ELCO Intelligent I/O-FS200

SM | Manual

May 2011

Note

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CE Conformity

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

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

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

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Contents

About this manual

This manual describes the signal modules (SM) of the FS200 from ELCO. 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 FS200 SM modules.

Overview

Chapter 1: Basics and Assembly

The focus of this chapter is on the introduction of the ELCO FS200. Here you will find the information required to assemble and wire a controller system consisting of FS200 components.

Besides the dimensions the general technical data of FS200 will be found.

Chapter 2: Digital input

In this chapter you will find the description of the digital input modules of the FS200 from ELCO.

Chapter 3: Digital output

The digital output modules of the FS200 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 FS200 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 FS200 will be found here.

Objective and contents

This manual describes the FS200 signal modules from ELCO.
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 FS200 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 ELCO FS200. Here you will find the information required to assemble and wire a controller system consisting of FS200 components.

Besides the dimensions the general technical data of FS200 will be found.

Content

Safety Information for Users

Handling of electrostatic sensitive modules

ELCO 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.

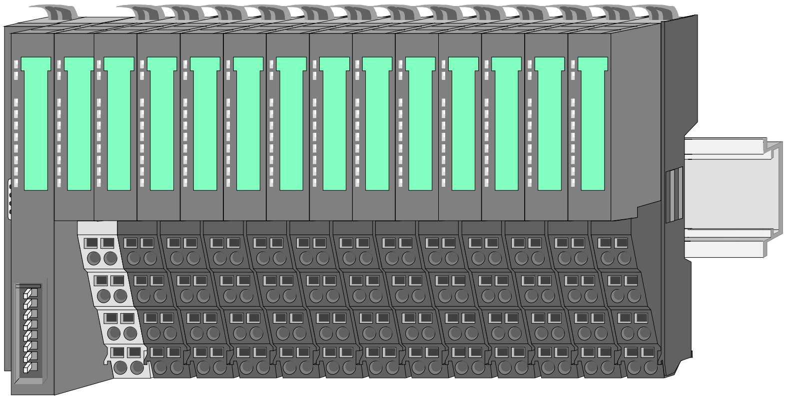
System conception

Overview

FS200 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.

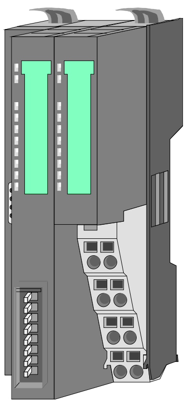


Components

The FS200 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.

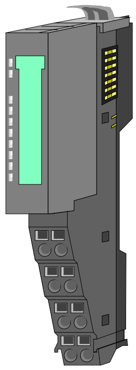
Via the integrated power module for power supply the bus interface is supplied as well as the electronic of the connected periphery modules.

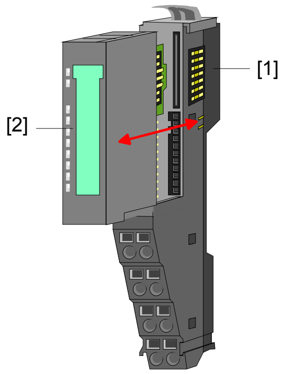
The DC 24 power section supply for the linked periphery modules is established via a further connection.

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.

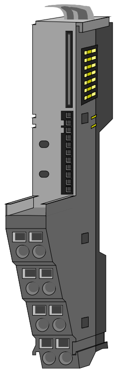




[1] Terminal module

[2] Electronic module

Terminal module

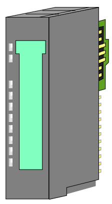


The *terminal module* serves to carry the electronic module, contains the backplane bus with power supply for the electronic, the DC 24V power section supply and the staircase-shaped terminal for wiring.

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

By means of this locking system your FS200 may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

Electronic module



The functionality of a FS200 periphery module is defined by the *electronic module*, which is mounted to the terminal module by a save sliding mechanism.

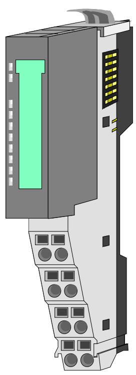
With an error the defective module may be exchanged for a functional module with standing installation.

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

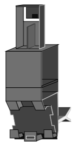


In the FS200 the power supply is established by power modules. These are either integrated to the bus coupler or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined and additionally the electronic power supply may be extended with 2A.

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

Accessories

Shield bus carrier



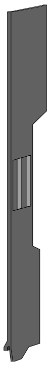
The shield bus carrier serves to carry the shield bus to connect cable shields.

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

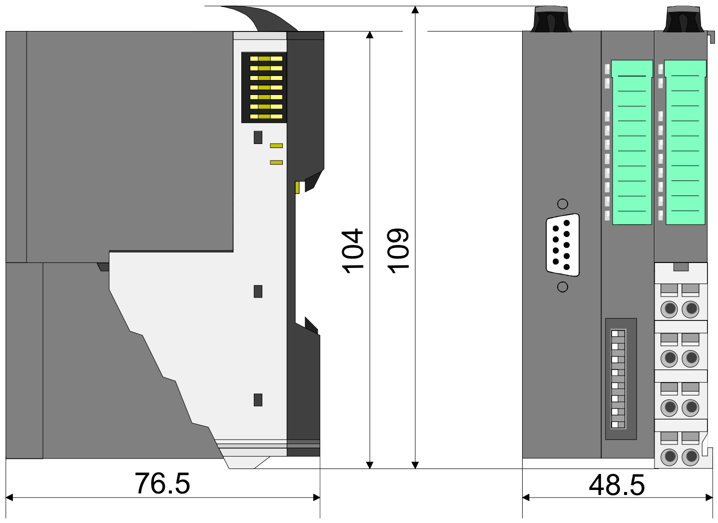


With each bus coupler, to protect the backplane bus connectors, there is a mounted bus cover in the scope of delivery. You have to remove the bus cover of the bus coupler before mounting a FS200 module.

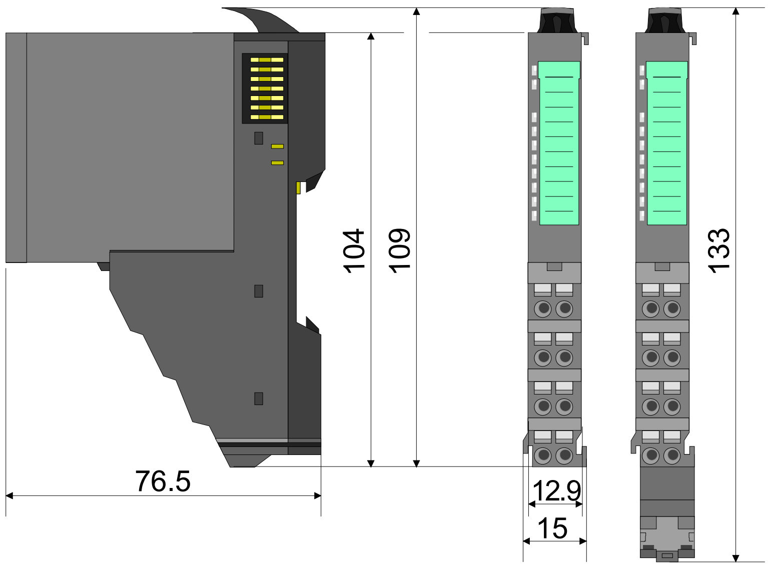
For the protection of the backplane bus connector you should always mount the bus cover at the last module of your system again.

Dimensions

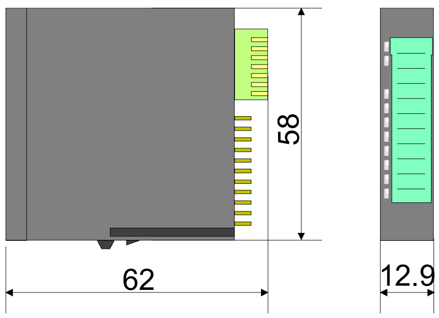
Dimensions bus coupler



Dimensions periphery module



Dimensions electronic module



Dimensions in mm

Installation

Functional principle

Mounting terminal module

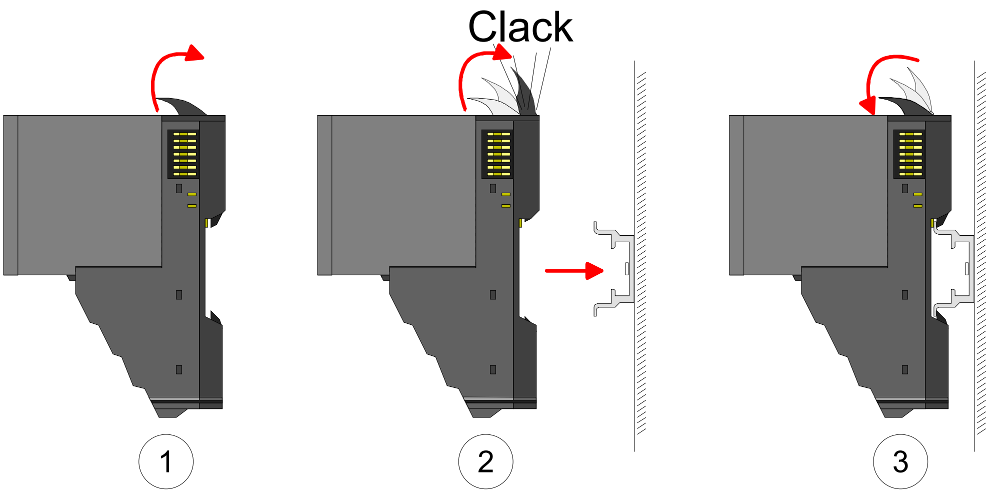
There is a locking lever at the top side of the terminal module. For mounting and de-mounting this locking lever is to turn upwards until this engages audible.

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.

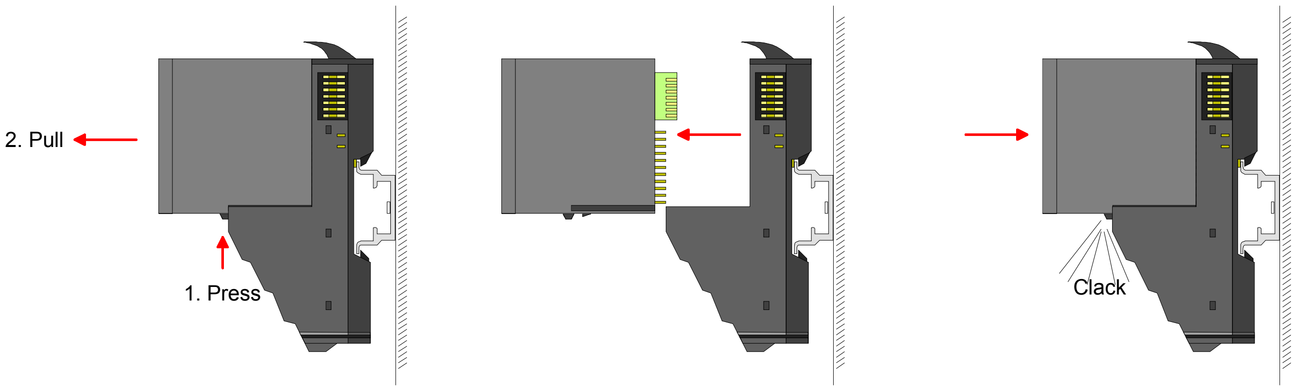
The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened.



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.



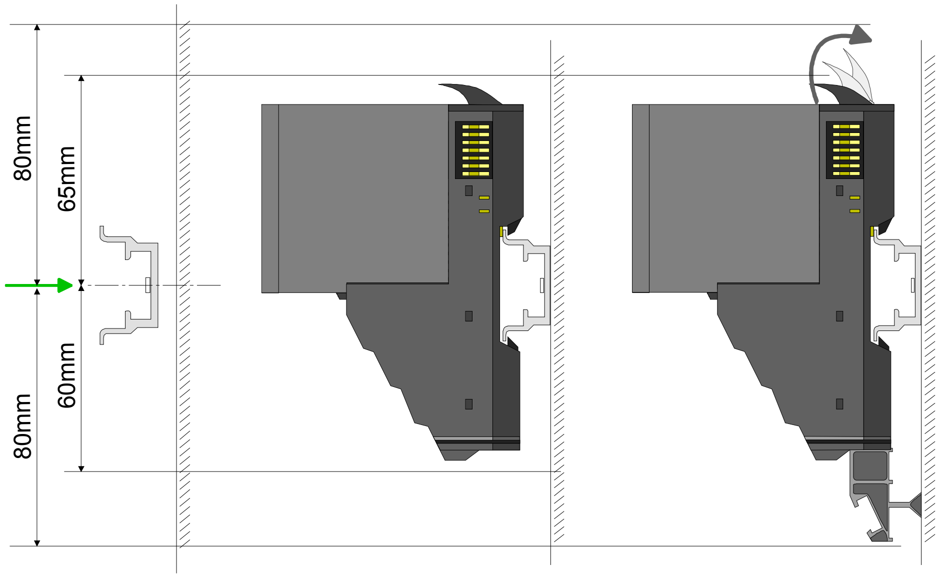
Mounting Proceeding

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 FS2-PS-AB10 the current of the electronic power supply may be expanded with 2A. More about this may be found at "Wiring".

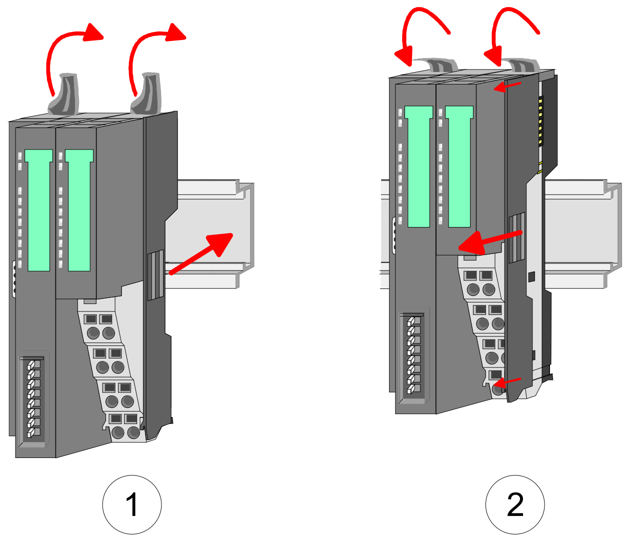
Mounting mounting rail

- 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.



