other measuring ranges - wrong measuring range	 Check connections Parameterize another measuring range Parameterize another measuring range
Measuring range overflow	Input value higher than overdrive region	Parameterize another measuring range
Process interrupt lost	During the processing of a process interrupt in OB40, a new process interrupt with the same error cause occurs.	
Failure of the external power supply	Connection of the external power supply forgotten Power supply failure Cable defect res. not correctly connected	Supply the module with external DC 24V Control external power supply and change it Control cable res. replace it
Common mode	Different potentials between grounds >3V or wire break at ground	Remove wire break, lower potential difference

Process interrupts

Process interrupts are limit value interrupts. They occur if they are released via parameterization and a measuring value is outside the defined range. Process interrupts may only parameterized for the channels 0 and 2.

When a process interrupt occurs, the CPU interrupts the user application and processes the OB 40.

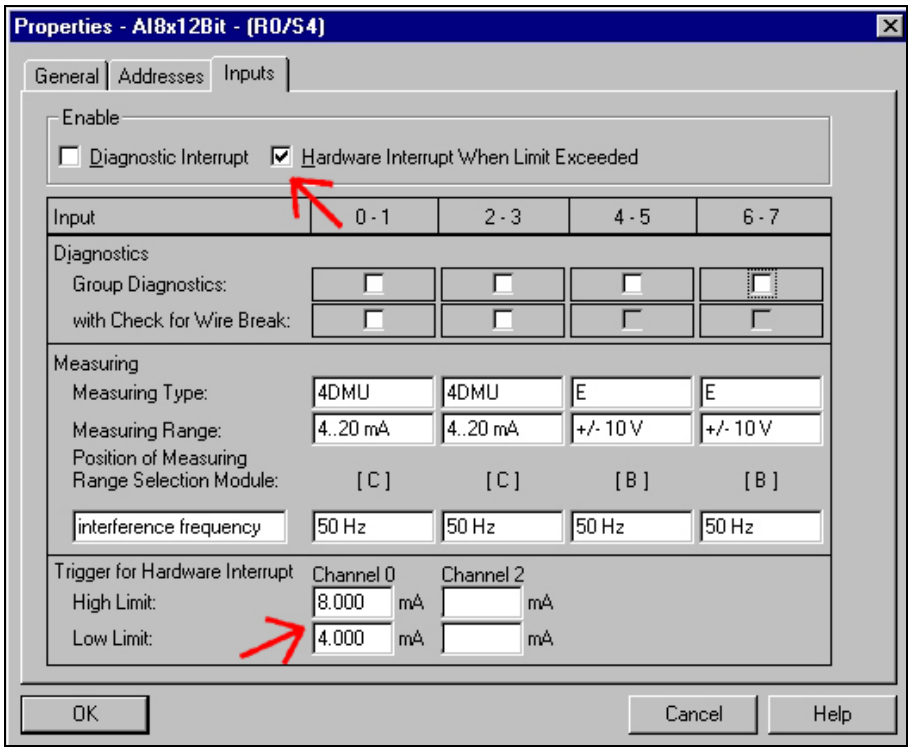
With the help of the OB 40 you may define, how your CPU should react at a process interrupt.

Initializing the process interrupt

As soon as a measuring value is out of the range defined in the parameterization, a processes interrupt is initialized, if this option is released.

Via the parameterization you define the part of the nominal range, in which the value has to be, by means of defining high and low limit.

A process interrupt may only be initialized, when you have activated *hardware interrupt when limit exceeded*.



You may activate a process interrupt for channel 0 and 2.

Using the default configuration, the process interrupts are not activated.

Reaction to a the process interrupt

At a process interrupt the CPU interrupts the user application and branches into the OB 40.

More detailed information about the channel, which limit value has been exceeded, are stored in the OB 40 in the variable OB 40_POINT_ADR in the local data double word 8 (LD 8).

The LD 8 has the following structure:

Byte	Bit 7... Bit 0
0	Bit:0 = 1: Upper limit value of channel 0 has been exceeded Bit:1 = 1: Upper limit value of channel 2 has been exceeded
1	Bit:0 = 1: Lower limit value of channel 0 has been exceeded Bit:1 = 1: Lower limit value of channel 2 has been exceeded
2 ... 3	reserved

Diagnostic message "Process interrupt lost"

If a second identical process interrupt occurs during processing interrupt in OB 40, the CPU branches into the OB 82 and activates the bit 6 in record set 0 of byte 3 for "process interrupt lost".

After having processed the OB 82, the CPU jumps back to OB 40.

Influence of the measuring values

The behavior of the analog input module depends on the location of the measuring value inside the value range.

The following table lists the different behaviors:

Measuring value is in	transmitted	SF-LED [4]	Diagnostics	Interrupt
Nominal range	meas. value	-	-	-
Over-/Underdrive region	meas. value	-	-	-
Overflow	7FFFh	ON [3]	Entry is set [3]	Diag. interrupt [1]
Underflow	8000h	ON [3]	Entry is set [3]	Diag. interrupt [1]
outside the parameterized limit value	meas. value	-	-	Process interrupt [2]

[1] only if diagnostic interrupt is released in the parameterization.

[2] only if process interrupt is released in the parameterization.

[3] only if group diagnostics is released in the parameterization.

[4] independently from the chosen diagnostics, the group error LED is on when the external power supply is missing.

331-7KF01 - AI 8x12Bit - Technical Data

Order number	331-7KF01
Type	SM 331
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	95 mA
Power loss	3 W
Technical data analog inputs	
Number of inputs	8
Cable length, shielded	200m / 50m at measuring range ±80mV
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	100 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	-80 mV ... +80 mV -250 mV ... +250 mV -500 mV ... +500 mV -1 V ... +1 V -2.5 V ... +2.5 V -5 V ... +5 V +1 V ... +5 V -10 V ... +10 V
Operational limit of voltage ranges	+/-0.6% ... +/-1.0%
Basic error limit voltage ranges with SFU	+/-0.4% ... +/-0.7%
Current inputs	✓
Min. input resistance (current range)	85 Ω
Input current ranges	-3.2 mA ... +3.2 mA -10 mA ... +10 mA -20 mA ... +20 mA 0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.7%
Basic error limit current ranges with SFU	+/-0.5%
Resistance inputs	✓
Resistance ranges	0 ... 150 Ohm 0 ... 300 Ohm 0 ... 600 Ohm
Operational limit of resistor ranges	+/-0.7%
Basic error limit	+/-0.5%
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100 Ni100
Operational limit of resistance thermometer ranges	+/-0.7% ... +/-0.8%
Basic error limit thermoresistor ranges	+/-0.5% ... +/-0.6%
Thermocouple inputs	✓
Thermocouple ranges	type J type R type K type N type L type E type T type S type B

Order number	**331-7KF01**
	type C
Operational limit of thermocouple ranges	+/-1.3% ... +/-2.0%
Basic error limit thermoelement ranges	+/-0.7% ... +/-1.0%
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	14
Measurement principle	Sigma-Delta
Basic conversion time	4ms...68ms / channel
Noise suppression for frequency	10 Hz/400 Hz
Initial data size	16 Byte
Status information, alarms, diagnostics	
Status display	none
Interrupts	yes
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	red SF LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 3 V
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	DC 3 V
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	240 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

331-7KB01 - AI 2x12Bit - Technical Data

Order number	331-7KB01
Type	SM 331
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	95 mA
Power loss	3 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	-
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	100 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	-80 mV ... +80 mV -250 mV ... +250 mV -500 mV ... +500 mV -1 V ... +1 V -2.5 V ... +2.5 V -5 V ... +5 V +1 V ... +5 V -10 V ... +10 V
Operational limit of voltage ranges	+/-0.6% ... +/-1.0%
Basic error limit voltage ranges with SFU	+/-0.4% ... +/-0.7%
Current inputs	✓
Min. input resistance (current range)	85 Ω
Input current ranges	-3.2 mA ... +3.2 mA -10 mA ... +10 mA -20 mA ... +20 mA 0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.7%
Basic error limit current ranges with SFU	+/-0.5%
Resistance inputs	✓
Resistance ranges	0 ... 150 Ohm 0 ... 300 Ohm 0 ... 600 Ohm
Operational limit of resistor ranges	+/-0.7%
Basic error limit	+/-0.5%
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100 Ni100
Operational limit of resistance thermometer ranges	+/-0.7% ... +/-0.8%
Basic error limit thermoresistor ranges	+/-0.5% ... +/-0.6%
Thermocouple inputs	✓
Thermocouple ranges	type J type R type K type N type L type E type T type S type B type C

