

# **VIPA System SLIO**

**SM-AIO || Manual** HB300 | SM-AIO || en | 17-16 Analog signal modules - SM 03x



www.vipa.com/en/service-support/manual

**VIPA CONTROLS** 

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# **1.2 About this manual**

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	<ul> <li>The following guides are available in the manual:</li> <li>An overall table of contents at the beginning of the manual</li> <li>References with page numbers</li> </ul>		
Availability	<ul> <li>The manual is available in:</li> <li>printed form, on paper</li> <li>in electronic form as PDF-file (Adobe Acrobat Reader)</li> </ul>		
Icons Headings	Important passages in the text are highlighted by following icons and headings:           DANGER!           Immediate or likely danger. Personal injury is possible.		



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



Supplementary information and useful tips.

# 1.3 Safety information

Applications conforming with specifications

- The system is constructed and produced for:
- communication and process control
- general control and automation tasks
- 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



### **CAUTION!**

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

- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware 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!

Safety information for users

# 2 Basics and mounting

# 2.1 Safety information for users

Handling of electrostatic sensitive modules VIPA modules make use of highly integrated components in MOS-Technology. These components are extremely sensitive to over-voltages that can occur during electrostatic discharges. The following symbol is attached to modules that can be destroyed by electrostatic discharges.



The Symbol is located on the module, the module rack or on packing material and it indicates the presence of electrostatic sensitive equipment. It is possible that electrostatic sensitive equipment is destroyed by energies and voltages that are far less than the human threshold of perception. These voltages can occur where persons do not discharge themselves before handling electrostatic sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable. Modules that have been damaged by electrostatic discharges can fail after a temperature change, mechanical shock or changes in the electrical load. Only the consequent implementation of protection devices and meticulous attention to the applicable rules and regulations for handling the respective equipment can prevent failures of electrostatic sensitive modules.

Shipping of modules

Modules must be shipped in the original packing material.

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

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

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



#### CAUTION!

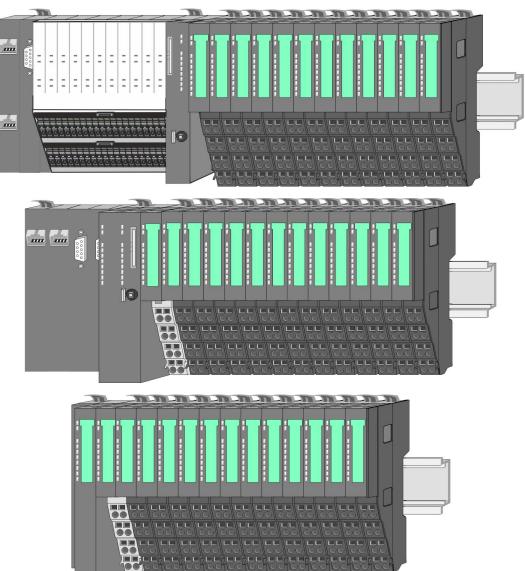
Personnel and instruments should be grounded when working on electrostatic sensitive modules.

System conception > Overview

# 2.2 System conception

# 2.2.1 Overview

System SLIO is a modular automation system for assembly on a 35mm mounting rail. By means of the peripheral modules with 2, 4 or 8 channels this system may properly be adapted matching to your automation tasks. The wiring complexity is low, because the supply of the DC 24V power section is integrated to the backplane bus and defective modules may be replaced with standing wiring. By deployment of the power modules in contrasting colors within the system, further isolated areas may be defined for the DC 24V power section supply, respectively the electronic power supply may be extended with 2A.



System conception > Components

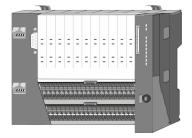
# 2.2.2 Components

- CPU (head module)
- Bus coupler (head module)
- Line extension
- Periphery modules
- Accessories

# **CAUTION!**

Only modules of VIPA may be combined. A mixed operation with thirdparty modules is not allowed!

## CPU 01xC



With this CPU 01xC, the CPU electronic, input/output components and power supply are integrated to one casing. In addition, up to 64 periphery modules of the System SLIO can be connected to the backplane bus. As head module via the integrated power supply CPU electronic and the I/O components are power supplied as well as the electronic of the connected periphery modules. To connect the power supply of the I/O components and for DC 24V power supply of via backplane bus connected peripheral modules, the CPU has removable connectors. By installing of up to 64 periphery modules at the backplane bus, 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.

### **CPU 01x**



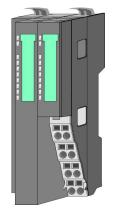
With this CPU 01x, the CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24 power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the backplane bus, 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.



# **CAUTION!**

CPU part and power module may not be separated! Here you may only exchange the electronic module!

#### **Bus coupler**



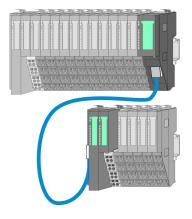
With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module, via the integrated power module for power supply, bus interface and the electronic of the connected periphery modules are supplied. The DC 24 power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the bus coupler, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

System conception > Components



CAUTION! Bus interface and power module may not be separated! Here you may only exchange the electronic module!

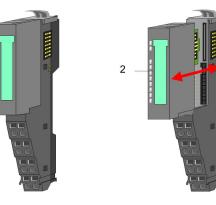
#### Line extension



In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension master at each end of a line and the subsequent line has to start with a line extension slave. Master and slave are to be connected via a special connecting cable. In this way, you can divide a line on up to 5 lines. For each line extension the maximum number of pluggable modules at the System SLIO bus is decreased by 1. To use the line extension no special configuration is required.

**Periphery modules** 

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



- 1 Terminal module
- 2 Electronic module

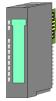
### Terminal module



The *terminal* module serves to carry the electronic module, contains the backplane bus with power supply for the electronic, the DC 24V power section supply and the staircase-shaped terminal for wiring. Additionally the terminal module has a locking system for fixing at a mounting rail. By means of this locking system your SLIO system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

System conception > Accessories

#### Electronic module

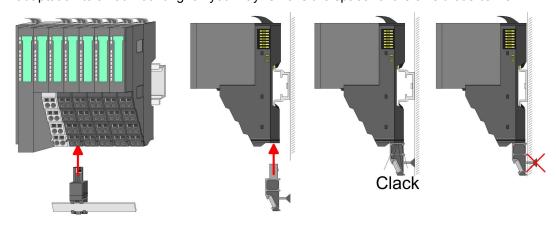


The functionality of a SLIO periphery module is defined by the *electronic* module, which is mounted to the terminal module by a sliding mechanism. With an error the defective module may be exchanged for a functional module with standing installation. At the front side there are LEDs for status indication. For simple wiring each module shows a corresponding connection diagram at the front and at the side.

## 2.2.3 Accessories Shield bus carrier



The shield bus carrier (order no.: 000-0AB00) serves to carry the shield bus (10mm x 3mm) to connect cable shields. Shield bus carriers, shield bus and shield fixings are not in the scope of delivery. They are only available as accessories. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.



#### Bus cover



With each head module, 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 head module before mounting a System SLIO module. For the protection of the backplane bus connector you always have to mount the bus cover at the last module of your system again. The bus cover has the order no. 000-0AA00.

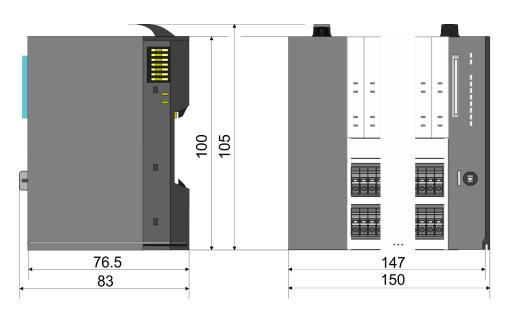
Coding pins



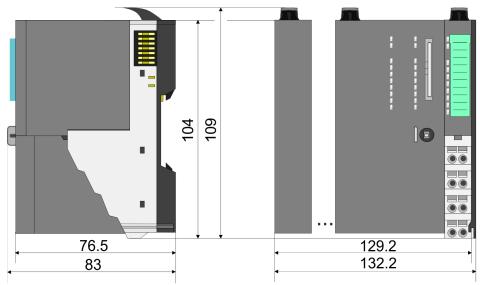
There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) from VIPA can be used. The coding pin consists of a coding jack and a coding plug. By combining electronic and terminal module with coding pin, the coding jack remains in the electronic module and the coding plug in the terminal module. This ensures that after replacing the electronics module just another electronic module can be plugged with the same encoding.

Dimensions

# 2.3 Dimensions Dimensions CPU 01xC

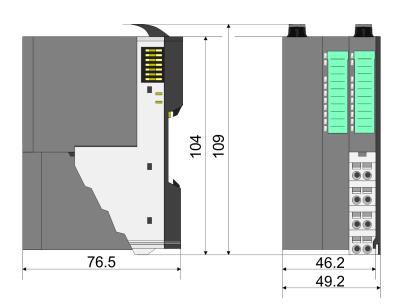


# Dimensions CPU 01x

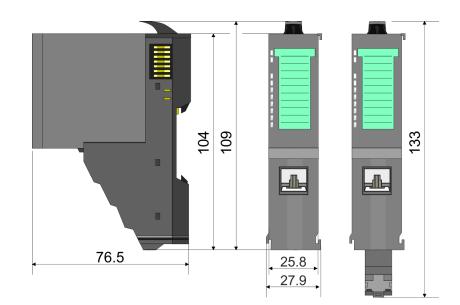


Dimensions

# Dimensions bus coupler and line extension slave

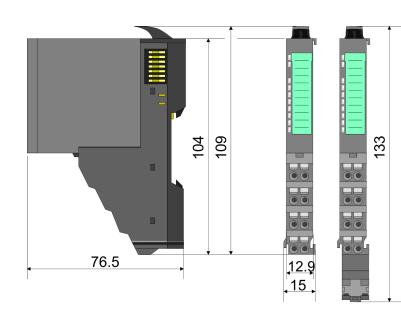


# Dimensions line extension master

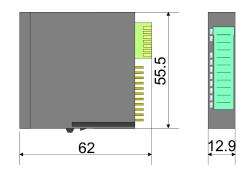


Dimensions

# Dimension periphery module



# Dimensions electronic module



Dimensions in mm

Mounting periphery modules

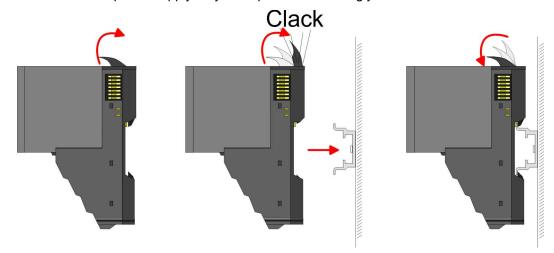
# 2.4 Mounting periphery modules



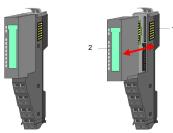
#### Requirements for UL compliance use

- Use for power supply exclusively SELV/PELV power supplies.
- The System SLIO must be installed and operated in a housing according to IEC 61010-1 9.3.2 c).

There is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place 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 downward 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. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



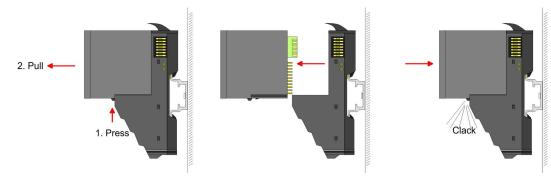
# Terminal and electronic module



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

- 1 Terminal module
- 2 Electronic module

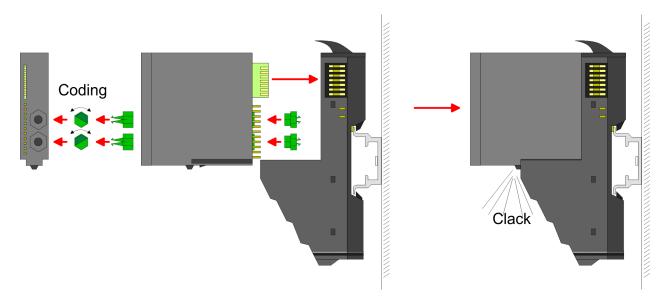
For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



Coding



There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) from VIPA can be used. The coding pin consists of a coding jack and a coding plug. By combining electronic and terminal module with coding pin, the coding jack remains in the electronic module and the coding plug in the terminal module. This ensures that after replacing the electronics module just another electronic module can be plugged with the same encoding.



Each electronic module has on its back 2 coding sockets for coding jacks. Due to the characteristics, with the coding jack 6 different positions can be plugged, each. Thus there are 36 possible combinations for coding with the use of both coding sockets.

- 1. Plug, according to your coding, 2 coding jacks in the coding sockets of your electronic module until they lock
- **2.** Now plug the according coding plugs into the coding jacks.
- 3. To fix the coding put both the electronic and terminal module together until they lock



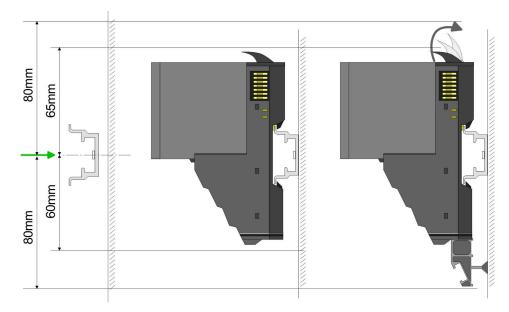
### CAUTION!

Please consider that when replacing an already coded electronic module, this is always be replaced by an electronic module with the same coding.

Even with an existing coding on the terminal module, you can plug an electronic module without coding. The user is responsible for the correct usage of the coding pins. VIPA assumes no liability for incorrectly attached electronic modules or for damages which arise due to incorrect coding!

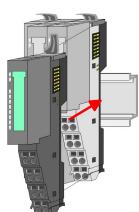
Mounting periphery modules

# Mounting periphery modules

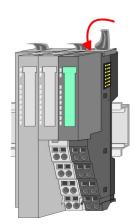


- **1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.
- 2. Mount your head module such as CPU or field bus coupler.
- **3.** Before mounting the periphery 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.



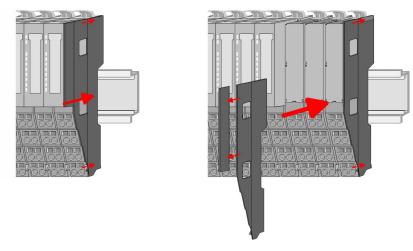


- **4.** For mounting turn the locking lever of the module upward until it engages.
- **5.** For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.
- **6.** Turn the locking lever of the periphery module downward, again.



#### **Basics and mounting**

Wiring periphery modules



7. After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now. If the last module is a clamp module, for adaptation the upper part of the bus cover is to be removed.

# 2.5 Wiring periphery modules

#### Terminal module terminals



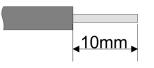
## CAUTION!

Do not connect hazardous voltages!

If this is not explicitly stated in the corresponding module description, hazardous voltages are not allowed to be connected to the corresponding terminal module!

With wiring the terminal modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

#### Data



 U<sub>max</sub>
 240V AC / 30V DC

 I<sub>max</sub>
 10A

 Cross section
 0.08 ... 1.5mm² (AWG 28 ... 16)

 Stripping length
 10mm

#### Wiring procedure

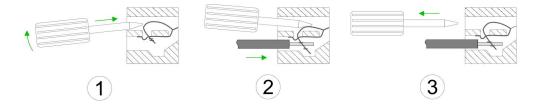


- 1 Pin number at the connector
- 2 Opening for screwdriver
- 3 Connection hole for wire

# VIPA System SLIO

Wiring periphery modules

**Basics and mounting** 



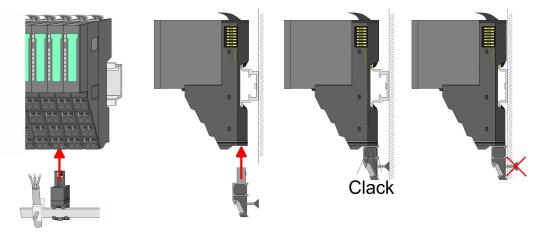
- **1.** Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
- **2.** Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>
- **3.** By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

. . . . . . .

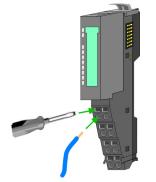
- 1 Shield bus carrier 2 Shield bus (10mm x 3m
- 2 Shield bus (10mm x 3mm)
- 3 Shield clamp4 Cable shield

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.

- **1.** Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.
- 2. Put your shield bus into the shield bus carrier.



**3.** Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.



Shield attachment

# 2.6 Wiring power modules

**Terminal module terminals** 

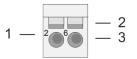
Power modules are either integrated to the head module or may be installed between the periphery modules. With power modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

## Data

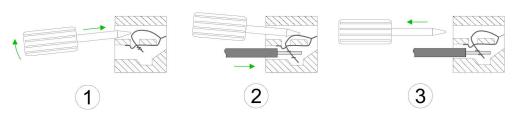
**\_**10mm

U<sub>max</sub> 240V AC / 30V DC 10A Imax 0.08 ... 1.5mm<sup>2</sup> (AWG 28 ... 16) Cross section Stripping length 10mm

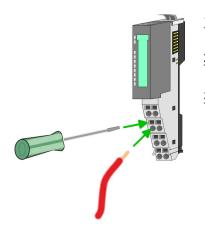
### Wiring procedure



- Pin number at the connector 1
- 2 3 Opening for screwdriver
- Connection hole for wire



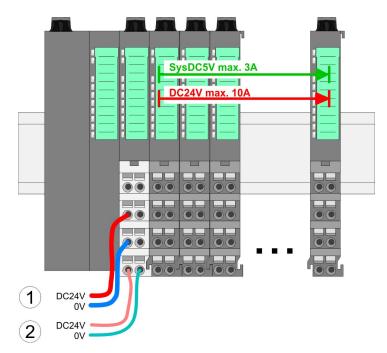
- Insert a suited screwdriver at an angel into the square opening as shown. Press 1. and hold the screwdriver in the opposite direction to open the contact spring.
- 2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>
- By removing the screwdriver, the wire is securely fixed via the spring contact to the 3. terminal.



## **Basics and mounting**

Wiring power modules

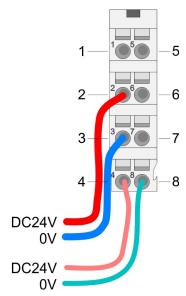
#### Standard wiring



(1) DC 24V for power section supply I/O area (max. 10A)

(2) DC 24V for electronic power supply bus coupler and I/O area

### **PM - Power module**



For wires with a core cross-section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.

Pos.	Function	Туре	Description
1			not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic section supply
5			not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND for electronic section supply

I: Input



# **CAUTION!**

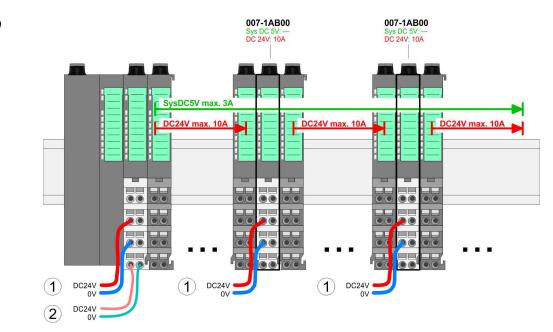
Since the power section supply is not internally protected, it is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected by a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!



The electronic power section supply is internally protected against higher voltage by fuse. The fuse is within the power module. If the fuse releases, its electronic module must be exchanged!

Fusing	<ul> <li>The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!</li> <li>It is recommended to externally protect the electronic power supply for head modules and I/O area with a 2A fuse (fast) respectively by a line circuit breaker 2A characteristics Z.</li> <li>The electronic power supply for the I/O area of the power module 007-1AB10 should also be externally protected with a 1A fuse (fast) respectively by a line circuit breaker 1A characteristics Z.</li> </ul>	
State of the electronic power supply via LEDs	After PowerON of the System SLIO the LEDs RUN respectively MF get on so far as the sum current does not exceed 3A. With a sum current greater than 3A the LEDs may not be activated. Here the power module with the order number 007-1AB10 is to be placed between the peripheral modules.	
Deployment of the power modules	<ul> <li>If the 10A for the power section supply is no longer sufficient, you may use the power module from VIPA with the order number 007-1AB00. So you have also the possibility to define isolated groups.</li> <li>The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with max. 4A.</li> <li>By placing the power module 007-1AB10 at the following backplane bus modules.</li> </ul>	

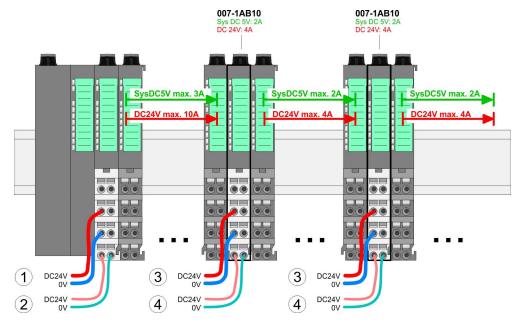
By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards a power module is to be placed again. To secure the power supply, the power modules may be mixed used.



Power module 007-1AB00

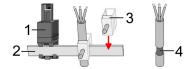
Wiring power modules

### Power module 007-1AB10



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

Shield attachment



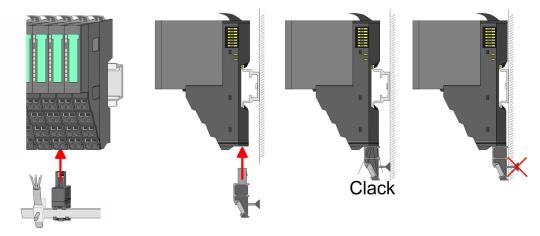
- Shield bus carrier 1
- 2 Shield bus (10mm x 3mm)
- Shield clamp 3
- 4 Cable shield

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.

- 1. Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.
- 2. Put your shield bus into the shield bus carrier.

## **Basics and mounting**

Wiring power modules



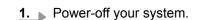
**3.** Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

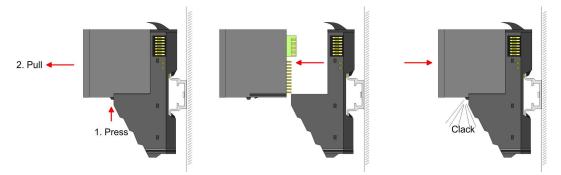
Demounting periphery modules

# 2.7 Demounting periphery modules

## Proceeding

Exchange of an electronic module





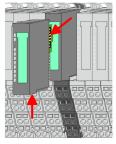
- **2.** For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.
- **3.** For installation plug the new electronic module guided by the strips at the lower side until this engages to the terminal module.
  - $\Rightarrow$  Now you can bring your system back into operation.

# Exchange of a periphery module

**1.** Power-off your system.

3.

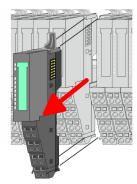
**2.** Remove if exists the wiring of the module.



For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module <u>right</u> beside. After mounting it may be plugged again.

Press the unlocking lever at the lower side of the just mounted right module and pull it forward.

**4.** Turn the locking lever of the module to be exchanged upwards.



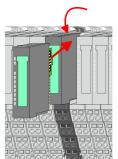
- **5.** Pull the module.
- **6.** For mounting turn the locking lever of the module to be mounted upwards.

To mount the module put it to the gap between the both modules and push it, 7. guided by the stripes at both sides, to the mounting rail.

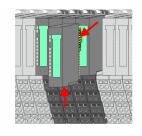
**9.** Plug again the electronic module, which you have removed before.

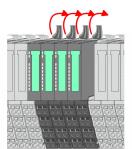
⇒ Now you can bring your system back into operation.

**8.** Turn the locking lever downward, again.



Exchange of a module group





1. Power-off your system.

**10.** Wire your module.

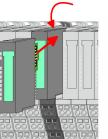
**2.** Remove if exists the wiring of the module group.



For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.

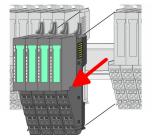
Press the unlocking lever at the lower side of the just mounted right module near the module group and pull it forward.

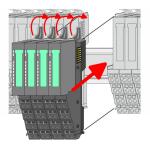
**4.** Turn all the locking lever of the module group to be exchanged upwards.

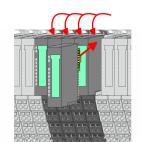


## **Basics and mounting**

Trouble shooting - LEDs







- 5. Pull the module group forward.
- **6.** For mounting turn all the locking lever of the module group to be mounted upwards.
- **7.** To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
- 8. Turn all the locking lever downward, again.
- **9.** Plug again the electronic module, which you have removed before.
- **10.** Wire your module group.
  - $\Rightarrow$  Now you can bring your system back into operation.

# 2.8 Trouble shooting - LEDs

### General

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

In the following illustrations flashing LEDs are marked by  $\dot{\heartsuit}.$ 

Sum current of the electronic power supply exceeded

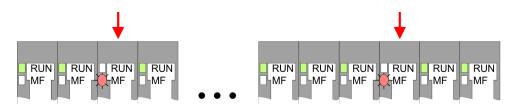


*Behaviour*: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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

*Remedy*: As soon as the sum current of the electronic power supply is exceeded, always place the power module 007-1AB10. *Chapter 2.6 Wiring power modules' on page 23* 

## Error in configuration



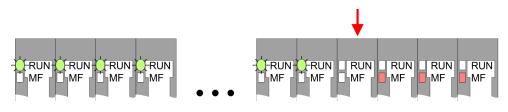
*Behaviour*: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

Trouble shooting - LEDs

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

Remedy: Match configuration and hardware structure.

Module failure



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

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

Remedy: Replace the defective module.

Installation guidelines

# 2.9 Installation guidelines

General	The installation guidelines contain information about the interference free deployment of a PLC system. There is the description of the ways, interference may occur in your PLC, how you can make sure the electromagnetic compatibility (EMC), and how you manage the isolation.
What does EMC mean?	Electromagnetic compatibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interfered respectively without interfering the environment.
	The components of VIPA are developed for the deployment in industrial environments and meets 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	Electromagnetic interferences may interfere your control via different ways:
causes	<ul> <li>Electromagnetic fields (RF coupling)</li> <li>Magnetic fields with power frequency</li> <li>Bus system</li> <li>Power supply</li> <li>Protected earth conductor</li> </ul>
	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.
	There are:
	<ul> <li>galvanic coupling</li> <li>capacitive coupling</li> <li>inductive coupling</li> <li>radiant coupling</li> </ul>
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.
	<ul> <li>Take care of a correct area-wide grounding of the inactive metal parts when installing your components.</li> <li>Install a central connection between the ground and the protected earth conductor system.</li> <li>Connect all inactive metal extensive and impedance-low.</li> <li>Please try not to use aluminium parts. Aluminium is easily oxidizing and is therefore less suitable for grounding.</li> <li>When cabling, take care of the correct line routing.</li> <li>Organize your cabling in line groups (high voltage, current supply, signal and data lines).</li> <li>Always lay your high voltage lines and signal respectively data lines in separate channels or bundles.</li> <li>Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).</li> </ul>

- 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 favourable.
- 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 metallised plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Consider to wire all inductivities with erase links.
  - Please consider luminescent lamps can influence signal lines.
- 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 serves for protection and functionality activity.
  - Connect installation parts and cabinets with your PLC in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If there are potential differences between installation parts and cabinets, 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. Here you have to make sure, that the connection to the protected earth conductor is impedancelow, 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 respectively μA) are transferred.
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metallised 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 your PLC 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

# 2.10 General data

Conformity and approval		
Conformity		
CE	2014/35/EU	Low-voltage directive
	2014/30/EU	EMC directive
Approval		
UL	-	Refer to Technical data
others		
RoHS	2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment

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	-	-		
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 hanging	EN 61131-2	0+60°C	
Horizontal installation lying	EN 61131-2	0+55°C	
Vertical installation	EN 61131-2	0+50°C	
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 1095%)	
Pollution	EN 61131-2	Degree of pollution 2	
Installation altitude max.	-	2000m	
Mechanical			
Oscillation	EN 60068-2-6	1g, 9Hz 150Hz	
Shock	EN 60068-2-27	15g, 11ms	

# VIPA System SLIO

## **Basics and mounting**

General data

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

EMC	Standard		Comment
Emitted interference	EN 61000-6-4		Class A (Industrial area)
Noise immunity	EN 61000-6-2		Industrial area
zone B	EN 61000-4-2	ESD	
			8kV at air discharge (degree of severity 3),
			4kV at contact discharge (degree of severity 2)
		EN 61000-4-3	HF field immunity (casing)
			80MHz 1000MHz, 10V/m, 80% AM (1kHz)
			1.4GHz 2.0GHz, 3V/m, 80% AM (1kHz)
			2GHz 2.7GHz, 1V/m, 80% AM (1kHz)
		EN 61000-4-6	HF conducted
			150kHz 80MHz, 10V, 80% AM (1kHz)
		EN 61000-4-4	Burst, degree of severity 3
	EN 61000-4-5	Surge, degree of severity 3 *	

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

General

# 3 Analog Input

3.1 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



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.

ParameterizationThe parameterization via CPU, PROFIBUS and PROFINET happens by means of record<br/>sets (DS). The corresponding record set number may be found at the respective module<br/>description. Here also the indices (IX) respectively subindices (SX) for CANopen respec-<br/>tively EtherCAT are listed.

**Diagnostic functions** 

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

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

Alternated blinking of the channel error LEDs

The alternate blinking of the channel error LEDs of channel 0 and 1 indicates a watchdog error due to a system overload. Restart with a power cycle your system. If the error occurred again, check configuration and circuit and adjust them if necessary. If the error persists, please contact our support.

## 3.2 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 <sup>14</sup>	2 <sup>13</sup>	2 <sup>12</sup>	2 <sup>11</sup>	2 <sup>10</sup>	2 <sup>9</sup>	2 <sup>8</sup>	27	2 <sup>6</sup>	25	24	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
12Bit+sign	SG	Measuring value					0	0	0							
15Bit+sign	SG								Measurir	ng value						

Resolution	With a resolution of 12bit plus sign bit, the not used low value positions (3bits) are filled with "0".
Sign bit (SG)	Here it is essential: ■ Bit 15 = "0": → positive value ■ Bit 15 = "1": → negative value
Behavior at error	<ul> <li>As soon as a measured value exceeds the overdrive region respectively falls below the underdrive region, the following value is issued:</li> <li>Measuring value &gt; end of overdrive region: 32767 (7FFFh)</li> <li>Measuring value &lt; end of underdrive region: -32768 (8000h)</li> <li>At a parameterization error the value 32767 (7FFFh) is issued.</li> </ul>

# 3.3 Measuring ranges and function numbers

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

# -80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{80}$
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{80}$
(11h)	0V	0	0000h		
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	
-80 80mV	100mV	20480	5000h	overrange	D 16294 U
Siemens S7 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	16384

# 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	16384

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
			7555		
±10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	10
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{10}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

# ±10V

## Current

# 0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 27(49 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27648
0 20mA	25.00mA	20480	5000h	overrange	D ICODE I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	16384
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
Siemens	20mA	27648	6C00h	nominal range	16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		$T = D + \frac{1}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$
S5 format	12mA	8192	2000h		
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

# 0 ... 20mA / 4KM format

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	20.457mA	4095	0FFFh	overrange	I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{1}{20}$
(3Fh)	10mA	2000	07D0h		
	0mA	0	0000h		$I = D \cdot \frac{20}{2}$
				underrange	$1 = D + \frac{4000}{4000}$

#### Resistance

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
2 wire: PT100	+1000°C	+10000	overrange
(50h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: PT1000	+1000°C	+10000	overrange
(51h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100	+295°C	+2950	overrange
(52h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000	+295°C	+2950	overrange
(53h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: PT100	+1000°C	+10000	overrange
(58h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000	+1000°C	+10000	overrange
(59h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100	+295°C	+2950	overrange
(5Ah)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: NI1000	+295°C	+2950	overrange
(5Bh)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: PT100	+1000°C	+10000	overrange
(60h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
4 wire: PT1000	+1000°C	+10000	overrange
(61h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
4 wire: NI100	+295°C	+2950	overrange
(62h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: NI1000	+295°C	+2950	overrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
(63h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: 0 $60\Omega$			overrange
(70h)	0 60Ω	0 32767	nominal range
			underrange
2 wire: 0 $600\Omega$			overrange
(71h)	0 600Ω	0 32767	nominal range
			underrange
2 wire: 0 3000 $\Omega$			overrange
(72h)	0 3000Ω	0 32767	nominal range
			underrange
3 wire: 0 $60\Omega$			overrange
(78h)	0 60Ω	0 32767	nominal range
			underrange
3 wire: 0 600 $\Omega$			overrange
(79h)	0 600Ω	0 32767	nominal range
			underrange
3 wire: 0 3000 $\Omega$			overrange
(7Ah)	0 3000Ω	0 32767	nominal range
			underrange
4 wire: 0 $60\Omega$			overrange
(80h)	0 60Ω	0 32767	nominal range
			underrange
4 wire: 0 $600\Omega$			overrange
(81h)	0 600Ω	0 32767	nominal range
			underrange
4 wire: 0 3000 $\Omega$			overrange
(82h)	0 3000Ω	0 32767	nominal range
			underrange
2 wire: 0 $60\Omega$			overrange
(90h)	0 60Ω	0 6000	nominal range
			underrange
2 wire: 0 $600\Omega$			overrange
(91h)	0 600Ω	0 6000	nominal range
			underrange

Measuring range (funct. no.)	Measuring value	Signal range	Range
2 wire: 0 3000Ω			overrange
(92h)	0 3000Ω	0 30000	nominal range
			underrange
3 wire: 0 60Ω			overrange
(98h)	0 60Ω	0 6000	nominal range
(00)			underrange
3 wire: 0 600 $\Omega$			overrange
(99h)	0 600Ω	0 6000	nominal range
			underrange
3 wire: 0 3000Ω			overrange
(9Ah)	 0 3000Ω	0 30000	
(0/41)			nominal range
4 wine 0 000			underrange
4 wire: 0 60Ω			overrange
(A0h)	0 60Ω	0 6000	nominal range
			underrange
4 wire: 0 600Ω			overrange
(A1h)	0 600Ω	0 6000	nominal range
			underrange
4 wire: 0 3000Ω			overrange
(A2h)	0 3000Ω	0 30000	nominal range
			underrange
2 wire: 0 60Ω	70.55Ω	32511	overrange
(D0h)	0 60Ω	0 27648	nominal range
			underrange
2 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(D1h)	0 600Ω	0 27648	nominal range
			underrange
2 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(D2h)	0 3000Ω	0 27648	nominal range
			underrange
3 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(D8h)	0 60Ω	0 27648	nominal range
			underrange
3 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(D9h)	0 600Ω	0 27648	nominal range
			-

Measuring range (funct. no.)	Measuring value	Signal range	Range
			underrange
3 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(DAh)	0 3000Ω	0 27648	nominal range
			underrange
4 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(E0h)	0 60Ω	0 27648	nominal range
			underrange
4 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(E1h)	0 600Ω	0 27648	nominal range
			underrange
4 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(E2h)	0 3000Ω	0 27648	nominal range
			underrange

# Temperature

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J: [Fe-Cu-Ni IEC] -210 +1200°C -346 2192°F 63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)	+14500 -2100 +12000 	26420 -3460 21920 	17232 632 14732 	overrange nominal range underrange
Type K: [Ni-Cr-Ni] -270 +1372°C -454 2501.6°F 0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)	+16220 -2700 +13720 	29516 -4540 25016 	18952 0 16452 	overrange nominal range underrange
Type N: [Ni-Cr-Si] -270 +1300°C -454 2372°F	+15500 -2700 +13000	28220 -4540 23720	18232 0 15732	overrange nominal range

Measuring range (funct. no.)	Measuring value in °C	Measuring value in °F	Measuring value in K (0.1K/digit)	Range
	(0.1°C/digit)	(0.1°F/digit)	(o. no aigit)	
0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Туре Т:	+5400	10040	8132	overrange
[Cu-Cu-Ni]	-2700 +4000	-4540 7520	32 6732	nominal range
-270 +400°C -454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
[PtRh-PtRh]	0 +18200	320 27865	2732 20932	nominal range
0 +1820°C 32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре С:	+25000	32766	23432	overrange
[WRe5-WRe26]	0 +23150	320 27865	2732 20932	nominal range
0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	-1200	-1840	1532	underrange

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Туре Е:	+12000	21920	14732	overrange
[Ni-Cr - Cu-Ni ]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

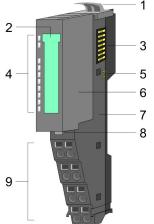
# 3.4 031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO

## **Properties**

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. The sensor supplies are isolated from each other and via DC/DC converter from the DC 24V power supply.

- 2 galvanically separated analog inputs
- Integrated sensor supply for each channel max. 35mA, (short circuit to 39mA)
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- Interrupt and diagnostics function
- 12bit resolution

#### Structure



#### **Status indication**

RUN MF

> AI 0 AI 1

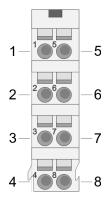
- 1 Locking lever terminal module
- Labeling strip 2
- 3 Backplane bus 4
- LED status indication 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

RUN green	MF	Al x	Description
_		x	Bus communication is OK
		^	Module status is OK
_	_	х	Bus communication is OK
	-	^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
•		•	<ul> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> <li>Overload/short circuit of the DC 24V_ISO</li> </ul>
not relevant	:: X		

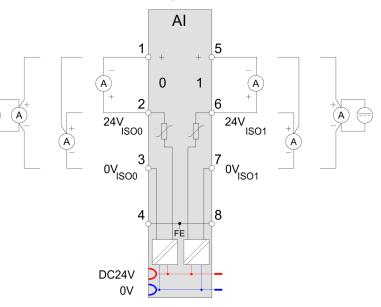
1

031-1BB10 - Al 2x12Bit 0(4)...20mA - ISO

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	24V_ISO_0	0	DC 24V encoder supply Channel 0
3	0V_ISO_0	0	Ground channel 0
4	FE		Shield
5	AI 1	I	+ Channel 1
6	24V_ISO_1	0	DC 24V encoder supply Channel 1
7	0V_ISO_1	0	Ground Channel 1
8	FE		Shield

I: Input, O: Output

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

#### Output area

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

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Technical data

# 3.4.1 Technical data

Order no.	031-1BB10
Туре	SM 031
Module ID	0411 1543
Current consumption/power loss	
Current consumption from backplane bus	50 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	$\checkmark$
Max. input resistance (current range)	60 Ω
Input current ranges	+4 mA +20 mA
	0 mA +20 mA
Operational limit of current ranges	+/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

# Analog Input

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Technical data

Order no.	031-1BB10
Resistance thermometer inputs	-
Resistance thermometer ranges	
Operational limit of resistance thermometer ranges	
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1.15 ms all channels
Noise suppression for frequency	>80dB (UCM<20V)
Technical data sensor supply	
Output voltage typ.	2
Output voltage typ.	+24 V (-1.5 V)
Output current, rated value	35 mA
Short-circuit protection of output	yes, electronic
Connection of potential area	corresponding analog input
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Technical data

Order no.	031-1BB10
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	✓
Between channels of groups to	1
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	DC 75 V/ AC 50 V
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 3.4.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
SHORT_EN	1	Monitoring of sensor voltage*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
RES	1	reserved*	00h	00h	3103h	04h
CH0FN	1	Function number channel 0	31h	80h	3104h	05h
CH0FO	1	Function option channel 0	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CHOLL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	31h	81h	310Ah	09h
CH1FO	1	Function option channel 1	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch

\* This record set may only be transferred at STOP state.

DIAG_EN Diagnostic inter- rupt	Byte	Bit 7 0
	0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>
	Here y	you can enable respectively disable the diagnostic interrupt.
SHORT_EN Monitoring sensor voltage	Byte	Bit 7 0
School Voltage	0	<ul> <li>Bit 0: Monitoring of sensor voltage channel 0 (1: on)</li> <li>Bit 1: Monitoring of sensor voltage channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>
LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> </ul>

Bit 7 ... 2: reserved

#### 031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Parameter data

# CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is disabled and disabled the respective sensor supply. 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.

#### 0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 27640 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{I}{20}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27648
0 20mA	25.00mA	20480	5000h	overrange	D IG204 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
Siemens	20mA	27648	6C00h	nominal range	$D = 27048 \cdot \frac{16}{16}$
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		$T = D + \frac{1}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens	20mA	16384	4000h	nominal range	D = 10304 + 16
S5 format	12mA	8192	2000h		
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

#### 0 ... 20mA / 4KM format

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	20.457mA	4095	0FFFh	overrange	D 1000 I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{I}{20}$
(3Fh)	10mA	2000	07D0h		
	0mA	0	0000h		$I = D \cdot \frac{20}{4000}$
				underrange	$1 = D + \frac{4000}{4000}$

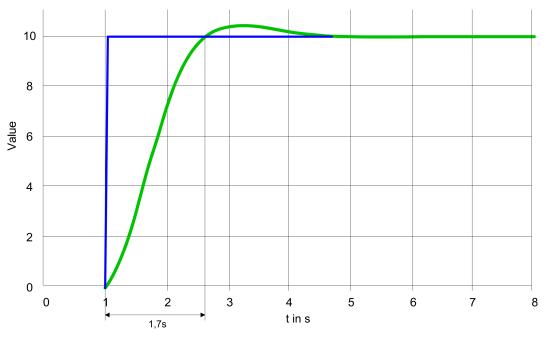
031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Diagnostics and interrupt

# CHxFO Function option channel x

As function option for each channel a time constant x10ms may be preset for a low-pass filter. This is a second-order Butterworth filter. Here frequencies, which lie above the critical frequency, can be filtered. The setting for interference suppression of 50Hz respectively 60Hz is 200ms respectively 170ms.

