

System SLIO

SM-AIO || Manual HB300 | SM-AIO || en | 23-20 Analog signal modules - SM 03x



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1 General

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1.2 About this manual

Objective and contents This manual describes the

This manual describes the Analog signal modules of the System SLIO.

- It describes the structure, configuration and application.
- The manual is written for users with basic knowledge of automation technology.
- The manual consists of chapters. Each chapter describes a completed topic.
- The following guides are available in the manual:
 - An overall table of contents at the beginning of the manual.
 - References with pages numbers.

Icons Headings



DANGER!

Immediate or likely danger. Personal injury is possible.

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



CAUTION!

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

Supp

Supplementary information and useful tips.

1.3 Safety information

Applications conforming with specifications

The system is constructed and produced for:

- communication and process control
- general control and automation tasks
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle



DANGER!

This device is not certified for applications in

in explosive environments (EX-zone)

Safety information

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

CAUTION!

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

- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware modifications only by properly trained personnel.
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

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

Safety notes for the user

Basics and mounting 2

2.1 Safety notes for the user



Protection against dangerous voltages

- When using System SLIO modules, the user must be protected from touching hazardous voltage.
- You must therefore create an insulation concept for your system that includes safe separation of the potential areas of ELV and hazardous voltage.
- Here, observe the insulation voltages between the potential areas specified for the System SLIO modules and take suitable measures, such as using PELV/SELV power supplies for System SLIO modules.

Handling of electrostatic sensitive modules

The modules are equipped with highly integrated components in MOS technology. These components are highly sensitive to over-voltages that occur, e.g. with electrostatic discharge. The following symbol is used to identify these hazardous modules:



The symbol is located on modules, module racks or on packaging and thus indicates electrostatic sensitive modules. Electrostatic sensitive modules can be destroyed by energies and voltages that are far below the limits of human perception. If a person who is not electrically discharged handles electrostatic sensitive modules, voltages can occur and damage components and thus impair the functionality of the modules or render the modules unusable. Modules damaged in this way are in most cases not immediately recognized as faulty. The error can only appear after a long period of operation. Components damaged by static discharge can show temporary faults when exposed to temperature changes, vibrations or load changes. Only the consistent use of protective devices and responsible observance of the handling rules can effectively prevent malfunctions and failures on electrostatic sensitive modules.

Shipping of modules

Please always use the original packaging for shipping.

Measurement and modification of electrostatic sensitive modules

For measurements on electrostatic sensitive modules the following must be observed:

- Floating measuring instruments must be discharged before use.
- Measuring instruments used must be grounded.

When modifying electrostatic sensitive modules, ensure that a grounded soldering iron is used.



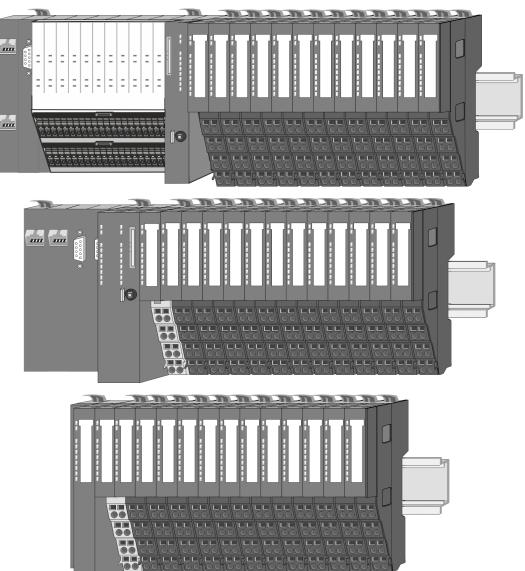
CAUTION!

When working with and on electrostatic sensitive modules, make sure that personnel and equipment are adequately grounded.

2.2 System conception

2.2.1 Overview

The System SLIO is a modular automation system for assembly on a 35mm mounting rail. By means of the periphery modules with 2, 4, 8 and 16 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 supply 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
- 8x periphery modules
- 16x periphery modules
- Power modules
- Accessories



CAUTION!

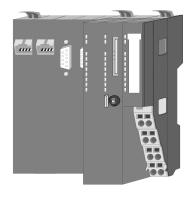
Only Yaskawa modules may be combined. A mixed operation with thirdparty modules is not allowed!

CPU 01xC



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

CPU 01x

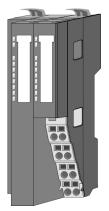


With this CPU 01x, CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24V power section supply for the linked periphery modules is established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

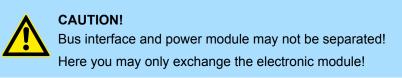


CPU part and power module may not be separated! Here you may only exchange the electronic module!

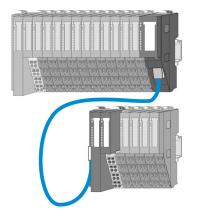
Bus coupler



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 24V 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.



Line extension

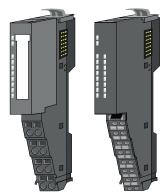


In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension master at each end of a line and the subsequent line has to start with a line extension slave. Master and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



Please note that some modules do not support line extensions due to the system. For more information, please refer to the compatibility list. This can be found in the 'Download Center' of www.yaskawa.eu.com under 'System SLIO Compatibility list'.

Periphery modules



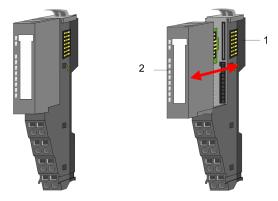
The periphery modules are available in the following 2 versions, whereby of each the electronic part can be replaced with standing wiring:

- 8x periphery module for a maximum of 8 channels.
- 16x periphery module for a maximum of 16 channels.

System conception > Components

8x periphery modules

Each 8x periphery module consists of a terminal and an electronic module.



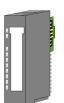
- 1 Terminal module
- 2 Electronic module

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 system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

Electronic module

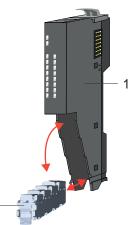


The functionality of a periphery module is defined by the *electronic module*, which is mounted to the terminal module by a sliding mechanism. With an error the defective electronic module may be exchanged for a functional module with standing installation. At the front side there are LEDs for status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

16x periphery modules

Each 16x periphery module consists of an *electronic unit* and a *terminal block*.





- 1 Electronic unit
- 2 Terminal block

System conception > Accessories

Electronic unit



The functionality of a 16x periphery module is defined via the terminal block, which is connected to the *electronic unit* via a secure flap mechanism. In the case of an error you can exchange the defective electronic unit for a functional unit with standing wiring. At the front side there are LEDs for status indication. For easy wiring each electronic unit shows corresponding connection information at the side. The electronic unit provides the slot for the terminal block for the wiring and contains the backplane bus with power supply for the electronic and the connection to the DC 24V power section supply. Additionally the electronic unit has a locking system for fixing it at a mounting rail. By means of this locking system your system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

Terminal block



the module. When mounting the terminal block, it is attached to the bottom of the electronic unit and turned towards the electronic unit until it clicks into place. With the wiring a "push-in" spring-clip technique is used. This allows a quick and easy connection of your signal and supply lines. The clamping off takes place by means of a screwdriver.

The terminal block provides the electrical interface for the signalling and supplies lines of

Power module



In the System SLIO the power supply is established by power modules. These are either integrated to the head module or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined respectively the electronic power supply may be extended with 2A. For better recognition the colour of the power modules are contrasting to the periphery modules.

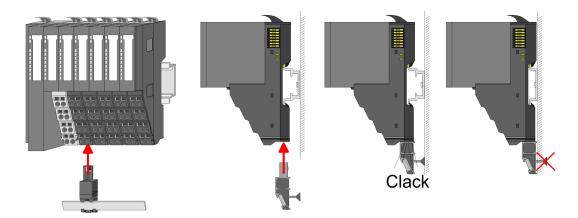
2.2.3 Accessories Shield bus carrier



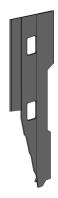
Please note that a shield bus carrier cannot be mounted on a 16x periphery module!

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.

System conception > Accessories



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



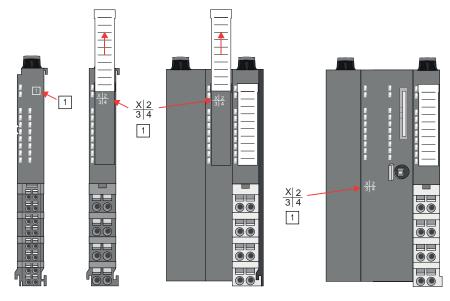
Please note that a coding pin cannot be installed on a 16x periphery module! Here you have to make sure that the associated terminal block is plugged again when the electronics unit is replaced.

There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) 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 electronic module just another electronic module can be plugged with the same encoding.

2.2.4 Hardware revision

```
Hardware revision on the front
```

- The hardware revision is printed on every System SLIO module.
- Since a System SLIO 8x periphery module consists of a terminal and electronic module, you will find a hardware revision printed on each of them.
- Authoritative for the hardware revision of a System SLIO module is the hardware revision of the electronic module. This is located under the labeling strip of the corresponding electronic module.
- Depending on the module type, there are the following 2 variants e.g. to indicate hardware revision 1:
 - With current labelling there is a 1 on the front.
 - With earlier labelling, the 1 is marked with 'X' on a number grid.

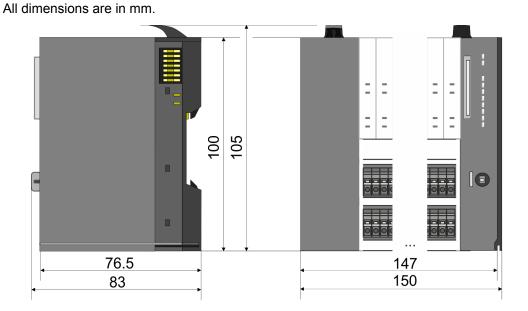


Hardware revision via web server

On the CPUs and some bus couplers, you can check the hardware revision '*HW Revision*' via the integrated web server.

2.3 Dimensions

CPU 01xC



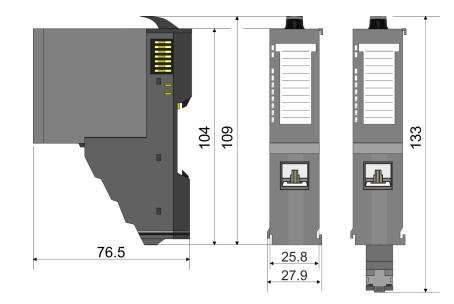
Dimensions

CPU 01x



Bus coupler and line extension slave



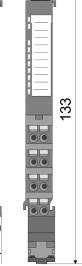


Line extension master

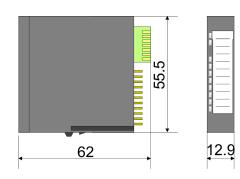
Dimensions

8x periphery module

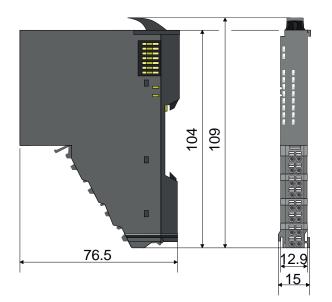
104 109 76.5 <u>12.</u>9 15



Electronic module



16x periphery module



Mounting 8x periphery modules

2.4 Mounting 8x periphery modules

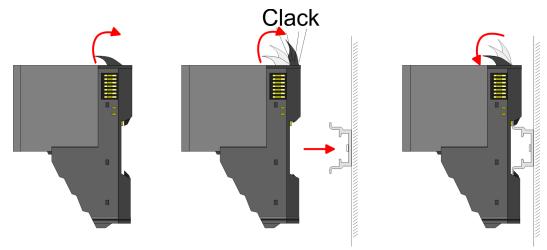


CAUTION!

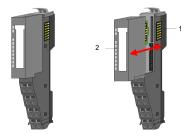
Requirements for UL compliance use

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

There is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



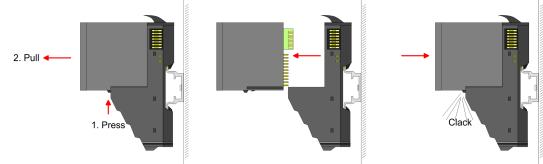
Terminal and electronic module



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

- 1 Terminal module
- 2 Electronic module

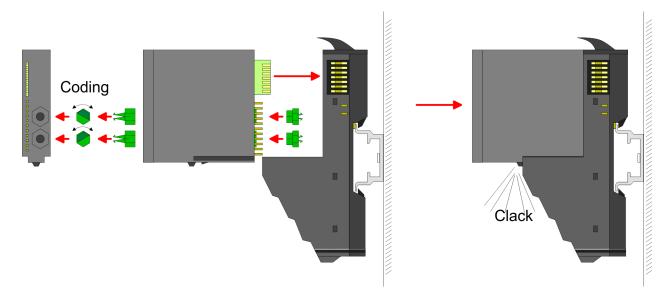
For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



Coding



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



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

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



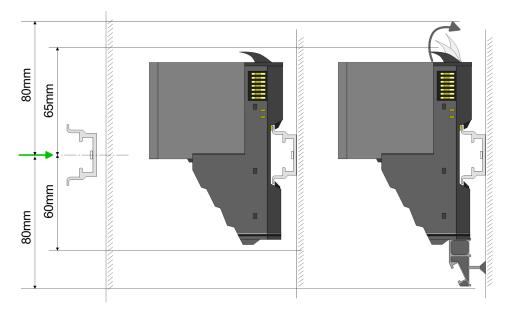
CAUTION!

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

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

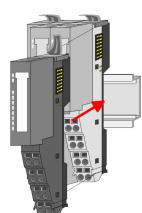
Mounting 8x periphery modules

Mounting periphery modules



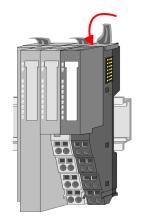
- **1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.
- 2. Mount your head module such as CPU or field bus coupler.
- **3.** Before mounting the periphery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

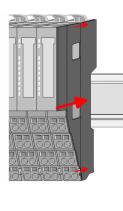


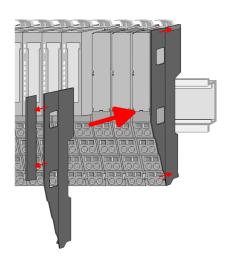


- **4.** For mounting turn the locking lever of the module upwards until it engages.
- **5.** For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.
- **6.** Turn the locking lever of the periphery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

Mounting 16x periphery modules







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

2.5 Mounting 16x periphery modules

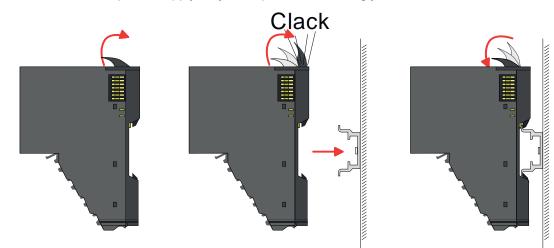


CAUTION!

Requirements for UL compliance use
 Use for power supply exclusively SELV/PELV power supplies.

The System SLIO must be installed and operated in a housing according to IEC 61010-1 9.3.2 c).

There is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



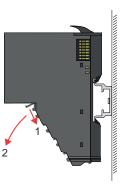
Mounting 16x periphery modules

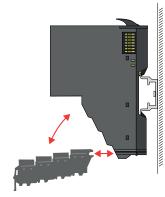
Electronic unit and terminal block

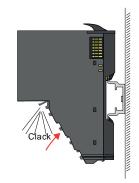
Each 16x periphery module consists of an *electronic unit* and a *terminal block*.

- Electronic unit
 Terminal block

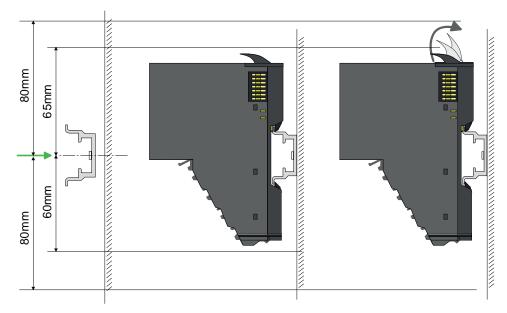
To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock. To mount the terminal block, place it horizontally on the lower side of the electronic unit and push it towards the electronic unit until it clicks into place.





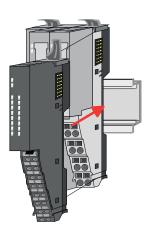


Mounting periphery module

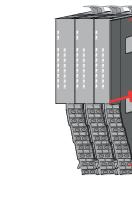


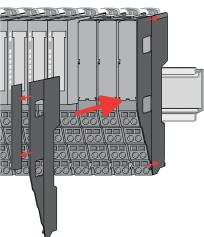
- **1.** Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 80mm below exist.
- **2.** Mount your head module such as CPU or field bus coupler.
- **3.** Before mounting the periphery modules you have to remove the bus cover at the 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 upwards 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.

2.6 Wiring 8x periphery modules

Terminal module terminals



Do not connect hazardous voltages! If this is not explicitly stated in the corresponding module description,

hazardous voltages are not allowed to be connected to the corresponding terminal module!

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



Wiring 8x periphery modules

Data

↓ 10mm

 U_{max}
 240V AC / 30V DC

 I_{max}
 10A

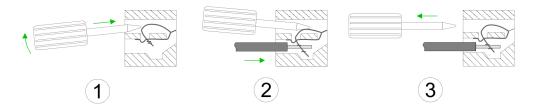
 Cross section
 0.08 ... 1.5mm² (AWG 28 ... 16)

 Stripping length
 10mm

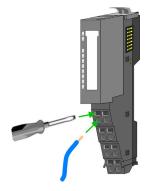
Wiring procedure

$1 - \frac{2}{2} - \frac{2}{3}$

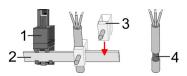
- 1 Pin number at the connector
- 2 Opening for screwdriver
- 3 Connection hole for wire



- **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 0.08mm² up to 1.5mm²
- **3.** By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.



Shield attachment

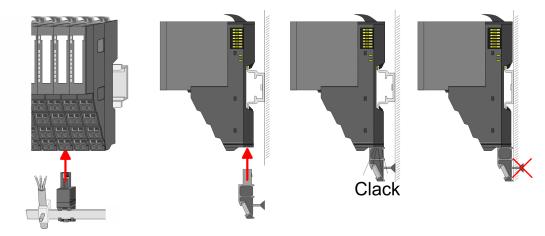


- 1 Shield bus carrier
- 2 Shield bus (10mm x 3mm)
- 3 Shield clamp
- 4 Cable shield

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 8x periphery 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.

Wiring 16x periphery modules



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

2.7 Wiring 16x periphery modules

Terminal block connectors

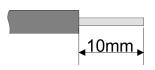


CAUTION! Do not connect hazardous voltages!

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

- The 16x periphery module has a removable terminal block for wiring.
- With the wiring of the terminal block a "push-in" spring-clip technique is used. This allows a quick and easy connection of your signal and supply lines.
- The clamping off takes place by means of a screwdriver.
- Please use copper wire only!