Order number	**331-7KB01**
Operational limit of thermocouple ranges	+/-1.3% ... +/-2.0%
Basic error limit thermoelement ranges	+/-0.7% ... +/-1.0%
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	14
Measurement principle	Sigma-Delta
Basic conversion time	4 ms/18 ms/22 ms/68 ms / channel
Noise suppression for frequency	10 Hz/400 Hz
Initial data size	4 Byte
Status information, alarms, diagnostics	
Status display	none
Interrupts	yes
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	red SF LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 3 V
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	DC 3 V
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	220 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Thermocouple for high temperature measurement

The thermocouples for high temperature measurement (Type S, B, C, R) produce physically caused smaller thermo electromotive forces than the "normal" thermocouples (Type E, N, J, K, L).

In the following table there is a comparison between the thermo electromotive forces of the thermocouple of the type N to type S, B, C, R.

Thermo electromotive forces of Thermocouples	0°C	500°C	1000°C	1700°C
Type N in µV / °C	26	38	39	not possible
Type S in µV / °C	5	10	12	12
Type B in µV / °C	0	5	9	11
Type C in µV / °C	13	19	18	14
Type R in µV / °C	5	11	13	13

Chapter 7 Analog Output Modules

Outline

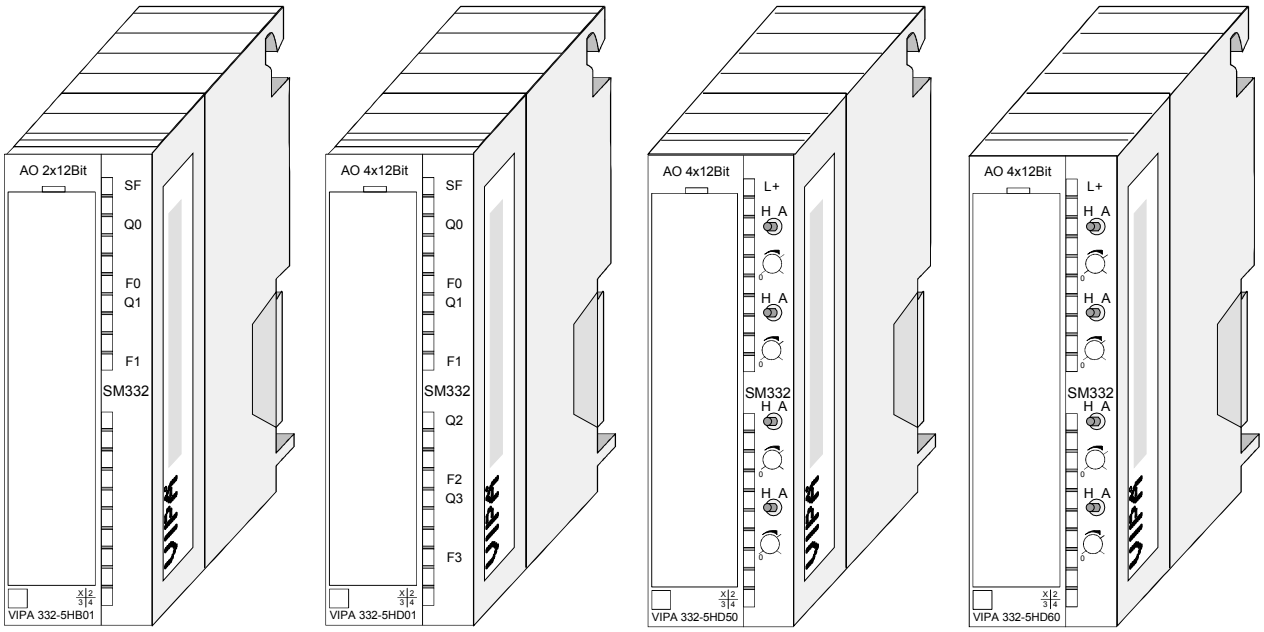
This chapter contains a description of the structure and the operation of the VIPA analog output modules.

Content

System overview

Analog output modules SM 332

In the following you will get an overview over the analog output modules that are available at VIPA:



Order data analog output modules

Type	Order number	Page
AO 2x12Bit, U/I	VIPA 332-5HB01	7-13
AO 4x12Bit, U/I	VIPA 332-5HD01	7-13
AO 4x12Bit, I for manual operation	VIPA 332-5HD50	7-19
AO 4x12Bit, U for manual operation	VIPA 332-5HD60	7-19

Security hint

Attention!

Please regard that the modules VIPA 332-5Hx01 do not have hardware precautions against wrong parameterization. The setting of the according measuring range is exclusively at the project engineering. At the project engineering you should be very careful.

With the modules VIPA 332-5HDx0 you can cause a jump in the analog value by means of the switch, independently of the mode of operation of the CPU, as long as the module is power supplied. This could lead to material damage or personal injury!

Please regard also that disconnecting res. connecting during operation, the so-called "Hot Swapping", is not possible!

General

Cables for analog signals

For analog signals you should use isolated cables to reduce interference. The cable screening should be grounded at both ends. If there are differences in the potential between the cable ends, there may occur a potential compensating current that could disturb the analog signals. In this case you should ground the cable screening only at one end.

Connecting loads and actuators

Depending on the module the following actuators may be connected:

- Current input: ±20mA, 4 ... 20mA, 0 ... 20mA
- Voltage input: ±10V, 1 ... 5V, 0 ... 10V

Note!

Please take always care of the correct polarity when connecting actuators!

Please leave the output pins of not used channels disconnected and configure the *output type* of the channel to "deactivated".

Parameterization

The modules can be configured by means of a hardware configuration or rather during run time by SFCs.

In not parameterized status, the modules with order number 332-5Hx01 are set to voltage output "±10V". The interrupt output of every module is deactivated.

Diagnostic functions

Every module described here has diagnostic functions. Depending on the module the following errors may initialize a diagnostic message:

A diagnostic interrupt is only transmitted to the CPU, if you have activated the diagnostic interrupt in the parameterization window.

The following errors a diagnosis:

- Wire break at current output (only 332-5Hx01)
- Ground short circuit (only 332-5Hx01)
- Operate the front switch (only 332-5HDx0)
- Failure of the external voltage supply
- Project engineering and parameterization error

For more detailed diagnostic information you may call the SFCs 51 and 59 during run time. You can request detailed diagnostic information and react on it by means of the SFCs.

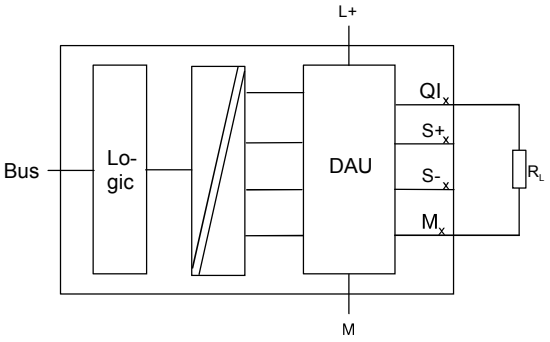
Output pulse at Power ON/OFF and at output range alterations during run time

System-dependently at switching on/off the power supply and at output range alterations during run time, there may arise wrong values for app. 10ms.

Connecting loads and actuators

Connecting loads at current output

Loads at the current output have to be connected at Q_X and associated ground M_X of the analog circuit. Please always pay attention to correct polarity.

