VIPA System SLIO

SM | Manual

HB300E_SM | Rev. 10/50

December 2010

VIPA art of automation

VIPA, Gesellschaft für Visualisierung und Prozessautomatisierung mbH
Ohmstraße 4, D-91074 Herzogenaurach, Germany
Tel.: +49 (91 32) 744 -0
Fax.: +49 9132 744 1864
EMail: info@vipa.de
http://www.vipa.de

Note

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CE Conformity

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

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

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

Conformity Information

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VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telefax:+49 9132 744 1204
EMail: documentation@vipa.de

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Contact your local VIPA Customer Service Organization representative if you encounter problems with the product or have questions regarding the product. If you are unable to locate a customer service center, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telephone: +49 9132 744 1150/1180 (Hotline)
EMail: support@vipa.de

Contents

About this manual

This manual describes the signal modules (SM) of the system SLIO from VIPA. Here you may find besides of a product overview a detailed description of the single modules. You'll receive information about the connection and the deployment of the System SLIO SM modules.

Overview

Chapter 1: Basics and Assembly

The focus of this chapter is on the introduction of the VIPA System SLIO. Here you will find the information required to assemble and wire a controller system consisting of System SLIO components.
Besides the dimensions the general technical data of System SLIO will be found.

Chapter 2: Digital input

In this chapter you will find the description of the digital input modules of the System SLIO from VIPA.

Chapter 3: Digital output

The digital output modules of the System SLIO will be found here.

Chapter 4: Analog input

After the introduction to the analog input modules and the list of the measuring ranges the description of the analog input modules of the System SLIO will be found here.

Chapter 5: Analog output

After the introduction to the analog output and the list of the output ranges the description of the analog output modules of the System SLIO will be found here.

Objective and contents

This manual describes the System SLIO signal modules from VIPA.
It contains a description of the structure, project engineering and deployment.

Target audience

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

Structure of the manual

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

Guide to the document

The following guides are available in the manual:

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

Availability

The manual is available in:

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

Icons Headings

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

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

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

Note!
Supplementary information and useful tips.

Safety information

Applications conforming with specifications

The System SLIO is constructed and produced for:

- 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 and Assembly

Overview

The focus of this chapter is on the introduction of the VIPA System SLIO. Here you will find the information required to assemble and wire a controller system consisting of System SLIO components.

Besides the dimensions the general technical data of System SLIO will be found.

Content

Safety Information for Users

Handling of electrostatic 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 electrostatic sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable.

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

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

Shipping of modules

Modules must be shipped in the original packing material.

Measurements and alterations on electrostatic sensitive modules

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

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

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

Attention!

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

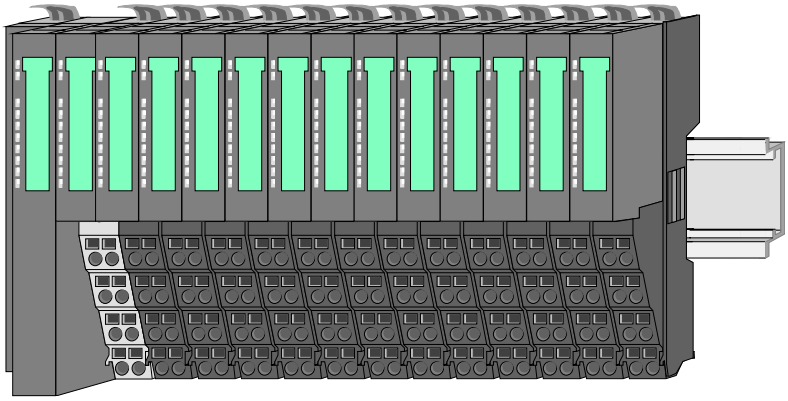
System conception

Overview

System SLIO is a modular automation system for assembly on a 35mm mounting rail. By means of the peripheral modules with 2, 4 or 8 channels this system may properly be adapted matching to your automation tasks.

The wiring complexity is low, because the supply of the DC 24V power section is integrated to the backplane bus and defective modules may be replaced with standing wiring.

By deployment of the power modules in contrasting colors within the system, further isolated areas may be defined for the DC 24V power section supply, respectively the electronic power supply may be extended with 2A.

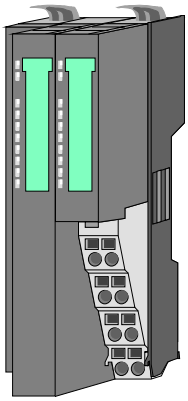


Components

The System SLIO consists of the following components:

- Bus coupler
- Periphery modules
- Power modules
- Accessories

Bus coupler



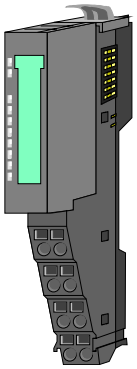
With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system.

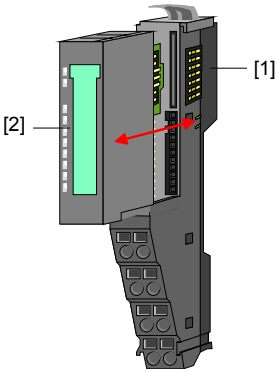
Via the integrated power module for power supply the bus interface is supplied as well as the electronic of the connected periphery modules.

The DC 24 power section supply for the linked periphery modules is established via a further connection at the power module.

By installing of up to 64 periphery modules at the bus coupler, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

Periphery modules Each periphery module consists of a *terminal* and an *electronic* module.

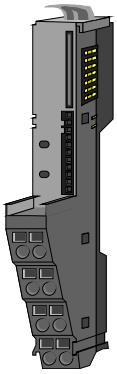




[1] Terminal module

[2] Electronic module

Terminal module

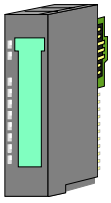


The *terminal module* serves to carry the electronic module, contains the backplane bus with power supply for the electronic, the DC 24V power section supply and the staircase-shaped terminal for wiring.

Additionally the terminal module has a locking system for fixing at a mounting rail.

By means of this locking system your SLIO system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

Electronic module



The functionality of a SLIO periphery module is defined by the *electronic module*, which is mounted to the terminal module by a save sliding mechanism.

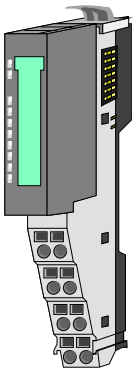
With an error the defective module may be exchanged for a functional module with standing installation.

By an integrated coding only the modules may be plugged, which may be combined.

At the front side there are LEDs for status indication.

For simple wiring each module shows a corresponding connection diagram at the front and at the side.

Power module



In the system SLIO the power supply is established by power modules. These are either integrated to the bus coupler or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined respectively the electronic power supply may be extended with 2A.

For better recognition the color of the power modules are contrasting to the periphery modules.

Accessories

Shield bus carrier

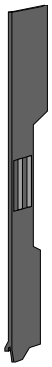
The shield bus carrier serves to carry the shield bus (10mm x 3mm) to connect cable shields.

Shield bus carriers, shield bus and shield fixings are not in the scope of delivery. They are only available as accessories.

The shield bus carrier is mounted underneath the terminal of the terminal module.

With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.

Bus cover

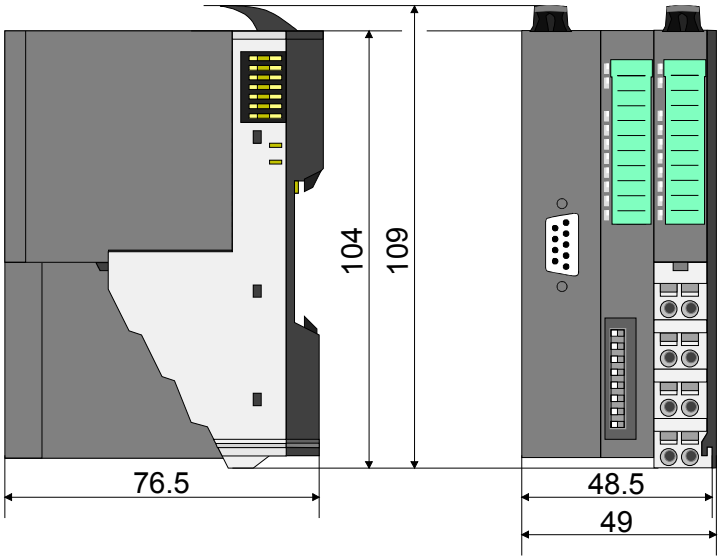


With each bus coupler, to protect the backplane bus connectors, there is a mounted bus cover in the scope of delivery. You have to remove the bus cover of the bus coupler before mounting a SLIO module.

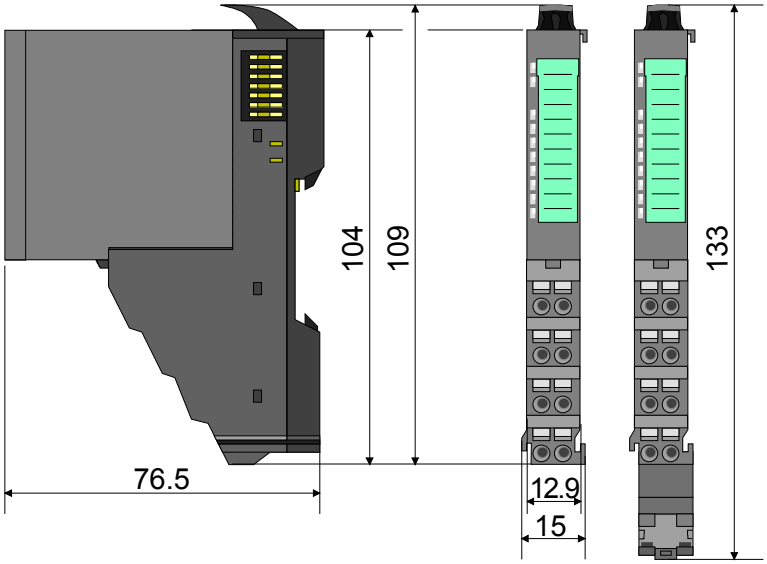
For the protection of the backplane bus connector you always have to mount the bus cover at the last module of your system again.

Dimensions

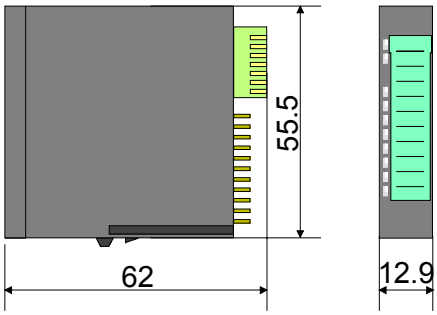
Dimensions bus coupler



Dimensions periphery module



Dimensions electronic module



Dimensions in mm

Installation

Functional principle

Mounting terminal module

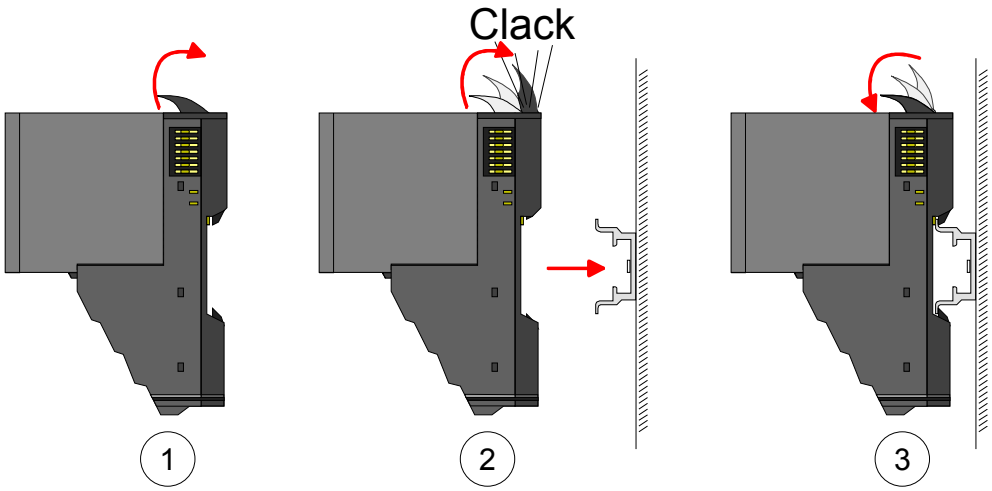
There is a locking lever at the top side of the terminal module. For mounting and de-mounting this locking lever is to turn upwards until this engages audible.

Now the module may be pulled forward.

For mounting plug the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.

The module is fixed to the mounting rail by pushing downwards the locking lever.

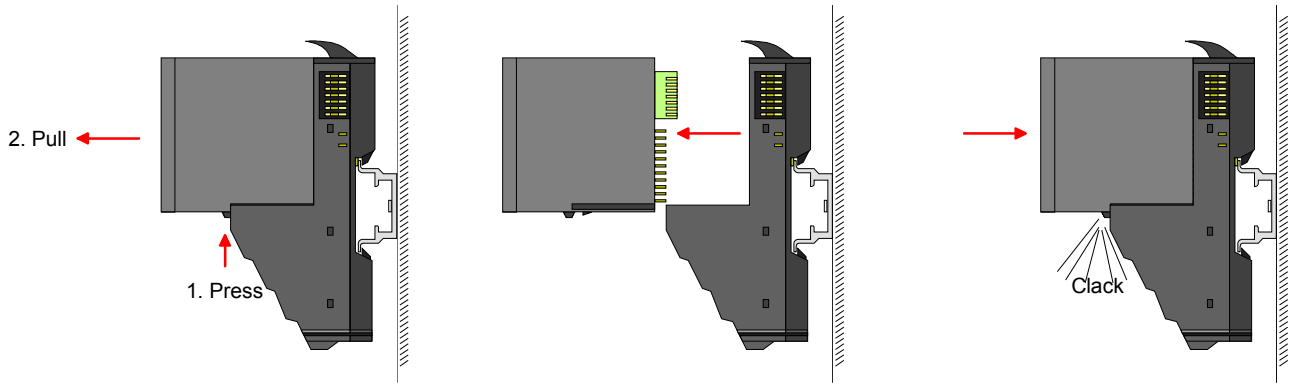
The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened.



Mounting electronic module

For mounting between 2 modules and for the exchange of a defective electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.

For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



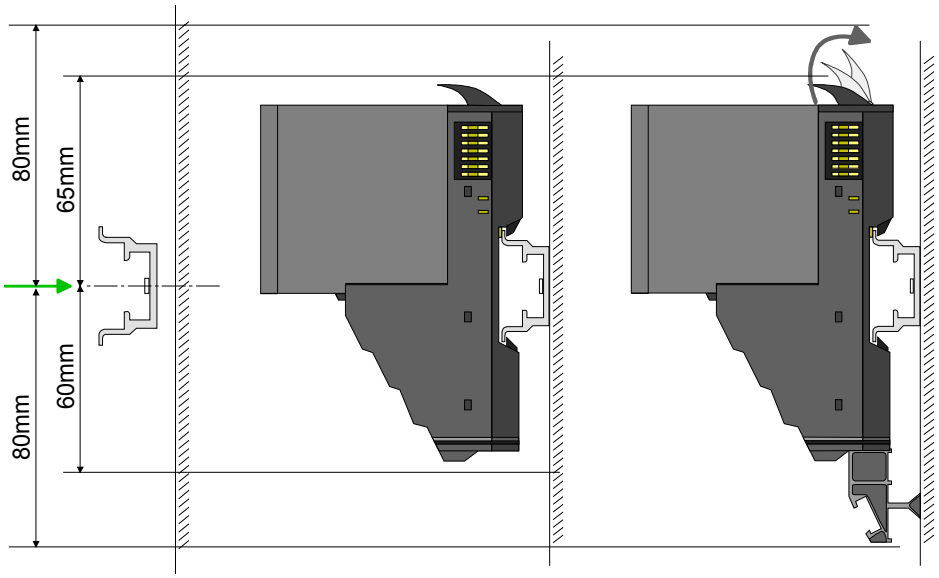
Mounting Proceeding

The modules were directly be mounted to the mounting rail and so connected to the backplane bus and the power supply for the electronic and power section.

Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded with 2A. More about this may be found at "Wiring".

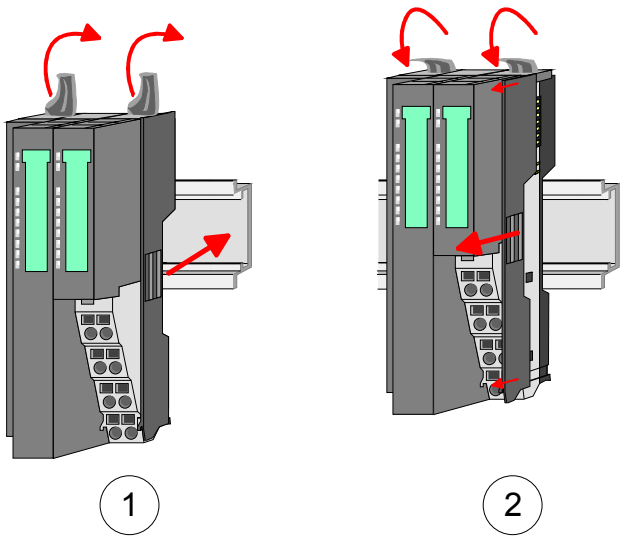
Mounting mounting rail

- Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.



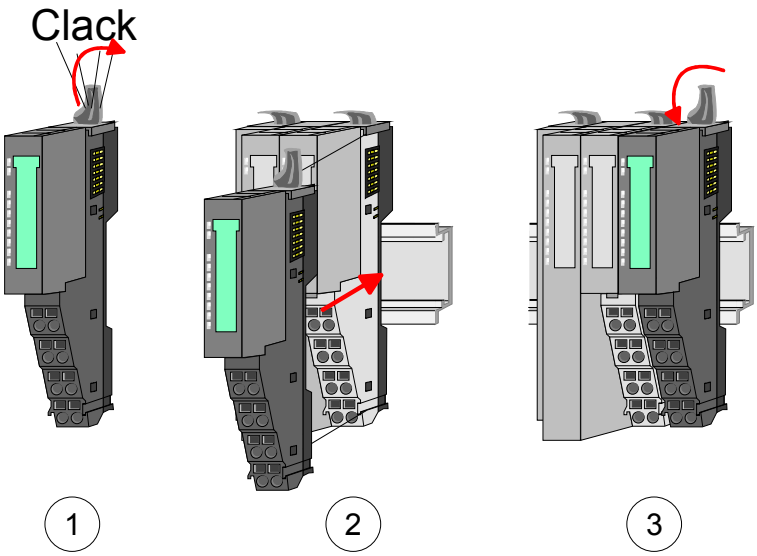
Mounting Head module (e.g. bus coupler)

- Start at the left side with the head module (e.g. bus coupler). For this turn both locking lever upwards, put the head module to the mounting rail and turn both locking lever downwards.
- Before mounting the periphery modules you have to remove the bus cover at the right side of the Head module by pulling it forward. Keep the cover for later mounting.



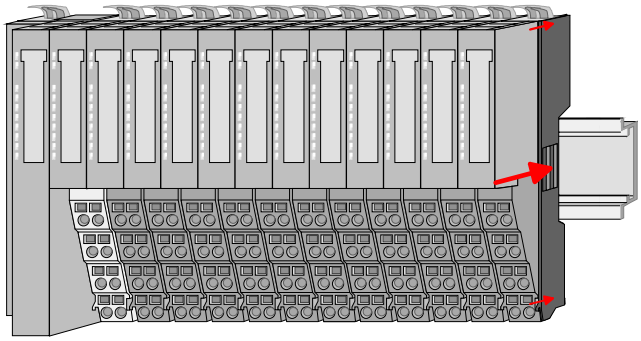
Mounting periphery module

- Mount the periphery modules you want.



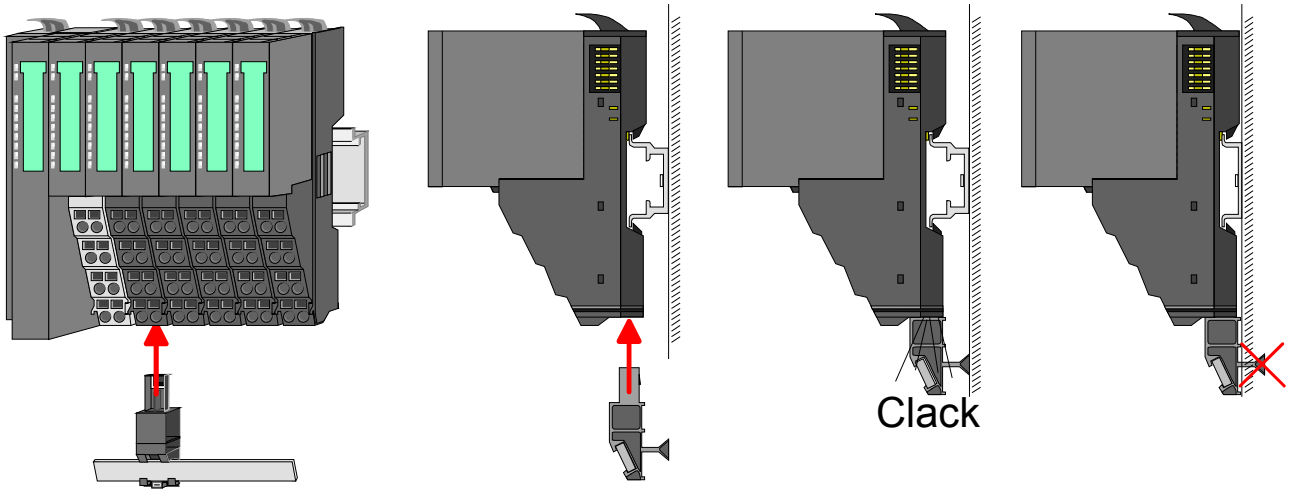
Mounting the bus cover

- After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now.



Mounting shield bus carrier

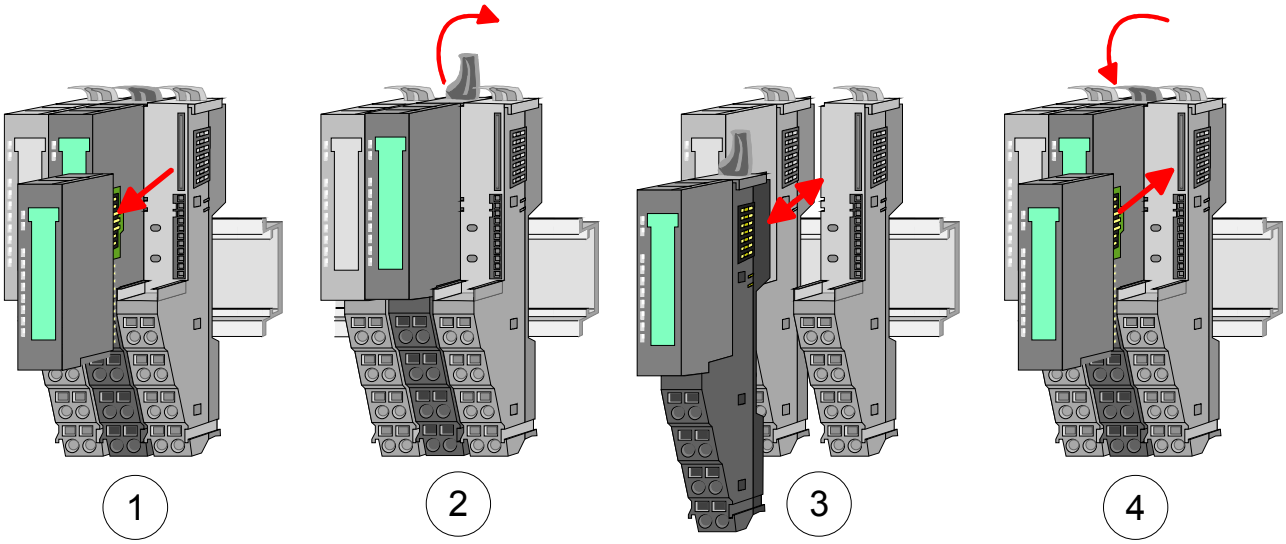
The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.



Mounting between 2 modules

With the mounting of a SLIO module respectively of a group of SLIO modules between two modules for mounting reasons you have always to remove the electronic module of the just mounted right module. After that it may be plugged again.

To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.



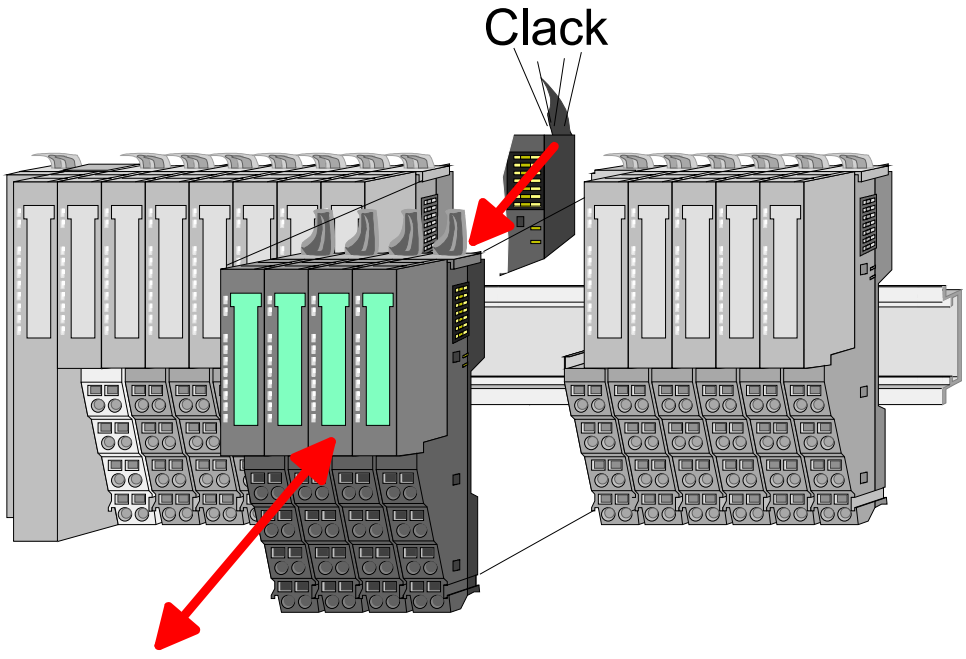
1 module group between 2 modules

With mounting respectively de-mounting of a module group you also have to remove the electronic module of the just mounted right module! After mounting it may be plugged again.

For mounting respectively de-mounting the locking lever of the modules of the block must be turned upwards.

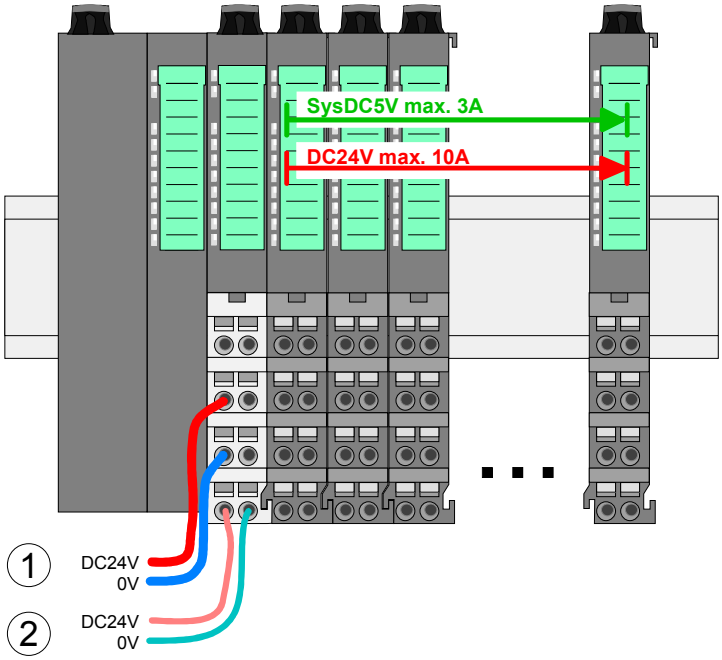
To mount the group of modules put them to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.

After mounting the block turn each locking lever of the modules downwards.



Wiring

Standard wiring



(1) DC 24V for power section supply I/O area (max 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area

Note!

Power section and electronic power section supply are internally protected against higher voltage by fuses. The fuses are within the power module.
If one fuse released, its electronic module must be exchanged!

It is recommended to externally protect the corresponding supply with a fuse (fast).

Fusing

- The power section supply is to be externally protected with a fuse (fast), which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast).
- The electronic power supply for bus coupler and I/O area is to be externally protected with a 4A fuse (fast).
- The electronic power supply for the I/O area of the power module 007-1AB10 is to be externally protected with a 1A fuse (fast).

State of the electronic power supply via LEDs

After PowerON of the System SLIO the LEDs RUN respectively MF get on so far as the sum current does not exceed 3A.

With a sum current greater than 3A the LEDs may not be activated. Here the power module with the order number 007-1AB10 is to be placed between the peripheral modules. More concerning this may be found at the following page.

Deployment of the power modules

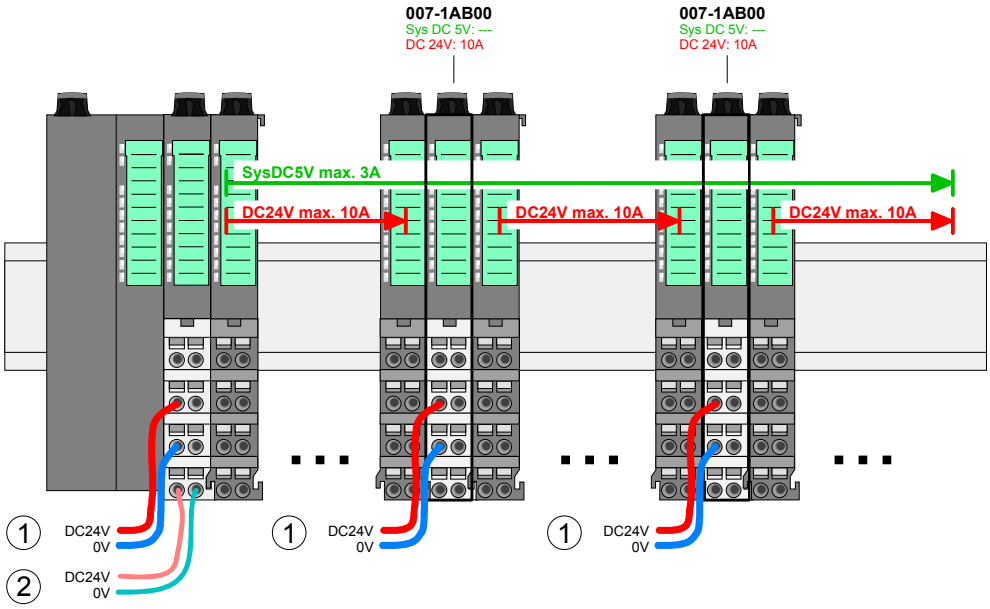
If the 10A for the power section supply is no longer sufficient, you may use the power module from VIPA with the order number 007-1AB00. So you have also the possibility to define isolated groups.