Data



U _{max}	30V DC
l _{max}	10A
Cross section solid wire	0.25 0.75mm ²
Cross section with ferrule	0.14 0.75mm ²
Wire type	CU
AWG	24 16
Stripping length	10mm

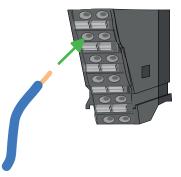
Wiring procedure



- 1 Release area
- 2 Connection hole for wire

Wiring power modules

Insert wire



The wiring happens without a tool.

- **1.** Determine according to the casing labelling the connection position.
- **2.** Insert through the round connection hole of the according contact your prepared wire until it stops, so that it is fixed.
 - ⇒ By pushing the contact spring opens, thus ensuring the necessary contact pressure.

Remove wire



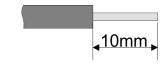
- The wire is to be removed by means of a screwdriver with 2.5mm blade width.
- **1.** Press with your screwdriver vertically at the release button.
 - \Rightarrow The contact spring releases the wire.
- **2.** Pull the wire from the round hole.

2.8 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



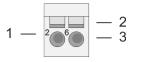
 U_{max}
 30V DC

 I_{max}
 10A

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

 Stripping length
 10mm

Wiring procedure

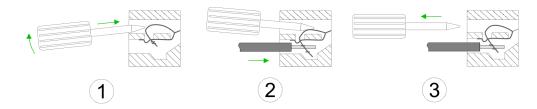


- Pin number at the connector 2
 - Opening for screwdriver

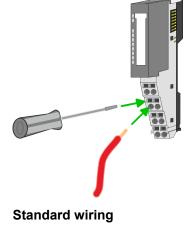
1

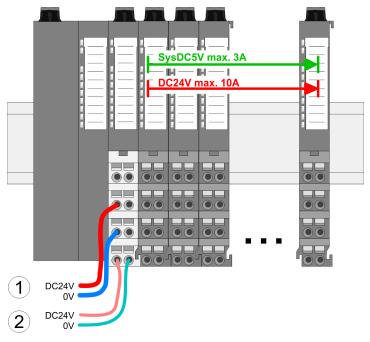
3

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 0.08mm² up to 1.5mm²
- By removing the screwdriver, the wire is securely fixed via the spring contact to the 3. terminal.

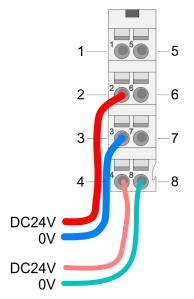




- (1) DC 24V for power section supply I/O area (max. 10A)
- (2) DC 24V for electronic power supply bus coupler and I/O area

Wiring power modules

PM - Power module



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

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

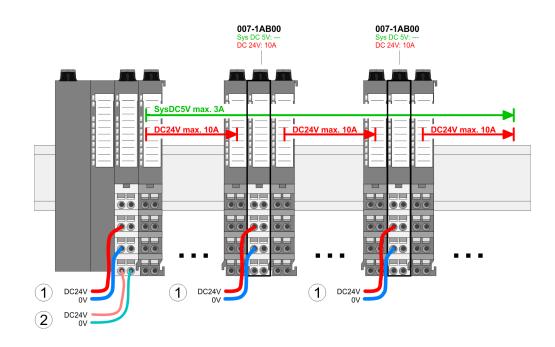
- The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!
- It is recommended to externally protect the electronic power supply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

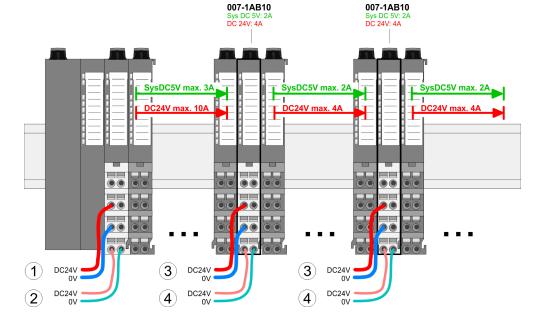
Deployment of the power modules

- If the 10A for the power section supply is no longer sufficient, you may use the power module with the order number 007-1AB00. So you have also the possibility to define isolated groups.
- The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with max. 4A.
- By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards a power module is to be placed again. To secure the power supply, the power modules may be mixed used.



Power module 007-1AB00

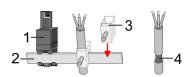
Power module 007-1AB10



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

Wiring power modules

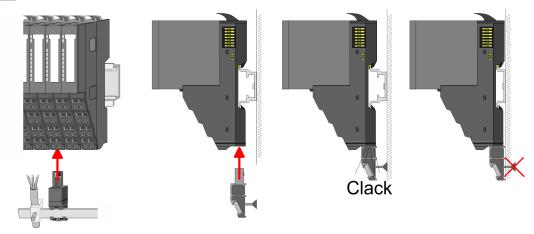
Shield attachment



- 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 8x periphery 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.

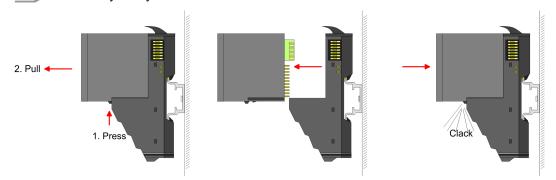
Demounting 8x periphery modules

2.9 Demounting 8x periphery modules

Proceeding

Exchange of an electronic module

1. Power-off your system.



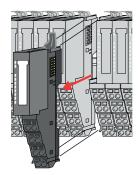
- **2.** For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.
- **3.** For installation plug the new electronic module guided by the strips at the lower side until this engages to the terminal module.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



Easy Maintenance

'Easy Maintenance' means the support for adding and removing electronic modules during operation without having to restart the system. If this is supported by your head module, you will find more detailed information on this in the "Deployment" chapter. & Chap. 2.11 'Easy Maintenance' page 39 Demounting 8x periphery modules

Exchange of a periphery module



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

3.

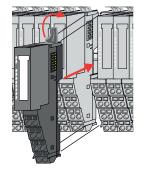


For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module <u>right</u> beside. After mounting it may be plugged again.

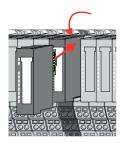
Press the unlocking lever at the lower side of the just mounted right module and pull it forward.

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

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



- **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.



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

Demounting 8x periphery modules

Exchange of a module

1. Power-off your system.

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



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

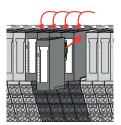
Press the unlocking lever at the lower side of the just mounted right module near the module group and pull it forward.

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

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

5. Pull the module group forward.

- **7.** To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
- 8. Turn all the locking lever downward, again.



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

group

System SLIO

2.10 Demounting 16x periphery modules

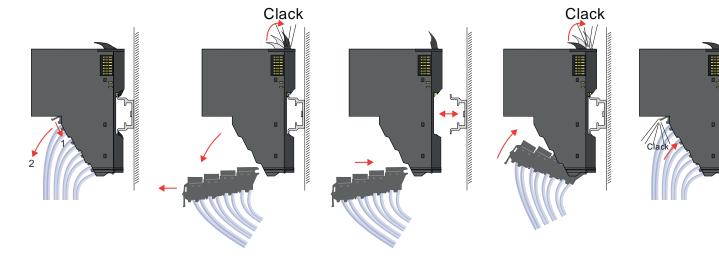
Proceeding

Exchange of an electronic unit

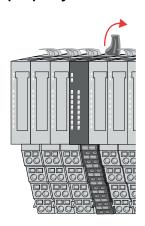
- **1.** Power-off your system.
- **2.** To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock.

To mount the terminal block, place it horizontally on the lower side of the electronic unit and push it towards the electronic unit until it clicks into place.

 \Rightarrow Now you can bring your system back into operation.



Exchange of a 16x periphery module



1. Power-off your system.

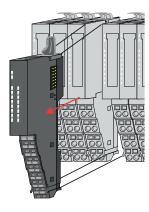
2. Remove if exists the wiring of the module respectively the wired terminal block.



In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.

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

Demounting 16x periphery modules

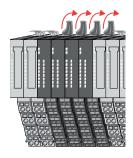


- **4.** Pull the module.
- **5.** For mounting turn the locking lever of the module to be mounted upwards.

6. 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.

- **7.** Turn the locking lever downward, again.
- **8.** Wire your module respectively plug the wired terminal block again.
 - ⇒ Now you can bring your system back into operation.

Exchange of a module group

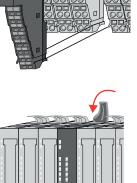


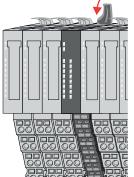
- **1.** Power-off your system.
- **2.** Remove if exists the wiring of the module group respectively the wired terminal blocks.



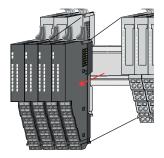
In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.

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



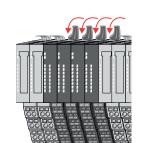


Demounting 16x periphery modules



6. 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.

5. For mounting turn all the locking lever of the module group to be mounted upwards.



7. Turn all the locking lever downward, again.

4. Pull the module group forward.

- **8.** Wire your module group respectively plug the wired terminal blocks again.
 - \Rightarrow Now you can bring your system back into operation.

2.11 Easy Maintenance

Overview

Easy Maintenance means the support for adding and removing an electronic module during operation without having to restart the system. Here the following behavior is shown by the example of a CPU:

- Electronic module is removed
 - The CPU detects a module failure on the backplane bus.
 - Diagnostic message 'System SLIO bus failure' (0x39D0) is triggered.
 - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
 - The SF LED of the CPU lights up.
 - The I/O data of all modules become invalid.
- Identical electronic module is plugged
 - The CPU detects the module return on the backplane bus.
 - The SF-LED of the CPU gets off.
 - All RUN LEDs on the modules get on and the MF LEDs get off.
 - Diagnostic message 'System SLIO bus recovery' (0x38D0) is triggered.
 - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
 - The I/O data of all modules become valid again.
- Wrong electronic module is plugged
 - The CPU detects the wrong module.
 - Diagnostic message 'System SLIO bus recovery, but expected configuration does not match actual configuration' (0x38D1) is triggered.
 - The SF LED of the CPU remains on.
 - The MF LED of the wrong module flashes.
 - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
 - With the exception of the wrong module, the I/O data of all modules become valid again.



CAUTION!

Please note that only electronic modules may be exchanged during operation! Replacing an 8x or 16x periphery module during operation can damage the module and the system!



Please note that the CPU switches to STOP, if there is no OB 86 configured when adding or removing System SLIO modules! Trouble shooting - LEDs

RUN

MF

RUN 💭 RUN

MF

MF

RUN

MF

2.12 Trouble shooting - LEDs

General

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

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

Sum current of the electronic power supply exceeded



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

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

Remedy: As soon as the sum current of the electronic power supply is exceeded, always place the power module 007-1AB10. *Chap. 2.8 Wiring power modules' page 28*

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.

RUN

MF

RUN

MF

Remedy: Match configuration and hardware structure.

RUN

MF

RUN 📙 RUN

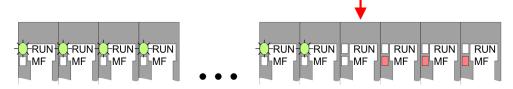
MF

MF

RUN

MF

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.

2.13 Industrial security and installation guidelines

2.13.1 Industrial security in information technology

Latest version	This chapter can also be found as a guide <i>'IIndustrial IT Security'</i> at <u>www.yaskawa.eu.com</u>							
Hazards	The topic of data security and access protection has become increasingly important in the industrial environment. The increased networking of entire industrial systems to the network levels within the company together with the functions of remote maintenance have all served to increase vulnerability. Hazards can arise from:							
	 Internal manipulation such as technical errors, operating and program errors and deliberate program or data manipulation. External manipulation such as software viruses, worms and Trojans. Human carelessness such as password phishing. 							
Precautions	The most important precautions to prevent manipulation and loss of data security in the industrial environment are:							
	 Encrypting the data traffic by means of certificates. Filtering and inspection of the traffic by means of VPN - "Virtual Private Networks". Identification of the user by "Authentication" via save channels. Segmenting in protected automation cells, so that only devices in the same group can exchange data. Deactivation of unnecessary hardware and software. 							
Further Information	You can find more information about the measures on the following websites:							
	 Federal Office for Information Technology <u>www.bsi.bund.de</u> Cybersecurity & Infrastructure Security Agency <u>us-cert.cisa.gov</u> VDI / VDE Society for Measurement and Automation Technology <u>www.vdi.de</u> 							

Industrial security and installation guidelines > Industrial security in information technology

- 2.13.1.1 **Protection of hardware and applications**
- Precautions
- Do not integrate any components or systems into public networks.
 - Use VPN "Virtual Private Networks" for use in public networks. This allows you to control and filter the data traffic accordingly.
- Always keep your system up-to-date.
 - Always use the latest firmware version for all devices.
 - Update your user software regularly.
- Protect your systems with a firewall.
 - The firewall protects your infrastructure internally and externally.
 - This allows you to segment your network and isolate entire areas.
- Secure access to your plants via user accounts.
 - If possible, use a central user management system.
 - Create a user account for each user for whom authorization is essential.
 - Always keep user accounts up-to-date and deactivate unused user accounts.
- Secure access to your plants via secure passwords.
 - Change the password of a standard login after the first start.
 - Use strong passwords consisting of upper/lower case, numbers and special characters. The use of a password generator or manager is recommended.
 - Change the passwords according to the rules and guidelines that apply to your application.
- Deactivate inactive communication ports respectively protocols.
 - Only the communication ports that are used for communication should be activated.
 - Only the communication protocols that are used for communication should be activated.
- Consider possible defence strategies when planning and securing the system.
 - The isolation of components alone is not sufficient for comprehensive protection. An overall concept is to be drawn up here, which also provides defensive measures in the event of a cyber attack.
 - Periodically carry out threat assessments. Among others, a comparison is made here between the protective measures taken and those required.
- Limit the use of external storage media.
 - Via external storage media such as USB memory sticks or SD memory cards, malware can get directly into a system while bypassing a firewall.
 - External storage media or their slots must be protected against unauthorized physical access, e.g. by using a lockable control cabinet.
 - Make sure that only authorized persons have access.
 - When disposing of storage media, make sure that they are safely destroyed.
- Use secure access paths such as HTTPS or VPN for remote access to your plant.
- Enable security-related event logging in accordance with the applicable security policy and legal requirements for data protection.

2.13.1.2 Protection of PC-based software

Precautions

Since PC-based software is used for programming, configuration and monitoring, it can also be used to manipulate entire systems or individual components. Particular caution is required here!

- Use user accounts on your PC systems.
 - If possible, use a central user management system.
 - Create a user account for each user for whom authorization is essential.
 - Always keep user accounts up-to-date and deactivate unused user accounts.
- Protect your PC systems with secure passwords.
 - Change the password of a standard login after the first start.
 - Use strong passwords consisting of upper/lower case, numbers and special characters. The use of a password generator or manager is recommended.
 - Change the passwords according to the rules and guidelines that apply to your application.
- Enable security-related event logging in accordance with the applicable security policy and legal requirements for data protection.
- Protect your PC systems by security software.
 - Install virus scanners on your PC systems to identify viruses, trojans and other malware.
 - Install software that can detect phishing attacks and actively prevent them.
- Always keep your software up-to-date.
- Update your operating system regularly.
- Update your software regularly.
- Make regular backups and store the media at a safe place.
- Regularly restart your PC systems. Only boot from storage media that are protected against manipulation.
- Use encryption systems on your storage media.
- Perform security assessments regularly to reduce the risk of manipulation.
- Use only data and software from approved sources.
- Uninstall software which is not used.
- Disable unused services.

- Activate a password-protected screen lock on your PC systems.
- Always lock your PC systems as soon as you leave your PC workstation.
- Do not click any links that come from unknown sources. If necessary ask, e.g. on emails.
- Use secure access paths such as HTTPS or VPN for remote access to your PC system.

2.13.2 Installation guidelines

General The installation guidelines contain information about the interference free deployment of a PLC system. There is the description of the ways, interference may occur in your PLC, how you can make sure the electromagnetic compatibility (EMC), and how you manage the isolation.

What does EMC mean? Electromagnetic compatibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interfered respectively without interfering the environment.

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

Industrial security and installation guidelines > Installation guidelines

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

- Electromagnetic fields (RF coupling)
- Magnetic fields with power frequency
- Bus system
- Power supply
- Protected earth conductor

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

There are:

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

Basic rules for EMC

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

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

Isolation of conductors Electrical, magnetically and electromagnetic interference fields are weakened by means of an isolation, one talks of absorption. Via the isolation rail, that is connected conductive with the rack, interference currents are shunt via cable isolation to the ground. Here you have to make sure, that the connection to the protected earth conductor is impedancelow, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area. Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
 - the conduction of a potential compensating line is not possible.
 - analog signals (some mV respectively µA) are transferred.
 - foil isolations (static isolations) are used.
- With data lines always use metallic or metallised plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to your PLC and don't lay it on there again!



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

2.14 General data for the System SLIO

Conformity and approval					
Conformity					
CE	2014/35/EU	Low Voltage Directive			
	2014/30/EU	EMC Directive			
RoHS (EU)	2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment			
UKCA	2016 No. 1101	Electrical Equipment (Safety) Regulations			
	2016 No. 1091	Electromagnetic Compatibility Regulations			
RoHS (UK)	2012 No. 3032	Use of Certain Hazardous Substances			
Approval					
UL	-	Refer to Technical data			

General data for the System SLIO

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

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

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

General data for the System SLIO > Use in difficult operating conditions

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

1) 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.

2.14.1 Use in difficult operating conditions



Without additional protective measures, the products must not be used in locations with difficult operating conditions; e.g. due to:

- dust generation
- chemically active substances (corrosive vapors or gases)
- strong electric or magnetic fields

System SLIO product variants for extended application range

2.15 System SLIO product variants for extended application range

The System SLIO product variants listed below only differ from the basic modules only in the extended temperature range and the use under condensation. All other data correspond to those of the basic modules. Information on structure and configuration can be found in the manuals for the basic modules in the *'Download Center'* of *www.yaskawa.eu.com*



Please note that the product variants listed here may only be operated in combination with one another on the backplane bus! Mixed operation is not possible!

Basic modules	Product variants	Description
053-1PN01	053-1PN01-C	IM - 053-1PN01 - interface module PROFINET
021-1BF00	021-1BF00-C	SM 021 - digital input - 8xDI - DC 24V
022-1BF00	022-1BF00-C	SM 022 - digital output - 8xDO - DC 24V 0.5A
031-1CD30	031-1CD30-C	SM 031 - analog input - 4xAI - 16bit 0 10V
031-1BD80	031-1BD80-C	SM 031 - analog input - 4xAI - 16bit R/RTD
032-1CD30	032-1CD30-C	SM 032 - analog output - 4xAI - 16bit 0 10V

Environmental conditions according to EN 61131-2 for System SLIO basic modules

Climatic		
Storage / transport	EN 60068-2-14	-25+70°C
Operation		
Horizontal installation hanging	EN 61131-2	0+60°C
Horizontal installation lying	EN 61131-2	0+55°C
Vertical installation	EN 61131-2	0+50°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 1095%)
Pollution	EN 61131-2	Degree of pollution 2

Environmental conditions according to EN 61131-2 for System SLIO product variants

Climatic		
Storage / transport	EN 60068-2-14	-25+70°C
Operation		
Horizontal installation hanging	EN 61131-2	-25 + 60 ° C
Horizontal installation lying	EN 61131-2	-25+55°C
Vertical installation	EN 61131-2	-25 + 50 ° C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 1095%)
Climate	GS 95024-3-1:2010	Condensation
Pollution	EN 61131-2	Degree of pollution 2

3 Analog input

3.1 General

```
Cables for analog signals
```

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

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

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



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

ParameterizationThe parameterization via CPU, PROFIBUS and PROFINET happens by means of record
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 respec-
tively EtherCAT are listed.