Range of values: 0 ... 250 (0 = deactivated)

The following diagram shows the transient behavior of the filter with a time constant of 500ms. Here the filter reaches the desired value after 1700ms for the first time.



# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

#### 3.4.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics inter- rupt	parameterizable
Error in project engineering/param.	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
diagnostics buffer overflow	-	Х	-
Process interrupt lost	-	Х	-
Sensor voltage monitoring	-	Х	-

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Diagnostics and interrupt

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Upper limit overflow channel x	00h	02h
PRIT_UL	1	Lower limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h 05h

PRIT_OL upper limit over- flow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Upper limit overflow channel 0</li> <li>Bit 1: Upper limit overflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

PRIT_UL Limit underflow	Byte	Bit 7 0
-	0	<ul> <li>Bit 0: Lower limit underflow channel 0</li> <li>Bit 1: Lower limit underflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

PRIT_US μs-Ticker	Byte	Bit 7 0		
	01	16bit µs value at the moment of the interrupt		
	$\mu$ s ticker In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the $\mu$ s ticker value (0 2 <sup>16</sup> -1).			
diagnostics interrupt the module serves for diagnostics data for diagnostics at a for diagnostic at a for diagnostic interrupt is no long nostic interrupt <sub>going</sub> automatically takes place. All events of a channer interrupt <sub>incoming</sub> and diagnostic interrupt <sub>going</sub> are not stored and get los		arameterization you may activate a diagnostic interrupt for the module. With a cs interrupt the module serves for diagnostics data for diagnostic interrupt <sub>incoming</sub> . as the reason for releasing a diagnostic interrupt is no longer present, the diag- errupt <sub>going</sub> automatically takes place. All events of a channel between diagnostic coming and diagnostic interrupt <sub>going</sub> are not stored and get lost. Within this time 1. diagnostic interrupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the s on.		

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
RES2	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic	08h			07h
		bits per channel				
NUMCH	1	Number of channels	02h			08h
		of a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific	00h			0Ah
		error channel 0				
CH1ERR	1	Channel-specific	00h			0Bh
		error channel 1				
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Diagnostics and interrupt

FRR D Diagnostic		
ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>
CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> </ul>
	0	<ul> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel group 0
		Bit 1: set at error in channel group 1
		Bit 7 2: reserved
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
·	0	Channel-specific error: Channel x:
		<ul> <li>Bit 0: set at project engineering/parameterization error</li> <li>Bit 1: row value above the permissible range</li> <li>Bit 2: row value below the acceptable range</li> <li>Bit 3: reserved</li> <li>Bit 4: error sensor supply voltage</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH2ERR CH7ERR		

CH2ERR ... CH7ERR reserved

	Byte	Bit 7 0
(	0	reserved

031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO > Diagnostics and interrupt

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

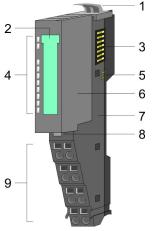
# 3.5 031-1BB30 - AI 2x12Bit 0...10V

#### Properties

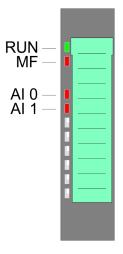
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

#### Structure



#### **Status indication**



RUN	MF	Al x	Description		
green	<b>red</b>	red	Description		
		х	Bus communication is OK		
		^	Module status is OK		
-	-	х	Bus communication is OK		
-	-	~	Module status reports an error		
	-	х	Bus communication is not possible		
	-	~	Module status reports an error		
		Х	Error at bus power supply		
Х	2Hz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30		
			Error channel x		
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
not relevant: X					

#### 5 DC 24V power section supply 6 Electronic module

Labeling strip

Backplane bus

LED status indication

- 7 Terminal module
- 8 Locking lever electronic module

Locking lever terminal module

9 Terminal

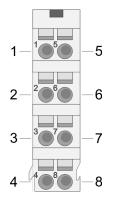
1 2

3

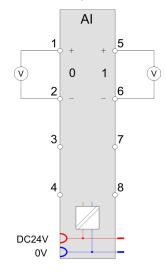
4

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

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



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

I: Input

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

#### Output area

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

031-1BB30 - AI 2x12Bit 0...10V > Technical data

# 3.5.1 Technical data

Order no.	031-1BB30
Туре	SM 031
Module ID	0401 15C3
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

# Analog Input

031-1BB30 - AI 2x12Bit 0...10V > Technical data

Order no.	031-1BB30
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

031-1BB30 - AI 2x12Bit 0...10V > Parameter data

Order no.	031-1BB30
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

# 3.5.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1BB30 - AI 2x12Bit 0...10V > Diagnostic data

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

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

#### 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	16384

#### 3.5.3 Diagnostic data

This module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1BB30 - AI 2x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels	02h			08h
		of a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error	00h			0Ah
		channel 0				
CH1ERR	1	Channel-specific error	00h			0Bh
		channel 1				
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR	D	Diagnostic	•

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

031-1BB30 - AI 2x12Bit 0...10V > Diagnostic data

CHTYP Channel type	Byte	Bit 7 0		
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>		
NUMBIT Diagnostic bits	Byte	Bit 7 0		
	0	Number of diagnostic bits per channel (here 08h)		
NUMCH Channels	Byte	Bit 7 0		
	0	Number of channels of a module (here 02h)		
CHERR Channel error	Byte	Bit 7 0		
	0	<ul> <li>Bit 0: set at error in channel group 0</li> </ul>		
	-	<ul> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>		
CH0ERR / CH1ERR	Byte	Bit 7 0		
Channel-specific	0	Channel-specific error channel x:		
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> </ul>		
		<ul> <li>Bit 5 1: reserved</li> <li>Dit C. act at measuring measured offered</li> </ul>		
		<ul><li>Bit 6: set at measuring range underflow</li><li>Bit 7: set at measuring range overflow</li></ul>		
CH2ERR CH7ERR	Byte	Bit 7 0		
reserved	0	reserved		
DIAG_US μs ticker	Byte	Bit 7 0		
	03	Value of the µs ticker at the moment of the diagnostic		
	µs ticker	IO module there is a timer (µs ticker). With PowerON the timer starts counting		
		Ter $2^{32}$ -1µs the timer starts with 0 again.		

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

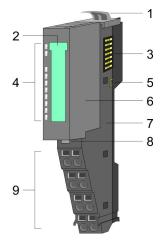
# 3.6 031-1BB40 - AI 2x12Bit 0(4)...20mA

#### **Properties**

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

#### Structure



#### Status indication

RUN MF

AI 0

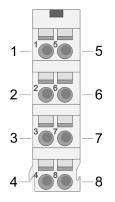
AI 1

- Locking lever terminal module 1
- 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

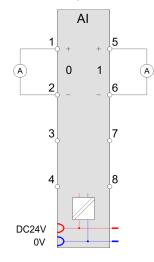
RUN	MF red	Al x	Description
		х	Bus communication is OK
_			Module status is OK
_	_	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
		^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant:	Х		

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

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



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

#### I: Input

 $\bigcirc$ 

If a 2wire measuring transducer is used, you have to connect in line an external power supply.

#### In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

#### Input area

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

031-1BB40 - AI 2x12Bit 0(4)...20mA > Technical data

#### Output area

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

# 3.6.1 Technical data

Order no.	031-1BB40
Туре	SM 031
Module ID	0402 15C3
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	$\checkmark$
Max. input resistance (current range)	110 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.3% +/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.2% +/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-

# Analog Input

031-1BB40 - AI 2x12Bit 0(4)...20mA > Technical data

Order no.	031-1BB40
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel

031-1BB40 - AI 2x12Bit 0(4)...20mA > Technical data

Order no.	031-1BB40
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

031-1BB40 - AI 2x12Bit 0(4)...20mA > Parameter data

#### 3.6.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	31h	80h	3100h	01h
CH1FN	1	Function number channel 1	31h	81h	3101h	02h

#### CHxFN Function number channel x

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

#### 0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
0 20mA Siemens	23.52mA	32511	7EFFh	overrange	D 27649 I	
	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange	27648	
0 20mA	25.00mA	20480	5000h	overrange	D ICODA I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$	
S5 format	10mA	8192	2000h			
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$	
	-4,00mA	-3277	F333h	underrange	16384	
4 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$	
	20mA	27648	6C00h	nominal range	$D = 27048 \cdot \frac{16}{16}$	
	12mA	13824	3600h		16	
	4mA	0	0000h		$I = D \cdot \frac{16}{27648} + 4$	
	1.19mA	-4864	ED00h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$	
Siemens S5 format (40h)	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$	
	12mA	8192	2000h		16	
	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$	
	0.8mA	-3277	F333h	underrange		

#### 3.6.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels	02h			08h
		of a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error	00h			0Ah
		channel 0				
CH1ERR	1	Channel-specific error	00h			0Bh
		channel 1				
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR\_A Diagnostic

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## VIPA System SLIO

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

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>
ERR_D Diagnostic	Byte	Bit 7 0

ugnoouo	Вуте	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

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CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0			
	0	Channel-specific error channel x:			
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>			
CH2ERR CH7ERR reserved	Byte	Bit 7 0			
10001100	0	reserved			
DIAG_US μs ticker	Byte	Bit 7 0			

0...3 Value of the µs ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

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## 3.7 031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor

1

2

3

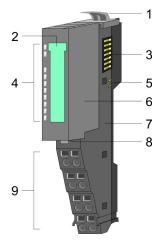
4

**Properties** 

The electronic module has 2 inputs with parameterizable functions. The channels of the module are isolated to the backplane bus.

- 2 analog inputs
- Integrated sensor supply
- Suited for sensors with 0(4) ... 20mA with external supply
- **Diagnostics function**
- 12bit resolution

#### Structure



#### LED status indication 5 DC 24V power section supply

6 Electronic module 7

Labeling strip

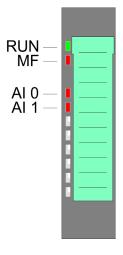
Backplane bus

- Terminal module 8
  - Locking lever electronic module

Locking lever terminal module

9 Terminal

#### Status indication



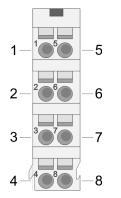
RUN	MF	Al x	Description
green	red 📕	red 📕	
-		x	Bus communication is OK
-		λ	Module status is OK
_	-	х	Bus communication is OK
	-	^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant	: X		



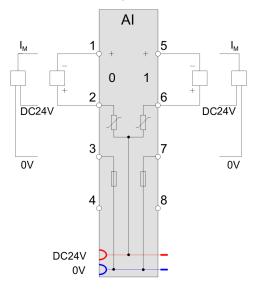
If the terminal module is not yet wired, when the module is power supplied the AI x LEDs get on due to the default parameterization 4 ... 20mA.

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#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	DC 24V	0	DC 24V for sensor Channel 0
3	0V	0	Ground for sensor
			(with 3 wire measurement)
4			not connected
5	+AI 0	I	+ Channel 0
6	DC 24V	0	DC 24V for sensor Channel 1
7	0V	0	Ground for sensor
			(with 3 wire measurement)
8			not connected

I: Input, O: Output

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

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

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

#### Output area

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

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## 3.7.1 Technical data

D       consumption/power loss         consumption from backplane bus       s         consumption from backplane bus       s         al data analog inputs       s         of inputs       s         ngth, shielded       s         ad voltage       s         consumption from load voltage L+ (without load)       s	SM 031 0407 15C3 50 mA 0.7 W 2 200 m DC 24 V 15 mA -
consumption/power lossconsumption from backplane bussssal data analog inputsof inputsof inputsad voltageconsumption from load voltage L+ (without load)nputsut resistance (voltage range)	50 mA 0.7 W 2 200 m DC 24 V 15 mA
consumption from backplane bus#assfal data analog inputsfof inputsfngth, shieldedfad voltagefconsumption from load voltage L+ (without load)fnputsfut resistance (voltage range)f	0.7 W 2 200 m DC 24 V 15 mA
al data analog inputs of inputs ngth, shielded ad voltage consumption from load voltage L+ (without load) nputs ut resistance (voltage range)	0.7 W 2 200 m DC 24 V 15 mA
al data analog inputsof inputsad yoltageconsumption from load yoltage L+ (without load)nputsut resistance (voltage range)	2 200 m DC 24 V 15 mA
of inputs 2 ngth, shielded 2 ad voltage I consumption from load voltage L+ (without load) 2 nputs 2 ut resistance (voltage range) 2	200 m DC 24 V 15 mA
ngth, shielded 2 ad voltage I consumption from load voltage L+ (without load) 4 nputs 4 ut resistance (voltage range) 4	200 m DC 24 V 15 mA
ad voltage I consumption from load voltage L+ (without load) I nputs - ut resistance (voltage range) -	DC 24 V 15 mA
consumption from load voltage L+ (without load)       -         nputs       -         ut resistance (voltage range)       -	15 mA
nputs	
ut resistance (voltage range)	- - -
	- - -
tage ranges -	-
	-
nal limit of voltage ranges -	
nal limit of voltage ranges with SFU -	-
or limit voltage ranges -	-
or limit voltage ranges with SFU -	-
ion limit voltage -	-
nputs	$\checkmark$
ut resistance (current range)	110 Ω
rent ranges (	0 mA +20 mA
-	+4 mA +20 mA
nal limit of current ranges ·	+/-0.5%
nal limit of current ranges with SFU -	-
or limit current ranges ·	+/-0.3%
error limit current ranges with SFU -	-
ion limit current inputs (voltage)	max. 24V
ion limit current inputs (electrical current)	max. 40mA
ce inputs -	-
ce ranges -	-
nal limit of resistor ranges -	-
nal limit of resistor ranges with SFU -	-
or limit -	-
or limit with SFU -	-
ion limit resistance inputs -	

031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor > Technical data

ance thermometer inputs ance thermometer ranges	-
J J J J J J J J J J J J J J J J J J J	-
tional limit of resistance thermometer ranges	-
tional limit of resistance thermometer ranges with	-
error limit thermoresistor ranges	-
error limit thermoresistor ranges with SFU	-
ction limit resistance thermometer inputs	-
ocouple inputs	-
ocouple ranges	-
tional limit of thermocouple ranges	-
tional limit of thermocouple ranges with SFU	-
error limit thermoelement ranges	-
error limit thermoelement ranges with SFU	-
ction limit thermocouple inputs	-
immable temperature compensation	-
al temperature compensation	-
al temperature compensation	-
erature error internal compensation	-
cal unit of temperature measurement	-
ution in bit	12
irement principle	successive approximation
conversion time	2 ms all channels
suppression for frequency	>50dB at 50Hz (UCM<2V)
ical data sensor supply	
t voltage typ.	2
t voltage typ.	L+ (-250 mV)
t current, rated value	50 mA
circuit protection of output	Multifuse 0.1 A
ction of potential area	Field voltage DC 24V
s information, alarms, diagnostics	
display	yes
pts	no
ss alarm	no
ostic interrupt	no
ostic functions	yes

031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor > Technical data

Module state         green LED           Module error display         red LED per channel           Channel error display         red LED per channel           Isolation         -           Between channels         -           Between channels of groups to         -           Between channels and backplane bus         -           Between channels and power supply         -           Max. potential difference between circuits         -           Max. potential difference between niputs (Ucm)         -           Max. potential difference between niputs and Mana (Ucm)         -           Max. potential difference between niputs and Mana (Ucm)         -           Max. potential difference between niputs and Minterm (Uiso)         -           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         0           Output bytes         0           Parameter bytes         6           Diagnostic bytes         PPE / PPE GF10           Material         PPE / PPE GF10           Moting         0           Methanical data         -           Dimensions (WxHxD)         2.9 mm x 109 mm x 76.5 m	Order no.	031-1BB60
Addule error display         red LED           Channel error display         red LED per channel           Edetween channels         -           Between channels of groups to         -           Between channels and backplane bus         -           Between channels and power supply         -           Awax, potential difference between inputs (Ucm)         -           Max, potential difference between inputs (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Max, potential difference between inputs and Mana (Ucm)         -           Parsenter bytes         0           Datazizes         -           Input bytes         4           Output bytes         0           Parameter bytes         0           Diagnostic bytes         2           Material         Pre/ PPE GF10           Metanici data         -	Diagnostics information read-out	possible
Channel error display         red LED per channel           Isolation         -           Between channels         -           Between channels of groups to         -           Between channels and backplane bus         -           Between channels and power supply         -           Between channels and power supply         -           Max, potential difference between inputs (Ucm)         -           Max, potential difference between inputs and Mintern (Uso)         -           Max, potential difference between inputs and Mintern (Uso)         -           Max, potential difference between inputs and Mintern (Uso)         -           Max, potential difference between inputs and Mintern (Uso)         -           Max, potential difference between Mintern and outputs         -           Max, potential difference between Mintern and outputs         -           Max, potential difference between Mintern and outputs         -           Parameter bytes         0           Dutput bytes         -           Dutput bytes         -           Dutput bytes         -           Diagnostic bytes         -           Dutput bytes         -           Material         PE/PPE GF10           Metarial difference bytes         -	Module state	green LED
Isolation         Image: style sty	Module error display	red LED
Between channels         -           Between channels of groups to         -           Between channels and backplane bus         -           Between channels and power supply         -           Max. potential difference between circuits         -           Max. potential difference between inputs (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mintern         DC 75 V/ AC 50 V           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Output bytes         0           Diagnostic bytes         20           Houting         Per / PPE GF10           Material         Per / PPE GF10           Monting         Co g           Dimensions (WxHxD)         2.9 mm x 109 mm x 76.5 mm           Weight         60 g           Dimensions (WxHxD)         0 °C to 60 °C           Storage temperature	Channel error display	red LED per channel
Between channels of groups to         -           Between channels and backplane bus         -           Between channels and power supply         -           Max. potential difference between circuits         -           Max. potential difference between inputs (Ucm)         -           Max. potential difference between inputs and Mintern (Uiso)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between inputs and Mintern (Uiso)         DC 500 V           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Output bytes         0           Parameter bytes         6           Diagnostic bytes         Profile rail 35 mm           Mounting         Profile rail 35 mm           Muchanical data         -           Dimensions (WxHxD)         12.9 mm x 10.9 mm x 76.5 mm           Weight         0 °C to 60 °C           Cortifications	Isolation	
Between channels and backplane bus         ✓           Between channels and power supply         –           Max. potential difference between inputs (Ucm)         –           Max. potential difference between inputs (Ucm)         –           Max. potential difference between inputs (Ucm)         –           Max. potential difference between inputs and Mintern (Uiso)         –           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between inputs and Mintern (Uiso)         –           Max. potential difference between inputs and Mintern (Uiso)         –           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between Mintern and outputs         –           Insulation tested with         DC 500 V           Datasizes         –           Input bytes         0           Output bytes         0           Diagnostic bytes         20           Material         PPE / PPE GF10           Mounting         12.9 mm x 109 mm x 76.5 mm           Mechanical data         –           Dimensions (WXHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         – <t< td=""><td>Between channels</td><td>-</td></t<>	Between channels	-
Between channels and power supply         -           Max. potential difference between inputs (Ucm)         -           Max. potential difference between inputs and Mintern (Uiso)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         0           Input bytes         4           Output bytes         0           Diagnostic bytes         20           Material         PPE / PPE GF10           Mounting         Profile rail 35 mm           Mechanical data         -           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         6 o g           Environmental conditions         -           Output bytes         0.0 c C to 60 °C           Dimensions (WxHxD)         -25 °C to 70 °C           Weight         -25 °C to 70 °C           Certifications         -25 °C to 70 °C	Between channels of groups to	-
Max. potential difference between inputs (Ucm)         -           Max. potential difference between inputs and Mintern (Uso)         -           Max. potential difference between niputs and Mana (Ucm)         -           Max. potential difference between inputs and Mintern (Uso)         DC 75 V/ AC 50 V           Max. potential difference between inputs and Mintern (Uso)         -           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Parameter bytes         6           Diagnostic bytes         PPE / PPE GF10           Mouting         Profile rail 35 mm           Methanical data         -           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         -           Operating temperature         -           Operating temperature         -           Operating temperature         -           Certification         yes	Between channels and backplane bus	✓
Are potential difference between inputs (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Mana (Ucm)         -           Max. potential difference between inputs and Minterm (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between inputs and Minterm (Uiso)         -           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Output bytes         0           Parameter bytes         6           Diagnostic bytes         PPE / PPE GF10           Mouting         Pofile rail 35 mm           Mouting         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         -           Operating temperature         0 °C to 60 °C           Storage temperature         -5° C to 70 °C           Certifications         -	Between channels and power supply	-
Max. potential difference between Mana and Mintern (Uiso)       -         Max. potential difference between inputs and Mana (Ucm)       -         Max. potential difference between inputs and Mintern (Uiso)       DC 75 V/ AC 50 V         Max. potential difference between Mintern and outputs       -         Insulation tested with       DC 500 V         Datasizes       -         Input bytes       4         Output bytes       0         Parameter bytes       6         Diagnostic bytes       20         Material       PPE / PPE GF10         Mounting       Profile rail 35 mm         Mechanical data       -         Dimensions (WxHxD)       12.9 mm x 109 mm x 76.5 mm         Weight       60 g         Environmental conditions       -         Operating temperature       0 °C to 60 °C         Storage temperature       -25 °C to 70 °C         Certification       yes	Max. potential difference between circuits	-
(Uiso)       -         Max. potential difference between inputs and Mintern (Uiso)       DC 75 V/ AC 50 V         Max. potential difference between Mintern and outputs       -         Insulation tested with       DC 500 V         Datasizes       -         Input bytes       4         Output bytes       0         Diagnostic bytes       6         Diagnostic bytes       20         Material       PPE / PPE GF10         Mechanical data       -         Dimensions (WxHxD)       12.9 mm x 109 mm x 76.5 mm         Weight       0° C to 60°C         Storage temperature       -2° C to 70°C         Certifications       -2° C to 70°C	Max. potential difference between inputs (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 50 V           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Parameter bytes         6           Diagnostic bytes         20           Housing         PPE / PPE GF10           Material         PPE / PPE GF10           Mounting         Profile rail 35 mm           Mechanical data         -           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Operating temperature         0 °C to 60 °C           Storage temperature         -25 °C to 70 °C           Certifications         yes	Max. potential difference between Mana and Mintern (Uiso)	-
(Uiso)Insulation tested with-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes4Output bytes0Parameter bytes6Diagnostic bytes20Housing-MaterialPPE / PPE GF10MountingProfile rail 35 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions-Operating temperature0° C to 60°CStorage temperature-25°C to 70°CCertificationsyes	Max. potential difference between inputs and Mana (Ucm)	-
Insulation tested with         DC 500 V           Datasizes         -           Input bytes         4           Output bytes         0           Output bytes         0           Parameter bytes         6           Diagnostic bytes         20           Material         PPE / PPE GF 10           Mounting         Profile rail 35 mm           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         -           Operating temperature         0°C to 60°C           Storage temperature         -25°C to 70°C           Certifications         yes	Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
DatasizesImput bytesInput bytes4Output bytes0Parameter bytes6Diagnostic bytes20MaterialPPE / PPE GF10MountingPofile rail 35 mmMechanical data20Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gOperating temperature0° C to 60°CStorage temperature25°C to 70°CCertificationsyes	Max. potential difference between Mintern and outputs	-
Input bytes         4           Output bytes         0           Parameter bytes         6           Diagnostic bytes         20           Housing         PPE / PPE GF10           Material         PPE / PPE GF10           Mounting         Profile rail 35 mm           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Operating temperature         0° Cto 60° C           Storage temperature         25° Cto 70° C           Certifications         yes	Insulation tested with	DC 500 V
Dutp ut bytes0Parameter bytes6Diagnostic bytes20HousingPPE / PPE GF10MaterialProfile rail 35 mmMountingProfile rail 35 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0°C to 60°CStorage temperature-25 °C to 70 °CCertificationsyes	Datasizes	
Parameter bytes6Diagnostic bytes20HousingMaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical dataDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditionsOperating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Input bytes	4
Diagnostic bytes       20         Housing       PPE / PPE GF 10         Material       PPE / PPE GF 10         Mounting       Profile rail 35 mm         Mechanical data       12.9 mm x 109 mm x 76.5 mm         Dimensions (WxHxD)       20 g         Environmental conditions       0 g         Operating temperature       0 °C to 60 °C         Storage temperature       -25 °C to 70 °C         Certifications       yes	Output bytes	0
HousingPPE / PPE GF10MaterialProfile rail 35 mmMountingProfile rail 35 mmMechanical dataImage: Comparison (WxHxD)Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditionsImage: Comparison of Compariso	Parameter bytes	6
MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data-Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions-Operating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Diagnostic bytes	20
MountingProfile rail 35 mmMechanical dataProfile rail 35 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °COperating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Housing	
Mechanical dataImage: Second seco	Material	PPE / PPE GF10
Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions	Mounting	Profile rail 35 mm
Weight60 gEnvironmental conditions0 °C to 60 °COperating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Mechanical data	
Environmental conditions     0 °C to 60 °C       Operating temperature     0 °C to 60 °C       Storage temperature     -25 °C to 70 °C       Certifications     yes	Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Operating temperature     0 °C to 60 °C       Storage temperature     -25 °C to 70 °C       Certifications     -25 °C to 70 °C       UL certification     yes	Weight	60 g
Storage temperature     -25 °C to 70 °C       Certifications     yes	Environmental conditions	
Certifications UL certification yes	Operating temperature	0 °C to 60 °C
UL certification yes	Storage temperature	-25 °C to 70 °C
	Certifications	
KC certification ves	UL certification	yes
	KC certification	yes

#### 3.7.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	30h	80h	3100h	01h
CH1FN	1	Function number channel 1	30h	81h	3101h	02h

#### CHxFN Function number channel x

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

#### 0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 27640 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27648
0 20mA	25.00mA	20480	5000h	overrange	D IG204 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	16384
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
Siemens	20mA	27648	6C00h	nominal range	16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		$I = D \cdot \frac{1}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens S5 format	20mA	16384	4000h	nominal range	$D = 10304 + \frac{16}{16}$
	12mA	8192	2000h		
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor > Diagnostic data

#### 3.7.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels	02h			08h
		of a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific	00h			0Ah
		error channel 0				
CH1ERR	1	Channel-specific	00h			0Bh
		error channel 1				
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor > Diagnostic data

EPP A Disapostia		
ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>
MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>
ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>
CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Dute	
	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> </ul>
		Bit 7 2: reserved

031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor > Diagnostic data

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
onanner speerne	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

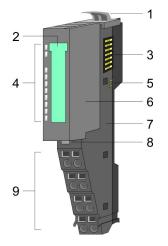
## 3.8 031-1BB70 - AI 2x12Bit ±10V

## Properties

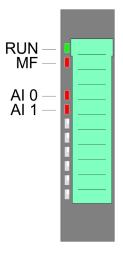
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog inputs
- Suited for sensors with ±10V, 0 ... 10V
- Diagnostics function
- 12bit resolution

#### Structure



#### Status indication



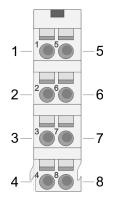
RUN	MF	Al x	Description
green	red	red	Description
		х	Bus communication is OK
		^	Module status is OK
_	-	х	Bus communication is OK
-	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant	: X		

## Locking lever terminal module Labeling strip

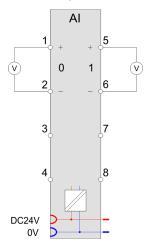
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1BB70 - AI 2x12Bit ±10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



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

I: Input

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

#### Output area

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

031-1BB70 - AI 2x12Bit ±10V > Technical data

## 3.8.1 Technical data

Order no.	031-1BB70
Туре	SM 031
Module ID	0408 15C3
Current consumption/power loss	
Current consumption from backplane bus	50 mA
Power loss	0.5 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

## Analog Input

031-1BB70 - AI 2x12Bit ±10V > Technical data

Order no.	031-1BB70
Resistance thermometer inputs	-
Resistance thermometer ranges	
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	

031-1BB70 - AI 2x12Bit ±10V > Parameter data

Order no.	031-1BB70
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 3.8.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1BB70 - AI 2x12Bit ±10V > Parameter data

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	12h	80h	3100h	01h
CH1FN	1	Function number channel 1	12h	81h	3101h	02h

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

#### ±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

031-1BB70 - AI 2x12Bit ±10V > Diagnostic data

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format (20h)	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	16384

#### 0 ... 10V

#### 3.8.3 Diagnostic data

This module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h

031-1BB70 - AI 2x12Bit ±10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>
MODTYP Module informa-	Byto	Rit 7 0

tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

0 Bit 6 0: Channel type - 70h: Digital input - 71h: Analog input - 72h: Digital output - 73h: Analog output - 74h: Analog input/-output	CHTYP Channel type	Byte	Bit 7 0
<ul> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>		0	<ul> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> </ul>

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

031-1BB70 - AI 2x12Bit ±10V > Diagnostic data

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
reserveu	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic
	µs ticker	
		O module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting ter 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

031-1BB90 - AI 2x16Bit TC

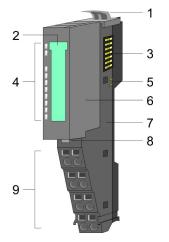
## 3.9 031-1BB90 - AI 2x16Bit TC

Properties

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.

- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- Interrupt and diagnostics function
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC140V/AC60V between the inputs

#### Structure



#### Status indication

RUN MF

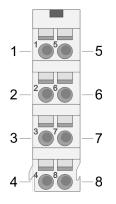
> AI 0 AI 1

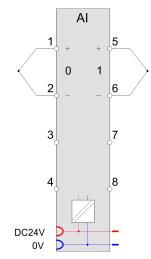
- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module8 Locking lever ele
- Locking lever electronic module
- 9 Terminal

MF d	Al x	Description
	v	Bus communication is OK
	^	Module status is OK
-	v	Bus communication is OK
	^	Module status reports an error
-	v	Bus communication is not possible
	^	Module status reports an error
	Х	Error at bus power supply
ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
		Error channel x
	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li><li>Wire break (if parameterized)</li></ul>
	<ul> <li>red</li> <li></li></ul>	redredredredxxxxxxxx

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	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



#### CAUTION!

Please consider that the electronic module AI 2x16Bit TC may exclusively be used together with the terminal module 001-0AA20!

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.

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.

031-1BB90 - AI 2x16Bit TC > Technical data

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

#### Output area

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

#### 3.9.1 Technical data

Order no.	031-1BB90
Туре	SM 031
Module ID	0403 1543
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	1.1 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	10 ΜΩ
Input voltage ranges	-80 mV +80 mV
Operational limit of voltage ranges	±0.3%
Operational limit of voltage ranges with SFU	±0.1%
Basic error limit voltage ranges	±0.25%
Basic error limit voltage ranges with SFU	±0.05%
Destruction limit voltage	max. 20V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-

031-1BB90 - AI 2x16Bit TC > Technical data

Order no.	031-1BB90
Operational limit of current ranges with SFU	
Basic error limit current ranges	
Radical error limit current ranges with SFU	
Destruction limit current inputs (voltage)	
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	$\checkmark$
Thermocouple ranges	type B
	type C
	type E
	type J
	type K type L
	type N
	type R
	type S
	type T
Operational limit of thermocouple ranges	Type E, L, T, J, K, N: ±2.5K / Type B, C, R, S: ±8.0K
Operational limit of thermocouple ranges with SFU	Type E, L, T, J, K, N: ±1.5K / Type B, C, R, S: ±4.0K
Basic error limit thermoelement ranges	Type E, L, T, J, K, N: ±2.0K / Type B, C, R, S: ±7.0K
Basic error limit thermoelement ranges with SFU	Type E, L, T, J, K, N: ±1.0K / Type B, C, R, S: ±3.0K
Destruction limit thermocouple inputs	max. 20V
Programmable temperature compensation	$\checkmark$

## Analog Input

031-1BB90 - AI 2x16Bit TC > Technical data

Order no.	031-1BB90
External temperature compensation	✓
Internal temperature compensation	$\checkmark$
Temperature error internal compensation	1 K
Technical unit of temperature measurement	°C, °F, K
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	4.2324.1 ms (50 Hz) 3.8270.5 ms (60 Hz) per channel
Noise suppression for frequency	>90dB at 50Hz (UCM<10V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	22
Diagnostic bytes	20

031-1BB90 - AI 2x16Bit TC > Technical data

Order no.	031-1BB90
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	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

#### 3.9.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
RES3	1	reserved*	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression	02h	01h	3105h	06h
CH0FN	1	Function number channel 0	C1h	80h	3106h	07h
CH0FO	1	Function option channel 0	02h	80h	3107h	08h
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3108h 3109h	09h
CHOLL	2	Lower limit value channel 0	8000h	80h	310Ah 310Bh	0Ah
CH1FN	1	Function number channel 1	C1h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	02h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh 310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h3111h	0Eh

\* This record set may only be transferred at STOP state.

#### DIAG\_EN Diagnostic interrupt

Byte	Bit 7 0
0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

WIBRK EN Bit 7 ... 0 Byte Wire break recognition 0 Bit 0: Wire break recognition channel 0 (1: on) Bit 1: Wire break recognition channel 1 (1: on) Bit 7 ... 2: reserved Due to the high sensitivity of the inputs, unused inputs should be deactivated in the parametrization. Due to the high input impedance, open inputs can be influenced by adjacent channels or due to the measuring method during wire break detection. Since the entire measuring range moves in the mV range, open-loop inputs can already cause measuring range overshoots. LIMIT\_EN Byte Bit 7 ... 0 Limit value monitoring 0 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 ... 2: reserved TEMPCNF Byte Bit 7 ... 0 **Temperature system** 0 Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 ... 2: reserved **SUPR Interference** Byte Bit 7 ... 0 frequency suppression 0 Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 ... 2: reserved 

CHxFN Function number channel x

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

With FFh the corresponding channel is deactivated.

## Voltage

## -80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{80}$
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{80}$
(11h)	0V	0	0000h		
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	27648
-80 80mV	100mV	20480	5000h	overrange	D 16294 U
Siemens S7 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	16384

## Temperature

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J:	+14500	26420	17232	overrange
[Fe-Cu-Ni IEC]	-2100 +12000	-3460 21920	632 14732	nominal range
-210 +1200°C -346 2192°F 63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)				underrange
Туре К:	+16220	29516	18952	overrange
[Ni-Cr-Ni]	-2700 +13720	-4540 25016	0 16452	nominal range
-270 +1372°C -454 2501.6°F 0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
[Ni-Cr-Si] -270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C)	-2700 +13000	-4540 23720	0 15732	nominal range

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
(C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Туре Т:	+5400	10040	8132	overrange
[Cu-Cu-Ni]	-2700 +4000	-4540 7520	32 6732	nominal range
-270 +400°C -454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
[PtRh-PtRh]	0 +18200	320 27865	2732 20932	nominal range
0 +1820°C 32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре С:	+25000	32766	23432	overrange
[WRe5-WRe26]	0 +23150	320 27865	2732 20932	nominal range
0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	-1200	-1840	1532	underrange
Type E:	+12000	21920	14732	overrange

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
[Ni-Cr - Cu-Ni ]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

# CHxFO Function option channel x

Depending on the Interference frequency suppression for each channel the transducer velocity may be set.

Velocity (in ms) / channel at interference frequency suppression			
50Hz	60Hz		
324.1	270.5		
164.2	137.2		
84.2	70.5		
44.1	37.2		
24.2	20.5		
14.2	12.2		
9.2	8.0		
6.6	5.9		
4.2	3.8		
	<b>50Hz</b> 324.1 164.2 84.2 44.1 24.2 14.2 9.2 6.6		

\*) For Code 00h, 01h and 02h the tolerances of the technical data "with interference frequency suppression" are valid.

# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated.

As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

031-1BB90 - AI 2x16Bit TC > Diagnostics and interrupt

#### 3.9.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/param.	-	Х	-
Wire break	-	Х	Х
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

#### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h 05h

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	Bit 0: Limit overflow channel 0
		Bit 1: Limit overflow channel 1
		Bit 7 2: reserved

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	Bit 0: Limit underflow channel 0
		Bit 1: Limit underflow channel 1
		Bit 7 2: reserved

module is on.

PRIT_US μs ticker	Byte	Bit 7 0	
	0 1	16bit µs value at the moment of the interrupt	
	µs ticker		
	In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the $\mu$ s ticker value (0 2 <sup>16</sup> -1).		
Diagnostic data	Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt <sub>incomin</sub> As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt <sub>going</sub> automatically takes place. All events of a channel between diagnosti interrupt <sub>incoming</sub> and diagnostic interrupt <sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the		

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
RES2	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels of	02h			08h
		a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error	00h			0Ah
		channel 0				
CH1ERR	1	Channel-specific error	00h			0Bh
		channel 1				
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

031-1BB90 - AI 2x16Bit TC > Diagnostics and interrupt

ERR_A	Diagnostic
-------	------------

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class <ul> <li>0101b analog module</li> </ul> </li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> </ul>
		Bit 4: set at internal communication error
		<ul><li>Bit 5: reserved</li><li>Bit 6: set at process interrupt lost</li></ul>
		Bit 7: reserved

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0

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

#### **NUMCH Channels**

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

CHERR	Channel	error
-------	---------	-------

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> </ul>
	Bit 7 2: reserved

#### CH0ERR / CH1ERR Channel-specific

Byte	Bit 7 0						
0	Channel-specific error: Channel x:						
	<ul> <li>Bit 0: set at project engineering/parameterization error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire break</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>						

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

### 3.10 031-1BD30 - AI 4x12Bit 0...10V

#### Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4 5

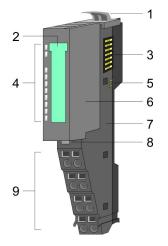
6

7

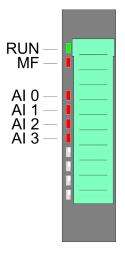
8

9

#### Structure



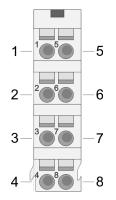
#### Status indication



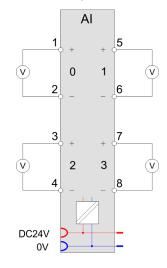
RUN	MF	Al x	Description
green	red	red	Description
		х	Bus communication is OK
		^	Module status is OK
	-	х	Bus communication is OK
	-	^	Module status reports an error
		x	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
x	2Hz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant:	Х		

031-1BD30 - AI 4x12Bit 0...10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

#### Output area

Input area

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

031-1BD30 - AI 4x12Bit 0...10V > Technical data

### 3.10.1 Technical data

Order no.	031-1BD30
Туре	SM 031
Module ID	0404 15C4
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
•	

### Analog Input

031-1BD30 - AI 4x12Bit 0...10V > Technical data

Order no.	031-1BD30
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

031-1BD30 - AI 4x12Bit 0...10V > Parameter data

Order no.	031-1BD30
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 3.10.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1BD30 - AI 4x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	10h	80h	3100h	01h
CH1FN	1	Function number channel 1	10h	81h	3101h	02h
CH2FN	1	Function number channel 2	10h	82h	3102h	03h
CH3FN	1	Function number channel 3	10h	83h	3103h	04h

### CHxFN Function number channel x

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

#### 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16204}$
	-2V	-3277	F333h	underrange	16384

#### 3.10.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1BD30 - AI 4x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR	Α	Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa-	
tion	

Byte	Bit 7 0						
0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>						

ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

### CHTYP Channel type

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

Byte
0

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
onamici specific	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH4ERR CH7ERR reserved	Byte	Bit 7 0
10001104	0	reserved

031-1BD30 - AI 4x12Bit 0...10V > Diagnostic data

### DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

031-1BD40 - AI 4x12Bit 0(4)...20mA

### 3.11 031-1BD40 - AI 4x12Bit 0(4)...20mA

1 2

3

4

5

6

7

8

9

### Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

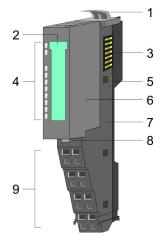
LED status indication

Electronic module

Terminal module

Terminal

### Structure



### Status indication

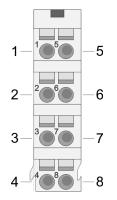
RUN — MF — AI 0 — AI 1 — AI 2 — AI 3 —

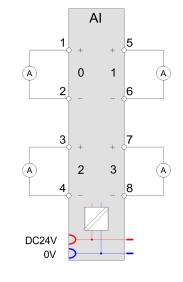
RUN	MF	Al x	Description		
		x	Bus communication is OK Module status is OK		
•		х	Bus communication is OK Module status reports an error		
		x	Bus communication is not possible Module status reports an error		
		Х	Error at bus power supply		
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30		
•		•	<ul><li>Error channel x</li><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
not relevant: X					

031-1BD40 - AI 4x12Bit 0(4)...20mA

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





#### I: Input

Pos.	Function	Туре	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	-Al 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

#### I: Input

If a 2wire measuring transducer is used, you have to connect in line an external power supply.