The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with 4A.

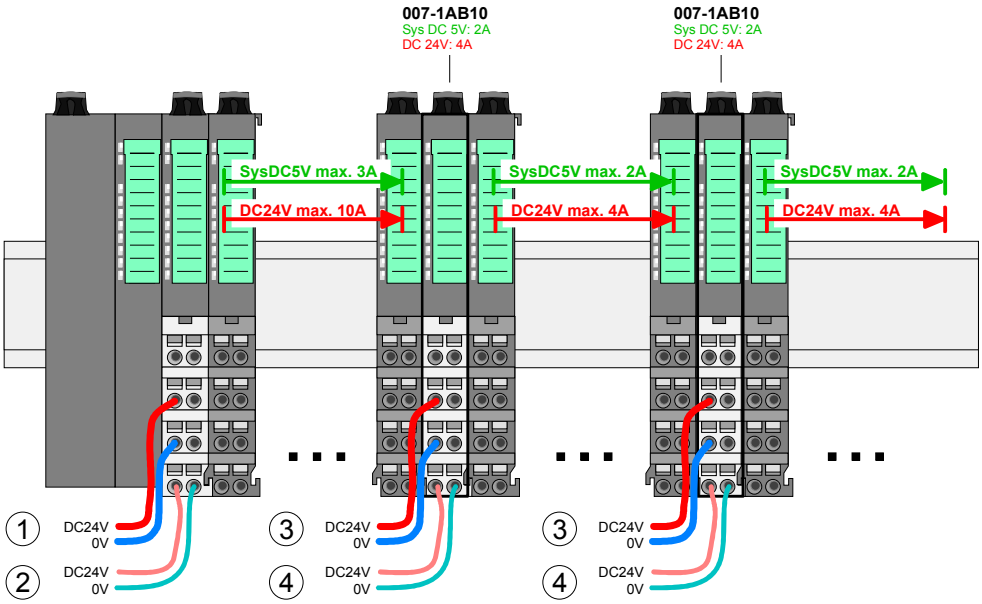
By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards the power module 007-1AB10 is to be placed again.

To secure the power supply, the power modules may be mixed used.

Power module 007-1AB00



Power module 007-1AB10



(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area
(3) DC 24V for power section supply I/O area (max. 4A)
(4) DC 24V for electronic power supply I/O area

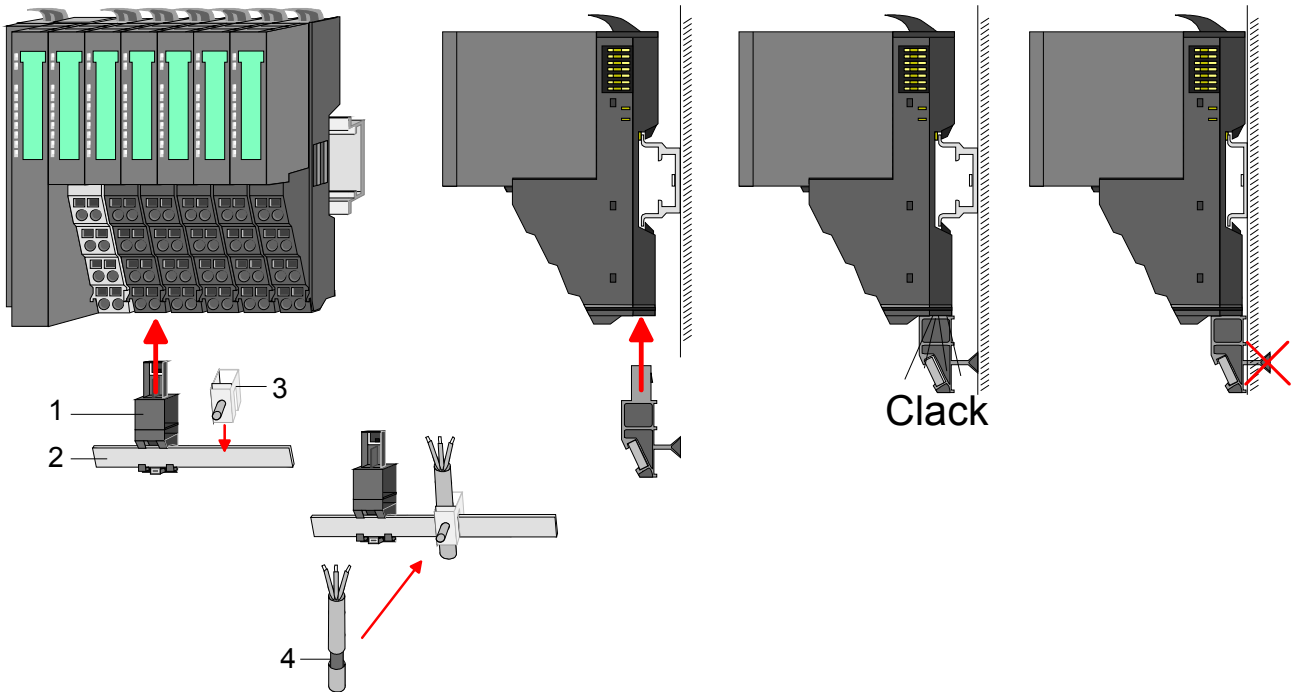
Shield attachment

To attach the shield the mounting of shield bus carriers are necessary.

The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields.

The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.

After mounting the shield bus carrier with the shield bus, the cables with the accordingly stripped cable screen may be attached and fixed by the shield clamp.



[1] Shield bus carrier
[2] Shield bus (10mm x 3mm)
[3] Shield clamp
[4] Cable shield

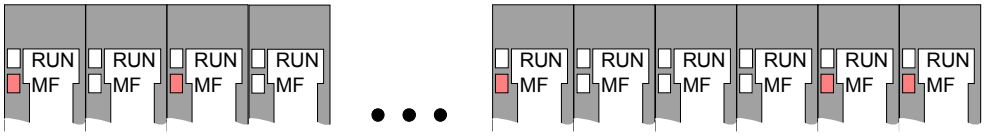
Trouble shooting - LEDs

General

Each module has the LEDs RUN and MF on its front side. Errors or incorrect modules may be located by means of these LEDs.

In the following illustrations flashing LEDs are marked by ☼.

Sum current of the electronic power supply exceeded

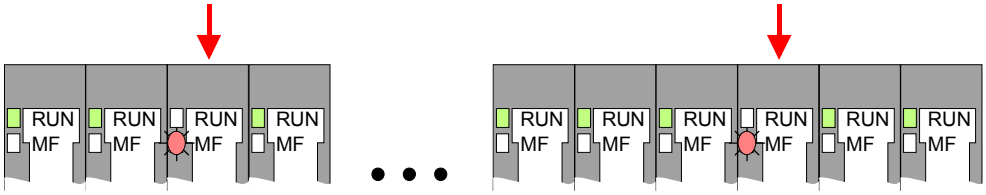


Behavior: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

Reason: The maximum current for the electronic power supply is exceeded.

Remedy: As soon as the sum current of the electronic power supply is exceeded, always place the power module 007-1AB10.
More concerning this may be found above at "Wiring".

Error in configuration

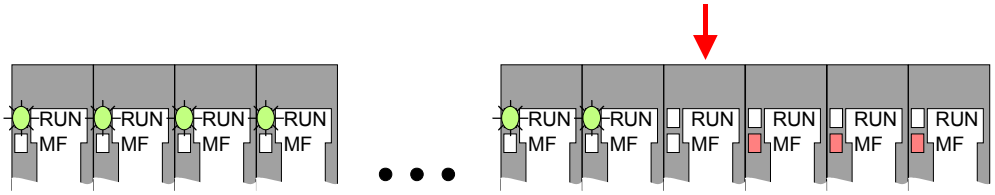


Behavior: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

Reason: At this position a module is placed, which does not correspond to the configured module.

Remedy: Match configuration and hardware structure.

Module failure



Behavior: After PowerON all of the RUN LEDs up to the defective module are flashing. With all following modules the MF LED is on and the RUN LED is off.

Reason: The module on the right of the flashing modules is defective.

Remedy: Replace the defective module.

Installation guidelines

General

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

What means EMC?

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

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

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

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

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

One differs:

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

Basic rules for EMC

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

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

Isolation of conductors

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

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

When isolating cables you have to regard the following:

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

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

Please regard at installation!

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

Remedy: Potential compensation line

General data

Conformity and approval		
Conformity		
CE	2006/95/EG	Low-voltage directive
Approval		
UL	UL 508	Approval for USA and Canada
others		
RoHs	-	Product is unleaded

Protection of persons and device protection		
Type of protection	-	IP20
Electrical isolation		
to the field bus	-	electrically isolated
to the process level	-	electrically isolated
Insulation resistance	EN 61131-2	-
Insulation voltage to reference earth		
Inputs / outputs	-	AC / DC 50V, test voltage AC 500V
Protective measures	-	against short circuit

Environmental conditions to EN 61131-2		
Climatic		
Storage / transport	EN 60068-2-14	-25…+70°C
Operation		
Horizontal installation	EN 61131-2	0…+60°C
Vertical installation	EN 61131-2	0…+60°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 10 … 95%)
Pollution	EN 61131-2	Degree of pollution 2
Mechanical		
Oscillation	EN 60068-2-6	1G
Shock	EN 60068-2-27	15G

Mounting conditions		
Mounting place	-	In the control cabinet
Mounting position	-	Horizontal and vertical

EMC	Standard		Comment
Emitted interference	EN 61000-6-4		Class A (Industry area)
Noise immunity zone B	EN 61000-6-2		Industry area
		EN 61000-4-2	ESD Degree of severity 3, i.e. 8kV at air discharge, 4kV at contact discharge
		EN 61000-4-3	HF irradiation (casing) 80MHz … 1000MHz, 10V/m 80% AM (1kHz)
		EN 61000-4-6	HF conducted 150kHz … 80MHz, 10V/m 80% AM (1kHz)
		EN 61000-4-4	Burst, degree of severity 3
		EN 61000-4-5	Surge, degree of severity 3 *)

*) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

Chapter 2 Digital Input

Overview

In this chapter you will find the description of the digital input modules of the System SLIO from VIPA.

Content

VIPA 021-1BB00 - DI 2xDC 24V

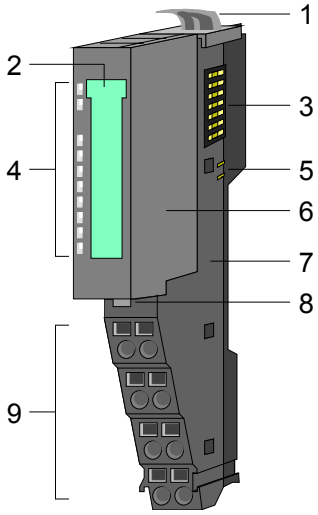
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 2 channels and their status is monitored via LEDs.

Properties

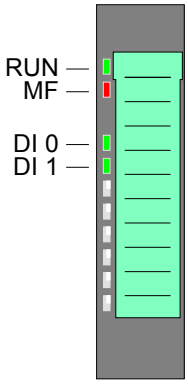
- 2 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs
  also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

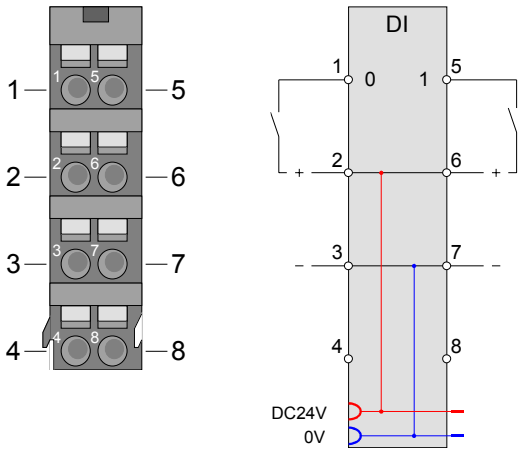


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	---	---	not connected
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	---	---	not connected

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area. Information about accessing the system SLIO may be found in the manual of the CPU respectively of the corresponding bus coupler.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 7 ... 2: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	021-1BB00
Type	SM 021
Module ID	0001 9F82
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.5 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	2
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	IEC 61131, type 1
Initial data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BB10 - DI 2xDC 24V 2µs...4ms

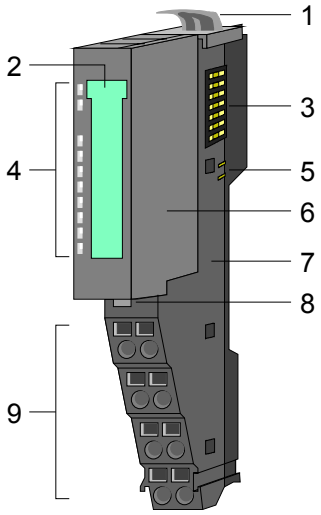
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
The module has 2 fast digital input channels and their status is monitored via LEDs.

Properties

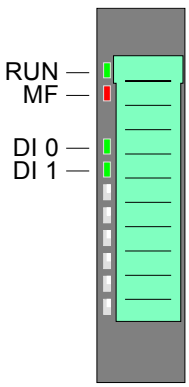
- 2 fast digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs
  also with de-activated electronic power supply
- Parameterizable input delay
- Interrupt and diagnostics function

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

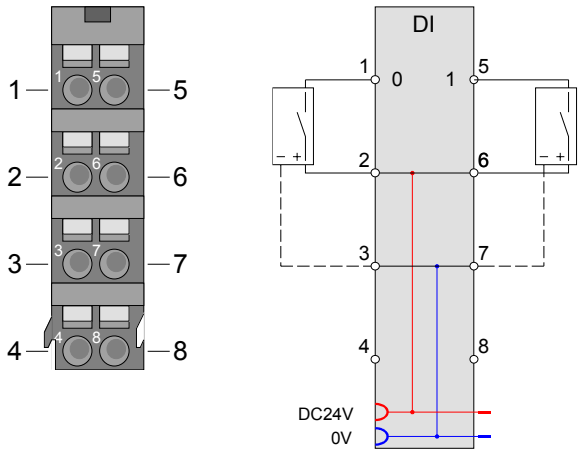


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	---	---	not connected
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	---	---	not connected

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 7 ... 2: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	**021-1BB10**
Type	SM 021
Module ID	000A 1F02
Current consumption/power loss	
Current consumption from backplane bus	95 mA
Power loss	0.9 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	12 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	parameterizable
Input delay of "1" to "0"	parameterizable
Number of simultaneously utilizable inputs horizontal configuration	2
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	IEC 61131, type 1
Initial data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostic interrupt	00h	00h	3100h	01h
CH0D	1	Input delay DI 0	02h	01h	3101h	02h
CH1D	1	Input delay DI 1	02h	01h	3102h	03h
INTRE	1	Process interrupt at edge 0-1 of DI x	00h	80h	3103h	04h
INTFE	1	Process interrupt at edge 1-0 of DI x	00h	80h	3104h	05h

DIAG_EN
Diagnostic interrupt

Byte	Bit 7 ... 0
0	Diagnostic interrupt 00h = disable 40h = enable

- Here you activate res. de-activate the diagnostic function.

CHxD
Input delay

Byte	Function	Possible values
0	Input delay DI x	00h: 1µs 07h: 86µs 02h: 3µs 09h: 342µs 04h: 10µs 0Ch: 2731µs Other values are not permissible!

- *Input delay* allows you to preset a filter for the corresponding channel. With the help of filters you may e.g. filter signal peaks at a blurred input signal.

INTRE
Interrupt edge 0-1

Byte	Bit 7 ... 0
0	Bit 0: Process interrupt at edge 0-1 of DI 0 Bit 1: Process interrupt at edge 0-1 of DI 1 (0: disable, 1: enable) Bit 7 ... 2: reserved

INTFE
Interrupt edge 1-0

Byte	Bit 7 ... 0
0	Bit 0: Process interrupt at edge 1-0 of DI 0 Bit 1: Process interrupt at edge 1-0 of DI 1 (0: disable, 1: enable) Bit 7 ... 2: reserved

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Edge 0-1 DI x	X	-	X
Edge 1-0 DI x	X	-	X
Process interrupt lost	-	X	X

Process interrupt data

So you may react to asynchronous events, there is the possibility to activate a process interrupt. A process interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the process interrupt accordingly.

With CANopen the process interrupt data a transferred via an emergency telegram.

Operating with CPU, Profibus and Profinet the process interrupt data were transferred via diagnostics telegram.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	SX
PRIT_A	1	Process interrupt data	00h	02h
PRIT_B	1	State of the inputs	00h	03h
PRIT_US	2	µs ticker	00h	04h ... 05h

PRIT_A
Process interrupt data

Byte	Bit 7 ... 0
0	Bit 0: Edge at Digital input DI 0 Bit 1: Edge at Digital input DI 1 Bit 7 ... 2: reserved

PRIT_B
State of the inputs

Byte	Bit 7 ... 0
0	State of the inputs at the moment of the process interrupt Bit 0: State Input DI 0 Bit 1: State Input DI 1 Bit 7 ... 2: reserved

PRIT_US
µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the process interrupt

µs ticker

In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parameterization you may activate a diagnostic interrupt for the module.

With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$.

As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place.

All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost.

Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Process interrupt	00h			05h
CHTYP	1	Channel type	70h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: reserved Bit 2: set at external error Bit 3: set at channel error Bit 4: overload at output Bit 7 ... 5: reserved

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

ERR_C
reserved

Byte	Bit 7 ... 0
0	reserved

ERR_D
Process interrupt

Byte	Bit 7 ... 0
0	Bit 5 ... 0: reserved Bit 6: Process interrupt lost Bit 7: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 70h: Digital input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: Edge lost at DI 0 Bit 1: Edge lost at DI 1 Bit 7 ... 2: reserved

CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 021-1BB50 - DI 2xDC 24V NPN

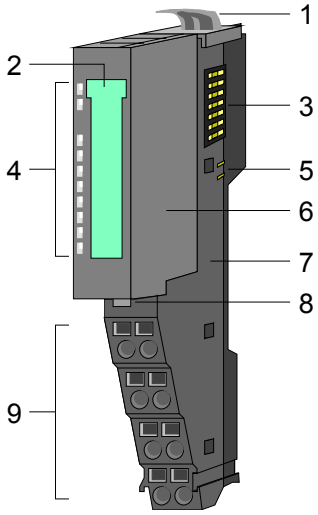
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 2 channels and their status is monitored via LEDs.
An input becomes active as soon as it is connected to ground.

Properties

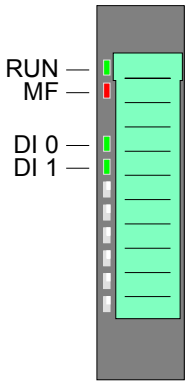
- 2 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

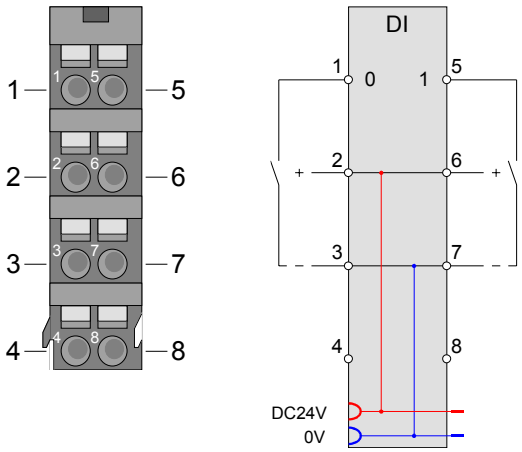


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	---	---	not connected
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	---	---	not connected

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 7 ... 2: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	021-1BB50
Type	SM 021
Module ID	0002 9F82
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.5 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 15...28.8 V
Input voltage for signal "1"	DC 0...5 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	2
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	-
Initial data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BB70 - DI 2xDC 24V ETS

Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 2 channels and their status is monitored via LEDs.

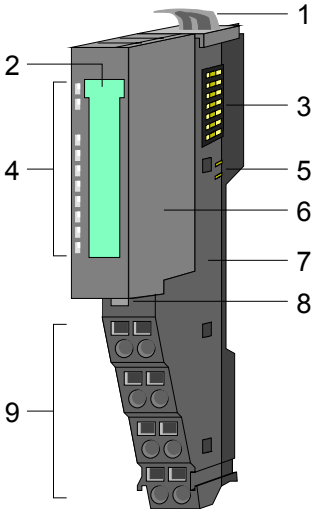
With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) and the corresponding (rising/falling) edge the current time value of the µs timer is stored together with the state of the inputs in the process image.

Depending on the configuration 5 (20byte) respectively 15 (60byte) ETS entries may be stored in the process image one after another.

Properties

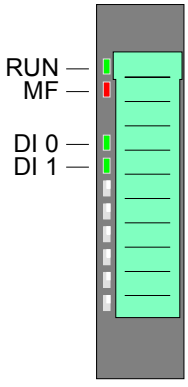
- 2 digital inputs, isolated to the backplane bus
- Configurable ETS functionality for 5 respectively 15 ETS entries (each 4byte)
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

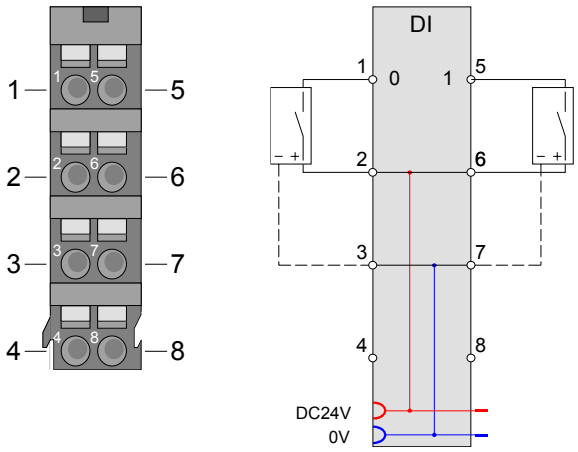


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	---	---	not connected
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	---	---	not connected

I: Input, O: Output

In-/Output area

With configured ETS functionality (ETS=**e**dge **t**ime **s**tamp) and the corresponding edge the current time value of the SLIO µs timer is stored together with the state of the inputs and a running number as ETS entry in the process image.

You may configure the following variants:

- 021-1BB70 DI 2xDC24V (20): uses 20byte in the PII for 5 ETS entries
- 021-1BB70 DI 2xDC24V (60): uses 60byte in the PII for 15 ETS entries

Output area

No byte of the output area is used by the module.

Input area 20byte respectively 60byte

Depending on the configured variant, the module serves for an area for 5 resp. 15 ETS entries. Each ETS entry uses 4byte in input area:

Structure of an ETS entry

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5430h/s	01h
+1	RN	1	Running number	5431h/s	02h
+2	ETS_US	2	µs ticker	5432h/s	03h

PII

Here the state of the inputs after an edge change is stored.
The input byte has the following bit assignment:

Bit 0: DI 0

Bit 1: DI 1

Bit 2 ... 7: 0 (fix)

RN

The **R**unning **N**umber (RN) is a continuous number 0 ... 127, which starts with 1. The RN corresponds to the chronological order of the edges.

ETS_US

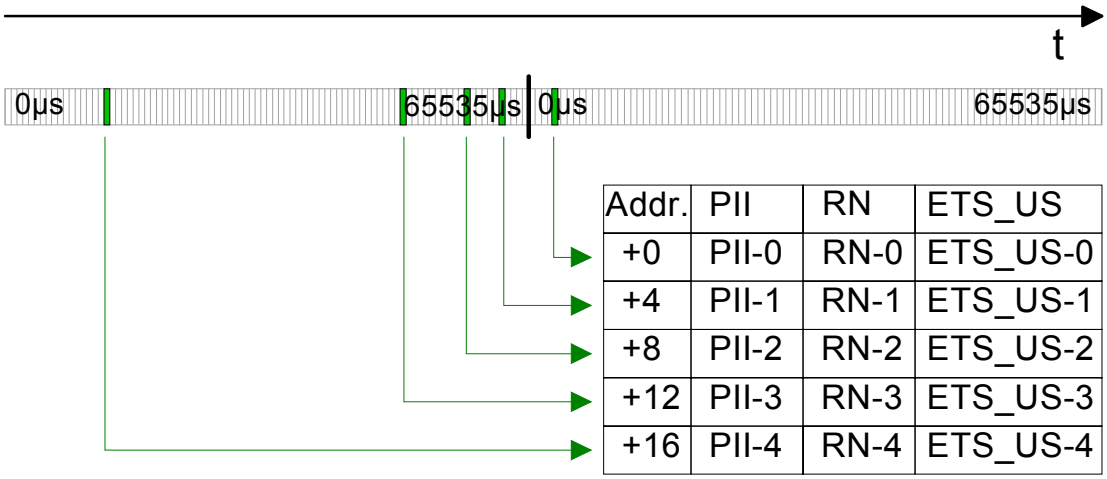
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

ETS_US always contains the low word of the µs ticker (0...65535µs).

ETS functionality

With the corresponding edge the value of the timer is stored as ETS entry in the process image as ETS_US together with the state of the inputs PII and the running number RN.

The following figure shows the sequence of how the ETS entries are stored in the input area.



Assignment of the input area

At CPU, Profibus and Profinet the input area is embedded to the corresponding address area.

IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX = Subindex for access via EtherCAT.

Configured as 021-1BB70 — DI 2xDC 24V (20), 20byte - 5 ETS entries

Addr	PII	IX= 5430h	SX
+0	PII-0	s=1	01h
+4	PII-1	s=2	04h
+8	PII-2	s=3	07h
+12	PII-3	s=4	0Ah
+16	PII-4	s=5	0Dh

Addr	RN	IX= 5431h	SX
+1	RN-0	s=1	02h
+5	RN-1	s=2	05h
+9	RN-2	s=3	08h
+13	RN-3	s=4	0Bh
+17	RN-4	s=5	0Eh

Addr	ETS-US	IX= 5432h	SX
+2	ETS_US-0	s=1	03h
+6	ETS_US-1	s=2	06h
+10	ETS_US-2	s=3	09h
+14	ETS_US-3	s=4	0Ch
+18	ETS_US-4	s=5	0Fh

Configured as 021-1BB70 — DI 2xDC 24V (60), 60byte - 15 ETS entries

Addr	PII	IX= 5430h	SX
+0	PII-0	s=1	01h
+4	PII-1	s=2	04h
+8	PII-2	s=3	07h
+12	PII-3	s=4	0Ah
+16	PII-4	s=5	0Dh
+20	PII-5	s=6	10h
+24	PII-6	s=7	13h
+28	PII-7	s=8	16h
+32	PII-8	s=9	19h
+36	PII-9	s=10	1Ch
+40	PII-10	s=11	1Fh
+44	PII-11	s=12	22h
+48	PII-12	s=13	25h
+52	PII-13	s=14	28h
+56	PII-14	s=15	2Bh

Addr	RN	IX= 5431h	SX
+1	RN-0	s=1	02h
+5	RN-1	s=2	05h
+9	RN-2	s=3	08h
+13	RN-3	s=4	0Bh
+17	RN-4	s=5	0Eh
+21	RN-5	s=6	11h
+25	RN-6	s=7	14h
+29	RN-7	s=8	17h
+33	RN-8	s=9	1Ah
+37	RN-9	s=10	1Dh
+41	RN-10	s=11	20h
+45	RN-11	s=12	23h
+49	RN-12	s=13	26h
+53	RN-13	s=14	29h
+57	RN-14	s=15	2Ch

Addr	ETS-US	IX= 5432h	SX
+2	ETS_US-0	s=1	03h
+6	ETS_US-1	s=2	06h
+10	ETS_US-2	s=3	09h
+14	ETS_US-3	s=4	0Ch
+18	ETS_US-4	s=5	0Fh
+22	ETS_US-5	s=6	12h
+26	ETS_US-6	s=7	15h
+30	ETS_US-7	s=8	18h
+34	ETS_US-8	s=9	1Bh
+38	ETS_US-9	s=10	1Eh
+42	ETS_US-10	s=11	21h
+46	ETS_US-11	s=12	24h
+50	ETS_US-12	s=13	27h
+54	ETS_US-13	s=14	2Ah
+58	ETS_US-14	s=15	2Dh

Technical data

Order number	**021-1BB70**
Type	SM 021
Module ID	0F01 47C1
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.9 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24V
Current consumption from load voltage L+ (without load)	10 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	parameterizable
Input delay of "1" to "0"	parameterizable
Number of simultaneously utilizable inputs horizontal configuration	2
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	IEC 61131, type 1
Initial data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	2
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

The following variants may be configured:

- 021-1BB70 DI 2xDC24V (20): uses 20byte in the PII for 5 ETS entries
- 021-1BB70 DI 2xDC24V (60): uses 60byte in the PII for 15 ETS entries

Both variants have the following parameter data:

DS = Data set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
PII_L	1	Length process image * input data	14h resp. 3Ch (fix)	02h	3100h	01h
PIQ_L	1	Length process image output data	00h (fix)	02h	3101h	02h
CH0D	1	Input delay DI 0	02h	01h	3102h	03h
CH1D	1	Input delay DI 1	02h	01h	3103h	04h
TSER	1	Raising edge 0-1 at DI x	00h	80h	3104h	05h
TSEF	1	Falling edge 1-0 at DI x	00h	80h	3105h	06h

*) This parameter corresponds of the configured variant.

PII_L

Byte	Bit 7 ... 0
0	The length for the process image is fixed adjusted to the length of the parameterized variant (14h or 3Ch).

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to 0byte.

CHxD
DI x

Byte	Description	Possible values
0	Input delay DI x	00h: 1µs 07h: 86µs 02h: 3µs 09h: 342µs 04h: 10µs 0Ch: 2731µs Other values are not permissible!

With the help of filters you may e.g. filter signal peaks at a blurred input signal.

Edge select

Here the ETS function for DI 0 and DI 1 may be activated. With these 2 bytes you may define the type of edge of the input signal, to which the current µs timer value is stored in the process image together with the state of the inputs.

TSER edge 0-1 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 0-1 (rising edge) DI 0 Bit 1: ETS record at edge 0-1 (rising edge) DI 1 (0: disable, 1: enable) Bit 7 ... 2: reserved

TSEF edge 1-0 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 1-0 (falling edge) DI 0 Bit 1: ETS record at edge 1-0 (falling edge) DI 1 (0: disable, 1: enable) Bit 7 ... 2: reserved

Example of the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored.

In this example a module is configured, which occupies 20byte for 5 ETS entries.