Diagnostic functions

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

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

Alternated blinking of the channel error LEDs

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

3.2 Analog value

Representation of analog values

Analog values are exclusively processed in a binary format. For this the analog module transforms every process signal into a digital value and transfers this as word. The analog values are displayed as a fixed-point number in the two's complement.

Resolution		Analog value														
		High byte (byte 0)								Low byte (byte 1)						
Bit number	15	14	13	12	12 11 10 9 8 7 6 5 4 3 2 1									0		
Value	SG	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	27	2 ⁶	2 ⁵	24	2 ³	2 ²	2 ¹	2 ⁰
12Bit	SG						Measu	iring valu	le					0	0	0
15Bit	SG								Measurir	ng value						
Resolution Sign bit (S0		With a resolution of 12bit plus sign bit, the not used low value positions (3bits) are filled with "0".														
	<i></i>	Here it is essential: ■ Bit 15 = "0": → positive value ■ Bit 15 = "1": → negative value														
Behavior a	t error	error As soon as a measured value exceeds the overdrive region respectively falls below the underdrive region, the following value is issued:														
				 Measuring value > end of overdrive region: 32767 (7FFFh) Measuring value < end of underdrive region: 												
						(8000) Neteriza	n) Ition err	or the	value 3	2767 (7	7FFFh)	is issue	ed.			

3.3 Measuring ranges and function numbers

General

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

The here listed formulas allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range and vice versa.

Voltage

-80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
-80 80mV	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{100}$	
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27048 \cdot \frac{1}{80}$	
(11h)	0V	0	0000h		0.0	
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$	
	-94.07mV	-32512	8100h	underrange	27048	
-80 80mV	100mV	20480	5000h	overrange	D 16294 U	
Siemens S5 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$	
(21h)	0V	0	0000h		0.0	
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$	
	-100mV	-20480	B000h	underrange	10384	

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
0 10V	11.76V	32511	7EFFh	overrange	D = 27648 U	
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$	
(10h)	5V	13824	3600h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$	
	-1.76V	-4864	ED00h	underrange	27070	
0 10V	12.5V	20480	5000h	overrange	D = 16294 U	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$	
(20h)	5V	8192	2000h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$	
	-2V	-3277	F333h	underrange	10384	

±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D = 27648 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h	U = L	$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27040
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		10384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

Current

0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 27649 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		20
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	27048
0 20mA	25.00mA	20480	5000h	overrange	D IG204 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	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 16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

0 ... 20mA / 4KM format

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	20.457mA	4095	0FFFh	overrange	D (000 I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{I}{20}$
(3Fh)	10mA	2000	07D0h		
	0mA	0	0000h		$I = D \cdot \frac{20}{4000}$
				underrange	4000

Resistance

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
2 wire: PT100	+1000°C	+10000	overrange
(50h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: PT1000	+1000°C	+10000	overrange
(51h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
2 wire: NI100	+295°C	+2950	overrange
(52h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI1000	+295°C	+2950	overrange
(53h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI120 ¹	+400°C	+4000	overrange
(54h)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	underrange
3 wire: PT100	+1000°C	+10000	overrange
(58h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: PT1000 (59h)	+1000°C	+10000	overrange
	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
3 wire: NI100	+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
3 wire: NI120 ¹	+400°C	+4000	overrange
(5Ch)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	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

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
(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
wire: NI120 ¹	+400°C	+4000	overrange
64h)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	underrange
2 wire: 0 60Ω			overrange
70h)	0 60Ω	0 32767	nominal range
			underrange
2 wire: 0 600 Ω			overrange
71h)	0 600Ω	0 32767	nominal range
			underrange
wire: 0 3000Ω			overrange
72h)	0 3000Ω	0 32767	nominal range
			underrange
3 wire: 0 60Ω			overrange
(78h)	0 60Ω	0 32767	nominal range
			underrange
3 wire: 0 600Ω			overrange
(79h)	0 600Ω	0 32767	nominal range
			underrange
$3 \text{ wire: } 0 \dots 3000 \Omega$			overrange
7Ah)	0 3000Ω	0 32767	nominal range
			underrange
wire: 0 60Ω			overrange
(80h)	0 60Ω	0 32767	nominal range
			underrange
$1 \text{ wire: } 0 \dots 600 \Omega$			overrange
81h)	0 600Ω	0 32767	nominal range
			underrange
			-

4 wire: 0 3000Ω overrange (82h) 0 3000Ω 0 32767 nominal range underrange 2 wire: 0 60Ω overrange (90h) overrange 2 wire: 0 60Ω overrange (90h) 0 60Ω 0 600Ω nominal range 2 wire: 0 60ΩΩ underrange 2 wire: 0 60ΩΩ underrange (91h) 0 60ΩΩ 0 60ΩΩ nominal range (92h) underrange (92h) overrange (92h) overrange (92h) overrange (98h) overrange (98h) underrange (99h) underrange (99h) underrange <td< th=""></td<>
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
2 wire: 060Ω overrange (90h) 060Ω 0600 nominal range underrange 2 wire: 0600Ω overrange (91h) $$ overrange 0600Ω 0600Ω nominal range $(91h)$ 0600Ω 0600Ω nominal range $2 wire: 03000\Omega$ $$ $$ underrange $(92h)$ $$ $$ winderrange $(92h)$ $$ $$ winderrange $(92h)$ $$ $$ winderrange $(98h)$ $$ $$ winderrange $(98h)$ $$ $$ winderrange $(99h)$ $$ $$ wi
$ \begin{array}{ c c c } (90h) & 0 60\Omega & 0 6000 & nominal range \\ & & underrange \\ & & underrange \\ (91h) & & & 0 & 0 & 0 & 0 & 0 & 0 & 0$
underrange 2 wire: 0 600Ω overrange (91h) overrange 2 wire: 0 3000Ω underrange 2 wire: 0 3000Ω underrange 2 wire: 0 3000Ω underrange (92h) overrange (92h) overrange 3 wire: 0 60Ω underrange (98h) overrange (98h) overrange 3 wire: 0 60Ω overrange (99h) underrange (99h) overrange (99h) overrange (99h) overrange (99h) overrange
2 wire: 0 600Ω overrage (91h) 0 600Ω 0 600Ω nominal range 2 wire: 0 3000Ω underrange 2 wire: 0 3000Ω overrange (92h) 0 3000Ω 0 3000Ω nominal range (98h) underrange (98h) 0 60Ω 0 60Ω nominal range (99h) underrange (99h) underrange (99h) underrange (99h) underrange (99h) underrange (99h) 0 600Ω 0 600Ω nominal range
(91h)
$\frac{1}{1-1} = \frac{1}{1-1} = \frac{1}$
2 wire: 0 3000Ω overrange (92h) 0 3000Ω 0 3000Ω nominal range underrange 3 wire: 0 60Ω overrange (98h) 0 60Ω overrange 0 60Ω 0 60Ω nominal range 1 underrange 3 wire: 0 60Ω 0 60Ω nominal range 1 underrange 3 wire: 0 60ΩΩ 0 60ΩΩ nominal range 1 underrange 3 wire: 0 60ΩΩ 0 60ΩΩ overrange (99h) overrange (99h) 0 600Ω 0 60ΩΩ nominal range 1 overrange
(92h) 03000Ω 03000Ω nominal range ··· ··· ··· underrange 3 wire: 060Ω ··· ··· overrange (98h) 060Ω 060Ω nominal range 3 wire: 060Ω ··· 060Ω nominal range (98h) 060Ω 060Ω nominal range 3 wire: 0600Ω ··· ··· underrange (99h) ··· ··· overrange (99h) ··· ··· overrange ··· ··· ··· overrange ··· ··· ··· overrange
underrange 3 wire: 0 60Ω overrange (98h) 0 60Ω 0 60Ω nominal range 3 wire: 0 600Ω underrange 3 wire: 0 600Ω 0 60Ω nominal range (99h) underrange (99h) overrange (underrange (99h) overrange (overrange (underrange
3 wire: 0 60Ω overrange (98h) 0 60Ω 0 600Ω nominal range underrange 3 wire: 0 600Ω underrange 3 wire: 0 600Ω overrange (99h) 0 600Ω overrange (overrange (overrange
(98h) 060Ω 06000 nominal range underrange 3 wire: 0600Ω overrange (99h) 0600Ω overrange overrange (99h) 0600Ω nominal range wire: 0
underrange 3 wire: 0 600Ω overrange (99h) 0 600Ω 0 600Ω nominal range underrange underrange
3 wire: 0 600Ω overrange (99h) 0 600Ω 0 600Ω nominal range 0 600Ω underrange
(99h) 0 600Ω 0 6000 nominal range underrange
underrange
3 wire: 0 3000Ω overrange
(9Ah) 0 3000Ω 0 30000 nominal range
underrange
4 wire: 0 60Ω overrange
(A0h) 0 60Ω 0 6000 nominal range
underrange
4 wire: 0 600Ω overrange
(A1h) 0 600Ω 0 6000 nominal range
underrange
4 wire: 0 3000Ω overrange
(A2h) 0 3000Ω 0 30000 nominal range
underrange
2 wire: 0 60Ω 70.55Ω 32511 overrange
(D0h) 0 60Ω 0 27648 nominal range
underrange
2 wire: 0 600Ω 705.5Ω 32511 overrange
(D1h) 0 600Ω 0 27648 nominal range

(D2h)	Measuring range (funct. no.)	Measuring value	Signal range	Range
(D2h)				underrange
Arrow of the second	2 wire: 0 3000 Ω	3528Ω	32511	overrange
A wire: 0 60Ω 70.55Ω 32511 overrange (D8h) 0 60Ω 0 27648 nominal range underrange 3 wire: 0 60Ω 70.55Ω 32511 overrange 3 wire: 0 60ΩΩ 70.55Ω 32511 overrange 3 wire: 0 60ΩΩ 0 27648 nominal range (D9h) 0 60ΩΩ 0 27648 overrange (D4h) 328Ω 32511 overrange (D4h) 0 3000Ω 0 27648 nominal range (D4h) 0 60Ω 0 27648 nominal range (E0h) 70.55Ω 32511 overrange (E0h) 70.55Ω 32511 overrange (E0h) 0 60Ω 0 27648 nominal range (E0h) 70.55Ω 32511 overrange (E1h) 70.55Ω 32511 overrange (E1h) 0 60ΩΩ 0 27648 overrange (E1h) 0 60ΩΩ 0 27648 overrange	(D2h)	0 3000Ω	0 27648	nominal range
(D8h) 060Ω 027648 nominal range underrange 3 wire: 0600Ω 705.5Ω 32511 overrange (D9h) 0600Ω 027648 nominal range (D9h) 0600Ω 027648 overrange (D9h) 3528Ω 32511 overrange (DAh) 3528Ω 32511 overrange (DAh) 03000Ω 027648 overrange (DAh) 0300Ω 027648 overrange (DAh) 0300Ω 027648 overrange (E0h) 060Ω 027648 overrange (E0h) 060Ω 027648 overrange (E0h) 060Ω 027648 overrange (E1h) 060Ω 32511 overrange (E1h) 060Ω 027648 overrange (E1h) 060Ω 027648 overrange (E1h) 060Ω 027648 overrange				underrange
Image: here Image: here Image: here underrange 3 wire: 0 600Ω 705.5Ω 32511 overrange (D9h) 0 600Ω 0 27648 nominal range underrange 3 wire: 0 3000Ω 3528Ω 32511 overrange (DAh) 55Ω 0 27648 nominal range (DAh) 0 3000Ω 0 27648 nominal range (E0h) 70.55Ω 32511 overrange (E0h) 0 60Ω 0 27648 nominal range (E0h) 0 60Ω 0 27648 nominal range underrange underrange (E1h) 70.55Ω 32511 overrange underrange underrange (E1h) 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648 nominal range underrange underrange <td< td=""><td>3 wire: 0 60Ω</td><td>70.55Ω</td><td>32511</td><td>overrange</td></td<>	3 wire: 0 60Ω	70.55Ω	32511	overrange
A wire: 0 600Ω 705.5Ω 32511 overrange (D9h) 0 600Ω 0 27648 nominal range underrange 3 wire: 0 3000Ω 3528Ω 32511 overrange (DAh) 3528Ω 32511 overrange (DAh) 0 3000Ω 0 27648 nominal range (DAh) 70.55Ω 32511 overrange 4 wire: 0 60Ω 70.55Ω 32511 overrange (E0h) 70.55Ω 32511 overrange (E0h) 705.5Ω 32511 overrange (E1h) 705.5Ω 32511 overrange (E1h) 705.5Ω 32511 overrange (E1h) 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648	(D8h)	0 60Ω	0 27648	nominal range
(D9h)				underrange
μ μ	3 wire: 0 600Ω	705.5Ω	32511	overrange
A wire: 0 3000Ω 3528Ω 32511 overrange (DAh) 0 3000Ω 0 27648 nominal range underrange 4 wire: 0 60Ω 70.55Ω 32511 overrange (Ebh) 0 60Ω 0 27648 overrange 20 27648 overrange overrange 4 wire: 0 60Ω 0 60Ω 0 27648 nominal range underrange underrange 4 wire: 0 600Ω 705.5Ω 32511 overrange (E1h) 705.5Ω 32511 overrange (E1h) 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648 nominal range underrange underrange infair ange 20 27648 nominal range infair ange underrange infair ange 20 27648 infair ange infair ange underrange	(D9h)	0 600Ω	0 27648	nominal range
(DAh) 0 3000Ω 0 27648 nominal range 4 wire: 0 60Ω 70.55Ω 32511 overrange (E0h) 0 60Ω 0 27648 nominal range (E1h) 705.5Ω 32511 overrange (E1h) 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648 nominal range (L1h) 0 600Ω 0 600Ω 0 60Ω <td></td> <td></td> <td>underrange</td>				underrange
μ μ	3 wire: 0 3000Ω (DAh)	3528Ω	32511	overrange
4 wire: 0 60Ω 70.55Ω 32511 overrange (E0h) 0 60Ω 0 27648 nominal range 4 wire: 0 600Ω underrange 4 wire: 0 600Ω 705.5Ω 32511 overrange (E1h) 705.5Ω 32511 overrange (E1h) 0 600Ω 0 27648 overrange (E1h) 0 600Ω 0 27648 overrange 4 wire: 0 3000Ω 3528Ω 32511 overrange		0 3000Ω	0 27648	nominal range
(E0h) 0 60Ω 0 27648 nominal range 4 wire: 0 600Ω underrange (E1h) 705.5Ω 32511 overrange 0 600Ω 0 27648 nominal range (E1h) 0 600Ω 0 27648 overrange 4 wire: 0 3000Ω 3528Ω 32511 overrange				underrange
$\frac{1}{1} + \frac{1}{1} + \frac{1}$	4 wire: 0 60Ω (E0h)	70.55Ω	32511	overrange
4 wire: 0 600Ω 705.5Ω 32511 overrange (E1h) 0 600Ω 0 27648 nominal range underrange 4 wire: 0 3000Ω 3528Ω 32511 overrange		0 60Ω	0 27648	nominal range
(E1h) 0 600Ω 0 27648 nominal range underrange 4 wire: 0 3000Ω 3528Ω 32511 overrange				underrange
α α α α α α underrange4 wire: 0 3000Ω3528Ω32511overrange	4 wire: 0 600Ω (E1h)	705.5Ω	32511	overrange
4 wire: 0 3000Ω 3528Ω 32511 overrange		0 600Ω	0 27648	nominal range
, and the second s				underrange
(E2h) 0 3000Ω 0 27648 nominal range	4 wire: 0 3000Ω	3528Ω	32511	overrange
Ŭ	(E2h)	0 3000Ω	0 27648	nominal range
underrange				underrange

1) Supported by 031-BD80 from version 03V54 and 031-1LD80 from version 02V26.

The version information can be found on the outer packaging or via the website of the corresponding head module.

Temperature

Temperature

Measuring range (funct. no.)	Measuring value in °C	Measuring value in °F	Measuring value in K	Range
((0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
Туре Ј:	+14500	26420	17232	overrange
[Fe-Cu-Ni IEC] -210 +1200°C -346 2192°F 63.2 1473.2K (B0h: ext. comp. 0°C)	-2100 +12000	-3460 21920	632 14732	nominal range

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
(C0h: int. comp. 0°C)				underrange
Туре К:	+16220	29516	18952	overrange
[Ni-Cr-Ni]	-2700 +13720	-4540 25016	0 16452	nominal range
-270 +1372°C -454 2501.6°F 0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Туре N:	+15500	28220	18232	overrange
[Ni-Cr-Si]	-2700 +13000	-4540 23720	0 15732	nominal range
-270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Туре Т:	+5400	10040	8132	overrange
[Cu-Cu-Ni]	-2700 +4000	-4540 7520	32 6732	nominal range
-270 +400°C -454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange

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
[PtRh-PtRh] 0 +1820°C	0 +18200 -1200	320 27865 -1840	2732 20932 1532	nominal range underrange
32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)				uncontange
Туре С:	+25000	32766	23432	overrange
[WRe5-WRe26]	0 +23150	320 27865	2732 20932	nominal range
0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре Е:	+12000	21920	14732	overrange
[Ni-Cr - Cu-Ni]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

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

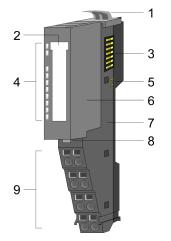
3.4 031-1BB10 - AI 2x12Bit 0(4)...20mA - ISO

Properties

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

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

Structure



Status indication

RUN MF

> AI 0 AI 1

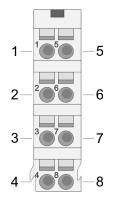
- 1 Locking lever terminal module
- 2 Labeling strip3 Backplane bus
- 3 Backplane bus4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

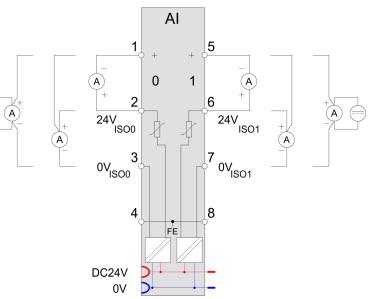
MF red	Al x	Description
	v	Bus communication is OK
	^	Module status is OK
_	v	Bus communication is OK
-	X	Module status reports an error
_	v	Bus communication is not possible
-	^	Module status reports an error
	Х	Error at bus power supply
ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
		Error channel x
	•	 Signal leaves measuring range Error in parameterization Overload/short circuit of the DC 24V_ISO
	 red 	red red red x x x x x x

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

Pin assignment

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





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

Output area

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

System SLIO

3.4.1 Technical data

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

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

Order no.	031-1BB10
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1.15 ms all channels
Noise suppression for frequency	>80dB (UCM<20V)
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	\checkmark
Between channels of groups to	1
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	DC 75 V/ AC 50 V
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V

Analog input

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

System SLIO

Order no.	031-1BB10
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	2
Output voltage (typ)	+24 V (-1.5 V)
Output voltage (rated value)	35 mA
Short-circuit protection	yes, electronic
Binding of potential	corresponding analog input
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
Net weight	65 g
Weight including accessories	65 g
Gross weight	79 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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.