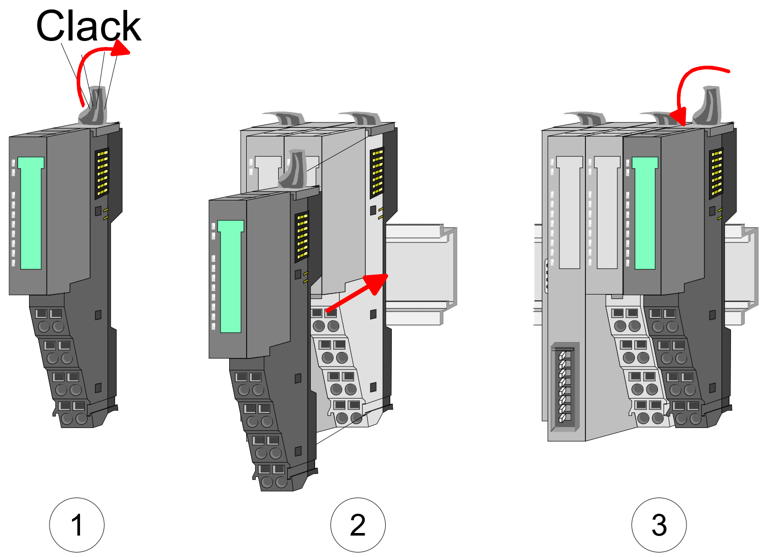
Mounting Head module (e.g. bus coupler)

- 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.



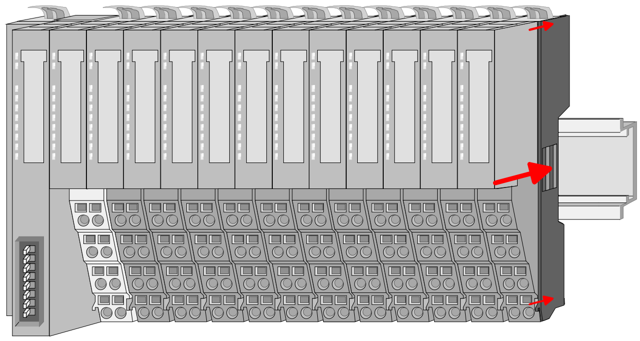
Mounting periphery module

- Mount the periphery modules you want.



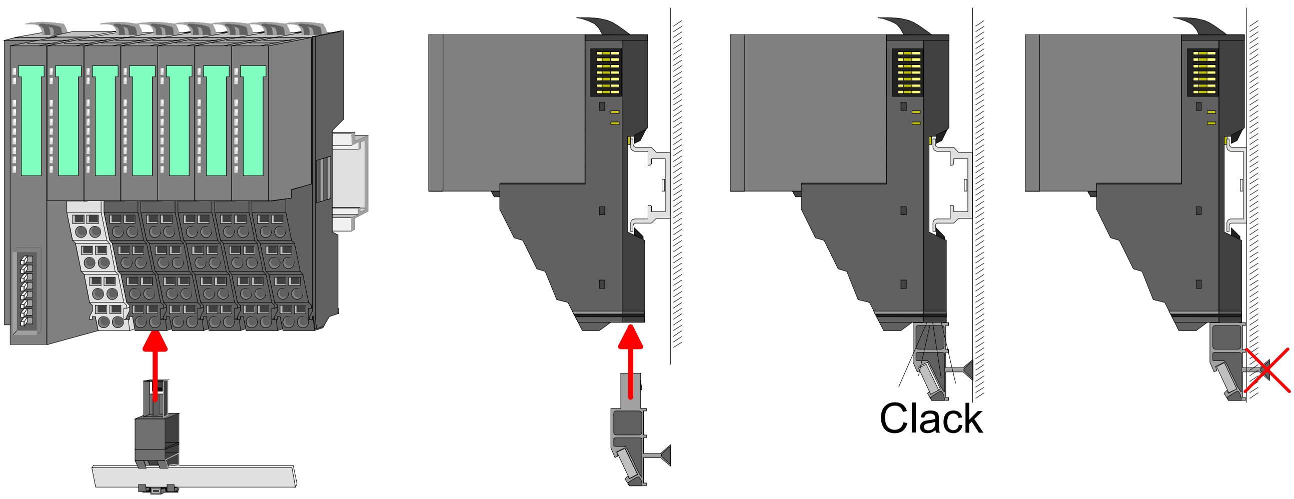
Mounting the bus cover

- After mounting the whole system, to protect the backplane bus connectors the bus cover may now be mounted at the last module



Mounting shield bus carrier

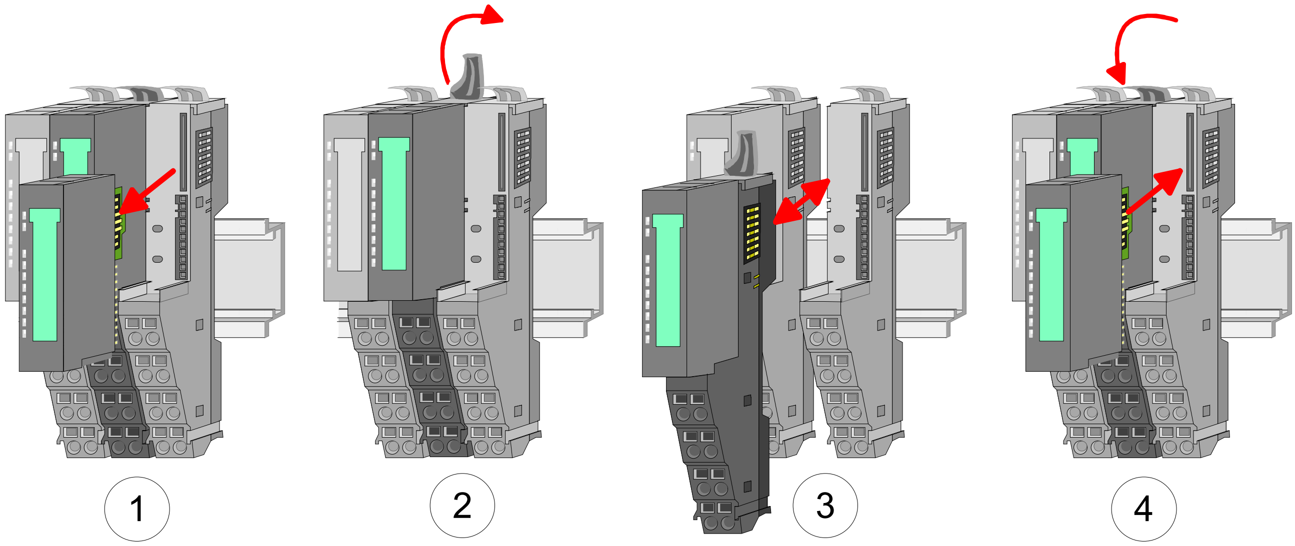
The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.



Mounting between 2 modules

With the mounting of a FS200 module respectively of a group of FS200 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.



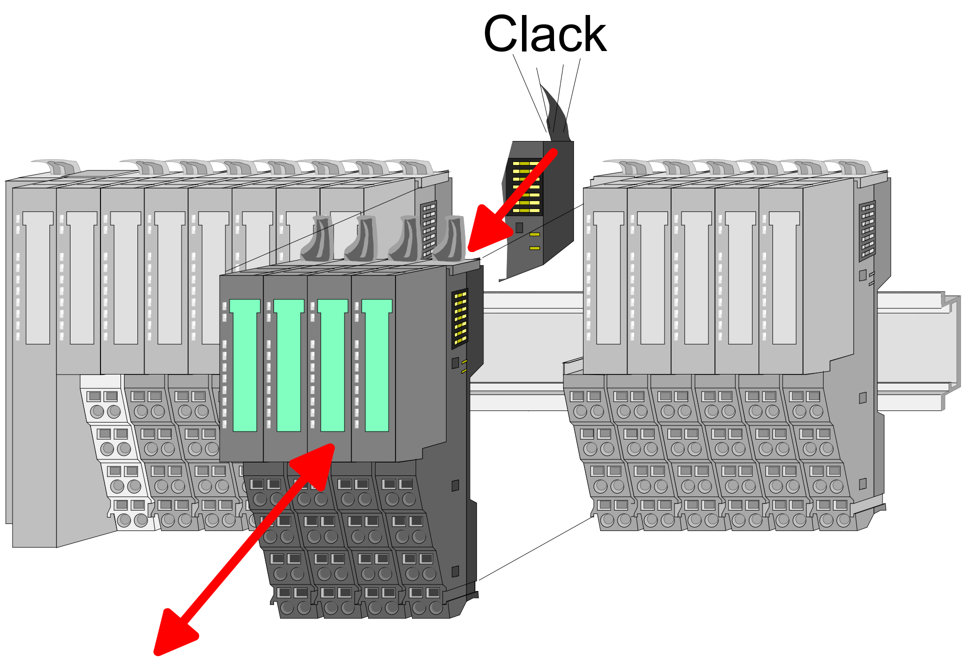
1 module group between 2 modules

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.

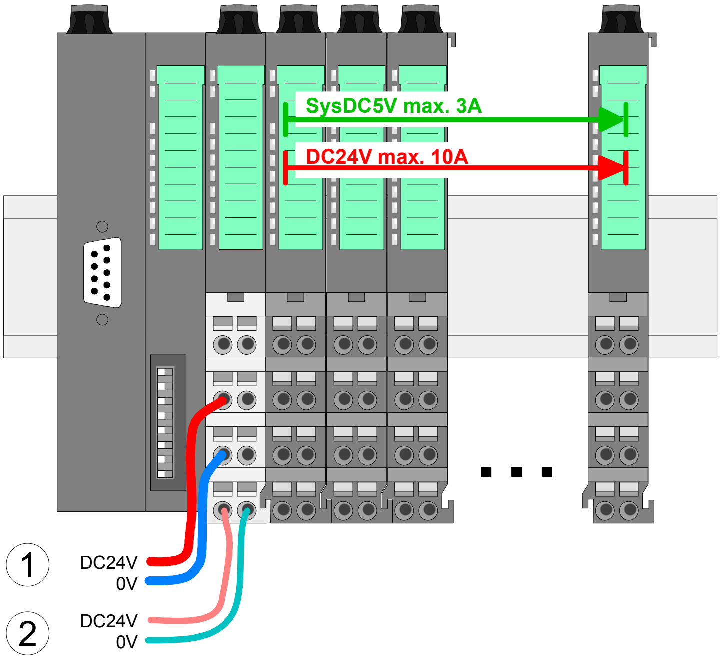
To mount the group of modules put them to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.

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



Wiring

Standard wiring



[1] DC 24V Power section supply I/O area

[2] DC 24V 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 power section supply with a fast 10A fuse and the electronic power supply with a fast 4A fuse.

State of the electronic power supply via LEDs

After PowerON of the FS200 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.

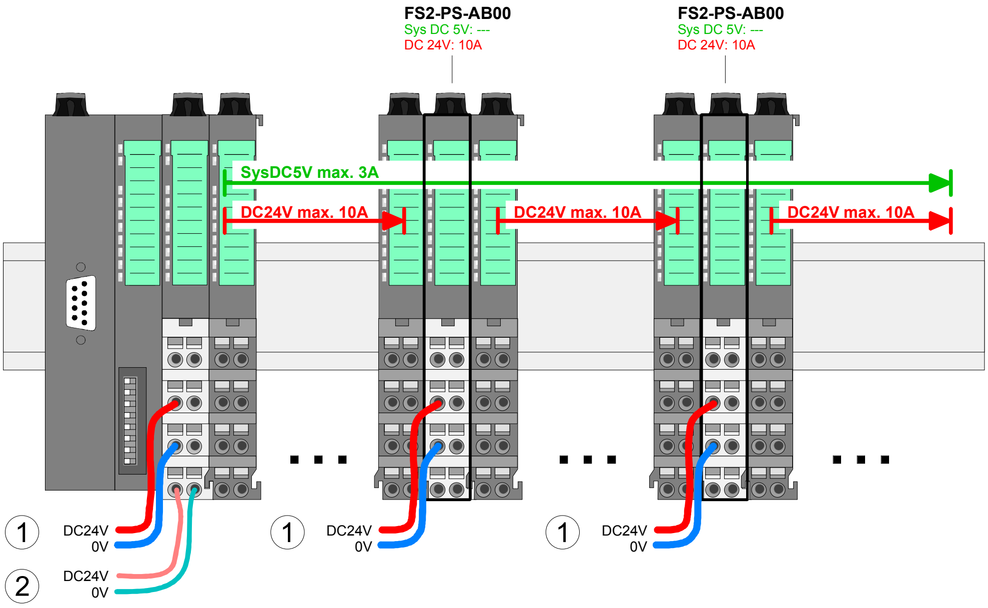
Deployment of the power modules

If the 10A for the power section supply is no longer sufficient, you may use the power module from ELCO with the order number FS2-PS-AB00. So you have also the possibility to define isolated groups.

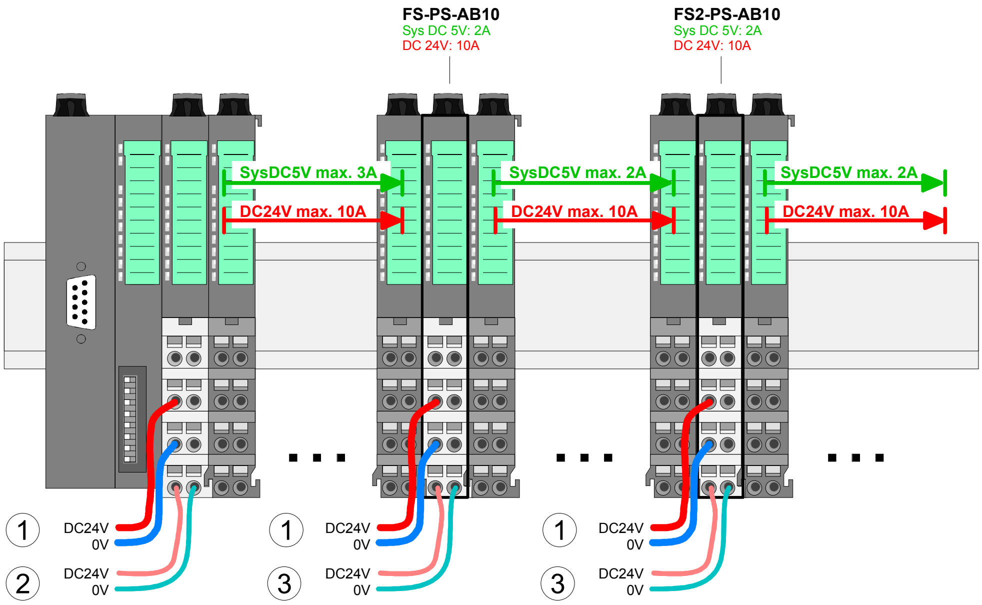
The power module with the order number FS2-PS-AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient.
Additionally you get an isolated group for the DC 24V power section supply with 10A.