#### In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

### Input area

031-1BD40 - AI 4x12Bit 0(4)...20mA > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

### Output area

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

### 3.11.1 Technical data

Order no.	031-1BD40
Туре	SM 031
Module ID	0405 15C4
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	110 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.3% +/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.2% +/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA

031-1BD40 - AI 4x12Bit 0(4)...20mA > Technical data

Order no.	031-1BD40
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no

### Analog Input

Order no.	031-1BD40
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 3.11.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	31h	80h	3100h	01h
CH1FN	1	Function number channel 1	31h	81h	3101h	02h
CH2FN	1	Function number channel 2	31h	82h	3102h	03h
CH3FN	1	Function number channel 3	31h	83h	3103h	04h

# CHxFN Function number channel x

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

031-1BD40 - AI 4x12Bit 0(4)...20mA > Diagnostic data

### 0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	23.52mA	32511	7EFFh	overrange	D OTCO I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27648
0 20mA	25.00mA	20480	5000h	overrange	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	16384
4 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	D = 27048 + 16
	12mA	13824	3600h		16
	4mA	0	0000h		$I = D \cdot \frac{16}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 20mA Siemens	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	$D = 10364 \cdot \frac{16}{16}$
S5 format	12mA	8192	2000h		16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

### 3.11.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

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

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

- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1BD40 - AI 4x12Bit 0(4)...20mA > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	Diagnostic 00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel				07h
NUMCH	1	Number of channels of a module	04h		08h	
CHERR	1	Channel error	00h		09h	
CH0ERR	1	Channel-specific error channel 0				0Ah
CH1ERR	1	Channel-specific error channel 1				0Bh
CH2ERR	1	Channel-specific error 00h Channel 2			0Ch	
CH3ERR	1	Channel-specific error 00h channel 3			0Dh	
CH4ERR CH7ERR	4	reserved 00h				0Eh 11h
DIAG_US	4	µs-Ticker	00h			13h

ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: reserved</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa-	
tion	

Byte	Bit 7 0
0	<ul> <li>Bit 3 0: module class <ul> <li>0101b analog module</li> </ul> </li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

### ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

### CHTYP Channel type

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

031-1BD40 - AI 4x12Bit 0(4)...20mA > Diagnostic data

### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

031-1BD70 - AI 4x12Bit ±10V

### 3.12 031-1BD70 - AI 4x12Bit ±10V

### Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4 5

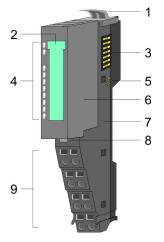
6

7

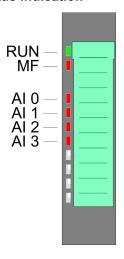
8

9

#### Structure



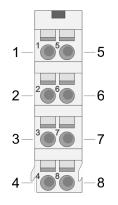
### Status indication

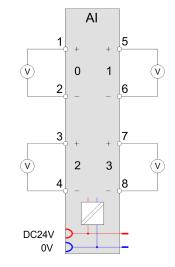


RUN	MF <mark>  </mark> red	Al x	Description
		х	Bus communication is OK Module status is OK
	•	х	Bus communication is OK Module status reports an error
	•	x	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
•		•	<ul><li>Error channel x</li><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant	:: X		

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

Input area

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

031-1BD70 - AI 4x12Bit ±10V > Technical data

### 3.12.1 Technical data

Order no.	031-1BD70
Туре	SM 031
Module ID	0409 15C4
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.5 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

031-1BD70 - AI 4x12Bit ±10V > Technical data

Order no.	031-1BD70
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-

#### **Analog Input**

031-1BD70 - AI 4x12Bit ±10V > Parameter data

Order no.	031-1BD70
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 3.12.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1BD70 - AI 4x12Bit ±10V > Parameter data

Name	Bytes	Function	Default	DS	IX	SX
CH0FN	1	Function number channel 0	12h	80h	3100h	01h
CH1FN	1	Function number channel 1	12h	81h	3101h	02h
CH2FN	1	Function number channel 2	12h	82h	3102h	03h
CH3FN	1	Function number channel 3	12h	83h	3103h	04h

### CHxFN Function number channel x

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

### ±10V

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
±10V	11.76V	32511	7EFFh	overrange	D 27(10 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

031-1BD70 - AI 4x12Bit ±10V > Diagnostic data

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	16384

### 0 ... 10V

### 3.12.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h

ERR\_A Diagnostic

031-1BD70 - AI 4x12Bit ±10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

Byte
0

MODTYP Module informa- tion	Byte	Bit 7 0
	0	Bit 3 0: module class
		<ul> <li>0101b analog module</li> </ul>
		Bit 4: set at channel information present
		Bit 7 5: reserved

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

NUMBIT Diagnostic bits

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

031-1BD70 - AI 4x12Bit ±10V > Diagnostic data

NUMCH Channels	Byte 0	Bit 7 0 Number of channels of a module (here 04h)
CHERR Channel error	Byte 0	<ul> <li>Bit 7 0</li> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 5 1: reserved Bit 6: set at measuring range underflow
		Bit 7: set at measuring range overflow

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

## 3.13 031-1BD80 - AI 4x16Bit R/RTD

### Properties

The electronic module has 4 inputs for resistance measurement with parameterizable functions. The channels of the module are isolated to the backplane bus.

- 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 wire (3 and 4 wire only via channel 0 respectively 1)
- Interrupt and diagnostics function

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1

2

3

4

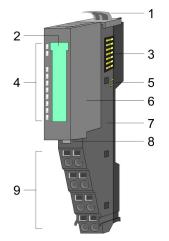
5

6

7 8

9

#### Structure



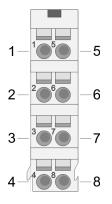
#### Status indication

RUN — MF — AI 0 — AI 1 — AI 2 — AI 3 —

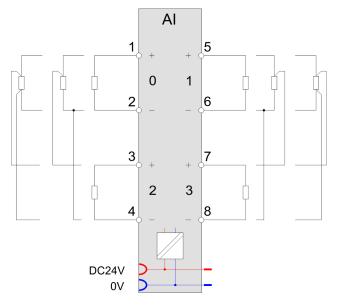
RUN	MF	Al x	Description	
green		X	Bus communication is OK	
		^	Module status is OK	
_	-	х	Bus communication is OK	
		^	Module status reports an error	
		x	Bus communication is not possible	
			Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
			Error channel x	
•		•	<ul> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> <li>Wire break (if parameterized)</li> </ul>	
not relevant:	Х			

031-1BD80 - AI 4x16Bit R/RTD

### Pin assignment



For wires with a cross section of  $0.08 \text{mm}^2$  up to  $1.5 \text{mm}^2$ .



Pos.	Function	Туре	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

2, 3, 4 wire measurement	At the pin assignment above you can see how the sensors are to be connected at 2, 3 respectively 4 wire measurement.					
	<ul> <li>With every channel a 2 wire measurement may be performed.</li> <li>3 wire measurement is only possible via the channels 0 and 1.         <ul> <li>Please consider with 3 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.</li> </ul> </li> <li>4 wire measurement is only possible via the channels 0 and 1.         <ul> <li>The measurement current for channel 0 is applied at pin 1 and 2. The measurement for channel 0 happens at pin 3 and 4. The analog value for channel 0 is represented in input word 0.</li> </ul> </li> </ul>					
	<ul> <li>The measurement current for channel 1 is applied at pin 5 and 6. The measurement for channel 1 happens at pin 7 and 8. The analog value for channel 1 is represented in input word 1.</li> </ul>					
	<ul> <li>Please consider with 4 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.</li> </ul>					
In-/Output area	At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.					
	<ul> <li>IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules</li> </ul>					
	SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot					
	More can be found in the according manual of your bus coupler.					

Input area	Addr.	Name	Bytes	Function	IX	SX
	+0	AI 0	2	Analog value channel 0	6401h/s	01h
	+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
	+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
	+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

### Output area

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

### 3.13.1 Technical data

Order no.	031-1BD80
Туре	SM 031
Module ID	0406 1544
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	1 W
Technical data analog inputs	

### Analog Input

031-1BD80 - AI 4x16Bit R/RTD > Technical data

Order no.	031-1BD80
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	$\checkmark$
Resistance ranges	0 60 Ohm
	0 600 Ohm
	0 3000 Ohm
Operational limit of resistor ranges	+/- 0.4 %
Operational limit of resistor ranges with SFU	+/- 0,2 %
Basic error limit	+/- 0.2 %
Basic error limit with SFU	+/- 0,1 %
Destruction limit resistance inputs	max. 24V
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100
	Pt1000
	Ni100 Ni1000
Operational limit of resistance thermometer ranges	+/- 0.4 %
operational limit of resistance thermometer ranges	·/- U.+ /U

031-1BD80 - AI 4x16Bit R/RTD > Technical data

Order no.	031-1BD80
Operational limit of resistance thermometer ranges with SFU	+/- 0,2 %
Basic error limit thermoresistor ranges	+/- 0.2 %
Basic error limit thermoresistor ranges with SFU	+/- 0,1 %
Destruction limit resistance thermometer inputs	max. 24V
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	°C, °F, K
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	4.2324.1 ms (50 Hz) 3.8270.5 ms (60 Hz) per channel
Noise suppression for frequency	>80dB at 50Hz (UCM<6V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-

### Analog Input

031-1BD80 - AI 4x16Bit R/RTD > Technical data

Order no.	031-1BD80
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 6 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	34
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 3.13.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics <sup>1</sup>	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition <sup>1</sup>	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring <sup>1</sup>	00h	00h	3102h	03h
RES3	1	reserved	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression	02h	01h	3105h	06h
CH0FN	1	Function number channel 0	50h	80h	3106h	07h
CH0FO	1	Function option channel 0	00h	80h	3107h	08h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3108h 3109h	09h
CH0LL	2	Lower limit value channel 0	8000h	80h	310Ah 310Bh	0Ah
CH1FN	1	Function number channel 1	50h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	00h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh 310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h3111h	0Eh
CH2FN	1	Function number channel 2	50h <sup>2</sup>	82h	3112h	0Fh
CH2FO	1	Function option channel 2	00h	82h	3113h	10h
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3114h 3115h	11h
CH2LL	2	Lower limit value channel 2	8000h	82h	3116h 3117h	12h
CH3FN	1	Function number channel 3	50h <sup>2</sup>	83h	3118h	13h
CH3FO	1	Function option channel 3	00h	83h	3119h	14h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	311Ah 311Bh	15h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ch 311Dh	16h

1) This record set may only be transferred at STOP state.

2) with 2 channel operation FFh

031-1BD80 - AI 4x16Bit R/RTD > Parameter data

DIAG_EN Diagnostic inter- rupt	Byte	Bit 7 0
	0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt. 

WIBRK_	EN	Wire	break
recogni	tion		

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire break recognition channel 0 (1: on)</li> <li>Bit 1: Wire break recognition channel 1 (1: on)</li> <li>Bit 2: Wire break recognition channel 2 (1: on)</li> <li>Bit 3: Wire break recognition channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>

LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 2: Limit value monitoring channel 2 (1: on)</li> <li>Bit 3: Limit value monitoring channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>

TEMPCNF Temperature system	Byte	Bit 7 0
	0	<ul> <li>Bit 0, 1: Temperature system         <ul> <li>00: °C</li> <li>01: °F</li> <li>10: K</li> </ul> </li> <li>Bit 7 2: reserved</li> </ul>

SUPR Interference fre- quency suppression	Byte	Bit 7 0
4	0	<ul> <li>Bit 0, 1: Interference frequency suppression <ul> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 7 2: reserved</li> </ul>

#### **CHxFN Function number** 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 channel x is deactivated.

Measuring range (funct. no.)	Measuring value	Signal range	Range
2 wire: PT100	+1000°C	+10000	overrange
(50h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
2 wire: PT1000	+1000°C	+10000	overrange
(51h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100	+295°C	+2950	overrange
(52h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000	+295°C	+2950	overrange
(53h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: PT100	+1000°C	+10000	overrange
(58h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000	+1000°C	+10000	overrange
(59h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100	+295°C	+2950	overrange
(5Ah)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: NI1000	+295°C	+2950	overrange
(5Bh)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: PT100	+1000°C	+10000	overrange
(60h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
4 wire: PT1000	+1000°C	+10000	overrange
(61h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
4 wire: NI100	+295°C	+2950	overrange
(62h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: NI1000	+295°C	+2950	overrange
(63h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: 0 $60\Omega$			overrange
(70h)	0 60Ω	0 32767	nominal range

Measuring range (funct. no.)	Measuring value Signal range		Range
			underrange
2 wire: 0 $600\Omega$			overrange
(71h)	0 600Ω	0 32767	nominal range
			underrange
2 wire: 0 3000 $\Omega$			overrange
(72h)	0 3000Ω	0 32767	nominal range
			underrange
3 wire: 0 $60\Omega$			overrange
(78h)	0 60Ω	0 32767	nominal range
			underrange
3 wire: 0 600 $\Omega$			overrange
(79h)	0 600Ω	0 32767	nominal range
			underrange
3 wire: 0 3000 $\Omega$			overrange
(7Ah)	0 3000Ω	0 32767	nominal range
			underrange
4 wire: 0 $60\Omega$			overrange
(80h)	0 60Ω	0 32767	nominal range
			underrange
4 wire: 0 $600\Omega$			overrange
(81h)	0 600Ω	0 32767	nominal range
			underrange
4 wire: 0 3000 $\Omega$			overrange
(82h)	0 3000Ω	0 32767	nominal range
			underrange
2 wire: 0 $60\Omega$			overrange
(90h)	0 60Ω	0 6000	nominal range
			underrange
2 wire: 0 $600\Omega$			overrange
(91h)	0 600Ω	0 6000	nominal range
			underrange
2 wire: 0 3000 $\Omega$			overrange
(92h)	0 3000Ω	0 30000	nominal range
			underrange
3 wire: 0 $60\Omega$			overrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
(98h)	0 60Ω	0 6000	nominal range
			underrange
3 wire: 0 600 $\Omega$			overrange
(99h)	0 600Ω	0 6000	nominal range
			underrange
3 wire: 0 3000 $\Omega$			overrange
(9Ah)	0 3000Ω	0 30000	nominal range
			underrange
4 wire: 0 $60\Omega$			overrange
(A0h)	0 60Ω	0 6000	nominal range
			underrange
4 wire: 0 $600\Omega$			overrange
(A1h)	0 600Ω	0 6000	nominal range
			underrange
4 wire: 0 $3000\Omega$			overrange
(A2h)	0 3000Ω	0 30000	nominal range
			underrange
2 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(D0h)	0 60Ω	0 27648	nominal range
			underrange
2 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(D1h)	0 600Ω	0 27648	nominal range
			underrange
2 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(D2h)	0 3000Ω	0 27648	nominal range
			underrange
3 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(D8h)	0 60Ω	0 27648	nominal range
			underrange
3 wire: 0 600 $\Omega$	705.5Ω	32511	overrange
(D9h)	0 600Ω	0 27648	nominal range
			underrange
3 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(DAh)	0 3000Ω	0 27648	nominal range
			underrange

Measuring range (funct. no.)	Measuring value	Signal range	Range
4 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(E0h)	0 60Ω	0 27648	nominal range
			underrange
4 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(E1h)	0 600Ω	0 27648	nominal range
			underrange
4 wire: 0 $3000\Omega$	3528Ω	32511	overrange
(E2h)	0 3000Ω	0 27648	nominal range
			underrange

# CHxFO Function option channel x

Depending on the Interference frequency suppression for each channel the transducer velocity may be set.

Code*	Velocity (in ms) / channel at Interference frequency suppression				
	50Hz	60Hz			
00h*	324.1	270.5			
01h*	164.2	137.2			
02h*	84.2	70.5			
03h	44.1	37.2			
04h	24.2	20.5			
05h	14.2	12.2			
06h	9.2	8.0			
07h	6.6	5.9			
08h	4.2	3.8			

\*) For Code 00h, 01h and 02h the tolerances of the technical data "with interference frequency suppression" are valid.

**CHxUL / CHxLL channel x** For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated.

As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

031-1BD80 - AI 4x16Bit R/RTD > Diagnostics and interrupt

#### 3.13.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/param.	-	Х	-
Wire break	-	Х	Х
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

#### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h 05h

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	Bit 0: Limit overflow channel 0
		Bit 1: Limit overflow channel 1
		Bit 7 4: reserved

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	Bit 0: Limit underflow channel 0
		Bit 1: Limit underflow channel 1
		Bit 7 4: reserved

#### PRIT\_US µs ticker

Byte	Bit 7 0
<b>b j</b> to	

16bit µs value at the moment of the interrupt

µs ticker

0 ... 1

In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again. PRIT\_US represents the lower 2 byte of the  $\mu$ s ticker value (0 ... 2<sup>16</sup>-1).

Diagnostic data

Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh

031-1BD80 - AI 4x16Bit R/RTD > Diagnostics and interrupt

Name	Bytes	Function	Default	DS	IX	SX
CH4ERR CH7ERR	4	reserved	00h			0Eh11h
DIAG_US	4	µs ticker	00h			13h

# ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	Bit 3 0: module class
		<ul> <li>0101b analog module</li> </ul>
		Bit 4: set at channel information present
		Bit 7 5: reserved

ERR_D Diagnose	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

# NUMBIT Diagnostic bits

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

CHERR Channel error

031-1BD80 - AI 4x16Bit R/RTD > Diagnostics and interrupt

# NUMCH Channels Byte Bit 7 ... 0 0 Number of channels of a module (here 04h)

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>

CH0ERR/CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error: channel x:
		<ul> <li>Bit 0: set at error in project engineering/parameterization</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire break</li> </ul>
		<ul> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at process underflow</li> </ul>
		<ul> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

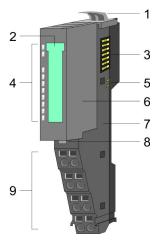
# 3.14 031-1BF60 - AI 8x12Bit 0(4)...20mA

#### **Properties**

The electronic module has 8 inputs with parameterizable functions. The channels of the module are isolated to the backplane bus.

- 8 analog single ended inputs (reference potential 0V)
- Suited for sensors with 0(4) ... 20mA with external supply
- Interference frequency suppression parameterizable (50/60Hz)
- Diagnostics function
- 12bit resolution

#### Structure



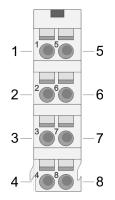
#### Status indication

RUN	MF	Al x	Description
green	red	red	Description
		х	Bus communication is OK
		Λ	Module status is OK
_	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant	:: X		

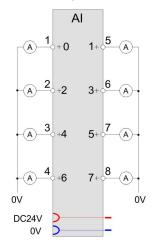
- Locking lever terminal module
   Labeling strip
- 2 Labeling strip3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1BF60 - AI 8x12Bit 0(4)...20mA

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	+AI 2	I	+ Channel 2
3	+AI 4	I	+ Channel 4
4	+AI 6	I	+ Channel 6
5	+AI 1	I	+ Channel 1
6	+AI 3	I	+ Channel 3
7	+AI 5	I	+ Channel 5
8	+AI 7	I	+ Channel 7

I: Input

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h
+8	AI 4	2	Analog value channel 4	6401h/s+4	05h
+10	AI 5	2	Analog value channel 5	6401h/s+5	06h

Input area

031-1BF60 - AI 8x12Bit 0(4)...20mA > Technical data

Addr.	Name	Bytes	Function	IX	SX
+12	AI 6	2	Analog value channel 6	6401h/s+6	07h
+14	AI 7	2	Analog value channel 7	6401h/s+7	08h

#### Output area

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

# 3.14.1 Technical data

Order no.	031-1BF60
Туре	SM 031
Module ID	0416 15C5
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	8
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	$\checkmark$
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 30V
Destruction limit current inputs (electrical current)	max. 40mA

# Analog Input

031-1BF60 - AI 8x12Bit 0(4)...20mA > Technical data

Resistance ranges-Operational limit of resistor ranges-Coperational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Basic error limit with SFU-Besistance thermometer inputs-Resistance thermometer ranges-Operational limit of resistance thermometer ranges-Operational limit of resistance thermometer ranges-Stu-Basic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer ranges-Basic error limit thermoresistor ranges with SFU-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Temperature error internal compensation-Resolution in bit12Basic enversion time2 mad lennelisNoise suppression for frequencySodd at SOHz (UCM<2V)Status displayyes<	Order no.	031-1BF60
Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Basic error limit with SFU-Resistance inputs-Resistance thermometer inputs-Resistance thermometer ranges-Operational limit of resistance thermometer ranges-Operational limit of resistance thermometer ranges-Basic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Operational limit of thermocouple ranges with SFU-Operational limit of thermocouple ranges with SFU-Destruction limit themocouple ranges with SFU-Destruction limit thermocouple inputs-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Resolution in bit12Resolution in bit12Basic enversion time2 mad lchannelsNoise suppression for frequencySodB at SOHz (UCM<2V)	Resistance inputs	-
Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Destruction limit resistance inputs-Resistance thermometer inputs-Resistance thermometer ranges-Operational limit of resistance thermometer ranges-Stabic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-Destruction limit thermocouple inputs-Programmable temperature compensation-Internal temperature compensation-Internal temperature compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlescessive approximationBasic conversion time> Solds at Soltz (UCM<2V)	Resistance ranges	-
Basic error limit•Basic error limit with SFU•Destruction limit resistance inputs•Resistance thermometer inputs•Resistance thermometer ranges•Operational limit of resistance thermometer ranges•Operational limit of resistance thermometer ranges•Operational limit of resistance thermometer ranges•SFU•Basic error limit thermoresistor ranges•Basic error limit thermoresistor ranges with SFU•Destruction limit resistance thermometer inputs•Thermocouple ranges•Operational limit of thermocouple ranges•Operational limit thermocouple inputs•Programmable temperature compensation•Programmable temperature compensation•Thermocouple inputs•Thermocouple inputs•Product of temperature measurement•Tenhcical unit of temperature measurement•Resolution in bit12Basic conv	Operational limit of resistor ranges	-
Basic error limit with SFU         - Added and a second and a second and and and and and and and and and a	Operational limit of resistor ranges with SFU	-
Destruction limit resistance inputs-Resistance thermometer inputs-Qoerational limit of resistance thermometer ranges-Operational limit of resistance thermometer ranges with-SFU-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Destruction limit resistance thermometer inputs-Destruction limit resistance thermometer inputs-Thermocouple inputs-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit thermocouple inputs-Destruction limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time-Noise suppression for frequency>SodB at SoHz (UCM<2V)	Basic error limit	-
Resistance thermometer inputs	Basic error limit with SFU	-
Resistance thermometer ranges	Destruction limit resistance inputs	-
Operational limit of resistance thermometer ranges         -           Operational limit of resistance thermometer ranges with SFU         -           Basic error limit thermoresistor ranges with SFU         -           Basic error limit thermoresistor ranges with SFU         -           Destruction limit resistance thermometer inputs         -           Thermocouple inputs         -           Thermocouple ranges         -           Operational limit of thermocouple ranges         -           Operational limit of thermocouple ranges         -           Operational limit of thermocouple ranges with SFU         -           Basic error limit thermoelement ranges         -           Operational limit of thermocouple ranges with SFU         -           Basic error limit thermocouple ranges with SFU         -           Destruction limit thermocouple inputs         -           Programmable temperature compensation         -           Programmable temperature compensation         -           Temperature error internal compensation         -           Technical unit of temperature measurement         -           Resolution in bit         12           Measurement principle         successive approximation           Basic conversion time         -SodB at 50Hz (UCM<2V)	Resistance thermometer inputs	-
Operational limit of resistance thermometer ranges with SFU-Basic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges-Programmable temperature compensation-External temperature compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Resistance thermometer ranges	-
SFUImage: SFUBasic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocement ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermoelement ranges-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Staus display2m sall channelsNoise suppression for frequency>SOdB at 50Hz (UCM<2V)	Operational limit of resistance thermometer ranges with SFU	-
Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion frequency>SodB at 50Hz (UCM<2V)	Basic error limit thermoresistor ranges	-
Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Tepherature error internal compensation-Tepherature error internal compensation-Tepherature error internal compensation-Resolution in bit12Measurement principlesuccessive approximationBasic conversion firequency>50B at 50Hz (UCM<2V)	Basic error limit thermoresistor ranges with SFU	-
Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement12Resolution in bit12Measurement principlesuccessive approximationBasic conversion firequency>50dB at 50Hz (UCM<2V)	Destruction limit resistance thermometer inputs	-
Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Resolution in bit12Measurement principlesuccessive approximationBasic conversion fire quency>50dB at 50Hz (UCM<2V)	Thermocouple inputs	-
Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion for frequency>50dB at 50Hz (UCM<2V)	Thermocouple ranges	-
Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time-Noise suppression for frequency>50dB at 50Hz (UCM<2V)	Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Operational limit of thermocouple ranges with SFU	-
Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time-Noise suppression for frequency>50dB at 50Hz (UCM<2V)	Basic error limit thermoelement ranges	-
Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Basic error limit thermoelement ranges with SFU	-
External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Technical unit of temperature measurement12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Destruction limit thermocouple inputs	-
Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Programmable temperature compensation	-
Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	External temperature compensation	-
Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Internal temperature compensation	-
Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Temperature error internal compensation	-
Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Technical unit of temperature measurement	-
Basic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Resolution in bit	12
Noise suppression for frequency     >50dB at 50Hz (UCM<2V)	Measurement principle	successive approximation
Status information, alarms, diagnostics     yes       Status display     yes       Interrupts     no       Process alarm     no	Basic conversion time	2 ms all channels
Status display     yes       Interrupts     no       Process alarm     no	Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Interrupts no	Status information, alarms, diagnostics	
Process alarm no	Status display	yes
	Interrupts	no
Diagnostic interrupt no	Process alarm	no
	Diagnostic interrupt	no

031-1BF60 - AI 8x12Bit 0(4)...20mA > Technical data

Order no.	031-1BF60
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	16
Output bytes	0
Parameter bytes	14
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	in preparation

031-1BF60 - AI 8x12Bit 0(4)...20mA > Parameter data

#### 3.14.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
SUPR	2	Interference frequency suppression	0000h	01h	3100h, 3101h	01h
CH0FN	1	Function number channel 0	31h	80h	3102h	02h
CH1FN	1	Function number channel 1	31h	81h	3103h	03h
CH2FN	1	Function number channel 2	31h	82h	3104h	04h
CH3FN	1	Function number channel 3	31h	83h	3105h	05h
CH4FN	1	Function number channel 4	31h	84h	3106h	06h
CH5FN	1	Function number channel 5	31h	85h	3107h	07h
CH6FN	1	Function number channel 6	31h	86h	3108h	08h
CH7FN	1	Function number channel 7	31h	87h	3109h	09h

SUPR Interference fre- quency suppression	Byte	Bit 15 0
quency suppression	0	<ul> <li>Bit 0, 1: Interference frequency suppression channel 0</li> <li>Bit 2, 3: Interference frequency suppression channel 1</li> <li>Bit 4, 5: Interference frequency suppression channel 2</li> <li>Bit 6, 7: Interference frequency suppression channel 3</li> <li>Bit 8, 9: Interference frequency suppression channel 4</li> <li>Bit 10, 11: Interference frequency suppression channel 5</li> <li>Bit 12, 13: Interference frequency suppression channel 6</li> <li>Bit 14, 15: Interference frequency suppression channel 7</li> <li>00: deactivated</li> </ul>
		– 01: 60Hz

– 10: 50Hz

# CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa. 0(4) ... 20mA

031-1BF60 - AI 8x12Bit 0(4)...20mA > Diagnostic data

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	23.52mA	32511	7EFFh	overrange	
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27648
0 20mA	25.00mA	20480	5000h	overrange	D IGON I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	16384
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$
Siemens	20mA	27648	6C00h	nominal range	D = 27040 + 16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		$I = D \cdot \frac{1}{27648} + 4$
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$
S5 format	12mA	8192	2000h		16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

#### 3.14.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

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

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

- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1BF60 - AI 8x12Bit 0(4)...20mA > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	08h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR	1	Channel-specific error channel 4	00h			0Eh
CH5ERR	1	Channel-specific error channel 5	00h			0Fh
CH6ERR	1	Channel-specific error channel 6	00h			10h
CH7ERR	1	Channel-specific error channel 7	00h			11h
DIAG_US	4	µs ticker	00h			13h

# ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa-	Byte	Bit 7 0
(	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

# ERR\_D Diagnostic

Byte	Bit 7 0		
0	<ul> <li>Bit 3 0: reserved</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>		

031-1BF60 - AI 8x12Bit 0(4)...20mA > Diagnostic data

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 08h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel 0</li> <li>Bit 1: set at error in channel 1</li> <li>Bit 2: set at error in channel 2</li> <li>Bit 3: set at error in channel 3</li> <li>Bit 4: set at error in channel 4</li> <li>Bit 5: set at error in channel 5</li> <li>Bit 6: set at error in channel 6</li> <li>Bit 7: set at error in channel 7</li> </ul>
CH0ERR CH7ERR Channel-specific	Byte	Bit 7 0
	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring-/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
DIAG_US µs ticker	Der	
	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic
	µs ticker	IO module there is a timer (µs ticker). With PowerON the timer starts counting
		fter $2^{32}$ -1µs the timer starts with 0 again.

# 3.15 031-1BF74 - AI 8x12Bit ±10V

#### Properties

The electronic module has 8 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus.

- 8 analog single ended inputs (reference potential 0V)
- Suited for sensors with ±10V, 0 ... 10V with external supply
- Interference frequency suppression parameterizable (50/60Hz)
- Diagnostics function

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1

2

3

4

5

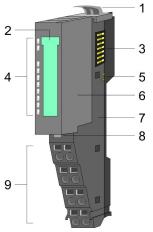
6

7

8

9

#### Structure



# Status indication

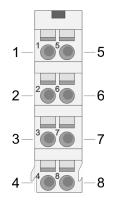
RUN — 1 MF — 1 AI 0 — 1 AI 1 — 1 AI 2 — 1 AI 3 — 1 AI 3 — 1 AI 4 — 1 AI 5 — 1 AI 6 — 1 AI 7 — 1

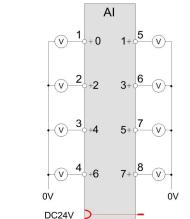
RUN	MF	AI x	Description		
green	red	red	Description		
		х	Bus communication is OK		
		^	Module status is OK		
	_	х	Bus communication is OK		
	-	^	Module status reports an error		
	_	х	Bus communication is not possible		
	-	^	Module status reports an error		
		Х	Error at bus power supply		
Х	2Hz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30		
			Error channel x		
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
not relevant	: X				

031-1BF74 - AI 8x12Bit ±10V

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





0V D

Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	+AI 2	I	+ Channel 2
3	+AI 4	I	+ Channel 4
4	+AI 6	I	+ Channel 6
5	+AI 1	I	+ Channel 1
6	+AI 3	I	+ Channel 3
7	+AI 5	I	+ Channel 5
8	+AI 7	I	+ Channel 7

I: Input

In-/Output area

Input area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h
+8	AI 4	2	Analog value channel 4	6401h/s+4	05h
+10	AI 5	2	Analog value channel 5	6401h/s+5	06h

031-1BF74 - AI 8x12Bit ±10V > Technical data

Addr.	Name	Bytes	Function	IX	SX
+12	AI 6	2	Analog value channel 6	6401h/s+6	07h
+14	AI 7	2	Analog value channel 7	6401h/s+7	08h

#### Output area

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

## 3.15.1 Technical data

Order no.	031-1BF74
Туре	SM 031
Module ID	0415 15C5
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	8
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	✓
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V +10 V
	-10 V +10 V
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-

# Analog Input

031-1BF74 - AI 8x12Bit ±10V > Technical data

Order no.	031-1BF74
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no

# Analog Input

031-1BF74 - AI 8x12Bit ±10V > Technical data

Order no.	031-1BF74
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	16
Output bytes	0
Parameter bytes	14
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	in preparation

#### 3.15.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
SUPR	2	Interference frequency suppression	0000h	01h	3100h, 3101h	01h
CH0FN	1	Function number channel 0	12h	80h	3102h	02h
CH1FN	1	Function number channel 1	12h	81h	3103h	03h
CH2FN	1	Function number channel 2	12h	82h	3104h	04h
CH3FN	1	Function number channel 3	12h	83h	3105h	05h
CH4FN	1	Function number channel 4	12h	84h	3106h	06h
CH5FN	1	Function number channel 5	12h	85h	3107h	07h
CH6FN	1	Function number channel 6	12h	86h	3108h	08h
CH7FN	1	Function number channel 7	12h	87h	3109h	09h

SUPR Interference fre- quency suppression	Byte	Bit 15 0
quency suppression	0	<ul> <li>Bit 0, 1: Interference frequency suppression channel 0</li> <li>Bit 2, 3: Interference frequency suppression channel 1</li> <li>Bit 4, 5: Interference frequency suppression channel 2</li> <li>Bit 6, 7: Interference frequency suppression channel 3</li> <li>Bit 8, 9: Interference frequency suppression channel 4</li> <li>Bit 10, 11: Interference frequency suppression channel 5</li> <li>Bit 12, 13: Interference frequency suppression channel 6</li> <li>Bit 14, 15: Interference frequency suppression channel 7 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> </ul> </li> </ul>

10: 50Hz

\_

# CHxFN Function number channel x

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

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format (12h)	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

#### 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16204}$
	-2V	-3277	F333h	underrange	16384

# 3.15.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	08h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR	1	Channel-specific error channel 4	00h			0Eh
CH5ERR	1	Channel-specific error channel 5	00h			0Fh
CH6ERR	1	Channel-specific error channel 6	00h			10h
CH7ERR	1	Channel-specific error channel 7	00h			11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> </ul>
	<ul> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

031-1BF74 - AI 8x12Bit ±10V > Diagnostic data

MODTYP Module informa-		
tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> </ul>
		<ul> <li>Bit 4: set at channel information present</li> </ul>
		Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	Bit 3 0: reserved
		<ul> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>
CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>70h: Digital sectors.</li> </ul>
		<ul> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> </ul>
		<ul> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMPIT Disamostis bits		
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 08h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel 0</li> <li>Bit 1: set at error in channel 1</li> <li>Bit 2: set at error in channel 2</li> <li>Bit 3: set at error in channel 3</li> <li>Bit 4: set at error in channel 4</li> <li>Bit 5: set at error in channel 5</li> <li>Bit 6: set at error in channel 6</li> <li>Bit 7: set at error in channel 7</li> </ul>

031-1BF74 - AI 8x12Bit ±10V > Diagnostic data

CH0ERR CH7ERR Channel-specific	Byte	Bit 7 0
Channel-Specific	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring-/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
DIAG IIS us ticker		

#### DIAG\_US µs ticker

Буге	DIL 7 U
03	Value of the $\mu$ s ticker at the moment of the diagnostic

### µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

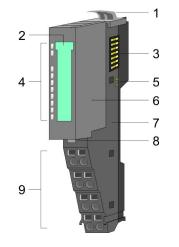
# 3.16 031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS)

Properties

The electronic module has one channel and is suited to connect it to a strain gauge DMS sensor in load cells, force transducer and torque measuring shaft. The module has a configurable input filter and supports diagnostic interrupt.

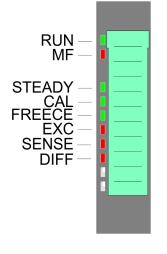
- 1-channel for connecting a full bridge
- Absolute accuracy (basic error ±0.1%)
- Manual calibration (zero and load adjustment)
- Configurable self-calibration (offset and gain error)
- Fast measurement by high signal bandwidth (ADC with 4 kHz limit frequency)
- Parametrizable IIR filter (300µs 3.6s or dynamic)
- Parametrizable 50/60 Hz rejection
- Programmable power supply for the load cell(s) / full bridge(s)
- Parallel operation of load cells possible
- Diagnostic function
- 16bit resolution (24bit internal)

#### 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**



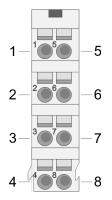
RUN	MF red	Description
		Bus communication is OK
		Module status is OK
	-	Bus communication is OK
		Module status reports an error
		Bus communication is not possible
		Module status reports an error
		Error at bus power supply
х		Error in configuration
^	2Hz	♦ Chapter 2.8 'Trouble shooting - LEDs' on page 30
not relevant	:: X	

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS)

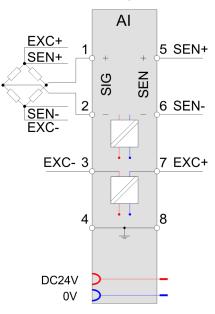
STEADY	CAL	FREECE	EXC	SENSE	DIFF	Description
green	green	green	red	<b>red</b>	red	Description
	Х	Х	Х	Х	Х	On in Steady State.
Х		Х	Х	Х	Х	On at active self-calibration
Х	Х		Х	Х	Х	On at activated Input-Freeze.
х	х	х		Х	х	On at short circuit respectively over- load of the excitation voltage.
х	х	х	х		х	On at overrange of the excitation voltage
х	х	х	х	Х		On at overrange of the differential voltage
not relevant	: X					

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Connection variants

#### Pin assignment



For wires with a core cross-section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	SIG+	I	+ Signal of the differential voltage $U_{SIG}$ of the measuring bridge
2	SIG-	I	- Signal of the differential voltage $U_{SIG}$ of the measuring bridge
3	EXC-	0	- Signal of the excitation voltage U <sub>EXC</sub>
4	Shield		Connection for cable shield
5	SEN+	1	+ Sensor of the excitation voltage U <sub>SEN</sub>
6	SEN-	I	- Sensor of the excitation voltage U <sub>SEN</sub>
7	EXC+	0	+ Signal of the excitation voltage U <sub>EXC</sub>
8	Shield		Connection for cable shield

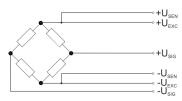
O: Output, I: Input



Please always use the excitation voltage  $U_{EXC}$  of the module! The connection of sensors with external power supply is not possible.

#### 3.16.1 Connection variants

#### 6 wire measurement



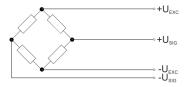
The following table shows the properties of the sensors, which can be used with the 6 wire measurement.

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Connection variants

#### Sensor properties

Excitation	Bridge resistance R <sub>B</sub>					
voltage U <sub>EXC</sub>	120Ω	350Ω	700Ω	1000Ω		
2.5V	Х	Х	Х	Х		
5V	Х	Х	Х	Х		
7.5V	Х	Х	Х	Х		
10V	Х	Х	Х	Х		
12V	Х	Х	Х	Х		

#### 4 wire measurement



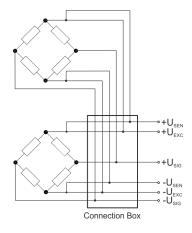
With the 4 wire measurement the  $U_{\text{SEN}}$  pins are not connected. With this operating mode there is an internal connection between  $U_{\text{EXC}}$  and  $U_{\text{SEN}}$ .

The following table shows the properties of the sensors, which can be used with the 4 wire measurement.

Excitation	Bridge resistance R <sub>B</sub>					
voltage U <sub>EXC</sub>	120Ω	350Ω	700Ω	1000Ω		
2.5V	Х	Х	Х	Х		
5V	Х	Х	Х	Х		
7.5V	Х	Х	Х	Х		
10V	Х	Х	Х	Х		
12V	Х	Х	Х	Х		

#### Sensor properties

#### **Parallel connection**



Normally large mechanical loads are divided to multiple strain gauge DMS load cells and these parallel connected via a connection box to the strain gauge DMS module. Please consider that the load cells are aligned together for this operating mode and approved by the manufacturer. And the current feed capacity of the transducer electronic should not be overloaded. The current feed capacity is derived from the number of parallel-connected load cells, excitation voltage  $U_{EXC}$  and the bridge resistance.

Depending on the excitation voltage U<sub>EXC</sub>, I<sub>EXC</sub> may not exceed a maximum current:

- 2.5V: maximum current 120mA
- 5V: maximum current 120mA
- 7.5V: maximum current 100mA
- 10V: maximum current 90mA
- 12V: maximum current 80mA

For the calculation of I<sub>EXC</sub> the following formula is used:

$$I_{EXC} = \frac{U_{EXC}}{\frac{R_B}{n}}$$

I<sub>EXC</sub> Supply current

U<sub>EXC</sub> Excitation voltage

R<sub>B</sub> Bridge resistance

n Number of parallel connections

The following tables show the properties of the sensors for e.g. 2 respectively 3 parallel connected load cells.

#### Example

2 parallel		Bridge res		
Excitation voltage	60Ω	175Ω	350Ω	500Ω
U <sub>EXC</sub>				
2.5V	Х	Х	Х	Х
5V	Х	Х	Х	Х
7.5V	not possible	Х	Х	Х
10V	not possible	Х	Х	Х
12V	not possible	Х	Х	Х

3 parallel	Bridge resistance R <sub>B</sub>							
Excitation voltage	40Ω	116.7Ω	233.3Ω	333.3Ω				
U <sub>EXC</sub>								
2.5V	Х	Х	Х	Х				
5V	not possible	Х	Х	Х				
7.5V	not possible	Х	Х	Х				
10V	not possible	Х	Х	Х				
12V	not possible	not possible	Х	Х				

To connect your sensors please always use shielded cables!

Please always use the excitation voltage  $U_{EXC}$  of the module! The connection of sensors with external power supply is not possible.

