Handbücher/Manuals

art of automation

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Manual

VIPA System 200V

SM

Order No.: VIPA HB97E_SM
Rev. 11/30

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Disclaimer of liability

The contents of this manual were verified with respect to the hard- and software.

However, we assume no responsibility for any discrepancies or errors. The information in this manual is verified on a regular basis and any required corrections will be included in subsequent editions.

Suggestions for improvement are always welcome.

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About this manual

This manual describes the System 200V SM modules that are available from VIPA. In addition to the product summary it contains detailed descriptions of the different modules. You are provided with information on the connection and the utilization of the System 200V SM modules. Every chapter is concluded with the technical data of the respective module.

Overview

Chapter 1: Basics

This introduction presents the VIPA System 200V as a centralized as well as decentralized automation system.

The chapter also contains general information about the System 200V, i.e. dimensions, installation and operating conditions.

Chapter 2: Assembly and installation guidelines

This chapter provides all the information required for the installation and the hook-up of a controller using the components of the System 200V.

Chapter 3-5: Digital input/output modules

These chapters describe the digital remote I/O that is available from VIPA. It provides all the information that is required for applications using these modules. Chapter 3 contains information on the input modules, chapter 4 the information on the output modules and chapter 5 provides details on input/output modules.

Chapter 6-8: Analog input/output modules

These chapters contain a description of the analog remote I/O. The chapter also provides all the information that is required for applications using each module. Chapter 6 describes the input modules, chapter 7 the output modules and chapter 8 the analog input/output modules that are available from VIPA.

Chapter 9: SM238C - Combination module

In this chapter follows the description of the combination module SM 238C that includes a digital in-/output module with counter function and an analog in-/output module.

Contents

User considerations

Objective and contents

This manual describes the modules that are suitable for use in the System 200V. It contains a description of the construction, project implementation and 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
- an index at the end of the manual.

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 System 200V is constructed and produced for:

- all VIPA System 200V 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

Overview

The focus of this chapter is on the introduction of the VIPA System 200V. Various options of configuring central and decentral systems are presented in a summary.

The chapter also contains the general specifications of the System 200V, i.e. dimensions, installation and environmental conditions.

Content

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 electrostatic sensitive equipment.

It is possible that electrostatic 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 that have been damaged by electrostatic discharges may 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 electrostatically sensitive modules

Modules have to 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!

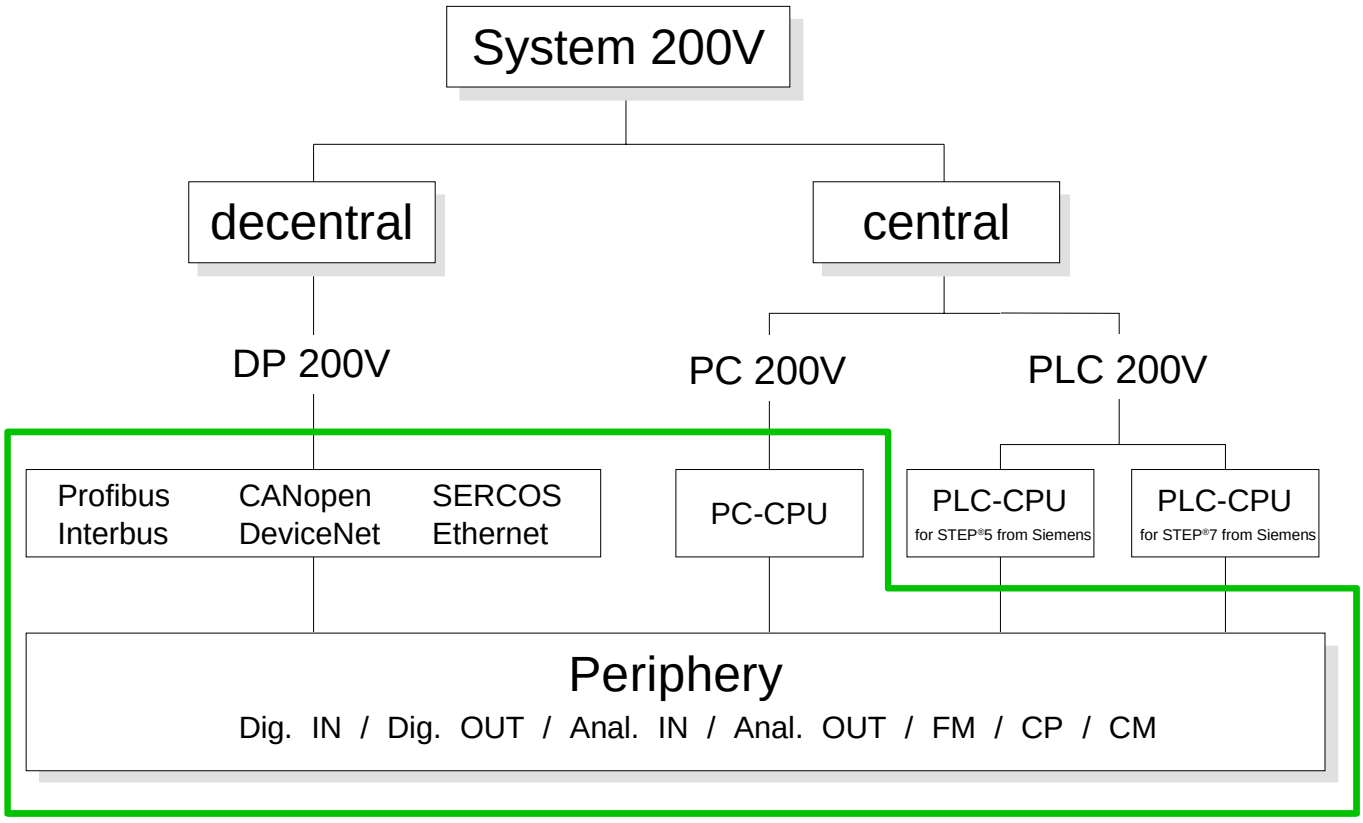
Personnel and instruments should be grounded when working on electrostatically sensitive modules.

Overview

The System 200V

The System 200V is a modular automation system for centralized and decentralized applications requiring low to medium performance specifications. The modules are installed directly on a 35mm mounting rail. Bus connectors inserted into the mounting rail provide the interconnecting bus.

The following figure illustrates the capabilities of the System 200V:



Components

Centralized system

The System 200V series consists of a number of PLC-CPUs. These are programmed in STEP®5 or STEP®7 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.

The PC based CPU 288 can be used to implement operating/monitoring tasks, control applications or other file processing applications.

The modules are programmed in C++ or Pascal.

The PC 288-CPU provides an active interface to the backplane bus and can therefore be employed as central controller for all peripheral and function modules of the VIPA System 200V.

With the appropriate expansion interface the System 200V can support up to 4 rows.

Decentralized 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 WinNCS VIPA configuration tool res. Siemens SIMATIC Manager.

Other fieldbus systems may be connected by means of slaves for Interbus, CANopen, DeviceNet, SERCOS and Ethernet.

Peripheral modules

A large number of peripheral modules are available from VIPA, for example digital as well as analog inputs/outputs, counter functions, displacement sensors, positioners and serial communication modules.

These peripheral modules can be used in centralized as well as decentralized mode.

Integration over GSD File

The functionality of all VIPA system components are available via different GSD-files.

For the Profibus interface is software standardized, we are able to guarantee the full functionality by including a GSD-file using the Siemens SIMATIC Manager.

For every system family there is an own GSD-file. Actual GSD files can be found at ftp.vipa.de/support.

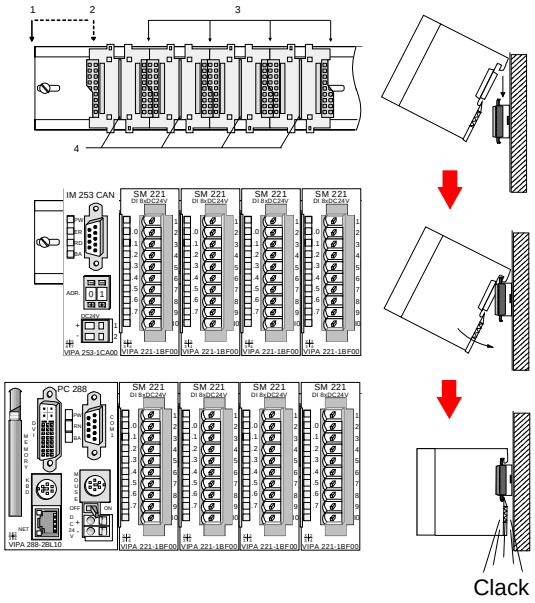
General description System 200V

Structure/ dimensions

- Mounting rail 35mm
- Peripheral modules with recessed labelling
- Dimensions of the basic enclosure:
  1tier width: (HxWxD) in mm: 76x25.4x74 in inches: 3x1x3
  2tier width: (HxWxD) in mm: 76x50.8x74 in inches: 3x2x3

Installation

Please note that you can only install header modules, like the CPU, the PC and couplers into plug-in location 1 or 1 and 2 (for double width modules).



[1] Header modules, like PC, CPU, bus couplers (double width)
[2] Header module (single width)
[3] Peripheral module
[4] Guide rails

Note

A maximum of 32 modules can be connected at the back plane bus. Take attention that here the **maximum sum current** of **3.5A** is not exeeded.

Please install modules with a high current consumption directly beside the header module.

Reliability

- Wiring by means of spring pressure connections (CageClamps) at the front-facing connector, core cross-section 0.08...2.5mm^2 or 1.5 mm^2 (18pole plug)
- Complete isolation of the wiring when modules are exchanged
- Every module is isolated from the backplane bus
- ESD/Burst acc. IEC 61000-4-2 / IEC 61000-4-4 (to level 3)
- Shock resistance acc. IEC 60068-2-6 / IEC 60068-2-27 (1G/12G)
- Class of protection IP20

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

Chapter 2 Assembly and installation guidelines

Overview

This chapter contains the information required to assemble and wire a controller consisting of Systems 200V components.

Content

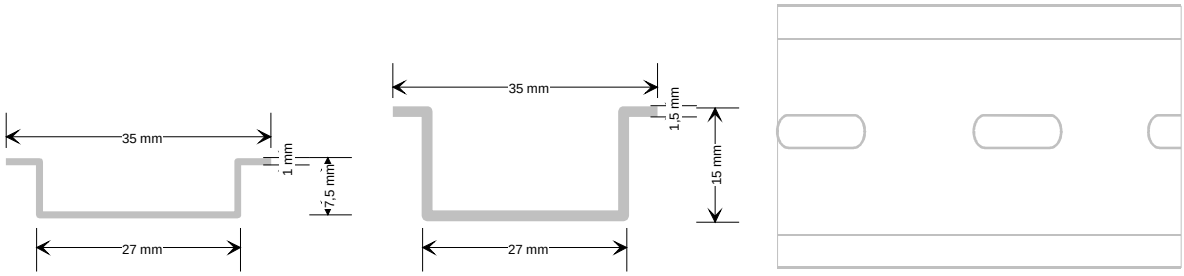
Overview

General

The modules are installed on a carrier rail. A bus connector provides interconnections between the modules. This bus connector links the modules via the backplane bus of the modules and it is placed into the mounting rail that carries the modules.

Mounting rail

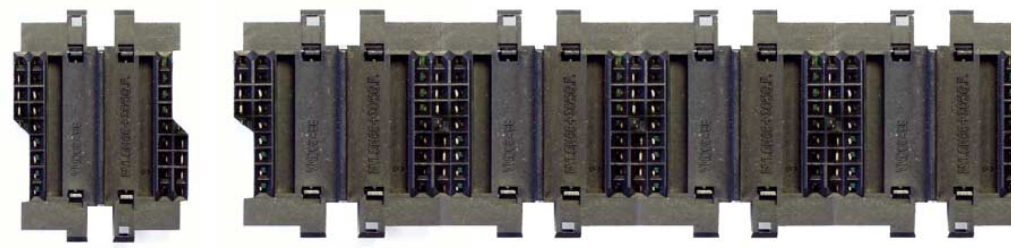
You may use the following standard 35mm mounting rails to mount the System 200V modules:



Bus connector

System 200V modules communicate via a backplane bus connector. The backplane bus connector is isolated and available from VIPA in of 1-, 2-, 4- or 8tier width.

The following figure shows a 1tier connector and a 4tier connector bus:

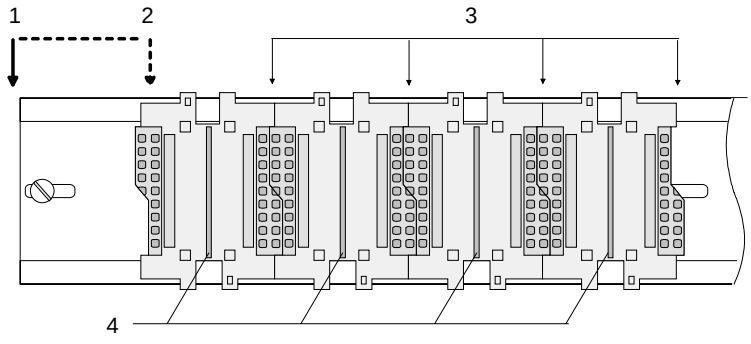


The bus connector is isolated and has to be inserted into the mounting rail until it clips in its place and the bus connections protrude from the rail.

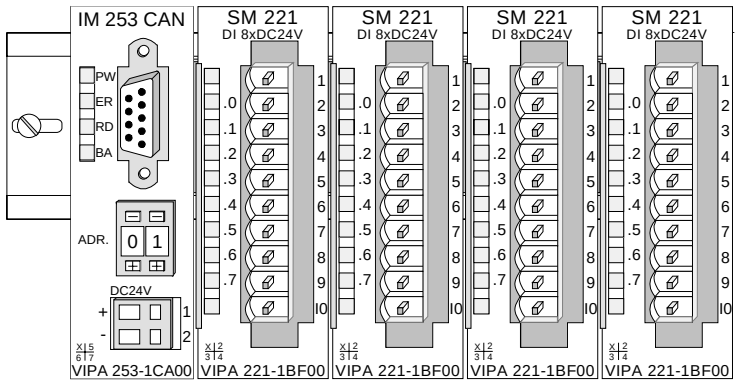
Mounting rail installation

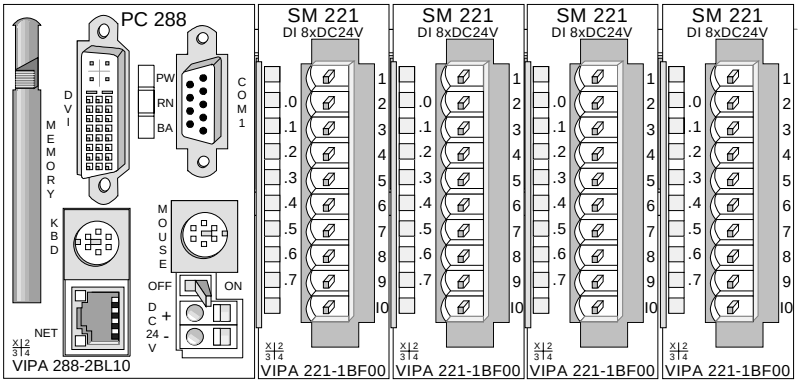
The following figure shows the installation of a 4tier width bus connector in a mounting rail and the plug-in locations for the modules.

The different plug-in locations are defined by guide rails.



[1] Header module, like PC, CPU, bus coupler, if double width
[2] Header module (single width)
[3] Peripheral module
[4] Guide rails





Note

A maximum of 32 modules can be connected at the back plane bus.

Take attention that here the **maximum sum current** of **3.5A** is not exceeded.

Assembly regarding the current consumption

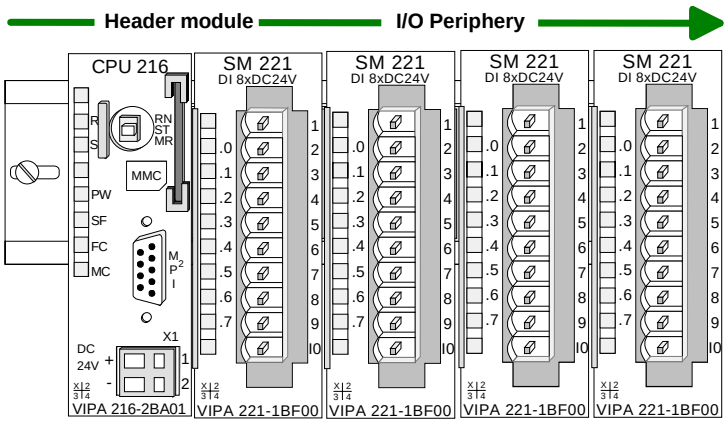
- Use bus connectors as long as possible.
- Sort the modules with a high current consumption right beside the header module. At ftp.vipa.de/manuals/system200v a list of current consumption of every System 200V module can be found.

Assembly horizontal respectively vertical

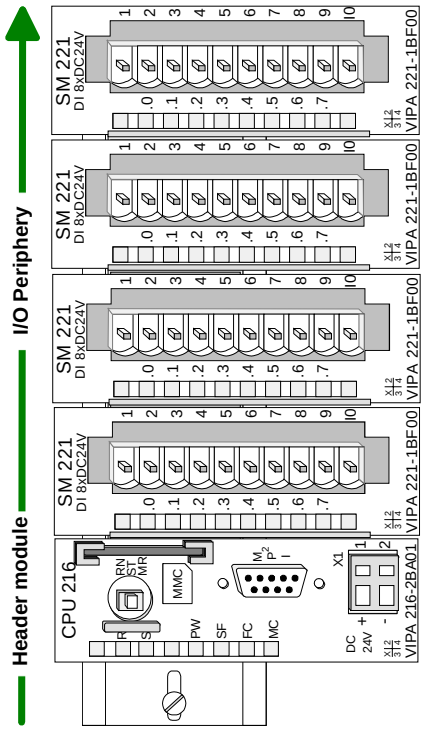
You may install the System 200V as well horizontal as vertical. Please regard the allowed environment temperatures:

- horizontal structure: from 0 to 60°
- vertical structure: from 0 to 40°

The horizontal structure always starts at the left side with a header module (CPU, bus coupler, PC), then you plug-in the peripheral modules beside to the right. You may plug-in maximum 32 peripheral modules.



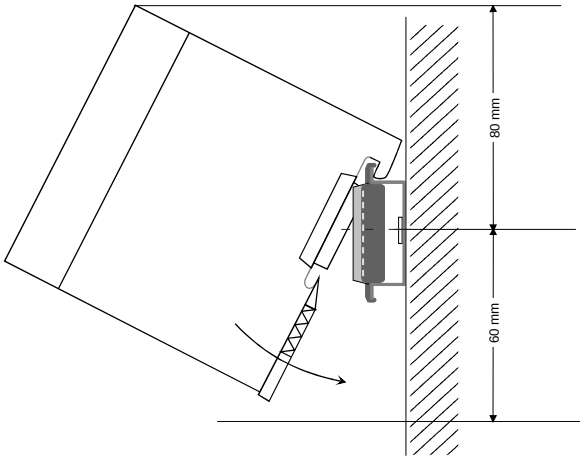
The vertical structure is turned for 90° against the clock.



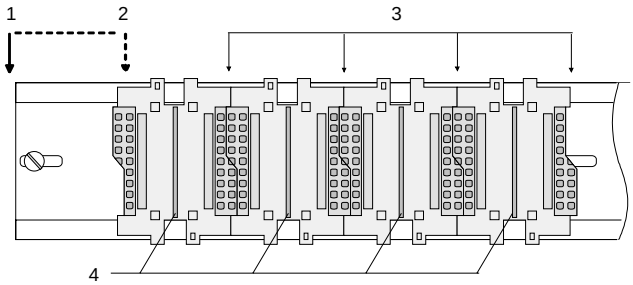
Assembly

Please follow these rules during the assembly!

- Turn off the power supply before you insert or remove any modules!
- Make sure that a clearance of at least 60mm exists above and 80mm below the middle of the bus rail.



- Every row must be completed from left to right and it has to start with a header module (PC, CPU, and bus coupler).



[1] Header module, like PC, CPU, bus coupler, if double width
[2] Header module (single width)
[3] Peripheral module
[4] Guide rails

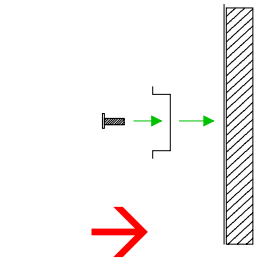
- Modules are to install adjacent to each other. Gaps are not permitted between the modules since this would interrupt the backplane bus.
- A module is only installed properly and connected electrically when it has clicked into place with an audible click.
- Plug-in locations after the last module may remain unoccupied.

Note!

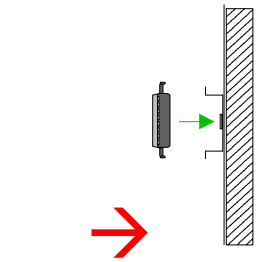
A maximum of 32 modules can be connected at the back plane bus. Take attention that here the maximum **sum current** of **3.5A** is not exceeded.

Assembly procedure

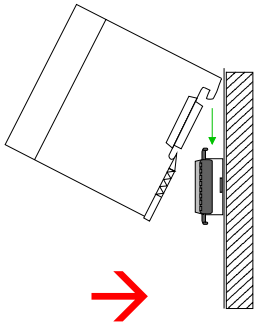
The following sequence represents the assembly procedure as viewed from the side.



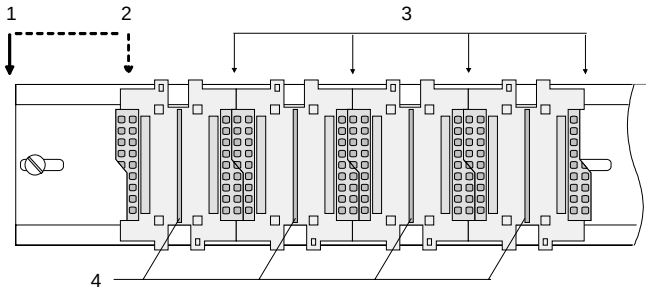
- Install the mounting rail. Make sure that a clearance of at least 60mm exists above and 80mm below the middle of the bus rail.



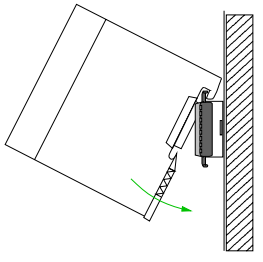
- Press the bus connector into the rail until it clips securely into place and the bus-connectors protrude from the mounting rail. This provides the basis for the installation of your modules.



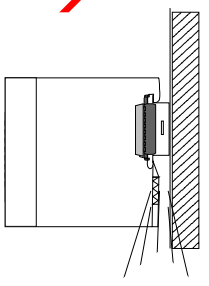
- Start at the outer left location with the installation of your header module like CPU, PC or bus coupler and install the peripheral modules to the right of this.



[1] Header module like PC, CPU, bus coupler
[2] Header module when this is a double width or a peripheral module
[3] Peripheral module
[4] Guide rails



- Insert the module that you are installing into the mounting rail at an angle of 45 degrees from the top and rotate the module into place until it clicks into the mounting rail with an audible click. The proper connection to the backplane bus can only be guaranteed when the module has properly clicked into place.

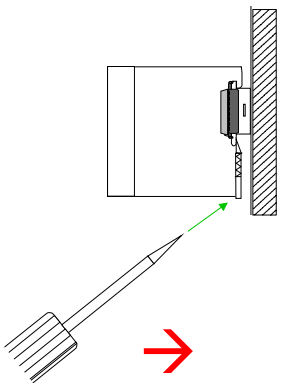


Attention!

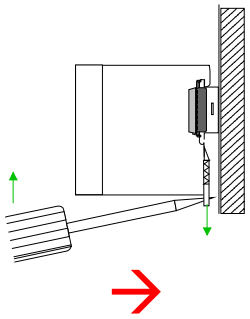
Power must be turned off before modules are installed or removed!

Removal procedure

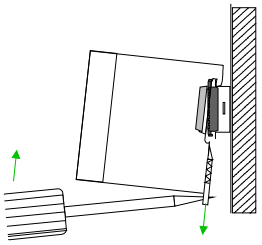
The following sequence shows the steps required for the removal of modules in a side view.



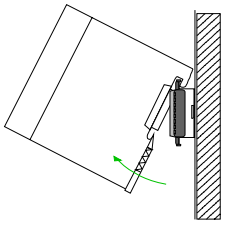
- The enclosure of the module has a spring-loaded clip at the bottom by which the module can be removed from the rail.
- Insert a screwdriver into the slot as shown.

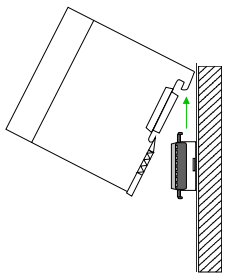


- The clip is unlocked by pressing the screwdriver in an upward direction.



- Withdraw the module with a slight rotation to the top.





Attention!

Power must be turned off before modules are installed or removed!

Please remember that the backplane bus is interrupted at the point where the module was removed!

Wiring

Outline

Most peripheral modules are equipped with a 10pole or an 18pole connector. This connector provides the electrical interface for the signaling and supply lines of the modules.

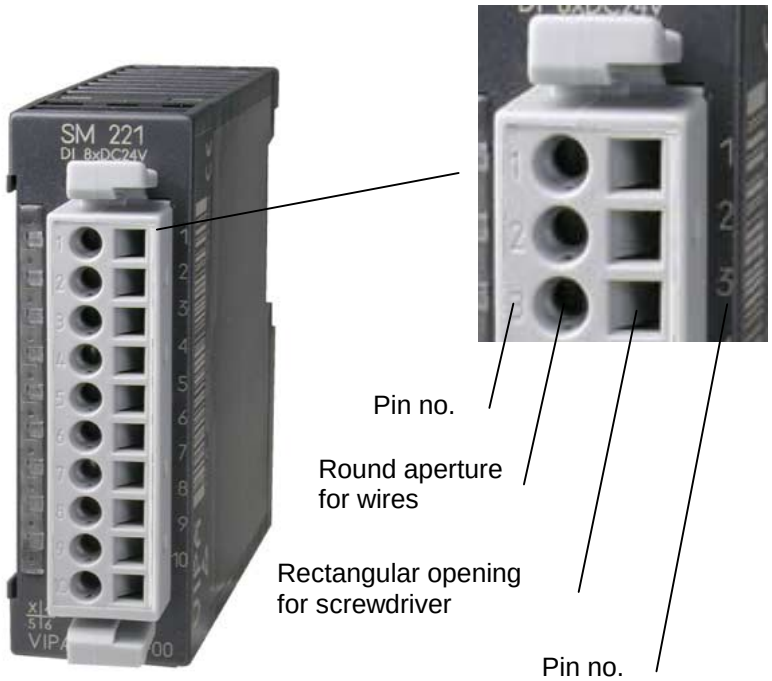
The modules carry spring-clip connectors for the interconnections and wiring.

The spring-clip connector technology simplifies the wiring requirements for signaling and power cables.

In contrast to screw terminal connections, spring-clip wiring is vibration proof. The assignment of the terminals is contained in the description of the respective modules.

You may connect conductors with a wire cross-section from 0.08mm^2 up to 2.5mm^2 (max. 1.5mm^2 for 18pole connectors).

The following figure shows a module with a 10pole connector.

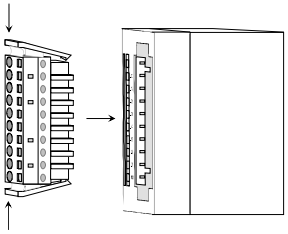


Note!

The spring-clip is destroyed if you insert the screwdriver into the opening for the hook-up wire!

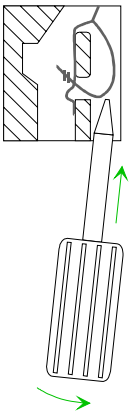
Make sure that you only insert the screwdriver into the square hole of the connector!

Wiring procedure

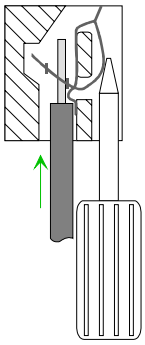


- Install the connector on the module until it locks with an audible click. For this purpose you press the two clips together as shown.
  The connector is now in a permanent position and can easily be wired.

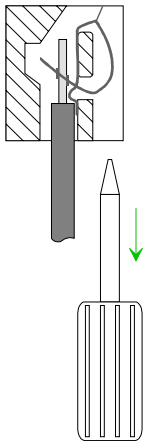
The following section shows the wiring procedure from above.



- Insert a screwdriver at an angel into the square opening as shown.
- Press and hold the screwdriver in the opposite direction to open the contact spring.



- Insert the stripped end of the hook-up wire into the round opening. You can use wires with a diameter of 0.08mm^2 to 2.5mm^2 (1.5mm^2 for 18pole connectors).



- When you remove the screwdriver, the wire is clipped securely.

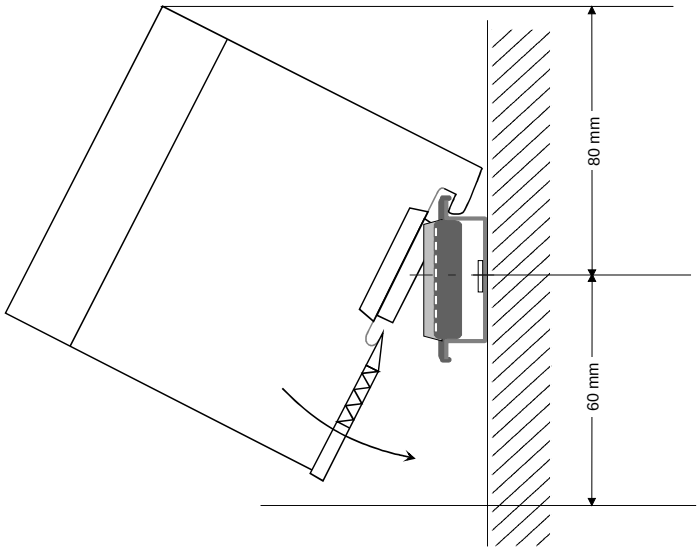
Wire the power supply connections first
followed by the signal cables (inputs and outputs).

Assembly dimensions

Overview Here follow all the important dimensions of the System 200V.

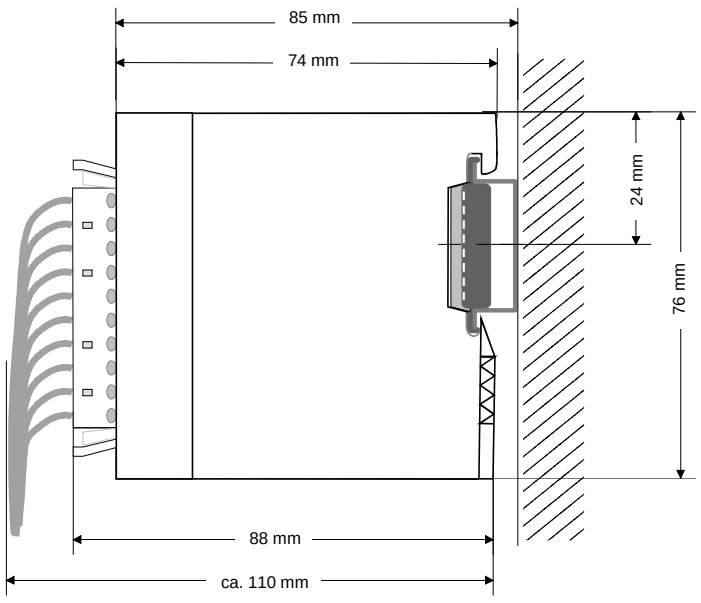
Dimensions Basic enclosure
1tier width (HxWxD) in mm: 76 x 25.4 x 74
2tier width (HxWxD) in mm: 76 x 50.8 x 74

Installation dimensions

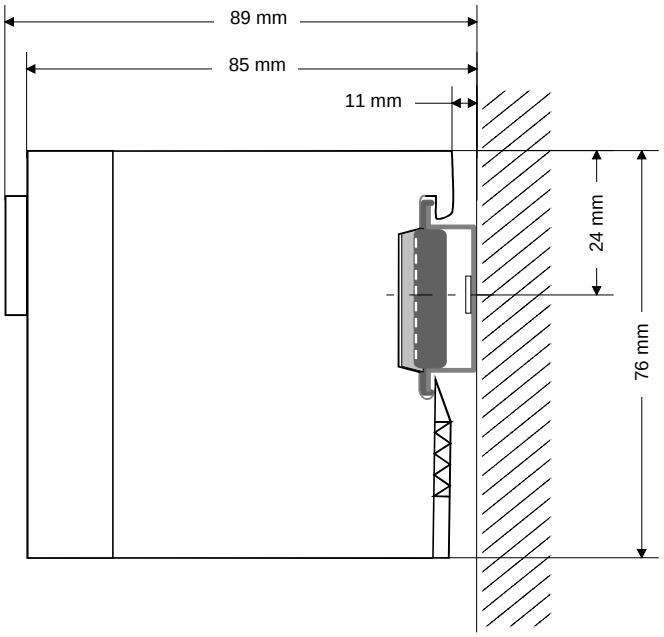


Installed and wired dimensions

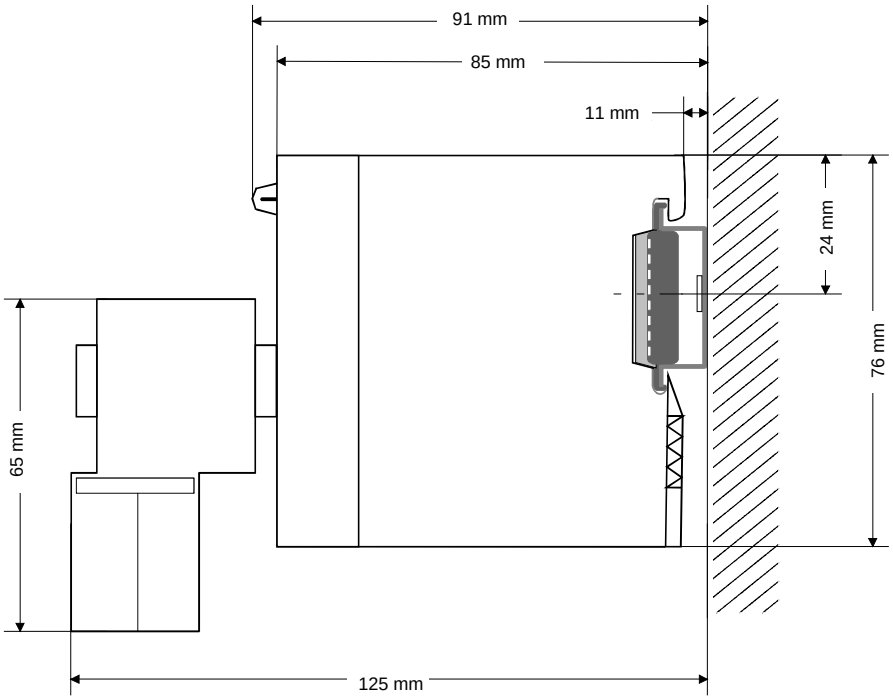
In- / Output modules



Function modules



CPUs here with EasyConn from VIPA



Installation guidelines

General

The installation guidelines contain information on the proper assembly of System 200V. Here we describe possible ways of interference that may disturb the controlling system and how you have to approach shielding and screening issues to ensure the electromagnetic compatibility (EMC).

What is EMC?

The term "electromagnetic compatibility" (EMC) refers to the ability of an electrical device to operate properly in an electromagnetic environment without interference from the environment or without the device causing illegal interference to the environment.

All System 200V components were developed for applications in harsh industrial environments and they comply with EMC requirements to a large degree. In spite of this you should implement an EMC strategy before installing any components which should include any possible source of interference.

Possible sources for disturbances

Electromagnetic interference can enter your system in many different ways:

- Fields
- I/O signal lines
- Bus system
- Power supply
- Protective conductor

Interference is coupled into your system in different ways, depending in the propagation medium (conducted or not) and the distance to the source of the interference.
We differentiate between:

- galvanic coupling
- capacitive coupling
- inductive coupling
- radiated power coupling

The most important rules for ensuring EMC

In many cases, adherence to a set of very elementary rules is sufficient to ensure EMC. For this reason we wish to advise you to heed the following rules when you are installing your controllers.

- During the installation of your components you have to ensure that any inactive metal components are grounded via a proper large-surface earth.
  - Install a central connection between the chassis ground and the earthing/protection system.
  - Interconnect any inactive metal components via low-impedance conductors with a large cross-sectional area.
  - Avoid aluminum components. Aluminum oxidizes easily and is therefore not suitable for grounding purposes.
- Ensure that wiring is routed properly during installation.
  - Divide the cabling into different types of cable. (Heavy current, power supply, signal and data lines).
  - Install heavy current lines and signal or data lines in separate channeling or cabling trusses.
  - Install signaling and data lines as close as possible to any metallic ground surfaces (e.g. frames, metal rails, sheet metal).
- Ensure that the screening of lines is grounded properly.
  - Data lines must be screened.
  - Analog lines must be screened. Where low-amplitude signals are transferred, it may be advisable to connect the screen on one side of the cable only.
  - Attach the screening of cables to the ground rail by means of large surface connectors located as close as possible to the point of entry. Clamp cables mechanically by means of cable clamps.
  - Ensure that the ground rail has a low-impedance connection to the cabinet/cubicle.
  - Use only metallic or metallized covers for the plugs of screened data lines.
- In critical cases you should implement special EMC measures.
  - Connect snubber networks to all inductive loads that are controlled by System 200V modules.
  - Use incandescent lamps for illumination purposes inside cabinets or cubicles, do not use fluorescent lamps.
- Create a single reference potential and ensure that all electrical equipment is grounded wherever possible.
  - Ensure that earthing measures are implemented effectively. The controllers are earthed to provide protection and for functional reasons.
  - Provide a star-shaped connection between the plant, cabinets/cubicles of the System 200V and the earthing/protection system. In this way you avoid ground loops.
  - Where potential differences exist you must install sufficiently large equipotential bonding conductors between the different parts of the plant.

Screening of cables

The screening of cables reduces the influence of electrical, magnetic or electromagnetic fields; we talk of attenuation.

The earthing rail that is connected conductively to the cabinet diverts interfering currents from screen conductors to ground. It is essential that the connection to the protective conductor is of low-impedance as the interfering currents could otherwise become a source of trouble in themselves.

The following should be noted when cables are screened:

- Use cables with braided screens wherever possible.
- The coverage of the screen should exceed 80%.
- Screens should always be grounded at both ends of cables. High frequency interference can only be suppressed by grounding cables on both ends.

  Grounding at one end may become necessary under exceptional circumstances. However, this only provides attenuation to low frequency interference. One-sided earthing may be of advantage where:
  - it is not possible to install equipotential bonding conductors.
  - analog signals (in the mV or µA range) are transferred.
  - foil-type shields (static shields) are used.
- Always use metallic or metallized covers for the plugs on data lines for serial links. Connect the screen of the data line to the cover. Do **not** connect the screen to PIN 1 of the plug!
- In a stationary environment it is recommended that the insulation is stripped from the screened cable interruption-free and to attach the screen to the screening/protective ground rail.
- Connect screening braids by means of metallic cable clamps. These clamps need a good electrical and large surface contact with the screen.
- Attach the screen of a cable to the grounding rail directly where the cable enters the cabinet/cubicle. Continue the screen right up to the System 200V module but do **not** connect the screen to ground at this point!

Please heed the following when you assemble the system!

Where potential differences exist between earthing connections it is possible that an equalizing current could be established where the screen of a cable is connected at both ends.

Remedy: install equipotential bonding conductors

Chapter 3 Digital input modules

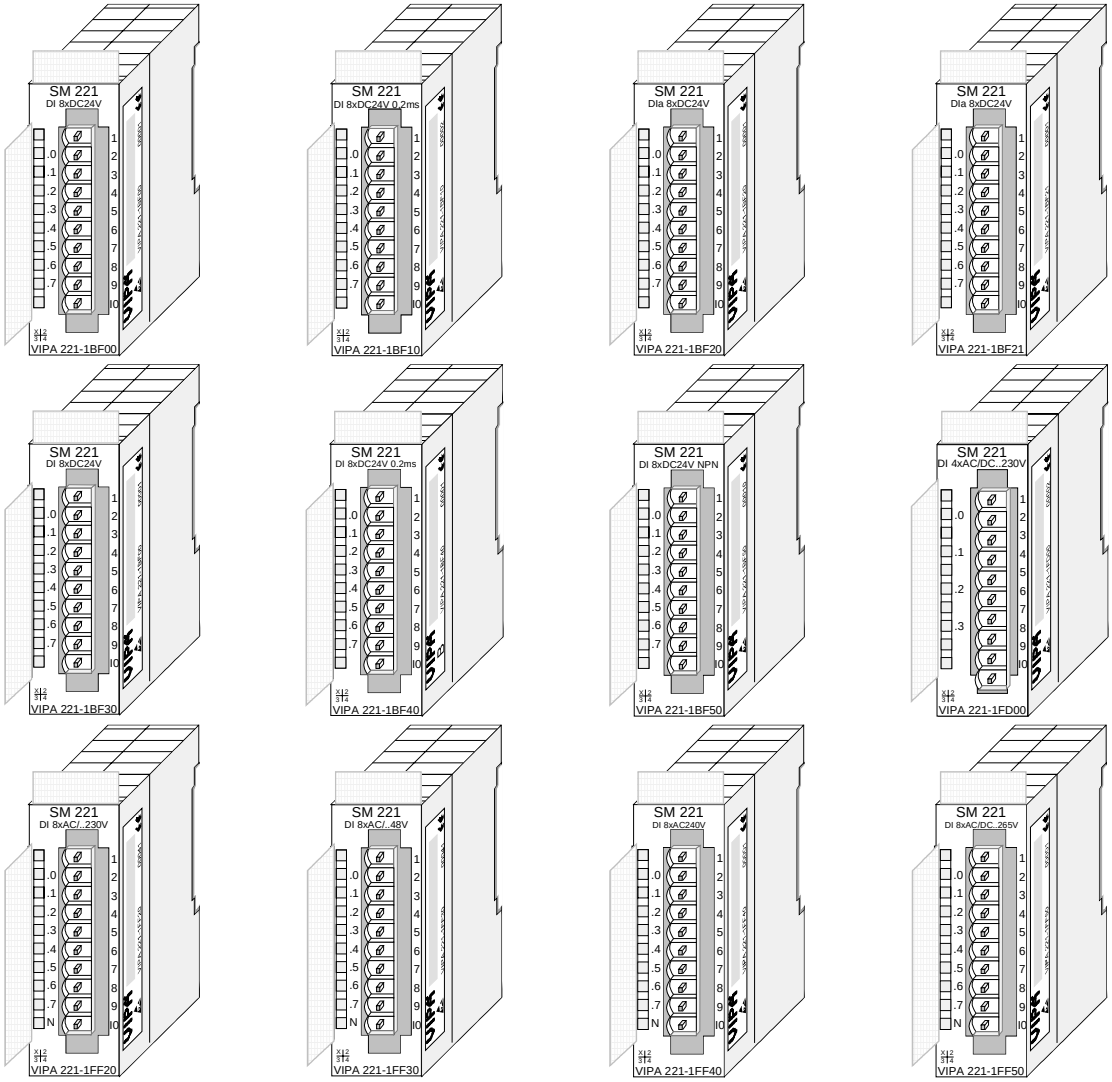
Overview

This chapter contains a description of the construction and the operating of the VIPA digital input modules.

Contents

System overview

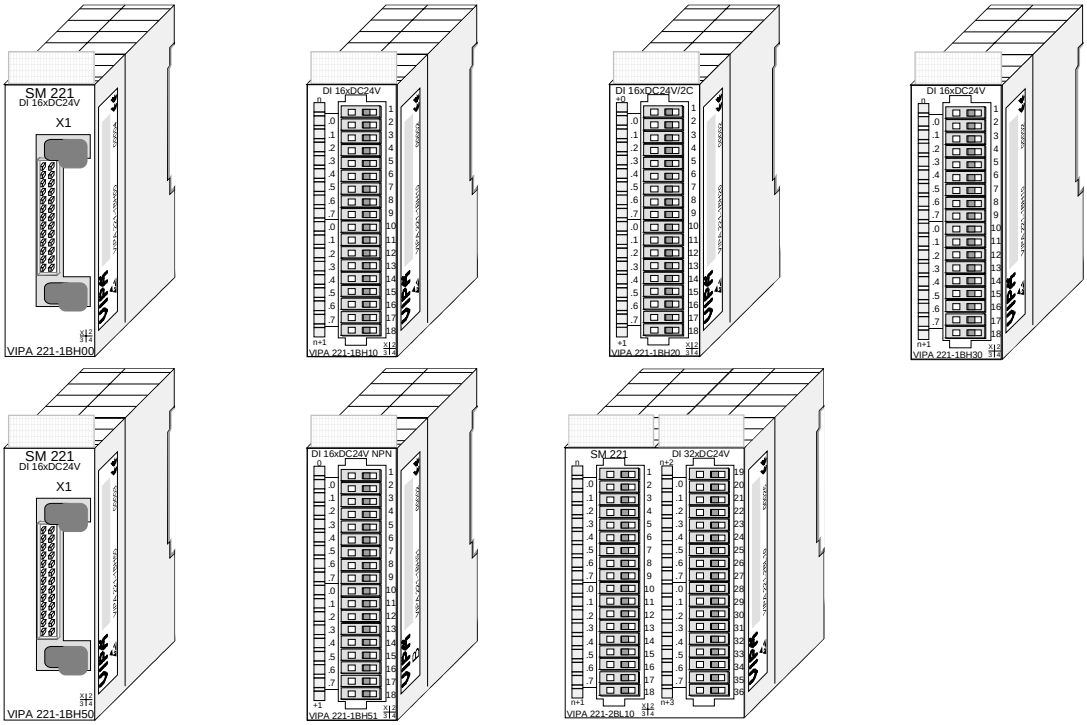
Input modules
SM 221



Order data input modules

Type	Order number	Page
DI 8xDC 24V	VIPA 221-1BF00	3-4
DI 8xDC 24V 0.2ms	VIPA 221-1BF10	3-6
DIa 8xDC 24V	VIPA 221-1BF20	3-8
DIa 8xDC 24V 0.2ms	VIPA 221-1BF21	3-10
DI 8xDC 24V - ECO	VIPA 221-1BF30	3-12
DI 8xDC 24V 0.2ms	VIPA 221-1BF40	3-14
DI 8xDC 24V NPN	VIPA 221-1BF50	3-16
DI 4xAC/DC 90...230V	VIPA 221-1FD00	3-18
DI 8xAC/DC 60...230V	VIPA 221-1FF20	3-20
DI 8xAC/DC 24...48V	VIPA 221-1FF30	3-22
DI 8xAC 240V	VIPA 221-1FF40	3-24
DI 8xAC/DC 180...265V	VIPA 221-1FF50	3-26

Continued
Input modules
SM 221



Order data input modules

Type	Order number	Page
DI 16xDC 24V with UB4x	VIPA 221-1BH00	3-28
DI 16xDC 24V	VIPA 221-1BH10	3-30
DI 16xDC 24V/1C	VIPA 221-1BH20	3-32
DI 16xDC 24V - ECO	VIPA 221-1BH30	3-42
DI 16xDC 24V NPN with UB4x	VIPA 221-1BH50	3-44
DI 16xDC 24V NPN	VIPA 221-1BH51	3-46
DI 32xDC 24V	VIPA 221-2BL10	3-48

221-1BF00 - DI 8xDC 24V

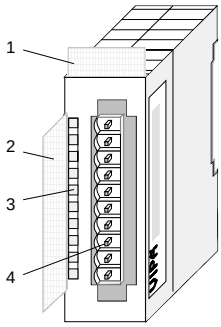
Order data DI 8xDC 24V VIPA 221-1BF00

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

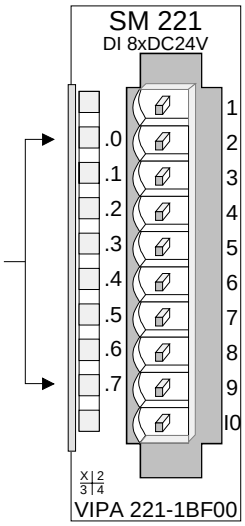
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Connector edge

Status indicator pin assignment

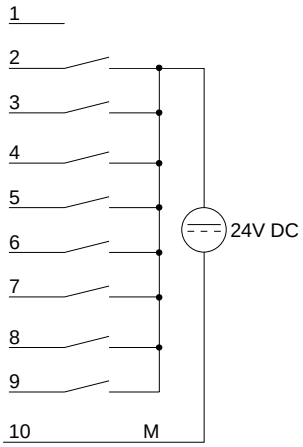
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



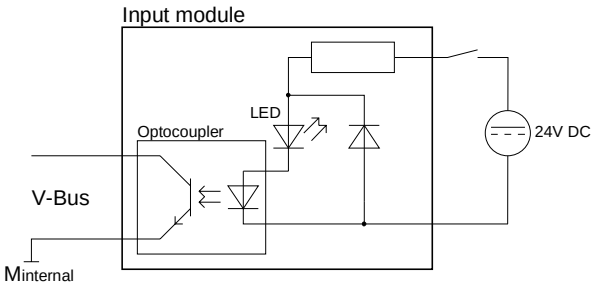
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF00
Number of inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF10 - DI 8xDC 24V 0.2ms

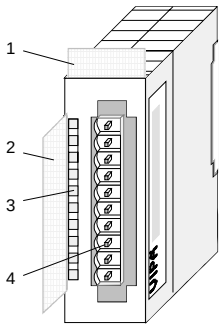
Order data DI 8xDC 24V 0.2ms VIPA 221-1BF10

Description The digital input module accepts binary control signals from the process level and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the backplane bus
- Delay time 0.2ms
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

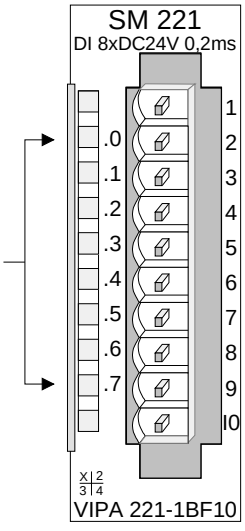
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

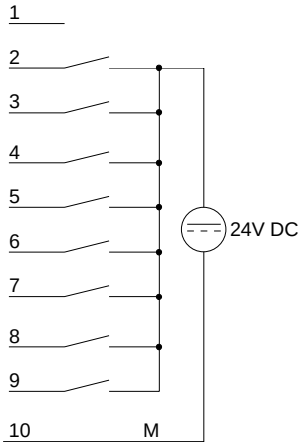
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



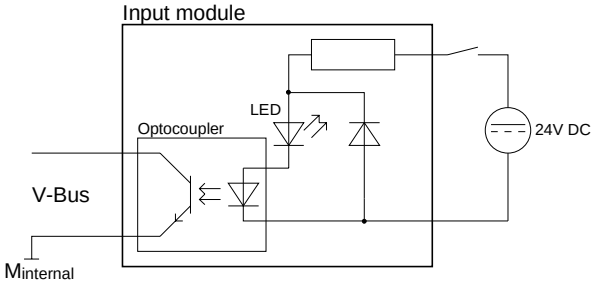
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF10
Number of inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	0.2ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF20 - DIa 8xDC 24V

Order data DIa 8xDC 24V VIPA 221-1BF20

Description

The digital input module accepts the binary control signals from the process level and provides an electrically isolated interface to the central bus system.

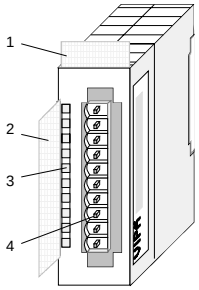
All inputs are configurable as alarms. With the rising edge of the input, the alarm is activated. The alarm calls the OB 40 in the CPU. If this OB isn't available, the OB 85 is called. If this OB is also not programmed, the CPU switches to STOP.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 alarm inputs, isolated from the backplane bus
- nominal input voltage DC 24V
- suited for urgent signals (switches and proximity switches)
- Status indicator for each channel by means of an LED

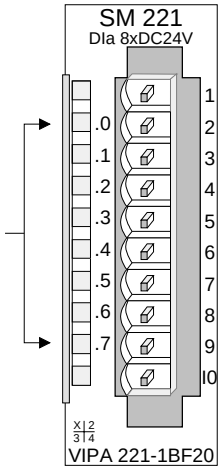
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

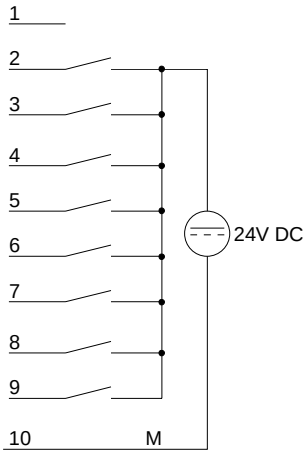
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



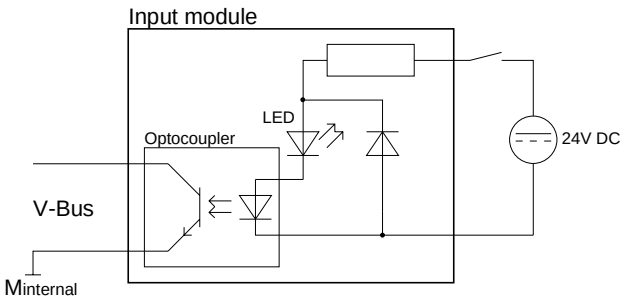
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note!

The module may be deployed in the System 200V starting from CPU firmware versions:

CPU 21x: Version 2.2.1
CPU 24x: Version 3.0.6

The deployment with lower firmware versions causes error messages and a CPU switch to STOP!

Technical data

Electrical data	VIPA 221-1BF20
Number of alarm inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF21 - DIa 8xDC 24V 0.2ms

Order data DIa 8xDC 24V 0.2ms VIPA 221-1BF21

Description

The digital input module accepts the binary control signals from the process level and provides an electrically isolated interface to the central bus system.

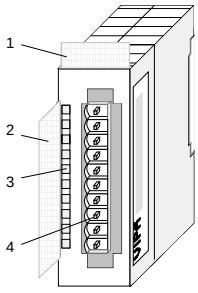
All inputs are configurable as alarms. With the rising edge of the input, the alarm is activated. The alarm calls the OB 40 in the CPU. If this OB isn't available, the OB 85 is called. If this OB is also not programmed, the CPU switches to STOP.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 alarm inputs, isolated from the backplane bus
- nominal input voltage DC 24V
- suited for urgent signals (switches and proximity switches), delay time 0.2ms
- Status indicator for each channel by means of an LED

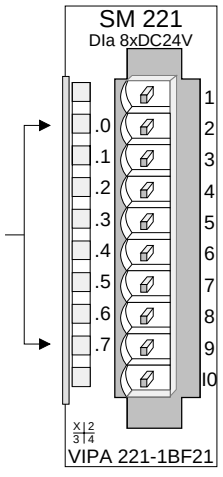
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

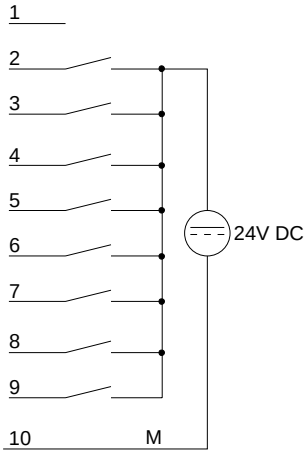
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



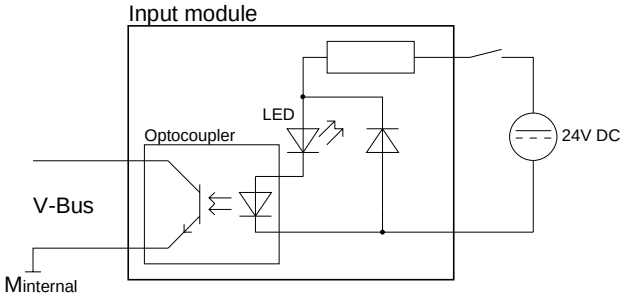
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note!

The module may be deployed in the System 200V starting from CPU firmware versions:

CPU 21x: Version 2.2.1
CPU 24x: Version 3.0.6

The deployment with lower firmware versions causes error messages and a CPU switch to STOP!

Technical data

Electrical data	VIPA 221-1BF21
Number of alarm inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	0.2ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF30 - DI 8xDC 24V - ECO

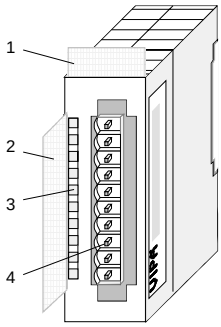
Order data DI 8xDC 24V VIPA 221-1BF30

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

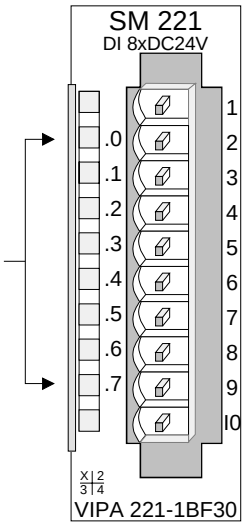
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Connector edge

Status indicator pin assignment

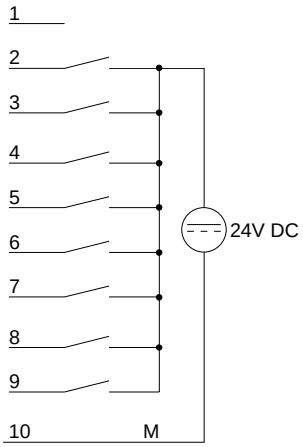
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



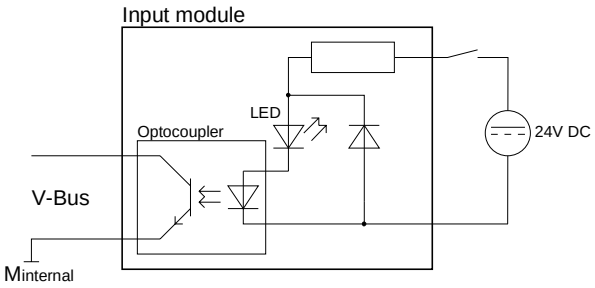
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF30
Number of inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF40 - DI 8xDC 24V 0.2ms

Order data DI 8xDC 24V 0.2ms VIPA 221-1BF40

Description

The digital input module accepts the binary control signals from the process level and provides an electrically isolated interface to the central bus system. This module is only suited for central deployment together with a CPU. Here the module detects and stores the rising edges of input pulses with a duration > 0.2ms.