By placing the power module FS2-PS-AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards the power module FS2-PS-AB10 is to be placed again.

Power module FS2-PS-AB00



Power module FS2-PS-AB10



[1] DC 24V Power section supply I/O area (max. 10A)

[2] DC 24V Electronic power supply bus coupler and I/O area (max. 3A)

[3] DC 24V Electronic power supply I/O area (max. 2A)

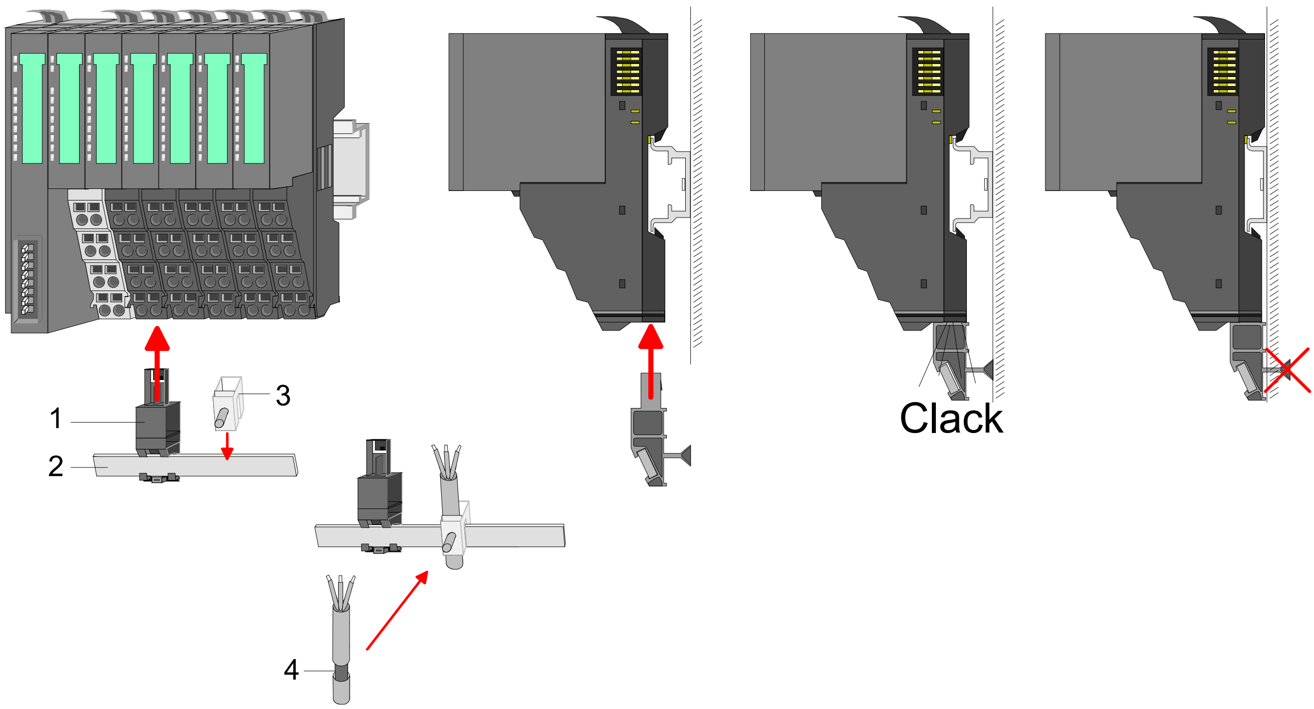
Shield attachment

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
[3] Shield clamp
[4] Cable shield

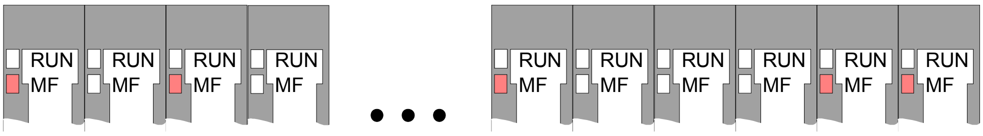
Trouble shooting

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

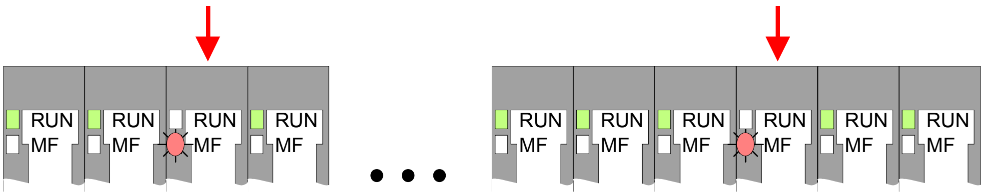


Behavior: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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 FS2-PS-AB10.
More concerning this may be found above at "Wiring".

Error in configuration

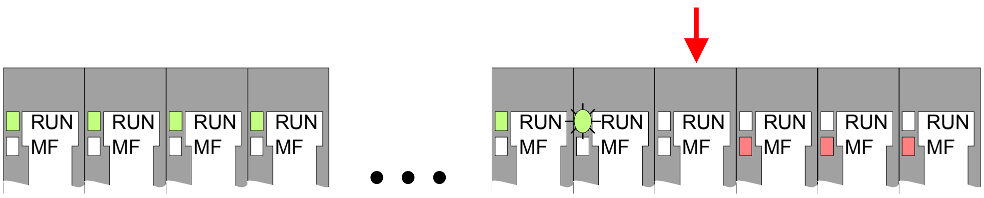


Behavior: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

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 the RUN LED flashes at one module. The RUN and MF LEDs of the following module are off. With all following modules the MF LED is on and the RUN LED is off.

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

Remedy: Replace the defective module.

Installation guidelines

General

The installation guidelines contain information about the interference free deployment of FS200. 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 FS200 components are developed for the deployment in hard industrial environments and fulfill high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

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

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

One differs:

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

Basic rules for EMC

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

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Install a central connection between the ground and the protected earth conductor system.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminum parts. Aluminum is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal res. data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated.
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favorable.
  - Lay the line isolation extensively on an isolation/protected earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metalized plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Wire all inductivities with erase links, which are not addressed by the FS200 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 FS200 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 FS200 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	73/23/EWG	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

Chapter 2 Digital Input

Overview

In this chapter you will find the description of the digital input modules of the System FS200 from ELCO.

Content

ELCO FS2-DI-BB00 - DI 2xDC 24V

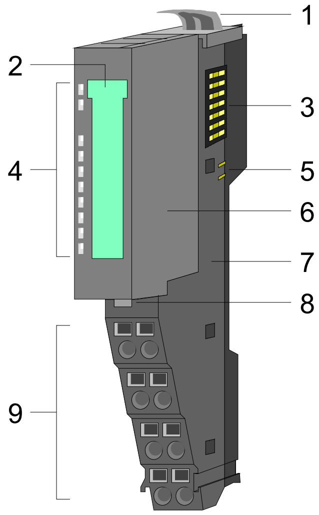
Description

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

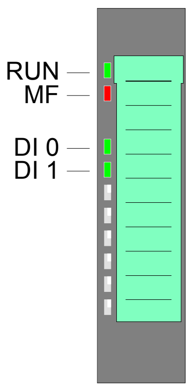
- 2 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

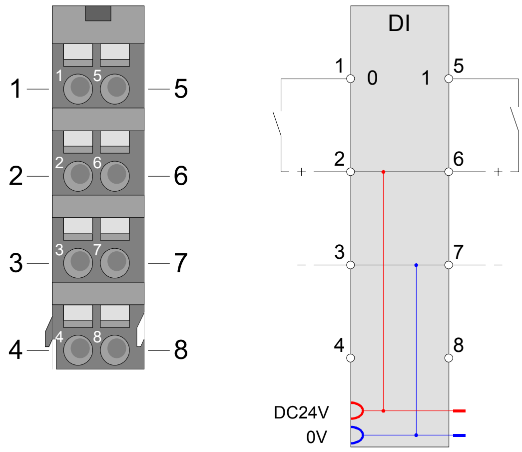


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BB00
Number of inputs	2
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Current consumption 5V 24V	 55mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0001 9F82
Bit-width in the process image	2bits
Configurable	no

ELCO FS2-DI-BB50 - DI 2xDC 24V NPN

Description

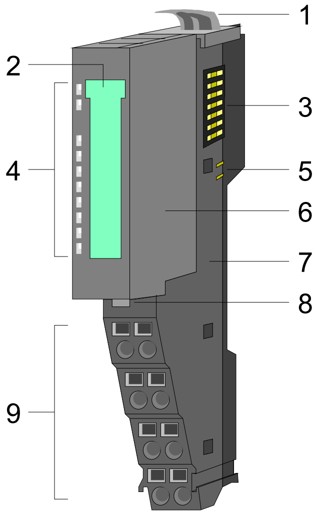
The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 2 channels and their status is monitored via LEDs.

An input becomes active as soon as it is connected to ground.

Properties

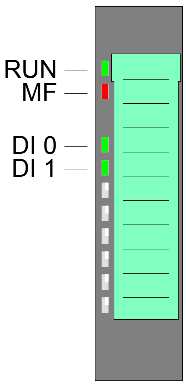
- 2 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

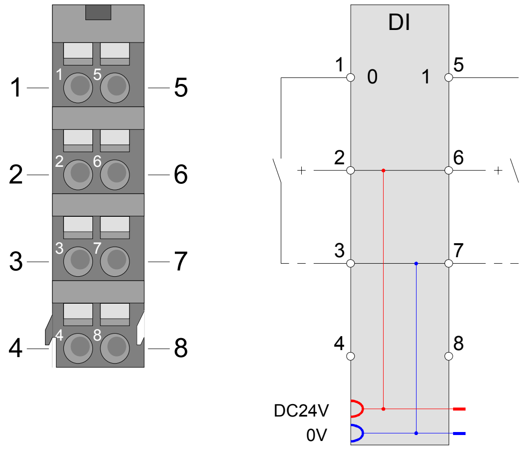


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BB50
Number of inputs	2
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	15 ... 30V
Signal voltage "1"	0 ... 5V
Current consumption 5V 24V	 60mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0002 9F82
Bit-width in the process image	2bits
Configurable	no

ELCO FS2-DI-BD00 - DI 4xDC 24V

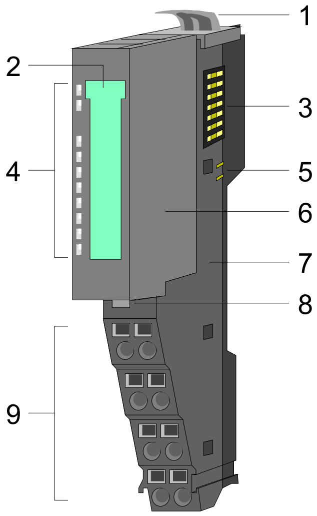
Description

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

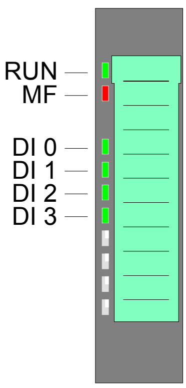
- 4 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

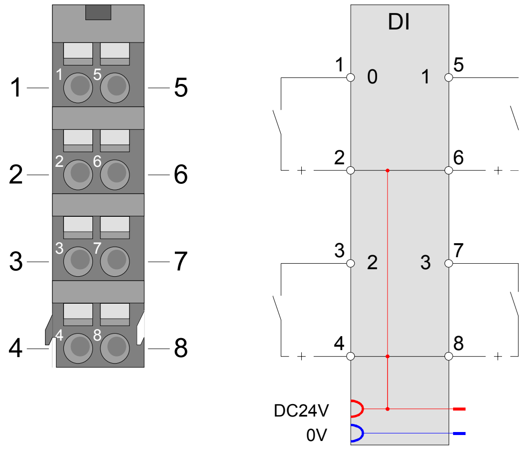


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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	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

Technical data

Data	ELCO FS2-DI-BD00
Number of inputs	4
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Current consumption 5V 24V	 55mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0003 9F84
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DI-BD40 - DI 4xDC 24V 3 wire

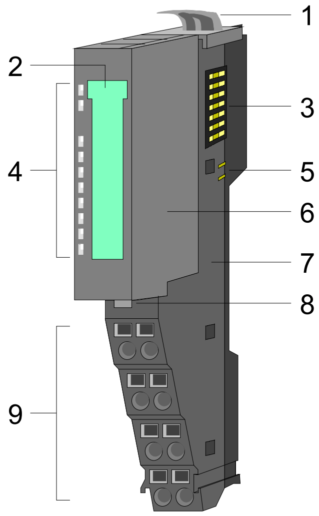
Description

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

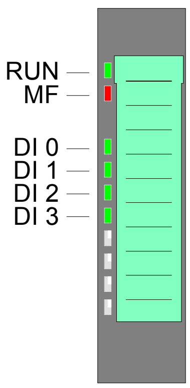
- 4 digital inputs with 3 wire connection, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

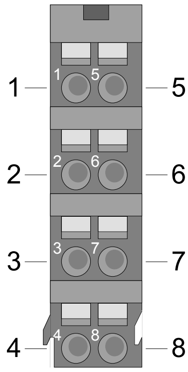


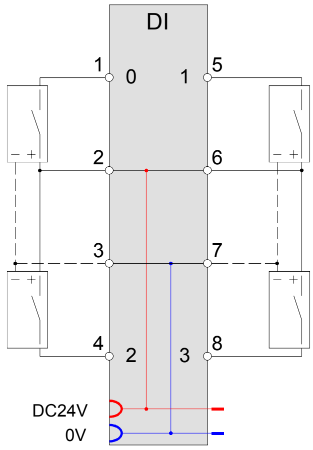
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BD40
Number of inputs	4
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Current consumption 5V 24V	 55mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0008 9F84
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DI-BD50 - DI 4xDC 24V NPN

Description

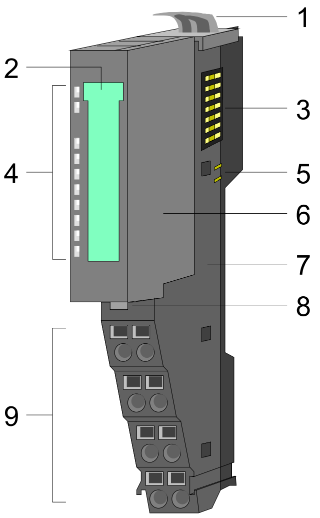
The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 4 channels and their status is monitored via LEDs.

