# **VIPA System SLIO**

**SM-AIO || Manual** HB300 | SM-AIO || GB | 15-45 Analog signal modules - SM 03x



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### 1 General

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#### **1.2 About this manual**

Target audience	The manual is targeted at users who have a background in automa- tion technology.
Structure of the manual	The manual consists of chapters. Every chapter provides a self-con- tained 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>

Safety information

#### **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 con**forming with specifications

The system is constructed and produced for:

- communication and process control
- 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 ...)

Safety information

#### Disposal

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

#### 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!

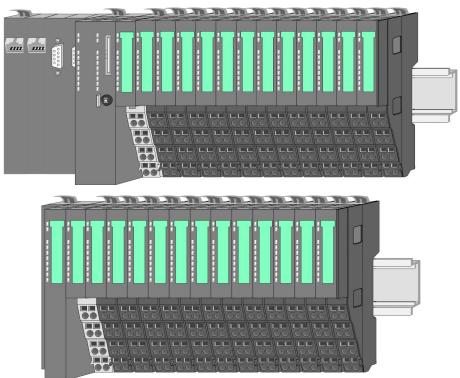
Personnel and instruments should be grounded when working on electrostatic sensitive modules.

System conception > Components

#### 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.



#### 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 third-party modules is not allowed!

#### CPU 01x

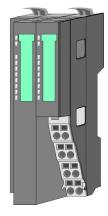


With this CPU 01x, the CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24 power section supply for the linked periphery modules is 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**

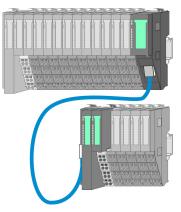


With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module, via the integrated power module for power supply, bus interface and the electronic of the connected periphery modules are supplied. The DC 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.

### CAUTION!

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

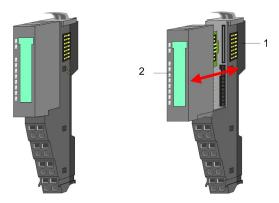
#### Line extension



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. To use the line extension no special configuration is required. System conception > Accessories

#### Periphery modules

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



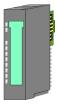
- 1 Terminal module
- 2 Electronic module

#### Terminal module



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

#### Electronic module



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

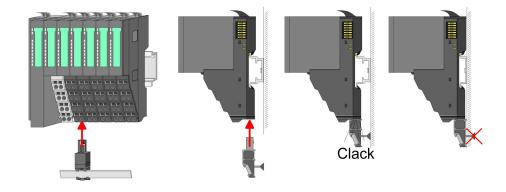
#### 2.2.3 Accessories

#### 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.

Dimensions



#### **Bus cover**



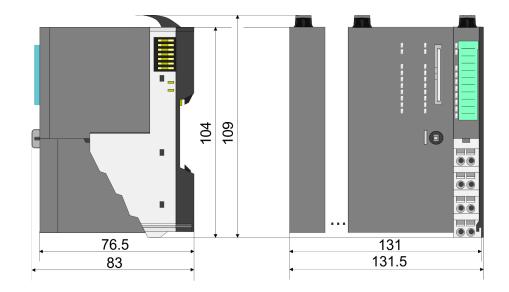
With each head module, to protect the backplane bus connectors, there is a mounted bus cover in the scope of delivery. You have to remove the bus cover of the head module before mounting a System SLIO module. For the protection of the backplane bus connector you always have to mount the bus cover at 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.

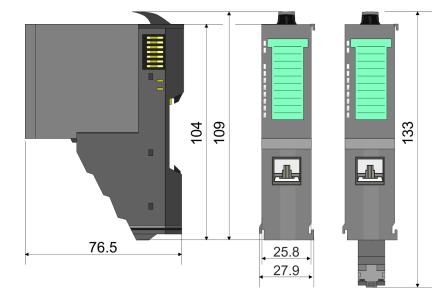
#### 2.3 Dimensions Dimensions CPU 01x



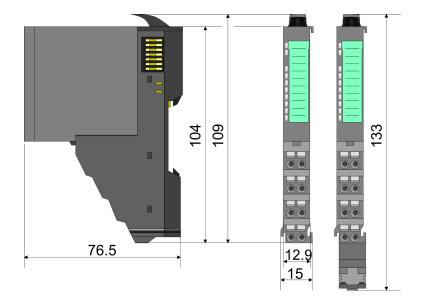
Dimensions bus coupler and line extension slave

Dimensions

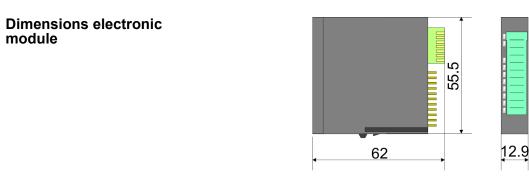
# Dimensions line extension master



Dimension periphery module



Mounting > Mounting CPU 01x

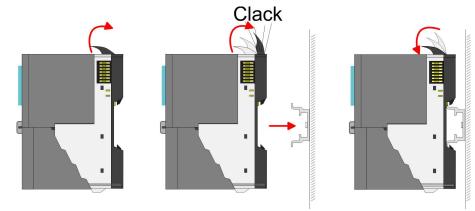


Dimensions in mm

#### 2.4 Mounting

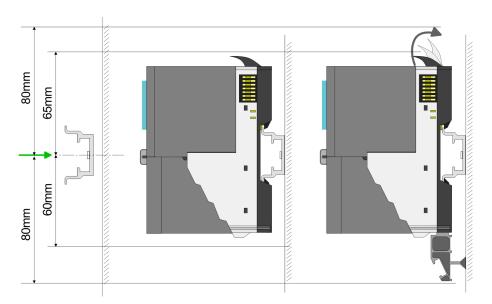
#### 2.4.1 Mounting CPU 01x

There are locking lever at the top side of the CPU. For mounting and demounting these locking lever are to be turned upwards until these engage. Place the CPU at the mounting rail. The CPU is fixed to the mounting rail by pushing downward the locking levers. The CPU is directly mounted at a mounting rail. Up to 64 modules may be mounted. The electronic and power section supply are connected via the backplane bus. 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.

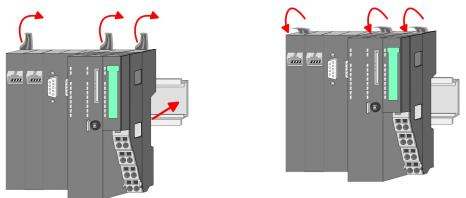


Mounting > Mounting CPU 01x

#### Proceeding

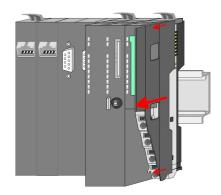


**1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.



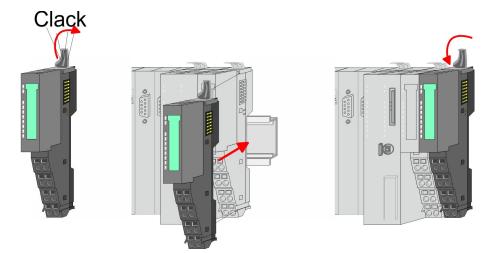
**2.** Turn the locking lever upwards, place the CPU at the mounting rail and turn the lever downward.

# Mounting periphery modules

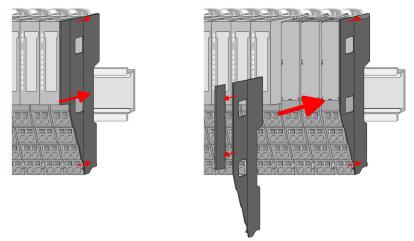


**1.** Before mounting the periphery modules you have to remove the bus cover at the right side of the CPU by pulling it forward. Keep the cover for later mounting.

Mounting > Mounting bus coupler



**2.** Mount the periphery modules you want.  $\Leftrightarrow$  'Mounting periphery modules' on page 22



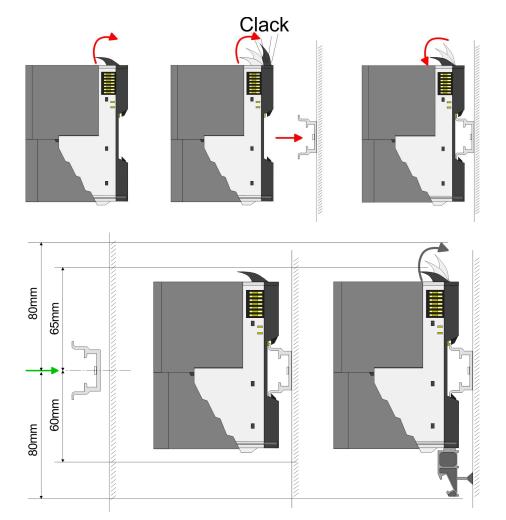
3. After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now. If the last module is a clamp module, for adaptation the upper part of the bus cover is to be removed.

#### 2.4.2 Mounting bus coupler

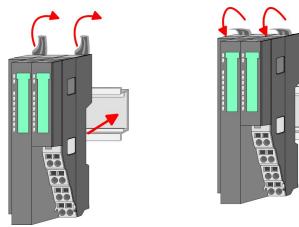
There are locking lever at the top side of the bus coupler. For mounting and demounting these locking lever are to be turned upwards until these engage. Place the bus coupler at the mounting rail. The bus coupler is fixed to the mounting rail by pushing downward the locking levers. The bus coupler is directly mounted at a mounting rail. Up to 64 modules may be mounted. The electronic and power section supply are connected via the backplane bus. 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.

Proceeding

Mounting > Mounting bus coupler



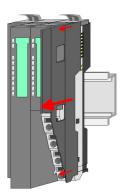
**1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.



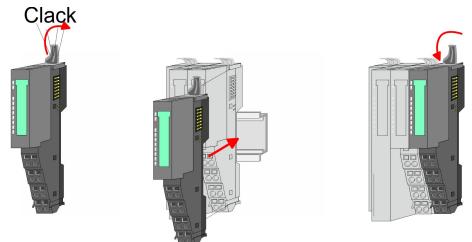
**2.** Turn the locking lever upwards, place the bus coupler at the mounting rail and turn the lever downward.

Mounting > Mounting bus coupler

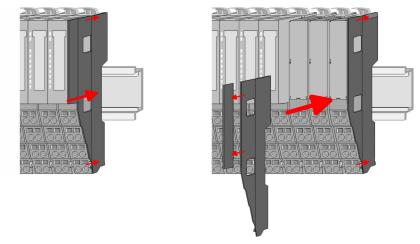
# Mounting of the periphery modules



**1.** Before mounting the periphery modules you have to remove the bus cover at the right side of the bus coupler by pulling it forward. Keep the cover for later mounting.



2. Mount the periphery modules you want.  $\Leftrightarrow$  'Mounting periphery modules' on page 22

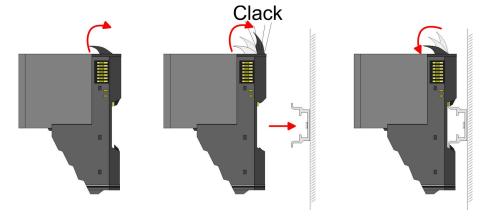


3. After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now. If the last module is a clamp module, for adaptation the upper part of the bus cover is to be removed.

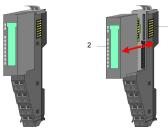
Mounting > Mounting periphery modules

#### 2.4.3 Mounting periphery modules

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.



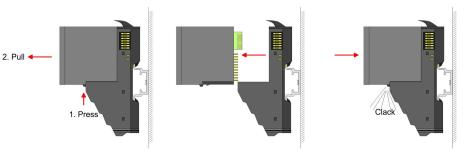
# Terminal and electronic module



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

- 1 Terminal module
- 2 Electronic module

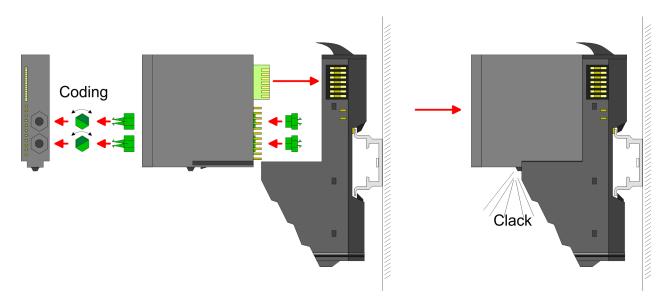
For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



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

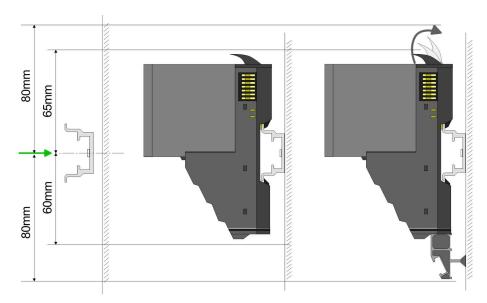
# 

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!

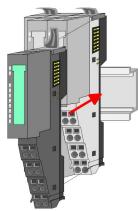
Mounting > Mounting periphery modules

# Mounting periphery modules

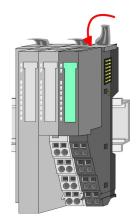


- **1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.
- **2.** Mount your head module such as CPU or field bus coupler.
- **3.** Before mounting the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

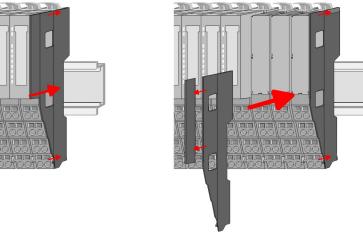




- **4.** For mounting turn the locking lever of the module upward until it engages.
- **5.** For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.



**6.** Turn the locking lever of the periphery module downward, again.



**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.

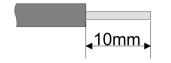
### 2.5 Wiring

#### 2.5.1 Wiring CPU 01x

Terminal module terminals

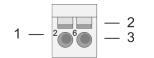
The System SLIO CPUs have a power module integrated. Terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines.

#### Data



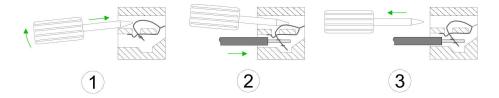
 $\mathsf{U}_{\max}$ 240V AC / 30V DC 10A I<sub>max</sub> 0.08 ... 1.5mm<sup>2</sup> (AWG 28 ... 16) Cross section Stripping length 10mm

#### Wiring procedure

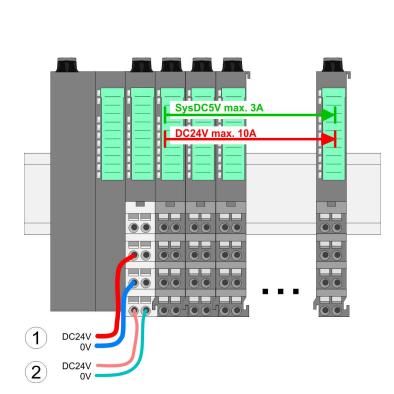


- Pin number at the terminal module 1
- 2 3 Opening for screwdriver
  - Connection hole for wire

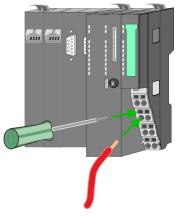
Wiring > Wiring CPU 01x



- **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 connect 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.

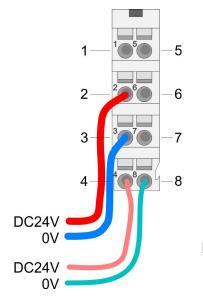


(1) DC 24V for power section supply I/O area (max. 10A)(2) DC 24V for electronic power supply bus coupler and I/O area



Standard wiring

#### PM - Power module



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

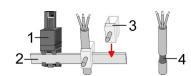
- The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!
- It is recommended to externally protect the electronic power supply for bus coupler and I/O area with a 2A fuse (fast) respectively by a line circuit breaker 2A characteristics Z.
- 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.

# 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.

Wiring > Wiring bus coupler

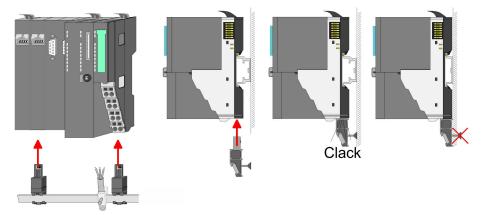
#### Shield attachment



- 1 Shield bus carrier
- 2 Shield bus (10mm x 3mm)
- 3 Shield clamp
- 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.

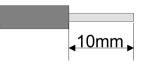


**3.** Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

#### 2.5.2 Wiring bus coupler

**Terminal module terminals** The System SLIO bus coupler have a power module integrated. 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



 Umax
 240V AC / 30V DC

 Imax
 10A

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

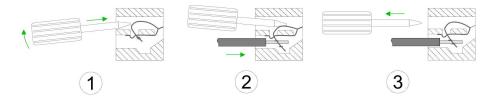
 Stripping length
 10mm

#### Wiring procedure

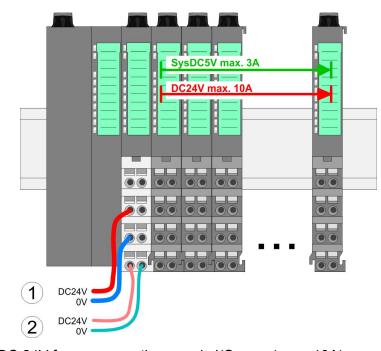


- 1 Pin number at the connector 2 Opening for screwdriver
- 3 Connection hole for wire

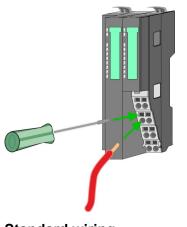
Wiring > Wiring bus coupler



- **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.



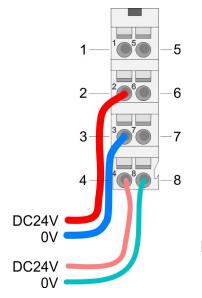
(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area



Standard wiring

Wiring > Wiring bus coupler

#### **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

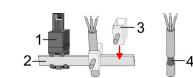
- The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!
- It is recommended to externally protect the electronic power supply for bus coupler and I/O area with a 2A fuse (fast) respectively by a line circuit breaker 2A characteristics Z.
- 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.

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.

Wiring > Wiring periphery modules

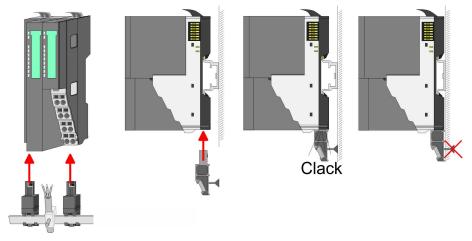
#### Shield attachment



- 1 Shield bus carrier
- 2 Shield bus (10mm x 3mm)
- 3 Shield clamp
- 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.

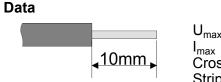
- **1.** Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.
- **2.** Put your shield bus into the shield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



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

#### 2.5.3 Wiring periphery modules

**Terminal module terminals** 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.



 Umax
 240V AC / 30V DC

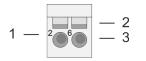
 Imax
 10A

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

 Stripping length
 10mm

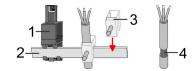
Wiring > Wiring periphery modules

#### Wiring procedure



Pin number at the connector
 Opening for screwdriver
 Connection hole for wire

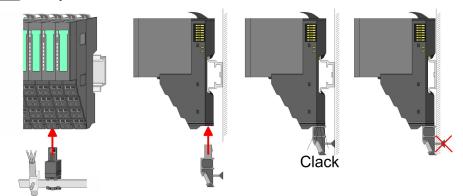
- 1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
- 2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2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



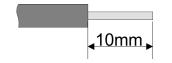
**3.** Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

Shield attachment

#### 2.5.4 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



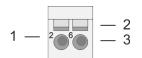
 U<sub>max</sub>
 240V AC / 30V DC

 I<sub>max</sub>
 10A

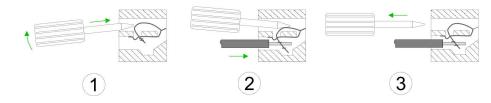
 Cross section
 0.08 ... 1.5mm² (AWG 28 ... 16)

 Stripping length
 10mm

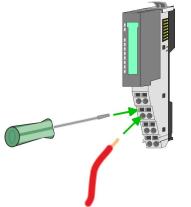
#### Wiring procedure



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

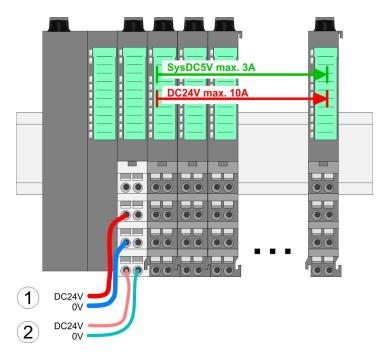


- Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
   Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>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



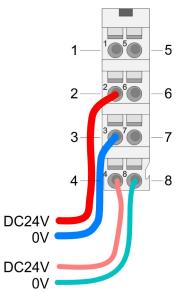
Wiring > Wiring power modules

#### 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	l	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

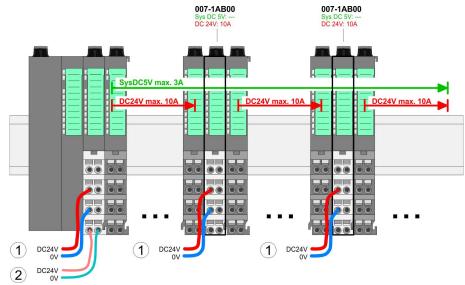
I Input

#### CAUTION! Since the p

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!

Wiring > Wiring power modules

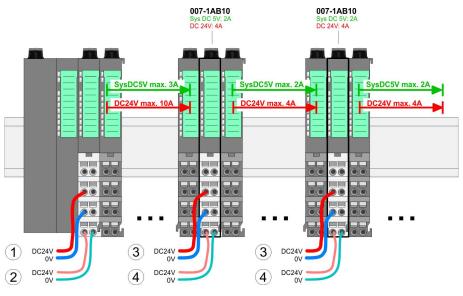
	The electronic power section supply is internally protected against higher voltage by fuse. The fuse is within the power module. If the fuse releases, its electronic module must be exchanged!
Fusing	<ul> <li>The power section supply is to be externally protected with a fuse, which corresponds to the 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 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.</li> </ul>
<b>D</b>	007-14800 007-14800



*Power module 007-1AB00* 

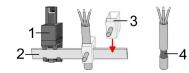
Wiring > Wiring power modules

#### 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

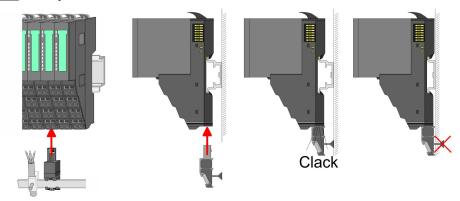
Shield attachment



- Shield bus carrier 1
- Shield bus (10mm x 3mm) 2
- 3 Shield clamp
- 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.



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

Demounting > Demounting CPU 01x

## 2.6 Demounting

2.6.1 Demounting CPU 01x

## Proceeding



## CAUTION!

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

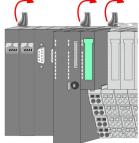
- **1.** Power-off your system.
- 2. Remove if exists the wiring of the CPU.
- 3.



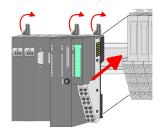
For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module <u>right</u> beside. After mounting it may be plugged again.

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

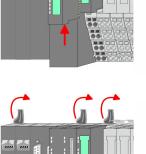
**4.** Turn all the locking lever of the CPU to be exchanged upwards.



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

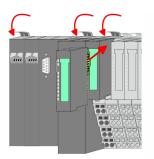


- **7.** To mount the CPU put it to the left periphery module and push it, guided by the stripes, to the mounting rail.
- **8.** Turn all the locking lever downward, again.



## **Basics and mounting**

Demounting > Demounting bus coupler



- **9.** Plug again the electronic module, which you have removed before. For installation plug the electronic module guided by the strips at the lower side until this engages to the terminal module.
- 10. Wire your CPU.
  - $\Rightarrow$  Now you can bring your system back into operation.

## 2.6.2 Demounting bus coupler

## Proceeding



## CAUTION! Bus interface and power m

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

- **1.** Power-off your system.
- **2.** Remove if exists the wiring of the bus coupler.

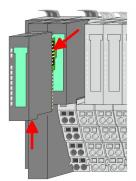
3.

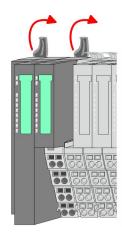


For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module <u>right</u> beside. After mounting it may be plugged again.

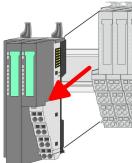
Press the unlocking lever at the lower side of the just mounted right module near the bus coupler and pull it forward.

**4.** Turn all the locking lever of the bus coupler to be exchanged upwards.





Demounting > Demounting periphery module



- 5. Pull the bus coupler forward.
- 6. For mounting turn all the locking lever of the bus coupler to be exchanged upwards.

- 7. To mount the bus coupler put it to the left periphery module and push it, guided by the stripes, to the mounting rail.
- 8. Turn all the locking lever downward, again.

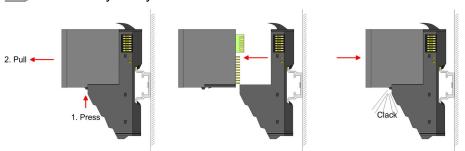
- 9. Plug again the electronic module, which you have removed before.
- **10.** Wire your bus coupler.
  - $\Rightarrow$  Now you can bring your system back into operation.

2.6.3 Demounting periphery module

### Proceeding

Exchange of an electronic module

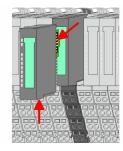
**1.** Power-off your system.



- **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.

Demounting > Demounting periphery module

### Exchange of a periphery module



- **1.** Power-off your system.
- 2. Remove if exists the wiring of the module.

3.



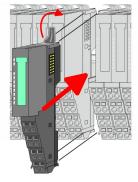
5. Pull the module.

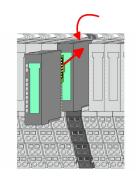
For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.

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

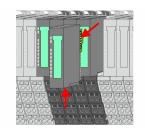
**4.** Turn the locking lever of the module to be exchanged upwards.

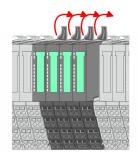
- - 6. For mounting turn the locking lever of the module to be mounted upwards.
    - 7. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
    - 8. Turn the locking lever downward, again.





# Exchange of a module group





before. 10. Wire your module.

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

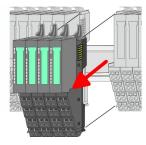
- $\Rightarrow$  Now you can bring your system back into operation.
- **1.** Power-off your system.
- **2.** Remove if exists the wiring of the module group.
- 3.