At the cycle control point the status information of the module is transferred to the process image and then reset in the module again by the CPU.

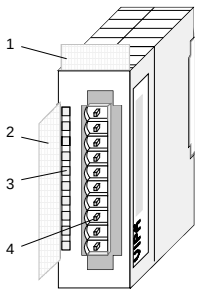
Since the status information exist over one cycle, a cyclically processing is necessary. Here the module must always be mapped to an address within the process image.

The module has 8 input channels. The status of the input signals is indicated by light emitting diodes.

Properties

- 8 inputs, isolated from the backplane bus
- nominal input voltage DC 24V
- Suitable for fast, short signals (pulse)
- Status indicator for each channel by means of an LED

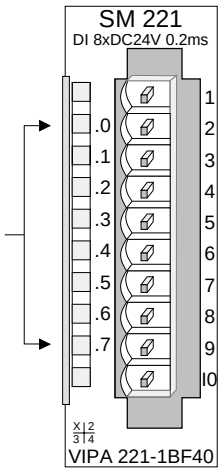
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

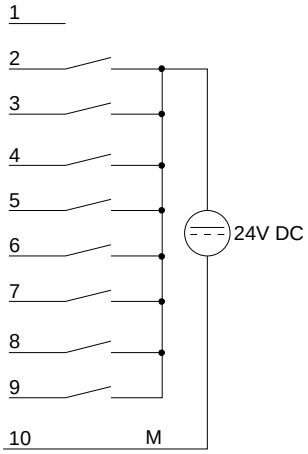
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



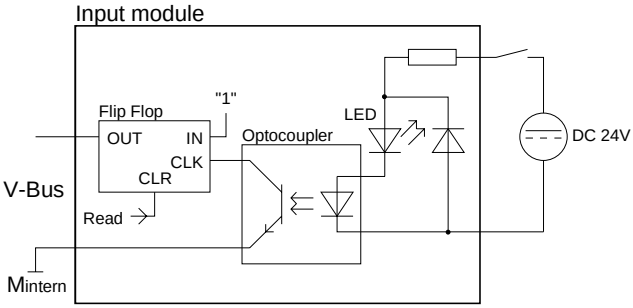
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note!

System dependent the module should only be used in a central system! The module is always to be mapped to an address within the process image.

Technical data

Electrical data	VIPA 221-1BF40
Number of alarm inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	0.2ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	25mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BF50 - DI 8xDC 24V NPN

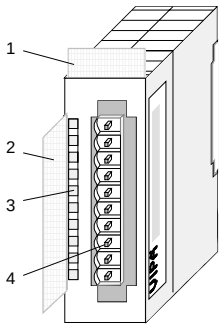
Order data DI 8xDC 24V NPN VIPA 221-1BF50

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The module has 8 channels, each one with a light emitting diode to indicate the status of the channel. The input becomes active when it is connected to ground.

Properties

- 8 floating inputs, isolated from the backplane bus
- Active low input (signal level "1" when input is at ground)
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

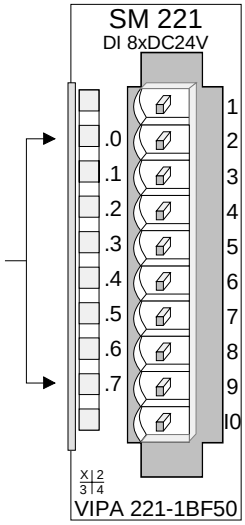
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

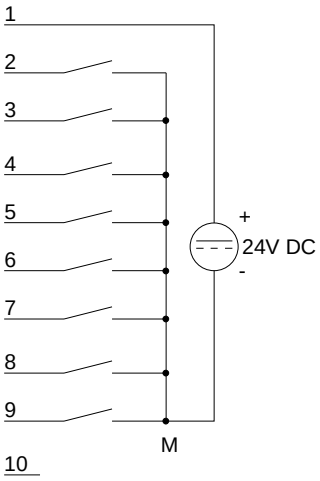
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 when an input is at ground a "1" is detected and the respective LED is turned on



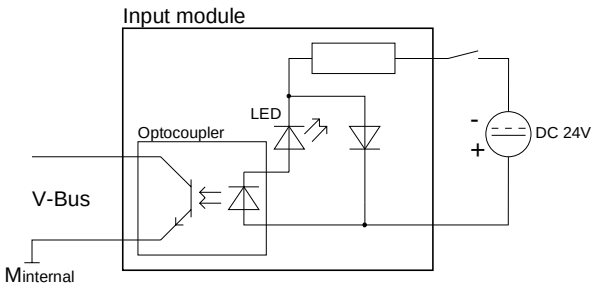
Pin	Assignment
1	+DC 24V
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	reserved

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BF50
Number of inputs	8
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	10mA
Power dissipation	1.5W
Isolation tested with	DC 500V
Isolation	
- between channels and bus	yes
- between channels	no
Length of cable	
- shielded	1000m
- unshielded	600m
Number simultaneously trigger able inputs	
- horizontal config. up to 60°C	8
- vertical config. up to 40°C	8
Status indicator	via LEDs located on the front
Data for selecting a sensor	
Input voltage	
- Rated value	DC 24V (20.4 ... 28.8V)
- for signal "1"	0 ... 5V [1]
- for signal "0"	15 ... 28.8V [1]
Input current	
- for signal "1"	7mA
Input filter delay	3ms
Connection of two-wire Beros	possible
- permitted bias current	1.5mA
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostics data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

[1] Reference potential is ground of DC 24V.

221-1FD00 - DI 4xAC/DC 90...230V

Order data DI 4xAC/DC 90...230V VIPA 221-1FD00

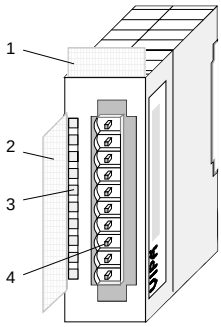
Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 4 channels and the respective status is displayed by means of LEDs.

Properties

- 4 floating inputs, isolated from the backplane bus and from each other
- Status indicator for each channel by means of an LED
- Nominal input voltage 90 ... 230V AC/DC

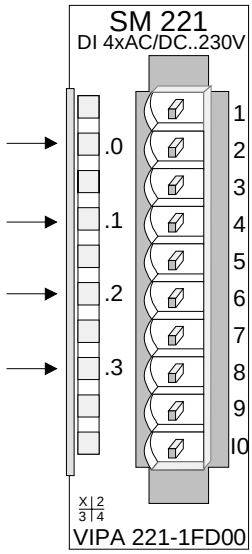
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

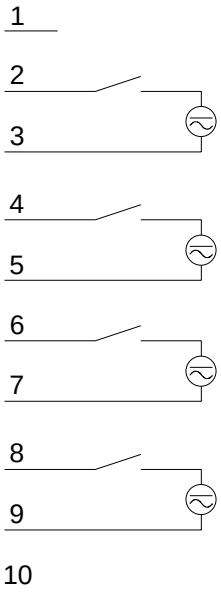
LED	Description
.0	LEDs (green)
.1	I+0.0 to I+0.3
.2	from app. DC 80V or AC
.3	65V (50Hz) a signal "1" is detected and the respective LED is turned on



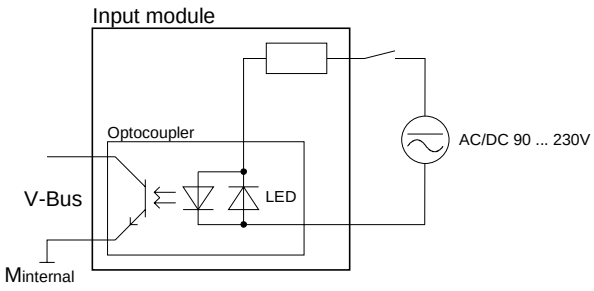
Pin	Assignment
1	not connected
2	I+0.0
3	Neutral conductor I+0.0
4	I+0.1
5	Neutral conductor I+0.1
6	I+0.2
7	Neutral conductor I+0.2
8	I+0.3
9	Neutral conductor I+0.3
10	not connected

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FD00
Number of inputs	4
Nominal input voltage	AC/DC 90 ... 230V
Signal voltage "0"	AC/DC 0 ... 35V
Signal voltage "1"	AC/DC 90 ... 230V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistance	136kΩ
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	40mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte (bit 0 ... bit 3)
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1FF20 - DI 8xAC/DC 60...230V

Order data DI 8xAC/DC 60...230V VIPA 221-1FF20

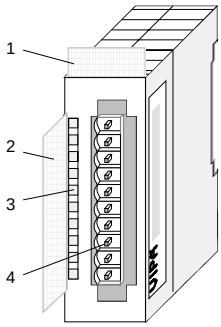
Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 inputs, isolated from the backplane bus
- Nominal input voltage 60 ... 230V AC/DC
- Status indicator for each channel by means of an LED

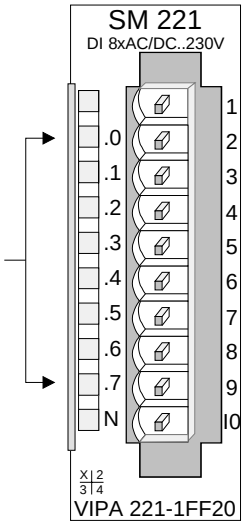
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

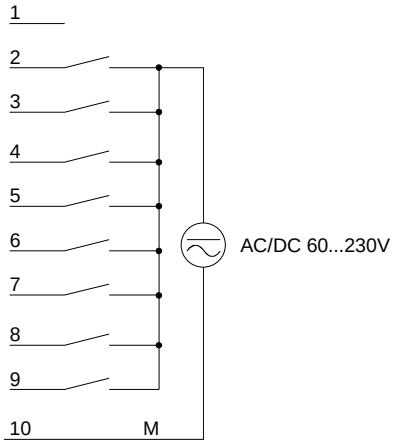
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 from app. DC 55V or AC 45V (50Hz) a signal "1" is detected and the respective LED is turned on



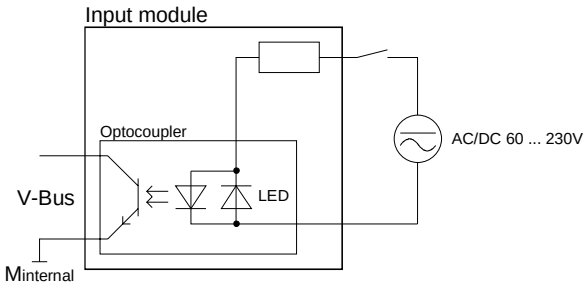
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Neutral conductor

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FF20
Number of inputs	8
Nominal input voltage	AC/DC 60 ... 230V
Signal voltage "0"	AC/DC 0 ... 35V
Signal voltage "1"	AC/DC 60 ... 230V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistance	136kΩ
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	60mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1FF30 - DI 8xAC/DC 24...48V

Order data DI 8xAC/DC 24...48V VIPA 221-1FF30

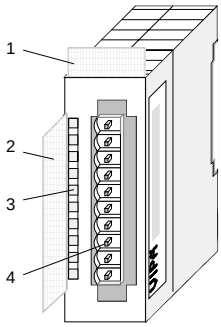
Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the backplane bus
- Nominal input voltage AC/DC 24 ... 48V
- Status indicator for each channel by means of an LED

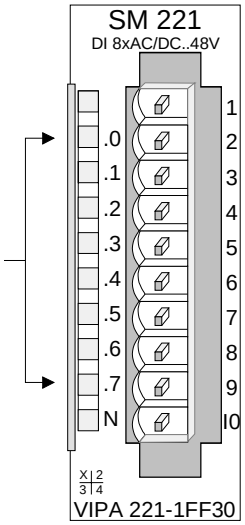
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

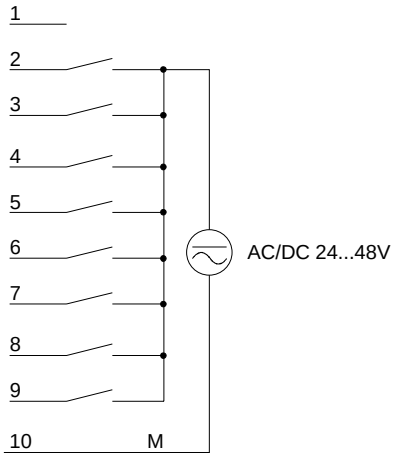
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 from app. DC 14V or AC 12V (50Hz) a signal "1" is detected and the respective LED is turned on



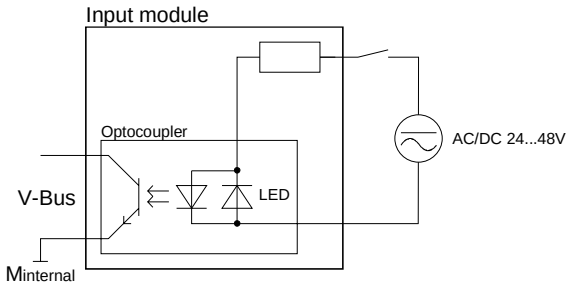
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Neutral conductor

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FF30
Number of inputs	8
Nominal input voltage	AC/DC 24 ... 48V
Signal voltage "0"	AC/DC 0 ... 8V
Signal voltage "1"	AC/DC 18 ... 48V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistance	16.4kΩ
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	60mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1FF40 - DI 8xAC 240V

Order data DI 8xAC 240V VIPA 221-1FF40

Description

The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

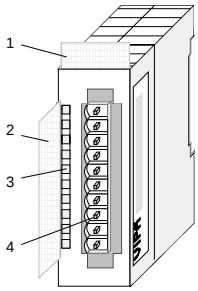
The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

In a defined voltage range, the signal state of the respective input is not modified (Hysterese).

Properties

- 8 floating inputs, isolated from the backplane bus
- Nominal input voltage AC 240V
- Status indicator for each channel by means of an LED
- Hysterese
- Current consumption 20mA per channel

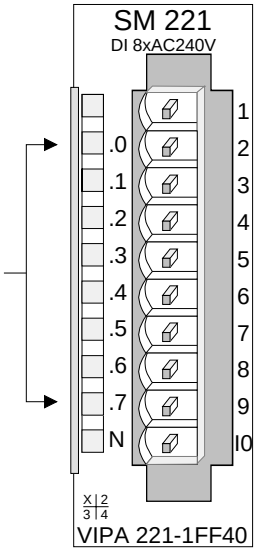
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

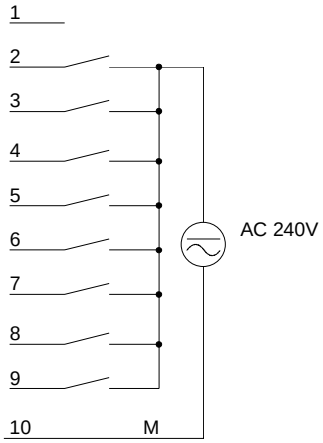
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 from app. AC 190 V (50Hz) the signal "1" is detected and the respective LED is turned on



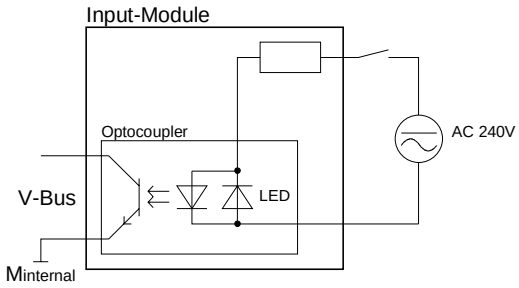
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Neutral conductor

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note!

This module is specified for voltages of max. AC 260V.

If inductive loads occur on the network, this load has to be filtered either directly at the module or at the according device, for example by using a snubber network.

Technical data

Electrical data	VIPA 221-1FF40
Number of inputs	8
Nominal input voltage	AC 240V
Current consumption per channel	20mA
Signal voltage "0"	AC 0 ...70V
Hysterese	AC 90 ... 160V
Signal voltage "1"	AC 190 ... 260V
Input filter time delay	25ms
Frequency of input voltage	50Hz
Input resistance	136kΩ
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	60mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	ca. 50g

221-1FF50 - DI 8xAC/DC 180...265V

Order data DI 8xAC/DC 180...265V VIPA 221-1FF50

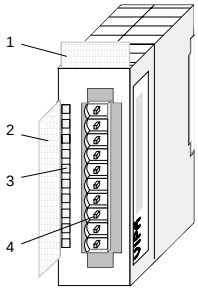
Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system.

The module has 8 channels, each one with a light emitting diode to indicate the status of the channel.

Properties

- 8 floating inputs, isolated from the backplane bus
- Nominal input voltage AC/DC 180...265V
- Status indicator for each channel by means of an LED

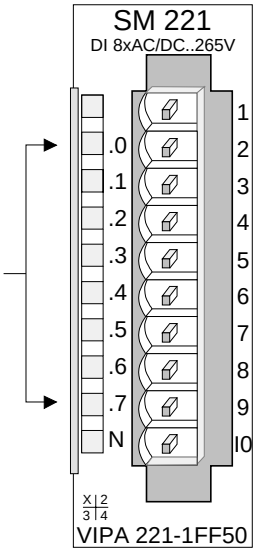
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

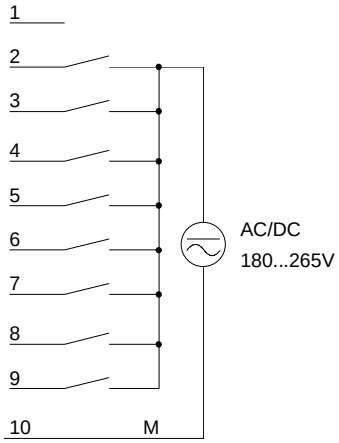
LED	Description
.0... .7	LEDs (green) I+0.0 to I+0.7 from app. DC 150V resp. AC 170V (50Hz) the signal "1" is detected and the respective LED is turned on



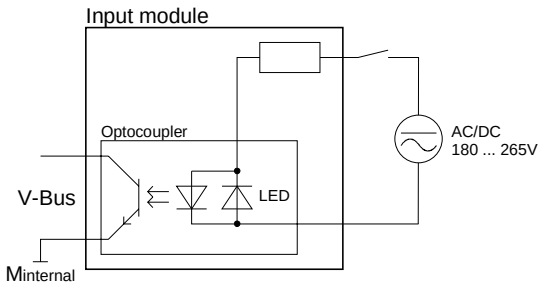
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
4	Input I+0.2
5	Input I+0.3
6	Input I+0.4
7	Input I+0.5
8	Input I+0.6
9	Input I+0.7
10	Neutral conductor

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1FF50
Number of inputs	8
Nominal input voltage	AC/DC 180...265V
Signal voltage "0"	AC/DC 0 ...150V
Signal voltage "1"	AC/DC 180 ... 265V
Input filter time delay	25ms
Frequency of input voltage	50 ... 60Hz
Input resistance	136kΩ
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	80mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH00 - DI 16xDC 24V with UB4x

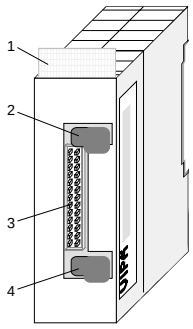
Order data DI 16xDC 24V VIPA 221-1BH00

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. This module requires an UB4x-converter. It has 16 channels that indicate the respective status via LEDs on the UB4x. The module has to be connected to the converter module (DEA-UB4x) by means of a flattened round cable (DEA-KB91C).

Properties

- 16 inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of a LED located on the conversion module UB4x

Construction

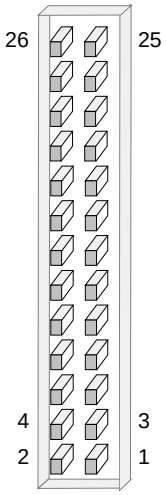


[1] Label for module description
[2] Clip
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable
[4] Clip

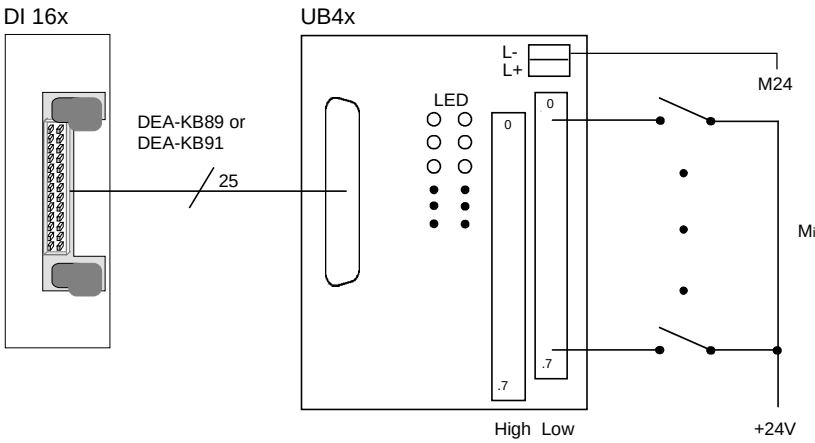
Status indicator on UB4x

LED	Description
0... .15	LEDs (yellow) I+0.0 to I+0.7 High I+0.0 to I+0.7 Low A "1" signal level is recognized as of app. 15V and the respective LED is turned on
L+ L-	LED (green) Supply voltage available

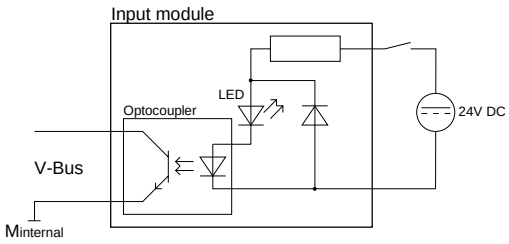
Pin assignment module

Connector	Pin	Assignment
	23...26	Supply voltage +DC 24V
	22	Input I+0.0
	.	.
	.	.
	.	.
	15	Input I+0.7
	14	Input I+1.0
	.	.
	.	.
	.	.
	7	Input I+1.7
	1...6	Supply voltage Ground

Interface to UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 221-1BH00
Number of inputs	16
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	35mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the UB4x
Programming specifications	
Input data	2byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH10 - DI 16xDC 24V

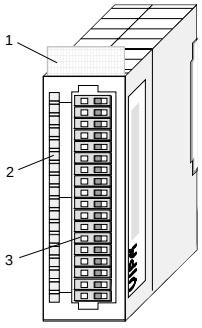
Order data DI 16xDC 24V VIPA 221-1BH10

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LEDs.

Properties

- 16 inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

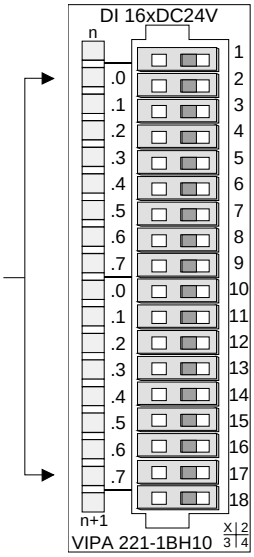
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

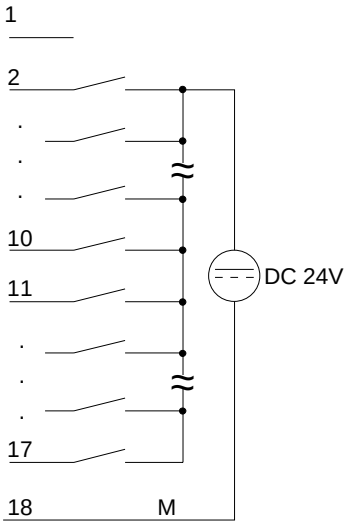
LED	Description
.0 7	LEDs (green) I+0.0 to I+0.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



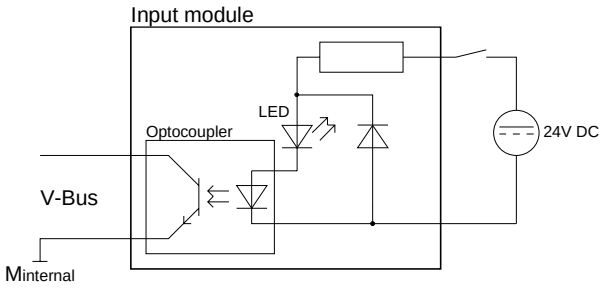
Pin	Assignment
1	not connected
2	Input I+0.0
3	Input I+0.1
.	.
.	.
.	.
9	Input I+0.7
10	Input I+1.0
.	.
.	.
.	.
16	Input I+1.6
17	Input I+1.7
18	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BH10
Number of inputs	16
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	40mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	2byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH20 - DI 16xDC24V/1C

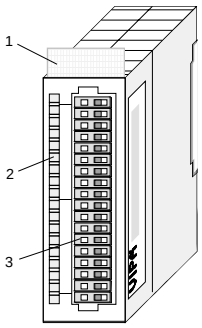
Order data DI 16xDC24V/1C VIPA 221-1BH20

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LEDs. Additionally, the first two channels may head for counters.

Properties

- 16 inputs, isolated from the backplane bus
- 2 inputs (I+0.0 and I+0.01) are configurable as one counter, frequency or period measurement
- Pull up abbr. pull down resistors are inside, so sensors with positive and negative logic can be connected
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

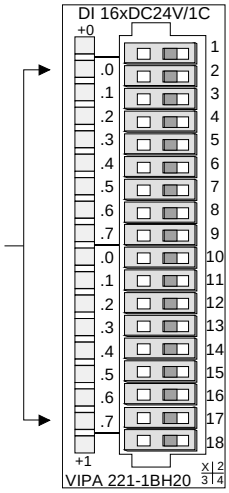
Construction



[1] Label for module name
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

LED	Description
.0 7	LEDs (green) I+0.0 to I+1.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on

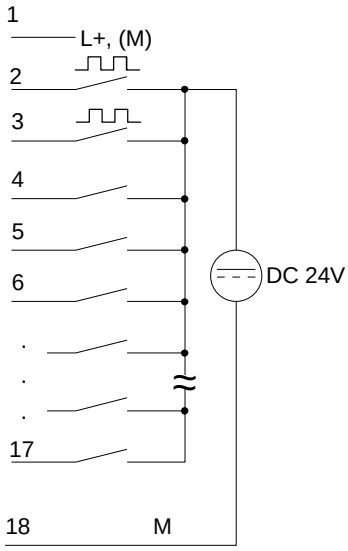


Pin	Assignment
1	L+ DC 24V or Ground*)
2	Input I+0.0 / Counter (A)
3	Input I+0.1 / Counter (B)
4	Input I+0.2
.	.
.	.
.	.
9	Input I+0.7
10	Input I+1.0
.	.
.	.
.	.
17	Input I+1.7
18	Ground

*) DC 24V or Ground to connect sensors with positive or negative logic at I+0.0 or I+0.1

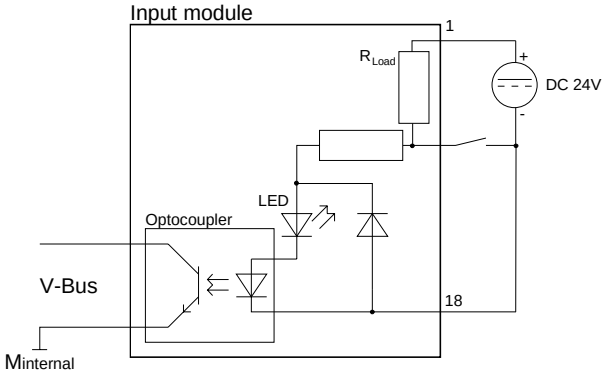
Circuit and schematic diagram

Wiring diagram

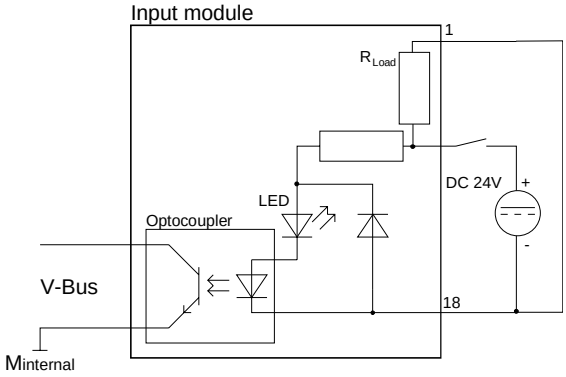


Schematic diagram

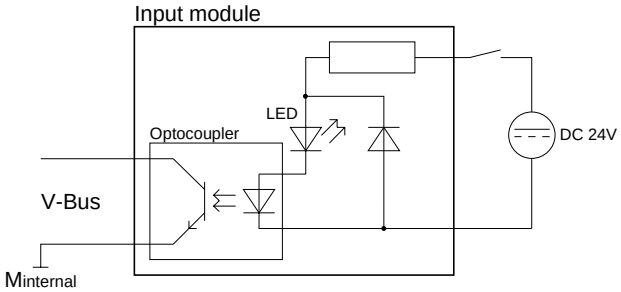
Input I+0.0, I+0.1 (negative logic)



Input I+0.0, I+0.1 (positive logic)



Input I+0.2 … I+1.5



Note!

The inputs I+0.0 and I+0.1 have also internal pull up (-down) resistors, which lead to pin 1 of the connector strip.

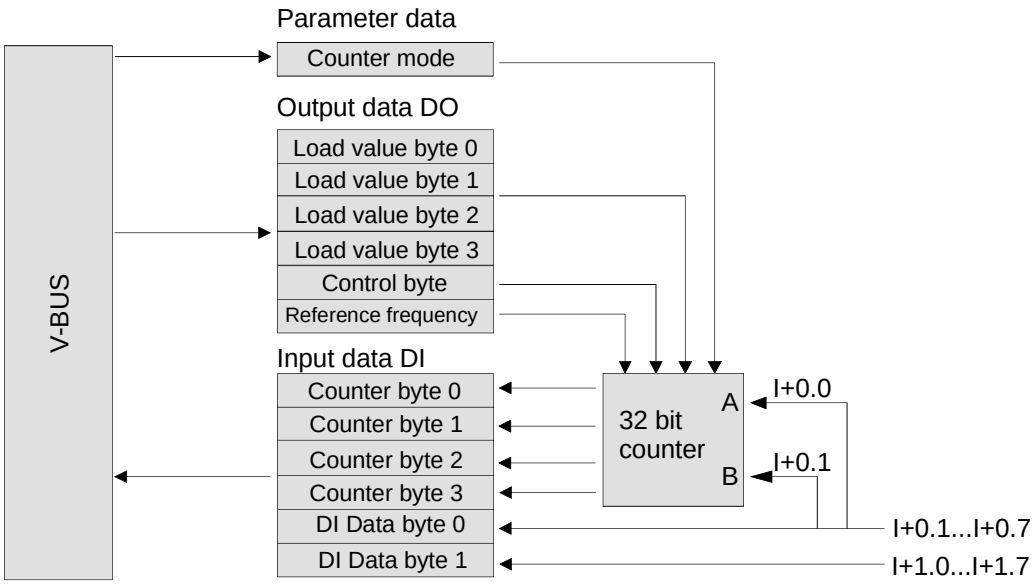
You can connect the sensors with negative logic output directly to the inputs I+0.0 and I+0.1. Here you have to supply pin 1 with DC 24V.

Connect pin 1 to Ground (bridge to pin 18) when I+0.0 and I+0.1 are used as "normal" inputs with positive logic.

Overview

The module is a 16bit digital input module for System 200V combined with a one-channel 32bit counter.

Inputs I+0.0 and I+0.1 are used as 'normal' process inputs and as counter inputs (signal A and signal B) simultaneously.



By writing *output data DO* to the module, you may preset a counter value with a *load value* as well as a *reference frequency*. The activation of this values takes place by means of the *control byte*.

With a read access on the *input data DI* you obtain the current counter value.

The counting is started res. stopped via the *control byte* (software gate).

There are 5 counter functions supported. The appropriate counter function is set by parameterization.

Counter activation via software gate

Many applications require that the count can be started or stopped at a defined time depending on other events. This starting and stopping of the count process is done via a software gate function. If the gate is opened, count pulses can reach the counter and the count is started. If the gate is closed, count pulses can no longer reach the counter and the count is stopped.

The software gate is controlled via the bits START and STOP in the Control Byte. Setting the bit START will open the software gate whereas setting the bit STOP will close the software gate.

Count range / Limit values

The counter module can count up and down. The count value is 32Bit wide and is to be interpreted as of type unsigned integer. Therefore the count limits are given as:

Lower count limit	Upper count limit
0	+ 4.294.967.295 ($2^{32} - 1$)

Load value

It is possible to specify a load value for the counter. After loading the counter starts counting up res. down from this new value to the upper res. lower limit value. After receiving a new counting pulse, the counter jumps to the lower (counting up) res. upper limit (counting down) and starts the counting again.

In the operation mode "Frequency Measurement" the load value is used to define the time window of the measurement.

The load mechanism is controlled via the bit LOAD in the control byte.

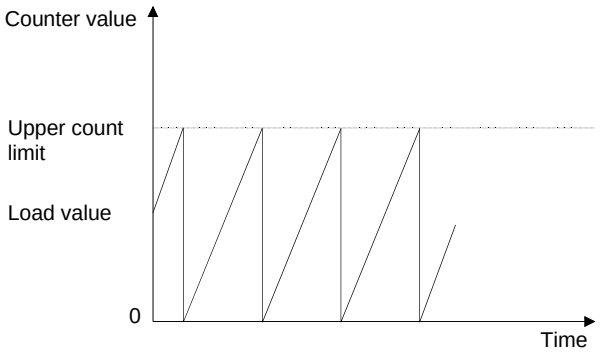
Continuous counting

In all counter modes, a continuous counter function is used as described in the following paragraphs and as shown in figure.

If the counter reaches the upper count limit when counting up and a further count pulse is received, the counter jumps to the lower count limit and starts to add the count pulses again, meaning it counts continuously.

If the counter reaches the lower count limit when counting down and a further count pulse is received, the counter jumps to the upper count limit and continues to count down from there.

The count range in all modes is 0 to +4.294.967.295 and cannot be changed. The counter starts to count at 0 when a complete restart (Power-On Reset or VBUS-Reset) is executed on the module or the counter is cleared by setting bit CLEAR in the control byte.



Maximum counter frequency

At the designation of maximum counter frequency, two types of indication are distinguished:

- *Maximum impulse frequency*
  The maximum impulse frequency is the maximum frequency the adjacent signal may have, i.e. the maximum frequency at witch the impulses arrive at the module. At this module the maximum impulse frequency is 100Hz.
- *Maximum counter frequency*
  The maximum counter frequency is the frequency at witch can be internally counted to the maximum. At this module the maximum impulse frequency is 400Hz.

Module access

For input and output data, the module occupies each 6byte in the address area. For setting the counter mode there are 1byte parameter data at disposal.

Loading the counter res. presetting of a reference frequency is via a control byte by typing the wanted value into the output address area and setting the bit 2 of the control byte to activate the counter.

You may see the counter value and the state of the inputs in the input address area. Also during count operation you may call all input channels.

Input data
DI data bytes

Input bytes 0 to 3 are assigned to the 32bit counter value whereas bytes 4 and 5 are assigned to the 16Bit digital inputs.

Byte	Bit 7 ... Bit 0
0	Counter value byte 0
1	Counter value byte 1
2	Counter value byte 2
3	Counter value byte 3
4	DI Data byte 0 (I+0.7 ... I+0.0)
5	DI Data byte 1 (I+1.7 ... I+1.0)

Output data
DO data bytes

Byte 0 to 3 are assigned to a load value according to the selected counter mode. Byte 4 is used as control byte for the counter. Byte 5 selects a reference frequency for the counter modes "Frequency Measurement" and "Period Measurement".

Byte	Bit 7 ... Bit 0
0	Load value byte 0
1	Load value byte 1
2	Load value byte 2
3	Load value byte 3
4	Control byte
5	Reference Frequency

Control byte

Bit	Function
0	1 = START counter (the software gate is open)
1	1 = STOP counter (the software gate is closed)
2	1 = LOAD counter
3	1 = CLEAR counter
7 ... 4	reserved

Reference frequency

Value	Reference frequency
00h	16 MHz
01h	8 MHz
02h	4 MHz
03h	1 MHz
04h	100 kHz
05h	10 kHz
06h	1 kHz
07h	100 Hz
others	not allowed

Parameter data

The module has 3byte parameter data for selecting the counter mode and configuring the digital input filters.

Byte	Bit 7 ... Bit 0
0	Counter function 00h: Quadruple Pulse Evaluation 01h: Pulse and Direction Evaluation 02h: Clock Up / Clock Down Evaluation 03h: Frequency Measurement 04h: Period Measurement others: not allowed
1	Filter (Divider 0) value: 0 ... 255
2	Filter (Divider 1) value: 0 ... 255

Counter function

A description of the counter functions can be found at the next page.

Filter

The counter inputs are debounced by means of digital filters, which can be adjusted via parameter Filter (Divider 0 and Divider 1).

So that an pulse can be evaluated as a counting pulse, this must be present longer than the parameterized filter value. Shorter pulses are not evaluated.

For calculation of the pulse time the following formula is to be used:

$T_{Pulse} \geq$ *(Divider 0* +1)*(*Divider 1* +1)*2.5µs

Example: *Divider 0* = 3, *Divider 1* = 0

$T_{Pulse} \geq (3+1)*1*2.5\mu s = 10\mu s$

In this way filter for a pulse time of 2.5 ... 163840µs can be parameterized.

Example (default:) *Divider 0* = 0, *Divider 1* = 0

$T_{Pulse} \geq 1*1*2.5\mu s = 2.5\mu s$

By default (after Reset) a filter width of 2.5µs is used.

Counter functions

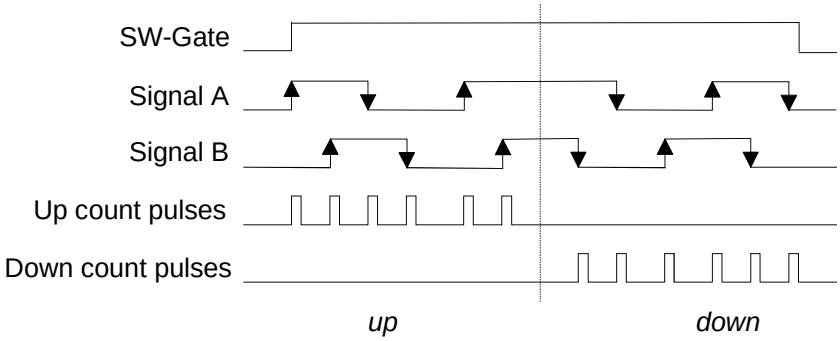
Quadruple Pulse Evaluation (00h)

Quadruple evaluation means that the rising and falling edges of A and B are evaluated; whether up or down count pulses are generated depends on which channel hurries first.

In this counting mode I+0.0 and I+0.1 have the following function:

I+0.0 as channel A: If channel A hurries in front, the counter counts up.

I+0.1 as channel B: If channel B hurries in front, the counter counts down.



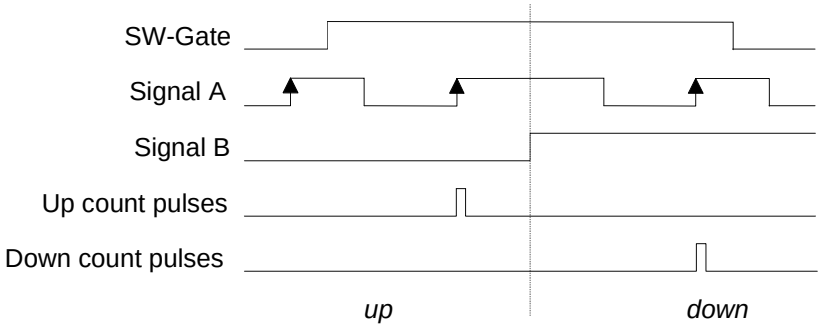
Pulse and Direction Evaluation (01h)

Every rising edge of A is evaluated. Channel B defines the counter direction.

In this counting mode I+0.0 and I+0.1 have the following function:

I+0.0 as channel A: Clock pulse for the counter at rising edge.

I+0.1 as channel B: Defines the counter direction (0 = up, 1 = down)



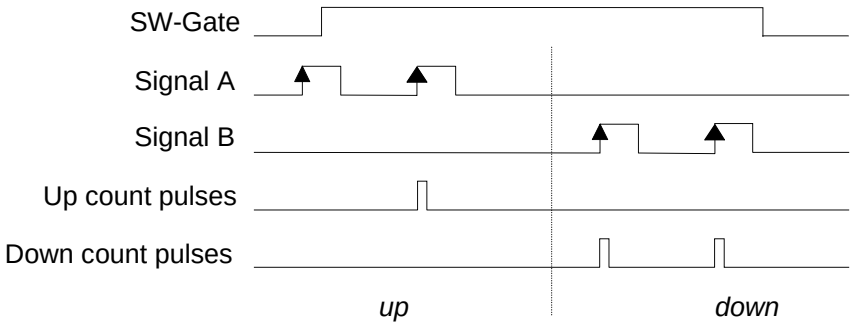
Clock Up / Clock Down Evaluation (02h)

The rising edges of channel A and B are evaluated. The counter is incremented with every rising edge of A and decremented with every rising edge of B.

In this counting mode I+0.0 and I+0.1 have the following function:

I+0.0 as channel A: Clock up pulse for the counter at rising edge.

I+0.1 as channel B: Clock down pulse for the counter at rising edge.



Frequency measurement (03h)

In frequency measurement mode, the module counts the number of rising edges of channel A received within a specified time window.

Channel B is not used in this mode.

The time window T_W is specified indirectly by selecting a *reference frequency* with DO byte 5 and defining a *load value* in DO bytes 0 to 3:

$$T_W = \frac{1}{\text{Reference Frequency}} * Load\ Value$$

By setting the Bit 2 of the *control byte*, the time window is transferred. When the counter is enabled (software gate is open), the reference counter is started with the first rising edge of channel A and is incremented with every rising edge of the reference clock.

When the reference counter reaches the load value (time T_W has expired), the current counter value is copied to DI byte 0 to 3 and can be read.

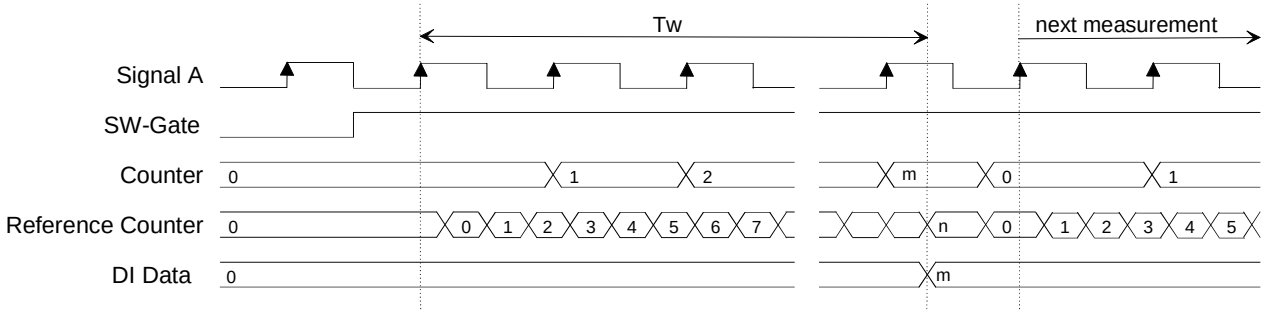
Then the counter and the reference counter are cleared automatically and the next frequency measurement is started with the next rising edge of channel A. If there aren't at least two rising edges of channel A within the time window T_W , the counter value will be read as 0 for this measurement.

Frequency measurement is started and ended by using the software gate that is as long as the software gate is open, the frequency of channel A is measured.

The counter can be cleared at any time by CLEAR='1' in the *control byte* while the *load value* stays valid until a new value is loaded or a Reset is detected.

The recent frequency can be computed by using the following formula:

$$Frequency = \text{Reference Frequency} * \frac{Counter\ Value}{Load\ Value}$$



Example:

Reference Frequency :	1 MHz
Load Value (n) :	1.000.000
Counter Value (m) :	10.000

$$Frequency = 1\ MHz * \frac{10.000}{1.000.000} = 10\ kHz$$

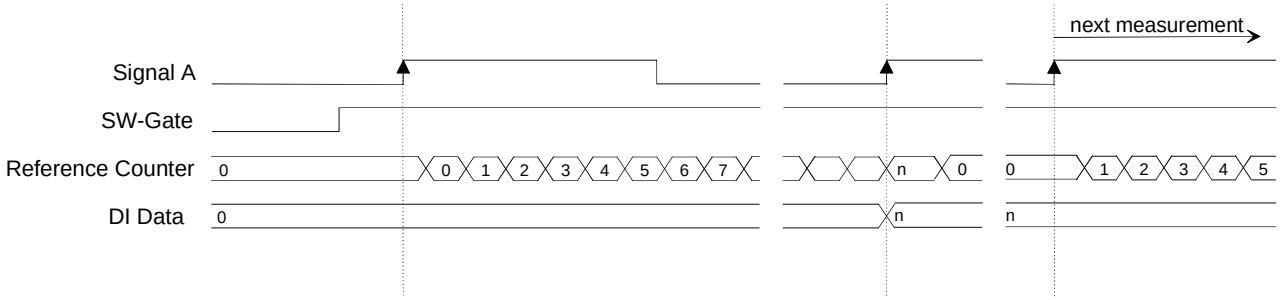
Period measurement (04h)

With very small frequencies, it is convenient to measure the period instead of the frequency. In the operating mode "Period Measurement", the time between two rising edges of channel A is measured by counting the number of rising edges of the selected reference clock occurring between two rising edges of channel A. Channel B is not used in this mode.

Period measurement is started and ended by using the software gate, that is: as long as the software gate is open the period of channel A is measured continuously. The counter can be cleared at any time by CLEAR="1" in the *control byte*. The period measurement will then start again with the next rising edge of channel A.

The recent signal period can be computed by using the following formula:

$$Period = \frac{1}{\text{Reference Frequency}} * Counter\ Value$$



Example: Reference Frequency : 1 MHz
Counter Value (n) : 10.000

$$Period = \frac{1}{1\,\text{MHz}} * 10.000 = 10\,ms$$

Note!

The counter value stays valid until the next measurement is completed or the counter is cleared.

If the next measurement is never completed (e.g. because the second rising edge of channel A never occurs), you will always see the "old" counter value and not the current value of the Reference Counter.

Technical data

Electrical data	VIPA 221-1BH20
Number of inputs	16
Counter	1 (2 inputs A, B)
Rated input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input filter counter	100µs
Max. impulse frequency	100kHz
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	85mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	6byte
Output data	6byte
Parameter data	3byte
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH30 - DI 16xDC 24V - ECO

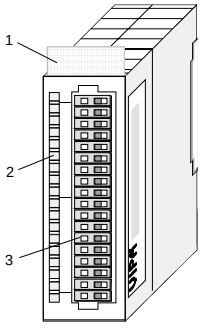
Order data DI 16xDC 24V VIPA 221-1BH30

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LEDs.

Properties

- 16 inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

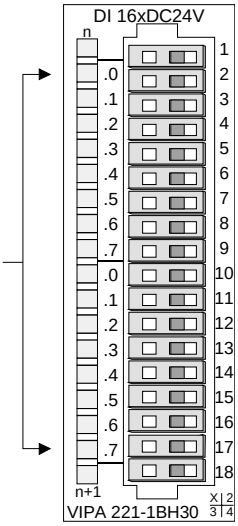
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

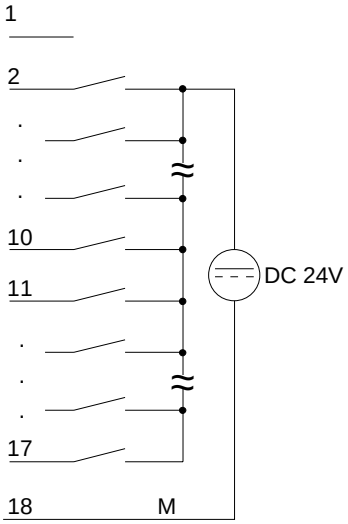
LED	Description
.0 7	LEDs (green) I+0.0 to I+1.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



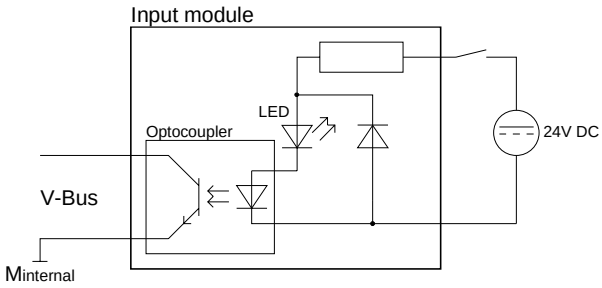
Pin	Assignment
1	Not connected
2	Input I+0.0
3	Input I+0.1
.	.
.	.
.	.
9	Input I+0.7
10	Input I+1.0
.	.
.	.
.	.
17	Input I+1.7
18	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BH30
Number of inputs	16
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	45mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	2byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH50 - DI 16xDC 24V NPN with UB4x

Order data DI 16xDC 24V NPN VIPA 221-1BH50

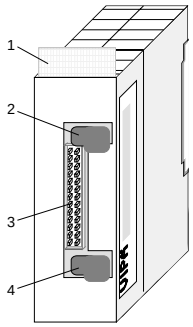
Description

The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. The input becomes active when it is connected to ground.
This module requires an UB4x-converter. It has 16 channels that indicate the respective status via LEDs on the UB4x. The module has to be connected to the converter module (DEA-UB4x) by means of a flattened round cable (DEA-KB91C).

Properties

- 16 inputs, isolated from the backplane bus
- Active low input (signal level "1" when input is at ground)
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of a LED located on the conversion module UB4x

Construction

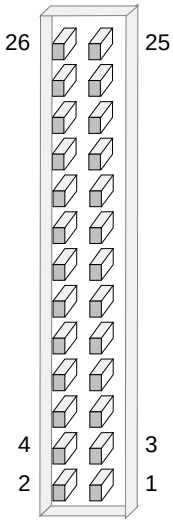


[1] Label for module description
[2] Clip
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable
[4] Clip

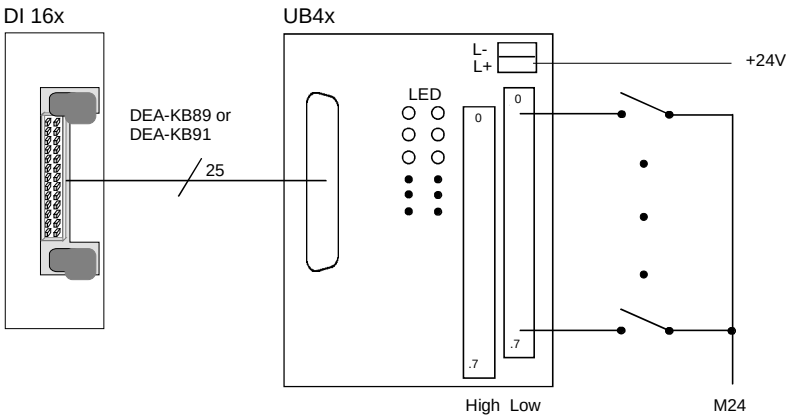
Status indicator on UB4x

LED	Description
0... .15	LEDs (yellow) I+0.0 to I+0.7 High I+0.0 to I+0.7 Low A "1" signal level is recognized as of app. 15V and the respective LED is turned on
L+ L-	LED (green) Supply voltage available

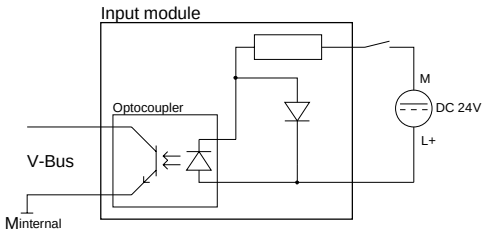
Pin assignment module

Connector	Pin	Assignment
	23...26	Supply voltage +DC 24V
	22	Input I+0.0
	.	.
	.	.
	.	.
	15	Input I+0.7
	14	Input I+1.0
	.	.
	.	.
	.	.
	7	Input I+1.7
	1...6	Supply voltage Ground

Interface to UB4x



Schematic diagram module



Technical data

Electrical data	VIPA 221-1BH50
Number of inputs	16
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	15 ... 28.8V
Signal voltage "1"	0 ... 5V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	40mA
Isolation	500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the UB4x
Programming specifications	
Input data	2byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

221-1BH51 - DI 16xDC 24V NPN

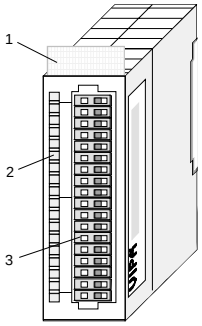
Order data DI 16xDC 24V NPN VIPA 221-1BH51

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LEDs. The input becomes active when it is connected to ground.

Properties

- 16 inputs, isolated from the backplane bus
- Active low input (signal level "1" when input is at ground)
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

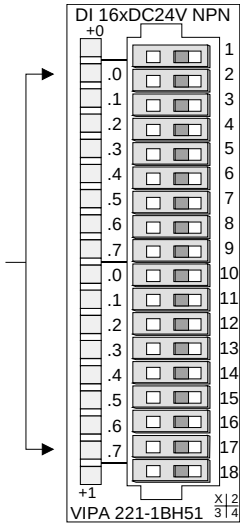
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator connector assignment

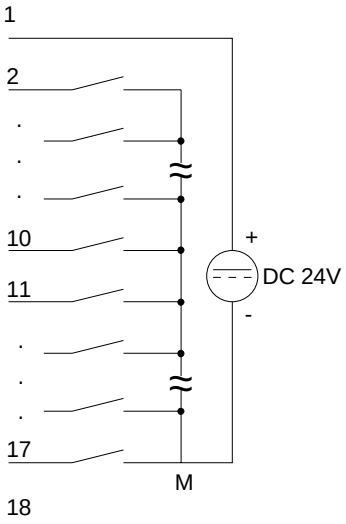
LED	Description
.0 7	LEDs (green) I+0.0 to I+1.7 A "1" signal level is recognized as of app. ground and the respective LED is turned on



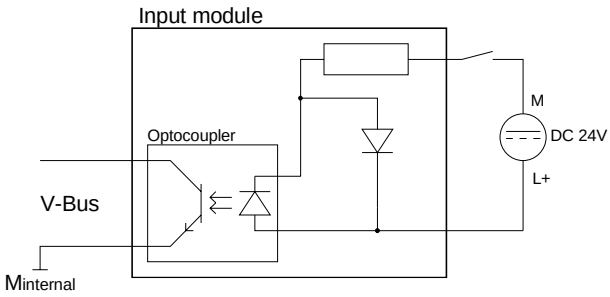
Pin	Assignment
1	+DC 24V
2	Input I+0.0
3	Input I+0.1
.	.
.	.
.	.
9	Input I+0.7
10	Input I+1.0
.	.
.	.
.	.
17	Input I+1.7
18	Not connected

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-1BH51
Number of inputs	16
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	20mA
Power dissipation	3W
Isolation tested with	DC 500V
Isolation	
- between channels and bus	yes
- between channels	no
Length of cable	
- shielded	1000m
- unshielded	600m
Number simultaneously trigger able inputs	
- horizontal config. up to 60°C	16
- vertical config. up to 40°C	16
Status indicator	via LEDs located on the front
Data for selecting a sensor	
Input voltage	
- Rated value	DC 24V (20.4 ... 28.8V)
- for signal "1"	0 ... 5V [1]
- for signal "0"	15 ... 28.8V [1]
Input current	
- for signal "1"	7mA
Input filter delay	3ms
Connection of two-wire Beros	possible
- permitted bias current	1.5mA
Programming specifications	
Input data	2byte
Output data	-
Parameter data	-
Diagnostics data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	55g

[1] Reference potential is ground of DC 24V.

221-2BL10 - DI 32xDC 24V

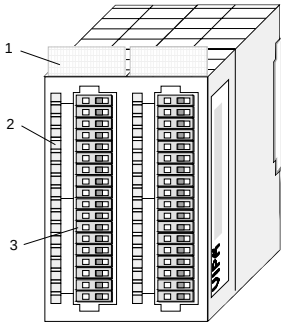
Order data DI 32xDC 24V VIPA 221-2BL10

Description The digital input module accepts binary control signals from the process and provides an electrically isolated interface to the central bus system It has 32 channels that indicate the respective status by means of LEDs.