An input becomes active as soon as it is connected to ground.

Properties

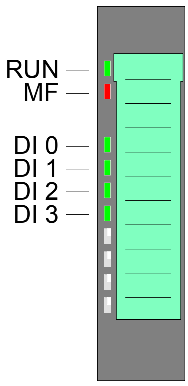
- 4 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

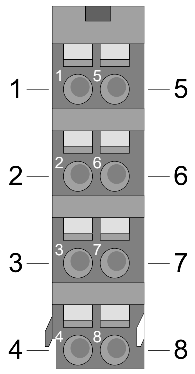


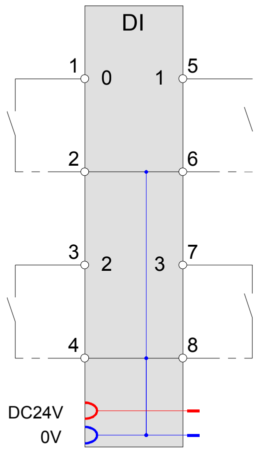
LED	Color	Description		
RUN MF	green red	RUN	MF	
		●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BD50
Number of inputs	4
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	15 ... 30V
Signal voltage "1"	0 ... 5V
Current consumption 5V 24V	 65mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0004 9F84
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DI-BF00 - DI 8xDC 24V

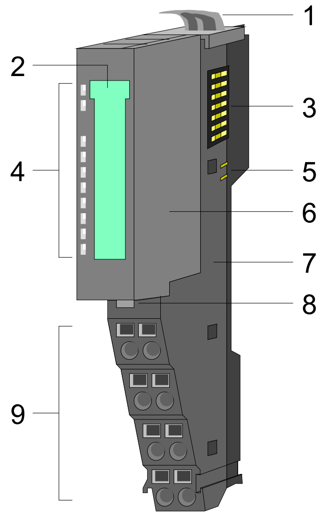
Description

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

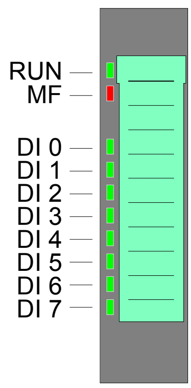
- 8 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

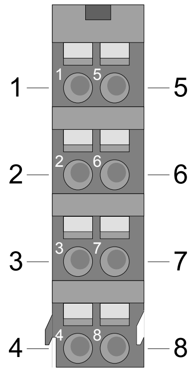


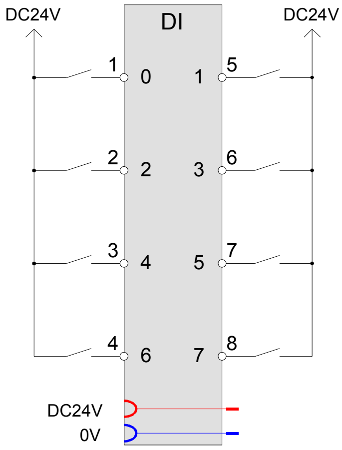
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BF00
Number of inputs	8
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	0 ... 5V
Signal voltage "1"	15 ... 30V
Current consumption 5V 24V	 60mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0005 9FC1
Bit-width in the process image	8bits
Configurable	no

ELCO FS2-DI-BF50 - DI 8xDC 24V NPN

Description

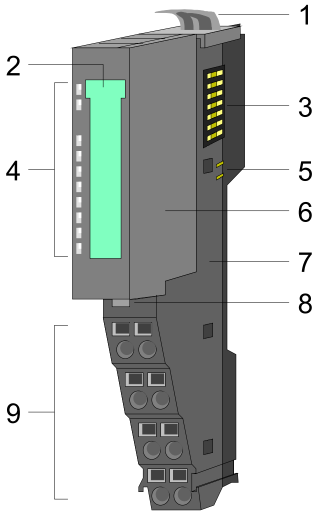
The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system.
It has 8 channels and their status is monitored via LEDs.

An input becomes active as soon as it is connected to ground.

Properties

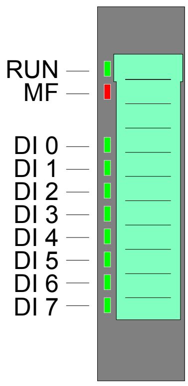
- 8 digital inputs (N switching), isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

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

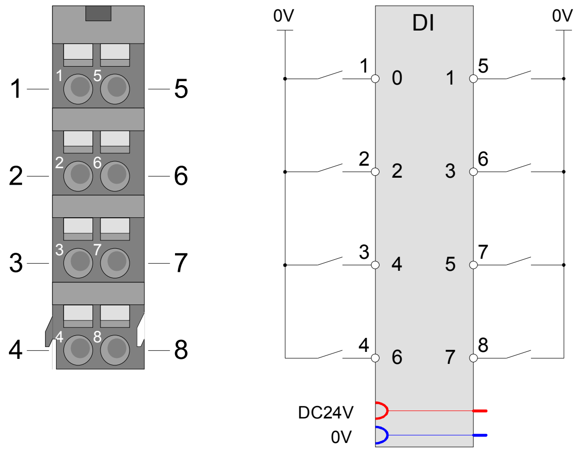


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DI-BF50
Number of inputs	8
Nominate input voltage	DC 24V (20.4 ... 28.8V)
Signal voltage "0"	15 ... 30V
Signal voltage "1"	0 ... 5V
Current consumption 5V 24V	 65mA ---
Input filter time delay	3ms
Input current	typ. 3mA (EN 61131-2, type 1)
Isolation	500Veff (field voltage to the bus)
Module ID	0007 9FC1
Bit-width in the process image	8bits
Configurable	no

Chapter 3 Digital Output

Overview

The digital output modules of the FS200 will be found here.

Content

ELCO FS2-DO-BB00 - DO 2xDC 24V 0.5A

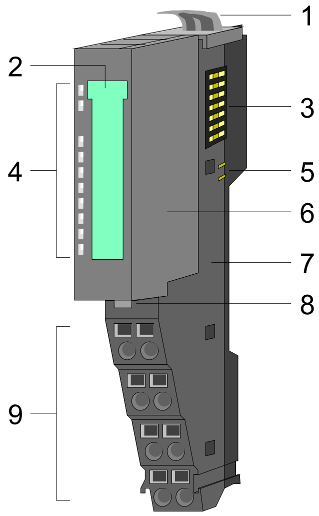
Description

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

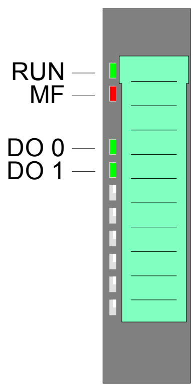
- 2 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

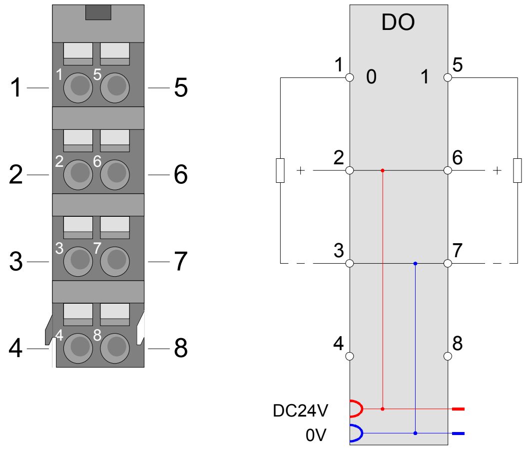


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BB00
Number of outputs	2
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 55mA 5mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0101 AF90
Bit-width in the process image	2bits
Configurable	no

ELCO FS2-DO-BB20 - DO 2xDC 24V 2A

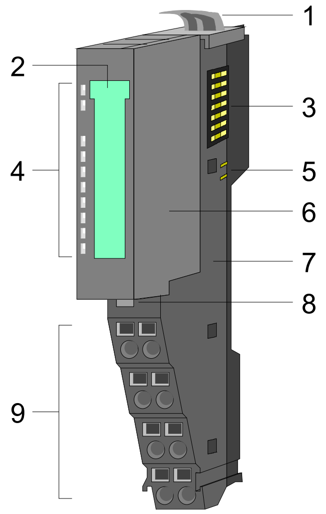
Description

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

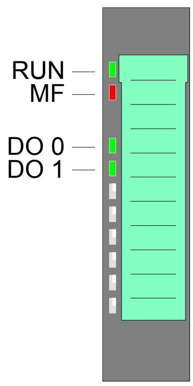
- 2 digital 2A outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

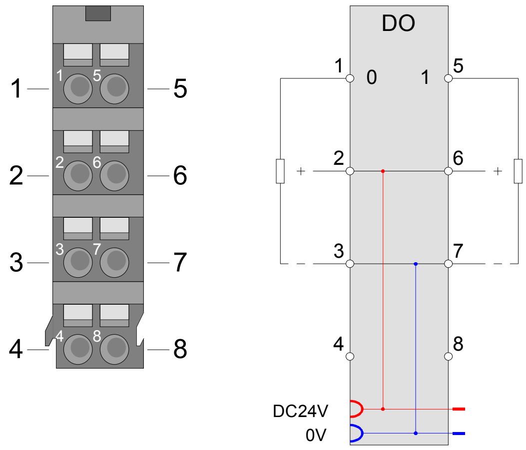


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BB20
Number of outputs	2
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 55mA 5mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 2A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0102 AF90
Bit-width in the process image	2bits
Configurable	no

ELCO FS2-DO-BB50 - DO 2xDC 24V 0.5A NPN

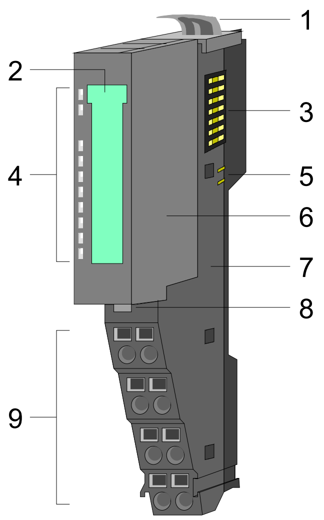
Description

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

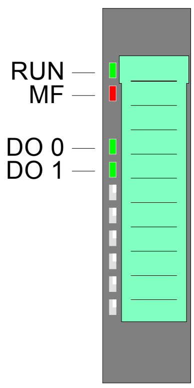
- 2 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

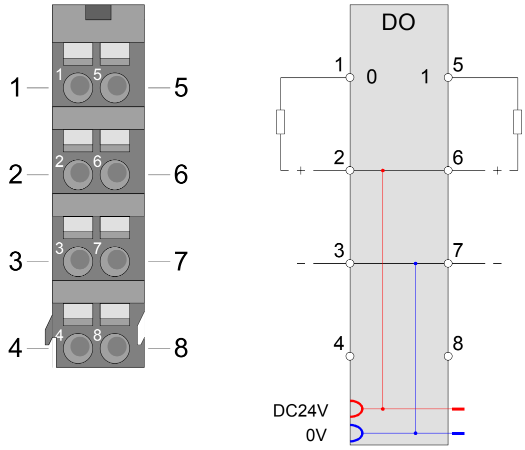


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BB50
Number of outputs	2
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 60mA 2.5mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0103 AF90
Bit-width in the process image	2bits
Configurable	no

ELCO FS2-DO-BD00 - DO 4xDC 24V 0.5A

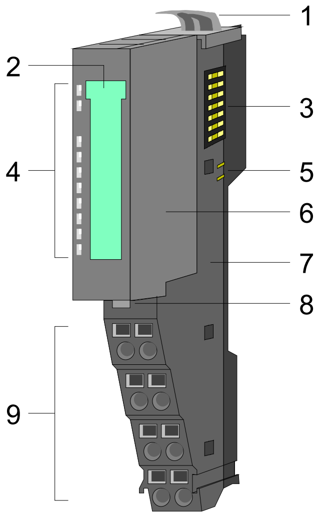
Description

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

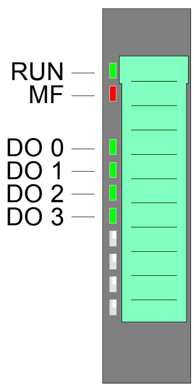
- 4 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

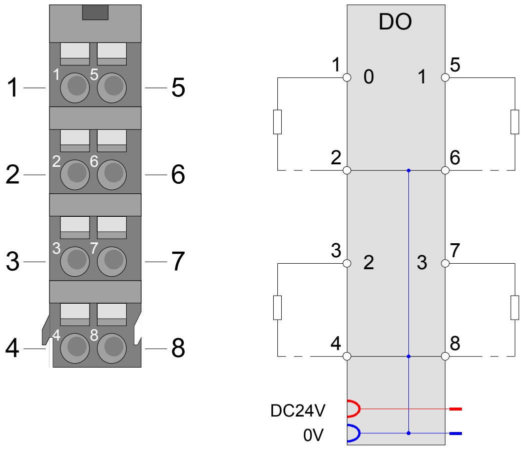


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BD00
Number of outputs	4
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 55mA 10mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0104 AFA0
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DO-BD20 - DO 4xDC 24V 2A

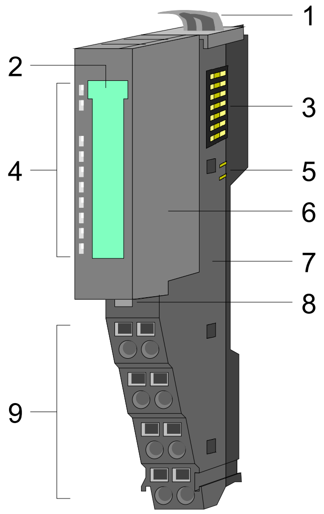
Description

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

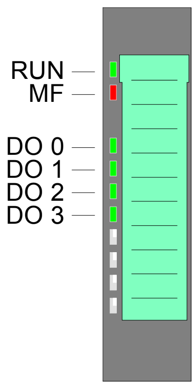
- 4 digital 2A outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