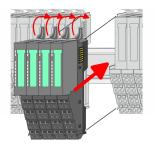


For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module <u>right</u> beside. After mounting it may be plugged again.

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

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

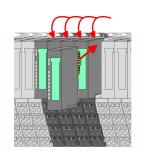




- **5.** Pull the module group forward.
- **6.** For mounting turn all the locking lever of the module group to be mounted upwards.
- **7.** To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
- 8. Turn all the locking lever downward, again.

## **Basics and mounting**

Trouble shooting - LEDs



- **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.

## 2.7 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  $\Diamond$ .

#### 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 2.5.4 Wiring power modules' on page 33* 

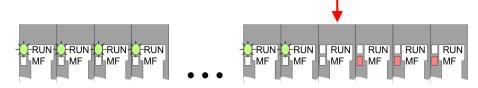
## Error in configuration

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

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

Remedy: Match configuration and hardware structure.

## Module failure



*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.

2.8 Installation guide	lines
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. Neverthe-
	less you should project an EMC planning before installing the compo- nents and take conceivable interference causes into account.
Possible interference causes	Electromagnetic interferences may interfere your control via different ways:
	<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>

Installation guidelines

- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated.
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be 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 impedance-low, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area. Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible.
  - analog signals (some mV 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!

Installation guidelines



#### CAUTION! 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

## 2.9 General data

Conformity and approval		
Conformity		
CE	2006/95/EG	Low-voltage directive
	2004/108/EG	EMC directive
Approval		
UL	UL 508	Approval for USA and Canada
others		
RoHS	2011/65/EU	Product is lead-free; 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 e	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 10 95%)					
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					

General data

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

EMC	Standard		Comment
Emitted interfer- ence	EN 61000-6-4		Class A (Industrial area)
Noise immunity	EN 61000-6-	2	Industrial area
zone B	one 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	
		EN 61000-4-4	Burst, degree of severity 3
		EN 61000-4-5	Surge, installation class 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.

Analog value

## 3 Analog Input

3.1 General	
Cables for analog sig- nals	For analog signals you should use screened cables to reduce interfer- ence. 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	<ul> <li>Depending on the module the following sensors may be connected to the analog input modules:</li> <li>Current sensor</li> <li>Voltage sensor</li> <li>Resistance-type sensors</li> <li>Temperature sensors</li> </ul>
	<ul> <li>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.</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 can release a diagnostic:</li> <li>Error in parameterization</li> <li>Measuring range over-/underflow</li> <li>Wire break</li> </ul>

## 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.

Resolu- tion		Analog value														
		High byte (byte 0)   Low byte (byte 1)							1)							
Bit number	15	14	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>	2 <sup>5</sup>	24	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	20
12Bit+sign	SG	G Measuring value							0	0	0					
15Bit+sign	SG	SG Measuring value														

Resolution	With a resolution of 12bit plus sign bit, the not used low value positions (3bits) are filled with "0".
Sign bit (SG)	<ul> <li>Here it is essential:</li> <li>Bit 15 = "0": → positive value</li> <li>Bit 15 = "1": → negative value</li> </ul>
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>

**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	$D = 27648 \cdot \frac{U}{}$
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{80}$
(11h)	0V	0	0000h		
(111)	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	
-80 80mV	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{80}$
Siemens S7 format	80mV	16384	4000h	nominal range	80
(21h)	0V	0	0000h		80
(~)	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	

## 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	10
(10h)	5V	13824	3600h		10
(1011)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	D = 16384 . U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

## ±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±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		
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		
	-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	$D = 10384 + \frac{10}{10}$
(22h)	5V	8192	2000h		10
(2211)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

## Current

## 0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	(1) 23.52mA	32511	7EFFh	overrange	I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h	Ū	20
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	
0 20mA	25.00mA	20480	5000h	overrange	D = 16384 . $I$
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		20
(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	16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		27048
	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	16
S5 format	12mA	8192	2000h		$I = D \cdot \frac{16}{16384} + 4$
(40h)	4mA	0	0000h		16384
	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 4000 I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{1}{20}$
(3Fh)	10mA	2000	07D0h		20
	0mA	0	0000h		$I = D \cdot \frac{20}{4000}$
				underrange	4000

## Resistance

Measuring range	Measuring value	Signal range	Range
(funct. no.)	1000°C	10000	
2 wire: PT100 (50h)	+1000°C	+10000	overrange
(3011)	-200 +850°C	-2000 +8500	nominal range
0 . 574000	-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
			J

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 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 $60\Omega$	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 600Ω	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: -210 +1200°C -346 2192°F	+14500 -2100 +12000	26420 -3460 21920	17232 632 14732	overrange nominal range
63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)				underrange
Туре К:	+16220	29516	18952	overrange
-270 +1372°C -454 2501.6°F	-2700 +13720	-4540 25016	0 16452	nominal range
0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
-270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	-2700 +13000	-4540 23720	0 15732	nominal range

Measuring range (funct. no.)	Measuring value in °C	Measuring value in °F	Measuring value in K	Range
(runot: no.)	(0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
				underrange
Type R:	+20190	32766	22922	overrange
-50 +1769°C	-500 +17690	-580 32162	2232 20422	nominal range
-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
-50 +1769°C	-500 +17690	-580 32162	2232 20422	nominal range
-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
-270 +400°C	-2700 +4000	-4540 7520	32 6732	nominal range
-454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
0 +1820°C	0 +18200	320 27865	2732 20932	nominal range
32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Type C:	+25000	32766	23432	overrange
0 +2315°C	0 +23150	320 27865	2732 20932	nominal range
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
-270 +1000°C -454 1832°F	-2700 +10000	-4540 18320	0 12732	nominal range
0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange

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

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 L:	+11500	21020	14232	overrange
-200 +900°C	-2000 +9000	-3280 16520	732 11732	nominal range
-328 1652°F				underrange
73.2 1173.2K				
(B9h: ext. comp. 0°C)				
(C9h: int. comp. 0°C)				

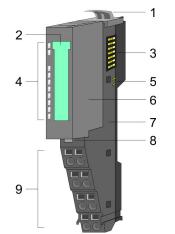
## 3.4 031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO

### **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



- Locking lever terminal module 1
- 2 3 Labeling strip
- 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

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

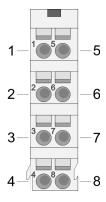
## **Status indication**

	RUN	MF	Al x	Description
	green	red	red	
MF — 🖣				
	•	0	х	Bus communication is OK
Al 1 — 🖣 💶	Ū	Ũ	Λ	Module status is OK
8-1		•	х	Bus communication is OK
	•	•	~	Module status reports an error
H I	0		х	Bus communication is not possible
	0	•	^	Module status reports an error
	0	0	Х	Error at bus power supply
	Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
				Error channel x
	•	0	•	<ul> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> <li>Overload/short circuit of the DC 24V_ISO</li> </ul>
	on: •   o	off: 0   bli	nks with	2Hz: B   not relevant: X

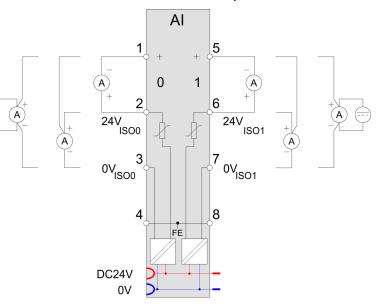
HB300 | SM-AIO | | GB | 15-45

#### 031-1BB10 - AI 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.

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

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

## Output area

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

## 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 current	-
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 cur- rent)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-

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

Order no.	031-1BB10
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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)
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

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         -           Max. potential difference between circuits         DC 75 V/ AC 60 V           Max. potential difference between niputs (Ucm)         DC 75 V/ AC 60 V           Max. potential difference between mana and         -           Max. potential difference between inputs and         DC 75 V/ AC 60 V           Max. potential difference between inputs and         DC 75 V/ AC 60 V           Max. potential difference between inputs and         DC 75 V/ AC 60 V           Max. potential difference between inputs and         DC 75 V/ AC 60 V           Max. potential difference between inputs and         DC 75 V/ AC 60 V           Max. potential difference between Mintern and         -           Insulation tested with         DC 500 V           Datasizes         20           Input bytes         0           Parameter bytes         20           Diagnostic bytes         20           Material         PPE / PPE GF10           Mounting	Order no.	031-1BB10
Vertifications         red LED           Channel error display         red LED per channel           Isolation         red LED per channel           Isolation         1           Between channels of groups to         1           Between channels and backplane bus         ✓           Between channels and power supply         ✓           Max. potential difference between inputs (UCD)         DC 75 V/ AC 60 V           Max. potential difference between inputs (UCD)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 500 V           Datasizes         2           Insulation tested with         DC 500 V           Datasizes         2           Input bytes         4           Output bytes         20           Diagnostic bytes         20           Diagnostic bytes         20           Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         22 °C to 70 °C	Diagnostics information read-out	possible
Channel error display       red LED per channel         Isolation	Module state	green LED
Isolation         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 60 V           Max. potential difference between inputs (Ucm)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between Mintern and Outputs         DC 500 V           Datasizes            Input bytes         0           Output bytes         0           Output bytes         0           Diagnostic bytes         20           Material         PPE / PPE GF10           Mechanical data            Dimensions (WxHxD)         12.9 mm x 109 mm x 76.5 mm           Weight         60 g           Environmental conditions         -25 °C to 70 °C           Ore	Module error display	red LED
Setween 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 60 V           Max. potential difference between inputs (Ucm)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between inputs and Mintern (Uiso)         DC 75 V/ AC 60 V           Max. potential difference between Mintern and outputs         -           Insulation tested with         DC 500 V           Datasizes         -           Input bytes         0           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         60 g           Environmental conditions         -           Ovec to 60 °C         -           Storage temperature         0 °C to 60 °C	Channel error display	red LED per channel
Between channels of groups to1Between channels and backplane bus~Between channels and power supply~Max. potential difference between circuitsDC 75 V/ AC 60 VMax. potential difference between inputs (UCM)DC 75 V/ AC 60 VMax. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and outputsDC 75 V/ AC 60 VMax. potential difference between Mintern and outputsDC 500 VDatasizesDC 500 VDatasizes20Unput bytes0Diagnostic bytes20MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0° C to 60 °COperating temperature0° C to 60 °CStorage temperatureC 5° C to 70 °CCertifications0° C to 60 °C	Isolation	
Between channels and backplane bus <ul> <li>Addition of the state state</li></ul>	Between channels	$\checkmark$
Between channels and power supplyBetween channels and power supplyMax. potential difference between circuitsDC 75 V/ AC 60 VMax. potential difference between inputs (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between minuts and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-De C 500 VDE 500 VDatasizes0Input bytes4Output bytes0Parameter bytes20Diagnostic bytes20MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions-Operating temperature-25 °C to 70 °CCertifications-25 °C to 70 °C	Between channels of groups to	1
Max. potential difference between inputsDC 75 V/ AC 60 VMax. potential difference between inputs (Ucm)DC 75 V/ AC 60 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and outputsDC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Dt 500 VDC 500 VDatasizes0Input bytes4Output bytes0Parameter bytes20Diagnostic bytes20MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0° °C to 60 °COperating temperature0° °C to 70 °CCertifications-	Between channels and backplane bus	$\checkmark$
Max. potential difference between inputs (Ucm)DC 75 V/ AC 60 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and MoutputsDC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Datasizes-Input bytes4Output bytes0Parameter bytes20Diagnostic bytes20HousingPref / PPE GF10MountingProfile rail 35 mmMechanical data-Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °CStorage temperature-25 °C to 70 °CCertifications-	Between channels and power supply	$\checkmark$
Max. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputsDC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes0Parameter bytes0Parameter bytes20Diagnostic bytes20HousingProfile rail 35 mmMechanical dataPPE / PPE GF10Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions-Operating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertifications-	Max. potential difference between circuits	DC 75 V/ AC 60 V
Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VDatasizes4Input bytes0Parameter bytes20Diagnostic bytes20HousingPPE / PPE GF10MountingProfile rail 35 mmMechanical data2.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °CStorage temperature-25 °C to 70 °CCertifications-25 °C to 70 °C	Max. potential difference between inputs (Ucm)	DC 75 V/ AC 60 V
Mana' (Ucm)Constrained and the second and	Max. potential difference between Mana and Mintern (Uiso)	-
Mintern (Uiso)Andrew Particular and outputsMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes4Output bytes0Parameter bytes20Diagnostic bytes20MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 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 °CCertifications-	Max. potential difference between inputs and Mana (Ucm)	DC 75 V/ AC 60 V
outputsInsulation tested withDC 500 VDatasizes-Input bytes4Output bytes0Output bytes0Parameter bytes20Diagnostic 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 °CCertifications-	Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
DatasizesInput bytesInput bytes4Output bytes0Output bytes20Diagnostic bytes20HousingPPE / PPE GF10MaterialPPE / PPE GF10MountingProfile 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 °CCertifications-25 °C to 70 °C	Max. potential difference between Mintern and outputs	-
Input bytes4Output bytes0Output bytes20Parameter bytes20Diagnostic bytes20HousingPPE / PPE GF10MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °CStorage temperature-25 °C to 70 °CCertifications-25 °C to 70 °C	Insulation tested with	DC 500 V
Output bytes0Parameter bytes20Diagnostic bytes20HousingPPE / PPE GF10MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °CStorage temperature-25 °C to 70 °CCertifications-25 °C to 70 °C	Datasizes	
Parameter bytes20Diagnostic bytes20HousingPPE / PPE GF10MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 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 °CCertificationsImage: Condition set to the set	Input bytes	4
Diagnostic bytes20Housing20MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data12.9 mm x 109 mm x 76.5 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmWeight60 gEnvironmental conditions0 °C to 60 °COperating temperature0 °C to 70 °CStorage temperature-25 °C to 70 °CCertifications	Output bytes	0
HousingMaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical dataImage: Comparison of the test of test o	Parameter bytes	20
MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical dataImage: Standard standar	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 °CCertificationsItem temperature	Housing	
Mechanical data12.9 mm x 109 mm x 76.5 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 °CCertifications-25 °C to 70 °C	Material	PPE / PPE GF10
Dimensions (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 °CCertifications-25 °C to 70 °C	Mounting	Profile rail 35 mm
Weight     60 g       Environmental conditions     0 °C to 60 °C       Operating temperature     0 °C to 60 °C       Storage temperature     -25 °C to 70 °C       Certifications     -25 °C to 70 °C	Mechanical data	
Environmental conditions     0 °C to 60 °C       Operating temperature     0 °C to 60 °C       Storage temperature     -25 °C to 70 °C       Certifications     -25 °C to 70 °C	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	Weight	60 g
Storage temperature     -25 °C to 70 °C       Certifications     -25 °C to 70 °C	Environmental conditions	
Certifications	Operating temperature	0 °C to 60 °C
	Storage temperature	-25 °C to 70 °C
UL certification yes	Certifications	
	UL 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 interrupt

#### Byte Bit 7 ... 0

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

Here you can enable respectively disable the diagnostic interrupt.

SHORT\_EN Monitoring sensor voltage

Byte
0

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

	EN	Limit value	
monit	ōrin	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>

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

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

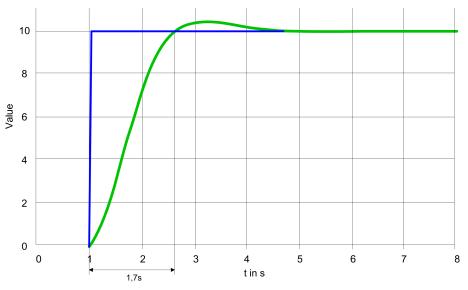
Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	20.457mA	4095	0FFFh	overrange	D = 4000 I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{I}{20}$
(3Fh)	10mA	2000	07D0h		20
	0mA	0	0000h		$I = D \cdot \frac{20}{4000}$
				underrange	4000

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

## 3.4.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	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	-

### **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 overflow	Byte	Bit 7 0
oveniow	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 under-	Byte	Bit 7 0

PRIT UL	Limit	under-
flow		

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>

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

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>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.
- IN 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 diagnostic08hbits per channel			07h	
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific 00h error channel 0			0Ah	
CH1ERR	1	Channel-specific error channel 1	00h			0Bh

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

Name	Bytes	Function	Default	DS	IX	SX
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 infor-	
mation	

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 5: reserved
  - Bit 6: set at process interrupt lost
  - 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

0

Number of diagnostic bits per channel (here 08h)

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

**Analog Input** 

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	<ul> <li>Channel-specific error: Channel x:</li> <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> </ul>

- Bit 3: reserved
- Bit 4: error sensor supply voltage
- Bit 5: set at process interrupt lost
- Bit 6: set at measuring range underflow
- Bit 7: set at measuring range overflow

CH2ERR ... CH7ERR reserved

Byte	Bit 7 0
0	reserved

DIAG\_US µs ticker

ByteBit 7 ... 00...3Value 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

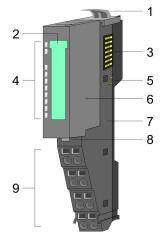
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

## **Analog Input**

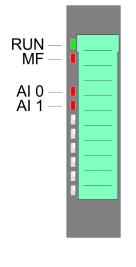
031-1BB30 - AI 2x12Bit 0...10V

### Structure



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

## **Status indication**

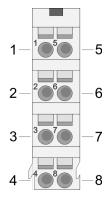


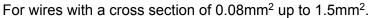
RUN	MF	Al x	Description	
green	red	red		
•	0	х	Bus communication is OK	
•	0	^	Module status is OK	
•	•	х	Bus communication is OK	
•	•	~	Module status reports an error	
0	•	х	Bus communication is not possible	
0	• ×	^	Module status reports an error	
0	0	Х	Error at bus power supply	
Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42	
			Error channel x	
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>	
on: ● Loff: ○ Lblinks with 2Hz: B Lnot relevant: X				

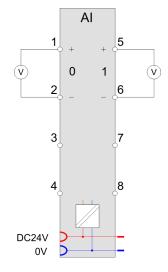
on: • | off:  $\circ$  | blinks with 2Hz: B | not relevant: X

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

#### Pin assignment







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	-Al 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	70 mA		
Power loss	0.7 W		
Technical data analog inputs			
Number of inputs	2		
Cable length, shielded	200 m		
Rated load voltage	DC 24 V		
Current consumption from load voltage L+ (without load)	15 mA		
Voltage inputs	$\checkmark$		
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	-		

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

Order no.	031-1BB30
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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

## **Analog Input**

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

Order no.	031-1BB30
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 60 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

## 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.

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.

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
format (10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5	10V	16384	4000h	nominal range	$D = 10384 \cdot \frac{10}{10}$
format (20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

## 0 ... 10V

## 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

031-1BB30 - AI 2x12Bit 0...10V> 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	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 00h channel 0		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	infor-
mation		

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>

031-1BB30 - AI 2x12Bit 0...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> <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>
CH0ERR / CH1ERR 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>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

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

DIAG\_US µs ticker

#### Bit 7 ... 0 **Byte**

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

#### µs ticker

In the SLIO module there is a timer (us ticker). With PowerON the timer starts counting with 0. After 232-1µs the timer starts with 0 again.

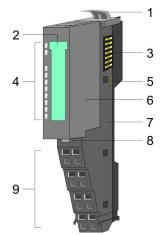
## 3.6 031-1BB40 - AI 2x12Bit 0(4)...20mA

**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



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

## Status indication

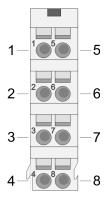
		RUN	MF	Al x	Description
RUN — I	]	green	red	red	
MF — 📕					
AI 0 — I —		•	0	х	Bus communication is OK
Al 1 — I		•	0	~	Module status is OK
	•		v	Bus communication is OK	
			•	^	Module status reports an error
i —		0	•	Y	Bus communication is not possible
		0	•	~	Module status reports an error
		0	0	Х	Error at bus power supply
		•	•	x x x	Module status reports an error Bus communication is not possible Module status reports an error

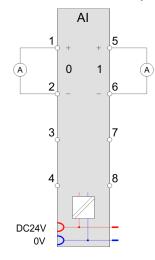
031-1BB40 - AI 2x12Bit 0(4)...20mA

RUN	MF	Al x	Description				
х	В	Х	Error in configuration				
			Error channel x				
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>				
on: •   c	on: ●   off: ○   blinks with 2Hz: B   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			not connected
4			not connected
5	+AI 1	I	+ Channel 1
6	-Al 1	I	Ground Channel 1
7			not connected
8			not connected

## 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.

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

- 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.

## 3.6.1 Technical data

Order no.	031-1BB40	
Туре	SM 031	
Module ID	0402 15C3	
Current consumption/power loss		
Current consumption from backplane bus	70 mA	
Power loss	0.7 W	
Technical data analog inputs		
Number of inputs	2	
Cable length, shielded	200 m	
Rated load voltage	DC 24 V	
Current consumption from load voltage L+ (without load)	15 mA	
Voltage inputs	-	
Min. input resistance (voltage range)	-	
Input voltage ranges	-	
Operational limit of voltage ranges	-	
Operational limit of voltage ranges with SFU	-	
Basic error limit voltage ranges	-	
Basic error limit voltage ranges with SFU	-	
Destruction limit current	-	
Current inputs	✓	
Max. input resistance (current range)	110 Ω	
Input current ranges	0 mA +20 mA +4 mA +20 mA	

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

Order no.	031-1BB40
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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-

## **Analog Input**

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

Order no.	031-1BB40		
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	-		
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 60 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		

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

Order no.	031-1BB40
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

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

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

## 0(4) ... 20mA

## 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			
ERR_C	1	reserved	00h			
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 infor- mation	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>

031-1BB40 - AI 2x12Bit 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	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>
CH0ERR / CH1ERR Channel-specific	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>
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved

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

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 (us ticker). With PowerON the timer starts counting with 0. After 232-1µs the timer starts with 0 again.

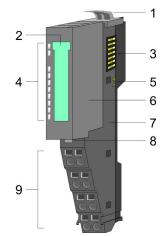
## 3.7 031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor

**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



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

## Status indication

			RUN	MF	Al x	Description
RUN —			green	red	red	
MF —	• — I					
AI 0 —				0	х	Bus communication is OK
AI 1 —	Al 1 — 📕		•	0	^	Module status is OK
			х	Bus communication is OK		
	1 <u> </u>		•	•	^	Module status reports an error
			0	-	Х	Bus communication is not possible
				•		Module status reports an error
		0	0	Х	Error at bus power supply	
			Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42

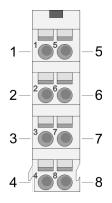
031-1BB60 - AI 2x12Bit 0(4)...20mA - Sensor

RUN	MF	Al x	Description	
			Error channel x	
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>	
on: •   off: •   blinks with 2Hz: B   not relevant: X				

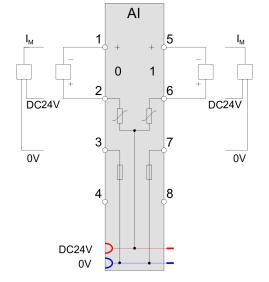


If the terminal module is not yet wired, when the module is power supplied the AI x LEDs get on due to the default parameterization 4 ... 20mA.

## 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.

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

- 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.

## 3.7.1 Technical data

Order no.	031-1BB60
Туре	SM 031
Module ID	0407 15C3
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)	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 current	-
Current inputs	$\checkmark$
Max. input resistance (current range)	110 Ω
Input current ranges	0 mA +20 mA +4 mA +20 mA

## **Analog Input**

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

Order no.	031-1BB60
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 cur- rent)	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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-

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

Order no.	031-1BB60
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	-
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 60 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

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

Order no.	031-1BB60
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

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

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

## 0(4) ... 20mA

## 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

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

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

MODTYP Module infor- mation	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> </ul>
		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> </ul>
		Bit 7: reserved
NUMBIT Diagnostic bits	Byte	Bit 7 0
NUMBIT Diagnostic bits	-	Bit 7 0 Number of diagnostic bits per channel (here 08h)
NUMBIT Diagnostic bits	-	
NUMBIT Diagnostic bits NUMCH Channels	-	
	0	Number of diagnostic bits per channel (here 08h)
	0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0
	0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0
NUMCH Channels	0 <b>Byte</b> 0	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 02h)
NUMCH Channels	0 <b>Byte</b> 0 <b>Byte</b>	<ul> <li>Number of diagnostic bits per channel (here 08h)</li> <li>Bit 7 0</li> <li>Number of channels of a module (here 02h)</li> <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> </ul>
NUMCH Channels	0  Byte  0  Byte  0	Number of diagnostic bits per channel (here 08h)         Bit 7 0         Number of channels of a module (here 02h)         Bit 7 0         Bit 0: set at error in channel group 0         Bit 1: set at error in channel group 1         Bit 7 2: reserved
NUMCH Channels CHERR Channel error	0  Byte  0  Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 02h) Bit 7 0 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved Bit 7 0
NUMCH Channels CHERR Channel error CH0ERR / CH1ERR	0  Byte  0  Byte  0	Number of diagnostic bits per channel (here 08h)     Bit 7 0     Number of channels of a module (here 02h)     Bit 7 0     Bit 0: set at error in channel group 0   Bit 1: set at error in channel group 1   Bit 7 2: reserved

## **Analog Input**

031-1BB70 - AI 2x12Bit ±10V

CH2ERR	CH7ERR
reserved	

B	yte	Bit 7 0
0		reserved

DIAG\_US µs ticker

#### **Byte** Bit 7 ... 0

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

µs ticker

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

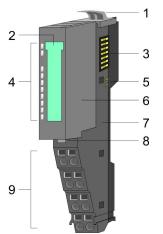
## 3.8 031-1BB70 - AI 2x12Bit ±10V

**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



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

031-1BB70 - AI 2x12Bit ±10V

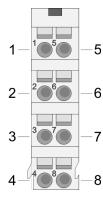
	RUN	MF	Al x	Description		
	green	red	red			
MF — 🖣						
AI 0 — 🛯 📃		0	х	Bus communication is OK		
AI 1 — 📕	•	0	~	Module status is OK		
		•	х	Bus communication is OK		
	•	•	~	Module status reports an error		
i — I	0		×	Bus communication is not possible		
	0	•	Х	Module status reports an error		
	0	0	Х	Error at bus power supply		
	Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42		
				Error channel x		
	•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
	on: •   off: •   blinks with 2Hz: B   not relevant: X					

## Status indication

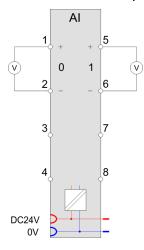
-

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.