Properties

- 32 inputs, isolated from the backplane bus
- DC 24V nominal input voltage
- Suitable for standard switches and proximity switches
- Status indicator for each channel by means of an LED

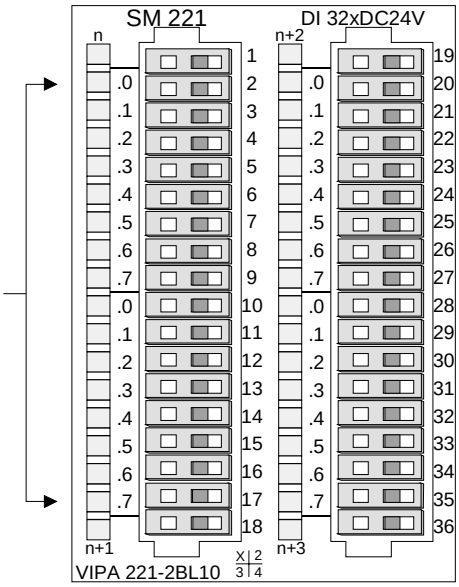
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator
pin assignment

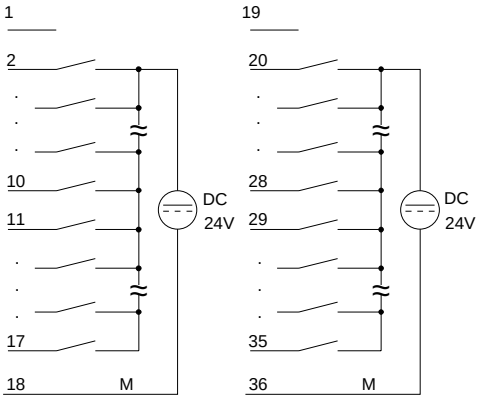
LED	Description
.0 7	LEDs (green) I+0.0 to I+3.7 A "1" signal level is recognized as of app. 15V and the respective LED is turned on



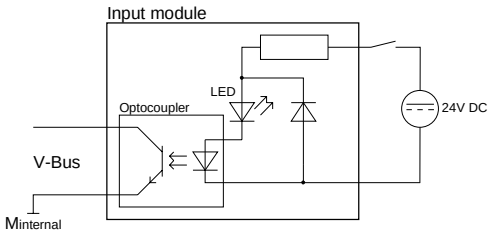
Pin	Assignment
1	Not connected
2 ... 17	Input I+0.0...I+1.7
.	.
.	.
.	.
18	Ground
19	Not connected
.	.
.	.
.	.
20 ... 35	Input I+2.0...I+3.7
36	Ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 221-2BL10
Number of inputs	32
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Power supply	DC 5V via backplane bus
Current consumption via backplane bus	40mA
Isolation	in 2 groups of 16 inputs each 500Vrms (field voltage to the bus)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	4byte
Output data	-
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50.8x76x88
Weight	50g

Chapter 4 Digital output modules

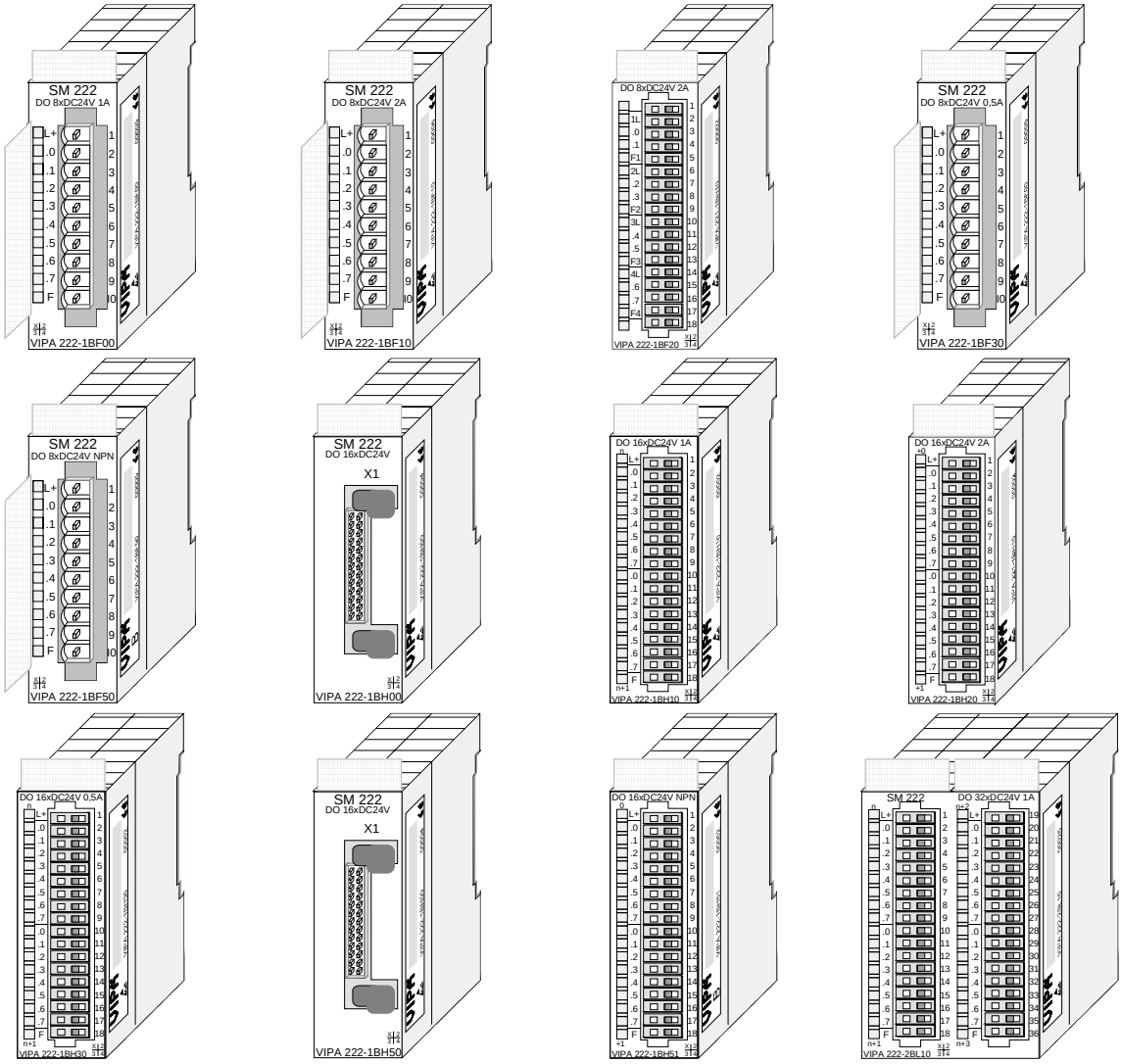
Overview

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

Contents

System overview

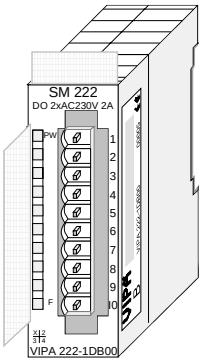
DC 24V output modules SM 222



Order data DC 24V output modules

Type	Order number	Page
DO 8xDC 24V 1A	VIPA 222-1BF00	4-4
DO 8xDC 24V 2A	VIPA 222-1BF10	4-6
DO 8xDC 24V 2A floating 4 á 2	VIPA 222-1BF20	4-8
DO 8xDC 24V 0.5A - ECO	VIPA 222-1BF30	4-10
DO 8xDC 24V NPN	VIPA 222-1BF50	4-12
DO 16xDC 24V 0.5A with UB4x	VIPA 222-1BH00	4-14
DO 16xDC 24V 1A	VIPA 222-1BH10	4-16
DO 16xDC 24V 2A	VIPA 222-1BH20	4-18
DO 16xDC 24V 0.5A - ECO	VIPA 222-1BH30	4-20
DO 16xDC 24V 0.5A NPN	VIPA 222-1BH50	4-22
DO 16xDC 24V 0.5A NPN	VIPA 222-1BH51	4-24
DO 32xDC 24V 1A	VIPA 222-2BL10	4-26

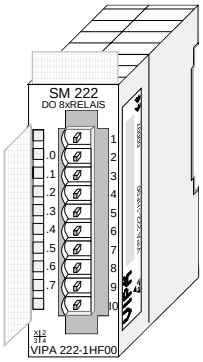
Dimmer output module SM 222

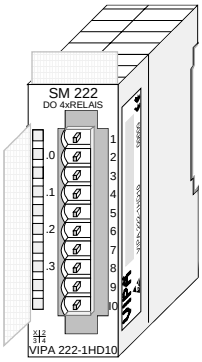


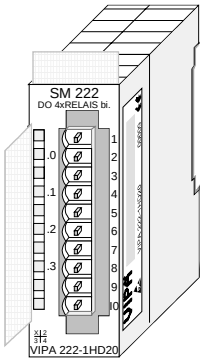
Order data Dimmer output module

Type	Order number	Page
DO 2xAC 100...230V, 2A	VIPA 222-1DB00	4-28

Relay output modules SM 222



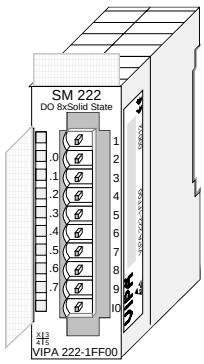


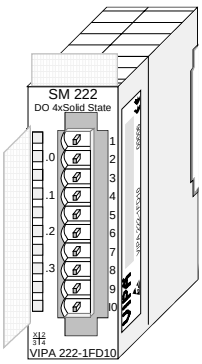


Order data relay output modules

Type	Order number	Page
DO 8xRelay COM	VIPA 222-1HF00	4-37
DO 4xRelay	VIPA 222-1HD10	4-39
DO 4xRelay bistable	VIPA 222-1HD20	4-41

Solid-state output modules SM 222





Order data solid-state output modules

Type	Order number	Page
DO 8xSolid State COM	VIPA 222-1FF00	4-43
DO 4xSolid State	VIPA 222-1FD10	4-45

222-1BF00 - DO 8xDC 24V 1A

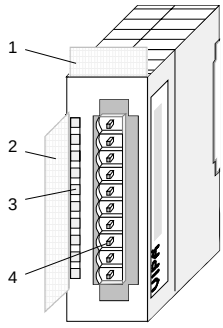
Order data DO 8xDC 24V 1A VIPA 222-1BF00

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a supply of DC 24V via the front-facing connector. It provides 8 channels and the status of each channel is displayed by means of an LED.

Properties

- 8 outputs, isolated from the backplane bus
- DC 24V supply voltage
- 1A output current
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

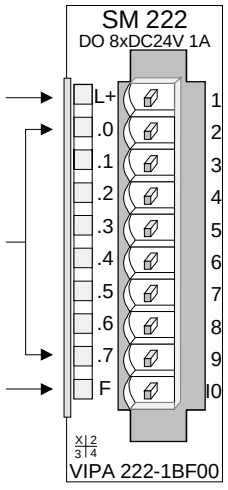
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

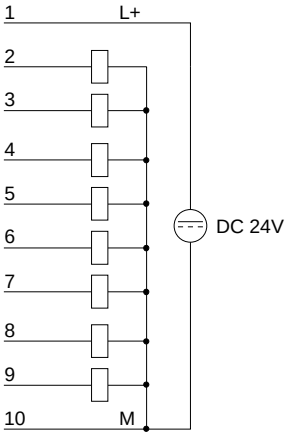
LED	Description
L+	LED (green) Supply voltage available
.0... .7	LEDs (green) Q+0.0 to Q+0.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



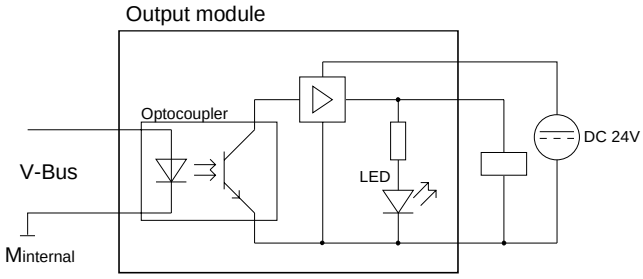
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q+0.1
4	Output Q+0.2
5	Output Q+0.3
6	Output Q+0.4
7	Output Q+0.5
8	Output Q+0.6
9	Output Q+0.7
10	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF00
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	70mA
Output current per channel	1A protected against sustained short circuits
Total current	8A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BF10 - DO 8xDC 24V 2A

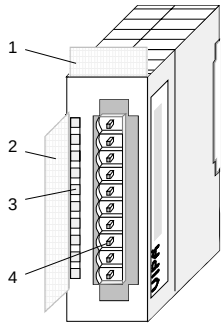
Order data DO 8xDC 24V 2A VIPA 222-1BF10

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a DC 24V supply via the connector located on the front. It provides 8 channels and the status of each channel is displayed by means of an LED. The maximum load current per output is 2A.

Properties

- 8 outputs, isolated from the backplane bus
- DC 24V supply voltage
- Output current 2A
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

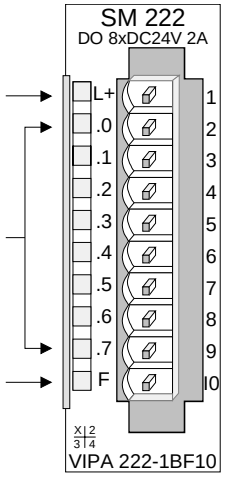
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

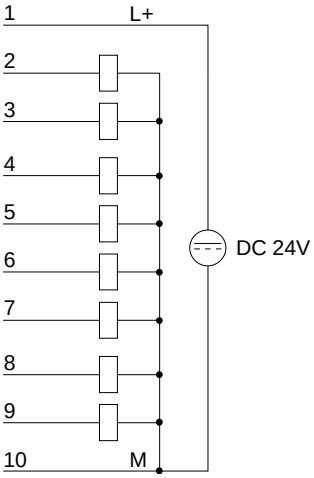
LED	Description
L+	LED (green) Supply voltage available
.0... .7	LEDs (green) Q+0.0 to Q+0.7 when an output becomes active the respective LED is turned on
F	LED (red) Overload, overheat, short circuit error



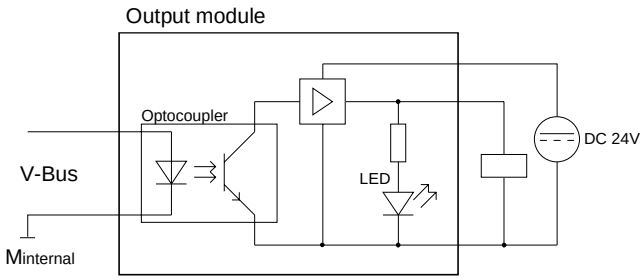
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q+0.1
4	Output Q+0.2
5	Output Q+0.3
6	Output Q+0.4
7	Output Q+0.5
8	Output Q+0.6
9	Output Q+0.7
10	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF10
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	70mA
Output current per channel	2A protected against sustained short circuits
Total current	10A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BF20 - DO 8xDC 24V 2A separated 4 á 2

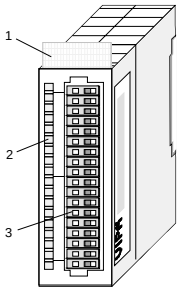
Order data DO 8xDC 24V 2A VIPA 222-1BF20

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a DC 24V supply via the connector located on the front. It provides 8 channels and the status of each channel is displayed by means of an LED. The maximum load current per output is 2A.

Properties

- 8 outputs, isolated from the backplane bus
- Potential separation in 4 groups á 2 outputs
- DC 24V supply voltage
- Output current 2A
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

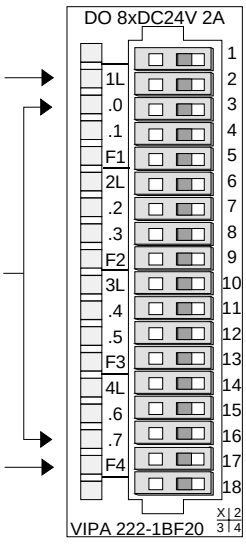
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator pin assignment

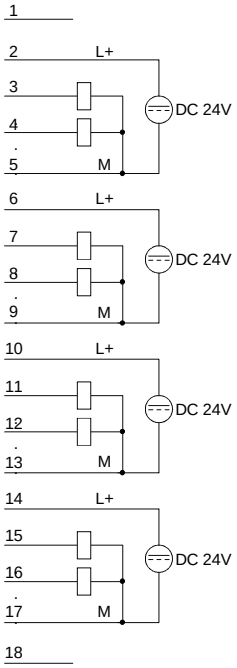
LED	Description
1L...4L	LED (green) Supply voltage available
	LEDs (green)
.0... .7	Q+0.0 to Q+0.7 (green) when an output becomes active the respective LED is turned on
F1...F4	LED (red) Overload, overheat, short circuit error



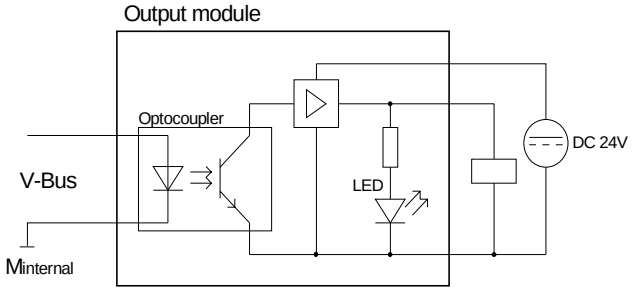
Pin	Assignment
1	not used
2	Supply voltage 1L+
3	Output Q+0.0
4	Output Q+0.1
5	Ground 1M
6	Supply voltage 2L+
7	Output Q+0.2
8	Output Q+0.3
9	Ground 2M
...	...
14	Supply voltage 4L+
15	Output Q+0.6
16	Output Q+0.7
17	Ground 4M
18	not used

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF20
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	70mA
Output current per channel	2A protected against sustained short circuits
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BF30 - DO 8xDC 24V 0.5A - ECO

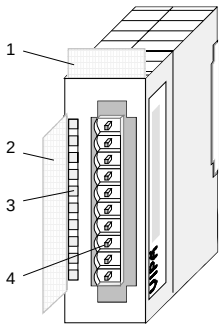
Order data DO 8xDC 24V 0.5A VIPA 222-1BF30

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires a supply of DC 24V via the front-facing connector. It provides 8 channels and the status of each channel is displayed by means of an LED.

Properties

- 8 outputs, isolated from the backplane bus
- DC 24V supply voltage
- 0.5A output current
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

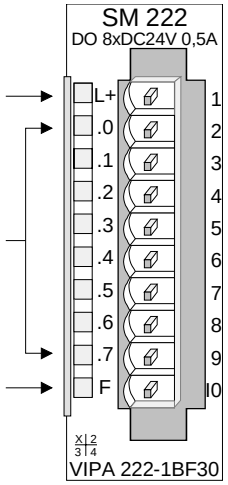
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

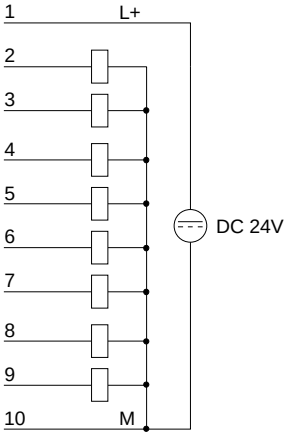
LED	Description
L+	LED (green) Supply voltage available
.0... .7	LEDs (green) Q+0.0 to Q+0.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



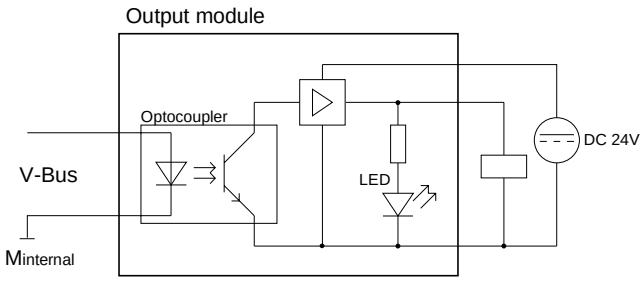
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q+0.1
4	Output Q+0.2
5	Output Q+0.3
6	Output Q+0.4
7	Output Q+0.5
8	Output Q+0.6
9	Output Q+0.7
10	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF30
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	70mA
Output current per channel	0.5A protected against sustained short circuits
Total current	4A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BF50 - DO 8xDC 24V 0.5A NPN

Order data DO 8xDC 24V 0.5A NPN VIPA 222-1BF50

Description

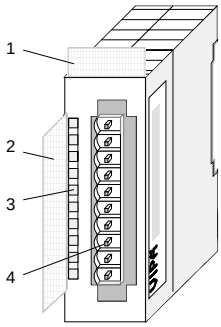
The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via Misfit outputs. It provides 8 channels that operate as Low-Side switches and that are interconnected via the load voltage. Low-Side switches are suitable for the control of grounds. When a short circuit occurs between the switched line and ground the result is that the load is activated until the short circuit has been removed. Short circuits do not place an additional load on the supply voltage.

Due to the system an overload at a channel can lead to the fact that the other channels are switched off. The LEDs however are further on, since they indicate the specified condition of the channels.

Properties

- 8 Low-Side outputs
- Output current per channel 0.5A
- Suitable for small motors, lamps, magnetic valves and contactors

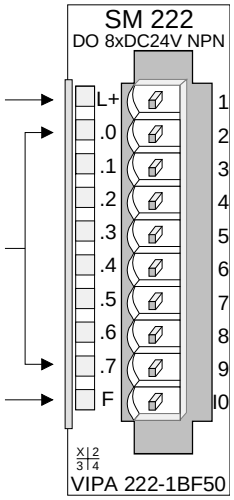
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

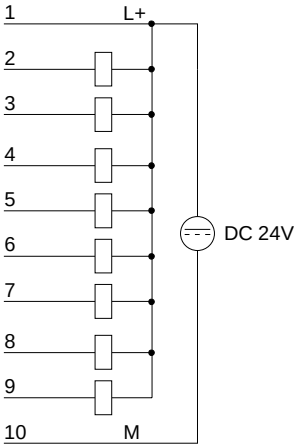
LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.0 to Q+0.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



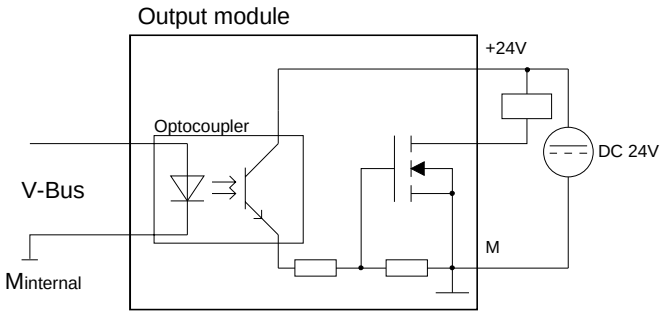
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q+0.1
4	Output Q+0.2
5	Output Q+0.3
6	Output Q+0.4
7	Output Q+0.5
8	Output Q+0.6
9	Output Q+0.7
10	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BF50
Number of outputs	8 via Low-Side
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption L+ without load	15mA (every A.x=off)
max. output current per channel	0.5A
Total current of outputs	4A
Power supply	DC 5V via backplane bus
Current consumption via bus	50mA
Power dissipation	1.5W
Isolation tested with	DC 500V
Isolation	
- between channels and bus	yes
- between channels	no
Short circuit protection of output	yes (1.7A threshold)
Length of cable (unshielded)	600m
Switch rate	
- for resistive load	1kHz
- for inductive load	0.5Hz (IEC947-5-1, DC13)
- for lamp load	10Hz
Status indicator	via LEDs located on the front
Data for selecting an actor	
Output current signal "1"	
- maximum current	125mV
- minimum current	0V
Output current signal "1"	0.5A (rated value)
Output current signal "0"	100µA (leakage current)
Output delay resistive load	
- from "0" to "1"	10µs
- from "1" to "0"	55µs
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostics data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	55g

222-1BH00 - DO 16xDC 24V 0.5A with UB4x

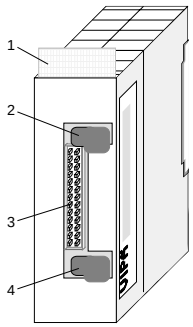
Order data DO 16xDC 24V 0.5A VIPA 222-1BH00

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. It has 16 channels and the status of each channel is displayed by means of an LED. This module requires a converter (DEA-UB4x). The module must be connected to the converter module by means of a flattened round cable (DEA-KB91C).

Properties

- 16 outputs, isolated from the backplane bus
- DC 24V supply voltage
- Output current 0.5A
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of a LED located on converter module UB4x

Construction

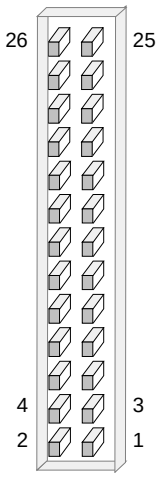


[1] Label for module description
[2] Clip
[3] Recessed connector for the interface to a conversion module UB4x via the flattened round cable
[4] Clip

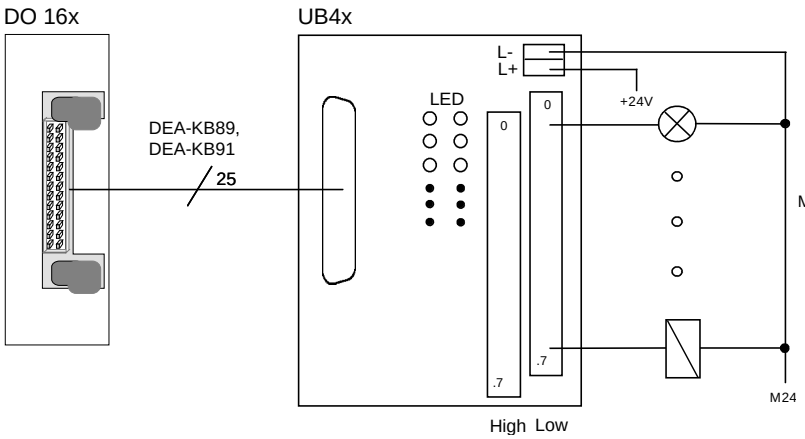
Status indicator on UB4x

LED	Description
0... .15	LEDs (yellow) Q+0.0 to Q+0.7 High Q+1.0 to Q+1.7 Low when an output is active the respective LED is turned on
L+ L-	LED (green) Supply voltage available

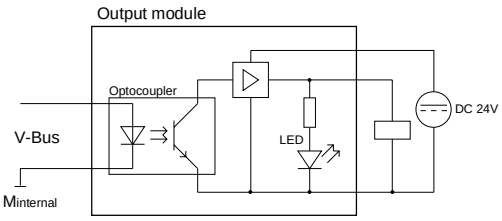
Pin assignment module

Connector	Pin	Assignment
	23...26	DC 24V supply voltage
	22	Output Q+0.0
	.	.
	.	.
	.	.
	15	Output Q+0.7
	14	Output Q+1.0
	.	.
	.	.
	.	.
	7	Output Q+1.7
	1...6	Supply ground

Interfacing of UB4x



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH00
Number of outputs	16
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	120mA
Output current per channel	0.5A protected against sustained short circuits
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the UB4x
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BH10 - DO 16xDC 24V 1A

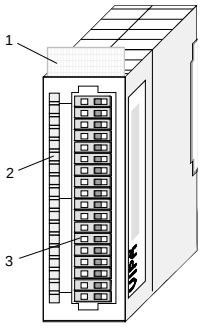
Order data DO 16xDC 24V 1A VIPA 222-1BH10

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. It has 16 channels and the status of each channel is displayed by means of an LED.

Properties

- 16 outputs, isolated from the backplane bus
- DC 24V supply voltage
- 1A output current rating
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

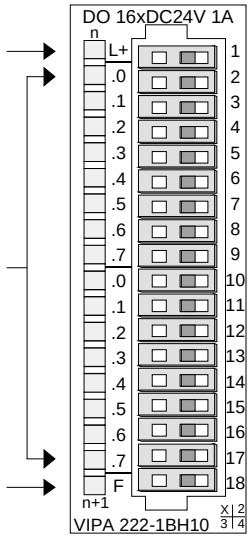
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator pin assignment

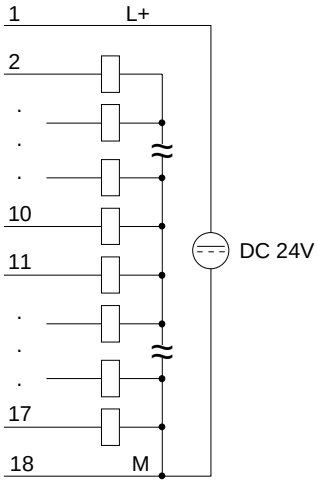
LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.0 to Q+1.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



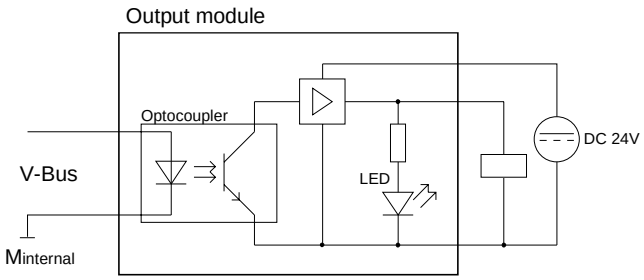
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q+0.1
.	.
.	.
.	.
9	Output Q+0.7
10	Output Q+1.0
.	.
.	.
.	.
16	Output Q+1.6
17	Output Q+1.7
18	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH10
Number of outputs	16
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	120mA
Output current per channel	1A protected against sustained short circuits
Total current	10A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BH20 - DO 16xDC 24V 2A

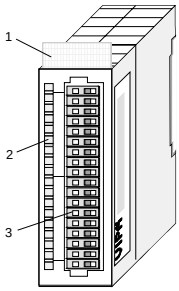
Order data DO 16xDC 24V 2A VIPA 222-1BH20

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. It has 16 channels and the status of each channel is displayed by means of an LED.

Properties

- 16 outputs, isolated from the backplane bus
- DC 24V supply voltage
- 2A output current rating
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

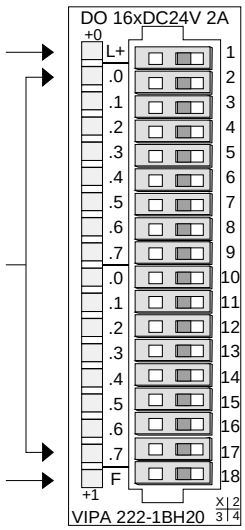
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator pin assignment

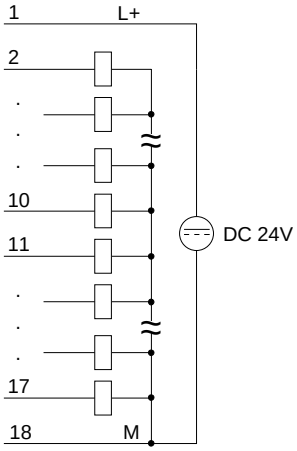
LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.0 to Q+1.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



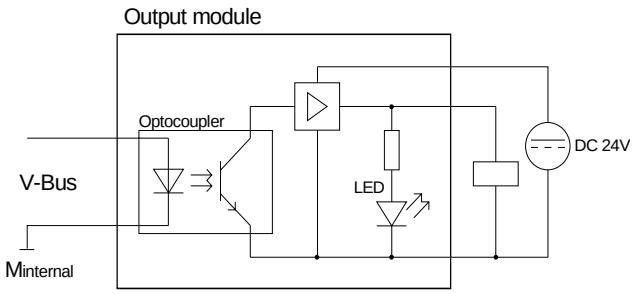
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
.	.
.	.
.	.
9	Output Q+0.7
10	Output Q+1.0
.	.
.	.
.	.
17	Output Q+1.7
18	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH20
Number of outputs	16
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	120mA
Output current per channel	2A protected against sustained short circuits
max. total current	10A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BH30 - DO 16xDC 24V 0.5A - ECO

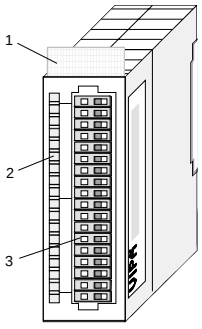
Order data DO 16xDC 24V 0.5A VIPA 222-1BH30

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. It has 16 channels and the status of each channel is displayed by means of an LED.

Properties

- 16 outputs, isolated from the backplane bus
- DC 24V supply voltage
- 0.5A output current rating
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

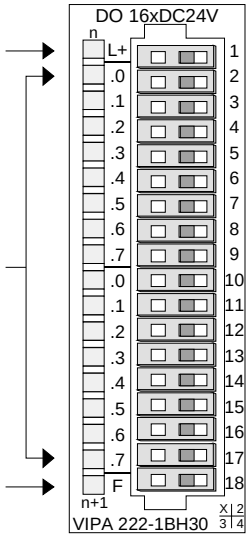
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator
pin assignment

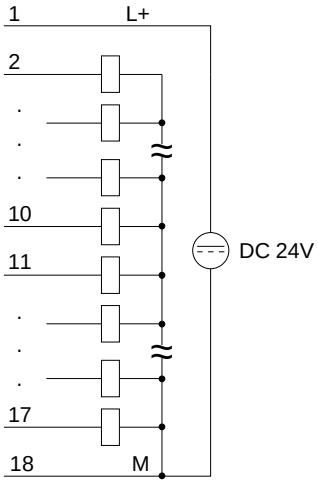
LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.0 to Q+1.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



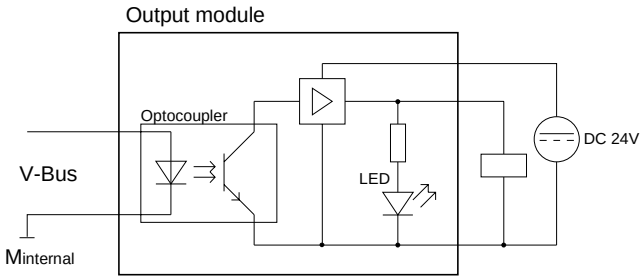
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
.	.
.	.
.	.
9	Output Q+0.7
10	Output Q+1.0
.	.
.	.
.	.
17	Output Q+1.7
18	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH30
Number of outputs	16
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Current consumption via backplane bus	120mA
Output current per channel	0.5A protected against sustained short circuits
Total current	8A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

222-1BH50 - DO 16xDC 24V 0.5A NPN

Order data

DO 16xDC 24V 0.5A NPN VIPA 222-1BH50

Description

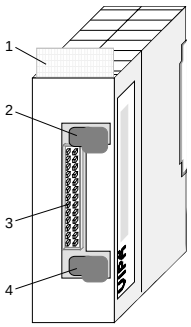
The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via Misfit outputs. It provides 16 channels that operate as Low-Side switches and that are interconnected via the load voltage. Low-Side switches are suitable for the control of grounds. When a short circuit occurs between the switched line and ground the result is that the load is activated until the short circuit has been removed. Short circuits do not place an additional load on the supply voltage.

Due to the system an overload at a channel can lead to the fact that the other channels are switched off. The LEDs however are further on, since they indicate the specified condition of the channels.

Properties

- 16 Low-Side outputs
- Output current per channel 0.5A
- Suitable for small motors, lamps, magnetic valves and contactors

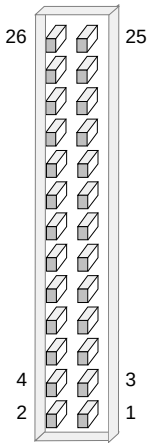
Construction



[1] Label for module description
[2] Clip
[3] Recessed connector for the interface to a output connection
[4] Clip

Pin assignment

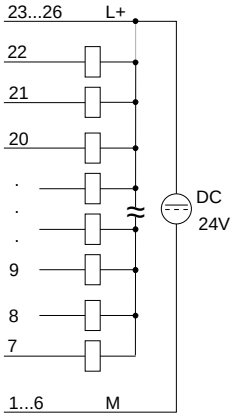
Connector



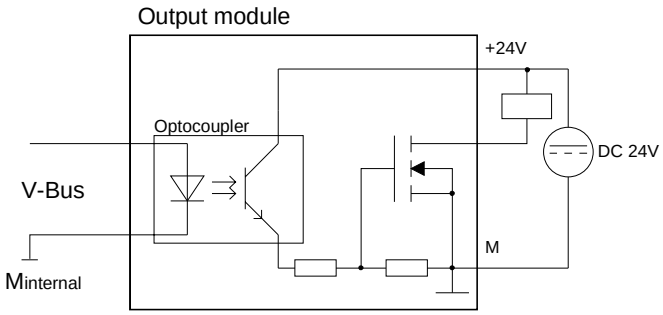
Pin	Assignment
23...26	DC 24V supply voltage
22	Output Q+0.0
21	Output Q+0.1
.	.
.	.
.	.
8	Output Q+1.6
7	Output Q+1.7
1...6	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Attention!

This module is not deployable with UB4x from VIPA without technical intervention. For deploying the module with a converter module from VIPA, please call the VIPA Hotline.

Technical data

Electrical data	VIPA 222-1BH50
Number of outputs	16 via Low-Side
Nominal load voltage	DC 24V (20.4 ... 28.8V)
max. output current per channel	0.5A
Current consumption via backplane bus	120mA
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	500Vrms (field voltage to the bus)
Switching rate	20kHz max.
Status indicator	-
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

222-1BH51 - DO 16xDC 24V 0.5A NPN

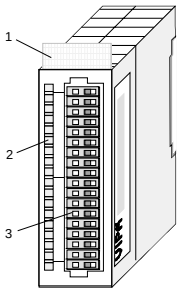
Order data DO 16xDC 24V 0.5A NPN VIPA 222-1BH51

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via Mosfet outputs. It provides 16 channels that operate as Low-Side switches and that are interconnected via the load voltage. Low-Side switches are suitable for the control of grounds. When a short circuit occurs between the switched line and ground the result is that the load is activated until the short circuit has been removed. Short circuits do not place an additional load on the supply voltage.

Properties

- 16 Low-Side outputs
- Output current per channel 0.5A
- Suitable for small motors, lamps, magnetic valves and contactors

Construction

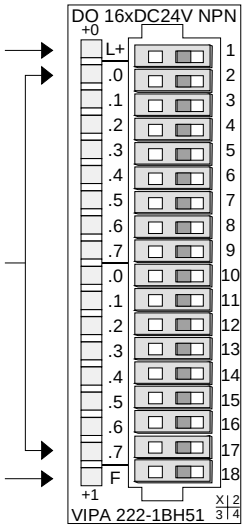


[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator

LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.0 to Q+1.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error

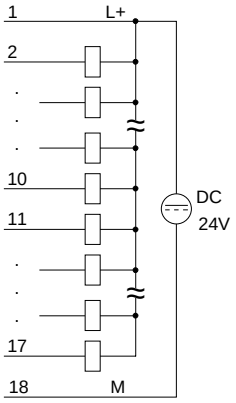
pin assignment



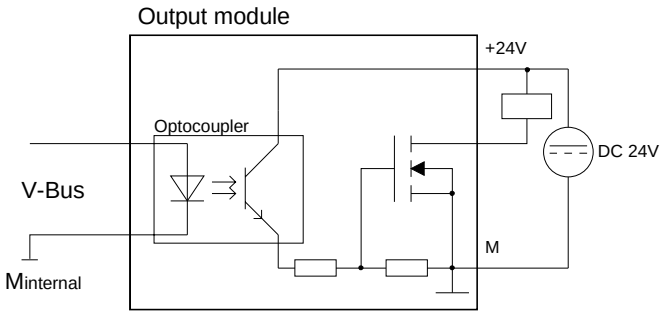
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
.	.
.	.
.	.
9	Output Q+0.7
10	Output Q+1.0
.	.
.	.
.	.
17	Output Q+1.7
18	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-1BH51
Number of outputs	16 via Low-Side
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption L+ without load	25mA (every A.x=off)
max. output current per channel	0.5A
Total current of outputs	8A
Power supply	DC 5V via backplane bus
Current consumption via bus	90mA
Power dissipation	2.5W
Isolation tested with	DC 500V
Isolation	
- between channels and bus	yes
- between channels	no
Short circuit protection of output	yes (1.7A threshold)
Length of cable (unshielded)	600m
Switch rate	
- for resistive load	1kHz
- for inductive load	0.5Hz (IEC947-5-1, DC13)
- for lamp load	10Hz
Status indicator	via LEDs located on the front
Data for selecting an actor	
Output current signal "1"	
- maximum current	125mV
- minimum current	0V
Output current signal "1"	0.5A (rated value)
Output current signal "0"	100µA (leakage current)
Output delay resistive load	
- from "0" to "1"	10µs
- from "1" to "0"	55µs
Programming specifications	
Input data	-
Output data	2byte
Parameter data	-
Diagnostics data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	55g

222-2BL10 - DO 32xDC 24V 1A

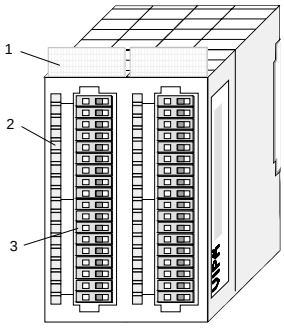
Order data DO 32xDC 24V 1A VIPA 222-2BL10

Description The digital output module accepts binary control signals from the central bus system and transfers them to the process level via outputs. The module requires 24V via the connector on the front. It provides 32 channels and the status of each channel is displayed by means of LEDs.

Properties

- 32 outputs, isolated from the backplane bus
- DC 24V supply voltage
- Output current per channel 1A
- Suitable for magnetic valves and DC contactors
- LEDs for supply voltage and error message
- Active channel indication by means of an LED

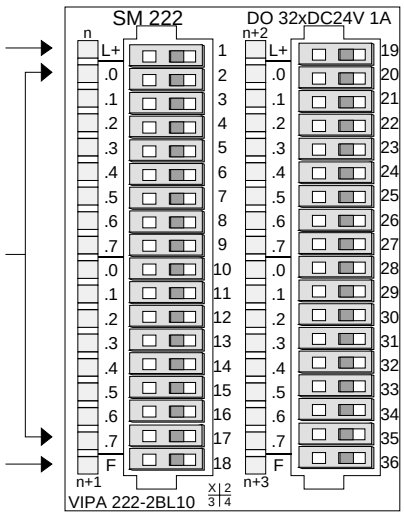
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator pin assignment

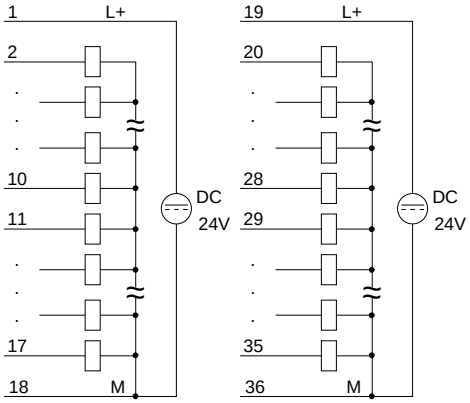
LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) Q+0.1 to Q+1.7 when an output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error



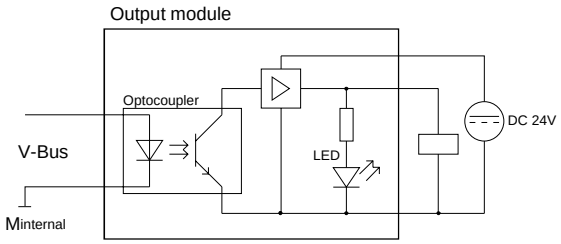
Pin	Assignment
1	DC 24V supply voltage
2	Output Q+0.0
3	Output Q +0.1
...	...
17	Output Q +1.7
18	supply ground
19	DC 24V supply voltage
20	Output Q +2.0
...	...
34	Output Q +3.6
35	Output Q +3.7
36	supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 222-2BL10
Number of outputs	32 (at groups to 16)
Nominal load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	15mA
Current consumption via backplane bus	180mA
max. output current per channel	1A protected against sustained short circuits
max. contact load	10A
Voltage supply	DC 5V via backplane bus
	DC 24V (20.4 ... 28.8V)
Isolation	per group
	500Vrms (field voltage to the bus)
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	4byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50.8x76x88
Weight	50g

222-1DB00 - DO 2xAC 100...230V 2A

Order data DO 2xAC 100...230V 2A VIPA 222-1DB00

Description

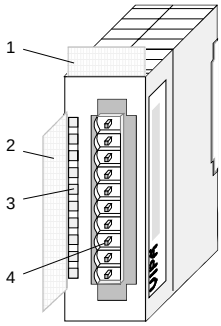
The digital output module controls the power drain of the outputs by using the settings of the user program. The module provides 2 individual trigger able channels and requires an AC 100...230V supply via the connector located on the front. The maximum load current per output is 2A.

The module has a configurable software dimmer function to avoid a step change of the load current. The software dimmer function transforms a step change of the load current into a slow dim up or down of the load.

Properties

- Software dimmer for resistive, inductive or capacitive load
- 2 outputs, isolated from the backplane bus
- Output current 2A
- Automatic load detection
- Voltage AC 100 ... 230V
- Frequency range 47 ... 63Hz
- LEDs for supply voltage and error message

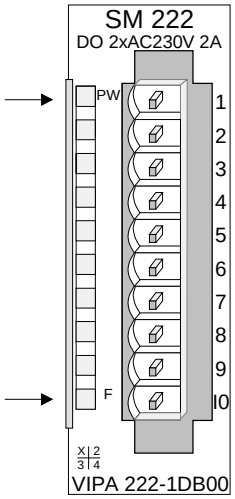
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

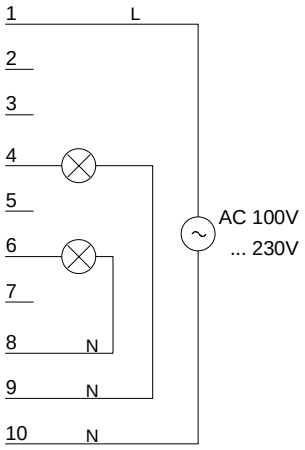
LED	Description
PW	LED (green) Module is power supplied by back plane bus
F	LED (red) Overload, overheat, missing power supply or parameterization error



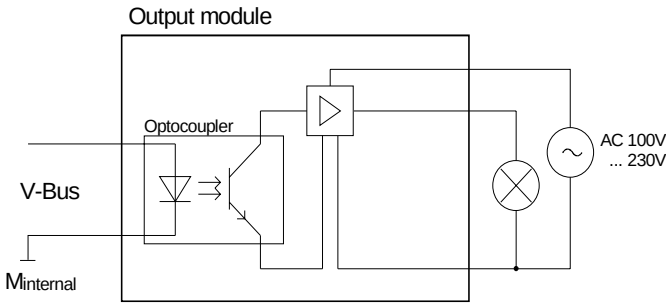
Pin	Assignment
1	AC 100...230V load voltage (L)
2	AC 100...230V load voltage (L)
3	not connected
4	Output Q+0.0 channel 0
5	not connected
6	Output Q+2.0 channel 1
7	not connected
8	AC 100...230V neutral conductor (N)
9	AC 100...230V neutral conductor (N)
10	AC 100...230V neutral conductor (N)

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Safety precautions

Danger!

- The module is not certified for applications in explosive environments (EX-zone)!
- You have to disconnect the module from the main power source before commencing installation or maintenance work, i.e. before you start to work the main supply line must be disconnected (disconnect plugs, on permanent installations the respective fuse has to be turned off)!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!
- To provide a sufficient level of ventilation and cooling to the power supply components whilst maintaining the compact construction it was not possible to protect the unit from incorrect handling and a proper level of fire protection. For this reason the required level of fire protection must be provided by the environment where the power supply is installed (e.g. installation in a switchboard that satisfies the fire protection rules and regulations)!
- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).

Automatic load detection

For each channel the module has an automatic load detection. On each channel you may connect either an inductive or a capacitive load.

Attention!

Mixing respectively switching over inductive and capacitive loads at one channel is not allowed. Resistive loads may always be merged.

Data output area

The module uses 2bytes per channel of the data output area. During run time a value 0...100 may be preset. This is corresponding to dim value 0% (switched off) ... 100% (max. load).

A channel is deactivated with values > 100%.

Data output area:

Byte	Bit 7 ... Bit 0
0, 1	0 ... 100: Software dimmer in % for output channel 0
2, 3	0 ... 100: Software dimmer in % for output channel 1

Parameter data

15byte are available for the configuration data.

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic alarm byte: Bit 0: 0: Overcurrent recognition channel 0 off 1: Overcurrent recognition channel 0 on Bit 1: 0: Overcurrent recognition channel 1 off 1: Overcurrent recognition channel 1 on Bit 3 ... 2: reserved Bit 4: 0: Overheat recognition off 1: Overheat recognition on Bit 5: reserved Bit 6: 0: Diagnostic interrupt disabled 1: Diagnostic interrupt enabled Bit 7: reserved	00h
1	reserved	00h
2	Software coefficient channel 0 1 ... 255: Software coefficient	09h
3	Software coefficient channel 1 1 ... 255: Software coefficient	09h
4	Preheat time channel 0 0 ... 255: Periods of the load voltage	09h
5	Preheat time channel 1 0 ... 255: Periods of the load voltage	09h
6	Bit 0: Behavior at CPU STOP channel 0 0: Switch substitute value 1: Keep last value Bit 1: Behavior at CPU STOP channel 1 0: Switch substitute value 1: Keep last value Bit 7 ... 2: reserved	00h
7, 8	Substitute value channel 0	00h
9, 10	Substitute value channel 1	00h
11, 12	Preheat value channel 0 (0 ... 100%)	00h
13, 14	Preheat value channel 1 (0 ... 100%)	00h

Diagnostic interrupt

A diagnostic is an error message to the CPU. If diagnostic interrupt is enabled by parameterization, the following events may release a diagnostic interrupt:

- Overcurrent recognition channel 0
- Overcurrent recognition channel 1
- Overheat recognition for both channels
- Missing or failure of load voltage

The error events *overcurrent* and *overheat* recognition may be activated respectively deactivated by the parameterization.

With a diagnostic 10bytes are transferred to the CPU.
Within the CPU you may react to the diagnostic by an appropriate program. Details may be found at "Diagnostic data".

Software coefficient

For each channel the module has a configurable software dimmer function to avoid a step change of the load current. The software dimmer function transforms a step change of the load current into a slow dim up or down of the load.

By means of the *software coefficient* you may determine a constant rate of change for the dimming operation.

The software coefficient results from the desired time for dimming from 0% to 100% and the period duration of the load voltage. It is valid:

$$n = \frac{time}{2 \cdot P}$$

with n = Software coefficient (1...255)
$time$ = desired time for 0%...100% in s (max. 10s)
P = Period duration of the load voltage in s at f = 47...63Hz

A higher *software coefficient* results in a slower slew rate of the dimmer function.

Behavior at CPU STOP, substitute value

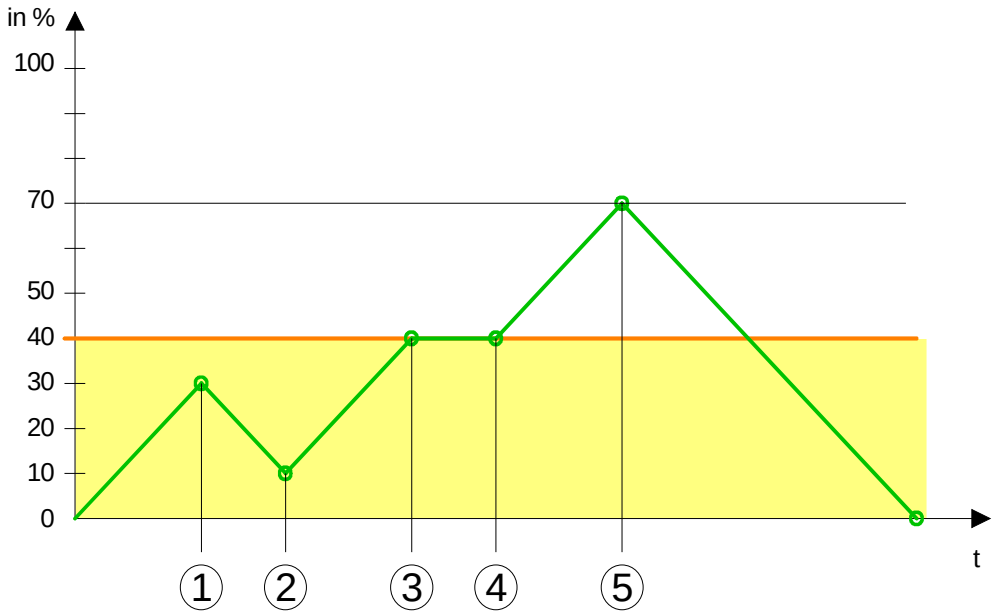
For each channel the behavior of the module at a CPU STOP may be configured here. You may either keep the last value or switch a substitute value. This may be defined at *substitute value*.

Preheat time
Preheat value

For each channel the module has a configurable preheat function to avoid overcurrent errors by fast dimming of a cold filament. For configuration there are the parameters *preheat time* and *preheat value*. With the preheat time the duration of preheating may be preset. With the preheat value a threshold in % may be preset starting from the preheat function is active.

The following figure shows the usage of the preheat function at an example.

The preheat value is e.g. 40%. Values below this threshold are output without preheating. Here it is dimmed to maximally 70%.



(1) Dim up to 30% (no preheating - below the threshold)
(2) Dim down to 10%
(3) Dim up to 70%, at 40% constant during the preheat time
(4) At preheat time it is dimmed up to the preset 70%.
(5) It is directly dimmed down to 0%.

Diagnostic data

The diagnostic data have a size of 10bytes and are stored in the record sets 0 and 1 of the system data area.

As soon as you activated the alarm release in byte 0 of the parameter area, in case of an error *record set 0* is transferred to the superordinated system.

Record set 0 has a fixed content and a length of 4byte. The contents of *record set 0* may be monitored in plain text via the diagnosis window of the CPU.

For extended diagnostic purposes during runtime, you may evaluate the *record set 1* with a size of 10bytes via the SFCs 51 and 59.

Evaluate diagnosis

At a diagnostic task the CPU interrupts the user application and branches into OB 82. With according programming, you may request in this OB with the SFCs 51 and 59 detailed diagnostic information and react on it.

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

Record set 0

Byte 0 to 3:

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: reserved Bit 5: Error load voltage (L) Bit 6: reserved Bit 7: Wrong parameter in module	00h
1	Bit 3 ... 0: Module class 1111 Digital module Bit 4: Channel information present Bit 7 ... 5: reserved	1Fh
2	not used	00h
3	Bit 7 ... 0: reserved	00h

Record set 1

Byte 0 to 9:

Record set 1 contains the 4byte of record set 0 and 6byte module specific diagnostic data.

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 9):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	Content of record set 0 (see page above)	-
4	Bit 6 ... 0: Channel type 72h: Digital output Bit 7: reserved	72h
5	Bit 7 ... 0: Number of diagnostic output bits per channel	08h
6	Bit 7 ... 0: Number of similar channels of a module	02h
7	Bit 0: Channel 0: Channel error Bit 1: Channel 1: Channel error Bit 7 ... 2: reserved	00h
8	Bit 0: Channel 0: Parameterization error recognized Bit 2, 1: reserved Bit 3: Channel 0: Overload recognized Bit 5, 4: reserved Bit 6: Channel 0: Missing load voltage or is failed Bit 7: Channel 0: Overheat recognized	00h
9	Bit 0: Channel 1: Parameterization error recognized Bit 2, 1: reserved Bit 3: Channel 1: Overload recognized Bit 5, 4: reserved Bit 6: Channel 1: Missing load voltage or is failed Bit 7: Channel 1: Overheat recognized	00h

Technical data

Module name	VIPA 222-1DB00
Dimensions and weight	
Dimensions WxHxD	25.4x76x88
Weight	65g
Data for specific module	
Number of outputs	2
Length of cable - unshielded	 600m
Programming specifications	
Input data Output data Parameter data Diagnostic data	- 4byte 15byte 10byte
Voltages, Currents, Potentials	
Rated load voltage (L)	AC 100/230V
Frequency range	47 ... 63Hz
Total current of the outputs - horizontal configuration up to 40°C up to 60°C - vertical configuration up to 40°C	 max. 4A max. 3A max. 4A
Isolation - between channels and backplane bus - between the channel	 yes no
Insulation tested with	AC4000V
Current consumption - from the backplane bus - from the load voltage L1 (without load)	 190mA max. 15mA
Power dissipation of the module	6W
Status, Interrupts, Diagnostics	
Interrupts - Diagnosis error	 parameterizable
Diagnosis functions - Sum error display - Error power supply - Diagnostic information readable	 red F-LED green LED possible

continued ...

... continue

Data for selecting an actuator	
Output voltage	
- at signal "1"	
at maximal current	L (-1.3V)
at minimal current	L (-0.7V)
Output current	
- at signal "1"	
Rated value	2A
permitted range for 0°C to 40°C	10mA up to 2A
permitted range for 40°C to 60°C	10mA up to 1.5A
- at signal "0" (leakage current)	100µA
Switch-off delay for resistive load	
- "0" to "1"	max. 1 AC cycle
- "1" to "0"	max. 1 AC cycle
Lamp load	max. 460W
Connecting two outputs in parallel	
- for redundant triggering of a load	not possible
- to increase performance	not possible
Short-circuit protection of output	yes, electronic (2A protected against sustained)

222-1HF00 - DO 8xRelay COM

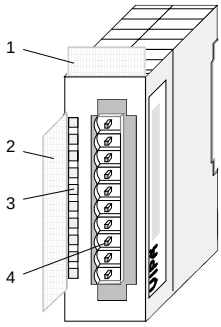
Order data DO 8xRelay COM VIPA 222-1HF00

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via relay outputs. The module derives power from the backplane bus. The load voltage must be connected to terminal 1. When the total current exceeds 8A you have to balance the load current between terminals 1 and 10. The module has 8 channels and the status of each channel is displayed by means of an LED.

Properties

- 8 relay outputs
- Power supply via backplane bus
- External load voltage AC 230V / DC 30V
- Output current per channel 5A (AC 230V / DC 30V)
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of LED

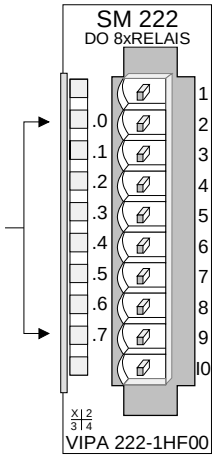
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

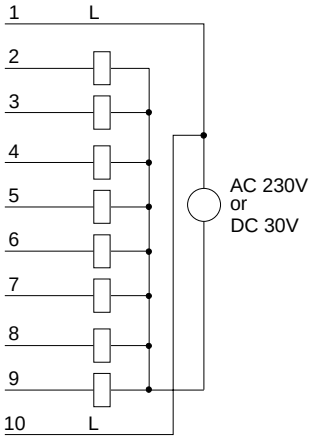
LED	Description
.0... .7	LEDs (green) Q+0.0 to Q+0.7 when an output is active the respective LED is turned on



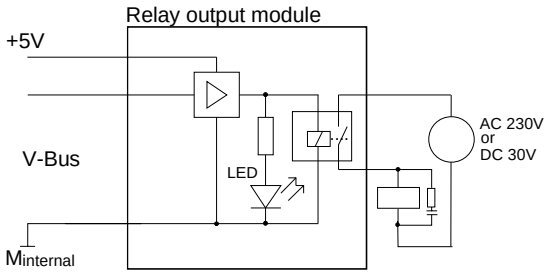
Pin	Assignment
1	Supply voltage L
2	Relay output Q+0.0
3	Relay output Q+0.1
4	Relay output Q+0.2
5	Relay output Q+0.3
6	Relay output Q+0.4
7	Relay output Q+0.5
8	Relay output Q+0.6
9	Relay output Q+0.7
10	Supply voltage L

Wiring and schematic diagram

Wiring diagram

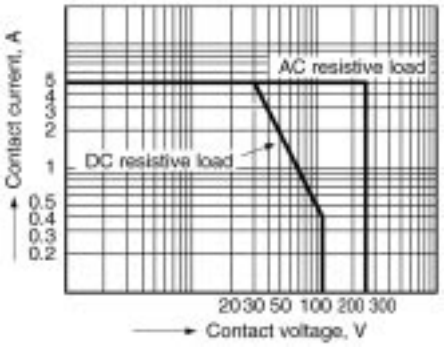


Schematic diagram

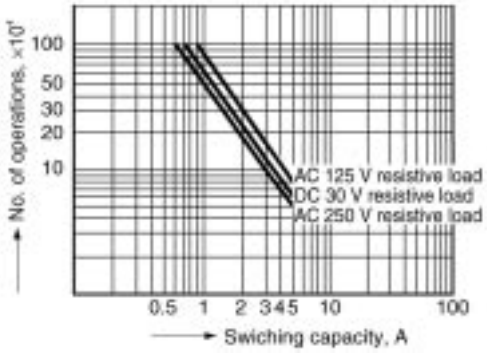


Note: When using inductive load please take a suitable protector (see installation guidelines).