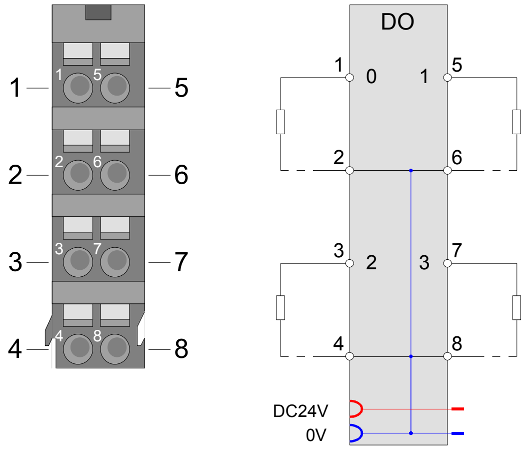


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or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

Technical data

Data	ELCO FS2-DO-BD20
Number of outputs	4
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 55mA 10mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 2A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0108 AFA0
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DO-BD50 - DO 4xDC 24V 0.5A NPN

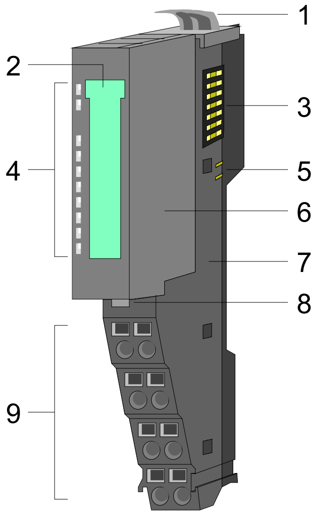
Description

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

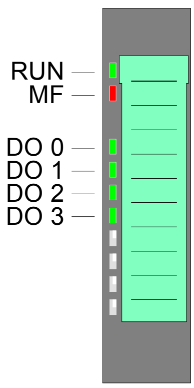
- 4 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

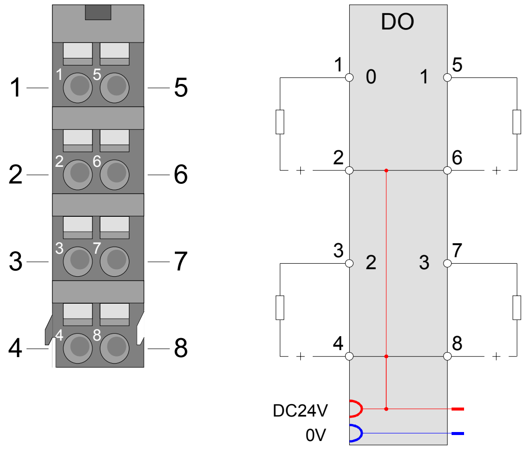


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BD50
Number of outputs	4
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 65mA 5mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0105 AFA0
Bit-width in the process image	4bits
Configurable	no

ELCO FS2-DO-BF00 - DO 8xDC 24V 0.5A

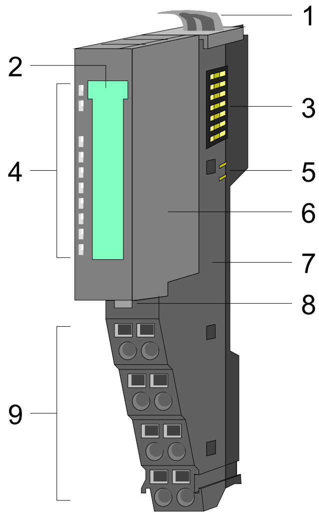
Description

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

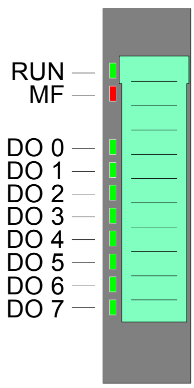
- 8 digital outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

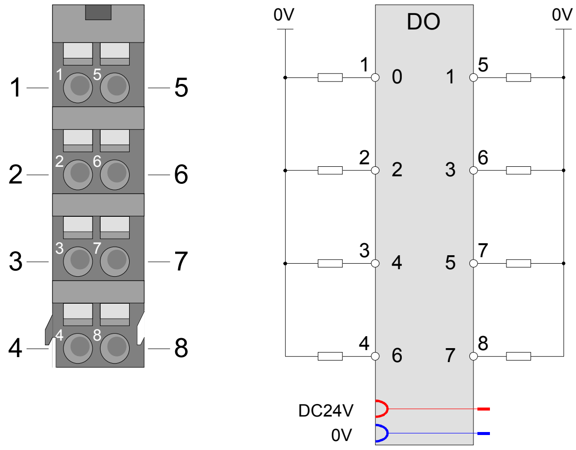


LED	Color	Description		
RUN MF	green red	RUN	MF	
		●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BF00
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 65mA 15mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0106 AFC8
Bit-width in the process image	8bits
Configurable	no

ELCO FS2-DO-BF50 - DO 8xDC 24V 0.5A NPN

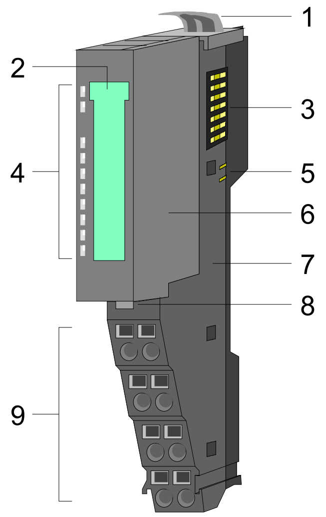
Description

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

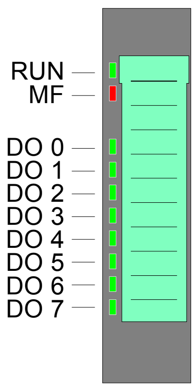
- 8 digital low-side outputs, isolated to the backplane bus
- Status indication of the channels via LEDs

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

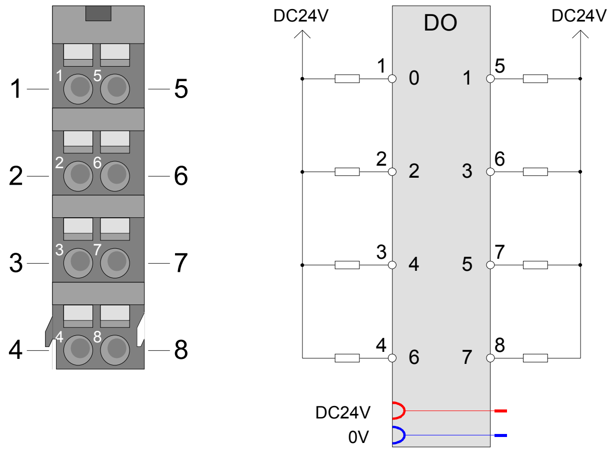


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error with overload, short circuit or overheat
		○	●	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)
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

Technical data

Data	ELCO FS2-DO-BF50
Number of outputs	8
Nominal load voltage	DC 24V (20.4 ... 28.8V)
Current consumption 5V 24V	 70mA 10mA + load
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 0.5A (short-circuit proofed)
Switch rate for resistive load for ind. load (IEC947-5-1, DC13) for lamp load	 max. 1kHz max. 0.5Hz max. 10Hz
Module ID	0107 AFC8
Bit-width in the process image	8bits
Configurable	no

ELCO FS2-DO-HB10 - DO 2xRelay

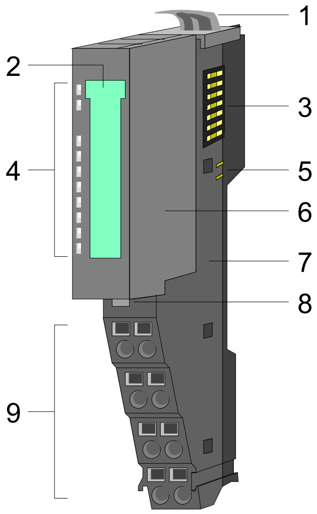
Description

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

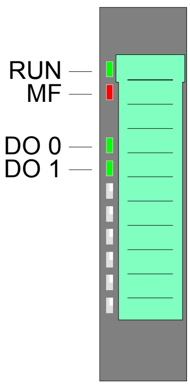
- 2 relay outputs, isolated to the backplane bus
- DC 30V / AC 230V, 3A
- Status indication of the channels via LEDs

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

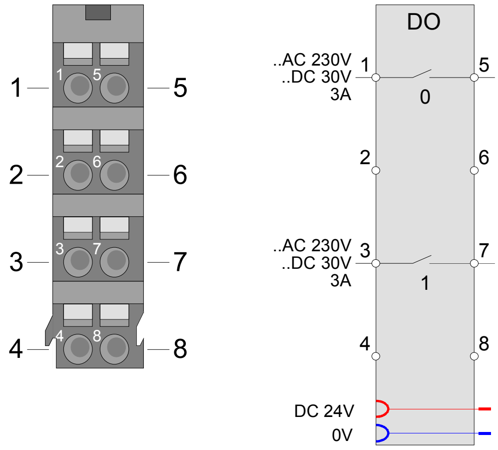


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization (if parameterizable)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

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

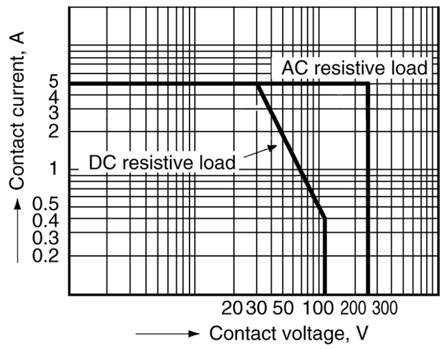
For wires with a cross section of 0.08mm² up to 1.5mm².



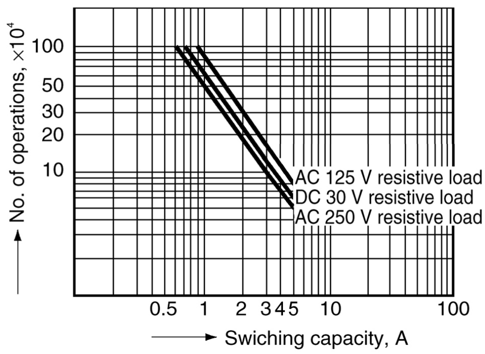
Pos.	Function	Type	Description
1	DO 0	O	Relay output DO 0
2	---	---	not connected
3	DO 1	O	Relay output DO 1
4	---	---	not connected
5	DO 0	O	Relay output DO 0
6	---	---	not connected
7	DO 1	O	Relay output DO 1
8	---	---	not connected

O: Output

Maximum load



Service life



Technical data

Data	ELCO FS2-DO-HB10
Number of outputs	2 via relay
Nominal load voltage	AC 230V / DC 30V
Current consumption 5V 24V	 55mA ---
Isolation	500Veff (field voltage to the bus)
Load	resistive, inductive or lamp load
Output current (per channel)	max. 3A (short-circuit proofed)
Switch rate	max. 10Hz
Module ID	0109 AF90
Bit-width in the process image	2bits
Configurable	no

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 FS200 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 modules may be parameterized by hardware configuration respectively at run time by means of SFCs.

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)

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

Bit 15 = "0" → positive value

Bit 15 = "1" → 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	$D = 27648 \cdot \frac{U}{80}$
	80mV	27648	6C00h	nominal range	
	0V	0	0000h		
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	
-80 ... 80mV Siemens S5 format (12h)	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{80}$
	80mV	16384	4000h	nominal range	
	0V	0	0000h		
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-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	$D = 27648 \cdot \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4.00mA	-3277	F333h	underrange	
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		$I = D \cdot \frac{16}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	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	Measuring value in °F	Measuring value in K	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

ELCO FS2-AI-BB30 - AI 2x12Bit 0...10V

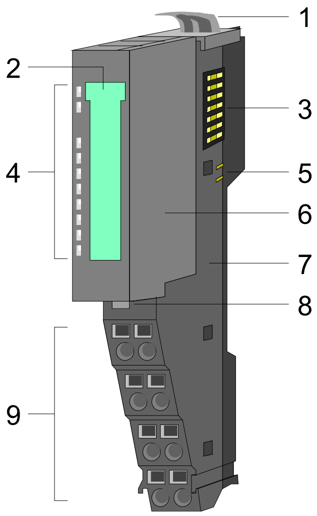
Description

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 converters.

Properties

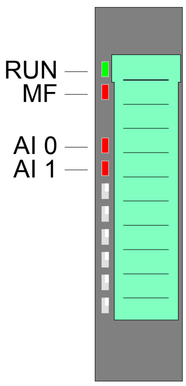
- 2 analog inputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

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

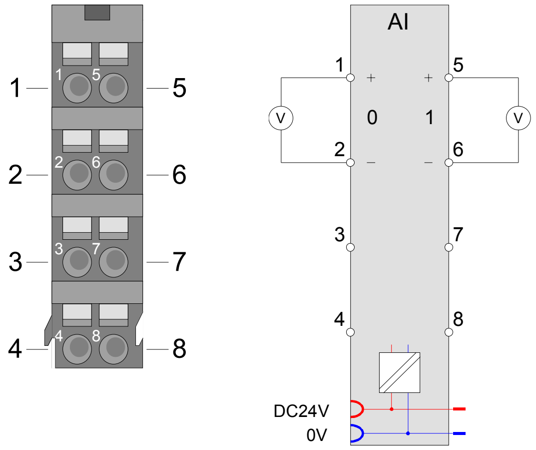


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red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

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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



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

Technical data

Data	ELCO FS2-AI-BB30
Number of inputs	2
Power supply	DC 24V via power module
Input range	0 ... 10V
Current consumption 5V 24V	 70mA 15mA
Internal resistor	100kΩ
Limit frequency input filter	1kHz
Resolution	12bit
Conversion time	4ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
Voltage range	±0.3%
Basic error limit (Operational limit at 25°C, referred to the input range)	
Voltage range	±0.2%
Isolation	500Veff (field voltage to the bus)
Module ID	0401 15C3
Bit-width in the process image	Input: 2x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Record set Byte	Meaning	Default
128	0	Function number channel 0	10h
129	0	Function number channel 1	10h

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

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
- Measuring range overflow
- Measuring range underflow

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2/3	0 (fix)
4	Bit 6 ... 0: channel type 71h: analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 02h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 7 ... 2: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
10 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AI-BB40 - AI 2x12Bit 0(4)...20mA

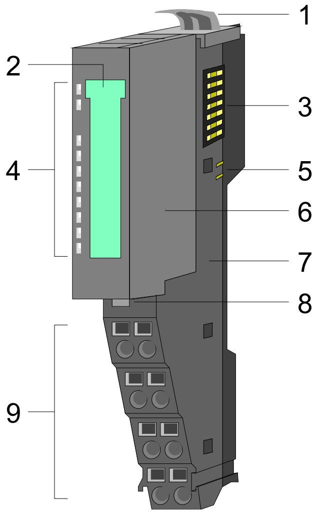
Description

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 converters.