## 3.8.1 Technical data

031-1BB70
SM 031
0408 15C3
50 mA
0.5 W
2
- 200 m
DC 24 V
15 mA
$\checkmark$
100 κΩ
-10 V +10 V 0 V +10 V
+/-0.3%
-
+/-0.2%
-
max. 30V
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

## **Analog Input**

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

Order no.	031-1BB70
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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

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

Order no.	031-1BB70
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 60 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

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

## 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.

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.

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
±10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{1}$
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5	10V	16384	4000h	nominal range	$D = 10384 \cdot \frac{10}{10}$
format (22h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

## ±10V

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

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
format (10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5	10V	16384	4000h	nominal range	$D = 10384 \cdot \frac{10}{10}$
format (20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

## 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

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

Name	Bytes	Function	Default	DS	IX	SX
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 infor- mation	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
Dyte	DIL / V

0

- Bit 6 ... 0: Channel type
  - 70h: Digital input
    - 71h: Analog input
    - 72h: Digital output
    - 73h: Analog output
    - \_ 74h: Analog input/-output
    - 76h: Counter
  - Bit 7: reserved

HB300 | SM-AIO | | GB | 15-45

031-1BB90 - AI 2x16Bit TC

**Analog Input** 

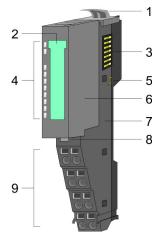
NUMBIT Diagnostic bits	Byte	Bit 7 0			
	0	Number of diagnostic bits per channel (here 08h)			
NUMCH Channels	Byte	Bit 7 0			
	0	Number of channels of a module (here 02h)			
CHERR Channel error	Byte	Bit 7 0			
	0	<ul> <li>Bit 0: set at error in channel group 0</li> <li>Bit 1: set at error in channel group 1</li> <li>Bit 7 2: reserved</li> </ul>			
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0			
	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	Byte	Bit 7 0			
reserved	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.				
3.9 031-1BB90 - Al 2x	16Bit <sup>·</sup>	ТС			
Properties	The electronic module has 2 inputs for temperature and voltage				

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

031-1BB90 - AI 2x16Bit TC

## Structure



- Locking lever terminal module Labeling strip Backplane bus LED status indication DC 24V power section supply Electronic module 1 2 3 4

- 5 6 7
- Terminal module
- . 8 9 Locking lever electronic module
- Terminal

## **Status indication**

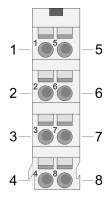
RUN MF

Al 0 Al 1

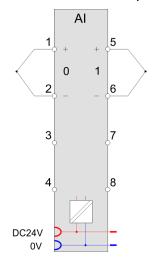
RUN	MF	Al x	Description
green	red	red	
•	0	х	Bus communication is OK
·	Ũ	Λ	Module status is OK
•	•	Х	Bus communication is OK
•	•	^	Module status reports an error
0	•	х	Bus communication is not possible
0	•	^	Module status reports an error
0	0	Х	Error at bus power supply
х	В	Х	Error in configuration
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li><li>Wire break</li></ul>
on: ●   off: ○   blinks with 2Hz: B   not relevant: X			

031-1BB90 - AI 2x16Bit TC

## 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!

# 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	75 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 MΩ
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)	-

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

Order no.	031-1BB90
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 cur- rent)	-
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	-
Operational limit of resistance thermometer 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

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

Order no.	031-1BB90
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	✓
External temperature compensation	$\checkmark$
Internal temperature compensation	$\checkmark$
Internal temperature compensation	1 K
Technical unit of temperature measurement	-
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 140 V/ AC 60 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-

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

Order no.	031-1BB90
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	22
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

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.

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

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
CH0UL	2	Upper limit value channel 0	7FFFh	80h	3108h 3109h	09h
CH0LL	2	Lower limit value channel 0	8000h	80h	310Ah 310Bh	0Ah
CH1FN	1	Function number channel 1	C1h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	02h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh 310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h 3111h	0Eh

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

## DIAG\_EN Diagnostic interrupt

Byte	Bit 7	0

0

- Diagnostics interrupt
  - 00h: enabled
  - 40h: disabled
- 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>

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>

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

TEMPONE Tomporatura			
TEMPCNF Temperature system	Byte	Bit 7 0	
System	0	<ul> <li>Bit 0, 1: Temperature system</li> <li>- 00: °C</li> <li>- 01: °F</li> <li>- 10: K</li> </ul>	
		Bit 7 2: reserved	
SUPR Interference fre-	Byte	Bit 7 0	
quency suppression	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.		
-80 80mV			

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{}$
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{80}$
(11h)	0V	0	0000h		$U = D \cdot \frac{80}{27648}$
(111)	-80mV	-27648	9400h		
	-94.07mV	-32512	8100h	underrange	
-80 80mV	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{20}$
Siemens S7 format	80mV	16384	4000h	nominal range	$D = 10384 \cdot \frac{1}{80}$
(21h)	0V	0000h	80		
(2111)	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	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:	+14500	26420	17232	overrange
-210 +1200°C -346 2192°F 63.2 1473.2K (B0h: ext. comp. 0°C)	-2100 +12000	-3460 21920	632 14732	nominal range

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

Measuring range	Measuring value in °C	Measuring value in °F	Measuring value in K	Range
(funct. no.)	(0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
(C0h: int. comp. 0°C)				underrange
Туре К:	+16220	29516	18952	overrange
-270 +1372°C -454 2501.6°F	-2700 +13720	-4540 25016	0 16452	nominal range
0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
-270 +1300°C -454 2372°F	-2700 +13000	-4540 23720	0 15732	nominal range
0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
-50 +1769°C	-500 +17690	-580 32162	2232 20422	nominal range
-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
-50 +1769°C	-500 +17690	-580 32162	2232 20422	nominal range
-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
-270 +400°C	-2700 +4000	-4540 7520	32 6732	nominal range
-454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
0 +1820°C	0 +18200	320 27865	2732 20932	nominal range
32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange

031-1BB90 - AI 2x16Bit TC > Parameter 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
Type C:	+25000	32766	23432	overrange
0 +2315°C	0 +23150	320 27865	2732 20932	nominal range
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
-270 +1000°C -454 1832°F	-2700 +10000	-4540 18320	0 12732	nominal range
0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
-200 +900°C	-2000 +9000	-3280 16520	732 11732	nominal range
-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.

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.

031-1BB90 - AI 2x16Bit TC> 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.

#### 3.9.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics inter- rupt	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

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

PRIT_OL Li	imit over	flow Byte	Bit 7 0				
		0	Bit 0: Limit over	flow chanr	nel 0		
			Bit 1: Limit over				
		Bit 7 2: reser	ved				
PRIT_UL Li	mit unde	er- Byte	Bit 7 0				
flow		0	Bit 0: Limit unde	erflow char	nnel 0		
			Bit 1: Limit unde	erflow char	nnel 1		
			Bit 7 2: reser	ved			
PRIT_US µs	s ticker	Byte	Bit 7 0				
		01					
		µs ticke					
		•	LIO module there	e is a 32 bi	t timer (us	s ticker). V	Vith PowerON
		the time	r starts counting RIT_US represe	with 0. After	er 2 <sup>32</sup> -1µs	the timer	starts with 0
		(0 2 <sup>16</sup>			/el 2 Dyle	or the µs	licker value
Diagnostic	data		Via the parameterization you may activate a diagnostic interrupt for				
		nostics (	the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt <sub>incoming</sub> . As soon as the reason for				
		releasin	releasing a diagnostic interrupt is no longer present, the diagnostic				
		betweer	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 a	stored and get lost. Within this time window (1. diagnostic inter- rupt <sub>incoming</sub> until last diagnostic interrupt <sub>aoing</sub> ) the MF-LED of the				
			module is on.				
			DS - Record set for access via CPU, PROFIBUS and PROFINET.				
		m	The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.				
		IX - In	<ul> <li>IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX</li> </ul>				
			-011. Additionally -00h.	y the first 4	bytes ma	ly De acce	
		SX - Si	ubindex for acces	ss via Ethe	rCAT with	n Index 50	05h.
		More ca	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

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

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

Name	Bytes	Function	Default	DS	IX	SX
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of 02h a module		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	Α	Diag	nostic

#### Byte Bit 7 ... 0

0

Bit 0: set at module failu
----------------------------

	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 infor- mation	Byte	Bit 7 0
	0	<ul> <li>Bit 3 0: module class</li> <li>0101b analog module</li> <li>Dit 4: est et channel information respect</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	Bit 2 0: reserved
	Bit 3: set at internal diagnostics buffer overflow
	Bit 4: set at internal communication error
	Bit 5: reserved
	Bit 6: set at process interrupt lost
	Bit 7: reserved

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

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		
CHERR Chainer en or	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	Byte	Bit 7 0
Channel-specific	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
reserved	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic
	μs ticke	
	•	<sup>π</sup> SLIO module there is a timer (μs ticker). With PowerON the
	timer st	tarts counting with 0. After $2^{32}$ -1µs the timer starts with 0 again.

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

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

#### **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

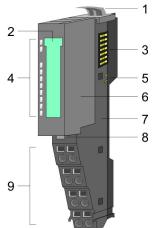
6

7

8

9

#### Structure



#### Status indication

RUN MF

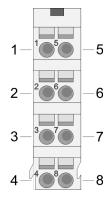
AI 0

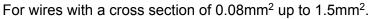
AI 1 AI 2 AI 3

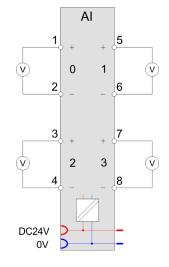
RUN MF Al x **Description** green red red Bus communication is OK Х 0 Module status is OK Bus communication is OK Х • • Module status reports an error Bus communication is not possible Х 0 Module status reports an error 0 0 Х Error at bus power supply Error in configuration & Chapter 2.7 Х В Х 'Trouble shooting - LEDs' on page 42 Error channel x 0 • Signal leaves measuring range Error in parameterization on: • | off: • | blinks with 2Hz: B | not relevant: X

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

#### Pin assignment







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.

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

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

#### Output area

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

#### 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	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	$\checkmark$
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 cur- rent)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-

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

Order no.	031-1BD30
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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

#### **Analog Input**

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

Order no.	031-1BD30
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
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 60 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

#### 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.

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 (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
format (10h)	5V	13824	3600h		$U = D \cdot \frac{10}{27648}$
(101)	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$D = 10584 + \frac{10}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

#### 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.

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

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

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 infor-	Dute	D:4 7 0
mation	Byte	Bit 7 0 Bit 3 0: module class
	0	<ul> <li>Bit 3 0. Inodule 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	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

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

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
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 ticke	er in the second se

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.

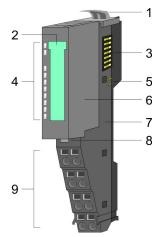
#### 3.11 031-1BD40 - AI 4x12Bit 0(4)...20mA

#### **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
  - 4 ... 20mA with external su
- Diagnostics function
   12bit resolution
- 12bit resolution

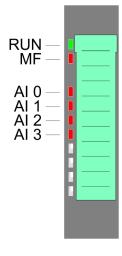
#### Structure



- Locking lever terminal module Labeling strip Backplane bus LED status indication
- 1 2 3 4

- DC 24V power section supply Electronic module 5 6 7
- Terminal module
- 8 Locking lever electronic module
- 9 Terminal

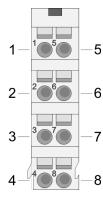
#### **Status indication**



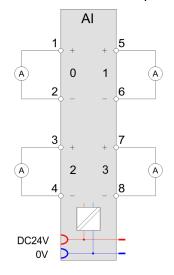
RUN	MF	Al x	Description
green	red	red	
•	0	х	Bus communication is OK
•	0	^	Module status is OK
		х	Bus communication is OK
•	•	^	Module status reports an error
0		х	Bus communication is not possible
0	•	^	Module status reports an error
0	0	Х	Error at bus power supply
Х	В	Х	Error in configuration
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
on: •   c	off:	nks with :	2Hz: B   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.

031-1BD40 - AI 4x12Bit 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
	+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	70 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit current	-
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%

#### **Analog Input**

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

Order no.	031-1BD40
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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12

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

Order no.	031-1BD40
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	-
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 60 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	

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

Order no.	031-1BD40
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

#### 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

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$
Siemens	20mA	27648	6C00h	nominal range	$D = 27048 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		20
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$
Siemens	20mA	16384	4000h	nominal range	$D = 10504 + \frac{1}{20}$
S5 format	10mA	8192	2000h		20
(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	16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		27048
	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	16
	12mA	8192	2000h		$I = D \cdot \frac{16}{16384} + 4$
(40h)	4mA	0	0000h		16384
	0.8mA	-3277	F333h	underrange	

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

#### 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

031-1BD40 - AI 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	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs-Ticker	00h			13h

ERR\_A Diagnostic

Byte	Bit 7 0
0	Bit 0: set at

- Bit 0: set at module failure
  - Bit 1: reserved
  - 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

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

MODTYP Module infor-		
mation	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	Dute	
Nombri Diagnoolio bilo	-	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)
	0	
CHERR Channel error	Byte	Bit 7 0
	0	<ul> <li>Bit 0: set at error in channel group 0</li> </ul>
	U	<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	<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>

#### **Analog Input**

031-1BD70 - AI 4x12Bit ±10V

CH4ERR	CH7ERR
reserved	

Byte	Bit 7 0
0	reserved

DIAG\_US µs ticker

**Byte** Bit 7 ... 0

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

µs ticker

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

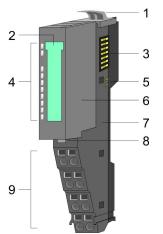
#### 3.12 031-1BD70 - AI 4x12Bit ±10V

**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
- **Diagnostics function**
- 12bit resolution

Structure



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

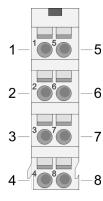
031-1BD70 - AI 4x12Bit ±10V

	RUN	MF	Al x	Description
	green	red	red	
MF — 🖣 [				
AI 0 — I	-	• 0	Х	Bus communication is OK
Al 1 — <b>I</b> — <b>I</b> — <b>I</b> — <b>I</b>	•		Λ	Module status is OK
AI 3 — 📕 📃	-	•	х	Bus communication is OK
	•	• • ^	Module status reports an error	
	0		Х	Bus communication is not possible
	0	•		Module status reports an error
	0	0	Х	Error at bus power supply
	х	В	Х	Error in configuration
				Error channel x
	•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
	2Hz: B   not relevant: X			

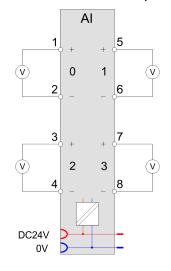
### Status indication

031-1BD70 - AI 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	+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

#### 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.

#### 3.12.1 Technical data

Order no.	031-1BD70
Туре	SM 031
Module ID	0409 15C4
Current consumption/power loss	
Current consumption from backplane bus	50 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 cur- rent)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-

#### **Analog Input**

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

Order no.	031-1BD70
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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

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

Order no.	031-1BD70
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 60 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

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

#### 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.

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	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
±10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$	
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$	
(12h)	5V	13824	3600h			
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$	
	-5V	-13824	CA00h			
	-10V	-27648	9400h			
	-11.76V	-32512	8100h	underrange		
±10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$	
Siemens S5	10V	16384	4000h	nominal range	D = 10304 + 10	
format (22h)	5V	8192	2000h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$	
	-5V	-8192	E000h			
	-10V	-16384	C000h			
	-12.5V	-20480	B000h	underrange		

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

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7	10V	27648	6C00h	nominal range	10
format (10h)	5V	13824	3600h		10
(1011)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5	10V	16384	4000h	nominal range	$D = 10384 \cdot \frac{10}{10}$
format (20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

#### 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.
- IN 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

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

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
CH4ERR CH7ERR	4	reserved	00h			0Eh 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	infor-
mation		

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
0

031-1BD70 - AI 4x12Bit ±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 04h)
	Ū	
CUEDD Channel arrest		
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	<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>
CH4ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US µs ticker	-	
	Byte	Bit 7 0
	03	Value of the $\mu$ s ticker at the moment of the diagnostic
	µs ticke	
		SLIO module there is a timer ( $\mu$ s ticker). With PowerON the tarts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

031-1BD80 - AI 4x16Bit R/RTD

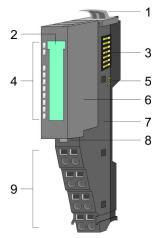
# 3.13 031-1BD80 - AI 4x16Bit R/RTD

# **Properties**

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

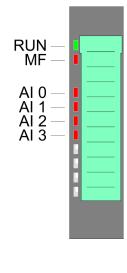
- 4 analog inputs
- Suited for resistance-type sensors 0 ... 3000Ω and resistance temperature sensors Pt100, Pt1000, NI100 and NI1000
- Resistance measurement with 2, 3 and 4 wire (3 and 4 wire only via channel 0 respectively 1)
- Interrupt and diagnostics function
- 16bit resolution

#### Structure



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

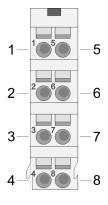
## **Status indication**

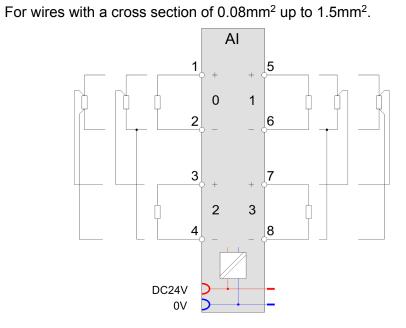


RUN	MF	Al x	Description	
green	red	red		
	0	х	Bus communication is OK	
•	0	^	Module status is OK	
•	•	х	Bus communication is OK	
•	•	^	Module status reports an error	
0	•	×	Bus communication is not possible	
0	• X	^	Module status reports an error	
0	0	Х	Error at bus power supply	
Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42	
			Error channel x	
•	0	٠	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li><li>Wire break</li></ul>	
on: ●   off: ○   blinks with 2Hz: B   not relevant: X				

031-1BD80 - 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	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

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

				ve you can see how th vely 4 wire measurem		e to be	
	<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.</li> <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 deactivated in the parametrization.</li> <li>4 wire measurement is only possible via the channels 0 and 1.</li> <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>						
	6.	The mea	asureme	current for channel 1 is nt for channel 1 happe or channel 1 is represe	ens at pin 7 a	nd 8.	
	sr Ti cł	oonding one correst nannel 1	channel is ponding is channe	th 4 wire measuremen s always deactivated in channel of channel 0 el 3. Not used channel ametrization.	n the parame is channel 2 a	trization. and of	
	<ul> <li>At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area.</li> <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 car	n be foun	d in the a	according manual of y	our bus coup	er.	
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

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

Order no.	031-1BD80
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit current	-
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 cur- rent)	-
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	$\checkmark$

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

Order no.	031-1BD80
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 %
Operational limit of resistance thermometer ranges with SFU	+/- 0,1 %
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	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
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

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

Module error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus✓Between channels and power supply-Between channels difference between circuits-Max. potential difference between niputs (Ucm)DC 6 VMax. potential difference between inputs (Ucm)-Max. potential difference between niputs and mintern (Uiso)-Max. potential difference between niputs and mintern (Uiso)-Max. potential difference between niputs and potential difference between Nintern and potuputs-Insulation tested withDC 500 VDatasizes-Input bytes8
IsolationIsolationBetween 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 6 VMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputsDC 500 VMay potential difference between Mintern and outputsB
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 6 VMax. potential difference between Mana 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)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputsC 500 VDatasizes Input bytes8
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 6 VMax. potential difference between Mana 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 Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes8
Between channels and backplane bus✓Between channels and power supply-Max. potential difference between circuits-Max. potential difference between inputs (Ucm)DC 6 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes8
Between channels and power supply-Max. potential difference between circuits-Max. potential difference between inputs (Ucm)DC 6 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes8
Max. potential difference between circuits-Max. potential difference between inputs (Ucm)DC 6 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes8
Max. potential difference between inputs (Ucm)DC 6 VMax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-DatasizesDC 500 VInput bytes8
Max. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes8
Mintern (Uiso)Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes8
Mana (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes8
Mintern (Uiso)Additional of the second s
outputsDC 500 VInsulation tested withDC 500 VDatasizesSInput bytes8
Datasizes       Input bytes     8
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

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

## 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
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	50h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	00h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh 310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h 3111h	0Eh
CH2FN	1	Function number channel 2	50h <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	Byte	Bit 7 0		
interrupt	0	Diagnos	stic interrupt	
		– 00h	enabled	
			disabled	
	Here	e you can en	able respectively disable	the diagnostic interrupt.
WIBRK_EN Wire break	Byte	Bit 7 0		
recognition	0	<ul> <li>Bit 1: Wi</li> <li>Bit 2: Wi</li> <li>Bit 3: Wi</li> </ul>	re break recognition chai re break recognition chai re break recognition chai re break recognition chai I: reserved	nnel 1 (1: on) nnel 2 (1: on)
LIMIT_EN Limit value	Byte	Bit 7 0		
monitoring 0		<ul> <li>Bit 1: Lin</li> <li>Bit 2: Lin</li> <li>Bit 3: Lin</li> </ul>	<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		
System	0	<ul> <li>Bit 0, 1: 1</li> <li>00: 1</li> <li>01: 1</li> <li>10: K</li> </ul>	F	
			2: reserved	
SUPR Interference fre- quency suppression	Byte			
	<b>Byte</b> 0	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> </ul>	2: reserved Interference frequency so 0Hz	uppression
	-	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> </ul>	2: reserved Interference frequency so 0Hz 0Hz	uppression
	0 In the fo	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> <li>Bit 7 2</li> <li>Dilowing there number lister</li> </ul>	2: reserved Interference frequency so 0Hz 0Hz	es with corresponding by the analog module.
quency suppression CHxFN Function number channel x	0 In the fo	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> <li>Bit 7 2</li> <li>Dilowing there number lister h the correspondences</li> </ul>	2: reserved Interference frequency su 0Hz 0Hz 2: reserved 2: are the measuring rang ed, which were supported	es with corresponding by the analog module.
quency suppression CHxFN Function number channel x	0 In the fo function With FF	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> <li>Bit 7 2</li> <li>Dilowing there number lister h the correspondences</li> </ul>	2: reserved Interference frequency su 0Hz 0Hz 2: reserved 2: reserved e are the measuring rang ed, which were supported bonding channel is deact	es with corresponding by the analog module. ivated.
quency suppression CHxFN Function number channel x Measuring range (funct. no.)	0 In the fo function With FF	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1: - 01: 6 - 10: 5</li> <li>Bit 7 2</li> <li>Dilowing there number lister h the correspondences</li> </ul>	2: reserved Interference frequency su 0Hz 0Hz 2: reserved 2: reserved e are the measuring rang ed, which were supported bonding channel is deact	es with corresponding by the analog module. ivated.
quency suppression CHxFN Function number channel x Measuring range (funct. no.) 2 wire: PT100	0 In the for function With FF	<ul> <li>Bit 7 2</li> <li>Bit 7 0</li> <li>Bit 0, 1:         <ul> <li>01: 6</li> <li>10: 5</li> </ul> </li> <li>Bit 7 2</li> <li>billowing there is number lister in the correspondence of the corre</li></ul>	2: reserved Interference frequency su OHz OHz 2: reserved e are the measuring rang ed, which were supported bonding channel is deact Signal range	es with corresponding I by the analog module. ivated. Range

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

Measuring range (funct. no.)	Measuring value	Signal range	Range
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

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

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
			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

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

Measuring range (funct. no.)	Measuring value	Signal range	Range
(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

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

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 inter- rupt	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 under- flow	Byte	Bit 7 0			
non	0	Bit 0: Limit underflow channel 0			
		Bit 1: Limit underflow channel 1			

Bit 7 ... 4: reserved

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

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>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.
- IN 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

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

Name	Bytes	Function	Default	DS	IX	SX
CH2ERR	1	Channel-specific error channel 2	00h		0Ch	
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR. CH7ERR	4	reserved	00h			11h
DIAG_US	4	µs ticker	00h			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 infor- mation	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>

Byte
0

CHTYP Channel type

ERR\_D Diagnose

- 0 Bit 6 ... 0: Channel type - 70h: Digital input

  - 71h: Analog input \_
  - 72h: Digital output
  - 73h: Analog output
  - 74h: Analog input/-output \_
  - 76h: Counter
  - Bit 7: reserved

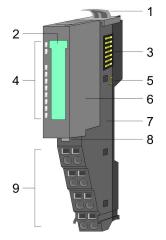
031-1BF60 - AI 8x12Bit 0(4)...20mA

NUMBIT Diagnostic bits	Byto	Bit 7 0		
<b>J</b>	0	Number of diagnostic bits per channel (here 08h)		
	0	Number of diagnostic bits per channel (here oon)		
NUMCH Channela				
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 error in project engineering/parameterization</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> </ul>		
		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		
		er SLIO module there is a timer (μs ticker). With PowerON the tarts counting with 0. After 2 <sup>32</sup> -1μs the timer starts with 0 again.		
3.14 031-1BF60 - AI 8	Bx12B	it 0(4)20mA		
Properties		ectronic module has 8 inputs with parameterizable functions. annels of the module are isolated to the backplane bus.		
	<ul> <li>8 analog single ended inputs (reference potential 0V)</li> <li>Suited for sensors with 0(4) 20mA with external supply</li> <li>Interference frequency suppression parameterizable (50/60Hz)</li> <li>Diagnostics function</li> <li>12bit resolution</li> </ul>			

# **Analog Input**

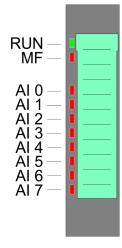
031-1BF60 - AI 8x12Bit 0(4)...20mA

## Structure



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

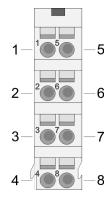
# **Status indication**



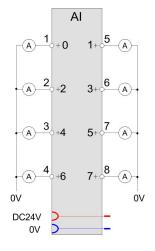
RUN	MF	Al x	Description
green	red	red	
•	0	X	Bus communication is OK
•	0	Х	Module status is OK
•		$\mathbf{v}$	Bus communication is OK
•	•	Х	Module status reports an error
0	•	х	Bus communication is not possible
0			Module status reports an error
0	0	Х	Error at bus power supply
х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
on: •   o	off:	nks with	2Hz: B   not relevant: X

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.