#### 3.16.2 In-/Output area

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h/7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

#### VIPA System SLIO

031-1CA20 - Al 1x16(24)Bit Strain gauge (DMS) > In-/Output area

#### Input area

Addr.	Name	Bytes	Function	IX	SX
+0	DMS_VAL	4	Measured value	5470h/s	01h
+3	DMS_STAT	1	Status	5471h/s	02h

#### DMS\_VAL measured value (weight value)

		Byte 0									Byte 1						
Bit number	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	
Significance	SG	2 <sup>30</sup>	2 <sup>29</sup>	2 <sup>28</sup>	2 <sup>27</sup>	2 <sup>26</sup>	2 <sup>25</sup>	2 <sup>24</sup>	2 <sup>23</sup>	2 <sup>22</sup>	2 <sup>21</sup>	2 <sup>20</sup>	2 <sup>19</sup>	2 <sup>18</sup>	2 <sup>17</sup>	2 <sup>16</sup>	
31Bit+SG	SG							Measu	ured va	alue							

		Byte 2									Byte 3						
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Significance	2 <sup>15</sup>	2 <sup>14</sup>	2 <sup>13</sup>	<b>2</b> <sup>12</sup>	2 <sup>11</sup>	<b>2</b> <sup>10</sup>	2 <sup>9</sup>	2 <sup>8</sup>	27	2 <sup>6</sup>	<b>2</b> <sup>5</sup>	24	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>	
2404100								Maaau	red ve	lua							

31Bit+SG

... Measured value

#### DMS\_STAT Status

Addr.	Name	Bytes	Function
+3	DMS_STAT	1	<ul> <li>Status byte</li> <li>Bit 0: 1 = <i>Input Freeze</i> active</li> <li>Bit 1: 1 = <i>Steady State</i> active *</li> <li>Bit 2: 1 = Self-calibration is running *</li> <li>Bit 3: 1 = Tara was changed</li> <li>Bit 4: 1 = Error in adjustment</li> <li>Bit 5: 1 = Adjustment was changed</li> <li>Bit 6: reserved</li> <li>Bit 7: 1 = Zero balance respectively reference point set</li> </ul>

\*) These status bits are set by internal event of the module.

- Input Freeze
  - In the activated state no measurement values are passed to the digital filter.
  - As long as the command bit is set, this bit remains set.
- Steady State
  - As soon as a measured value is longer than the time *SSW* within the tolerance window *SST*, in the status word the *Steady State* bit is set.
  - As soon as this condition is not true, the last measured value is first used, the comparison timer restarted and the bit is reset.
  - The values SSW and SST can be specified by the parametrization. Schapter 3.16.5 'Parameter data' on page 182
- Self calibration
  - As long as the self calibration is active, this bit is set.
  - During the self calibration there are two reference values internally measured and based on this the internal offset & factor are calculated.
  - With the self calibration the internal offset and gain error may be compensated.
  - The calibration interval *CI* can be preset by the parametrization.

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > In-/Output area

- Tara
  - When setting or clearing the tare value, this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.
- Adjustment
  - When you save or delete the adjustment data, this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.
- Zero balance respectively reference point
  - When setting the zero balance respectively reference point this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.

Output area	Addr.	Name	Bytes	Function	IX	SX
	+0	DMS_CMD	1	Command byte	5670h/s	01h

#### DMS\_CMD

Addr.	Name	Bytes	Function
+0	DMS_CMD	1	<ul> <li>Command byte Each set bit in DMS_CMD is acknowledged by a bit in DMS_STAT.</li> <li>Bit 0: Activate Input Freeze → DMS_STAT bit 0: active</li> <li>Bit 1: Store adjustment → DMS_STAT bit 5: active</li> <li>Bit 2: Delete adjustment → DMS_STAT bit 5: active</li> <li>Bit 3: Set Tara → DMS_STAT bit 3: active</li> <li>Bit 4: Delete Tara → DMS_STAT bit 3: active</li> <li>Bit 5: reserved</li> <li>Bit 6: Set zero point → DMS_STAT bit 7: active</li> <li>Bit 7: Set reference point → DMS_STAT bit 7: active</li> </ul>
		  Adju             	It Freeze In the activated state no measurement values are passed to the digital filter. By a brief activation of <i>Input Freeze</i> pulses, e.g. caused by a filling procedure can be prevented, which would override the filter unnecessarily. The status of <i>Input Freeze</i> can be determined at any time via bit 0 of DMS_STAT. Istment Store adjustment: Used to store the adjustment data when loaded with the refer- ence weight. Delete adjustment: Used to delete the adjustment data. With both commands bit 5 of DMS_STAT is set. In case of error bit 4 is set. A Set Tara: The current value is taken as tara. Delete Tara: Tara is reset to 0. With both commands bit 3 of DMS_STAT is set. b balance respectively reference point Both commands are used for user adjustment and on both commands bit 7 of DMS_STAT is set. Set zero balance: Used to set the balance to 0 when operated without load. Set reference point: Used to adjust the balance when it is loaded with a reference weight.

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Technical data

# 3.16.3 Technical data

Order no.	031-1CA20
Туре	SM 031
Module ID	0841 1809
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data strain gauge DMS inputs	
Number of inputs	1
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	18 mA
Relative accuracy according to self-calibration	+/-0.01%
Operational limit Usense	+/-0.2%
Operational limit Usig	+/-0.2%
Basic error limit Usense	+/-0.1%
Basic error limit Usig	+/-0.1%
Destruction limit current	max. 12V
External bridge supply possible	-
Internal bridge supply possible	$\checkmark$
Configurable bridge supply	2.5V / max. 120mA
	5V / max. 120mA
	7.5V / max. 100mA
	10V / max. 90mA
	12V / max. 80mA
Resolution in bit	24
Measurement principle	successive approximation
Basic conversion time	1ms cycle, 10ms330ms depending on the filter
Input filter hardware	Low pass 10kHz 3rd order
Input filter software	dynamic IIR filter
	configurable IIR filter 0.1Hz1000Hz
Initial data aina	configurable FIR filter 50Hz/60Hz
Initial data size	4 Byte
Data for selecting of the strain gauge DMS sensor	0 121/
Bridge supply voltage EXC	012V
Bridge differential voltage SIG	+/-29mV
Rated output	0.54mV/V

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Technical data

Information, alarms, diagnosticslisplayyestsyes,alarmnostic interruptyes,stic functionsyes,stics information read-outposserror displayred L	1CA20
e bridge configuration symm information, alarms, diagnostics yes lisplay yes ts yes, alarm no stic interrupt yes, stic functions yes etics information read-out poss error display red L	
Information, alarms, diagnosticslisplayyestsyes,alarmnostic interruptyes,stic functionsyesstics information read-outposserror displayred L	
lisplayyestsyes,alarmnotic interruptyes,tic functionsyes,tics information read-outposserror displayred L	metric full bridge
ts yes, alarm no stic interrupt yes, stic functions yes stics information read-out poss error display red L	
alarm no yes, tic interrupt yes, tic functions yes error display red L	
tic interruptyes,stic functionsyesstics information read-outposserror displayred L	parameterizable
error display red L	
error display red L	parameterizable
error display red L	
	sible
	LED
l error display red L	LED
n	
h channels and backplane bus $\checkmark$	
tential difference between circuits -	
tential difference between inputs (Ucm) -	
tential difference between Mana and Mintern -	
tential difference between inputs and Mana (Ucm) -	
tential difference between inputs and Mintern DC 7	75 V/ AC 50 V
tential difference between Mintern and outputs -	
on tested with DC 5	500 V
es	
tes 5	
bytes 1	
ter bytes 30	
tic bytes 20	
9	
PC /	
g Profil	PPE GF10
ical data	PPE GF10 ile rail 35 mm
ons (WxHxD) 12.9	
60 g	

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Functionality

Order no.	031-1CA20
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	in preparation

### 3.16.4 Functionality

### 3.16.4.1 Basics - Strain gauge DMS

Strain gauge DMS

Strain gauge DMS are fixed directly on a body or part of a sensor and serve for the following possibilities:

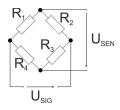
- Measurement of strains, compressions or torsions
- Measurement of forces and movements
- There are the following strain gauge DMS types:
- electrical strain gauge DMS
  - An electrical strain gauge DMS consists of a carrier material (e.g. stretchable plastic film) with applied metal film. From this a grid of electrically conductive resistive material is created. During the measurement the behavior is used, that e.g. at the elongation of a metallic conductor resistance its length increases and its diameter decreases. Here the electrical resistance increases proportionally.
- optical strain gauge DMS
  - An optical strain gauge DMS consists of a fibre used as a sensor, with a laserapplied grid in the fibre. During the measurement the behavior is used, that with mechanical load the optical properties of the sensor are changed. Light is passed with a certain wavelength into the sensor. Depending on the deformation of the laser-applied grid of the sensor, a part of the light is reflected and evaluated with a suitable sensor (interrogator).

Characteristics of an strain gauge DMS

- Nominal load
  - Maximum permissible load for normal operation.
  - The nominal load is preset unit-free.
- Rated output
  - The rated output is a measure of the sensitivity of the resistance bridge in dependence of the used excitation voltage.
  - A typical value for a full bridge is 2mV/V, this means at nominal load with an excitation voltage of 12V the bridge differential voltage is ±24mV.
  - The common area is 0.5...4mV/V, depending on the bridge and sensor type.

#### 3.16.4.2 Function

### Measurement



To get a weight value a power supply is applied to the bridge circuit and a differential voltage (U<sub>SIG</sub>) and excitation voltage (U<sub>SEN</sub>) are measured. The principle of measurement is based on that the differential voltage U<sub>SIG</sub> of the bridge changes with a deformation. Thus, a relative weight value is calculated by the difference of the both voltages U<sub>SIG</sub> and U<sub>SEN</sub>, which are measured at the same time. The resulting difference is converted to a weight value and stored as process data in the input area.

### Weight value determination

With the exception of differential and excitation voltage the remaining values are to be preset by the parametrization. The resulting weight value Y is determined within the module via the following formulas:

- Relative value Y<sub>R</sub>
- U<sub>SIG</sub> Measured differential voltage of the measuring bridge
- U<sub>SEN</sub> Measured excitation voltage

 $Y_{R} = \frac{U_{SIG}}{U_{SEN}}$ RO Rated output

 $Y_A = Y_R \cdot NL \cdot SF$ 

 $Y = Y_A \cdot GN + TA$ 

- Y<sub>A</sub> Absolute value Y<sub>R</sub> Relative value
- NL Nominal load
- SF Scale factor
- Y Resulting weight value
  - Y<sub>A</sub> Absolute value GN Gain TA Tara

#### 3.16.5 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

### **Parameters**

Due to the extensive parameter data you can use up to 8 of these modules with a PROFIBUS slave system.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostic interrupt *	00h	00h	3100h	01h
UEXC	1	Excitation voltage *	00h	01h	3101h	02h
CAL	2	Calibration interval *	0000	01h	3102h	03h
MEAS	1	Measurement method	23h	80h	3104h	04h
FILT	1	Filter selection	00h	80h	3105h	05h
DFCT	2	Dynamic filter change time	10h	80h	3106h	06h
DFD	2	Dynamic filter delta	20h	80h	3108h	07h

Name	Bytes	Function	Default	DS	IX	SX
RO	2	Rated output	4E20h	80h	310Ah	08h
ZB	2	Zero balance	0000h	80h	310Ch	09h
GN	2	Gain	1000h	80h	310Eh	0Ah
TA	2	Tara	0000h	80h	3110h	0Bh
NL	2	Nominal load	0002h	80h	3112h	0Ch
SF	2	Scale factor	03E8h	80h	3114h	0Dh
SST	2	Steady state tolerance	0005h	80h	3116h	0Eh
SSW	2	Steady state window	03E8h	80h	3118h	0Fh
RL	4	Reference load	00000100	80h	311Ah	10h
*) This record set may only be transferred at STOP state.						

**DIAG\_EN Diagnostic inter**rupt

Byte	Bit 7 0
0	<ul> <li>Diagnostic interrupt</li> <li>00h: disable</li> <li>40h: enable</li> </ul>

Here you activate respectively de-activate the diagnostic function. 

### **UEXC** select power supply

Byte	Bit 7 0
0	<ul> <li>Power supply         <ul> <li>00h: 2.5V</li> <li>01h: 5V</li> <li>02h: 7.5V</li> <li>03h: 10V</li> <li>04h: 12V</li> </ul> </li> </ul>

Here you can specify the power supply for the excitation voltage U<sub>EXC</sub>, which the module provides via the pins EXC+ und EXC-.



Please always use the excitation voltage U of the module<sub>FXC</sub>! The connection of strain gauge DMS sensors with external power supply is not possible.

### **CAL** Calibration interval

Byte	Bit 7 0
01	<ul> <li>Interval for the calibration.</li> <li>Calibration interval as 100ms value</li> <li>00h: de-activates the calibration</li> </ul>
By sett	ing a calibration interval as 100ms value, the self-calibration is always per-

- formed after this time.
- With the self-calibration the internal offset and gain error may be compensated.
- There is always the entire signal path including all passive components checked.

- During self-calibration, the CAL LED is on an the measured value is frozen.
- 00h de-activates the calibration.

MEAS	Measurement
metho	t

Byte	Bit 7 0
0	<ul> <li>Measurement method</li> <li>23h: 6 wire measurement</li> <li>25h: 4 wire measurement</li> <li>FFh: de-activated</li> </ul>

Here you can choose between 4 and 6 wire measurement respectively disable the measurement.

### **FILT Filter selection**

Byte	Bit 7 0
0	<ul> <li>Filter selection         <ul> <li>00h: Filter de-activated</li> <li>01h: Activate dynamic IIR filter</li> <li>02h: IIR1</li> <li>03h: IIR2</li> <li>04h: IIR3</li> <li>05h: IIR4</li> <li>06h: IIR5</li> <li>07h: IIR6</li> <li>08h: IIR7</li> <li>09h: IIR8</li> <li>0Ah: FIR 50Hz</li> <li>0Bh: FIR 60Hz</li> </ul> </li> </ul>
Filter funct	
– Su ■ Dynam – aut	ppression of mains frequency interference nic IIR filter comatic selection er selection dependent on the current weight change

- Static IIR filter
  - De-activation respectively fix setting of a filter level (IIR1...IIR8)

DFCT Dynamic Filter Change Time	Byte	Bit 7 0
	01	Sampling rate for filter change-over in ms
	Here y	ou can specify the time for re-evaluation for the filter change-over in ms.
Dynamic filter delta	Byte	Bit 7 0
	01	Limit value for filter change-over
	Here y	ou can specify the limit value for the filter change-over.
RO Rated output	Byte	Bit 7 0
	01	Rated output in 0.0001mV/V

Here you can specify the rated output in 0.0001mV/V. Information to the rated output can be found in the data sheet of you force transducer.

ZB Zero balance	Byte	Bit 7 0		
	01	Zero balance in 0.0001mV/V		
		ou can specify the zero balance as 0.0001mV/V value. Information to the zero e can be found in the data sheet of you force transducer.		
GN Gain	Byte	Bit 7 0		
	01	Gain for user scaling of the output value		
	Here you can specify a factor as 2 <sup>-12</sup> value. The factor is multiplied with the output value.			
TA Tara	Byte	Bit 7 0		
	01	User offset for the output value		
	Here you output	ou can specify an offset as 2 <sup>-12</sup> value. The offset is added to the determined value.		
NL Nominal load	Byte	Bit 7 0		
	01	Nominal load of the force transducer		
		ou can specify the nominal load of the force transducer unit-free. Information to I load can be found in the data sheet of you force transducer.		
SF Scale factor	Byte	Bit 7 0		
	01	Scale factor for the nominal load		
		ou can specify the scale factor for the nominal load, such as to convert kg to g. ample: Nominal load in kg and scale factor 1000 (03E8h) results display in g.		
SST Steady state toler- ance	Byte	Bit 7 0		
	01	Tolerance for Steady State		
	as a de – Exa	bu can specify a tolerance window for the state <i>Steady State</i> . This is specified eviation of the scaled nominal load. Ample: With a rated load in kg and scaling factor of 1000 (03E8h) you must ecify the value 0005h to set a tolerance window of 5g.		
SSW Steady state window	Byte	Bit 7 0		
	01	Time interval for <i>Steady State</i> in ms		

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- Here you can specify a time interval for the setting of the Steady State bit (DMS\_STAT-Bit 1).
- If the measured value is within the tolerance window SST longer than the time interval SSW, then bit 1 of the status word DMS\_STAT is set.

### **RL Reference load**

Byte	Bit 7 0
03	Reference load for the calibration

Here you can specify the reference load for the calibration unit-free. The reference load must be at least 20% of the Nominal load NL.

### 3.16.6 Deployment of the filter functions

05h: IIR4

Overview	The module has the tion: FIR 50/60 Hz Dynamic IIR filt Static IIR filter	,	ns, which can be activa	ited via the parametriza-			
FIR 50/60 Hz	In the parametrization via FILT you can specify the filter <i>FIR 50 Hz</i> respectively <i>FIR 60 Hz</i> . These filters acts a notch filter. Notch filter generate at the configured frequency and the multiple thereof zeros (notches) in the frequency response. They attenuate these frequencies here in the amplitude. When filters are used, these influence the conversion time of your module. The higher the filter frequency, the faster the conversion time. This can be used for the suppression of mains frequency interferences.						
Dynamic IIR filter	<ul> <li>By activation of the dynamic IIR filter in the FILT parameter, dependent on the overage weight change, it is automatically switched between 8 different filters. The aim is to obtain a filter with the best possible damping, which must lead to stable mean values. The <i>Dynamic IIR filter</i> acts as 1. order low-pass filter and has the follow properties:         <ul> <li>If there is a rapid change of the input value, it is switched-over to the next log filter (e.g. IIR1→IIR2). In this way the load changes are less precise, but it is faster recognized.</li> <li>If there is small change in the measured value, it is switched-over to the new higher filter (e.g. IIR2→IIR1), so you will get a higher precision.</li> <li>With the IIR1 filter you get the lowest noise suppression and the most unstameasured value.</li> <li>With the IIR8 filter you get the highest noise suppression and the most stable measured value.</li> <li>The revaluation, which can lead to a modification of the filter levels, takes p a fixed interval, which can be specified via parameter <i>DFCT</i> in ms.</li> </ul> </li> </ul>						
	Filter level	Limit frequency	Filter constant	Rise time 10-90% [s] (typ.)			
	02h: IIR1	1000	a <sub>0</sub> = 0.5	0.0003			
	03h: IIR2	500Hz	a <sub>0</sub> = 0.25	0.0008			
	04h: IIR3	125Hz	a <sub>0</sub> = 62.5x10 <sup>-3</sup>	0.0035			

30Hz

 $a_0 = 15.6 \times 10^{-3}$ 

0.014

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Steady state detection

Filter level	Limit frequency	Filter constant	Rise time 10-90% [s] (typ.)
06h: IIR5	8Hz	a <sub>0</sub> = 3.91x10 <sup>-3</sup>	0.056
07h: IIR6	2Hz	a <sub>0</sub> = 977x10 <sup>-6</sup>	0.225
08h: IIR7	0.5Hz	a <sub>0</sub> = 244x10 <sup>-6</sup>	0.9
09h: IIR8	0.1Hz	a <sub>0</sub> = 61.0x10 <sup>-6</sup>	3.6



### Prevent overriding the filter

By a brief activation of Input Freeze in the command byte DMS\_CMD pulses, e.g. caused by a filling procedure can be prevented, which would override the filter unnecessarily. As soon as Input Freeze is activated, no measurement values are passed to the digital filter.

Static IIR filter Via the FILT parameter you can de-activate the filter function or you can specify a fix filter level (IIR1...IIR8).

### 3.16.7 Calibration

Proceeding

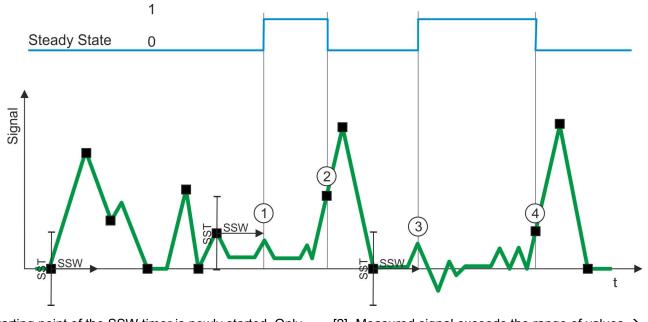
Please use for the calibration the software filter IR8 (slow). The following steps are necessary for the calibration:

- **1.** Specify in the parametrization the *Reference load* RL. The *Reference load* must be at least 20% of the *Nominal load*.
- **2.** Operate the balance without load.
- **3.** As soon as a stable value is shown, bit 6 (set zero point) in the command byte *DMS\_CMD* is to set.
- **4.** Apply the balance with the reference load. As soon as a stable value is shown, bit 7 (set reference point) in the command byte *DMS\_CMD* is to set.
- 5. Set bit 1 (store adjustment) in the command byte DMS\_CMD.
  - ⇒ As soon as the adjustment data were stored successfully, the module measures with these parameters. The adjustment data remain even after a power loss condition and can be deleted (delete adjustment) via bit 2. The adjustment data can be rewritten only every 120 seconds.

### 3.16.8 Steady state detection

**Functionality** 

- If the measured value is within the range of values SST longer than the the time interval SSW, then bit 1 (steady state active) of the status word DMS\_STAT is set. The current measured value is used as the starting point for the range of values and the steady state timer is started. 'DMS\_STAT Status' on page 177
- If the measured value remains within SST over the period SSW, the steady-state bit is set.
- If the tolerance range SST is exceeded, the last measured value is used as starting point and the time is newly started.
- The values SSW and SST can be specified by the parametrization. Chapter 3.16.5 'Parameter data' on page 182



Starting point of the SSW timer is newly started. Only when the measured signal is longer than the time SSW within the range of values SST, steady state is set.

 SSW timer has expired and the measured signal is within the range of values → Steady state bit is set.

- [2] Measured signal exceeds the range of values → Steady state bit is reset.
- [3] SSW timer has expired and the measured signal is within the range of values → Steady state bit is set.
- [4] Measured signal exceeds the range of values → Steady state bit is reset.

### 3.16.9 Diagnostics

### **Diagnostic data**

Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

The following events can cause a diagnostic interrupt:

- External auxiliary supply is missing
- Internal diagnostic puffer overflow
- Internal communication error
- Project engineering/parametrization error
- Measuring range underflow
- Measuring range overerflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Diagnostics

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	01h			08h
CHERR	1	Channel error	00h			09h
CHxERR	8	Channel-specific error channel x	00h			0Ah11h
DIAG_US	4	µs ticker	00h			13h

0 Bit 0: set at module failure Bit 1: reserved	ERR_A Diagnostic	Byte	Bit 7 0
<ul> <li>Bit 1: reserved</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>		0	<ul> <li>Bit 1: reserved</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_C reserved	Byte	Bit 7 0
	0	reserved

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Diagnostics

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
	0	
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of the module (here 01h)
CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel 0
CHxERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel 0
		<ul> <li>Bit 0: set at project engineering respectively parametrization error</li> <li>Bit 21: reserved</li> <li>Bit 3: set at short circuit of excitation voltage U<sub>EXC</sub></li> <li>Bit 54: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
	17	reserved

# DIAG\_US µs ticker

0.3 Value of the us ticker at the moment of the diagnostic	Byte	Bit 7 0
value of the particle at the moment of the diagnostic	03	Value of the $\mu$ s ticker at the moment of the diagnostic

# µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

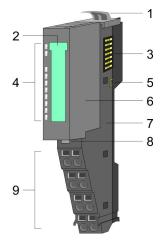
#### 3.17 031-1CB30 - AI 2x16Bit 0...10V

### **Properties**

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog inputs
- Suited for sensors with 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

### Structure



### Status indication

RUN MF

AI 0

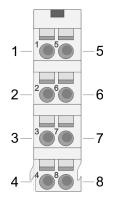
AI 1

- Locking lever terminal module 1
- 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

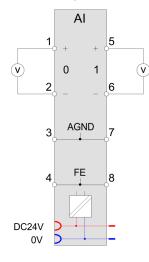
RUN	MF <b>e</b> red	Al x	Description
-		х	Bus communication is OK
		Λ	Module status is OK
	_	х	Bus communication is OK
	-	^	Module status reports an error
_	_	x	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
		•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant: 2	х		

031-1CB30 - AI 2x16Bit 0...10V

### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	AGND	I	Reference potential for
			differential-mode input
4	FE	L	Functional ground for cable shield
			(an additional shield bus carrier is not necessary)
5	+AI 1	I	+ Channel 1
6	-Al 1	I	Ground Channel 1
7	AGND	I	Reference potential for
			differential-mode input
8	FE	I	Functional ground for cable shield
			(an additional shield bus carrier is not necessary)

I: Input

### In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

### Input area

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

031-1CB30 - AI 2x16Bit 0...10V > Technical data

# Output area

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

# 3.17.1 Technical data

Order no.	031-1CB30
Туре	SM 031
Module ID	040A 1543
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-

# Analog Input

031-1CB30 - AI 2x16Bit 0...10V > Technical data

Order no.	031-1CB30
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	

031-1CB30 - AI 2x16Bit 0...10V > Technical data

Order no.	031-1CB30
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

031-1CB30 - AI 2x16Bit 0...10V > Parameter data

### 3.17.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	10h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	10h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch

\* This record set may only be transferred at STOP state.

DIAG_	EN	Diagnostic	inter-
rupt			

Byte	Bit 7 0
0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit	value
monito	oring	g	

Byte	Bit 7 0
0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>

SUPR Interference frequency suppression

Byte	Bit 7 0
0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0 <ul> <li>00: deaktiviert</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 3, 2: Interference frequency suppression channel 1 <ul> <li>00: deaktiviert</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 7 4: reserved</li> </ul>

# CHxFN Function number channel x

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

### 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16204}$
	-2V	-3277	F333h	underrange	16384

# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

# 3.17.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	Х	-
Measuring range overflow	-	Х	-

**Process interrupt** 

031-1CB30 - AI 2x16Bit 0...10V > Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit overflow channel 0</li> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

PRIT\_UL Limit underflow

Byte	Bit 7 0
0	<ul> <li>Bit 0: Limit underflow channel 0</li> <li>Bit 1: Limit underflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

### PRIT\_US µs ticker

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

### µs ticker

In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again. PRIT\_US represents the lower 2 byte of the  $\mu$ s ticker value (0 ... 2<sup>16</sup>-1).

### **Diagnostic data**

Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Process interrupt lost
- Power supply failed
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

# ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> </ul>
		<ul> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> </ul>
		<ul> <li>Bit 7: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0

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

### **NUMCH Channels**

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

**VIPA System SLIO** 

### CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

### CH0ERR CH1ERR Channel-specific

Byte	Bit 7 0						
0	Channel-specific error channel x:						
	<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>						

DIAG\_US µs ticker

03 Value of the µs ticker at the moment of the diagnostic	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic

### µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

031-1CB40 - AI 2x16Bit 0(4)...20mA

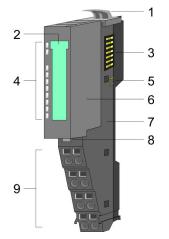
# 3.18 031-1CB40 - AI 2x16Bit 0(4)...20mA

### Properties

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog inputs
- Suited for sensors with 0 ... 20mA;
   4 ... 20mA with external supply
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

# Structure



# Status indication

RUN MF

> AI 0 AI 1

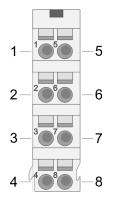
- 1 Locking lever terminal module
- 2 Labeling strip3 Backplane bus
- 3 Backplane bus4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

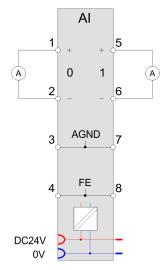
red	Al x	Description
	х	Bus communication is OK Module status is OK
	x	Bus communication is OK Module status reports an error
	х	Bus communication is not possible Module status reports an error
	Х	Error at bus power supply
ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
	•	<ul><li>Error channel x</li><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
		.       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X         .       X

031-1CB40 - AI 2x16Bit 0(4)...20mA

### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	AGND	I	Reference potential for
			differential-mode input
4	FE	I	Functional ground for cable shield
			(an additional shield bus carrier is not neces- sary)
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	AGND	I	Reference potential for
			differential-mode input
8	FE	I	Functional ground for cable shield
			(an additional shield bus carrier is not neces- sary)

# I: Input



If a 2wire measuring transducer is used, you have to connect in line an external power supply.

### In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1CB40 - AI 2x16Bit 0(4)...20mA > Technical data

Input area

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

# Output area

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

# 3.18.1 Technical data

Order no.	031-1CB40
Туре	SM 031
Module ID	040B 1543
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA

031-1CB40 - AI 2x16Bit 0(4)...20mA > Technical data

Order no.	031-1CB40
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB (UCM<4V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable

# Analog Input

Order no.	031-1CB40
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 3 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 3.18.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	31h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	31h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch

\* This record set may only be transferred at STOP state.

DIAG_EN Diagnostic inter- rupt	Byte	Bit 7 0
	0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit	value
monite	oring	g	

Byte	Bit 7 0				
0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>				

031-1CB40 - AI 2x16Bit 0(4)...20mA > Parameter data

SUPR Interference fre- quency suppression	Byte	Bit 7 0
4	0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0 <ul> <li>00: deaktiviert</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 3, 2: Interference frequency suppression channel 1 <ul> <li>00: deaktiviert</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 7 4: reserved</li> </ul>

# CHxFN Function number channel x

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

### 0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
0 20mA	23.52mA	32511	7EFFh	overrange	D 27649 I	
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{I}{20}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange	27648	
0 20mA	25.00mA	20480	5000h	overrange	D ICODA I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$	
S5 format	10mA	8192	2000h			
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$	
	-4,00mA	-3277	F333h	underrange	16384	
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$	
Siemens	20mA	27648	6C00h	nominal range	16	
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$	
(30h)	4mA	0	0000h		$I = D \cdot \frac{1}{27648} + 4$	
	1.19mA	-4864	ED00h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$	
Siemens S5 format	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$	
	12mA	8192	2000h		. 16	
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$	
	0.8mA	-3277	F333h	underrange		

### CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

# 3.18.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project	-	Х	-
engineering/parameterization			
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

PRIT	OL	Limit	overflow	

Byte	Bit 7 0
0	<ul> <li>Bit 0: Limit overflow channel 0</li> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

PRIT_UL Limit underflow	Byte	Bit 7 0			
	0	Bit 0: Limit underflow channel 0			
		<ul> <li>Bit 1: Limit underflow channel 1</li> <li>Bit 7 - 2: recorded</li> </ul>			
		Bit 7 2: reserved			
PRIT_US μs ticker	Byte	Bit 7 0			
	0 1	Value of the µs ticker at the moment of the diagnostic.			
	PRIT_US µ	s ticker			
	counting wit	module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts h 0. After 232-1 $\mu$ s the timer starts with 0 again. PRIT_US represents the of the $\mu$ s ticker value (0 2 <sup>16</sup> -1).			
Diagnostic data	Via the parameterization you may activate a diagnostic interrupt for the module. diagnostics interrupt the module serves for diagnostics data for diagnostic interr As soon as the reason for releasing a diagnostic interrupt is no longer present, t nostic interrupt <sub>going</sub> automatically takes place. All events of a channel between d interrupt <sub>incoming</sub> and diagnostic interrupt <sub>going</sub> are not stored and get lost. Within thi window (1. diagnostic interrupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-L module is on.				
	The followin	g errors are listed in the diagnostics data:			
	<ul> <li>Error in project engineering / parameterization</li> </ul>				
		ng range overflow			
		ng range underflow interrupt lost			
	<ul> <li>Power supply failed</li> </ul>				
		rd set for access via CPU, PROFIBUS and PROFINET. The access happens S 01h. Additionally the first 4 bytes may be accessed by DS 00h.			
		for access via CANopen. The access happens by IX 2F01h. Additionally the bytes may be accessed by IX 2F00h.			

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels of a module	02h			08h

Name	Bytes	Function	Default	DS	IX	SX
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERRCH7 ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR	Α	Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> </ul>
		<ul><li>Bit 4: set at channel information present</li><li>Bit 7 5: reserved</li></ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>

CHTYP	Channel	type
-------	---------	------

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

NUMPIT Disamostic bits			
NUMBIT Diagnostic bits	Byte	Bit 7 0	
	0	Number of diagnostic bits per channel (here 08h)	
NUMCH Channels	-		
NOMER Channels	Byte	Bit 7 0	
	0	Number of channels of a module (here 02h)	
CHERR Channel error	Byte	Bit 7 0	
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>	
CH0ERR CH1ERR	Desta		
Channel-specific	Byte	Bit 7 0	
	0	Channel-specific error channel x:	
		Bit 0: set at configuring/parameter assignment error	
		<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> </ul>	
		<ul> <li>Bit 5: set at measuring range underflow</li> </ul>	
		<ul> <li>Bit 7: set at measuring range overflow</li> </ul>	
CH2ERR CH7ERR			
reserved	Byte	Bit 7 0	
	0	reserved	
DIAG_US µs ticker	Byte	Bit 7 0	
	03	Value of the $\mu$ s ticker at the moment of the diagnostic	
	us ticker		

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

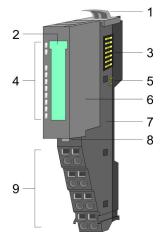
# 3.19 031-1CB70 - AI 2x16Bit ±10V

# Properties

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog inputs
- Suited for sensors with ±10V, 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

# Structure



# Status indication

RUN MF

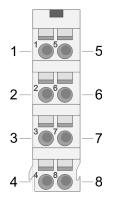
> AI 0 AI 1

- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

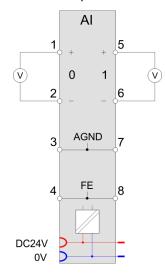
cation is OK s is OK
cation is OK reports an error
cation is not possible reports an error
ower supply
uration & Chapter 2.8 'Trouble Ds' on page 30
x ves measuring range arameterization

031-1CB70 - AI 2x16Bit ±10V

### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	AGND	I	Reference potential for
			differential-mode input
4	FE	I	Functional ground for cable shield
			(an additional shield bus carrier is not neces- sary)
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	AGND	I	Reference potential for
			differential-mode input
8	FE	I	Functional ground for cable shield
			(an additional shield bus carrier is not neces- sary)

I: Input

### In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

### Input area

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

031-1CB70 - AI 2x16Bit ±10V > Technical data

# Output area

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

# 3.19.1 Technical data

Order no.	031-1CB70
Туре	SM 031
Module ID	040C 1543
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-

# Analog Input

031-1CB70 - AI 2x16Bit ±10V > Technical data

Order no.	031-1CB70
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel

031-1CB70 - AI 2x16Bit ±10V > Technical data

Order no.	031-1CB70
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

031-1CB70 - AI 2x16Bit ±10V > Parameter data

#### 3.19.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	12h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CHOLL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	12h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch

\* This record set may only be transferred at STOP state.

DIAG_EN Diagnostic inter- rupt	Byte	Bit 7 0
	0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit	value
monitoring			

Byte	Bit 7 0
0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>

031-1CB70 - AI 2x16Bit ±10V > Parameter data

SUPR Interference frequency suppression

Byte	Bit 7 0
0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 3, 2: Interference frequency suppression channel 1 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>Bit 7 4: reserved</li> </ul>

# CHxFN Function number channel x

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

#### ±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D = U = U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

0	••••	10V
0	•••	10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h	U = D	$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$D = 10384 \cdot \frac{10}{10}$
(20h)	5V	8192	2000h		
	0V 0 0000h U	$U = D \cdot \frac{10}{16384}$			
	-2V	-3277	F333h	underrange	16384

#### CHxUL / CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

### 3.19.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project	-	Х	-
engineering/parameterization			
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

#### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

#### SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit overflow channel 0</li> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

0	= Dit 0.1 imit underflow shannel 0
	<ul> <li>Bit 0: Limit underflow channel 0</li> <li>Bit 1: Limit underflow channel 1</li> <li>Bit 7 2: reserved</li> </ul>

PRIT_US μs ticker	Byte	Bit 7 0
	0 1	Value of the µs ticker at the moment of the diagnostic.
	µs-ticker	
	counting with	nodule there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again. PRIT_US represents the lower $\mu$ s ticker value (0 2 <sup>16</sup> -1).

**Diagnostic data** Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Process interrupt lost
- Power supply failed

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

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

MODTYP Module informa- tion	Byte
	0

1-	Byte	Bit 7 0
	0	Bit 3 0: module class
		<ul> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> </ul>
		Bit 7 5: reserved

ERR_D Diagnostic	Dute	D:4 7 0
	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> </ul>
		<ul> <li>Bit 4: set at internal communication error</li> </ul>
		Bit 5: reserved
		Bit 6: set at process interrupt lost
		Bit 7: reserved
CHTYP Channel type	Byte	Bit 7 0
	0	Bit 6 0: Channel type
		– 70h: Digital input
		<ul> <li>71h: Analog input</li> <li>70h: Disital autout</li> </ul>
		<ul> <li>72h: Digital output</li> <li>73h: Analog output</li> </ul>
		<ul> <li>74h: Analog input/-output</li> </ul>
		– 76h: Counter
		Bit 7: reserved
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels		
	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel group 0
		Bit 1: set at error in channel group 1
		Bit 7 2: reserved
		- ·
CH0ERR/CH1ERR	Byte	
CH0ERR/CH1ERR Channel-specific	Byte 0	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> </ul>
	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x:</li> </ul>
	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> </ul>
	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> </ul> </li> </ul>
	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> </ul> </li> </ul>
	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> </ul> </li> </ul>
Channel-specific	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> </ul> </li> </ul>
Channel-specific CH2ERR CH7ERR	-	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> </ul> </li> </ul>
Channel-specific	0	<ul> <li>Bit 7 2: reserved</li> <li>Bit 7 0</li> <li>Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul> </li> </ul>

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

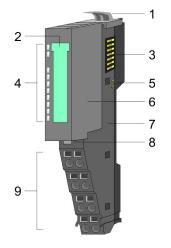
# 3.20 031-1CD30 - AI 4x16Bit 0...10V

#### Properties

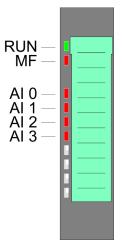
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Chapter 3.21 '031-1CD35 AI 4x16Bit 0...10V' on page 236 with limited parameter set

Structure



#### Status indication



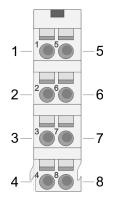
RUN	MF	Al x	Description	
green	red	red	Description	
-		х	Bus communication is OK	
-			Module status is OK	
-	-	х	Bus communication is OK	
	-	^	Module status reports an error	
	_	х	Bus communication is not possible	
	-	^	Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
			Error channel x	
	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
not relevant: X				

# Locking lever terminal module Labeling strip

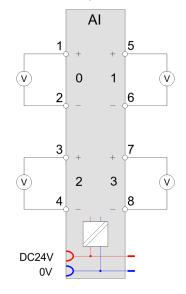
- 2 Labeling strip3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1CD30 - AI 4x16Bit 0...10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

Input area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

031-1CD30 - AI 4x16Bit 0...10V > Technical data

# Output area

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

# 3.20.1 Technical data

Current consumption from backplane bus65 mAPower loss0.9 WTechnical data analog inputsNumber of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs✓Min. input resistance (voltage range)200 kΩInput voltage ranges0V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Basic error limit voltage rangesmax. 30V	Order no.	031-1CD30
Current consumption/power loss65 mACurrent consumption from backplane bus65 mAPower loss0.9 WTechnical data analog inputs7Number of inputs4Cable length, shielded200 mRated load voltage00 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs200 kQIni, input resistance (voltage ranges)200 kQInput voltage ranges100 kQOperational limit of voltage ranges1-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges-Max. input resistance (current ranges)-Max. input resistance (current ranges)-Operational limit of current ranges-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Operational limit of current ranges)-Operational limit of current ranges-Nax. input resistance (current ranges)-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Destruction limit current ranges- <td>Туре</td> <td>SM 031</td>	Туре	SM 031
Current consumption from backplane bus65 mAPower loss0.9 WTechnical data analog inputs4Number of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputsvMin. input resistance (voltage ranges)200 kQOperational limit of voltage ranges0V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges+/-0.1%Basic error limit voltage ranges-Destruction limit voltage ranges-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Querational limit of current ranges-Basic error limit voltage ranges with SFU-Destruction limit current ranges-Querational limit of current ranges-Querational limit of current ranges-Querational limit of current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges-Radical error limit current ranges-Resistance ranges- <td>Module ID</td> <td>040D 1544</td>	Module ID	040D 1544
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Technical data analog inputsImage: stand of the stand of	Current consumption from backplane bus	65 mA
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Operational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Basic error limit current ranges-Redical error limit current ranges with SFU-Destruction limit current ranges-Resistance inputs-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Oper	Min. input resistance (voltage range)	200 kΩ
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Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Resistance ranges-Operational limit of resistor ranges-Basic error limit-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error li	Basic error limit voltage ranges	+/-0.1%
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Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-State error limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-State error limit-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operati	Destruction limit voltage	max. 30V
Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit-<	Current inputs	-
Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Serie ranges-Serie ranges-Operational limit of resistor ranges with SFU-Serie ranges-Serie ranges-Ser	Max. input resistance (current range)	-
Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Basic	Input current ranges	-
Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operati	Operational limit of current ranges	-
Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU- <t< td=""><td>Operational limit of current ranges with SFU</td><td>-</td></t<>	Operational limit of current ranges with SFU	-
Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-	Basic error limit current ranges	-
Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-	Radical error limit current ranges with SFU	-
Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-	Destruction limit current inputs (voltage)	-
Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-	Destruction limit current inputs (electrical current)	-
Operational limit of resistor ranges     -       Operational limit of resistor ranges with SFU     -       Basic error limit     -	Resistance inputs	-
Operational limit of resistor ranges with SFU     -       Basic error limit     -	Resistance ranges	-
Basic error limit -	Operational limit of resistor ranges	-
	Operational limit of resistor ranges with SFU	-
Basic error limit with SFU -	Basic error limit	-
	Basic error limit with SFU	-

# Analog Input

031-1CD30 - AI 4x16Bit 0...10V > Technical data

Order no.	031-1CD30
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	

031-1CD30 - AI 4x16Bit 0...10V > Technical data

Order no.	031-1CD30
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

031-1CD30 - AI 4x16Bit 0...10V > Parameter data

#### 3.20.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	10h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	10h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch
CH2FN	1	Function number channel 2	10h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	10h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

\* This record set may only be transferred at STOP state.