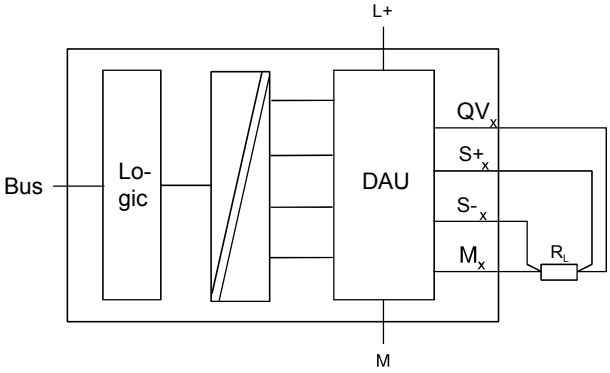


Connecting loads at voltage output at 4-wire cabling (only 332-5Hx01)

The connection of a load at a voltage output can take place both in 2- and in 4-wire cabling. Please note with the modules 332-5HDx0 the 4-wire cabling is not possible.

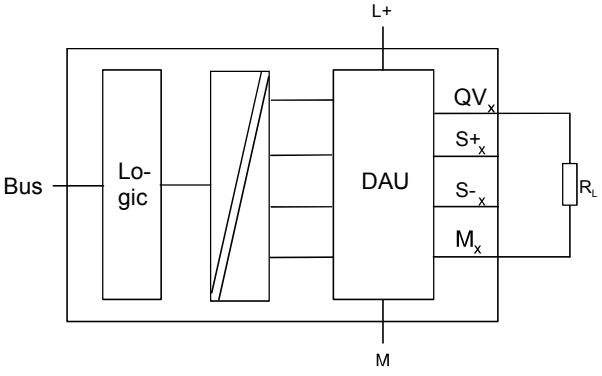
With 4-wire cabling you achieve a high exactness at the load. The sensor lines $S+_X$ and $S-_X$ are directly connected to the load. Thus, the voltage may be measured and adjusted directly at the load.

Interference or voltage losses may cause potential differences between $S-_X$ and M_X. These should not exceed the permissible value of DC 3V, because this may disturb the accuracy of the analog signal.



Connecting loads at voltage output at 2-wire cabling

Connect the load at pin QV_X and the point of reference of the measuring circle M_X (x = No. of the channel).



Analog value representation

Analog value representation

The analog values are only processed by the CPU in binary representation. Hereby the process signals are transformed into digital format in the analog module and passed on to the CPU as word variable.

The digitized analog value is the same for input and output values at the same nominal range.

The resolution depends on the used module as follows:

	Analog value															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Resolution	SG	Analog value (word)														
12bit + Sign	SG	Relevant output value												X	X	X
11bit + Sign	SG	Relevant output value											X	X	X	X
10bit + Sign	SG	Relevant output value										X	X	X	X	X

* The least significant irrelevant bits of the output value are marked by "X".

Sign bit (SG)

The algebraic sign bit is represented by Bit 15. Here it is essential:

Bit 15 = "0" → positive value

Bit 15 = "1" → negative value

Parameterization - Basics

Overview

There are the following possibilities for parameterization:

- Parameterization by hardware configuration of Siemens SIMATIC manager or with WinPLC7 from VIPA.
- Parameterization during run time by means of SFCs.

Parameterization by hardware configuration

To be compatible to the Siemens SIMATIC manager the following steps are to be accomplished:

- Start the hardware configurator from Siemens
- Create a new project
- Configure your CPU.
- Link-up your System 300V modules in the plugged-in sequence starting with slot 4. Here the analog output modules of VIPA are to be projected as analog output modules of Siemens in accordance with the following rules:

  VIPA 332-5HD01 to be configured as **6ES7 332-5HD01-0AB0**
  VIPA 332-5HDx0

  VIPA 332-5HB01 to be configured as **6ES7 332-5HB01-0AB0**

  The analog output modules can be found at the hardware catalog at *Simatic 300 > SM-300.*

- If needed parameterize the CPU respectively the modules. The parameter window appears as soon as you double click on the according module. At this window the according parameter can be changed.
- Save your project, switch the CPU to STOP and transfer your project to the CPU. As soon as the CPU is switched to RUN the parameters are transferred to the connected modules.

Parameters

The following parameters can be adjusted at the analog output modules:

- Starting address of the output data
- Output type and behavior
- Reaction at CPU-STOP
- Diagnostics and interrupt reaction

A closer description of the parameters can be found at the following pages.

Parameterization during run time by means of SFCs

If the module gets parameters, which are not supported by the module, for example a current module is to be configured as a voltage module, these parameters are interpreted as wrong parameters and an error is initialized.

At the parameterization, 16byte long parameter area is set in the record sets 0 and 1. Deploying the SFCs 55, 56 and 57, you may alter parameters during run time and transfer them to the module. The following tables show the structure of the parameters in record set 0 and 1:

Parameters Record set 0
(not parameterizable via SFC)

Record set 0 (Byte 0 to 1):

Byte	Bit 7 ... Bit 0	Default
0	Sum diagnosis bit coded Bit 0: Channel 0 Bit 1: Channel 1 Bit 2: Channel 2 Bit 3: Channel 3 Bit 7 ... 4: reserved	00h
1	reserved	00h

Parameters Record set 1

Record set 1 (Byte 0 to 13):

Byte	Bit 7 ... Bit 0	Default 332-5Hx01	Default 332-5HD50	Default 332-5HD60
0	Bit 5 ... 0: reserved Bit 6: Diagnostic interrupt release Bit 7: reserved	00h	00h	00h
1	Reaction at CPU-STOP Bit 0: Channel 0 Bit 1: Channel 1 Bit 2: Channel 2 Bit 3: Channel 3 0: Switch output current and voltage free res. set replacement value 1: hold last value	00h	00h	00h
2	Mode Channel 0 Bit 3 ... 0: Output range Bit 7 ... 4: Output type	19h (+/-10V)	23h (4...20mA)	18h (0...10V)
3	Mode Channel 1 Bit 3 ... 0: Output range Bit 4 ... 7: Output type	19h (+/-10V)	23h (4...20mA)	18h (0...10V)
4	Mode Channel 2 Bit 3 ... 0: Output range Bit 7 ... 4: Output type	19h (+/-10V)	23h (4...20mA)	18h (0...10V)
5	Mode Channel 3 Bit 3 ... 0: Output range Bit 7 ... 4: Output type	19h (+/-10V)	23h (4...20mA)	18h (0...10V)
6, 7	Replacement value Channel 0	0000h	0000h	0000h
8, 9	Replacement value Channel 1	0000h	0000h	0000h
10, 11	Replacement value Channel 2	0000h	0000h	0000h
12, 13	Replacement value Channel 3	0000h	0000h	0000h

The according coding of output type and output range can be found at the following page!

Note!

With setting the mode parameter to 00h the according channel is deactivated. To switch at not symmetric output range the current respectively the voltage output to 0 value at CPU STOP, the following replacement values should be used:

output range 1...5V: 0V ↔ -6912dez = E500h

output range 4...20mA: 0mA ↔ -6912dez = E500h

Release diagnostic interrupt

Please regard as soon as you release the diagnostic interrupt at run time, the according group diagnostics are just activated during hardware configuration. Otherwise no interrupt can be initialized.

More information can be found at "Diagnostics" further down.

CPU-Stop reaction

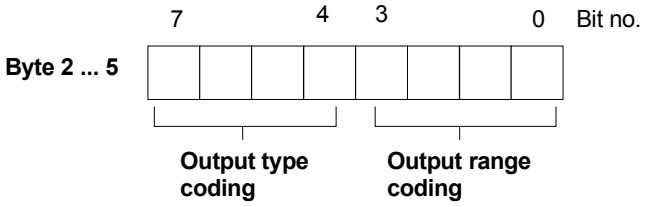
Here the module reaction at CPU-STOP can be set. You have the following possibilities:

- 0CV: output de-energized (according to the module)
- KLV: Keep last value
- SV: Substitute a value

Get mode output type output range

Depending on the module at the register "Outputs" at *Output* the type voltage, current output or deactivated and the according range can be selected.