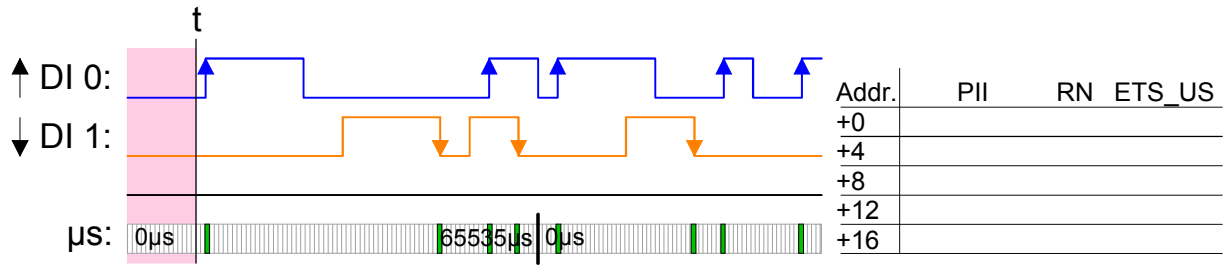
The following edges for the input channels are preset.

- DI 0: Edge 0-1: ↑
- DI 1: Edge 1-0: ↓

The green area of the diagram indicates the ETS entries, which were available at time "t". ETS entries, which are not (longer) available are marked red.

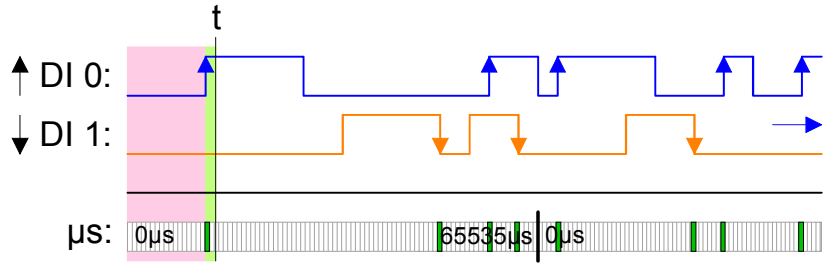
Process image is empty

New ETS entries are always registered starting from address +0. Thereby already existing ETS entries are shifted 4 byte each.



1. ETS entry

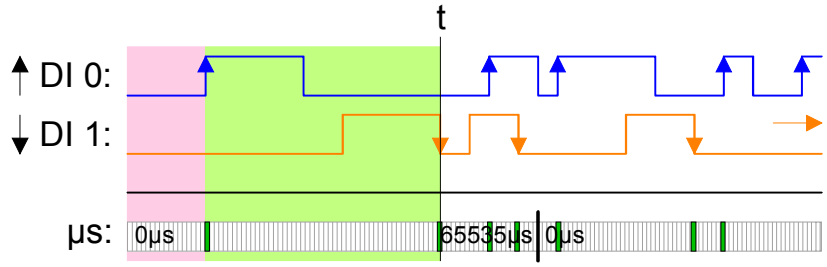
Released by an edge 0-1 from DI 0 the 1. ETS entry is registered starting from address +0.



Addr.	PII	RN	ETS_US
+0	00000001	1	12602
+4			
+8			
+12			
+16			

2. ETS entry

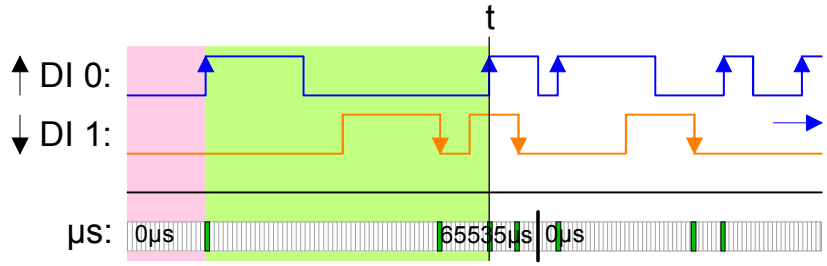
Released by an edge 1-0 from DI 1 the 2. ETS entry is registered starting from address +0 and the 1. ETS entry is shifted 4 byte.



Addr.	PII	RN	ETS_US
+0	00000000	2	50411
+4	00000001	1	12602
+8			
+12			
+16			

3. ETS entry

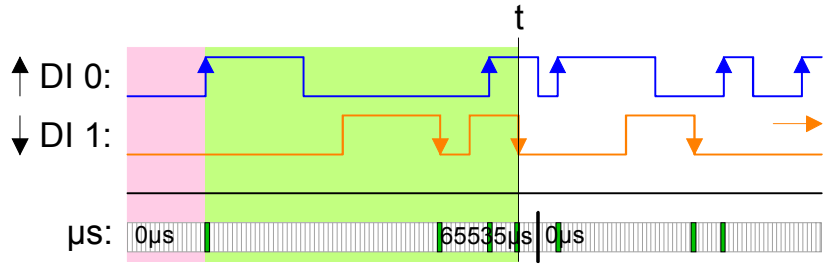
Released by an edge 0-1 from DI 0 the 3. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



Addr.	PII	RN	ETS_US
+0	00000011	3	57973
+4	00000000	2	50411
+8	00000001	1	12602
+12			
+16			

4. ETS entry

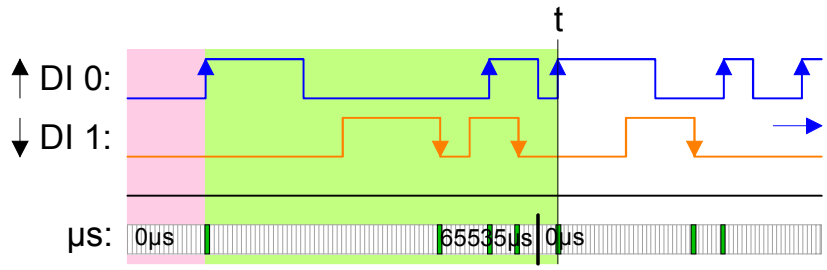
Released by an edge 1-0 from DI 1 the 4. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



Addr.	PII	RN	ETS_US
+0	00000001	4	62384
+4	00000011	3	57973
+8	00000000	2	50411
+12	00000001	1	12602
+16			

5. ETS entry

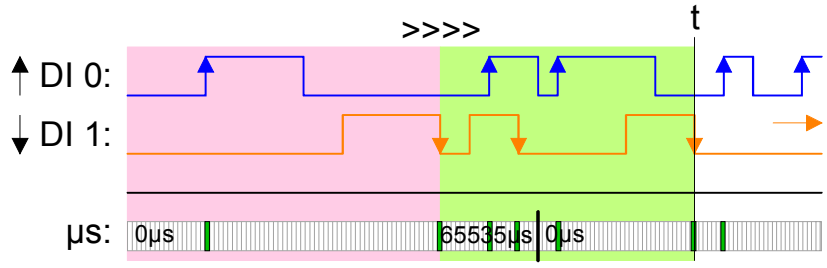
Released by an edge 0-1 from DI 0 the 5. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. The maximum number of ETS entries is reached.



Addr.	PII	RN	ETS_US
+0	00000001	5	3150
+4	00000001	4	62384
+8	00000011	3	57973
+12	00000000	2	50411
+16	00000001	1	12602

6. ETS entry

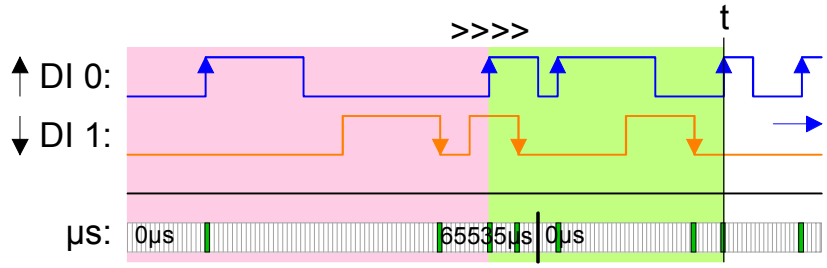
Released by an edge 1-0 from DI 1 the 6. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 1. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000000	6	25205
+4	00000001	5	3150
+8	00000001	4	62384
+12	00000011	3	57973
+16	00000000	2	50411
	00000001	1	12602

7. ETS entry

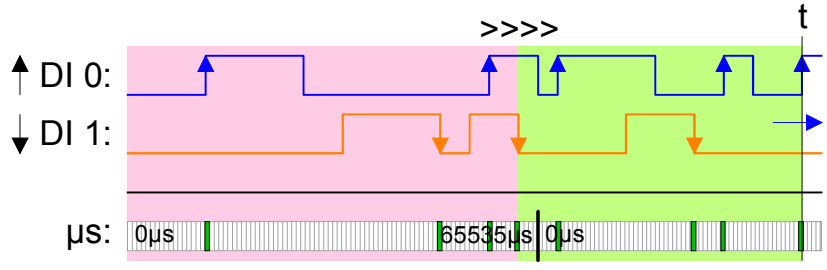
Released by an edge 0-1 from DI 0 the 7. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 2. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	7	29616
+4	00000000	6	25205
+8	00000001	5	3150
+12	00000001	4	62384
+16	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

8. ETS entry

Released by an edge 0-1 from DI 0 the 8. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 3. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	8	42219
+4	00000001	7	29616
+8	00000000	6	25205
+12	00000001	5	3150
+16	00000001	4	62384
	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

Diagnostic data

So this module does not support interrupt functions, the diagnostic data serve the information about this module.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	reserved	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	70h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	02h			08h
CHERR	1	reserved	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker (32Bit)	00h			12h

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 70h: Digital input Bit 7: 0 (fix)

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D
CHERR, CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

VIPA 021-1BD00 - DI 4xDC 24V

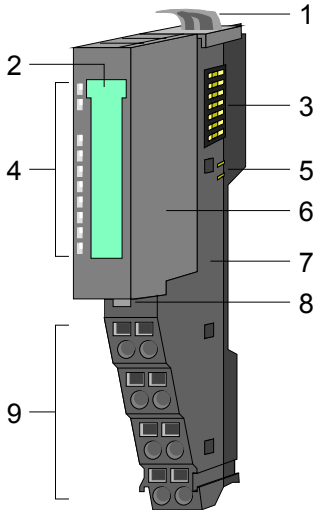
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 channels and their status is monitored via LEDs.

Properties

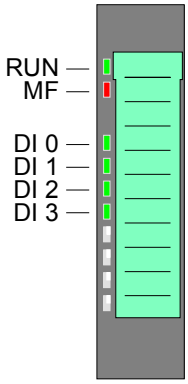
- 4 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

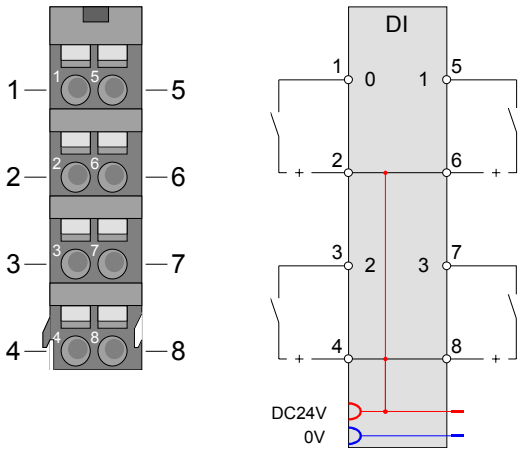


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	DI 2	I	Digital input DI 2
4	DC 24V	O	DC 24V for sensor
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	DI 3	I	Digital input DI 3
8	DC 24V	O	DC 24V for sensor

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 7 ... 4: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	**021-1BD00**
Type	SM 021
Module ID	0003 9F84
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.6 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131, type 1
Initial data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BD10 - DI 4xDC 24V 2µs...4ms

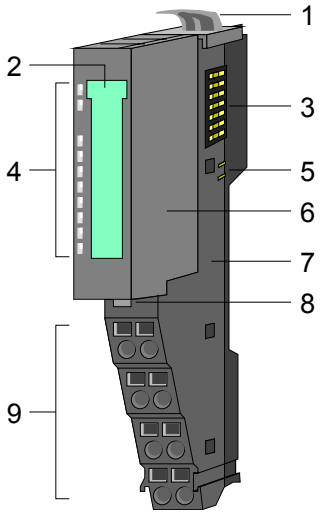
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 fast digital input channels and their status is monitored via LEDs.

Properties

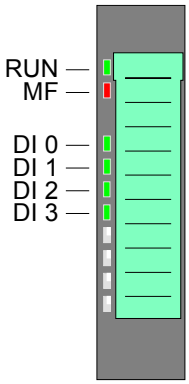
- 4 fast digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs
  also with de-activated electronic power supply
- Parameterizable input delay
- Interrupt and diagnostics function

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

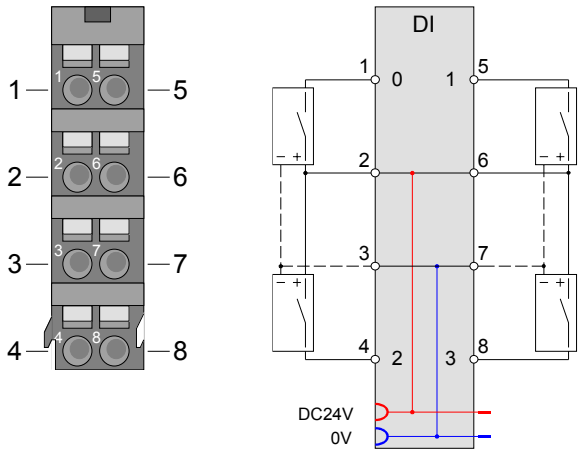


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	DI 2	I	Digital input DI 2
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	DI 3	I	Digital input DI 3

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 7 ... 4: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	021-1BD10
Type	SM 021
Module ID	0009 1F04
Current consumption/power loss	
Current consumption from backplane bus	95 mA
Power loss	0.95 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	15 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	parameterizable
Input delay of "1" to "0"	parameterizable
Number of simultaneously utilizable inputs horizontal configuration	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131, type 1
Initial data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostic interrupt	00h	00h	3100h	01h
CH0D	1	Input delay DI 0	02h	01h	3101h	02h
CH1D	1	Input delay DI 1	02h	01h	3102h	03h
CH2D	1	Input delay DI 2	02h	01h	3103h	04h
CH3D	1	Input delay DI 3	02h	01h	3104h	05h
INTRE	1	Diagnostic interrupt at edge 0-1 of DI x	00h	80h	3105h	06h
INTFE	1	Diagnostic interrupt at edge 0-1 of DI x	00h	80h	3106h	07h

DIAG_EN
Diagnostic interrupt

Byte	Bit 7 ... 0
0	Diagnostic interrupt 00h = disable 40h = enable

- Here you activate res. de-activate the diagnostic function.

CHxD
Input delay

Byte	Function	Possible values
0	Input delay DI x	00h: 1µs 07h: 86µs 02h: 3µs 09h: 342µs 04h: 10µs 0Ch: 2731µs Other values are not permissible!

- *Input delay* allows you to preset a filter for the corresponding channel. With the help of filters you may e.g. filter signal peaks at a blurred input signal.

INTRE
Interrupt edge 0-1

Byte	Bit 7 ... 0
0	Bit 0: Diagnostic interrupt at edge 0-1 of DI 0 Bit 1: Diagnostic interrupt at edge 0-1 of DI 1 Bit 2: Diagnostic interrupt at edge 0-1 of DI 2 Bit 3: Diagnostic interrupt at edge 0-1 of DI 3 (0: disable, 1: enable) Bit 7 ... 4: reserved

INTFE
Interrupt edge 1-0

Byte	Bit 7 ... 0
0	Bit 0: Diagnostic interrupt at edge 1-0 of DI 0 Bit 1: Diagnostic interrupt at edge 1-0 of DI 1 Bit 0: Diagnostic interrupt at edge 1-0 of DI 2 Bit 0: Diagnostic interrupt at edge 1-0 of DI 3 (0: disable, 1: enable) Bit 7 ... 4: reserved

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Edge 0-1 DI x	X	-	X
Edge 1-0 DI x	X	-	X
Process interrupt lost	-	X	X

Process interrupt

So you may react to asynchronous events, there is the possibility to activate a process interrupt. A process interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the process interrupt accordingly.

With CANopen the process interrupt data a transferred via an emergency telegram.

Operating with CPU, Profibus and Profinet the process interrupt data were transferred via diagnostics telegram.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	SX
PRIT_A	1	Process interrupt data	00h	02h
PRIT_B	1	State of the inputs	00h	03h
PRIT_US	2	µs ticker	00h	04h ... 05h

PRIT_A
Process interrupt data

Byte	Bit 7 ... 0
0	Bit 0: Edge at Digital input DI 0 Bit 1: Edge at Digital input DI 1 Bit 2: Edge at Digital input DI 2 Bit 3: Edge at Digital input DI 3 Bit 7 ... 4: reserved

PRIT_B
State of the inputs

Byte	Bit 7 ... 0
0	State of the inputs at the moment of the process interrupt Bit 0: State Input DI 0 Bit 1: State Input DI 1 Bit 2: State Input DI 2 Bit 3: State Input DI 3 Bit 7 ... 4: reserved

PRIT_US
µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the process interrupt

µs ticker

In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parameterization you may activate a diagnostic interrupt for the module.

With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$.

As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place.

All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost.

Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Process interrupt	00h			05h
CHTYP	1	Channel type	70h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: reserved Bit 2: set at external error Bit 3: set at channel error Bit 4: overload at output Bit 7 ... 5: reserved

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b: Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

ERR_C
reserved

Byte	Bit 7 ... 0
0	reserved

ERR_D
Process interrupt

Byte	Bit 7 ... 0
0	Bit 5 ... 0: reserved Bit 6: Process interrupt lost Bit 7: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 70h: Digital input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: Edge lost at DI 0 Bit 1: Edge lost at DI 1 Bit 2: Edge lost at DI 2 Bit 3: Edge lost at DI 3 Bit 7 ... 4: reserved

CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 021-1BD40 - DI 4xDC 24V 3 wire

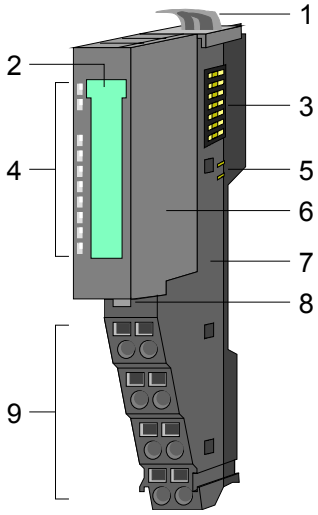
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 channels and their status is monitored via LEDs.

Properties

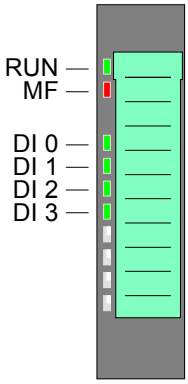
- 4 digital inputs with 3 wire connection, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

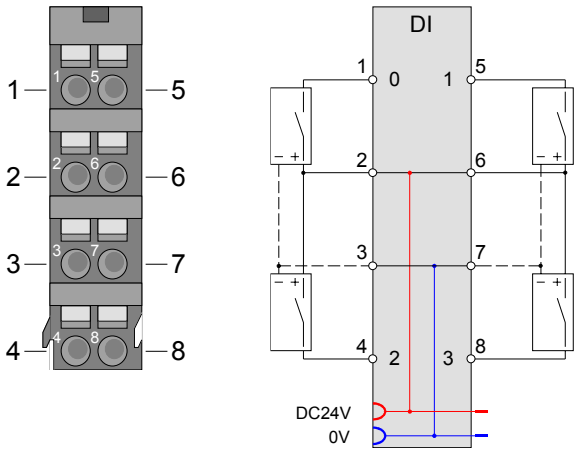


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	DI 2	I	Digital input DI 2
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	DI 3	I	Digital input DI 3

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 7 ... 4: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	**021-1BD40**
Type	SM 021
Module ID	0008 9F84
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.6 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131, type 1
Initial data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BD50 - DI 4xDC 24V NPN

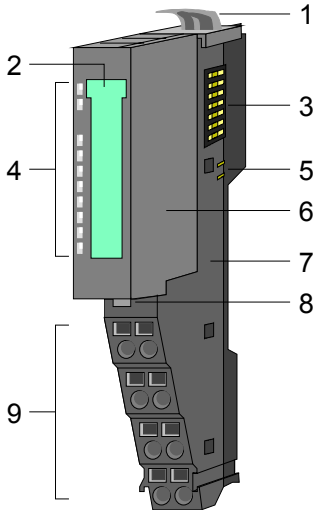
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 channels and their status is monitored via LEDs.
An input becomes active as soon as it is connected to ground.

Properties

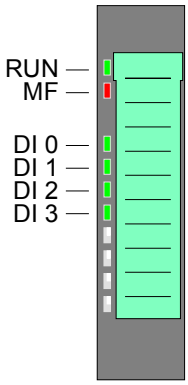
- 4 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

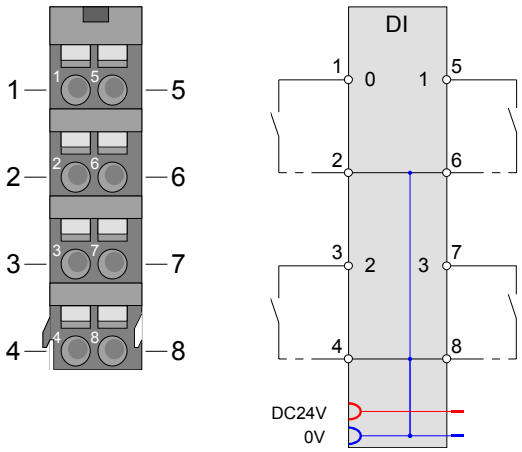


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	0V	O	GND
3	DI 2	I	Digital input DI 2
4	0V	O	GND
5	DI 1	I	Digital input DI 1
6	0V	O	GND
7	DI 3	I	Digital input DI 3
8	0V	O	GND

I: Input, O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 7 ... 4: reserved		

Output area

No byte of the output area is used by the module.

Technical data

Order number	021-1BD50
Type	SM 021
Module ID	0004 9F84
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.6 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 15...28.8 V
Input voltage for signal "1"	DC 0...5 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	-
Initial data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BD70 - DI 4xDC 24V ETS

Description

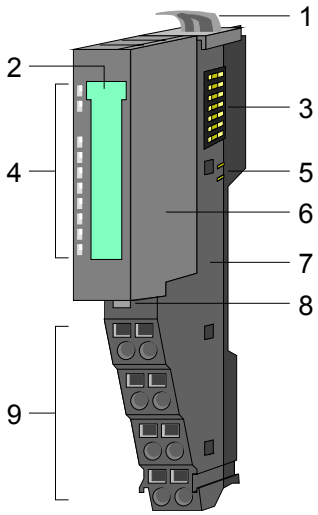
The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 channels and their status is monitored via LEDs.

With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) and the corresponding (rising/falling) edge the current time value of the µs timer is stored together with the state of the inputs in the process image.
Depending on the configuration 5 (20byte) respectively 15 (60byte) ETS entries may be stored in the process image one after another.

Properties

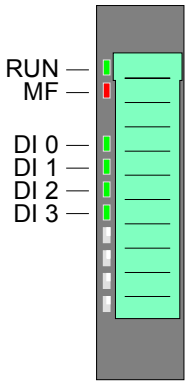
- 4 digital inputs, isolated to the backplane bus
- Configurable ETS functionality for 5 respectively 15 ETS entries (each 4byte)
- Suited for switches and approximate switches
- Status indication of the channels via LEDs
  also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

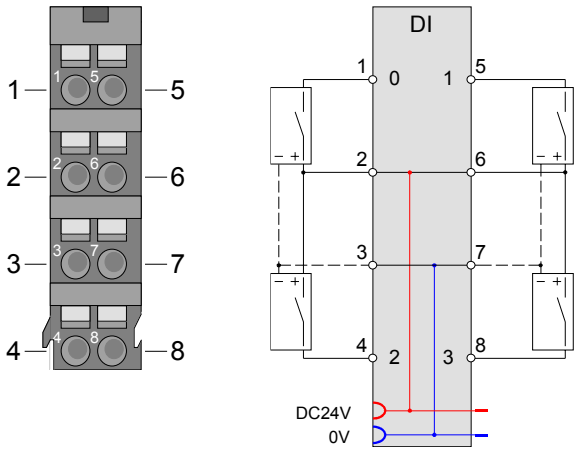


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	DI 2	I	Digital input DI 2
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	DI 3	I	Digital input DI 3

I: Input, O: Output

In-/Output area

With configured ETS functionality (ETS=**e**dge **t**ime **s**tamp) and the corresponding edge the current time value of the SLIO µs timer is stored together with the state of the inputs and a running number as ETS entry in the process image.

You may configure the following variants:

- 021-1BD70 DI 4xDC24V (20): uses 20byte in the PII for 5 ETS entries
- 021-1BD70 DI 4xDC24V (60): uses 60byte in the PII for 15 ETS entries

Output area

No byte of the output area is used by the module.

Input area 20byte respectively 60byte

Depending on the configured variant, the module serves for an area for 5 resp. 15 ETS entries. Each ETS entry uses 4byte in input area:

Structure of an ETS entry

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5430h/s	01h
+1	RN	1	Running number	5431h/s	02h
+2	ETS_US	2	µs ticker	5432h/s	03h

PII

Here the state of the inputs after an edge change is stored. The input byte has the following bit assignment:

Bit 0: DI 0

Bit 1: DI 1

Bit 2: DI 2

Bit 3: DI 3

Bit 4 ... 7: 0 (fix)

RN

The **R**unning **N**umber (RN) is a continuous number 0 ... 127, which starts with 1. The RN corresponds to the chronological order of the edges.

ETS_US

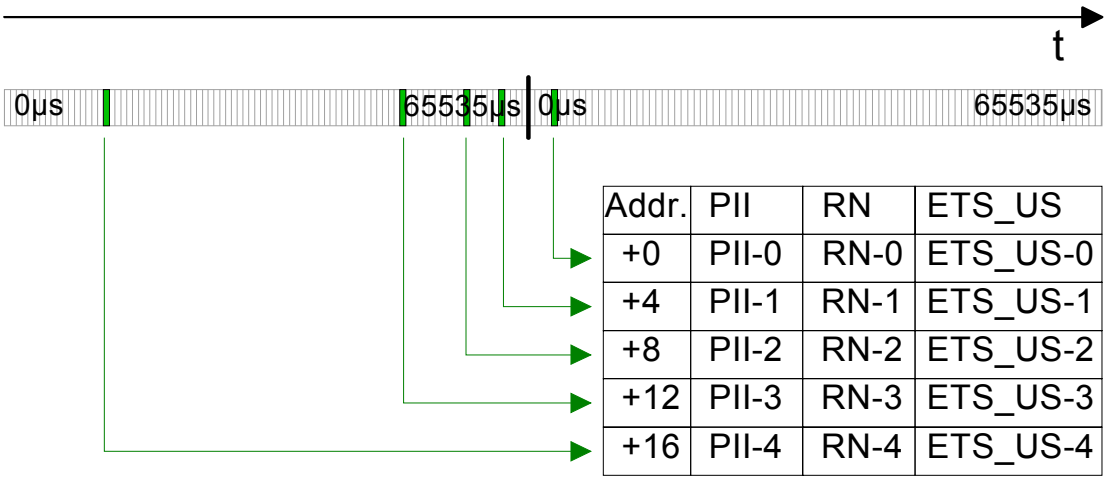
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

ETS_US always contains the low word of the µs ticker (0...65535µs).

ETS functionality

With the corresponding edge the value of the timer is stored as ETS entry in the process image as ETS_US together with the state of the inputs PII and the running number RN.

The following figure shows the sequence of how the ETS entries are stored in the input area.



Assignment of the input area

At CPU, Profibus and Profinet the input area is embedded to the corresponding address area.

IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX = Subindex for access via EtherCAT.

Configured as 021-1BD70

DI 4xDC 24V (20)
20byte - 5 ETS entries

Addr	PII	IX= 5430h	SX
+0	PII-0	s=1	01h
+4	PII-1	s=2	04h
+8	PII-2	s=3	07h
+12	PII-3	s=4	0Ah
+16	PII-4	s=5	0Dh

Addr	RN	IX= 5431h	SX
+1	RN-0	s=1	02h
+5	RN-1	s=2	05h
+9	RN-2	s=3	08h
+13	RN-3	s=4	0Bh
+17	RN-4	s=5	0Eh

Addr	ETS-US	IX= 5432h	SX
+2	ETS_US-0	s=1	03h
+6	ETS_US-1	s=2	06h
+10	ETS_US-2	s=3	09h
+14	ETS_US-3	s=4	0Ch
+18	ETS_US-4	s=5	0Fh

Configured as 021-1BD70

DI 4xDC 24V (60)
60byte - 15 ETS entries

Addr	PII	IX= 5430h	SX
+0	PII-0	s=1	01h
+4	PII-1	s=2	04h
+8	PII-2	s=3	07h
+12	PII-3	s=4	0Ah
+16	PII-4	s=5	0Dh
+20	PII-5	s=6	10h
+24	PII-6	s=7	13h
+28	PII-7	s=8	16h
+32	PII-8	s=9	19h
+36	PII-9	s=10	1Ch
+40	PII-10	s=11	1Fh
+44	PII-11	s=12	22h
+48	PII-12	s=13	25h
+52	PII-13	s=14	28h
+56	PII-14	s=15	2Bh

Addr	RN	IX= 5431h	SX
+1	RN-0	s=1	02h
+5	RN-1	s=2	05h
+9	RN-2	s=3	08h
+13	RN-3	s=4	0Bh
+17	RN-4	s=5	0Eh
+21	RN-5	s=6	11h
+25	RN-6	s=7	14h
+29	RN-7	s=8	17h
+33	RN-8	s=9	1Ah
+37	RN-9	s=10	1Dh
+41	RN-10	s=11	20h
+45	RN-11	s=12	23h
+49	RN-12	s=13	26h
+53	RN-13	s=14	29h
+57	RN-14	s=15	2Ch

Addr	ETS-US	IX= 5432h	SX
+2	ETS_US-0	s=1	03h
+6	ETS_US-1	s=2	06h
+10	ETS_US-2	s=3	09h
+14	ETS_US-3	s=4	0Ch
+18	ETS_US-4	s=5	0Fh
+22	ETS_US-5	s=6	12h
+26	ETS_US-6	s=7	15h
+30	ETS_US-7	s=8	18h
+34	ETS_US-8	s=9	1Bh
+38	ETS_US-9	s=10	1Eh
+42	ETS_US-10	s=11	21h
+46	ETS_US-11	s=12	24h
+50	ETS_US-12	s=13	27h
+54	ETS_US-13	s=14	2Ah
+58	ETS_US-14	s=15	2Dh

Technical data

Order number	**021-1BD70**
Type	SM 021
Module ID	0F03 47C2
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.95 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24V
Current consumption from load voltage L+ (without load)	15 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	parameterizable
Input delay of "1" to "0"	parameterizable
Number of simultaneously utilizable inputs horizontal configuration	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131, type 1
Initial data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	4
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

The following variants may be configured:

- 021-1BD70 DI 4xDC24V (20): uses 20byte in the PII for 5 ETS entries
- 021-1BD70 DI 4xDC24V (60): uses 60byte in the PII for 15 ETS entries

Both variants have the following parameter data:

DS = Data set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
PII_L	1	Length process image * input data	14h resp. 3Ch (fix)	02h	3100h	01h
PIQ_L	1	Length process image output data	00h (fix)	02h	3101h	02h
CH0D	1	Input delay DI 0	02h	01h	3102h	03h
CH1D	1	Input delay DI 1	02h	01h	3103h	04h
CH2D	1	Input delay DI 2	02h	01h	3104h	05h
CH3D	1	Input delay DI 3	02h	01h	3105h	06h
TSER	1	Raising edge 0-1 at DI x	00h	80h	3106h	07h
TSEF	1	Falling edge 1-0 at DI x	00h	80h	3107h	08h

*) This parameter corresponds of the configured variant.