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
	+8	AI 4	2	Analog value channel 4	6401h/s+4	05h
	+10	AI 5	2	Analog value channel 5	6401h/s+5	06h

031-1BF60 - 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 current	-
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	+/-1.1%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 30V

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

Order no.	031-1BF60
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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1.1 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	

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

Order no.	031-1BF60
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
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 60 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

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

Order no.	031-1BF60
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation

## 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 sup- pression	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 frequency suppression

# ByteBit 15 ... 00Bit 0, 1: Interference frequency suppression channel 0Bit 2, 3: Interference frequency suppression channel 1Bit 4, 5: Interference frequency suppression channel 2Bit 6, 7: Interference frequency suppression channel 3

- Bit 6, 7. Interference frequency suppression channel 3
   Bit 8, 9: Interference frequency suppression channel 4
   Bit 10, 11: Interference frequency suppression channel 5
   Bit 12, 13: Interference frequency suppression channel 6
- Bit 14, 15: Interference frequency suppression channel 7
  - 00: deactivated
  - 01: 60Hz
  - 10: 50Hz

031-1BF60 - AI 8x12Bit 0(4)...20mA> Diagnostic 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 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 (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
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		20
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$
Siemens	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		20
(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	16
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$
(30h)	4mA	0	0000h		27048
	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	16
S5 format	12mA	8192	2000h		$I = D \cdot \frac{16}{16384} + 4$
(40h)	4mA	0	0000h		16384
	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.
- IN 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	Dit 0, oot et medule feilure
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

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

MODTYP Module infor-	Byte	Bit 7 0		
mation	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>		
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>		

031-1BF74 - AI 8x12Bit ±10V

CH0ERR ... CH7ERR Channel-specific

<b>Byto</b>	Bit 7 0
Byte	DIL / V

- 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

DIAG\_US µs ticker

# Byte Bit 7 ... 0

µs ticker

0

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.

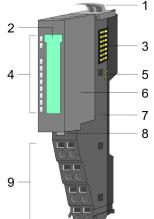
## 3.15 031-1BF74 - AI 8x12Bit ±10V

### Properties

The electronic module has 8inputs 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
- 12bit resolution

# Structure



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

<sup>0...3</sup> Value of the µs ticker at the moment of the diagnostic

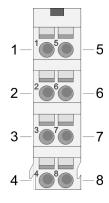
031-1BF74 - AI 8x12Bit ±10V

# Status indication

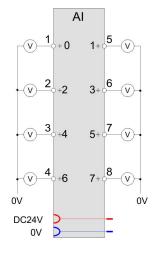
	RUN	MF	Al x	Description
	green	red	red	
MF — 🖣				
AI 0 — I		0	х	Bus communication is OK
Al 1 — I Al 2 — I	•	0	~	Module status is OK
Al 3 — 1		•	х	Bus communication is OK
Al 5 — 🔳 💳 🛛	•	•	~	Module status reports an error
AI 6 — I — I — I — I — I — I — I — I — I	0	o •	Х	Bus communication is not possible
	0			Module status reports an error
	0	0	Х	Error at bus power supply
	х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
				Error channel x
	•	• 0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
	on: •   o	ff: ○   bliı	nks with	2Hz: B   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>.



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.

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
	+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	$\checkmark$
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V +10 V
	-10 V +10 V
Operational limit of voltage ranges	+/-1.1%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-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)	-

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

Order no.	031-1BF74
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1.1 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	

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

Order no.	031-1BF74
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	$\checkmark$
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 60 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

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

Order no.	031-1BF74
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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

Name	Bytes	Function	Default	DS	IX	SX
SUPR	2	Interference frequency sup- pression	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 frequency suppression

# Byte Bit 15 ... 0

-	
0	Bit 0, 1: Interference frequency suppression channel 0 Bit 2, 3: Interference frequency suppression channel 1 Bit 4, 5: Interference frequency suppression channel 2 Bit 6, 7: Interference frequency suppression channel 3 Bit 8, 9: Interference frequency suppression channel 4 Bit 10, 11: Interference frequency suppression channel 5 Bit 12, 13: Interference frequency suppression channel 6
	Bit 14, 15: Interference frequency suppression channel 7 – 00: deactivated
	– 01: 60Hz
	– 10: 50Hz

031-1BF74 - AI 8x12Bit ±10V> 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 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	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	D = 27040 10
(12h)	5V	13824	3600h		
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		
	-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	$D = 10304 \cdot \frac{10}{10}$
(22h)	5V	8192	2000h		10
(2211)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		
	-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	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	10
(10h)	5V	13824	3600h		10
(101)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	10
(20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

### 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.
- IN 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

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

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 infor- mation	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>
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)

031-1CA20 - AI 1x16Bit Strain gauge (DMS)

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	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

# 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.

# 3.16 031-1CA20 - AI 1x16Bit Strain gauge (DMS)

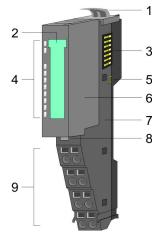
# **Properties**

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

031-1CA20 - AI 1x16Bit Strain gauge (DMS)

# Structure



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

# **Status indication**

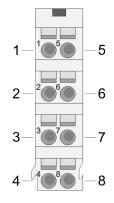
	RUN	MF	Description
	green	red	
MF — 🖣 [			
STEADY —			Bus communication is OK
	•	0	Module status is OK
EXC — I SENSE — I	•	•	Bus communication is OK
			Module status reports an error
	0	•	Bus communication is not possible
	0		Module status reports an error
	0	0	Error at bus power supply
	Х	В	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
	on: •   off	f: o   blinki	ing (2Hz): B   not relevant: X

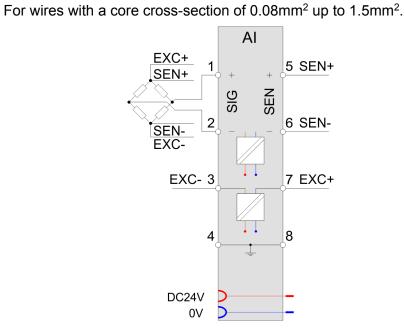
STEADY	CAL	FREECE	EXC	SENSE	DIFF	Description
green	green	green	red	red	red	
•	Х	Х	Х	Х	Х	On in Steady State.
Х	•	Х	Х	Х	Х	On at active self-calibration
Х	Х	•	Х	Х	Х	On at activated Input-Freeze.
х	Х	Х	•	Х	Х	On at short circuit respectively overload of the excitation voltage.
Х	Х	Х	Х	•	Х	On at overrange of the excita- tion voltage

031-1CA20 - AI 1x16Bit Strain gauge (DMS)

STEADY	CAL	FREECE	EXC	SENSE	DIFF	Description		
Х	х	х	Х	Х	•	On at overrange of the differ- ential voltage		
on: •   off:	on: ●   off: ○   blinking (2Hz): B   not relevant: X							

# Pin assignment





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 <sub>SIG</sub> of the meas- uring bridge
3	EXC-	0	- Signal of the excitation voltage U <sub>EXC</sub>
4	Shield		Connection for cable shield
5	SEN+	I	+ 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 $\mathrm{U}_{\mathrm{EXC}}$
8	Shield		Connection for cable shield
O: Output	, I: Input		

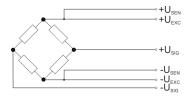


Please always use the excitation voltage  $U_{EXC}$  of the module! The connection of sensors with external power supply is not possible.

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Connection variants

# 3.16.1 Connection variants

# 6 wire measurement

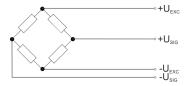


The following table shows the properties of the sensors, which can be used with the 6 wire measurement.

#### **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



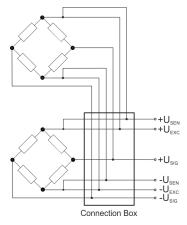
With the 4 wire measurement the  $U_{\text{SEN}}$  pins are not connected. With this operating mode there is an internal connection between  $U_{\text{EXC}}$  and  $U_{\text{SEN}}$ .

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

#### **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		

#### **Parallel connection**

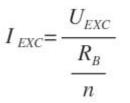


Normally large mechanical loads are divided to multiple strain gauge DMS load cells and these parallel connected via a connection box to the strain gauge DMS module. Please consider that the load cells are aligned together for this operating mode and approved by the manufacturer. And the current feed 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  $U_{\text{EXC}}$ ,  $I_{\text{EXC}}$  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  $I_{EXC}$  the following formula is used:



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 resistance R <sub>B</sub>						
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			

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> In-/Output area

(	С	)

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.

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
Signifi- cance	SG	2 <sup>30</sup>	2 <sup>29</sup>	2 <sup>28</sup>	2 <sup>27</sup>	2 <sup>26</sup>	<b>2</b> <sup>25</sup>	2 <sup>24</sup>	2 <sup>23</sup>	2 <sup>22</sup>	<b>2</b> <sup>21</sup>	220	2 <sup>19</sup>	2 <sup>18</sup>	2 <sup>17</sup>	2 <sup>16</sup>
31Bit+SG	SG						ľ	Measu	red v	alue	•					

031-1CA20 - AI 1x16Bit Strain gauge (DMS) > In-/Output area

		Byte 2						Byte 3								
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Signifi- cance	2 <sup>15</sup>	2 <sup>14</sup>	2 <sup>13</sup>	<b>2</b> <sup>12</sup>	<b>2</b> <sup>11</sup>	2 <sup>10</sup>	2 <sup>9</sup>	2 <sup>8</sup>	27	2 <sup>6</sup>	2 <sup>5</sup>	24	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
31Bit+SG							N	leasu	red va	lue						

# DMS\_STAT Status

Addr.	Name	Bytes	Function
+3	DMS_STAT	1	<ul> <li>Status byte</li> <li>Bit 0: 1 = Input Freeze active</li> <li>Bit 1: 1 = Steady State 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 193
- 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.
- 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.

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> In-/Output area

#### 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>
			<ul> <li>Input Freeze <ul> <li>In the activated state no measurement values are passed to the digital filter.</li> <li>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.</li> <li>The status of <i>Input Freeze</i> can be determined at any time via bit 0 of DMS_STAT.</li> </ul> </li> <li>Adjustment <ul> <li>Store adjustment: Used to store the adjustment data when loaded with the reference weight.</li> <li>Delete adjustment: Used to delete the adjustment data.</li> <li>With both commands bit 5 of DMS_STAT is set. In case of error bit 4 is set.</li> </ul> </li> <li>Tara <ul> <li>Set Tara: The current value is taken as tara.</li> <li>Delete Tara: Tara is reset to 0.</li> <li>With both commands bit 3 of DMS_STAT is set.</li> </ul> </li> <li>Zero balance respectively reference point <ul> <li>Both commands are used for user adjustment and on both commands bit 7 of DMS_STAT is set.</li> <li>Set zero balance: Used to set the balance to 0 when operated without load.</li> <li>Set reference point: Used to adjust the balance when it is loaded with a reference weight.</li> </ul> </li> </ul>

# 3.16.3 Technical data

Wodule ID         0841 1809           Fechnical data strain gauge DMS         1           Number of inputs         1           Cable length, shielded         200           Rated load voltage         DC 24 V           Reverse polarity protection of rated load voltage         *           Current consumption from load voltage L+ withou load)         85           Current consumption from load voltage L+ withou load)         */-0.2%           Deparational limit Usense         */-0.2%           Basic error limit Usig         */-0.1%           Deparational limit usense         */-0.1%           Sasic error limit Usig         */-0.1%           Destruction limit current         max. 12V           External bridge supply possible         -           V         25V / max. 120mA           Stor max. 12V         */-0.1%           Configurable bridge supply         Successive approximation           10V / max. 90mA         1.2V / max. 100MA           10V / max. 90mA         1.2V / max. 100M           100/ mas. 90mA         1.2V / max. 100M           100/ max. 90mA	Order no.	031-1CA20
Technical data strain gauge DMSINumber of inputs1Cable length, shielded200Rated load voltageDC 24 VReverse polarity protection of rated load voltage*Current consumption from load voltage L+ without load)85Relative accuracy according to self-calibration porational limit Usense+/0.01%Derational limit Usense+/0.2%Derational limit Usense+/0.1%Basic error limit Usig+/0.1%Basic error limit Usig2.5V / max. 12VExternal bridge supply possible-Configurable bridge supply2.5V / max. 120mA 5V / max. 120mA 1.5V / max. 1	Туре	SM 031
Number of inputs1Cable length, shielded200Rated load voltageDC 24 VReverse polarity protection of rated load voltage-Current consumption from load voltage L+ without load)85Relative accuracy according to self-calibration+/-0.01%Operational limit Usense+/-0.2%Operational limit Usig+/-0.1%Sasic error limit Usig+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-VConfigurable bridge supplyConfigurable bridge supply2.5V / max. 120mA 5V / max. 120mA 10V / max. 90mA 12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion timeIms cycle, 10ms330ms depending on the filternput filter softwareDynamic IIR filter configurable IR filter 0.1Hz1000Hz configurable IR filter 50Hz/60Hznut filter software4Data for selection of the strain gauge DMS Sensor12VStridge differential voltage SIG+/-29mV	Module ID	0841 1809
Cable length, shielded200Rated load voltageDC 24 VReverse polarity protection of rated load voltage-Current consumption from load voltage L+ without load)85Relative accuracy according to self-calibration+/-0.01%Cperational limit Usense+/-0.2%Operational limit Usense+/-0.2%Destruction limit Usense+/-0.1%Basic error limit Usense+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-Configurable bridge supply2.5V / max. 120mA 5V / max. 120mA 10V / max. 90mA 12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion timeIms cycle, 10ms30ms depending on the filternput filter Ardware nput filter softwareDynamic IIR filter configurable IIR filter 0.1Hz1000Hz configurable IIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS sensor012VBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Technical data strain gauge DMS	
Rated load voltageDC 24 VReverse polarity protection of rated load voltage✓Current consumption from load voltage L+ without load)85Relative accuracy according to self-calibration+/-0.01%Cperational limit Usense+/-0.2%Operational limit Usense+/-0.2%Destruction limit Usig+/-0.1%Destruction limit using+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-Configurable bridge supply2.5V / max. 120mA 5V / max. 120mA 10V / max. 90mA 12V / max. 80mAResolution in bit24Weasurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms30ms depending on the filternput filter Ardware nput filter softwareDynamic IIR filter configurable IR filter 0.1Hz1000Hz configurable IR filter 50Hz/60HzDeta for selection of the strain gauge DMS sensor012VBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Number of inputs	1
Reverse polarity protection of rated load voltage Current consumption from load voltage L+ Relative accuracy according to self-calibration Poperational limit Usense +/-0.1% Relative accuracy according to self-calibration +/-0.01% Coperational limit Usig +/-0.2% Basic error limit Usense +/-0.1% Basic error limit Usig +/-0.1% Basic error limit Usig +/-0.1% Basic error limit Usig +/-0.1% Configurable supply possible	Cable length, shielded	200
voltage <t< td=""><td>Rated load voltage</td><td>DC 24 V</td></t<>	Rated load voltage	DC 24 V
without load)	Reverse polarity protection of rated load voltage	$\checkmark$
Deperational limit Usense+/-0.2%Deperational limit Usig+/-0.2%Basic error limit Usense+/-0.1%Basic error limit Usig+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-✓✓Configurable bridge supply2.5V / max. 120mA 5V / max. 120mA 7.5V / max. 120mA 10V / max. 90mA 	Current consumption from load voltage L+ (without load)	85
Deperational limit Usig+/-0.2%Basic error limit Usense+/-0.1%Basic error limit Usig+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-VVConfigurable bridge supply2.5V / max. 120mA 5V / max. 120mA 7.5V / max. 120mA 10V / max. 90mA 12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter Hardware nput filter softwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filter configurable FIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS Sensor012VBridge supply voltage EXC012V	Relative accuracy according to self-calibration	+/-0.01%
Basic error limit Usense+/-0.1%Basic error limit Usig+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-VVConfigurable bridge supply2.5V / max. 120mA5V / max. 120mA5V / max. 120mA7.5V / max. 100mA10V / max. 90mA12V / max. 80mA24Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filternput filter software4Data for selection of the strain gauge DMS Sensor4Bridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Operational limit Usense	+/-0.2%
Basic error limit Usig+/-0.1%Destruction limit currentmax. 12VExternal bridge supply possible-✓✓Configurable bridge supply2.5V / max. 120mASV / max. 120mA5V / max. 120mA7.5V / max. 120mA10V / max. 90mA12V / max. 90mA12V / max. 90mA12V / max. 80mA10V / max. 90mABasic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filternput filter software4Data for selection of the strain gauge DMS012VBridge differential voltage SIG+/-29mV	Operational limit Usig	+/-0.2%
Destruction limit current max. 12V External bridge supply possible - - - - - - - - - -	Basic error limit Usense	+/-0.1%
External bridge supply possible       -         Image: Configurable bridge supply       2.5V / max. 120mA         SV / max. 120mA       5V / max. 120mA         SV / max. 120mA       5V / max. 120mA         SV / max. 100mA       10V / max. 90mA         12V / max. 80mA       24         Measurement principle       successive approximation         Basic conversion time       1ms cycle, 10ms330ms depending on the filter         nput filter Hardware       Low pass 10kHz 3rd order         nput filter software       Dynamic IIR filter         onfigurable IIR filter 0.1Hz1000Hz       configurable IIR filter 50Hz/60Hz         nitial data size       4         Data for selection of the strain gauge DMS       Image: Singe supply voltage EXC         Bridge differential voltage SIG       1.2V	Basic error limit Usig	+/-0.1%
VConfigurable bridge supply2.5V / max. 120mASV / max. 120mA5V / max. 120mA7.5V / max. 100mA10V / max. 90mA12V / max. 90mA12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filternput filter software4Data for selection of the strain gauge DMS sensor4Bridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Destruction limit current	max. 12V
Configurable bridge supply2.5V / max. 120mA 5V / max. 120mA 7.5V / max. 100mA 10V / max. 90mA 12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter Hardware nput filter softwareLow pass 10kHz 3rd ordernput filter software ntitial data sizeJunamic IIR filter configurable IIR filter 50Hz/60HzBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	External bridge supply possible	-
SV / max. 120mA7.5V / max. 100mA10V / max. 90mA12V / max. 80mAResolution in bit24Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filternput filter softwareDynamic IIR filter 0.1Hz1000Hz configurable IIR filter 50Hz/60Hzntital data size4Data for selection of the strain gauge DMS Bridge supply voltage EXC012V		$\checkmark$
Measurement principlesuccessive approximationBasic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filter configurable IIR filter 0.1Hz1000Hz configurable FIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS Bridge supply voltage EXC012VStrage differential voltage SIG+/-29mV	Configurable bridge supply	5V / max. 120mA 7.5V / max. 100mA 10V / max. 90mA
Basic conversion time1ms cycle, 10ms330ms depending on the filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filter configurable IIR filter 0.1Hz1000Hz configurable FIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS Bridge supply voltage EXC012VSidge differential voltage SIG+/-29mV	Resolution in bit	24
filternput filter HardwareLow pass 10kHz 3rd ordernput filter softwareDynamic IIR filternput filter softwareConfigurable IIR filter 0.1Hz1000Hz configurable FIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS SensorSelection of the strain gauge DMS SensorBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Measurement principle	successive approximation
nput filter softwareDynamic IIR filter configurable IIR filter 0.1Hz1000Hz configurable FIR filter 50Hz/60Hznitial data size4Data for selection of the strain gauge DMS sensorSelection of the strain gauge DMS on 12VBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Basic conversion time	
And	Input filter Hardware	Low pass 10kHz 3rd order
Anitial data sizeConfigurable FIR filter 50Hz/60HzData for selection of the strain gauge DMSConfigurable FIR filter 50Hz/60HzBridge supply voltage EXC012VBridge differential voltage SIG+/-29mV	Input filter software	Dynamic IIR filter
Data for selection of the strain gauge DMS         Bridge supply voltage EXC       012V         Bridge differential voltage SIG       +/-29mV		-
Sensor     012V       Bridge differential voltage SIG     +/-29mV	Initial data size	4
Bridge differential voltage SIG +/-29mV	Data for selection of the strain gauge DMS sensor	
5 5	Bridge supply voltage EXC	012V
	Bridge differential voltage SIG	+/-29mV
Rated output 0.54mV/V	Rated output	0.54mV/V

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Functionality

Order no.	031-1CA20
4 wire connection possible	$\checkmark$
6 wire connection possible	$\checkmark$
possible bridge configuration	symmetric full bridge
Housing	
Material	PC / 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

#### 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:

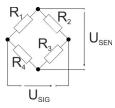
- electrical strain gauge DMS
  - An electrical strain gauge DMS consists of a carrier material (e.g. stretchable plastic film) with applied metal film. From this a grid of electrically conductive resistive material is created. During the measurement the behavior is used, that e.g. at the elongation 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 laser-applied 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 Usig 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	determina-
tion		

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:

U<sub>SIG</sub> Measured differential voltage of the measuring bridge

 $Y_{R} = \frac{\overline{U_{SEN}}}{\overline{U_{SEN}}}$ 

 $Y_A = Y_R \cdot NL \cdot SF$ 

 $Y = Y_A \cdot GN + TA$ 

Y<sub>R</sub>

Y<sub>A</sub> Absolute value

RO Rated output

- Y<sub>R</sub> Relative value
- NL Nominal load
- SF Scale factor
- Y Resulting weight value

Relative value

USEN Measured excitation voltage

- 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.

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Parameter data

### 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
RO	2	Rated output	4E20h	80h	310Ah	08h
ZB	2	Zero balance	0000h	80h	310Ch	09h
GN	2	Gain	1000h	80h	310Eh	0Ah
ТА	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 se	t) This record set may only be transferred at STOP state					

 $^{\ast}\xspace$  ) This record set may only be transferred at STOP state.

DIAG_	EN	Diagnostic
interru	ıpt	-

Byte	Bit 7 0

0	Dia	agnostic interrupt
	-	00h: disable
	-	40h: enable

Here you activate respectively de-activate the diagnostic function.

<b>UEXC</b> select	power
supply	

0 ■ Power supply - 00h: 2.5V - 01h: 5V - 02h: 7.5V - 03h: 10V	Byte	Bit 7 0
– 04h: 12V	0	<ul> <li>00h: 2.5V</li> <li>01h: 5V</li> <li>02h: 7.5V</li> <li>03h: 10V</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>EXC</sub>! The connection of strain gauge DMS sensors with external power supply is not possible.

#### CAL Calibration interval

Byte Bit 7 ... 0

- 0...1 Interval for the calibration.
  - Calibration interval as 100ms value
    - 00h: de-activates the calibration
- By setting a calibration interval as 100ms value, the self-calibration is always performed 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 method

#### Byte Bit 7 ... 0

0

- Measurement method
  - 23h: 6 wire measurement
  - 25h: 4 wire measurement
  - FFh: de-activated
- Here you can choose between 4 and 6 wire measurement respectively disable the measurement.

# **FILT Filter selection**

#### **Byte** Bit 7 ... 0 0 Filter selection 00h: Filter de-activated 01h: Activate dynamic IIR filter 02h: IIR1 \_ 03h: IIR2 \_ 04h: IIR3 \_ 05h: IIR4 - 06h: IIR5 07h: IIR6 08h: IIR7 \_ 09h: IIR8 \_ 0Ah: FIR 50Hz 0Bh: FIR 60Hz \_

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Parameter data

	<ul> <li>FIR \$         <ul> <li>FIR \$                 </li> <li>Dyna</li> <li>- a</li> <li>- F</li> </ul> </li> <li>Stati</li> </ul>	<ul> <li>automatic selection</li> <li>Filter selection dependent on the current weight change</li> </ul>		
DFCT Dynamic Filter	Byte	Bit 7 0		
Change Time	01	Sampling rate for filter change-over in ms		
		you can specify the time for re-evaluation for the filter ge-over in ms.		
Dynamic filter delta	Byte	Bit 7 0		
	01	Limit value for filter change-over		
	Here	you can specify the limit value for the filter change-over.		
RO Rated output	Byte	Bit 7 0		
	01	Rated output in 0.0001mV/V		
	to the	you can specify the rated output in 0.0001mV/V. Information e rated output can be found in the data sheet of you force aducer.		
ZB Zero balance	Byte	Bit 7 0		
	01	Zero balance in 0.0001mV/V		
	Infor	you can specify the zero balance as 0.0001mV/V value. mation to the zero balance can be found in the data sheet of force transducer.		
GN Gain	Byte	Bit 7 0		
	01	Gain for user scaling of the output value		
		you can specify a factor as 2 <sup>-12</sup> value. The factor is multiplied the output value.		
TA Tara	Byte	Bit 7 0		
	01	User offset for the output value		
		you can specify an offset as 2 <sup>-12</sup> value. The offset is added e determined output value.		

031-1CA20 - AI 1x16Bit Strain gauge (DMS) > Deployment of the filter functions

NL Nominal load	Byte	Bit 7 0
	01	Nominal load of the force transducer
	unit-t	you can specify the nominal load of the force transducer free. Information to nominal load can be found in the data to f you force transducer.
SF Scale factor	Byte	Bit 7 0
	01	Scale factor for the nominal load
	as to – E	you can specify the scale factor for the nominal load, such convert kg to g. Example: Nominal load in kg and scale factor 1000 (03E8h) esults display in g.
SST Steady state toler-	Byte	Bit 7 0
ance	01	Tolerance for Steady State
	State – E ((	e you can specify a tolerance window for the state <i>Steady</i> e. This is specified as a deviation of the scaled nominal load. Example: With a rated load in kg and scaling factor of 1000 03E8h) you must specify the value 0005h to set a tolerance <i>v</i> indow of 5g.
SSW Steady state window	Byte	Bit 7 0
	01	Time interval for Steady State in ms
		you can specify a time interval for the setting of the <i>Steady</i> bit (DMS_STAT-Bit 1).
	If the than	e measured value is within the tolerance window SST longer the time interval SSW, then bit 1 of the status word S_STAT is set.
RL Reference load	Byte	Bit 7 0
	03	Reference load for the calibration
		you can specify the reference load for the calibration unit- The reference load must be at least 20% of the <i>Nominal load</i>

3.16.6 Deployment of the filter functions

Overview

- The module has the following filter functions, which can be activated via the parametrization:
- FIR 50/60 Hz
- Dynamic IIR filter
- Static IIR filter

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Deployment of the filter functions

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 current weight change, it is automatically switched between 8 different filters. The aim here is to obtain a filter with the best possible damping, which must lead to stable measuring values. The <i>Dynamic IIR filter</i> acts as 1. order low-pass filter and has the following properties:         <ul> <li>If there is a rapid change of the input value, it is switched-over to the next lower 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 next 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 unstable measured 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 place in a fixed interval, which can be specified</li> </ul> </li> </ul>

via parameter DFCT in ms.