As shown in the following illustration the parameter *mode* is made up of the coding of the output range and type during run time parameterization each channel.



The corresponding codes can be found in the following table. Within the output types the output ranges are specified, for which a binary output range code is to be specified in each case.

Output type voltage output ***(Output type coding: 0001b)***

Output range	Range / Unit	Output range coding
0...10V	11.758V= End overdrive region (32511) 0...10V = Nominal region (0...27648)	1000b
1...5V	5.879V = End overdrive region (32511) 1...5V = Nominal range (0...27648) 0V = End underdrive region (-6912)	0111b
+/- 10V	11.758V = End overdrive region (32511) -10...10V = Nominal range (-27648...27648) -11.759V = End underdrive region (-32512)	1001b

Output type current output ***(Output type coding: 0010b)***

Output range	Range / Unit	Output range coding
0...20mA	23.515mA = End overdrive region (32511) 0...20mA = Nominal range (0...27648)	0010b
4...20mA	22.810mA = End overdrive region (32511) 4...20mA = Nominal range (0...27648) 0mA = End underdrive region (-6912)	0011b
+/- 20mA	23.515mA = End overdrive region (32511) -20...20mA = Nominal range (-27648...27648) -23.515mA = End underdrive region (-32512)	0100b

Diagnostics

Outline

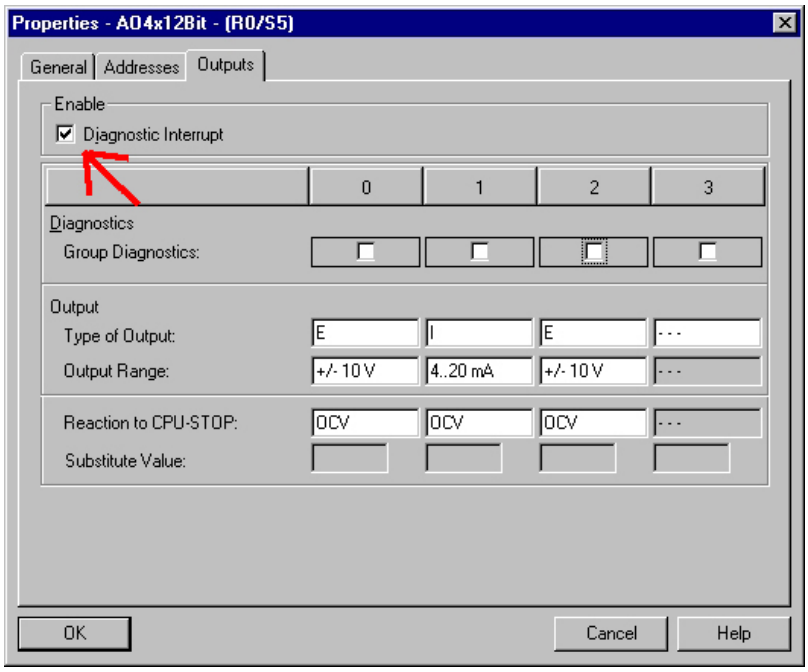
As soon as an error occurs and activated *Group diagnostics*, it is protocolled in the diagnostic area that can be evaluated by means of the user application.

If the diagnostic interrupt is released at the parameterization, incoming and outgoing error events are signaled by interrupts and monitored on the according analog output module via LED.

At a diagnostic interrupt the CPU interrupts its user application and works on the OB 82. For more detailed diagnostic information you may call the SFC 51 res. SFC 59 in the OB 82. The diagnostic data is consistent until you leave the OB 82.

Starting the diagnosis

When an error occurs and after error correction, the diagnosis is started. Via the parameterization you fix the diagnosis behavior at error:



A diagnostic interrupt is only transmitted to the CPU, if you have activated the diagnostic interrupt in the parameterization window.

The following errors a diagnosis:

- Wire break at current output (only 332-5Hx01)
- Ground short circuit (only 332-5Hx01)
- Operate the front switch (only 332-5HDx0)
- Failure of the external voltage supply
- Project engineering and parameterization error

Diagnostics data

The diagnostics data is stored in the record sets 0 and 1 of the system data area.

As soon as you have activated the diagnostic interrupt release of the parameter area (record set 1, byte 0), on error *record set 0* of the diagnostics data is transferred to the superordinated system.

For extended diagnosis during run time, you may also evaluate the *Record set 1* via the SFCs 51 and 59.

Evaluate diagnosis

At a diagnostics event the CPU interrupts the user program and branches into OB 82. This OB allows you via according programming to request detailed diagnostic information by means of the SFCs 51 and 59 and react to it.

After the working off of the OB 82, the processing of the user application is continued. The diagnostic data are consistent until leaving the OB 82.

Diagnosis Record set 0

The *record set 0* has a fixed content. The content of *record set 0* may be monitored in plain text in the diagnosis window of the CPU.

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Error in module Bit 1: reserved Bit 2: External error Bit 3: Channel error Bit 4: external voltage supply missing Bit 5, 6: reserved Bit 7: Wrong parameter in module	00h
1	Bit 3 ... 0: Module class 0101 Analog module Bit 4: Channel information present	15h
2	Bit 0, 1 reserved Bit 2: Operating status 0: RUN 1: STOP Bit 7 ... 4: reserved	00h
3	not used	00h

Diagnosis Record set 1

The record set 1 contains the 4byte of record set 0 and additionally 8byte module specific diagnostic data.

The diagnostic bytes have the following content:

Byte	Bit 7 ... Bit 0		Default
0 ... 3	Content record set 0 (see page before)		
4	Bit 6 ...0: Channel type: 73h: Analog output Bit 7: More channel types present 0: no 1: yes		73h
5	Bit 7 ... 0: Number of diagnostic bits, that the module throws per channel		08h
6	Bit 7 ... 0: Number of similar channels of a module		04h
7	Bit 0: Channel error Channel 0 Bit 1: Channel error Channel 1 Bit 2: Channel error Channel 2 Bit 3: Channel error Channel 3 Bit 4: Channel error Channel 4 Bit 7 ... 5: reserved		00h
	332-5Hx01	332-5HDx0	
8	Channel specific error: Channel 0 Bit 0: Project engineering/ Parameterization error Bit 1, 2: reserved Bit 3: Short circuit after M Bit 4: Wire break Bit 7...5: reserved	Channel specific error: Channel 0 Bit 0: Project engineering/ Parameterization error Bit 4...1: reserved Bit 5: Front switch 0: Automatic 1: Hand operation Bit 7...6: reserved	00h
9	Channel specific error: Channel 1 Content see Channel 0	Channel specific error: Channel 1 Content see Channel 0	00h
...			
11	Channel specific error: Channel 3 Content see Channel 0	Channel specific error: Channel 3 Content see Channel 0	00h
12 ... 15	reserved		

Channel error by switching to manual operation at 332-5HDx0

The switch to *manual operation* is interpreted as a channel error. The appropriate bit for channel errors in byte 7 of record set 1 is set.

An $Interrupt_{going}$ is only possible if all by group diagnostics activated switches are turned to automatic operation.

Error indication via LEDs (only 332-5Hx01)

At activated *group diagnostics* the group error LED (SF) and the according channel error LED are activated by diagnostic requirement of the modules with order no. 332-5Hx01.

Evaluating the diagnosis

At a diagnostic requirement the CPU interrupts the user program and branches into OB 82. This OB allows you via according programming to request detailed diagnostic information by means of the SFCs 51 and 59 and react to it.

After the working off of the OB 82, the processing of the user application is continued. The diagnostic data are consistent until leaving the OB 82.