PII_L

Byte	Bit 7 ... 0
0	The length of the process image of the input data is fix set to the configured variant (14h or 3Ch).

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to 0byte.

CHxD
DI x

Byte	Description	Possible values
0	Input delay DI x	00h: 1µs 07h: 86µs 02h: 3µs 09h: 342µs 04h: 10µs 0Ch: 2731µs Other values are not permissible!

With the help of filters you may e.g. filter signal peaks at a blurred input signal.

Edge select

Here the ETS function for DI 0 ... DI 3 may be activated. With these 2 bytes you may define the type of edge of the input signal, to which the current µs timer value is stored in the process image together with the state of the inputs.

TSER edge 0-1 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 0-1 (rising edge) DI 0 Bit 1: ETS record at edge 0-1 (rising edge) DI 1 Bit 2: ETS record at edge 0-1 (rising edge) DI 2 Bit 3: ETS record at edge 0-1 (rising edge) DI 3 (0: disable, 1: enable) Bit 7 ... 4: reserved

TSEF edge 1-0 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 1-0 (falling edge) DI 0 Bit 1: ETS record at edge 1-0 (falling edge) DI 1 Bit 2: ETS record at edge 1-0 (falling edge) DI 2 Bit 3: ETS record at edge 1-0 (falling edge) DI 3 (0: disable, 1: enable) Bit 7 ... 2: reserved

Example of the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored.

In this example a module is configured, which occupies 20byte for 5 ETS entries.

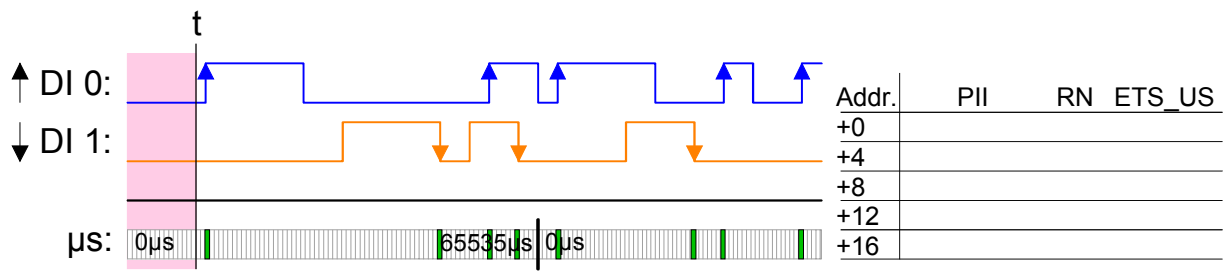
The following edges for the input channels are preset.

- DI 0: Edge 0-1: ↑
- DI 1: Edge 1-0: ↓
- DI 2 and DI 3 are 0 constant

The green area of the diagram indicates the ETS entries, which were available at time "t". ETS entries, which are not (longer) available are marked red.

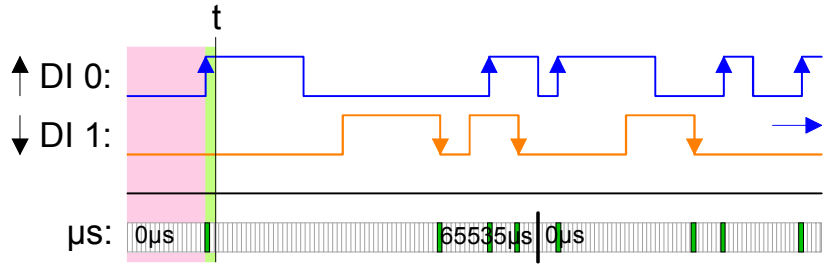
Process image is empty

New ETS entries are always registered starting from address +0. Thereby already existing ETS entries are shifted 4 byte each.



1. ETS entry

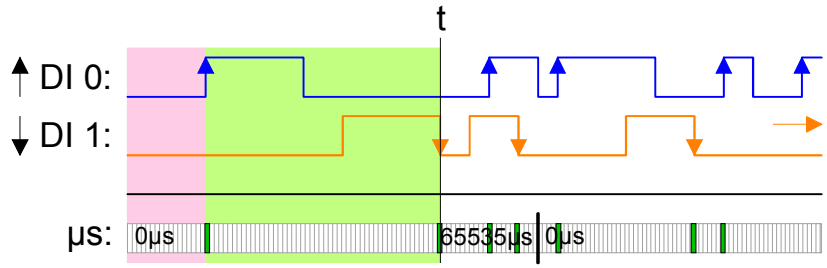
Released by an edge 0-1 from DI 0 the 1. ETS entry is registered starting from address +0.



Addr.	PII	RN	ETS_US
+0	00000001	1	12602
+4			
+8			
+12			
+16			

2. ETS entry

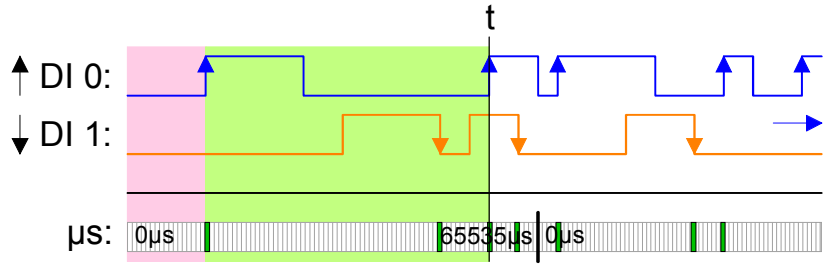
Released by an edge 1-0 from DI 1 the 2. ETS entry is registered starting from address +0 and the 1. ETS entry is shifted 4 byte.



Addr.	PII	RN	ETS_US
+0	00000000	2	50411
+4	00000001	1	12602
+8			
+12			
+16			

3. ETS entry

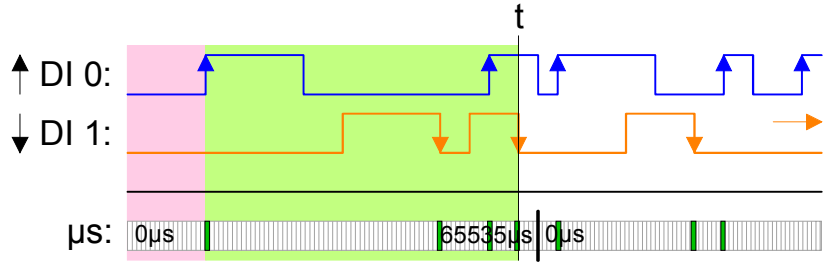
Released by an edge 0-1 from DI 0 the 3. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



Addr.	PII	RN	ETS_US
+0	00000011	3	57973
+4	00000000	2	50411
+8	00000001	1	12602
+12			
+16			

4. ETS entry

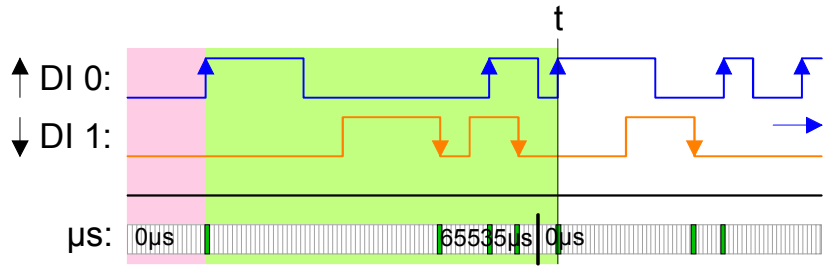
Released by an edge 1-0 from DI 1 the 4. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



Addr.	PII	RN	ETS_US
+0	00000001	4	62384
+4	00000011	3	57973
+8	00000000	2	50411
+12	00000001	1	12602
+16			

5. ETS entry

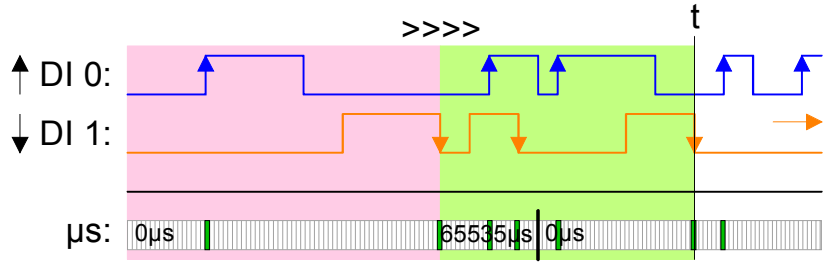
Released by an edge 0-1 from DI 0 the 5. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.
The maximum number of ETS entries is reached.



Addr.	PII	RN	ETS_US
+0	00000001	5	3150
+4	00000001	4	62384
+8	00000011	3	57973
+12	00000000	2	50411
+16	00000001	1	12602

6. ETS entry

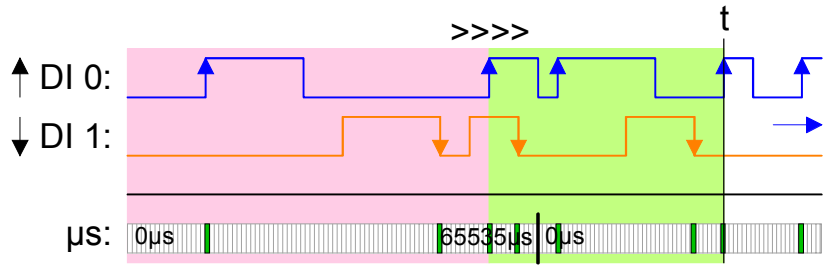
Released by an edge 1-0 from DI 1 the 6. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.
Thereby the 1. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000000	6	25205
+4	00000001	5	3150
+8	00000001	4	62384
+12	00000011	3	57973
+16	00000000	2	50411
	00000001	1	12602

7. ETS entry

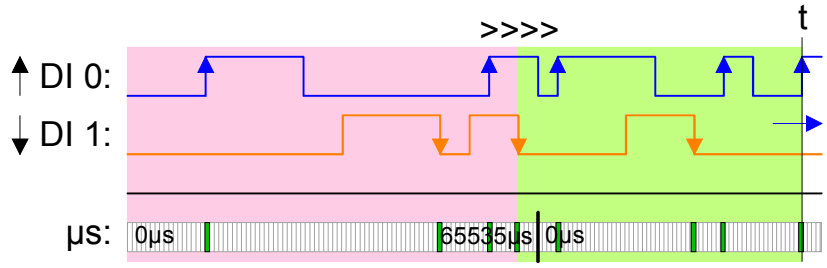
Released by an edge 0-1 from DI 0 the 7. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.
Thereby the 2. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	7	29616
+4	00000000	6	25205
+8	00000001	5	3150
+12	00000001	4	62384
+16	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

8. ETS entry

Released by an edge 0-1 from DI 0 the 8. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 3. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	8	42219
+4	00000001	7	29616
+8	00000000	6	25205
+12	00000001	5	3150
+16	00000001	4	62384
	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

Diagnostic data

So this module does not support interrupt functions, the diagnostic data serve the information about this module.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	reserved	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	70h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	04h			08h
CHERR	1	reserved	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker (32Bit)	00h			12h

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 70h: Digital input Bit 7: 0 (fix)

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D
CHERR, CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

VIPA 021-1BF00 - DI 8xDC 24V

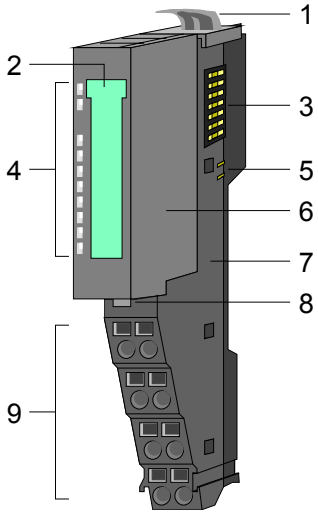
Description

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

Properties

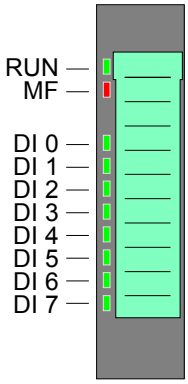
- 8 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

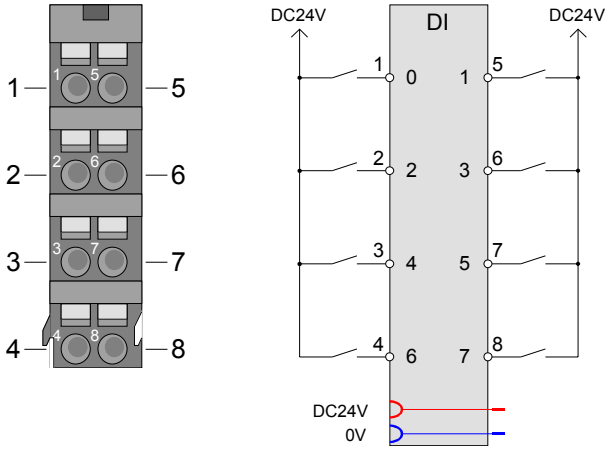


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DI 2	I	Digital input DI 2
3	DI 4	I	Digital input DI 4
4	DI 6	I	Digital input DI 6
5	DI 1	I	Digital input DI 1
6	DI 3	I	Digital input DI 3
7	DI 5	I	Digital input DI 5
8	DI 7	I	Digital input DI 7

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	6000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 4: DI 4		05h
			Bit 5: DI 5		06h
			Bit 6: DI 6		07h
			Bit 7: DI 7		08h

Output area

No byte of the output area is used by the module.

Technical data

Order number	**021-1BF00**
Type	SM 021
Module ID	0005 9FC1
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.9 W
Technical data digital inputs	
Number of inputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	8
Number of simultaneously utilizable inputs vertical configuration	8
Input characteristic curve	IEC 61131, type 1
Initial data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 021-1BF50 - DI 8xDC 24V NPN

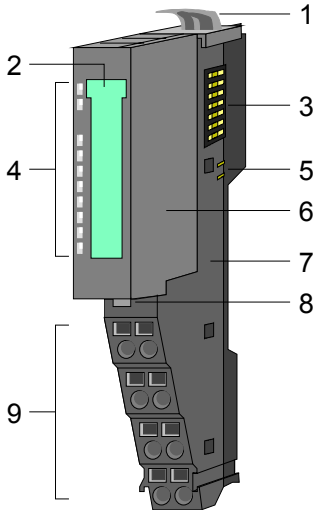
Description

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 8 channels and their status is monitored via LEDs.
An input becomes active as soon as it is connected to ground.

Properties

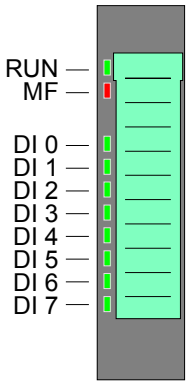
- 8 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

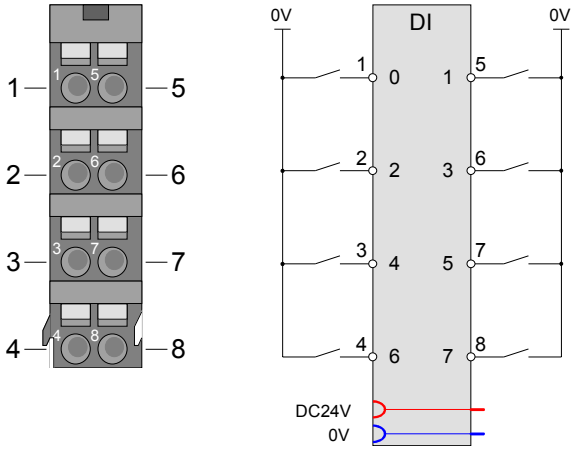


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DI x	green	●		Digital input is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DI 2	I	Digital input DI 2
3	DI 4	I	Digital input DI 4
4	DI 6	I	Digital input DI 6
5	DI 1	I	Digital input DI 1
6	DI 3	I	Digital input DI 3
7	DI 5	I	Digital input DI 5
8	DI 7	I	Digital input DI 7

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	6000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 4: DI 4		05h
			Bit 5: DI 5		06h
			Bit 6: DI 6		07h
			Bit 7: DI 7		08h

Output area

No byte of the output area is used by the module.

Technical data

Order number	021-1BF50
Type	SM 021
Module ID	0007 9FC1
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data digital inputs	
Number of inputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 15...28.8 V
Input voltage for signal "1"	DC 0...5 V
Input voltage hysteresis	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	3 ms
Input delay of "1" to "0"	3 ms
Number of simultaneously utilizable inputs horizontal configuration	8
Number of simultaneously utilizable inputs vertical configuration	8
Input characteristic curve	-
Initial data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Chapter 3 Digital Output

Overview

The digital output modules of the System SLIO will be found here.

Content

VIPA 022-1BB00 - DO 2xDC 24V 0.5A

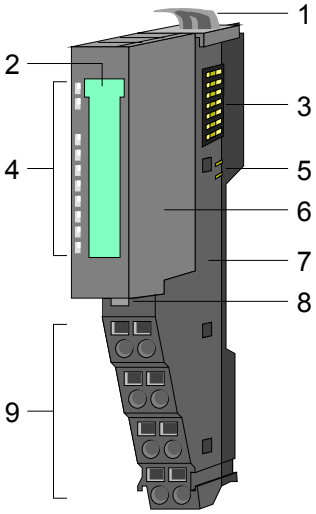
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 2 channels and their status is monitored via LEDs.

Properties

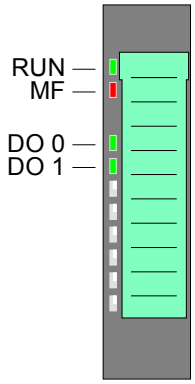
- 2 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

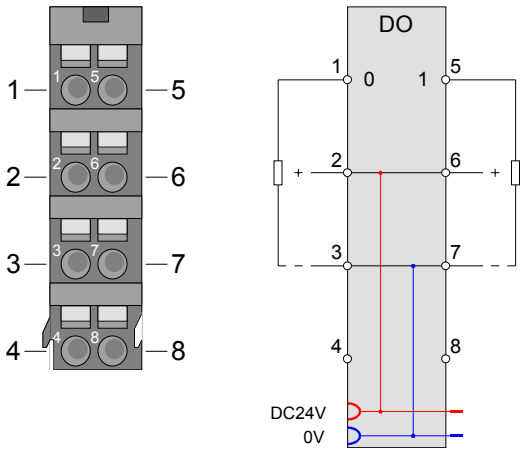


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DC 24V	O	DC 24V
3	0V	O	GND for actuator
4	---	---	not connected
5	DO 1	O	Digital output DO 1
6	DC 24V	O	DC 24V
7	0V	O	GND for actuator
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 7 ... 2: reserved		

Technical data

Order number	**022-1BB00**
Type	SM 022
Module ID	0101 AF90
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.4 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	5 mA
Total current per group, horizontal configuration, 40°C	1 A
Total current per group, horizontal configuration, 60°C	1 A
Total current per group, vertical configuration	1 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	175 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BB20 - DO 2xDC 24V 2A

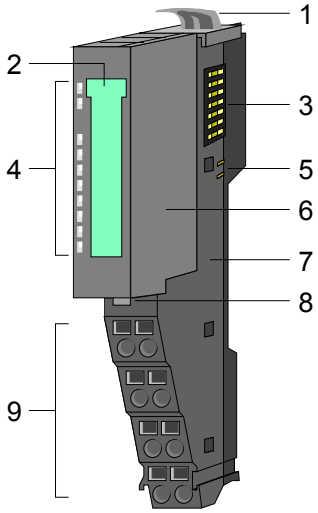
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 2 channels and their status is monitored via LEDs.

Properties

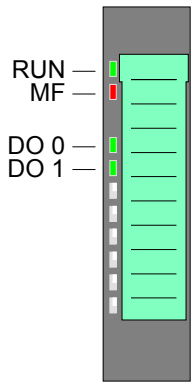
- 2 digital 2A outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

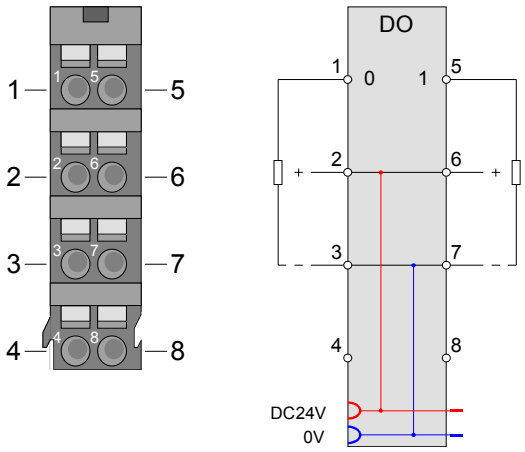


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DC 24V	O	DC 24V
3	0V	O	GND for actuator
4	---	---	not connected
5	DO 1	O	Digital output DO 1
6	DC 24V	O	DC 24V
7	0V	O	GND for actuator
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 7 ... 2: reserved		

Technical data

Order number	**022-1BB20**
Type	SM 022
Module ID	0102 AF90
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.55 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	10 mA
Total current per group, horizontal configuration, 40°C	4 A
Total current per group, horizontal configuration, 60°C	4 A
Total current per group, vertical configuration	4 A
Output current at signal "1", rated value	2 A
Output delay of "0" to "1"	100 µs
Output delay of "1" to "0"	250 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	2.7 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BB50 - DO 2xDC 24V 0.5A NPN

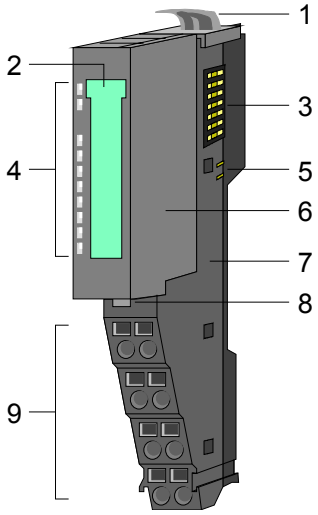
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 2 channels connected to the power supply, which operate as low-side switch and their status is monitored via LEDs. Low-side switches are suited to switch grounds. With a short circuit between switch line and ground the load is activated but the power supply is not influenced.

Properties

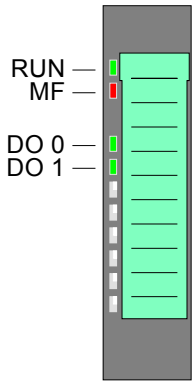
- 2 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

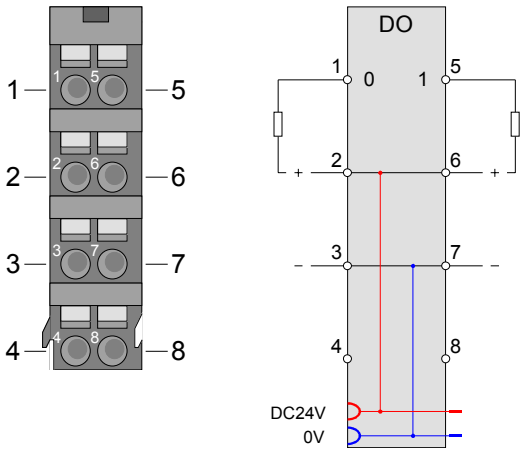


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DC 24V	O	DC 24V for actuator
3	0V	O	GND
4	---	---	not connected
5	DO 1	O	Digital output DO 1
6	DC 24V	O	DC 24V for actuator
7	0V	O	GND
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		01h
			Bit 7 ... 2: reserved		

Technical data

Order no.	**022-1BB50**
Type	SM 022
Module ID	0103 AF90
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.4 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	2.5 mA
Total current per group, horizontal configuration, 40°C	1 A
Total current per group, horizontal configuration, 60°C	1 A
Total current per group, vertical configuration	1 A
Output voltage signal "1" at max. current	M (+250 mV)
Output voltage signal "1" at min. current	M (+0 V)
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	ja
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	+45 V
Short-circuit protection of output	yes, electronic
Trigger level	1.7 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	ja
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BB70 - DO 2xDC 24V 0.5A ETS

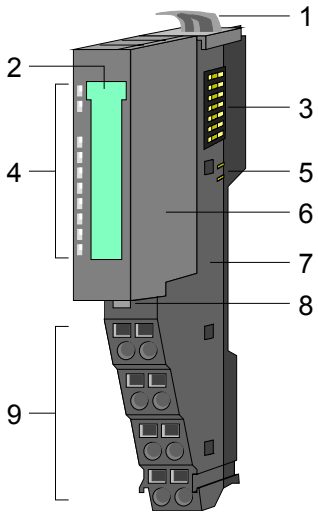
Description

The electronic module accepts binary control signals from the central bus system and transfers them time-controlled by means of ETS functionality to the process level via outputs.
It has 2 channels and their status is monitored via LEDs.
With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) depending on the configuration 5 (20byte) respectively 15 (60byte), you may transfer the states for the outputs together with a time value of the µs ticker as an ETS entry to the FIFO stack. The FIFO memory serves for space for max. 31 ETS entries.

Properties

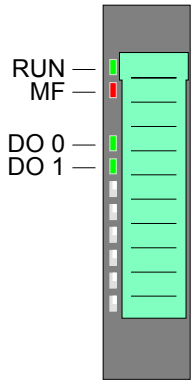
- 2 digital outputs, isolated to the backplane bus
- FIFO stack for 5 respectively 15 ETS entries (each 4byte)
- Controlling by process image respectively handling blocks
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

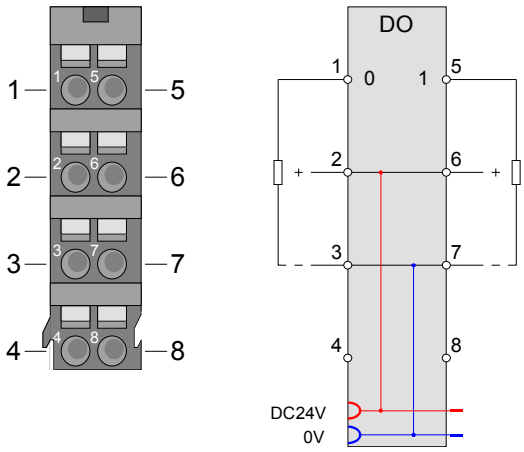


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DC 24V	O	DC 24V
3	0V	O	GND for actuator
4	---	---	not connected
5	DO 1	O	Digital output DO 1
6	DC 24V	O	DC 24V
7	0V	O	GND for actuator
8	---	---	not connected

O: Output

In-/Output area

With configured ETS functionality (ETS=**e**dge **t**ime **s**tamp) a time value (ETS_US) together with the state of the outputs (PIQ) and a running number (RN) may be stored as ETS entry in the process image

You may configure the following variants:

- 022-1BB70 DO 2xDC 24V (20): FIFO with 20byte for 5 ETS entries
- 022-1BB70 DO 2xDC 24V (60): FIFO with 60byte for 15 ETS entries

Note!

Please consider, with a full FIFO stack no further ETS entries may be accepted.

To ensure that your ETS entries are kept, you should always check the state of the FIFO stack by STS_FIFO in the input area before.

Input area 4byte

At CPU, Profibus and Profinet the input area is embedded to the corresponding address area.

IX = Index for access via CANopen.

SX = Subindex for access via EtherCAT.

Addr.	Name	Bytes	Function	IX	SX
+0	RN_LAST	1	Bit 5 ... 0 RN last FIFO entry Bit 6: 1 (fix) Bit 7: 0 (fix)	5440h	01h
+1	RN_NEXT	1	Bit 5 ... 0 RN next FIFO entry to be processed Bit 6: 1 (fix) Bit 7: 1 (fix)		02h
+2	STS_FIFO	1	State of the FIFO stack		03h
+3	NUM_ETS	1	Number of ETS entries in the FIFO stack		04h

RN _LAST

Bit 5 ... 0: Here the RN of the last ETS entry may be found, which was recognized as valid and written into the FIFO memory of the module.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 0 (fix) - serves for the identification in the process image

RN_NEXT

Bit 5 ... 0: Here the RN of the ETS entry may be found, which will be executed next in the FIFO memory of the module. Please consider Bit 6 and 7 of RN_NEXT are always set.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 1 (fix) - serves for the identification in the process image

STS_FIFO

The *State* informs about the state of the FIFO stack:

STS_FIFO	Description
00h/80h	Everything is OK. You will get this message directly after the storage in the FIFO memory of the module.
01h/81h	There is no following ETS entry in the FIFO. The RN does not correspond to the expected RN. Please check your RN in the output area.
02h/82h	There are no new ETS entries in the FIFO.
03h/83h	FIFO stack is full. There is no more place for further ETS entries.

If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6. If there is an ETS entry in the FIFO memory, whose bit 6 is set, STS_FIFO is always returned ored with 80h.

NUM_ETS

Here always the current number of the ETS entries in the FIFO memory of the module may be found.

Structure of an ETS entry

Depending on the configuration up to 15 ETS entries may be written via the output area. Each ETS entry uses 4byte in the process image:

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	Output byte	5640h/s	01h
+1	RN	1	Running number	5641h/s	02h
+2	ETS_US	2	µs ticker	5642h/s	03h

PIQ

Here the state of the outputs for the corresponding time may be defined and the output channels may be enabled respectively disabled. The output byte has the following bit allocation:

Bit 3 ... 0: 0 (fix)

Bit 4: Enable DO 1 (0: disable, 1: enable)

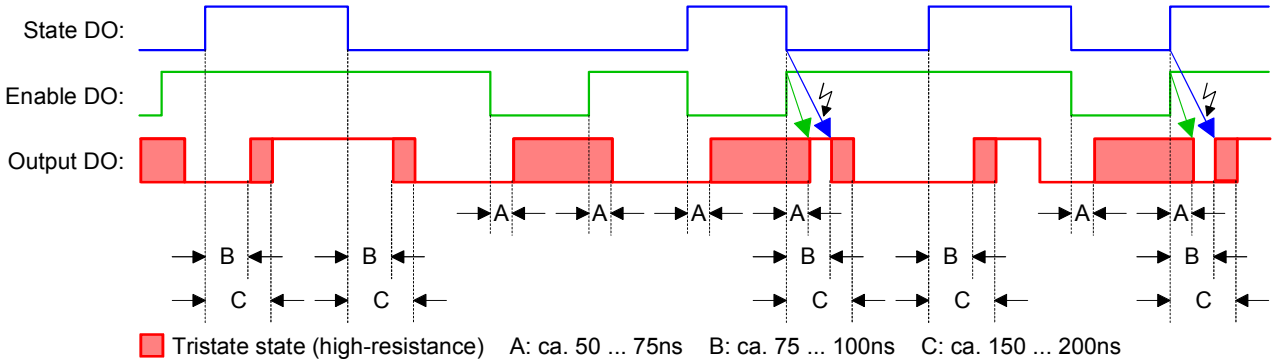
Bit 5: Enable DO 0 (0: disable, 1: enable)

Bit 6: State DO 1

Bit 7: State DO 0

Time characteristics of an output

The simultaneous enabling and state change of an output should be avoided. Due to the different run times (see times A, B and C) up to the change of state this may affect unwanted switching effects.
The following figure shows the time characteristics of an output when using the enable bit.