Filter level	Limit fre- quency	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
05h: IIR4	30Hz	a <sub>0</sub> = 15.6x10 <sup>-3</sup>	0.014
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:

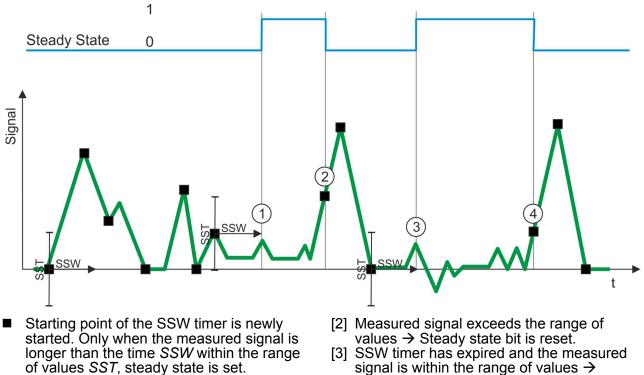
- **1.** Specify in the parametrization the *Reference load* RL. The *Reference load* must be at least 20% of the *Nominal load*.
- **2.** Operate the balance without load.
- **3.** As soon as a stable value is shown, bit 6 (set zero point) in the command byte *DMS\_CMD* is to set.
- **4.** Apply the 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 189
- 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. ♦ 'Parameter data' on page 193

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Diagnostics



[1] SSW timer has expired and the measured signal is within the range of values  $\rightarrow$ Steady state bit is set.

signal is within the range of values  $\rightarrow$ Steady state bit is set.

[4] Measured signal exceeds the range of values  $\rightarrow$  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 interruptincoming. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt going automatically takes place. All events of a channel between diagnostic interrupt<sub>incoming</sub> and diagnostic interrupt<sub>going</sub> are not stored and get lost. Within this time window (1. diagnostic interruptincoming until last diagnostic interruptaoing) 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.

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	00h			0Ah11h
		channel x				
DIAG_US	4	µs ticker	00h			13h

ERR\_A Diagnostic

#### Byte Bit 7 ... 0

0

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

MODTYP Module infor- mation	Byte	Bit 7 0
materi	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

reserved

0

031-1CA20 - AI 1x16Bit Strain gauge (DMS)> Diagnostics

ERR_D Diagnostic	Durta	
g	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	_	
	Byte	Bit 7 0
	Byte 0	Bit 7 0 Number of channels of the module (here 01h)
	-	
CHERR Channel error	-	
	0	Number of channels of the module (here 01h)
	0 Byte	Number of channels of the module (here 01h) Bit 7 0
CHERR Channel error CHxERR Channel-spe-	0 Byte	Number of channels of the module (here 01h) Bit 7 0
CHERR Channel error	0 <b>Byte</b> 0	Number of channels of the module (here 01h) Bit 7 0 Bit 0: set at error in channel 0
CHERR Channel error CHxERR Channel-spe-	0 <b>Byte</b> 0 <b>Byte</b>	Number of channels of the module (here 01h) Bit 7 0 Bit 0: set at error in channel 0 Bit 7 0
CHERR Channel error CHxERR Channel-spe-	0 <b>Byte</b> 0 <b>Byte</b>	<ul> <li>Number of channels of the module (here 01h)</li> <li>Bit 7 0</li> <li>Bit 0: set at error in channel 0</li> <li>Bit 7 0</li> <li>Channel-specific error channel 0</li> <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> </ul>
CHERR Channel error CHxERR Channel-spe-	0 <b>Byte</b> 0 <b>Byte</b> 0	<ul> <li>Number of channels of the module (here 01h)</li> <li>Bit 7 0</li> <li>Bit 0: set at error in channel 0</li> <li>Bit 7 0</li> <li>Channel-specific error channel 0</li> <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>
CHERR Channel error CHxERR Channel-spe-	0 <b>Byte</b> 0 <b>Byte</b> 0	<ul> <li>Number of channels of the module (here 01h)</li> <li>Bit 7 0</li> <li>Bit 0: set at error in channel 0</li> <li>Bit 7 0</li> <li>Channel-specific error channel 0</li> <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>

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  $2^{32}$ -1 $\mu$ s the timer starts with 0 again.

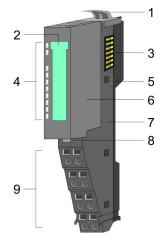
#### 3.17 031-1CB30 - AI 2x16Bit 0...10V

# **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

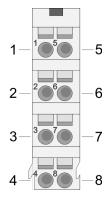
> AI 0 AI 1

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

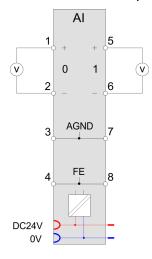
RUN	MF	Al x	Description
green	red	red	
•	0	х	Bus communication is OK
•	0	~	Module status is OK
•	•	х	Bus communication is OK
•	•	~	Module status reports an error
0	•	х	Bus communication is not possible
0	•	~	Module status reports an error
0	0	Х	Error at bus power supply
х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
on: ●   off: ○   blinks with 2Hz: B   not relevant: X			

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	I	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.

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

# 3.17.1 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)	-

# Analog Input

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

Order no.	031-1CB30
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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	

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

Order no.	031-1CB30
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	$\checkmark$
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)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
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

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

Order no.	031-1CB30
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

# 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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 sup- pression	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
CHOLL	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 Diagnostics**

# Byte Bit 7 ... 0

0

- Diagnostics interrupt
   00h: enable
   40h: disable
- Here you can enable respectively disable the diagnostic interrupt.

## **Analog Input**

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

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>
SUPR Interference fre- quency 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	10
(10h)	5V	13824	3600h		10
(1011)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$D = 10584 + \frac{10}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-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. 031-1CB30 - AI 2x16Bit 0...10V> Diagnostics and interrupt

# 3.17.3 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 under- flow	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>

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

PRIT_US µs	ticker	Byte	Bit 7 0						
		0 1	Value of the µs tick	er at the n	noment of t	he diagno	ostic		
					and diagric				
		In the SLI the timer s again. PR	$\mu$ 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).						
Diagnostic o	data	the modul nostics da releasing a interrupt <sub>go</sub> between c stored and rupt <sub>incoming</sub>	Via the parameterization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diag- nostics 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 inter- rupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the module is on.						
		<ul> <li>The following errors are listed in the diagnostics data:</li> <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> </ul>							
<ul> <li>DS - Record set for access via CPU, PROFIBUS and PROFINT The access happens by DS 01h. Additionally the first 4 b may be accessed by DS 00h.</li> <li>IX - Index for access via CANopen. The access happens by 2F01h. Additionally the first 4 bytes may be accessed by 2F00h.</li> </ul>									
		SX - Sub	index for access via	EtherCAT	with Inde>	c 5005h.			
		More can	be found in the acco	ording man	ual of your	bus coup	oler.		
Name	Bytes	Function		Default	DS	IX	SX		

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 08h channel				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

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

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

0

0

0

- 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 infor- mation	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

- Bit 2 ... 0: reserved
  Bit 3: set at internal diagnostics buffer overflow
  Bit 4: set at internal communication error
  - Bit 4: set at internal 4
     Bit 5: reserved
  - Bit 6: set at process interrupt lost
  - Bit 7: reserved

CHTYP Channel type

# Byte Bit 7 ... 0

- Bit 6 ... 0: Channel type
  - 70h: Digital input
    - 71h: Analog input
    - 72h: Digital output
  - 73h: Analog output
  - 74h: Analog input/-output
  - 76h: Counter
  - Bit 7: reserved

NUMBIT Diagnostic bits

#### Byte Bit 7 ... 0

Number of diagnostic bits per channel (here 08h)

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

NUMCH Channels

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

CHERR Channel error

вуте	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

. . .

Channel-specific error channel x:
Bit 0: set at configuring/parameter assignment error
Bit 4 1: reserved
Bit 5: set at process interrupt lost

- Bit 5: set at measuring range underflow
- Bit 7: set at measuring range overflow

DIAG\_US µs ticker

# Byte Bit 7 ... 0

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

µs ticker

0

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.

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

Properties

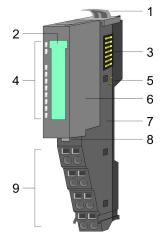
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 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

# **Analog Input**

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

# Structure



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

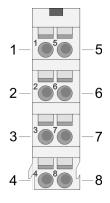
# **Status indication**

			RUN	MF	Al x	Description
RUN —			green	red	red	
MF — I AI 0 — I						
			•	0	х	Bus communication is OK
AI 1 —			•	0	^	Module status is OK
			•	•	х	Bus communication is OK
			•	•	^	Module status reports an error
		_	0	•	Х	Bus communication is not possible
			0	•		Module status reports an error
			0	0	Х	Error at bus power supply
			Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
						Error channel x
			•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>

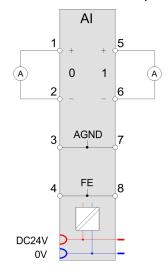
on: • | off: • | blinks with 2Hz: B | not relevant: X

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 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



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 current	-
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

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

Order no.	031-1CB40
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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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	

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

Order no.	031-1CB40
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	$\checkmark$
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 60 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

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

Order no.	031-1CB40
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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 interrupt

Byte Bit 7 ... 0

0

- Diagnostic interrupt
  - 00h: enable
  - 40h: disable
- Here you can enable respectively disable the diagnostic interrupt.

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

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>
SUPR Interference fre- quency 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>
CHVEN Eurotion	le the f	Nowing there are the measuring ranges with corresponding

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

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

#### 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 inter- rupt	Diagnostics inter- rupt	parameterizable
Error in project	-	Х	-
engineering/parameterization			
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х

031-1CB40 - AI 2x16Bit 0(4)...20mA> Diagnostics and interrupt

Event	Process inter- rupt	Diagnostics inter- rupt	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	

B	yte Bi	it 7 0
0		Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 7 2: reserved

PRIT	UL	Limit	under-
flow	-		

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 $\mu$ s ticker at the moment of the diagnostic.

#### PRIT\_US µs ticker

In the SLIO module there is a 32 bit timer ( $\mu$ s ticker). With PowerON the timer starts counting with 0. After 232-1 $\mu$ 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.
- 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

031-1CB40 - AI 2x16Bit 0(4)...20mA> Diagnostics and interrupt

ERR_	Α	Diad	no	stic

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 infor-	
mation	

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>

<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>	ERR_D Diagnostic	Byte	Bit 7 0
<ul> <li>Bit 5: reserved</li> <li>Bit 6: set at process interrupt lost</li> <li>Bit 7: reserved</li> </ul>		0	<ul> <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> </ul>

CHTYP Channel type

#### Byte Bit 7 ... 0

- Bit 6 ... 0: Channel type
  70h: Digital input
  71h: Analog input
  72h: Digital output
  73h: Analog output
  74h: Analog input/-output
  - 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)

#### **Analog Input**

031-1CB70 - AI 2x16Bit ±10V

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	<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>
CH2ERR CH7ERR reserved	Byte	Bit 7 0
reserveu	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.

#### 3.19 031-1CB70 - AI 2x16Bit ±10V

Properties

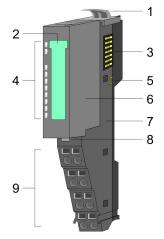
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

## **Analog Input**

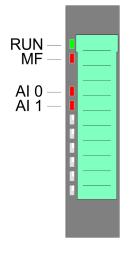
031-1CB70 - AI 2x16Bit ±10V

#### Structure



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

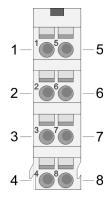
## **Status indication**



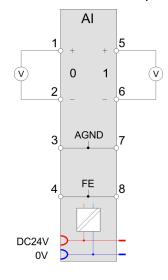
RUN	MF	Al x	Description		
green	red	red			
•	0	х	Bus communication is OK		
•	0	^	Module status is OK		
•	•	х	Bus communication is OK		
•	•	^	Module status reports an error		
0		х	Bus communication is not possible		
0	•	^	Module status reports an error		
0	0	Х	Error at bus power supply		
х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42		
			Error channel x		
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
on: ●   off: ○   blinks with 2Hz: B   not relevant: X					

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 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.

031-1CB70 - AI 2x16Bit ±10V> 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.

## 3.19.1 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)	-

031-1CB70 - AI 2x16Bit ±10V > Technical data

Order no.	031-1CB70
Destruction limit current inputs (electrical cur- rent)	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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	

031-1CB70 - AI 2x16Bit ±10V> Technical data

Order no.	031-1CB70
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	$\checkmark$
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)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
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

031-1CB70 - AI 2x16Bit ±10V > Parameter data

Order no.	031-1CB70
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

## 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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	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

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

## **DIAG\_EN Diagnostics**

Byte Bit 7 ... 0

0

- Diagnostics interrupt
  - 00h: enabled
    - 40h: disabled
- Here you can enable respectively disable the diagnostic interrupt.

031-1CB70 - AI 2x16Bit ±10V> Parameter data

LIMIT_EN Limit value monitoring	Byte	Bit 7 0
monitoring	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 fre- quency 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> </ul>

Bit 7 ... 4: reserved

#### 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	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	D = 27040 10
(12h)	5V	13824	3600h		10
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		
	-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	$D = 10504 \cdot \frac{10}{10}$
(22h)	5V	8192	2000h		10
(2211)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

031-1CB70 - AI 2x16Bit ±10V > Diagnostics and interrupt

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V Siemens S7	11.76V 10V	32511 27648	7EFFh 6C00h	overrange nominal range	$D = 27648 \cdot \frac{U}{10}$
format (10h)	5V	13824	3600h	nominai range	$U = D \cdot \frac{10}{27648}$
	0V -1.76V	0 -4864	0000h ED00h	underrange	27648
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		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

#### 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.

## 3.19.3 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. 031-1CB70 - AI 2x16Bit ±10V> Diagnostics and interrupt

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 under- flow	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 $\mu$ 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 diag- nostics 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 inter- rupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the module is on.				
	The follow	ring errors are listed in the diagnostics data:			
	n project engineering / parameterization iring range overflow iring range underflow				
		ss interrunt lost			

- 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 information

#### Byte Bit 7 ... 0

0

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

031-1CB70 - AI 2x16Bit ±10V> Diagnostics and interrupt

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 Ch	annel 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 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
Channel-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>
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved

031-1CD30 - AI 4x16Bit 0...10V

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 (us ticker). With PowerON the timer starts counting with 0. After 232-1µs the timer starts with 0 again.

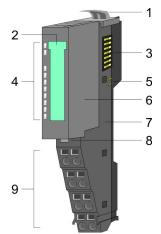
#### 031-1CD30 - AI 4x16Bit 0...10V 3.20

**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

#### Structure



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

#### Status indication

RUN MF

> AI 0 AI 1 AI 2 AI 3

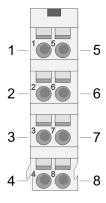
	RU	N MF	Al x	Description
_ []	gree	en red	red	
_		0	х	Bus communication is OK
	•	0	^	Module status is OK
			V	Bus communication is OK
i	•	•	Х	Module status reports an error
	0		х	Bus communication is not possible
	0	•	^	Module status reports an error
	0	0	Х	Error at bus power supply
	0	0	Х	·

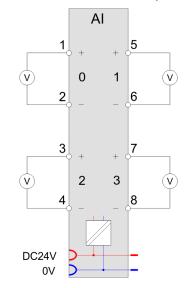
031-1CD30 - AI 4x16Bit 0...10V

RUN	MF	Al x	Description	
Х	В	Х	Error in configuration	
•	0	•	Error channel x <ul> <li>Signal leaves measuring range</li> <li>Error in parameterization</li> </ul>	
on: ●   off: ○   blinks with 2Hz: B   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.

031-1CD30 - AI 4x16Bit 0...10V > 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
	+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.

## 3.20.1 Technical data

Order no.	031-1CD30
Туре	SM 031
Module ID	040D 1544
Current consumption/power loss	
Current consumption from backplane bus	60 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	✓
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	-

## **Analog Input**

031-1CD30 - AI 4x16Bit 0...10V> Technical data

Order no.	031-1CD30
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical cur- rent)	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation

031-1CD30 - AI 4x16Bit 0...10V > Technical data

Order no.	031-1CD30	
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		
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 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 60 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	

031-1CD30 - AI 4x16Bit 0...10V> Parameter data

Order no.	031-1CD30
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

#### 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
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
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

031-1CD30 - AI 4x16Bit 0...10V > Parameter data

Name	Bytes	Function	Default	DS	IX	SX
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.

DIAG_EN	I Diagnostic
interrupt	-

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

D. 4 . D. 4 . 7

Here you can enable respectively disable the diagnostic interrupt.

	EN Limit val	ue
monite	oring	

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	Inter	ferer	nce	fre-
quenc	v sur	opres	ssic	n

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 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. 031-1CD30 - AI 4x16Bit 0...10V> Diagnostics and interrupt

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7	10V	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
format (10h)	5V	13824	3600h		10
(101)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$D = 10584 \cdot \frac{10}{10}$
(20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

#### 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.

## 3.20.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameteriz- able
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. 031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

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 under- flow	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>

DDIT 110						
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).					
	the module nostics da releasing a interrupt <sub>goi</sub> between d stored and	rameterization you may activate a diagnostic interrupt for e. With a diagnostics interrupt the module serves for diag- ta for diagnostic interrupt <sub>incoming</sub> . As soon as the reason for a diagnostic interrupt is no longer present, the diagnostic <sub>ng</sub> automatically takes place. All events of a channel iagnostic interrupt <sub>incoming</sub> and diagnostic interrupt <sub>going</sub> are not I get lost. Within this time window (1. diagnostic inter- until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the on.				

031-1CD30 - AI 4x16Bit 0...10V> Diagnostics and interrupt

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.
- IN 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
CH4ERR CH7ERR	4	reserved	00h			0Eh 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

031-1CD30 - AI 4x16Bit 0...10V > Diagnostics and interrupt

MODTYP Module infor-	Byte	Bit 7 0
mation	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	Byto	Bit 7 0
_ 0	0	<ul> <li>Bit 7 0</li> <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)
	U	
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>

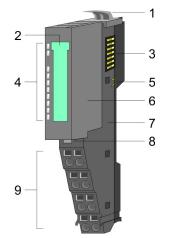
031-1CD35 - AI 4x16Bit 0...10V

CH0ERR CH3ERR	Byte	Bit 7 0			
Channel-specific	-				
	0	Channel-specific error channel x:			
		Bit 0: set at configuring/parameter assignment error			
		Bit 4 1: reserved			
		<ul> <li>Bit 5: set at process interrupt lost</li> <li>Bit 6: set at process interrupt lost</li> </ul>			
		<ul> <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 µs ticker	Puto	Bit 7 0			
	Byte				
	03	Value of the µs ticker at the moment of the diagnostic			
	µs ticke	er			
	In the SLIO module there is a timer (µs ticker). With PowerON the				
		arts counting with 0. After 2 <sup>32</sup> 1µs the timer starts with 0 again.			
3.21 031-1CD35 - Al	4x16Bi	t 010V			
Properties	The ele	ctronic module has 4 inputs with parameterizable functions.			

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

#### 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

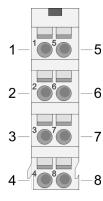
031-1CD35 - AI 4x16Bit 0...10V

		RUN	MF	Al x	Description	
		green	red	red		
MF — 📕	_					
AI 0 — 🛯 🗕			0	х	Bus communication is OK	
Al 1 — I — Al 2 — I _	-	•	0	^	Module status is OK	
AÏ 3 — 📕			•	х	Bus communication is OK	
	•	•	^	Module status reports an error		
8-		0	•	х	Bus communication is not possible	
		0			Module status reports an error	
		0	0	Х	Error at bus power supply	
		х	В	х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42	
					Error channel x	
	•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
	on: ●   off: ○   blinks with 2Hz: B   not relevant: X					

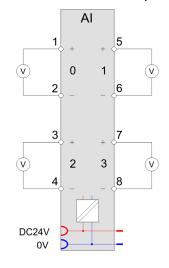
# Status indication

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

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.

# 3.21.1 Technical data

Order no.	031-1CD35
Туре	SM 031
Module ID	0413 15C4
Current consumption/power loss	
Current consumption from backplane bus	60 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 cur- rent)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-

## **Analog Input**

031-1CD35 - AI 4x16Bit 0...10V> Technical data

Order no.	031-1CD35
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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

031-1CD35 - AI 4x16Bit 0...10V > Technical data

Order no.	031-1CD35
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 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 60 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

031-1CD35 - AI 4x16Bit 0...10V> Parameter data

### 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.

Name	Bytes	Function	Default	DS	IX	SX
SUPR	1	Interference frequency sup- pression	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

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> </ul>
	e.g.: 10101010: all channels frequency suppression 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.

031-1CD35 - AI 4x16Bit 0...10V > Diagnostic data

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	10
(10h)	5V	13824	3600h		
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	10
(20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	

#### 0 ... 10V

### 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.

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

031-1CD35 - AI 4x16Bit 0...10V> Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
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 infor-	
mation	

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

0

- Bit 6 ... 0: Channel type
  - 70h: Digital input
  - 71h: Analog input
  - 72h: Digital output
  - 73h: Analog output
  - 74h: Analog input/-output
  - 76h: Counter
  - Bit 7: reserved

NUMBIT Diagnostic bits

# Byte Bit 7 ... 0

Number of diagnostic bits per channel (here 08h)

031-1CD40 - AI 4x16Bit 0(4)...20mA

**Analog Input** 

NUMCH Channels	
----------------	--

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

**CHERR Channel error** 

ByteBit 7 ... 00Bit 0: set at error in channel group 00Bit 1: set at error in channel group 10Bit 2: set at error in channel group 20Bit 3: set at error in channel group 30Bit 7 ... 4: reserved

CH0ERR CH3ERR	
Channel-specific	

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG\_US µs ticker

**Properties** 

ByteBit 7 ... 00...3Value 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

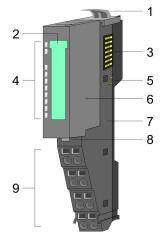
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 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

### **Analog Input**

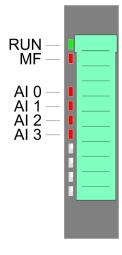
031-1CD40 - AI 4x16Bit 0(4)...20mA

### Structure



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

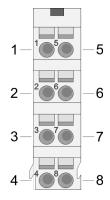
### **Status indication**



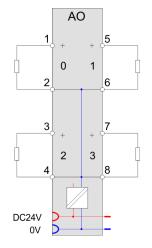
RUN	MF	Al x	Description
green	red	red	
	0	х	Bus communication is OK
•	0	^	Module status is OK
	•	х	Bus communication is OK
•	•	^	Module status reports an error
0	•	х	Bus communication is not possible
0	•	^	Module status reports an error
0	0	Х	Error at bus power supply
х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>
on: ●   off: ○   blinks with 2Hz: B   not relevant: X			

031-1CD40 - 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	-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

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

031-1CD40 - 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.

### 3.22.1 Technical data

Order no.	031-1CD40
Туре	SM 031
Module ID	0412 1544
Current consumption/power loss	
Current consumption from backplane bus	60 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 current	-
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

031-1CD40 - AI 4x16Bit 0(4)...20mA > Technical data

Order no.	031-1CD40
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	-
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	-
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 thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Internal temperature 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	

031-1CD40 - AI 4x16Bit 0(4)...20mA> Technical data

Order no.	031-1CD40
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	$\checkmark$
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)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
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

031-1CD40 - AI 4x16Bit 0(4)...20mA > Parameter data

Order no.	031-1CD40
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

### 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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 suppres- sion	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

031-1CD40 - AI 4x16Bit 0(4)...20mA> Parameter data

Name	Bytes	Function	Default	DS	IX	SX
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

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

### **DIAG\_EN Diagnostics**

0	Diagnostics interrupt
	<ul> <li>– 00h: enabled</li> </ul>
	<ul> <li>40h: disabled</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 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
queries capproceren	0	Bit 1, 0: Interference frequency suppression channel 0

quency suppression	Byte	Bit / 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> </ul>
		e.g.: 10101010: all channels frequency suppression 50Hz
CHxFN Function number channel x	function	ollowing there are the measuring ranges with corresponding n number listed, which were supported by the analog module. The the corresponding channel is deactivated. The formulas

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

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

#### 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	parameteriz- able
Error in project	-	Х	-
engineering/parameterization			
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	parameteriz- able
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 under- flow	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> </ul>

	Bit 2. Limit undernow channel 2	
1.00	Bit 3 <sup>•</sup> Limit underflow channel 3	

Bit 7 ... 4: reserved

### PRIT\_US µs ticker

Byte	Bit 7 0
0 1	Value of the $\mu$ s ticker at the moment of the diagnostic.
µs ticker	

031-1CD40 - AI 4x16Bit 0(4)...20mA > Diagnostics and interrupt

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.
- IN 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.

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

031-1CD40 - AI 4x16Bit 0(4)...20mA> Diagnostics and interrupt

Name	Bytes	Function	Default	DS	IX	SX
CH4ERR CH7ERR	4	reserved	00h			0Eh 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 infor-	
mation	

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

- Bit 2 ... 0: reserved Bit 3: set at internal diagnostics buffer overflow
  - Bit 4: set at internal communication error
  - Bit 5: reserved
  - Bit 6: set at process interrupt lost
  - Bit 7: reserved

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

NUMBIT Diagnostic bits

## Byte Bit 7 ... 0

0

Number of diagnostic bits per channel (here 08h)

031-1CD45 - AI 4x16Bit 0(4)...20mA

**Analog Input** 

NUMCH Cha	nnels
-----------	-------

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

**CHERR Channel error** 

ByteBit 7 ... 00Bit 0: set at error in channel group 00Bit 1: set at error in channel group 10Bit 2: set at error in channel group 20Bit 3: set at error in channel group 30Bit 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 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

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.