031-1CD30 - AI 4x16Bit 0...10V > Parameter data

DIAG_EN Diagnostic inter-	Byte	Bit 7 0
rupt	0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>
	Here y	ou can enable respectively disable the diagnostic interrupt.
LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 2: Limit value monitoring channel 2 (1: on)</li> <li>Bit 3: Limit value monitoring channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>
SUPR Interference fre- quency suppression	Byte	Bit 7 0
	0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0</li> <li>Bit 3, 2: Interference frequency suppression channel 1</li> <li>Bit 5, 4: Interference frequency suppression channel 2</li> <li>Bit 7, 6: Interference frequency suppression channel 3 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>e.g.: 10101010: all channels frequency suppression 50Hz</li> </ul>
channel x	listed, whi is deactiva	owing there are the measuring ranges with corresponding function number ch were supported by the analog module. With FFh the corresponding channel ated. The formulas listed here allow you to transform an evaluated measuring ital value) to a value assigned to the measuring range (analog value) and vice

### 0 ... 10V

versa.

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16204}$
	-2V	-3277	F333h	underrange	16384

031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

#### 3.20.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project	-	Х	-
engineering/parameterization			
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

#### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

PRIT	OL	Limit	overflow	

Byte	Bit 7 0
0	<ul> <li>Bit 0: Limit overflow channel 0</li> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 2: Limit overflow channel 2</li> <li>Bit 3: Limit overflow channel 3</li> <li>Bit 7 4: reserved</li> </ul>

# 031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

PRIT_US µs ticker       Byte       Bit 70         PRIT_US µs ticker       Byte       Bit 70         0      1       Value of the us ticker at the moment of the diagnostic.         µs ticker       0      1       Value of the us ticker at the moment of the diagnostic.         µs ticker       0      1       Value of the us ticker at the moment of the diagnostic.         µs ticker       In the SLIC module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2 <sup>(2)</sup> , 1y the timer starts with 0.again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>(6, 1)</sup> ).         Diagnostic data       Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostic interrupt the module serves for diagnostics data for diagnostic interrupt hecorem, and algonostic interrupt the reason for releasing a diagnostic interrupt he diagnostic interrupt hecorem, and a get tost. Within this time window (1. diagnostic interrupt hecorem) are not stored and get tost. Within this time window (1. diagnostic interrupt hecorem) are not stored and get tost. Within this time window (1. diagnostic interrupt hecorem) the diagnostic interrupt hecorem is a released by NDS 01h. Additionally the first 4 bytes may be accessed by NDS 00h.         X       - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by NDS 00h.         X       - Style set are according manual of your bus coupler.         Name       Bytes       Function <t< th=""><th>PRIT_UL Limit</th><th>underflow</th><th>Byte</th><th>Bit 7 0</th><th></th><th></th><th></th><th></th></t<>	PRIT_UL Limit	underflow	Byte	Bit 7 0				
Diagnostic data     D1     Value of the µs ticker at the moment of the diagnostic.       µs ticker     In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2 <sup>92,4</sup> 1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>10,-1</sup> ).       Diagnostic data     Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostic interrupt the module serves for diagnostic interrupt for the module. With a diagnostic interrupt gaing a diagnostic interrupt is no longer present, the diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> of diagnostic interrupt <sub>locomman</sub> and diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> and diagnostic data:       Error in project engineering / parameterization     Error in project engineering / parameterization       Measuring range underflow     Process interrupt lost       DS - Record set for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h. <t< td=""><td></td><td></td><td></td><td><ul> <li>Bit 0: Limit underflow</li> <li>Bit 1: Limit underflow</li> <li>Bit 2: Limit underflow</li> <li>Bit 3: Limit underflow</li> </ul></td><td>channel 1 channel 2</td><td></td><td></td><td></td></t<>				<ul> <li>Bit 0: Limit underflow</li> <li>Bit 1: Limit underflow</li> <li>Bit 2: Limit underflow</li> <li>Bit 3: Limit underflow</li> </ul>	channel 1 channel 2			
Diagnostic data     D1     Value of the µs ticker at the moment of the diagnostic.       µs ticker     In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2 <sup>92,4</sup> 1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>10,-1</sup> ).       Diagnostic data     Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostic interrupt the module serves for diagnostic interrupt for the module. With a diagnostic interrupt gaing a diagnostic interrupt is no longer present, the diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> of diagnostic interrupt <sub>locomman</sub> and diagnostic interrupt <sub>locomman</sub> . As soon as the reason for releasing a diagnostic interrupt <sub>locomman</sub> and diagnostic data:       Error in project engineering / parameterization     Error in project engineering / parameterization       Measuring range underflow     Process interrupt lost       DS - Record set for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h. <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>								
µs ticker         In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2 <sup>32,4</sup> µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>16,4</sup> ).         Diagnostic data       Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostic interrupt is no longer present, the diagnostic interrupt <sub>incomeng</sub> and diagnostic interrupt <sub>incomeng</sub> and diagnostic interrupt <sub>incomeng</sub> until last diagnostic interrupt <sub>incomeng</sub> in the MF-LED of the module is on.         The following errors are listed in the diagnostic stata: <ul> <li>Error in project engineering / parameterization</li> <li>Measuring range overflow</li> <li>Process interrupt lost</li> <li>Power supply failed</li> <li>DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01n. Additionally the first 4 bytes may be accessed by DS 00n.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by DS 00n.</li> <li>IX - Index for access via EtherCAT with Index 5005h.</li> <li>More can be found in the according manual of your bus coupler.</li> <li>Name Bytes Function Diagnostic 00h 01h 2F01h 02h 03h 03h 03h 04h 05h 04h 05h 04h 05h 05h.</li> <li>ERR_A 1 Diagnostic 00h 01h 01h 01h 03h 03h 03h 03h 03h 03h 03h 03h 03h 03</li></ul>	PRII_US µs tic	ker		Bit 7 0				
In the SLIO module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2 <sup>12,4</sup> µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>16,</sup> -1).         Diagnostic data       Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostic interrupt is no longer present, the diagnostic interrupt a diagnostic interrupt so to stored and gene present, the diagnostic interrupt <sub>becomp</sub> and diagnostic interrupt <sub>becomp</sub> of undiagnostic interrupt <sub>becomp</sub> or stored and gene present, the diagnostic interrupt <sub>becomp</sub> or diagnostic interrupt <sub>becomp</sub> present, the diagnostic interrupt <sub>becomp</sub> or diagnostic interrupt <sub>becomp</sub> or stored and gene stored and per present, the diagnostic interrupt <sub>becomp</sub> or diagnostic interrupt <sub>becomp</sub> or stored and gene stored and per present, the diagnostic interrupt <sub>becomp</sub> or diagnostic interrupt <sub>becomp</sub> or stored and per stored			0 1	Value of the µs ticker at the	ne moment of	the diagnosti	c.	
counting with 0. After 2 <sup>3%</sup> -1 µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 2 <sup>16</sup> -1).         Diagnostic data       Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostic interrupt the module serves for diagnostic interrupt is no longer present, the diagnostic interrupt datase place. All events of a channel between diagnostic interrupt <sub>acoming</sub> and stornatically takes place. All events of a channel between diagnostic interrupt <sub>acoming</sub> and diagnostic interrupt <sub>acoming</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt <sub>acoming</sub> until last diagnostics data: <ul> <li>Error in project engineering / parameterization</li> <li>Measuring range overflow</li> <li>Power supply failed</li> </ul> DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.         IX + Index for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.           X - Index for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.         IX + Index for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by ZF00h.           SX - Subindex for access via EtherCAT with Index 5005h.         More can be found in the according manual of your bus coupler.           Name         Bytes         Function         Default         DS         IX         SX           ERR_A         1         D			µs ticker					
diagnostics interrupt the module serves for diagnostic interrupt As soon as the reason for releasing a diagnostic interrupt paging automatically takes place. All events of a channel between diagnostic interrupt 			counting wit	n 0. After $2^{32}$ -1µs the timer	starts with 0 a			
<ul> <li>Error in project engineering / parameterization</li> <li>Measuring range overflow</li> <li>Measuring range underflow</li> <li>Process interrupt lost</li> <li>Power supply failed</li> <li>DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.</li> <li>SX - Subindex for access via EtherCAT with Index 5005h.</li> <li>More can be found in the according manual of your bus coupler.</li> <li>Mome and the provide information formation formation 15h</li> <li>ERR_C 1</li> <li>Module information 15h</li> <li>ERR_C 1</li> <li>Diagnostic 00h</li> <li>Oth 01h</li> <li>Oth 02h</li> <li>Oth 04h</li> <li>Oth 05h</li> <li>Oth 06h</li> </ul>	Diagnostic data	3	diagnostics i As soon as t nostic interru interrupt <sub>incom</sub> window (1. c	nterrupt the module serves he reason for releasing a d upt <sub>going</sub> automatically takes ing and diagnostic interrupt <sub>g</sub> liagnostic interrupt <sub>incoming</sub> ur	for diagnostic iagnostic inter place. All ever <sub>oing</sub> are not sto	es data for dia rupt is no lor nts of a chani pred and get l	agnostic inten Iger present nel between ost. Within t	errupt <sub>incoming</sub> . , the diag- diagnostic ;his time
<ul> <li>Measuring range overflow</li> <li>Measuring range underflow</li> <li>Process interrupt lost</li> <li>Power supply failed</li> <li>DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.</li> <li>SX - Subindex for access via EtherCAT with Index 505h.</li> <li>More can be found in the according manual of your bus coupler.</li> <li>Mame</li> <li>Bytes</li> <li>Function</li> <li>Diagnostic</li> <li>Module information</li> <li>ISh</li> <li>ERR_C</li> <li>I metrication</li> <li>I metrication</li></ul>			The following	g errors are listed in the dia	gnostics data	:		
<ul> <li>Measuring range underflow</li> <li>Process interrupt lost</li> <li>Power supply failed</li> <li>DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F01h. Additionally the f</li></ul>			Error in page 1	project engineering / param	eterization			
<ul> <li>Process interrupt lost</li> <li>Power supply failed</li> <li>DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.</li> <li>SX - Subindex for access via EtherCAT with Index 5005h.</li> <li>More can be found in the according manual of your bus coupler.</li> <li>Name Bytes Function Default DS IX SX</li> <li>ERR_A 1 Diagnostic</li> <li>Module information</li> <li>ISh</li> <li>ERR_C 1 reserved</li> <li>Diagnostic</li> <li>O0h</li> <li>O1h</li> <li>ERR_D 1</li> <li>Diagnostic</li> <li>O0h</li> <li>O1h</li> <li>Diagnostic</li> <li>O0h</li> <li>O1h</li> <li>O3h</li> <li>O4h</li> <li>O5h</li> <li>O5h</li> <li>O6h</li> </ul>								
DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.SX - Subindex for access via EtherCAT with Index 5005h. More can be found in the according manual of your bus coupler.NameBytesFunctionDefaultDSIXSXERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h03h03hERR_D1Diagnostic00h01h05h05hCHTYP1Channel type71h06h05h								
by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h. SX - Subindex for access via EtherCAT with Index 5005h. More can be found in the according manual of your bus coupler.NameBytesFunctionDefaultDSIXSXERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h03h03hERR_C1reserved00h01h04hERR_D1Diagnostic00h01h05hCHTYP1Channel type71h01h			Power s	upply failed				
SX - Subindex for access via EtherCAT with Index 5005h. More can be found in the according manual of your bus coupler.NameBytesFunctionDefaultDSIXSXERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h01h2F01h03hERR_C1reserved00h00h04hERR_D1Diagnostic00h00h05hCHTYP1Channel type71h00h			by DS IX - Index	01h. Additionally the first 4 for access via CANopen. T	bytes may be he access ha	e accessed b	y DS 00h.	
NameBytesFunctionDefaultDSIXSXERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h04h03hERR_C1reserved00h00h04hERR_D1Diagnostic00h00h05hCHTYP1Channel type71h01h				, , ,		005		
NameBytesFunctionDefaultDSIXSXERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h03h03hERR_C1reserved00h00h04hERR_D1Diagnostic00h00h05hCHTYP1Channel type71h00h								
ERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h03h03hERR_C1reserved00h00h04h04hERR_D1Diagnostic00h00h05h05hCHTYP1Channel type71h01h06h			More can be	tound in the according ma	nual of your b	us coupler.		
ERR_A1Diagnostic00h01h2F01h02hMODTYP1Module information15h03h03hERR_C1reserved00h00h04h04hERR_D1Diagnostic00h00h05h05hCHTYP1Channel type71h01h06h06h	Name	Bytes	Function		Default	DS	IX	SX
ERR_C1reserved00h04hERR_D1Diagnostic00h05hCHTYP1Channel type71h06h	ERR_A		Diagnostic		00h	01h	2F01h	02h
ERR_D1Diagnostic00h05hCHTYP1Channel type71h06h	-	1	J. J	ation	15h			03h
CHTYP 1 Channel type 71h 06h	ERR_C	1	reserved		00h			04h
	ERR_D	1	Diagnostic		00h			05h
NUMBIT         1         Number diagnostic bits per channel         08h         07h	CHTYP	1	Channel type		71h			06h
	NUMBIT	1	Number diagno	ostic bits per channel	08h			07h

031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

Name	Bytes	Function	Default	DS	IX	SX
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error 00h (		09h		
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
0	D	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

# **VIPA System SLIO**

031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

NUMPIT Disgractic hits	_	
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>
CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
		<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> </ul>
CH4ERR CH7ERR	Byte	<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> </ul>
CH4ERR CH7ERR reserved	Byte 0	<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
	-	<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
	-	<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
reserved	0	<ul> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul> Bit 7 0 reserved

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

031-1CD35 - AI 4x16Bit 0...10V

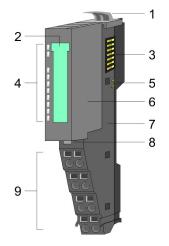
# 3.21 031-1CD35 - AI 4x16Bit 0...10V

#### Properties

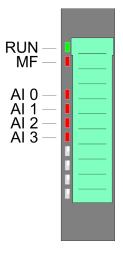
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 10V
- Diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Chapter 3.20 '031-1CD30 AI 4x16Bit 0...10V' on page 225 with extended parameter set

#### Structure



#### Status indication



RUN	MF	Al x	Description
green	<b>red</b>	red	Description
		x	Bus communication is OK
_			Module status is OK
-	_	х	Bus communication is OK
	-	~	Module status reports an error
	_	v	Bus communication is not possible
	-	Х	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant:	х		

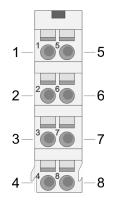
- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

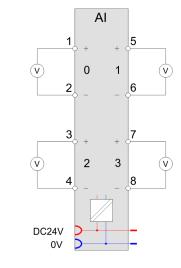
HB300 | SM-AIO | | en | 17-16

031-1CD35 - AI 4x16Bit 0...10V

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area

the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

Input area

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

031-1CD35 - AI 4x16Bit 0...10V > Technical data

# 3.21.1 Technical data

Order no.	031-1CD35
Туре	SM 031
Module ID	0413 15C4
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-

031-1CD35 - AI 4x16Bit 0...10V > Technical data

Order no.	031-1CD35
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

#### **Analog Input**

031-1CD35 - AI 4x16Bit 0...10V > Parameter data

Order no.	031-1CD35
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	9
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	yes

# 3.21.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

031-1CD35 - AI 4x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
SUPR	1	Interference frequency suppression	00h	01h	3100h	01h
CH0FN	1	Function number channel 0	10h	80h	3101h	02h
CH1FN	1	Function number channel 1	10h	81h	3102h	03h
CH2FN	1	Function number channel 2	10h	82h	3103h	04h
CH3FN	1	Function number channel 3	10h	83h	3104h	05h

#### SUPR Interference frequency suppression

<ul> <li>Bit 1, 0: Interference frequency suppression channel 0</li> <li>Bit 3, 2: Interference frequency suppression channel 1</li> <li>Bit 5, 4: Interference frequency suppression channel 2</li> <li>Bit 7, 6: Interference frequency suppression channel 3 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>e.g.: 10101010: all channels frequency suppression 50Hz</li> </ul>	Byte	Bit 7 0
	0	<ul> <li>Bit 3, 2: Interference frequency suppression channel 1</li> <li>Bit 5, 4: Interference frequency suppression channel 2</li> <li>Bit 7, 6: Interference frequency suppression channel 3 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> </ul>

# CHxFN Function number channel x

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

#### 0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U	
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$	
(10h)	5V	13824	3600h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$	
	-1.76V	-4864	ED00h	underrange	27048	
0 10V	12.5V	20480	5000h	overrange	D 16294 U	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$	
(20h)	5V	8192	2000h			
	0V	0	0000h		$U = D \cdot \frac{10}{16204}$	
	-2V	-3277	F333h	underrange	16384	

#### 3.21.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Power supply failed
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

031-1CD35 - AI 4x16Bit 0...10V > Diagnostic data

MODTYP Module informa- tion	Byte	Bit 7 0				
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>				
CHTYP Channel type	Byte	Bit 7 0				
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>				
NUMBIT Diagnostic bits	Byte	Bit 7 0				
	-					
NUMCH Channels	Byte	Bit 7 0				
	0	Number of channels of a module (here 04h)				
CHERR Channel error	Byte	Bit 7 0				
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>				
CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0				
	0	Channel-specific error channel x:				
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>				
CH4ERR CH7ERR reserved	Byte	Bit 7 0				
	0	reserved				

031-1CD35 - AI 4x16Bit 0...10V > Diagnostic data

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

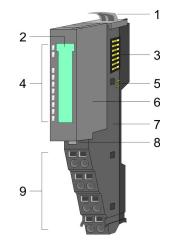
# 3.22 031-1CD40 - AI 4x16Bit 0(4)...20mA

**Properties** 

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 20mA;
   4 ... 20mA with external supply
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Chapter 3.23 '031-1CD45 AI 4x16Bit 0(4)...20mA' on page 257 with limited parameter set

#### Structure

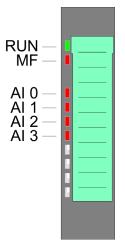


- Locking lever terminal module
- 2 Labeling strip

1

- 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

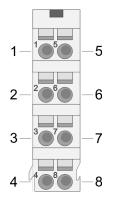


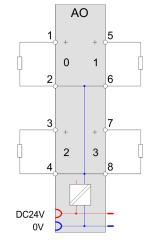
RUN	MF red	Al x	Description	
-		х	Bus communication is OK	
-		Λ	Module status is OK	
_	_	х	Bus communication is OK	
-		^	Module status reports an error	
	-	x	Bus communication is not possible	
	-	~	Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
			Error channel x	
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>	
not relevant: X				

031-1CD40 - AI 4x16Bit 0(4)...20mA

#### Pin assignment

For wires with a cross section of  $0.08 \text{mm}^2$  up to  $1.5 \text{mm}^2$ .





Pos.	Function	Туре	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



If a 2wire measuring transducer is used, you have to connect in line an external power supply.

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

#### Input area

031-1CD40 - AI 4x16Bit 0(4)...20mA > Technical data

# Output area

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

# 3.22.1 Technical data

Order no.	031-1CD40
Туре	SM 031
Module ID	0412 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	$\checkmark$
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-

# Analog Input

031-1CD40 - AI 4x16Bit 0(4)...20mA > Technical data

Order no.	031-1CD40
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 μs all channels
Noise suppression for frequency	>80dB (UCM<4V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel

031-1CD40 - AI 4x16Bit 0(4)...20mA > Technical data

Order no.	031-1CD40
Isolation	
Between channels	-
Between channels of groups to	
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

031-1CD40 - AI 4x16Bit 0(4)...20mA > Parameter data

#### 3.22.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	31h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	31h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch
CH2FN	1	Function number channel 2	31h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	31h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

\* This record set may only be transferred at STOP state.

#### DIAG\_EN Diagnostic interrupt

Bit 7 ... 0

Byte

0

- Diagnostic interrupt
   00h: disabled
  - 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 2: Limit value monitoring channel 2 (1: on)</li> <li>Bit 3: Limit value monitoring channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>

CLIDD Interference fre					
SUPR Interference fre- quency suppression	Byte	Bit 7 0			
	0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0</li> <li>Bit 3, 2: Interference frequency suppression channel 1</li> <li>Bit 5, 4: Interference frequency suppression channel 2</li> <li>Bit 7, 6: Interference frequency suppression channel 3 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>e.g.: 10101010: all channels frequency suppression 50Hz</li> </ul>			
CHxFN Function number channel x		owing there are the measuring ranges with corresponding function number			
		ich were supported by the analog module. With FFh the corresponding channel			

**CHxFN** Fu channel x 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.

031-1CD40 - AI 4x16Bit 0(4)...20mA > Diagnostics and interrupt

#### 0(4) ... 20mA

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	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$	
	20mA	16384	4000h	nominal range		
	10mA	8192	2000h			
	0mA	0	0000h			
	-4,00mA	-3277	F333h	underrange		
4 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$	
	20mA	27648	6C00h	nominal range		
	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$	
	4mA	0	0000h		$I = D \cdot \frac{1}{27648} + 4$	
	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		

# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

# 3.22.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х

031-1CD40 - AI 4x16Bit 0(4)...20mA > Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit overflow channel 0</li> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 2: Limit overflow channel 2</li> <li>Bit 3: Limit overflow channel 3</li> <li>Bit 7 4: reserved</li> </ul>

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit underflow channel 0</li> <li>Bit 1: Limit underflow channel 1</li> <li>Bit 2: Limit underflow channel 2</li> <li>Bit 3: Limit underflow channel 3</li> <li>Bit 7 4: reserved</li> </ul>

#### PRIT\_US µs ticker

Byte	Bit 7 0
0 1	Value of the $\mu$ s ticker at the moment of the diagnostic.

µs ticker

In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again. PRIT\_US represents the lower 2 byte of the  $\mu$ s ticker value (0 ... 2<sup>16</sup>-1).

**Diagnostic data** Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Process interrupt lost
- Power supply failed
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

031-1CD40 - AI 4x16Bit 0(4)...20mA > Diagnostics and interrupt

# ERR\_A Diagnostic

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

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> </ul>
		Bit 4: set at internal communication error
		<ul><li>Bit 5: reserved</li><li>Bit 6: set at process interrupt lost</li></ul>
		Bit 7: reserved

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Buto	Bit 7 0
5	Byte	

Буге	
0	Number of diagnostic bits per channel (here 08h)

# **NUMCH Channels**

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

031-1CD40 - AI 4x16Bit 0(4)...20mA > Diagnostics and interrupt

CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel group 0
		Bit 1: set at error in channel group 1
		Bit 2: set at error in channel group 2
		Bit 3: set at error in channel group 3
		Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
channer-specific	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

# DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

# µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

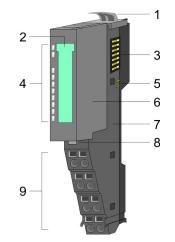
# 3.23 031-1CD45 - AI 4x16Bit 0(4)...20mA

**Properties** 

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 20mA;
   4 ... 20mA with external supply
- Diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Chapter 3.22 '031-1CD40 AI 4x16Bit 0(4)...20mA' on page 245 with extended parameter set

#### Structure

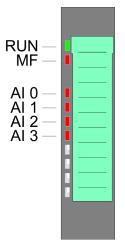


- Locking lever terminal module
- 2 Labeling strip

1

- 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

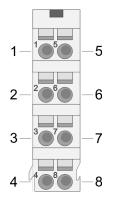
### Status indication



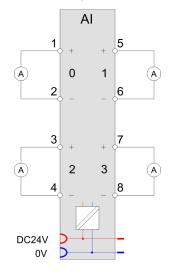
RUN	MF	Al x	Description
			Bus communication is OK
		Х	Module status is OK
-	-	х	Bus communication is OK
-	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant	: X		

031-1CD45 - AI 4x16Bit 0(4)...20mA

### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	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

If a 2wire measuring transducer is used, you have to connect in line an external power supply.

In-/Output area

- At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.
- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

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

# **Analog Input**

031-1CD45 - AI 4x16Bit 0(4)...20mA > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

# Output area

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

# 3.23.1 Technical data

Order no.	031-1CD45
Туре	SM 031
Module ID	0414 15C4
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA

# Analog Input

031-1CD45 - AI 4x16Bit 0(4)...20mA > Technical data

Order no.	031-1CD45
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB (UCM<4V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no

031-1CD45 - AI 4x16Bit 0(4)...20mA > Technical data

Order no.	031-1CD45
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	9
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	yes

031-1CD45 - AI 4x16Bit 0(4)...20mA > Parameter data

### 3.23.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
SUPR	1	Interference frequency suppression	00h	01h	3100h	01h
CH0FN	1	Function number channel 0	31h	80h	3101h	02h
CH1FN	1	Function number channel 1	31h	81h	3102h	03h
CH2FN	1	Function number channel 2	31h	82h	3103h	04h
CH3FN	1	Function number channel 3	31h	83h	3104h	05h

Byte
0

# CHxFN Function number channel x

SUPR Interference frequency suppression

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.

031-1CD45 - AI 4x16Bit 0(4)...20mA > Diagnostic data

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas	
0 20mA	23.52mA	32511	7EFFh	overrange	Ι	
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange	27648	
0 20mA	25.00mA	20480	5000h	overrange	D IGON I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$	
S5 format	10mA	8192	2000h			
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$	
	-4,00mA	-3277	F333h	underrange	16384	
4 20mA	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$	
Siemens	20mA	27648	6C00h	nominal range	$D = 27048 \cdot \frac{16}{16}$	
S7 format	12mA	13824	3600h		16	
(30h)	4mA	0	0000h		$I = D \cdot \frac{16}{27648} + 4$	
	1.19mA	-4864	ED00h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$	
Siemens	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$	
S5 format	12mA	8192	2000h		16	
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$	
	0.8mA	-3277	F333h	underrange		

#### 0(4) ... 20mA

# 3.23.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Power supply failed
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1CD45 - AI 4x16Bit 0(4)...20mA > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR	D	Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

031-1CD45 - AI 4x16Bit 0(4)...20mA > Diagnostic data

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits		
Nombri Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	_	
CHERR Channel en of	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>
CH0ERR CH3ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 5 1: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH4ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG US us tickor	_	
DIAG_US μs ticker	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic
	µs ticker	
		IO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting fter 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

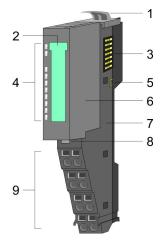
#### 3.24 031-1CD70 - AI 4x16Bit ±10V

# **Properties**

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with ±10V, 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

#### Structure



#### Status indication

RUN MF AI 0 AI 1 AI 2 AI 3 

RUN	MF	Al x	Description
green	ned 📕	<b>r</b> ed	
-		х	Bus communication is OK
		^	Module status is OK
-	-	х	Bus communication is OK
	-	^	Module status reports an error
	_	x	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
х	2Hz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
not relevant: X			

Locking lever terminal module

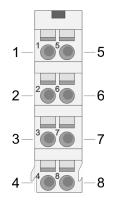
2 Labeling strip

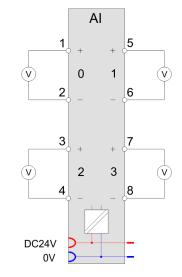
1

- 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

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

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

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

#### Output area

Input area

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

031-1CD70 - AI 4x16Bit ±10V > Technical data

# 3.24.1 Technical data

Order no.	031-1CD70
Туре	SM 031
Module ID	040E 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	$\checkmark$
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

031-1CD70 - AI 4x16Bit ±10V > Technical data

Order no.	031-1CD70
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<35V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-

# Analog Input

031-1CD70 - AI 4x16Bit ±10V > Technical data

Order no.	031-1CD70
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

# 3.24.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
RES1	1	reserved*	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring*	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	12h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	12h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch
CH2FN	1	Function number channel 2	12h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	12h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

\* This record set may only be transferred at STOP state.

DIAG_	EN	Diagnostic	inter-
rupt			

Byte Bit 7 ... 0

0

	Dia	gnostic interrupt
	-	00h: disabled

031-1CD70 - AI 4x16Bit ±10V > Parameter data

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit value monitoring channel 0 (1: on)</li> <li>Bit 1: Limit value monitoring channel 1 (1: on)</li> <li>Bit 2: Limit value monitoring channel 2 (1: on)</li> <li>Bit 3: Limit value monitoring channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>

SUPR Interference fre- quency suppression	Byte	Bit 7 0
4	0	<ul> <li>Bit 1, 0: Interference frequency suppression channel 0</li> <li>Bit 3, 2: Interference frequency suppression channel 1</li> <li>Bit 5, 4: Interference frequency suppression channel 2</li> <li>Bit 7, 6: Interference frequency suppression channel 3 <ul> <li>00: deactivated</li> <li>01: 60Hz</li> <li>10: 50Hz</li> </ul> </li> <li>e.g.: 10101010: all channels frequency suppression 50Hz</li> </ul>

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

#### ±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27048
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h	U = D	$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		16384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27048
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	16384

#### 0 ... 10V

# CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an *upper* and a *lower limit* may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a process interrupt is initialized.

# 3.24.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project	-	Х	-
engineering/			
parameterization			
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Process interrupt lost	-	Х	-

#### **Process interrupt**

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

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

Operating with CPU, PROFIBUS and PROFINET the process interrupt data were transferred via diagnostics telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit overflow channel x	00h	02h
PRIT_UL	1	Limit underflow channel x	00h	03h
PRIT_US	2	µs ticker	00h	04h 05h

	PRIT_OL Limit overflow	Byte	Bit 7 0
0 Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 2: Limit overflow channel 2 Bit 3: Limit overflow channel 3 Bit 7 4: reserved		0	<ul><li>Bit 2: Limit overflow channel 2</li><li>Bit 3: Limit overflow channel 3</li></ul>

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Limit underflow channel 0</li> <li>Bit 1: Limit underflow channel 1</li> <li>Bit 2: Limit underflow channel 2</li> <li>Bit 3: Limit underflow channel 3</li> <li>Bit 7 4: reserved</li> </ul>

#### PRIT\_US µs ticker

Byte	Bit 7 0
0 1	Value of the $\mu$ s ticker at the moment of the diagnostic.

#### µs ticker

In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again. PRIT\_US represents the lower 2 byte of the  $\mu$ s ticker value (0 ... 2<sup>16</sup>-1).

### **Diagnostic data**

Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt<sub>incoming</sub>. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt<sub>going</sub> automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interrupt<sub>incoming</sub> until last diagnostic interrupt<sub>going</sub>) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Process interrupt lost
- Power supply failed

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

0 Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error	ERR_A Diagnostic	Byte	Bit 7 0
<ul> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>		0	<ul> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> </ul>

P Module informa-	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

MODTYP tion

# ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

•	te	Bit 7 0
0		Number of channels of a module (here 04h)

CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel group 0
		Bit 1: set at error in channel group 1
		Bit 2: set at error in channel group 2
		Bit 3: set at error in channel group 3
		Bit 7 4: reserved

Channel-specific	Byte	Bit 7 0
	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 4 1: reserved</li> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>

# CH4ERR ... CH7ERR reserved

Byte	Bit 7 0
0	reserved

# DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

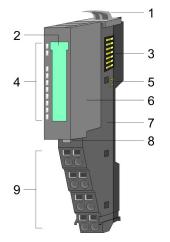
# 3.25 031-1LB90 - AI 2x16Bit TC

Properties

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.

- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- Diagnostics function
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC140V/AC60V between the inputs

# Structure

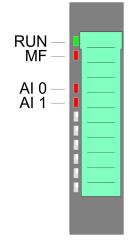


### Status indication

- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

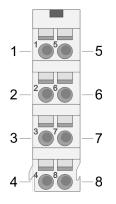
RUN	MF	Al x	Description
	□ x		Bus communication is OK
		~	Module status is OK
	-	x	Bus communication is OK
	-	^	Module status reports an error
		х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
•		•	<ul> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> <li>Wire break (if parameterized)</li> </ul>
not relevant	:: X		

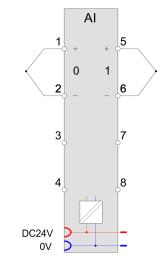
HB300 | SM-AIO | | en | 17-16



# Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	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



### CAUTION!

Please consider that the electronic module AI 2x16Bit TC may exclusively be used together with the terminal module 001-0AA20!

.

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.

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.

031-1LB90 - AI 2x16Bit TC > Technical data

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

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

# Output area

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

# 3.25.1 Technical data

Order no.	031-1LB90
Туре	SM 031
Module ID	040F 1543
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	10 ΜΩ
Input voltage ranges	-80 mV +80 mV
Operational limit of voltage ranges	±0.3%
Operational limit of voltage ranges with SFU	±0.1%
Basic error limit voltage ranges	±0.25%
Basic error limit voltage ranges with SFU	±0.05%
Destruction limit voltage	max. 20V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-

# Analog Input

031-1LB90 - AI 2x16Bit TC > Technical data

Order no.	031-1LB90
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	$\checkmark$
Thermocouple ranges	type B
	type C
	type E
	type J
	type K
	type L
	type N
	type R type S
	type T
Operational limit of thermocouple ranges	Type E, L, T, J, K, N: ±2.5K / Type B, C, R, S: ±8.0K
Operational limit of thermocouple ranges with SFU	Type E, L, T, J, K, N: ±1.5K / Type B, C, R, S: ±4.0K
Basic error limit thermoelement ranges	Type E, L, T, J, K, N: ±2.0K / Type B, C, R, S: ±7.0K
Basic error limit thermoelement ranges with SFU	Type E, L, T, J, K, N: ±1.0K / Type B, C, R, S: ±3.0K
Destruction limit thermocouple inputs	max. 20V
Programmable temperature compensation	✓

# Analog Input

031-1LB90 - AI 2x16Bit TC > Technical data

Order no.	031-1LB90
External temperature compensation	✓
Internal temperature compensation	✓
Temperature error internal compensation	1 K
Technical unit of temperature measurement	°C, °F, K
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	84.2 ms (50 Hz) 70.5 ms (60 Hz) per channel
Noise suppression for frequency	>90dB at 50Hz (UCM<10V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	10
Diagnostic bytes	20

Order no.	031-1LB90
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	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

# 3.25.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics*	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition*	00h	00h	3101h	02h
TEMPCNF	1	Temperature system	00h	01h	3102h	03h
SUPR	1	Interference frequency suppression	02h	01h	3103h	04h
CH0FN	1	Function number channel 0	C1h	80h	3104h	05h
CH1FN	1	Function number channel 1	C1h	81h	3105h	06h

\* This record set may only be transferred at STOP state.

### DIAG\_EN Diagnostic interrupt

Byte	Bit 7 0
0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

WIBRK_EN	
Wire break recognition	

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire break recognition channel 0 (1: on)</li> <li>Bit 1: Wire break recognition channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>
	Due to the high sensitivity of the inputs, unused inputs should be deacti- vated in the parametrization. Due to the high input impedance, open inputs can be influenced by adjacent channels or due to the measuring

inputs can be influenced by adjacent channels or due to the measuring method during wire break detection. Since the entire measuring range moves in the mV range, open-loop inputs can already cause measuring range overshoots.

TEMPCNF Temperature system	Byte	Bit 7 0
	0	<ul> <li>Bit 0, 1: Temperature system         <ul> <li>00: °C</li> <li>01: °F</li> <li>10: K</li> </ul> </li> <li>Bit 7 2: reserved</li> </ul>

SUPR Interference frequency suppression	Byte	Bit 7 0
	0	<ul> <li>Bit 0, 1: Interference frequency suppression</li> <li>01: 60Hz</li> <li>10: 50Hz</li> <li>Bit 7 2: reserved</li> </ul>

# CHxFN Function number channel x

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

# Voltage

# -80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{200}$
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{80}$
(11h)	0V	0	0000h		
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	27648
-80 80mV	100mV	20480	5000h	overrange	
Siemens S7 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	16384

# Temperature

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J:	+14500	26420	17232	overrange
[Fe-Cu-Ni IEC]	-2100 +12000	-3460 21920	632 14732	nominal range
-210 +1200°C -346 2192°F				underrange
63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)				
Туре К:	+16220	29516	18952	overrange
[Ni-Cr-Ni]	-2700 +13720	-4540 25016	0 16452	nominal range
-270 +1372°C -454 2501.6°F 0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
[Ni-Cr-Si] -270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C)	-2700 +13000	-4540 23720	0 15732	nominal range

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
(C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Туре Т:	+5400	10040	8132	overrange
[Cu-Cu-Ni]	-2700 +4000	-4540 7520	32 6732	nominal range
-270 +400°C -454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
PtRh-PtRh]	0 +18200	320 27865	2732 20932	nominal range
0 +1820°C 32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре С:	+25000	32766	23432	overrange
[WRe5-WRe26]	0 +23150	320 27865	2732 20932	nominal range
0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре Е:	+12000	21920	14732	overrange

031-1LB90 - AI 2x16Bit TC > Diagnostic data

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
[Ni-Cr - Cu-Ni ]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

# 3.25.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
RES2	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per	08h			07h
		channel				

# Analog Input

ERR\_A Diagnostic

031-1LB90 - AI 2x16Bit TC > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
NUMCH	1	Number of channels of a	02h			08h
		module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error	00h			0Ah
		channel 0				
CH1ERR	1	Channel-specific error	00h			0Bh
		channel 1				
CH2ERR	6	reserved	00h			0Ch 11h
CH7ERR						
DIAG_US	4	µs ticker	00h			13h

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

031-1LB90 - AI 2x16Bit TC > Diagnostic data

NUMBIT Diagnostic bits	Byte	Bit 7 0		
	0	Number of diagnostic bits per channel (here 08h)		
NUMCH Channels	Byte	Bit 7 0		
	0	Number of channels of a module (here 02h)		
CHERR Channel error	Byte	Bit 7 0		
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>		
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0		
CH0ERR / CH1ERR Channel-specific	Byte 0	Bit 7 0 Channel-specific error: Channel x:		
	-	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error		
	-	Channel-specific error: Channel x:		
	-	<ul> <li>Channel-specific error: Channel x:</li> <li>Bit 0: set at project engineering/parameterization error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire break</li> <li>Bit 5: reserved</li> </ul>		
	-	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break		
	-	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: reserved Bit 6: set at measuring range underflow		
Channel-specific CH2ERR CH7ERR	-	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: reserved Bit 6: set at measuring range underflow		
Channel-specific	0	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow		
Channel-specific CH2ERR CH7ERR	0 Byte	Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow		

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

### µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

031-1LD80 - AI 4x16Bit R/RTD

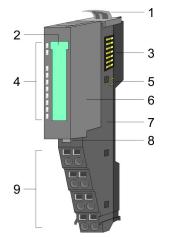
## 3.26 031-1LD80 - AI 4x16Bit R/RTD

#### Properties

The electronic module has 4 inputs for resistance measurement with parameterizable functions. The channels of the module are isolated to the backplane bus.

- 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 wire
   (3 and 4 wire only via channel 0 respectively 1)
- Diagnostics function
- 16bit resolution

#### Structure



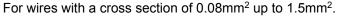
#### Status indication

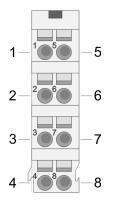
RUN green	MF red	Al x	Description
•		х	Bus communication is OK Module status is OK
		х	Bus communication is OK Module status reports an error
	•	х	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
•		•	<ul> <li>Error channel x</li> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> <li>Wire break (if parameterized)</li> </ul>
not relevant:	X		

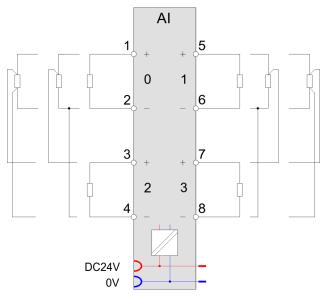
- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1LD80 - AI 4x16Bit R/RTD

#### Pin assignment







Pos.	Function	Туре	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	1	+ 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	1	+ Channel 3
8	-AI 3	1	Ground Channel 3

I: Input

2, 3, 4 wire measurement

At the pin assignment above you can see how the sensors are to be connected at 2, 3 respectively 4 wire measurement.

- With every channel a 2 wire measurement may be performed.
- 3 wire measurement is only possible via the channels 0 and 1.
  - Please consider with 3 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.
- 4 wire measurement is only possible via the channels 0 and 1.
  - The measurement current for channel 0 is applied at pin 1 and 2. The measurement for channel 0 happens at pin 3 and 4. The analog value for channel 0 is represented in input word 0.
  - The measurement current for channel 1 is applied at pin 5 and 6. The measurement for channel 1 happens at pin 7 and 8. The analog value for channel 1 is represented in input word 1.
  - Please consider with 4 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.