Error cause and remedy

Message	Possible error cause	Remedial
External load voltage missing	Load voltage L+ of the module is missing	Proof connections L+ and M, Proof power supply
Project engineering/ Parameterization error	Wrong parameters have been transferred to the module	Proof parameterization
Ground short circuit (only 332-5Hx01)	Output overload Short circuit of the output QV after M-	Remove overload Check load connection for short circuit
Wire break (only 332-5Hx01)	Line interruption between module and actuator actuator is too high-resistance Channel is not used	Check line Use another actuator type Use lines with more core-cross section Deactivate channel in parameterization
Front switch manual mode (only 332-5HDx0)	Manual intervention by means of the front switch.	switch all by group diagnostics activated switches to *automatic operation*.

332-5Hx01 - AO 2/4x12Bit U/I

Order data

AO 2x12Bit	VIPA 332-5HB01
AO 4x12Bit	VIPA 332-5HD01

Description

Depending on the module there are up to 4 analog outputs which functions may be parameterized individually.

The module has to be provided with external DC 24V.

Properties

- 4 individual parameterizable outputs (332-5HB01 has 2 output channels)
- the outputs are parameterizable per channel as
  - voltage output
  - current output
  - deactivated
- usable for actuators with inputs of ±10V, 1 ... 5V, 0 ... 10V, ±20mA, 4 ... 20mA or 0 ... 20mA
- parameterizable diagnostics and diagnostics interrupt
- isolated between backplane bus and load voltage

Parameterization

After Power ON, the modules have the following default settings:

- Output range: ±10V for all channels
- Interrupts are deactivated

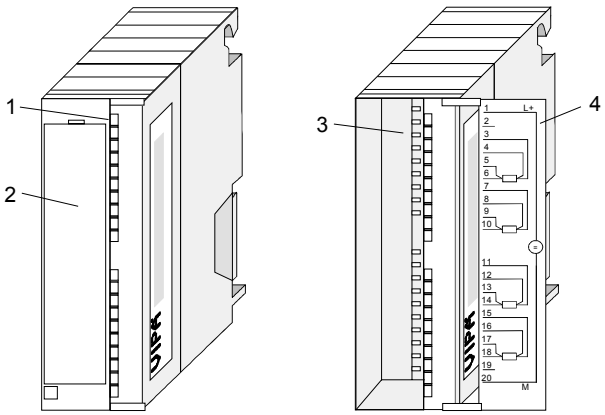
The modules are to be projected as analog output modules of Siemens in accordance with the following rules:

VIPA 332-5HB01	to be configured as	**6ES7 332-5HB01-0AB0**
VIPA 332-5HD01	to be configured as	**6ES7 332-5HD01-0AB0**

Note!

The deployment of the module at the active backplane bus is not possible!

Structure



[1] LEDs

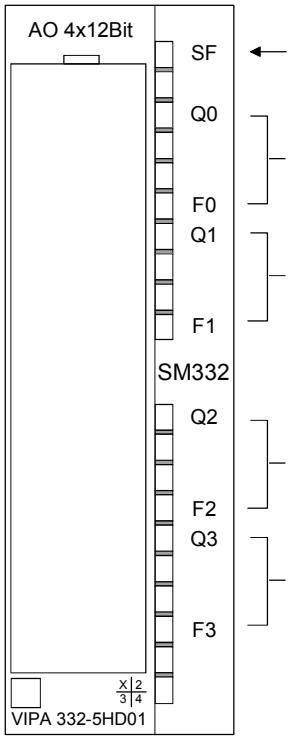
[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

Pin assignment
Status monitor

Pin	Circuit diagram
1	1 L+ DC 24V
2	2
3	3 QI_0 QV_0
4	4 $S+_0$
5	5 CH0 $S-_0$
6	6 M_0 M_0
7	7 QI_1 QV_1
8	8 $S+_1$
9	9 CH1 $S-_1$
10	10 M_1 M_1
11	
12	11 QI_2 QV_2
13	12 $S+_2$
14	13 CH2 $S-_2$
15	14 M_2 M_2
16	15 QI_3 QV_3
17	16 $S+_3$
18	17 CH3 $S-_3$
19	18 M_3 M_3
20	19
	20 M



LED	Description
SF	LED (red) Sum error, flashes at missing ext. voltage supply
Q0 ... Q3	LED (green) the according channel is activated
F0 ... F3	LED (red) Error channel 0 ... 3

Note!
Please regard, that you must not connect the S-Pin at current output!

Restriction AO 2x12Bit (332-5HB01)

Due to the 2 channels of the module the channels CH2 and CH3 and the LEDs Q2, Q3, F2 and F3 are not available.

Status monitor via LEDs

LED	Description
SF	Group error: On at parameterized group diagnostics, as soon as a diagnostic entry is present. On independently from diagnostics at missing external voltage supply
Q0...Q3	Channel active On when the according output channel has been activated
F0... F3	Channel error On together with SF at the according channel with error.

Technical data 332-5HB01

Order number	**332-5HB01**
Type	SM 332
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Power loss	2.5 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	-
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	70 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	1 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	-10 V ... +10 V 0 V ... +10 V +1 V ... +5 V
Operational limit of voltage ranges	+/-0.2% ... +/-0.8%
Basic error limit voltage ranges with SFU	+/-0.1% ... +/-0.5%
Current outputs	✓
Max. in load resistance (current range)	500 Ω
Max. inductive load (current range)	10 mH
Output current ranges	-20 mA ... +20 mA 0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.8%
Basic error limit current ranges with SFU	+/-0.2% ... +/-0.5%
Settling time for ohmic load	0.2 ms
Settling time for capacitive load	1 ms
Settling time for inductive load	1 ms
Resolution in bit	13
Conversion time	0.5 ms all channels
Substitute value can be applied	yes
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	red SF LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and	-

Order number	**332-5HB01**
Mintern (Uiso)	
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

1) The error limits were determined with a load R=1GΩ.
At voltage output the resistance of output of the module amounts 30Ω.

2) The error limits were determined with a load R=10Ω.

Technical data 332-5HD01

Order number	**332-5HD01**
Type	SM 332
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	125 mA
Power loss	3.5 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	-
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	115 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	1 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	-10 V ... +10 V 0 V ... +10 V +1 V ... +5 V
Operational limit of voltage ranges	+/-0.2% ... +/-0.8%
Basic error limit voltage ranges with SFU	+/-0.1% ... +/-0.5%
Current outputs	✓
Max. in load resistance (current range)	500 Ω
Max. inductive load (current range)	10 mH
Output current ranges	-20 mA ... +20 mA 0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.8%
Basic error limit current ranges with SFU	+/-0.2% ... +/-0.5%
Settling time for ohmic load	0.2 ms
Settling time for capacitive load	1 ms
Settling time for inductive load	1 ms
Resolution in bit	13
Conversion time	1 ms all channels
Substitute value can be applied	yes
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	red SF LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and	-

Order number	**332-5HD01**
Mintern (Uiso)	
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

332-5HDx0 - AO 4x12Bit for manual operation

Order data

AO 4x12Bit I for manual operation	VIPA 332-5HD50
AO 4x12Bit U for manual operation	VIPA 332-5HD60

Description

For each channel there is a 2-pole switch with associated potentiometer on the front side of the two modules. An analog value may be preset by the potentiometer, which is issued at the corresponding channel by switching to manual operation.

The module has to be provided with external DC 24V.