### 3.23 031-1CD45 - AI 4x16Bit 0(4)...20mA

Properties

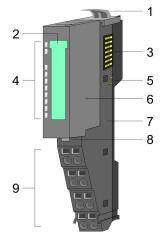
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

### **Analog Input**

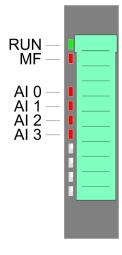
031-1CD45 - AI 4x16Bit 0(4)...20mA

### Structure



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

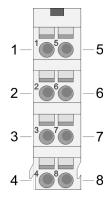
### **Status indication**

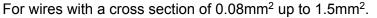


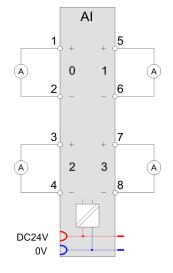
RUN	MF	Al x	AI x Description		
green	red	red			
•	0	х	Bus communication is OK		
•	0	^	Module status is OK		
•	•	$\mathbf{v}$	Bus communication is OK		
•	• X	^	Module status reports an error		
0	•	х	Bus communication is not possible		
0	•	^	Module status reports an error		
0	0	Х	Error at bus power supply		
х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42		
			Error channel x		
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
on: •   o	on: ●   off: ○   blinks with 2Hz: B   not relevant: X				

031-1CD45 - AI 4x16Bit 0(4)...20mA

### Pin assignment







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

031-1CD45 - AI 4x16Bit 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
	+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	60 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 current	-
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%

031-1CD45 - AI 4x16Bit 0(4)...20mA > Technical data

al error limit current ranges with SFU - uction limit current inputs (voltage) max	0.1% x. 24V x. 40mA
al error limit current ranges with SFU-action limit current inputs (voltage)maxaction limit current inputs (electrical cur-maxtance inputs-tance ranges-tance ranges-tance ranges-tional limit of resistor ranges with SFU-error limit-error limit with SFU-uction limit of resistance inputs-tance thermometer inputs-tance thermometer ranges-tional limit of resistance thermometer-tional limit of resistance thermometer-swith SFU-error limit thermoresistor ranges-ational limit of resistance thermometer-swith SFU-error limit thermoresistor ranges-ational limit of resistance thermometer-ational limit	x. 24V
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error limit thermoelement ranges -	
error limit thermoelement ranges with -	
uction limit thermocouple inputs -	
ammable temperature compensation -	
nal temperature compensation -	
al temperature compensation -	
al temperature compensation -	
ical unit of temperature measurement -	
ution in bit 16	

# **Analog Input**

031-1CD45 - AI 4x16Bit 0(4)...20mA> Technical data

Order no.	031-1CD45	
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	
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)	-	
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V	
Max. potential difference between Mintern and outputs	-	
Insulation tested with	DC 500 V	
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		

031-1CD45 - AI 4x16Bit 0(4)...20mA > Parameter data

Order no.	031-1CD45
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

### 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

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> </ul>
		e.g.: 10101010: all channels frequency suppression 50Hz
CHxFN Function		ollowing there are the measuring ranges with corresponding
number channel x		n number listed, which were supported by the analog module. The the corresponding channel is deactivated. The formulas

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	D = 27649 I	
Siemens S7 format	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{I}{20}$	
	10mA	13824	3600h		20	
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange		
0 20mA	25.00mA	20480	5000h	overrange	D = 16284 I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$	
S5 format (41h)	10mA	8192	2000h		20	
	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	16	
S7 format	12mA	13824	3600h		$I = D \cdot \frac{16}{27648} + 4$	
(30h)	4mA	0	0000h		27048	
	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	16	
S5 format	12mA	8192	2000h		$I = D \cdot \frac{16}{16384} + 4$	
(40h)	4mA	0	0000h		16384	
	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.
- IN 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
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

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 infor- mation	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\_A

031-1CD45 - AI 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	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 Channel-specific	Byte	Bit 7 0
Chame-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>
CH4ERR CH7ERR reserved	Byte	Bit 7 0
10001700	0	reserved

031-1CD70 - AI 4x16Bit ±10V

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 (us ticker). With PowerON the timer starts counting with 0. After 232-1µs the timer starts with 0 again.

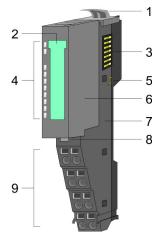
#### 031-1CD70 - AI 4x16Bit ±10V 3.24

**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



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

### Status indication

RUN MF

> AI 0 AI 1 AI 2 AI 3

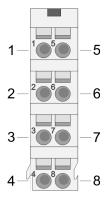
RUN	MF	Al x	Description
green	red	red	
	0	Y	Bus communication is OK
 •	0	~	Module status is OK
		• X	Bus communication is OK
•	•		Module status reports an error
0		• X	Bus communication is not possible
0	•		Module status reports an error
0	0	Х	Error at bus power supply
	green • •	greenred●●●●●●●●●●	greenredred•••••ו•ו•×

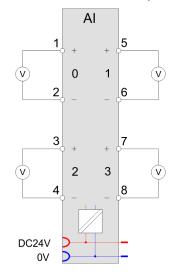
031-1CD70 - AI 4x16Bit ±10V

RUN	MF	Al x	Description		
Х	В	Х	Error in configuration		
	0		Error channel x		
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li></ul>		
on: •   c	on: ●   off: ○   blinks with 2Hz: B   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

031-1CD70 - AI 4x16Bit ±10V > 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
	+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.

## 3.24.1 Technical data

Order no.	031-1CD70
Туре	SM 031
Module ID	040E 1544
Current consumption/power loss	
Current consumption from backplane bus	60 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	✓
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	-

# **Analog Input**

031-1CD70 - AI 4x16Bit ±10V> Technical data

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-Basic error limit with SFU-Destruction limit resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Destruction limit resistance inputs-Resistance thermometer inputs-	
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-Basic error limit with SFU-Destruction limit resistance inputs-Coperational limit of SFU-Basic error limit with SFU-Basic error limit with SFU-Destruction limit resistance inputs-	
Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Destruction limit with SFU-Destruction limit resistance inputs-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Destruction limit resistance inputs-	
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Basic error limit-Basic error limit with SFU-Destruction limit resistance inputs-	
Basic error limit with SFU-Destruction limit resistance inputs-	
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 -	
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 thermoelement ranges with SFU	
Destruction limit thermocouple inputs -	
Programmable temperature compensation -	
External temperature compensation -	
Internal temperature compensation -	
Internal temperature compensation -	
Technical unit of temperature measurement -	
Resolution in bit 16	

031-1CD70 - AI 4x16Bit ±10V > Technical data

Order no.	031-1CD70
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	-
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 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 60 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	

031-1CD70 - AI 4x16Bit ±10V> Parameter data

Order no.	031-1CD70
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

### 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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 sup- pression	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

031-1CD70 - AI 4x16Bit ±10V > Parameter data

Name	Bytes	Function	Default	DS	IX	SX
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.

<b>DIAG_EN</b> Diagnostics	
----------------------------	--

Byte	Bit 7 0
------	---------

0

Di	agnostics interrupt
_	00h: enabled
_	40h: disabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit	value
monite	ōrin	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 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	Interfe	erence	fre-
auenc	v supr	pressio	on

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

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. 031-1CD70 - AI 4x16Bit ±10V> Parameter data

#### ±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	V 27648 6C00h	nominal range	10	
(12h)	5V	13824	3600h		
(1211)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D = 16384 . U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		10
(2211)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		
	-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	$D = 27648 \cdot \frac{U}{10}$
Siemens S7 format	10V	27648	6C00h	nominal range	10
(10h)	5V	13824	3600h		
(1011)	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	
0 10V	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	10
(20h)	5V	8192	2000h		10
(2011)	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-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.

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	-

## 3.24.3 Diagnostics and interrupt

Process interrupt	So you may react to asynchro
	activate a process interrupt.
	program sequence and jump

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

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	

W	Byte	Bit 7 0
	0	Bit 0: Limit overflow channel 0
		<ul> <li>Bit 1: Limit overflow channel 1</li> <li>Bit 2: Limit overflow channel 2</li> </ul>
		<ul> <li>Bit 2: Limit overflow channel 2</li> <li>Bit 3: Limit overflow channel 3</li> </ul>
		Bit 7 4: reserved

031-1CD70 - AI 4x16Bit ±10V> Diagnostics and interrupt

DDIT III Limit under					
PRIT_UL Limit under- flow	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 diag- nostics 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 no stored and get lost. Within this time window (1. diagnostic inter- rupt <sub>incoming</sub> until last diagnostic interrupt <sub>going</sub> ) the MF-LED of the module is on.				
	The follow	ving errors are listed in the diagnostics data:			
	Error in project engineering / parameterization				
	<ul> <li>Measuring range overflow</li> <li>Measuring range underflow</li> </ul>				
	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.				
	<ul> <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> </ul>				
	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

031-1CD70 - AI 4x16Bit ±10V > Diagnostics and interrupt

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

ERR	Α	Dia	ano	stic

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 infor- mation	Byte	Bit 7 0
maton	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>
FRR D Diagnostic	D. 4	

#### 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 5: reserved
  - Bit 6: set at process interrupt lost
  - Bit 7: reserved

031-1CD70 - AI 4x16Bit ±10V> Diagnostics and interrupt

CHTYP Channel type	Dete	
	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 Channel-specific	Byte	Bit 7 0
onanner-speenne	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>
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 tick	er
	In the S	SLIO module there is a timer ( $\mu$ s ticker). With PowerON the tarts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

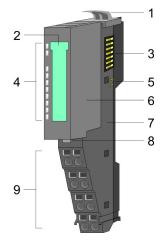
#### 3.25 031-1LB90 - AI 2x16Bit TC

#### **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**

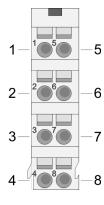


RUN	MF	Al x	Description	
green	red	red		
	0	х	Bus communication is OK	
•	0	~	Module status is OK	
	•	х	Bus communication is OK	
•	•	~	Module status reports an error	
0	•	х	Bus communication is not possible	
0	•	~	Module status reports an error	
0	0	Х	Error at bus power supply	
Х	В	Х	Error in configuration	
			Error channel x	
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li><li>Wire break</li></ul>	
on: $\bullet$   off: $\circ$   blinks with 2Hz: B   not relevant: X				

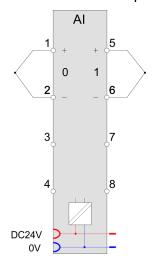
- Locking lever terminal module 1
- Labeling strip
- 2 3 Backplane bus
- 4 LED status indication
- 5 6 DC 24V power section supply Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1LB90 - AI 2x16Bit TC

#### 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!

# Supplementation to the installation guidelines

To avoid variations in temperature within the module, which may affect the accuracy of the measurement, you should consider the following points when assembling:

- Do not arrange the module directly apart from a power module with a high feeding current.
- Do not install the module at the end of a line.
- The module should be in a static condition, i.e. the temperature should be as constant as possible in the environment of your module (closed switchgear cabinet free from air draught).
- The accuracy is reached after approx. 30 minutes after entering the static condition.

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

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

## **Analog Input**

031-1LB90 - AI 2x16Bit TC> Technical data

Order no.	031-1LB90
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 cur- rent)	-
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	-
Operational limit of resistance thermometer 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

031-1LB90 - AI 2x16Bit TC > Technical data

Order no.	031-1LB90
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	$\checkmark$
External temperature compensation	$\checkmark$
Internal temperature compensation	$\checkmark$
Internal temperature compensation	1 K
Technical unit of temperature measurement	-
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 140 V/ AC 60 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-

### **Analog Input**

031-1LB90 - AI 2x16Bit TC> Parameter data

Order no.	031-1LB90
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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.

031-1LB90 - AI 2x16Bit TC > Parameter data

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 I	Diagnostics
-----------	-------------

#### Bit 7 ... 0 **Byte**

Here you can enable respectively disable the diagnostic interrupt.

WIBRK_EN Wire break recognition	Byte	Bit 7 0
recognition	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>
TEMPCNF Temperature	Byte	Bit 7 0

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-	Byte	Bit 7 0
quency suppression	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	In the f	ollowing there are the measuring ranges with corresponding

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.

031-1LB90 - AI 2x16Bit TC> Parameter data

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
-80 80mV	94.07mV	32511	7EFFh	overrange	D = 27648 U
Siemens S7	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{80}$
format (11h)	0V	0	0000h		
(111)	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	
-80 80mV	100mV	20480	5000h	overrange	D = 16384 U
Siemens S7 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		80
(2111)	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	

## -80 ... 80mV

## Temperature

Measuring range (funct. no.)	Measuring value in °C	Measuring value in °F	Measuring value in K	Range
<b>x y</b>	(0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
Type J:	+14500	26420	17232	overrange
-210 +1200°C -346 2192°F	-2100 +12000	-3460 21920	632 14732	nominal range
63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)				underrange
Type K:	+16220	29516	18952	overrange
-270 +1372°C -454 2501.6°F	-2700 +13720	-4540 25016	0 16452	nominal range
0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
-270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	-2700 +13000	-4540 23720	0 15732	nominal range
				underrange
Type R:	+20190	32766	22922	overrange
-50 +1769°C -58 3216.2°F	-500 +17690	-580 32162	2232 20422	nominal range

031-1LB90 - AI 2x16Bit TC > Parameter data

Measuring range	Measuring	Measuring value	Measuring value	Range
(funct. no.)	value in °Č	in °F	in K	
000.0 0040.01/	(0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
-50 +1769°C	-500 +17690	-580 32162	2232 20422	nominal range
-58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type T:	+5400	10040	8132	overrange
-270 +400°C	-2700 +4000	-4540 7520	32 6732	nominal range
-454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Type B:	+20700	32766	23432	overrange
0 +1820°C	0 +18200	320 27865	2732 20932	nominal range
32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Type C:	+25000	32766	23432	overrange
0 +2315°C	0 +23150	320 27865	2732 20932	nominal range
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
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)	-2700 +10000	-4540 18320	0 12732	nominal range
				underrange
Type L: -200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C)	+11500	21020	14232	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
(C9h: int. comp. 0°C)	-2000 +9000	-3280 16520	732 11732	nominal range
				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 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

031-1LB90 - AI 2x16Bit TC > 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

	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 infor- mation	Byte	Bit 7 0
mation	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)

031-1LD80 - AI 4x16Bit R/RTD

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 project engineering/parameterization error</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>

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

Bit 7 ... 0

DIAG\_US µs ticker

**Properties** 

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

µs ticker

**Byte** 

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

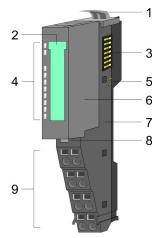
## 3.26 031-1LD80 - AI 4x16Bit R/RTD

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
   Desistance measurement with 2, 2 and 4 with
- Resistance measurement with 2, 3 and 4 wire (3 and 4 wire only via channel 0 respectively 1)
- Diagnostics function
- 16bit resolution

031-1LD80 - AI 4x16Bit R/RTD

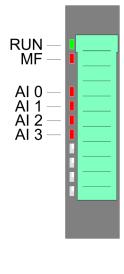
#### Structure



- Locking lever terminal module Labeling strip Backplane bus LED status indication DC 24V power section supply Electronic module
- 1 2 3 4

- 5 6 7
- Terminal module
- . 8 9 Locking lever electronic module
- Terminal

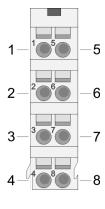
#### **Status indication**

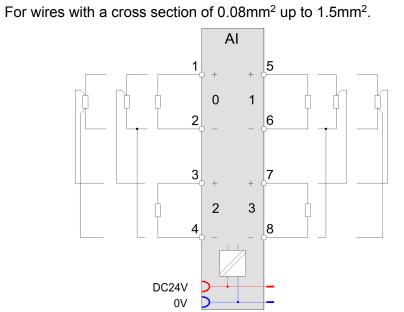


RUN	MF	Al x	Description
green	red	red	
	0	х	Bus communication is OK
•	0	^	Module status is OK
	•	х	Bus communication is OK
•	•	^	Module status reports an error
0	•	х	Bus communication is not possible
0	•	^	Module status reports an error
0	0	Х	Error at bus power supply
Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
			Error channel x
•	0	•	<ul><li>Signal leaves measuring range</li><li>Error in parameterization</li><li>Wire break</li></ul>
on: •   o	off:	nks with	2Hz: B   not relevant: X

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	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

				031-1LD80 - AI 4x16Bit	R/RTD > Tech	nical data
2, 3, 4 wire measure- ment				ove you can see how th ively 4 wire measureme		e to be
	<ul> <li>3 wir</li> <li>- F</li> <li>s</li> <li>T</li> <li>c</li> <li>a</li> <li>4 wir</li> <li>- T</li> </ul>	e measu Please co ponding he corre hannel 1 ctivated re measu he measu	irement is onsider w channel sponding is chanr in the pa irement is surement	2 wire measurement m s only possible via the o ith 3 wire measuremen is always deactivated in channel of channel 0 i lel 3. Not used channel rametrization. s only possible via the o current for channel 0 is ent for channel 0 happe	channels 0 a t that the cor n the parame s channel 2 a s must alway channels 0 a s applied at p	nd 1. re- trization. and of /s be de- nd 1. bin 1 and
				or channel 0 is represe		
	6	. The me	easureme	current for channel 1 is ent for channel 1 happe for channel 1 is represe	ns at pin 7 a	nd 8.
	s T c	ponding he corre hannel 1	channel sponding is chann	ith 4 wire measuremen is always deactivated ir J channel of channel 0 i lel 3. Not used channel rametrization.	n the parame s channel 2	trization. and of
In-/Output area				PROFINET the input re corresponding address		utput
				CANopen with s = Su analog modules	bindex, depe	nds on
		ubindex f herCAT-		s via EtherCAT with Inc	lex 6000h +	
	More ca	n be fou	nd in the	according manual of yo	our bus coup	ler.
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

## **Analog Input**

031-1LD80 - AI 4x16Bit R/RTD> Technical data

Current consumption/power loss55 mACurrent consumption from backplane bus55 mAPower loss1 WTechnical data analog inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Number of input seistance (voltage ranges)-Operational limit of voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges-Basic error limit voltage ranges with SFU-Destruction limit current-Current inputs-Max. input resistance (current ranges)-Input voltage ranges with SFU-Destruction limit current ranges-Max. input resistance (current ranges)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Sacie error limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Resistance inputs-Resistance inputs-Operational limit or current ranges-Operational limit or resistor ander-	Order no.	031-1LD80
Power loss1 WTechnical data analog inputs.Number of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Number of init of voltage ranges-Input voltage ranges-Operational limit of voltage ranges-Basic error limit voltage ranges-Basic error limit voltage ranges-Current inputs-Max. input resistance (current ranges)-Current inputs-Max. input resistance (current ranges)-Operational limit of current ranges-Basic error limit voltage ranges with SFU-Destruction limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU-Resistance inputs-Resistance inputs-Quert limit dr current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU-Resistance inputs-Quert limit dr fesistor ranges-Quert limit of resistor ranges-Quert limit of resistor	Current consumption/power loss	
Technical data analog inputs4Number of inputs40 or mCable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Number of inmit of voltage ranges-Input voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges-Current inputs-Max. input resistance (current range)-Input resistance (current ranges)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destruction limit current space-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges <td>Current consumption from backplane bus</td> <td>55 mA</td>	Current consumption from backplane bus	55 mA
Number of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Nin. input resistance (voltage range)-Input voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit current-Current inputs-Max. input resistance (current range)-Input ourrent ranges-Operational limit of current ranges-Operational limit of current ranges-Current inputs-Max. input resistance (current ranges-Operational limit of current ranges with SFU-Destruction limit current inputs (voltage)-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-Operational limit of resistor ranges*/Operational limit of resistor ranges+/<0.4 %	Power loss	1 W
Cable lendy, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Min. input resistance (voltage range)-Input voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Current inputs-Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance inputs-Resistance inputs-Operational limit of resistor ranges+/-0.0 Ohm0 600 Ohm 3000 Ohm0 3000 Ohm 3000 Ohm0 3000 Ohm 3000 Ohm0 3000 Ohm 3000 Ohm0 400 Chim 3000 Ohm0 500 Chim 3000 Ohm <td< td=""><td>Technical data analog inputs</td><td></td></td<>	Technical data analog inputs	
Rated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)30 mAVoltage inputs-Min. input resistance (voltage range)-Input voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Current inputs-Max. input resistance (current range)-Input resistance (current range)-Input current ranges-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Radical error limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Querational limit of resistor ranges+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Operational limit of resistance inputsmax. 24V	Number of inputs	4
Current cosumption from load voltage L+ (without load)     30 mA       Voltage inputs     -       Min. input resistance (voltage range)     -       Input voltage ranges     -       Operational limit of voltage ranges with SFU     -       Basic error limit voltage ranges with SFU     -       Basic error limit voltage ranges with SFU     -       Destruction limit current     -       Current ranges     -       Max. input resistance (current range)     -       Input current ranges     -       Operational limit of current ranges with SFU     -       Destruction limit current ranges with SFU     -       Diput current ranges     -       Operational limit of current ranges     -       Operational limit of current ranges with SFU     -       Destruction limit current inputs (voltage)     -       Radical error limit current inputs (electrical currertrent)     -       Destruction limit current inputs (electrical currert)     -       Resistance inputs     -       Resistance ranges     -       Operational limit of resistor ranges with SFU     -       Operational limit of resistor ranges with SFU     -	Cable length, shielded	200 m
(without lead)-Voltage inputs-Min. input resistance (voltage range)-Input voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit current-Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Resistance inputs-Resistance inputs-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU<	Rated load voltage	DC 24 V
Nin. input resistance (voltage range)-Input voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit current-Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Radical error limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (lectrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destruction limit or resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V		30 mA
Input voltage ranges-Operational limit of voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit current-Current 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-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limitSFU+/- 0.1 %Operational limit of resistance inputsmax. 24V	Voltage inputs	-
Operational limit of voltage ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit current-Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges-Redical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current'-Resistance inputsAreasibance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Resistance ranges-Operational limit of resistor ranges+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Basic error limit with SFUmax. 24V	Min. input resistance (voltage range)	-
Operational limit of voltage ranges with SFU-Basic error limit voltage ranges-Basic error limit voltage ranges with SFU-Destruction limit current-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 with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance inputs-Resistance ranges0 60 Ohm0 600 Ohm 3000 Ohm0 3000 Ohm 3000 Ohm0 600 Ohm 3000 Ohm0 600 Chm 3000 Ohm0 600 Chm 400 Chm0 600 Chm 400 Chm0 600 Chm 3000 Ohm0 600 Chm 400 Chm0 600 Chm 400 Chm <t< td=""><td>Input voltage ranges</td><td>-</td></t<>	Input voltage ranges	-
Basic error limit voltage ranges-Basic error limit voltage ranges with SFU-Destruction limit current-Current 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-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU-Redical error limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputsResistance ranges0 600 Ohm0 600 Ohm 3000 Ohm0 3000 Ohm 3000 Ohm0perational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V	Operational limit of voltage ranges	-
Basic error limit voltage ranges with SFU-Destruction limit current-Current 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 with SFU-Destruction 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-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Basic error limit with SFUmax. 24V	Operational limit of voltage ranges with SFU	-
Destruction limit current-Current inputs-Max. input resistance (current range)-Input 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 ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputsResistance ranges0 60 Ohm0 3000 Ohm 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit terrent inputswith SFUDestruction limit of resistance inputswith SFUDestructional limit of resistor ranges with SFU+/- 0.1 %	Basic error limit voltage ranges	-
Current inputs-Max. input resistance (current range)-Input 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 ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputsResistance ranges060 Ohm0600 Ohm3000 Ohm03000 Ohm3000 Ohm0perational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %max. 24Vmax. 24V	Basic error limit voltage ranges with SFU	-
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 inputsResistance ranges0600 Ohm0600 Ohm3000 Ohm03000 Ohm13000 Ohm03000 Ohm13000 Ohm0600 Chm1600 Chm0600 Chm	Destruction limit current	-
Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputsResistance ranges0 60 OhmOperational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V	Current inputs	-
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 inputsResistance ranges0 60 Ohm0 600 Ohm0 3000 Ohm0 3000 Ohm0 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0,1 %Destruction limit resistance inputsmax. 24V	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 ranges0 60 Ohm0 600 Ohm0 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0,1 %Destruction limit resistance inputsmax. 24V	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 inputsResistance ranges0 60 Ohm 0 600 Ohm 0 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputswax. 24V	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 ranges0 60 Ohm 0 600 Ohm 0 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V	Operational limit of current ranges with SFU	-
Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs✓Resistance ranges0 60 Ohm 0 600 Ohm 0 600 Ohm 0 3000 Ohm 0 3000 OhmOperational limit of resistor ranges with SFU+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V	Basic error limit current ranges	-
Destruction limit current inputs (electrical current)-Resistance inputs✓Resistance ranges0 60 Ohm 0 600 Ohm 0 3000 OhmOperational 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 inputsmax. 24V	Radical error limit current ranges with SFU	-
rent)Resistance inputs✓Resistance ranges0 60 Ohm 0 600 Ohm 0 600 Ohm 0 3000 OhmOperational limit of resistor ranges+/- 0.4 %Operational limit of resistor ranges with SFU+/- 0.2 %Basic error limit+/- 0.1 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24V	Destruction limit current inputs (voltage)	-
Resistance ranges0 60 Ohm 0 600 Ohm 0 3000 OhmOperational 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 inputsmax. 24V		-
JunctionJunctionOperational 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 inputsmax. 24V	Resistance inputs	$\checkmark$
Operational limit of resistor ranges with SFU+/- 0,2 %Basic error limit+/- 0.2 %Basic error limit with SFU+/- 0,1 %Destruction limit resistance inputsmax. 24V	Resistance ranges	0 600 Ohm
Basic error limit+/- 0.2 %Basic error limit with SFU+/- 0,1 %Destruction limit resistance inputsmax. 24V	Operational limit of resistor ranges	+/- 0.4 %
Basic error limit with SFU+/- 0,1 %Destruction limit resistance inputsmax. 24V	Operational limit of resistor ranges with SFU	+/- 0,2 %
Destruction limit resistance inputs max. 24V	Basic error limit	+/- 0.2 %
	Basic error limit with SFU	+/- 0,1 %
Resistance thermometer inputs $\checkmark$	Destruction limit resistance inputs	max. 24V
	Resistance thermometer inputs	$\checkmark$

031-1LD80 - AI 4x16Bit R/RTD > Technical data

Order no.	031-1LD80
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 %
Operational limit of resistance thermometer ranges with SFU	+/- 0,1 %
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	-
Internal temperature compensation	-
Technical unit of temperature measurement	-
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

031-1LD80 - AI 4x16Bit R/RTD> Technical data

Order no.	031-1LD80
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 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 60 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
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

#### 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	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 sup- pression	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

#### Byte Bit 7 ... 0

0 Diagnostics interrupt – 00h: enabled

\_

- 40h: disabled
- Here you can enable respectively disable the diagnostic interrupt.

## WIBRK\_EN Wire break recognition

Byte	Bit 7 0
0	Bit 0: Wire break recognition channel 0 (1: on)

- Bit 1: Wire break recognition channel 1 (1: on)
- Bit 2: Wire break recognition channel 2 (1: on)
- Bit 3: Wire break recognition channel 3 (1: on)
- Bit 7 ... 4: reserved

**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>

031-1LD80 - AI 4x16Bit R/RTD> Parameter data

#### 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> </ul>
	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.