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
SHORT_EN	1	Monitoring of sensor voltage ¹	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	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
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3106h3 107h	07h
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h3 109h	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

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

DIAG_EN Diagnostic inter- rupt	Byte	Bit 7 0
	0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

SHORT_EN Monitoring sensor voltage	Byte	Bit 7 0		
	0	 Bit 0: Monitoring of sensor voltage channel 0 (1: on) Bit 1: Monitoring of sensor voltage channel 1 (1: on) Bit 7 2: reserved 		
LIMIT_EN Limit value monitoring	Byte	Bit 7 0		
	0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 2: reserved 		
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.			

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

0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	23.52mA	32511	7EFFh	overrange	D 07(40 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	2/048
0 20mA	25.00mA	20480	5000h	overrange	D 16294 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$
S5 format	10mA	8192	2000h		20
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	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 16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

0 ... 20mA / 4KM format

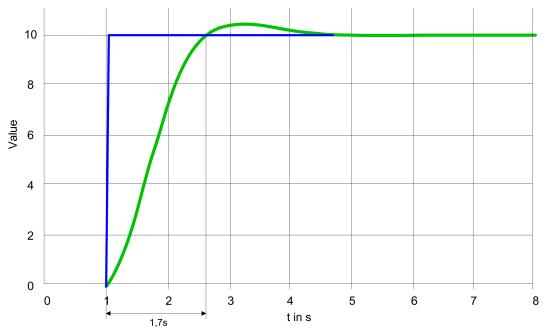
Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	20.457mA	4095	0FFFh	overrange	D 1000 I
4KM format	20mA	4000	0FA0h	nominal range	$D = 4000 \cdot \frac{1}{20}$
(3Fh)	10mA	2000	07D0h		
	0mA	0	0000h		$I = D \cdot \frac{20}{4000}$
				underrange	4000

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 (SFU) of 50Hz respectively 60Hz is 200ms respectively 170ms.

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

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



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 hardware interrupt is initialized.

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering / parameterization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
diagnostics buffer overflow	-	Х	-
Hardware interrupt lost	-	Х	-
Sensor voltage monitoring	-	Х	-

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

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL upper limit over- flow	Byte	Bit 7 0
	0	 Bit 0: Upper limit overflow channel 0 Bit 1: Upper limit overflow channel 1 Bit 7 2: reserved

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

Byte	Bit 7 0
01	16bit µs value at the moment of the interrupt

µs ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

Diagnostic data

PRIT_US µs-Ticker

P

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

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

MODTYP Module information

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

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

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 hardware interrupt lost Bit 7: reserved

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

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

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

CH0ERR / CH1ERR Channel-specific	Byte O	 Bit 7 0 Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 1: raw value above the permissible range Bit 2: raw value below the acceptable range Bit 3: reserved Bit 4: error sensor supply voltage Bit 5: set at hardware interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow
CH2ERR CH7ERR	Byte	Bit 7 0

reserved

0

NUMCH Channels

CHERR Channel error

yte	Bit 7 0
	reserved

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

DIAG_US µs ticker

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

µs ticker

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

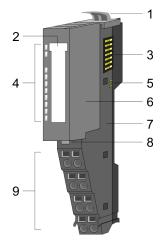
3.5 031-1BB30 - AI 2x12Bit 0...10V

Properties

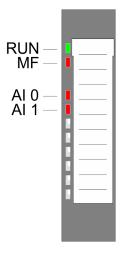
The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

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

Structure



Status indication



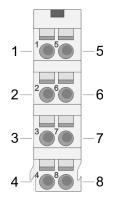
RUN	MF red	Al x	Description		
•		Х	Bus communication is OK		
			Module status is OK		
•	•	х	Bus communication is OK		
			Module status reports an error		
		х	Bus communication is not possible		
			Module status reports an error		
		Х	Error at bus power supply		
Х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40		
			Error channel x		
			Signal leaves measuring rangeError in parameterization		
not relevant: X					

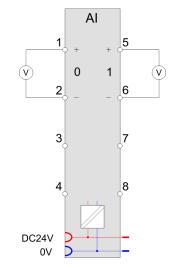
- Locking lever terminal module
- Locking lever to
 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

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

Pin assignment

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





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

I: Input

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

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

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

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

Output area

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

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

3.5.1 Technical data

Order no.	031-1BB30
Туре	SM 031
Module ID	0401 15C3
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	\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	-
Resistance thermometer inputs	-

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

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

Analog input

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

Order no.	031-1BB30
Between channels and backplane bus	\checkmark
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	59 g
Weight including accessories	59 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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.

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D 16284 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

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 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		Byte
 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 parametrization 	t at internal error t at external error t at channel error t at external auxiliary supply missing 5: reserved	0

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

ERR_D Diagnostic

B

Byte	Bit 7 0
)	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

System SLIO

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 5 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the μ s ticker at the moment of the diagnostic
	µs ticker	
		m SLIO module there is a timer (µs ticker). With PowerON the timer starts
	h 0. After 2^{32} -1µs the timer starts with 0 again.	

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

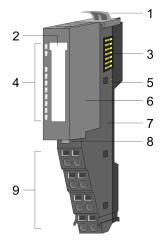
3.6 031-1BB40 - AI 2x12Bit 0(4)...20mA

Properties

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

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

Structure



Status indication

RUN MF

> AI 0 AI 1

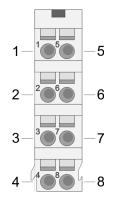
- Locking lever terminal module 1
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module 7
- Terminal module 8
 - Locking lever electronic module
- 9 Terminal

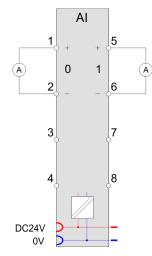
RUN	MF e red	Al x	Description
		x	Bus communication is OK
		х	Module status is OK Bus communication is OK
	2		Module status reports an error Bus communication is not possible
		Х	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Signal leaves measuring rangeError in parameterization
not relevant: X			

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

Pin assignment

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





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

I: Input

 \bigcirc

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

In-/Output area

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

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

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

Input area

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

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

Output area

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

3.6.1 Technical data

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

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

Destruction limit resistance inputs - Resistance thermometer ranges - Operational limit of resistance thermometer ranges - Operational limit of resistance thermometer ranges with SFU - Basic error limit thermoresistor ranges - Basic error limit thermoresistor ranges with SFU - Destruction limit resistance thermometer inputs - Thermocouple ranges - Operational limit of thermocouple ranges - Thermocouple ranges - Operational limit of thermocouple ranges with SFU - Destruction limit thermoneuple ranges with SFU - Destruction limit thermocouple ranges with SFU - Destruction limit thermocouple inputs - Destruction limit thermocouple inputs - Programmable temperature compensation - Programmable temperature compensation - Technical unit of temperature measurement - Resolution in bit 12 Measurement principle successive approximation Basic conversion time - Noise suppression for frequency	Order no.	031-1BB40
Resistance thermometer ranges - Operational limit of resistance thermometer ranges - Operational limit of resistance thermometer ranges with SFU - Basic error limit thermoresistor ranges with SFU - Basic error limit thermoresistor ranges with SFU - Destruction limit resistance thermometer inputs - Thermocouple inputs - Operational limit of thermocouple ranges - Operational limit of thermocouple ranges - Operational limit of thermocouple ranges with SFU - Operational limit of thermocouple ranges - Operational limit of thermocouple ranges - Destruction limit thermolement ranges with SFU - Destruction limit thermocouple inputs - Destruction limit thermocouple inputs - Destruction limit thermocouple inputs - Resolution in bit - Thermocouple inputs - Technical unit of temperature compensation - Technical unit of temperature compensation - Resolution in bit 12 Measurement principle succ	Basic error limit with SFU	-
Resistance thermometer ranges- Indext and the second term on the rangesOperational limit of resistance thermometer ranges with SFU- Indext and term on the second term of term on the second term of term on the second term on the second term of term on the sec	Destruction limit resistance inputs	-
Operational limit of resistance thermometer rangesOperational limit of resistance thermometer ranges with SFUBasic error limit thermoresistor ranges with SFUDestruction limit resistance thermometer inputsThermocouple inputsThermocouple rangesOperational limit of thermocouple ranges with SFUBasic error limit thermocouple inputsBasic error limit thermocouple inputsDestruction limit thermocouple inputsProgrammable temperature compensationInternal temperature compensationInternal temperature compensationInternal temperature compensationTechnical unit of temperature measurementInternal temperature compensationStatus displayyesNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Resistance thermometer inputs	-
Operational limit of resistance thermometer ranges with SFU - Basic error limit thermoresistor ranges - Basic error limit thermoresistor ranges with SFU - Destruction limit resistance thermometer inputs - Thermocouple inputs - Thermocouple ranges - Operational limit of thermocouple ranges - Operational limit of thermocouple ranges - Operational limit of thermocouple ranges with SFU - Basic error limit thermoelement ranges - Basic error limit thermocouple inputs - Destruction limit thermocouple inputs - Programmable temperature compensation - External temperature compensation - Temperature error internal compensation - Temperature error internal compensation - Temperature error internal compensation - Basic conversion time 2 Noise suppression for frequency >SOdB at SOHz (UCM<2V)	Resistance thermometer ranges	-
SFU-Basic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Textonical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic enversion firequency>50dB at 50Hz (UCM<2V)	Operational limit of resistance thermometer ranges	-
Basic error limit thermoresistor ranges with SFU- (All All All All All All All All All Al	Operational limit of resistance thermometer ranges with SFU	-
Destruction limit resistance thermometer inputs- (Addition of the second of	Basic error limit thermoresistor ranges	-
Thermocouple inputs- (and (and (and (and (and (and (and (and	Basic error limit thermoresistor ranges with SFU	-
Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Destruction limit resistance thermometer inputs	-
Operational limit of thermocouple ranges- (and (and (and (and (and (and (and (and	Thermocouple inputs	-
Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-External temperature compensation-Temperature error internal compensation-Temperature error internal compensation-Technical unit of temperature measurement12Basic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Thermocouple ranges	-
Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion for frequency>50dB at 50Hz (UCM<2V)	Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Operational limit of thermocouple ranges with SFU	-
Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Basic error limit thermoelement ranges	-
Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Basic error limit thermoelement ranges with SFU	-
External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Destruction limit thermocouple inputs	-
Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Programmable temperature compensation	-
Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	External temperature compensation	-
Technical unit of temperature measurement-Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Internal temperature compensation	-
Resolution in bit12Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Temperature error internal compensation	-
Measurement principlesuccessive approximationBasic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Technical unit of temperature measurement	-
Basic conversion time2 ms all channelsNoise suppression for frequency>50dB at 50Hz (UCM<2V)	Resolution in bit	12
Noise suppression for frequency>50dB at 50Hz (UCM<2V)Status information, alarms, diagnosticsStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionsyesDiagnostic sinformation read-outpossibleModule error displayred LED	Measurement principle	successive approximation
Status information, alarms, diagnosticsStatus displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outyesModule stategreen LEDModule error displayred LED	Basic conversion time	2 ms all channels
Status displayyesInterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
InterruptsnoProcess alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Status information, alarms, diagnostics	
Process alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Status display	yes
Diagnostic interruptnoDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Interrupts	no
Diagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Process alarm	no
Diagnostics information read-out possible Module state green LED Module error display red LED	Diagnostic interrupt	no
Module state green LED Module error display red LED	Diagnostic functions	yes
Module error display red LED	Diagnostics information read-out	possible
	Module state	green LED
Channel error display red LED per channel	Module error display	red LED
	Channel error display	red LED per channel

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

Order no.	031-1BB40
Isolation	
Between channels	-
Between channels of groups to	
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	59 g
Weight including accessories	59 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.6.2 Parameter data

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

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

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

CHxFN Function number channel x

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

0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	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	27048
0 20mA	25.00mA	20480	5000h	overrange	D ICODA I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens S5 format	20mA	16384	4000h	nominal range	$D = 10504 \cdot \frac{16}{16}$
	12mA	8192	2000h		16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

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

3.6.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits 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 failureBit 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 parametrization

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

MODTYP Module informa-		
tion	Byte	Bit 7 0
	0	Bit 3 0: module class
		 0101b analog module Bit 4: set at channel information present
		Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	Bit 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	Byte	Bit 7 0
	0	Bit 6 0: Channel type
		 70h: Digital input 71h: Appleg 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)
CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel group 0
		 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR		
Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 5 1: reserved
		Bit 6: set at measuring range underflow
		Bit 7: set at measuring range overflow

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

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

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

1

2

3

4

5

6

7

8

9

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Suited for sensors with 0(4) ... 20mA with external supply
- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

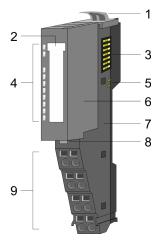
LED status indication

Electronic module

Terminal module

Terminal

Structure



Status indication

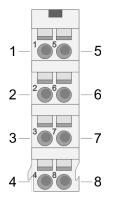
RUN	MF	Al x	Description
green	red	red	Description
-		х	Bus communication is OK
-		~	Module status is OK
_	_	х	Bus communication is OK
-	-	^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
x	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Signal leaves measuring rangeError in parameterization
not relevant: X			



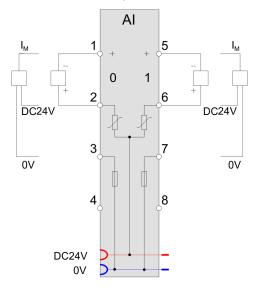
If the terminal module is not yet wired, when the module is power supplied the AI x LEDs get on due to the default parameterization 4 ... 20mA.

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

Pin assignment



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



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

I: Input, O: Output

In-/Output area At CPU, PROFIBUS and PROFINET the input respectively output area is embedded to the corresponding address area. IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot More can be found in the according manual of your bus coupler. Input area Addr. Name Function IX SX **Bytes** +0 2 AI 0 Analog value channel 0 6401h/s 01h +2 AI 1 2 6401h/s+1 02h Analog value channel 1

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

Output area

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

3.7.1 Technical data

Order no.	031-1BB60
Туре	SM 031 - Analog input
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 voltage	-
Current inputs	\checkmark
Max. input resistance (current range)	110 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.3% +/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.2% +/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-

Analog input

Order no.	031-1BB60
Operational limit of resistance thermometer ranges	
Operational limit of resistance thermometer ranges with SFU	
Basic error limit thermoresistor ranges	
Basic error limit thermoresistor ranges with SFU	
Destruction limit resistance thermometer inputs	
Thermocouple inputs	
Thermocouple ranges	
Operational limit of thermocouple ranges	
Operational limit of thermocouple ranges with SFU	
Basic error limit thermocouple ranges	
Basic error limit thermocouple ranges with SFU	
Destruction limit thermocouple inputs	
Programmable temperature compensation	-
External temperature compensation	
Internal temperature compensation	
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in 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)	-

System SLIO

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

Order no.	031-1BB60
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	2
Output voltage (typ)	L+ (-250 mV)
Output voltage (rated value)	50 mA
Short-circuit protection	Multifuse 0.1 A
Binding of potential	Field voltage DC 24V
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
Net weight	58 g
Weight including accessories	58 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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.

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

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

CHxFN Function number channel x

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

0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 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	27048
0 20mA	25.00mA	20480	5000h	overrange	D 16294 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	10584
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		27648
	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 16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

3.7.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits 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 parametrization

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

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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		
Citi iF Channel type	Byte	Bit 7 0
Ciri ir Channel type	Byte 0	 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
Ciri ir Channel type	-	 Bit 6 0: Channel type 70h: Digital input 71h: Analog input 72h: Digital output 73h: Analog output 74h: Analog input/-output 76h: Counter
NUMBIT Diagnostic bits	-	 Bit 6 0: Channel type 70h: Digital input 71h: Analog input 72h: Digital output 73h: Analog output 74h: Analog input/-output 76h: Counter
	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

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

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

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 5 1: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

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

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

031-1BB70 - AI 2x12Bit ±10V

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

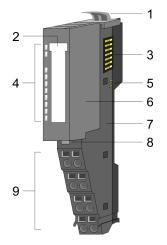
5

6

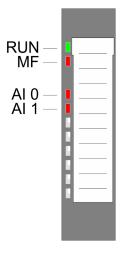
7 8

9

Structure



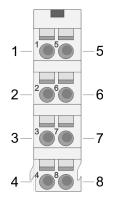
Status indication

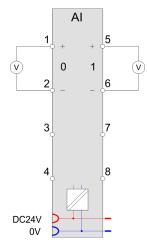


RUN	MF	Al x	Description		
green	red	red	Description		
		х	Bus communication is OK		
-		^	Module status is OK		
-	-	х	Bus communication is OK		
-	-	^	Module status reports an error		
	-	х	Bus communication is not possible		
	-	~	Module status reports an error		
		Х	Error at bus power supply		
Х	2Hz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40		
			Error channel x		
			Signal leaves measuring rangeError in parameterization		
not relevant:	Х				

Pin assignment

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





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.