RN

RN (**R**unning **N**umber) is a continuous number 0 ... 63, which has to start with 1. With the RN the chronological order of the ETS entries may be defined. With each ETS entry RN is to be incremented, otherwise the ETS entry may not be recognized by the module.

Note!

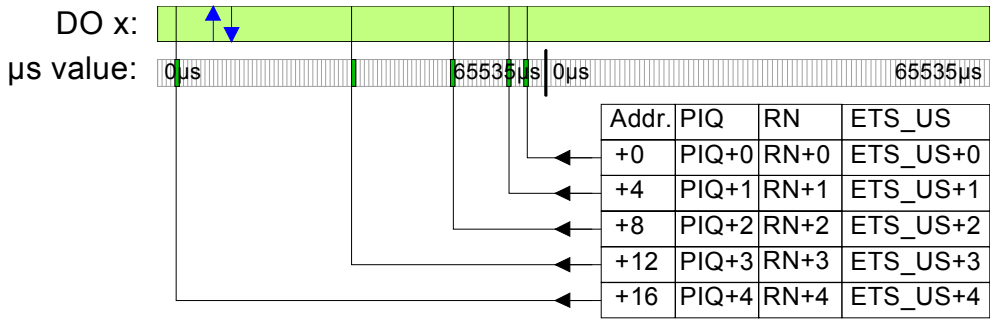
If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6.

ETS_US

In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting. After 2^{32}-1µs the timer starts with 0 again.
For ETS_US of an ETS entry you have to define a time value from the low word of the µs ticker (0...65535µs).
Here please enter a time value in µs, to which the state of the outputs is to be taken.
Range of values: 0 ... 65535

ETS functionality

The following picture shows how the ETS entries are to be preset in the output area, so that these can be stored in the FIFO memory.



Output area 20byte respectively 60byte

At CPU, Profibus and Profinet the output area is embedded to the corresponding address area.

IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX = Subindex for access via EtherCAT

Configured as 022-1BB70 — DO 2xDC 24V (20), 20byte - 5 ETS entries

Addr.	PIQ	IX= 5640h	SX
+0	PIQ+0	s=1	01h
+4	PIQ+1	s=2	04h
+8	PIQ+2	s=3	07h
+12	PIQ+3	s=4	0Ah
+16	PIQ+4	s=5	0Dh

Addr.	RN	IX= 5641h	SX
+1	RN+0	s=1	02h
+5	RN+1	s=2	05h
+9	RN+2	s=3	08h
+13	RN+3	s=4	0Bh
+17	RN+4	s=5	0Eh

Addr.	ETS-US	IX= 5642h	SX
+2	ETS_US+0	s=1	03h
+6	ETS_US+1	s=2	06h
+10	ETS_US+2	s=3	09h
+14	ETS_US+3	s=4	0Ch
+18	ETS_US+4	s=5	0Fh

Configured as 022-1BB70 — DO 2xDC 24V (60), 60byte - 15 ETS entries

Addr.	PIQ	IX= 5640h	SX
+0	PIQ+0	s=1	01h
+4	PIQ+1	s=2	04h
+8	PIQ+2	s=3	07h
+12	PIQ+3	s=4	0Ah
+16	PIQ+4	s=5	0Dh
+20	PIQ+5	s=6	10h
+24	PIQ+6	s=7	13h
+28	PIQ+7	s=8	16h
+32	PIQ+8	s=9	19h
+36	PIQ+9	s=10	1Ch
+40	PIQ+10	s=11	1Fh
+44	PIQ+11	s=12	22h
+48	PIQ+12	s=13	25h
+52	PIQ+13	s=14	28h
+56	PIQ+14	s=15	2Bh

Addr.	RN	IX= 5641h	SX
+1	RN+0	s=1	02h
+5	RN+1	s=2	05h
+9	RN+2	s=3	08h
+13	RN+3	s=4	0Bh
+17	RN+4	s=5	0Eh
+21	RN+5	s=6	11h
+25	RN+6	s=7	14h
+29	RN+7	s=8	17h
+33	RN+8	s=9	1Ah
+37	RN+9	s=10	1Dh
+41	RN+10	s=11	20h
+45	RN+11	s=12	23h
+49	RN+12	s=13	26h
+53	RN+13	s=14	29h
+57	RN+14	s=15	2Ch

Addr.	ETS-US	IX= 5642h	SX
+2	ETS_US+0	s=1	03h
+6	ETS_US+1	s=2	06h
+10	ETS_US+2	s=3	09h
+14	ETS_US+3	s=4	0Ch
+18	ETS_US+4	s=5	0Fh
+22	ETS_US+5	s=6	12h
+26	ETS_US+6	s=7	15h
+30	ETS_US+7	s=8	18h
+34	ETS_US+8	s=9	1Bh
+38	ETS_US+9	s=10	1Eh
+42	ETS_US+10	s=11	21h
+46	ETS_US+11	s=12	24h
+50	ETS_US+12	s=13	27h
+54	ETS_US+13	s=14	2Ah
+58	ETS_US+14	s=15	2Dh

Technical data

Order number	022-1BB70
Type	SM 022
Module ID	0F41 57E1
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.95 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	15 mA
Total current per group, horizontal configuration, 40°C	1 A
Total current per group, horizontal configuration, 60°C	1 A
Total current per group, vertical configuration	1 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	max. 100 ns
Output delay of "1" to "0"	max. 100 ns
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 40 kHz
Switching frequency with inductive load	max. 40 kHz
Switching frequency on lamp load	max. 40 kHz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic; only highside
Trigger level	2.5 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	2
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

The module has the following parameter data, which were fix set and may not be altered.

DS = Data set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
PII_L	1	Length process image input data	04h (fix)	02h	3100h	01h
PIQ_L	1	Length process image * output data	14h resp. 3Ch (fix)	02h	3101h	02h

*) This parameter depends on the configured variant.

PII_L

Byte	Bit 7 ... 0
0	The length of the process image of the input data is fix set to 4byte.

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to the configured variant (14h or 3Ch).

Example for the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored and processed.
With this example a module is configured, which uses 20byte for 5 ETS entries in the output area PIQ.

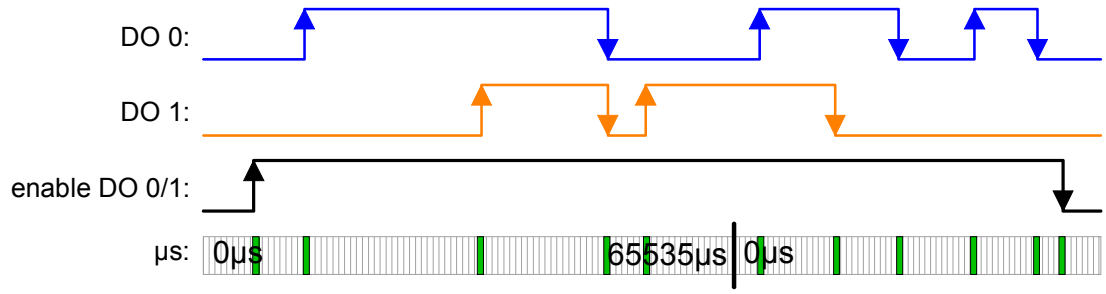
ETS values

With the following times of the µs ticker the following states of the outputs should be taken:

RN	ETS_US in µs	PIQ DO 0 (Bit 7)	PIQ DO 1 (Bit 6)	PIQ enable DO 0 (Bit 5)	PIQ enable DO 1 (Bit 4)
01h	6000	0	0	1	1
02h	12506	1	0	1	1
03h	34518	1	1	1	1
04h	49526	0	0	1	1
05h	54529	0	1	1	1
06h	3500	1	1	1	1
07h	12443	1	0	1	1
08h	20185	0	0	1	1
09h	30140	1	0	1	1
0Ah	37330	0	0	1	1
0Bh	40000	0	0	0	0

Time diagram

From the table you get the following time diagram:



Writing 5 ETS entries

After writing the ETS entries into the process output image they are directly stored in the FIFO memory of the module.

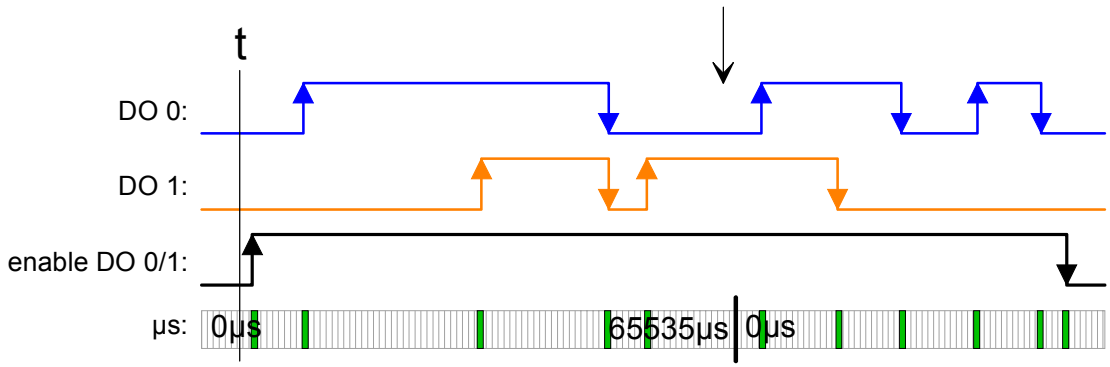
The state of the outputs are shown in the diagram at the time "t".

In the PII you will find the status bytes.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	00110000	01h	6000	RN_LAST: 45h RN_NEXT: C1h STS_FIFO: 00h NUM_ETS: 05h
2	10110000	02h	12506	
3	11110000	03h	34518	
4	00110000	04h	49526	
5	01110000	05h	54529	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



Executing ETS function for RN = 01h

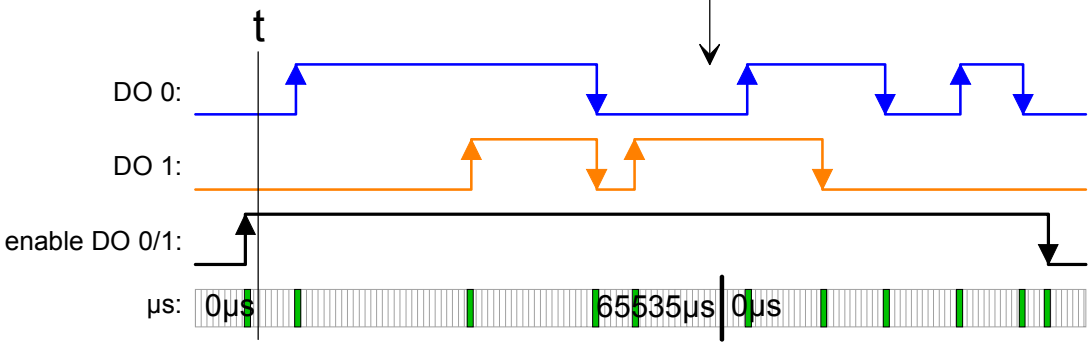
So that the outputs can be controlled, they must be enabled before. In this example both outputs are enabled with the 1. RN.

The ETS entry (RN = 01h) is executed and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	02h	12506	RN_LAST: 45h RN_NEXT: C2h STS_FIFO: 00h/02h NUM_ETS: 04h
2	11110000	03h	34518	
3	00110000	04h	49526	
4	01110000	05h	54529	
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



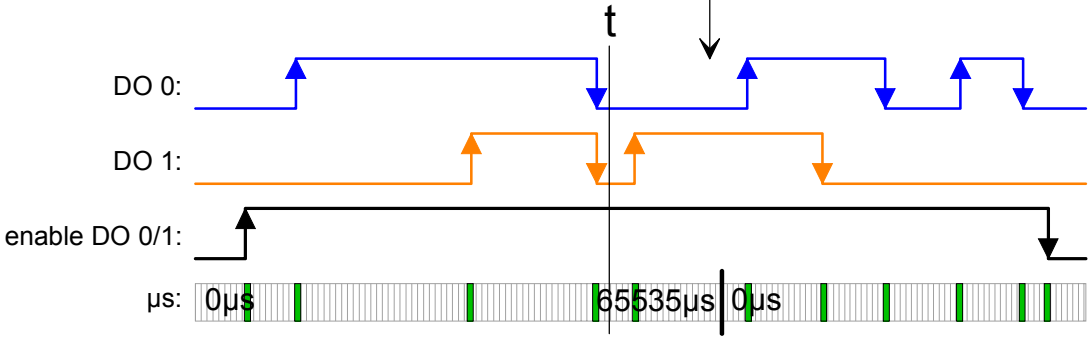
Executing ETS function for RN = 02h ... 04h

The states of RN = 02h ... RN 04h are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	01110000	05h	54529	RN_LAST: 45h RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 01h
2	00000000	00h	0	
3	00000000	00h	0	
4	00000000	00h	0	
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



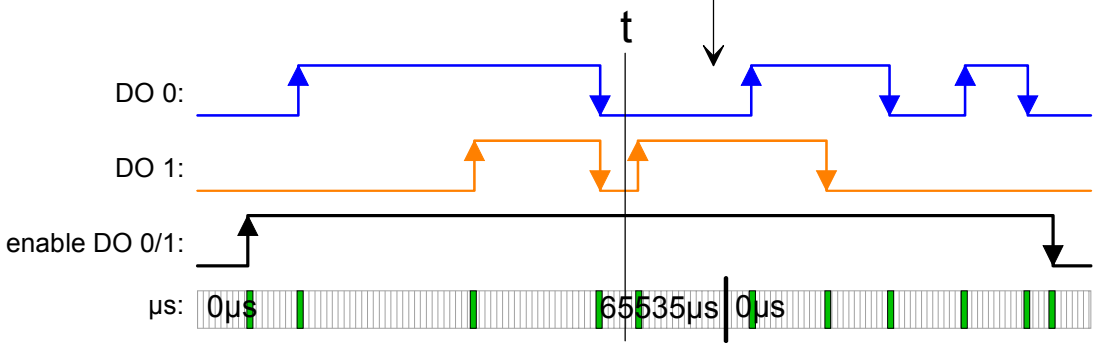
Writing 5 ETS entries

After writing the next 5 ETS entries into the process output image they are directly stored in the FIFO memory of the module.

Addr	PIQ	RN	ETS_US
+0	11110000	06h	3500
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	01110000	05h	54529	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 06h
2	11110000	06h	3500	
3	10110000	07h	12443	
4	00110000	08h	20185	
5	10110000	09h	30140	
6	00110000	0Ah	37330	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



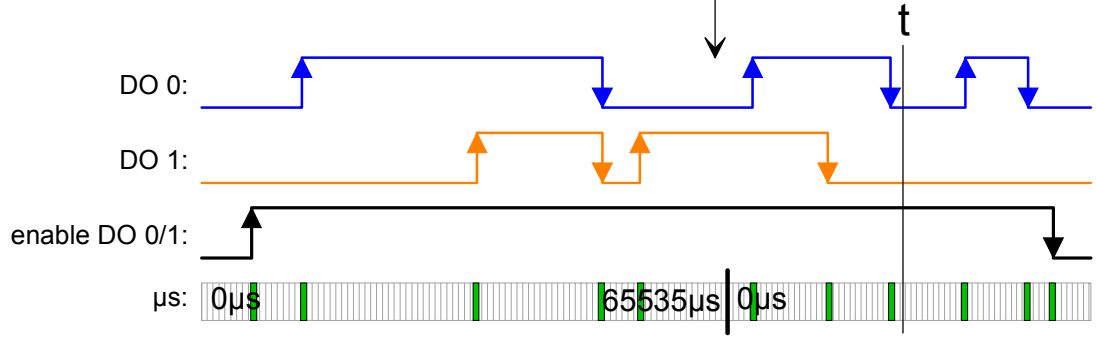
Executing ETS function for RN = 06h ... 08h

The states of RN = 06h ... RN 08h are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	11110000	06h	3500
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	09h	30140	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 02h
2	00110000	0Ah	37330	
3	00000000	00h	0	
4	00000000	00h	0	
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



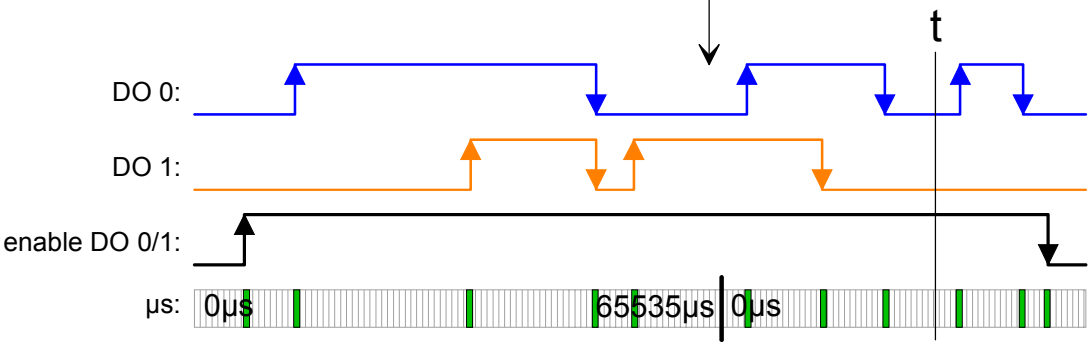
Writing last ETS entry

Since less than 5 ETS entries are written, bit 6 of RN of the last ETS entry must always be set. RN = 0Bh becomes 4Bh.

Addr	PIQ	RN	ETS_US
+0	00000000	4Bh	40000
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	09h	30140	RN_LAST: 4Bh
2	00110000	0Ah	37330	RN_NEXT: C9h
3	00000000	4Bh	40000	STS_FIFO: 80h/82h
4	00000000	00h	0	NUM_ETS: 03h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



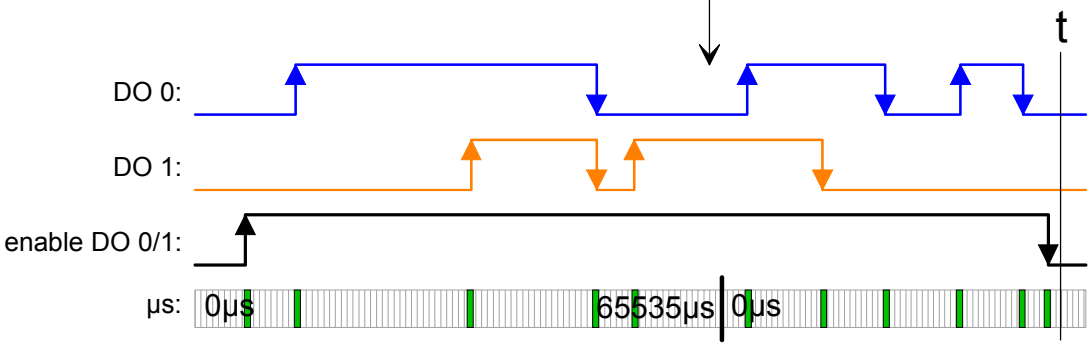
Executing ETS function for RN = 09h ... 4Bh

The states of RN = 09h ... RN 4Bh are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00000000	4Bh	40000
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	00000000	00h	0	RN_LAST: 4Bh
2	00000000	00h	0	RN_NEXT: CCh
3	00000000	00h	0	STS_FIFO: 80h/82h
4	00000000	00h	0	NUM_ETS: 00h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



Diagnostic data

This module does not support interrupt functions, the diagnostic data serve the information about this module.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	reserved	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	72h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	02h			08h
CHERR	1	reserved	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker (32Bit)	00h			12h

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 72h: Digital output Bit 7: 0 (fix)

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
Number of channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D
CHERR, CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

VIPA 022-1BB90 - DO 2xDC 24V 0.5A PWM

Description

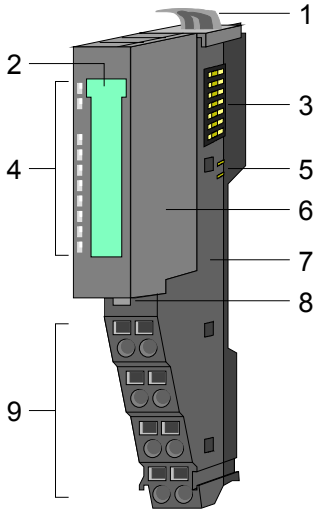
The electronic has 2 output channels with PWM functionality (PWM = **p**ulse **w**idth **m**odulation).

By presetting of time parameter a pulse sequence with according pulse/break ratio may be issued at the corresponding output channel.

Properties

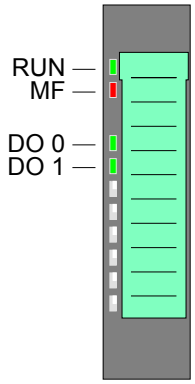
- 2 PWM outputs, isolated to the backplane bus
- PWM outputs switchable between *push/pull* and *high side*
- Status indication of the channels via LEDs
- PWM status
- Variable period duration and pulse duty ratio

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

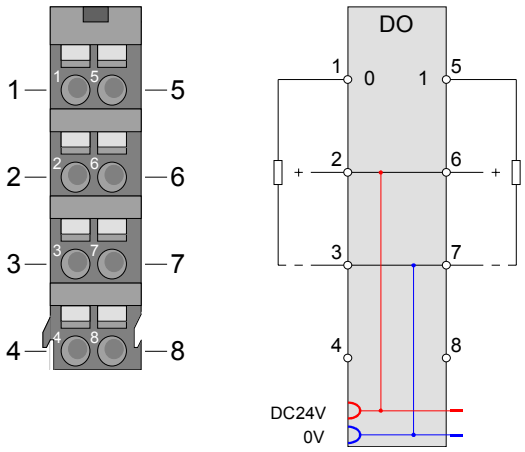


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●	PWM output is set	

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	PWM output DO 0
2	DC 24V	O	DC 24V
3	0V	O	GND for actuator
4	---	---	not connected
5	DO 1	O	PWM output DO 1
6	DC 24V	O	DC 24V
7	0V	O	GND for actuator
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 7 ... 2: reserved		

Technical data

Order number	**022-1BB90**
Type	SM 022
Module ID	0901 4880
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.95 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	15 mA
Total current per group, horizontal configuration, 40°C	1 A
Total current per group, horizontal configuration, 60°C	1 A
Total current per group, vertical configuration	1 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	max. 100 ns
Output delay of "1" to "0"	max. 100 ns
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 40 kHz
Switching frequency with inductive load	max. 40 kHz
Switching frequency on lamp load	max. 40 kHz
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	yes, electronic; only highside
Trigger level	2.5 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	12 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	2
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

In-/Output area

The following areas of the input/output area are used by the module:

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = subindex, depends on number of PWM modules

SX = Subindex for access via EtherCAT

Input area 4byte

Addr.	Name	Bytes	Function	IX	SX
+0	PWMSTS_I	2	PWM 0: Status	5420h/s	01h
+2	PWMSTS_II	2	PWM 1: Status	5420h/s+1	02h

Status PWM x

Bit	Name	Function
0	-	reserved
1	STS_PWM	Status PWM 0: PWM output stopped 1: PWM output activated
2	STS_OUTBV	Status output 0: Push/Pull output 1: High side output
3 ... 15	-	reserved

Output area 12byte

Addr.	Name	Bytes	Function	IX	SX
+0	PWMPD_I	4	PWM 0: Pulse duration	5620h/s	01h
+4	PWMPD_II	4	PWM 1: Pulse duration	5620h/s+1	02h
+8	PWMCTRL_I	2	PWM 0: Control word	5621h/s	03h
+10	PWMCTRL_II	2	PWM 1: Control word	5621h/s+1	04h

PWMPD_I
PWMPD_II
Pulse duration

Here you have to define the pulse duty ratio for the configured *period duration*, by presetting the high level for the corresponding PWM channel.

The pulse duration is to be preset as factor to the base 20.83ns.

Range of values: 48 ... 8388607 (1µs ... ca. 175ms)

PWMCTRL_I
PWMCTRL_II
Control word

Here for the corresponding channel the PWM output behavior may be preset and the PWM output may be started respectively stopped.

Bit	Name	Function
0 ... 1	-	reserved
2	CTRL_OUTBV	PWM output behavior 0: Push/Pull output 1: High side output With *Push/Pull* operation it is active switched to high and low level. With *High side* operation it is only active switched to high level.
3 ... 7	-	reserved
8	CTRL_STRT	Edge 0-1 starts PWM output at channel x
9	CTRL_STP	Edge 0-1 stops PWM output at channel x
10 ... 15	-	reserved

Parameter data

DS = Data set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
PWMPD_I	4	PWM 0: Period duration (Base time: 20.83ns)	1F40h	80h	3102h	03h
PWMPD_II	4	PWM 1: Period duration (Base time: 20.83ns)	1F40h	81h	3103h	04h

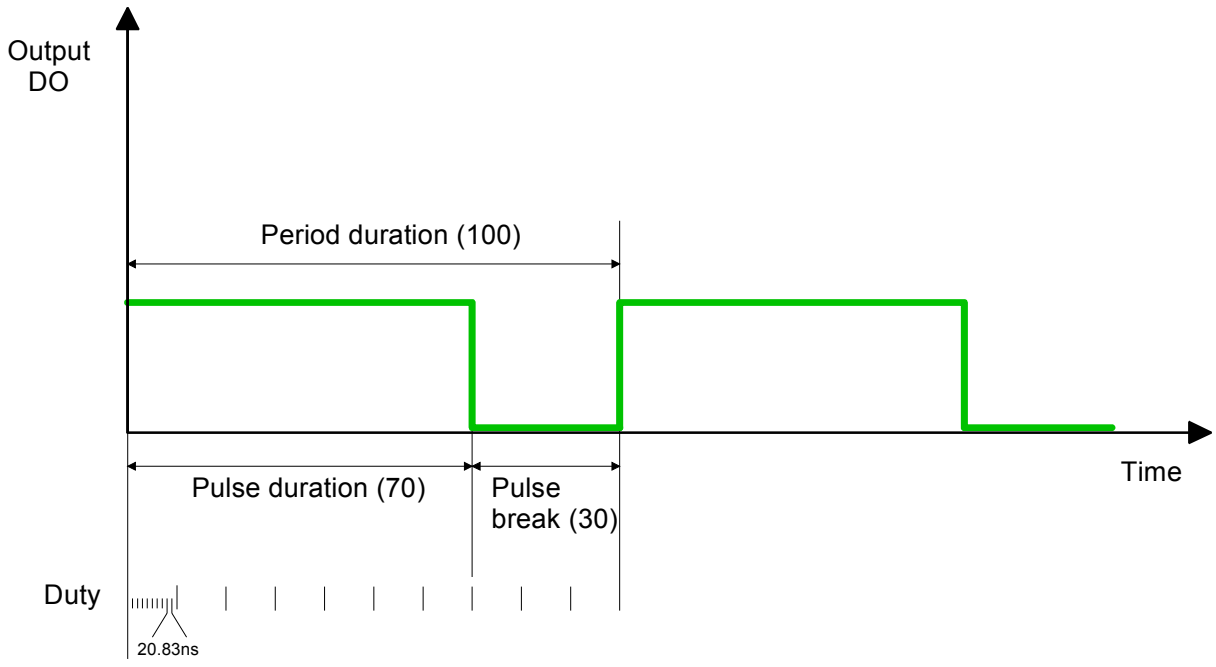
PWMPD_x Period duration

Byte	Bit 7 ... 0
0 ... 3	PWM x Period duration Here you have to configure the whole time for *Pulse duration* and Pulse break. The time is to be preset as factor to the base 20.83ns. Values lower than 25µs are ignored. Is the *pulse duration* value greater than or equal the value of *period duration* the output is permanently set. Range of values: 1200 ... 8388607 (25µs ... ca. 175ms)

Principle of operation

By presetting the *period duration* via parameterization and the *pulse duration* via the output area, the pulse duty ratio for the corresponding PWM output channel may be defined.

By changing the pulse duty ration e.g. a drive system, which is connected via PWM may be controlled by the user program.



Diagnostic data

So this module does not support process interrupts, the diagnostics data serve for information about this module.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	72h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	02h			08h
CHERR	1	reserved	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker	0			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b: Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 72h: Digital output Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_C/D
CHERR, CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

VIPA 022-1BD00 - DO 4xDC 24V 0.5A

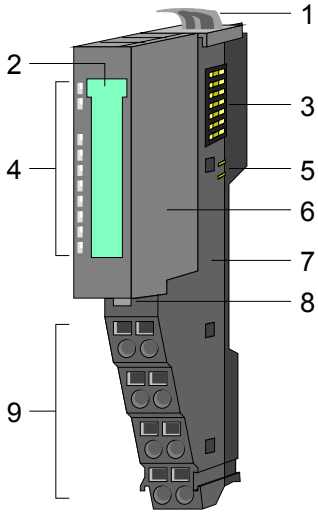
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs. It has 4 channels and their status is monitored via LEDs.

Properties

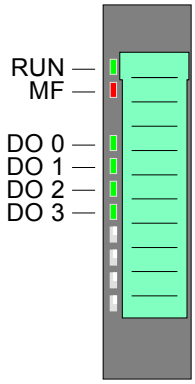
- 4 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

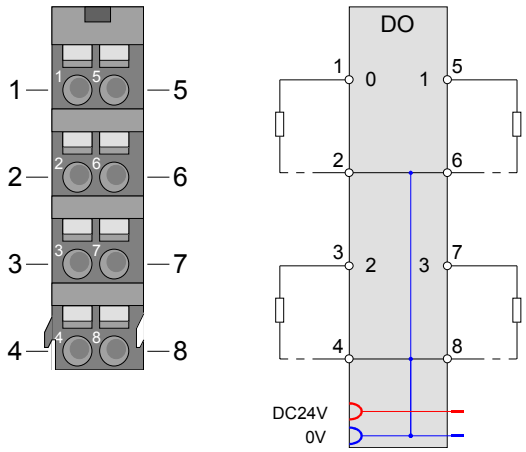


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	0V	O	GND for actuator DO 0
3	DO 2	O	Digital output DO 2
4	0V	O	GND for actuator DO 2
5	DO 1	O	Digital output DO 1
6	0V	O	GND for actuator DO 1
7	DO 3	O	Digital output DO 3
8	0V	O	GND for actuator DO 3

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 7 ... 4: reserved		

Technical data

Order number	**022-1BD00**
Type	SM 022
Module ID	0104 AFA0
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.5 W
Technical data digital outputs	
Number of outputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	10 mA
Total current per group, horizontal configuration, 40°C	2 A
Total current per group, horizontal configuration, 60°C	2 A
Total current per group, vertical configuration	2 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	175 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BD20 - DO 4xDC 24V 2A

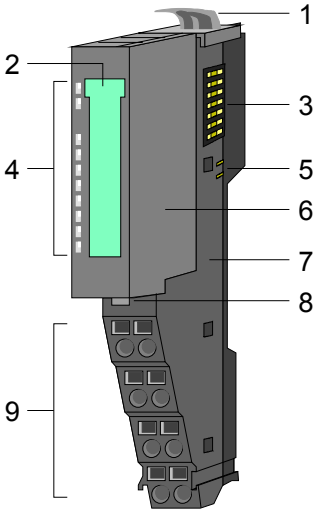
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs. It has 4 channels and their status is monitored via LEDs.