Maximum load



Service life



Technical data

Electrical data	VIPA 222-1HF00
Number of outputs	8 via relay
Nominal load voltage	max. AC 230V or DC 30V
No-load current consumption at L+ (all A.x=off)	-
Current consumption via bus	300mA
Total current	with 1 L: max. 8A with 2 L: max. 16A
max. output current per channel	AC 230V: 5A / DC 30V: 5A
Voltage supply	DC 5V via backplane bus
Isolation	500Vrms (field voltage to the bus)
Switching rate	max. 100Hz
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

222-1HD10 - DO 4xRelay

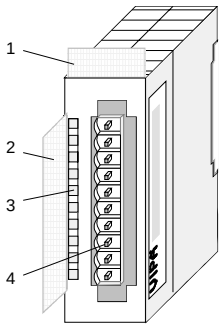
Order data DO 4xRelay VIPA 222-1HD10

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via relay outputs. The module derives power from the backplane bus. The module has 4 isolated channels that operate as switches and the status of each channel is displayed by means of a LED. Power required by active loads must be supplied externally.

Properties

- 4 isolated relay outputs
- Power supply via backplane bus
- External load voltage AC 230V / DC 30V (may be mixed)
- Max. output current per channel 5A (AC 230V / DC 30V)
- Suitable for motors, lamps, magnetic valves and DC contactors
- Active channel indication by means of an LED

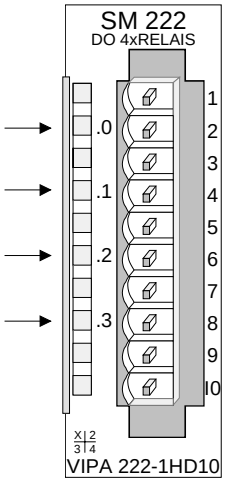
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

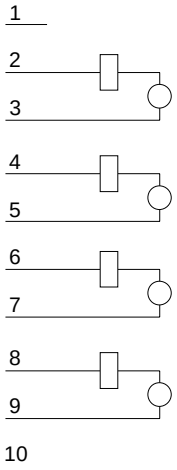
LED	Description
.0... .3	LEDs (green) Q+0.0 to Q+0.3 when an output is active the respective LED is turned on



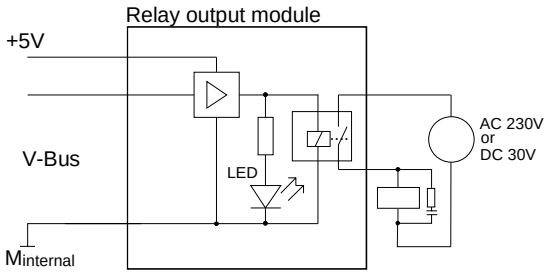
Pin	Assignment
1	not connected
2+3	Relay output Q+0.0
4+5	Relay output Q+0.1
6+7	Relay output Q+0.2
8+9	Relay output Q+0.3
10	not connected

Wiring and schematic diagram

Wiring diagram

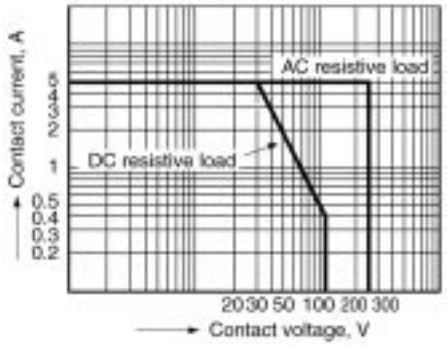


Schematic diagram

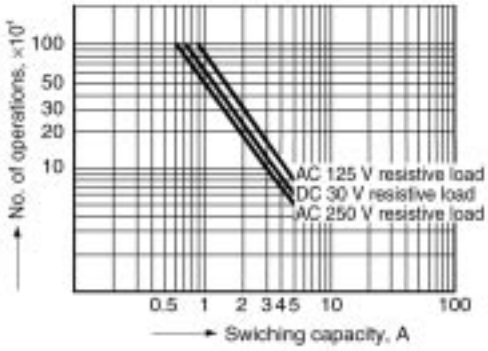


Note: When using inductive load please take a suitable protector (see installation guidelines).

Maximum load



Service life



Technical data

Electrical data	VIPA 222-1HD10
Number of outputs	4 via relay
Nominal load voltage	AC 230V or max. DC 30V
max. output current	AC 230V: 5A / DC 30V: 5A
Current consumption via backplane bus	160mA
Voltage supply	DC 5V via backplane bus
Isolation	500Vrms (field voltage to the bus)
Switching rate	max. 100Hz
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte (bit 0 ... bit 3)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

222-1HD20 - DO 4xRelay bistable

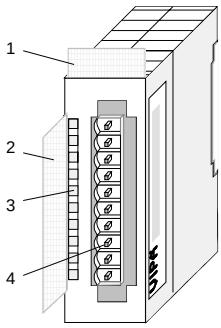
Order data DO 4xRelay bistable VIPA 222-1HD20

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via bistable relay outputs. The module derives power from the backplane bus. The module has 4 channels that operate as switches. The status of the respective switch is retained if the power from the controlling system fails.

Properties

- 4 isolated relay outputs
- Power supply via backplane bus
- External load voltage AC 230V / DC 30V (may be mixed)
- Max. Output current per channel 16A (AC 230V / DC 30V)
- Suitable for motors, lamps, magnetic valves and DC contactors

Construction



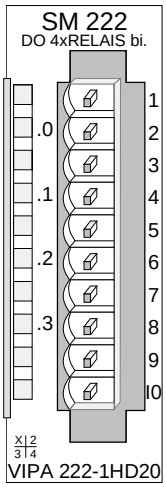
[1] Label for module description
[2] Label for the bit address with description
[3] LEDs (not used)
[4] Edge connector

Output byte / Pin assignment

Bit	Description
Bit 0	set Q+0.0
Bit 1	set Q+0.1
Bit 2	set Q+0.2
Bit 3	set Q+0.3
Bit 4	reset Q+0.0
Bit 5	reset Q+0.1
Bit 6	reset Q+0.2
Bit 7	reset Q+0.3

Setting the Bits 0...3 activates the concerning channel.

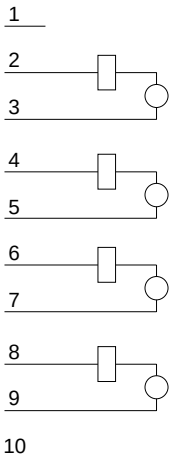
Setting Bits 4..7 causes a reset of the concerning channel after min. 50ms.



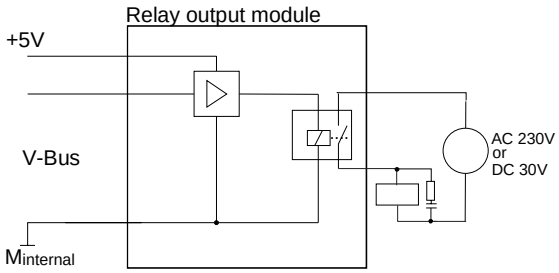
Pin	Assignment
1	not connected
2+3	Relay output Q+0.0
4+5	Relay output Q+0.1
6+7	Relay output Q+0.2
8+9	Relay output Q+0.3
10	not connected

Wiring and schematic diagram

Wiring diagram

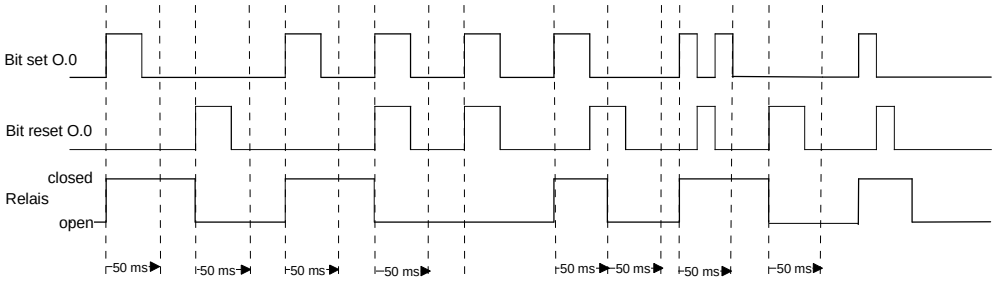


Schematic diagram



Note: When using inductive load please take a suitable protector (see installation guidelines).

Signaling diagram



Note!

Please remember that a relay output that has been set may only be reset after at least 50ms when the set-signal has been removed.

Technical data

Electrical data	VIPA 222-1HD20
Number of outputs	4 via relay
Nominal load voltage	AC 230V or DC 30V
max. output current per channel	AC 230V: 16A / DC 30V: 16A
Current consumption via backplane bus	200mA
Voltage supply	DC 5V via backplane bus
Isolation	500Vrms (field voltage to the bus)
Switching rate	max. 100Hz
Status indicator	-
Programming specifications	
Input data	-
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

222-1FF00 - DO 8xSolid State COM

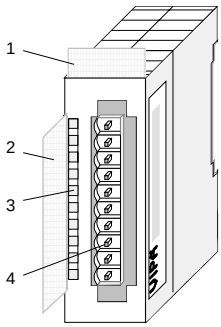
Order data DO 8xSolid State COM VIPA 222-1FF00

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via solid-state relay outputs. The module derives power from the backplane bus. The module has 8 channels that are interconnected via the load voltage that act as switches and display the status by means of LEDs. Solid-state relays change state when the load voltage passes through zero (AC).

Properties

- 8 solid-state outputs with active channel indication by means of a LED
- Extended service life due to the fact that the load voltage (provided this is AC) is switched when it passes through zero
- External load voltage AC 230V or DC 400V
- Max. output current per channel 0.5A (AC 230V / DC 400V)
- Suitable for small motors, lamps, magnetic valves and contactors

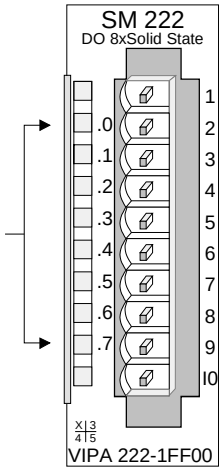
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

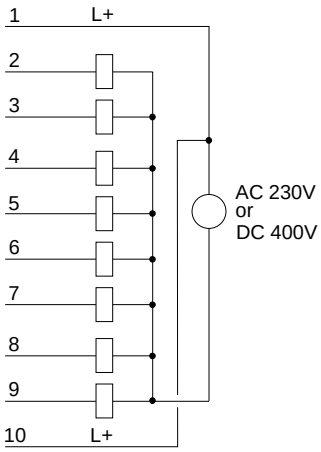
LED	Description
.0 7	LEDs (green) Q+0.0 to Q+0.7 when an output is active the respective LED is turned on



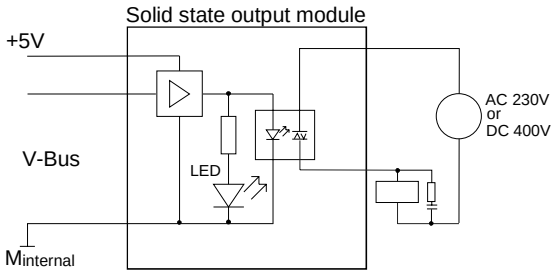
Pin	Assignment
1	Supply voltage
2	Output Q+0.0
3	Output Q+0.1
4	Output Q+0.2
5	Output Q+0.3
6	Output Q+0.4
7	Output Q+0.5
8	Output Q+0.6
9	Output Q+0.7
10	Supply voltage

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note: When using inductive load please take a suitable protector (see installation guidelines).

Technical data

Electrical data	VIPA 222-1FF00
Number of outputs	8 via solid-state
Nominal load voltage	AC 230V or DC 400V
max. output current per channel	AC 230V: 0.5A / DC 400V: 0.5A
Contact resistance	typ. 2.1Ω , max. 3.2Ω
Current consumption via backplane bus	150mA
Voltage supply	DC 5V via backplane bus
Isolation	500Vrms (field voltage to the bus)
Switching rate	max. 100Hz
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte (bit 0 ... bit 7)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

222-1FD10 - DO 4xSolid State

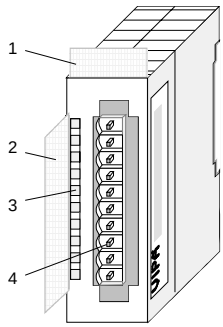
Order data DO 4xSolid State VIPA 222-1FD10

Description The digital output module accepts binary control signals from the central bus system and controls the connected loads at the process level via solid-state relay outputs. The module derives power from the backplane bus. The module has 4 separate channels that operate as switches and display the status by means of LEDs. Active loads must be supplied with external power.

Properties

- 4 isolated solid-state outputs
- Power supply via backplane bus
- External load voltage AC 230V or DC 400V
- Max. output current per channel 0.5A (AC 230V / DC 400V)
- Suitable for motors, lamps, magnetic valves and contactors
- Active channel indication by means of an LED

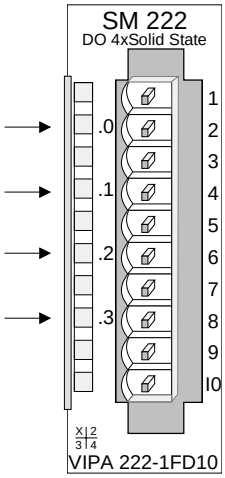
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator
pin assignment

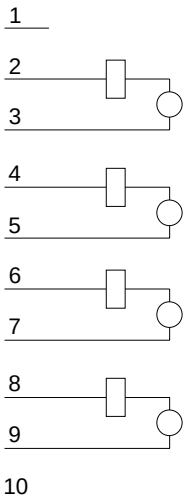
LED	Description
.0... .3	LEDs (green) Q+0.0 to Q+0.3 when an output is active the respective LED is turned on



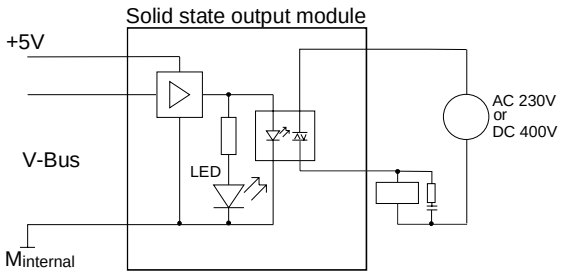
Pin	Assignment
1	not connected
2+3	Output Q+0.0
4+5	Output Q+0.1
6+7	Output Q+0.2
8+9	Output Q+0.3
10	not connected

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Note: When using inductive load please take a suitable protector (see installation guidelines).

Technical data

Electrical data	VIPA 222-1FD10
Number of outputs	4 via solid state
Nominal load voltage	AC 230V or DC 400V
max. output current per channel	AC 230V: 0.5A / DC 400V: 0.5A
Current consumption via backplane bus	100mA
Voltage supply	DC 5V via backplane bus
Isolation	500Vrms (field voltage to the bus)
Switching rate	max. 100Hz
Status indicator	via LEDs located on the front
Programming specifications	
Input data	-
Output data	1byte (bit 0 ... bit 3)
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	80g

Chapter 5 Digital input/output modules

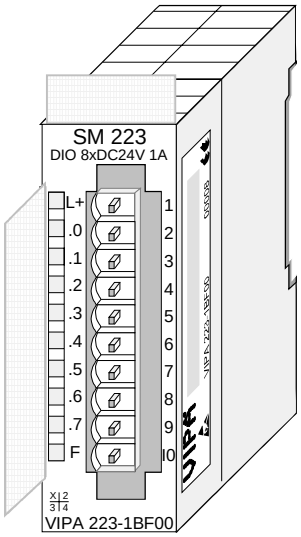
Overview

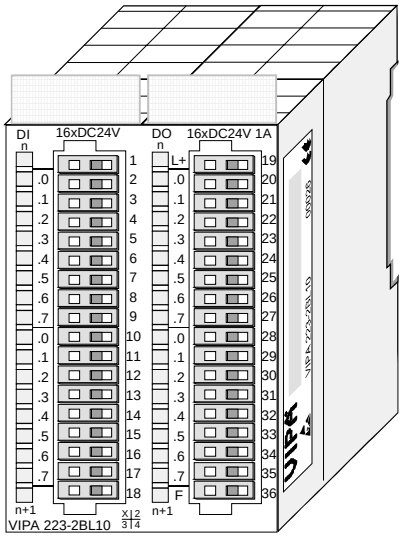
This chapter contains a description of the construction and the operation of the VIPA digital input/output modules.

Contents

System overview

Input/output modules SM 223





Order data input/output modules

Type	Order number	Page
DIO 8xDC 24V 1A	VIPA 223-1BF00	5-3
DI 16xDC 24V, DO 16xDC 24V 1A	VIPA 223-2BL10	5-5

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.

223-1BF00 - DIO 8xDC 24V 1A

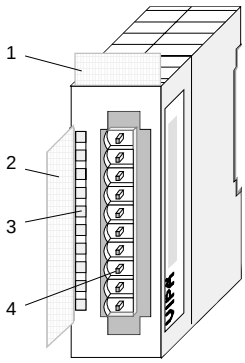
Order data DIO 8xDC 24V 1A VIPA 223-1BF00

Description This module is a combination module. It has 8 channels that may be used as input or as output channel. The status of the channels is displayed by means of LEDs. Every channel is provided with a diagnostic function, i.e. when an output is active the respective input is set to "1". When a short circuit occurs at the load, the input is held at "0" and the error is detectable by analyzing the input.

Properties

- 8 channels, isolated from the backplane bus (as input or output)
- Diagnostic function
- Nominal input voltage DC 24V / supply voltage DC 24V
- Output current 1A
- LED error display for overload, overheat or short circuit
- Active channels displayed by means of LED

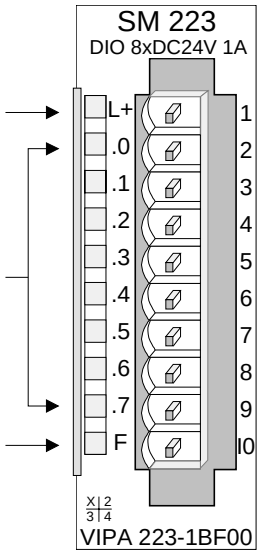
Construction



[1] Label for the module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator

LED	Description
L+	LED (green) Supply voltage available
.0 7	LEDs (green) when the input signal is "1" or the output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error

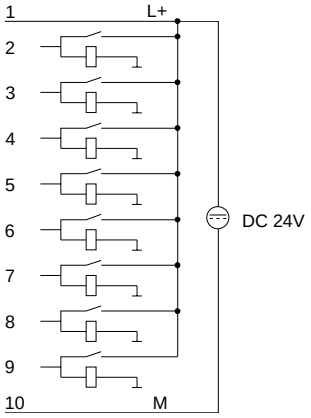


Pin assignment

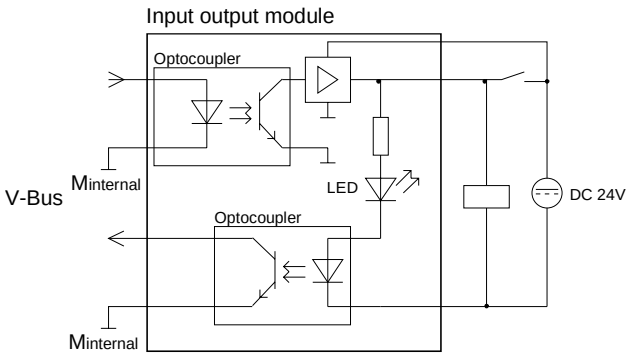
Pin	Assignment
1	+DC 24V supply voltage
2	I/Q+0.0
3	I/Q+0.1
4	I/Q+0.2
5	I/Q+0.3
6	I/Q+0.4
7	I/Q+0.5
8	I/Q+0.6
9	I/Q+0.7
10	Supply ground

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 223-1BF00
Number of channels	8
Rated load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	50mA
Output current per channel	1A protected against short circuits
Total output current	12A
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Voltage supply	DC 5V via backplane bus
Current consumption (backplane bus)	65mA
Data width in the process image	1byte PII, 1byte PIQ
Status indicator	via LEDs located on the front
Programming specifications	
Input data	1byte
Output data	1byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88
Weight	50g

223-2BL10 - DI 16xDC 24V, DO 16xDC 24V 1A

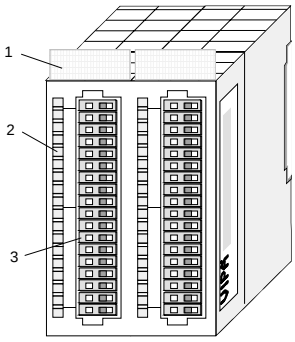
Order data DI 16xDC 24V, DO 16xDC 24V 1A VIPA 223-2BL10

Description The module has 32 channels that are isolated from the backplane bus. 16 channels operate as inputs and 16 as outputs. The status of the channels is displayed by means of LEDs.

Properties

- 32 channels, of these 16 input and 16 output channels
- Nominal input voltage DC 24V
- Supply voltage DC 24V(external) for outputs
- Output current 1A per channel
- LED error display for overload, overheat or short circuit
- Active channels displayed by means of an LED

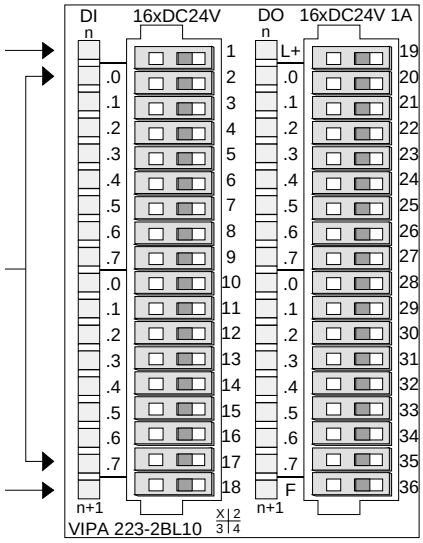
Construction



[1] Label for the module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator

LED	Description
L+	LED (green) Supply voltage available
.0 7	LED (green) I+0.0 ... I+1.7 Q+0.0 ... Q+1.7 when the signal (input) is "1" or the output is active, the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error

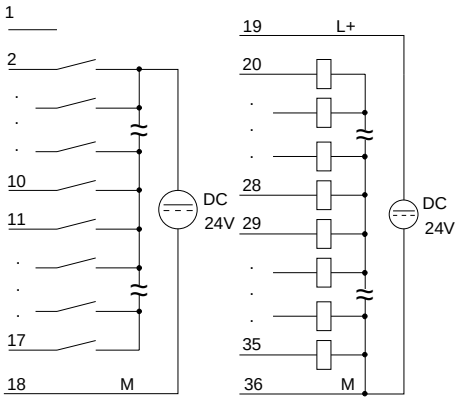


Pin assignment

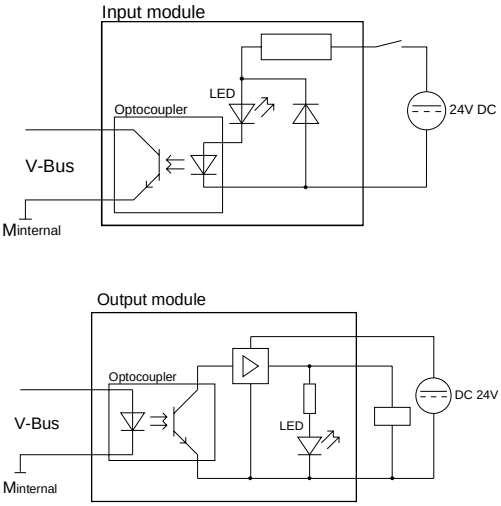
Pin	Assignment
1	not connected
2	Input I+0.0
.	.
.	.
.	.
17	Input I+1.7
18	Ground for inputs
19	Supply voltage +24V
20	Output Q+0.0
.	.
.	.
35	Output Q+1.7
36	Supply voltage ground outputs

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Technical data

Electrical data	VIPA 223-2BL10
Number of channels	32
Rated load voltage	DC 24V (20.4 ... 28.8V)
No-load current consumption at L+ (all A.x=off)	10mA
Output current per channel	1A protected against short circuits
max. contact load per connector	10A
Switch rate	
- for resistive load	max. 1kHz
- for ind. load (IEC947-5-1, DC13)	max. 0.5Hz
- for lamp load	max. 10Hz
Limit (internal) of the inductive circuit interruption voltage	typ. L+ (-52V)
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input current	typ. 7mA
Voltage supply	DC 5V via backplane bus
Current consumption (backplane bus)	120mA
Data width in the process image	2byte PII, 2byte PIQ
Status indicator	via LEDs located on the front
Programming specifications	
Input data	2byte
Output data	2byte
Parameter data	-
Diagnostic data	-
Dimensions and weight	
Dimensions (WxHxD) in mm	50.8x76x88
Weight	100g

Chapter 6 Analog input modules

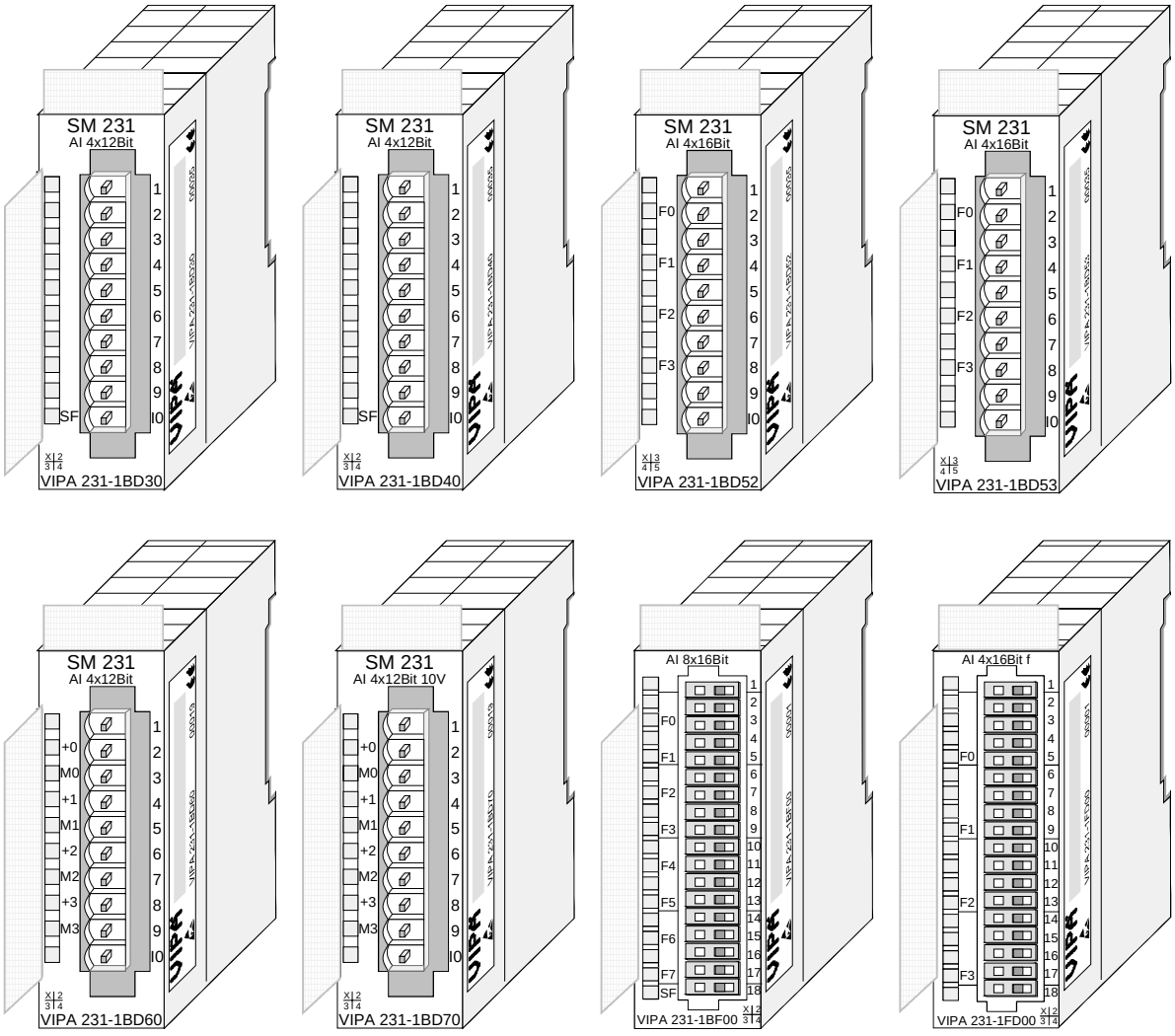
Overview

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

Contents

System overview

Input modules
SM 231



Order data input modules

Type	Order number	Page
AI4x12Bit ±10V - ECO,	VIPA 231-1BD30	6-6
AI4x12Bit 4 ... 20mA, ±20mA - ECO	VIPA 231-1BD40	6-11
AI4x16Bit, multiinput	VIPA 231-1BD52	6-16
AI4x16Bit, multiinput	VIPA 231-1BD53	6-24
AI4x12Bit, 4 ... 20mA, isolated	VIPA 231-1BD60	6-38
AI4x12Bit, ±10V, isolated	VIPA 231-1BD70	6-41
AI8x16Bit	VIPA 231-1BF00	6-44
AI4x16Bit f	VIPA 231-1FD00	6-54

General

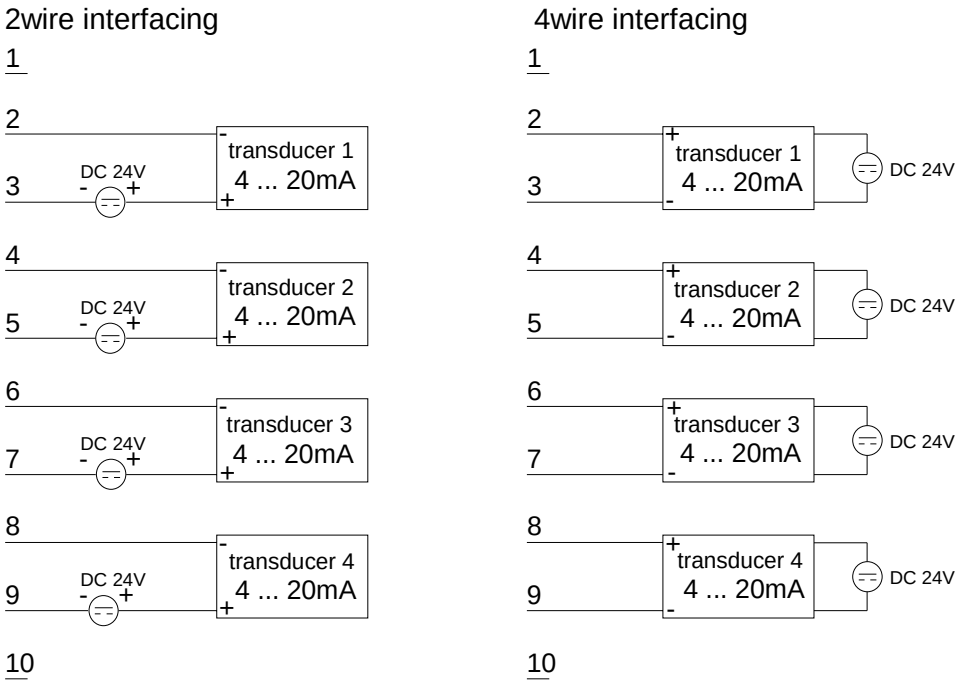
Cabling for analog signals

You must only use screened cable when you are connecting analog signals. These cables reduce the effect of electrical interference. The screen of the analog signal cable should be grounded at both ends. When there are potential differences between the cable ends, there may flow a current will to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting current sensor

Our analog input modules provide a large number of input configurations for 2- and 4wire transducers.

Please remember that sensors require an external power supply. You have to connect an external power supply in line with any 2wire sensor. The following diagram explains the connection of 2- and 4wire sensors:



Note!

Please ensure that you connect the sensors with the correct polarity!
Unused inputs should be short circuited by placing a link between the positive pole and the common ground for the channel.

Parameterization and diagnosis during runtime

By using the SFCs 55, 56 and 57 you may change the parameters of the analog modules during runtime via the CPU 21x.

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

Numeric notation in S5 from Siemens

In S5 format, the input data are stored in one word. The word consists of the binary value and the information bits.

Please regard only the Siemens S7 format (two's complement) is supported by the Siemens SIMATIC manager for decimal representation. When the Siemens S5 format is used the decimal values are incorrectly represented.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value within measuring range 1: measuring range overrun Bit 1: error bit (set at internal error) Bit 2: activity bit (always 0) Bit 7 ... 3: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V (two's complement)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0000
5V	8192	2000
10V	16384	4000

+/- 10V (value and sign)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	A000
0V	0	0000
5V	8192	2000
10V	16384	4000

4....20mA (value and sign)

Current	Decimal	Hex
4mA	0	0000
12mA	8192	2000
20mA	16384	4000

+/- 20mA (two's complement)

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

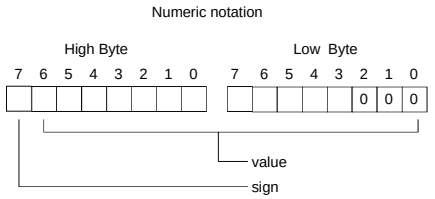
+/- 20mA (value and sign)

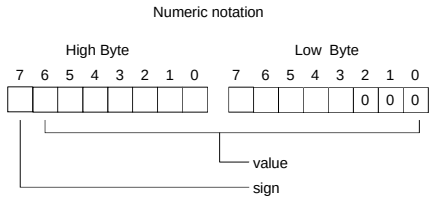
Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	A000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: Decimal value

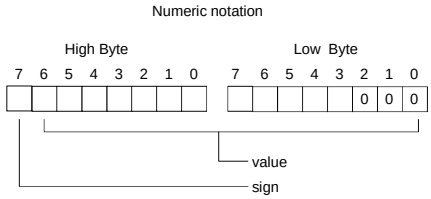




Formula for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: Current, Value: Decimal value



Numeric notation in S7 from Siemens

Analog values are represented as a two's complement value.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

231-1BD30 - AI 4x12Bit ±10V - ECO

Order data AI 4x12Bit, ±10V VIPA 231-1BD30

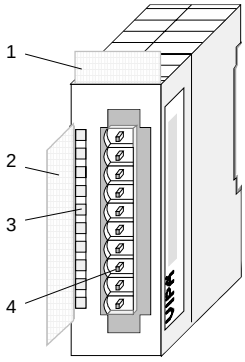
Description The module has 4 inputs that you may configure individually. This module requires a total of 8byte of the process image for the input data (2byte per channel).

DC/DC converters provide electrical isolation for the channels of the module with respect to the backplane bus.

Properties

- 4 inputs, channels isolated from the backplane bus
- the different channels are individually configurable and may be turned off
- Suitable for transducers with ±10V outputs
- LED leave end overdrive region or leave end underdrive region or wrong parameterization

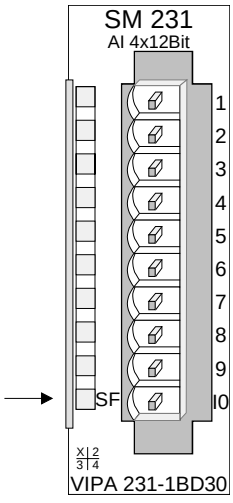
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Pin assignment

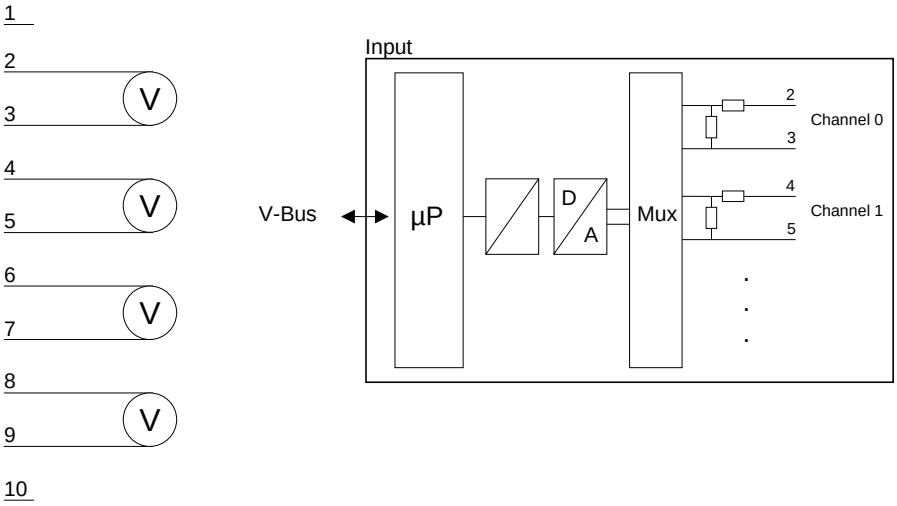
LED	Description
SF	LED (red) Sum error at: - Leave end of overdrive region or end of underdrive region - wrong parameterization



Pin	Assignment
1	
2	pos. connection Channel 0
3	Channel 0 common
4	pos. connection Channel 1
5	Channel 1 common
6	pos. connection Channel 2
7	Channel 2 common
8	pos. connection Channel 3
9	Channel 3 common
10	

Wiring and schematic diagram

Wiring diagram **Schematic diagram**



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

Measurement data acquisition

During a measurement the data is stored in the data input area.
The following figure shows the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Parameter data

Every channel is individual parameterizable. For the parameterization, 10byte parameterization data are available. The parameterization data are stored permanently and remain also in off mode. By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 60ms. During this time, the measuring value output is 7FFFh.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0, 1	reserved	00h
2	Function-no. channel 0	28h
3	Function-no. channel 1	28h
4	Function-no. channel 2	28h
5	Function-no. channel 3	28h
6...9	reserved	00h

Function-no. assignment

For each channel here the function-no. of your measuring function can be set. Please see the according table.

The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation
00h	Does not affect permanently stored configuration data	
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V **/** 11.76V= max. value before over range (32511) -10...10V= nominal range (-27648...27648) -11.76V= min. value before under range (-32512)
2Bh	Voltage ±10V Siemens S5 format (value and sign)	±12.50V **/** 12.50V = max. value before over range (20480) -10...10V = rated range (-16384...16384) -12.50V = min. value before under range (-20480)
3Bh	Voltage ±10V Siemens S5 format (two's complement)	±12.50V / 12.50V = max. value before over range (20480) -10...10V = nominal range (-16384...16384) -12.50V = min. value before under range (-20480)
FFh	Channel not active (turned off)	

Note!

The module is preset to the range "±10V voltage" in S7 format from Siemens.

Technical data

Module specific Data	VIPA 231-1BD30	
Number of inputs	4	
Length of cable: shielded	200m	
Voltages, Currents, Potentials		
Isolation - channels / backplane bus - between channels	 yes no	
Permitted potential difference - between the inputs (U_{CM}) - between the inputs and M_{INTERN} (U_{ISO})	 DC 2V DC 75V / AC 60V	
Isolation tested with	DC 500V	
Current consumption - from the backplane bus	 120mA	
Dissipation power of the module	0.6W	
Analog value generation		
Measuring principle	SAR (Successive approximation)	
programmable	yes	
conversion time/resolution (per channel)		
- Basic conversion time (ms)	n x 2ms	
- Resolution (Bit) incl. overrange	13bit	
Noise suppression, limits of error		
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)	f=50Hz...400Hz	
Common-mode interference (U_{CM} < 2V)	> 80dB	
Crosstalk between the inputs	> 50dB	
Operational limit (in the entire temperature range, with reference to the input range)		
	Measuring range	Tolerance
Voltage input	±10V	±0.2%
Basic error (operational limit at 25°C, referred to input range)		
	Measuring range	Tolerance
Voltage input	±10V	±0.1%
Temperature error (with reference to the input range)	±0.005%/K	
Linearity error (with reference to the input range)	±0.02%	
Repeatability (in steady state at 25°C, with reference to the input range)	±0.05%	
Diagnostics	no	
Diagnostic interrupt	none	
Sum error	red SF LED	

n= Number of channels

continued ...

... continue technical data

Data for selecting a sensor		
	Input range	Input resistance
Voltage	±10V	100kΩ
Maximum input voltage for voltage input (destruction limit)	max. 30V	
Connection of the sensor for measuring voltage	possible	
Permissible environment conditions		
Operating temperature	0°C...+60°C	
Transport and storage temperature	-25°C...+70°C	
relative humidity	95% without condensation	
Vibration/Shock resistance	acc. IEC 68000-2-6/IEC 68000-2-27	
EMC resistance ESD/Burst	acc. IEC 61000-4-2 / IEC 61000-4-2 / IEC 61000-4-4 (to level 3)	
Project engineering		
Input data	8byte (1 Word per channel)	
Output data	-	
Parameter data	10byte	
Diagnostics data	-	
Dimensions and Weight		
Dimensions (WxHxD in mm)	25.4x76x88mm	
Weight	ca. 80g	

231-1BD40 - AI 4x12Bit 4...20mA, ±20mA - ECO

Order data AI 4x12Bit, 4...20mA, ±20mA VIPA 231-1BD40

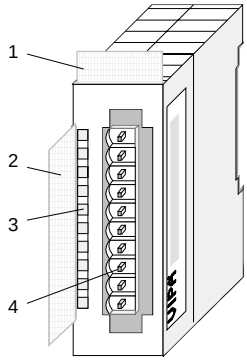
Description The module has 4 inputs that you may configure individually. This module requires a total of 8byte of the process image for the input data (2byte per channel).

DC/DC converters are employed to provide electrical isolation for the channels of the module with respect to the backplane bus.

Properties

- 4 inputs, channels isolated from the backplane bus
- the different channels are individually configurable and may be turned off
- Suitable for transducers with 4...20mA, ±20mA outputs
- LED leave end overdrive region or leave end underdrive region or wrong parameterization

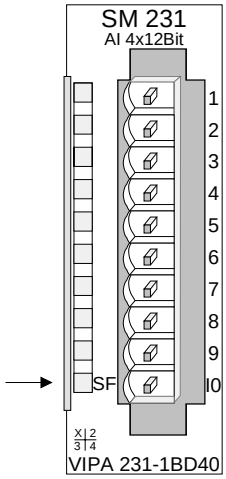
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator

LED	Description
SF	LED (red) Sum error at: - Leave end of overdrive region or leave end of underdrive region - or wrong parameterization

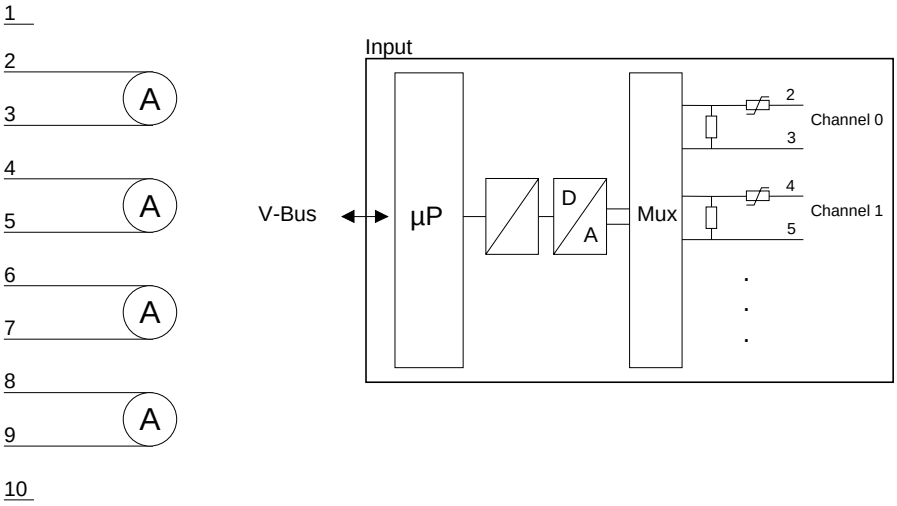


pin assignment

Pin	Assignment
1	
2	pos. connection Ch. 0
3	Channel 0 common
4	pos. connection Ch.1
5	Channel 1 common
6	pos. connection Ch.2
7	Channel 2 common
8	pos. connection Ch.3
9	Channel 3 common
10	

Wiring and schematic diagram

Wiring diagram **Schematic diagram**



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

Measurement data acquisition

During a measurement the data is stored in the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Parameter data

Every channel is individual parameterizable. For the parameterization, 10byte parameterization data are available. The parameterization data are stored permanently and remain also in off mode. By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 60ms. During this time, the measuring value output is 7FFFh.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0, 1	reserved	00h
2	Function-no. channel 0	2Ch
3	Function-no. channel 1	2Ch
4	Function-no. channel 2	2Ch
5	Function-no. channel 3	2Ch
6...9	reserved	00h

Function-no. assignment

For each channel here the function-no. of your measuring function can be set. Please see the according table.

The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation
00h	Does not affect permanently stored configuration data	
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.52mA **/** 23.52mA = max. value before over range (32511) -20...20mA = rated value (-27648...27648) -23.52mA = min. value before under range (-32512)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185 .. +22.81mA / 22.81mA = max. value before over range (32511) 4...20mA = rated range (0...27648) 1.185 mA = min. value before under range (-4864)
2Eh	Current 4...20mA Siemens S5 format (value and sign)	0.8 .. +24.00mA / 24.00mA = max. value before over range (20480) 4 .. 20mA = rated range (0...16384) 0.8mA = min. value before under range (-3277)
2Fh	Current ±20mA Siemens S5 format (value and sign)	±25.00mA / 25.00mA = max. value before over range (20480) -20...20mA = rated value (-16384...16384) -25.00mA = min. value before under range (-20480)
39h	Current 4...20mA Siemens S5 format (two's complement)	0.8 .. +24.00mA / 24.00mA = max. value before over range (20480) 4 .. 20mA = rated range (0...16384) 0.8mA = min. value before under range (-3277)
3Ah	Current ±20mA Siemens S5 format (two's complement)	±25.00mA / 25.00mA = max. value before over range (20480) -20...20mA = nominal range (-16384...16384) -25.00mA = min. value before under range (-20480)
FFh	Channel not active (turned off)	

Note!

The module is preset to the range "±20mA current" in S7-format from Siemens.

Technical data

Module specific Data	VIPA 231-1BD40	
Number of inputs	4	
Length of cable: shielded	200m	
Voltages, Currents, Potentials		
Isolation - channels / backplane bus - between channels	 yes no	
Permitted potential difference - between the inputs (U_{CM}) - between the inputs and M_{INTERN} (U_{ISO})	 DC 2V DC 75V / AC 60V	
Isolation tested with	DC 500V	
Current consumption - from the backplane bus	 120mA	
Dissipation power of the module	0.6W	
Analog value generation		
Measuring principle	SAR (Successive approximation)	
programmable	yes	
conversion time/resolution (per channel) - Basic conversion time (ms) - Resolution (Bit) incl. overrange	 n x 2ms 13bit	
Noise suppression, limits of error		
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)	f=50Hz...400Hz	
Common-mode interference (U_{CM} < 2V)	> 80dB	
Crosstalk between the inputs	> 50dB	
Operational limit (in the entire temperature range, with reference to the input range)		
Current input	Measuring range	Tolerance
	±20mA	±0.2%
	4...20mA	±0.5%
Basic error (operational limit at 25°C, referred to input range)		
Current input	Measuring range	Tolerance
	±20mA	±0.1%
	4...20mA	±0.2%
Temperature error (with reference to the input range)	±0.005%/K	
Linearity error (with reference to the input range)	±0.02%	
Repeatability (in steady state at 25°C, with reference to the input range)	±0.05%	
Diagnostics	no	
Diagnostic interrupt	none	
Sum error	red SF LED	

n= Number of channels

continued ...

... continue technical data

Data for selecting a sensor		
	Input range	Input resistance
Current	±20mA 4...20mA	110Ω 110Ω
Maximum input current for current input (destruction limit)	40mA	
Connection of the sensor for measuring current as 2wire transmitter as 4wire transmitter	 possible, with external supply possible	
Permissible environment conditions		
Operating temperature	0°C...+60°C	
Transport and storage temperature	-25°C...+70°C	
relative humidity	95% without condensation	
Vibration/Shock resistance	acc. IEC 68000-2-6/IEC 68000-2-27	
EMC resistance ESD/Burst	acc. IEC 61000-4-2 / IEC 61000-4-2 / IEC 61000-4-4 (to level 3)	
Project engineering		
Input data	8byte (1 Word per channel)	
Output data	-	
Parameter data	10byte	
Diagnostics data	-	
Dimensions and Weight		
Dimensions (WxHxD in mm)	25.4x76x88mm	
Weight	ca. 80g	

231-1BD52 - AI 4x16Bit, multiinput

Order data AI 4x16Bit multiinput VIPA 231-1BD52

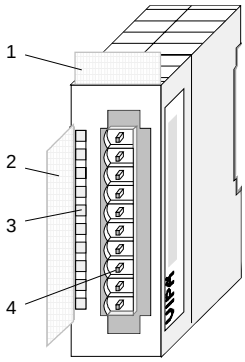
Description The module has got 4 inputs that you may configure individually. The module requires a total of 8 input data bytes in the process image (2byte per channel).

Isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers.

Properties

- the different channels are individually configurable and may be turned off
- the common signal inputs of the channels are not isolated from each other and the permitted potential difference is up to 5V
- LED for cable break and over current in sensor circuits
- diagnostic function

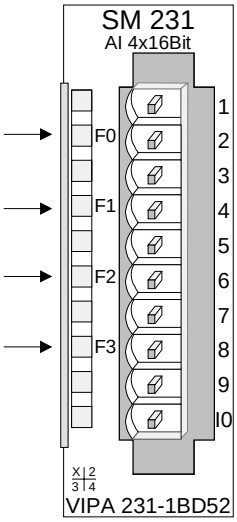
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicators pin assignment

LED	Description
F0 ... F3	LED (red): turned on when an open circuit exists on the 4...20mA sensor circuits blinks when the current > 40mA at all current sensor circuits



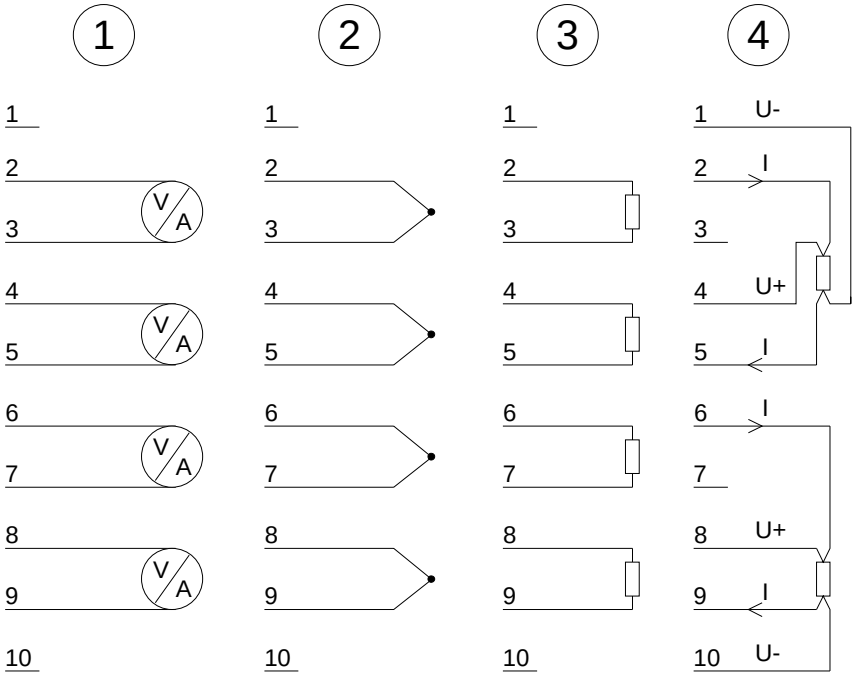
Pin	Assignment
1	For 4wire systems channel 0
2	+ channel 0
3	Channel 0 common
4	+ channel 1
5	Channel 1 common
6	+ channel 2
7	Channel 2 common
8	+ channel 3
9	Channel 3 common
10	For 4wire systems channel 2

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 "Function-no. assignment" on the next pages.

Note!

Please note that the module 231-1BD52 was developed from the VIPA 231-1BD50. The measuring function no longer starts at 00h but it is offset by one to 01h.



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation	Tolerance	Conn.
00h	Does not affect permanently stored configuration data			
01h	Pt100 in 2wire mode	-200 .. +850°C **/** in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
02h	Pt1000 in 2wire mode	-200 .. +500°C **/** in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
03h	NI100 in 2wire mode	-50 .. +250°C **/** in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
04h	NI1000 in 2wire mode	-50 .. +250°C **/** in units of 1/10°C, two's complement	1)2)3) ±1°C	(3)
05h	Resistance measurement 60Ohm 2wire	- **/** 60Ω= final value (32767)	1)2)3) ±0.2% of final value	(3)
06h	Resistance measurement 600Ohm 2wire	- **/** 600Ω = final value (32767)	1)2)3) ±0.1% of final value	(3)
07h	Resistance measurement 3000Ohm 2wire	- **/** 3000Ω = final value (32767)	1)2)3) ±0.1% of final value	(3)
08h	Resistance measurement 6000Ohm 2wire	- / 6000Ω = final value (32767)	1)2)3) ±0.1% of final value	(3)
09h	Pt100 via 4wire connection	-200 .. +850°C **/** in units of 1/10°C, two's complement	1)2) ±0.5°C	(4)
0Ah	Pt1000 via 4wire connection	-200 .. +500°C **/** in units of 1/10°C, two's complement	1)2) ±0.5°C	(4)
0Bh	NI100 via 4wire connection	-50 .. +250°C **/** in units of 1/10°C, two's complement	1)2) ±0.5°C	(4)
0Ch	NI1000 via 4wire connection	-50 .. +250°C **/** in units of 1/10°C, two's complement	1)2) ±0.5°C	(4)
0Dh	Resistance measurement 60Ohm 4wire	- **/** 60Ω= final value (32767)	1)2) ±0.1% of final value	(4)
0Eh	Resistance measurement 600Ohm 4wire	- **/** 600Ω= final value (32767)	1)2) ±0.05% of final value	(4)
0Fh	Resistance measurement 3000Ohm 4wire	- **/** 3000Ω = final value (32767)	1)2) ±0.05% of final value	(4)
10h	Thermocouple type J , externally compensated	-210°C .. 850°C **/** in units of 1/10°C, two's complement	1)2)4) ±1°C	(2)
11h	Thermocouple type K, externally compensated	-270°C .. 1200°C **/** in units of 1/10°C, two's complement	1)2)4) ±1.5°C	(2)
12h	Thermocouple type N, externally compensated	-200°C .. 1300°C **/** in units of 1/10°C, two's complement	1)2)4) ±1.5°C	(2)
13h	Thermocouple type R, externally compensated	-50°C .. 1760°C **/** in units of 1/10°C, two's complement	1)2)4) ±4°C	(2)
14h	Thermocouple type T, externally compensated	-270°C .. 400°C **/** in units of 1/10°C, two's complement	1)2)4) ±1.5°C	(2)
15h	Thermocouple type S, externally compensated	-50°C .. 1760°C **/** in units of 1/10°C, two's complement	1)2)4) ±5°C	(2)
18h	Thermocouple type J, internally compensated	-210°C .. 850°C **/** in units of 1/10°C, two's complement	1)2)5) ±1.5°C	(2)
19h	Thermocouple type K, internally compensated	-270°C .. 1200°C **/** in units of 1/10°C, two's complement	1)2)5) ±2°C	(2)
1Ah	Thermocouple type N, internally compensated	-200°C .. 1300°C **/** in units of 1/10°C, two's complement	1)2)5) ±2°C	(2)

continued ...

… continue

No.	Function	Measurement range / representation	Tolerance	Conn.
1Bh	Thermocouple type R, internally compensated	-50°C .. 1760°C **/** in units of 1/10°C, two's complement	1)2)5) ±5°C	(2)
1Ch	Thermocouple type T, internally compensated	-270°C .. 400°C **/** in units of 1/10°C, two's complement	1)2)5) ±2°C	(2)
1Dh	Thermocouple type S, internally compensated	-50°C .. 1760°C **/** in units of 1/10°C, two's complement	1)2)4) ±5°C	(2)
27h	Voltage 0...50mV Siemens S7 format (two's complement)	0...50mV **/** 59.25mV = max. range before over range (32767) 0...50mV = nominal value (0...27648)	1) ±0.1% of final value	(1)
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.85V **/** 11.85V = max. value before over range (32767) -10...10V = nominal range (-27648...27648) -11.85V = min. value before under range (-32767)	1) ±0.05% of final value	(1)
29h	Voltage ±4V Siemens S7 format (two's complement)	±4.74V **/** 4.74V = max. value before over range (32767) -4...4V = rated range (-27648...27648) -4.74V = min. value before under range (-32767)	1) ±0.05% of final value	(1)
2Ah	Voltage ±400mV Siemens S7 format (two's complement)	±474mV **/** 474mV = max. value before over range (32767) -400...400mV = rated range (-27648...27648) -474mV = min. value before under range (-32767)	1) ±0.1% of final value	(1)
2Bh	Voltage ±10V Siemens S5 format (value and sign)	±11.85V **/** 12.5V = max. value before over range (20480) -10...10V = rated range (-16384...16384) -12.5V = min. value before under range (-20480)	1) ±0.2% of final value	(1)
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.70mA **/** 23.70mA = max. value before over range (32767) -20...20mA = rated value (-27648...27648) -23.70mA = min. value before under range (-32767)	1) ±0.05% of final value	(1)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185 .. +22.96mA / 22.96mA = max. value before over range (32767) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-5530)	1) ±0.05% of final value	(1)
2Eh	Current 4...20mA Siemens S5 format (two's complement)	1.185 .. +22.96mA / 22.96mA = max. value before over range (20480) 4...20mA = rated range (0...16384) 0mA = min. value before under range (-4096)	1) ±0.2% of final value	(1)
2Fh	Current ±20mA Siemens S5 format (value and sign)	±23.70mA / 23.70mA = max. value before over range (19456) -20...20mA = rated value (-16384...16384) -23.70mA = min. value before under range (-19456)	1) ±0.05% of final value	(1)
32h	Resistance measurement 6000Ohm 4wire	- / 6000Ω= final value (32767)	1)2) ±0.05% of final value	(4)
33h	Resistance measurement 6000Ohm 4wire	- / 6000Ω= final value (6000)	1)2) ±0.05% of final value	(4)
35h	Resistance measurement 60Ohm 2wire	- / 60Ω= final value (6000)	1)2)3) ±0.2% of final value	(3)
36h	Resistance measurement 600Ohm 2wire	- / 600Ω = final value (6000)	1)2)3) ±0.1% of final value	(3)
37h	Resistance measurement 3000Ohm 2wire	- / 3000Ω = final value (30000)	1)2)3) ±0.1% of final value	(3)
38h	Resistance measurement 6000Ohm 2wire	- / 6000Ω = final value (6000)	1)2)3) ±0.1% of final value	(3)

continued ...