In-/Output area

At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area	Addr.	Name	Bytes	Function	IX	SX
	+0	AI 0	2	Analog value channel 0	6401h/s	01h
	+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
	+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
	+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

#### Output area

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

#### 3.26.1 Technical data

Order no.	031-1LD80
Туре	SM 031
Module ID	0410 1544
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	-
Max. input resistance (current range)	-

Order no.	031-1LD80
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	$\checkmark$
Resistance ranges	0 60 Ohm 0 600 Ohm 0 3000 Ohm
Operational limit of resistor ranges	+/- 0.4 %
Operational limit of resistor ranges with SFU	+/- 0,2 %
Basic error limit	+/- 0.2 %
Basic error limit with SFU	+/- 0,1 %
Destruction limit resistance inputs	max. 24V
Resistance thermometer inputs	$\checkmark$
Resistance thermometer ranges	Pt100 Pt1000 Ni100 Ni1000
Operational limit of resistance thermometer ranges	+/- 0.4 %
Operational limit of resistance thermometer ranges with SFU	+/- 0,2 %
Basic error limit thermoresistor ranges	+/- 0.2 %
Basic error limit thermoresistor ranges with SFU	+/- 0,1 %
Destruction limit resistance thermometer inputs	max. 24V
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	_

Order no.	031-1LD80
Temperature error internal compensation	-
Technical unit of temperature measurement	°С, °F, К
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	84.2 ms (50 Hz) 70.5 ms (60 Hz) per channel
Noise suppression for frequency	>80dB at 50Hz (UCM<6V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 6 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	12
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10

Order no.	031-1LD80
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 3.26.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostic <sup>1</sup>	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition <sup>1</sup>	00h	00h	3101h	02h
TEMPCNF	1	Temperature system	00h	01h	3102h	03h
SUPR	1	Interference frequency suppression	02h	01h	3103h	04h
CH0FN	1	Function number channel 0	50h	80h	3104h	05h
CH1FN	1	Function number channel 1	50h	81h	3105h	06h
CH2FN	1	Function number channel 2	50h <sup>2</sup>	82h	3106h	07h
CH3FN	1	Function number channel 3	50h <sup>2</sup>	83h	3107h	08h

1) This record set may only be transferred at STOP state.

2) with 2 channel operation FFh

DIAG_EN Diagnostic inter- rupt	Ву
i apt	•

Byte	Bit 7 0
0	<ul> <li>Diagnostic interrupt</li> <li>00h: disabled</li> <li>40h: enabled</li> </ul>

Here you can enable respectively disable the diagnostic interrupt.

WIBRK\_EN Wire break recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire break recognition channel 0 (1: on)</li> <li>Bit 1: Wire break recognition channel 1 (1: on)</li> <li>Bit 2: Wire break recognition channel 2 (1: on)</li> <li>Bit 3: Wire break recognition channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>

TEMPCNF Temperature system	Byte	Bit 7 0
.,	0	<ul> <li>Bit 1, 0: Temperature system         <ul> <li>00: °C</li> <li>01: °F</li> <li>10: K</li> </ul> </li> <li>Bit 7 2: reserved</li> </ul>

SUPR Interference frequency suppression

Byte	Bit 7 0
0	<ul> <li>Bit 1, 0: Interference frequency suppression</li> <li>- 01: 60Hz</li> <li>- 10: 50Hz</li> <li>Bit 7 2: reserved</li> </ul>

**CHxFN Function number channel x** In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated.

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
2 wire: PT100	+1000°C	+10000	overrange
(50h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: PT1000	+1000°C	+10000	overrange
(51h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100	+295°C	+2950	overrange
(52h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000	+295°C	+2950	overrange
(53h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: PT100	+1000°C	+10000	overrange
(58h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000	+1000°C	+10000	overrange
(59h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100	+295°C	+2950	overrange
(5Ah)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
3 wire: NI1000	+295°C	+2950	overrange
(5Bh)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: PT100	+1000°C	+10000	overrange
(60h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
4 wire: PT1000	+1000°C	+10000	overrange
(61h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
4 wire: NI100	+295°C	+2950	overrange
(62h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
4 wire: NI1000	+295°C	+2950	overrange
(63h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: 0 $60\Omega$			overrange
(70h)	0 60Ω	0 32767	nominal range
			underrange
2 wire: 0 $600\Omega$			overrange
(71h)	0 600Ω	0 32767	nominal range
			underrange
2 wire: 0 3000 $\Omega$			overrange
(72h)	0 3000Ω	0 32767	nominal range
			underrange
3 wire: 0 $60\Omega$			overrange
(78h)	0 60Ω	0 32767	nominal range
			underrange
3 wire: 0 $600\Omega$			overrange
(79h)	0 600Ω	0 32767	nominal range
			underrange
3 wire: 0 3000 $\Omega$			overrange
(7Ah)	0 3000Ω	0 32767	nominal range
			underrange
4 wire: 0 $60\Omega$			overrange
(80h)	0 60Ω	0 32767	nominal range
			underrange
4 wire: 0 $600\Omega$			overrange
(81h)	0 600Ω	0 32767	nominal range
			underrange
4 wire: 0 $3000\Omega$			overrange
(82h)	0 3000Ω	0 32767	nominal range

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
			underrange
2 wire: 0 $60\Omega$			overrange
(90h)	0 60Ω	0 6000	nominal range
			underrange
2 wire: 0 $600\Omega$			overrange
(91h)	0 600Ω	0 6000	nominal range
			underrange
2 wire: 0 3000 $\Omega$			overrange
(92h)	0 3000Ω	0 30000	nominal range
			underrange
3 wire: 0 $60\Omega$			overrange
(98h)	0 60Ω	0 6000	nominal range
			underrange
3 wire: 0 600 $\Omega$			overrange
(99h)	0 600Ω	0 6000	nominal range
			underrange
3 wire: 0 3000 $\Omega$			overrange
(9Ah)	0 3000Ω	0 30000	nominal range
			underrange
4 wire: 0 $60\Omega$			overrange
(A0h)	0 60Ω	0 6000	nominal range
			underrange
4 wire: 0 $600\Omega$			overrange
(A1h)	0 600Ω	0 6000	nominal range
			underrange
4 wire: 0 $3000\Omega$			overrange
(A2h)	0 3000Ω	0 30000	nominal range
			underrange
2 wire: 0 60Ω	70.55Ω	32511	overrange
(D0h)	0 60Ω	0 27648	nominal range
			underrange
2 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(D1h)	0 600Ω	0 27648	nominal range
			underrange
2 wire: 0 $3000\Omega$	3528Ω	32511	overrange

031-1LD80 - AI 4x16Bit R/RTD > Diagnostic data

Measuring range (funct. no.)	Measuring value	Signal range	Range
(D2h)	0 3000Ω	0 27648	nominal range
			underrange
3 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(D8h)	0 60Ω	0 27648	nominal range
			underrange
3 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(D9h)	0 600Ω	0 27648	nominal range
			underrange
3 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(DAh)	0 3000Ω	0 27648	nominal range
			underrange
4 wire: 0 $60\Omega$	70.55Ω	32511	overrange
(E0h)	0 60Ω	0 27648	nominal range
			underrange
4 wire: 0 $600\Omega$	705.5Ω	32511	overrange
(E1h)	0 600Ω	0 27648	nominal range
			underrange
4 wire: 0 3000 $\Omega$	3528Ω	32511	overrange
(E2h)	0 3000Ω	0 27648	nominal range
			underrange

#### 3.26.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

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

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

- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

031-1LD80 - AI 4x16Bit R/RTD > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH 7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

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 6 5: reserved Bit 7: set at error in parameterization	

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class <ul> <li>0101b analog module</li> </ul> </li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

## ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

031-1LD80 - AI 4x16Bit R/RTD > Diagnostic data

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>
CH0ERR CH3ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error: channel x:
		<ul> <li>Bit 0: set at error in project engineering/parameterization</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire break</li> <li>Bit 5: reserved</li> <li>Bit 6: set at measuring range underflow</li> <li>Bit 7: set at measuring range overflow</li> </ul>
CH4ERR CH7ERR reserved	Byte	Bit 7 0
16361760	0	reserved
DIAG_US μs ticker	Byte	Bit 7 0

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

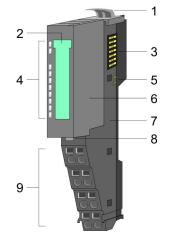
## 3.27 031-1PA00 - Al1x 3Ph 230/400V 1A

#### **Properties**

The module allows the measurement of electric data for counting energy and power measurement. Here, the voltage measurement of each phase is directly measured and the current is measured indirectly via current transformers. In consideration of the permissible total current, you can also perform an energy measurement on devices, which are within the same phase.

- 3-phase and neutral wires 230/400V 1A
- Retentive storage of the energy values
- Diagnostic function
- Resolution of the measured value 24bit
- The following measurands can be found in 4-quadrant operation:
  - Voltage, current
  - Electrical power
  - Electrical work
  - Harmonics
  - Phase shift cos φ
  - Frequency

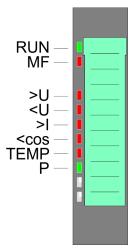
#### Structure



- 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

031-1PA00 - Al1x 3Ph 230/400V 1A

## Status indication

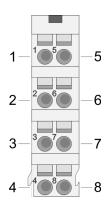


RUN	MF	Description
green	<b>red</b>	Description
-		Bus communication is OK
		Module status is OK
-	_	Bus communication is OK
		Module status reports an error
	-	Bus communication is not possible
	-	Module status reports an error
		Error at bus power supply
х		Error in configuration
~	2Hz	♦ Chapter 2.8 'Trouble shooting - LEDs' on page 30
>U		Voltage in the parametrized range
-0		Voltage limit value exceeded
		Voltage in the parametrized range
<u< td=""><td>_</td><td>Voltage limit value undershot</td></u<>	_	Voltage limit value undershot
		(omitted in 1-phase operation)
>		Current in the parametrized range
-1		Current limit value exceeded
		Phase shift $\cos \phi$ in the parametrized range
<cos< td=""><td>_</td><td>Phase shift <math>\cos \varphi</math> limit value undershot</td></cos<>	_	Phase shift $\cos \varphi$ limit value undershot
		(omitted in 1-phase operation)
темр		Temperature in the parametrized range
TEMP		Temperature limit value exceeded
		P: Power-proportional
Ρ		blinks with increasing frequency proportional to the active power at 20 pulses/Wh. The current transformer factor is not considered.
not relevan	4. V	

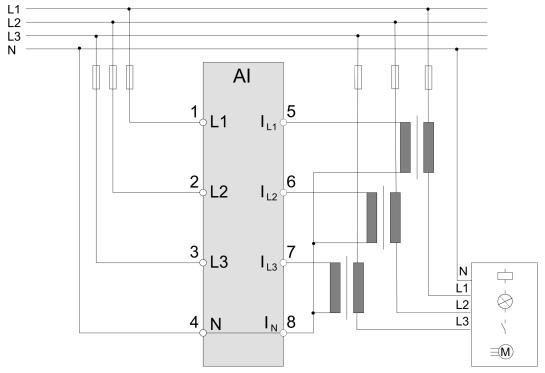
not relevant: X

031-1PA00 - Al1x 3Ph 230/400V 1A

## Pin assignment



For wires with a core cross-section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>. The voltage is measured directly. The current is determined indirectly via current transformers.



Pos.	Function	Туре	Description
1	L1	I	Voltage measurement L1
2	L2	I	Voltage measurement L2
3	L3	I	Voltage measurement L3
4	Ν	I	Voltage measurement N
5	I <sub>L1</sub>	L	Current measurement I <sub>L1</sub>
6	I <sub>L2</sub>	I	Current measurement I <sub>L2</sub>
7	I <sub>L3</sub>	I	Current measurement IL3
8	I <sub>N</sub>	I	Current measurement I <sub>N</sub>
I. Input			

### I: Input



When using the 031-1PA00 the DC 24V power section supply of the further backplane bus is interrupted. By installing a power module after the 031-1PA00, the DC 24V power section supply at the backplane bus can be continued.



#### CAUTION! Use only with terminal module 001-0AA40!

Please consider that the electronic module AI1x 3Ph 230/400V 1A may only be used at the terminal module 001-0AA40!

031-1PA00 - Al1x 3Ph 230/400V 1A > Technical data

#### In-/Output area

- At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.
  - IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
  - SX Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area	Addr.	Name	Byte	Function	IX	SX
	+0	B0 B3	4	Header byte 0 3	6401h/s	01h
	+4	D00 D11	12	User data input byte 0 11	6401h/s+1	02h

Output area	Addr.	Name	Byte	Function	IX	SX
	+0	B0 B3	4	Header byte 0 3	6401h/s	01h
	+4	D00D 11	12	User data output byte 0 11	6401h/s+1	02h

## 3.27.1 Technical data

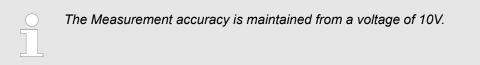
Order no.	031-1PA00
Туре	SM 031
Module ID	0882 2880
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.9 W
Rated load voltage	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	-
Isolation	
Between channels	-
Insulation tested with	AC 2200 V

031-1PA00 - Al1x 3Ph 230/400V 1A > Technical data

Order no.	031-1PA00
Energy measurement	
Number of channels for measuring	1* 13 phases U/I
Voltage measuring range	0300 V each phase
Coupling voltage measurement	directly
Current range	-
Coupling current measurement	Transformer
Frequency range	4664 Hz
Measurement accuracy	1 %
Available measurement Adjustable limits	Active energyTemperatureFrequencyVoltage RMSCurrent RMSActive powerActive powerApparent powerCos phiHarmonic voltage RMSHarmonic current RMSVoltage RMS min/maxCurrent RMS min/maxCos phi minTemperature max.
	Frequency min/max
Datasizes	
Input bytes	16
Output bytes	16
Parameter bytes	28
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C

031-1PA00 - AI1x 3Ph 230/400V 1A > Safety precautions

Order no.	031-1PA00
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	-
KC certification	-



#### 3.27.2 Safety precautions

#### Please note!

With the 031-1PA00 only AC voltages 230/400 V and currents can be measured. Please note when using the module the following safety instructions:

## CAUTION!

This device is not certified for applications in

in explosive environments (EX-zone)

## CAUTION!

#### Connection and module exchange only without power!

- Before you start to work on at the module for installation or maintenance, you have to disconnect it from the main power source, i.e. the power line is to be switched off (possibly remove fuses)!
- The electronic module may only be replaced on power off!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!
- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).



## CAUTION!

#### Provide overvoltage protection!

The module is designed for overvoltage category II. Provide a corresponding overvoltage protection in the supply lines (phases and neutral) so that a hazard to persons by touching on the low voltage side is excluded.



## CAUTION!

Provide touch protection

Provide a touch protected wiring of the measurement and mark it with the according warnings!

031-1PA00 - AI1x 3Ph 230/400V 1A > Safety precautions



#### No use with System SLIO safety modules!

The simultaneous use of 031-1PA00 modules and System SLIO safety modules on the backplane bus is not permitted!



**CAUTION!** 

## Use only with terminal module 001-0AA40!

Please consider that the electronic module AI1x 3Ph 230/400V 1A may only be used at the terminal module 001-0AA40!



#### CAUTION! Line voltage max. 400V!

The line voltage at a voltage connector must not exceed 400V!



#### CAUTION!

Do not exchange current and voltage connections!

Please note when connecting, that the current and voltage paths are not exchanged! The module will be destroyed by directly connecting one phase to a low-resistance current connector!



#### Use current transformer with max. 1A!

You may only use current transformer with max. current of 1A! Please consider the data sheet of your current transformer!



#### CAUTION!

#### Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!



#### CAUTION!

All phases of one supply grid!

Please note that the phases to be measured must be from the same supply grid!

#### Reset energy counters after installation!

As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measurement is not interrupted by STOP or RESET of the CPU respectively the bus coupler. After installing the module the energy counters should be reset by CMD-Frame. & Chapter 3.27.7.2.5 'CMD Frame' on page 328

3.27.3Basics3.27.3.1TermsMeasurand	A <i>measurand</i> is a physical quantity that can be measured such as current, voltage or temperature. <i>S Chapter 3.27.6 'Measurands' on page 317</i>				
Measured value	A <i>measured value</i> is a value of a measurand, which is determined by measurement or by calculation.				
ID	In the module each <i>measurand</i> one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> . $\Leftrightarrow$ <i>Chapter 3.27.6 'Measurands' on page 317</i>				
DS-ID	<ul> <li>As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measured values of all the measurands are stored in the module with one record set ID <i>DS-ID</i>. The following must be observed:</li> <li>All measured values with the same <i>DS-ID</i> come from the same measurement and are consistent.</li> <li>By specifying the <i>DS-ID</i> you can address the individual measured values of the same measurement.</li> <li>The <i>DS-ID</i> covers the values 1 15. The start value can freely be selected.</li> <li>To refresh the measured values the <i>DS-ID</i> is to be incremented by 1. The value 15 must be followed by 1.</li> <li>If the <i>DS-ID</i> is incremented and there is still no new value available, the current value is returned with an error. <i>S</i> '<i>Status communication' on page 320</i></li> <li><i>DS-ID</i> = 0 - Auto increment mode <ul> <li>With <i>DS-ID</i> = 0 there is a request with <i>auto increment mode</i>. Here the module always returns the current measured value. As soon as a new measured value is available, here the <i>DS-ID</i> is incremented by one within the values 1 15. If there is no new measured value available, the <i>DS-ID</i> is not changed and a error message is returned. <i>S</i> '<i>Status communication' on page 320</i></li> </ul></li></ul>				

031-1PA00 ·	Al1x 3Ph	230/400V	1A >	Basics
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In the module you can combine some measurands to one data package (Frame), which is transferred in one step. One data package consists of 12byte user data. Considering the data length of 12 bytes, you can define the content of a frame by specifying the <i>ID</i> of the measurands. Up to 256 frames may be configured ( <i>Frame 0 Frame 255</i> ). The following must be observed:				
<ul> <li>The definition of <i>Frame 1</i> to <i>Frame 255</i> happens by the command <i>Set_Frame</i>. <i>Chapter 3.27.7.2.3 'Set Frame' on page 324</i>.</li> <li><i>Frame 0</i> with the corresponding measurands can exclusively be specified by the parametrization. <i>Chapter 3.27.5 'Parameter data' on page 315</i>.</li> <li>With telegram type <i>Zero Frame</i> the data package of Frame 0 can be accessed. After the start-up of the module there are automatic <i>Zero Frame</i> requests as long as the process data communication comes from the head module. <i>Chapter 3.27.7.2.4 'Read Frame' on page 326</i>.</li> </ul>				
When defining frames by means of <i>'Set Frame'</i> , via the <i>FR-ID</i> these are assigned to a number between 0 255. By specifying the <i>FR-ID</i> you can request the corresponding frame.				
In the following the data types are listed, which are used in the module. The length is to be considered particularly by the definition of <i>Frames</i> .				
Data type	Length in byte	Description		
UINT_8	1	Integer 8bit		
UINT_16	2	Integer 16bit		
UINT_32	4	Integer 32bit		

1

2

4 4

INT 8

**INT\_16** 

**INT\_32** 

FLOAT

3.27.3.2 Principle of measurement

Calculation of the effective

values of current and

voltage

3-phase AC low-voltage networks are characterized by the following relationship:
 Nominal voltage is the RMS voltage U<sub>RMS</sub> e.g. 230V<sub>RMS</sub> as star voltage between one of the three phase conductors (L1, L2 or L3) and the neutral conductor N.

Signed integer 8bit

Signed integer 16bit Signed integer 32bit

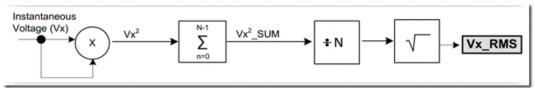
32bit floating point IEEE 754

- The module is used for detecting the current and voltage values and the energy values of all 3 phases. Here, the module measures the real effective value (True RMS) of voltages and currents.
- The sampling rate of the digitally processed measured values is 2.7 kHz. The time interval for the calculation of the actual values is 200 ms. This results in an evaluation window of the measured data of 540 measured values, which can be requested at any time.

031-1PA00 - AI1x 3Ph 230/400V 1A > Basics

#### Voltage measurement

#### Averaging



**1.** The square of the voltage measurement is calculated.

⇒ Vx<sup>2</sup>

**2.** The sum of  $Vx^2$  is calculated via the time interval  $n = 0 \dots n = N-1$ .

 $\Rightarrow$  Vx<sup>2</sup>\_SUM

- **3.**  $Vx^2$  SUM is divided by N the number of measurements.
- **4.** From the result of the division, the square root is drawn.

#### ⇒ AverageVx\_RMS

#### Current measurement

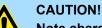
For current measurement you have to use external current transformers!



## CAUTION!

Use current transformer with max. 1A! You may only use current transformer with max. current of 1A! Please

consider the data sheet of your current transformer!



#### Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!

 Please note that the overall accuracy of the assembly of measuring module and current transformers depends on the accuracy class of the transformers.

- The transformer factor is retentive stored and taken into account while counting.
- A change of the transformer factor is taken immediately recognized. Current counter values are not changed, new values are added.
- When the transformer factor was changed, current counter values are not changed, new values are added considering the new factor.

#### Calculating power, energy

To calculate the effective power P, each time synchronous sample value of the currents and voltages are used. In this case, phase shifts between the currents and voltages are considered. The energy is calculated from integration of the power by time.

For the power is valid:

- Positive sign (+): Consumed respectively received power
- Negative sign (-): Fed in power

Determine frequency	The <i>frequency</i> of the phases is determined by a zero crossing detection of the sampled signals and calculating from the frequency.
Apparent power S = U x I	The apparent power S is a combination of active power P and reactive power Q. It is calculated from the product of effective current $I_{eff}$ and effective voltage $U_{eff}$ . With the apparent power you get the total power of a power grid.
Reactive power $Q = U x I x \sin \varphi$	<i>Reactive power</i> Q means a load in the power grid, which opposes the current flow from the producer to the consumer. The reactive power is the product of current and voltage at a reactance. Reactive power forms to all devices that are connected to AC networks. With voltage supplied any electrical device generates an electromagnetic field. By alternating voltage, the magnetic field is regularly built and removed. During the removement the energy gained in the field is fed back into the power grid and results in a higher resistance to the applied current flow.
Active power $P = U x I x \cos \varphi$	The <i>active power P</i> is the effectively used power. This is the part without phase shift between voltage and current and refers to a resistive load. In an AC voltage, the active power is calculated by multiplying the effective values of current and voltage.
Calculation of the power factor $\cos \phi$ (phi)	In real networks energy consumers / producers typically are not purely ohmic. There is a phase shift between current and voltage. The $\cos \varphi$ is a measure of the phase shift between current and voltage of the basic frequency of the corresponding phase. The <i>total</i> $\cos \varphi$ is calculated by dividing <i>total active power P</i> and <i>total apparent power S</i> .
Harmonics	Harmonics are oscillations of the voltages and currents, whose frequency is an integer multiple of the basic frequency. The 1. harmonic is the basic frequency or mains frequency, nominally 50Hz or 60Hz. The level of harmonics is a measure for the network quality. Harmonics or harmonic oscillations are caused by equipment with non-linear characteristics such as transformers, fluorescent lamps and power electronic equipment such as rectifiers and thyristors. The non-sinus-shaped currents of these consumers cause the net interference voltages, which distorts the nominal line voltage. During parametrization you can specify the level of the harmonic. With this frequency the <i>'harmonic'</i> current and voltage values are filtered.

## 3.27.4 Connection

Please note

	CAUTION! Connection and module exchange only without power!
<u> </u>	- Before you start to work on at the module for installation or mainte- nance, you have to disconnect it from the main power source, i.e. the power line is to be switched off (possibly remove fuses)!
-	- The electronic module may only be replaced on power off!
-	<ul> <li>Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!</li> </ul>
-	<ul> <li>Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety pre- cautions, EMC).</li> </ul>

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#### **CAUTION!**

#### Do not exchange current and voltage connections!

Please note when connecting, that the current and voltage paths are not exchanged! The module will be destroyed by directly connecting one phase to a low-resistance current connector!



#### **CAUTION!**

#### Use current transformer with max. 1A!

You may only use current transformer with max. current of 1A! Please consider the data sheet of your current transformer!

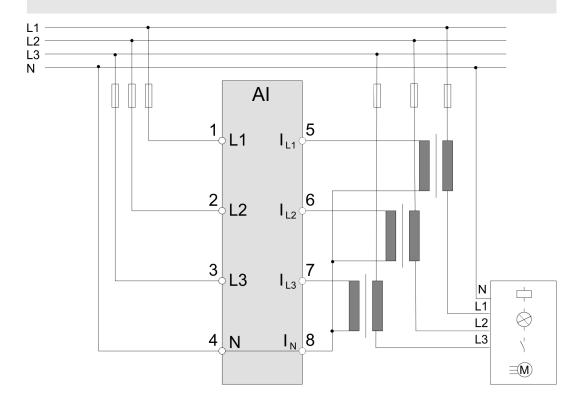


#### All phases of one supply grid!

Please note that the phases to be measured must be from the same supply grid!

#### Reset energy counters after installation!

As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measurement is not interrupted by STOP or RESET of the CPU respectively the bus coupler. After installing the module the energy counters should be reset by CMD-Frame. & Chapter 3.27.7.2.5 'CMD Frame' on page 328



## 3.27.5 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Data type	Description	Default (dec.)	DS	IX	SX
CFG	UINT_8	Choice of phases and data formats	0	80h	3100h	01h
F0V1	UINT_8	Frame 0: Value 1 (ID)	1	81h	3101h	02h
F0V2	UINT_8	Frame 0: Value 2 (ID)	9		3102h	03h
F0V3	UINT_8	Frame 0: Value 3 (ID)	13		3103h	04h
F0V4	UINT_8	Frame 0: Value 4 (ID)	0		3104h	05h
F0V5	UINT_8	Frame 0: Value 5 (ID)	0		3105h	06h
IRMS_MAX	UINT_32	Current upper limit [mA] Range of values: 0 25000000	0	82h	3106h 3109h	07h
VRMS_MAX	UINT_16	Voltage upper limit [V] Range of values: 0 500	260	83h	310Ah 310Bh	08h
VRMS_MIN	UINT_16	Voltage lower limit [V] Range of values: 0 500	200		310Ch 310Dh	09h
PF_MIN	UINT_8	CosPhi lower limit [0.01] Range of values: 0 100	30	84h	310Eh	0Ah
T_MAX	UINT_16	Temperature upper limit [0.01 °C] Range of values: 0 20000	7000	85h	310Fh 3110h	0Bh
F_MAX	UINT_16	Frequency upper limit [0.01 Hz] Range of values: 0 20000	5100		3111h 3112h	0Ch
F_MIN	UINT_16	Frequency lower limit [0.01 Hz] Range of values: 0 20000	4900		3113h 3114h	0Dh
CT_FACTOR	UINT_16	Current transformer factor Range of values: 1 5000	1		3115h 3116h	0Eh
HARM	UINT_8	Harmonic number 🤄 'Harmonics' on page 313 Range of values: 1 30	1	86h	3117h	0Fh

The parameters are transferred in big-endian format (byte order: high byte, low byte).

 As long as no parameters have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the parameters stored in the module.

- After transferring the parameters to the module the status bits are reset and the measurement is interrupted for a short time!
- Please note when at least one phase is de-activated, the parameters PF\_MIN and VRMS\_MIN are ignored and set to "0".
- On error in the parametrization the MF LED blinks and you receive an error message. 
   'Status communication' on page 320

#### Data type

🔄 'Data type' on page 311

#### CFG

Bit	Name	Description	Default
0	reserved		0
1	Write Protect *)	Write protection bit for parameterization via Web server 0: Write Protect de-activated 1: Write Protect activated Please see the following note!	1 *)
2	reserved		0
3	Phase 1	Measurement phase L1 0: Measurement is activated 1: Measurement is de-activated	0
4	Phase 2	Measurement phase L2 0: Measurement is activated 1: Measurement is de-activated	0
5	Phase 3	Measurement phase L3 0: Measurement is activated 1: Measurement is de-activated	0
6	Data type	Data type of the measured values in the user data 0: Integer (INT) 1: 32bit floating point (FLOAT) DIN IEEE 754	0
7	Byteorder	Data type of the measured values in the user data 0: Big-Endian: Byte order: high byte, low byte 1: Little-Endian: Byte order: low byte, high byte	0

\*) Access to the 'Write Protect' parameter is only possible via the Web server of the head module (not via GSD or GSDML).

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$\bigcirc$

#### Write Protect

The parameter 'Write Protect' is only relevant, if the module is connected to a head module with an integrated Web server. If the module is parameterized via the Web server 'Write Protect' must be set to "0", otherwise the changed parameters will not be used!

# **F0V1 ... F0V5** In the module you can combine some measurands to one data package (Frame), which is transferred in one step.

♦ 'Frame' on page 311

By specifying the *ID* of the corresponding measurand, via *F0V1* ... *F0V5* the data areas of Frame 0 can be defined. Please note that here the user data length of 12 bytes is not exceeded.

& Chapter 3.27.6 'Measurands' on page 317

Range of values: 0 ... 41

Default:

- F0V1: 1 (active energy consumer)
- F0V2: 9 (total active power)
- F0V3: 13 (total cos φ)
- F0V4: 0
- F0V5: 0

#### 3.27.6 Measurands

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	INT_32	1Wh *	0	4 294 967 295
2	Counter: Active energy producer	INT_32	1Wh *	0	4 294 967 295
3	Counter: Active energy L1 consumer	INT_32	1Wh *	0	4 294 967 295
4	Counter: Active energy L1 producer	INT_32	1Wh *	0	4 294 967 295
5	Counter: Active energy L2 consumer	INT_32	1Wh *	0	4 294 967 295
6	Counter: Active energy L2 producer	INT_32	1Wh *	0	4 294 967 295
7	Counter: Active energy L3 consumer	INT_32	1Wh *	0	4 294 967 295
8	Counter: Active energy L3 producer	INT_32	1Wh *	0	4 294 967 295
9	Total active power	INT_32	1mW	-3 750 000	3 750 000
10	Total reactive power	INT_32	1mW	-3 750 000	3 750 000
11	Total apparent power	INT_32	1mW	-3 750 000	3 750 000
12	Frequency	INT_16	0.01Hz	4600	6400
13	Total Cos phi *)	INT_8	0.01	-100	100
14	Temperature	INT_16	0.01°C	-2500	8500
15	Active power L1	INT_32	1mW	-1 250 000	1 250 000
16	Reactive power L1	INT_32	1mW	-1 250 000	1 250 000
17	Total power L1	INT_32	1mW	-1 250 000	1 250 000

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ID	Description	Data type	Unit	Min. value	Max. value
18	Voltage L1	INT_32	1mV	0	300 000
19	Current L1	INT_16	1mA	0	5 000 000
20	Cos phi L1 *)	INT_8	0.01	-100	100
21	Harmonic voltage L1	INT_32	1mV	0	300 000
22	Harmonic current L1	INT_16	1mA	0	5 000 000
23	Active power L2	INT_32	1mW	-1 250 000	1 250 000
24	Reactive power L2	INT_32	1mW	-1 250 000	1 250 000
25	Total power L2	INT_32	1mW	-1 250 000	1 250 000
26	Voltage L2	INT_32	1mV	0	300 000
27	Current L2	INT_16	1mA	0	5 000 000
28	Cos phi L2 *)	INT_8	0.01	-100	100
29	Harmonic voltage L2	INT_32	1mV	0	300 000
30	Harmonic current L2	INT_16	1mA	0	5 000 000
31	Active power L3	INT_32	1mW	-1 250 000	1 250 000
32	Reactive power L3	INT_32	1mW	-1 250 000	1 250 000
33	Total power L3	INT_32	1mW	-1 250 000	1 250 000
34	Voltage L3	INT_32	1mV	0	300 000
35	Current L3	INT_16	1mA	0	5 000 000
36	Cos phi L3 *)	INT_8	0.01	-100	100
37	Harmonic voltage L3	UINT_32	1mV	0	300 000
38	Harmonic current L3	UINT_16	1mA	0	5 000 000
39	Overflow energy meter	UINT_32			
	Is incremented by 1 in case of overflow of the energy meter (ID = 1)				
40	Overflow energy meter	UINT_32			
	Is incremented by 1 in case of overflow of the energy meter $(ID = 2)$				
41	🌣 'Status measurement' on page 319	UINT_16			

\*) The measuring accuracy of the Cos phi is maintained from a minimum current of 5mA x CT-FACTOR (current transformer factor).

Resolution energy meter	The display resolution of the energy meter is 1Wh x <i>CT-FACTOR</i> (current transformer factor). <i>S Chapter 3.27.5 'Parameter data' on page 315</i>
Tolerance	The measuring tolerance for each measurand is continuously 1%.
ID	Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .

Data type	∜ 'Data type' on page 311
Status measurement	With status measurement you get information about limit violations.
	The limit values can be defined via the parametrization. Schapter 3.27.5 Parameter data' on page 315
	The status measurement is refreshed together with the other measurement values, as soon as the DS-ID is incremented.
	Set bits of status measurement remain set as long as they are acknowledged by Chapter 3.27.7.2.5 'CMD Frame' on page 328.

Byte order: high byte, low byte (big endian)

Byte	Description
0	<ul> <li>0: de-activated, 1: activated</li> <li>Bit 0: Voltage at phase L2 below limit value (L2: VRMS_MIN)</li> <li>Bit 1: Voltage at phase L3 below limit value (L3: VRMS_MIN)</li> <li>Bit 2: Voltage at phase L1 above limit value (L1: VRMS_MAX)</li> <li>Bit 3: Voltage at phase L2 above limit value (L2: VRMS_MAX)</li> <li>Bit 4: Voltage at phase L3 above limit value (L3: VRMS_MAX)</li> <li>Bit 5: Temperature above limit value (T_MAX)</li> <li>Bit 6: Frequency below limit value (T_MAX)</li> <li>Bit 7: Temperature above limit value (T_MAX)</li> </ul>
1	<ul> <li>0: de-activated, 1: activated</li> <li>Bit 0 <ul> <li>0: deleted via CMD Frame (0x04)</li> <li>1: if there was a RESET of the module. This happens after PowerON.</li> </ul> </li> <li>Bit 1: Current at phase L1 above limit value (L1: IRMS_MAX)</li> <li>Bit 2: Current at phase L2 above limit value (L2: IRMS_MAX)</li> <li>Bit 3: Current at phase L3 above limit value (L3: IRMS_MAX)</li> <li>Bit 4: Efficiency cos φ phase L1 below limit value (L1: PF_MIN)</li> <li>Bit 5: Efficiency cos φ phase L2 below limit value (L2: PF_MIN)</li> <li>Bit 6: Efficiency cos φ phase L3 below limit value (L3: PF_MIN)</li> <li>Bit 7: Voltage at phase L1 below limit value (L1: VRMS_MIN)</li> </ul>

#### 3.27.7 Process data communication

Overview

During runtime the communication with the module happens via telegrams in the process image. Here you have the following possibilities:

- Read measured value
- Define Frame with measurands
- Read Frame with measured values
- Send control command

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3.27.7.1 Structure

```
Telegram
```

The communication takes place via the I/O area of the head module. The head module sends via the output area a request telegram to the module. This responds with the requested data within the input area of the head module. Depending on the used head module this may take several cycles to complete, until the data are received in the input area. To ensure the consistency of all measured values, which originate from the same measurement, are stored in the module under one  $\Leftrightarrow$  *'DS-ID' on page 310*. For input and output data the telegram has a length of 16byte and the following structure:

Byte	Function
В0	B0: Header byte 0 ■ Bit 3 0: ఈ 'Status communication' on page 320 ■ Bit 6 4: Telegram type ■ Bit 7: 0 fix reserved
B1	<ul> <li>B1: Header byte 1</li> <li>ID of the measurand (1 41)   </li> <li>← Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i></li> </ul>
B2	<ul> <li>B2: Header byte 2</li> <li>Bit 3 0: Data set ID (DS-ID) of the measured value (1 15)</li> <li>Bit 7 4: Length of the user data (1 12)</li> </ul>
Β3	<ul> <li>B3: Header byte 3 - Common status</li> <li>Bit 0: Frequency F_MAX exceeded</li> <li>Bit 1: Frequency F_MIN undershot</li> <li>Bit 2: Temperature T_MAX exceeded</li> <li>Bit 3: Voltage VRMS_MAX exceeded</li> <li>Bit 4: Voltage VRMS_MIN undershot</li> <li>Bit 5: Efficiency PF_MIN undershot</li> <li>Bit 6: Current IRMS_MAX exceeded</li> <li>Bit 7: reserved</li> </ul>
D00	D00 D11: User data:
	User data for data to be sent and received
D11	

#### Status communication

Via the header byte (bit 3 ... 0) the status of the communication can be determined. On error no user data are transferred i.e. the length of the user data is 0. Please note that low error IDs are overridden by higher error IDs.

Status	Designation
0x00	OK (no error)
0x01	Error: No new measured values available
0x02	Error: DS-ID
0x03	Error: Telegram length
0x04	Error: <i>Frame</i> too big

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Status	Designation
0x05	Error: <i>Frame</i> not defined
0x06	Error: Measurand not available
	🌣 Chapter 3.27.6 'Measurands' on page 317
0x07	Error: 'CMD Frame' - Command could not be executed
0x08	Error: 'Set Frame' - Frame definition is not valid (Set Frame)
0x09	Error: Telegram type not available - invalid request
0x0A	Error: Parameter - the last parameter set was not valid
0x0E	External error - Please contact our support
0x0F	Internal error - Please contact our support
	On an <i>internal error</i> (0x0F) all the measurements are stopped and a Reset of the module to default parameters is triggered! Here all counter values and Frame definitions are deleted!

# **Telegram types** By specifying the *Telegram type* the content of the responded data is defined. The following telegram types are available:

Туре	Designation	Page
0x00	'Zero Frame': Accessing Frame 0	♦ 322
0x01	'Read Value': Read the measured value of a measurand	♦ 322
0x02	<i>'Read Frame'</i> : Read a previously defined data package (Frame)	ଓ 326
0x03	'Set Frame': Define the data areas of a data package (Frame)	♦ 324
0x04	<i>'CMD Frame'</i> : Send a command	♦ 328

Length of the user data Length of user data are specified from D00 ... D11: On error no user data are transferred i.e. the length of the user data is 0 and the module returns an error ID.

Range of values: 0 ... 12

**Common status** With this byte you get an overview of possible error messages. With  $\Leftrightarrow$  'Status measurement' on page 319 you get detailed information about an error.

- Bit 0: Frequency *F\_MAX* exceeded
- Bit 1: Frequency *F\_MIN* undershot
- Bit 2: Temperature *T\_MAX* exceeded
- Bit 3: Voltage VRMS\_MAX exceeded
- Bit 4: Voltage VRMS\_MIN undershot
- Bit 5: Efficiency *PF\_MIN* undershot
- Bit 6: Current IRMS\_MAX exceeded
- Bit 7: reserved

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#### User data

Depending on the telegram type, here up to 12 byte user data can be found.

#### 3.27.7.2 Telegram types

#### **Telegram types**

By specifying the *Telegram type* the content of the responded data is defined. The following telegram types are available:

Туре	Designation	Page
0x00	'Zero Frame': Accessing Frame 0	♦ 322
0x01	'Read Value': Read the measured value of a measurand	⊗ 322
0x02	<i>'Read Frame'</i> : Read a previously defined data package (Frame)	ଓ 326
0x03	'Set Frame': Define the data areas of a data package (Frame)	⊗ 324
0x04	'CMD Frame': Send a command	⊗ 328

#### 3.27.7.2.1 Zero Frame

This telegram type is the same as the telegram type *'Read Frame'* applied at *Frame 0*. After the start-up of the module there are automatic *Zero Frame* requests as long as the process data communication comes from the head module. *Schapter 3.27.7.2.4 'Read Frame'* on page 326

#### 3.27.7.2.2 Read Value

With 'Read Value' all the measured values can be requested.

#### Request

Byte	Value	Description
В0	0x10	<ul> <li>Bit 3 0: Error code (not relevant)</li> <li>Bit 6 4: 001 Telegram type '<i>Read Value</i>'</li> <li>Bit 7: 0 fix reserved</li> </ul>
B1	?	§ 'ID' on page 310 of the measurand
B2	0x?0	Length user data: 0
B3	0x00	Common status (not relevant)
D00		User data (not relevant)
D11		

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#### Response

Byte	Value	Description
B0	0x10	<ul> <li>Bit 3 0: 5 <i>Status communication' on page 320</i></li> <li>Bit 6 4: 001 Telegram type <i>Read Value'</i></li> <li>Bit 7: 0 fix reserved</li> </ul>
B1		ID of the measurand from the request
B2		Length of the user data with measured values in byte
		DS-ID of the measured value from the request, which was read
B3		
D00		User data with the requested measured value
		Byte order: high byte, low byte (big endian)
D11		

**Example** '*Read Value*' In the example with *ID* = 14 the temperature of the module for *DS-ID* = 1 is requested.

#### Request

Byte	Value	Description
B0	0x10	Telegram type 'Read Value'
B1	0x0E	♦ 'ID' on page 310 of the measurand
B2	0x01	(5  DS-ID) on page 310 of the measured value to be read (DS-ID = 1)
B3	0x00	Common status (not relevant)
D00	-	User data (not relevant)
D11		

## Response

Byte	Value	Description
B0	0x10	Telegram type 'Read value' from the request
B1	0x0E	ID of the measurand from the request
B2	0x21	Length of the user data here temperature 2 byte
		DS-ID of the measured value from the request, which was read
B3	0x00	♦ 'Common status' on page 321: OK
D00	0x00	User data with the requested temperature e.g. 35°C
D01	0x23	

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## 3.27.7.2.3 Set Frame

Overview

In the module you can combine some measurands to one data package (Frame), which is transferred in one step  $\mathcal{G}$  (*Frame' on page 311*. With 'Set Frame' a Frame can be built.