Properties

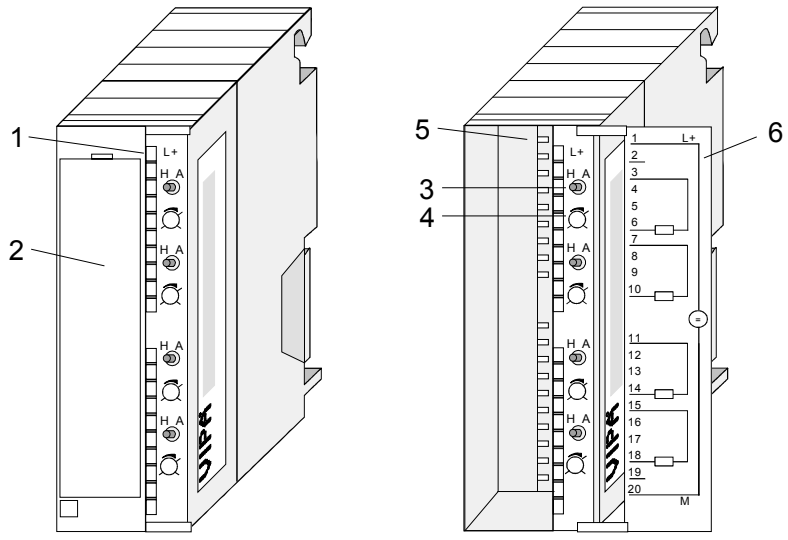
- 4 individual parameterizable outputs
- the outputs are parameterizable per channel as:
  VIPA 332-5HD50: - Current output 4...20mA
  - deactivated
  VIPA 332-5HD60: - voltage output 0...10V
  - deactivated
- usable for actuators with an input of 4 ... 20mA (VIPA 332-5HD50)
- usable for actuators with an input of 0 ... 10V (VIPA 332-5HD60)
- parameterizable diagnostics and diagnostics interrupt
- 1 switch each channel (Automatic-/Manual operation)
- 1 potentiometer each channel
- isolated between backplane bus and load voltage
- status LED for power supply

Parameterization

After Power ON the interrupts are deactivated.

The modules have are to be configured as 6ES7 332-5HD01 from Siemens. More information can be found at chapter "Parameterization - Basics" above.

Structure



[1] LED L+

[2] flap with labeling strip

[3] switch: H/A
Manual/Automatic mode

[4] potentiometer

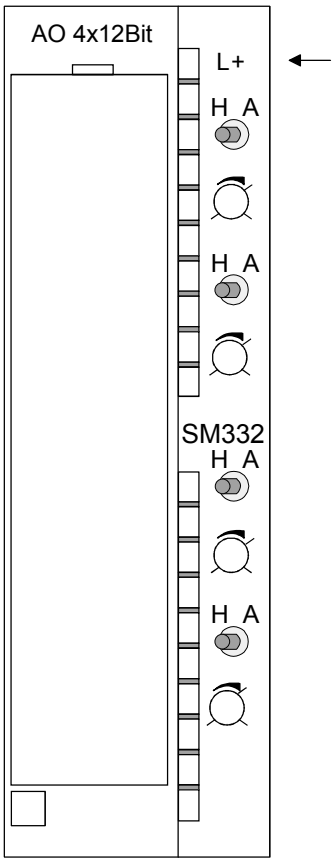
[5] contact bar

[6] flap opened with inner label

Pin assignment
Status monitor

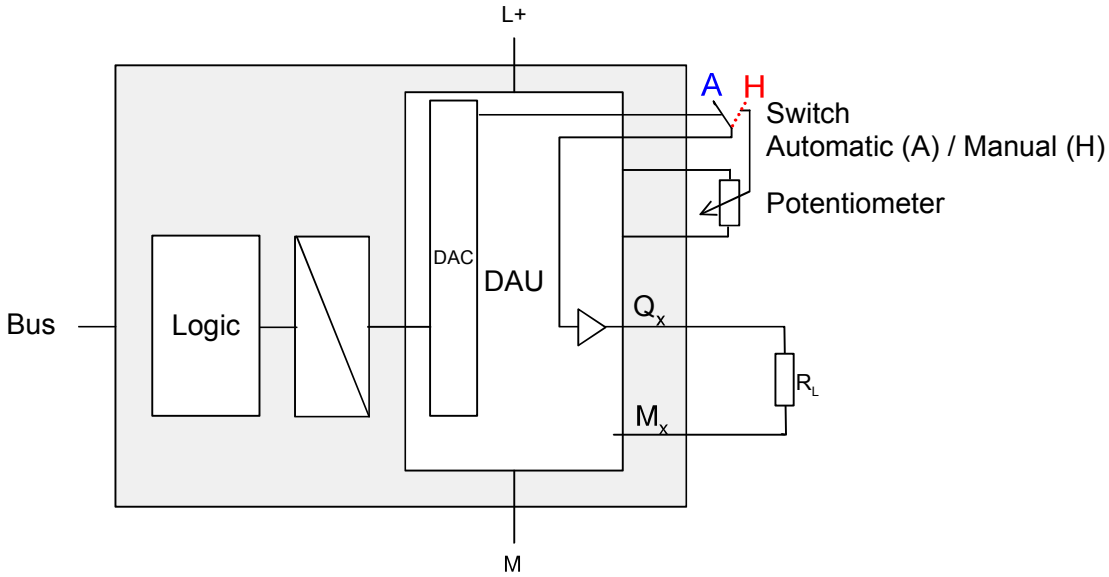
Pin	Circuit diagram
1	1 L+ DC 24V
2	2
3	3 Q_0
4	4
5	5
6	6 M_0
7	7 Q_1
8	8
9	9
10	10 M_1
11	
12	11 Q_2
13	12
14	13
15	14 M_2
16	15 Q_3
17	16
18	17
19	18 M_3
20	19
	20 M

CH0 CH1 CH2 CH3



LED	Description
L+	LED (green) supply voltage is on

Schematic diagram



Manual operation

For each channel there is a 2-pole switch with associated potentiometer on the front side.

The operating mode automatic or manual may be toggled by the switch.

At *manual operation* the module issues the value at the according channel adjusted by the potentiometer.

Depending on the switch position there is the following action:

Front switch	Description
Manual operation 	Issues at the output channel the value adjusted by the potentiometer. **Note! As long as the module is supplied with DC24V, in manual operation, independently of the mode of operation of the CPU, the by potentiometer adjusted value is issued at the output channel.**
Automatic operation 	The channel operates as a "normal" analog output channel and can be controlled by PLC program.

Potentiometer

For each channel there is a potentiometer on the front side. Here you can preset an analog value from min. up to max. of the nominal range.

If the potentiometer is turned in the clockwise direction beyond the *max.* position, then the overdrive region is reached. Hardware conditionally an exact marking of the ranges is not possible.

As soon as you turn the switch into position "H" (manual operation), the value adjusted by the potentiometer is issued at the according output channel.

Depending on the module there are the following ranges:

Order no.	Nominal range (min. ... max.)	max. overdrive region
VIPA 332-5HD50	4...20mA	ca. 24mA
VIPA 332-5HD60	0...10V	ca. 12V

Channel error by switching to manual operation

The switch to *manual operation* is interpreted as a channel error. The appropriate bit for channel errors in byte 7 of the diagnostics record set 1 is set.

An $Interrupt_{going}$ is only possible if all by group diagnostics activated switches are turned to automatic operation.

More can be found in the chapter "Diagnostics" above.

Danger!

With the modules you can cause a jump in the analog value by means of the switch, independently of the CPU operation mode, as long as the module is power supplied. This could lead to material damage or personal injury!

Technical data

Module name	VIPA 332-5HD50	VIPA 332-5HD60
Dimensions and Weight		
Dimensions (WxHxD in mm)	40x125x120mm	
Weight	250g	
Data for Specific Module		
Number of inputs	4	
Length of cable: shielded	200m	
Programming specifications	to configure as 6ES7 332-5HD01-0AB0	
Output data	8byte (1word each channel)	
Parameter data	16byte	
Diagnostics data	16byte	
Voltages, Currents, Potentials		
Rated load voltage L+	DC 24V	
- Reverse polarity protection	yes	
Isolation		
- between channels and backplane bus	yes	
- between channels and power supply of the electronics	yes	
- between channels	no	
- between channels and load voltage L+	yes	
Permitted potential difference		
- between M_{ANA} and $M_{INTERNAL}$(U_{ISO})	DC 75V / AC 60V	
Isolation tested with	DC 500V	
Current consumption		
- from the backplane bus	80mA	
- from power supply L+ (no load)	130mA	
Power dissipation of the module	3.5W	
Analog value generation		
Resolution (incl. sign)		
0 ... 10V		12Bit
4 ... 20mA	12Bit	
Conversion time	0.5ms (all channels)	
Settling time		
- resistive load	0.5ms	1.5ms
- capacitive load	-	1.5ms
- inductive load	0.5ms	-
Suppression of interference, Limits of error		
Crosstalk between the outputs	> 40dB	

Operational limit (in the entire temperature range, with reference to the output range)

	Range	Tolerance	Range	Tolerance
- Voltage outputs	-	-	0 ... 10V	±0.4%
- Current outputs	4 ... 20mA	±0.4%[1)]	-	-

Basic error (operational limit at 25°C, referred to output range)

	Range	Tolerance	Range	Tolerance
- Voltage output	-	-	0 ... 10V	±0.2%
- Current output	4 ... 20mA	±0.2%[1)]	-	-

1) The error limits were determined with a load R=10Ω.

continued ...