… continue

No.	Function	Measurement range / representation	Tolerance	Conn.
[6])3Ah	Current ±20mA Siemens S5 format (two's complement)	±23.70mA / 23.70mA = max. value before over range (19456) -20...20mA = nominal range (-16384...16384) -23.70mA = min. value before under range (-19456)	[1] ±0.05% of final value	(1)
[6])3Bh	Voltage ±10V Siemens S5 format (two's complement)	±11.85V / 12.5V = max. value before over range (20480) -10...10V = nominal range (-16384...16384) -12.5V = min. value before under range (-20480)	[1] ±0.2% of final value	(1)
3Dh	Resistance measurement 60Ohm 4wire	- **/** 60Ω= final value (6000)	[1)2)] ±0.1% of final value	(4)
3Eh	Resistance measurement 600Ohm 4wire	- **/** 600Ω= final value (6000)	[1)2)] ±0.05% of final value	(4)
3Fh	Resistance measurement 3000Ohm 4wire	- **/** 3000Ω = final value (30000)	[1)2)] ±0.05% of final value	(4)
57h	Voltage 0...50mV two's complement	0...50mV **/** 59.25mV = max. value before over range (5925) 0...50mV = rated range (0...5000)	[1] ±0.1% of final value	(1)
58h	Voltage ±10V two's complement	±11.85V **/** 11.85V = max. value before over range (11850) -10...10V = rated range (-10000...10000) -11.85V = min. value before under range (-11850)	[1] ±0.05% of final value	(1)
59h	Voltage ±4V two's complement	±4.74V **/** 4.74V = max. value before over range (4740) -4...4V = rated range (-4000...4000) -4.74V = min. value before under range (-4740)	[1] ±0.05% of final value	(1)
5Ah	Voltage ±400mV two's complement	±474mV **/** 474mV = max. value before over range (4740) -400...400mV = rated range (-4000...4000) -474mV = min. value before under range (-4740)	[1] ±0.1% of final value	(1)
5Ch	Current ±20mA two's complement	±23.70mA **/** 23.70mA = max. value before over range (23700) -20...20mA = rated value (-20000...20000) -23.70mA = min. value before under range (-23700)	[1] ±0.05% of final value	(1)
5Dh	Current 4...20mA two's complement	1.185 .. +22.96mA **/** 22.96mA = max. value before over range (18960) 4...20mA = rated range (0...16000) 0mA = min. value before under range (-4000)	[1] ±0.05% of final value	(1)
FFh	Channel not active (turned off)			

1) measured at an environmental temperature of 25°C, velocity of 15 conversions/s

2) excluding errors caused by transducer inaccuracies

3) excluding errors caused by contact resistance and line resistance

4) the compensation of the neutralization must be implemented externally

5) the compensation for the neutralization is implemented internally by including the temperature of the front plug. The thermal conductors have to be connected directly to the front plug, and where necessary these must be extended by means of Thermocouple extension cables

6) starting from hardware release 11

Note!

The module is preset to the range "±10V voltage" at S7 format.

Measurement data acquisition

During a measurement the data is stored in the data input area. The table above shows the allocation of the data to a measured value as well as the respective tolerance.

The following figure shows the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

Only channels 0 and 2 are used in 4wire systems.

Parameter data

Every channel is individual parameterizable. 10byte are available for the configuration data. Configuration parameters are stored in permanent memory and they will be retained even if power is turned off.

The following table show the structure of the parameter area:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic alarm byte: Bit 5 ... 0: reserved Bit 6: 0: diagnostic alarm inhibited 1: diagnostic alarm enabled Bit 7: reserved	00h
1	reserved	00h
2	Function-no. channel 0 (see table)	28h
3	Function-no. channel 1 (see table)	28h
4	Function-no. channel 2 (see table)	28h
5	Function-no. channel 3 (see table)	28h
6	Option byte channel 0	00h
7	Option byte channel 1	00h
8	Option byte channel 2	00h
9	Option byte channel 3	00h

Parameters

Diagnostic interrupt

The Diagnostic interrupt is enabled by means of bit 6 of byte 0. In this case an error a 4byte diagnostic message will be issued to the master system.

Function-no.

Here you have to enter the function number of your measurement function for every channel. The allocation of the function number to a measurement function is available from the table above.

Option byte

Here you may specify the conversion rate. In addition selection and envelope functions have been implemented.

Note!

Please note that the resolution is reduced when conversion rate is increased due to the shorter integration time.

The format of the data transfer remains the same. The only difference is that the lower set of bits (LSBs) loose significance for the analog value.

Structure of the option byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 9	Option byte:		00h
	Bit 3 ... 0: rate*		
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 123 conversions/s	14	
	0100 168 conversions/s	12	
	0101 202 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 5 ... 4: Selection function		
	00 deactivated		
	01 use 2 of 3 values		
	10 use 4 of 6 values		
	Bit 7 ... 6: Envelope function		
	00 deactivated		
	01 envelope ± 8		
	10 envelope ±16		

*) These specifications apply to 1channel operation. For multi-channel operations, the conversion rate per channel can be calculated by dividing the specified conversion rate by the number of active channels.

Diagnostic data

As soon as you activated the alarm release in byte 0 of the parameter area, 4 diagnostic bytes with fixed content are transferred to the superordinated system in case of an error. Please note that analog modules only use the first two bytes for diagnostic purposes. The remaining two byte are not used. The structure of the diagnostic bytes is as follows:

Diagnostic data:

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: constant 0 Bit 2: external error Bit 3: channel error present Bit 7 ... 4: reserved	-
1	Bit 3 ... 0: class of module 0101 analog module Bit 4: channel information available Bit 7 ... 5: reserved	-
2 ... 3	not assigned	-

Technical data

Electrical data	VIPA 231-1BD52
Number of inputs	4 differential inputs
Input resistance	> 2MΩ (voltage range) < 50Ω (current range)
measuring range - Thermocouple - Resistance thermometer - Resistance measuring - Voltage measuring - Current measuring	 Type J, K, N, R, S, T Pt100, Pt1000, NI100, NI1000 60Ω, 600Ω, 3kΩ 0...50mV, 0...10V, ±4mV, ±4V, ±10V 4...20mA, ±20mA
Power supply	5V via backplane bus
Current consumption	280mA via backplane bus
Isolation	500Vrms (field voltage - backplane bus)
Status indicators	via LEDs on the front
Programming specifications	
Input data	8byte (1 word per channel)
Output data	-
Parameter data	10byte
Diagnostic data	4byte
Process alarm data	-
Dimensions and weight	
Dimensions (WxHxD)	25.4x76x88mm
Weight	100g

231-1BD53 - AI 4x16Bit, multiinput

Order data AI 4x16Bit multiinput VIPA 231-1BD53

Description

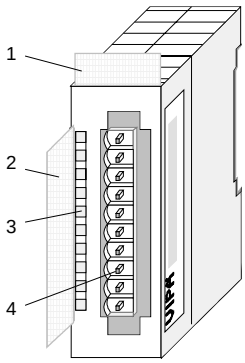
The module has 4 inputs that you may configure individually. The module requires a total of 8 input data bytes in the periphery area (2byte per channel).

Isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers.

Properties

- the different channels are individually configurable and may be turned off
- the common signal inputs of the channels are not isolated from each other and the permitted potential difference is up to 5V
- diagnostic function

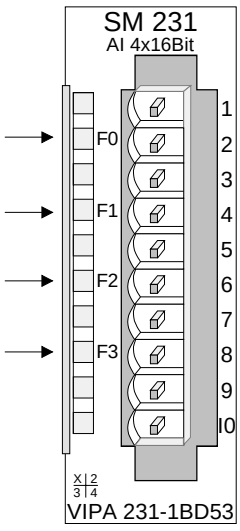
Construction



[1] Label for module description
[2] Label for the bit address with description
[3] LEDs
[4] Edge connector

Status indicators pin assignment

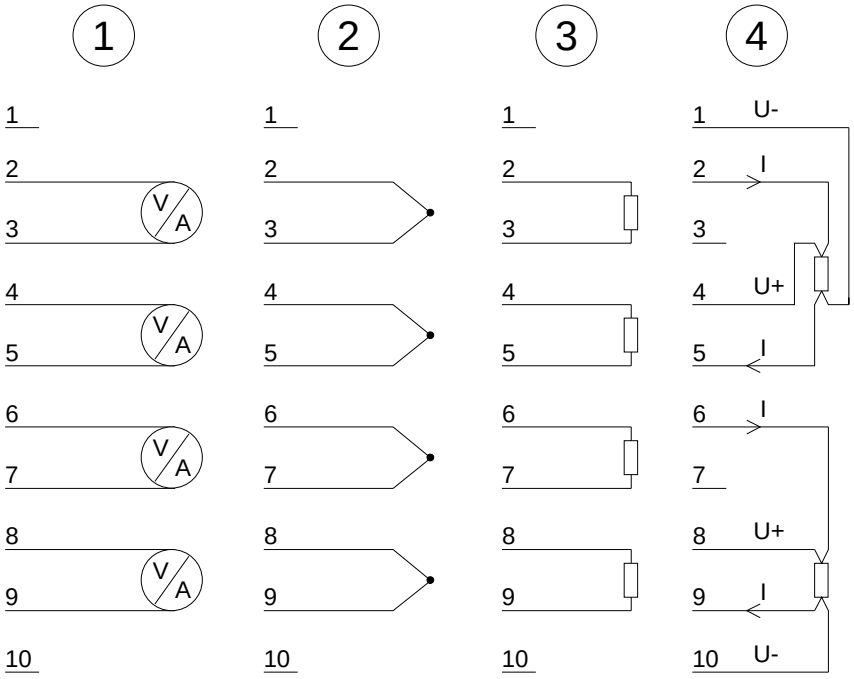
LED	Description
F0 ... F3	LED (red): turned on as soon as an channel error is detected res. an entry in the diagnostic bytes happened



Pin	Assignment
1	For 4wire systems channel 0
2	+ channel 0
3	Channel 0 common
4	+ channel 1
5	Channel 1 common
6	+ channel 2
7	Channel 2 common
8	+ channel 3
9	Channel 3 common
10	For 4wire systems channel 2

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 "Function-no. assignment" on the next pages.



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation	Conn.
00h	Does not affect permanently stored configuration data		
01h	Pt100 in 2wire mode	-200°C ... +850°C **/** in units of 1/10°C, two's complement	(3)
02h	Pt1000 in 2wire mode	-200°C ... +850°C **/** in units of 1/10°C, two's complement	(3)
03h	NI100 in 2wire mode	-60°C ... +250°C **/** in units of 1/10°C, two's complement	(3)
04h	NI1000 in 2wire mode	-60°C ... +250°C **/** in units of 1/10°C, two's complement	(3)
05h	Resistance measurement 60Ohm 2wire	- **/** 60Ω= final value (32767)	(3)
06h	Resistance measurement 600Ohm 2wire	- **/** 600Ω = final value (32767)	(3)
07h	Resistance measurement 3000Ohm 2wire	- **/** 3000Ω = final value (32767)	(3)
08h	Resistance measurement 6000Ohm 2wire	- / 6000Ω = final value (32767)	(3)
09h	Pt100 via 4wire connection	-200°C ... +850°C **/** in units of 1/10°C, two's complement	(4)
0Ah	Pt1000 via 4wire connection	-200°C ... +850°C **/** in units of 1/10°C, two's complement	(4)
0Bh	NI100 via 4wire connection	-60°C ... +250°C **/** in units of 1/10°C, two's complement	(4)
0Ch	NI1000 via 4wire connection	-60°C ... +250°C **/** in units of 1/10°C, two's complement	(4)
0Dh	Resistance measurement 60Ohm 4wire	- **/** 60Ω= final value (32767)	(4)
0Eh	Resistance measurement 600Ohm 4wire	- **/** 600Ω= final value (32767)	(4)
0Fh	Resistance measurement 3000Ohm 4wire	- **/** 3000Ω = final value (32767)	(4)
10h	Thermocouple type J, [1] externally compensated	-210°C ... 1200°C **/** in units of 1/10°C, two's complement	(2)
11h	Thermocouple type K, [1] externally compensated	-270°C . . +1372°C **/** in units of 1/10°C, two's complement	(2)
12h	Thermocouple type N, [1] externally compensated	-270°C . . +1300°C **/** in units of 1/10°C, two's complement	(2)
13h	Thermocouple type R, [1] externally compensated	-50°C . . +1769°C **/** in units of 1/10°C, two's complement	(2)
14h	Thermocouple type T, [1] externally compensated	-270°C . . +400°C **/** in units of 1/10°C, two's complement	(2)
15h	Thermocouple type S, [1] externally compensated	-50°C . . +1769°C **/** in units of 1/10°C, two's complement	(2)
16h	Thermocouple type E, [1] externally compensated	-270°C . . +1000°C **/** in units of 1/10°C, two's complement	(2)
18h	Thermocouple type J, [2] internally compensated	-210°C . . +1200°C **/** in units of 1/10°C, two's complement	(2)

continued ...

… continue

No.	Function	Measurement range / representation	Conn.
19h	Thermocouple type K, [2] internally compensated	-270°C . . +1372°C **/** in units of 1/10°C, two's complement	(2)
1Ah	Thermocouple type N, [2] internally compensated	-270°C . . +1300°C **/** in units of 1/10°C, two's complement	(2)
1Bh	Thermocouple type R, [2] internally compensated	-50°C . . +1769°C **/** in units of 1/10°C, two's complement	(2)
1Ch	Thermocouple type T, [2] internally compensated	-270°C .. +400°C **/** in units of 1/10°C, two's complement	(2)
1Dh	Thermocouple type S, [2] internally compensated	-50°C .. +1769°C **/** in units of 1/10°C, two's complement	(2)
1Eh	Thermocouple type E, [2] internally compensated	-270°C .. +1000°C **/** in units of 1/10°C, two's complement	(2)
27h	Voltage ±50mV Siemens S7 format (two's complement)	±58.79mV **/** 58.79mV = max. value before over range (32511) -50...50mV= nominal range (-27648...27648) -58.79mV = min. value before under range (-32512)	(1)
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V **/** 11.76V= max. value before over range (32511) -10...10V= nominal range (-27648...27648) -11.76V= min. value before under range (-32512)	(1)
29h	Voltage ±4V Siemens S7 format (two's complement)	±4.70V **/** 4.70V = max. value before over range (32511) -4...4V = rated range (-27648...27648) -4.70V = min. value before under range (-32512)	(1)
2Ah	Voltage ±400mV Siemens S7 format (two's complement)	±470mV **/** 470mV = max. value before over range (32511) -400...400mV = rated range (-27648...27648) -470mV = min. value before under range (-32512)	(1)
2Bh	Voltage ±10V Siemens S5 format (value and sign)	±12.50V **/** 12.50V = max. value before over range (20480) -10...10V = rated range (-16384...16384) -12.50V = min. value before under range (-20480)	(1)
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.52mA **/** 23.52mA = max. value before over range (32511) -20...20mA = rated value (-27648...27648) -23.52mA = min. value before under range (-32512)	(1)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185 .. +22.81mA / 22.81mA = max. value before over range (32511) 4...20mA = rated range (0...27648) 1.185 mA = min. value before under range (-4864)	(1)
2Eh	Current 4...20mA Siemens S5 format (value and sign)	0.8 .. +24.00mA / 24.00mA = max. value before over range (20480) 4 .. 20mA = rated range (0...16384) 0.8mA = min. value before under range (-3277)	(1)
2Fh	Current ±20mA Siemens S5 format (value and sign)	±25.00mA / 25.00mA = max. value before over range (20480) -20...20mA = rated value (-16384...16384) -25.00mA = min. value before under range (-20480)	(1)

continued ...

… continue

No.	Function	Measurement range / representation	Conn.
32h	Resistance measurement 6000Ω 4wire	- / 6000Ω= final value (32767)	(4)
33h	Resistance measurement 6000Ω 4wire	- / 6000Ω= final value (6000)	(4)
35h	Resistance measurement 60Ω 2wire	- / 60Ω= final value (6000)	(3)
36h	Resistance measurement 600Ω 2wire	- / 600Ω = final value (6000)	(3)
37h	Resistance measurement 3000Ω 2wire	- / 3000Ω = final value (30000)	(3)
38h	Resistance measurement 6000Ω 2wire	- / 6000Ω = final value (6000)	(3)
3Ah	Current ±20mA Siemens S5 format two's complement	±25.00mA / 25.00mA = max. value before over range (20480) -20...20mA = nominal range (-16384...16384) -25.00mA = min. value before under range (-20480)	(1)
3Bh	Voltage ±10V Siemens S5 format two's complement	±12.50V / 12.50V = max. value before over range (20480) -10...10V = nominal range (-16384...16384) -12.50V = min. value before under range (-20480)	(1)
3Dh	Resistance measurement 60Ω 4wire	- ***/*** 60Ω= final value (6000)	(4)
3Eh	Resistance measurement 600Ω 4wire	- ***/*** 600Ω= final value (6000)	(4)
3Fh	Resistance measurement 3000Ω 4wire	- ***/*** 3000Ω = final value (30000)	(4)
57h	Voltage ±50mV two's complement	±58.79mV ***/*** 58.79mV = max. value before over range (5879) -50...50mV = rated range (-5000...5000) -58.79V = min. value before under range (-5879)	(1)
58h	Voltage ±10V two's complement	±11.76V ***/*** 11.76V = max. value before over range (11760) -10...10V = rated range (-10000...10000) -11.76V = min. value before under range (-11760)	(1)
59h	Voltage ±4V two's complement	±4.70V ***/*** 4.70V = max. value before over range (4700) -4...4V = rated range (-4000...4000) -4.70V = min. value before under range (-4700)	(1)
5Ah	Voltage ±400mV two's complement	±470mV ***/*** 470mV = max. value before over range (4700) -400...400mV = rated range (-4000...4000) -470mV = min. value before under range (-4700)	(1)
5Ch	Current ±20mA two's complement	±23.51mA ***/*** 23.51mA = max. value before over range (23510) -20...20mA = rated value (-20000...20000) -23.51mA = min. value before under range (-23510)	(1)
5Dh	Current 4...20mA two's complement	1.185 .. +22.81mA ***/*** 22.81mA = max. value before over range (18810) 4...20mA = rated range (0...16000) 1.185mA = min. value before under range (-2815)	(1)
62h	Cu50 2wire	-50°C ... +150°C ***/*** in units of 1/10°C, two's complement	(3)
6Ah	Cu50 4wire	-50°C ... +150°C ***/*** in units of 1/10°C, two's complement	(4)

continued ...

… continue

No.	Function	Measurement range / representation	Conn.
91h	PTC KTY81-110 [3] 990-1010Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
92h	PTC KTY81-120 [3] 980-1020Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
93h	PTC KTY81-121 [3] 980-1000Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
94h	PTC KTY81-122 [3] 1000-1020Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
95h	PTC KTY81-150 [3] 950-1050Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
96h	PTC KTY81-151 [3] 950-1000Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
97h	PTC KTY81-152 [3] 1000-1050Ω Two-wire connection	200°C = max. value before over range (2000) -55 ... 150°C = nominal range (-550... 1500) -100°C = min. value before under range (-1000) Values in 0.1°C	(3)
FFh	Channel not active (turned off)		

[1] The compensation of the neutralization must be implemented externally

[2] The compensation for the neutralization is implemented internally by including the temperature of the front plug. The thermal conductors have to be connected directly to the front plug, and where necessary these must be extended by means of thermo element extension cables

[3] This function is available starting with firmware version 143 of the module.

Note!

The module is preset to the range "±10V voltage" at S7 format.

Measurement data acquisition

During a measurement the data is stored in the data input area.

The following figure shows the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

Only channels 0 and 2 are used in 4wire systems.

Diagnosis at wire break with Thermocouples always active

When using Thermocouples the diagnosis for wire break is always active. If a diagnosis alarm is parameterized, the module initializes a diagnosis at wire break for the corresponding channel.

Parameter data

Every channel is individual parameterizable. For the parameterization, 10byte parameterization data are available. The parameterization data are stored permanently and remain also in off mode. By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 60ms. During this time, the measuring value output is 7FFFh.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	diagnostic: Bit 5 ... 0: reserved Bit 6: diagnostic interrupt 0: deactivated 1: activated Bit 7: reserved	00h
1	Bit 7 ... 0: reserved	00h
2	Function-no. channel 0	28h
3	Function-no. channel 1	28h
4	Function-no. channel 2	28h
5	Function-no. channel 3	28h
6	Option-Byte channel 0	00h
7	Option-Byte channel 1	00h
8	Option-Byte channel 2	00h
9	Option-Byte channel 3	00h

Parameters

Diagnostic interrupt

With the help of bit 6 of byte 0, you may release the diagnostic interrupt. In case of an error, the *record set 0* with a size of 4byte is transferred to the superordinated system.

More detailed information is to find below under "Diagnostic data".

Function-no.

Here you set the function-no. of your measuring function for every channel. Please see the according table above.

Option-Byte

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower Bits (LSBs) are not longer relevant for the analog value.

Structure Option-Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 7	Bit 3 ... 0: Velocity per channel*		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 120 conversions/s	14	
	0100 170 conversions/s	12	
	0101 200 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 5 ... 4: Mean value evaluation		
	00 deactivated		
	01 use 2 of 3 values		
	10 use 4 of 6 values		
	11 deactivated		
	Bit 7 ... 6: Envelope function		
	00 deactivated		
	01 envelope ± 8		
	10 envelope ±16		
	11 deactivated		

*) These specifications apply to 1channel operation. For multi-channel operations, the conversion rate per channel can be calculated by dividing the specified conversion rate by the number of active channels.

Mean value evaluation

Mean value function 2 of 3 values:

After every measuring, the module evaluates the mean value of the last 3 binary values. The value most different from the mean value is deleted and another mean value evaluated from the remaining 2 values. This value is monitored.

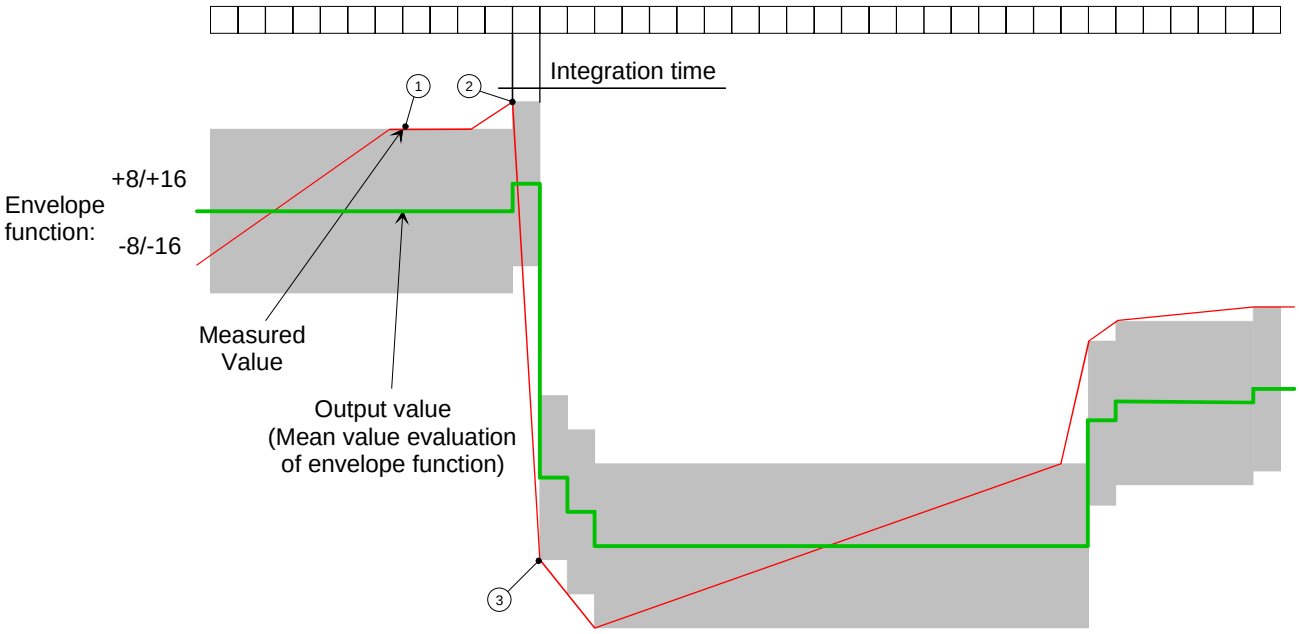
Mean value function 4 of 6 values:

After every measuring, the module evaluates the mean value of the last 6 binary values. The 2 values most different from the mean value are deleted and another mean value evaluated from the remaining 4 values. This value is monitored.

Envelope function

The output valued is "wrapped" with an envelope. If the measured value over- res. underruns the envelope, the envelope migrates accordingly. The output value is the mean value of the envelope.

The following sample illustrates this:



① Measuring value within envelope → no envelope shift, Output is mean value of the current envelope upper and lower limit.

② Measuring value oversteps the envelope → Envelope shift up for the difference between "old" envelope upper limit and measuring range, output value is the mean value of the "new" envelope upper and lower limit.

③ Measuring value shortfalls the envelope → Envelope shift down for the difference between "old" envelope lower limit and measuring range, output value is the mean value of the "new" envelope upper and lower limit.

Diagnostic data

The diagnostic data uses 12byte and are stored in the record sets 0 and 1 of the system data area.

When you enable the diagnostic interrupt in byte 0 of the parameter area, modules will transfer *record set 0* to the superordinated system when an error is detected.

Record set 0 has a predefined content and a length of 4byte. The content of the record set may be read in plain text via the diagnostic window of the CPU.

For extended diagnosis during runtime, you may evaluate the 12byte wide *record set 1* via the SFCs 51 and 59.

Evaluate diagnosis

At present diagnosis, the CPU interrupts the user application and branches into the OB 82. This OB gives you detailed diagnostic data via the SFCs 51 and 59 when programmed correctly.

After having processed the OB 82, the user application processing is continued. Until leaving the OB 82, the data remain consistent.

Record set 0

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present Bit 6 ... 4: reserved Bit 7: Wrong parameters in the 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	reserved	00h

Record set 1

The *record set 1* contains the 4byte of record set 0 and additional 8byte channel specific diagnostic data.

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

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: reserved	74h
5	Bit 7 ... 0: Number of diagnostic bits of the module per channel	08h
6	Bit 7 ... 0: Number of identical 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 7 ... 4: reserved	00h
8	Bit 0: Wire break Channel 0 (only at Thermocouples) Bit 1: Parameterization error Channel 0 Bit 2: Measuring range underflow Channel 0 Bit 3: Measuring range overflow Channel 0 Bit 7 ... 4: reserved	00h
9	Bit 0: Wire break Channel 1 (only at Thermocouples) Bit 1: Parameterization error Channel 1 Bit 2: Measuring range underflow Channel 1 Bit 3: Measuring range overflow Channel 1 Bit 7 ... 4: reserved	00h
10	Bit 0: Wire break Channel 2 (only at Thermocouples) Bit 1: Parameterization error Channel 2 Bit 2: Measuring range underflow Channel 2 Bit 3: Measuring range overflow Channel 2 Bit 7 ... 4: reserved	00h
11	Bit 0: Wire break Channel 3 (only at Thermocouples) Bit 1: Parameterization error Channel 3 Bit 2: Measuring range underflow Channel 3 Bit 3: Measuring range overflow Channel 3 Bit 7 ... 4: reserved	00h

Technical data

Electrical Data	VIPA 231-1BD53							
Number of inputs - at 4wire resistance-type sensor	4 2							
Length of cable (shielded)	200m							
Voltages, Currents, Potentials								
Constant current for resistance-type sensor	1.25mA							
Isolation - channel / backplane bus - between the channels	 yes no							
Permitted potential difference - between the inputs (U_{CM}) - between inputs and $M_{INTERNAL}$ (U_{ISO})	 DC 5V DC 75V/AC 60V							
Isolation proofed with	DC 500V							
Current consumption - via backplane bus	 280mA							
Power dissipation of the module	1.4W							
Analog value generation	Calculation time/Resolution (per channel)							
Measuring principle	Sigma-Delta							
parameterizable	yes							
Conversion rate (Hz)	200	170	120	60	30	15	7.5	3.7
Integration time (ms)	5	6	8	17	33	67	133	270
Basic conversion time (ms) - Additional conversion time for open-circuit monitoring (ms) - Service time per cycle (only by thermocouple) (ms)	7 135 10	8 135 10	10 135 10	19 135 10	35 135 10	69 135 10	135 135 10	272 135 10
Resolution (Bit) incl. overrange	10	12	14	15	16	16	16	16
Noise suppression for frequency f1 (Hz)	no					50 and 60Hz		
Basic execution time of the module, in ms (all channels enabled)	28	32	40	76	140	276	540	1088
Averaging	2 of 3 or 4 of 6							
Envelope function	±8 or ±16							
Suppression of interference, Limits of error								
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)								
Common-mode interference (U_{CM} < 5V)	> 80dB							
Series-mode noise (peak value of noise < nominal value of input range	> 80dB							
Crosstalk between the inputs	> 50dB							

continued ...

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Operational limit (only valid to 120W/s) (in the entire temperature range, with reference to the input range)		
	Measuring range	Tolerance
At voltage input	±50mV	±0.6%
	±400mV, ±4V, ±10V	±0.3%
At current input	±20mA	±0.3%
	0...20mA	±0.6%
	4...20mA	±0.8%
Resistance	0...60Ω	±0.8%
	0...600Ω, 0...3kΩ, 0...6kΩ	±0.4%
Resistance thermometer	Pt100, Pt1000	±0.4%
	Ni100, Ni1000	±1.0%
	PTC KTY81-110, 990-1010Ω [1)] PTC KTY81-120, 980-1020Ω PTC KTY81-121, 980-1000Ω PTC KTY81-122, 1000-1020Ω PTC KTY81-150, 950-1050Ω PTC KTY81-151, 950-1000Ω PTC KTY81-152, 1000-1050Ω	±1.0% ± Tolerance of the encoder
	Cu50	±1.4%
Thermocouple	Type J, K, N, R, S, E, T	±1.5%
Basic error limit (only valid to 120W/s) (during temperature is 25°C, referring to input range)		
	Measuring range	Tolerance
Voltage input	±50mV	±0.4%
	±400mV, ±4V, ±10V	±0.2%
Current input	±20mA	±0.2%
	0...20mA	±0.4%
	4...20mA	±0.5%
Resistance	0...60Ω	±0.4%
	0...600Ω, 0...3kΩ, 0...6kΩ	±0.2%
Resistance thermometer	Pt100, Pt1000	±0.2%
	Ni100, Ni1000	±0.5%
	PTC KTY81-110, 990-1010Ω PTC KTY81-120, 980-1020Ω PTC KTY81-121, 980-1000Ω PTC KTY81-122, 1000-1020Ω PTC KTY81-150, 950-1050Ω PTC KTY81-151, 950-1000Ω PTC KTY81-152, 1000-1050Ω	±0.5% ± Tolerance of the encoder
	Cu50	±0.7%
Thermocouple	Type J, K, N, R, S, E, T	±1.0%
Temperature error (with reference to the input range) measuring current		 ±0.005%/K ±0.015%/K
Linearity error (with reference to the input range)		±0.02%
Repeatability (in steady state at 25°C referred to the input range)		±0.05%
Temperature error of internal compensation		±1.5%

[1)] PTC measurement only available starting with firmware version 143 of the module.

continued ...

... continue

States, Interrupts, Diagnosis	
Diagnostic interrupt	parameterizable
Diagnosis functions - Sum error monitor - Diagnostic information read-out	 red SF LED (per channel) possible
Data for selecting a sensor	
Voltage ±50mV, ±400mV, ±4V, ±10V	 20MΩ
Current ±20mA, 0...20mA, 4...20mA	 85Ω
Resistors 0...60Ω, 0...600Ω, 0...3kΩ, 0...6kΩ	 20MΩ
Resistance thermometer Pt100, Pt1000, Ni100, Ni1000, Cu50	 20MΩ
Thermocouple Type J, K, N, R, S, E, T	 20MΩ
Maximum input voltage for voltage input (destruction limit)	25V
Maximum input current for current input (destruction limit)	30mA
Connection of the sensor For measuring voltage For measuring current as 2wire transmitter as 4wire transmitter For measuring resistance with 2conductor connection with 4conductor connection	 possible possible with external power supply possible possible possible
Characteristic linearization parameterizable for RTD Thermocouple	 yes Pt100, Pt1000, Ni100, Ni1000, Cu50 Typ J, K, N, R, S, E, T
Temperature compensation parameterizable internal temperature compensation external temperature compensation with comparison point (0°C)	 yes possible possible
Unit for temperature measurement	°C
Parameter data	
Input data	8byte (1 Word per channel)
Parameter data	10byte
Diagnostic data	12byte
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88mm
Weight	80g

231-1BD60 - AI 4x12Bit, 4 ... 20mA, isolated

Order data AI 4x12Bit, 4...20mA, isolated VIPA 231-1BD60

Description

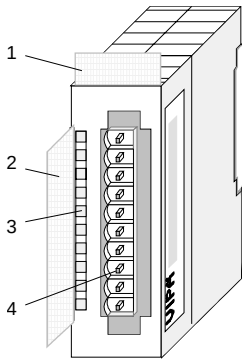
The module has 4 inputs that are permanently configured to measure current signals (4 ... 20mA). This module requires a total of 8byte of the process image for the input data (2byte per channel).

The measured values are returned in S5 format from Siemens. DC/DC converters and isolation amplifiers are employed to provide electrical isolation for the channels of the module with respect to the backplane bus and between the different channels.

Properties

- 4 inputs, channels isolated from the backplane bus and from each other (galvanic isolation of the channels by means of isolation amplifiers)
- Permanently configured for current measurements
- No parameterization required
- Suitable for transducers with 4 ... 20mA outputs
- LEDs to indicate wire break

Construction

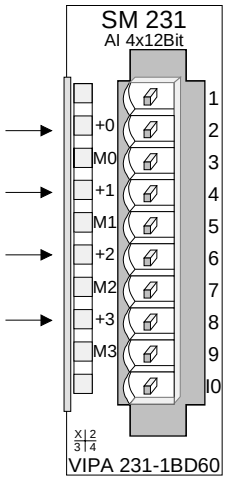


[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator

LED	Description
+0 ... +3	LED (red) wire break detection These LEDs is turned on when the transducer is disconnected.

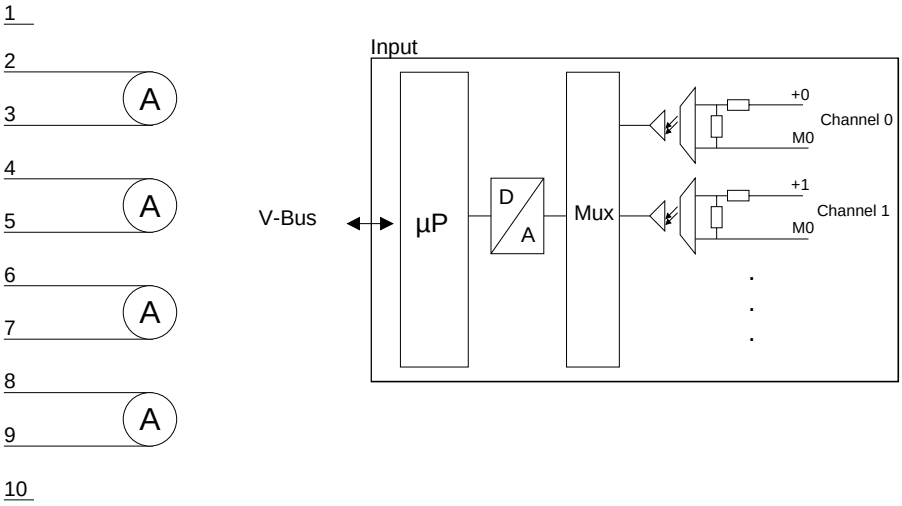
pin assignment



Pin	Assignment
1	
2	pos. connection Ch. 0
3	Channel 0 common
4	pos. connection Ch.1
5	Channel 1 common
6	pos. connection Ch.2
7	Channel 2 common
8	pos. connection Ch.3
9	Channel 3 common
10	

Wiring and schematic diagram

Wiring diagram **Schematic diagram**



Wire break recognition

The wire break recognition is always active. In case of a wire break res. when no encoder is connected, the LED of the according channel is turned on. The module has no diagnostic ability.

Numeric notation

Input data in Siemens S5 format is stored in a word. The word contains the binary value and information bits:

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value within measuring range 1: measuring range exceeded Bit 1: error bit (set at internal error) Bit 2: activity bit (always 0) Bit 7 ... 3: **binary measured value** (see table below)
1	Bit 6 ... 0: **binary measured value** (see table below) Bit 7: sign 0 positive 1 negative

The following table shows the allocation of binary values to the respective measured values.

Numeric notation in Siemens S5 format

Measured value in mA	Units	**Binary measured value**	T	E	Ü	Range
24.0	2560	0 1 0 1 0 0 0 0 0 0 0 0 0 0	0	0	0	overdrive region
20.016	2049	0 1 0 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
20.0	2048	0 1 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	nominal range
19.98	2047	0 0 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	
12.0	1024	0 0 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
8.0	512	0 0 0 1 0 0 0 0 0 0 0 0 0 0	0	0	0	
6.0	256	0 0 0 0 1 0 0 0 0 0 0 0 0 0	0	0	0	
5.0	128	0 0 0 0 0 1 0 0 0 0 0 0 0 0	0	0	0	
4.016	2	0 0 0 0 0 0 0 0 0 0 0 0 1 0	0	0	0	
4.008	1	0 0 0 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
4	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
3.984	-2	1 1 1 1 1 1 1 1 1 1 1 1 1 0	0	0	0	Underdrive region
3.0	-128	1 1 1 1 1 1 0 0 0 0 0 0 0 0	0	0	0	
2.0	-256	1 1 1 1 1 0 0 0 0 0 0 0 0 0	0	0	0	
1.0	-384	1 1 1 1 0 1 0 0 0 0 0 0 0 0	0	0	0	
0.0	-512	1 1 1 1 0 0 0 0 0 0 0 0 0 0	0	0	0	

Technical data

Electrical data	VIPA 231-1BD60
Number of inputs	4 individually isolated
Current measuring range	4 ... 20mA
Input filter time delay	3ms
Input resistance	20Ω
Power supply	5V via backplane bus
Current consumption	280mA via backplane bus
Isolation	yes, every channel separately, isolation tested at 500Vrms
Status indicators	via LEDs on the front
Programming specifications	
Input data	8byte (1 word per channel)
Output data	-
Parameter data	-
Diagnostic data	-
Process alarm data	-
Dimensions and weight	
Dimensions (WxHxD)	25.4x76x88mm
Weight	120g

231-1BD70 - AI 4x12Bit, ±10V, isolated

Order data AI 4x12Bit, ±10V, isolated VIPA 231-1BD70

Description

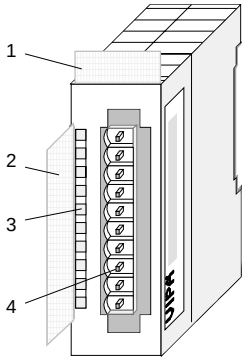
The module has 4 inputs that are permanently configured to measure voltage signals (±10V). This module requires a total of 8byte of the process image for the input data (2byte per channel).

The measured values are returned in S5 format from Siemens. DC/DC converters and isolation amplifiers are employed to provide electrical isolation for the channels of the module with respect to the backplane bus and between the different channels.

Properties

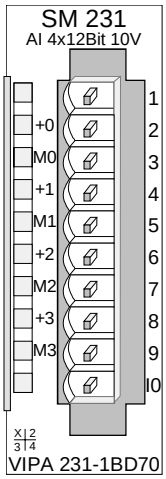
- 4 inputs, channels isolated from the backplane bus and from each other (Galvanic isolation of the channels by means of isolation amplifiers)
- Permanently configured for voltage measurements
- No parameterization required
- Suitable for transducers with ±10V outputs

Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

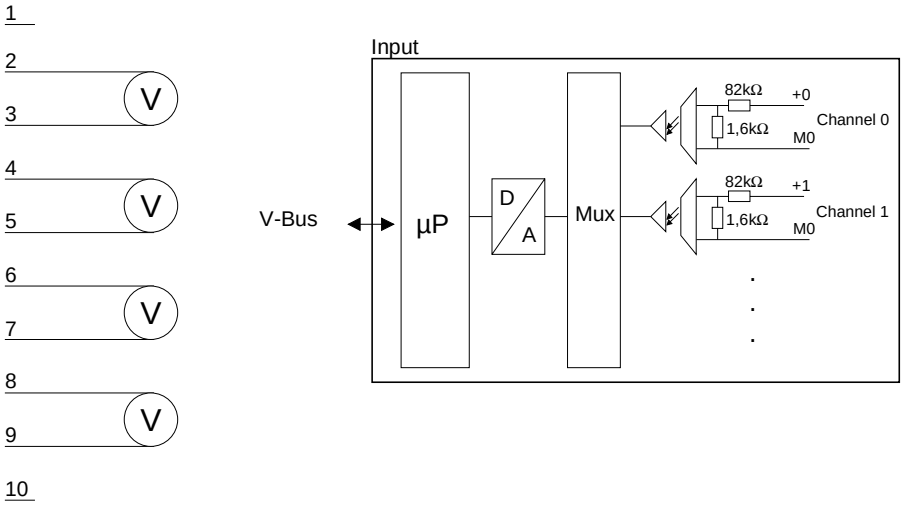
Pin assignment



Pin	Assignment
1	
2	pos. connection Channel 0
3	Channel 0 common
4	pos. connection Channel 1
5	Channel 1 common
6	pos. connection Channel 2
7	Channel 2 common
8	pos. connection Channel 3
9	Channel 3 common
10	

Wiring and schematic diagram

Wiring diagram **Schematic diagram**



Numeric notation

Input data in Siemens S5 format is stored in a word. The word contains the binary value and information bits:

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value within measuring range 1: measuring range exceeded Bit 1: error bit (set at internal error) Bit 2: activity bit (always 0) Bit 7 ... 3: **binary measured value** (see table below)
1	Bit 6 ... 0: **binary measured value** (see table below) Bit 7: sign 0 positive 1 negative

The following table shows the allocation of binary values to the respective measured values.

Numeric notation in Siemens S5 format

Measured value in V	Units	**Binary measured value**	T	E	Ü	Range
12.5	2560	0 1 0 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	overdrive region
10.005	2049	0 1 0 0 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
10.0	2048	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	nominal range
5	1024	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
2.5	512	0 0 0 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
1.25	256	0 0 0 0 1 0 0 0 0 0 0 0 0 0 0	0	0	0	
0.625	128	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0	0	0	0	
0.005	1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	0	0	0	
0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
-0.005	-1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	
-0.625	-128	1 1 1 1 1 1 0 0 0 0 0 0 0 0 0	0	0	0	
-1.25	-256	1 1 1 1 1 0 0 0 0 0 0 0 0 0 0	0	0	0	
-2.5	-512	1 1 1 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
-5	-1024	1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
-10.0	-2048	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	
-10.005	-2049	1 0 1 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	Underdrive region
-12	-2560	1 0 1 1 0 0 0 0 0 0 0 0 0 0 0	0	0	0	

Technical data

Electrical data	VIPA 231-1BD70
Number of inputs	4 individually isolated
Voltage measuring range	±10V
Input filter time delay	3ms
Input resistance	83.5kΩ
Power supply	5V via backplane bus
Current consumption	280mA via backplane bus
Isolation	yes, every channel separately, isolation tested at 500Vrms
Programming specifications	
Input data	8byte (1 word per channel)
Output data	-
Parameter data	-
Diagnostic data	-
Process alarm data	-
Dimensions and weight	
Dimensions (WxHxD)	25.4x76x88mm
Weight	120g

231-1BF00 - AI 8x16Bit

Order data

AI 8x16Bit	VIPA 231-1BF00

Description

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

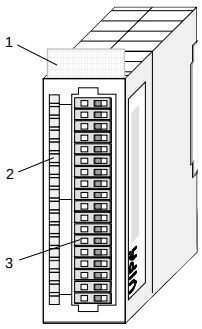
As transducer you may connect thermo couplers type J, K, T and resistance thermometer Pt100.

The modules has 8 inputs that you may configure in groups of two channels individually.

Properties

- 8 analog inputs
- wire break detection
- resolution 15Bit + sign

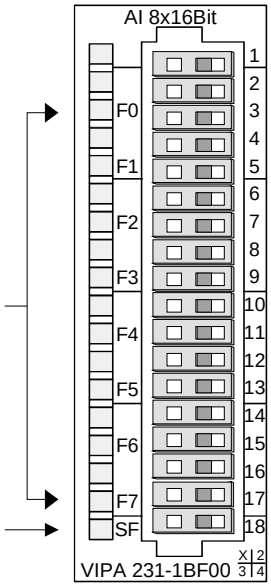
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator
pin assignment

LED	Description
F0...F7	LED (red): error for each channel
SF	LED (red): sum error



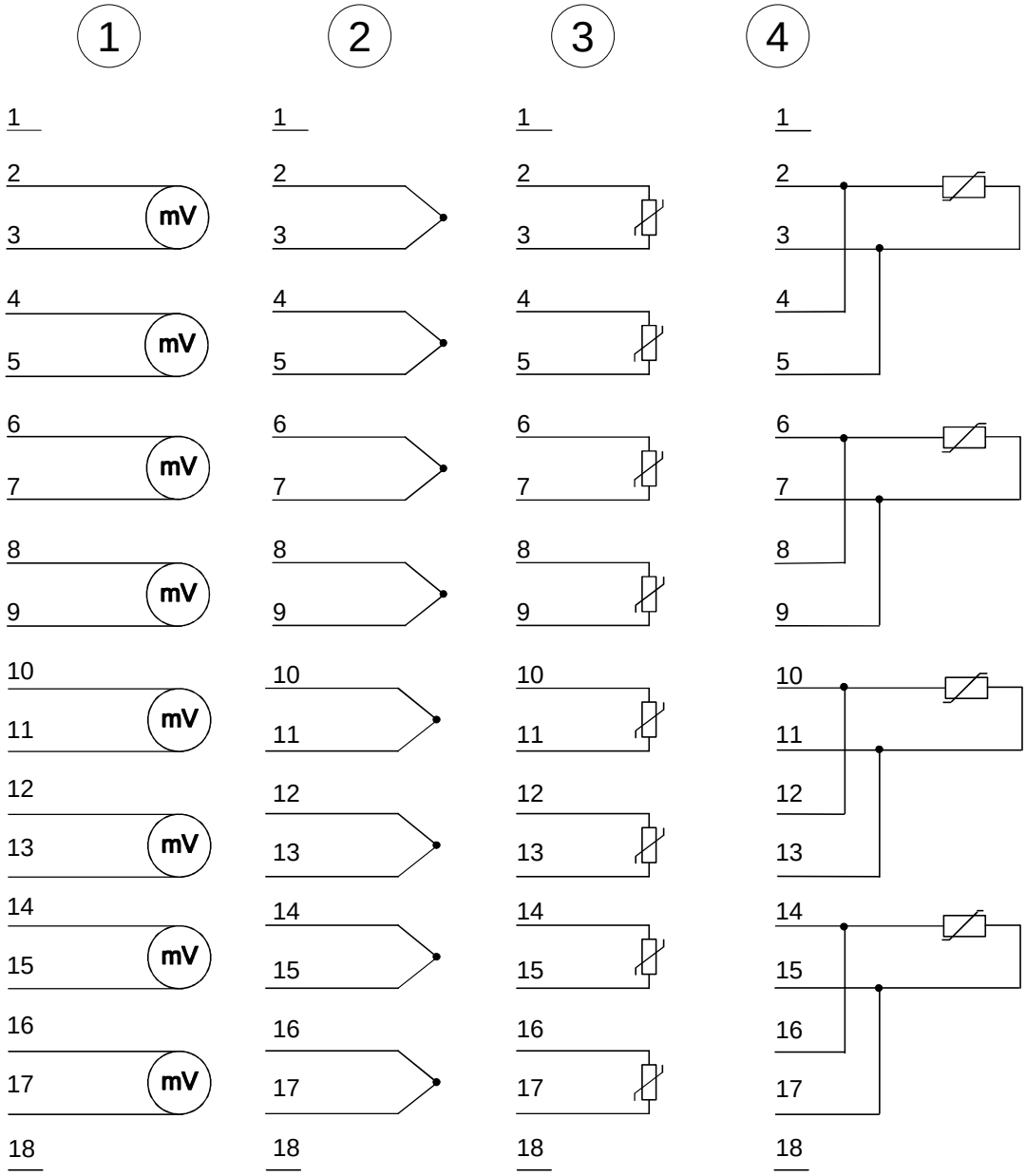
Pin	Assignment
1	not connected
2	pos. connection Ch.0
3	Channel 0 common
4	pos. connection Ch.1
5	Channel 1 common
6	pos. connection Ch.2
7	Channel 2 common
8	pos. connection Ch.3
9	Channel 3 common
10	pos. connection Ch.4
11	Channel 4 common
12	pos. connection Ch.5
13	Channel 5 common
14	pos. connection Ch.6
15	Channel 6 common
16	pos. connection Ch.7
17	Channel 7 common
18	not connected

Note!

Unused inputs on activated channels have to be connected to the respective ground.

This is not necessary when the unused channels are turned off by means of FFh.

Connection diagram



Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data. Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation	Tolerance ref. to nominal range	Conn.
00h	Does not affect permanently stored configuration data			
01h	RTD Pt100 in 2wire mode	-200 .. +850°C **/** in units of 1/10°C, two's complement	[1)2)3)] ±0.15%	(3)
61h	RTD Pt100 in 2wire mode	-328 .. 1562°F in units of 1/10°F, two's complement	[1)2)3)] ±0.15%	(3)
09h	RTD Pt100 via 4wire connection	-200 .. +850°C **/** in units of 1/10°C, two's complement	[1)2)] ±0.15%	(4)
69h	RTD Pt100 via 4wire connection	-328 .. 1562°F in units of 1/10°F, two's complement	[1)2)] ±0.15%	(4)
10h	Thermocouple type J, externally compensated	0 °C .. 1000°C **/** in units of 1/10°C, two's complement	[1)2)4)] ±0.1%	(2)
40h	Thermocouple type J, externally compensated	32 .. 1832°F in units of 1/10°F, two's complement	[1)2)4)] ±0.1%	(2)
11h	Thermocouple type K, externally compensated	0 °C .. 1300°C **/** in units of 1/10°C, two's complement	[1)2)4)] ±0.1%	(2)
41h	Thermocouple type K, externally compensated	32 .. 2372°F in units of 1/10°F, two's complement	[1)2)4)] ±0.1%	(2)
14h	Thermocouple type T, externally compensated	-200 °C .. +400°C **/** in units of 1/10°C, two's complement	[1)2)4)] -200..-60.1 ±0.5% -60...400 ±0.2%	(2)
44h	Thermocouple type T, externally compensated	-328 .. 752°F in units of 1/10°F, two's complement	[1)2)4)] -328...-76,1 ±0.5% -76...752 ±0.2%	(2)
18h	Thermocouple type J, internally compensated	0 °C .. 1000°C **/** in units of 1/10°C, two's complement	[1)2)5)] ±1.0%	(2)
48h	Thermocouple type J, internally compensated	32 .. 1832°F in units of 1/10°F, two's complement	[1)2)5)] ±1.0%	(2)
19h	Thermocouple type K, internally compensated	0 °C .. 1300°C **/** in units of 1/10°C, two's complement	[1)2)5)] ±1.0%	(2)
49h	Thermocouple type K, internally compensated	32 .. 2372°F in units of 1/10°F, two's complement	[1)2)5)] ±1.0%	(2)
1Ch	Thermocouple type T, internally compensated	-200 °C .. +400°C **/** in units of 1/10°C, two's complement	[1)2)5)] ±2.0%	(2)
4Ch	Thermocouple type T, internally compensated	-328 .. 752°F in units of 1/10°F, two's complement	[1)2)5)] ±2.0%	(2)
26h	Voltage 0...60mV	0...60mV = nominal range (0-27648)	[1)] ±0.1%	(1)
56h	Voltage 0...60mV	0...60mV = nominal range (0-6000) in units of 1/100mV	[1)] ±0.1%	(1)
FFh	Channel not active (off)			

1) measured at an ambient temperature of 25°C, velocity of 15 conversions/s

2) excluding errors caused by transducer inaccuracies

3) excluding errors caused by contact resistance and line resistance

4) the compensation of the neutralization has to be implemented externally

5) the compensation for the neutralization is implemented internally by including the temperature of the front plug. The thermal conductors have to be connected directly to the front plug, and where necessary these have to be extended by means of Thermocouple extension cables.

Measurement data acquisition

During a measurement, the data is stored in the data input area. The table above shows the allocation of the data to a measured value as well as the respective tolerance.

The following figures show the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3
8	High-Byte channel 4
9	Low-Byte channel 4
10	High-Byte channel 5
11	Low-Byte channel 5
12	High-Byte channel 6
13	Low-Byte channel 6
14	High-Byte channel 7
15	Low-Byte channel 7

Note!

Only channels 0, 2, 4 and 6 are used in 4wire systems.

Parameter data

You may configure the channels in groups of two individually. 10byte are available for the configuration data. Configuration parameters are stored in permanent memory and they will be retained even if power is turned off.

The following table shows the structure of the parameter area:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic interrupt byte: Bit 0: 0: wire break recognition channel 0/1 off 1: wire break recognition channel 0/1 on Bit 1: 0: wire break recognition channel 2/3 off 1: wire break recognition channel 2/3 on Bit 2: 0: wire break recognition channel 4/5 off 1: wire break recognition channel 4/5 on Bit 3: 0: wire break recognition channel 6/7 off 1: wire break recognition channel 6/7 on Bit 4, 5: reserved Bit 6: 0: diagnostic interrupt inhibited 1: diagnostic interrupt enabled Bit 7: reserved	0Fh
1	reserved	00h
2	Function-no. channel 0/1 (see table)	26h
3	Function-no. channel 2/3 (see table)	26h
4	Function-no. channel 4/5 (see table)	26h
5	Function-no. channel 6/7 (see table)	26h
6	Option Byte channel 0/1	00h
7	Option Byte channel 2/3	00h
8	Option Byte channel 4/5	00h
9	Option Byte channel 6/7	00h

Parameters

Diagnostic interrupt

The diagnostic interrupt is enabled by means of bit 6 of byte 0. In this case an error a 4byte diagnostic message will be issued to the master system.

Function-no.

Here you have to enter the function number of your measurement function for 2 channels. The allocation of the function number to a measurement function is available from the table above.

Option-Byte

Here you may specify for 2 channels the conversion rate.

Note!

Please note that the resolution is reduced when conversion rate is increased due to the shorter integration time.

The format of the data transfer remains the same. The only difference is that the lower set of bits (LSBs) loose significance for the analog value.

Structure of the option byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 9	Option byte:		00h
	Bit 3 ... 0: rate *		
	0000 15 conversions/s	16	
	0001 30.1 conversions/s	16	
	0010 60 conversions/s	15	
	0011 123.2 conversions/s	14	
	0100 168.9 conversions/s	12	
	0101 202.3 conversions/s	10	
	0110 3.76 conversions/s	16	
	0111 7.51 conversions/s	16	
	Bit 7 ... 4: reserved		

*) These specifications apply to 1channel operation. For multi-channel operations the conversion rate per channel can be calculated by dividing the specified conversion rate by the number of active channels.

Diagnostic data

The diagnostic data have a size of 12byte and are stored in the record sets 0 and 1 of the system data area.

As soon as you activated the alarm release in byte 0 of the parameter area, in case of an error *record set 0* is transferred to the superordinated system.

Record set 0 has a fixed content and a length of 4byte. The contents of *record set 0* may be monitored in plain text via the diagnosis window of the CPU.

For extended diagnostic purposes during runtime, you may evaluate the *record set 1* with a size of 12byte via the SFCs 51 and 59.

Evaluate diagnosis

At a diagnostic task the CPU interrupts the user application and branches into OB 82. With according programming, you may request in this OB with the SFCs 51 and 59 detailed diagnostic information and react on it.

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

Record set 0

Byte 0 to 3:

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 6 ... 4: reserved Bit 7: wrong parameter in module	00h
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 6: reserved	15h
2	not used	00h
3	Bit 5 ... 0: reserved Bit 6: missing (lost) process alarm (see process alarm) Bit 7: reserved	00h

Record set 1

Byte 0 to 11:

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

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	content of record set 0 (see page above)	-
4	Bit 6 ... 0: channel type 70h: digital input 71h: analog input 72h: digital output 73h: analog output Bit 7: reserved	71h
5	Bit 7 ... 0: number of diagnostic output bits per channel	04h
6	Bit 7 ... 0: number of similar channels of a module	08h
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 5: Channel error channel 5 Bit 6: Channel error channel 6 Bit 7: Channel error channel 7	00h
8	Bit 0: Wire break channel 0 Bit 1: Parameterization error channel 0 Bit 2: Measuring range underflow channel 0 Bit 3: Measuring range overflow channel 0 Bit 4: Wire break channel 1 Bit 5: Parameterization error channel 1 Bit 6: Measuring range underflow channel 1 Bit 7: Measuring range overflow channel 1	00h
9	Bit 0: Wire break channel 2 Bit 1: Parameterization error channel 2 Bit 2: Measuring range underflow channel 2 Bit 3: Measuring range overflow channel 2 Bit 4: Wire break channel 3 Bit 5: Parameterization error channel 3 Bit 6: Measuring range underflow channel 3 Bit 7: Measuring range overflow channel 3	00h

continued ...