Properties

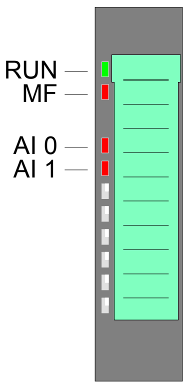
- 2 analog inputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA with external supply
- 12bit resolution

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

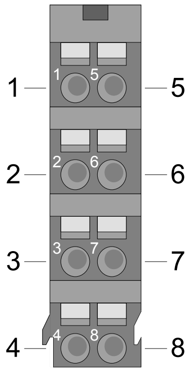


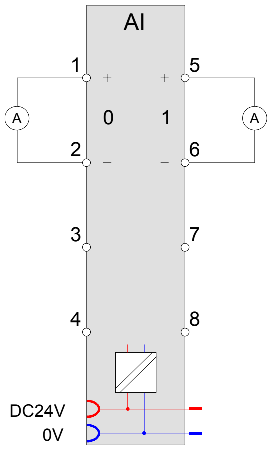
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red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

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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





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

Technical data

Data	ELCO FS2-AI-BB40
Number of inputs	2
Power supply	DC 24V via power module
Input range	0 ... 20mA / 4 ... 20mA
Current consumption 5V 24V	 70mA 15mA
Internal resistor	110Ω
Limit frequency input filter	1kHz
Resolution	12bit
Conversion time	4ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
0 ... 20mA	±0.3%
4 ... 20mA	±0.5%
Basic error limit (Operational limit at 25°C, referred to the input range)	
0 ... 20mA	±0.2%
4 ... 20mA	±0.3%
Measuring error	0 ... 20mA: ±0.2% 4 ... 20mA: ±0.3% (relating to operational limit at 25°C)
Isolation	500Veff (field voltage to the bus)
Module ID	0402 15C3
Bit-width in the process image	Input: 2x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Record set Byte	Meaning	Default
128	0	Function number channel 0	31h
129	0	Function number channel 1	31h

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	$D = 27648 \cdot \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-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	$D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		$I = D \cdot \frac{16}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	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
- Measuring range overflow
- Measuring range underflow

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2/3	0 (fix)
4	Bit 6 ... 0: channel type 71h: analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 02h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 7 ... 2: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
10 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AI-BB90 - AI 2x16Bit TC

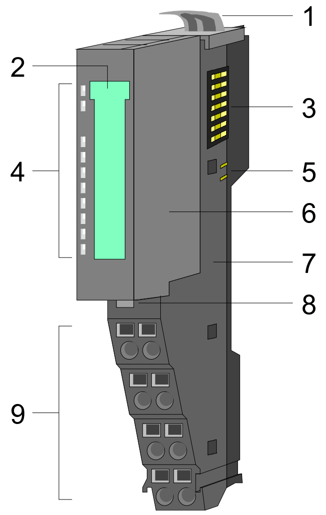
Description

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 converters.

Properties

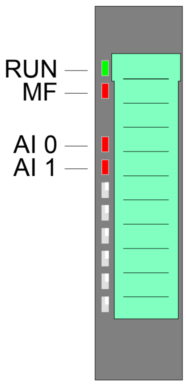
- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC140V/AC100V between the inputs

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

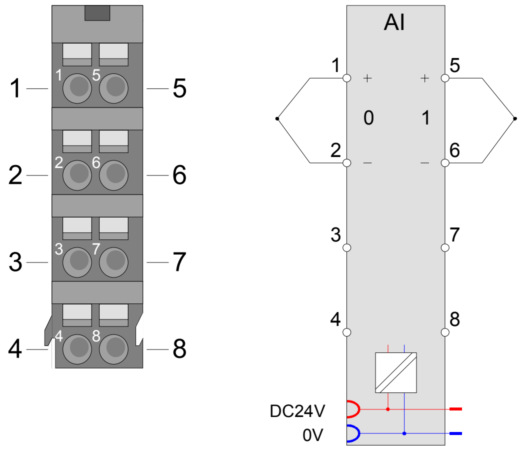


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red	●	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 $0.08mm^2$ up to $1.5mm^2$.



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.

Technical data

Data	ELCO FS2-AI-BB90
Number of inputs	2 (differential)
Power supply	DC 24V via power module
Input range	±80mV Type J, K, N, R, S, T, B, C, E, L
Current consumption 5V 24V	 75mA 30mA
Internal resistor	10MΩ
Resolution	16bit
Conversion time	4.2 ... 324.1ms each channel at 50Hz 3.8 ... 270.5ms each channel at 60Hz
Operational limit* (in the entire temperature range, referred to the input range)	
±80mV	with interference frequency suppression: ±0.1%
±80mV	without interference frequency suppression: ±0.3%
Type E, L, T, J, K, N	with interference frequency suppression: ±1.5K
Type E, L, T, J, K, N	without interference frequency suppression: ±2.5K
Type B, C, R, S	with interference frequency suppression: ±4.0K
Type B, C, R, S	without interference frequency suppression: ±8.0K
Basic error limit* (Operational limit at 25°C, referred to the input range)	
±80mV	with interference frequency suppression: ±0.05%
±80mV	without interference frequency suppression: ±0.25%
Type E, L, T, J, K, N	with interference frequency suppression: ±1.0K
Type E, L, T, J, K, N	without interference frequency suppression: ±2.0K
Type B, C, R, S	with interference frequency suppression: ±3.0K
Type B, C, R, S	without interference frequency suppression: ±7.0K
Isolation	500Veff (field voltage to the bus)
Module ID	0403 1543
Bit-width in the process image	Input: 2x16bit data
Configurable	yes

*) 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

The parameter data may be accessed during runtime with the following record sets:

Record set Nr.	Byte	Meaning	Default
0	0	Diagnostics Bit 5 ... 0: reserved Bit 6: Diagnostics interrupt (1: activated) Bit 7: reserved	00h
	1	Bit 0: Wire break recognition channel 0 (1: on) Bit 1: Wire break recognition channel 1 (1: on) Bit 7 ... 2: reserved	00h
	2	Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 ... 2: reserved	00h
	3	reserved	00h
1	0	Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 ... 2: reserved	00h
	1	Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 ... 2: reserved	02h
128	0	Function number channel 0	C1h
	1	Function option channel 0	02h
	2, 3	Upper limit value channel 0	7FFFh
	4, 5	Lower limit value channel 0	8000h
129	0	Function number channel 1	C1h
	1	Function option channel 1	02h
	2, 3	Upper limit value channel 1	7FFFh
	4, 5	Lower limit value channel 1	8000h

Function option

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

Upper limit value
Lower limit value

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.

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 (12h)	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	Measuring value in °F	Measuring value in K	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

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Recognized 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

A process interrupt causes a call of the OB 40. Within the OB 40 you may find the logical basic address of the module that initialized the process interrupt by using the *Local word 6*. More detailed information about the initializing event is to find in the *local double word 8*.

Local double word 8 of the OB 40

The *local double word 8* of the OB 40 has the following structure:

Local byte	Bit 7 ... 0
8	Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 7 ... 2: 0 (fix)
9	Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 7 ... 2: 0 (fix)
10 ... 11	16bit µs value at the moment of the interrupt

16bit µs value

In the FS200 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 65535µs the timer starts with 0 again.

With each process interrupt the timer value is stored as 16bit µs value and may be accessed via the local double word 8 of the OB 40.

Diagnostic interrupt

Via the parameterization (record set 00h) you may activate a global diagnostic interrupt for the analog and digital part.

A diagnostic interrupt occurs when e.g. during a process interrupt execution in OB 40 another process interrupt is thrown for the same event. The initialization of a diagnostic interrupt interrupts the recent process interrupt execution in OB 40 and branches in OB 82 to diagnostic interrupt processing$_{\text{incoming}}$.

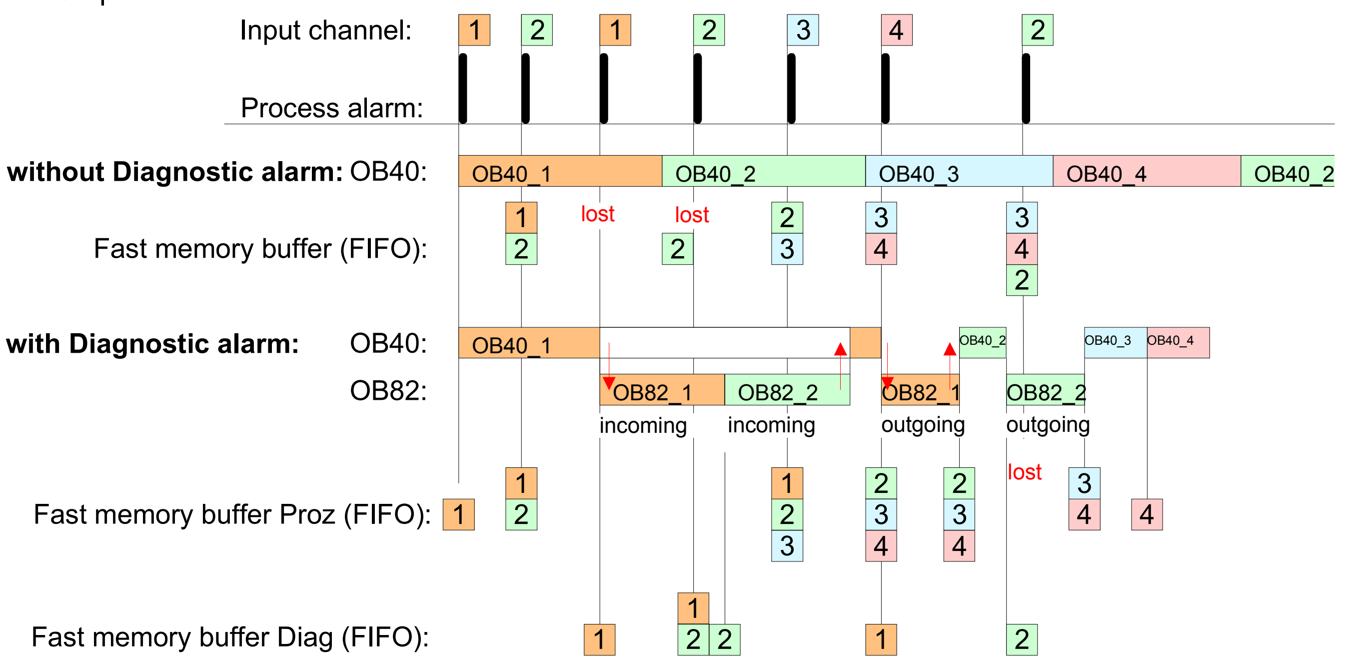
If during the diagnostic interrupt processing other events are occurring at other channels that may also cause a process res. diagnostic interrupt, these are interim stored.

After the end of the diagnostic interrupt processing at first all interim-stored diagnostic interrupts are processed in the sequence of their occurrence and then all process interrupts.

If a channel where currently a diagnostic interrupt$_{\text{incoming}}$ is processed res. interim stored initializes further process interrupts, these get lost. When a process interrupt for which a diagnostic interrupt$_{\text{incoming}}$ has been released is ready, the diagnostic interrupt processing is called again as diagnostic interrupt$_{\text{going}}$.

All events of a channel between diagnostic interrupt$_{\text{incoming}}$ and diagnostic interrupt$_{\text{going}}$ are not stored and get lost. Within this time window (1. diagnostic interrupt$_{\text{incoming}}$ until last diagnostic interrupt$_{\text{going}}$) the MF LED of the module. Additionally for every diagnostic interrupt$_{\text{incoming/going}}$ an entry in the diagnostic buffer of the CPU occurs.

Example



Diagnostic interrupt processing

By using the SFB 52 you may read the diagnostic bytes. At de-activated diagnostic interrupt you have access to the last recent diagnostic event. If you've activated the diagnostic function in your hardware configuration, OB 82 is automatically called. Here you may react accordingly to the diagnostic. The SFB 52 allows you to also read the record set 1 that contains additional information. After leaving the OB 82 a clear assignment of the data to the last diagnostic interrupt is not longer possible.

The record set 1 has the following structure:

Record set 1 Diagnostic$_{incoming}$

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 when external auxiliary supply is missing Bit 6 ... 5: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: Module class 0101b: Analog module Bit 4: Channel information present Bit 7 ... 5: 0 (fix)
2	0 (fix)
3	Bit 3 ... 0: 0 (fix) Bit 4: internal communication error Bit 5: 0 (fix) Bit 6: Process interrupt lost Bit 7: 0 (fix)
4	Bit 6 ... 0: channel type 71h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 02h)
7	Bit 0: Error in channel 0 Bit 1: Error in channel 1 Bit 7 ... 2: 0 (fix)
8	Channel specific error: Channel 0: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow
9	Channel specific error: Channel 1: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow
10 ... 15	0 (fix)

Record set 1 Diagnostic$_{going}$

After the removing error a diagnostic message$_{going}$ takes place.

ELCO FS2-AI-BD30 - AI 4x12Bit 0...10V

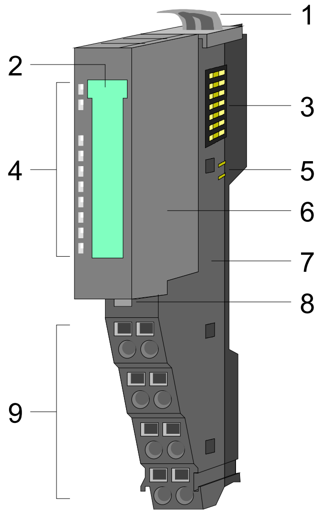
Description

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 converters.