3.8.1 Technical data

TypeSM 031Module ID0408 15C3Current consumption/power loss50 mAPower loss0.5 WPower loss0.5 WTechnical data analog inputs2Number of inputs2Cale length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs✓Voltage inputs100 kΩOurgent consumption from load voltage L+ (without load)100 kΩNumber of inputs√Voltage inputs√Voltage ranges100 kΩInput voltage ranges100 kΩOperational limit of voltage ranges+/0.3%Operational limit voltage ranges+/0.3%Destruction limit voltage ranges-Scie corro limit voltage ranges-Mut resistance (current range)-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges-Mut resistance (current range)-Input resistance (current range)-Input resistance (current ranges)-Input resistance (current ranges)-Operational limit of current ranges-Input resistance (current ranges)-Input resistance (current ranges)	Order no.	031-1BB70
Current consumption/power lossImage: construction from backplane busSo mAPower loss0.5 WTechnical data analog inputs2Number of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs·Number of inputs100 kΩOurge inputs·Voltage inputs·Voltage ranges·10 V +10 V 0 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges-Max. input resistance (current ranges)-Asi, input resistance (current ranges)-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Operational limit of current ranges)-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Current inputs-Max. input resistance (current ranges)-Input current ranges-Operational limit of current	Туре	SM 031
Current consumption from backplane bus50 mAPower loss0.5 WTechnical data analog inputsNumber of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputsVoltage inputs100 kΩInput voltage ranges-10 V +10 V 0 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.3%Operational limit of voltage with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current ranges)-Input voltage ranges with SFU-Destruction limit voltage-Current inputs-Current inputs-Current inputs-Max. input resistance (current ranges)-Input current ranges-Current inputs-Max. input resistance (current ranges)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Max. input resistance (current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges wi	Module ID	0408 15C3
Power loss0.5 WTechnical data analog inputs0.5 WNumber of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs·Nin. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Current inputs-Current inputs-Current inputs-Current inputs-Current inputs-Max. input resistance (current ranges)-Input voltage ranges with SFU-Destruction limit of voltage ranges-Current inputs-Current inputs-Operational limit of current ranges-Max. input resistance (current ranges)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU- </td <td>Current consumption/power loss</td> <td></td>	Current consumption/power loss	
Technical data analog inputsImage: Constraint of the second	Current consumption from backplane bus	50 mA
Number of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs~Nin. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Input current ranges-Input current ranges-Operational limit of current ranges-Input current ranges-Operational limit of current ranges-Input current ranges-Input current ranges-Operational limit of current	Power loss	0.5 W
Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs~Nin. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage-Operational limit of current ranges-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational l	Technical data analog inputs	
Rated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)15 mAVoltage inputs✓Min. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges+/-0.2%Current inputs-Max. 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-Operational limit of voltage ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current rang	Number of inputs	2
Current consumption from load voltage L+ (without load)15 mAVoltage inputs✓Min. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges+/-0.2%Current inputs-Max. input resistance (current ranges)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Operational limit of torrent ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit o	Cable length, shielded	200 m
Voltage inputs·Min. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational li	Rated load voltage	DC 24 V
Nin. input resistance (voltage range)100 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.3%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU<	Current consumption from load voltage L+ (without load)	15 mA
Input voltage ranges-10 V +10 V 0 V +10 VOperational 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 ranges with SFU-Destruction limit voltage rangesmax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit	Voltage inputs	\checkmark
Note of the sector of the se	Min. input resistance (voltage range)	100 kΩ
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 ranges with SFUmax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational	Input voltage ranges	-10 V +10 V
Note of the sector of the se		0 V +10 V
Pasic error limit voltage ranges+/-0.2%Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges- <td>Operational limit of voltage ranges</td> <td>+/-0.3%</td>	Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-	Operational limit of voltage ranges with SFU	-
Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-	Basic error limit voltage ranges	+/-0.2%
Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-	Basic error limit voltage ranges with SFU	-
Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-	Destruction limit voltage	max. 30V
Input current ranges - Operational limit of current ranges with SFU - Operational limit of current ranges with SFU -	Current inputs	-
Operational limit of current ranges - Operational limit of current ranges with SFU -	Max. input resistance (current range)	-
Operational limit of current ranges with SFU -	Input current ranges	-
	Operational limit of current ranges	-
Basic error limit current ranges -	Operational limit of current ranges with SFU	-
	Basic error limit current ranges	-
Radical error limit current ranges with SFU -	Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage) -	Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current) -	Destruction limit current inputs (electrical current)	-
Resistance inputs -	Resistance inputs	-
Resistance ranges -	Resistance ranges	-
Operational limit of resistor ranges -	Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU -	Operational limit of resistor ranges with SFU	-
Basic error limit -	Basic error limit	-
Basic error limit with SFU -	Basic error limit with SFU	-
Destruction limit resistance inputs -	Destruction limit resistance inputs	-

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

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

Analog input

Order no.	031-1BB70
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	

Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

System SLIO

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.

±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27040
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		10384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

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

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	U = 16284 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10584

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.

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per 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
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	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 parametrization

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

ERR	D	Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x:
		Bit 0: set at configuring/parameter assignment error
		Bit 5 1: reservedBit 6: set at measuring range underflow
		 Bit 7: set at measuring range overflow
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic
	µs ticker	
	-	m SLIO module there is a timer (μ s ticker). With PowerON the timer starts

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

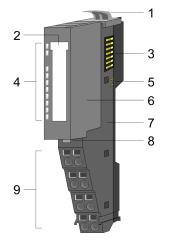
3.9 031-1BB90 - AI 2x16Bit TC

Properties

The electronic module has 2 inputs for temperature and voltage measuring with parameterizable functions. The channels of the module are isolated to the backplane bus.

- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- Interrupt and diagnostics function
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC75V/AC50V between the inputs

Structure



Status indication

RUN MF

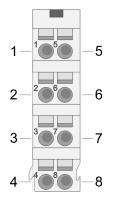
> AI 0 AI 1

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

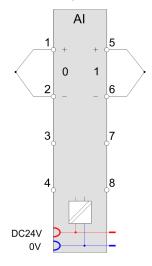
RUN	MF	Al x	Description	
		х	Bus communication is OK	
		~	Module status is OK	
_	-	х	Bus communication is OK	
	-	^	Module status reports an error	
	_	х	Bus communication is not possible	
	-	^	Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
		•	 Signal leaves measuring range Error in parameterization Wire break (if parameterized) 	
not relevant: X				

031-1BB90 - AI 2x16Bit TC

Pin assignment



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



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

I: Input



CAUTION!

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



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

Supplementation to the installation guidelines

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

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

In-/Output area

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

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

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

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

Output area

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

3.9.1 Technical data

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

Analog input

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

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

Order no.	031-1BB90
External temperature compensation	✓
Internal temperature compensation	✓
Temperature error internal compensation	1 K
Technical unit of temperature measurement	°C, °F, K
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	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	✓
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	22
	20

Order no.	031-1BB90
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g
Weight including accessories	58 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

The indicated error limits are valid starting from the following temperatures:

- Thermoelement type T: -200 °C
- Thermoelement type K: -100 °C
- Thermoelement type B: +700 °C
- Thermoelement type N: -150 °C
- Thermoelement type E: -150 °C
- Thermoelement type R: +200 °C
- Thermoelement type S: +100 °C
- Thermoelement type J: -100 °C

3.9.2 Parameter data

DS - Record set for access via CPU, PROFIBUS and PROFINET

- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition ¹	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
RES3	1	reserved	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression (SFU)	02h	01h	3105h	06h
CH0FN	1	Function number channel 0	C1h	80h	3106h	07h
CH0FO	1	Function option channel 0	02h	80h	3107h	08h
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3108h 3109h	09h
CHOLL	2	Lower limit value channel 0	8000h	80h	310Ah 310Bh	0Ah
CH1FN	1	Function number channel 1	C1h	81h	310Ch	0Bh
CH1FO	1	Function option channel 1	02h	81h	310Dh	0Ch
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Eh 310Fh	0Dh
CH1LL	2	Lower limit value channel 1	8000h	81h	3110h 3111h	0Eh

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

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 7 2: reserved

Due to the high sensitivity of the inputs, unused inputs should be deactivated in the parametrization. Due to the high input impedance, open inputs can be influenced by adjacent channels or due to the measuring method during wire break detection. Since the entire measuring range moves in the mV range, open-loop inputs can already cause measuring range overshoots.

LIMIT_EN Limit value monitoring	Byte	Bit 7 0
	0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 2: reserved

TEMPCNF Temperature system	Byte	Bit 7 0
	0	 Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 2: reserved

SUPR Interference frequency suppression	Byte	Bit 7 0
(SFU)	0	 Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 2: reserved

CHxFN Function number
channel xIn the following there are the measuring ranges with corresponding function number
listed, which were supported by the analog module.With FFh the corresponding channel is deactivated.

Voltage

-80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{80}$
(11h)	0V	0	0000h		0.0
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	2/048
-80 80mV	100mV	20480	5000h	overrange	D 16294 U
Siemens S5 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		0.0
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	10384

Temperature

Measuring range (funct. no.)	Measuring value in °C	Measuring value in °F	Measuring value in K	Range
	(0.1°C/digit)	(0.1°F/digit)	(0.1K/digit)	
Type J:	+14500	26420	17232	overrange
[Fe-Cu-Ni IEC]	-2100 +12000	-3460 21920	632 14732	nominal range
-210 +1200°C -346 2192°F 63.2 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)				underrange
Туре К:	+16220	29516	18952	overrange
[Ni-Cr-Ni]	-2700 +13720	-4540 25016	0 16452	nominal range
-270 +1372°C -454 2501.6°F 0 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)				underrange
Type N:	+15500	28220	18232	overrange
[Ni-Cr-Si]	-2700 +13000	-4540 23720	0 15732	nominal range
-270 +1300°C -454 2372°F 0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)				underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type T: [Cu-Cu-Ni]	+5400	10040	8132	overrange

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
-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
[PtRh-PtRh]	0 +18200	320 27865	2732 20932	nominal range
0 +1820°C 32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре С:	+25000	32766	23432	overrange
[WRe5-WRe26]	0 +23150	320 27865	2732 20932	nominal range
0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре Е:	+12000	21920	14732	overrange
[Ni-Cr - Cu-Ni]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

CHxFO Function option channel x

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

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

Code	Velocity (in ms) / channel	at interference frequency suppression	
	50Hz	60Hz	
00h ¹	324.1	270.5	
01h ¹	164.2	137.2	
02h ¹	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	

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

CHxUL / CHxLL limit value

You can specify an upper or lower limit value for each channel x:

- With CHxUL you specify an upper limit value. This is deactivated by specifying 7FFFh.
- With CHxLL you specify a lower limit value. This is deactivated by specifying 8000h.
- You may only specify values from the nominal range, otherwise you will get a parametrization error.
- As soon as your measured value is outside a limit value and you have activated limit value monitoring, a hardware interrupt is triggered.

3.9.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parametrization	-	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	-
Hardware interrupt lost	-	Х	-

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

Hardware interrupt So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

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

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

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 (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

Diagnostic data

PRIT_US µs ticker

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

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

Byt	е	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 parametrization

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

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

ERR_D Diagnostic

NUMCH Channels

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 hardware interrupt lost Bit 7: reserved 					

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

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

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

CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
onannei-speeine	0	 Channel-specific error: Channel x: Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: set at hardware 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

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

DIAG_US µs ticker

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

µs ticker

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

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

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

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

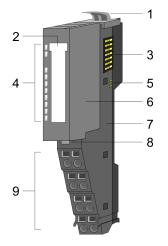
4 5

6

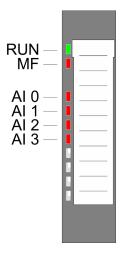
7 8

9

Structure



Status indication

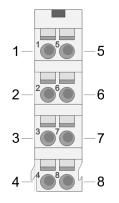


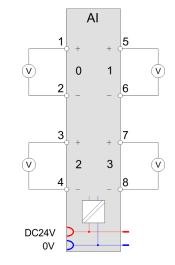
RUN	MF	Al x	Description
green	red	red	Description
		х	Bus communication is OK
-		^	Module status is OK
	_	V	Bus communication is OK
	-	Х	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Signal leaves measuring rangeError in parameterization
not relevant: X			

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

Pin assignment

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





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	1	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

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

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

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

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

Output area

Input area

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

Order pe	024 48020
Order no.	031-1BD30
Туре	SM 031
Module ID	0404 15C4
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	\checkmark
Min. input resistance (voltage range)	100 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-

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

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

Analog input

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

Order no.	031-1BD30
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	59 g
Weight including accessories	59 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

3.10.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

031-1BD30 - AI 4x12Bit 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	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
CH4ERRCH7 ERR	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 parametrization

MODTYP Module informa-	
tion	

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

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

CHTYP Channel type

CHERR Channel error

Byte
0

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

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

Byte
0

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

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

System SLIO

DIAG_US µs ticker

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

µs ticker

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

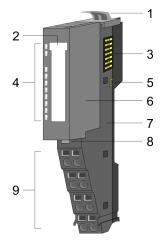
3.11 031-1BD40 - AI 4x12Bit 0(4)...20mA

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
- Diagnostics function
- 12bit resolution

Structure



Status indication

RUN MF

AI 0

AI 1 AI 2 AI 3

- Locking lever terminal module
- 2 Labeling strip

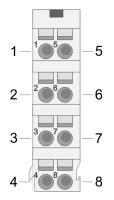
1

- 3 Backplane bus4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

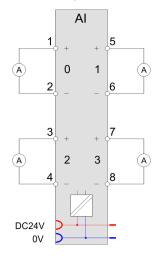
RUN	MF e red	Al x	Description
		x	Bus communication is OK Module status is OK
	•	x	Bus communication is OK Module status reports an error
	•	x	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
•		•	Error channel xSignal leaves measuring rangeError in parameterization
not relevant:	Х		

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

Pin assignment



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



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	1	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	1	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input



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

In-/Output area

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

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

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

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

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

Input area

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

Output area

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

3.11.1 Technical data

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

Analog input

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

Order no.	031-1BD40
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	4 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark

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

Order no.	031-1BD40
Max. potential difference between circuits	
Max. potential difference between inputs (Ucm)	DC 2 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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.

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

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.

0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
0 20mA	23.52mA	32511	7EFFh	overrange	D 27649 I	
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$	
S7 format	10mA	13824	3600h		•	
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange	27048	
0 20mA	25.00mA	20480	5000h	overrange	D IG204 I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$	
S5 format	10mA	8192	2000h		•	
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$	
	-4,00mA	-3277	F333h	underrange	10384	
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		27648	
	1.19mA	-4864	ED00h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$	
Siemens	20mA	16384	4000h	nominal range	$D = 10384 + \frac{16}{16}$	
S5 format	12mA	8192	2000h		16	
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$	
	0.8mA	-3277	F333h	underrange		

3.11.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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: 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 parametrization

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

MODTYP Module informa-		
tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)

CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

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

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

031-1BD70 - AI 4x12Bit ±10V

3.12 031-1BD70 - AI 4x12Bit ±10V

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

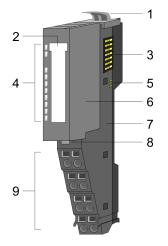
5

6

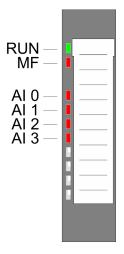
7 8

9

Structure



Status indication

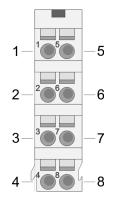


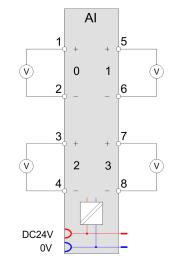
RUN	MF	Al x	Description
green	red	red	Description
		х	Bus communication is OK
-		^	Module status is OK
	_	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
		^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Signal leaves measuring rangeError in parameterization
not relevant:	Х		

031-1BD70 - AI 4x12Bit ±10V

Pin assignment

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





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

I: Input

In-/Output area

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

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

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

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

Output area

Input area

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

3.12.1 Technical data

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

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

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

Analog input

Order no.

Between channels and backplane busBetween channels and power supplyMax. potential difference between circuits-Max. potential difference between inputs (Ucm)DC 2 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)DC 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)DC 500 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-Material-Housing-
NameAntipier of the properties of the pro
Max. potential difference between inputs (Ucm)DC 2 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 50 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizesDC 500 VInput bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-
Nax. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm) (Uiso)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizesInput bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-
(Uiso)Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-
Nax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizesDC 500 VInput bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-
(Uiso)ImplementMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing-
Insulation tested with DC 500 V Datasizes DC 500 V Input bytes 8 Output bytes 0 Parameter bytes 8 Diagnostic bytes 0 Housing 0 U
DatasizesInput bytes8Output bytes0Parameter bytes8Diagnostic bytes20Housing
Input bytes 8 Output bytes 0 Parameter bytes 8 Diagnostic bytes 20 Housing 1
Output bytes 0 Parameter bytes 8 Diagnostic bytes 20 Housing
Parameter bytes 8 Diagnostic bytes 20 Housing
Diagnostic bytes 20 Housing
Housing
Material PPE / PPE GF10
Mounting Profile rail 35 mm
Mechanical data
Dimensions (WxHxD) 12.9 mm x 109 mm x 76.5 mm
Net weight 60 g
Weight including accessories 60 g
Gross weight 75 g
Environmental conditions
Operating temperature 0 °C to 60 °C
Storage temperature -25 °C to 70 °C
Certifications
UL certification yes
KC certification yes

SFU - Interference frequency suppression

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 = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27040
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		10384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

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

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
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
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

3.12.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERRCH7 ERR	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 parametrization

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

ERR_D	Diagnostic
-------	------------

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
CH0ERR CH3ERR	Byte	Bit 7 0
Channel-specific		

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_	US µs	ticker
-------	-------	--------

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

µs ticker

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

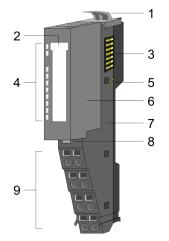
3.13 031-1BD80 - AI 4x16Bit R/RTD

Properties

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

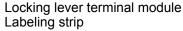
- 4 analog inputs
- Suited for resistance-type sensors 0 ... 3000Ω and resistance temperature sensors Pt100, Pt1000, NI100, NI120 and NI1000
- Resistance measurement with 2, 3 and 4 wire
 (3 and 4 wire only via channel 0 respectively 1)
- Interrupt and diagnostics function
- 16bit resolution

Structure



Status indication

RUN	MF	Al x	Description
green	red	red	
-		x	Bus communication is OK
		Λ	Module status is OK
-	-	х	Bus communication is OK
	-	^	Module status reports an error
	_	x	Bus communication is not possible
	-	~	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
		•	 Signal leaves measuring range Error in parameterization Wire break (if parameterized)
not relevant	X		

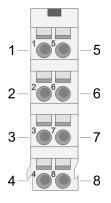


- 2 Labeling strip3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

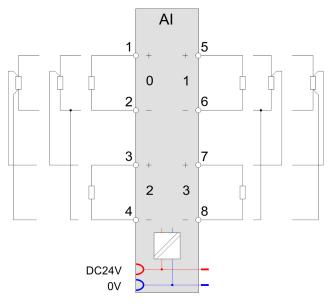
1

031-1BD80 - AI 4x16Bit R/RTD

Pin assignment



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



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

I: Input

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

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

Output area

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

3.13.1 Technical data

Order no.	031-1BD80
Туре	SM 031 - Analog input
Module ID	0406 1544
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	4

Analog input

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

Order no.	031-1BD80
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	✓
Resistance ranges	0 60 Ohm
	0 600 Ohm
	0 3000 Ohm
Operational limit of resistor ranges	+/- 0.4 %
Operational limit of resistor ranges with SFU	+/- 0.2 %
Basic error limit	+/- 0.2 %
Basic error limit with SFU	+/- 0.1 %
Destruction limit resistance inputs	max. 24V
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100
	Pt1000
	Ni100 Ni120
	Ni1000
Operational limit of resistance thermometer ranges	+/- 0.4 %
Operational limit of resistance thermometer ranges with SFU	+/- 0.2 %
Basic error limit thermoresistor ranges	+/- 0.2 %
Basic error limit thermoresistor ranges with SFU	+/- 0.1 %