#### Request

Byte	Value	Description
B0	0x30	<ul> <li>Bit 3 0: Error code (not relevant)</li> <li>Bit 6 4: 011 Telegram type 'Set Frame'</li> <li>Bit 7: 0 fix reserved</li> </ul>
B1	?	
B2	2 0x0?	Length user data: 1 byte each measurand
		■ <i>DS-ID</i> here fix 0
B3	0x00	Common status (not relevant)
D00	?	<ul> <li>1 byte each measurand regarding that the measured values do not exceed the total length of 12 byte. Here, the format of the measured values is taken into account.</li> <li></li></ul>
D11		♦ 'Data type' on page 311

#### Response

Byte	Value	Description
B0	0x30	<ul> <li>Bit 3 0: 5 <i>Status communication' on page 320</i></li> <li>Bit 6 4: 011 Telegram type <i>Set Frame'</i></li> <li>Bit 7: 0 fix reserved</li> </ul>
B1		<i>FR-ID</i> of the Frame from the request
B2		Length of the user data from the request
		■ <i>DS-ID</i> here fix 0
B3		
D00		User data from the request
D11		

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Example 'Set Frame'

Here a Frame with *FR-ID* 0x01 is defined. The Frame contains the following measurands:

- ID: 03: Counter: Active energy L1 (consumer)
- ID: 13: total cos φ
- ID: 12: Frequency

#### Request

Byte	Value	Description	
B0	0x30	Telegram type <i>'Set Frame'</i>	
B1	0x01	♦ 'FR-ID' on page 311 of the Frame to be read (FR-ID = 1)	
B2	0x03	Length user data: 3 byte	
B3	0x00	Common status (not relevant)	
D00	0x03	User data with the ID of the measurands	
D01	0x0D		
D02	0x0C		
D03	-	Remaining user data are not relevant	
D11			

Byte	Value	Description	
B0	0x30	Telegram type 'Set Frame' from the request	
B1	0x01	FR-ID of the Frame from the request	
B2	0x03	Length of the user data from the request	
B3	0x00	♦ 'Common status' on page 321: OK	
D00	0x03	User data from the request	
D01	0x0D		
D02	0x0C		
D03	-	Remaining user data are not relevant	
D11			

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## 3.27.7.2.4 Read Frame

Overview

In the module you can combine some measurands to one data package (Frame), which is transferred in one step.

🖏 'Frame' on page 311

With 'Read Frame' a Frame can be requested.

#### Request

Byte	Value	Description	
В0	0x20	<ul> <li>Bit 3 0: Error code (not relevant)</li> <li>Bit 6 4: 010 Telegram type <i>'Read Frame'</i></li> <li>Bit 7: 0 fix reserved</li> </ul>	
B1	?		
B2	0x00	Length of the user data is 0	
	?		
B3	0x00	Common status (not relevant)	
D00	-	Common status (not relevant)	
D11			

Byte	Value	Description		
B0	0x20	<ul> <li>Bit 3 0: 5 'Status communication' on page 320</li> <li>Bit 6 4: 010 Telegram type 'Read Frame'</li> <li>Bit 7: 0 fix reserved</li> </ul>		
B1		FR-ID of the Frame from the request		
B2		Length of the user data with measured values in byte		
		DS-ID of the measured value from the request, which was read		
B3		Gommon status' on page 321		
D00		User data with the requested Frame with measured values		
		Byte order: high byte, low byte (big endian)		
D11				

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 Example 'Read Frame'
 In the example the previously via 'Set Frame' defined FR-ID (0x01) is requested with the following measurands:

 ID: 03: Counter: Active energy L1 (consumer): 4byte

- ID: 13: total cos φ: 1byte
- ID: 12: Frequency 2byte

#### Request

Byte	Value	Description	
B0	0x20	Telegram type 'Read Frame'	
B1	0x01	♦ 'FR-ID' on page 311 of the Frame to be read (FR-ID = 1)	
B2	0x71	Length of the user data is 7	
		(DS-ID'  on page 310 of the measured value to be read (DS-ID = 1)	
B3	0x00	Common status (not relevant)	
D00	-	User data (not relevant)	
D11			

Byte	Value	Description	
B0	0x20	Telegram type 'Read value' from the request	
B1	0x01	FR-ID of the Frame from the request	
B2	0x71	Length of the Frame with measured values: 7	
		DS-ID of the measured value from the request	
B3	0x00	♦ 'Common status' on page 321: OK	
D00	0x00	Counter: Active energy L1 (consumer): 500kWh	
D01	0x07		
D02	0xA1		
D03	0x20		
D04	0x5A	Total cos φ: 0.9	
D05	0x13	Frequency: 50Hz	
D06	0x88		
D07	-	Remaining user data are not relevant	
D11			

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#### 3.27.7.2.5 CMD Frame

With *'CMD Frame'* you can send control commands to the module. This can trigger various actions or be used for reading and writing of control registers. The following control commands are available:

- Reset the energy counter
- Reset the status bits
- Request the firmware version

#### Request

Byte	Value	Description		
B0	0x40	Bit 3 0: Error code (not relevant) Bit 6 4: 100 Telegram type <i>'CMD Frame'</i> Bit 7: 0 fix reserved		
B1	?	<ul> <li><i>CMD-ID</i> of the control command, which is to be executed</li> <li>0x01: Reset of all energy counters</li> <li>0x03: Reset the status bits</li> <li>0x04: Request the firmware version</li> </ul>		
B2	?	<ul> <li>Length of the user data depending on <i>CMD-ID</i></li> <li>0x01: Reset of all energy counters (length user data: 0byte)</li> <li>0x03: Reset the status bits: (length user data: 4byte)</li> <li>0x04: Request the firmware version (Length user data: 0byte)</li> </ul>		
	?	DS-ID (not relevant)		
B3	0x00	Common status (not relevant)		
D00	-	User data depending on CMD-ID		
		<ul> <li>0x01: Reset of all energy counters (user data: not relevant)</li> <li>0x03: Reset the status bits: (User data: 4byte with the corresponding set bits)</li> </ul>		
D11		<ul> <li>0x04: Request the firmware version (user data: not relevant)</li> </ul>		

Byte	Value	Description	
В0	0x40	<ul> <li>Bit 3 0: 5 <i>Status communication' on page 320</i></li> <li>Bit 6 4: 100 Telegram type <i>CMD Frame'</i></li> <li>Bit 7: 0 fix reserved</li> </ul>	
B1		CMD-ID from the request	
B2		<ul> <li>Length of the user data depending on <i>CMD-ID</i></li> <li>0x01: Reset of all energy counters (length user data: 0byte)</li> <li>0x03: Reset the status bits: (length user data: 4byte)</li> <li>0x04: Request the firmware version (Length user data: 10byte)</li> </ul>	
		DS-ID (not relevant)	
B3			
D00		<ul> <li>User data depending on <i>CMD-ID</i></li> <li>0x01: Reset of all energy counters (user data: nothing)</li> <li>0x03: Reset the status bits: (User data: 4byte with the corresponding set bits)</li> <li>0x04: Request the firmware version (user data: 10byte with the version information)</li> </ul>	

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Byte	Value	Description	
 D11		Byte order: high byte, low byte (big endian)	
		<ul> <li>Firmware version</li> <li>Byte 2 0: Firmware version</li> <li>Byte 5 3: Protocol version <ul> <li>Byte 3: Major</li> <li>Byte 4: Minor</li> <li>Byte 5: Revision</li> </ul> </li> <li>Byte 5: Revision</li> <li>Byte 9 6: Measuring chip version <ul> <li>Byte 6: Day</li> <li>Byte 7: Month</li> <li>Byte 8: Year (hundreds)</li> <li>Byte 9: Year (one)</li> </ul> </li> </ul>	
Example 'CM	D Frame'	In this example all the status bits are reset.	

## Request

Byte	Value	Description	
B0	0x40	Telegram type 'CMD Frame'	
B1	0x03	CMD-ID: Reset the status bits	
B2	0x40	Reset the status bits: (length user data: 4byte)	
B3	0x00	Common status (not relevant)	
D00	0xFF	User data: Reset the status bits	
D01	0xFF		
D02	0xFF		
D03	0xFF		

Byte	Value	Description	
B0	0x40	Telegram type 'CMD Frame' from the request	
B1	0x03	CMD-ID from the request	
B2	0x40	Length of the user data from the request	
B3	0x00	& 'Common status' on page 321: OK	
D00	0xFF	User data from the request	
D01	0xFF		
D02	0xFF		
D03	0xFF		

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#### 3.27.7.2.6 Example

Communication

Here the communication and the query of the status bits (ID = 41) are described on an example.

No.	Request	Response	Description
1	0x10 0x01 0x03 0x00		An <i>ID</i> and <i>DS-ID</i> is requested: e.g.: M 1-3 M ( <i>ID</i> )-( <i>DS-ID</i> )
3		0x10 0x01 0x43 0x01 (4 byte data)	M 1-3 indicates frequency exceeded.
4	0x10 0x29 0x03 0x00		Query the status bits M 41-3.
5		0x10 0x29 0x43 0x05 0x00 0x00 0x80 0x00	Frequency exceeded and temperature exceeded is reported.
6	0x10 0x29 0x04 0x00		Query the status bits M 41-4.
7		0x10 0x29 0x44 0x05 0x00 0x00 0xA0 0x00	The status bit were refreshed ( $ID = 41$ ) and temperature exceeded is reported.
8	0x40 0x03 0x45 0x00 0x00 0x00 0xA0 0x00		Reset the status bits.
9		0x40 0x03 0x45 0x00 0x00 0x00 0xA0 0x00	Status bits have been reset.
10	0x10 0x29 0x05 0x00		Query the status bits M 41-5.
11		0x10 0x29 0x45 0x04	Status bits have been reset.
		0x00 0x00 0x00 0x00	Temperature exceeded is reported.

#### 3.27.8 Error messages and diagnostics

#### 3.27.8.1 Status and error messages

- Common status & 'Common status' on page 321
- Status communication \$ 'Status communication' on page 320

3.27.8.2 Diagnostic data

This module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

Error in configuration / parametrization

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- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels	01h			08h
		of a module				
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error	00h			0Ah
		channel 0				
CH1ERR CH7ERR	7	reserved	00h			0Bh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

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#### ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

#### CHTYP Channel type

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

0 Number of chappeds of the module (here 01b)	NUMCH Channels	Byte	Bit 7 0
o Number of chamers of the module (here of fi)		0	Number of channels of the module (here 01h)

CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel 0

CH0ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel 0
		Bit 0: set at configuration / parametrization error
		Bit 7 1: reserved

CH1ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

#### DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

#### µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

## 3.27.9 Use handling block

## 3.27.9.1 Include VIPA library

Overview	The VIPA specific blocks can be found in the service area of www.vipa.com as library download file at Downloads > VIPA LIB. The library is available as packed zip file. As soon as you want to use VIPA specific blocks you have to import them into your project. Execute the following steps:
	1. Unzip Zip file
	2. Retrieve" the library
	3. Open library and transfer blocks into the project
Unzip the Zip file	Start your unzip application with a double click on the Zip file and copy the unzipped file to your work directory. It is not necessary to extract this file, too.
Retrieve library	1. To retrieve your library for the CPUs, start the SIMATIC manager from Siemens. Open the dialog window for archive selection via <i>'File</i> → <i>Retrieve'</i> . Navigate to your work directory.
	<b>2.</b> Select the unzipped file and click at [Open].
	3. Select a destination folder where the blocks are to be stored.
	<b>4.</b> With [OK] the extraction is started.
Open library and transfer	<b>1.</b> Open the library after the extraction.
blocks into the project	Open your project and copy the FB 325 and the UDT 325 from the library into the directory "blocks" of your project.
	$\Rightarrow$ Now you have access to the blocks via your user application.
	<b>3.</b> To use the UDT with your data block, create a new data block in your project and enter at <i>'Type'</i> in the declaration view UDT 325.
	⇒ The data block is created and the structure of the UDT is used.
3.27.9.2 FB 325 - EM CO	M_1 - Communication with 031-1PA00

Overview

This module enables the communication with the module 031-1PA00 for energy metering and power measurement. For the communication a data block is necessary. Here the DB gets its structure from the UDT 325 EM\_COM\_1. The block has the following functionalities:

- Load default parameters after start-up
- Storage of parameters, limit values, measured values and messages
- Transfer of consistent measured values
- Definition of the measured values by means of an UDT structure
- Communication by means of telegram type and ID
- Functional diagnostics, connection monitoring and error message evaluation

#### Parameter

Parameter	Declaration	Data type	Description
MODE	INPUT	BYTE	<ul> <li>0x01 = Data exchange via process data Currently only the MODE = 1 is supported</li> </ul>
CHANNEL_ IN	INPUT	ANY	Pointer to the input data
			<ul> <li>With MODE = 0x01 exclusively data type BYTE and length 16 are permitted.</li> <li>Example: P#E100.0 BYTE 16 or P#DB10.DBX0.0 BYTE 16</li> </ul>
CHANNEL_OUT	INPUT	ANY	Pointer to the output data
			<ul> <li>With MODE = 0x01 exclusively data type BYTE and length 16 are permitted.</li> <li>Example: P#A100.0 BYTE 16 or P#DB10.DBX16.0 BYTE 16</li> </ul>
MEAS_DATA	IN_OUT	UDT	UDT for the measured values Chapter 3.27.9.3 'UDT 325 - EM_DATA_R1 - Data structure for FB 325' on page 334

3.27.9.3 UDT 325 - EM\_DATA\_R1 - Data structure for FB 325

#### UDT - Header

Name	Declaration	Data type	Description
Timeout	INPUT	TIME	Timeout for reading measured values
Polltime	INPUT	TIME	Interval for the periodic reading
Control_Global	INPUT	BYTE	<ul> <li>0: de-activated, 1: activated</li> <li>Bit 0: Periodic execution according to the <i>Polltime</i> (default)</li> </ul>
			<ul> <li>Bit 0. Periodic execution according to the Politime (default)</li> <li>Bit 1: Immediate execution - bit is to be reset after the execution.</li> <li>Bit 6 2: reserved</li> <li>Bit 7: Re-initialization of the block by the configuration is sent again</li> </ul>
Status_Global	OUTPUT	BYTE	Block status
			<ul> <li>0x00: Not processed</li> <li>0x01: In process (BUSY)</li> <li>0x02: Ready without error (DONE)</li> <li>0x80: Error on processing (ERROR)</li> </ul>
Status	OUTPUT	BYTE	Corresponds to B3: Header byte 3 - Common status
Alarm_Global			<ul> <li>Bit 0: Frequency F_MAX exceeded</li> <li>Bit 1: Frequency F_MIN undershot</li> <li>Bit 2: Temperature T_MAX exceeded</li> <li>Bit 3: Voltage VRMS_MAX exceeded</li> <li>Bit 4: Voltage VRMS_MIN undershot</li> <li>Bit 5: Efficiency PF_MIN undershot</li> <li>Bit 6: Current IRMS_MAX exceeded</li> <li>Bit 7: reserved</li> </ul>
			🌣 'Common status' on page 321

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Name	Declaration	Data type	Description
Cmd	INPUT	BYTE	0: de-activated, 1: activated
			<ul> <li>Bit 0: Reset the energy counters</li> <li>Bit 1: Trigger Reset at current transformer</li> <li>Bit 2: Reset status measurement</li> <li><i>§</i> 'Status measurement' on page 319</li> <li>If several bits are set, they are sequentially processed.</li> </ul>
Status_Cmd	OUTPUT	BYTE	Status command
			<ul> <li>0x00: Not processed</li> <li>0x01: In process (BUSY)</li> <li>0x02: Ready without error (DONE)</li> <li>0x80: Error on processing (ERROR)</li> </ul>
Jobtime	OUTPUT	TIME	Duration to read the measured values respectively to run a command
DsID	OUTPUT	BYTE	Number of the current DS-ID
			♦ 'DS-ID' on page 310
Frame_ID	OUTPUT	BYTE	Number of the current FR-ID
			♦ 'FR-ID' on page 311
Error_ID	OUTPUT	WORD	Detailed error information
Reserved		ARRAY of BYTE (128)	reserved

#### UDT - data

After the header data, in the UDT there are the measurands sequentially listed with the following structure:

Name	Declaration	Data type	Description
Name	IN_OUT	STRUCT	Name of the measurand
Read_Mode	INPUT	BYTE	<ul> <li>Bit 0: Accessing the measured value</li> <li>- 0: Measured value is not read</li> <li>- 1: Measured value is read</li> </ul>
Value	OUTPUT	DWORD	Current measured value

#### **ERROR IDs**

ERROR ID	Description
0x0000	no error
0x8070	Error: Parameter MODE
0x8073	Error: Parameter CHANNEL_IN does not match MODE
0x8074	Error: Parameter CHANNEL_OUT does not match MODE
0x8080	Error: Write parameter: Data length is beyond 1 or 2 byte
0x8081	Error: Write parameter: Timeout detected when writing
0x8091	Error: Read measured value: Timeout detected when reading

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ERROR ID	Description
0x80A1	Error: Telegram type not available - invalid request
0x80A2	Error: Frame not defined
0x80A3	Error: Measurand not available
0x80A4	Error: Telegram length
0x80A5	Error: Frame too big
0x80A6	Error: No new measured values available
0x80A7	Error: DS-ID
0x80A8	Error: "CMD Frame" - Command could not be executed
0x80AF	Internal error - Please contact the hotline!
	On an internal error (0x0F) all the measurements are stopped and a reset to the default parame- ters of the module is triggered! Here all counter values and Frame definitions are deleted!

## 4 Analog Output

4.1 General						
<b>Cabling for analog signals</b> You must only use screened cable when you are connecting analog signals. cables reduce the effect of electrical interference. The screen of the analog should be grounded at both ends. In situations with different electrical poten sible that a current will flow to equalize the potential difference. This current fere with the analog signals. Under these circumstances it is advisable to grounded at one end only.						
Connecting loads and actuators	You can use the analog output modules to supply loads and actuators with current or voltage.					
	<ul> <li>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.</li> </ul>					
Parameterization	The parameterization via CPU, PROFIBUS and PROFINET happens by means of record sets (DS). The corresponding record set number may be found at the respective module description. Here also the indices (IX) respectively subindices (SX) for CANopen respectively EtherCAT are listed.					
Diagnostic functions	<ul> <li>The modules have diagnostics capability. The following errors may release a diagnostic:</li> <li>Error in parameterization</li> <li>Short-circuit recognition</li> <li>Wire-break recognition</li> </ul>					
	<ul> <li>Alternated blinking of the channel error LEDs</li> <li>The alternate blinking of the channel error LEDs of channel 0 and 1 indicates a watchdog error due to a system overload. Restart with a power cycle your system. If the error occurred again, check configuration and</li> </ul>					

## 4.2 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.

our support.

circuit and adjust them if necessary. If the error persists, please contact

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 <sup>14</sup> 2 <sup>13</sup> 2 <sup>12</sup> 2 <sup>11</sup> 2 <sup>10</sup> 2 <sup>9</sup> 2 <sup>8</sup> 2 <sup>7</sup> 2 <sup>6</sup> 2 <sup>5</sup> 2 <sup>4</sup> 2 <sup>3</sup>					2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>				
12Bit+SG	SG	G Analog value (word)							Х	Х	Х			
15Bit+SG	SG Analog value (word)													

Output ranges and function numbers

# 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

## 4.3 Output ranges and function numbers

**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 ranges	voltage

#### 0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		II
(10h)	0V	0	0000h		$D = 27648 x \frac{U}{10}$
	Not possible, is lin	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lin	mited to 0V.		underrange	

Output ranges and function numbers

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	$U = D \times \frac{10}{10}$
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		IJ
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		IJ
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

#### ±10V

## Output ranges

Current

## 0 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	20
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible, is li	mited to 0mA.		underrange	20
0 20mA	25.00mA	20480	5000h	overrange	20
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, is li	mited to 0mA.		underrange	20

## Analog Output

Output ranges and function numbers

## 4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D x \frac{16}{27648} + 4$	
Siemens	20mA	27648	6C00h	nominal range	27648	
S7 format	12mA	13824	3600h		I-4	
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$	
	0mA	-6912	E500h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$	
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384}$	
S5 format	12mA	8192	2000h		I-4	
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$	
	0mA	-4096	F000h	underrange		

## 4.4 032-1BB30 - AO 2x12Bit 0...10V

#### Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4 5

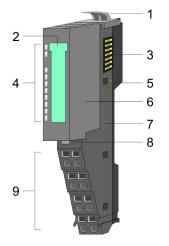
6

7

8

9

#### Structure



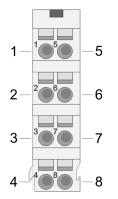
#### Status indication

RUN — MF — AO 0 — AO 1 —

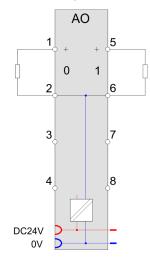
RUN	MF	AO x	Description
green	red 📕	red	becomption
_		х	Bus communication is OK
-		~	Module status is OK
	_	х	Bus communication is OK
-	-	^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul> <li>Overload, short-circuit</li> </ul>
			<ul> <li>Error in parameterization</li> </ul>
not relevant	: X		

032-1BB30 - AO 2x12Bit 0...10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected

O: Output

Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1BB30 - AO 2x12Bit 0...10V > Technical data

## 4.4.1 Technical data

Order no.	032-1BB30
Туре	SM 032
Module ID	0501 25D8
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	$\checkmark$
Voltage outputs	$\checkmark$
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no
Output data size	4 Byte

032-1BB30 - AO 2x12Bit 0...10V > Technical data

Order no.	032-1BB30
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C

032-1BB30 - AO 2x12Bit 0...10V > Parameter data

Order no.	032-1BB30
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 4.4.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 7 2: reserved</li> </ul>

**CHxFN** Function number 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.

channel x

032-1BB30 - AO 2x12Bit 0...10V > Diagnostic data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		IJ
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	U = D x 10
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		IJ
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	

#### 0 ... 10V

#### 4.4.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah

032-1BB30 - AO 2x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

## ERR\_A Diagnostic

Byte	Bit 7 0							
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>							

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0

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

#### **Analog Output**

032-1BB30 - AO 2x12Bit 0...10V > Diagnostic data

NUMCH Channels				
NOMCH Channels	Byte	Bit 7 0		
	0	Number of channels of a module (here 02h)		
CHERR Channel error	Byte	Bit 7 0		
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>		
CH0ERR / CH1ERR Channel specific	Byte	Bit 7 0		
onanner speeme	0	Channel-specific error channel x:		
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>		
CH2ERR CH7ERR reserved	Byte	Bit 7 0		
	0	reserved		
DIAG_US µs ticker	Byte	Bit 7 0		
	03	Value of the $\mu$ s ticker at the moment of the diagnostic		
	µs ticker			
	In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.			

## 4.5 032-1BB40 - AO 2x12Bit 0(4)...20mA

1 2

3

4

5

6

7 8

9

## Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

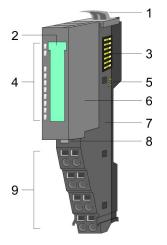
LED status indication

Electronic module

Terminal module

Terminal

#### Structure



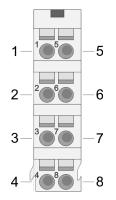
#### Status indication

RUN — MF — AO 0 — AO 1 —

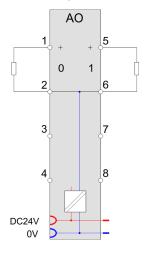
RUN	MF	AO x	Description	
green	red	red	Description	
		х	Bus communication is OK	
-		^	Module status is OK	
	-	х	Bus communication is OK	
-	-	X	Module status reports an error	
	-	х	Bus communication is not possible	
	-	^	Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
			Error channel x	
			<ul> <li>Error in parameterization</li> </ul>	
			Wire break (if parameterized)	
not relevant: X				

032-1BB40 - AO 2x12Bit 0(4)...20mA

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected

O: Output

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1BB40 - AO 2x12Bit 0(4)...20mA > Technical data

## 4.5.1 Technical data

Order no.	032-1BB40
Туре	SM 032
Module ID	0502 25D8
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	$\checkmark$
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.4% +/-0.5%
Basic error limit current ranges	+/-0.2% +/-0.3%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no

## Analog Output

032-1BB40 - AO 2x12Bit 0(4)...20mA > Technical data

information, alarms, diagnosticsdisplayyedisplayyeotsnos alarmnostic interruptnostic functionsyestics information read-outpovoltage displaygrerror displayre	4 Byte yes no
displayyedisplayyeatsnds alarmndstic interruptndstic functionsyestics information read-outpdvoltage displaygrerror displayreel error displayreonnn channels-n channels of groups to-n channels and backplane bus✓n channels and power supply✓	
ats       nd         s alarm       nd         stic interrupt       nd         stic functions       ye         stics information read-out       pd         voltage display       gr         error display       re         en channels       -         n channels of groups to       -         n channels and backplane bus       -         n channels and power supply       -	
s alarm nd stic interrupt nd stic functions 2000 stics information read-out 2000 voltage display 2000 error display re error display re en channels of groups to - n channels and backplane bus 2000 n channels and power supply 2000	าด
stic interrupt nd stic functions % stics information read-out % voltage display gr error display re el error display re on 1 n channels of groups to 1 n channels and backplane bus 1 n channels and power supply 1	
stic functions yes stics information read-out po voltage display gr error display re el error display re on 1 n channels of groups to - n channels and backplane bus v n channels and power supply v	no
stics information read-out po voltage display gr error display re el error display re on	no
voltage display gr error display re el error display re on	yes
error display re el error display re on	possible
el error display re on n channels n channels of groups to n channels and backplane bus n channels and power supply	green LED
n channels of groups to	red LED
n channels of groups to	red LED per channel
n channels of groups to	
n channels and backplane bus $\checkmark$ n channels and power supply $\checkmark$	-
n channels and power supply	-
	$\checkmark$
tential difference between circuits	/
	-
otential difference between inputs (Ucm) -	-
otential difference between Mana and Mintern D	DC 75 V/ AC 50 V
otential difference between inputs and Mana (Ucm) -	-
otential difference between inputs and Mintern -	
otential difference between Mintern and outputs -	-
on tested with D	DC 500 V
zes	
vtes 0	0
bytes 4	4
eter bytes 8	8
stic bytes 20	20
g	
I PI	PPE / PPE GF10
ng Pi	Profile rail 35 mm
nical data	
ions (WxHxD) 12	
60	12.9 mm x 109 mm x 76.5 mm
nmental conditions	12.9 mm x 109 mm x 76.5 mm 60 g

032-1BB40 - AO 2x12Bit 0(4)...20mA > Parameter data

Order no.	032-1BB40
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 4.5.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h

# WIBRK\_EN Wire-break recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire-break recognition channel 0 (1: on)</li> <li>Bit 1: Wire-break recognition channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>

CHxFN Function number channel x

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

#### 0 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	20
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible, is li	mited to 0mA.		underrange	20
0 20mA	25.00mA	20480	5000h	overrange	20
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, is lin	mited to 0mA.		underrange	20

#### 4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$
Siemens	20mA	27648	6C00h	nominal range	$1 = D \times \frac{1}{27648} + 4$
S7 format	12mA	13824	3600h		I-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384} + 4$
S5 format	12mA	8192	2000h		I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$
	0mA	-4096	F000h	underrange	

#### 4.5.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

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

#### MODTYP Module information

orma-	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

## ERR\_D Diagnostic

Byte	Bit 7 0
0	Bit 2 0: reserved
	Bit 3: set at internal diagnostics buffer overflow
	Bit 4: set at internal communication error
	Bit 7 5: reserved

#### CHTYP Channel type

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

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

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	<ul> <li>Channel-specific error channel x</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire-break</li> <li>Bit 7 5: reserved</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0

0

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

032-1BB70 - AO 2x12Bit ±10V

## 4.6 032-1BB70 - AO 2x12Bit ±10V

#### Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog outputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

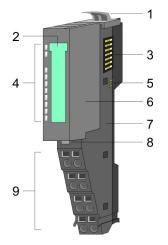
5

6

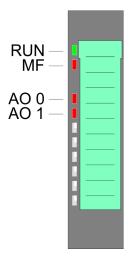
7 8

9

#### Structure



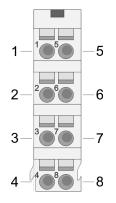
#### Status indication

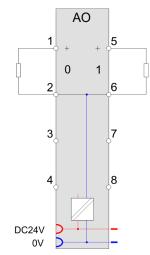


	RUN	MF	AO x	Description
	green	red	red	Description
			х	Bus communication is OK
				Module status is OK
		•	х	Bus communication is OK
				Module status reports an error
			х	Bus communication is not possible
				Module status reports an error
			Х	Error at bus power supply
	Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x	
			•	<ul> <li>Overload, short-circuit</li> </ul>
				Error in parameterization
	not relevant: X			

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected

O: Output

Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Adr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1BB70 - AO 2x12Bit ±10V > Technical data

## 4.6.1 Technical data

Order no.	032-1BB70
Туре	SM 032
Module ID	0505 25D8
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	$\checkmark$
Voltage outputs	$\checkmark$
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no

032-1BB70 - AO 2x12Bit ±10V > Technical data

Order no.	032-1BB70
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1BB70 - AO 2x12Bit ±10V > Parameter data

Order no.	032-1BB70
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 4.6.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h

## SHORT\_EN Short-circuit recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 7 2: reserved</li> </ul>

CHxFN Function number channel x

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

±10V

032-1BB70 - AO 2x12Bit ±10V > Diagnostic data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	$U = D \times \frac{10}{10}$
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		IJ
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	10 III
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		IJ
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		10
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

#### 0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lin	mited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	U = D r 10
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lin	mited to 0V.		underrange	

## 4.6.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

032-1BB70 - AO 2x12Bit ±10V > Diagnostic data

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

032-1BB70 - AO 2x12Bit ±10V > Diagnostic data

ERR_D	Diagnostic
-------	------------

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> </ul>
	Bit 7 5: reserved

CHTYP	Channel	type
-------	---------	------

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

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

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

032-1BB70 - AO 2x12Bit ±10V > Diagnostic data

#### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

## 4.7 032-1BD30 - AO 4x12Bit 0...10V

### Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

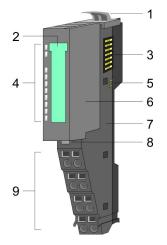
5

6

7 8

9

#### Structure

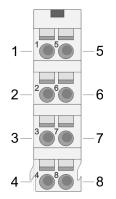


## Status indication

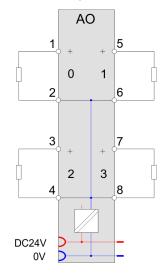
RUN	MF	AO x	Description
green	<b>red</b>	red	Description
		х	Bus communication is OK
		^	Module status is OK
	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
x	2Hz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul> <li>Overload, short-circuit</li> </ul>
			Error in parameterization
not relevant:	Х		

032-1BD30 - AO 4x12Bit 0...10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1BD30 - AO 4x12Bit 0...10V > Technical data

## 4.7.1 Technical data

Order no.	032-1BD30
Туре	SM 032
Module ID	0503 25E0
Current consumption/power loss	
Current consumption from backplane bus	90 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	$\checkmark$
Voltage outputs	$\checkmark$
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no
Output data size	8 Byte

032-1BD30 - AO 4x12Bit 0...10V > Technical data

Order no.	032-1BD30
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C

032-1BD30 - AO 4x12Bit 0...10V > Parameter data

Order no.	032-1BD30
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

### 4.7.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h
CH2FN	1	Function number channel 2	10h	82h	3104h	05h
CH3FN	1	Function number channel 3	10h	83h	3105h	06h

# SHORT\_EN Short-circuit recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 2: Short-circuit recognition channel 2 (1:on)</li> <li>Bit 3: Short-circuit recognition channel 3 (1:on)</li> <li>Bit 7 4: reserved</li> </ul>

## CHxFN Function number channel x

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

032-1BD30 - AO 4x12Bit 0...10V > Diagnostic data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		IJ
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	U = D x 10
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		IJ
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	

#### 0 ... 10V

#### 4.7.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah

032-1BD30 - AO 4x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	
--------------------	--

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

032-1BD30 - AO 4x12Bit 0...10V > Diagnostic data

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0

Byte	Bit 7 0
0	Bit 0: set at error in channel group 0
	Bit 1: set at error in channel group 1
	Bit 2: set at error in channel group 2
	Bit 3: set at error in channel group 3
	Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

## 4.8 032-1BD40 - AO 4x12Bit 0(4)...20mA

1 2

3

4

5

6

7 8

9

### Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with 0...20mA; 4...20mA

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

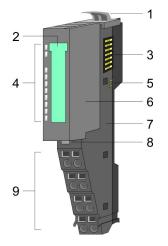
LED status indication

Electronic module

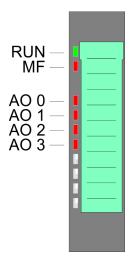
Terminal module

Terminal

#### Structure



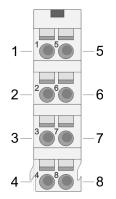
#### Status indication



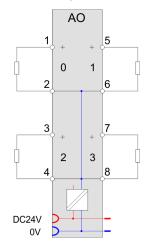
RUN	MF	AO x	Description
green	red	red	Description
_		х	Bus communication is OK
-		^	Module status is OK
_	•	х	Bus communication is OK
-		^	Module status reports an error
	-	x	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
		-	<ul><li>Error in parameterization</li><li>Wire break (if parameterized)</li></ul>
not relevant:	Х		

032-1BD40 - AO 4x12Bit 0(4)...20mA

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1BD40 - AO 4x12Bit 0(4)...20mA > Technical data

## 4.8.1 Technical data

Order no.	032-1BD40
Туре	SM 032
Module ID	0504 25E0
Current consumption/power loss	
Current consumption from backplane bus	90 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	$\checkmark$
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.4% +/-0.5%
Basic error limit current ranges	+/-0.2% +/-0.3%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no

## Analog Output

032-1BD40 - AO 4x12Bit 0(4)...20mA > Technical data

Order no.	032-1BD40
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1BD40 - AO 4x12Bit 0(4)...20mA > Parameter data

Order no.	032-1BD40
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### 4.8.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h
CH2FN	1	Function number channel 2	31h	82h	3104h	05h
CH3FN	1	Function number channel 3	31h	83h	3105h	06h

# WIBRK\_EN Wire-break recognition

Byte	Bit 7 0						
0	<ul> <li>Bit 0: Wire-break recognition channel 0 (1: on)</li> <li>Bit 1: Wire-break recognition channel 1 (1: on)</li> <li>Bit 2: Wire-break recognition channel 2 (1: on)</li> <li>Bit 3: Wire-break recognition channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>						

## CHxFN Function number channel x

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

032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic data

#### 0 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	20
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible, is li	mited to 0mA.		underrange	20
0 20mA	25.00mA	20480	5000h	overrange	20
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, is li	mited to 0mA.		underrange	20

#### 4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$
Siemens	20mA	27648	6C00h	nominal range	$1 = D \times \frac{1}{27648} + 4$
S7 format	12mA	13824	3600h		I-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384} + 4$
S5 format	12mA	8192	2000h		I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{1-4}{16}$
	0mA	-4096	F000h	underrange	

#### 4.8.3 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)

032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic data

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic data

#### ERR\_D Diagnostic

Byte B	it 7 0
	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

#### **CHTYP Channel type**

CHERR Channel error

Byte
0

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

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire-break</li> <li>Bit 7 5: reserved</li> </ul>
DIAG_US μs ticker	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

## 4.9 032-1BD70 - AO 4x12Bit ±10V

## Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

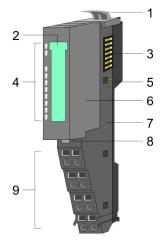
5

6

7 8

9

#### Structure

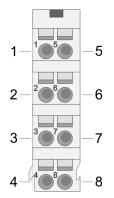


### Status indication

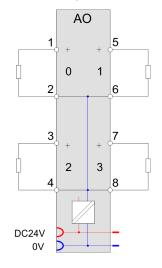
RUN	MF	AO x	Description			
green	<b>red</b>	red	Description			
		х	Bus communication is OK			
		^	Module status is OK			
	_	х	Bus communication is OK			
	-	^	Module status reports an error			
	_	х	Bus communication is not possible			
	-	^	Module status reports an error			
		Х	Error at bus power supply			
x	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30			
			Error channel x			
			Overload, short-circuit			
			Error in parameterization			
not relevant:	Х					

032-1BD70 - AO 4x12Bit ±10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

#### Input area

Output area

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

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1BD70 - AO 4x12Bit ±10V > Technical data

## 4.9.1 Technical data

TypeSM 032Module ID0506 25E0Current consumption/power loss60 mAPower loss0.8 WPower loss0.8 WTechnical data analog outputs4Number of outputs4Cable length, shielded200 mRated load voltage~Reverse polarity protection of rated load voltage~Voltage output short-circuit protection~Voltage outputs~Min. load resistance (voltage range)5 kΩMax. inductive load (current range)10 mAOutput voltage ranges~Poster constitution for totage applied voltage10 mAMax. inductive load (current range)10 mAOutput voltage ranges+/0.3%Basice error limit voltage ranges+/0.2%Current outputs-Operational limit of voltage ranges-Max. in load resistance (current range)-Output current applied voltageDestruction limit against external applied voltage-Max. in load resistance (current range)-Max. in load resistance (current range)Max. in load resistance (current range) <th>Order no.</th> <th>032-1BD70</th>	Order no.	032-1BD70
Current consumption/power lossComACourrent consumption from backplane bus60 mAPower loss0.8 WTechnical data analog outputs4Cable length, shielded200 mRated load voltage0C 24 VReverse polarity protection of rated load voltage·Voltage output short-circuit protection·Voltage output short-circuit protection·Number of outputs·Min. load resistance (voltage range)·Max. inductive load (current range)10 mAOutput voltage ranges·Voltage output short-circuit protection·Max. inductive load (current range)10 mAOutput voltage ranges·Poertional limit of voltage ranges·Poertion limit against external applied voltage·Max. in load resistance (current range)·Max. in load resistance (current range)·Max. in load resistance (current range)·Poertion limit against external applied voltage·Max. in load resistance (current range)·Max. in load resistance (current range)· <td>Туре</td> <td>SM 032</td>	Туре	SM 032
Current consumption from backplane bus60 mAPower loss0.8 WTechnical data analog outputs4Number of outputs4Cable length, shielded200 mRated load voltage>Reverse polarity protection of rated load voltage-Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection-Voltage output short-circuit protection-Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)10 mAOutput voltage ranges-Output voltage ranges+/-0.3%Basic error limit voltage rangesmax. 24VCurrent outputs-Max. in load resistance (current range)-Operational limit of voltage ranges-Max. in load resistance (current range)max. 24VCurrent outputs-Ass. in load resistance (current range)-Poperational limit of voltage ranges-Max. in load resistance (current range)max. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Max. inductive load (current range)- <t< td=""><td>Module ID</td><td>0506 25E0</td></t<>	Module ID	0506 25E0
Power loss0.8 WTechnical data analog outputs4Number of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage output short-circuit protection·Number of outputs·Max. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges+/0.3%Basic error limit dottage ranges+/-0.3%Basic error limit dottage rangesimax. 24VCurrent outputs-Max. in load resistance (current range)imax. 24VCurrent outputs-Ass. in load resistance (current range)-Max. in load resistance (current range)-Typ. open circuit voltage current output-Current outputs-Current outputs-Max. in load resistance (current range)-Max. in load resistance (current range)- <td< td=""><td>Current consumption/power loss</td><td></td></td<>	Current consumption/power loss	
Technical data analog outputsImage: stand outputsNumber of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection·Voltage outputs·Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)10 mAOutput voltage ranges·Output voltage ranges·Output voltage ranges·Perational limit of voltage ranges+/-0.3%Basic error limit voltage rangesmax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. in load resistance (current range)max. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resi	Current consumption from backplane bus	60 mA
Number of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltageCurrent consumption from load voltage L+ (without load)-Voltage output short-circuit protectionVoltage outputs short-circuit protectionVoltage outputsMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage rangesOutput voltage rangesPerstonal limit of voltage rangesHon Saiceror limit voltage rangesPerstonal limit against external applied voltagemax. 24VCurrent outputsMax. in load resistance (current range)Max. in load resistance (current range)Perstonal limit of voltage rangesHon Saiceror limit voltage rangesHon Saiceror limit voltage rangesHon Saiceror limit voltage rangesPerstonal limit of voltage rangesPerstonal limit of voltage rangesHon Saiceror limit voltage rangesHon Saiceror limit voltage rangesPerstonal limit of voltage rangesPerstonal limit of voltage rangesRestonal external applied voltageMax. in load resistance (current range)Perstonal restonal external applied voltageMax. in load resistance (current range)Perstonal rangePerstonal range <td>Power loss</td> <td>0.8 W</td>	Power loss	0.8 W
Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection·Voltage output short-circuit protection·Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges·10 V+10 V o V+10 V o V+10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage rangesmax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)max. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current r	Technical data analog outputs	
Rated load voltageDC 24 VReverse polarity protection of rated load voltage✓Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection✓Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Current outputs-Max. in load resistance (current range)-Max. in load resistance (c	Number of outputs	4
Reverse polarity protection of rated load voltageCurrent consumption from load voltage L+ (without load)-Voltage output short-circuit protectionVoltage outputsNo. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)-10 V +10 VOutput voltage ranges-10 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage rangesmax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Perturb outputs-Operational limit of voltage ranges+/-0.3%Basic error limit voltage ranges-Max. in load resistance (current range)-Max. in load resistance (current range)-M	Cable length, shielded	200 m
Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection✓Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Current outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. in load resistance (current range)-Max. inductive load (curr	Rated load voltage	DC 24 V
Voltage output short-circuit protection✓Voltage outputs✓Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. in load resistance (current range)-Max. inductive load (current range)-	Reverse polarity protection of rated load voltage	$\checkmark$
Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage rangesmax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-<	Current consumption from load voltage L+ (without load)	-
Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. inductive load (curren	Voltage output short-circuit protection	$\checkmark$
Max. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-10 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Voltage outputs	$\checkmark$
Max. inductive load (current range)10 mAOutput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Min. load resistance (voltage range)	5 kΩ
Output voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Yp. open circuit voltage current output-	Max. capacitive load (current range)	1 μF
Operational limit of voltage rangesV +10 VOperational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Max. inductive load (current range)	10 mA
Operational limit of voltage ranges+/-0.3%Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Yp. open circuit voltage current output-	Output voltage ranges	-10 V +10 V
Basic error limit voltage ranges+/-0.2%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-		0 V +10 V
Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Operational limit of voltage ranges	+/-0.3%
Current outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Basic error limit voltage ranges	+/-0.2%
Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-	Destruction limit against external applied voltage	max. 24V
Max. inductive load (current range)     -       Typ. open circuit voltage current output     -	Current outputs	-
Typ. open circuit voltage current output -	Max. in load resistance (current range)	-
	Max. inductive load (current range)	-
Output current ranges -	Typ. open circuit voltage current output	-
ouput our on thingeo	Output current ranges	-
Operational limit of current ranges -	Operational limit of current ranges	-
Basic error limit current ranges -	Basic error limit current ranges	-
Destruction limit against external applied voltage -	Destruction limit against external applied voltage	-
Settling time for ohmic load 1.5 ms	Settling time for ohmic load	1.5 ms
Settling time for capacitive load 2 ms	Settling time for capacitive load	2 ms
Settling time for inductive load -	Settling time for inductive load	-
Resolution in bit 12	Resolution in bit	12
Conversion time 2 ms all channels	Conversion time	2 ms all channels
Substitute value can be applied no	Substitute value can be applied	no