Properties

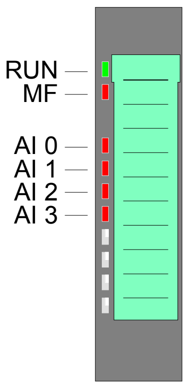
- 4 analog inputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

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

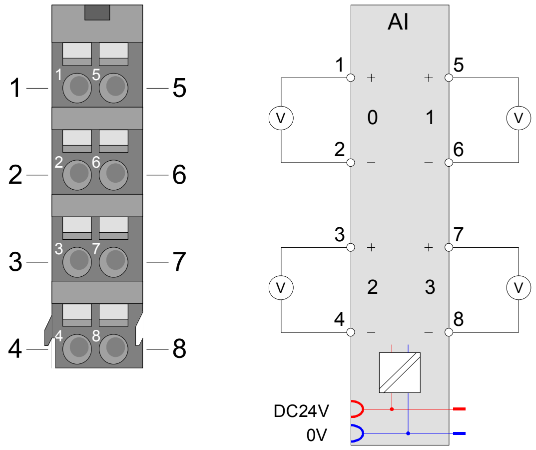


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red	●	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

Technical data

Data	ELCO FS2-AI-BD30
Number of inputs	4
Power supply	DC 24V via power module
Input range	0 ... 10V
Current consumption 5V 24V	 70mA 15mA
Internal resistor	100kΩ
Limit frequency input filter	1kHz
Resolution	12bit
Conversion time	8ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
Voltage range	±0.3%
Basic error limit (Operational limit at 25°C, referred to the input range)	
Voltage range	±0.2%
Isolation	500Veff (field voltage to the bus)
Module ID	0404 15C4
Bit-width in the process image	Input: 4x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Record set Byte	Meaning	Default
128	0	Function number channel 0	10h
129	0	Function number channel 1	10h
130	0	Function number channel 2	10h
131	0	Function number channel 3	10h

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 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

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2/3	0 (fix)
4	Bit 6 ... 0: channel type 71h: analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 04h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 2: channel error channel 2 Bit 3: channel error channel 3 Bit 7 ... 4: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
10	Channel-specific error channel 2: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
11	Channel-specific error channel 3: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
12 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AI-BD40 - AI 4x12Bit 0(4)...20mA

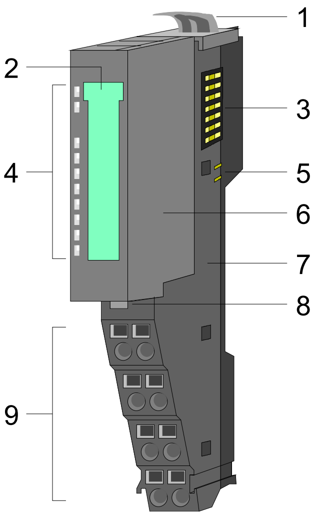
Description

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 converters.

Properties

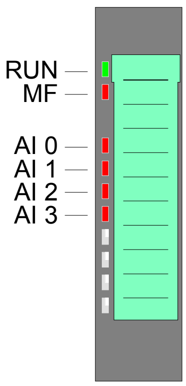
- 4 analog inputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA with external supply
- 12bit resolution

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

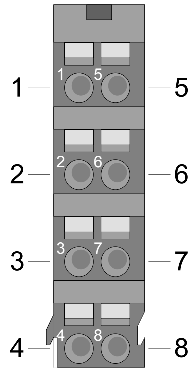


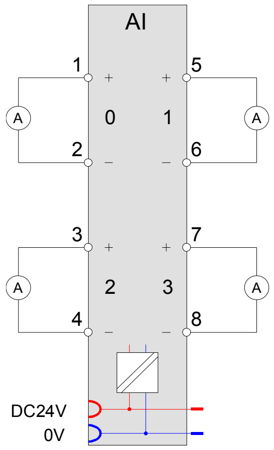
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red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

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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





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

Technical data

Data	ELCO FS2-AI-BD40
Number of inputs	4
Power supply	DC 24V via power module
Input range	0 ... 20mA / 4 ... 20mA
Current consumption 5V 24V	 70mA 15mA
Internal resistor	110Ω
Limit frequency input filter	1kHz
Resolution	12bit
Conversion time	8ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
0 ... 20mA	±0.3%
4 ... 20mA	±0.5%
Basic error limit (Operational limit at 25°C, referred to the input range)	
0 ... 20mA	±0.2%
4 ... 20mA	±0.3%
Isolation	500Veff (field voltage to the bus)
Module ID	0405 15C4
Bit-width in the process image	Input: 4x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Byte	Meaning	Default
128	0	Function number channel 0	31h
129	0	Function number channel 1	31h
130	0	Function number channel 2	31h
131	0	Function number channel 3	31h

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 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

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2/3	0 (fix)
4	Bit 6 ... 0: channel type 71h: analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 04h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 2: channel error channel 2 Bit 3: channel error channel 3 Bit 7 ... 4: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
10	Channel-specific error channel 2: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
11	Channel-specific error channel 3: Bit 0: configuring/parameter assignment error Bit 5 ... 1: 0 (fix) Bit 6: measuring range underflow Bit 7: measuring range overflow
12 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AI-BD80 - AI 4x16Bit R/RTD

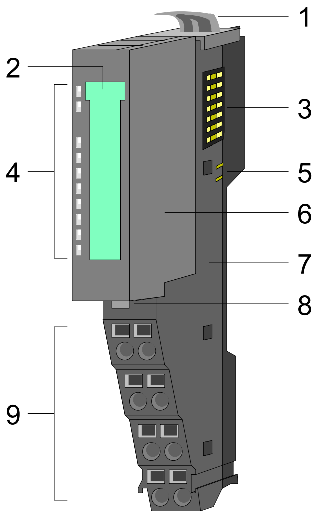
Description

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 converters.

Properties

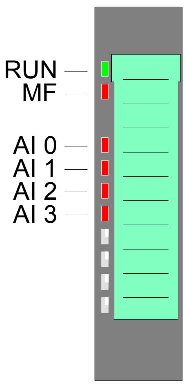
- 4 analog inputs
- Suited for resistance-type sensors 0 ... 3000Ω and resistance temperature sensors Pt100, Pt1000, NI100 and NI1000
- Resistance measurement with 2-, 3- and 4 wires
- 16bit resolution

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

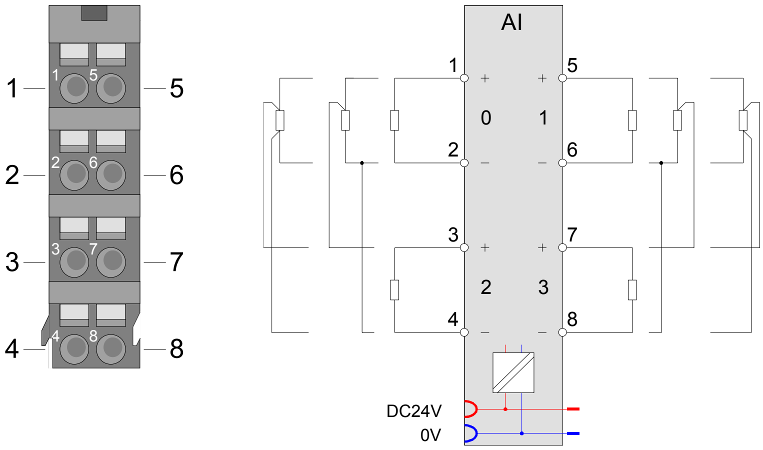


LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AI x	red	●	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 0.08mm^2 up to 1.5mm^2.



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

Technical data

Data	ELCO FS2-AI-BD80
Number of inputs	4 (differential)
Power supply	DC 24V via power module
Input range	Resistor 0 ... 3000Ω, Pt100, Pt1000, NI100, NI1000
Current consumption 5V 24V	 75mA 30mA
Internal resistor	min. 10MΩ
Resolution	16bit
Conversion time	4.2 ... 324.1ms each channel at 50Hz 3.8 ... 270.5ms each channel at 60Hz
Operational limit (in the entire temperature range, referred to the input range)	
Resistor areas	±0.4%
Resistance thermometer	±0.4%
Basic error limit (Operational limit at 25°C, referred to the input range)	
Resistor areas	±0.2%
Resistance thermometer	±0.2%
Isolation	500Veff (field voltage to the bus)
Module ID	0406 1544
Bit-width in the process image	Input: 4x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set Nr.	Byte	Meaning	Default
0	0	Diagnostics Bit 5 ... 0: reserved Bit 6: Diagnostics interrupt (1: activated) Bit 7: reserved	
	1	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	
	2	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	
	3	reserved	
1	0	Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 ... 2: reserved	
	1	Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 ... 2: reserved	
128	0	Function number channel 0	50h
	1	Function option channel 0	00h
	2, 3	Upper limit value channel 0	7FFFh
	4, 5	Lower limit value channel 0	8000h
129	0	Function number channel 1	50h
	1	Function option channel 1	00h
	2, 3	Upper limit value channel 1	7FFFh
	4, 5	Lower limit value channel 1	8000h
130	0	Function number channel 2	50h*
	1	Function option channel 2	00h
	2, 3	Upper limit value channel 2	7FFFh
	4, 5	Lower limit value channel 2	8000h
131	0	Function number channel 3	50h*
	1	Function option channel 3	00h
	2, 3	Upper limit value channel 3	7FFFh
	4, 5	Lower limit value channel 3	8000h

*) with 2 channel operation FFh

Function option

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

Upper limit value
Lower limit value

For each channel an *upper* and a *lower limit* may be defined. As soon as the measuring value is be beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

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
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 function number

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 function number

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

Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Recognized 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

A process interrupt causes a call of the OB 40. Within the OB 40 you may find the logical basic address of the module that initialized the process interrupt by using the *Local word 6*. More detailed information about the initializing event is to find in the *local double word 8*.

Local double word 8 of the OB 40

The *local double word 8* of the OB 40 has the following structure:

Local byte	Bit 7 ... 0
8	Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 2: Limit overflow channel 2 Bit 3: Limit overflow channel 3 Bit 7 ... 4: 0 (fix)
9	Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 2: Limit underflow channel 2 Bit 3: Limit underflow channel 3 Bit 7 ... 4: 0 (fix)
10	16bit µs value (high byte)
11	16bit µs value (low byte)

16bit µs value

In the FS200 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 65535µs the timer starts with 0 again.

With each process interrupt the timer value is stored as 16bit µs value and may be accessed via the local double word 8 of the OB 40.

Diagnostic interrupt

Via the parameterization (record set 00h) you may activate a global diagnostic interrupt for the analog and digital part.

A diagnostic interrupt occurs when e.g. during a process interrupt execution in OB 40 another process interrupt is thrown for the same event. The initialization of a diagnostic interrupt interrupts the recent process interrupt execution in OB 40 and branches in OB 82 to diagnostic interrupt processing$_{incoming}$.

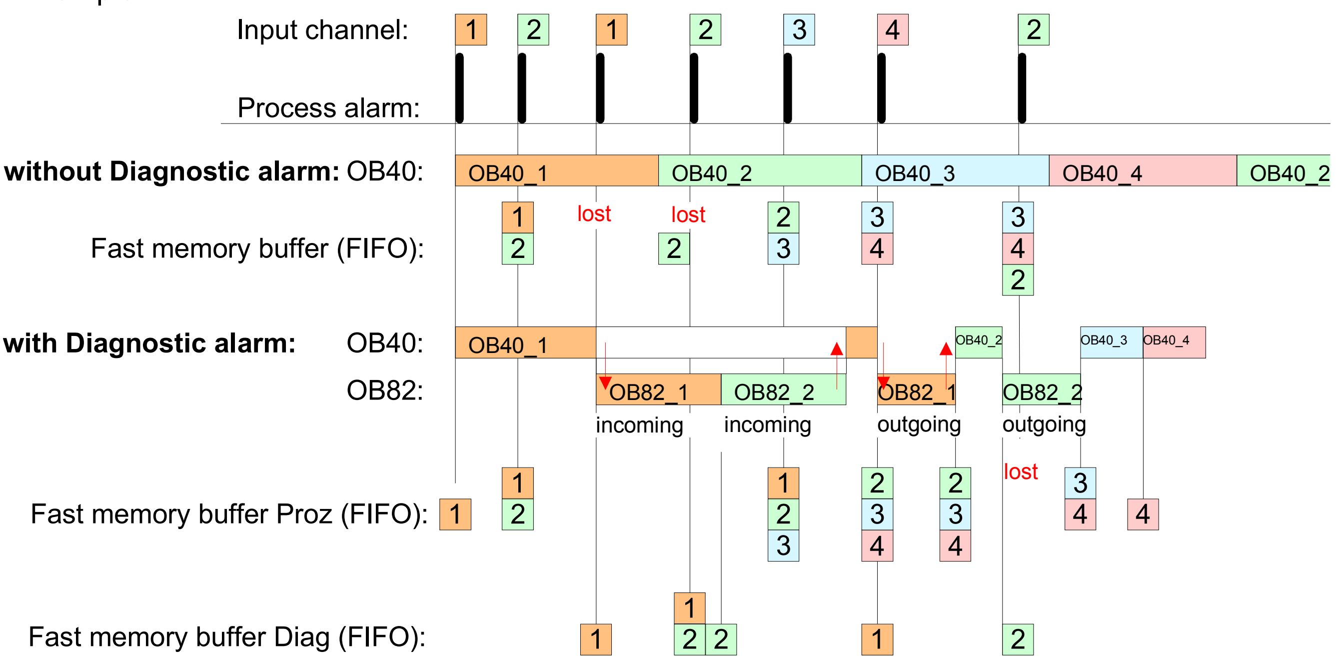
If during the diagnostic interrupt processing other events are occurring at other channels that may also cause a process res. diagnostic interrupt, these are interim stored.

After the end of the diagnostic interrupt processing at first all interim-stored diagnostic interrupts are processed in the sequence of their occurrence and then all process interrupts.

If a channel where currently a diagnostic interrupt$_{incoming}$ is processed res. interim stored initializes further process interrupts, these get lost. When a process interrupt for which a diagnostic interrupt$_{incoming}$ has been released is ready, the diagnostic interrupt processing is called again as diagnostic interrupt$_{going}$.

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. Additionally for every diagnostic interrupt$_{incoming/going}$ an entry in the diagnostic buffer of the CPU occurs.

Example



Diagnostic interrupt processing

By using the SFB 52 you may read the diagnostic bytes. At de-activated diagnostic interrupt you have access to the last recent diagnostic event. If you've activated the diagnostic function in your hardware configuration, OB 82 is automatically called. Here you may react accordingly to the diagnostic. The SFB 52 allows you to also read the record set 1 that contains additional information. After leaving the OB 82 a clear assignment of the data to the last diagnostic interrupt is not longer possible.