... continue

Byte	Bit 7 ... Bit 0	Default
10	Bit 0: Wire break channel 4 Bit 1: Parameterization error channel 4 Bit 2: Measuring range underflow channel 4 Bit 3: Measuring range overflow channel 4 Bit 4: Wire break channel 5 Bit 5: Parameterization error channel 5 Bit 6: Measuring range underflow channel 5 Bit 7: Measuring range overflow channel 5	00h
11	Bit 0: Wire break channel 6 Bit 1: Parameterization error channel 6 Bit 2: Measuring range underflow channel 6 Bit 3: Measuring range overflow channel 6 Bit 4: Wire break channel 7 Bit 5: Parameterization error channel 7 Bit 6: Measuring range underflow channel 7 Bit 7: Measuring range overflow channel 7	00h

Technical data

Electrical data	VIPA 231-1BF00
Number of inputs	8
Input resistance	> 2MΩ
measuring range - Thermocouple - Resistance thermometer - Voltage measuring	 Type J, K, T Pt100 0...60mV
Power supply	5V via backplane bus
Current consumption	280mA via backplane bus
Isolation	500Vrms (field voltage - backplane bus)
Dissipation power	typ. 1.3W
Status indicators	via LEDs on the front
Programming specifications	
Input data	16byte (1 word per channel)
Output data	-
Parameter data	10byte
Diagnostic data	12byte
Process alarm data	-
Dimensions and weight	
Dimensions (WxHxD)	25.4x76x88mm
Weight	120g

231-1FD00 - AI 4x16Bit f

Order data AI 4x16Bit f VIPA 231-1FD00

Description

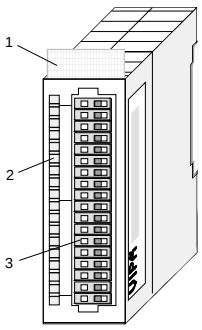
The module has 4 fast (f=fast) inputs that you may configure individually. The module requires a total of 8 input data bytes in the process image (2byte per channel).

Isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers.

Properties

- Using each 4 channels, the cycle time is ca. 0.8ms
- Different channels are individually configurable and may be turned off
- LED for signaling wire break in current loop operation
- Diagnostic function
- Resolution 16Bit
- Easy to connect 2-wire current sensors via splitting the front power supply
- Potentiometer are supplied via internal reference power supply

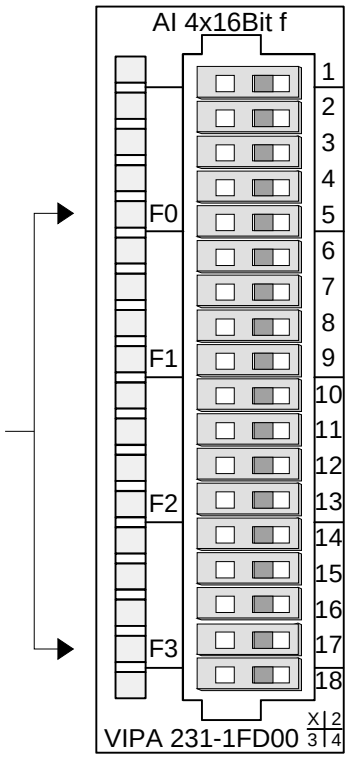
Construction



[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator
pin assignment

LED	Description
F0 ... F3	LED (red): is on if the measured current value exceeds the range 4...20mA (cable break or overload).



Pin	Assignment
1	L+ (In)
2	+2.5V
3	pos. connection channel 0
4	neg. connection channel 0
5	L+ (Out)
6	+2.5V
7	pos. connection channel 1
8	neg. connection channel 1
9	L+ (Out)
10	+2.5V
11	pos. connection channel 2
12	neg. connection channel 2
13	L+ (Out)
14	+2.5V
15	pos. connection channel 3
16	neg. connection channel 3
17	L+ (Out)
18	GND

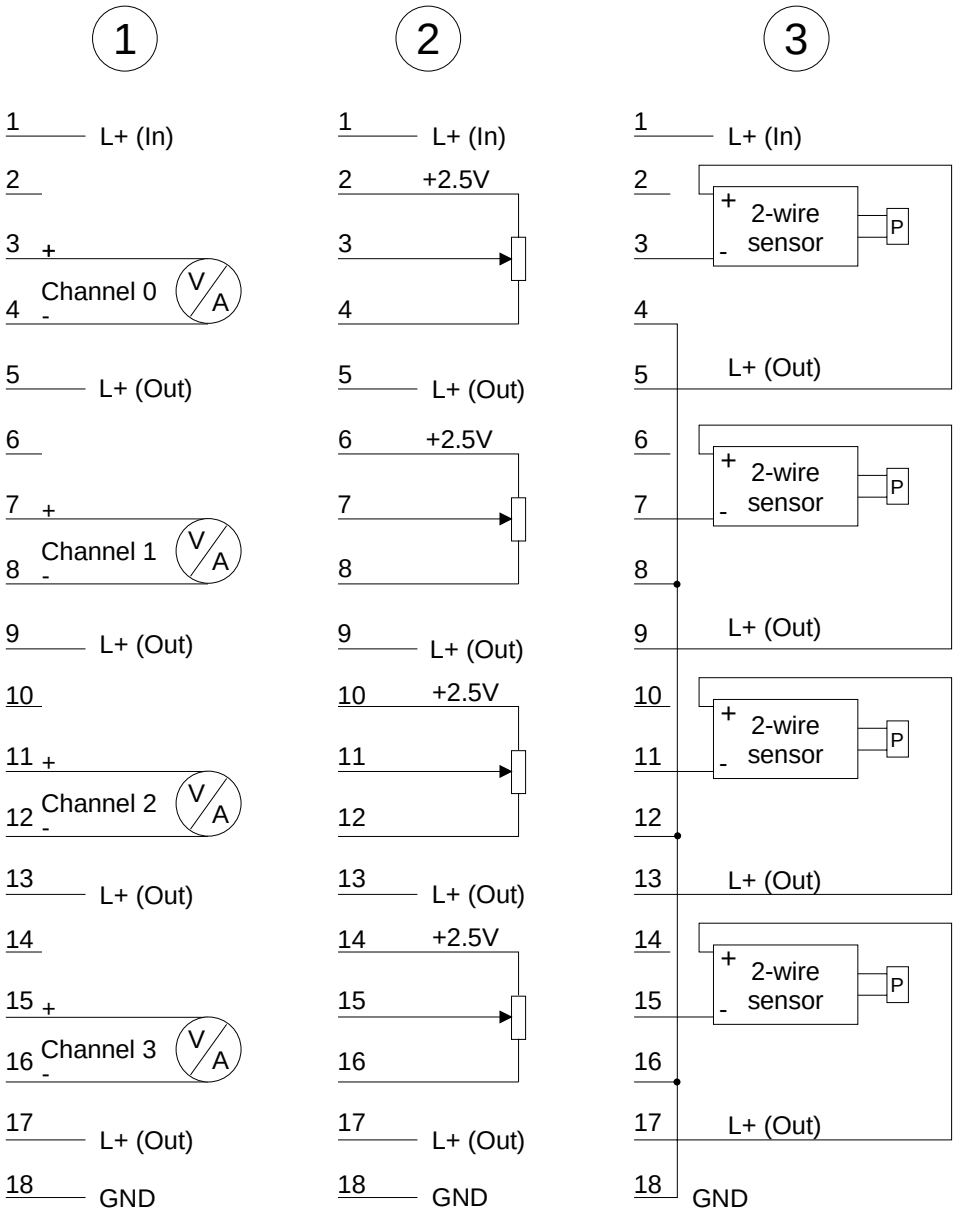
Note!

Unused inputs on activated channels have to be connected to the respective ground. This is not necessary when the unused channels are turned off by means of FFh.

The following circumstances may cause damages at the analog module:

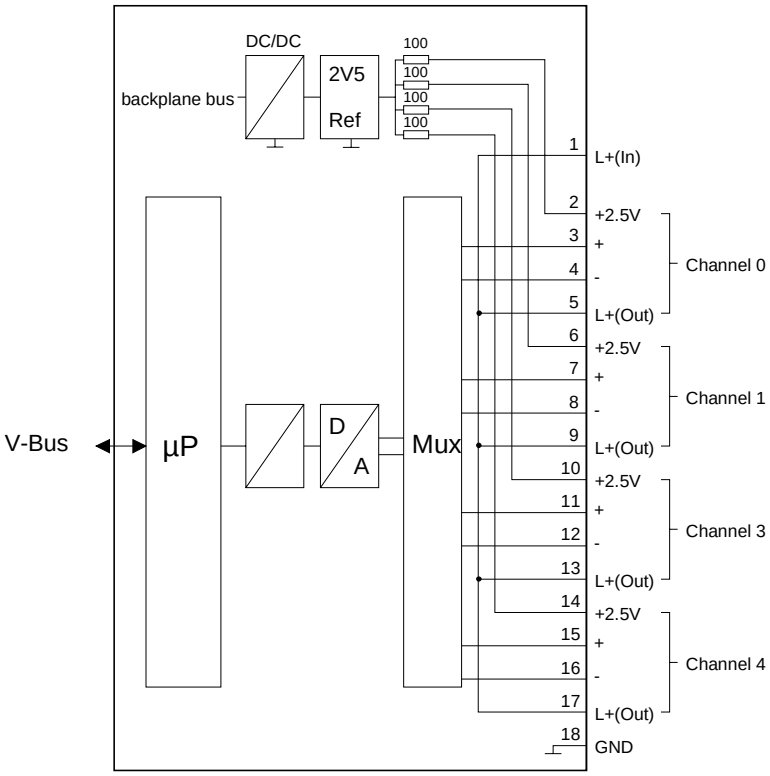
- The module must always first be power supplied via backplane bus before connecting the external power supply (current/voltage) to the front connector.
- Parameterization and connection of the input must always be congruent!
- You must not apply a voltage >15V to the input!

Wiring diagram

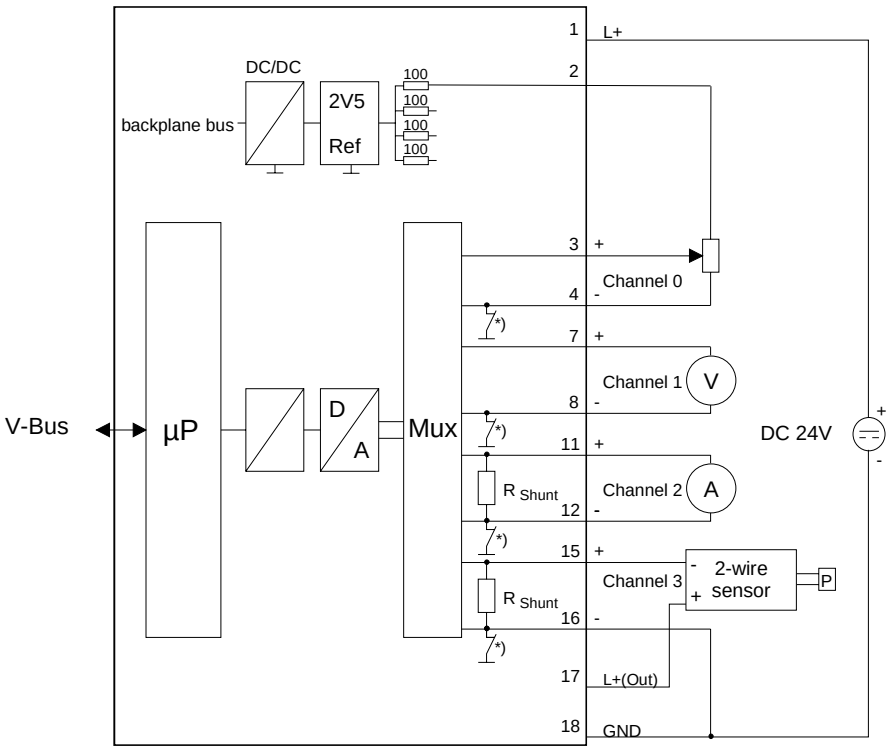


Schematic diagrams

Overview



Connection variants



*) During measuring the connection to ground is closed.

Attention!

If you connect one or more external differential sources (e.g. current shunts), a further connection to GND (Pin 18) is not allowed! This may damage the module!

Function-no. allocation

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Measurement range / representation	Connection
00h	Does not affect permanently stored configuration data		
28h	Default value Voltage ±10V Siemens S7 format (two's complement)	±10V 9.9 ... 10V (27371 ... 27648) [1)] -9.9...9.9V= rated range (-27370... 27370) -10V ... -9.9V (-27648 ... -27371) [1)]	(1), (2)
29h	Voltage ±4V Siemens S7 format (two's complement)	±4.70V **/** 4.70V = max. value before over range (32511) -4...4V = rated range (-27648...27648) -4.70V = min. value before under range (-32512)	(1), (2)
2Ah	Voltage ±400mV Siemens S7 format (two's complement)	±470mV **/** 470mV = max. value before over range (32511) -400...400mV = rated range(-27648...27648) -470mV = min. value before under range (-32512)	(1)
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.51mA **/** 23.51mA = max. value before over range (32511) -20...20mA = rated range (-27648...27648) -23.51mA = min. value before under range (-32512)	(1), (3)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185 .. +22.81mA **/** 22.81mA = max. value before over range (32511) 4...20mA = rated range (0...27648) 1.18mA = min. value before under range (-4864)	(1), (3)
58h	Voltage ±10V (two's complement)	±10V 9.9 ... 10V (9901 ... 10000) [1)] -9.9 ... 9.9V rated range (-9900 ... 9900) -10 ... -9.9V (-10000 ... -9901) [1)]	(1), (2)
59h	Voltage ±4V (two's complement)	±4.95V **/** 4,95V = max. value before over range (4950) -4...4V = rated range (-4000...4000) -4.95V = min. value before under range (-4950)	(1), (2)
5Ah	Voltage ±400mV (two's complement)	±495mV **/** 495mV = max. value before over range (4950) -400...400mV = rated range (-4000...4000) -495mV = min. value before under range (-4950)	(1)
5Ch	Current ±20mA (two's complement)	±25mA **/** 25mA = max. value before over range (25000) -20...20mA = rated range (-20000...20000) -25mA = min. value before under range(-25000)	(1), (3)
5Dh	Current 4...20mA (two's complement)	0.8 .. +24.00mA **/** 24.00mA = End over range (20000) 4...20mA = rated range (0...16000) 0.8mA = min. value before under range (-3200)	(1), (3)
FFh	Channel not active (turned off)		

1) depends on calibration factor and is not guaranteed.

Note!

The module is preset to the range "±10V voltage" in S7 format from Siemens.

Numeric notation in S7 from Siemens

Analog values are represented as a two's complement value.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Measurement data acquisition

During a measurement the data is stored in the data input area. The table above shows the allocation of the data to a measured value as well as the respective tolerance.

The following figures show the structure of the data input area:

Data input area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Parameter data

You may configure every channel individually. 32byte are available for the configuration data. Configuration parameters are stored in permanent memory and they will be retained even if power is turned off.

The following table shows the structure of the parameter area:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Diagnostic alarm byte: Bit 5 ... 0: reserved Bit 6: 0: diagnostic interrupt inhibited 1: diagnostic interrupt enabled Bit 7: reserved	00h
1	Limit value monitoring: Bit 0: limit value monitoring channel 0 Bit 1: limit value monitoring channel 1 Bit 2: limit value monitoring channel 2 Bit 3: limit value monitoring channel 3 Bit 7 ... 4: reserved	00h
2	Function-no. channel 0 (see table)	28h
3	Function-no. channel 1 (see table)	28h
4	Function-no. channel 2 (see table)	28h
5	Function-no. channel 3 (see table)	28h
6-9	reserved	00h

continued ...

... continue

Byte	Bit 7 ... Bit 0	Default
10	Bit 2 ... 0: mean value 000: disabled 001: mean value over 2 values 010: mean value over 4 values 011: mean value over 8 values 100: mean value over 16 values 101, 011, 111: disabled Bit 7 ... 3: reserved	00h
11-15	reserved	00h
16	channel 0, upper limit, High-Byte	7Fh
17	channel 0, upper limit, Low-Byte	FFh
18	channel 0, lower limit, High-Byte	80h
19	channel 0, lower limit, Low-Byte	00h
20	channel 1, upper limit, High-Byte	7Fh
21	channel 1, upper limit, Low-Byte	FFh
22	channel 1, lower limit, High-Byte	80h
23	channel 1, lower limit, Low-Byte	00h
24	channel 2, upper limit, High-Byte	7Fh
25	channel 2, upper limit, Low-Byte	FFh
26	channel 2, lower limit, High-Byte	80h
27	channel 2, lower limit, Low-Byte	00h
28	channel 3, upper limit, High-Byte	7Fh
29	channel 3, upper limit, Low-Byte	FFh
30	channel 3, lower limit, High-Byte	80h
31	channel 3, lower limit, Low-Byte	00h

Diagnostic data

The diagnostic data have a size of 12byte and are stored in the record sets 0 and 1 of the system data area.

As soon as you activated the alarm release in byte 0 of the parameter area, in case of an error *record set 0* is transferred to the superordinated system.

Record set 0 has a fixed content and a length of 4byte. The contents of *record set 0* may be monitored in plain text via the diagnosis window of the CPU.

For extended diagnostic purposes during runtime, you may evaluate the *record set 1* with a size of 12byte via the SFCs 51 and 59.

Evaluate diagnosis

At a diagnostic task the CPU interrupts the user application and branches into OB 82. With according programming, you may request in this OB with the SFCs 51 and 59 detailed diagnostic information and react on it.

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

Record set 0

Byte 0 to 3:

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 6 ... 4: reserved Bit 7: wrong parameter in module	00h
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: reserved	15h
2	not used	00h
3	Bit 5 ... 0: reserved Bit 6: missing (lost) process alarm (see process alarm) Bit 7: reserved	00h

Record set 1

Byte 0 to 11:

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

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	content of record set 0 (see page above)	-
4	Bit 6 ... 0: channel type 70h: digital input 71h: analog input 72h: digital output 73h: analog output Bit 7: reserved	71h
5	Bit 7 ... 0: number of diagnostic output bits per channel	04h
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 7 ... 4: reserved	00h
8	Bit 0: reserved Bit 1: parameterization error channel 0 Bit 4 ... 2: reserved Bit 5: parameterization error channel 1 Bit 6, 7: reserved	00h
9	Bit 0: reserved Bit 1: parameterization error channel 2 Bit 4 ... 2: reserved Bit 5: parameterization error channel 3 Bit 6, 7: reserved	00h
10 ... 11	reserved	00h

Process alarm

The upper and the lower limit value is parameterizable for every channel. Please regard during parameterization that you have to enable the limit value monitoring in parameter byte 1.

If the signal is beyond the defined operation range, a process alarm is initialized. In the CPU, the process alarm block (OB 40) is called.

The 4byte of process alarm additional information are used as follows:

Process alarm additional information

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: upper limit exceeded channel 0 Bit 1: upper limit exceeded channel 1 Bit 2: upper limit exceeded channel 2 Bit 3: upper limit exceeded channel 3 Bit 7 ... 4: reserved	00h
1	Bit 0: lower limit underrun channel 0 Bit 1: lower limit underrun channel 1 Bit 2: lower limit underrun channel 2 Bit 3: lower limit underrun channel 3 Bit 7 ... 4: reserved	00h
2	reserved	00h
3	reserved	00h

Note!

When a process alarm has not yet been acknowledged by the CPU and a new process alarm of the same type occurs at this channel, a diagnostic interrupt is initialized, containing the information "Process alarm missing/lost" (diagnostic data byte 3).

Technical data

Module name	VIPA 231-1FD00
Dimensions and Weight	
Dimensions (WxHxD in mm)	25.4 x 76 x 88mm
Weight	80g
Data for specific module	
Number of inputs	4 differential inputs
Length of cable - shielded	 200m
Programming specifications	
Input data	8byte (1Word per channel)
Parameter data	32byte
Diagnostic data	12byte
Process interrupt data	4byte
Voltages, Currents, Potentials	
Power supply via backplane bus	5V
Isolation - between channels and backplane bus - between channels	 yes no
Permitted potential difference - between channels (U_{CM}) - between channels and $M_{INTERNAL}$ (U_{ISO})	 DC 2.0V DC 75V / AC 60V
Isolation tested with	DC 500V
Current consumption - from the backplane bus (5V)	 300mA
Power dissipation of the module	1.5W
Analog value generation	
Measuring principle	Successive approximation
Integration time/conversion time/resolution (per channel) - parameterizable - Basic conversion time - Resolution (incl. over range) in bit	 no nx0.2ms (n = number of channels) 15bit + sign
Averaging	2, 4, 8, 16
Suppression of interference	
Noise suppression for f=nx (f1±1%) (f1= Interference frequency, n=1,2,...) - Common-mode interference (U_{CM}<1.5V)	 >80dB
Crosstalk between the inputs	>50dB

continued ...

... continue

Limits of error	VIPA 231-1FD00
Operational limit (in the entire temperature range with reference to the input range)	
- Voltage input ±400mV	±0.4%
- Voltage input ±4V	±0.2%
- Voltage input ±10V	±0.2%
- Current input ±20mA	±0.2%
- Current input 4...20mA	±0.5%
Basic error (Operational limit at 25°C referred to the input range)	
- Voltage input ±400mV	±0.3%
- Voltage input ±4V	±0.1%
- Voltage input ±10V	±0.1%
- Current input ±20mA	±0.1%
- Current input 4...20mA	±0.3%
Temperature error (reference to the input range) - via current measurement	±0.005%/K
Linearity error (with reference to the input range)	±0.02%
Repeatability (in steady state at 25°C, reference to the input range)	±0.05%
Status, Interrupts, Diagnostics	
Interrupts	
- Process interrupt when limit has been exceeded	parameterizable
- Diagnostic interrupt	parameterizable
Diagnostic functions	
- Channel error display	red LED (F0 ... F3)
- Diagnostic information read-out	possible
Data for selecting a sensor	
Input range	Input resistance
- Voltage ±400mV, ±4V, ±10V	10MΩ
- Current 4...20mA, ±20mA	57Ω
Maximum input voltage for voltage input (destruction limit)	max. 15V
Maximum input current for current input (destruction limit)	max. 50mA
Connection of the sensor	
- for measuring voltage	possible
- for measuring current via 2-wire transmitter	possible (via external supply) see wiring diagram 3
via 4-wire transmitter	possible

Chapter 7 Analog output modules

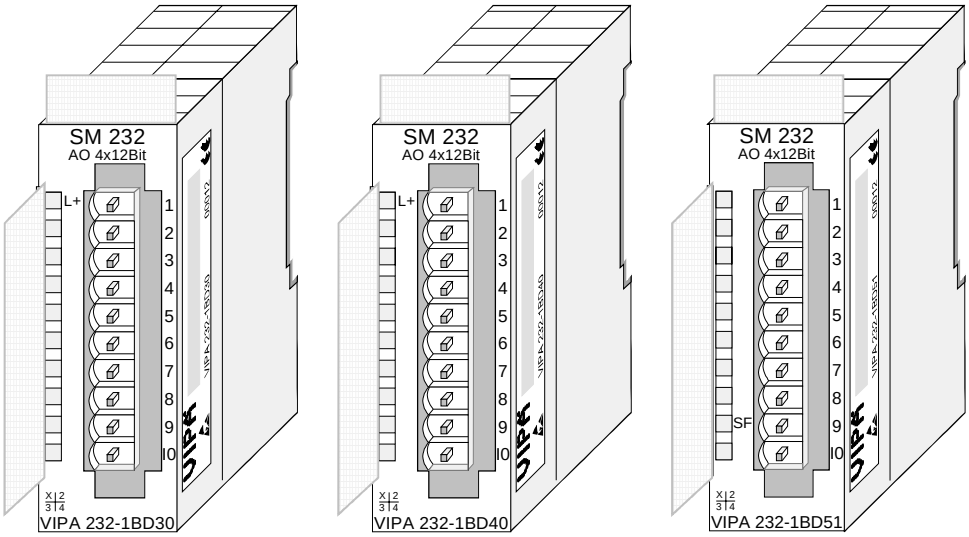
Overview

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

Contents

System overview

Output module
SM 232



Order data output module

Type	Order number	Page
AO 4x12Bit ±10V, 0...10V - ECO	VIPA 232-1BD30	7-7
AO 4x12Bit 0/4...20mA - ECO	VIPA 232-1BD40	7-12
AO 4x12Bit, multioutput	VIPA 232-1BD51	7-17

General

Cabling for analog signals

You must only use screened cable when you are connecting analog signals. These cables reduce the effect of electrical interference. The screen of the analog signal cable should be grounded at both ends. In situations with different electrical potentials, it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting loads and actuators

You can use the analog output modules to supply loads and actors with current or voltage.

Note!

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

Please leave the output clamps of not used channels disconnected and set the *output type* of the channel to "deactivated" in the hardware configurator from Siemens.

Parameterization and diagnosis during runtime

By using the SFCs 55, 56 and 57 you may change the parameters of the analog modules during runtime via the CPU 21x.

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

Analog value

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

Conversion within the Siemens S5-format

Please regard only the Siemens S7 format (two's complement) is supported by the Siemens SIMATIC manager for decimal representation. When the Siemens S5 format is used the decimal values are incorrectly represented.

Within the Siemens S5 format a value may be converted between decimal and output value by means of the following formulas.

+/- 10V

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	8192	2000
10V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	8192	2000
5V	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{16384} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{16384} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0
10mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: current, Value: decimal value

0...20mA

Current	Decimal	Hex
0mA	0	0
10mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: current, Value: decimal value

Conversion within the Siemens S7-format

Within the Siemens S7 format a value may be converted between decimal and output value by means of the following formulas.

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

0...20mA

Current	Decimal	Hex
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

232-1BD30 - AO 4x12Bit ±10V, 0 ... 10V - ECO

Order data AO 4x12Bit, ±10V, 0 ... 10V VIPA 232-1BD30

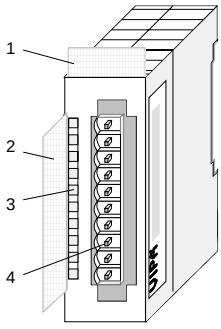
Description This module provides 4 outputs that can be configured individually. The module occupies a total of 8byte of output data (2byte per channel) in the process image. These values have to be defined as left justified two's complement entries.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC optocouplers. The module requires an external supply of DC 24V.

Properties

- 4 outputs with common ground
- Outputs with individually configurable functions
- Suitable for connection to actuators requiring ±10V or 0 … 10V inputs

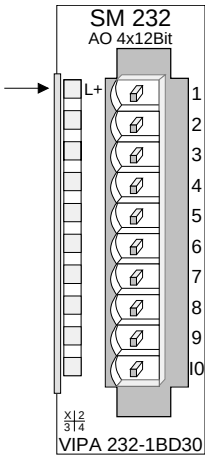
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

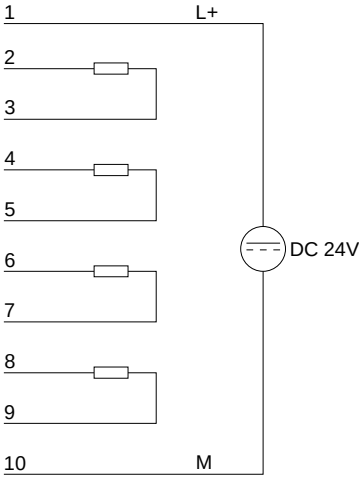
LED	Description
L+	LED (green) supply voltage is on



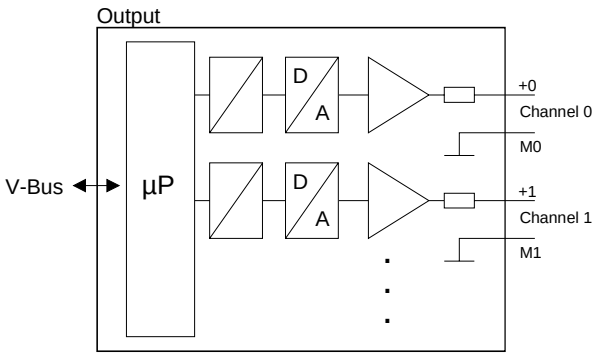
Pin	Assignment
1	DC 24V supply voltage
2	+ Channel 0
3	Channel 0 common
4	+ Channel 1
5	Channel 1 common
6	+ Channel 2
7	Channel 2 common
8	+ Channel 3
9	Channel 3 common
10	Supply voltage common

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Data output

The value of the output data is entered into the data output area. For every channel you may configure the relationship between the output value and the respective voltage value by means of a function-no.

The following table shows the structure of the data output area:

Data output area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

When new values are transferred from the CPU to the module, the module needs one cycle to update all outputs abbr. if the analog values change within this cycle, these are at least available at the concerning outputs at the end of the next following cycle.

Parameter data

6byte of parameter data are available for the configuration data. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0, 1	reserved	00h
2	Function-no. channel 0	09h
3	Function-no. channel 1	09h
4	Function-no. channel 2	09h
5	Function-no. channel 3	09h

Function-no. allocation

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Output range
00h	Does not affect permanently stored configuration data	
01h	Voltage ±10V Siemens S5 format (two's complement)	±12.5V 12.5V = max. value before over range (20480) -10...10V = rated range (-16384...16384) -12.5V = min. value before under range (-20480)
05h	Voltage 0...10V Siemens S5 format (two's complement)	0...12.5V 12.5V = max. value before over range (20480) 0...10V = rated range (0...16384) no under range available
09h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V 11.76V= max. value before over range (32511) -10V...10V = rated range (-27648...27648) -11.76 = min. value before under range (-32512)
0Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V = max. value before over range (32511) 0...10V = rated range (0...27648) no under range available
FFh	Channel not active (turned off)	

Note!

- The module is preset to the range "±10V voltage" in S7-format from Siemens.
- When cross over or underdrive range all modes return the value 0.

Technical data

Electrical data	VIPA 232-1BD30	
Number of output channels	4	
Length of cable: shielded	200m	
Supply voltage	DC 24V	
- Inverse polarity protection	yes	
Potential separation		
- between channels / backplane bus	yes	
- between channel / power supply of the electronic	yes	
- between the channels	no	
- channels/load voltage L+	yes	
Permitted potential difference		
- between the Outputs and $M_{INTERNAL}$ (U_{ISO})	DC 75V / AC 60V	
Isolation proofed with	DC 500V	
Current consumption		
- via backplane bus	60mA	
- from load voltage L+ (without load)	100mA	
Power dissipation of the module	2.7W	
Analog value calculation output channels		
Resolution (incl. Overdrive region)		
±10V	11bit + sign	
0...10V	11bit	
Cycle time (all channels)	700µs	
Settling time		
- impedance load	1.5ms	
- capacitive load	3.0ms	
- inductive load	-	
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
Voltage output	Measuring range	Tolerance
	±10V	±0.2%
	0...10V	±0.4%
Basic error limit (operational limit at 25°C, referring to output range)		
Voltage output	Measuring range	Tolerance
	±10V	±0.1%
	0...10V	±0.2%
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.05%	
Repeatability (in steady state at 25°C referred to the output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	

continued ...

... continue

Data for choosing an actuator	
Output ranges (rated values) Voltage	 ±10V 0...10V
Burden resistance (in nominal range of the output)	
at voltage outputs - capacitive load	min. 5kΩ max. 1µF
Voltage outputs Short-circuit protection Short-circuit current	 yes max. 6mA
Destruction limit against voltages/currents applied from outside Voltage at outputs to M_{ANA} Current	 max. 15V max. 30mA
Connection of actuators for voltage output	 2conductor connection
States, Alarms, Diagnosis	
Diagnosis alarm Diagnosis functions Sum error monitor Diagnostic information readable Substitute value can be applied	- - - - -
Programming specifications	
Input data Output data Parameter data Diagnostic data	- 8byte (1word per channel) 6byte -
Dimensions and weight	
Dimensions (WxHxD) Weight	25.4x76x88mm 100g

232-1BD40 - AO 4x12Bit, 0/4...20mA - ECO

Order data AO 4x12Bit, 0...20mA, 4 ... 20mA VIPA 232-1BD40

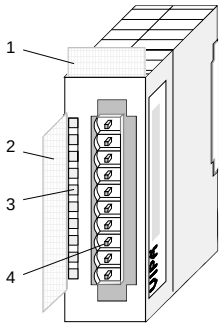
Description This module provides 4 outputs that can be configured individually. The module occupies a total of 8byte of output data (2byte per channel) in the process image. These values have to be defined as left justified two's complement entries.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC optocouplers. The module requires an external supply of DC 24V.

Properties

- 4 outputs with common ground
- Outputs with individually configurable functions
- Suitable for actuators with 0 ... 20mA or 4 ... 20mA input

Construction

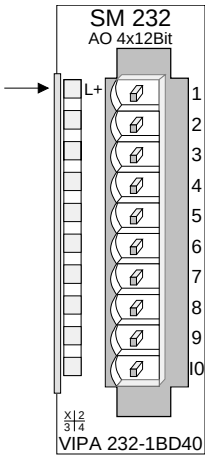


[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator

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

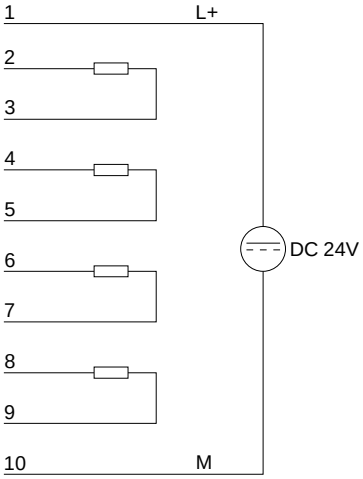
pin assignment



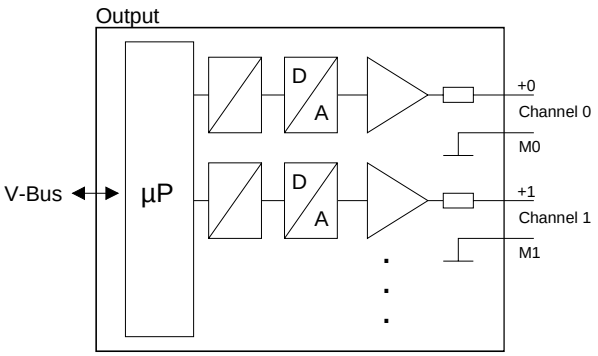
Pin	Assignment
1	DC 24V supply voltage
2	+ Channel 0
3	Channel 0 common
4	+ Channel 1
5	Channel 1 common
6	+ Channel 2
7	Channel 2 common
8	+ Channel 3
9	Channel 3 common
10	Supply voltage common

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Data output

The value of the output data is entered into the data output area. For every channel you may configure the relationship between the output value and the respective current value by means of a function-no.

The following table shows the structure of the data output area:

Data output area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

When new values are transferred from the CPU to the module, the module needs one cycle to update all outputs abbr. if the analog values change within this cycle, these are at least available at the concerning outputs at the end of the next following cycle.

Parameter data

6Byte of parameter data are available for the configuration data. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0, 1	reserved	00h
2	Function-no. channel 0	0Eh
3	Function-no. channel 1	0Eh
4	Function-no. channel 2	0Eh
5	Function-no. channel 3	0Eh

Function-no. allocation

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

Assigning FFh deactivates the according channel.

No.	Function	Output range
00h	Does not affect permanently stored configuration data	
04h	Current 4...20mA Siemens S5 format (two's complement)	0...24mA 24mA = max. value before over range (20480) 4...20mA = rated range (0...16384) 0mA = min. value before under range (-4096)
06h	Current 0...20mA Siemens S5 format (two's complement)	0...25mA 25mA = max. value before over range (20480) 0...20mA = rated range (0...16384) no under range available
0Ch	Current 4...20mA Siemens S7 format (two's complement)	0...22.81mA 22.81mA = max. value before over range (32511) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-6912)
0Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = max. value before over range (32511) 0...20mA = rated range (0...27648) no under range available
FFh	Channel not active (turned off)	

Note!

- The module is preset to the range "0...20mA" in S7-format from Siemens.
- When cross over or underdrive range all modes return the value 0.

Technical data

Electrical data	VIPA 232-1BD40	
Number of output channels	4	
Length of cable: shielded	200m	
Supply voltage	DC 24V	
- Inverse polarity protection	yes	
Potential separation		
- between channels / backplane bus	yes	
- between channel / power supply of the electronic	yes	
- between the channels	no	
- between channels/load voltage L+	yes	
Permitted potential difference		
- between the outputs and $M_{INTERNAL}$ (U_{ISO})	DC 75V / AC 60V	
Isolation proofed with	DC 500V	
Current consumption		
- via backplane bus	60mA	
- from load voltage L+ (without load)	50mA	
Power dissipation of the module	1.5W	
Analog value calculation output channels		
Resolution (incl. Overdrive region)		
0...20mA	12Bit	
4...20mA	11Bit	
Cycle time	700µs	
Settling time		
- impedance load	0.03ms	
- capacitive load	-	
- inductive load	1.5ms	
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
Current output	Measuring range	Tolerance
	0...20mA	±0.4%
	4...20mA	±0.5%
Basic error limit (during temperature is 25°C, referring to output range)		
Current output	Measuring range	Tolerance
	0...20mA	±0.2%
	4...20mA	±0.3%
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.05%	
Repeatability (in steady state at 25°C referred to the output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	

continued ...

... continue

Data for choosing an actuator	
Output ranges (rated values) Current	 0...20mA 4...20mA
Burden resistance (in nominal range of the output)	
at current outputs inductive load	max. 350Ω max. 10mH
Current outputs No-load voltage	 12V
Destruction limit against voltages/currents applied from outside Voltage at outputs to M_{ANA} Current	 max. 12V max. 30mA
Connection of actuators for current output	 2conductor connection
States, Alarms, Diagnosis	
Diagnosis alarm Diagnosis functions Sum error monitor Diagnostic information readable Substitute value can be applied	- - - - -
Programming specifications	
Input data Output data Parameter data Diagnostic data	- 8byte (1 word per channel) 6byte -
Dimensions and weight	
Dimensions (WxHxD) Weight	25.4x76x88mm 100g

232-1BD51 - AO 4x12Bit, multioutput

Order data

AO 4x12Bit multioutput VIPA 232-1BD51

Please be aware that this Module cannot be operated on a Profibus DP slave with revision level 4 or less. In this case please use our (spare-part) Module with order-no.: VIPA 232-1BD50 which has the identical function.

Description

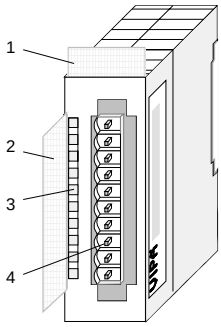
This module provides 4 outputs that can be configured individually. The module occupies a total of 8byte of output data (2byte per channel) in the process image. These values have to be defined as left justified two's complement entries.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers. The module requires an external supply of DC 24V.

Properties

- 4 outputs with common ground
- Outputs with individually configurable functions
- Suitable for connection to actuators requiring ±10V, 1 ... 5V, 0 … 10V, ±20mA, 4 … 20mA or 0 ... 20mA inputs
- Diagnostic LED and diagnostic function

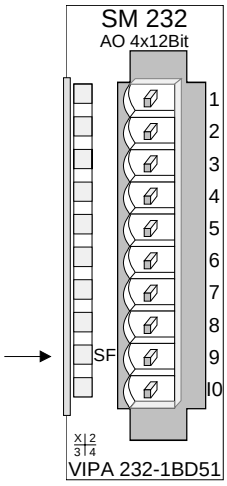
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator pin assignment

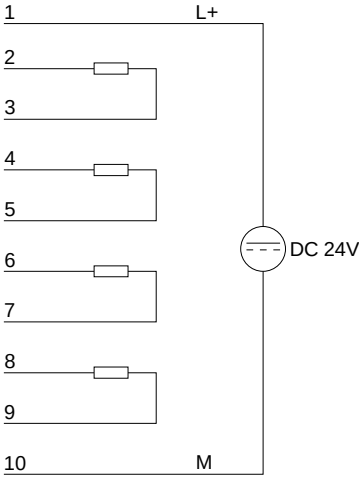
LED	Description
SF	Diagnostic LED (red) turned on by: - a short circuit is detected at the control voltage output - an open circuit is detected on the current output line - wrong parameter at module - the module does not receive supply voltage



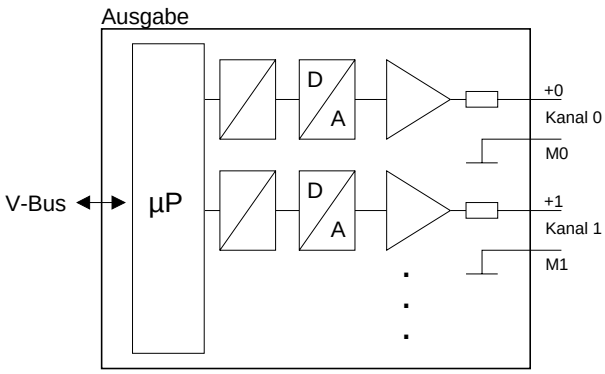
Pin	Assignment
1	DC 24V supply voltage
2	+ Channel 0
3	Channel 0 common
4	+ Channel 1
5	Channel 1 common
6	+ Channel 2
7	Channel 2 common
8	+ Channel 3
9	Channel 3 common
10	Supply voltage common

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Attention!

Switching off and on the load nominal voltage (L+) could lead to wrong values on the output for ca. 80ms!

Data output

The value of the output data is entered into the data output area. For every channel you may configure the relationship between the output value and the respective current or voltage by means of a function-no..

The following table shows the structure of the data output area:

Data output area:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Note!

When new values are transferred from the CPU to the module, the module needs one cycle to update all outputs abbr. if the analog values change within this cycle, these are at least available at the concerning outputs at the end of the next following cycle.

Parameter data

6Byte of parameter data are available for the configuration data. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0
0	Diagnostic interrupt byte: Bit 5 ... 0: reserved Bit 6: 0: diagnostic interrupt inhibited 1: diagnostic interrupt enabled Bit 7: reserved
1	reserved
2	Function-no. channel 0
3	Function-no. channel 1
4	Function-no. channel 2
5	Function-no. channel 3

Parameter

Diagnostic interrupt

You can enable diagnostic interrupts by means of bit 6 of byte 0. When an error occurs 4 diagnostic bytes are transmitted to the master system.

Function-no.

Here you enter the function-no. of the output function for every channel. The relationship between the function number and the output functions is available from the function-no. allocation table.

Diagnostic data

When you enable alarms in byte 0 of the parameter area, modules will transfer 4 diagnostic bytes with pre-defined contents to your master in case of an error. Please note that analog modules only use the first two bytes for diagnostic purposes. The remaining bytes are not used.

The structure of the diagnostic bytes is as follows:

Diagnostic data:

Byte	Bit 7 ... Bit 0
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present (wire break/short circuit) Bit 6 ... 4: reserved Bit 7: Wrong parameter at module
1	Bit 3 ... 0: class of module 0101 analog module Bit 4: channel information available Bit 7 ... 5: reserved
2	not assigned
3	not assigned

Function-no. allocation

The assignment of a function-no. to a certain channel happens during parameterization.

No.	Function	Output range
00h	Does not affect permanently stored configuration data	
01h	Voltage ±10V Siemens S5 format (two's complement)	±12.5V 12.5V = max. value before over range (20480) -10...10V = rated range (-16384...16384) -12.5V = min. value before under range (-20480)
02h	Voltage 1...5V Siemens S5 format (two's complement)	0...6V 6V = max. value before over range (20480) 1...5V = rated range (0...16384) 0V = min. value before under range (-4096)
05h	Voltage 0...10V Siemens S5 format (two's complement)	0...12.5V 12.5V = max. value before over range (20480) 0...10V = rated range (0...16384) no under range available
09h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V 11.76V= max. value before over range (32511) -10V...10V = rated range (-27648...27648) -11.76 = min. value before under range (-32512)
0Ah	Voltage 1...5V Siemens S7 format (two's complement)	0...5.704V 5.704V = max. value before over range (32511) 1...5V = rated range (0...27648) 0V = min. value before under range (-6912)
0Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V = max. value before over range (32511) 0...10V = rated range (0...27648) no under range available
03h	Current ±20mA Siemens S5 format (two's complement)	±25mA 25mA = max. value before over range (20480) -20...20mA = rated range (-16384...16384) -25mA = min. value before under range (-20480)
04h	Current 4...20mA Siemens S5 format (two's complement)	0...24mA 24mA = max. value before over range (20480) 4...20mA = rated range (0...16384) 0mA = min. value before under range (-4096)
06h	Current 0...20mA Siemens S5 format (two's complement)	0...25mA 25mA = max. value before over range (20480) 0...20mA = rated range (0...16384) no under range available
0Bh	Current ±20mA Siemens S7 format (two's complement)	±23.52mA 23.52mA = max. value before over range (32511) -20...20mA = rated range (-27648...27648) -23.52mA = min. value before under range (-32512)
0Ch	Current 4...20mA Siemens S7 format (two's complement)	0...22.81mA 22.81mA = max. value before over range (32511) 4...20mA = rated range (0...27648) 0mA = min. value before under range (-6912)
0Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = max. value before over range (32511) 0...20mA = rated range (0...27648) no under range available
FFh	Channel not active (turned off)	

Note!

The module is preset to the range "±10V voltage" in Siemens S7-format. When cross over or underdrive range all modes return the value 0.

Technical data

Electrical data	VIPA 232-1BD51	
Number of output channels	4	
Length of cable: shielded	200m	
Supply voltage	DC 24V	
- Inverse polarity protection	yes	
Potential separation		
- between channels / backplane bus	yes	
- between channel / power supply of the electronic	yes	
- between the channels	no	
- between channels/load voltage L+	yes	
Isolation proofed with	DC 500V	
Current consumption		
- via backplane bus	75mA	
- from load voltage L+ (without load)	60mA	
Power dissipation of the module	1.8W	
Analog value calculation output channels		
Resolution (incl. Overdrive region)		
±10V, ±20mA	11bit + sign	
4 ... 20mA, 1 ... 5V	10bit	
0 ... 10V, 0 ... 20mA	11bit	
Conversion time (per channel)	450µs	
Settling time		
- impedance load	0.05ms	
- capacitive load	0.5ms	
- inductive load	0.1ms	
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
	Measuring range	Tolerance
Voltage output	1 … 5V	±0.8%[1)]
	0 … 10V	±0.6%[1)]
	±10V	±0.4%[1)]
Current output	4 … 20mA	±0.8%[2)]
	0 … 20mA	±0.6%[2)]
	±20mA	±0.3%[2)]
Basic error limit (during temperature is 25°C, referring to output range)		
	Measuring range	Tolerance
Voltage output	1 … 5V	±0.4%[1)]
	0 … 10V	±0.3%[1)]
	±10V	±0.2%[1)]
Current output	4 … 20mA	±0.5%[2)]
	0 … 20mA	±0.4%[2)]
	±20mA	±0.2%[2)]
Temperature error (with reference to the output range)	±0.01%/K	

continued ...

... continue

Linearity error (with reference to the output range)	±0.05%
Repeatability (in steady state at 25°C referred to the output range)	±0.05%
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%
Data for choosing an actuator	
Output ranges (rated values) Voltage Current	 1 ... 5V, 0 ... 10V, ±10V 4 ... 20mA, 0 ... 20mA, ±20mA
Burden resistance (in nominal range of the output)	
at voltage outputs - capacitive load at current outputs - inductive load	min. 1kΩ max. 1µF max. 500Ω max. 10mH
Voltage outputs Short-circuit protection Short-circuit current	 yes max. 31mA
Current outputs No-load voltage	 max. 13V
Destruction limit against voltages/currents applied from outside Voltage at outputs to M_{ANA} Current	 max. 15V max. 30mA
Connection of actuators for voltage output for current output	 2conductor connection 2conductor connection
States, Alarms, Diagnosis	
Diagnosis alarm Diagnosis functions Sum error monitor Diagnostic information readable	parameterizable parameterizable red LED SF possible
Substitute value can be applied	no
Programming specifications	
Input data Output data Parameter data Diagnostic data	- 8byte (1 word per channel) 6byte 4byte
Dimensions and weight	
Dimensions (WxHxD) Weight	25.4x76x88mm 100g

[1] The error limits are measured with a load of R=1GΩ. For voltage output the output impedance is 30Ω.

[2] The error limits are measured with a load of R=10Ω.

Chapter 8 Analog input/output modules

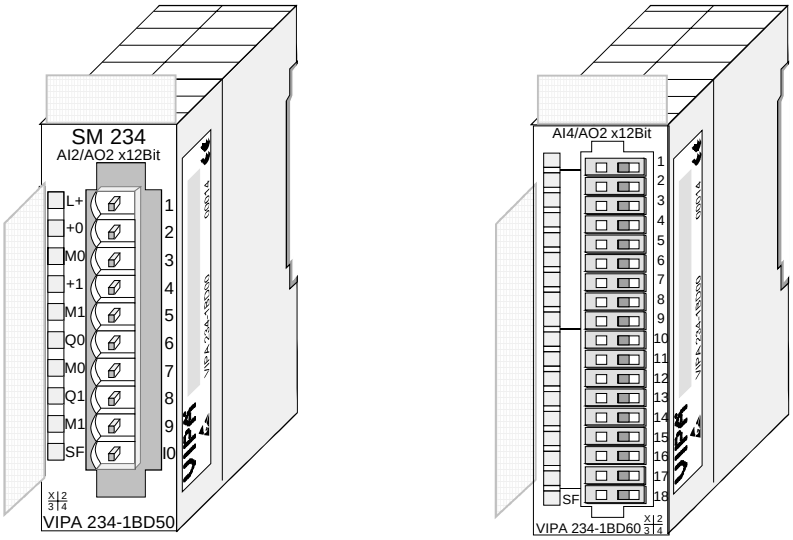
Overview

This chapter contains a description of the construction and the operation of the VIPA analog input/output modules.

Content

System overview

Input/output modules SM 234



Order data input/output modules

Type	Order number	Page
AI2/AO 2x12Bit, multiin-/output	VIPA 234-1BD50	8-4
AI4/AO 2x12Bit, multiin-/output	VIPA 234-1BD60	8-17

Security note for range allocation

Attention!

Please regard that the described modules have no hardware protection against wrong parameterization. The allocation of the according measuring res. output range is only during project engineering.

For example, the modules may be damaged when you connect a voltage at parameterized current measuring.

Please be extremely careful during project engineering.

General

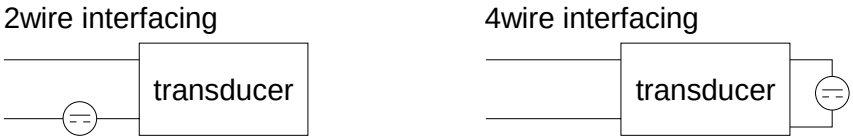
Cabling for analog signals

You must only use screened twisted-pair cable for analog signals. These cables reduce the effect of electrical interference. The screen of the analog signal cable should be grounded at both ends. In situations where the cable ends are at different electrical potentials, it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting sensors

Our analog modules provide a large number of configuration options suitable for 2wire and 4wire transducers. Please remember that transducers require an external power source. You have to connect an external power supply in line with any 2wire transducer.

The following diagram explains the connection of 2- and 4wire transducers:



Connecting loads and actuators

Due to the fact that actuators also require a source of external power, they may also be connected with 2 or 4wires. Where control signals are supplied to 2wire actuators a power supply has to be connected in series with the control cable. 4wire actuators need an external power source.

Note!

Please ensure that you connect actuators to the correct polarity!

Unused output terminals must not be connected!

Parameterization and diagnosis during runtime

By using the SFCs 55, 56 and 57 you may change the parameters of the analog modules during runtime via the CPU 21x.

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

Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

234-1BD50 - AI 2/AO 2x12Bit - Multiin-/output

Order data AI 2/AO 2x12Bit Multiin-/output VIPA 234-1BD50

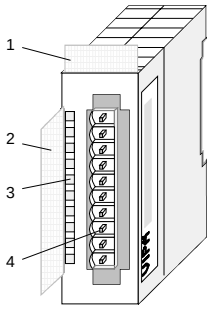
Description This module has 2 analog inputs and 2 analog outputs that may be configured individually. The module occupies a total of 4byte of input and 4byte of output data.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers. The module requires an external supply of DC 24V.

Properties

- 2 inputs and 2 outputs with common ground
- In-/Outputs with individually configurable functions
- Suitable for encoder res. actuators with in- res. output ranges of: ±10V, 1...5V, 0...10V, ±20mA, 0...20mA or 4...20mA
- Diagnostic LED

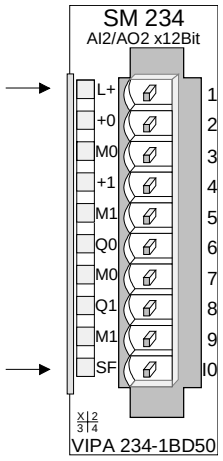
Construction



[1] Label for the name of the module
[2] Label for the bit address with description
[3] LED status indicator
[4] Edge connector

Status indicator
Pin assignment

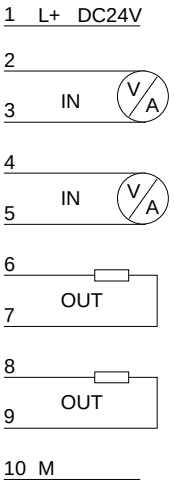
LED	Description
L+	LED (yellow) Supply voltage present
SF	Sum error LED (red) turned on as soon as an channel error is detected res. an entry in the diagnostic bytes happened



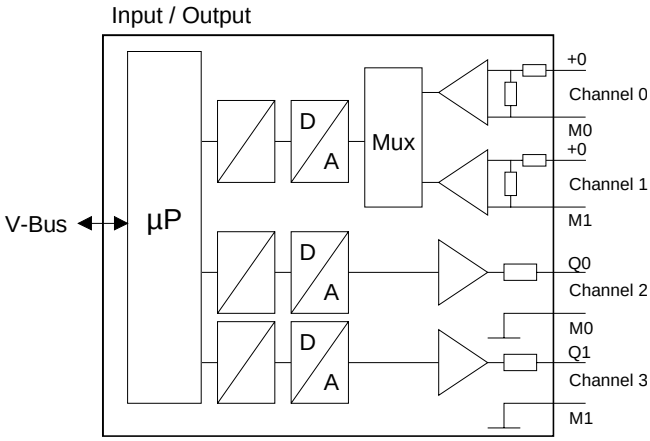
Pin	Assignment
1	DC 24V supply voltage
2	pos. connection Ch.0
3	Ground Channel 0
4	pos. connection Ch.1
5	Ground Channel 1
6	pos. connection Ch.2
7	Ground Channel 2
8	pos. connection Ch.3
9	Ground Channel 3
10	Supply voltage Ground

Circuit and schematic diagram

Circuit diagram



Schematic diagram



Attention!

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

Data input/ data output range

Data input range:

During the measuring, the measuring values are stored in the data input area with the following assignment.:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1

Note!

At 3wire res. 4wire measuring, only channel 0 is used.

Data output range:

For output of the data you set a value in the data output area. The functionality can be set by means of function-no. for each channel.

Byte	Bit 7 ... Bit 0
0	High-Byte channel 2
1	Low-Byte channel 2
2	High-Byte channel 3
3	Low-Byte channel 3

Parameter data

12byte of parameter data are available for the configuration. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Wire break recognition and diagnostic interrupt: Bit 0: Wire break recognition channel 0 0: deactivated 1: activated Bit 1: Wire break recognition channel 1 0: deactivated 1: activated Bit 5 ... 2: reserved Bit 6: 0: diagnostic interrupt inhibited 1: diagnostic interrupt enabled Bit 7: reserved	00h
1	reserved Bit 0: reserved Bit 1: reserved Bit 2: CPU-Stop reaction for channel 2 0: Set replacement value channel 2*) 1: Store last value channel 2 Bit 3: CPU-Stop reaction for channel 3 0: Set replacement value channel 3 1: Store last value channel 3 Bit 7 ... 4: reserved	00h
2	Function-no. channel 0 (see table input ranges)	28h
3	Function-no. channel 1 (see table input ranges)	28h
4	Function-no. channel 2 (see table input ranges)	09h
5	Function-no. channel 3 (see table input ranges)	09h
6	Meas. cycle channel 0	00h
7	Meas. cycle channel 1	00h
8	High-Byte replacement value channel 2	00h
9	Low-Byte replacement value channel 2	00h
10	High-Byte replacement value channel 3	00h
11	Low-Byte replacement value channel 3	00h

*) If you want to get 0A res. 0V as output value at CPU-STOP, you have to set the following replacement values at current output (4...20mA) res. voltage output (1...5V):
E500h for the S7 format from Siemens and F000h for the S5 format from Siemens.

Parameter

Wire break recognition

The bits 0 and 1 of byte 0 allow you to activate the wire break recognition for the input channels. The wire break recognition is only available for the current measuring range of 4...20mA. A wire break is recognized when the current input during current measuring sinks under 1.18mA.

A wire break at activated wire break recognition causes an entry in the diagnosis area. This is shown via the SF-LED.

If additionally a diagnostic interrupt is activated, a diagnosis message is sent to the superordinated system.

Diagnostic interrupt

With the help of bit 6 of byte 0, you may release the diagnostic interrupt. In case of an error, the *record set 0* with a size of 4byte is transferred to the superordinated system.

More detailed information is to find below under "Diagnostic data".

CPU-Stop reaction and replacement value

With Bit 2 and 3 of byte 1 and byte 8 ... 11 you may set the reaction of the module at CPU-Stop for every output channel.

Via Byte 8 ... 11 you predefine a replacement value for the output channel as soon as the CPU switches to Stop.

By setting Bit 2 res. 3, the last output value remains in the output at CPU-Stop. A reset sets the replacement value.