... continue technical data 332-5HDx0

Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the input range)	±0.15%	
Repeatability (in steady state at 25°C, referred to output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	
Status, Interrupt, Diagnostics		
Interrupts		
- Diagnostic interrupt	parameterizable	
Diagnostic functions	parameterizable	
- Power supply	LED (green)	
- Diagnostic information readable	possible	
Substitute value can be applied	yes	
Data for selecting an actuator		
Output range (rated values)		
- Voltage	-	0 ... +10V
- Current	+4mA ... +20mA	-
Load resistance (in the nominal range of the output)		
- for voltage outputs	-	min. 1kΩ
capacitive load	-	max. 1µF
- for current outputs	max. 500Ω	-
inductive load	max. 10mH	-
Voltage outputs		
- Short-circuit protection	-	yes
- Short-circuit current	-	25mA
Current outputs		
- No-load voltage	15V	-
Destruction limit against voltage/currents applied from outside		
- Voltage at outputs to M_{ANA}	max. 15V	
- Current	max. 25mA	max. 30mA
Connecting actuators		
- for voltage output		
2-conductor connection	-	possible
- for current output		
2-conductor connection	possible	-

Chapter 8 Analog In/Output Modules

Outline

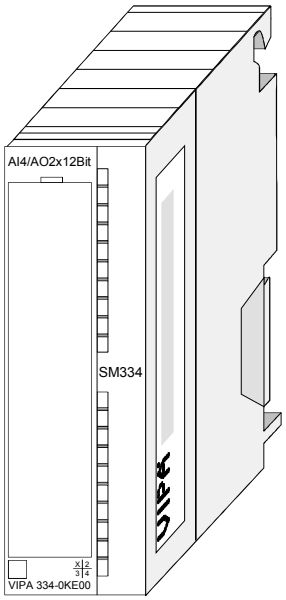
This chapter contains a description of the structure and the operation of the VIPA analog in/output modules.

Content

System overview

Analog in/output module SM 334

In the following you will get an overview over the analog input/output modules that are available at VIPA:



Order data analog output modules

Type	Order number	Page
AI 4/AO 2x12Bit	VIPA 334-0KE00	8-8

Security hint

Attention!

Please regard that the module VIPA 334-0KE00 does not have hardware precautions against wrong parameterization. The setting of the according measuring range is exclusively at the project engineering. At the project engineering you should be very careful.

Please regard also that disconnecting res. connecting during operation, the so-called "Hot Swapping", is not possible!

General

Cables for analog signals

For analog signals you should use isolated cables to reduce interference. The cable screening should be grounded at both ends. If there are differences in the potential between the cable ends, there may occur a potential compensating current that could disturb the analog signals. In this case you should ground the cable screening only at one end.

Note!

Please take always care of the correct polarity when connecting!

Please install short circuits at non-used inputs by connecting the positive contact with the channel ground.

Please leave the output pins of not used channels disconnected and configure the *output type* of the channel to "deactivated".

In this way the cycle time of the module gets shorter.

Parameterization

The module may be configured by means of a hardware configuration or rather during run time by SFCs.

After PowerON, the module has the following default settings:

- Input range: Pt100 Climate (RTD-4L)
- Output range: voltage 0 ... 10V

Analog value representation

General

As soon as a measuring value exceeds the overdrive res. underdrive range, the following value is returned:

Measuring value > Overdrive range: 32767 (7FFFh)

Measuring value < Underdrive range: -32768 (8000h)

At parameterization error or de-activated analog part the measuring value 32767 (7FFFh) is returned. When leaving the defined range during analog output 0V is issued.

In the following all measuring ranges are specified, which are supported by the analog part. With the formulas it may be converted between measuring and analog value.

Numeric notation in Siemens S7 format

The analog values are represented in two's complement format.

	Analog value															
	High byte								Low byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Resolution	SG	Analog value (word)														
12bit + sign	SG	Relevant output value												X	X	X

* The least significant irrelevant bits of the output value are marked by "X".

Sign bit (SG)

The algebraic sign bit is represented by Bit 15. Here it is essential:

Bit 15 = "0" $\rightarrow$ positive value

Bit 15 = "1" $\rightarrow$ negative value

Voltage measuring range 0 ... 10V

Formulas for the conversion:

$Value = 27648 \cdot \frac{U}{10}$, $U = Value \cdot \frac{10}{27648}$ U: voltage, Value: decimal value

0...10V	dez.	hex.	Range
> 11.759	32767	7FFFh	Overflow
11.759V . .	32511 . .	7EFFh . .	Overdrive range
10V . . 0V	27648 . . 0	6C00h . . 0	Nominal range
Negative values not possible			Underdrive range

Resistance measurement R-4L (0 ... 10kΩ)

Formulas for the conversion:

$Value = 27648 \cdot \frac{R}{10000}$, $R = Value \cdot \frac{10000}{27648}$ R: resistance value, Value: decimal value

10kΩ	dez.	hex.	Range
11.852kΩ	32767 32512	7FFFh 7F00h	Overflow
11.759kΩ . .	32511 27649 . .	7EFFh 6C01h . .	Overdrive range
10kΩ 7.5kΩ 361.7mΩ 0Ω	27648 20736 1 0	6C00h 5100h 0001h 0000h	Nominal range
Negative values physically not possible			Underdrive range

Resistance thermometer (Pt100 Climate)

With Pt 100 the temperature is directly shown with the adjusted unit. Here applies: 1 Digit = 0.01 temperature unit.

Pt100			Pt100			Range
in °C (1digit= 0.01°C)	dec.	hex.	in °F (1digit= 0.01°F)	dec.	hex.	
>155.0	32767	7FFFh	>311.0	32767	7FFFh	Overflow
155.0 . .	15500 . .	3C8Ch . .	311.0 . .	31100 . .	797Ch . .	Overdrive range
130.0 . . -120.0	13000 . . -12000	32C8h . . D120h	266.0 . . -184.0	26600 . . -18400	67E8h . . B820h	Nominal range
. . . -145.0	. . . -14500	. . . C75Ch	. . . -229.0	. . . -22900	. . . A68Ch	Underdrive range
< -145.0	-32768	8000h	<-229.0	-32768	8000h	Underflow

Voltage output range 0 ... 10V

Formulas for the conversion:

$Value = 27648 \cdot \frac{U}{10}$, $U = Value \cdot \frac{10}{27648}$ U: voltage, Value: decimal value

0...10V	dez.	hex.	Range
0V . .	32767 . .	7FFFh . .	Overflow
11.76V . .	32511 . .	7EFFh . .	Overdrive range
10V . . 0V	27648 . . 0	6C00h . . 0	Nominal range
. . . 0V	. . . -6912	. . . E500h	Underdrive range
. . . 0V	. . . -32768	. . . 8000h	Underflow

Parameterization

Overview

There are the following possibilities for parameterization:

- Parameterization by hardware configuration of Siemens SIMATIC manager or with WinPLC7 from VIPA.
- Parameterization during run time by means of SFCs.

Parameterization by hardware configuration

To be compatible to the Siemens SIMATIC manager the following steps are to be accomplished:

- Start the hardware configurator from Siemens
- Create a new project
- Configure your CPU.
- Link-up your System 300V modules in the plugged-in sequence starting with slot 4.
- Configure the analog in/output module as module from Siemens with the order number 6ES7 334-0KE00-0AB0.