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

Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges with SFU-Programmable temperature compensation-External temperature compensation-External temperature compensation-External temperature compensation-	
Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-	
Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-	
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Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-	
Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-	
Programmable temperature compensation - External temperature compensation -	
External temperature compensation -	
Internal temperature compensation -	
Temperature error internal compensation -	
Technical unit of temperature measurement °C, °F, K	
Resolution in bit 16	
Measurement principle Sigma-Delta	
Basic conversion time 4.2324.1 ms (50 Hz) 3.8270.5 ms (60 Hz) per cha	annel
Noise suppression for frequency >80dB at 50Hz (UCM<6V)	
Status information, alarms, diagnostics	
Status display yes	
Interrupts yes, parameterizable	
Process alarm yes, parameterizable	
Diagnostic interrupt yes, parameterizable	
Diagnostic functions yes	
Diagnostics information read-out possible	
Module state green LED	
Module error display red LED	
Channel error display red LED per channel	
Isolation	
Between channels -	
Between channels of groups to -	
Between channels and backplane bus	
Between channels and power supply -	
Max. potential difference between circuits -	
Max. potential difference between inputs (Ucm) DC 6 V	
Max. potential difference between Mana and Mintern (Uiso) -	
Max. potential difference between inputs and Mana (Ucm) -	
Max. potential difference between inputs and Mintern (Uiso) DC 75 V/ AC 50 V	
Max. potential difference between Mintern and outputs -	

Analog input

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

Instalation tested withDC 500 VTechnical data encoder supplyNumber of outputsOutput voltage (ryp)Output voltage (rated value)Short-cruit protectionBinding of potentialOutput voltage (rated value)DatasizesInput bytesOutput voltage (rated value)Output voltage (rated value)DatasizesInput bytesOutput bytesOutput bytesOutput bytesDatasizesIndensite bytesDiagnostic bytesMaterialPE / PPE GF 10MentrialMentrial GataNotificit GataNotificit GataNotificit GataNewightOutput bytesOutput bytesStreige Tege Tege Tege Tege Tege Tege Tege	Order no.	031-1BD80
Number of outputs-Output voltage (typ)-Output voltage (rated value)-Short-circuit protection-Binding of potential-Dataizes-Input bytes8Output tybtes0Output bytes0Parameter bytes34Diagnostic bytes-MaterialPE / PE GF10MountingPer Jong SmMethanical data-Netweight1.9Netweight1.9Netweight1.9Output sourcessories6.1Gross weight-Operating temperature-Output sourcessories0.1Output sourcessories0.1Output sourcessories-Operating temperature-Output sourcessories-Output sourcessories-<	Insulation tested with	DC 500 V
Output voltage (typ)-Output voltage (rated value)-Short-circuit protection-Binding of potential-Datasizes-Input bytes8Output tytes0Output bytes0Parameter bytes34Diagnostic bytes20MaterialPPE / PPE GF10MoutingPPE / PPE GF10Mouting12.9 mm x 10.9 mm x 76.5 mmNeweight61.9 gNeweight19.9 gOrgenating Leongerature75.9 gPorter Strategerature0°C to 60°C CStorage temperature-Output ficturing55.0 c C 70°C CChriffication19.0 c CUt certification19.0 c CUt certification19.0 c CStorage temperature-Ut certification-Ut certification-Ut certification-Ut certification-Storage temperature-Ut certification-Ut certification- <tr< td=""><td>Technical data encoder supply</td><td></td></tr<>	Technical data encoder supply	
Output voltage (rated value)-Shot-circuit protection-Binding of potential-Dataizes-Input bytes8Output bytes0Parameter bytes34Diagnosic bytes0MaterialPPE / PPE GF10MoutingPPE / PPE GF10Methanical data12.9 mm x 10.9 mm x 76.5 mmNeweight61 gNeweight19.9 GProtromental conditions75 gPorange temperature0° Co 60° CStorage temperature-Cortifications-Ut certification-Storage temperature-Ut certification-Storage temperature-Ut certification-Storage temperature-Ut certification-Storage temperature-Ut certification-Storage temperature-Storage temperature<	Number of outputs	-
Shot-circuit protection-Binding of potential-Datasizes-Input bytes8Output bytes0Parameter bytes34Diagnostic bytes20HousingPOE / PPE GF10MaterialPPE / PPE GF10Mounting20Dimensions (WxHxD)20Netweight9Output bytes9Output bytes9Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmNetweight61 gOross weight5 gOperating temperature0°C to 60°CStorage temperature-Curtifications-Ut certification-Ut certification-Material-Storage temperature-Storage temperat	Output voltage (typ)	-
Binding of potential-Datasizes-Input bytes8Output bytes0Output bytes0Parameter bytes34Diagnostic bytes20HousingPPE OPE GF10MaterialPPE IPPE GF10Mounting20Dimensions (WxHxD)12.9 mm x 10.9 mm x 76.5 mmNewight61 gVeright including accessories61 gGross weight5 gDiperating temperature0° Cto 60 °CStorage temperature	Output voltage (rated value)	-
DatasizesInput bytesInput bytes8Output bytes0Parameter bytes34Diagnostic bytes0Housing0MaterialPPE / PPE GF10MountingProfile rail 35 mmDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmNetweight61 gVerdight including accessories75 gGross weight0°C to 6°CStorage temperature25°C to 70°CChertificationsyesUt certificationyes	Short-circuit protection	-
Input bytes8Output bytes0Parameter bytes34Diagnostic bytes20HousingVMaterialPPE / PPE GF 10MountingProfiler ail 35 mmMounting12.9 mm x 109 mm x 76.5 mmNet weight61 gVergibut including accessories61 gGross weight75 gPorrating temperature0°C to 60°CStorage temperature-25°C to 70°CCertificationsyes	Binding of potential	-
Number of the set	Datasizes	
Parameter bytes34Parameter bytes20HousingVMaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical dataVDimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmNet weight61 gYolight including accessories61 gGross weight75 gDiperating temperature0°C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Input bytes	8
Diagnostic bytes20HousingVMaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical data20Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmNet weight61 gVeight including accessories61 gGross weight5 gEnvironmental conditions0° C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Output bytes	0
HousingPPE / PPE GF10MaterialProfile rail 35 mmMountingProfile rail 35 mmMechanical dataImage: Second Seco	Parameter bytes	34
MaterialPPE / PPE GF10MountingProfile rail 35 mmMechanical dataImage: Construction of the second of the s	Diagnostic bytes	20
MountingProfile rail 35 mmMechanical dataProfile rail 35 mmMechanical dataImage: Second sec	Housing	
Mechanical dataImage: constraint of the second	Material	PPE / PPE GF10
Dimensions (WxHxD)12.9 mm x 109 mm x 76.5 mmNet weight61 gWeight including accessories61 gGross weight75 gEnvironmental conditions0 °C to 60 °COperating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsyes	Mounting	Profile rail 35 mm
Net weight61 gWeight including accessories61 gGross weight75 gEnvironmental conditions0°C to 60 °COperating temperature0°C to 60 °CStorage temperature-25 °C to 70 °CCertificationsJul certificationVertificationyes	Mechanical data	
Weight including accessories61 gGross weight75 gEnvironmental conditions0°C to 60°COperating temperature0°C to 60°CStorage temperature-25°C to 70°CCertificationsyes	Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Gross weight75 gEnvironmental conditions0Operating temperature0 °C to 60 °CStorage temperature-25 °C to 70 °CCertificationsImage: Certification of the section	Net weight	61 g
Environmental conditions0°C to 60°COperating temperature0°C to 60°CStorage temperature-25°C to 70°CCertificationsUL certificationUL certificationyes	Weight including accessories	61 g
Operating temperature 0 °C to 60 °C Storage temperature -25 °C to 70 °C Certifications -25 °C to 70 °C UL certification yes	Gross weight	75 g
Storage temperature -25 °C to 70 °C Certifications ul certification UL certification yes	Environmental conditions	
Certifications UL certification yes	Operating temperature	0 °C to 60 °C
UL certification yes	Storage temperature	-25 °C to 70 °C
	Certifications	
KC certification yes	UL certification	yes
	KC certification	yes

SFU - Interference frequency suppression

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 ¹	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition ¹	00h	00h	3101h	02h

Name	Bytes	Function	Default	DS	IX	SX
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
RES3	1	reserved	00h	00h	3103h	04h
TEMPCNF	1	Temperature system	00h	01h	3104h	05h
SUPR	1	Interference frequency suppression (SFU)	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 ²	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 ²	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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

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

LIMIT_EN Limit value monitoring

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 2: Limit value monitoring channel 2 (1: on) Bit 3: Limit value monitoring channel 3 (1: on) Bit 7 4: reserved

TEMPCNF Temperature system	Byte	Bit 7 0
-,	0	 Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 2: reserved

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
4 , ,	0	 Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 2: reserved

CHxFN Function number channel x

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

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

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
	-105°C	-1050	underrange
2 wire: NI1000	+295°C	+2950	overrange
(53h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
2 wire: NI120 ¹	+400°C	+4000	overrange
(54h)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	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
3 wire: NI120 ¹	+400°C	+4000	overrange
(5Ch)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	underrange
4 wire: PT100	+1000°C	+10000	overrange
(60h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
1 wire: PT1000	+1000°C	+10000	overrange
(61h)	-200 +850°C	-2000 +8500	nominal range
	-243°C	-2430	underrange
wire: NI100	+295°C	+2950	overrange
62h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
wire: NI1000	+295°C	+2950	overrange
63h)	-60 +250°C	-600 +2500	nominal range
	-105°C	-1050	underrange
1 wire: NI120 ¹	+400°C	+4000	overrange

(tunct. no.) (64h)Image (100 and a second of a s	Measuring range	Measuring value	Signal range	Range
λοια λοια λοια λοια λοια 100°C 100°C 100°C underange 2 wire: 0 60Ω nominal range 2 wire: 0 60Ω nominal range 2 wire: 0 60Ω overrange 7(7h) overrange 3 wire: 0 60Ω overrange 7(7h) overrange 7(7h) overrange 7(7h) overrange 7(7h) overrange 7(7h) overrange 7(7h) <	(funct. no.)			
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2 wire: 0 60Ω overrange (90h) 0 60Ω 0 600Ω nominal range underrange 2 wire: 0 600Ω underrange 2 wire: 0 600Ω overrange 0 600Ω underrange (91h) 0 600Ω 0 600Ω nominal range	(82h)	0 3000Ω	0 32767	nominal range
(90h) 060Ω 06000 nominal range underrange 2 wire: 0600Ω overrange (91h) 0600Ω 0600Ω nominal range				underrange
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2 wire: 0 600Ω overrange (91h) 0 600Ω 0 600Ω nominal range	(90h)	0 60Ω	0 6000	nominal range
(91h) $0 \dots 600\Omega$ $0 \dots 6000$ nominal range				underrange
	2 wire: 0 600Ω			overrange
underrange	(91h)	0 600Ω	0 6000	nominal range
				underrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
2 wire: 0 3000 Ω			overrange
(92h)	0 3000Ω	0 30000	nominal range
			underrange
3 wire: 0 60Ω			overrange
(98h)	0 60Ω	0 6000	nominal range
			underrange
3 wire: 0 600Ω			overrange
(99h)	0 600Ω	0 6000	nominal range
			underrange
3 wire: 0 3000Ω			overrange
(9Ah)	0 3000Ω	0 30000	nominal range
			underrange
4 wire: 0 60Ω			overrange
(A0h)	0 60Ω	0 6000	nominal range
			underrange
4 wire: 0 600Ω			overrange
(A1h)	0 600Ω	0 6000	nominal range
			underrange
4 wire: 0 3000Ω			overrange
(A2h)	0 3000Ω	0 30000	nominal range
			underrange
2 wire: 0 60Ω	70.55Ω	32511	overrange
(D0h)	0 60Ω	0 27648	nominal range
			underrange
2 wire: 0 600Ω	705.5Ω	32511	overrange
(D1h)	0 600Ω	0 27648	nominal range
			underrange
2 wire: 0 3000Ω	3528Ω	32511	overrange
(D2h)	0 3000Ω	0 27648	nominal range
			underrange
3 wire: 0 60Ω	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	Measuring value	Signal range	Range	
(funct. no.)				
			underrange	
3 wire: 0 3000Ω	3528Ω	32511	overrange	
(DAh)	0 3000Ω	0 27648	nominal range	
			underrange	
4 wire: 0 60Ω	70.55Ω	32511	overrange	
(E0h)	0 60Ω	0 27648	nominal range	
			underrange	
4 wire: 0 600Ω	705.5Ω	32511	overrange	
(E1h)	0 600Ω	0 27648	nominal range	
			underrange	
4 wire: 0 3000Ω	3528Ω	32511	overrange	
(E2h)	0 3000Ω	0 27648	nominal range	
			underrange	
1) Supported by 031-BD80 from version 03V54 and 031-1LD80 from version 02V26.				

The version information can be found on the outer packaging or via the website of the corresponding head module.

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 ¹	324.1	270.5		
01h ¹	164.2	137.2		
02h ¹	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		

1) 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 hardware interrupt is initialized.

3.13.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	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	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL Limit overflow

Byte	Bit 7 0
0	 Bit 0: Limit overflow channel 0 Bit 7: Limit overflow channel 3 Bit 7 4: reserved

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	 Bit 0: Limit underflow channel 0 Bit 3: Limit underflow channel 3 Bit 7 4: reserved
PRIT_US μs ticker	Byte	Bit 7 0
	0 1	16bit µs value at the moment of the interrupt
	µs ticker	
		module there is a 32 bit timer (μ s ticker). With PowerON the timer starts

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

Diagnostic data

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

- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT 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			0Eh11h
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 parametrization

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

ERR D	Diagnostic

Byte	Bit 7 0
0	 Bit 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 hardware interrupt lost Bit 7: reserved

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

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

1

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Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

12bit resolution

Labeling strip

Backplane bus

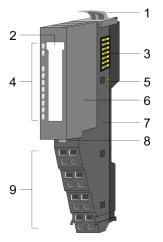
LED status indication

Electronic module

Terminal module

Terminal

Structure



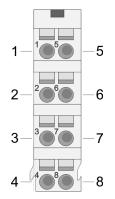
Status indication

RUN — 1 MF — 1 Al 0 — 1 Al 1 — 1 Al 2 — 1 Al 3 — 1 Al 4 — 1 Al 5 — 1 Al 6 — 1

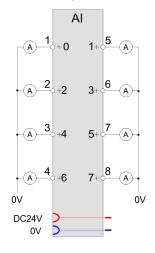
RUN	MF	Al x	Description	
green	red	red	Description	
	□ x		Bus communication is OK	
		^	Module status is OK	
-	-	х	Bus communication is OK	
	-	^	Module status reports an error	
	-	х	Bus communication is not possible	
	▲ ^		Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
			Signal leaves measuring rangeError in parameterization	
not relevant: X				

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

Pin assignment



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



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

I: Input

In-/Output area

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h
+8	AI 4	2	Analog value channel 4	6401h/s+4	05h
+10	AI 5	2	Analog value channel 5	6401h/s+5	06h
+12	AI 6	2	Analog value channel 6	6401h/s+6	07h
+14	AI 7	2	Analog value channel 7	6401h/s+7	08h

Input area

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

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 - Analog input
Module ID	0416 15C5
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	8
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	\checkmark
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-1,1%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-1,0%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 30V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

Analog input

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

Order no.	031-1BF60
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermocouple ranges	-
Basic error limit thermocouple ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in 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	
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	-

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

Order no.	031-1BF60
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	
Max. potential difference between Mana and Mintern (Uiso)	
Max. potential difference between inputs and Mana (Ucm)	
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-
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
Net weight	58 g
Weight including accessories	58 g
Gross weight	73 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.14.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
SUPR	2	Interference frequency suppression (SFU)	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 (SFU)

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

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.

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

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas	
0 20mA	23.52mA	32511	7EFFh	overrange	D OTCO I	
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{I}{20}$	
S7 format	10mA	13824	3600h			
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$	
	-3.52mA	-4864	ED00h	underrange	27648	
0 20mA	25.00mA	20480	5000h	overrange	D IGON I	
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$	
S5 format	10mA	8192	2000h			
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$	
	-4,00mA	-3277	F333h	underrange	10384	
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		27648	
	1.19mA	-4864	ED00h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$	
Siemens	20mA	16384	4000h	nominal range	D = 10504 + 16	
S5 format	12mA	8192	2000h		I = D 16	
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$	
	0.8mA	-3277	F333h	underrange		

0(4) ... 20mA

3.14.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	Diagnostic 00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits per channel	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	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

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

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

ERR_D Diagnostic

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

System SLIO

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

CHTYP Channel type	Byte	Bit 7 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
	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	 Bit 0: set at error in channel 0 Bit 1: set at error in channel 1 Bit 2: set at error in channel 2 Bit 3: set at error in channel 3 Bit 4: set at error in channel 4 Bit 5: set at error in channel 5 Bit 6: set at error in channel 6 Bit 7: set at error in channel 7
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	_	
DIAG_03 µs licker	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic
	µs ticker	
		m SLIO module there is a timer (μ s ticker). With PowerON the timer starts h 0. After 2 ³² -1 μ s the timer starts with 0 again.

031-1BF74 - AI 8x12Bit ±10V

3.15 031-1BF74 - AI 8x12Bit ±10V

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1

2

3

4

5

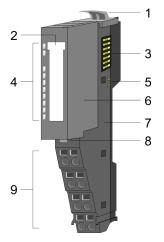
6

7

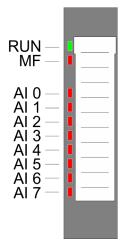
8

9

Structure



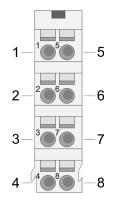
Status indication

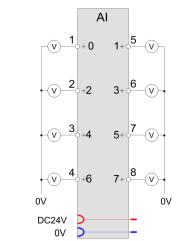


RUN	MF	Al x	Description				
green	red	red	Description				
		х	Bus communication is OK				
		^	Module status is OK				
	_	х	Bus communication is OK				
	-	^	Module status reports an error				
	_	V	Bus communication is not possible				
	-	Х	Module status reports an error				
		Х	Error at bus power supply				
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40				
			Error channel x				
			Signal leaves measuring rangeError in parameterization				
not relevant	: X						

Pin assignment

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





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	L	+ Channel 7

I: Input

In-/Output area

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h
+8	AI 4	2	Analog value channel 4	6401h/s+4	05h
+10	AI 5	2	Analog value channel 5	6401h/s+5	06h
+12	AI 6	2	Analog value channel 6	6401h/s+6	07h
+14	AI 7	2	Analog value channel 7	6401h/s+7	08h

Input area

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 - Analog input
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	+/-1.0%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

Analog input

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

Order no.	031-1BF74
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermocouple ranges	-
Basic error limit thermocouple ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in 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	
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	-

Analog input

Order no.	031-1BF74
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-
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
Net weight	57 g
Weight including accessories	57 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.15.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
SUPR	2	Interference frequency suppression (SFU)	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 (SFU)

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

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.