Properties

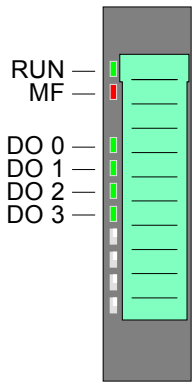
- 4 digital 2A outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

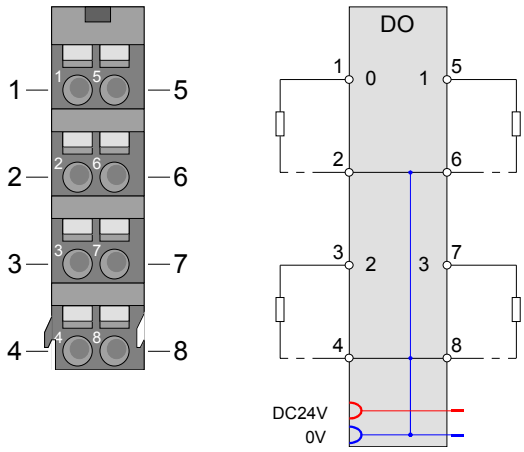


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	0V	O	GND for actuator DO 0
3	DO 2	O	Digital output DO 2
4	0V	O	GND for actuator DO 2
5	DO 1	O	Digital output DO 1
6	0V	O	GND for actuator DO 1
7	DO 3	O	Digital output DO 3
8	0V	O	GND for actuator DO 3

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 7 ... 4: reserved		

Technical data

Order number	022-1BD20
Type	SM 022
Module ID	0108 AFA0
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data digital outputs	
Number of outputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	15 mA
Total current per group, horizontal configuration, 40°C	4 A
Total current per group, horizontal configuration, 60°C	4 A
Total current per group, vertical configuration	4 A
Output current at signal "1", rated value	2 A
Output delay of "0" to "1"	100 µs
Output delay of "1" to "0"	250 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	-
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	2.7 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED / channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BD50 - DO 4xDC 24V 0.5A NPN

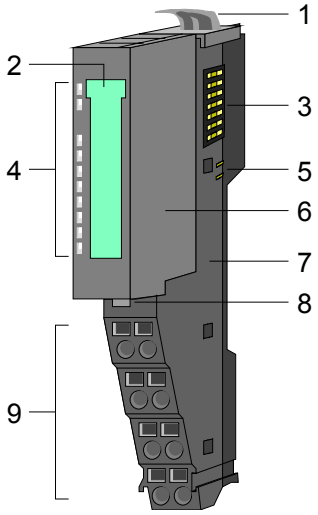
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 4 channels connected to the power supply, which operate as low-side switch and their status is monitored via LEDs. Low-side switches are suited to switch grounds. With a short circuit between switch line and ground the load is activated but the power supply is not influenced.

Properties

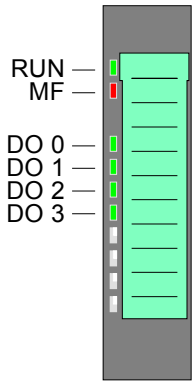
- 4 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

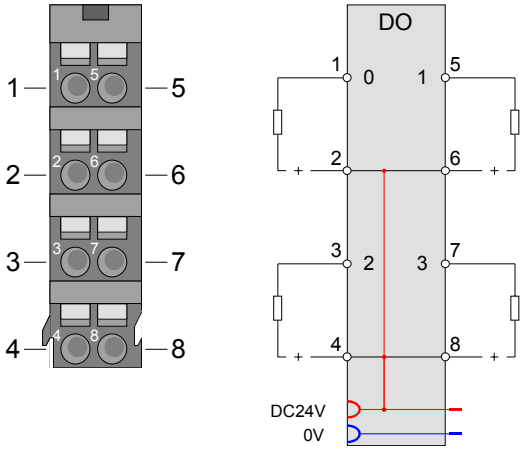


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DC 24V	O	DC 24V for actuator DO 0
3	DO 2	O	Digital output DO 2
4	DC 24V	O	DC 24V for actuator DO 2
5	DO 1	O	Digital output DO 1
6	DC 24V	O	DC 24V for actuator DO 1
7	DO 3	O	Digital output DO 3
8	DC 24V	O	DC 24V for actuator DO 3

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 7 ... 4: reserved		

Technical data

Order number	**022-1BD50**
Type	SM 022
Module ID	0105 AFA0
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.5 W
Technical data digital outputs	
Number of outputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	5 mA
Total current per group, horizontal configuration, 40°C	2 A
Total current per group, horizontal configuration, 60°C	2 A
Total current per group, vertical configuration	2 A
Output voltage signal "1" at max. current	M (+250 mV)
Output voltage signal "1" at min. current	M (+0 V)
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outp. for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	+45 V
Short-circuit protection of output	yes, electronic
Trigger level	1.7 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	4 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BD70 - DO 4xDC 24V 0.5A ETS

Description

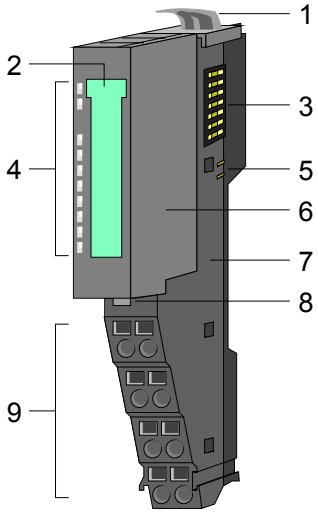
The electronic module accepts binary control signals from the central bus system and transfers them time-controlled by means of ETS functionality to the process level via outputs.
It has 4 channels and their status is monitored via LEDs.

With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) depending on the configuration 5 (20byte) respectively 15 (60byte), you may transfer the states for the outputs together with a time value of the µs ticker as an ETS entry to the FIFO stack. The FIFO memory serves for space for max. 31 ETS entries.

Properties

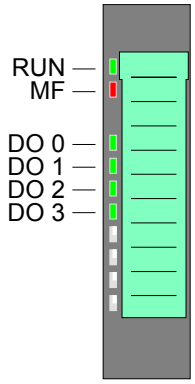
- 4 digital outputs, isolated to the backplane bus
- FIFO stack for 5 respectively 15 ETS entries (each 4byte)
- Controlling by process image respectively handling blocks
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

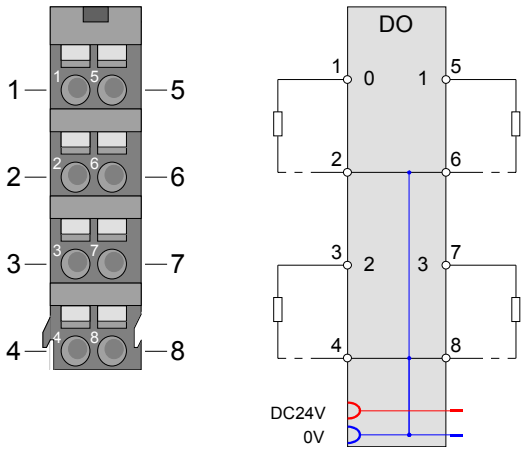


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	0V	O	GND for actuator DO 0
3	DO 2	O	Digital output DO 2
4	0V	O	GND for actuator DO 2
5	DO 1	O	Digital output DO 1
6	0V	O	GND for actuator DO 1
7	DO 3	O	Digital output DO 3
8	0V	O	GND for actuator DO 3

O: Output

In-/Output area

With configured ETS functionality (ETS=**e**dge **t**ime **s**tamp) a time value (ETS_US) together with the state of the outputs (PIQ) and a running number (RN) may be stored as ETS entry in the process image.

You may configure the following variants:

- 022-1BD70 DO 4xDC 24V (20): FIFO with 20byte for 5 ETS entries
- 022-1BD70 DO 4xDC 24V (60): FIFO with 60byte for 15 ETS entries

Note!

Please consider, with a full FIFO stack no further ETS entries may be accepted.

To ensure that your ETS entries are kept, you should always check the state of the FIFO stack by STS_FIFO in the input area before.

Input area 4byte

At CPU, Profibus and Profinet the input area is embedded to the corresponding address area.

IX = Index for access via CANopen.

SX = Subindex for access via EtherCAT.

Addr.	Name	Bytes	Function	IX	SX
+0	RN_LAST	1	Bit 5 ... 0 RN last FIFO entry Bit 6: 1 (fix) Bit 7: 0 (fix)	5440h	01h
+1	RN_NEXT	1	Bit 5 ... 0 RN next FIFO entry to be processed Bit 6: 1 (fix) Bit 7: 1 (fix)		02h
+2	STS_FIFO	1	State of the FIFO stack		03h
+3	NUM_ETS	1	Number of ETS entries in the FIFO stack		04h

RN_LAST

Bit 5 ... 0: Here the RN of the last ETS entry may be found, which was recognized as valid and written into the FIFO memory of the module.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 0 (fix) - serves for the identification in the process image

RN_NEXT

Bit 5 ... 0: Here the RN of the ETS entry may be found, which will be executed next in the FIFO memory of the module. Please consider Bit 6 and 7 of RN_NEXT are always set.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 1 (fix) - serves for the identification in the process image

STS_FIFO

The *State* informs about the state of the FIFO stack:

STS_FIFO	Description
00h/80h	Everything is OK. You will get this message directly after the storage in the FIFO memory of the module.
01h/81h	There is no following ETS entry in the FIFO. The RN does not correspond to the expected RN. Please check your RN in the output area.
02h/82h	There are no new ETS entries in the FIFO.
03h/83h	FIFO stack is full. There is no more place for further ETS entries.

If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6. If there is an ETS entry in the FIFO memory, whose bit 6 is set, STS_FIFO is always returned ored with 80h.

NUM_ETS

Here always the current number of the ETS entries in the FIFO memory of the module may be found.

Structure of an ETS entry

Depending on the configuration up to 15 ETS entries may be written via the output area. Each ETS entry uses 4byte in the process image:

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	Output byte	5640h/s	01h
+1	RN	1	Running number	5641h/s	02h
+2	ETS_US	2	µs ticker	5642h/s	03h

PIQ

Here the state of the outputs for the corresponding time may be defined and the output channels may be enabled respectively disabled. The output byte has the following bit allocation:

Bit 3 ... 0: 0 (fix)

Bit 4: State DO 3

Bit 5: State DO 2

Bit 6: State DO 1

Bit 7: State DO 0

RN

RN (**R**unning **N**umber) is a continuous number 0 ... 63, which has to start with 1. With the RN the chronological order of the ETS entries may be defined. With each ETS entry RN is to be incremented, otherwise the ETS entry may not be recognized by the module.

Note!

If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6.

ETS_US

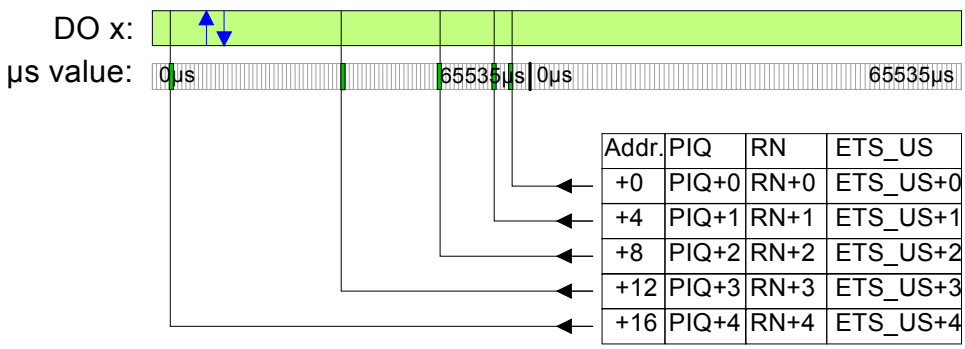
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting. After 2^{32}-1µs the timer starts with 0 again.
For ETS_US of an ETS entry you have to define a time value from the low word of the µs ticker (0...65535µs).

Here please enter a time value in µs, to which the state of the outputs is to be taken.

Range of values: 0 ... 65535

ETS functionality

The following picture shows how the ETS entries are to be preset in the output area, so that these can be stored in the FIFO memory.



Output area 20byte respectively 60byte

At CPU, Profibus and Profinet the output area is embedded to the corresponding address area.

IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX = Subindex for access via EtherCAT.

Configured as 022-1BD70 — DO 4xDC 24V (20), 20byte - 5 ETS entries

Addr	PIQ	IX= 5640h	SX
+0	PIQ+0	s=1	01h
+4	PIQ+1	s=2	04h
+8	PIQ+2	s=3	07h
+12	PIQ+3	s=4	0Ah
+16	PIQ+4	s=5	0Dh

Addr	RN	IX= 5641h	SX
+1	RN+0	s=1	02h
+5	RN+1	s=2	05h
+9	RN+2	s=3	08h
+13	RN+3	s=4	0Bh
+17	RN+4	s=5	0Eh

Addr	ETS-US	IX= 5642h	SX
+2	ETS_US+0	s=1	03h
+6	ETS_US+1	s=2	06h
+10	ETS_US+2	s=3	09h
+14	ETS_US+3	s=4	0Ch
+18	ETS_US+4	s=5	0Fh

Configured as 022-1BD70 — DO 4xDC 24V (60), 60byte - 15 ETS entries

Addr	PIQ	IX= 5640h	SX
+0	PIQ+0	s=1	01h
+4	PIQ+1	s=2	04h
+8	PIQ+2	s=3	07h
+12	PIQ+3	s=4	0Ah
+16	PIQ+4	s=5	0Dh
+20	PIQ+5	s=6	10h
+24	PIQ+6	s=7	13h
+28	PIQ+7	s=8	16h
+32	PIQ+8	s=9	19h
+36	PIQ+9	s=10	1Ch
+40	PIQ+10	s=11	1Fh
+44	PIQ+11	s=12	22h
+48	PIQ+12	s=13	25h
+52	PIQ+13	s=14	28h
+56	PIQ+14	s=15	2Bh

Addr	RN	IX= 5641h	SX
+1	RN+0	s=1	02h
+5	RN+1	s=2	05h
+9	RN+2	s=3	08h
+13	RN+3	s=4	0Bh
+17	RN+4	s=5	0Eh
+21	RN+5	s=6	11h
+25	RN+6	s=7	14h
+29	RN+7	s=8	17h
+33	RN+8	s=9	1Ah
+37	RN+9	s=10	1Dh
+41	RN+10	s=11	20h
+45	RN+11	s=12	23h
+49	RN+12	s=13	26h
+53	RN+13	s=14	29h
+57	RN+14	s=15	2Ch

Addr	ETS-US	IX= 5642h	SX
+2	ETS_US+0	s=1	03h
+6	ETS_US+1	s=2	06h
+10	ETS_US+2	s=3	09h
+14	ETS_US+3	s=4	0Ch
+18	ETS_US+4	s=5	0Fh
+22	ETS_US+5	s=6	12h
+26	ETS_US+6	s=7	15h
+30	ETS_US+7	s=8	18h
+34	ETS_US+8	s=9	1Bh
+38	ETS_US+9	s=10	1Eh
+42	ETS_US+10	s=11	21h
+46	ETS_US+11	s=12	24h
+50	ETS_US+12	s=13	27h
+54	ETS_US+13	s=14	2Ah
+58	ETS_US+14	s=15	2Dh

Technical data

Order number	**022-1BD70**
Type	SM 022
Module ID	0F43 57E2
Current consumption/power loss	
Current consumption from backplane bus	90 mA
Power loss	0.95 W
Technical data digital outputs	
Number of outputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	25 mA
Total current per group, horizontal configuration, 40°C	2 A
Total current per group, horizontal configuration, 60°C	2 A
Total current per group, vertical configuration	2 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	max. 100 ns
Output delay of "1" to "0"	max. 100 ns
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 40 kHz
Switching frequency with inductive load	max. 40 kHz
Switching frequency on lamp load	max. 40 kHz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic; only highside
Trigger level	2.5 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	4
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

The module has the following parameter data, which were fix set and may not be altered.

DS = Data set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
PII_L	1	Length process image input data	04h (fix)	02h	3100h	01h
PIQ_L	1	Length process image * output data	14h resp. 3Ch (fix)	02h	3101h	02h

*) This parameter depends on the configured variant.

PII_L

Byte	Bit 7 ... 0
0	The length of the process image of the input data is fix set to 4byte.

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to the configured variant (14h or 3Ch).

Example for the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored and processed.
With this example a module is configured, which uses 20byte for 5 ETS entries in the output area PIQ.

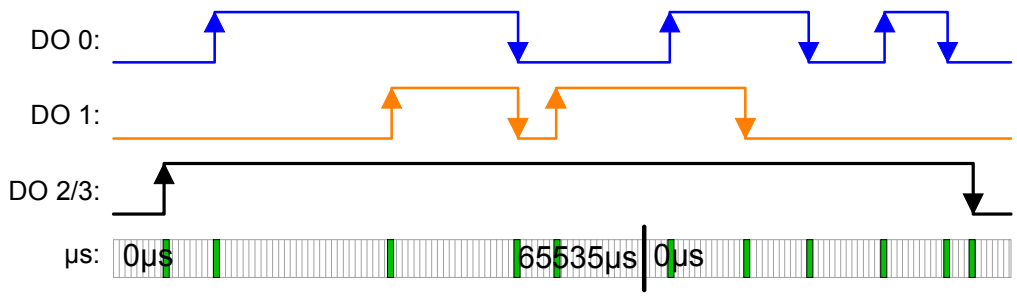
ETS values

With the following times of the µs ticker the following states of the outputs should be taken:

RN	ETS_US in µs	PIQ DO 0 (Bit 7)	PIQ DO 1 (Bit 6)	PIQ DO 2 (Bit 5)	PIQ DO 3 (Bit 4)
01h	6000	0	0	1	1
02h	12506	1	0	1	1
03h	34518	1	1	1	1
04h	49526	0	0	1	1
05h	54529	0	1	1	1
06h	3500	1	1	1	1
07h	12443	1	0	1	1
08h	20185	0	0	1	1
09h	30140	1	0	1	1
0Ah	37330	0	0	1	1
0Bh	40000	0	0	0	0

Time diagram

From the table you get the following time diagram:



Writing 5 ETS entries

After writing the ETS entries into the process output image they are directly stored in the FIFO memory of the module.

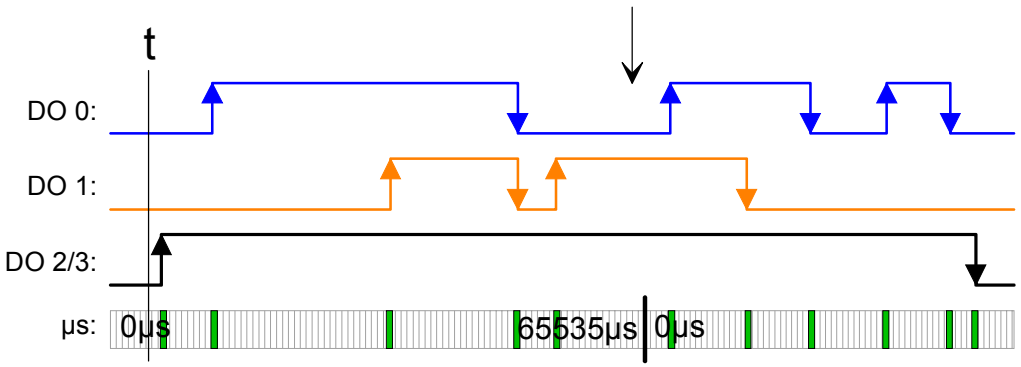
The state of the outputs are shown in the diagram at the time "t".

In the PII you will find the status bytes.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	00110000	01h	6000	RN_LAST: 45h RN_NEXT: C1h STS_FIFO: 00h NUM_ETS: 05h
2	10110000	02h	12506	
3	11110000	03h	34518	
4	00110000	04h	49526	
5	01110000	05h	54529	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



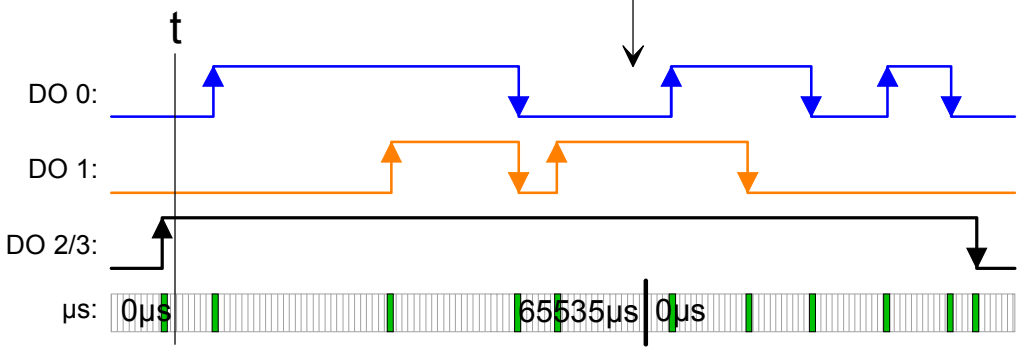
Executing ETS function for RN = 01h

The 1. ETS entry (RN = 01h) is executed and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	02h	12506	RN_LAST: 45h
2	11110000	03h	34518	RN_NEXT: C2h
3	00110000	04h	49526	STS_FIFO: 00h/02h
4	01110000	05h	54529	NUM_ETS: 04h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



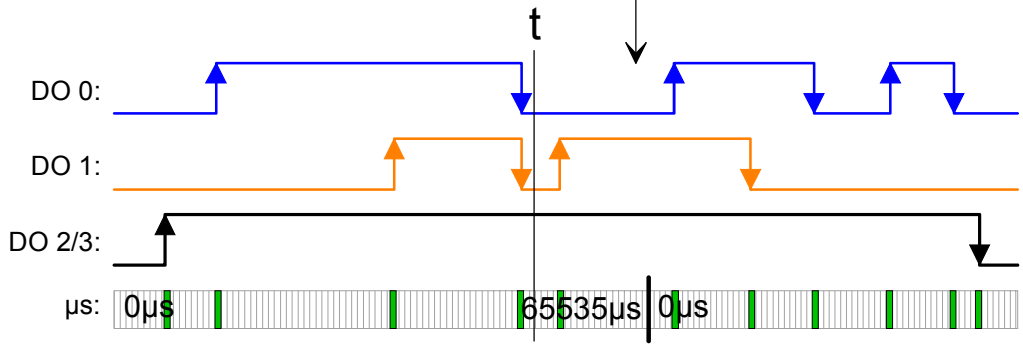
Executing ETS function for RN = 02h ... 04h

The states of RN = 02h ... RN 04h are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00110000	01h	6000
+4	10110000	02h	12506
+8	11110000	03h	34518
+12	00110000	04h	49526
+16	01110000	05h	54529

→

FIFO	PIQ	RN	ETS_US	PII
1	01110000	05h	54529	RN_LAST: 45h
2	00000000	00h	0	RN_NEXT: C5h
3	00000000	00h	0	STS_FIFO: 00h/02h
4	00000000	00h	0	NUM_ETS: 01h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



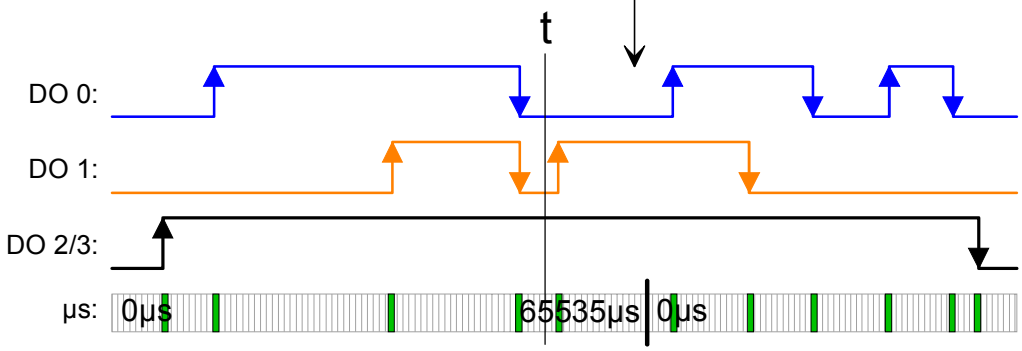
Writing 5 ETS entries

After writing the next 5 ETS entries into the process output image they are directly stored in the FIFO memory of the module.

Addr	PIQ	RN	ETS_US
+0	11110000	06h	3500
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	01110000	05h	54529	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 06h
2	11110000	06h	3500	
3	10110000	07h	12443	
4	00110000	08h	20185	
5	10110000	09h	30140	
6	00110000	0Ah	37330	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



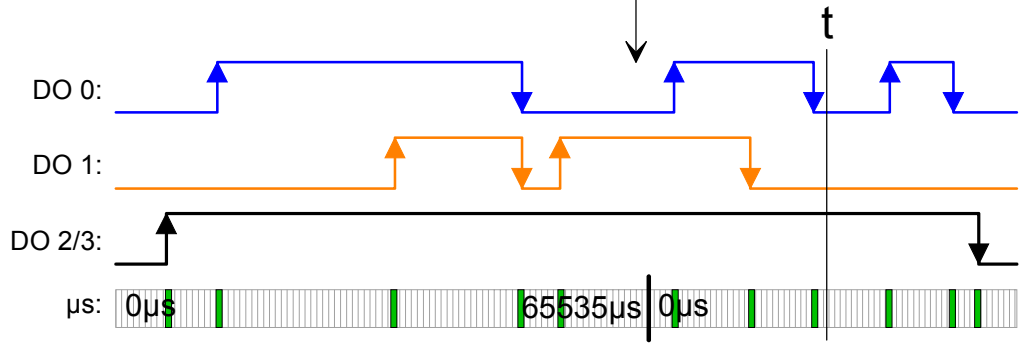
Executing ETS function for RN = 06h ... 08h

The states of RN = 06h ... RN 08h are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	11110000	06h	3500
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	09h	30140	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 02h
2	00110000	0Ah	37330	
3	00000000	00h	0	
4	00000000	00h	0	
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



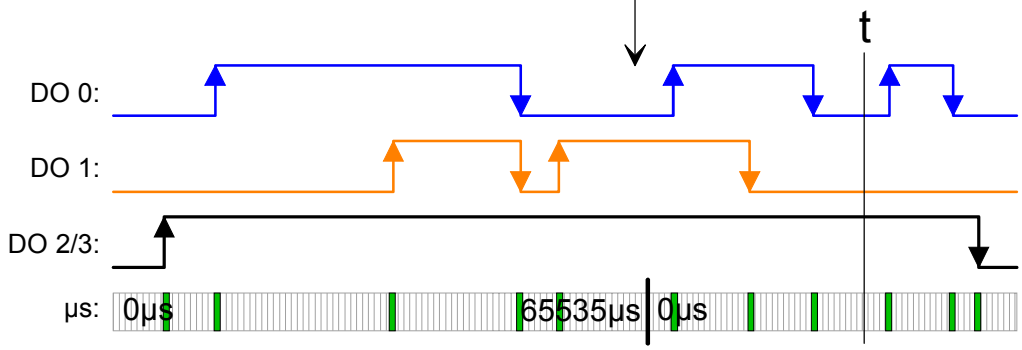
Writing last ETS entry

Since less than 5 ETS entries are written, bit 6 of RN of the last ETS entry must always be set. RN = 0Bh becomes 4Bh.

Addr	PIQ	RN	ETS_US
+0	00000000	4Bh	40000
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	10110000	09h	30140	RN_LAST: 4Bh
2	00110000	0Ah	37330	RN_NEXT: C9h
3	00000000	4Bh	40000	STS_FIFO: 80h/82h
4	00000000	00h	0	NUM_ETS: 03h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



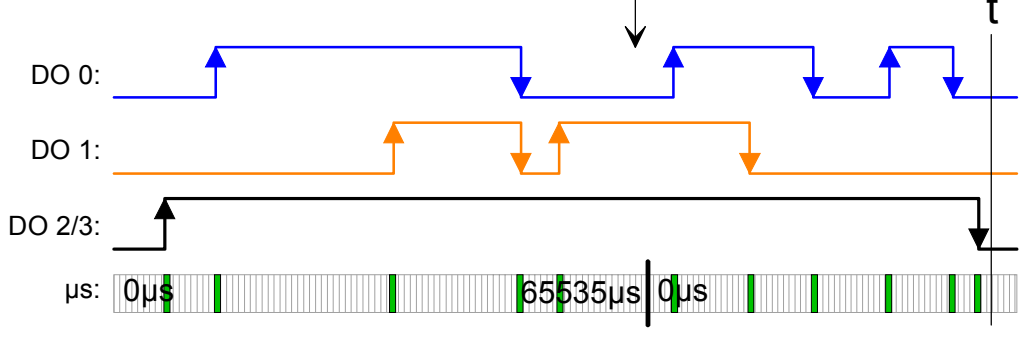
Executing ETS function for RN = 09h ... 4Bh

The states of RN = 09h ... RN 4Bh are successively issued and deleted in the FIFO.