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

031-1LD80 - AI 4x16Bit R/RTD > Parameter data

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

031-1LD80 - AI 4x16Bit R/RTD> Parameter data

Measuring range (funct. no.)	Measuring value	Signal range	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		
(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		

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

031-1LD80 - AI 4x16Bit R/RTD> 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.
- IN 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
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR\_A Diagnostic

Byte Bit 7 ... 0

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	infor-
mation		

Byte	Bit 7	0
------	-------	---

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

031-1LD80 - AI 4x16Bit R/RTD > 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	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	-	Bit 7 0					
	0	Number of diagnostic bits per channel (here 08h)					
NUMCH Channels							
	-	Bit 7 0					
	0	Number of channels of a module (here 04h)					
CHERR Channel error	-	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>Channel-specific error: channel x:</li> <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>					
		<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> </ul>					
CH4ERR CH7ERR	Byte	<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> </ul>					
CH4ERR CH7ERR reserved		<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>					

031-1LD80 - AI 4x16Bit R/RTD> Diagnostic data

#### 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.

## 4 Analog Output

4.1 General									
<b>Cabling for analog sig-</b> <b>nals</b> You must only use screened cable when you are connecting signals. These cables reduce the effect of electrical interference screen of the analog signal cable should be grounded at boo situations with different electrical potentials, it is possible the rent will flow to equalize the potential difference. This currence interfere with the analog signals. Under these circumstance advisable to ground the screen of the signal cable at one en-									
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>								

## 4.2 Analog value

#### Analog value representation The analog value Hereby the bina

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.

Resolu- tion	Analog value															
	High byte (byte 0)Low byte (byte 1)															
Bit number	15	14 13 12 11 10 9 8					8	7 6 5 4 3 2 1			0					
Resolu- tion	SG	2 <sup>14</sup>	2 <sup>13</sup>	2 <sup>12</sup>	211	2 <sup>10</sup>	2 <sup>9</sup>	2 <sup>8</sup>	27	2 <sup>6</sup>	2 <sup>5</sup>	24	2 <sup>3</sup>	2 <sup>2</sup>	21	2 <sup>0</sup>
12Bit+SG	SG	Analog value (word) X X X										Х				
15Bit+SG	SG							An	alog va	llue (woi	rd)					

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)	<ul> <li>The algebraic sign bit is represented by Bit 15. Here it is essential:</li> <li>Bit 15 = "0": → positive value</li> <li>Bit 15 = "1": → negative value</li> </ul>

## 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

#### 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	27648
S7 format	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(10h)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$
	Not possible, i	s limited to 0V	•	underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range	16384
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
	0V	0	0000h		$D = 10504 \times \frac{10}{10}$
	Not possible, is limited 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	$U = D x \frac{10}{27648}$
Siemens S format	10V	27648	6C00h	nominal range	27648
(12h)	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(1211)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens S5 format	10V	16384	4000h	nominal range	16384
(22h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
(2211)	0V	0	0000h		$D = 10304 \times \frac{10}{10}$
	-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	$I = D x \frac{20}{27648}$
Siemens	20mA	27648	6C00h	nominal range	T = D x - 27648
S7 format	10mA	13824	3600h		I
(31h)	0mA	0	0000h		$D = 27648 x \frac{I}{20}$
	Not possible, i	is limited to On	ıA.	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$I = D x \frac{20}{16384}$
Siemens	20mA	16384	4000h	nominal range	1 = D x - 16384
S5 format	10mA	8192	2000h		I
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{1}{20}$
	Not possible, i	is limited to On	ıA.	underrange	

### **Analog Output**

032-1BB30 - AO 2x12Bit 0...10V

Output range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
4 20mA Siemens	22.81mA 20mA	32511 27648	7EFFh 6C00h	overrange nominal range	$I = D \ x \ \frac{16}{27648} \ + \ 4$
S7 format	12mA	13824	3600h	nominarrange	$D = 27648 \ x \ \frac{I-4}{16}$
(30h)	4mA	0	0000h		10
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	16384
S5 format (40h)	12mA	8192	2000h		$D = 16384 \ x \ \frac{I-4}{16}$
	4mA	0	0000h		10
	0mA	-4096	F000h	underrange	

#### 4 ... 20mA

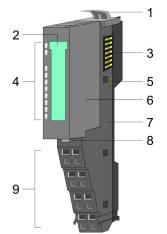
### 4.4 032-1BB30 - AO 2x12Bit 0...10V

#### **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
- **Diagnostics function**
- 12bit resolution

#### Structure



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

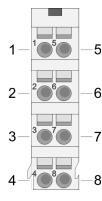
032-1BB30 - AO 2x12Bit 0...10V

		RUN	MF	AO x	Description
RUN —		green	red	red	
MF — 🖣 🔜	_				
AO 0 — 💶 📃			0	х	Bus communication is OK
AO 1 — 📕 💻	_	•	0	^	Module status is OK
				х	Bus communication is OK
H	-	•	•	^	Module status reports an error
8				• X	Bus communication is not possible
		0	• •	^	Module status reports an error
		0	0	Х	Fehler Busversorgungsspannung
		х	В	Х	Error at bus power supply 'Trouble shooting - LEDs' on page 42
					Error channel x
		•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>
	on: •  off: •   blinks with 2Hz: B   not relevant: X				

## Status indication

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>.

DC24V

24V D 0V D

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	80 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
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 κΩ
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

## Analog Output

032-1BB30 - AO 2x12Bit 0...10V > Technical data

Order no.	032-1BB30
Substitute value can be applied	no
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 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	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

032-1BB30 - AO 2x12Bit 0...10V > Parameter data

Order no.	032-1BB30
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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

**CHxFN** Function

number channel x

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>

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. 032-1BB30 - AO 2x12Bit 0...10V > Diagnostic data

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas	
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$	
Siemens	10V	27648	6C00h	nominal range	27648	
S7 format	5V	13824	3600h		D 27649 U	
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$	
	Not possible, i	s limited to 0V		underrange		
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens	10V	16384	4000h	nominal range		
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
	0V	0	0000h		$D = 10384 \ x \ \overline{10}$	
	Not possible, i	s limited 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.

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

032-1BB30 - AO 2x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error 00h channel 0				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

e	ы	<i>′</i>	U	

- 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 infor- mation	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

0

- Bit 6 ... 0: Channel type
  - 70h: Digital input
  - 71h: Analog input
  - 72h: Digital output
  - 73h: Analog output
  - 74h: Analog input/-output
  - 76h: Counter
  - Bit 7: reserved

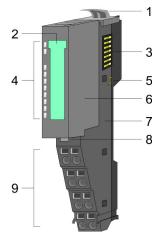
032-1BB40 - AO 2x12Bit 0(4)...20mA

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			
Channel Specific	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	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 ticke	er			
		SLIO module there is a timer ( $\mu$ s ticker). With PowerON the tarts 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					
Properties	ectronic module has 2 outputs with parameterizable functions. annels of the module are electrically isolated from the back- bus. In addition, the channels are isolated to the DC 24V power by means of DC/DC converter.				

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

032-1BB40 - AO 2x12Bit 0(4)...20mA

#### Structure



- Locking lever terminal module Labeling strip Backplane bus LED status indication DC 24V power section supply Electronic module

- 1 2 3 4
- 5 6 7
- Terminal module
- 8 Locking lever electronic module
- 9 Terminal

### **Status indication**

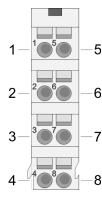
RUN MF

AO 0 AO 1

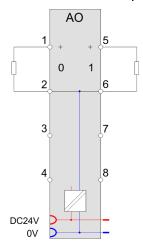
RUN	MF	AO x	Description		
green	red	red			
•	0	х	Bus communication is OK		
•	U	~	Module status is OK		
	•	х	Bus communication is OK		
•	•	~	Module status reports an error		
0	•	х	Bus communication is not possible		
0	•	~	Module status reports an error		
0	0	Х	Error at bus power supply		
Х	В	Х	Error in configuration		
			Error channel x		
•	0	•	<ul><li>Error in parameterization</li><li>Wire-break</li></ul>		
on: ●   off: ○   blinks with 2Hz: B   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

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	80 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
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

# Analog Output

032-1BB40 - AO 2x12Bit 0(4)...20mA > Technical data

Order no.	032-1BB40
Conversion time	2 ms all channels
Substitute value can be applied	no
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 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	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	

032-1BB40 - AO 2x12Bit 0(4)...20mA > Parameter data

Order no.	032-1BB40
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

#### 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. 032-1BB40 - AO 2x12Bit 0(4)...20mA > Diagnostic data

Output range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA Siemens S7 format (31h)	23.52mA 20mA 10mA 0mA	32511 27648 13824 0	7EFFh 6C00h 3600h 0000h	overrange nominal range	$I = D \ x \ \frac{20}{27648}$ $D = 27648 \ x \ \frac{I}{20}$
	Not possible,	s limited to On	ıA.	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$I = D x \frac{20}{16384}$
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384}$
S5 format (41h)	10mA	8192	2000h		I
	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, i	s limited to On	ıA.	underrange	

# 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	27648
S7 format	12mA	13824	3600h		$D = 27648 \ x \ \frac{I-4}{I6}$
(30h)	4mA	0	0000h		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	16384
S5 format	12mA	8192	2000h		$D = 16384 \ x \ \frac{I-4}{16}$
(40h)	4mA	0	0000h		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.

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 infor- mation	Byte	Bit 7 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>	Byte	Bit 7 0
	0	<ul><li>0101b analog module</li><li>Bit 4: set at channel information present</li></ul>

032-1BB40 - AO 2x12Bit 0(4)...20mA > Diagnostic data

ERR_D Diagnostic	Duto	Bit 7 0
	Byte	
	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>
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
Channer-Specific	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>
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved

032-1BB70 - AO 2x12Bit ±10V

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.

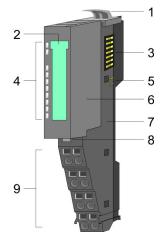
#### 4.6 032-1BB70 - AO 2x12Bit ±10V

**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
- Diagnostics function
- 12bit resolution

#### Structure



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

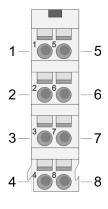
#### Status indication

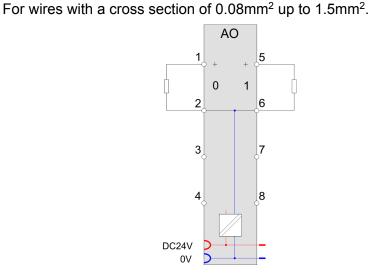
	RUN	MF	AO x	Description
	green	red	red	
MF — 🖣 💻 [				
AO 0 — <b>I</b>		0	х	Bus communication is OK
AO 1 — <b>I</b>	•	0	~	Module status is OK
			х	Bus communication is OK
	•	•	^	Module status reports an error
	0	•	х	Bus communication is not possible
	0	•	^	Module status reports an error
	0	0	Х	Error at bus power supply
	x	В	Х	Error in configuration

032-1BB70 - AO 2x12Bit ±10V

RUN	MF	AO x	Description		
			Error channel x		
•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>		
on: ●  off: ○   blinks with 2Hz: B   not relevant: X					

#### Pin assignment





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

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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

# 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	-

# Analog Output

032-1BB70 - AO 2x12Bit ±10V > Technical data

Order no.	032-1BB70
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
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

032-1BB70 - AO 2x12Bit ±10V > Parameter data

Order no.	032-1BB70
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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	
<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>	

032-1BB70 - AO 2x12Bit ±10V > 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 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

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	27648
(12h)	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(1211)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens S5 format	10V	16384	4000h	nominal range	16384
(22h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
	0V	0	0000h		$D = 10384 \times \frac{10}{10}$
	-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	27648
S7 format	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(10h)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$
	Not possible, i	s limited to 0V		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range	16384
S5 format	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
(20h)	0V	0	0000h		$D = 10334 \times \frac{10}{10}$
	Not possible, i	s limited 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.

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.

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

032-1BB70 - AO 2x12Bit ±10V > Diagnostic data

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 infor-	Byte	Bit 7 0
mation	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		
Ciff IF Channel type	Byte 0	<ul> <li>Bit 7 0</li> <li>Bit 6 0: Channel type <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> </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>

032-1BD30 - AO 4x12Bit 0...10V

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

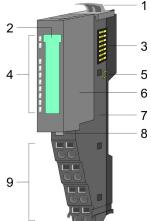
# 4.7 032-1BD30 - AO 4x12Bit 0...10V

#### **Properties**

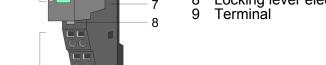
The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

#### Structure



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



# Analog Output

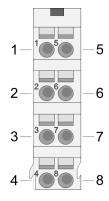
032-1BD30 - AO 4x12Bit 0...10V

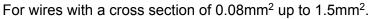
# Status indication

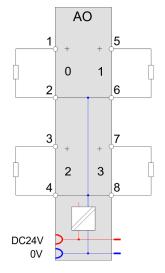
	RUN	MF	AO x	Description	
	green	red	red		
MF — 📕					
AO 0 — <b>I</b>		0	х	Bus communication is OK	
AO 1 — <b>I</b> — AO 2 — <b>I</b>	•	0	~	Module status is OK	
AO 3 —			х	Bus communication is OK	
H I	•	•	^	Module status reports an error	
	0	•	Х	Bus communication is not possible	
	0			Module status reports an error	
	0	0	Х	Error at bus power supply	
	х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42	
				Error channel x	
	•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>	
	on: $\bullet$   off: $\circ$   blinks with 2Hz: B   not relevant: X				

032-1BD30 - AO 4x12Bit 0...10V

#### Pin assignment







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

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

032-1BD30 - AO 4x12Bit 0...10V > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

# 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	80 mA
Power loss	1.2 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
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 κΩ
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	-

032-1BD30 - AO 4x12Bit 0...10V > Technical data

Destruction limit against external applied voltage-Settling time for ohmic load1.5 msSettling time for capacitive load2 msSettling time for inductive load-Resolution in bit12Conversion time2 ms all channelsSubstlute value can be appliednoOutput data size8 ByteStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic interruptnoDiagnostic information read-outyessibleStupply voltage displaygreen LEDGroup error displaygreen LEDChannel error display-Between channels-Between channels of groups to-Between channels of groups to-Between channels of groups to-Max. potential difference between inputs (um)-Max. potential difference between inputs (um)-Max. potential difference between inputs and mintern (Uiso)-Max. potential difference between inputs and mintern (Uiso)-Insulation tested withDC500 VDetaices-Input bytes0Output bytes-	Order no.	032-1BD30
Setting time for capacitive load2 msSetting time for inductive load-Resolution in bit12Conversion time2 ms all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnostics-Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesStatus displaygreen LEDGroup error displayred LEDChannel error displayred LEDBetween channels-Between channels of groups to-Between channels of groups to-Between channels of groups to-Between channels of groups to-Max. potential difference between inputs (utom)-Max. potential difference between inputs (utom)-Max. potential difference between inputs and miner (Uiso)-Max. potential difference between inputs and miner (Uiso)		-
Settling time for inductive load-Resolution in bit12Conversion time2 ms all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnostics-Status displayyesInterruptsnoProcess alarmnoDiagnostic functionsyesDiagnostic functionsyesDiagnostic information read-outpossibleSupply voltage displayred LEDGroup error displayred LEDChannel error displayred LEDBetween channels-Between channels of groups to-Between channels of groups to-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mana (Ucm)C75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Ulso)-Max. pot	Settling time for ohmic load	1.5 ms
Resolution in bit12Conversion time2 ms all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnosticsStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesStatus of splaygreen LEDGroup error displayred LEDChannel error displayred LED per channelBetween channels-Between channels of groups to-Between channels and backplane busMax. potential difference between inputs dufference between inputs and Mintern (Uiso)CMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)C 500 VInsulation tested withDC 500 VInput bytes0	Settling time for capacitive load	2 ms
Conversion time2 ms all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnosticsStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesStatus of splaygreen LEDChannel error displayred LED per channelBetween channels-Between channels of groups to-Between channels and power supplyví<	Settling time for inductive load	-
Substitute value can be appliednoOutput data size8 ByteStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesStatus displaygreen LEDGroup error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus-Patwar, potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Maran (Ucm)-Max. potential difference between inputs and Unterr (Uiso)-Max. potential difference between inputs and Unter (Uiso)-Max. potential difference between inputs and Unter (Uiso)-Max. potential difference between Mintern and Unter (Uiso)DC 500 VInsulation tested withDC 500 VDatasizes Input bytes0	Resolution in bit	12
Output data size8 ByteStatus information, alarms, diagnostics9Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsgreen LEDGroup error displayred LEDChannel error displayred LED per channelBetween channels-Between channels of groups to-Between channels and backplane bus·Between channels and power supply·Max. potential difference between inputs (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Maran (Ucm)C500 VMax. potential difference between Minter and butputsC 500 VInsulation tested withDC 500 VInsulation tested withDC 500 V	Conversion time	2 ms all channels
Status information, alarms, diagnosticsvesStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels and backplane bus·Between channels and power supply·Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Man (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Max. potential difference between inputs and furter (Uiso)-Max. potential difference between inputs and outputs-Max. potential difference between Mane and outputsC500 VInsulation tested withDC 500 VDiataizes Input bytes-	Substitute value can be applied	no
Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus-Max. potential difference between circuits-Max. potential difference between inputs and Man (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Max. potential difference between Man and Consolution-Max. potential difference between Mintern and outputs-Max. potential difference between Man and outputs-Max. potential difference between Man and ou	Output data size	8 Byte
InterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane busBetween channels and power supplyMax. potential difference between inputs (UCm)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and outputs-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and outputs-Max. potential difference between inputs and puts-Max. potential difference between inputs and putputs-Max. potential difference between inputs and putputs-Insulation tested withDC 500 VDatasizes Input bytes0	Status information, alarms, diagnostics	
Process alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functions read-outpossibleSupply voltage displaygreen LEDGroup error displayred LED per channelChannel error display-Between channels-Between channels of groups to-Between channels and backplane bus·Between channels and power supply·Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mann (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and outputs-Max. potential difference between inputs and outputs-Insulation tested withDC 500 VDatasizes Input bytes-	Status display	yes
Diagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels and backplane bus-Between channels and power supply-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and utters-Max. potential difference between inputs and utters-Insulation tested withDC 500 VDatasizes lnput bytes-Input bytes0	Interrupts	no
Diagnostic functionsyesDiagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-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 votential difference between inputs and burter (Uiso)-Max. potential difference between inputs and votential difference between inputs and votential difference between inputs and votential difference between inputs and votential difference between Mintern and votential difference between	Process alarm	no
Diagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus✓Between channels and power supply✓Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. 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 (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and Mintern (Uiso)C 500 VDatasizes Insulation tested with0	Diagnostic interrupt	no
Supply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus✓Between channels and power supply✓Max. potential difference between rinputs (Ucm)-Max. potential difference between ninputs and Mana (Ucm)-Max. potential difference between ninputs and Mintern (Uiso)-Max. potential difference between ninputs and Nintern (Uiso)-Max. potential difference between Nintern and Nintern (Uiso)DC 500 VDatasizes Insulation tested withO	Diagnostic functions	yes
Group error displayred LEDChannel error displayred LED per channelIsolation-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 (Ucm)DC 75 V/ AC 60 VMax. potential difference between niputs and Mana (Ucm)-Max. potential difference between niputs and Mintern (Uiso)-Max. potential difference between Nintern and Uitputs-DC 500 VDt 500 VDatasizes Input bytes0	Diagnostics information read-out	possible
Channel error displayred LED per channelIsolationred LED per channelBetween 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 (Ucm)-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 Mana (Ucm)-Max. potential difference between niputs and Dutputs-Max. potential difference between niputs and Untern (Uiso)-Max. potential difference between niputs and Dutputs-Max. potential difference between Nintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes0	Supply voltage display	green LED
IsolationImage: solationBetween 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 (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Numern (Uiso)-Max. potential difference between inputs and outputs-Max. potential difference between inputs and outputs-Datasizes Insulation tested withDC 500 VDatasizes Input bytes0	Group 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 Mintern (Uiso)-Max. potential difference between inputs and Vintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes0	Channel error display	red LED per channel
Between channels of groups to-Between channels and backplane busBetween channels and power supplyMax. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Max. potential difference between inputs and Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and bintern (Uiso)-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputsC 500 VDatasizes Input bytes0	Isolation	
Between channels and backplane bus✓Between channels and power supply✓Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VDatasizes-Input bytes0	Between channels	-
Between channels and power supply✓Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes0	Between channels of groups to	-
Detention of a porton outputMax. potential difference between circuitsMax. 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)Max. potential difference between Mintern and outputsInsulation tested withDc 500 VDatasizes Input bytesInput bytes	Between channels and backplane bus	$\checkmark$
Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Outputs-Max. potential difference between inputs and Outputs-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes-	Between channels and power supply	$\checkmark$
Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VInput bytes0	Max. potential difference between circuits	-
Mintern (Uiso)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 withDC 500 VDatasizes Input bytes0	Max. potential difference between inputs (Ucm)	-
Mana (Ucm)Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes0	Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Mintern (Uiso)AnswerMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes0		-
outputsInsulation tested withDC 500 VDatasizes0Input bytes0		-
Datasizes       Input bytes		-
Input bytes 0	Insulation tested with	DC 500 V
	Datasizes	
Output bytes 8	Input bytes	0
	Output bytes	8

032-1BD30 - AO 4x12Bit 0...10V > Parameter data

Order no.	032-1BD30
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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-cir-
cuit reco	Jgnit	tion

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>

#### 032-1BD30 - AO 4x12Bit 0...10V > Diagnostic 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 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

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens	10V	27648	6C00h	nominal range	27648
S7 format	5V	13824	3600h		D = 27648  m
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, i	s limited to 0V		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range	16384
S5 format	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
(20h)	0V	0	0000h		$D = 10384 x \frac{10}{10}$
	Not possible, i	s limited to 0V		underrange	

#### 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.
- IN 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.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h

032-1BD30 - AO 4x12Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
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

D:4 7 В

0

Byte Bit 7 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 infor- mation	Byte	Bit 7 0
Πατισπ	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 4: set at internal communication error
- Bit 7 ... 5: reserved

032-1BD30 - AO 4x12Bit 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 04h)
CHERR Channel error	Dute	D:4 7 0
		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
CH0ERR CH3ERR Channel-specific	<b>Byte</b> 0	<ul> <li>Bit 7 0</li> <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>
	-	<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	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> </ul>
Channel-specific	-	<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>
Channel-specific CH4ERR CH7ERR	0 Byte	Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved Bit 7 0
Channel-specific CH4ERR CH7ERR reserved	0 <b>Byte</b> 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> Bit 7 0 reserved
Channel-specific CH4ERR CH7ERR	0 <b>Byte</b> 0 <b>Byte</b>	Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> </ul> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> Bit 7 0 Reserved
Channel-specific CH4ERR CH7ERR reserved	0 <b>Byte</b> 0 <b>Byte</b> 03	Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> </ul> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> Bit 7 0 Reserved Bit 7 0 Value of the µs ticker at the moment of the diagnostic
Channel-specific CH4ERR CH7ERR reserved	0 <b>Byte</b> 0 <b>Byte</b> 03 μs ticke	Channel-specific error channel x: <ul> <li>Bit 0: set at configuring/parameter assignment error</li> <li>Bit 2 1: reserved</li> </ul> <li>Bit 3: set at short-circuit to ground</li> <li>Bit 7 4: reserved</li> Bit 7 0 Reserved Bit 7 0 Value of the µs ticker at the moment of the diagnostic

032-1BD40 - AO 4x12Bit 0(4)...20mA

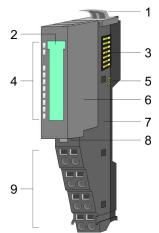
# 4.8 032-1BD40 - AO 4x12Bit 0(4)...20mA

### **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**
- 12bit resolution

#### Structure



#### Locking lever terminal module 1 Labeling strip

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

# **Status indication**

RUN MF

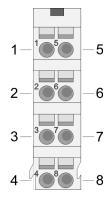
AO 0

AO 1 AO 2 AO 3

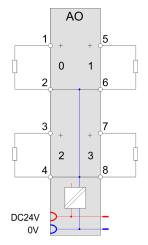
RUN	MF	AO x	Description
green	red	red	
	0	Х	Bus communication is OK
•	0	^	Module status is OK
		V	Bus communication is OK
•	•	Х	Module status reports an error
0	•	х	Bus communication is not possible
0	•	^	Module status reports an error
0	0	Х	Error at bus power supply
Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42
			Error channel x
•	0	•	<ul><li>Error in parameterization</li><li>Wire-break</li></ul>
on: •   o	off:	nks with	2Hz: B   not relevant: X

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

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

032-1BD40 - AO 4x12Bit 0(4)...20mA > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

# 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	80 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
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

032-1BD40 - AO 4x12Bit 0(4)...20mA > Technical data

Order no.	032-1BD40
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
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

# **Analog Output**

032-1BD40 - AO 4x12Bit 0(4)...20mA > Parameter data

Order no.	032-1BD40
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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>

#### 032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic 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 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 (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas	
•						
0 20mA	23.52mA	32511	7EFFh	overrange	$I = D x \frac{20}{27648}$	
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{1}{27648}$ $D = 27648 x \frac{1}{20}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h			
	Not possible, is limited to 0mA.			underrange		
0 20mA	25.00mA	20480	5000h	overrange	$I = D x \frac{20}{1}$	
Siemens S5 format (41h)	20mA	16384	4000h	nominal range	1 = D x 16384	
	10mA	8192	2000h		I	
	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$	
	Not possible, i	s limited to On	ıA.	underrange		

#### 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 (30h)	12mA	13824	3600h		$D = 27648 \ x \ \frac{I-4}{16}$	
	4mA	0	0000h		16	
	0mA	-6912	E500h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$	
Siemens S5 format (40h)	20mA	16384	4000h	nominal range	$D = 16384 \times \frac{1-4}{16}$	
	12mA	8192	2000h			
	4mA	0	0000h			
	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.

032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic 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

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

032-1BD40 - AO 4x12Bit 0(4)...20mA > Diagnostic data

MODTYP Module infor- mation	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	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	Dute			
	-	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	<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>		

032-1BD70 - AO 4x12Bit ±10V

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.