## Analog Output

032-1BD70 - AO 4x12Bit ±10V > Technical data

Order no.	032-1BD70
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1BD70 - AO 4x12Bit ±10V > Parameter data

Order no.	032-1BD70
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

#### 4.9.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h
CH2FN	1	Function number channel 2	12h	82h	3104h	05h
CH3FN	1	Function number channel 3	12h	83h	3105h	06h

# SHORT\_EN Short-circuit recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 2: Short-circuit recognition channel 2 (1:on)</li> <li>Bit 3: Short-circuit recognition channel 3 (1:on)</li> <li>Bit 7 4: reserved</li> </ul>

## CHxFN Function number channel x

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

032-1BD70 - AO 4x12Bit ±10V > Diagnostic data

#### ±10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	$U = D \times \frac{10}{10}$
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		II
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		II
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

#### 0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10	
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$	
S7 format	5V	13824	3600h			
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$	
	Not possible, is lir	nited to 0V.		underrange		
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens	10V	16384	4000h	nominal range	$C = D x \frac{16384}{16384}$	
S5 format	5V	8192	2000h		11	
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$	
	Not possible, is lir	nited to 0V.		underrange		

## 4.9.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

032-1BD70 - AO 4x12Bit ±10V > Diagnostic data

MODTYP Module informa-	Byte	Bit 7 0
tion	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>
ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>
CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte I	3it 7 0
	1 0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	-	Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>

032-1BD70 - AO 4x12Bit ±10V > Diagnostic data

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

032-1CB30 - AO 2x16Bit 0...10V

## 4.10 032-1CB30 - AO 2x16Bit 0...10V

#### Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

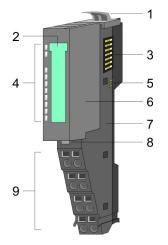
5

6

7 8

9

#### Structure



#### Status indication

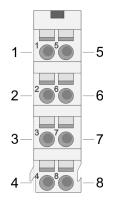
RUN — MF — AO 0 — AO 1 —

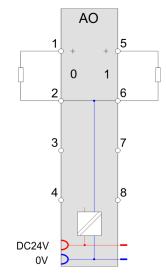
RUN	MF <mark></mark> red	AO x	Description	
		x	Bus communication is OK Module status is OK	
•	•	х	Bus communication is OK Module status reports an error	
	•	х	Bus communication is not possible Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
•		•	<ul><li>Error channel x</li><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>	
not relevant:	not relevant: X			

032-1CB30 - AO 2x16Bit 0...10V

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected



Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1CB30 - AO 2x16Bit 0...10V > Technical data

## 4.10.1 Technical data

TypeSM 032Module ID0507 2558Current consumption/power loss0 mACurrent consumption from backplane bus0 MAPower loss0.8 WTechnical data analog outputs2Cable length, shielded200 mRatel load voltage0 Cal VAReverse polarity protection of rated load voltage-Current consumption from load voltage L+ (withou load-Voltage outputs-Voltage outputs-Voltage outputs-Min. Ioad resistance (voltage range)0 MAOutput load voltage L+ (withou load-Voltage outputs-Voltage outputs-Min. Ioad resistance (voltage range)0 MAOutput voltage ranges0 V10 VOutput voltage ranges-Output voltage range-Output voltage ranges-Output voltage ranges-Output voltage range-Output voltage range-Output	Order no.	032-1CB30
Current consumption/power loss60 mAPower loss60 mAPower loss0.8 WTechnical data analog outputs7Number of outputs2Cable length, shieldedDC 24 VReverse polaryt protection of rated load voltage-Current consumption from load voltage L+ (without load)-Voltage outputs-Voltage outputs-Voltage outputs-Voltage outputs-Voltage outputs-Voltage outputs-Max. capacitive load (current range)10 mAOutput outgae ranges0V +10 VOutput outgae ranges-Output outgae current range)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ranges	Туре	SM 032
Current consumption from backplane bus60 mAPower loss0.8 WPower loss0.8 WTechnical data analog outputs2Number of outputs20 on mCable length, shieldedDC 24 VReverse polarity protection of rated load voltage-Reverse polarity protection of rated load voltage-Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection-Voltage output short-circuit protection-Min. load resistance (voltage range)5KQMax. inductive load (current range)1µFMax. inductive load (current range)0V+10 VOutput otlage ranges0V+10 VOutput otlage ranges-Output voltage ranges-Max. inductive load (current range)-Max. inductive load (current range)-Output voltage ranges-Output voltage ranges-Nutputs-Output voltage ranges-Nutputs-Output voltage current vange)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ra	Module ID	0507 2558
Power loss0.8 WTechnical data analog outputsNumber of outputs2Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltageCurrent consumption form load voltage L+ (without load)Voltage outputsVoltage outputsMin. load resistance (voltage range)5 KΩMax. capacitive load (current range)10 mAOutput voltage rangesNotuput voltage rangesVoltage outputsOutput voltage rangesOutput voltage rangesDestruction limit dyotage rangesMax. inductive load (current range)Output voltage rangesOutput voltage rangesVoltage outputsOutput voltage rangesMax. inductive load (current range)Destruction limit against external applied voltageMax. inductive load (current range)Max. inductive load (current range)Max. inductive load (current range)Max. inductive load (current range)Destruction limit against external applied voltagePorencicuti voltage current outputMax. inductive load (current rangesOutput current rangesDestruction limit against external applied voltageSettling time for ohmic loadSettling time for inductive loadSettling time for inductive load <td>Current consumption/power loss</td> <td></td>	Current consumption/power loss	
Technical data analog outputsImage of outputsNumber of outputs2Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage output short-circuit protection·Main. load resistance (voltage range)5 kΩMax. capacitive load (current range)0 Jm AOutput otlage ranges0 V+10 VOutput otlage ranges-Output voltage ranges-Output voltage ranges-Pestruction limit do voltage ranges-Max. inload resistance (current range)-Max. inload resistance (current range)-Section limit do fortige-Max. inductive load (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Section limit do ronter ranges-Section limit do ronter ranges-Section limit do ronter ranges-Setting time for onductive load </td <td>Current consumption from backplane bus</td> <td>60 mA</td>	Current consumption from backplane bus	60 mA
Number of outputs2Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage output short-circuit protection·Namber of outputs·Max. capacitive load (current range)1 μFMax. inductive load (current range)0 V+10 VOutput othgar anges·Output voltage ranges·Poerational limit of voltage ranges·Max. in load resistance (current range)·Max. incluctive load (current range)·Output urrent ranges·Output urrent ranges·Section limit against external applied voltage·Poerational limit of current ranges·Destruction limit against external applied voltage·Section limit against external applied voltage·Output current ranges·Destruction limit against external applied voltage·Setting time for ohmic load·Setting time for ohmic load·Setting time for ohmic load·Setting time for inductive lo	Power loss	0.8 W
Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltageCurrent consumption from load voltage L+ (without load)Voltage output short-circuit protectionVoltage outputsVoltage outputsMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage rangesOutput voltage rangesPerational limit of voltage rangesMax. inload resistance (current range)Output voltage current range)Output voltage current range)Max. inload resistance (current range)Nay. in load resistance (current range)Output current rangesOutput current rangesOutput current rangesOutput current rangesDestruction limit daginst external applied voltageSettling time for ohmic loadSettling time for ohmic loadSettling time for ohmic loadSettling time for ohmic loadSettling time for inductive loadSettling time for inductive loadSettling time for inductive loadSettling time	Technical data analog outputs	
Rated load voltageDC 24 VReverse polarity protection of rated load voltage✓Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection✓Voltage outputs✓Non. load resistance (voltage range)S kQMax. capacitive load (current range)1 µFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOutput voltage rangesPerational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. inductive load (current range)-Max. inductive load (current range)-Output voltage current ranges-Destruction limit against external applied voltage-Max. inductive load (current range)-Output current ranges-Output urrent ranges-Output urrent ranges-Output current ranges-Setting time for onbuic load10 µsSetting time for onbuic load10 µsSetting time for inductive load-Setting time for inductive load10 µsSetting time for inductive load-Setting time	Number of outputs	2
Reverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection·Voltage outputs·Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOutput voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inload resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Setting time for ohmic load150 μsSetting time for ohmic load16Conversion time200 μs all channelsSetting time for inductive load200 μs all channels	Cable length, shielded	200 m
Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection✓Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 µFMax. inductive load (current range)10 mAOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Setting time for ohmic load150 µsSetting time for ohmic load16Conversion time200 µs all channelsSubstitute value can be appliedro	Rated load voltage	DC 24 V
Voltage output short-circuit protection·Voltage outputs·Win. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inload resistance (current range)-Max. inductive load (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Output current ranges-Output current ranges-Operational limit of current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load-Settling time for inductive load-Settling time for inductive load200 μs all channelsConversion time200 μs all channels	Reverse polarity protection of rated load voltage	$\checkmark$
Voltage outputs $\checkmark$ Voltage outputs $\checkmark$ Min. load resistance (voltage range) $5 k\Omega$ Max. capacitive load (current range) $1 \mu$ FMax. inductive load (current range) $10 mA$ Output voltage ranges $0 \lor + 10 \lor$ Operational limit of voltage ranges $+/-0.2\%$ Basic error limit voltage ranges $+/-0.1\%$ Destruction limit against external applied voltagemax. 24 $\lor$ Current outputs $-$ Max. in load resistance (current range) $-$ Max. inductive load (current range) $-$ Operational limit of current range) $-$ Typ. open circuit voltage current output $-$ Output current ranges $-$ Output current ranges $-$ Destruction limit against external applied voltage $-$ Settling time for orbit cload $-$ Settling time for orbit cload $-$ Settling time for orbit cload $-$ Settling time for inductive load $-$ Settling time for inducti	Current consumption from load voltage L+ (without load)	-
Min. load resistance (voltage range)         5 kΩ           Max. capacitive load (current range)         1 μF           Max. inductive load (current range)         10 mA           Output voltage ranges         0 V +10 V           Operational limit of voltage ranges         +/-0.2%           Basic error limit voltage ranges         +/-0.1%           Destruction limit against external applied voltage         max. 24V           Current outputs         -           Max. in load resistance (current range)         -           Max. in load resistance (current range)         -           Max. inductive load (current range)         -           Max. inductive load (current range)         -           Max. inductive load (current range)         -           Output current ranges         -           Output current ranges         -           Output current ranges         -           Operational limit of current ranges         -           Destruction limit against external applied voltage         -           Output current ranges         -           Destruction limit against external applied voltage         -           Destruction limit against external applied voltage         -           Settling time for ohmic load         150 μs           Sett	Voltage output short-circuit protection	$\checkmark$
Max. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Voltage outputs	$\checkmark$
Max. inductive load (current range)10 mAOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Operational limit of current ranges-Basic error limit gainst external applied voltage-Output current ranges-Operational limit of current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for inductive load1Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Min. load resistance (voltage range)	5 kΩ
Output voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load-Settling time for capacitive load1Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. capacitive load (current range)	1 µF
Area of a constraint of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Operational limit of current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. inductive load (current range)	10 mA
Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Basic error limit against external applied voltage-Basic error limit quirent ranges-Basic error limit current ranges-Settling time for ohmic load150 µsSettling time for capacitive load1Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Output voltage ranges	0 V +10 V
Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Operational limit of voltage ranges	+/-0.2%
Current outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Basic error limit voltage ranges	+/-0.1%
Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Destruction limit against external applied voltage	max. 24V
Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load1 msSettling time for inductive load16Conversion time200 μs all channelsSubstitute value can be appliedno	Current outputs	-
Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load-Settling time for inductive load16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. in load resistance (current range)	-
Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. inductive load (current range)	-
Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Typ. open circuit voltage current output	-
Pasic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Output current ranges	-
Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Operational limit of current ranges	-
Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Basic error limit current ranges	-
Settling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Destruction limit against external applied voltage	-
Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for ohmic load	150 µs
Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for capacitive load	1 ms
Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for inductive load	-
Substitute value can be applied no	Resolution in bit	16
	Conversion time	200 µs all channels
Output data size 4 Byte	Substitute value can be applied	no
	Output data size	4 Byte

032-1CB30 - AO 2x16Bit 0...10V > Technical data

Order no.	032-1CB30
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C

032-1CB30 - AO 2x16Bit 0...10V > Parameter data

Order no.	032-1CB30
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

#### Parameter data 4.10.2

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 7 2: reserved</li> </ul>

**CHxFN** Function number 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.

channel x

032-1CB30 - AO 2x16Bit 0...10V > Diagnostic data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		IJ
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lin	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		IJ
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lin	nited to 0V.		underrange	

#### 0 ... 10V

## 4.10.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah

032-1CB30 - AO 2x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

## ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP Channel type	Byte	Bit 7 0
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>
NUMBIT Diagnostic bits	Byte	Bit 7 0

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

032-1CB30 - AO 2x16Bit 0...10V > Diagnostic data

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>
CH0ERR / CH1ERR Channel specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2: 4: recommender</li> </ul>
		<ul> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> </ul>
		Bit 7 4: reserved
CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic
	µs ticker	
		O module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting ter 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

# 4.11 032-1CB40 - AO 2x16Bit 0(4)...20mA

1 2

3

4

5

6

7 8

9

### Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

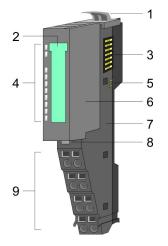
LED status indication

Electronic module

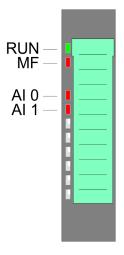
Terminal module

Terminal

#### Structure



#### Status indication

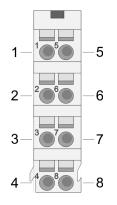


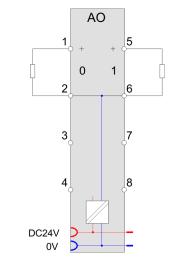
RUN	MF		Description
green	<b>red</b>	red	
-		х	Bus communication is OK
		λ	Module status is OK
-	-	х	Bus communication is OK
-	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul> <li>Error in parameterization</li> </ul>
			<ul> <li>Wire break (if parameterized)</li> </ul>
not relevant:	Х		

032-1CB40 - AO 2x16Bit 0(4)...20mA

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected

O: Output

#### Input area

Output area

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

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1CB40 - AO 2x16Bit 0(4)...20mA > Technical data

## 4.11.1 Technical data

Order no.	032-1CB40
Туре	SM 032
Module ID	050B 25D8
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.7 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	$\checkmark$
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Basic error limit current ranges	+/-0.1%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	16
Conversion time	400 µs all channels
Substitute value can be applied	no

032-1CB40 - AO 2x16Bit 0(4)...20mA > Technical data

Order no.	032-1CB40
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1CB40 - AO 2x16Bit 0(4)...20mA > Parameter data

Order no.	032-1CB40
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	yes

## 4.11.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h

# WIBRK\_EN Wire-break recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire-break recognition channel 0 (1: on)</li> <li>Bit 1: Wire-break recognition channel 1 (1: on)</li> <li>Bit 7 2: reserved</li> </ul>



Please consider with enabled wire break recognition with the output range 0 ... 20mA, when the current goes below of  $40\mu A$  (100 Digits), this can may lead to sporadic wire break messages!

# CHxFN Function number channel x

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

032-1CB40 - AO 2x16Bit 0(4)...20mA > Diagnostic data

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	20
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$
S7 format	10mA	13824	3600h		
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible, is limited to 0mA.			underrange	20
0 20mA	25.00mA	20480	5000h	overrange	20
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, is lin	mited to 0mA.		underrange	20

#### 0 ... 20mA

## 4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$
Siemens	20mA	27648	6C00h	nominal range	$1 = D \times \frac{1}{27648} + 4$
S7 format	12mA	13824	3600h		I-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D x \frac{16}{16384} + 4$
Siemens	20mA	16384	4000h	nominal range	1 = D x 16384
S5 format	12mA	8192	2000h		I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$
	0mA	-4096	F000h	underrange	

## 4.11.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

## ERR\_A Diagnostic

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

MODTYP Module informa-	
tion	

orma-	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

032-1CB40 - AO 2x16Bit 0(4)...20mA > Diagnostic data

ERR	D	Diagnostic
		•

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> </ul>
	<ul> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP	Channel	type
-------	---------	------

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

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

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	<ul> <li>Channel-specific error channel x</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire-break</li> <li>Bit 7 5: reserved</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0

0 reserved

032-1CB40 - AO 2x16Bit 0(4)...20mA > Diagnostic data

## DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

# 4.12 032-1CB70 - AO 2x16Bit ±10V

## Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 2 analog outputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

5

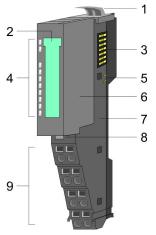
6

7

8

9

## Structure



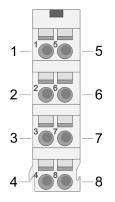
# Status indication

RUN — MF — AO 0 — AO 1 —

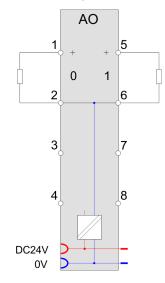
RUN	MF	AO x	Description	
green	red	red	Description	
		х	Bus communication is OK	
		^	Module status is OK	
		х	Bus communication is OK	
		^	Module status reports an error	
		х	Bus communication is not possible	
	-	^	Module status reports an error	
		Х	Error at bus power supply	
x	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30	
			Error channel x	
			<ul> <li>Overload, short-circuit</li> </ul>	
			Error in parameterization	
not relevant:	not relevant: X			

032-1CB70 - AO 2x16Bit ±10V

#### Pin assignment



For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected



Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

032-1CB70 - AO 2x16Bit ±10V > Technical data

# 4.12.1 Technical data

Type Module ID	SM 032
Module ID	
	0508 2558
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	$\checkmark$
Voltage outputs	$\checkmark$
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges	+/-0.1%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	150 μs
Settling time for capacitive load	1 ms
Settling time for inductive load	-
Resolution in bit	16
Conversion time	200 µs all channels

## Analog Output

032-1CB70 - AO 2x16Bit ±10V > Technical data

Order no.	032-1CB70
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1CB70 - AO 2x16Bit ±10V > Parameter data

Order no.	032-1CB70
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

## 4.12.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h

# SHORT\_EN Short-circuit recognition

Byte E	Bit 7 0
	<ul><li>Bit 0: Short-circuit recognition channel 0 (1:on)</li><li>Bit 1: Short-circuit recognition channel 1 (1:on)</li><li>Bit 7 2: reserved</li></ul>

CHxFN Function number channel x

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

032-1CB70 - AO 2x16Bit ±10V > Diagnostic data

## ±10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens S format	10V	27648	6C00h	nominal range	$C = D x \frac{1}{27648}$
(12h)	5V	13824	3600h		II
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	U = D r 10
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		II
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

## 0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens	10V	27648	6C00h	nominal range	$C = D x \frac{1}{27648}$
S7 format	5V	13824	3600h		17
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lin	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lin	nited to 0V.		underrange	

## 4.12.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
0	)	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

## ERR\_D Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

## CHTYP Channel type

CHERR Channel error

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>

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

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

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

032-1CB70 - AO 2x16Bit ±10V > Diagnostic data

### DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

032-1CD30 - AO 4x16Bit 0...10V

# 4.13 032-1CD30 - AO 4x16Bit 0...10V

### Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1

2

3

4

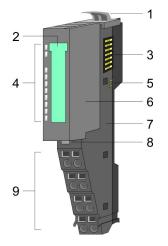
5

6

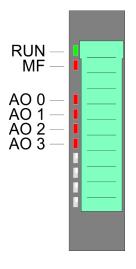
7 8

9

### Structure



#### Status indication

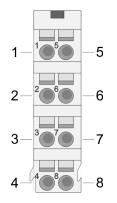


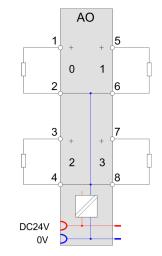
RUN	MF	AO x	Description
green	red	red	Description
		х	Bus communication is OK
		^	Module status is OK
_	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
x	ZHz	Х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>
not relevant:	X		

032-1CD30 - AO 4x16Bit 0...10V

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD30 - AO 4x16Bit 0...10V > Technical data

## 4.13.1 Technical data

TypeSM 032Module ID0509 2560Current consumption/power loss6 5 mACurrent consumption from backplane bus0.8 WPower loss0.8 WTechnical data nalog outputs4Cable length, shielded200 mRated outputs0.2 Val Val Cable Langton (Cable Lan	Order no.	032-1CD30
Current consumption/power lossConstructionCurrent consumption from backplane bus65 mAPower loss0.8 WTochnical data analog outputsNumber of outputs4Cable length, shielded200 mReverse polarity protection of rated load voltage>Reverse polarity protection of rated load voltageCurrent consumption from load voltage L+ (without load)-Voltage outputsVoltage outputsVoltage outputsMan. capacitive load (current range)10 mAOutput otage rangesOutput otage rangesMax. inductive load (current range)Output otage rangesMax. inductive load (current range)Max. inductive load (current range)Output current angesOutput current rangesOutput current rangesS	Туре	SM 032
Current consumption from backplane bus65 m APower loss0.8 WTechnical data analog outputs4Number of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage-Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection-Voltage output short-circuit protection-Number of outputs-Max. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges-Output voltage ranges-Sericor limit voltage ranges-Max. inductive load (current range)-Destruction limit against external applied voltage-Max. inductive load (current range)-Max. inductive load (current range)-Destruction limit against external applied voltage-Max. inductive load (current range)-Max. inductive load (current range) <td< td=""><td>Module ID</td><td>0509 2560</td></td<>	Module ID	0509 2560
Power loss0.8 WTechnical data analog outputsNumber of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltageCurrent consumption from load voltage L+ (without load)-Voltage outputsVoltage outputsMin. load resistance (voltage range)5 KQMax. capacitive load (current range)1 µFMax. inductive load (current range)10 mAOutput voltage rangesVoltage outputsMax. inductive load (current range)10 mAOutput voltage rangesVoltage outputsMax. inductive load (current range)Output voltage rangesVoltage outputsOutput voltage rangesVoltage outputsMax. in load resistance (current range)Max. in load resistance (current range)Output current rangesOutput current rangesPoerational limit of current rangesPoerational limit of current rangesPoerational limit of current rangesSettling time for ohmic loadSettling time for ohmic loadSettling time for ohmic loadSettl	Current consumption/power loss	
Technical data analog outputsImage: Comparison of the second outputsNumber of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage output short-circuit protection·Main. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. ductive load (current range)0 V+10 VOutput voltage ranges·Output voltage ranges·Voltage outputs·Output voltage ranges·Voltage routputs·Output current range·Output current ranges·Voltage current output·Output current ranges·Output current ranges·Output current ranges·Setting time for onductive load·Setting time for onductive load·Setting time for onductive load·Setting time for on	Current consumption from backplane bus	65 mA
Number of outputs4Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage output short-circuit protection·Main. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)0 V+10 VOutput otdage ranges·Output voltage ranges·Voltage outputs·Output voltage ranges·Voltage rom unit of voltage ranges·Voltage outputs·Output voltage ranges·Voltage content range)·Destruction limit against external applied voltage·Max. in load resistance (current range)·Max. inload resistance (current range)·Voltage current outputs·Output current ranges·Output current ranges·Output current ranges·Setting time for onmic load150 µsSetting time for onmic load150 µsSetting time for onductive load·Setting time for inductive load· <trr>Setting time for inductive load<td< td=""><td>Power loss</td><td>0.8 W</td></td<></trr>	Power loss	0.8 W
Cable length, shielded200 mRated load voltageDC 24 VReverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)·Voltage output short-circuit protection·Voltage outputs·Notage outputs·Max. capacitive load (current range)J µFMax. inductive load (current range)10 mAOutput voltage ranges·Output outputs-Current outputs-Max. inload resistance (current range)·Max. inload resistance (current range)·Output current ranges·Output current ranges·Output current ranges·Output current ranges·Output current ranges·Setting time for oninc load10 msSetting time for oninc load10 msSetting time for oninc load·Setting time for inductive load <td>Technical data analog outputs</td> <td></td>	Technical data analog outputs	
Rated load voltageDC 24 VReverse polarity protection of rated load voltage✓Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection✓Voltage outputs✓Non. load resistance (voltage range)S kQMax. capacitive load (current range)1 μFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOutput voltage rangesPoerational limit of voltage ranges+/-0.2%Basic eror limit voltage ranges-Max. inload resistance (current range)-Output voltage ranges-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Output coltage current output-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Setting time for ohmic load150 μsSetting time for capacitive load-Setting time for inductive load-Resolution in bit6Conversion time200 μs all channelsSubstitut value can be applied-	Number of outputs	4
Reverse polarity protection of rated load voltage·Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection·Voltage outputs·Voltage outputs·Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 µFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. inductive load (current range)-Operational limit of current ranges-Max. in load resistance (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Setting time for ohmic load150 µsSetting time for capacitive load-Setting time for inductive load-Setting time for inductive load-Output time for inductive load-Setting time for inductive load-Setting time for inductive load-Setting time for inductive load-Setting time for inductive load- <tr <td="">Setting time for</tr>	Cable length, shielded	200 m
Current consumption from load voltage L+ (without load)-Current consumption from load voltage L+ (without load)-Voltage output short-circuit protection-Voltage outputs-Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 µFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOutput voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Max. inductive load (current range)-Max. in load resistance (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Settling time for ohmic load150 µsSettling time for capacitive load-Settling time for inductive load-Settling time fo	Rated load voltage	DC 24 V
Voltage output short-circuit protection·Voltage outputs·Win. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)0 V +10 VOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Max. inload resistance (current range)-Output current ranges-Output current ranges-Output current ranges-Operational limit of current ranges-Basic error limit dualent external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load-Settling time for inductive load- <t< td=""><td>Reverse polarity protection of rated load voltage</td><td><math>\checkmark</math></td></t<>	Reverse polarity protection of rated load voltage	$\checkmark$
Voltage outputs✓Voltage outputs✓Min. load resistance (voltage range)5 kΩMax. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges0 ∨ +10 ∨Operational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24∨Current outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Voltage current range)-Yp. open circuit voltage current output-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Stilling time for control toput-Stilling time for ohmic load10 mASettling time for ohmic load10 mASettling time for inductive load-Settling time for inductive load10 mSSettling time for inductive load100 μs all channelsSettling time for inductive load-Settling time for inductive load100 μs all channelsSubstitute value can be applied200 μs all channelsSubstitute value can be appliedno	Current consumption from load voltage L+ (without load)	-
Min. load resistance (voltage range)         5 kΩ           Max. capacitive load (current range)         1 μF           Max. inductive load (current range)         10 mA           Output voltage ranges         0 V +10 V           Operational limit of voltage ranges         +/-0.2%           Basic error limit voltage ranges         +/-0.1%           Destruction limit against external applied voltage         max. 24V           Current outputs         -           Max. in load resistance (current range)         -           Output current ranges         -           Output current ranges         -           Output current ranges         -           Operational limit of current ranges         -           Operational limit of current ranges         -           Destruction limit against external applied voltage         -           Settling time for ohmic load         150 μs           Settling time for inductive load         1 ms           Settling time for inductive load         -           Resolution in bit         16           Conversion time <td< td=""><td>Voltage output short-circuit protection</td><td><math>\checkmark</math></td></td<>	Voltage output short-circuit protection	$\checkmark$
Max. capacitive load (current range)1 μFMax. inductive load (current range)10 mAOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Vip. open circuit voltage current output-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for inductive load1Settling time for inductive load1Conversion time200 μs all channelsSubstitute value can be appliedno	Voltage outputs	$\checkmark$
Max. inductive load (current range)10 mAOutput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Output current ranges-Basic error limit gainst external applied voltage-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Min. load resistance (voltage range)	5 kΩ
Output voltage rangesO V +10 VOperational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. capacitive load (current range)	1 μF
Operational limit of voltage ranges+/-0.2%Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. in load resistance (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Output current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsNustitute value can be appliedno	Max. inductive load (current range)	10 mA
Basic error limit voltage ranges+/-0.1%Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Basic error limit against external applied voltage-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load1Settling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Output voltage ranges	0 V +10 V
Destruction limit against external applied voltagemax. 24VCurrent outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Output current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Operational limit of voltage ranges	+/-0.2%
Current outputs-Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Basic error limit voltage ranges	+/-0.1%
Max. in load resistance (current range)-Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Destruction limit against external applied voltage	max. 24V
Max. inductive load (current range)-Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load-Settling time for inductive load16Conversion time200 µs all channelsSubstitute value can be appliedno	Current outputs	-
Typ. open circuit voltage current output-Output current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load-Settling time for inductive load16Conversion time200 μs all channelsSubstitute value can be appliedno	Max. in load resistance (current range)	-
Number of current ranges-Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Max. inductive load (current range)	-
Operational limit of current ranges-Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Typ. open circuit voltage current output	-
Basic error limit current ranges-Destruction limit against external applied voltage-Settling time for ohmic load150 μsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 μs all channelsSubstitute value can be appliedno	Output current ranges	-
Destruction limit against external applied voltage-Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Operational limit of current ranges	-
Settling time for ohmic load150 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Basic error limit current ranges	-
Settling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Destruction limit against external applied voltage	-
Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for ohmic load	150 µs
Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for capacitive load	1 ms
Conversion time200 µs all channelsSubstitute value can be appliedno	Settling time for inductive load	-
Substitute value can be applied no	Resolution in bit	16
	Conversion time	200 µs all channels
Output data size 8 Byte	Substitute value can be applied	no
	Output data size	8 Byte

032-1CD30 - AO 4x16Bit 0...10V > Technical data

Order no.	032-1CD30
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C

032-1CD30 - AO 4x16Bit 0...10V > Parameter data

Order no.	032-1CD30
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

## 4.13.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h
CH2FN	1	Function number channel 2	10h	82h	3104h	05h
CH3FN	1	Function number channel 3	10h	83h	3105h	06h

# SHORT\_EN Short-circuit recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 2: Short-circuit recognition channel 2 (1:on)</li> <li>Bit 3: Short-circuit recognition channel 3 (1:on)</li> <li>Bit 7 4: reserved</li> </ul>

# CHxFN Function number channel x

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

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		II
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	U = D r 10
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	

#### 0 ... 10V

## 4.13.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

MODTYP Module informa- tion	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

ERR_D Diagnostic	Byte	Bit 7 0
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP	Channel	type
-------	---------	------

Byte	Bit 7 0
0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> </ul>
	Bit 7: reserved

NUMBIT Di	agnostic bits
-----------	---------------

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

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>
CH0ERR CH3ERR	Byte	Bit 7 0
CH0ERR CH3ERR Channel-specific	Byte 0	Bit 7 0 Channel-specific error channel x:
		<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> </ul>
Channel-specific CH4ERR CH7ERR		<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> </ul>
Channel-specific	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>

DIAG_U	JS µs	ticker
--------	-------	--------

Byte	Bit 7 0
03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

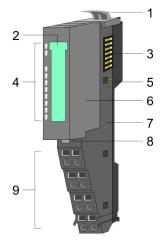
# 4.14 032-1CD40 - AO 4x16Bit 0(4)...20mA

### Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with 0...20mA; 4...20mA
- Diagnostics function
- 16bit resolution

#### Structure



## Status indication

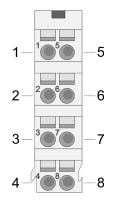
RUN	MF	AO x	Description
green	red 📕	red	
-		х	Bus communication is OK
-		~	Module status is OK
-	-	х	Bus communication is OK
-		^	Module status reports an error
		х	Bus communication is not possible
		^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			Error in parameterization
			Wire break (if parameterized)
not relevant	X		

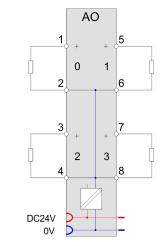
- Locking lever terminal module
- Locking lever te
   Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

032-1CD40 - AO 4x16Bit 0(4)...20mA

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD40 - AO 4x16Bit 0(4)...20mA > Technical data

## 4.14.1 Technical data

Order no.	032-1CD40
Туре	SM 032
Module ID	050C 25E0
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	$\checkmark$
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Basic error limit current ranges	+/-0.1%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	16
Conversion time	400 µs all channels
Substitute value can be applied	no

032-1CD40 - AO 4x16Bit 0(4)...20mA > Technical data

Order no.	032-1CD40
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

032-1CD40 - AO 4x16Bit 0(4)...20mA > Parameter data

Order no.	032-1CD40
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation
KC certification	yes

## 4.14.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h
CH2FN	1	Function number channel 2	31h	82h	3104h	05h
CH3FN	1	Function number channel 3	31h	83h	3105h	06h

# WIBRK\_EN Wire-break recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Wire-break recognition channel 0 (1: on)</li> <li>Bit 1: Wire-break recognition channel 1 (1: on)</li> <li>Bit 2: Wire-break recognition channel 2 (1: on)</li> <li>Bit 3: Wire-break recognition channel 3 (1: on)</li> <li>Bit 7 4: reserved</li> </ul>



Please consider with enabled wire break recognition with the output range 0 ... 20mA, when the current goes below of  $40\mu A$  (100 Digits), this can may lead to sporadic wire break messages!

# CHxFN Function number channel x

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

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

Output range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
0 20mA	23.52mA	32511	7EFFh	overrange	20	
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$	
	Not possible, is limited to 0mA.			underrange	20	
0 20mA	25.00mA	20480	5000h	overrange	20	
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$	
S5 format	10mA	8192	2000h			
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$	
	Not possible, is lin	mited to 0mA.		underrange	20	

#### 0 ... 20mA

## 4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$	
Siemens	20mA	27648	6C00h	nominal range	$1 = D \times \frac{1}{27648} + 4$	
S7 format	12mA	13824	3600h		$D = 27648 \ x \ \frac{I-4}{16}$	
(30h)	4mA	0	0000h			
	0mA	-6912	E500h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$	
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384} + 4$	
S5 format	12mA	8192	2000h		I-4	
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$	
	0mA	-4096	F000h	underrange		

## 4.14.3 Diagnostic data

So this module does not support interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> </ul>	ERR_A Diagnostic	Byte	Bit 7 0
Bit 7: set at error in parameterization		0	<ul> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> </ul>

Module informa-	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>

MODTYP tion

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

ERR	D	Diagnostic
_		•

Byte	Bit 7 0
0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>

CHTYP	Channel	type
-------	---------	------

NUMCH

CHERR Channel error

Byte
0

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

Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
onumer speeme	0	Channel-specific error channel x:
		<ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire-break</li> <li>Bit 7 5: reserved</li> </ul>
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.

032-1CD70 - AO 4x16Bit ±10V

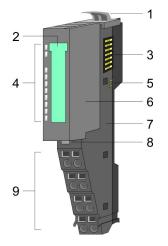
# 4.15 032-1CD70 - AO 4x16Bit ±10V

## Properties

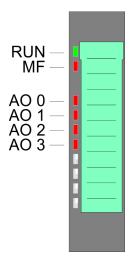
The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with ±10V, 0 ... 10V
- Diagnostics function
- 16bit resolution

#### Structure



## Status indication



RUN	MF	AO x	Description
green	lea	leu	
-		х	Bus communication is OK
-		Λ	Module status is OK
	-	х	Bus communication is OK
	-		Module status reports an error
	_	х	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
Х	ZHz	х	Error in configuration & Chapter 2.8 'Trouble shooting - LEDs' on page 30
			Error channel x
			<ul> <li>Overload, short-circuit</li> </ul>
			<ul> <li>Error in parameterization</li> </ul>
not relevant: X			

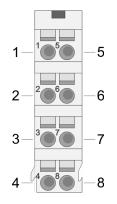
## Locking lever terminal module

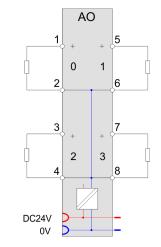
- Locking lever
   Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module8 Locking lever ele
  - Locking lever electronic module
- 9 Terminal

032-1CD70 - AO 4x16Bit ±10V

#### Pin assignment

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

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

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD70 - AO 4x16Bit ±10V > Technical data

## 4.15.1 Technical data

Order no.	032-1CD70
Туре	SM 032
Module ID	050A 2560
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	$\checkmark$
Current consumption from load voltage L+ (without load)	-
Voltage output short-circuit protection	$\checkmark$
Voltage outputs	$\checkmark$
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 μF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges	+/-0.1%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	150 μs
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	16
Conversion time	200 μs all channels
Substitute value can be applied	no

032-1CD70 - AO 4x16Bit ±10V > Technical data

Order no.	032-1CD70
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
Between channels and power supply	$\checkmark$
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
Environmental conditions	

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Order no.	032-1CD70
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

## 4.15.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h
CH2FN	1	Function number channel 2	12h	82h	3104h	05h
CH3FN	1	Function number channel 3	12h	83h	3105h	06h

# SHORT\_EN Short-circuit recognition

Byte	Bit 7 0
0	<ul> <li>Bit 0: Short-circuit recognition channel 0 (1:on)</li> <li>Bit 1: Short-circuit recognition channel 1 (1:on)</li> <li>Bit 2: Short-circuit recognition channel 2 (1:on)</li> <li>Bit 3: Short-circuit recognition channel 3 (1:on)</li> <li>Bit 7 4: reserved</li> </ul>

# CHxFN Function number channel x

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

±10V

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Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	U = D x 10
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		IJ
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		IJ
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		10
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

#### 0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is lir	nited to 0V.		underrange	

## 4.15.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

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The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

#### ERR\_A Diagnostic

Byte	Bit 7 0
0	<ul> <li>Bit 0: set at module failure</li> <li>Bit 1: set at internal error</li> <li>Bit 2: set at external error</li> <li>Bit 3: set at channel error</li> <li>Bit 4: set at external auxiliary supply missing</li> <li>Bit 6 5: reserved</li> <li>Bit 7: set at error in parameterization</li> </ul>

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MODTYP Module informa-	Byte	Bit 7 0		
tion	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Bit 4: set at channel information present</li> <li>Bit 7 5: reserved</li> </ul>		
ERR_D Diagnostic	Byte	Bit 7 0		
	0	<ul> <li>Bit 2 0: reserved</li> <li>Bit 3: set at internal diagnostics buffer overflow</li> <li>Bit 4: set at internal communication error</li> <li>Bit 7 5: reserved</li> </ul>		
CHTYP Channel type	Byte	Bit 7 0		
	0	<ul> <li>Bit 6 0: Channel type</li> <li>70h: Digital input</li> <li>71h: Analog input</li> <li>72h: Digital output</li> <li>73h: Analog output</li> <li>74h: Analog input/-output</li> <li>76h: Counter</li> <li>Bit 7: reserved</li> </ul>		
NUMBIT Diagnostic bits	Byte I	Bit 7 0		
	0 1	Number of diagnostic bits per channel (here 08h)		
NUMCH Channels	Byte	Bit 7 0		
	0	Number of channels of a module (here 04h)		
CHERR Channel error	Byte	Bit 7 0		
		<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 2: set at error in channel group 2</li> <li>Bit 3: set at error in channel group 3</li> <li>Bit 7 4: reserved</li> </ul>		
CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0		
Gianner-specific	0	<ul> <li>Channel-specific error channel x:</li> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> </ul>		

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CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

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

µs ticker

In the SLIO module there is a timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 2<sup>32</sup>-1 $\mu$ s the timer starts with 0 again.