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

±10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
±10V	11.76V	32511	7EFFh	overrange	D = 27649 U	
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$	
(12h)	5V	13824	3600h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$	
	-5V	-13824	CA00h		27040	
	-10V	-27648	9400h			
	-11.76V	-32512	8100h	underrange		
±10V	12.5V	20480	5000h	overrange	D 16294 U	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$	
(22h)	5V	8192	2000h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$	
	-5V	-8192	E000h		10384	
	-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	U = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		$U = D \cdot \frac{10}{27648}$
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	U = 16294 U
Siemens S5 format (20h)	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

3.15.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

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

Bit 7 ... 5: reserved

Bit 4: set at internal communication error

CHTYP Channel type	Byte	Bit 7 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
	0 Number of diagnostic bits per channel (here 08h)	
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 08h)

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

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

Byte	Bit 7 0
0	 Bit 0: set at error in channel 0 Bit 1: set at error in channel 1 Bit 2: set at error in channel 2 Bit 3: set at error in channel 3 Bit 4: set at error in channel 4 Bit 5: set at error in channel 5 Bit 6: set at error in channel 6 Bit 7: set at error in channel 7

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
03	Value of the μ s ticker at the moment of the diagnostic

µs ticker

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

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

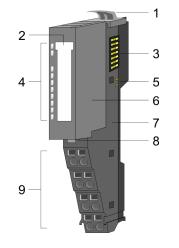
3.16 031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS)

Properties

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

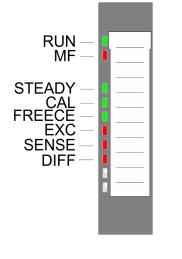
- 1-channel for connecting a full bridge
- Absolute accuracy (basic error ±0.1%)
- Manual calibration (zero and load adjustment)
- Configurable self-calibration (offset and gain error)
- Fast measurement by high signal bandwidth (ADC with 4 kHz limit frequency)
- Parametrizable IIR filter (300µs - 3.6s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

Structure



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

Status indication



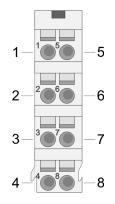
RUN	MF e red	Description			
_		Bus communication is OK			
		Module status is OK			
_	-	Bus communication is OK			
	-	Module status reports an error			
	•	Bus communication is not possible			
		Module status reports an error			
		Error at bus power supply			
х		Error in configuration			
^	2Hz	🌣 Chap. 2.12 'Trouble shooting - LEDs' page 40			
not relevant: X					

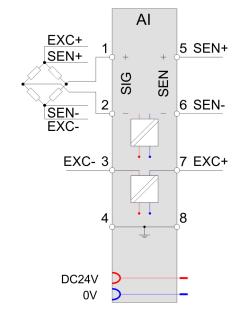
031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS)

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

Pin assignment

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





Pos.	Function	Туре	Description
1	SIG+	I	+ Signal of the differential voltage U_{SIG} of the measuring bridge
2	SIG-	I	- Signal of the differential voltage U_{SIG} of the measuring bridge
3	EXC-	0	- Signal of the excitation voltage U _{EXC}
4	Shield		Connection for cable shield
5	SEN+	I	+ Sensor of the excitation voltage U _{SEN}
6	SEN-	I	- Sensor of the excitation voltage U _{SEN}
7	EXC+	0	+ Signal of the excitation voltage U _{EXC}
8	Shield		Connection for cable shield
O: Output, I: Input			

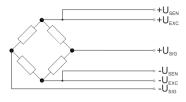
031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Connection variants



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

3.16.1 Connection variants

6 wire measurement

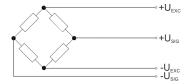


The following table shows the properties of the sensors, which can be used with the 6 wire measurement.

Sensor properties

Excitation	Bridge resistance R _B					
voltage U _{EXC}	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



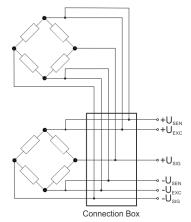
With the 4 wire measurement the U_{SEN} pins are not connected. With this operating mode there is an internal connection between U_{EXC} and U_{SEN} .

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

Sensor properties

Excitation	Bridge resistance R _B					
voltage U _{EXC}	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_{EXC} , I_{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:

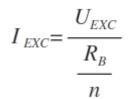
IEXC Supply current

- U_{EXC} Excitation voltage
- R_B 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.

2 parallel	Bridge resistance R _B						
Excitation voltage	60Ω	175Ω	350Ω	500Ω			
U _{EXC}							
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_B **Excitation** 40Ω 116.7Ω 233.3Ω 333.3Ω voltage UEXC 2.5V Х Х Х Х 5V Х Х Х not possible 7.5V not possible Х Х Х 10V not possible Х Х Х 12V Х Х not possible not possible



Example

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

\bigcirc

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
Significance	SG	2 ³⁰	2 ²⁹	2 ²⁸	2 ²⁷	2 ²⁶	2 ²⁵	2 ²⁴	2 ²³	2 ²²	2 ²¹	2 ²⁰	2 ¹⁹	2 ¹⁸	2 ¹⁷	2 ¹⁶
31Bit+SG	SG	SG Measured value														
				Byt	te 2				Byte 3							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance	2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	27	2 ⁶	2 ⁵	24	2 ³	2 ²	2 ¹	2 ⁰
31Bit+SG	Measured value															

DMS_STAT Status

Addr.	Name	Bytes	Function
+3	DMS_STAT	1	 Status byte Bit 0: 1 = Input Freeze active Bit 1: 1 = Steady State active¹ Bit 2: 1 = Self-calibration is running¹ Bit 3: 1 = Tara was changed Bit 4: 1 = Error in adjustment Bit 5: 1 = Adjustment was changed Bit 6: reserved Bit 7: 1 = Zero balance respectively reference point set
1) These status bits	s are set by internal event o	f the module.	

HB300 | SM-AIO | | en | 23-20

- 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. Schap. 3.16.5 'Parameter data' 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.
- 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	 Command byte Each set bit in DMS_CMD is acknowledged by a bit in DMS_STAT. Bit 0: Activate <i>Input Freeze</i> → DMS_STAT bit 0: active Bit 1: Store adjustment → DMS_STAT bit 5: active Bit 2: Delete adjustment → DMS_STAT bit 5: active Bit 3: Set <i>Tara</i> → DMS_STAT bit 3: active Bit 4: Delete <i>Tara</i> → DMS_STAT bit 3: active Bit 5: reserved Bit 6: Set zero point → DMS_STAT bit 7: active Bit 7: Set reference point → DMS_STAT bit 7: active
		 − In − B br − T Adjus − S − D 	Freeze the activated state no measurement values are passed to the digital filter. y a brief activation of <i>Input Freeze</i> pulses, e.g. caused by a filling procedure can e prevented, which would override the filter unnecessarily. he status of <i>Input Freeze</i> can be determined at any time via bit 0 of DMS_STAT. thent tore adjustment: Used to store the adjustment data when loaded with the refer- nce weight. elete adjustment: Used to delete the adjustment data. <i>V</i> ith both commands bit 5 of DMS_STAT is set. In case of error bit 4 is set.

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

- Tara
 - Set Tara: The current value is taken as tara.
 - Delete Tara: Tara is reset to 0.
 - With both commands bit 3 of DMS_STAT is set.
- Zero balance respectively reference point
 - Both commands are used for user adjustment and on both commands bit 7 of DMS_STAT is set.
 - Set zero balance: Used to set the balance to 0 when operated without load.
 - Set reference point: Used to adjust the balance when it is loaded with a reference weight.

3.16.3 Technical data

Order no.	031-1CA20
Туре	SM 031 - Analog input
Module ID	0841 1809
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data strain gauge DMS inputs	
Number of inputs	1
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	\checkmark
Current consumption from load voltage L+ (without load)	18 mA
Relative accuracy according to self-calibration	+/-0.01%
Operational limit Usense	+/-0.2%
Operational limit Usig	+/-0.2%
Basic error limit Usense	+/-0.1%
Basic error limit Usig	+/-0.1%
Destruction limit voltage	max. 12V
External bridge supply possible	-
Internal bridge supply possible	\checkmark
Configurable bridge supply	2.5V / max. 120mA 5V / max. 120mA 7.5V / max. 100mA 10V / max. 90mA 12V / max. 80mA
Resolution in bit	24
Measurement principle	successive approximation
Basic conversion time	1ms cycle, 10ms330ms depending on the filter
Input filter Hardware	Low pass 10kHz 3rd order

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

Input filter software Dynamic IIR filter configurable IIR filter 0.1Hz1000Hz configurable IIR filter 0.1Hz1000Hz configurable IIR filter 0.1Hz1000Hz Initial data size 4 Byte Data for solection of the strain gauge DMS sensor - Endge supply voltage EXC 0.12V Bridge differential voltage SIG 5.4mVV Avie connection possible 5.4mVV 4 wire connection possible 5.4mVV Status information, atams, diagnostics symetric full bridge Status information, atams, diagnostics symetric full bridge Diagnostic inferrupti ges parameterizable Diagnostic information read-out ges Module arear display cel LED Channel eror display cel LED Lonanel eror display cel LED Between channels of groups to cel LED Between channels of groups to cel LED Max. potential difference	Order no.	031-1CA20
initial data sizeconfigurable FIR filter S0HzB0HzInitial data size4 Stp3Data or solection of the strain gauge DMS sensor0.12VBridge sufferchial voltage EXC0.12VRade output0.5.4mVV4 wire connection possible06 wire connection possiblewire full bridge sufferchial voltage SIG7 bossible bridge configurationwire connection possible8 brite configurationwire connection possible8 brite sole suffercation safersyes parameterizable9 brite sole sole sole sole sole sole sole sol	Input filter software	Dynamic IIR filter
Initial data size4 ByleData for selection of the strain gauge DMS sensorBridge supply voltage EXC0.12VBridge differential voltage SIG4.29mVReled output0.54m/VA wire connection possible6 wire connection possible7 wire connection possible8 wire connection possible8 wire connection possibleyes9 wire connection po		configurable IIR filter 0.1Hz1000Hz
Data for selection of the strain gauge DMS sensorBridge supply voltage EXC012VBridge differential voltage SIG4:29mVRated output047MVVA wire connection possible-6 wire connection possiblesymmetric full bridgePossible bridge configurationsymmetric full bridgePossible bridge configurationges parameterizablePossible bridge configurationges, parameterizablePossible bridge configurationges, parameterizableProcess alamnoDiagnostic functionsges, parameterizableDiagnostic functionsgesDiagnostic functionsgesModule stategesModule stategesBetween channels of groups togesBetween channels of groups togesBetween channels and backplane busgesBetween channels and backplane busgesBetween channels and packplane busgesBetween channels and packplane busgesBetween channels and packplane busgesBetween channels and packplane busgesBetween channels difference between inputs dufter (Ucm)gesMax. potential difference between inputs duftamet (Utsm)gesMax. potential difference between inputs and Mana (Ucm)GesMax. potential difference between inputs and Mana (Ucm) </td <td></td> <td>configurable FIR filter 50Hz/60Hz</td>		configurable FIR filter 50Hz/60Hz
Bridge supply voltage EXC 012V Bridge differential voltage SIG +/-29mV Rated output 0.54mV/V 4 wire connection possible > 6 wire connection possible symmetric full bridge 9 bridge configuration symmetric full bridge Status information, alarms, diagnostics yes Status display yes, parameterizable Process alarm no Diagnostic interrupt yes, parameterizable Diagnostic interrupt yes, parameterizable Diagnostic information read-out yes Module state yes Module error display red LED Channel error display red LED Between channels - Between channels - Between channels and backplane bus - Between channels and power supply - Max. potential difference between inputs and Mintern (Uiso) - Max. potential difference between inputs and Mintern (Uiso) Chancel Max. potential difference between inputs and Mintern (Uiso) Chancel Max. potential difference between	Initial data size	4 Byte
Bridge differential voltage SIG 4/29mV Rated output 0.54mV/V 4 wire connection possible 6 wire connection possible symmetric full bridge Possible bridge configuration symmetric full bridge Status formation, alarms, diagnostics yes Status fisplay yes, parameterizable Interrupts yes, parameterizable Process alarm no Diagnostic functions yes	Data for selection of the strain gauge DMS sensor	
Rated output0.54mV/V4 wire connection possible6 wire connection possible9 ossible bridge configurationsymmetric full bridgeStatus displayyesInterruptsyes, parameterizableProcess alarmnoDiagnostic functionsyes, parameterizableDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesDiagnostic functionsyesModule error displayred LEDChannel error displayred LEDEtween channels-Between channels-Between channels and backplane bus-Max, potential difference between inputs (Ucm)-Max, potential difference between inputs and Mintern (Uiso)-Max, potential difference between inputs and Mintern (Uiso)-Insultation tested withDC 500 VDatasics-Input bytes-Output bytes-Diapotici bytes-Diapotici bytes-Diapotici bytes-Diapotici bytes-Diapotici bytes-Diapoti	Bridge supply voltage EXC	012V
A wire connection possible·6 wire connection possible·Possible bridge configurationsymetric full bridge7 Status information, atarms, diagnostics·5 Status information, atarms, diagnosticsyes, parameterizableProcess alarmnoDiagnostic interruptyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostic functionsyesModule error displayred LEDChannel error displayed LEDBetween 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 Mintern (Uiso)·Max, potential difference between inputs and Mintern (Uiso)·Input types·Diapotsic bityes·Diapotsic bityes·Diapotsic bityes·Diapotsic bityes·Diapotsic bityes·Max, potential difference between inputs and Mintern (Uiso)·Diapotsic bityes·Diapotsi	Bridge differential voltage SIG	+/-29mV
Switce control * Possible bridge configuration symmetric full bridge Status information, alarms, diagnostics * Status display yes Interrupts yes, parameterizable Process alarm no Diagnostic interrupt yes, parameterizable Diagnostic functions yes Diagnostic functions yes Diagnostic interrupt yes Module state yes Module error display red LED Channel error display red LED States of groups to - Between channels - Between channels and power supply - Between channels and power supply - Max. potential difference between circuits - 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 inputs and Mintern (Uiso) - Max. potential difference between inputs and Mintern (Uiso) -<	Rated output	0.54mV/V
Boundation planeStatus information, alarms, diagnosticsStatus information, alarms, diagnosticsStatus information, alarms, diagnosticsStatus displayprocess alarmnoDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostic functionsyesDiagnostic information read-outyesModule stateyesModule error displayred LEDBetween channels-Between channels-Between channels-Between channels of groups to-Max, potential difference between inputs (Ucm)-Max, potential difference between inputs and Mintern (Uiso)-Max, potential difference between inputs and Mintern (Uiso)C75V / AC50 VMax, potential difference between inputs and Mintern (Uiso)C75V / AC50 VInsulation tested withDC 500 VDetasizes-Input bytes5Output bytes1Output bytes3Output bytes3Output bytes3Output bytes3Output bytes3Output bytes3 <td>4 wire connection possible</td> <td>✓</td>	4 wire connection possible	✓
Status information, alarms, diagnosticsendinationStatus displayyes, parameterizableInterruptsnoDiagnostic interruptyes, parameterizableDiagnostic functionsyes, parameterizableDiagnostic functionsyesDiagnostic functionsyesModule stateyesModule stateyesBetween channelsred LEDBetween channels-Between channels of groups to-Between channels and backplane bus-Max, potential difference between inputs (Ucm)-Max, potential difference between inputs and Mintern (Uiso)-Max, potential difference between inputs and Mintern (Uiso)C75V/AC50VMax, potential difference between inputs and Mintern (Uiso)C750VMax, potential difference between inputs and Mintern (Uiso)C750VMax, potential difference between inputs and Mintern (Uiso)C750VMax, potential difference between inputs and Mintern (Uiso)DC30VInsulation tested withDC30VDataszes-Input bytes5Output bytes1Output bytes1Output bytes30Diagnostic bytes30Di	6 wire connection possible	✓
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Interruptsyes, parameterizableProcess alarmnoDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostic sinformation read-outpossibleModule stateyesModule error displayred LEDStattionred LEDStattionsBetween channels of groups to-Between channels and backplane bus-Between channels and power supply-Ama, potential difference between inputs (Ucm)-Max, potential difference between inputs and Mintern (Uisoo)-Max, potential difference between shannel and witherm (Uisoo)-Max, potential difference between inputs and Mintern (Uisoo)C75V/AC50VMax, potential difference between inputs and Mintern (Uisoo)-Max, potential difference between inputs and Mintern (Uisoo)C500VMax, potential difference between inputs and Mintern (Uisoo)-Max, potential difference between inputs and mintern (Uisoo)-Max potential difference between inputs and mintern (Uisoo)- <td>Status information, alarms, diagnostics</td> <td></td>	Status information, alarms, diagnostics	
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Diagnostic interruptese, parameterizableDiagnostic functionsyesDiagnostic information read-outpossibleModule stateyesModule statered LEDChannel eror displayred LEDBetween channels-Between channels of groups to-Between channels and backplane bus-Between channels of groups to-Between channels of groups to-Between channels and backplane bus-Between channels and power supply-Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mintern (Uisco)-Max. potential difference between inputs and Mintern (Uisco)-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Input bytes-Diaputstytes-Diaputstytes-Statese-Input bytes-Output bytes-Parameter bytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-Diaputstytes-	Interrupts	yes, parameterizable
Diagnostic functionsyesDiagnostics information read-outpossibleModule stateyesModule error displayred LEDIsolationred LEDIsolation-Between channels-Between channels of groups to-Between channels and backplane bus-Between channels of groups to-Batton-Between channels of groups to-Between channels of groups to-Between channels and power supply-Between channels ofference between inputs (UCm)-Max. potential difference between inputs (UCm)-Max. potential difference between inputs and Mintern (Uison)-Max. potential difference between inputs and Mintern (Uison)Co 150 VAC 500 VAMax. potential difference between Mintern and outputs-Input bytes-Diaptostyce-Input bytes-Output bytes-Input bytes-<	Process alarm	no
Diagnostics information read-outpossibleModule stateyesModule error displayred LEDChannel error displayred LEDIsolation-Between channels-Between channels of groups to-Between channels and backplane bus-Between channels of groups to-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 (Ucm)-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mintern (Uiso)Co150 VAC 500 VMax. potential difference between inputs and Mintern (Uiso)Co150 VMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)Co150 VMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mintern (Uiso)Co150 VMax. potential difference between inputs and Mintern (Uiso)-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern (Uiso)-Max. potential difference between Mintern (Uiso)-	Diagnostic interrupt	yes, parameterizable
Module stateyesModule error displayred LEDChannel error displayred LEDIsolatione CleDBetween 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)-Max. potential difference between inputs and Mantern (Uisco)-Max. potential difference between inputs and Mantern (Uisco)CD 57 V/ AC 50 VMax. potential difference between inputs and Mintern (Uisco)CD 500 VMax. potential difference between inputs and Mintern (Uisco)SC 500 VInput bytes5Output bytes1Input bytes30Output bytes30Input bytes20Input bytes30Input bytes <td>Diagnostic functions</td> <td>yes</td>	Diagnostic functions	yes
Addule error display red LED Channel error display red LED Isolation 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 (Ucm) - Max. potential difference between inputs (Ucm) - Max. potential difference between Mana and Mintern (Uiso) C75 V/ AC 50 V Max. potential difference between Mintern and outputs C500 V Max. potential difference between Mintern and outputs - Insulation tested with 5 Dubytes 5 Output bytes 30 Output bytes 30 Parameter bytes 20	Diagnostics information read-out	possible
Channel error displayred LEDIsolationImage: Comparison of the second of the	Module state	yes
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Between channels-Between channels of groups to-Between channels and backplane bus-Between channels and power supply-Between channels and power supply-Max. potential difference between circuits-Max. potential difference between niputs (Ucm)-Max. potential difference between niputs and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)C 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)C 500 VMax. potential difference between Mintern and outputs-Insulation tested withD C 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Channel error display	red LED
Between channels of groups to-Between channels and backplane busBetween channels and power supply-Between channels and power supply-Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mintern (Uiso)C 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	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 inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)DC 500 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Between channels	-
Between channels and power supply-Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between inputs and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between inputs and Mintern (Uiso)DC 500 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Between channels of groups to	-
Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputsDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Between channels and backplane bus	\checkmark
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Max. potential difference between Mana and Mintern (Uiso)-Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between circuits	-
Max. potential difference between inputs and Mana (Ucm)-Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizesDC 500 VInput bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between inputs (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)DC 75 V/ AC 50 VMax. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs-Insulation tested withDC 500 VDatasizes-Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between inputs and Mana (Ucm)	-
Insulation tested withDC 500 VDatasizesInput bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
DatasizesInput bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Max. potential difference between Mintern and outputs	-
Input bytes5Output bytes1Parameter bytes30Diagnostic bytes20	Insulation tested with	DC 500 V
Output bytes 1 Parameter bytes 30 Diagnostic bytes 20	Datasizes	
Parameter bytes30Diagnostic bytes20	Input bytes	5
Diagnostic bytes 20	Output bytes	1
	Parameter bytes	30
Housing	Diagnostic bytes	20
	Housing	

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

Order no.	031-1CA20
Material	PC / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	64 g
Weight including accessories	64 g
Gross weight	78 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	in preparation

3.16.4 Functionality

3.16.4.1 Basics - Strain gauge DMS

Strain gauge DMS

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

- Measurement of strains, compressions or torsions
- Measurement of forces and movements

There are the following strain gauge DMS types:

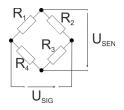
- electrical strain gauge DMS
 - An electrical strain gauge DMS consists of a carrier material (e.g. stretchable plastic film) with applied metal film. From this a grid of electrically conductive resistive material is created. During the measurement the behavior is used, that e.g. at the elongation of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

Characteristics of an strain gauge DMS

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

3.16.4.2 Function

Measurement



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

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

- Y_R Relative value
- U_{SIG} Measured differential voltage of the measuring bridge
- U_{SEN} Measured excitation voltage

RO Rated output

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

$$Y_A = Y_R \cdot NL \cdot SF$$

 $Y = Y_A \cdot GN + TA$

- Y_A Absolute value Y_R Relative value
- NL Nominal load
- SF Scale factor
- Y Resulting weight value
- Y_A 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.