Function-no.

Here you set the function-no. of your measuring res. output function for every channel. Please see the according table next page.

Meas. cycle

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower bits (LSBs) are not longer relevant for the analog value.

Structure Meas. cycle Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 7	Bit 3 ... 0: Velocity per channel		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 123 conversions/s	14	
	0100 168 conversions/s	12	
	0101 202 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 7 ... 4: reserved		

Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

By entering FFh you may deactivate the concerning channel.

The following tables list all functions that are supported by the depending channel.

Note!

When exceeding the overdrive region, the value 7FFFh (32767) is thrown, at underrun of the underdrive region the value is 8000h (-32768).

Input range (channel 0, channel 1)

No.	Function	Measuring range / representation
00h	Does not affect permanently stored configuration data.	
3Bh	Voltage ±10V Siemens S5 format (two's complement)	±12.5V ***/*** 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480)
2Bh	Voltage ±10V Siemens S5 format (value and sign)	±12.5V ***/*** 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480)
72h	Voltage 1...5V Siemens S5 format (value and sign)	0...6V 6V = End overdrive region (20480) 1...5V = nominal range (0...16384) 0V = End underdrive region (-4096)
75h	Voltage 0...10V Siemens S5 format (value and sign)	0...12.5V 12.5V = End overdrive region (20480) 0...10V = nominal range (0...16384) no underdrive region available
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V ***/*** 11.76V= End overdrive region (32511) -10...10V= nominal range (-27648...27648) -11.76V= End underdrive region (-32512)
7Ah	Voltage 1...5V Siemens S7 format (two's complement)	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912)

continued ...

... continue function-no. input range (channel 0, channel 1)

No.	Function	Measuring range / representation
7Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V= End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
3Ah	Current ±20mA Siemens S5 format (two's complement)	±25.0mA **/** 25.0mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25.0mA = End underdrive region (-20480)
2Fh	Current ±20mA Siemens S5 format (value and sign)	±25.0mA **/** 25.0mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25.0mA = End underdrive region (-20480)
2Eh	Current 4...20mA Siemens S5 format (value and sign)	0.8...+24.0mA **/** 24.0mA = End overdrive region(20480) 4 ... 20mA = nominal range (0...16384) 0.8mA = End underdrive region (-3277)
76h	Current 0...20mA Siemens S5 format (value and sign)	0...25mA 25mA = End overdrive region (20480) 0...20mA = nominal range (0...16384) no underdrive region available
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.51mA **/** 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185...+22.81mA **/** 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864)
7Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	

Note!

The module is preset to the range "±10V voltage" in S7 format from Siemens.

Output range (Channel 2, Channel 3)

No.	Function	Output or input range
00h	Does not affect permanently stored configuration data	
01h	Voltage ±10V Siemens S5 format (two's complement)	±12.5V 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480)
02h	Voltage 1...5V Siemens S5 format (two's complement)	0...6V 6V = End overdrive region (20480) 1...5V = nominal range (0...16384) 0V = End underdrive region (-4096)
05h	Voltage 0...10V Siemens S5 format (two's complement)	0...12.5V 12.5V = End overdrive region (20480) 0...10V = nominal range (0...16384) no underdrive region available
09h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V 11.76V= End overdrive region (32511) -10V...10V = nominal range (-27648...27648) -11.76 = End underdrive region (-32512)
0Ah	Voltage 1...5V Siemens S7 format (two's complement)	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912)
0Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V= End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
03h	Current ±20mA Siemens S5 format (two's complement)	±25.0mA 25mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25mA = End underdrive region (20480)
04h	Current 4...20mA Siemens S5 format (two's complement)	0...24mA 24mA = End overdrive region (20480) 4...20mA = nominal range (0...16384) 0mA = End underdrive region (-4096)
06h	Current 0...20mA Siemens S5 format (two's complement)	0...25mA 25mA = End overdrive region (20480) 0...20mA = nominal range (0...16384) no underdrive region available
0Bh	Current ±20mA Siemens S7 format (two's complement)	±23.52mA 23.52mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.52mA = End underdrive region (-32512)
0Ch	Current 4...20mA Siemens S7 format (two's complement)	0...22.81mA 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 0mA = End underdrive region (-6912)
0Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	

Note!

Leaving the defined range, the output is 0V res. 0A!

Numeric notation in Siemens S5 format

In Siemens S5 format, input data is saved into a word. The word consists of the binary value and the information bits.

Please regard only the Siemens S7 format (two's complement) is supported by the Siemens SIMATIC manager for decimal representation. When the Siemens S5 format is used the decimal values are incorrectly represented.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value within measuring range 1: measuring range exceeded Bit 1: error bit (set by internal errors) Bit 2: activity bit (always 0) Bit 7 ... 3: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V (two's complement)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0000
5V	8192	2000
10V	16384	4000

+/- 10V (value and sign)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	A000
0V	0	0000
5V	8192	2000
10V	16384	4000

4 ... 20mA / 1 ... 5V (value and sign)

Current / Voltage	Decimal	Hex
4mA / 1V	0	0000
12mA / 3V	8192	2000
20mA / 5V	16384	4000

+/- 20mA (two's complement)

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

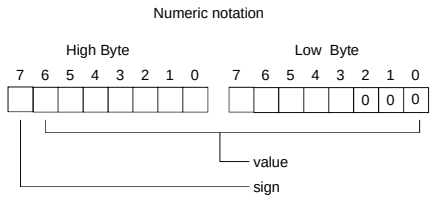
+/- 20mA (value and sign)

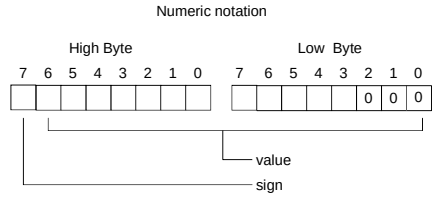
Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	A000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

U: voltage, Value: Decimal value

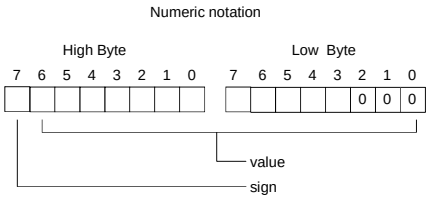




Formula for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: Current, Value: Decimal value



Numeric notation in Siemens S7 format

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

Numeric representation:

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured vale
1	Bit 6 ... 0: binary measured vale Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Diagnostic data

The diagnostic data uses 12byte and are stored in the record sets 0 and 1 of the system data area.

When you enable the diagnostic interrupt in byte 0 of the parameter area, modules will transfer *record set 0* to the superordinated system when an error is detected.

Record set 0 has a predefined content and a length of 4byte. The content of the record set may be read in plain text via the diagnostic window of the CPU.

For extended diagnosis during runtime, you may evaluate the 12byte wide *record set 1* via the SFCs 51 and 59.

Evaluate diagnosis

At present diagnosis, the CPU interrupts the user application and branches into the OB 82. This OB gives you detailed diagnostic data via the SFCs 51 and 59 when programmed correctly.

After having processed the OB 82, the user application processing is continued. Until leaving the OB 82, the data remain consistent.

Record set 0

Byte 0 to 3:

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present Bit 4: external supply voltage is missing Bit 5,6: reserved Bit 7: Wrong parameters in the 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	reserved	00h

Record set 1

Byte 0 to 11:

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

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

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: reserved	74h
5	Bit 7 ... 0: Number of diagnostic bits of the module per channel	08h
6	Bit 7 ... 0: Number of identical 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 7 ... 4: reserved	00h
8	Bit 0: Wire break Channel 0 Bit 1: Parameterization error Channel 0 Bit 2: Measuring range underflow Channel 0 Bit 3: Measuring range overflow Channel 0 Bit 7 ... 4: reserved	00h
9	Bit 0: Wire break Channel 1 Bit 1: Parameterization error Channel 1 Bit 2: Measuring range underflow Channel 1 Bit 3: Measuring range overflow Channel 1 Bit 7 ... 4: reserved	00h
10	Bit 0: Wire break at current output res. short circuit at voltage output Channel 2 Bit 1: Parameterization error Channel 2 Bit 7 ... 2: reserved	00h
11	Bit 0: Wire break at current output res. short circuit at voltage output Channel 3 Bit 1: Parameterization error Channel 3 Bit 7 ... 2: reserved	00h

Technical data

Electrical Data	VIPA 234-1BD50							
Number of in-/outputs	2/2							
Voltage supply	DC5V via backplane bus							
	DC24V (20.4 ... 28.8V)							
Current consumption	Backplane bus: 100mA							
	DC 24V extern: 100mA							
Short circuit current	30mA							
I/O ranges	±10V, 1 ... 5V, 0 ... 10V, ±20mA, 0 ... 20mA, 4 ... 20mA							
Analog value calculation inputs	Calculation time/Resolution (per channel)							
Parameterized velocity (Hz)	3.7	7.5	15	30	60	123	168	202
Basic calculation time (ms)	268	135	69	35,5	19	10	8	6,75
Additional calculation time (executed once per cycle) (ms)	10	10	10	10	10	10	10	10
Additional calculation time for wire break recognition (ms)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Resolution in Bit	16	16	16	16	15	14	12	10
Analogue value calculation outputs resolution (incl. overdrive region)								
±10V, ±20mA	11Bit + sign							
4 ... 20mA, 1 ... 5V	10Bit							
0 ... 10V, 0 ... 20mA	11Bit							
Cycle time	2.5ms							
Settling time								
- Ohm resistive load	0.05ms							
- Capacitive load	0.5ms							
- Inductive load	0.1ms							

Error limits	Measuring range	Tolerance
- Voltage in-/output	±10V	±0.2%
	0 ... 10V	±0.4%
	1 ... 5V	±0.6%
- Current in-/output	±20mA	±0.3%
	0 ... 20mA	±0.6%
	4 ... 20mA	±0.8%

continued ...

... continue

Electrical Data	
Data for choosing an encoder	
- Voltage input	100kΩ
- Current input	50Ω
Data for choosing an actuator	Load resistor
- Voltage outputs	Ohm resistive load - min. 1kΩ
	Capacitive load - max. 1µF
- Current outputs	Ohm resistive load - max. 500Ω
	Capacitive load - max. 10mH
Diagnosis interrupt	parameterizable
Potential separation	500Vrms
	(field voltage – backplane bus)
Status monitor	via LEDs at the front side
Parameter data	
Input data	4byte (1 Word per channel)
Output data	4byte (1 Word per channel)
Parameter data	12byte
Diagnostic data	12byte
Measurements and Weight	
Measurements (WxHxD)	25.4x76x76mm
Weight	100g

234-1BD60 - AI 4/AO 2x12Bit - Multiin-/output

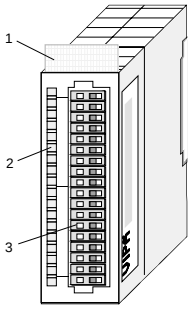
Order data AI 4/AO 2x12Bit Multiin-/output VIPA 234-1BD60

Description This module has 4 analog inputs and 2 analog outputs that may be configured individually. The module occupies a total of 8byte of input and 4byte of output data in the periphery area. Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers.

Properties

- 4inputs and 2 outputs with common ground
- In-/Outputs with individually configurable functions
- Channel 0 to 2 suitable for encoder with input ranges of:
  voltage ±10V, 1 ... 5V, 0 ... 10V, ±4V, ±400mV
  current ±20mA, 4...20mA or 0 ... 20mA
- Channel 3 suitable for encoder with input ranges of:
  Pt100, Pt1000, NI100, NI1000 and
  resistant measuring 600Ω, 3000Ω
- Channel 4 to 5 Suitable for actuators with output ranges of:
  ±10V, 1 ... 5V, 0 ... 10V, ±20mA, 0 ... 20mA or 4 ... 20mA

Construction

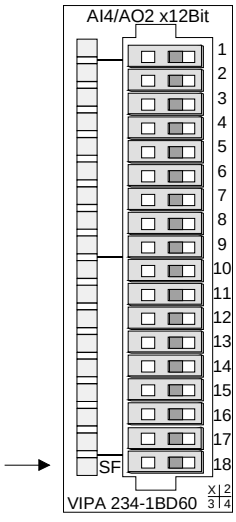


[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator

LED	Description
SF	Sum error LED (red) turned on as soon as an channel error is detected res. an entry in the diagnostic bytes happened

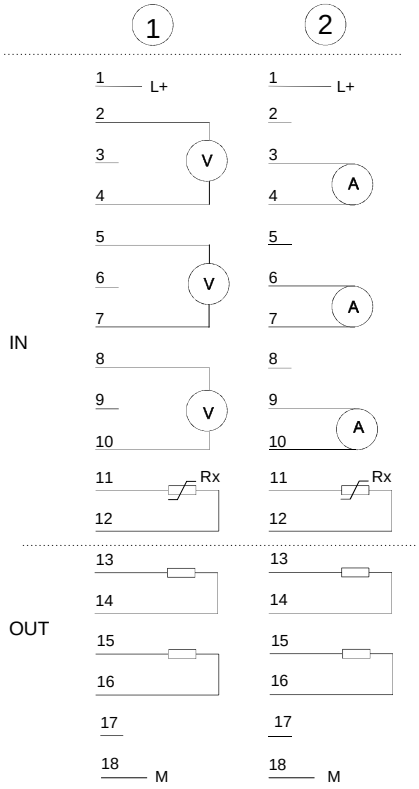
Pin assignment



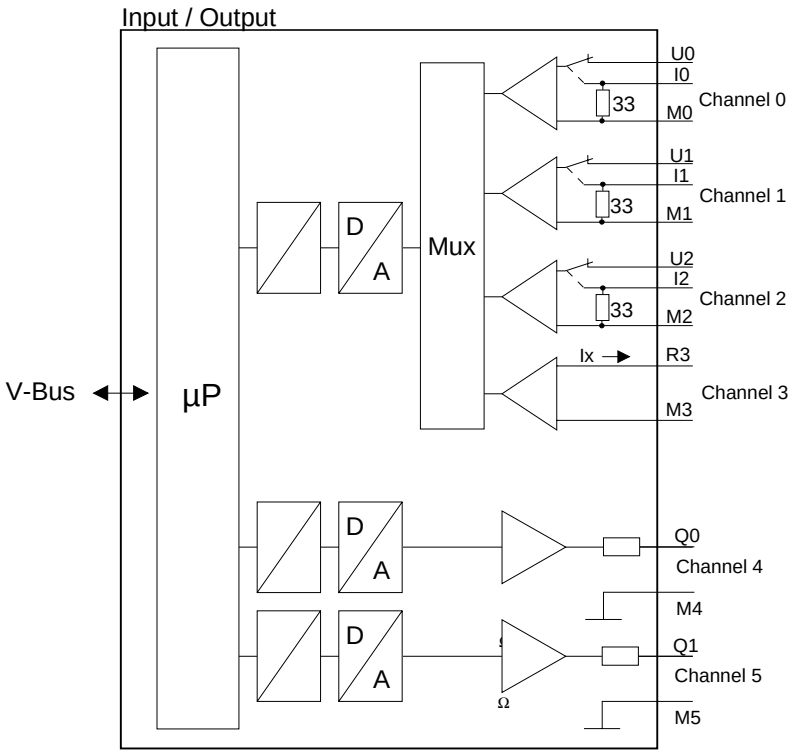
Pin	Assignment
1	DC 24V supply voltage
2	Voltage measuring Ch. 0
3	Current measuring Ch. 0
4	Ground Channel 0
5	Voltage measuring Ch. 1
6	Current measuring Ch. 1
7	Ground Channel 1
8	Voltage measuring Ch. 2
9	Current measuring Ch. 2
10	Ground channel 2
11	Measuring Ch. 3 (Pt, Ni, R)
12	Ground 3
13	Q0 output channel 4
14	M4 output channel 4
15	Q1 output channel 5
16	M5 output channel 5
17	reserved
18	Ground Supply voltage

Circuit and schematic diagram

Circuit diagram



Schematic diagram



Attention!

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

Data input/ data output range

Data input range:

During the measuring, the measuring values are stored in the data input area with the following assignment.:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Data output range:

For output of the data you set a value in the data output area.

Byte	Bit 7 ... Bit 0
0	High-Byte channel 4
1	Low-Byte channel 4
2	High-Byte channel 5
3	Low-Byte channel 5

Parameter data

16byte of parameter data are available for the configuration. These parameters are stored in non-volatile memory and are available after the unit has been powered off. By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 50ms. During this time, the measuring value output is 7FFFFh.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Wire break recognition channel 0 Bit 0: 0 = deactivated 1 = activated Wire break recognition channel 1 Bit 1: 0 = deactivated 1 = activated Wire break recognition channel 2 Bit 2: 0 = deactivated 1 = activated Wire break recognition channel 3 Bit 3: 0 = deactivated 1 = activated Bit 4, 5: reserved Diagnostic interrupt Bit 6: 0 = diagnostic interrupt inhibited 1 = diagnostic interrupt enabled Bit 7: reserved	00h
1	Bit 3 … 0: reserved CPU-Stop reaction for channel 4 Bit 4: 0 = Set replacement value *) 1 = Store last value CPU-Stop reaction for channel 5 Bit 5: 0 = Set replacement value *) 1 = Store last value Bit 6, 7: reserved	00h
2	Function-no. channel 0 (see table input ranges)	28h
3	Function-no. channel 1 (see table input ranges)	28h
4	Function-no. channel 2 (see table input ranges)	28h
5	Function-no. channel 3 (see table input ranges)	01h
6	Option-Byte channel 0 (see table next page)	00h
7	Option-Byte channel 1 (see table next page)	00h
8	Option-Byte channel 2 (see table next page)	00h
9	Option-Byte channel 3 (see table next page)	00h
10	Function-no. channel 4 (see table output ranges)	09h
11	Function-no. channel 5 (see table output ranges)	09h
12	High-Byte replacement value channel 4	00h
13	Low-Byte replacement value channel 4	00h
14	High-Byte replacement value channel 5	00h
15	Low-Byte replacement value channel 5	00h

*) If you want to get 0A res. 0V as output value at CPU-STOP, you have to set the following replacement values at current output (4...20mA) res. voltage output (1...5V):
E500h for the S7 format from Siemens.

Parameter

Wire break recognition

Via the bits 0 and 3 of byte 0, the wire break recognition is activated for the input channels. The wire break recognition is only available for the current measuring range of 4...20mA and at (thermo) resistance measuring. A wire break is recognized when the current input during current measuring sinks under 1.18mA res. when the resistance at (thermo) resistance measuring reaches infinite. This causes an entry in the diagnosis area and is shown via the SF-LED.

If a diagnostic interrupt is activated, a diagnosis message is sent to the super-ordinated system.

Diagnostic interrupt

With the help of bit 6 of byte 0, you may release the diagnostic interrupt. In case of an error like e.g. wire break, the superordinated system receives *record 0* (4byte). For an extended diagnosis you may then call *record 1* (12byte). More detailed information is to find below under "Diagnostic data".

CPU-Stop reaction and replacement value

With bit 4 and 5 of byte 1 and byte 12 ... 15 you may set the reaction of the module at CPU-Stop for every output channel.

Via byte 12 ... 15 you predefine a replacement value for the output channel as soon as the CPU switches to Stop.

By setting bit 4 res. 5, the last output value remains in the output at CPU-Stop. A reset sets the replacement value.

Function-no.

Here you set the function-no. of your measuring res. output function for every channel. Please see the according table next page.

Meas. cycle

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower Bits (LSBs) are not longer relevant for the analog value.

Structure Meas. cycle Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 9	Bit 3 ... 0: Velocity per channel		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 120 conversions/s	14	
	0100 170 conversions/s	12	
	0101 200 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 7 ... 4: reserved		

Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

By entering FFh you may deactivate the concerning channel.

The following tables list all functions that are supported by the depending channel.

You may find the connection type mentioned under "connection" at the "circuit diagram" above.

Note!

When exceeding the overdrive region, the value 7FFFh (32767) is thrown, at underrun of the underdrive region the value is 8000h (-32768).

Input range (channel 0 … 2)

No.	Function	Measuring range / representation	Connection
00h	Does not affect permanently stored configuration data.		
7Dh	Voltage 0 … 10V Siemens S7 format (two's complement)	-1.76 … 11.76V ***/*** 11.76V= End overdrive region (32511) 0...10V= nominal range (0...27648) -1.76V= End underdrive region (-4864)	(1)
7Ah	Voltage 1 … 5V Siemens S7 format (two's complement)	0.3 … 5.70V ***/*** 5.70V= End overdrive region (32511) 1...5V= nominal range (0...27648) 0.30V= End underdrive region (-4864)	(1)
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V ***/*** 11.76V= End overdrive region (32511) -10...10V= nominal range (-27648...27648) -11.76V= End underdrive region (-32512)	(1)
29h	Voltage ±4V Siemens S7 format (two's complement)	±4.70V ***/*** 4.70V= End overdrive region (32511) -4...4V= nominal range (-27648...27648) -4.70V= End underdrive region (-32512)	(1)
2Ah	Voltage ±400mV Siemens S7 format (two's complement)	±470mV ***/*** 470mV= End overdrive region (32511) -400...400mV= nominal range (-27648...27648) -470mV= End underdrive region (-32512)	(1)
7EH	Current 0 … 20mA Siemens S7 format (two's complement)	-3.51 … 23.51mA ***/*** 23.51mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) -3.51mA = End underdrive region (-4864)	(2)
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.51mA ***/*** 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512)	(2)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185...+22.81mA ***/*** 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864)	(2)
FFh	Channel not active (turned off)		

Input range (channel 3)

No.	Function	Measuring range / representation	Conn.
00h	Does not affect permanently stored configuration data.		
01h	Pt100 in 2wire mode	-200 .. +850°C **/** in units of 1/10°C, two's complement	(1, 2)
02h	Pt1000 in 2wire mode	-200 .. +500°C **/** in units of 1/10°C, two's complement	(1, 2)
03h	NI100 in 2wire mode	-50 .. +250°C **/** in units of 1/10°C, two's complement	(1, 2)
04h	NI1000 in 2wire mode	-50 .. +250°C **/** in units of 1/10°C, two's complement	(1, 2)
06h	Resistance measurement 600Ohm 2wire	- **/** 600Ω = Limit value (32767)	(1, 2)
07h	Resistance measurement 3000Ohm 2wire	- **/** 3000Ω = Limit value (32767)	(1, 2)
FFh	Channel not active (turned off)		

Output range (channel 4, channel 5)

No.	Function	Output range
00h	Does not affect permanently stored configuration data	
09h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V 11.76V= End overdrive region (32511) -10V...10V = nominal range (-27648...27648) -11.76 = End underdrive region (-32512)
0Ah	Voltage 1...5V Siemens S7 format (two's complement)	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912)
0Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V= End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
0Bh	Current ±20mA Siemens S7 format (two's complement)	±23.52mA 23.52mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.52mA = End underdrive region (-32512)
0Ch	Current 4...20mA Siemens S7 format (two's complement)	0...22.81mA 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 0mA = End underdrive region (-6912)
0Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	

Note!

When exceeding the predefined range, 0V res. 0A is shown as value!

Numeric notation in Siemens S7 format

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

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign (0: positive / 1: negative)

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

0....20mA

Current	Decimal	Hex
0mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Diagnostic data

The diagnostic data uses 12byte and are stored in the record sets 0 and 1 of the system data area.

When you enable the diagnostic interrupt in byte 0 of the parameter area, modules will transfer *record set 0* to the superordinated system when an error is detected.

Record set 0 has a predefined content and a length of 4byte. The content of the record set may be read in plain text via the diagnostic window of the CPU.

For extended diagnosis during runtime, you may evaluate the 12byte wide *record set 1* via the SFCs 51 and 59.

Evaluate diagnosis

At present diagnosis, the CPU interrupts the user application and branches into the OB 82. This OB gives you detailed diagnostic data via the SFCs 51 and 59 when programmed correctly.

After having processed the OB 82, the user application processing is continued. Until leaving the OB 82, the data remain consistent.

Record set 0

Byte 0 to 3:

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present Bit 4: external supply voltage is missing Bit 5, 6: reserved Bit 7: Wrong parameters in the 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	reserved	00h

Record set 1

Byte 0 to 11:

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

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

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: reserved	74h
5	Bit 7 ... 0: Number of diagnostic bits of the module per channel	04h
6	Bit 7 ... 0: Number of identical channels of a module	06h
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 5: Channel error Channel 5 Bit 6, 7: reserved	00h
8	Bit 0: Wire break Channel 0 Bit 1: Parameterization error Channel 0 Bit 2: Measuring range underflow Channel 0 Bit 3: Measuring range overflow Channel 0 Bit 4: Wire break Channel 1 Bit 5: Parameterization error Channel 1 Bit 6: Measuring range underflow Channel 1 Bit 7: Measuring range overflow Channel 1	00h
9	Bit 0: Wire break Channel 2 Bit 1: Parameterization error Channel 2 Bit 2: Measuring range underflow Channel 2 Bit 3: Measuring range overflow Channel 2 Bit 4: Wire break Channel 3 Bit 5: Parameterization error Channel 3 Bit 6: Measuring range underflow Channel 3 Bit 7: Measuring range overflow Channel 3	00h
10	Bit 0: Wire break at current output res. short circuit at voltage output Channel 4 Bit 1: Parameterization error Channel 4 Bit 2, 3: reserved Bit 4: Wire break at current output res. short circuit at voltage output Channel 5 Bit 5: Parameterization error Channel 5 Bit 6, 7: reserved	00h
11	reserved	00h

Technical Data

Electrical Data	VIPA 234-1BD60							
Number of Current-/Voltage input	3							
Number of resistance input	1							
Number of outputs	2							
Length of cable: shielded	200m							
Voltages, Currents, Potentials								
Supply voltage	DC 24V							
- reverse polarity protection	yes							
Constant current for resistance-type sensor	1.25mA							
Isolation								
- channels / backplane bus	yes							
- channel / power supply of the electronic	yes							
- between the channels	no							
Permitted potential difference								
- between the inputs (U_{CM})	DC4V							
- between the inputs and $M_{INTERNAL}$ (U_{ISO})	DC75V/AC60V							
Isolation tested with	DC 500V							
Current consumption								
- from the backplane bus	100mA							
- from the power supply L+	60mA (no load)							
Power dissipation of the module	2W							
Analog value calculation input	**Conversion time/Resolution (per channel)**							
Measuring principle	Sigma-Delta							
Parameterizable	Yes							
Conversion rate (Hz)	200	170	120	60	30	15	7.5	3.7
Integration time (ms)	5	6	8	17	33	67	133	270
Basic conversion time (ms)	7	8	10	19	35	69	135	272
Resolution (Bit) incl. overrange	10	12	14	15	16	16	16	16
Noise suppression for frequency f1 (Hz)	no					50 and 60Hz		
Basic execution time of the module, in ms (all channels enabled)	28	32	40	76	140	276	540	1088
Smoothing of the measured values	none							
Analog value calculation output channels								
Resolution (incl. overrange)								
±10V, ±20mA	11bit + sign							
4 ... 20mA, 1 ... 5V	10bit							
0 ... 10V, 0 ... 20mA	11bit							
Conversion time (per channel)	1.5ms							
Settling time								
- impedance load	0.3ms							
- capacitive load	1.0ms							
- inductive load	0.5ms							

continued ...

... continue

Suppression of interference, limits of error input channels		
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)		
Common-mode interference (U_{CM} < 5V)	> 80dB	
Series-mode noise (peak value of noise < nominal value of input range	> 80dB	
Crosstalk between the inputs	> 50dB	
Operational limit (only valid to 120W/s) (in the entire temperature range, referring to input range)		
	Measuring range	Tolerance
voltage input	±400mV, ±4V, ±10V	±0.3%
	1 ... 5V	±0.7%
	0 ... 10V	±0.4%
current input	±20mA	±0.3%
	0 ... 20mA	±0.6%
	4 ... 20mA	±0.8%
Resistors	0 … 600Ω, 0 …3kΩ	±0.4%
Resistance thermometer	Pt100, Pt1000	±0.4%
	Ni100, Ni1000	±1.0%
Basic error limit (only valid to 120W/s) (during temperature is 25°C, referring to input range)		
	Measuring range	Tolerance
Voltage input	400mV, ±4V, ±10V	±0.2%
	1 .. 5V	±0.5%
	0 ... 10V	±0.3%
Current input	±20mA	±0.2%
	0 ... 20mA	±0.4%
	4 ... 20mA	±0.5%
Resistors	0 …600Ω, 0 … 3kΩ	±0.2%
Resistance thermometer	Pt100, Pt1000	±0.2%
	Ni100, Ni1000	±0.5%
Temperature error (with reference to the input range) measuring current		±0.005%/K ±0.015%/K
Linearity error (with reference to the input range)		±0.02%
Repeatability (in steady state at 25°C referred to the input range)		±0.05%
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
	Measuring range	Tolerance
Voltage output	±10V	±0.4%[1)]
	0 … 10V	±0.6%[1)]
	1 … 5V	±0.8%[1)]
Current output	±20mA	±0.3%[2)]
	0 … 20mA	±0.6%[2)]
	4 … 20mA	±0.8%[2)]

continued ...

... continue

Basic error limit (during temperature is 25°C, referring to output range)		
	Measuring range	Tolerance
Voltage output	1 … 5V	±0.4%[1)]
	0 … 10V	±0.3%[1)]
	±10V	±0.2%[1)]
Current output	±20mA	±0.2%[2)]
	0 … 20mA	±0.4%[2)]
	4 … 20mA	±0.5%[2)]
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.05%	
Repeatability (in steady state at 25°C referred to the output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	
States, Alarms, Diagnosis		
Diagnosis alarm	parameterizable	
Diagnosis functions		
- Sum error monitor	red LED (SF)	
- Diagnostic information readable	possible	
Substitute value can be applied	yes	
Data for choosing an encoder		
Voltage input		
±400mV	10MΩ	
±4V, ±10V, 1 ... 5V, 0 ... 10V	120kΩ	
Current input		
±20mA, 0 ... 20mA, 4 ... 20mA	33Ω (90Ω starting with release 2)	
Resistors		
0...600Ω, 0...3kΩ	10MΩ	
Resistance thermometer		
Pt100, Pt1000, Ni100, Ni1000	10MΩ	
Maximum input voltage for voltage input (destruction limit)	25V	
Maximum input current for current input (destruction limit)	30mA	
Connection of the sensor		
For measuring voltage	yes	
For measuring current		
as 2wire transmitter	possible with external power supply	
as 4wire transmitter	yes	
For measuring resistance		
with 2conductor connection	yes	
Characteristic linearization		
for RTD	Pt100, Pt1000, Ni100, Ni1000	
Unit for temperature measurement	°C	

continued ...

... continue

Data for choosing an actuator	
Output ranges (rated values)	
Voltage	1 ... 5V, 0 ... 10V, ±10V
Current	4 ... 20mA, 0 ... 20mA, ±20mA
Load resistance (in nominal range of the output)	
At voltage outputs	min. 1kΩ
- capacitive load	max. 1µF
At current output	max. 500Ω
- Inductive load	max. 10mH
Voltage outputs	
Short-circuit protection	yes
Short-circuit current	max. 31mA
Current outputs	
No-load voltage	max. 13V
Destruction limit against voltages/currents applied from outside	
Voltage at outputs to M_{ANA}	max. 15V
Current	max. 30mA
Connection of actuators	
for voltage output	2conductor connection
for current output	2conductor connection
Parameter data	
Input data	8byte (1 word per channel)
Output data	4byte (1 word per channel)
Parameter data	16byte
Diagnostic data	12byte
Dimensions and weight	
Dimensions (WxHxD) in mm	25.4x76x88mm
Weight	80g

[1] The error limits are measured with a load of R=1GΩ. For voltage output the output impedance is 50Ω.

[2] The error limits are measured with a load of R=10Ω.

Chapter 9 SM 238C - Combination module

Overview

In this chapter follows the description of the combination module SM 238C that includes a digital in-/output module with counter function and an analog in-/output module.

The combination module can only be used together with a CPU 21x or with the DP-V1 Profibus coupler (253-xDP01)!
Here the max. number of modules is limited to 2.

Contents

Overview

General

The combination module includes a digital in-/output module with counter function and an analog in-/output module.

The following components are integrated:

- Analog input: 3xU/I, 1xPT100x12Bit
- Analog output: AO 2x12Bit COM
- Digital input: 16(12)xDC24V with parameterizable counter functions
- Digital output:: 0(4)xDC24V 1A
- Counter: max. 3 counter with the operating modes: endless, single or periodic counting.

Security hints for deploying I/O channels!

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, 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.

Project engineering

The combination module can only be used together with a CPU 21x or with the DP-V1 Profibus coupler (253-xDP01)! Here the max. number of modules is limited to 2.

The operation at a other bus coupler is not permitted.

The necessary GSD files can be found at "service" on ftp.vipa.de.

The project engineering takes place in the Siemens SIMATIC manager. For this the import of the corresponding GSD file is required.

After installation of the GSD the combination module can be found at the hardware catalog at:

Additional Field devices > *I/O* > *VIPA_System_200V* >...

as 2 modules:

238-2BC00 (1/2) AI4/AO2*12Bit

238-2BC00 (2/2) Counter

For the module has a digital and an analog part, you have to configure for each one component during the hardware configuration.

Counter

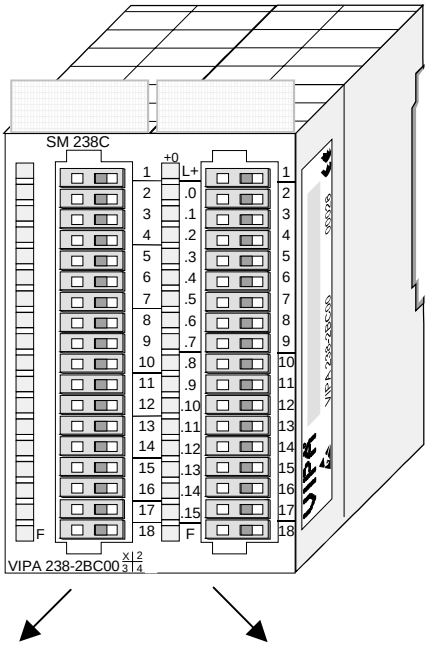
The control of the counter happens via digital input channels. For the counter you may configure alarms that influence one digital output channel per counter.

Ordering data

DI 16xDC24V / AI 4/AO 2x12Bit Combination module	VIPA 238-2BC00

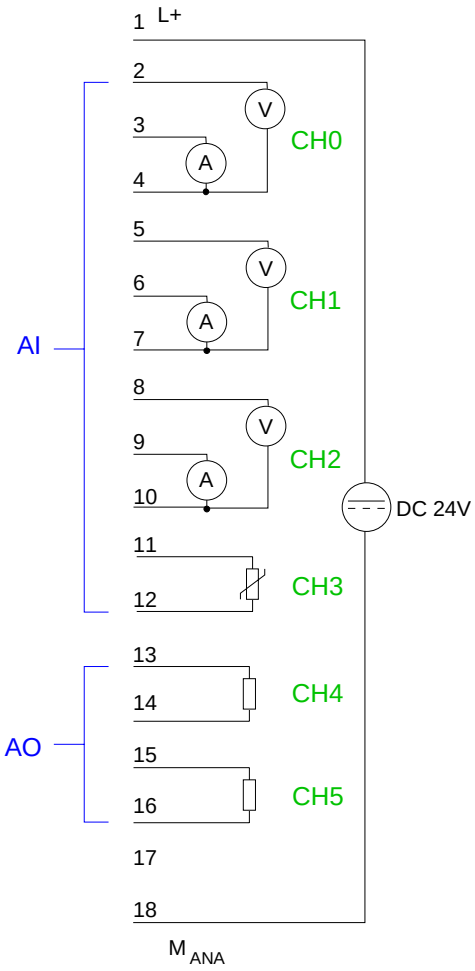
In-/Output part

Structure

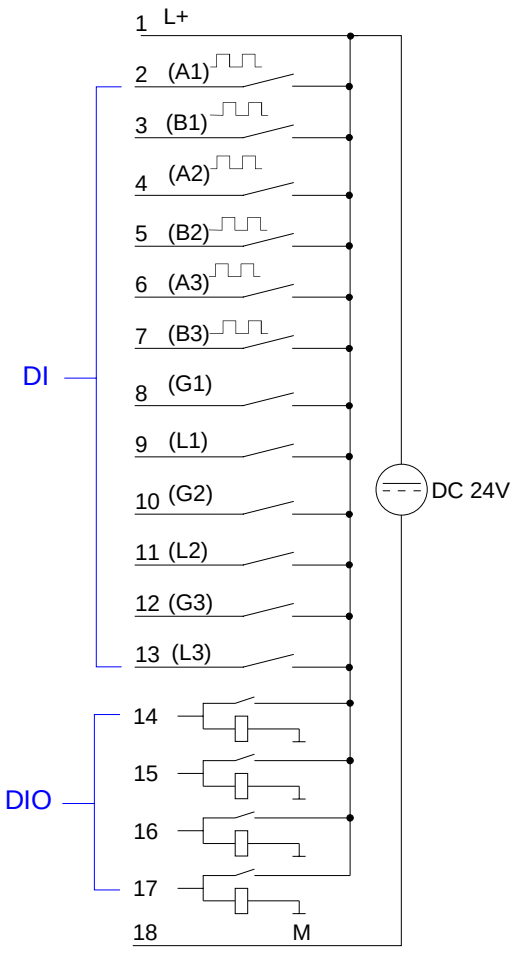


Pin assignment

Analog part



Digital part



Analog part

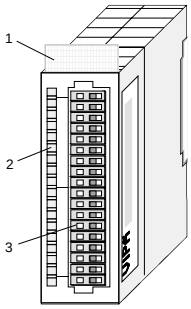
Properties

The analog part has 4 analog inputs and 2 analog outputs that may be configured individually. The module occupies a total of 8byte of input and 4byte of output data.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and opto couplers.

- 4inputs and 2 outputs with common ground
- In-/Outputs with individually configurable functions
- Channel 0 to 2 suitable for encoder with input ranges of:
  voltage ±10V, 1 ... 5V, 0 ... 10V, ±4V, ±400mV
  current ±20mA, 4...20mA, 0 ... 20mA
- Channel 3 suitable for encoder with input ranges of:
  Pt100, Pt1000, NI100, NI1000
  resistant measuring 600Ω, 3000Ω
- Channel 4 to 5 Suitable for actuators with output ranges of:
  ±10V, 1 ... 5V, 0 ... 10V, ±20mA, 0 ... 20mA or 4 ... 20mA

Construction

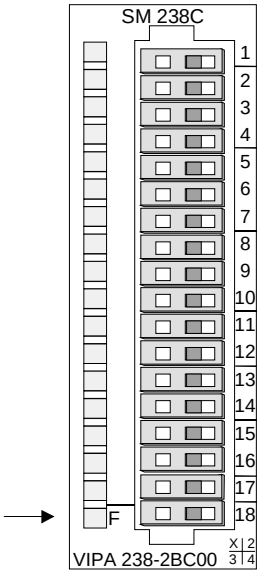


[1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator

LED	Description
F	Sum error LED (red) turned on as soon as an channel error is detected res. an entry in the diagnostic bytes happened

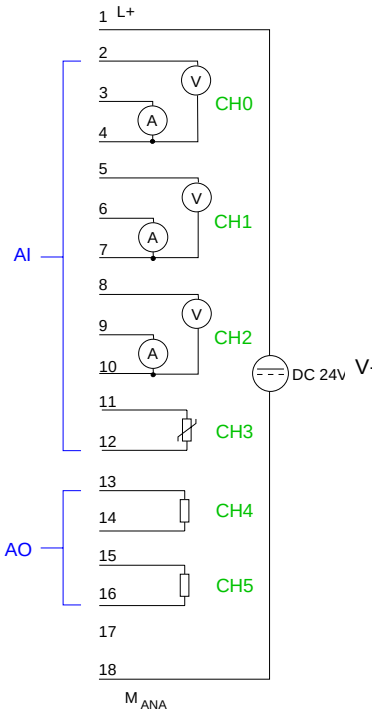
Pin assignment



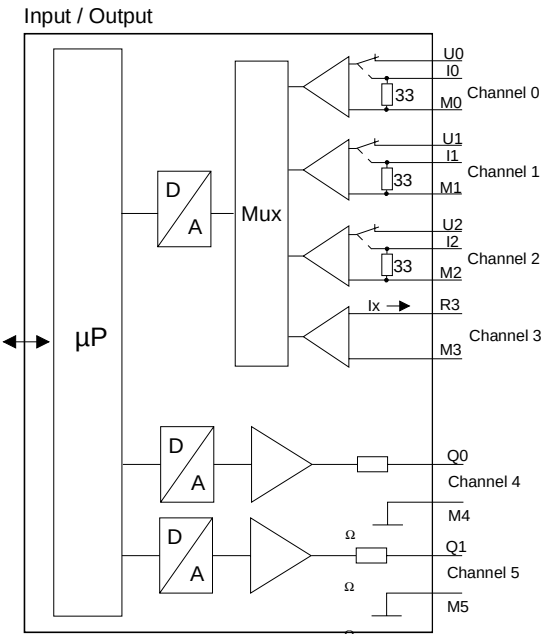
Pin	Assignment
1	DC 24V supply voltage
2	Voltage measuring Ch. 0
3	Current measuring Ch. 0
4	Ground Channel 0
5	Voltage measuring Ch. 1
6	Current measuring Ch. 1
7	Ground Channel 1
8	Voltage measuring Ch. 2
9	Current measuring Ch. 2
10	Ground channel 2
11	Measuring Ch. 3 (Pt, Ni, R)
12	Ground 3
13	Q0 output channel 4
14	M4 output channel 4
15	Q1 output channel 5
16	M5 output channel 5
18	Ground Supply voltage

Circuit and schematic diagram

Circuit diagram



Schematic diagram



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

Numeric notation in Siemens S7 format

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

Depending on the parameterized transformation speed the lowest value bits of the measuring value are irrelevant. With increasing sampling rate, the resolution decreases.

The following table lists the resolution in dependence of the sampling rate.

	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	sign	Measuring value														
15 Bit + sign	sign	Relevant output value (at 3.7 ... 30Hz)														
14 Bit + sign	sign	Relevant output value (at 60Hz)														X*
13 Bit + sign	sign	Relevant output value (at 120Hz)													X	X
11 Bit + sign	sign	Relevant output value (at 170Hz)											X	X	X	X
9 Bit + sign	sign	Relevant output value (at 200Hz)									X	X	X	X	X	X

* The lowest value irrelevant bits of the output value are marked with "X".

Algebraic sign bit (sign)

Bit 15 serves as algebraic sign bit. Here is:
Bit 15 = "0" → positive value
Bit 15 = "1" → negative value

Digital/Analog conversion

In the following all measuring ranges are listed that are supported by the analog part.

The here listed formulas allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range and vice versa.

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

0....20mA

Current	Decimal	Hex
0mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

Analog part - Project engineering

Access to the analog part

The combination module can only be used together with a CPU 21x or with the DP-V1 Profibus coupler (253-xDP01)! The project engineering takes place in the Siemens SIMATIC manager. For this the import of the corresponding GSD file is required which can be found at "service" on ftp.vipa.de.

After installation of the GSD file the combination module can be found at the hardware catalog at:

Additional Field devices > I/O > VIPA_System_200V > ...

as 2 modules:

238-2BC00 (1/2) AI4/AO2*12Bit

238-2BC00 (2/2) Counter

Please take care that you always configure both module parts in the sequence shown above

Data input/ data output range

For data input 8bytes and for data output 4bytes are available with the following assignment:

Data input range:

During the measuring, the measuring values are stored in the data input area.

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Data output range:

For output of the data you set a value in the data output area.

Byte	Bit 7 ... Bit 0
0	High-Byte channel 4
1	Low-Byte channel 4
2	High-Byte channel 5
3	Low-Byte channel 5

Behavior at errors

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

Measuring value > Overdrive region: 32767 (7FFFh)

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

When exceeding the predefined range the analog output is set to 0V res. 0A!

Parameter data

16byte of parameter data are available for the configuration. These parameters are stored in non-volatile memory and are available after the unit has been powered off.

By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 50ms. During this time, the measuring value output is 7FFFFh.

The following table shows the structure of the parameter data:

Parameter area
Record set 0

Byte	Bit 7 ... Bit 0	Default
0	Wire break recognition channel 0 Bit 0: 0 = deactivated 1 = activated Wire break recognition channel 1 Bit 1: 0 = deactivated 1 = activated Wire break recognition channel 2 Bit 2: 0 = deactivated 1 = activated Wire break recognition channel 3 Bit 3: 0 = deactivated 1 = activated Bit 4, 5: reserved Diagnostic interrupt Bit 6: 0 = diagnostic interrupt inhibited 1 = diagnostic interrupt enabled Bit 7: reserved	00h
1	Bit 3 … 0: reserved CPU-Stop reaction for channel 4 Bit 4: 0 = Set replacement value *) 1 = Store last value CPU-Stop reaction for channel 5 Bit 5: 0 = Set replacement value *) 1 = Store last value Bit 7 ... 6: reserved	00h
2	Function-no. channel 0 (see table input ranges)	28h
3	Function-no. channel 1 (see table input ranges)	28h
4	Function-no. channel 2 (see table input ranges)	28h
5	Function-no. channel 3 (see table input ranges)	01h
6	Option-Byte channel 0 (see table next page)	00h
7	Option-Byte channel 1 (see table next page)	00h
8	Option-Byte channel 2 (see table next page)	00h
9	Option-Byte channel 3 (see table next page)	00h
10	Function-no. channel 4 (see table output ranges)	09h
11	Function-no. channel 5 (see table output ranges)	09h
12	High-Byte replacement value channel 4	00h
13	Low-Byte replacement value channel 4	00h
14	High-Byte replacement value channel 5	00h
15	Low-Byte replacement value channel 5	00h

*) If you want to get 0A res. 0V as output value at CPU-STOP, you have to set the following replacement values at current output (4...20mA) res. voltage output (1...5V):
E500h for the S7-format from Siemens.

Parameters

Wire break recognition

Via the bits 0 and 3 of byte 0, the wire break recognition is activated for the input channels. The wire break recognition is only available for the current measuring range of 4...20mA and at (thermo) resistance measuring. A wire break is recognized when the current input during current measuring sinks under 1.18mA res. when the resistance at (thermo) resistance measuring reaches infinite. This causes an entry in the diagnostic area and is shown via the SF-LED.

If a diagnostic interrupt is activated, a diagnostic message is sent to the superordinated system.

Diagnostic interrupt

With the help of bit 6 of byte 0, you may release the diagnostic alarm. In case of an error like e.g. wire break, the superordinated system receives *record 0* (4byte). For an extended diagnostic you may then call *record 1* (12byte). More detailed information is to find below under "Diagnostic data".

CPU-Stop reaction and replacement value

With bit 4 and 5 of byte 1 and byte 12 ... 15 you may set the reaction of the module at CPU-Stop for every output channel.

Via byte 12 ... 15 you predefine a replacement value for the output channel as soon as the CPU switches to Stop.

By setting bit 4 res. 5, the last output value remains in the output at CPU-Stop. A reset sets the replacement value.

Function No.

Here you set the function no. of your measuring res. output function for every channel. Please see the according table above.

Meas. cycle

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower Bits (LSBs) are not longer relevant for the analog value.

Structure Meas. cycle Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 9	Bit 3 ... 0: Velocity per channel		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 120 conversions/s	14	
	0100 170 conversions/s	12	
	0101 200 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 7 ... 4: reserved		

Function-no. assignment

The assignment of a function no. to a certain channel happens during parameterization. The function no. 00h does not influence the function no. stored in the permanent parameterization data.

By entering FFh you may deactivate the concerning channel.

The following tables list all functions that are supported by the depending channel.

You may find the corresponding connection type at the "circuit diagram" above.

Note!

When exceeding the overdrive region, the value 7FFFh (32767) is thrown, at underrun of the underdrive region the value is 8000h (-32768).

Input range (channel 0 … 2)

No.	Function	Measuring range / representation
00h	Does not affect permanently stored configuration data.	
7Dh	Voltage 0 … 10V Siemens S7-format	-1.76 … 11.76V ***/*** 11.76V= End overdrive region (32511) 0...10V= nominal range (0...27648) -1.76V= End underdrive region (-4864) two's complement
7Ah	Voltage 1 … 5V Siemens S7-format	0.3 … 5.70V ***/*** 5.70V= End overdrive region (32511) 1...5V= nominal range (0...27648) 0.30V= End underdrive region (-4804) two's complement
28h	Voltage ±10V Siemens S7-format	±11.76V ***/*** 11.76V= End overdrive region (32511) -10...10V= nominal range (-27648...27648) -11.76V= End underdrive region (-32512) two's complement
29h	Voltage ±4V Siemens S7-format	±4.70V ***/*** 4.70V= End overdrive region (32511) -4...4V= nominal range (-27648...27648) -4.70V= End underdrive region (-32512) two's complement
2Ah	Voltage ±400mV Siemens S7-format	±470mV ***/*** 470mV= End overdrive region (32511) -400...400mV= nominal range (-27648...27648) -470mV= End underdrive region (-32512) two's complement

continued ...

... continue function-no. input range (channel 0…2)

7EH	Current 0 … 20mA Siemens S7-format	-3.51 … 23.51mA ***I*** 23.51mA = End overdrive region (32511) 0...20mA = nominal range (-27648...27648) -3.51mA = End underdrive region (-4864) two's complement
2Ch	Current ±20mA Siemens S7-format	±23.51mA ***I*** 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512) two's complement
2Dh	Current 4...20mA Siemens S7-format	1.185...+22.81mA ***I*** 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864) two's complement
FFh	Channel not active (turned off)	

Input range (channel 3)

No.	Function	Measuring range / representation
00h	Does not affect permanently stored configuration data.	
01h	Pt100 in 2wire mode	-200 .. +850°C ***I*** in units of 1/10°C, two's complement
02h	Pt1000 in 2wire mode	-200 .. +500°C ***I*** in units of 1/10°C, two's complement
03h	NI100 in 2wire mode	-50 .. +250°C ***I*** in units of 1/10°C, two's complement
04h	NI1000 in 2wire mode	-50 .. +250°C ***I*** in units of 1/10°C, two's complement
06h	Resistance measurement 600Ohm 2wire	- ***I*** 600Ω = Limit value (32767)
07h	Resistance measurement 3000Ohm 2wire	- ***I*** 3000Ω = Limit value (32767)
FFh	Channel not active (turned off)	

Output range (Channel 4, Ch. 5)

No.	Function	Output range
00h	Does not affect permanently stored configuration data	
09h	Voltage ±10V Siemens S7-format	±11.76V 11.76V= End overdrive region (32511) -10V...10V = nominal range (-27648...27648) -11.76 = End underdrive region (-32512) two's complement
0Ah	Voltage 1...5V Siemens S7-format	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912) two's complement
0Dh	Voltage 0...10V Siemens S7-format	0...11.76V 11.76V= End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
0Bh	Current ±20mA Siemens S7-format	±23.52mA 23.52mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.52mA = End underdrive region (-32512) two's complement
0Ch	Current 4...20mA Siemens S7-format	0...22.81mA 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 0mA = End underdrive region (-6912) two's complement
0Eh	Current 0...20mA Siemens S7-format	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	

Note!
When exceeding the predefined range, 0V res. 0A is shown as value!

Analog part - Alarm and diagnostic

Diagnostic functions

As soon as you've activated the diagnostic alarm release in the parameterization, the following events can release a diagnostic alarm:

- Wire break
- Parameterization error
- Measuring range overflow
- Measuring range underflow

At accumulated diagnostic the CPU interrupts the user application and branches to the OB82 for diagnostic (incoming). This OB allows you with an according programming to monitor detailed diagnostic information via the SFCs 51 and 59 and to react to it. After the execution of the OB82 the user application processing is continued. The diagnostic data is consistent until leaving the OB82.

After error correction automatically a diagnostic (going) occurs if the diagnostic alarm release is still active.

In the following the record sets for diagnostic (incoming) and diagnostic (going) are specified:

Record set 0
Diagnostic (incoming)

Record set 0 (Byte 0 to 3:)

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present Bit 4: external supply voltage is missing Bit 5,6: reserved Bit 7: Wrong parameters in the 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	reserved	00h

Record set 0
Diagnostic (going)

After error correction automatically a diagnostic (going) occurs if the diagnostic alarm release is still active.

Record set 0 (Byte 0 to 3:)

Byte	Bit 7 ... Bit 0	Default
0	00h (fix)	00h
1	Bit 3 ... 0: Module class 0101 Analog module Bit 4: Channel information present Bit 7 ... 5: reserved	15h
2	reserved	00h
3	reserved	00h

Record set 1
Addition diagnostic (incoming)

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

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

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: reserved	74h
5	Number of diagnostic bits per channel	04h
6	Number of identical channels of a module	06h
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 5: Channel error Channel 5 Bit 7 ... 6: reserved	00h
8	Bit 0: Wire break Channel 0 Bit 1: Parameterization error Channel 0 Bit 2: Measuring range underflow Channel 0 Bit 3: Measuring range overflow Channel 0 Bit 4: Wire break Channel 1 Bit 5: Parameterization error Channel 1 Bit 6: Measuring range underflow Channel 1 Bit 7: Measuring range overflow Channel 1	00h
9	Bit 0: Wire break Channel 2 Bit 1: Parameterization error Channel 2 Bit 2: Measuring range underflow Channel 2 Bit 3: Measuring range overflow Channel 2 Bit 4: Wire break Channel 3 Bit 5: Parameterization error Channel 3 Bit 6: Measuring range underflow Channel 3 Bit 7: Measuring range overflow Channel 3	00h
10	Bit 0: Wire break at current output res. short circuit at voltage output Channel 4 Bit 1: Parameterization error Channel 4 Bit 2,3: reserved Bit 4: Wire break at current output res. short circuit at voltage output Channel 5 Bit 5: Parameterization error Channel 5 Bit 6,7: reserved	00h
11	reserved	00h

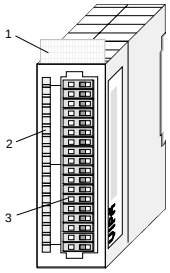
Digital part

Properties

The digital input part accepts binary control signals from the process and provides an electrically isolated interface to the central bus system. It has 16 channels that indicate the respective status by means of LEDs. Additionally, the first 12 inputs may control 3 counter.

- 16 inputs, isolated from the backplane bus whereof 4 inputs are switchable as outputs
- 3 configurable counter (continuously, once and periodically) parameterizable via the first 12 inputs / 3 counter outputs
- Status indicator for each channel by means of an LED

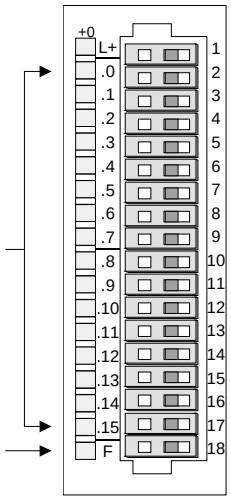
Construction



[1] Label for module description
[2] LED status indicator
[3] Edge connector

Status indicator
Pin assignment

LED	Description
L+	LED (green) Supply voltage available
.0...15	LEDs (green) I.0 up to I.15 when the input signal is "1" or the output is active the respective LED is turned on
F	LED (red) Overload, overheat or short circuit error

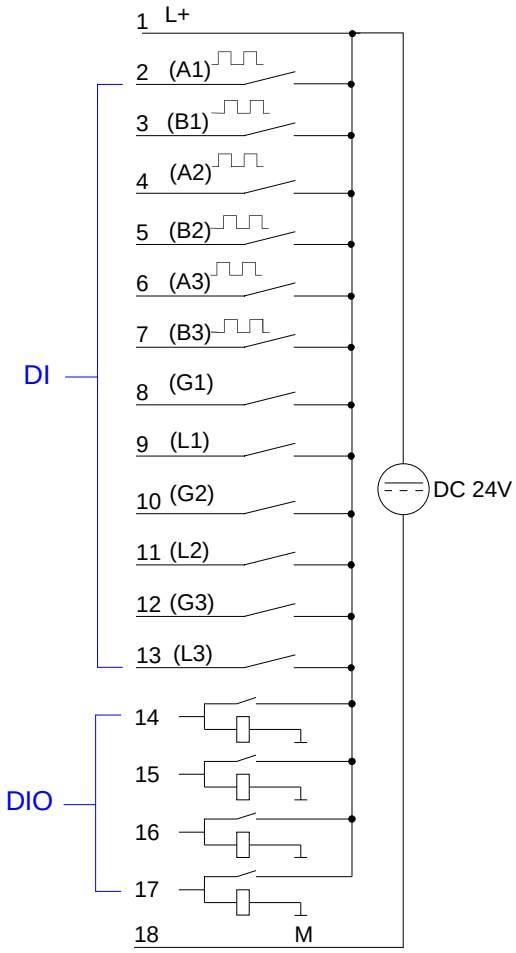


Pin	Assignment Counter activated	Counter deactivated
1	Power supply DC 24V	
2	Input Counter (A1)	I.0 (byte 3.0)*
3	Input Counter (B1)	I.1 (byte 3.1)
4	Input Counter (A2)	I.2 (byte 7.0)
5	Input Counter (B2)	I.3 (byte 7.1)
6	Input Counter (A3)	I.4 (byte 11.0)
7	Input Counter (B3)	I.5 (byte 11.1)
8	Input Counter Gate 1	I.6 (byte 12.0)
9	Input Counter Latch 1	I.7 (byte 12.4)
10	Input Counter Gate 2	I.8 (byte 12.1)
11	Input Counter Latch 2	I.9 (byte 12.5)
12	Input Counter Gate 3	I.10 (byte 12.2)
13	Input Counter Latch 3	I.11 (byte 12.6)
14	I/Q.12 Counter out 1 (byte 12.0) / Input (byte 15.0)	
15	I/Q.13 Counter out 2 (byte 12.1) / Input (byte 15.1)	
16	I/Q.14 Counter out 3 (byte 12.2) / Input (byte 15.2)	
17	I/Q.15 Output (byte 12.3) / Input (byte 15.3)	
18	Ground	

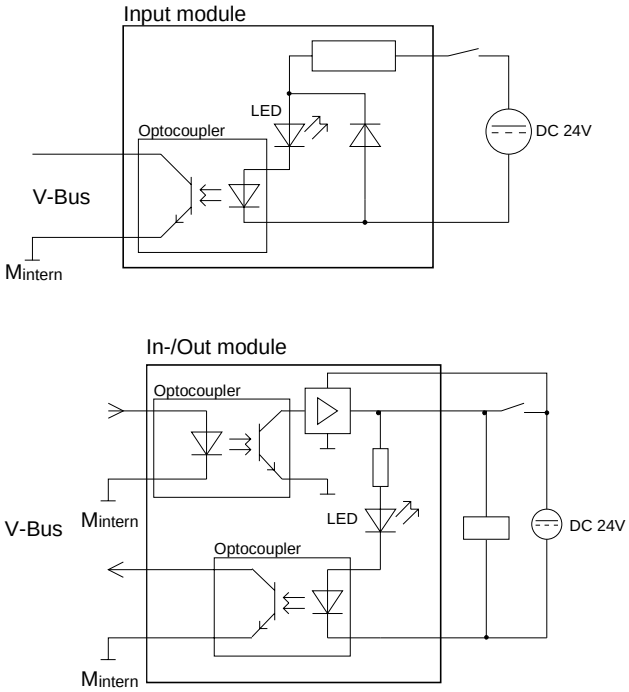
*) The byte data refer to the offset of the base address of the module.