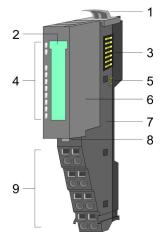
### 4.9 032-1BD70 - AO 4x12Bit ±10V

**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
- Diagnostics function
- 12bit resolution

### Structure



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

### **Status indication**

RUN MF

AO 0 AO 1 AO 2 AO 3

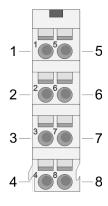
	RUN	MF	AO x	Description
	green	red	red	
	•	0	x	Bus communication is OK Module status is OK
	•	•	х	Bus communication is OK Module status reports an error
	0	•	Х	Bus communication is not possible Module status reports an error
	0	0	Х	Error at bus power supply
	х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42

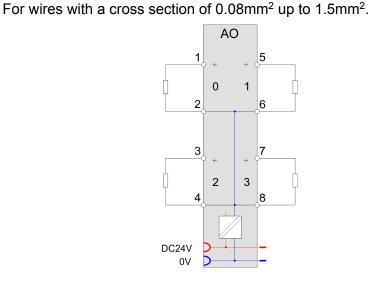
### **Analog Output**

032-1BD70 - AO 4x12Bit ±10V

RUN	MF	AO x	Description	
			Error channel x	
•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>	
on: ●   off: ○   blinks with 2Hz: B   not relevant: X				

### Pin assignment





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

032-1BD70 - AO 4x12Bit ±10V > Technical data

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

### 4.9.1 Technical data

	032-1BD70
Туре	SM 032
Module ID	0506 25E0
Current consumption/power loss	
Current consumption from backplane bus	60 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	+/-0.3%
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)	-

032-1BD70 - AO 4x12Bit ±10V > Technical data

Order no.	032-1BD70
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
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	-

032-1BD70 - AO 4x12Bit ±10V > Parameter data

Order no.	032-1BD70
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
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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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

### **Analog Output**

032-1BD70 - AO 4x12Bit ±10V > Parameter data

SHORT\_EN Short-cir-Byte Bit 7 ... 0 cuit recognition 0 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 ... 4: reserved In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. **CHxFN** Function number channel x 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

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	27648	
(12h)	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$	
(1211)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$	
	-5V	-13824	CA00h			
	-10V	-27648	9400h			
	-11.76V	-32512	8100h	underrange		
±10V	12.5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens S5	10V	16384	4000h	nominal range	16384	
format (22h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
(2211)	0V	0	0000h		$D = 10384 \times \frac{10}{10}$	
	-5V	-8192	E000h			
	-10V	-16384	C000h			
	-12.5V	-20480	B000h	underrange		

032-1BD70 - AO 4x12Bit ±10V > Diagnostic data

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas	
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$	
Siemens	10V	27648	6C00h	nominal range	27648	
S7 format	5V	13824	3600h		D 27(49 U	
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$	
	Not possible, i	s limited to 0V	•	underrange		
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens	10V	16384	4000h	nominal range		
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
	0V	0	0000h		$D = 10384 \ x \ \overline{10}$	
	Not possible, i	s limited to 0V		underrange		

### 0 ... 10V

### 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.

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

032-1BD70 - AO 4x12Bit ±10V > Diagnostic data

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
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR\_A Diagnostic

### Byte Bit 7 ... 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>	2,10	
Bit 7: set at error in parameterization	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> </ul>

MODTYP	Module	infor-
mation		

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	Duto	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 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		
Chamler-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>		
CH4ERR CH7ERR reserved	Byte	Bit 7 0		
16361760	0	reserved		
DIAG_US µs ticker	Byte	Bit 7 0		
	03	Value of the $\mu$ s ticker at the moment of the diagnostic		
		SLIO module there is a timer ( $\mu$ s ticker). With PowerON the carts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.		

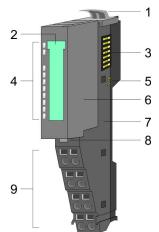
#### 4.10 032-1CB30 - AO 2x16Bit 0...10V

### **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
- **Diagnostics function**
- 16bit resolution

### Structure



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

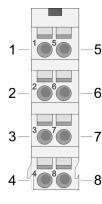
1

### **Status indication**

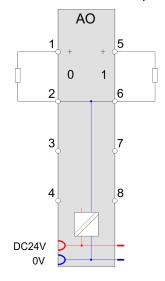
	RUN	MF	AO x	Description
RUN — 1 MF — 1	green	red	red	
AQ 0 — I	•	0	Х	Bus communication is OK
AO 1 — 📕 💶	•	Ũ	Λ	Module status is OK
		•	Х	Bus communication is OK
	• • ×		^	Module status reports an error
	0	•	х	Bus communication is not possible
	0	·	~	Module status reports an error
	0	0	Х	Error at bus power supply
	х	В	Х	Error in configuration
				Error channel x
	•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>
	on: •   c	off:	nks with :	2Hz: B   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

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

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

## 4.10.1 Technical data

Order no.	032-1CB30
Туре	SM 032
Module ID	0507 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 κΩ
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. 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

032-1CB30 - AO 2x16Bit 0...10V > Technical data

Order no.	032-1CB30
Substitute value can be applied	no
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 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	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

032-1CB30 - AO 2x16Bit 0...10V > Parameter data

Order no.	032-1CB30
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes

### 4.10.2 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.

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

**CHxFN** Function

number channel x

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>

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. 032-1CB30 - AO 2x16Bit 0...10V > Diagnostic data

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens	10V	27648	6C00h	nominal range	27648
S7 format	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(10h)	0V	0	0000h		$D = 27048 \ x \ \overline{10}$
	Not possible, i	s limited to 0V	•	underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range	16384
S5 format	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
(20h)	0V	0	0000h		$D = 10384 x \frac{10}{10}$
	Not possible, i	s limited 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.

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

032-1CB30 - AO 2x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
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 infor- mation	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>

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

CHTYP Channel type

Byte	Bit 7 0
Dyto	

0

- Bit 6 ... 0: Channel type
  - 70h: Digital input
    - 71h: Analog input
    - 72h: Digital output
    - 73h: Analog output
    - 74h: Analog input/-output
    - 76h: Counter
  - Bit 7: reserved

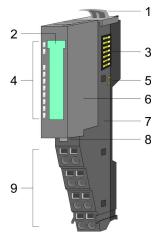
032-1CB40 - AO 2x16Bit 0(4)...20mA

NUMBIT Diagnostic bits	Dute	D:4 7 0			
	-	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	Byte	Bit 7 0			
Channel specific	0	Channel-specific error channel x:			
	Ū	<ul> <li>Bit 0: set at configuring/parameter assignment error</li> </ul>			
		Bit 2 1: reserved			
		<ul> <li>Bit 3: set at short-circuit to ground</li> <li>Dit 7 At researced</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 µs ticker at the moment of the diagnostic			
	µs ticke				
		SLIO module there is a timer ( $\mu$ s ticker). With PowerON the arts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.			
4.11 032-1CB40 - AO	2x16E	3it 0(4)20mA			
Properties		ectronic module has 2 outputs with parameterizable functions.			
	The channels of the module are electrically isolated from the back- plane bus. In addition, the channels are isolated to the DC 24V power				
		by means of DC/DC converter.			
	2 analog outputs				

- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- Diagnostics function
- 16bit resolution

032-1CB40 - AO 2x16Bit 0(4)...20mA

### Structure



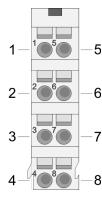
- Locking lever terminal module Labeling strip Backplane bus LED status indication DC 24V power section supply Electronic module
- 1 2 3 4
- 5 6 7
- Terminal module
- . 8 9 Locking lever electronic module
- Terminal

### **Status indication**

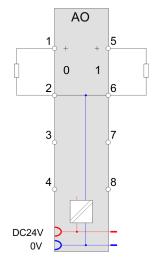
	RUN	MF	AO x	Description
RUN —	green	red	red	
MF — 📕				
		0	х	Bus communication is OK
	•		^	Module status is OK
			х	Bus communication is OK
	•	•	^	Module status reports an error
	0	•	х	Bus communication is not possible
	0			Module status reports an error
	0	0	Х	Error at bus power supply
	x	В	Х	Error in configuration
				Error channel x
	•	0	•	<ul><li>Error in parameterization</li><li>Wire-break</li></ul>
	on: •   c	off:	nks with	2Hz: B   not relevant: X

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* 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

Output area

## 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	$\checkmark$
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

### Analog Output

032-1CB40 - AO 2x16Bit 0(4)...20mA > Technical data

Order no.	032-1CB40
Conversion time	400 µs all channels
Substitute value can be applied	no
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 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	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	

032-1CB40 - AO 2x16Bit 0(4)...20mA > Parameter data

Order no.	032-1CB40
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

### 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	Bit 0: Wire-break recognition channel 0 (1: on)
	Bit 1: Wire-break recognition channel 1 (1: on)
	Bit 7 2: reserved

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 (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA Siemens S7 format (31h)	23.52mA 20mA 10mA 0mA	32511 27648 13824 0	7EFFh 6C00h 3600h 0000h	overrange nominal range	$I = D \ x \ \frac{20}{27648}$ $D = 27648 \ x \ \frac{I}{20}$
	Not possible,	s limited to On	ıA.	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$I = D x \frac{20}{16384}$
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384}$
S5 format	10mA	8192	2000h		I
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, i	s limited to On	ıA.	underrange	

### 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	27648
S7 format	12mA	13824	3600h		$D = 27648 \ x \ \frac{I-4}{16}$
(30h)	4mA	0	0000h		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	16384
S5 format	12mA	8192	2000h		$D = 16384 \ x \ \frac{I-4}{16}$
(40h)	4mA	0	0000h		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.

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 infor- mation	Byte	Bit 7 0

By By	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>

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>
		Bit 4: set at internal communication error
		Bit 7 5: reserved
CHTYP Channel type	Byte	Bit 7 0
	0	Bit 6 0: Channel type
		<ul> <li>70h: Digital input</li> <li>71h: Analog input</li> </ul>
		<ul> <li>72h: Digital output</li> </ul>
		<ul> <li>73h: Analog output</li> <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	Dute	
	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	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x
		Bit 0: set at configuring/parameter assignment error
		<ul> <li>Bit 3 1: reserved</li> <li>Bit 4: set at wire-break</li> </ul>
		<ul> <li>Bit 7 5: reserved</li> </ul>
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
	U	10001104

032-1CB70 - AO 2x16Bit ±10V

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.

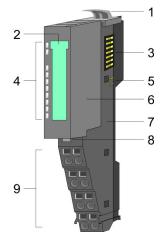
### 4.12 032-1CB70 - AO 2x16Bit ±10V

**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
- Diagnostics function
- 16bit resolution

#### Structure



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

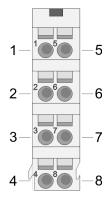
#### **Status indication**

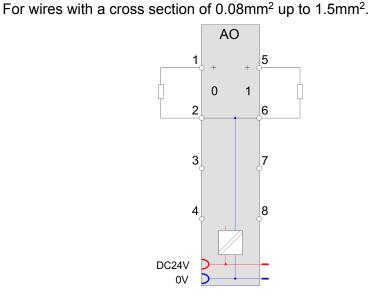
	RUN	MF	AO x	Description
	green	red	red	
MF — 🚺 [				
AO 0 — 🛯 📃	-	0	х	Bus communication is OK
AO 1 — 📕 📖	•	• • • •		Module status is OK
	-	•	х	Bus communication is OK
8 — I	•	•	~	Module status reports an error
	0	•	х	Bus communication is not possible
	0	•	^	Module status reports an error
	0	0	Х	Error at bus power supply
	x	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42

032-1CB70 - AO 2x16Bit ±10V

RUN	MF	AO x	Description	
			Error channel x	
•	0	•	<ul><li>Error in parameterization</li><li>Overload, short-circuit</li></ul>	
on: ●   off: ○   blinks with 2Hz: B   not relevant: X				

### Pin assignment





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

032-1CB70 - AO 2x16Bit ±10V > Technical data

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

### 4.12.1 Technical data

Order no.	032-1CB70
Туре	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	-

### Analog Output

032-1CB70 - AO 2x16Bit ±10V > Technical data

Order no.	032-1CB70
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
Substitute value can be applied	no
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	✓
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

032-1CB70 - AO 2x16Bit ±10V > Parameter data

Order no.	032-1CB70
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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	
	cuit recognition channel 0 (1:on) cuit recognition channel 1 (1:on) rved

032-1CB70 - AO 2x16Bit ±10V > 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 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

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 (12h)	10V	27648	6C00h	nominal range	27648
	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$
(1211)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens S5 format	10V	16384	4000h	nominal range	16384
(22h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
(2211)	0V	0	0000h		$D = 10384 \times \frac{10}{10}$
	-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	$U = D \times \frac{10}{10}$	
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$	
S7 format	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$	
(10h)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$	
	Not possible, i	s limited to 0V	•	underrange		
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens	10V	16384	4000h	nominal range	16384	
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
	0V	0	0000h		$D = 10384 x \frac{10}{10}$	
	Not possible, i	s limited 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.

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

032-1CB70 - AO 2x16Bit ±10V > Diagnostic data

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 infor- mation	Byte	Bit 7 0			
	O Dyte	Bit 3 0: module class			
	0	<ul> <li>Dit 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>			
NUMPIT Discreatio bito	_				
NUMBIT Diagnostic bits	-	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>			

032-1CD30 - AO 4x16Bit 0...10V

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> </ul>			
		<ul><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 (µs ticker). With PowerON timer starts counting with 0. After 2 <sup>32</sup> -1µs the timer starts with				

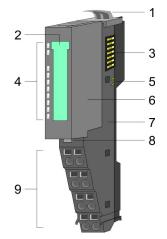
#### 4.13 032-1CD30 - AO 4x16Bit 0...10V

### **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
- **Diagnostics function**
- 16bit resolution

### Structure



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

### Analog Output

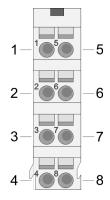
032-1CD30 - AO 4x16Bit 0...10V

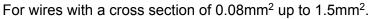
### Status indication

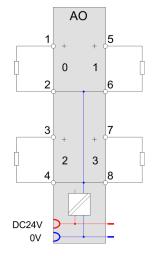
	RUN	MF	AO x	Description		
RUN — MF — AO 0 — AO 1 — AO 2 — AO 3 —	green	red	red			
	•	0	Х	Bus communication is OK		
				Module status is OK		
	•	•	Х	Bus communication is OK		
				Module status reports an error		
	0	•	х	Bus communication is not possible		
				Module status reports an error		
	0	0	Х	Error at bus power supply		
	Х	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42		
				Error channel x		
	•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>		
on: $\bullet$   off: $\circ$   blinks with 2Hz: B   not relevant: X						

032-1CD30 - AO 4x16Bit 0...10V

# Pin assignment







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

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

032-1CD30 - AO 4x16Bit 0...10V > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

# 4.13.1 Technical data

Order no.	032-1CD30
Туре	SM 032
Module ID	0509 2560
Current consumption/power loss	
Current consumption from backplane bus	60 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	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	-

032-1CD30 - AO 4x16Bit 0...10V > Technical data

Destruction limit against external applied voltage-Settling time for ohmic load160 µsSettling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliednoOutput data size8 ByteStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic interruptnoDiagnostic information read-outyessibleStatus displaygreen LEDGroup error displayred LEDChannel error displayred LEDBetween channels-Between channels of groups to-Between channels of groups to-Max. potential difference between inputs (unit)-Max. potential difference between inputs (unit)-Max. potential difference between inputs and minter (ulso)CT5 V/ AC 60 VMax. potential difference between inputs and minter (ulso)-Max. potential difference between inputs and minter (ulso)-Max. potential difference between inputs and minter (ulso)-Max. potential difference between inputs and minter (ulso)-Insulation tested withDC 500 VDetaices-Input bytes0Output bytes-Input bytes-Input bytes-Input bytes-Input bytes-Input	Order no.	032-1CD30
Settling time for capacitive load1 msSettling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnostics-Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesStatus displaygreen LEDGroup error displayred LEDChannel error displayred LEDBetween channels-Between channels of groups to-Between channels of groups to-Between channels of groups to-Between channels of groups to-Max. potential difference between inputs (utom)-Max. potential difference between inputs (utom)-Max. potential difference between inputs and miner (Uiso)-Max. potential difference between inputs and miner (U		-
Settling time for inductive load-Resolution in bit16Conversion time200 µs all channelsSubstitute value can be appliednoOutput data size8 ByteStatus information, alarms, diagnostics-Status displayyesInterruptsnoProcess alarmnoDiagnostic functionsyesDiagnostic functionsyesStatus displaygreen LEDGroup error displayred LEDChannel error displayred LEDBetween channels-Between channels and backplane bus-Between channels and backplane bus-Between channels and backplane bus-Max. potential difference between inputs (ufform (Uiso)CTS V/ AC 60 VMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)	Settling time for ohmic load	150 µs
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Output data size8 ByteStatus information, alarms, diagnostics9Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsgreen LEDGroup error displayred LEDChannel error displayred LED per channelBetween channels-Between channels of groups to-Between channels and backplane bus·Between channels and power supply·Max. potential difference between inputs (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Maran (Ucm)C500 VMax. potential difference between Minter and butputsC 500 VInsulation tested withDC 500 VInsulation tested withDC 500 V	Conversion time	200 µs all channels
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InterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane busBetween channels and power supplyMax. potential difference between inputs (UCm)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and outputs-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and outputs-Max. potential difference between inputs and puts-Max. potential difference between inputs and putputs-Max. potential difference between inputs and putputs-Insulation tested withDC 500 VDatasizes Input bytes0	Status information, alarms, diagnostics	
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Diagnostic functionsyesDiagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-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 votential difference between inputs and butters-Max. potential difference between inputs and Nana (Ucm)-Max. potential difference between inputs and votential difference between Mana and butters-Max. potential difference between inputs and votential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Mation tested withDC 500 VDatasizes Input bytes0	Process alarm	no
Diagnostics information read-outpossibleSupply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus✓Between channels and power supply✓Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mana (Ucm)DC 75 V/ AC 60 VMax. 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 (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and Mintern (Uiso)C 500 VDatasizes Insulation tested with0	Diagnostic interrupt	no
Supply voltage displaygreen LEDGroup error displayred LEDChannel error displayred LED per channelIsolation-Between channels-Between channels of groups to-Between channels and backplane bus✓Between channels and power supply✓Max. potential difference between rinputs (Ucm)-Max. potential difference between ninputs and Mana (Ucm)-Max. potential difference between ninputs and Mintern (Uiso)-Max. potential difference between ninputs and Nintern (Uiso)-Max. potential difference between Nintern and Nintern (Uiso)DC 500 VDatasizes Insulation tested withO	Diagnostic functions	yes
Group error displayred LEDChannel error displayred LED per channelIsolation-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 (Ucm)DC 75 V/ AC 60 VMax. potential difference between niputs and Mana (Ucm)-Max. potential difference between niputs and Mintern (Uiso)-Max. potential difference between Nintern and Uitputs-DC 500 VDt 500 VDatasizes Input bytes0	Diagnostics information read-out	possible
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IsolationImage: solationBetween 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 (Ucm)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Numern (Uiso)-Max. potential difference between inputs and outputs-Max. potential difference between inputs and outputs-Datasizes Insulation tested withDC 500 VDatasizes Input bytes0	Group error display	red LED
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Between channels and power supply✓Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VInsulation tested withDC 500 VDatasizes-Input bytes0	Between channels of groups to	-
Detention of a porton outputMax. potential difference between circuitsMax. 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)Max. potential difference between Mintern and outputsInsulation tested withDc 500 VDatasizes Input bytesInput bytes	Between channels and backplane bus	$\checkmark$
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Max. potential difference between Mana and Mintern (Uiso)DC 75 V/ AC 60 VMax. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-DatasizesDC 500 VInput bytes0	Max. potential difference between circuits	-
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Mana (Ucm)Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes Input bytes0		DC 75 V/ AC 60 V
Mintern (Uiso)Max. potential difference between Mintern and outputsInsulation tested withDC 500 VDatasizesInput bytes0		-
outputsInsulation tested withDC 500 VDatasizes0Input bytes0		-
Datasizes       Input bytes		-
Input bytes 0	Insulation tested with	DC 500 V
	Datasizes	
Output bytes 8	Input bytes	0
	Output bytes	8

032-1CD30 - AO 4x16Bit 0...10V > Parameter data

Order no.	032-1CD30
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -Slot

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-cir-
cuit reco	Jgnit	tion

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>

#### 032-1CD30 - AO 4x16Bit 0...10V > Diagnostic 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 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

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens	10V	27648	6C00h	nominal range	27648
S7 format	5V	13824	3600h		$D = 27648 \times U$
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, i	s limited to 0V		underrange	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range	16384
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$
	0V	0	0000h		$D = 10384 x \frac{10}{10}$
	Not possible, i	s limited to 0V		underrange	

#### 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.
- IN 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.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
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

В -

0

Byte Bit 7 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 infor- mation	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>

032-1CD30 - AO 4x16Bit 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>
NUMPIT Disancofis 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 04h)
CHERR Channel error	Dute	D:4 7 0
	-	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	<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>
CH4ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US µs ticker	Durte	<b>B</b> # 7 0
	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic
	µs ticke	
	In the S timer s	SLIO module there is a timer ( $\mu$ s ticker). With PowerON the tarts counting with 0. After 2 <sup>32</sup> -1 $\mu$ s the timer starts with 0 again.

032-1CD40 - AO 4x16Bit 0(4)...20mA

#### 4.14 032-1CD40 - AO 4x16Bit 0(4)...20mA

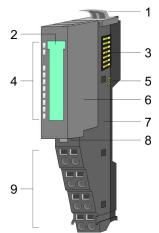
1

# **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



#### Labeling strip Backplane bus

Locking lever terminal module

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

# **Status indication**

RUN MF

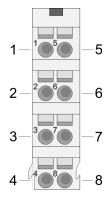
AO 0

AO 1 AO 2 AO 3

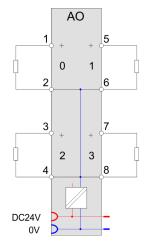
RUN	MF	AO x	Description	
green	red	red		
	0	Х	Bus communication is OK	
•	0	^	Module status is OK	
	-	х	Bus communication is OK	
•	•	^	Module status reports an error	
	_	х	Bus communication is not possible	
0	•	^	Module status reports an error	
0	0	Х	Error at bus power supply	
х	В	Х	Error in configuration	
			Error channel x	
•	0	•	<ul><li>Error in parameterization</li><li>Wire-break</li></ul>	
on: ●   off: ○   blinks with 2Hz: B   not relevant: X				

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

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

032-1CD40 - AO 4x16Bit 0(4)...20mA > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

# 4.14.1 Technical data

Order no.	032-1CD40
Туре	SM 032
Module ID	0509 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%

032-1CD40 - AO 4x16Bit 0(4)...20mA > Technical data

Order no.	032-1CD40
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
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

# **Analog Output**

032-1CD40 - AO 4x16Bit 0(4)...20mA > Parameter data

Order no.	032-1CD40
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	in preparation

## 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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.

# 0 ... 20mA

Output range (funct. no.)	Current	Decimal (D)	Hex	Range	Formulas
<b>x</b>	(I)				
0 20mA	23.52mA	32511	7EFFh	overrange	$I = D x \frac{20}{27648}$
Siemens	20mA	27648	6C00h	nominal range	27648
S7 format	10mA	13824	3600h		I
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible,	is limited to On	ıA.	underrange	
0 20mA	25.00mA	20480	5000h	overrange	$I = D x \frac{20}{16384}$
Siemens	20mA	16384	4000h	nominal range	1 = D x 16384
S5 format (41h)	10mA	8192	2000h		I
	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible, is limited to 0mA.			underrange	

# 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		$D = 27648 \ x \ \frac{I-4}{16}$	
(30h)	4mA	0	0000h		16	
	0mA	-6912	E500h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$I = D x \frac{16}{16384} + 4$	
Siemens S5 format (40h)	20mA	16384	4000h	nominal range	16384	
	12mA	8192	2000h		$D = 16384 \ x \ \frac{I-4}{16}$	
	4mA	0	0000h		16	
	0mA	-4096	F000h	underrange		

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

# 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.

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

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

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 infor-	Dute	D:4 7 0
mation	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	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)

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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 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

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.

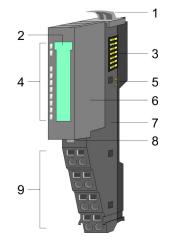
#### 4.15 032-1CD70 - AO 4x16Bit ±10V

#### **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



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

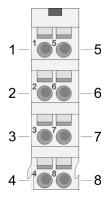
032-1CD70 - AO 4x16Bit ±10V

	RUN	MF	AO x	Description	
	green	red	red		
MF — 🖣					
AO 0 — 💶 📃	•	0	Х	Bus communication is OK	
AO 1 — I AO 2 — I		Ũ	Λ	Module status is OK	
AO 3 –	•	•	х	Bus communication is OK	
		•	Λ	Module status reports an error	
	0	•	Х	Bus communication is not possible	
	<i>C</i>	•	Λ	Module status reports an error	
	0	0	Х	Error at bus power supply	
	x	В	Х	Error in configuration & Chapter 2.7 'Trouble shooting - LEDs' on page 42	
				Error channel x	
	•	0	•	<ul><li>Overload, short-circuit</li><li>Error in parameterization</li></ul>	
	on: $\bullet$   off: $\circ$   blinks with 2Hz: B   not relevant: X				

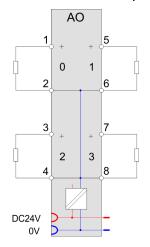
# Status indication

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

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

032-1CD70 - AO 4x16Bit ±10V > Technical data

Addr.	Name	Bytes	Function	IX	SX
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

# 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	60 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	-

# Analog Output

032-1CD70 - AO 4x16Bit ±10V > Technical data

Order no.	032-1CD70
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
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

032-1CD70 - AO 4x16Bit ±10V > Parameter data

Order no.	032-1CD70
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
Storage temperature	-25 °C to 70 °C
Certifications	
UL 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 +  $\ensuremath{\mathsf{EtherCAT}}$ -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>

032-1CD70 - AO 4x16Bit ±10V > 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 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

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	10V	27648	6C00h	nominal range	27648	
format (12h)	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$	
(1211)	0V	0	0000h		$D = 27048 \times \frac{10}{10}$	
	-5V	-13824	CA00h			
	-10V	-27648	9400h			
	-11.76V	-32512	8100h	underrange		
±10V	12.5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens S5 format (22h)	10V	16384	4000h	nominal range	16384	
	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
	0V	0	0000h		$D = 10384 \times \frac{10}{10}$	
	-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		
S7 format	5V	13824	3600h		$D = 27648 \ x \ \frac{U}{10}$	
(10h)	0V	0	0000h		$D = 27048 \ x \ 10$	
	Not possible, is limited to 0V.			underrange		
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$	
Siemens	ens 10V 16384 4000h	nominal range	16384			
S5 format (20h)	5V	8192	2000h		$D = 16384 \ x \ \frac{U}{10}$	
	0V	0	0000h		$D = 10334 x \frac{10}{10}$	
	Not possible, i	s limited 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.

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.

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

032-1CD70 - AO 4x16Bit ±10V > Diagnostic data

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 infor-	_	
mation	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	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

032-1CD70 - AO 4x16Bit ±10V > Diagnostic data

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 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
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

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.