The record set 1 has the following structure:

Record set 1 $\text{Diagnostic}_{\text{incoming}}$

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 when external auxiliary supply is missing Bit 6 ... 5: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: Module class 0101b: Analog module Bit 4: Channel information present Bit 7 ... 5: 0 (fix)
2	0 (fix)
3	Bit 3 ... 0: 0 (fix) Bit 4: internal communication error Bit 5: 0 (fix) Bit 6: Process interrupt lost Bit 7: 0 (fix)
4	Bit 6 ... 0: Channel type 71h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 04h)
7	Bit 0: Error in channel 0 Bit 1: Error in channel 1 Bit 2: Error in channel 2 Bit 3: Error in channel 3 Bit 7 ... 4: 0 (fix)
8	Channel specific error: Channel 0: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow

continued ...

... continue Record set 1

Byte	Bit 7 ... 0
9	Channel specific error: Channel 1: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow
10	Channel specific error: Channel 2: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow
11	Channel specific error: Channel 3: Bit 0: Error in project engineering/parameterization Bit 3 ... 1: 0 (fix) Bit 4: Wire break Bit 5: Process interrupt lost Bit 6: Measuring range underflow Bit 7: Measuring range overflow
12	0 (fix)
...	...
15	0 (fix)

Record set 1 Diagnostic$_{going}$

After the removing error a diagnostic message$_{going}$ takes place.

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 FS200 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 modules may be parameterized by hardware configuration respectively at run time by means of SFCs.

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" → positive value

Bit 15 = "1" → 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	

ELCO FS2-AO-BB30 - AO 2x12Bit 0...10V

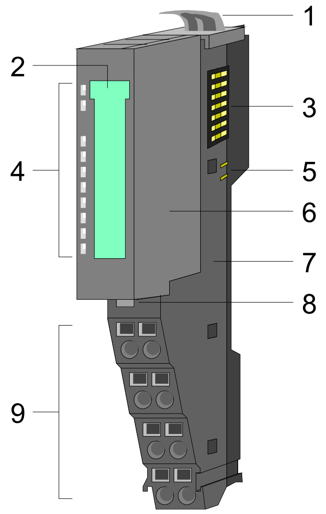
Description

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 converters.

Properties

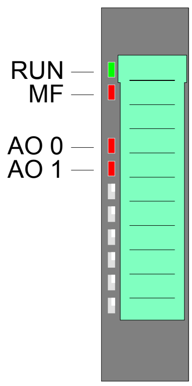
- 2 analog outputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

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

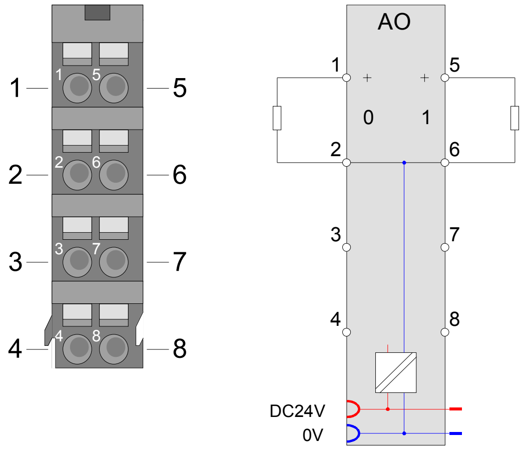


LED	Color	Description		
RUN MF	green red	RUN	MF	
		●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AO x	red	●	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

Technical data

Data	ELCO FS2-AO-BB30
Number of inputs	2 (single-ended)
Power supply	DC 24V via power module
Input range	0 ... 10V
Current consumption	
5V	80mA
24V	35mA
Burden	min. 5kΩ (short-circuit proof)
Resolution	12bit (incl. overrange area)
Conversion time	2ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
Voltage range	±0.3%
Basic error limit (Operational limit at 25°C, referred to the input range)	
Voltage range	±0.2%
Isolation	500Veff (field voltage to the bus)
Module ID	0501 25D8
Bit-width in the process image	Output: 2x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Record set Byte	Meaning	Default
0	1	Bit 0: Short-circuit recognition channel 0 (1:on) Bit 0: Short-circuit recognition channel 1 (1:on) Bit 7 ... 2: reserved	00h
128	0	Function number channel 0	10h
129	0	Function number channel 1	10h

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 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)

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2, 3	0 (fix)
4	Bit 6 ... 0: channel type 73h: analog output Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 02h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 7 ... 2: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
10 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AO-BB40 - AO 2x12Bit 0(4)...20mA

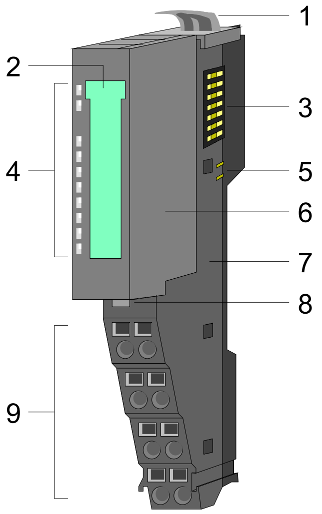
Description

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 converters.

Properties

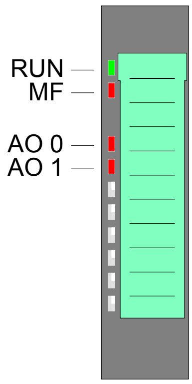
- 2 analog inputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- 12bit resolution

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

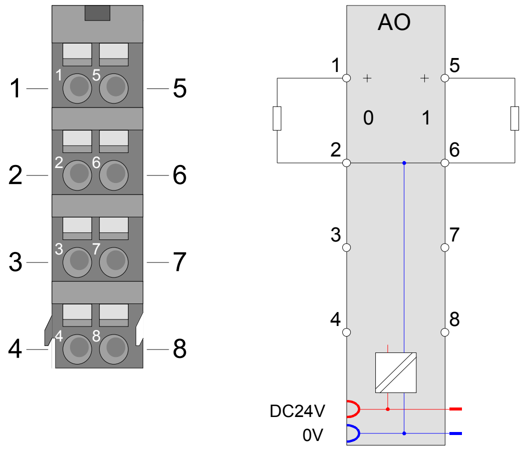


LED	Color	Description		
RUN MF	green red	RUN	MF	
		●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AO x	red	●	Error channel x - Error in parameterization - Wire-break	

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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



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

Technical data

Data	ELCO FS2-AO-BB40
Number of inputs	2 (single-ended)
Power supply	DC 24V via power module
Input range	0 ... 20mA / 4 ... 20mA
Current consumption 5V 24V	 80mA 15mA without load
Burden	max. 350Ω
Resolution	12bit (incl. overrange area)
Conversion time	2ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
0 ... 20mA	±0.4%
4 ... 20mA	±0.5%
Basic error limit (Operational limit at 25°C, referred to the input range)	
0 ... 20mA	±0.2%
4 ... 20mA	±0.3%
Isolation	500Veff (field voltage to the bus)
Module ID	0502 25D8
Bit-width in the process image	Output: 2x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Byte	Meaning	Default
0	1	Bit 0: Wire-break recognition channel 0 (1: on) Bit 1: Wire-break recognition channel 1 (1: on) Bit 7 ... 2: reserved	00h
128	0	Function number channel 0	31h
129	0	Function number channel 1	31h

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)

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2, 3	0 (fix)
4	Bit 6 ... 0: channel type 73h: analog output Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 02h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 7 ... 2: 0 (fix)
8	Channel-specific error channel 0 Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
9	Channel-specific error channel 1 Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
10 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AO-BD30 - AO 4x12Bit 0...10V

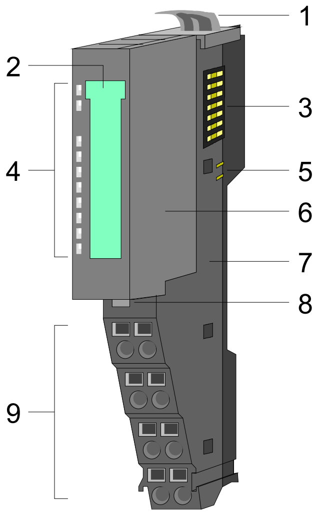
Description

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 converters.

Properties

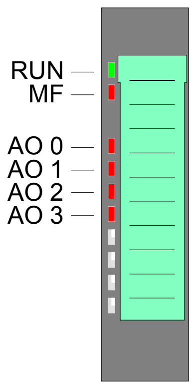
- 4 analog outputs
- Suited for sensors with 0 ... 10V
- 12bit resolution

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

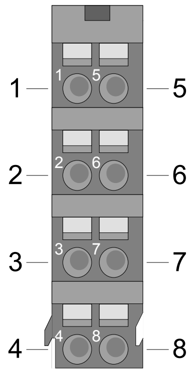


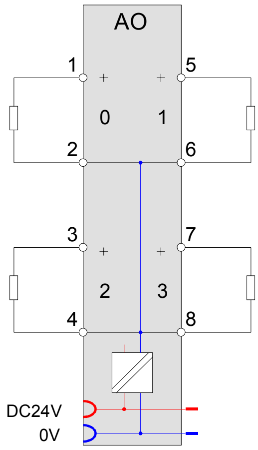
LED	Color	Description		
RUN	green	RUN	MF	
MF	red	●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AO x	red	●	Error channel x - Overload, short-circuit - Error in parameterization	

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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





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

Technical data

Data	ELCO FS2-AO-BD30
Number of inputs	4 (single-ended)
Power supply	DC 24V via power module
Input range	0 ... 10V
Current consumption 5V 24V	 80mA 35mA
Burden	min. 5kΩ (short-circuit proof)
Resolution	12bit (incl. overrange area)
Conversion time	2ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
Voltage range	±0.3%
Basic error limit (Operational limit at 25°C, referred to the input range)	
Voltage range	±0.2%
Isolation	500Veff (field voltage to the bus)
Module ID	0503 25E0
Bit-width in the process image	Output: 4x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Record set Byte	Meaning	Default
0	1	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	00h
128	0	Function number channel 0	10h
129	0	Function number channel 1	10h
130	0	Function number channel 2	10h
131	0	Function number channel 3	10h

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 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)

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Record set 1

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2, 3	0 (fix)
4	Bit 6 ... 0: channel type 73h: analog output Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 04h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 2: channel error channel 2 Bit 3: channel error channel 3 Bit 7 ... 4: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
10	Channel-specific error channel 2: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
11	Channel-specific error channel 3: Bit 0: configuring/parameter assignment error Bit 2 ... 1: 0 (fix) Bit 3: short-circuit to ground Bit 7 ... 4: 0 (fix)
12 ... 15	Bit 7 ... 0: 0 (fix)

ELCO FS2-AO-BD40 - AO 4x12Bit 0(4)...20mA

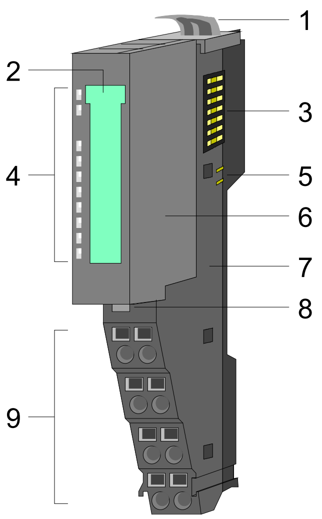
Description

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 converters.

Properties

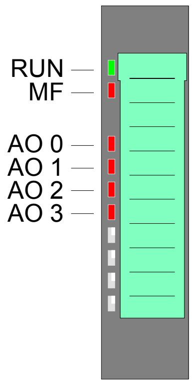
- 4 analog inputs
- Suited for sensors with 0...20mA; 4...20mA
- 12bit resolution

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

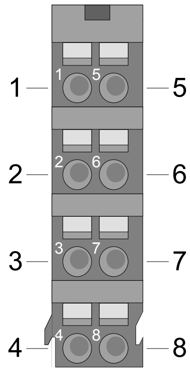


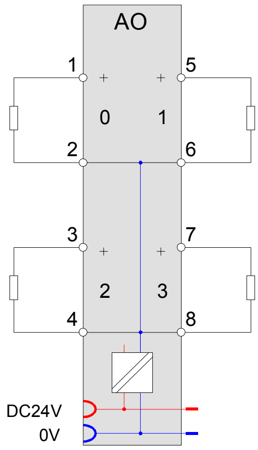
LED	Color	Description		
RUN MF	green red	RUN	MF	
		●	○	Bus communication is OK Module status is OK
		●	●	Bus communication is OK Module status reports an error
		○	●	Bus communication is not possible Module status reports an error
		○	○	Error at bus power supply
		☼	☼	Error in parameterization
AO x	red	●	Error channel x - Error in parameterization - Wire-break	

on: ● off: ○ blinks with 2Hz: ☼

Pin assignment

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





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

Technical data

Data	ELCO FS2-AO-BD40
Number of inputs	4 (single-ended)
Power supply	DC 24V via power module
Input range	0...20mA / 4...20mA
Current consumption 5V 24V	 80mA 15mA without load
Burden	max. 350Ω
Resolution	12bit (incl. overrange area)
Conversion time	2ms all channels
Operational limit (in the entire temperature range, referred to the input range)	
0 ... 20mA	±0.4%
4 ... 20mA	±0.5%
Basic error limit (Operational limit at 25°C, referred to the input range)	
0 ... 20mA	±0.2%
4 ... 20mA	±0.3%
Isolation	500Veff (field voltage to the bus)
Module ID	0504 25E0
Bit-width in the process image	Output: 4x16bit data
Configurable	yes

Parameter data

The parameter data may be accessed during runtime with the following record sets:

Record set No.	Byte	Meaning	Default
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	00h
128	0	Function number channel 0	31h
129	0	Function number channel 1	31h
130	0	Function number channel 2	31h
131	0	Function number channel 3	31h

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)

By using SFB 52 you always may access the diagnostic data of the module.

Record set 1 has the following structure:

Byte	Meaning
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: 0 (fix) Bit 7: Error in parameterization
1	Bit 3 ... 0: module class 0101 analog module Bit 4: channel information present Bit 7 ... 5: 0 (fix)
2, 3	0 (fix)
4	Bit 6 ... 0: channel type 73h: analog output Bit 7: 0 (fix)
5	Number of diagnostic bits per channel (here 08h)
6	Number of channels of a module (here 04h)
7	Bit 0: channel error channel 0 Bit 1: channel error channel 1 Bit 2: channel error channel 2 Bit 3: channel error channel 3 Bit 7 ... 4: 0 (fix)
8	Channel-specific error channel 0: Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
9	Channel-specific error channel 1: Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
10	Channel-specific error channel 2: Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
11	Channel-specific error channel 3: Bit 0: configuring/parameter assignment error Bit 3 ... 1: 0 (fix) Bit 4: wire-break Bit 7 ... 5: 0 (fix)
10 ... 15	Bit 7 ... 0: 0 (fix)