Addr	PIQ	RN	ETS_US
+0	00000000	4Bh	40000
+4	10110000	07h	12443
+8	00110000	08h	20185
+12	10110000	09h	30140
+16	00110000	0Ah	37330

→

FIFO	PIQ	RN	ETS_US	PII
1	00000000	00h	0	RN_LAST: 4Bh
2	00000000	00h	0	RN_NEXT: CCh
3	00000000	00h	0	STS_FIFO: 80h/82h
4	00000000	00h	0	NUM_ETS: 00h
5	00000000	00h	0	
6	00000000	00h	0	
7	00000000	00h	0	
8	00000000	00h	0	
9	00000000	00h	0	
...	00000000	00h	0	
31	00000000	00h	0	



Diagnostic data

This module does not support interrupt functions, the diagnostic data serve the information about this module.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	reserved	00h	01h	2F01h	02h
MODTYP	1	Module information	1Fh			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	72h			06h
NUMBIT	1	Number of diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	04h			08h
CHERR	1	reserved	00h			09h
CH0ERR… CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker (32Bit)	00h			12h

MODTYP
Modul information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 72h: Digital output Bit 7: 0 (fix)

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH
Number of channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 04h)

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D
CHERR, CHxERR
reserved

Byte	Bit 7 ... 0
0	reserved

VIPA 022-1BF00 - DO 8xDC 24V 0.5A

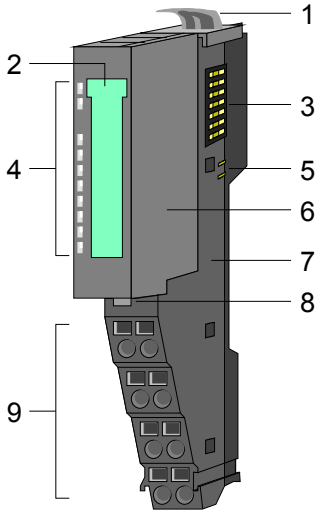
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 8 channels and their status is monitored via LEDs.

Properties

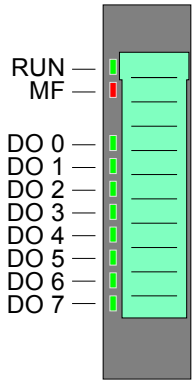
- 8 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

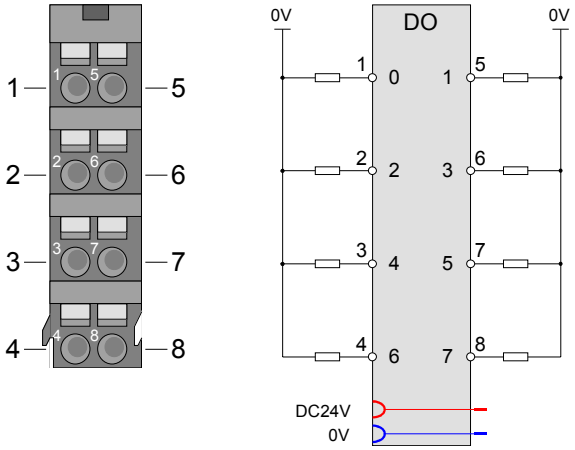


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DO 2	O	Digital output DO 2
3	DO 4	O	Digital output DO 4
4	DO 6	O	Digital output DO 6
5	DO 1	O	Digital output DO 1
6	DO 3	O	Digital output DO 3
7	DO 5	O	Digital output DO 5
8	DO 7	O	Digital output DO 7

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	6200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 4: DO 4		05h
			Bit 5: DO 5		06h
			Bit 6: DO 6		07h
			Bit 7: DO 7		08h

Technical data

Order number	**022-1BF00**
Type	SM 022
Module ID	0106 AFC8
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.7 W
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	15 mA
Total current per group, horizontal configuration, 40°C	4 A
Total current per group, horizontal configuration, 60°C	4 A
Total current per group, vertical configuration	4 A
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	175 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1BF50 - DO 8xDC 24V 0.5A NPN

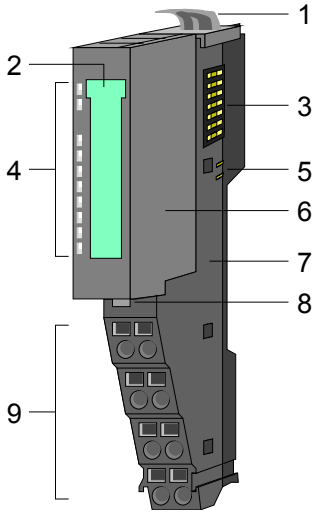
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via outputs.
It has 8 channels connected to the power supply, which operate as low-side switch and their status is monitored via LEDs. Low-side switches are suited to switch grounds. With a short circuit between switch line and ground the load is activated but the power supply is not influenced.

Properties

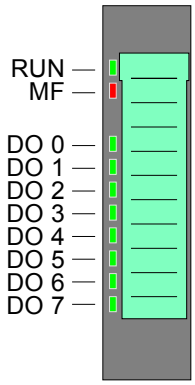
- 8 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

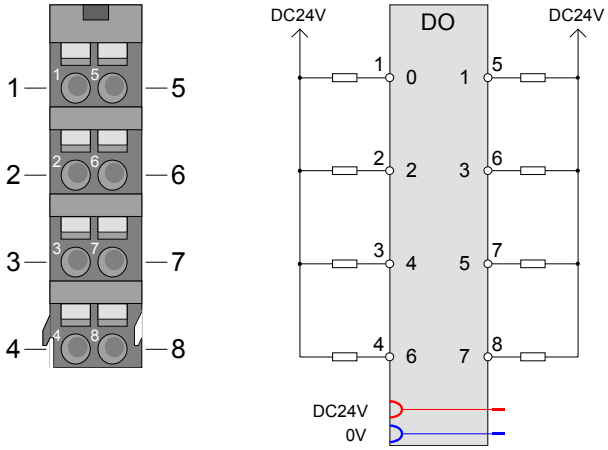


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Digital output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm^2 up to 1.5mm^2.



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DO 2	O	Digital output DO 2
3	DO 4	O	Digital output DO 4
4	DO 6	O	Digital output DO 6
5	DO 1	O	Digital output DO 1
6	DO 3	O	Digital output DO 3
7	DO 5	O	Digital output DO 5
8	DO 7	O	Digital output DO 7

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	6200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 4: DO 4		05h
			Bit 5: DO 5		06h
			Bit 6: DO 6		07h
			Bit 7: DO 7		08h

Technical data

Order number	**022-1BF50**
Type	SM 022
Module ID	0107 AFC8
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.6 W
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	10mA
Total current per group, horizontal configuration, 40°C	2.5 A
Total current per group, horizontal configuration, 60°C	2.5 A
Total current per group, vertical configuration	2.5 A
Output voltage signal "1" at max. current	M (+250 mV)
Output voltage signal "1" at min. current	M (+0 V)
Output current at signal "1", rated value	0.5 A
Output delay of "0" to "1"	30 µs
Output delay of "1" to "0"	100 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	+45 V
Short-circuit protection of output	yes, electronic
Trigger level	1.7 A
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	8 Bit
Status information, alarms, diagnostics	
Status display	red LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

VIPA 022-1HB10 - DO 2xRelay

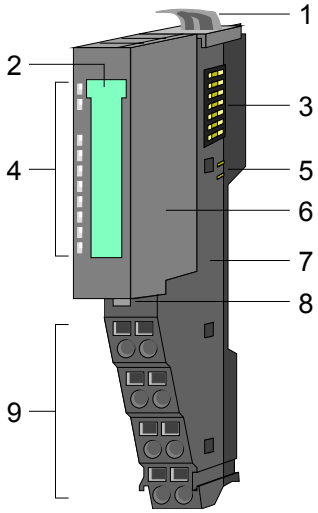
Description

The electronic module accepts binary control signals from the central bus system and transfers them to the process level via relay outputs.
It has 2 channels that operate as switches and the status of each channel is monitored via LEDs.

Properties

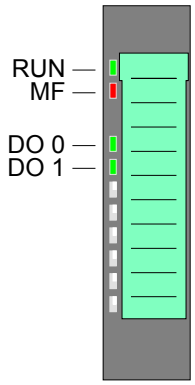
- 2 relay outputs, isolated to the backplane bus
- DC 30V / AC 230V, 3A
- Status indication of the channels via LEDs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

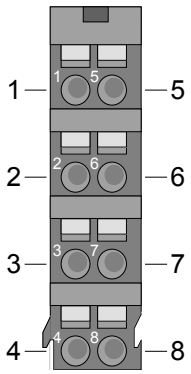


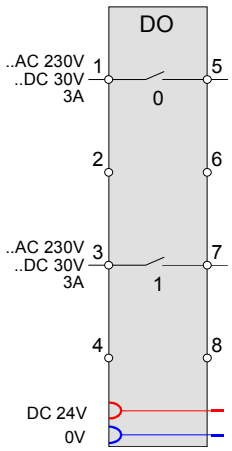
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
DO x	green	●		Relay output is set

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².

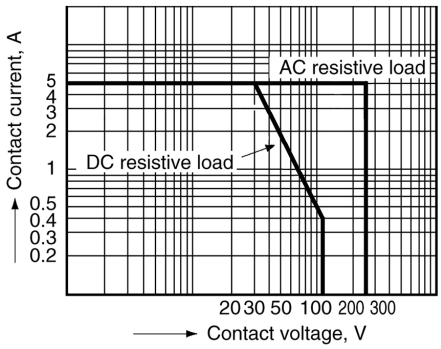




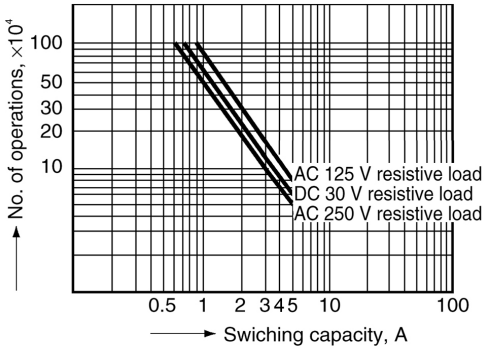
Pos.	Function	Type	Description
1	DO 0	O	Relay output DO 0
2	---	---	not connected
3	DO 1	O	Relay output DO 1
4	---	---	not connected
5	DO 0	O	Relay output DO 0
6	---	---	not connected
7	DO 1	O	Relay output DO 1
8	---	---	not connected

O: Output

Maximum load



Service life



In-/Output area

At CPU, Profibus and Profinet the input respectively out area is embedded to the corresponding address area.

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	5200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 7 ... 2: reserved		

Technical data

Order number	**022-1HB10**
Type	SM 022
Module ID	0109 AF90
Current consumption/power loss	
Current consumption from backplane bus	130 mA
Power loss	0.7 W
Technical data digital outputs	
Number of outputs	2
Cable length, shielded	-
Cable length, unshielded	-
Rated load voltage	DC 30 V/ AC 230 V
Current consumption from load voltage L+ (without load)	-
Total current per group, horizontal configuration, 40°C	3 A
Total current per group, horizontal configuration, 60°C	3 A
Total current per group, vertical configuration	3 A
Output current at signal "1", rated value	3 A
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-
Lamp load	-
Parallel switching of outputs for redundant control of a load	-
Parallel switching of outputs for increased power	-
Actuation of digital input	-
Switching frequency with resistive load	max. 100 Hz
Switching frequency with inductive load	-
Switching frequency on lamp load	-
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	-
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	2 Bit
Status information, alarms, diagnostics	
Status display	red LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	✓
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Chapter 4 Analog Input

Overview

After the introduction to the analog input modules and the list of the measuring ranges the description of the analog input modules of the System SLIO will be found here.

Content

General

Cables for analog signals

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

Connecting sensors

Depending on the module the following sensors may be connected to the analog input modules:

- Current sensor
- Voltage sensor
- Resistance-type sensors
- Temperature sensors

Note!

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

Parameterization

The parameterization via CPU, Profibus and Profinet happens by means of record sets (DS). The corresponding record set number may be found at the respective module description. Here also the indices (IX) respectively subindices (SX) for CANopen respectively EtherCAT are listed.

Diagnostic functions

The modules have diagnostics capability. The following errors can release a diagnostic:

- Error in parameterization
- Measuring range over-/underflow
- Wire break

Analog value

Representation of analog values

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

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

Resolution

With a resolution of 12bit plus sign bit, the not used low value positions (3bits) are filled with "0".

Sign bit (SG)

Here it is essential:

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

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

Behavior at error

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

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

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

At a parameterization error the value 32767 (7FFFh) is issued.

Measuring ranges

General

In the following there are the measuring ranges with function number listed, which were supported by the corresponding analog module.

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.

Voltage

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
-80 ... 80mV Siemens S7 format (11h)	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{27648}$
	80mV	27648	6C00h	nominal range	
	0V	0	0000h		
	-80mV	-27648	9400h		
	-94.07mV	-32512	8100h	underrange	
-80 ... 80mV Siemens S5 format (21h)	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{16384}$
	80mV	16384	4000h	nominal range	
	0V	0	0000h		
	-80mV	-16384	C000h		
	-100mV	-20480	B000h	underrange	
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-2V	-3277	F333h	underrange	

Current

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4.00mA	-3277	F333h	underrange	
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

Resistance

Measuring range (function number)	Measuring value	Signal range	Range
2 wire: PT100 (50h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
2 wire: PT1000 (51h)	+100°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100 (52h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000 (53h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
3 wire: PT100 (58h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000 (59h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100 (5Ah)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
3 wire: NI1000 (5Bh)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
4 wire: PT100 (60h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
4 wire: PT1000 (61h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
4 wire: NI100 (62h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
4 wire: NI1000 (63h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
2 wire: 0 ... 60Ω (70h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (71h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 3000Ω (72h)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange

continued ...

... continue resistance

Measuring range (function number)	Measuring value	Signal range	Range
3 wire: 0 ... 60Ω (78h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
3 wire: 0 ... 600Ω (79h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (7Ah)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (80h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (81h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (82h)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 60Ω (90h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (91h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
2 wire : 0 ... 3000Ω (92h)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange
3 wire: 0 ... 60Ω (98h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange
3 wire: 0 ... 600Ω (99h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (9Ah)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (A0h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (A1h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (A2h)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange

continued ...

... continue resistance

Measuring range (function number)	Measuring value	Signal range	Range
2 wire: 0 ... 60Ω (D0h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (D1h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
2 wire: 0 ... 3000Ω (D2h)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 60Ω (D8h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 600Ω (D9h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (DAh)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (E0h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (E1h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (E2h)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange

Temperature

Measuring range (function number)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J: -210 ... +1200°C -346 ... 2192°F 63.2 ... 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)	+14500	26420	17232	overrange
	-2100 ... +12000	-3460 ... 21920	632 ... 14732	nominal range
	---	---	---	underrange
Type K: -270 ... +1372°C -454 ... 2501.6°F 0 ... 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)	+16220	29516	18952	overrange
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	nominal range
	---	---	---	underrange
Type N: -270 ... +1300°C -454 ... 2372°F 0 ... 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	+15500	28220	18232	overrange
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	nominal range
	---	---	---	underrange
Type R: -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type S: -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type T: -270 ... +400°C -454 ... 752°F 3.2 ... 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)	+5400	10040	8132	overrange
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	nominal range
	---	---	---	underrange
Type B: 0 ... +1820°C 32 ... 2786.5°F 273.2 ... 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	+20700	32766	23432	overrange
	0 ... +18200	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange
Type C: 0 ... +2315°C 32 ... 2786.5°F 273.2 ... 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	+25000	32766	23432	overrange
	0 ... +23150	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange
Type E: -270 ... +1000°C -454 ... 1832°F 0 ... 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)	+12000	21920	14732	overrange
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	nominal range
	---	---	---	underrange
Type L: -200 ... +900°C -328 ... 1652°F 73.2 ... 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)	+11500	21020	14232	overrange
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	nominal range
	---	---	---	underrange

VIPA 031-1BB30 - AI 2x12Bit 0...10V

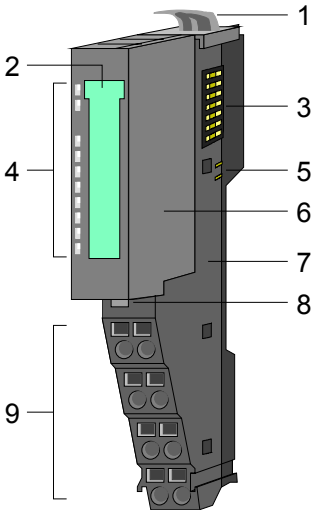
Description

The electronic module has 2 inputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

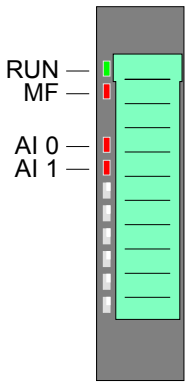
- 2 analog inputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

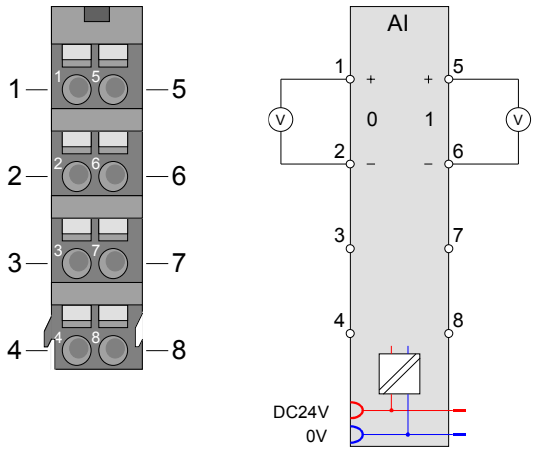


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	---	---	not connected
4	---	---	not connected
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	---	---	not connected
8	---	---	not connected

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

Technical data

Order number	**031-1BB30**
Type	SM 031
Module ID	0401 15C3
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Current inputs	-
Min. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Basic error limit	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Maximum input voltage for voltage input (destruction limit) max.	30 V
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 referred to input range)	±0.05%
Temperature error of internal compensation	-
Initial data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible

Order number	031-1BB30
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	10h	80h	3100h	01h
CH1FN	1	Function number channel 1	10h	81h	3101h	02h

CHxFN
Function number channel x

In the following there are the measuring ranges with function number listed, which were supported by the analog module.
With FFh the corresponding channel is deactivated.
The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Measuring range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-2V	-3277	F333h	underrange	

Diagnostic data

This module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR… CH7ERR	6	reserved	00h			0Ch ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 ... 2: reserved

CH0ERR
CH1ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 5 ... 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH2ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker

In the SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 031-1BB40 - AI 2x12Bit 0(4)...20mA

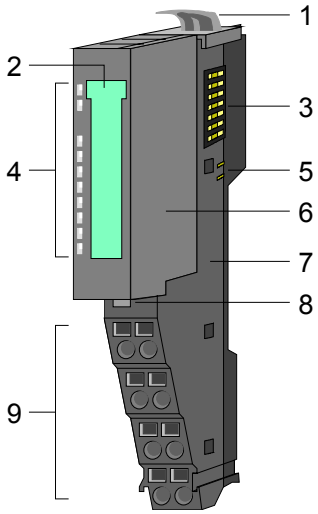
Description

The electronic module has 2 inputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

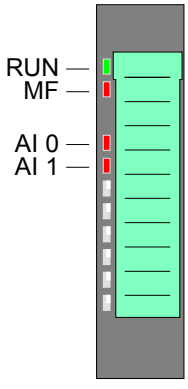
- 2 analog inputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA with external supply
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

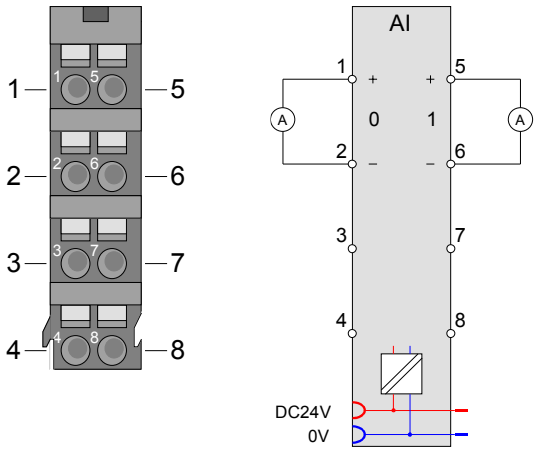


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	---	---	not connected
4	---	---	not connected
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	---	---	not connected
8	---	---	not connected

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

Technical data

Order number	031-1BB40
Type	SM 031
Module ID	0402 15C3
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Current inputs	✓
Min. input resistance (current range)	110 Ω
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.5%
Basic error limit current ranges	+/-0.2% ... +/-0.3%
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Basic error limit	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Maximum input current for current input (destruction limit)	40 mA
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 referred to input range)	±0.05 %
Temperature error of internal compensation	-
Initial data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes

Order number	**031-1BB40**
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	31h	80h	3100h	01h
CH1FN	1	Function number channel 1	31h	81h	3101h	02h

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4.00mA	-3277	F333h	underrange	

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR... CH7ERR	6	reserved	00h			0Ch ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 ... 2: reserved

CH0ERR
CH1ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 5 ... 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH2ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker

In the SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 031-1BB90 - AI 2x16Bit TC

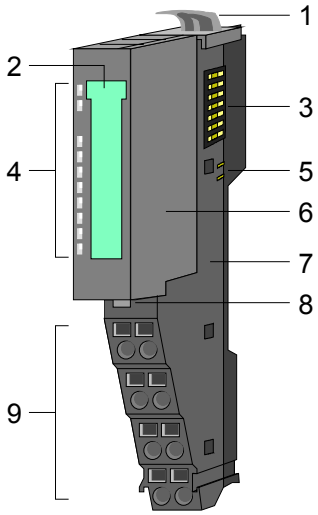
Description

The electronic module has 2 inputs for temperature and voltage measuring with parameterizable functions. The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

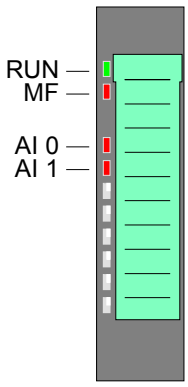
- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC140V/AC60V between the inputs

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

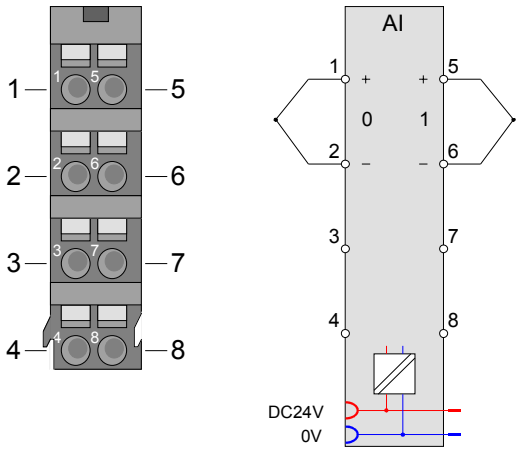


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization - Wire break

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+TC 0	I	+ Channel 0
2	-TC 0	I	Ground Channel 0
3	---	---	not connected
4	---	---	not connected
5	+TC 1	I	+ Channel 1
6	-TC 1	I	Ground Channel 1
7	---	---	not connected
8	---	---	not connected

I: Input

Attention!

Please consider that the electronic module AI 2x16Bit TC may exclusively be used together with the terminal module 001-0AA20!

Supplementation to the installation guidelines

To avoid variations in temperature within the module, which may affect the accuracy of the measurement, you should consider the following points when assembling:

- Do not arrange the module directly apart from a power module with a high feeding current.
- Do not install the module at the end of a line.
- The module should be in a static condition, i.e. the temperature should be as constant as possible in the environment of your module (closed switchgear cabinet free from air draught).
- The accuracy is reached after approx. 30 minutes after entering the static condition.

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

Technical data

Order number	031-1BB90
Type	SM 031
Module ID	0403 1543
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	✓
Min. input resistance (voltage range)	-
Input voltage ranges	-80 mV ... +80 mV
Operational limit of voltage ranges	with interference frequency suppression: ±0.1% without interference frequency suppression: ±0.3%
Basic error limit voltage ranges	with interference frequency suppression: ±0.05% without interference frequency suppression: ±0.25%
Current inputs	-
Min. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Basic error limit	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges	-
Thermocouple inputs	✓
Thermocouple ranges	type B, C, E, J, K, L, N, R, S, T
Operational limit of thermocouple ranges	with interference frequency suppression: type E, L, T, J, K, N ±1.5K type B, C, R, S ±4.0K without interference frequency suppression: type E, L, T, J ,K , N ±2.5K type B, C, R, S ±8.0K
Basic error limit thermoelement ranges	with interference frequency suppression: Typ E, L, T, J, K, N ±1.0K Typ B, C, R, S ±3.0K without interference frequency suppression: Typ E, L, T, J, K, N ±2.0K Typ B, C, R, S ±7.0K
Maximum input voltage for voltage input (destruction limit) max.	30 V
Temperature error (with reference to the input range)	±0.001 %/K
Linearity error (with reference to the input range)	±0.005 %

Order number	**031-1BB90**
Repeatability (in steady state at 25°C with reference to the input range)	±0.05 %
Temperature error of internal compensation	±0.2 %
Programmable temperature compensation	✓
External temperature compensation	✓
Internal temperature compensation	✓
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	4.2...324.1 ms (50 Hz) 3.8...270.5 ms (60 Hz) per channel
Noise suppression for frequency	>90dB at 50Hz (UCM<10V)
Initial data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 140 V / AC 60 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V / AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

*) The indicated error limits are valid starting from the following temperatures:
- Thermoelement type T: -200 °C
- Thermoelement type K: -100 °C
- Thermoelement type B: +700 °C
- Thermoelement type N: -150 °C
- Thermoelement type E: -150 °C
- Thermoelement type R: +200 °C
- Thermoelement type S: +100 °C
- Thermoelement type J: -100 °C

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
DIAG	1	Diagnostics	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring	00h	00h	3102h	03h
RES3	1	reserved	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression	02h	01h	3105h	06h
CH0FN	1	Function number channel 0	C1h	80h	3106h	07h
CH0FO	1	Function option channel 0	02h	80h	3107h	08h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3108h...3109h	09h
CH0LL	2	Lower limit value channel 0	8000h	80h	310Ah...310Bh	0Ah
CH1FN	1	Function number channel 1	C1h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	02h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh...310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h...3111h	0Eh

DIAG
Diagnostics

Byte	Bit 7 ... 0
0	Bit 5 ... 0: reserved Bit 6: Diagnostics interrupt (1: activated) Bit 7: reserved

WIBRK_EN
Wire break recognition

Byte	Bit 7 ... 0
0	Bit 0: Wire break recognition channel 0 (1: on) Bit 1: Wire break recognition channel 1 (1: on) Bit 7 ... 2: reserved

LIMIT_EN
Limit value monitoring

Byte	Bit 7 ... 0
0	Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 ... 2: reserved

TEMPCNF
Temperature system

Byte	Bit 7 ... 0
0	Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 ... 2: reserved

SUPR
Interference frequency suppression

Byte	Bit 7 ... 0
0	Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 ... 2: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

Voltage

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
-80 ... 80mV Siemens S7 format (11h)	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{27648}$
	80mV	27648	6C00h	nominal range	
	0V	0	0000h		
	-80mV	-27648	9400h		
	-94.07mV	-32512	8100h	underrange	
-80 ... 80mV Siemens S5 format (21h)	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{16384}$
	80mV	16384	4000h	nominal range	
	0V	0	0000h		
	-80mV	-16384	C000h		
	-100mV	-20480	B000h	underrange	

Temperature

Measuring range (function number)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J:-210 ... +1200°C -346 ... 2192°F 63.2 ... 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)	+14500	26420	17232	overrange
	-2100 ... +12000	-3460 ... 21920	632 ... 14732	nominal range
	---	---	---	underrange
Type K: -270 ... +1372°C -454 ... 2501.6°F 0 ... 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)	+16220	29516	18952	overrange
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	nominal range
	---	---	---	underrange
Type N: -270 ... +1300°C -454 ... 2372°F 0 ... 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	+15500	28220	18232	overrange
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	nominal range
	---	---	---	underrange
Type R: -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type S: -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type T: -270 ... +400°C -454 ... 752°F 3.2 ... 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)	+5400	10040	8132	overrange
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	nominal range
	---	---	---	underrange
Type B: 0 ... +1820°C 32 ... 2786.5°F 273.2 ... 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	+20700	32766	23432	overrange
	0 ... +18200	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange
Type C: 0 ... +2315°C 32 ... 2786.5°F 273.2 ... 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	+25000	32766	23432	overrange
	0 ... +23150	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange
Type E: -270 ... +1000°C -454 ... 1832°F 0 ... 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)	+12000	21920	14732	overrange
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	nominal range
	---	---	---	underrange
Type L: -200 ... +900°C -328 ... 1652°F 73.2 ... 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)	+11500	21020	14232	overrange
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	nominal range
	---	---	---	underrange

CHxFO
Function option channel x

Depending on the Interference frequency suppression for each channel the transducer velocity may be set.

Code*	Velocity (in ms) /channel at interference frequency suppression	
	50Hz	60Hz
00h	324.1	270.5
01h	164.2	137.2
02h	84.2	70.5
03h	44.1	37.2
04h	24.2	20.5
05h	14.2	12.2
06h	9.2	8.0
07h	6.6	5.9
08h	4.2	3.8

*) For Code 0, 1 and 2 the tolerances of the technical data "with interference frequency suppression" are valid.

CHxUL
CHxLL
Upper limit value
Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated.

As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Wire break	-	X	X
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
Process interrupt lost	-	X	-

Process interrupt

So you may react to asynchronous events, there is the possibility to activate a process interrupt. A process interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the process interrupt accordingly.

With CANopen the process interrupt data a transferred via an emergency telegram.

Operating with CPU, Profibus and Profinet the process interrupt data were transferred via diagnostics telegram.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h ... 05h

PRIT_OL
Limit overflow

Byte	Bit 7 ... 0
0	Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 7 ... 2: reserved

PRIT_UL
Limit underflow

Byte	Bit 7 ... 0
0	Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 7 ... 2: reserved

PRIT_US
µs ticker

Byte	Bit 7 ... 0
0 ... 1	16bit µs value at the moment of the interrupt

µs ticker

In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parameterization you may activate a diagnostic interrupt for the module.

With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place.

All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost.

Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
RES2	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR… CH7ERR	6	reserved	00h			0Ch ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 5: reserved Bit 6: set at process interrupt lost Bit 7: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 ... 2: reserved

CH0ERR
CH1ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 ... 1: reserved Bit 4: set at wire break Bit 5: set at process interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH2ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 031-1BD30 - AI 4x12Bit 0...10V

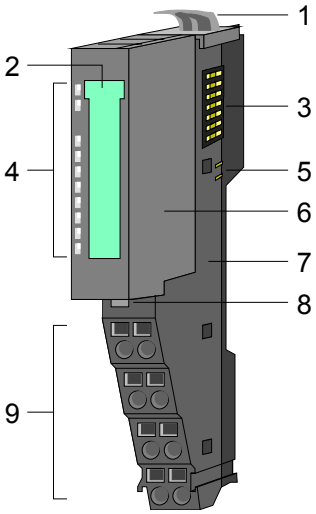
Description

The electronic module has 4 inputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

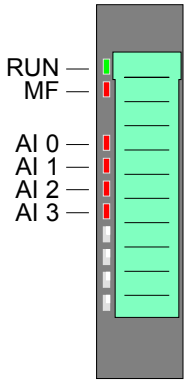
- 4 analog inputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

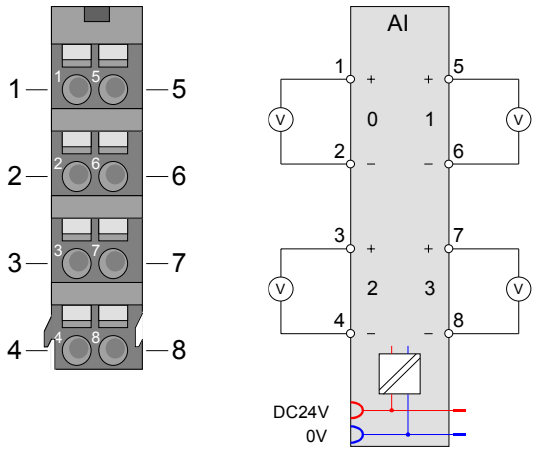


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

Technical data

Order number	**031-1BD30**
Type	SM 031
Module ID	0404 15C4
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Current inputs	-
Min. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Basic error limit	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Maximum input voltage for voltage input (destruction limit) max.	30 V
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 referred to input range)	±0.05%
Temperature error of internal compensation	-
Initial data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible

Order number	**031-1BD30**
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	10h	80h	3100h	01h
CH1FN	1	Function number channel 1	10h	81h	3101h	02h
CH2FN	1	Function number channel 2	10h	82h	3102h	03h
CH3FN	1	Function number channel 3	10h	83h	3103h	04h

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Measurement range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-2V	-3277	F333h	underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR... CH7ERR	4	reserved	00h			0Eh ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 ... 4: reserved

CH0ERR ...
CH3ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 5 ... 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH4ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker

In the SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 031-1BD40 - AI 4x12Bit 0(4)...20mA

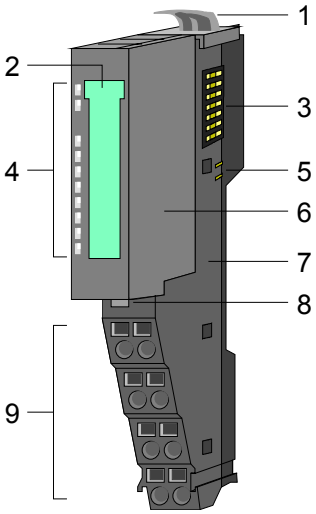
Description

The electronic module has 4 inputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

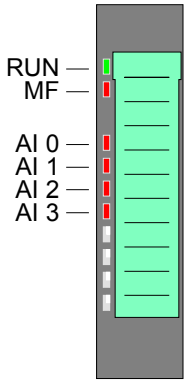
- 4 analog inputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA with external supply
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

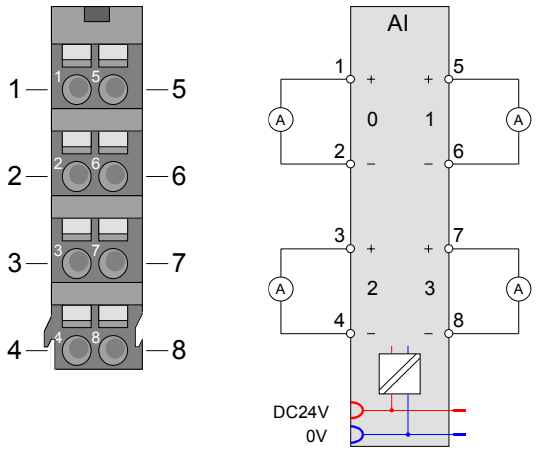


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

Technical data

Order number	**031-1BD40**
Type	SM 031
Module ID	0405 15C4
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Current inputs	✓
Min. input resistance (current range)	110 Ω
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.5%
Basic error limit current ranges	+/-0.2% ... +/-0.3%
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Basic error limit	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB bei 50Hz (UCM<2V)
Maximum input current for current input (destruction limit)	40 mA
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 referred to input range)	±0.05 %
Temperature error of internal compensation	-
Initial data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes

Order number	**031-1BD40**
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	31h	80h	3100h	01h
CH1FN	1	Function number channel 1	31h	81h	3101h	02h
CH2FN	1	Function number channel 2	31h	82h	3102h	03h
CH3FN	1	Function number channel 3	31h	83h	3103h	04h

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Measurement range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4.00mA	-3277	F333h	underrange	

Measurement range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

DS = Record set for access via CPU, Profibus and Profinet

IX = Index for access via CANopen

SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR ... CH7ERR	4	reserved	00h			0Eh ... 11h
DIAG_US	4	µs-Ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 ... 4: reserved

CH0ERR ...
CH3ERR
Channel specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 5 ... 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH4ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker

In the SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 031-1BD80 - AI 4x16Bit R/RTD

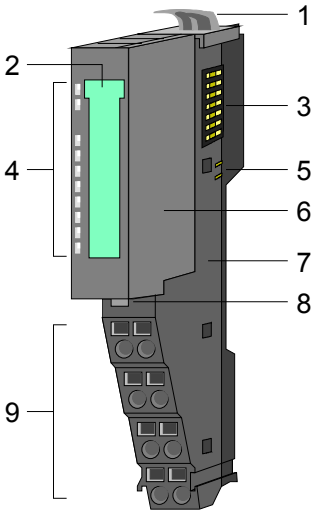
Description

The electronic module has 4 inputs for resistance measurement with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

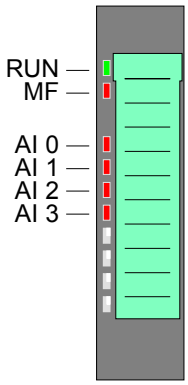
- 4 analog inputs
- Suited for resistance-type sensors 0 ... 3000Ω and resistance temperature sensors Pt100, Pt1000, NI100 and NI1000
- Resistance measurement with 2-, 3- and 4 wires
- 16bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

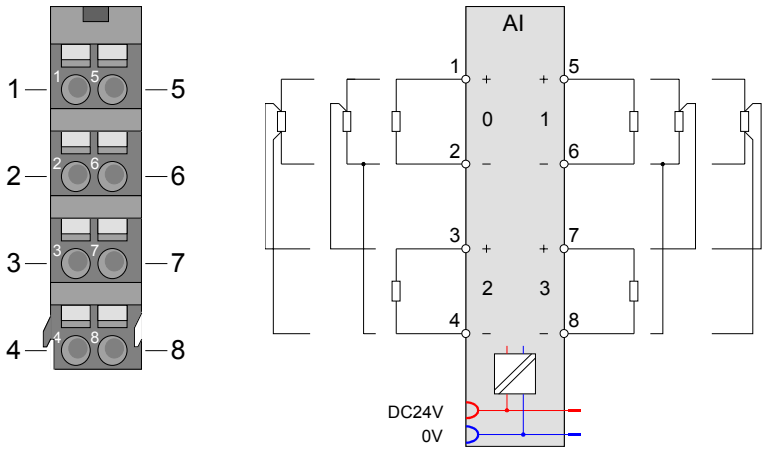


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AI x	red	●		Error channel x - Signal leaves measuring range - Error in parameterization - Wire break

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

Technical data

Order number	**031-1BD80**
Type	SM 031
Module ID	0406 1544
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Current inputs	-
Min. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Resistance inputs	✓
Resistance ranges	0 ... 60 Ohm 0 ... 600 Ohm 0 ... 3000 Ohm
Operational limit of resistor ranges	+/- 0.4 %
Basic error limit	+/- 0.2 %
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100 Pt1000 Ni100 Ni1000
Operational limit of resistance thermometer ranges	+/- 0.4 %
Basic error limit thermoresistor ranges	+/- 0.2 %
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	4.2...324.1 ms (50 Hz) 3.8...270.5 ms (60 Hz) per channel
Noise suppression for frequency	>80dB at 50Hz (UCM<6V)
Maximum input voltage for voltage input (destruction limit) max.	9 V
Temperature error (with reference to the input range)	±0.005 %/K
Linearity error (with reference to the input range)	±0.005 %
Repeatability (in steady state at 25°C with reference to the input range)	±0.05 %
Temperature error of internal compensation	-
Initial data size	8 Byte

Order number	**031-1BD80**
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 6 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
DIAG	1	Diagnostic	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring	00h	00h	3102h	03h
RES3	1	reserved	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression	02h	01h	3105h	06h
CH0FN	1	Function number channel 0	50h	80h	3106h	07h
CH0FO	1	Function option channel 0	00h	80h	3107h	08h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3108h...3109h	09h
CH0LL	2	Lower limit value channel 0	8000h	80h	310Ah...310Bh	0Ah
CH1FN	1	Function number channel 1	50h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	00h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh...310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h...3111h	0Eh
CH2FN	1	Function number channel 2	50h*	82h	3112h	0Fh
CH2FO	1	Function option channel 2	00h	82h	3113h	10h
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3114h...3115h	11h
CH2LL	2	Lower limit value channel 2	8000h	82h	3116h...3117h	12h
CH3FN	1	Function number channel 3	50h*	83h	3118h	13h
CH3FO	1	Function option channel 3	00h	83h	3119h	14h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	311Ah...311Bh	15h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ch...311Dh	16h

*) with 2 channel operation FFh

DIAG
Diagnostic

Byte	Bit 7 ... 0
0	Diagnostic interrupt 00h = disable 40h = enable

WIBRK_EN
Wire break recognition

Byte	Bit 7 ... 0
0	Bit 0: Wire break recognition channel 0 (1: on) Bit 1: Wire break recognition channel 1 (1: on) Bit 2: Wire break recognition channel 2 (1: on) Bit 3: Wire break recognition channel 3 (1: on) Bit 7 ... 4: reserved

LIMIT_EN
Limit value monitoring

Byte	Bit 7 ... 0
0	Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 2: Limit value monitoring channel 2 (1: on) Bit 3: Limit value monitoring channel 3 (1: on) Bit 7 ... 4: reserved

TEMPCNF
Temperature system

Byte	Bit 7 ... 0
0	Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 ... 2: reserved

SUPR
Interference frequency suppression

Byte	Bit 7 ... 0
0	Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 ... 2: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.
With FFh the corresponding channel is deactivated.

Function number

Measuring range (Function number)	Measuring value	Signal range	Range
2 wire: PT100 (50h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
2 wire: PT1000 (51h)	+100°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100 (52h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000 (53h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
3 wire: PT100 (58h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000 (59h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100 (5Ah)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
3 wire: NI1000 (5Bh)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
4 wire: PT100 (60h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange
4 wire: PT1000 (61h)	+1000°C	+10000	overrange
	-200 ... +850°C	-2000 ... +8500	nominal range
	-243°C	-2430	underrange

continued ...

... continue function number

Measuring range (Function number)	Measuring value	Signal range	Range
4 wire: NI100 (62h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
4 wire: NI1000 (63h)	+295°C	+2950	overrange
	-60 ... +250°C	-600 ... +2500	nominal range
	-105°C	-1050	underrange
2 wire: 0 ... 60Ω (70h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (71h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 3000Ω (72h)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange
3 wire: 0 ... 60Ω (78h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
3 wire: 0 ... 600Ω (79h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (7Ah)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (80h)	---	---	overrange
	0 ... 60Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (81h)	---	---	overrange
	0 ... 600Ω	0 ... 32767	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (82h)	---	---	overrange
	0 ... 3000Ω	0 ... 32767	nominal range
	---	---	underrange
2 wire: 0 ... 60Ω (90h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (91h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
2 wire : 0 ... 3000Ω (92h)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange
3 wire: 0 ... 60Ω (98h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange

continued ...

... continue function number

Measuring range (Function number)	Measuring value	Signal range	Range
3 wire: 0 ... 600Ω (99h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (9Ah)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (A0h)	---	---	overrange
	0 ... 60Ω	0 ... 6000	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (A1h)	---	---	overrange
	0 ... 600Ω	0 ... 6000	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (A2h)	---	---	overrange
	0 ... 3000Ω	0 ... 30000	nominal range
	---	---	underrange
2 wire: 0 ... 60Ω (D0h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
2 wire: 0 ... 600Ω (D1h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
2 wire: 0 ... 3000Ω (D2h)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 60Ω (D8h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 600Ω (D9h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
3 wire: 0 ... 3000Ω (DAh)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 60Ω (E0h)	70.55Ω	32511	overrange
	0 ... 60Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 600Ω (E1h)	705.5Ω	32511	overrange
	0 ... 600Ω	0 ... 27648	nominal range
	---	---	underrange
4 wire: 0 ... 3000Ω (E2h)	3528Ω	32511	overrange
	0 ... 3000Ω	0 ... 27648	nominal range
	---	---	underrange

CHxFO
Function option channel x

Depending on the Interference frequency suppression for each channel the transducer velocity may be set.

Code	Velocity/channel at Interference frequency suppression	
	50Hz	60Hz
00h	324.1	270.5
01h	164.2	137.2
02h	84.2	70.5
03h	44.1	37.2
04h	24.2	20.5
05h	14.2	12.2
06h	9.2	8.0
07h	6.6	5.9
08h	4.2	3.8

CHxUL
CHxLL
Upper limit value
Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated.

As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Wire break	-	X	X
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
Process interrupt lost	-	X	-

Process interrupt

So you may react to asynchronous events, there is the possibility to activate a process interrupt. A process interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the process interrupt accordingly.

With CANopen the process interrupt data a transferred via an emergency telegram.

Operating with CPU, Profibus and Profinet the process interrupt data were transferred via diagnostics telegram.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h ... 05h

PRIT_OL
Limit overflow

Byte	Bit 7 ... 0
0	Bit 0: Limit overflow channel 0 ... Bit 3: Limit overflow channel 3 Bit 7 ... 4: reserved

PRIT_UL
Limit underflow

Byte	Bit 7 ... 0
0	Bit 0: Limit underflow channel 0 ... Bit 3: Limit underflow channel 3 Bit 7 ... 4: reserved

PRIT_US
µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the diagnostic.

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parameterization you may activate a diagnostic interrupt for the module.

With a diagnostic interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$.

As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place.

All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost.

Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

DS = Record set for access via CPU, Profibus and Profinet. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR... CH7ERR	4	reserved	00h			11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 5: reserved Bit 6: set at process interrupt lost Bit 7: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 71h: analog input Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 ... 4: reserved

CH0ERR ...
CH3ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error: channel x: Bit 0: set at error in project engineering/parameterization Bit 3 ... 1: reserved Bit 4: set at wire break Bit 5: set at process interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH4ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic.

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

Chapter 5 Analog Output

Overview

After the introduction to the analog output and the list of the output ranges the description of the analog output modules of the System SLIO will be found here.

Content

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 actuators 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

The parameterization via CPU, Profibus and Profinet happens by means of record sets (DS). The corresponding record set number may be found at the respective module description. Here also the indices (IX) respectively subindices (SX) for CANopen respectively EtherCAT are listed.

Diagnostic functions

The modules have diagnostics capability. The following errors may release a diagnostic:

- Error in parameterization
- Short-circuit recognition
- Wire-break recognition

Analog value

Analog value representation

The analog values are only processed in binary representation. Hereby the binary word variable is transformed into an analog process signal and put out via the corresponding channel.

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

Resolution

With a resolution of 12bit plus sign bit, the least significant bits (3bit) are not relevant.

Sign bit (SG)

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

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

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

Output ranges

General

In the following there are the output ranges listed with function number, which were supported by the corresponding analog module.

The here listed formulas allow you to transform a value (digital value) to an analog value and vice versa.

Output ranges

Voltage

Output range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$U = D \cdot \frac{10}{27648}$ $D = 27648 \cdot \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$U = D \cdot \frac{10}{16384}$ $D = 16384 \cdot \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	

Current

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$I = D \cdot \frac{20}{27648}$ $D = 27648 \cdot \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$I = D \cdot \frac{20}{16384}$ $D = 16384 \cdot \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$I = D \cdot \frac{16}{27648} + 4$ $D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	0mA	-6912	E500h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$I = D \cdot \frac{16}{16384} + 4$ $D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0mA	-4096	F000h	underrange	

VIPA 032-1BB30 - AO 2x12Bit 0...10V

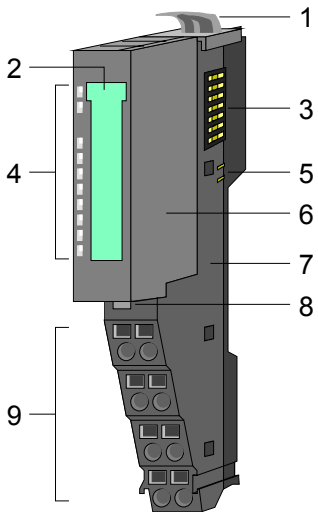
Description

The electronic module has 2 outputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

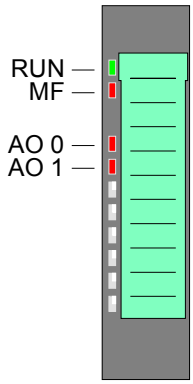
- 2 analog outputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

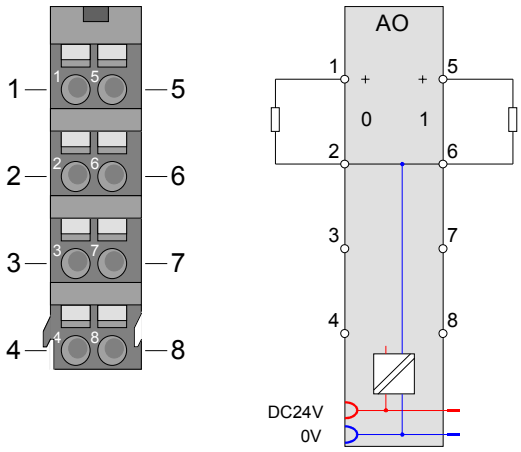


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AO x	red	●		Error channel x - Overload, short-circuit - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	---	---	not connected
4	---	---	not connected
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	---	---	not connected
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

Technical data

Order number	**032-1BB30**
Type	SM 032
Module ID	0501 25D8
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	35 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Suppression of interference Crosstalk between outputs	>40dB
Destruction limit against voltages/currents	
Voltage at outputs	15 V
Current	30 mA
Temperature error (with reference to the output range)	±0.01 %/K
Linearity error (with reference to the input range)	±0.1 %
Repeatability (in steady state at 25°C, referred to output range)	±0.05 %
Output ripple; range 0 to 50 kHz (referred to output range)	±0.05 %
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	yes
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓

Order number	**032-1BB30**
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h

SHORT_EN
Short-circuit recognition

Byte	Bit 7 ... 0
0	Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 7 ... 2: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Output range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$U = D \cdot \frac{10}{27648}$ $D = 27648 \cdot \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$U = D \cdot \frac{10}{16384}$ $D = 16384 \cdot \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)

DS = Record set for access via CPU, Profibus and Profinet
The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen
The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR... CH7ERR	6	reserved	00h			0Ch ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 73h: analog output Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 ... 2: reserved

CH0ERR
CH1ERR
Channel specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 2 ... 1: reserved Bit 3: set at short-circuit to ground Bit 7 ... 4: reserved

CH2ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 032-1BB40 - AO 2x12Bit 0(4)...20mA

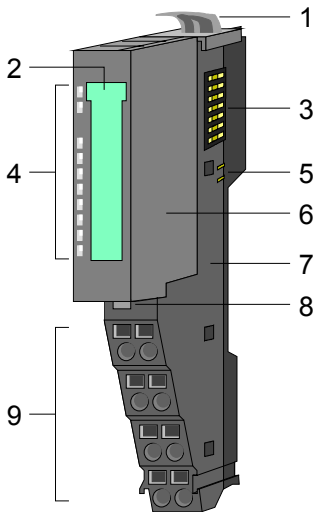
Description

The electronic module has 2 outputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

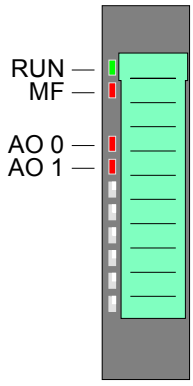
- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

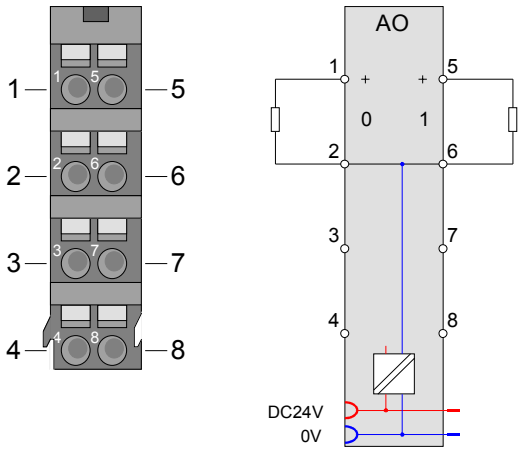


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AO x	red	●		Error channel x - Error in parameterization - Wire-break

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	---	---	not connected
4	---	---	not connected
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	---	---	not connected
8	---	---	not connected

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

Technical data

Order number	032-1BB40
Type	SM 032
Module ID	0502 25D8
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Current outputs	✓
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.4% ... +/-0.5%
Basic error limit current ranges	+/-0.2% ... +/-0.3%
Suppression of interference Crosstalk between outputs	>40dB
Destruction limit against voltages/currents	
Voltage at outputs	12 V
Current	-
Temperature error (with reference to the output range)	±0.01 %/K
Linearity error (with reference to the input range)	±0.1 %
Repeatability (in steady state at 25°C, referred to output range)	±0.05 %
Output ripple; range 0 to 50 kHz (referred to output range)	±0.05 %
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	yes
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

Order number	**032-1BB40**
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h

WIBRK_EN
Wire-break recognition

Byte	Bit 7 ... 0
0	Bit 0: Wire-break recognition channel 0 (1: on) Bit 1: Wire-break recognition channel 1 (1: on) Bit 7 ... 2: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$I = D \cdot \frac{20}{27648}$ $D = 27648 \cdot \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$I = D \cdot \frac{20}{16384}$ $D = 16384 \cdot \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$I = D \cdot \frac{16}{27648} + 4$ $D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	0mA	-6912	E500h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$I = D \cdot \frac{16}{16384} + 4$ $D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0mA	-4096	F000h	underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

DS = Record set for access via CPU, Profibus and Profinet
The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen
The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR... CH7ERR	6	reserved	00h			0Ch ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 73h: analog output Bit 7: reserved

NUMBIT
Diagnostic

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 ... 2: reserved

CHxERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x Bit 0: configuring/parameter assignment error Bit 3 ... 1: reserved Bit 4: wire-break Bit 7 ... 5: reserved

CH2ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 032-1BD30 - AO 4x12Bit 0...10V

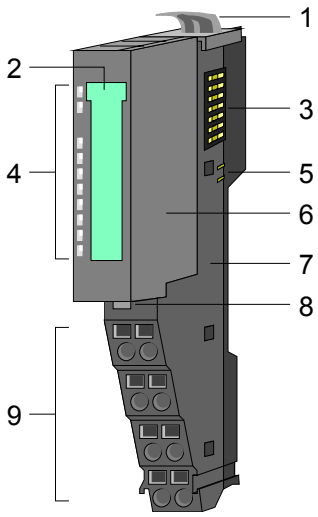
Description

The electronic module has 4 outputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

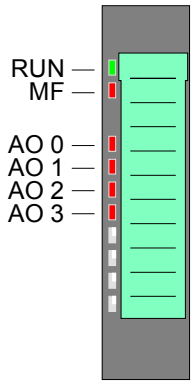
- 4 analog outputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

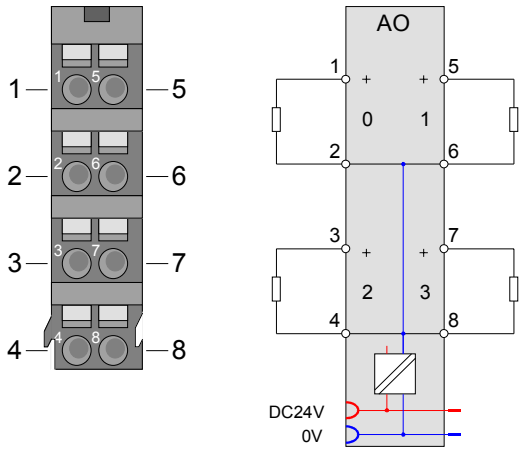


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AO x	red	●		Error channel x - Overload, short-circuit - Error in parameterization

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	AO 2	O	Channel 2
4	AGND	O	Ground channels
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	AO 3	O	Channel 3
8	AGND	O	Ground channels

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

Technical data

Order number	**032-1BD30**
Type	SM 032
Module ID	0503 25E0
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	35 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Suppression of interference Crosstalk between outputs	>40dB
Destruction limit against voltages/currents	
Voltage at outputs	15 V
Current	30 mA
Temperature error (with reference to the output range)	±0.01 %/K
Linearity error (with reference to the input range)	±0.1 %
Repeatability (in steady state at 25°C, referred to output range)	±0.05 %
Output ripple; range 0 to 50 kHz (referred to output range)	±0.05 %
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	yes
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓

Order number	**032-1BD30**
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h
CH2FN	1	Function number channel 2	10h	82h	3104h	05h
CH3FN	1	Function number channel 3	10h	83h	3105h	06h

SHORT_EN
Short-circuit recognition

Byte	Bit 7 ... 0
0	Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 ... 4: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Output range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$U = D \cdot \frac{10}{27648}$ $D = 27648 \cdot \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$U = D \cdot \frac{10}{16384}$ $D = 16384 \cdot \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	

Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)

DS = Record set for access via CPU, Profibus and Profinet.
The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen.
The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
RES2	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR		Channel-specific error channel 2	00h			0Ch
CH3ERR		Channel-specific error channel 3	00h			0Dh
CH4ERR ... CH7ERR	4	reserved	00h			0Eh ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 73h: analog output Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 ... 4: reserved

CH0ERR ...
CH3ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 2 ... 1: reserved Bit 3: set at short-circuit to ground Bit 7 ... 4: reserved

CH4ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

VIPA 032-1BD40 - AO 4x12Bit 0(4)...20mA

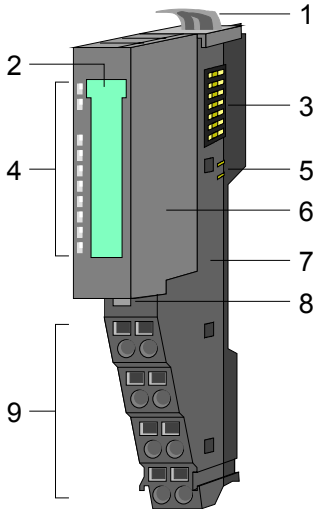
Description

The electronic module has 4 outputs with parameterizable functions.
The channels of the module are isolated to the backplane bus by means of DC/DC converter.

Properties

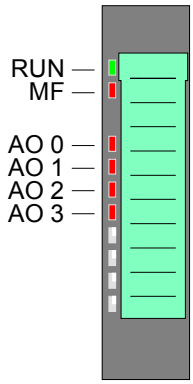
- 4 analog outputs
- Suited for sensors with 0...20mA; 4...20mA
- 12bit resolution

Structure



[1] Locking lever terminal module
[2] Labeling strip
[3] Backplane bus
[4] LED status indication
[5] DC 24V power section supply
[6] Electronic module
[7] Terminal module
[8] Locking lever electronic module
[9] Terminal

Status indication

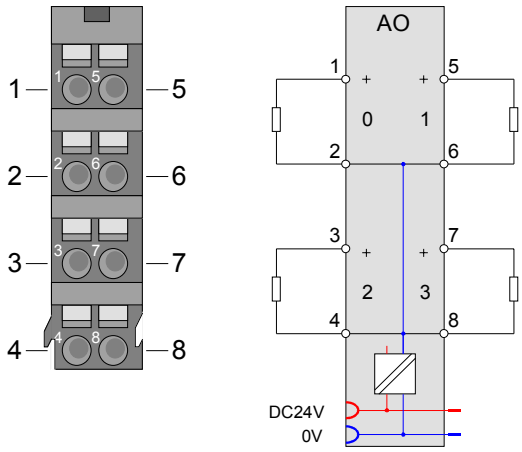


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in configuration (see Basics)
AO x	red	●		Error channel x - Error in parameterization - Wire-break

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	AO 2	O	Channel 2
4	AGND	O	Ground channels
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	AO 3	O	Channel 3
8	AGND	O	Ground channels

O: Output

In-/Output area

At CPU, Profibus and Profinet the input respectively output area is embedded to the corresponding address area.

IX = Index for access via CANopen with s = Subindex, depends on number and type of analog modules.

SX = Subindex for access via EtherCAT.

Input area

No byte of the input area is used by the module.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

Technical data

Order number	032-1BD40
Type	SM 032
Module ID	0504 25E0
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Current outputs	✓
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.4% ... +/-0.5%
Basic error limit current ranges	+/-0.2% ... +/-0.3%
Suppression of interference Crosstalk between outputs	>40dB
Destruction limit against voltages/currents	
Voltage at outputs	12 V
Current	-
Temperature error (with reference to the output range)	±0.01 %/K
Linearity error (with reference to the input range)	±0.1 %
Repeatability (in steady state at 25°C, referred to output range)	±0.05 %
Output ripple; range 0 to 50 kHz (referred to output range)	±0.05 %
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	yes
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

Order number	**032-1BD40**
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Mechanical data	
Dimensions (WxHxD)	12.9 x 109 x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

Parameter data

DS = Record set for access via CPU, Profibus and Profinet
IX = Index for access via CANopen
SX = Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h
CH2FN	1	Function number channel 2	31h	82h	3104h	05h
CH3FN	1	Function number channel 3	31h	83h	3105h	06h

WIBRK_EN
Wire-break recognition

Byte	Bit 7 ... 0
0	Bit 0: Wire-break recognition channel 0 (1: on) Bit 1: Wire-break recognition channel 1 (1: on) Bit 2: Wire-break recognition channel 2 (1: on) Bit 3: Wire-break recognition channel 3 (1: on) Bit 7 ... 4: reserved

CHxFN
Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module.

With FFh the corresponding channel is deactivated.

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$I = D \cdot \frac{20}{27648}$ $D = 27648 \cdot \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$I = D \cdot \frac{20}{16384}$ $D = 16384 \cdot \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	

Output range (function number)	Current (I)	Decimal (D)	Hex	Range	Formulas for calculation
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$I = D \cdot \frac{16}{27648} + 4$ $D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	0mA	-6912	E500h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$I = D \cdot \frac{16}{16384} + 4$ $D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0mA	-4096	F000h	underrange	

Diagnostic data

So this module does not support interrupt functions, the diagnostics data serve for information about this module.

On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

DS = Record set for access via CPU, Profibus and Profinet.
The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX = Index for access via CANopen.
The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR ... CH7ERR	4	reserved	00h			0Eh ... 11h
DIAG_US	4	µs ticker	00h			12h

ERR_A
Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP
Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 0101 analog module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D
Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP
Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 73h: analog output Bit 7: reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH
Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR
Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 ... 4: reserved

CH0ERR ...
CH3ERR
Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 3 ... 1: reserved Bit 4: set at wire-break Bit 7 ... 5: reserved

CH4ERR ...
CH7ERR
reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value µs ticker at the moment of the diagnostic data generation

µs ticker
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.