  The analog modules may be found at the hardware catalog at *Simatic 300 > SM-300.*
- If needed parameterize the CPU respectively the modules. The parameter window appears as soon as you double click on the according module. At this window the according parameter can be changed.
- Save your project, switch the CPU to STOP and transfer your project to the CPU. As soon as the CPU is switched to RUN the parameters are transferred to the connected modules.

Parameters

The following parameters may be adjusted at the analog in/output module:

- Starting address of the data
- Input area (de-activated, integration time, measuring type/range)
- Output area (de-activated, voltage output)

A closer description of the parameters may be found below.

Parameterization during run time by means of SFCs

If the module gets parameters, which are not supported by the module, these parameters are interpreted as wrong parameters and an error is initialized via the measuring value 32767 (7FFFh).

At the parameterization, a 14byte long parameter area is set in the record set 1. Deploying the SFCs 55, 56 and 57, you may alter parameters during run time and transfer them to the module.

Parameter record set 1

Byte	Bit 7 ... Bit 0				
0	Bit 7 ... 0: not relevant				
1	Integration time Bit 1, 0: Channel 0 Bit 3, 2: Channel 1 Bit 5, 4: Channel 2 Bit 7, 6: Channel 3	01: 16.6ms 10: 20ms			
2	Measuring channel 0 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	*Measuring type*	*Bit 7...4*	*Measuring range*	*Bit 3...0*
3	Measuring channel 1 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	de-activated	0000	de-activated	0000
4	Measuring channel 2 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	Voltage	0001	0 ... 10V	1000
5	Measuring channel 3 Bit 3 ... 0: Measuring range Bit 7 ... 4: Measuring type	Resistance R-4L	0100	10kΩ	1001
		Thermo-meter RTD-4L	1000	Pt100 Climate	0000
6	Output channel 0 Bit 3 ... 0: Output range Bit 7 ... 4: Output type	*Output type*	*Bit 7...4*	*Output range*	*Bit 3...0*
7	Output channel 1 Bit 3 ... 0: Output range Bit 7 ... 4: Output type	de-activated	0000	de-activated	0000
		Voltage	0001	0 ... 10V	1000
8 ... 13	not relevant				

Voltage measuring via channel 2 and 3

Please regard voltage measurement is only possible by channel 2 and 3.

334-0KE00 - AI 4/AO 2x12Bit

Order data AI 4/AO 2x12Bit VIPA 334-0KE00

Description There are up to 4 analog inputs and 2 analog outputs, which functions may be parameterized by groups.
The module has to be provided with external DC 24V.

Properties

- 4 inputs in 2 groups
- 2 outputs in one group
- Measuring type parameterizable per channel
  - voltage
  - resistor
  - temperature
- Type of output parameterizable per channel group
  - voltage
- isolated between backplane bus and load voltage

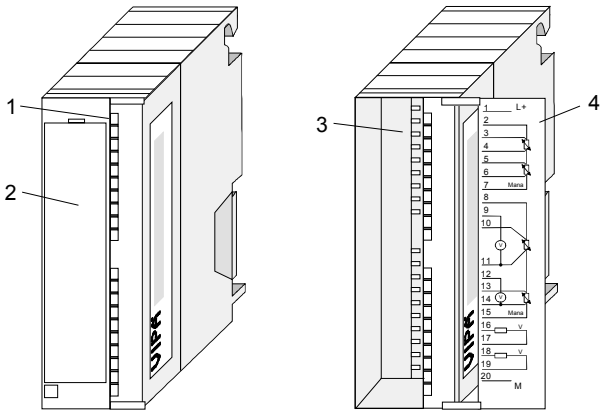
Parameterization After PowerON, the module has the following default settings:

- Input range: Pt100 Climate (RTD-4L)
- Output range: voltage 0 ... 10V

The module is to be configured as module from Siemens with order number 6ES7 334-0KE00-0AB0.

Note!
The deployment of the module at the active backplane bus is not possible!

Structure



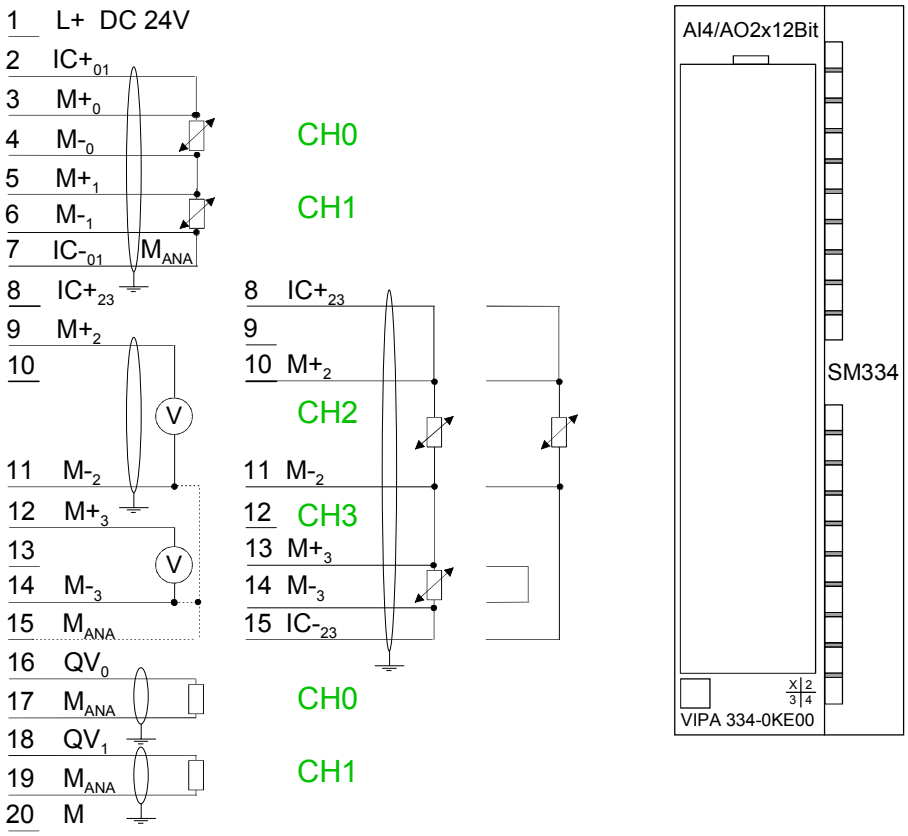
[1] LED stripe (without function)

[2] flap with labeling strip

[3] contact bar

[4] flap opened with inner label

Pin assignment **Circuit diagram** **334-0KE00**



Technical data

Order number	**334-0KE00**
Type	SM 334
SPEED-Bus	-
Current consumption/power loss	
Current consumption from backplane bus	95 mA
Power loss	2 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	-
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	40 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.7%
Basic error limit voltage ranges with SFU	+/-0.5%
Current inputs	-
Min. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges with SFU	-
Resistance inputs	✓
Resistance ranges	10000 Ohm
Operational limit of resistor ranges	+/-3.5%
Basic error limit	+/-2.8%
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100
Operational limit of resistance thermometer ranges	+/-0.1%
Basic error limit thermoresistor ranges	+/-0.8%
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	Sigma-Delta
Basic conversion time	350 ms
Noise suppression for frequency	50 Hz/60 Hz
Initial data size	8 Byte
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	40 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	1 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-1%
Basic error limit voltage ranges with SFU	+/-0.8%
Current outputs	-
Max. in load resistance (current range)	-

Order number	**334-0KE00**
Max. inductive load (current range)	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges with SFU	-
Settling time for ohmic load	0.8 ms
Settling time for capacitive load	0.8 ms
Settling time for inductive load	0.3 ms
Resolution in bit	12
Conversion time	0.5 ms per channel
Substitute value can be applied	-
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	none
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Supply voltage display	none
Group error display	none
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 1 V
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	40 x 125 x 120 mm
Weight	210 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	-