Wiring and schematic diagram

Wiring diagram



Schematic diagram



Security hints for deploying I/O channels!

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, 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.

Digital part - Counter - Fast introduction

Include GSD

The combination module can only be used together with a CPU 21x or with the DP-V1 Profibus coupler (253-xDP01)! The project engineering takes place in the Siemens SIMATIC manager. For this the import of the corresponding GSD file is required which can be found at "service" on ftp.vipa.de.

After installation of the GSD file the combination module can be found at the hardware catalog at:

Additional Field devices > *I/O* > *VIPA_System_200V* > ...

as 2 modules:

238-2BC00 (1/2) AI4/AO2*12Bit

238-2BC00 (2/2) Counter

Please take care that you always configure both module parts in the sequence shown above

The combination module has 3 parameterizable integrated counter that are controlled via the input channels. During the counter process, the counter signal is registered and evaluated. Operating mode and additional functions are set via the parameterization.

Counter preset and parameterization

By placing both module parts within hardware configuration the counter parameters can be set with the "238-2BC00 (2/2) Counter" properties.

The digital part has to be provided with 60Byte *parameter* data. Here you define among others:

- Alarm behavior
- Assignment I/O
- Counter operating mode res. behavior
- Start value for load value, end value and comparison value register

You may alter the parameters during runtime by using the SFC 55, 56, 57 and 58, except of the parameters in record set 0. Here you have to send the wanted parameters to the counter by means of the user application using the according SFC and sending the data as record set.

Control counter by commands

The controlling of the counters happens by the output image. Here the respective counter can be controlled by commands and the software gate can be (re-)set.

After transmitting a command, the respective counter confirms the successful processing of the command by setting the corresponding handshake bit. To enable the respective counter to accept a new command, you have to transmit the command 00h to the counter. After writing the command 00h, the handshake bit assigned to this counter will be reset. The counter is released for a new command.

Counter start/stop

The counter is controlled via the internal gate (I-gate). The I-gate is the result of logic operation of hardware- (HW) and Software-gate (SW), where the HW-gate evaluation may be deactivated via the parameterization.

HW-gate: Input at $Gate_x$-input at module

SW-gate: Open (activate): Output image byte 12, set bit 4 ... 6 depending on counter

Close (deactivate): Output image byte 12, reset bit 4 ... 6 depending on counter

The following states influence the gates:

SW-gate	HW-gate	influences I-gate
0	0	0
1	0	0
0	1	0
1	1	1
0	deactivated	0
1	deactivated	1

Access to counter values via input image

The module sends back a 16byte input image that is mapped into the memory area of the CPU. Here the current values and states of the counter can be found among others.

Counter inputs (connections)

For every counter, the following inputs are available:

Pulse/A (A_x)

Pulse input for counter signal res. line A of an encoder. Here you may connect encoders with 1-, 2- or 4-thread evaluation.

Direction/B (B_x)

Here you connect the direction signal res. line B of the encoder.

You may invert the direction signal by parameterization.

Latch (L_x)

A positive edge at the digital input „Latch“ stores the recent internal counter value.

HW Gate (G_x)

You start the counter via the digital input „Hardware gate“.

Counter output

Every counter has an assigned output channel. You may set the following behavior for the according output channel via the parameterization:

- No comparison: Output is not called
- Counter value ≥ comparison value: Output is set
- Counter value ≤ comparison value: Output is set
- Pulse at comparison value: Set output for a configurable pulse duration

Digital part - Counter - Project engineering

Overview

By including the appropriate GSD into your hardware configurator the module is available via the hardware catalog.

Please take care that you always configure both module parts in the sequence:

238-2BC00 (1/2) AI4/AO2*12Bit

238-2BC00 (2/2) Counter

You may employ a max. of 2 combination modules at one system!

Parameterization

The parameterization happens in the hardware configurator. Here 60Byte parameter data are transferred:

Byte	Record set	Description
0 ... 2	0	Basic parameter (Alarm behavior, assignment I/O)
3 ... 21	81h (129)	Counter parameter counter 1
22 ... 40	82h (130)	Counter parameter counter 2
41 ... 59	83h (131)	Counter parameter counter 3

By using SFC 55, 56 and 57 you may alter the parameterization in the module during runtime. On this occasion 60byte parameter data are stored at record set 0, 81h, 82h and 83h.

Basic parameter
Record set 0

The basic parameters allow you to control the alarm behavior of the digital part and the assignment of the I/O channels that can be accessed by the according counter as output.

Byte	Description
0	Alarm generation 0 = no 1 = yes
1	Alarm selection 00h = None 01h = Diagnostics 02h = Process alarm 03h = Diagnostics- und Process alarm
2	Assignment of the in-/output channels. Here you define the assignment of the 4 I/O channels. If an I/O channel is used as input, you may output the status of the input via Byte 15 of the input image. For the operation as output, a detailed definition of the control is required in the parameter section of the according counter. Bit 0: 0 = Input I.12 1 = Output Q.12 / Counter output Q.12 Bit 1: 0 = Input I.13 1 = Output Q.13 / Counter output Q.13 Bit 2: 0 = Input I.14 1 = Output Q.14 / Counter output Q.14 Bit 3: 0 = Input I.15 1 = Output Q.15

Counter parameter
Record set 81h : C1
Record set 82h : C2
Record set 83h : C3

The parameters for the counter 1 (C1) to 3 (C3) consist of 3 identical parameter groups with each a size of 19byte.

For every counter you may set a function and start data.

Byte	Description
0	Function 00h = counting continuously 01h = once without main counting direction 02h = once with main counting direction up 03h = once with main counting direction down 04h = periodically without main counting direction 05h = periodically with main counting direction up 06h = periodically with main counting direction down 07h = counter off If the counter is deactivated, the further parameters of this counter are ignored and the according I/O channel is set as "normal" output if you want to use this channel as output. At the main counting direction "up" the counter counts from the load value to the parameterized end value in positive direction and jumps then back again to the load value with the next following encoder pulse. At the main counting direction "down" the counter counts from the load value to the parameterized end value in negative direction and jumps then back again to the load value with the next following encoder pulse.
1	Signal evaluation Bit 1...0: 00b = Impulse/Direction (Impulse at A1 / Direction at B1) 01b = Rotary encoder single (at A1 and B1) 10b = Rotary encoder double (at A1 and B1) 11b = Rotary encoder quadruple (at A1 and B1) Counter direction inverted Bit 7: 0 =Off (Count direction at B1 not inverted) 1 = On (Count direction at B1 inverted)
2	Gate function (Behavior at interruption and gate restart) Bit 0: 0 = abort (counter process starts with load value) Bit 0: 1 = interrupt (counter process continues with counter value)
	HW gate (Hardware gate via input E.6) Bit 7: 0 = Off (Counter starts with set SW gate) 1 = On (Counter only starts with set HW and SW gate)
3	Behavior of the output 0 = no comparison (Output is not influenced by counter) 1 = if counter value ≥ comparison value, set output 2 = if counter value ≤ comparison value, set output 3 = gives a pulse to the output as soon as the comparison value has been reached. The pulse duration is configured via byte 9.

continued ...

... continue

Byte	Description
4	Hysteresis 0 = off 1 = off 2 ... 255: The hysteresis serves the avoidance of many toggle processes of the output and the alarm, if the counter value is in the range of the comparison value.
5	Pulse duration (Pulse duration for the output) 0 = Counter value = comparison value (without delay) 1 = 2ms 2 = 4ms ... 255 = 510ms Only even values are permitted.
6	Alarm masking Bit 0: 0 = deactivated 1 = Alarm at opening the HW gate
	Bit 1: 0 = deactivated 1 = Alarm at closing HW gate
	Bit 2: 0 = deactivated 1 = Alarm at over-/underrun
	Bit 3: 0 = deactivated 1 = Alarm at reaching comparison value
	Bit 4: 0 = deactivated 1 = Alarm at counter pulse loss
7 ... 10	Load value (Presetting a load value) Here you may load counter 1 with a value
11 ...14	End value (Presetting a end value) The end value for counter 1 is not relevant if there is no main counting direction defined (forwards or backwards).
15 ... 18	Compare value (Presetting a comparison value) The counter value is compared with the comparison value and depending on that the behavior of the according output of counter 1 is controlled.

Attention!

Please regard you have to store the record sets 81h, 82h and 83h within a data block starting with an **odd** address, otherwise you have shifts and incorrect double word accesses!

Data to digital part (output image)

The digital part gets its data from the CPU in form of a 16byte data block. The data block has the following structure:

Byte	Description
0 ... 3	Value counter 1
4 ... 7	Value counter 2
8 ... 11	Value counter 3
12	Bit 0: Output Bit Q.12 / Release counter output 1 [1)] Bit 1: Output Bit Q.13 / Release counter output 2 Bit 2: Output Bit Q.14 / Release counter output 3 Bit 3: Output Bit Q.15 Bit 4: Software Gate counter 1 Bit 5: Software Gate counter 2 Bit 6: Software Gate counter 3 Bit 7: not evaluated
13	Command for counter 1
14	Command for counter 2
15	Command for counter 3

1) The outputs may only be used as digital output if you parameterized them as "output" in the basic parameterization.

Communication via handshake bit

After transmitting a command, the respective counter confirms the successful processing of the command by setting the corresponding handshake bit. To enable the respective counter to accept a new command, you have to transmit the command 00h to the counter. After writing the command 00h, the handshake bit assigned to this counter will be reset. The counter is released for a new command.

Command overview

The following commands are available:

Command	Function	Description
00h	Reset command handshake	Release for a new command (must precede each command)
A0h	Set counter value	By means of these commands, a value set under "Value counter ..." is transferred to the according register of a counter.
A1h	Set load value	
A2h	Set comparison value	
A3h	Set end value	
A4h	Set latch value	
A5h	Set hysteresis value	
A6h	Set value of pulse duration	
A7h	reserved	
80h	Counter value	These commands cause the counter to send back a certain register value in the input image of the corresponding counter.
81h	Load value	
82h	Comparison value	
83h	End value	
84h	Latch (display latch value)	
85h	Hysteresis value	
86h	Pulse duration value	
87h	reserved	

Data from digital part (input image)

The module sends back a 16byte input image that maps into the memory area of the CPU. The structure of input data depends on counter activation:

Byte	Counter activated	Counter deactivated
0 ... 3	Image counter 1	Byte 0 ... 2: 0 Byte 3: Bit 0: I.0 Bit 1: I.1
4 ... 7	Image counter 2	Byte 4 ... 6: 0 Byte 7: Bit 0: I.2 Bit 1: I.3
8 ... 11	Image counter 3	Byte 8 ... 10: 0 Byte 11: Bit 0: I.4 Bit 1: I.5
12	Gate/Latch Bit 0: Input I.6: Status input HW gate counter 1 Bit 1: Input I.8: Status input HW gate counter 2 Bit 2: Input I.10: Status input HW gate counter 3 Bit 3: 0 (fix) Bit 4: Input I.7: Status input Latch 1 Bit 5: Input I.9: Status input Latch 2 Bit 6: Input I.11: Status input Latch 3 Bit 7: 0 (fix)	
13	Internal gate / last counter direction If the counter operating mode is set to "off", these Bits are "0". Bit 0: Status internal gate 1 Bit 1: Status internal gate 2 Bit 2: Status internal gate 3 Bit 3: 0 (fix) Bit 4: 0= counter direction counter 1 down 1= counter direction counter 1 up Bit 5: 0= counter direction counter 2 down 1= counter direction counter 2 up Bit 6: 0= counter direction counter 3 down 1= counter direction counter 3 up Bit 7: 0 (fix)	0
14	Status of the counter outputs/command handshake Bit 0: Status internal counter output counter 1 Bit 1: Status internal counter output counter 2 Bit 2: Status internal counter output counter 3 Bit 3: 0 (fix) Bit 4: Status command handshake counter 1 Bit 5: Status command handshake counter 2 Bit 6: Status command handshake counter 3 Bit 7: 0 (fix)	0
15	Status inputs If the channel is set as output, the according Bit is "0" Bit 0: Status input I.12 Bit 1: Status input I.13 Bit 2: Status input I.14 Bit 3: Status input I.15 Bit 7 ... 4: 0 (fix)	

Digital part - Counter - Functions

Operating modes

The combination module has 3 parameterizable integrated counter that are controlled via the input channels. During the counter process, the counter signal is registered and evaluated. Operating mode and additional functions are set via the parameterization.

For the counter, the following operating modes are available:

- Count endless – Distance measuring with incremental encoder
- Count once – Count to a maximum limit
- Count periodic– Count with repeated counter process

The operating modes "Count once" and "Count periodic“ allow you to transfer the counter area as start res. end value via the parameterization.

Each counter is parameterizable with additional functions like gate function, latch function, comparison, hysteresis a process alarm.

Counter inputs (connections)

For every counter, the following inputs are available:

Pulse/A (A_x)

Pulse input for counter signal res. line A of an encoder. Here you may connect encoders with 1-, 2- or 4-thread evaluation.

Direction/B (B_x)

Here you connect the direction signal res. line B of the encoder.

You may invert the direction signal by parameterization.

Latch (L_x)

A positive edge at the digital input „Latch“ stores the recent internal counter value.

HW Gate (G_x)

You start the counter via the digital input „Hardware gate“.

Counter output

Every counter has an assigned output channel. You may set the following behavior for the according output channel via the parameterization:

- No comparison: Output is not called
- Counter value ≥ comparison value: Output is set
- Counter value ≤ comparison value: Output is set
- Pulse at comparison value: Set output for a configurable pulse duration

Maximum counter frequency

At the designation of maximum counter frequency, two types of indication are distinguished:

- Maximum pulse frequency

  The maximum pulse frequency is the maximum frequency the adjacent signal may have, i.e. the maximum frequency at witch the pulses arrive at the module. At this module the maximum pulse frequency depends on the counter-signal-evaluation chosen.

Signal evaluation	Maximum pulse frequency
single	30kHz
duplicate	15kHz
quaduplicate	7.5kHz

- Maximum counter frequency

  The maximum counter frequency is the frequency at witch can be internally counted to the maximum.
  At employment of all 3 counters, every counter may use a frequency of max. 30kHz. If you employ only 1 counter channel, the counter supports a max. frequency of 100kHz.

Main counting direction

The parameterization allows you to define a main counting direction for every counter.

If you choose "none", the complete counting range is available:

	Valid value range
Lower count limit	- 2 147 483 648 (-2^{31})
Upper count limit	+ 2 147 483 647 (2^{31}-1)

Main counting direction forward

Upper restriction of the count range. The counter counts 0 res. load value in positive direction until the parameterized end value –1 and jumps then back to the load value with the next following encoder pulse.

Main counting direction backwards

Lower restriction of the count range. The counter counts from the parameterized start- res. load value in negative direction to the parameterized end value +1 and jumps then back to the start value with the next following encoder pulse.

Abort - interrupt

Abort count process

The count process starts after closing and restart of the gate beginning with the load value.

Interrupt count process

The count process continuous after closing and restart of the gate beginning with the last recent counter value.

Digital part - Counter - Operating modes

Overview

For the counter, the following operating modes are available separate configurable:

- Count endless – Distance measuring with incremental encoder
- Count once – Count to a maximum limit
- Count periodic– Count with repeated counter process

Continuously

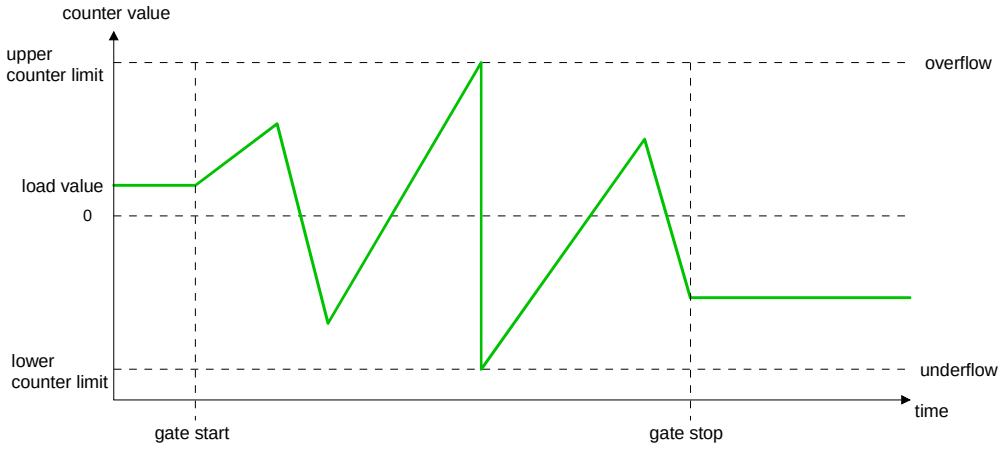
In this operating mode, the counter counts from 0 res. from the load value.

When the counter counts forward and reaches the upper count limit and another counting pulse in positive direction arrives, it jumps to the lower count limit and counts from there on.

When the counter counts backwards and reaches the lower count limit and another counting pulse in negative direction arrives, it jumps to the upper count limit and counts from there on.

The count limits are set to the maximum count range.

	Valid value range
Lower count limit	- 2 147 483 648 (-2^{31})
Upper count limit	+ 2 147 483 647 (2^{31}-1)
Counter value	- 2 147 483 648 (-2^{31}) to + 2 147 483 647 (2^{31}-1)
Load value	- 2 147 483 647 (-2^{31}+1) to + 2 147 483 646 (2^{31}-2)



Note!

When counting continuously the parameter *main counting direction* is ignored!

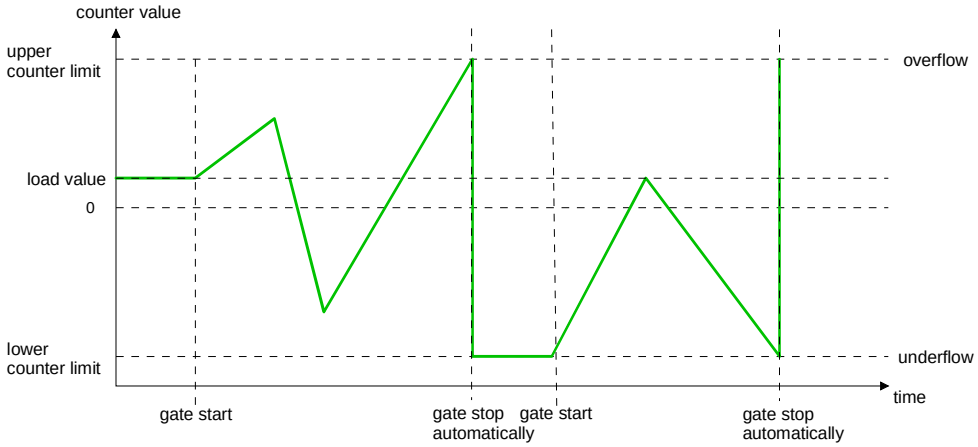
Once

No main counting direction

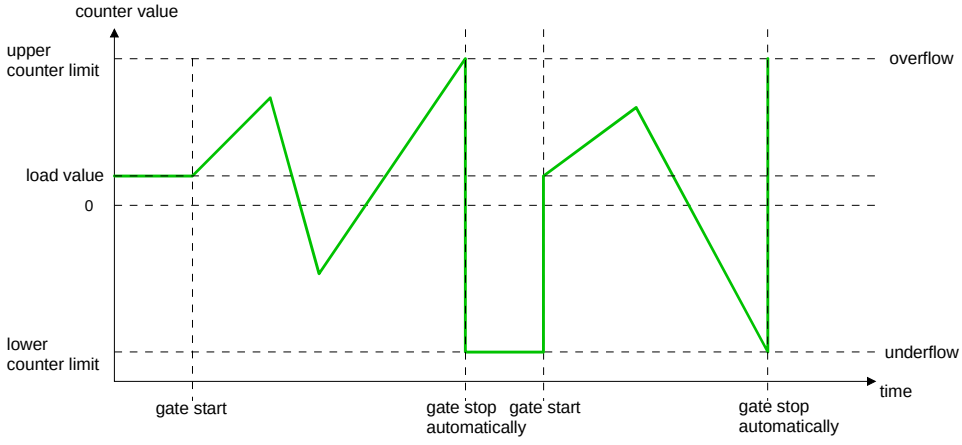
- The counter counts once starting with the load value.
- You may count forward and backwards.
- The count limits are set to the maximum count range.
- At over- or underrun at the count limits, the counter jumps to the according other count limit and counts from there on. The gate is automatically closed.
- To restart the count process, you must create a positive edge of the gate.
- At interrupting gate control, the count process continuous with the last recent counter value.
- At aborting gate control, the counter starts with the load value.

	Valid value range
Lower count limit	- 2 147 483 648 (-2^{31})
Upper count limit	+ 2 147 483 647 (2^{31}-1)
Counter value	- 2 147 483 648 (-2^{31}) to + 2 147 483 647 (2^{31}-1)
Load value	- 2 147 483 647 (-2^{31}+1) to + 2 147 483 646 (2^{31}-2)

Interrupting gate control:



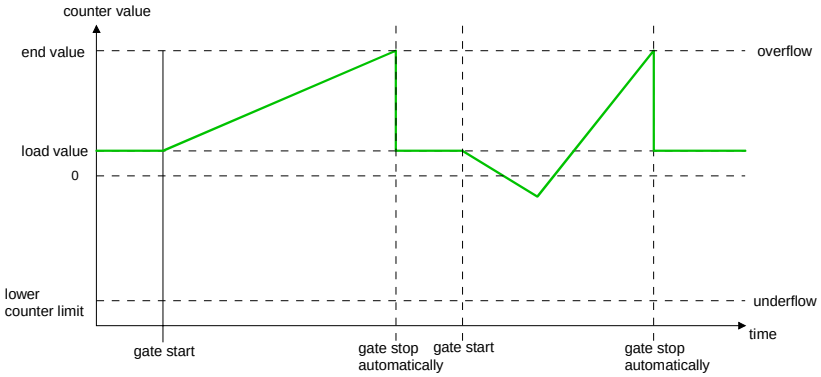
Aborting gate control:



Main counting direction forward

- The counter counts starting with the load value.
- When the counter reaches the end value –1 in positive direction, it jumps to the load value at the next positive count pulse and the gate is automatically closed.
- To restart the count process, you must create a positive edge of the gate. The counter starts with the load value.

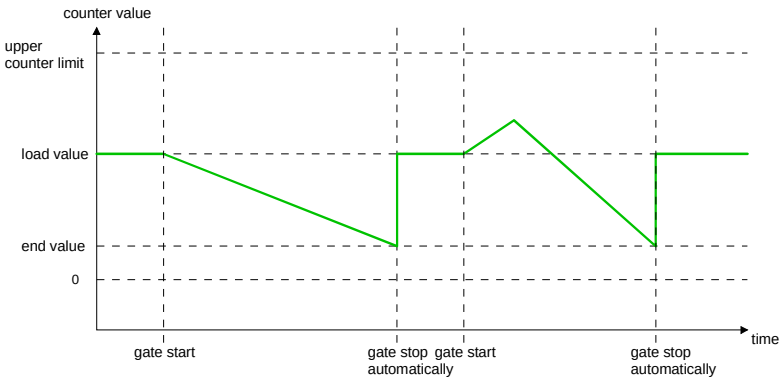
	Valid value range
End value	- 2 147 483 646 ($-2^{31}+1$) to + 2 147 483 646 ($2^{31}-1$)
Lower count limit	- 2 147 483 648 (-2^{31})
Counter value	- 2 147 483 648 (-2^{31}) to end value -1
Load value	- 2 147 483 648 (-2^{31}) to end value -2



Main counting direction backwards

- The counter counts starting with the load value.
- When the counter reaches the end value in negative direction, it jumps to the load value at the next negative count pulse and the gate is automatically closed.
- To restart the count process, you must create a positive edge of the gate. The counter starts with the load value.

	Valid value range
End value	- 2 147 483 646 ($-2^{31}+1$) to + 2 147 483 646 ($2^{31}-1$)
Upper count limit	+2 147 483 646 ($2^{31}-1$)
Counter value	- 2 147 483 646 ($-2^{31}+1$) to + 2 147 483 646 ($-2^{31}-1$)
Load value	- 2 147 483 646 ($-2^{31}+1$) to + 2 147 483 646 ($-2^{31}-1$)

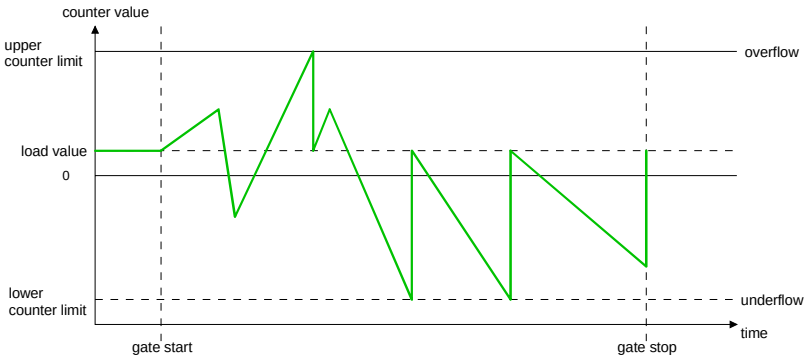


Periodically

No main counting direction:

- The counter counts starting with the load value.
- At over- or underrun at the count limits, the counter jumps to the according other count limit and counts from there on.
- The count limits are set to the maximum count range.

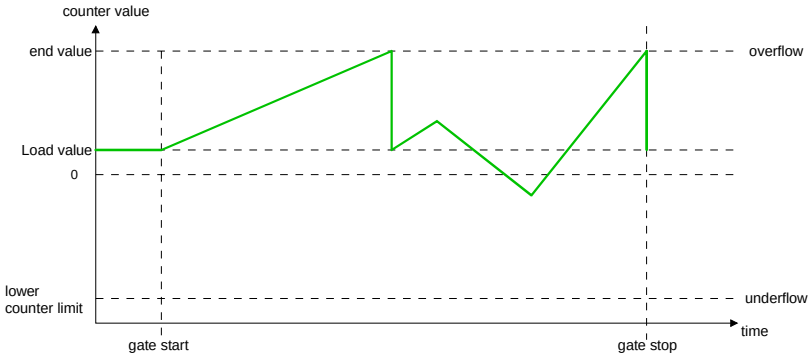
	Valid value range
Lower count limit	- 2 147 483 648 (-2^{31})
Upper count limit	+ 2 147 483 647 (2^{31}-1)
Counter value	- 2 147 483 648 (-2^{31}) to + 2 147 483 647 (2^{31}-1)
Load value	- 2 147 483 647 (-2^{31}+1) to + 2 147 483 646 (2^{31}-2)



Main counting direction forward

- The counter counts starting with the load value.
- When the counter reaches the end value –1 in positive direction, it jumps to the load value at the next positive count pulse.

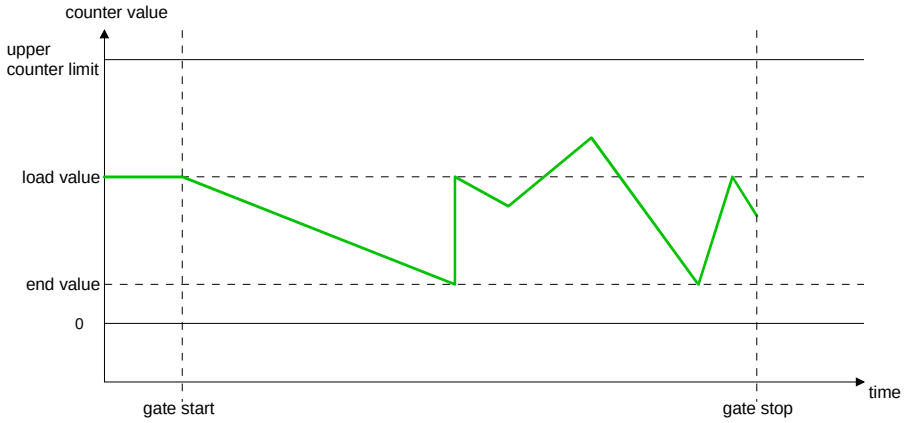
	Valid value range
Limit value	- 2 147 483 647 (-2^{31}+1) to + 2 147 483 647 (2^{31}-1)
Lower count limit	- 2 147 483 648 (-2^{31})
Counter value	- 2 147 483 648 (-2^{31}) to end value -1
Load value	- 2 147 483 648 (-2^{31}) to end value -2



Main counting direction backwards

- The counter counts starting with the load value.
- When the counter reaches the end value in negative direction, it jumps to the load value at the next negative count pulse.
- You may exceed the upper count limit.

	Valid value range
Limit value	- 2 147 483 647 ($-2^{31}+1$) to + 2 147 483 647 ($2^{31}-1$)
Upper count limit	+2 147 483 647 ($2^{31}-1$)
Counter value	- 2 147 483 647 ($-2^{31}+1$) to +2 147 483 647 ($2^{31}-1$)
Load value	- 2 147 483 647 ($-2^{31}+1$) to +2 147 483 647 ($2^{31}-1$)



Digital part - Counter - Additional functions

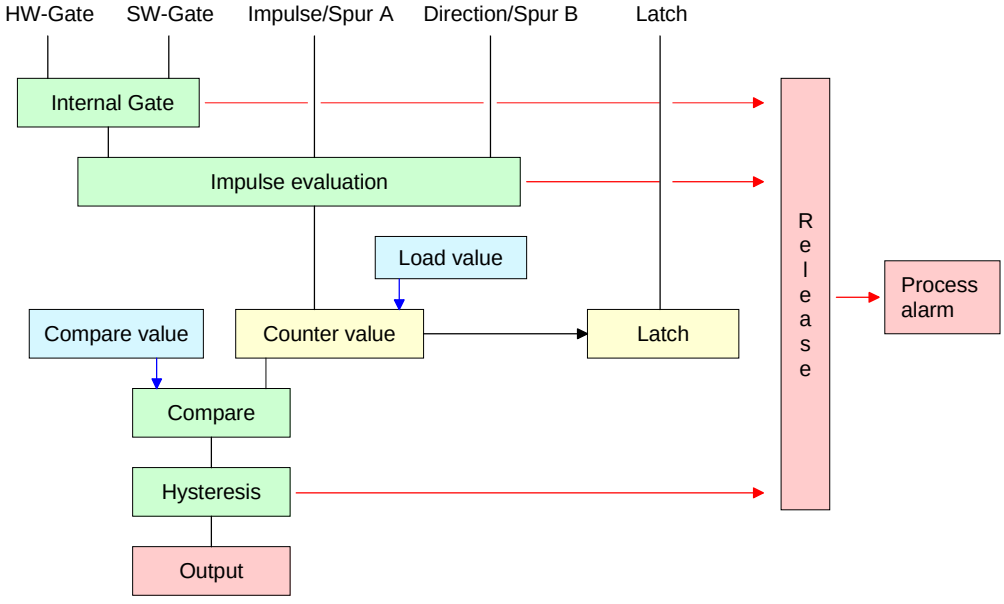
Overview

The additional functions listed in the following can be set for every counter via the parameterization:

- Gate function
  The gate function serves the start, stop and interruption of a counter function
- Latch function
  As soon as a positive edge is registered at the latch input, a recent counter value is stored in the latch register.
- Comparison
  You may set a comparison value that activates a digital output res. throws a process alarm depending on the recent counter value.
- Hysteresis
  By setting a hysteresis you may prevent a continuous toggling of an output if the value of an encoder signal fluctuates around a comparison value.
- Alarm
  For the following events you may parameterize an alarm:
  - status change of the HW gate
  - Over- res. underrun
  - Reaching a comparison value
  - Loss of a counter pulse

Schematic structure

The illustration shows how the additional functions influence the counter behavior. The following pages give you a more detailed explanation of the additional functions:



Gate function

The counter is controlled via the internal gate (I-gate). The I-gate is the result of logic operation of hardware- (HW) and Software-gate (SW), where the HW-gate evaluation may be deactivated via the parameterization.

HW-gate: Input at $Gate_x$-input at module

SW-gate: Open (activate): Output image Byte 12, set Bit 4 ... 6 depending on counter

Close (deactivate): Output image Byte 12, reset Bit 4 ... 6 depending on counter

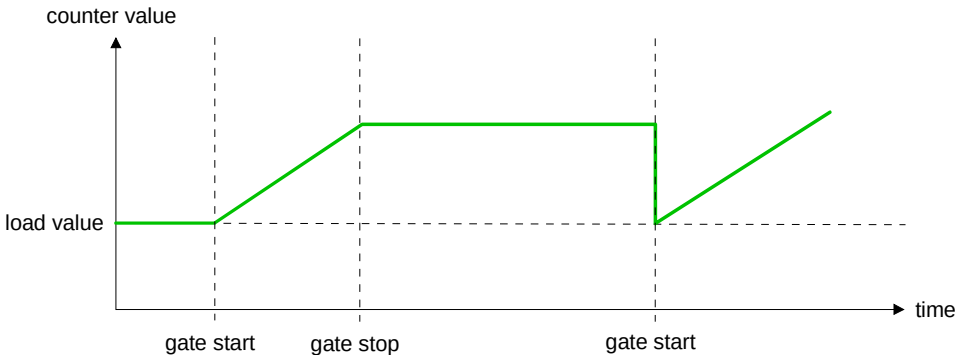
The following states influence the gates:

SW-gate	HW-gate	influences I-gate
0	0	0
1	0	0
0	1	0
1	1	1
0	deactivated	0
1	deactivated	1

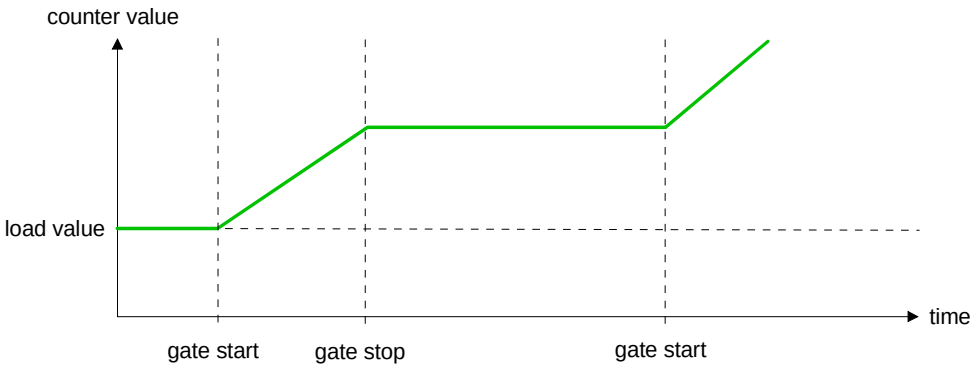
Gate function Abort and Interrupt

The parameterization defines if the gate interrupts or aborts the counter process.

- At *abort function* the counter starts counting with the load value after gate restart.



- At *interrupt function*, the counter starts counting with the last recent counter value after gate restart.



Latch function

As soon as a positive edge at the "latch input" results from the counter process, a recent counter value is stored in the according latch register.

The "input image" gives you access to the latch register.

Compare function

The parameterization presets the behavior of the counter output:

- No comparison
- Counter value ≥ comparison value
- Counter value ≤ comparison value
- Pulse at comparison value

No comparison

The output is set like a normal output.

Counter value ≥ comparison value

If the counter value is equal or higher than the comparison value, the output is set.

Counter value ≤ comparison value

If the counter value is smaller or equal than the comparison value, the output is set.

Pulse at comparison value

When the counter reaches the comparison value, the output is set active for the parameterized pulse duration.

If you've set a main counter direction, the output is only set off the main counter direction at reaching the comparison value.

Pulse duration

The pulse duration tells for what time the output is set. It can be preset in steps of 2ms between 0 and 510ms. Please regard that the counter pulse times must be higher than the minimum toggle times of the digital output.

If the pulse duration = 0, the output is set active until the comparison condition is not longer fulfilled.

The pulse duration starts with the setting of the according digital output. The inaccuracy of the pulse duration is smaller than 1ms.

There is no finish triggering of the pulse duration if the comparison value is not met for a short time during a pulse output.

Hysteresis

The hysteresis serves the avoidance of many toggle processes of the output and the alarm, if the counter value is in the range of the comparison value.

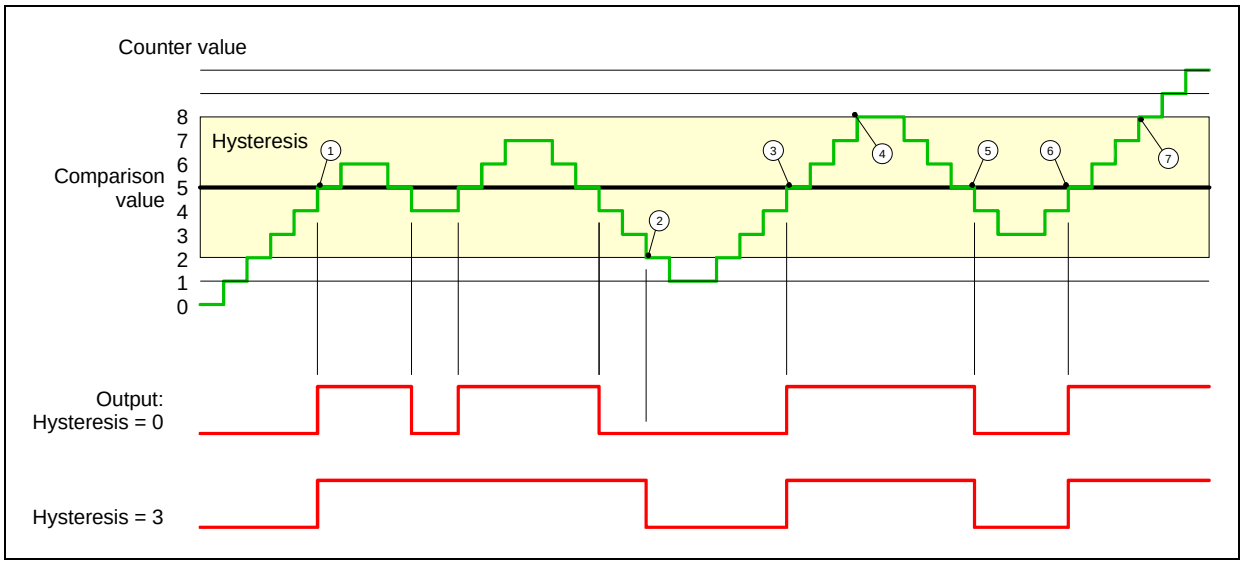
You may set a range of 0 to 255. The settings 0 and 1 deactivate the hysteresis. The hysteresis also influences the over- and underflow.

An activated hysteresis remains active after a change. The new hysteresis range is taken over at the next reach of the comparison value.

The view below shows the action of the at hysteresis 0 and 3

In the following illustration the behavior of the output is represented with hysteresis 0 and hysteresis 3 for the appropriate conditions:

Action when Counter value ≥ Comparison value



① Counter value ≥ Comparison value → Output is set and hysteresis is activated

② Leaving the hysteresis area → Output is reset

③ Counter value ≥ Comparison value → Output is set and hysteresis is activated

④ Leaving the hysteresis area, output is just set as Counter value ≥ Comparison value

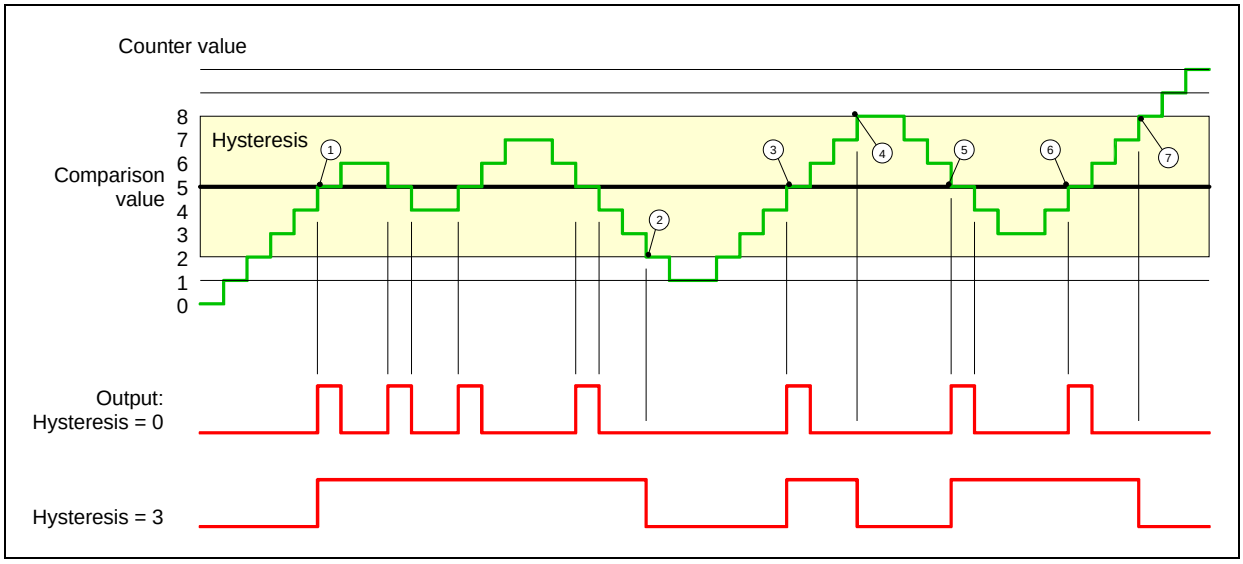
⑤ Counter value < Comparison value an hysteresis not activated → Output is reset

⑥ Counter value ≥ Comparison value → Output is set and hysteresis is activated

⑦ Leaving the hysteresis area, output is just set as Counter value ≥ Comparison value

As reaching the comparison condition the hysteresis is activated. The comparison result is as static as the counter value leaves the parameterized hysteresis area. After leaving the hysteresis area only again with reaching comparison condition the hysteresis is activated.

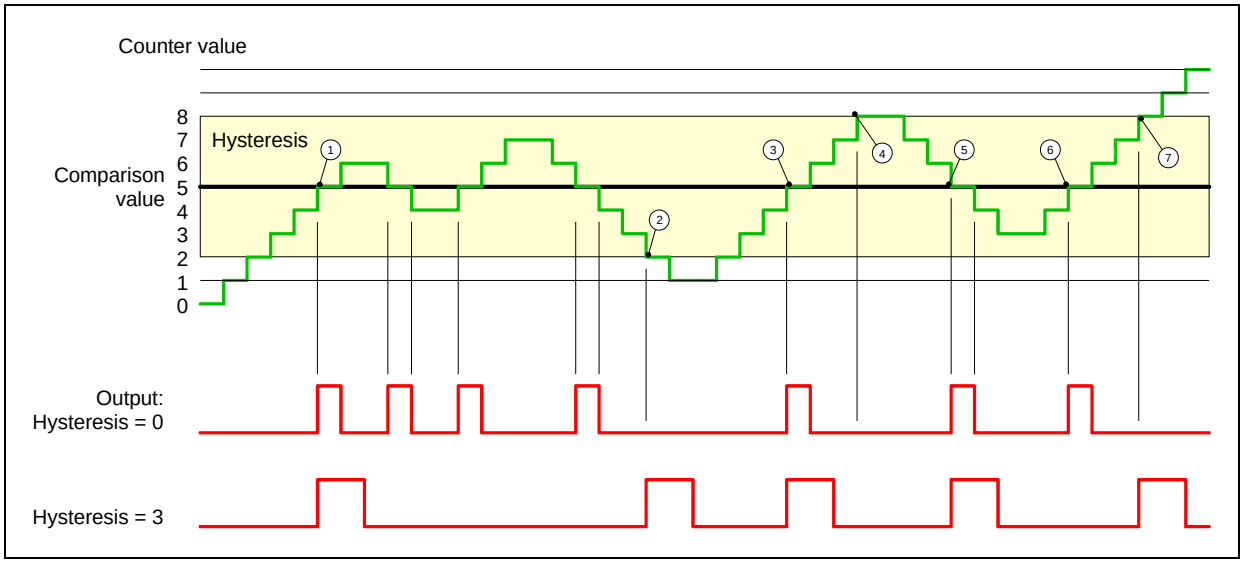
Action at pulse at comparison value and Pulse width equal to zero



① Counter value = Comparison value → Output is set and hysteresis is activated
② Leaving the hysteresis area → Output is reset
③ Counter value = Comparison value → Output is set and hysteresis is activated
④ Counter value > Comparison value and leaving the hysteresis area so output is reset
⑤ Counter value = Comparison value → Output is set and hysteresis is activated
⑥ Counter value = Comparison value and hysteresis is just activated → Output is static set
⑦ Leaving the hysteresis area and Counter value > Comparison value → Output is reset

As reaching the comparison condition the hysteresis is activated. The comparison result is as static as the counter value leaves the parameterized hysteresis area. After leaving the hysteresis area only again with reaching comparison condition the hysteresis is activated.

Action at pulse at comparison value and Pulse width not equal to zero



① Counter value = Comparison value → Hysteresis is switched active, a pulse of the specified length is output and the counting direction is stored

② Leaving the hysteresis area against the stored counter direction → A pulse of the specified length is output and the hysteresis deactivated

③ Counter value = Comparison value → Hysteresis is switched active, a pulse of the specified length is output and the counting direction is stored

④ Leaving Hysteresis area without changing counting direction → Hysteresis is deactivated

⑤ Counter value = Comparison value → Hysteresis is switched active, a pulse of the specified length is output and the counting direction is stored

⑥ Counter value = Comparison value and hysteresis is activated → no pulse

⑦ Leaving the hysteresis area against the stored counting direction → A pulse of the specified length is output and the hysteresis deactivated

As reaching the comparison condition the hysteresis is activated and a pulse of the specified length is output. As long as the counter value is within the hysteresis area no further pulse is output. With hysteresis activation the counting direction is stored by the PLC. If the counter value leaves the hysteresis area against the stored counting direction, an impulse of the of the specified length is output. When leaving the hysteresis area without change of counter direction there is no pulse output.

Digital part - Counter - Alarm and diagnostic

Overview

The parameterization allows you to define the following trigger for a process alarm:

- Status change of the HW gate
- Over- / Underflow
- Reaching a comparison value
- Loss of a counter pulse

You may globally activate a diagnostic alarm for all channels. A diagnostic alarm occurs as soon as at processing a process alarm a process alarm is initialized in OB40 for the same channel and the same event.

Process alarm

A process alarm causes the call of OB40. Within the OB40 you may search the logical basic address of the module that threw the process alarm by using the *local word 6*.

The *local word 8* allows you to access the data that the module provides in case of an alarm. The *local word 8* has the following structure:

Byte	Bit 7 ... Bit 0
8	Bit 0: Channel 1 Comparison value reached Bit 1: Channel 1 Pulse lost Bit 2: Channel 2 HW gate open Bit 3: Channel 2 HW gate closed Bit 4: Channel 2 Overflow Bit 5: Channel 2 Comparison value reached Bit 6: Channel 2 Pulse lost Bit 7: reserved
9	Bit 0: Channel 0 HW gate open Bit 1: Channel 0 HW gate closed Bit 2: Channel 0 Overflow Bit 3: Channel 0 Comparison value reached Bit 4: Channel 0 Pulse lost Bit 5: Channel 1 HW gate open Bit 6: Channel 1 HW gate closed Bit 7: Channel 1 Overflow

Release diagnostic alarm

During a process alarm is processed by the PLC in OB40 a diagnostic alarm can be released (if activated) by the same event at the same channel.

This interrupts the current process alarm execution in OB40 and branches to OB82 for processing the diagnostic alarm (incoming). If during the diagnostic alarm execution further events at other channels occur that may also initialize a process res. diagnostic alarm, these are temporarily stored.

After finishing the current diagnostic alarm execution, the sum diagnostic message "process alarm lost" informs the CPU that in the meantime other process alarms has occurred.

Diagnostic alarm

As soon as you've activated the diagnostic alarm a diagnostic alarm occurs during the processing a process alarm in OB40 for the same channel and the same event.

At accumulated diagnostic the CPU interrupts the user application and branches to the OB82 for diagnostic (incoming). This OB allows you with an according programming to monitor detailed diagnostic information via the SFCs 51 and 59 and to react to it.

After the execution of the OB82 the user application processing is continued. The diagnostic data is consistent until leaving the OB82.

After error correction automatically a diagnostic (going) occurs if the diagnostic alarm release is still active.

In the following the record sets for diagnostic (incoming) and diagnostic (going) are specified:

Record set 0
Diagnostic (incoming)

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: internal error Bit 2: reserved Bit 3: channel error present Bit 7 ... 4: reserved	00h
1	Bit 3 ... 0: Module class 1000: Function module Bit 4: Channel information present Bit 7 ... 5: reserved	18h
2	00h (fix)	00h
3	Bit 5 ... 0: reserved Bit 6: process alarm lost Bit 7: reserved	00h

Record set 0
Diagnostic (going)

After error correction automatically a diagnostic (going) occurs if the diagnostic alarm release is still active.

Record set 0 (Byte 0 to 3:)

Byte	Bit 7 ... Bit 0	Default
0	00h (fix)	00h
1	Bit 3 ... 0: Module class 1000: Function module Bit 4: Channel information present Bit 7 ... 5: reserved	18h
2	00h (fix)	00h
3	00h (fix)	00h

Record set 1
Extended diagnostic (incoming)

Byte 0 to 11:

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

Record set 1 (Byte 0 to 11):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	Content record set 0 (see page before)	-
4	Bit 6 ... 0: Channel type 76h: Counter Bit 7: reserved	76h
5	Number of diagnostic bits per channel	08h
6	Number of similar channels (Counter)	03h
7	Bit 0: Channel error channel 0 Bit 1: Channel error channel 1 Bit 2: Channel error channel 2 Bit 7 ... 3: reserved	00h
8	Error screen channel 0 Bit 0: HW gate open Bit 1: HW gate closed Bit 2: Overflow Bit 3: Comparison value reached Bit 4: Pulse lost Bit 7 ... 5: reserved	00h
9	Error screen channel 1 Bit 0: HW gate open Bit 1: HW gate closed Bit 2: Overflow Bit 3: Comparison value reached Bit 4: Pulse lost Bit 7 ... 5: reserved	00h
10	Error screen channel 2 Bit 0: HW gate open Bit 1: HW gate closed Bit 2: Overflow Bit 3: Comparison value reached Bit 4: Pulse lost Bit 7 ... 5: reserved	00h
11	reserved	00h

Technical Data

General

Dimensions and weight	238-2BC00
Current consumption via back plane bus	280mA
Dimensions (WxHxD) in mm	50.8x76x88mm
Weight	100g

Analog In-/Output

Electrical Data	VIPA 238-2BC00 (1/2) AI4/AO2*12Bit							
Number of Current-/Voltage input	3							
Number of resistance input	1							
Number of outputs	2							
Length of cable: shielded	200m							
Voltages, Currents, Potentials								
Supply voltage	DC 24V (20.4 ... 28.8V)							
- reverse polarity protection	yes							
Constant current for resistance-type sensor	1.25mA							
Isolation - channels / backplane bus - channel / power supply of the electronic - between the channels	 yes yes no							
Permitted potential difference - between the inputs (U_{CM}) - between the inputs and $M_{INTERNAL}$ (U_{ISO})	 DC 4V DC 75V/AC 60V							
Isolation tested with	DC 500V							
Current consumption								
- from the power supply L+	60mA (no load)							
Power dissipation of the module	2W							
Analog value calculation input	Conversion time/Resolution (per channel)							
Measuring principle	Sigma-Delta							
Parameterizable	Yes							
Conversion rate (Hz)	200	170	120	60	30	15	7.5	3.7
Integration time (ms)	5	6	8	17	33	67	133	270
Basic conversion time (ms)	7	8	10	19	35	69	135	272
Resolution (Bit) incl. overrange	10	12	14	15	16	16	16	16
Noise suppression for frequency f1 (Hz)	no					50 and 60Hz		
Basic execution time of the module, in ms (all channels enabled)	28	32	40	76	140	276	540	1088
Smoothing of the measured values	none							
Analog value calculation output channels								
Resolution (incl. overrange)								
±10V, ±20mA	11bit + sign							
4 ... 20mA, 1 ... 5V	10bit							
0 ... 10V, 0 ... 20mA	11bit							
Conversion time (per channel)	1.5ms							
Settling time								
impedance load	0.3ms							
capacitive load	1.0ms							
inductive load	0.5ms							

continued ...

... continue

Suppression of interference, limits of error input channels		
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)		
Common-mode interference (U_{CM} < 5V)	> 80dB	
Series-mode noise (peak value of noise < nominal value of input range	> 80dB	
Crosstalk between the inputs	> 50dB	
Operational limit (only valid to 120W/s) (in the entire temperature range, referring to input range)		
	Measuring range	Tolerance
voltage input	±400mV, ±4V, ±10V	±0.3%
	1 ... 5V	±0.7%
	0 ... 10V	±0.4%
current input	±20mA	±0.3%
	0 ... 20mA	±0.6%
	4 ... 20mA	±0.8%
Resistors	0 … 600Ω, 0 …3kΩ	±0.4%
Resistance thermometer	Pt100, Pt1000	±0.4%
	Ni100, Ni1000	±1.0%
Basic error limit (only valid to 120W/s) (during temperature is 25°C, referring to input range)		
	Measuring range	Tolerance
Voltage input	400mV, ±4V, ±10V	±0.2%
	1 .. 5V	±0.5%
	0 ... 10V	±0.3%
Current input	±20mA	±0.2%
	0 ... 20mA	±0.4%
	4 ... 20mA	±0.5%
Resistors	0 …600Ω, 0 … 3kΩ	±0.2%
Resistance thermometer	Pt100, Pt1000	±0.2%
	Ni100, Ni1000	±0.5%
Temperature error (with reference to the input range) measuring current		±0.005%/K ±0.015%/K
Linearity error (with reference to the input range)		±0.02%
Repeatability (in steady state at 25°C referred to the input range)		±0.05%
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
	Measuring range	Tolerance
Voltage output	±10V	±0.4%[1)]
	0 … 10V	±0.6%[1)]
	1 … 5V	±0.8%[1)]
Current output	±20mA	±0.3%[2)]
	0 … 20mA	±0.6%[2)]
	4 … 20mA	±0.8%[2)]

continued ...

... continue

Basic error limit (during temperature is 25°C, referring to output range)		
	Measuring range	Tolerance
Voltage output	1 … 5V	±0.4%[1)]
	0 … 10V	±0.3%[1)]
	±10V	±0.2%[1)]
Current output	±20mA	±0.2%[2)]
	0 … 20mA	±0.4%[2)]
	4 … 20mA	±0.5%[2)]
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.05%	
Repeatability (in steady state at 25°C referred to the output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	
States, Alarms, Diagnostic		
Diagnostic alarm	parameterizable	
Diagnostic functions		
- Sum error monitor	red LED (SF)	
- Diagnostic information readable	possible	
Substitute value can be applied	yes	
Data for choosing an encoder		
Voltage input		
±400mV	10MΩ	
±4V, ±10V, 1 ... 5V, 0 ... 10V	120kΩ	
Current input		
±20mA, 0 ... 20mA, 4 ... 20mA	33Ω (90Ω starting with release 3)	
Resistors		
0...600Ω, 0...3kΩ	10MΩ	
Resistance thermometer		
Pt100, Pt1000, Ni100, Ni1000	10MΩ	
Maximum input voltage for voltage input (destruction limit)	25V	
Maximum input current for current input (destruction limit)	30mA	
Connection of the sensor		
For measuring voltage	yes	
For measuring current		
as 2wire transmitter	possible with external power supply	
as 4wire transmitter	yes	
For measuring resistance		
with 2conductor connection	yes	
Characteristic linearization		
for RTD	Pt100, Pt1000, Ni100, Ni1000	

continued ...

... continue

Data for choosing an actuator	
Output ranges (rated values)	
Voltage	±10V, 1 ... 5V, 0 ... 10V
Current	±20mA, 0 ... 20mA, 4 ... 20mA
Load resistance (in nominal range of the output)	
At voltage outputs	min. 1kΩ
- capacitive load	max. 1µF
At current output	max. 500Ω
- Inductive load	max. 10mH
Voltage outputs	
Short-circuit protection	yes
Short-circuit current	max. 31mA
Current outputs	
No-load voltage	max. 13V
Destruction limit against voltages/currents applied from outside	
Voltage at outputs to M_{ANA}	max. 15V
Current	max. 30mA
Connection of actuators	
for voltage output	2conductor connection
for current output	2conductor connection
Parameter data	
Input data	8byte (1 word per channel)
Output data	4byte (1 word per channel)
Parameter data	16byte
Diagnostic data	12byte

[1] The error limits are measured with a load of R=1GΩ. For voltage output the output impedance is 50Ω.

[2] The error limits are measured with a load of R=10Ω.

Digital Input

Elektrical Data	VIPA 238-2BC00 (2/2) Counter
Number of inputs	16
Counter	3 (2 inputs each A, B)
Nominal input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 28.8V
Input filter time delay	3ms
Input filter pulse input	100µs
Maximum counter frequency	30kHz
Input current	typ. 7mA
Supply voltage	5V via backplane bus
Isolation	500Veff (field voltage - backplane bus)
Status monitor	via LEDs at the front side
Parameter data	
Input data	16byte
Output data	16byte
Parameter data	60byte
Diagnostic data	12byte

Appendix

A Index

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