ParametersDue 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 ¹	00h	00h	3100h	01h
UEXC	1	Excitation voltage ¹	00h	01h	3101h	02h
CAL	2	Calibration interval ¹	0000h	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

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

Name	Bytes	Function	Default	DS	IX	SX
RO	2	Rated output	4E20h	80h	310Ah	08h
ZB	2	Zero balance	0000h	80h	310Ch	09h
GN	2	Gain	1000h	80h	310Eh	0Ah
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	00000100h	80h	311Ah	10h
1) This record set may only be transferred at STOP state.						

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disable 40h: enable

Here you activate respectively de-activate the diagnostic function.

UEXC select power supply

Byte	Bit 7 0
0	 Power supply - 00h: 2.5V - 01h: 5V - 02h: 7.5V - 03h: 10V - 04h: 12V

Here you can specify the power supply for the excitation voltage U_{EXC}, which the module provides via the pins EXC+ und EXC-.



Please always use the excitation voltage U of the module_{EXC}! The connection of strain gauge DMS sensors with external power supply is not possible.

CAL Calibration interval

Byte	Bit 7 0
01	 Interval for the calibration. Calibration interval as 100ms value 00h: de-activates the calibration
By settin	a a calibration interval as 100ms value, the solf calibration is always per

- 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.

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

- 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 			
 Filter functions FIR 50/60 Hz Suppression of mains frequency interference Dynamic IIR filter automatic selection Filter selection dependent on the current weight change Static IIR filter De-activation respectively fix setting of a filter level (IIR1IIR8) 					
DFCT Dynamic Filter	Byte	Bit 7 0			
Change Time	01	Sampling rate for filter change-over in ms			
	Here you	a can specify the time for re-evaluation for the filter change-over in ms.			
DFD Dynamic filter delta	Byte	Bit 7 0			
	01	Limit value for filter change-over			
	Here you	a can specify the limit value for the filter change-over.			
RO Rated output	Byte	Bit 7 0			

Byte	
01	Rated output in 0.0001mV/V

ZB Zero balance

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

Bit 7 ... 0

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

System SLIO

Byte 0...1 Zero balance in 0.0001mV/V Here you can specify the zero balance as 0.0001mV/V value. Information to the zero balance can be found in the data sheet of you force transducer. **GN** Gain Bit 7 ... 0 **Byte** 0...1 Gain for user scaling of the output value Here you can specify a factor as 2⁻¹² value. The factor is multiplied with the output value. TA Tara **Byte** Bit 7 ... 0 0...1 User offset for the output value Here you can specify an offset as 2⁻¹² value. The offset is added to the determined output value. **NL Nominal load** Bit 7 ... 0 **Byte** 0...1 Nominal load of the force transducer Here you can specify the nominal load of the force transducer unit-free. Information to nominal load can be found in the data sheet of you force transducer. SF Scale factor process Bit 7 ... 0 **Byte** data 0...1 Scale factor for the nominal load Here you can specify the scale factor for the nominal load, such as to convert kg to g. Example: Nominal load in kg and scale factor 1000 (03E8h) results display in g. SST Steady state toler-Byte Bit 7 ... 0 ance 0...1 Tolerance for Steady State Here you can specify a tolerance window for the state Steady State. 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 window of 5g. SSW Steady state window Bit 7 ... 0 **Byte** 0...1 Time interval for Steady State in ms

031-1CA20 - AI 1x16(24)Bit Strain gauge (DMS) > Deployment of the filter functions

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

RL Reference load

Byte	Bit 7 0
03	Reference load for the calibration

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

3.16.6 Deployment of the filter functions

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 					
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	 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: 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. 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. With the IIR1 filter you get the lowest noise suppression and the most unstable measured value. With the IIR8 filter you get the highest noise suppression and the most stable measured value. The revaluation, which can lead to a modification of the filter levels, takes place in a fixed interval, which can be specified via parameter <i>DFCT</i> in ms. 					
	Filter Limit frequency Filter constant Rise time 10-90% [s] (typ.) level Image: second secon					
	02h: IIR1	1000	a ₀ = 0.5	0.0003		
	03h: IIR2	500Hz	a ₀ = 0.25	0.0008		
	04h: IIR3	125Hz	a ₀ = 62.5x10 ⁻³	0.0035		
	05h: IIR4	30Hz	a ₀ = 15.6x10 ⁻³	0.014		

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Filter level	Limit frequency	Filter constant	Rise time 10-90% [s] (typ.)
06h: IIR5	8Hz	a ₀ = 3.91x10 ⁻³	0.056
07h: IIR6	2Hz	a ₀ = 977x10 ⁻⁶	0.225
08h: IIR7	0.5Hz	a ₀ = 244x10 ⁻⁶	0.9
09h: IIR8	0.1Hz	a ₀ = 61.0x10 ⁻⁶	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 IIR8 filter (FILT = 09h - slow). The following steps are necessary for the calibration:

- 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, set bit 6 (set zero point) in the command byte *DMS_CMD*.
- **4.** Apply the balance with the reference load. As soon as a stable value is shown, set bit 7 (set reference point) in the command byte *DMS_CMD*.
- **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.
- **6.** Remove the reference weight again and wait until a stable value is shown.
- **7.** Tare the balance by setting bit 3 (set tare) in the *DMS_CMD* command byte.
 - \Rightarrow The calibration is complete.
 - 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 every 120 seconds.

3.16.8 Steady state detection

Functionality

- If the measured value is within the range of values SST longer than 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.
- If the measured value remains within SST over the period SSW, the steady-state bit is set.

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If the tolerance range SST is exceeded, the last measured value is used as starting

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

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

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

3.16.9 Diagnostics

Diagnostic data

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

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 overflow

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

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

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

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 parametrization

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

ERR_C reserved	Byte	Bit 7 0
	0	reserved

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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
-------	---------	------

Byte E
0

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

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of the module (here 01h)

CHERR Channel error	Byte	Bit 7 0
	0	Bit 0: set at error in channel 0

CHxERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel 0
		 Bit 0: set at project engineering respectively parametrization error Bit 21: reserved Bit 3: set at short circuit of excitation voltage U_{EXC} Bit 54: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow
	17	reserved

DIAG_US	us ticker
---------	-----------

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

µs ticker

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

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

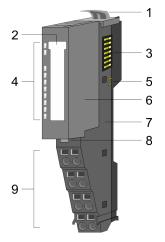
3.17 031-1CB30 - AI 2x16Bit 0...10V

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

Ē

E

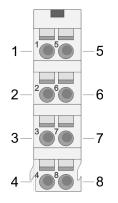
- Locking lever terminal module 1
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module 7
- Terminal module 8
 - Locking lever electronic module
- 9 Terminal

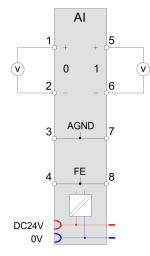
RUN	MF red	Al x	Description
		х	Bus communication is OK
		Λ	Module status is OK
	-	х	Bus communication is OK
	-	^	Module status reports an error
	_	x	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
		•	Signal leaves measuring rangeError in parameterization
not relevant: 2	Х		

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

Pin assignment

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





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

I: Input

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

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

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

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

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

Output area

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

3.17.1 Technical data

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

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

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

Analog input

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

Order no.	031-1CB30
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 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C

yes

yes SFU - Interference frequency suppression

Certifications UL certification

KC certification

3.17.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG	1	Diagnostics ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	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	07h
					3107h	
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h	08h
					3109h	
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	0Bh
					310Dh	
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh	0Ch
					310Fh	

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

DIAG_EN Diagnostic interrupt

0 Diagnostic interrupt	Byte
 Diagnostic interrupt 00h: disabled 40h: enabled 	0

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 2: reserved

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

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
циолој опрриссион (ст. с)	0	 Bit 1, 0: Interference frequency suppression channel 0 00: deactivated 01: 60Hz 10: 50Hz Bit 3, 2: Interference frequency suppression channel 1 00: deactivated 01: 60Hz 10: 50Hz 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.

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27648 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

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 hardware interrupt is initialized.

3.17.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

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

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	 Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 7 2: reserved
PRIT_US μs ticker	Byte	Bit 7 0
	0 1	Value of the µs ticker at the moment of the diagnostic.

µs ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

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

The following errors are listed in the diagnostics data:

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

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

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

ERR_A Diagnostic

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

MODTYP Module informa-	
tion	

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

ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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 hardware interrupt lost Bit 7: reserved

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

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

Number of channels of a module (here 02h)

0

CHERR Channel error

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

CH0ERR CH1ERR Channel-specific

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

DIAG_US µs ticker

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

µs ticker

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

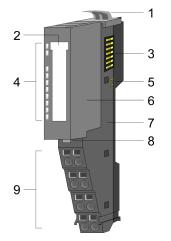
3.18 031-1CB40 - AI 2x16Bit 0(4)...20mA

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

Structure



Status indication

RUN MF

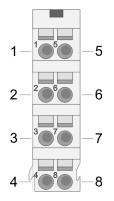
> AI 0 AI 1

- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

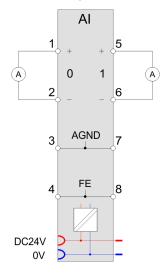
RUN	MF	Al x	Description
		x	Bus communication is OK Module status is OK
	•	x	Bus communication is OK Module status reports an error
	•	x	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
•		•	Error channel xSignal leaves measuring rangeError in parameterization
not relevant	:: X		

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

Pin assignment



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



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

I: Input



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

In-/Output area

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

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

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

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

Input area

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

Output area

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

3.18.1 Technical data

Order no.	031-1CB40
Туре	SM 031
Module ID	040B 1543
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-

Analog input

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

Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit with SFU-Basic error limit with SFU-Resistance thermometer inputs-Resistance thermometer ranges-Operational limit of resistance thermometer ranges with SFU-Operational limit of resistance thermometer ranges-Operational limit of resistance thermometer ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermoelement ranges-Destruction limit thermocouple ranges with SFU-Destruction limit thermocouple ranges-Destruction limit thermocouple ranges-Programmable temperature compensation-Internal temperature compensation-Internal temperature compensation-Resolution linit termocouple ranges-Resolution linit termocouple ranges-Restruction l	Order no.	031-1CB40
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Operational limit of resistance thermometer ranges-Operational limit of resistance thermometer ranges with SFU-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Destruction limit resistance thermometer inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Technical unit of temperature measurement-Resolution in bit-Measurement principleaccessive approximationBasic enversion time-Noise suppression for frequery>Noise suppression for frequery>Status displayyes, parameterizableInterruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic functionsyes, parameterizableDiagnostic functionsyes, parameterizableModule stateyessibleModule stateyessibleModule error displayyessible	Resistance thermometer inputs	-
Operational limit of resistance thermometer ranges with SFU-Basic error limit thermoresistor ranges-Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputs-Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges-Programmable temperature compensation-Temperature compensation-Technical unit of temperature and programmable-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time-Noise suppression for frequencyyesYesStatus displayInternation, alarms, diagnosticsyes, parameterizableDiagnostic information read-outyes, parameterizable	Resistance thermometer ranges	-
Basic error limit thermoresistor ranges.Basic error limit thermoresistor ranges with SFU.Destruction limit resistance thermometer inputs.Thermocouple inputs.Thermocouple ranges.Operational limit of thermocouple ranges.Basic error limit thermoelement ranges.Basic error limit thermocouple ranges with SFU.Basic error limit thermocouple ranges with SFU.Basic error limit thermocouple ranges with SFU.Destruction limit thermocouple ranges with SFU.Destruction limit thermocouple ranges with SFU.Destruction limit thermocouple inputs.Programmable temperature compensation.External temperature compensation.Tennel temperature compensation.Tennel temperature compensation.Resolution in bit16Measurement principlesuccessive approximationBasic conversion time.Noise suppression for frequency>.Status displayyesVictus displayyes, parameterizableProcess alarmyes, parameterizableDiagnostic information read-outyesDiagnostic information read-outyesDiagnostic information read-outyesModule error displayyesNotue terroryesDiagnostic information read-outyesDiagnostic information read-outyesModule error displayyesNotue terroryesNotue terroryes	Operational limit of resistance thermometer ranges	-
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Destruction limit resistance thermometer inputs- (Addet addet add	Basic error limit thermoresistor ranges	-
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 thermoelement ranges with SFU.Programmable temperature compensation.External temperature compensation.Internal temperature compensation.Tenchical unit of temperature measurement.Resolution in bit.Measurement principlesuccessive approximationBasic conversion frequency>&OBB (UCM<4V)	Basic error limit thermoresistor ranges with SFU	-
Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time-Noise suppression for frequency>Volus subpression for frequencyyesStatus displayyes, parameterizableInterruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic information read-outyes, parameterizableDiagnostic information read-outyesModule stateyes, parameterizableModule error displaygreen LEDModule error displayred LED	Destruction limit resistance thermometer inputs	-
Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Thermocouple inputs	-
Operational limit of thermocouple ranges with SFU-Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Thermocouple ranges	-
Basic error limit thermoelement ranges-Basic error limit thermocouple inputs-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequencysedB (UCM<4V)	Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 μs all channelsNoise suppression for frequency>80dB (UCM<4V)	Operational limit of thermocouple ranges with SFU	-
Destruction limit thermocouple inputs-Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Basic error limit thermoelement ranges	-
Programmable temperature compensation-External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Basic error limit thermoelement ranges with SFU	-
External temperature compensation-Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Destruction limit thermocouple inputs	-
Internal temperature compensation-Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Programmable temperature compensation	-
Temperature error internal compensation-Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	External temperature compensation	-
Technical unit of temperature measurement-Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Internal temperature compensation	-
Resolution in bit16Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Temperature error internal compensation	-
Measurement principlesuccessive approximationBasic conversion time240 µs all channelsNoise suppression for frequency>80dB (UCM<4V)	Technical unit of temperature measurement	-
Basic conversion time240 µs all channelsBasic conversion time>80dB (UCM<4V)	Resolution in bit	16
Noise suppression for frequency>80dB (UCM<4V)Status information, alarms, diagnostics>80dB (UCM<4V)Status displayyesStatus displayyesInterruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostic functionsyesNodule stategreen LEDModule error displayred LED	Measurement principle	successive approximation
Status information, alarms, diagnosticsStatus displayyesInterruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Basic conversion time	240 μs all channels
Status displayyesInterruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Noise suppression for frequency	>80dB (UCM<4V)
Interruptsyes, parameterizableProcess alarmyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Status information, alarms, diagnostics	
Process alarmyes, parameterizableDiagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Status display	yes
Diagnostic interruptyes, parameterizableDiagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Interrupts	yes, parameterizable
Diagnostic functionsyesDiagnostics information read-outpossibleModule stategreen LEDModule error displayred LED	Process alarm	yes, parameterizable
Diagnostics information read-out possible Module state green LED Module error display red LED	Diagnostic interrupt	yes, parameterizable
Module state green LED Module error display red LED	Diagnostic functions	yes
Module error display red LED	Diagnostics information read-out	possible
	Module state	green LED
Channel error display red LED per channel	Module error display	red LED
	Channel error display	red LED per channel

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

Order no.	031-1CB40
Isolation	
Between channels	-
Between channels of groups to	
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 3 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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

3.18.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	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	07h
					3107h	
CHOLL	2	Lower limit value channel 0	8000h	80h	3108h	08h
					3109h	
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	0Bh
					310Dh	
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh	0Ch
					310Fh	

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit	value
monito	bring	g	

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 2: reserved

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

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 0
0	 Bit 1, 0: Interference frequency suppression channel 0 00: deactivated 01: 60Hz 10: 50Hz Bit 3, 2: Interference frequency suppression channel 1 00: deactivated 01: 60Hz 10: 50Hz Bit 7 4: reserved

CHxFN Function number channel x

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

0(4) ... 20mA

Meas. range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	D 27649 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{1}{20}$
S7 format	10mA	13824	3600h		20
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	2/048
0 20mA	25.00mA	20480	5000h	overrange	D 16294 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{1}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	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		16
	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

031-1CB40 - AI 2x16Bit 0(4)...20mA > 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 hardware interrupt is initialized.

3.18.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL Limit overflow

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

System SLIO

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

PRIT_UL Limit underflow	Byte	Bit 7 0		
	0	 Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 7 2: reserved 		
PRIT_US μs ticker	Byte	Bit 7 0		
	0 1	Value of the µs ticker at the moment of the diagnostic.		
	PRIT_US με	sticker		
	In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 232-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 2 ¹⁶ -1).			
Diagnostic data	Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt _{ince} 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 diagno interrupt _{incoming} and diagnostic interrupt _{going} are not stored and get lost. Within this time window (1. diagnostic interrupt _{incoming} until last diagnostic interrupt _{going}) the MF-LED of module is on.			
	The following	g errors are listed in the diagnostics data:		
	Error in project engineering / parameterization			
		ng range overflow ng range underflow		
	Hardware interrupt lost			
	Power s	upply failed		
	DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.			
	IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.			
	SX - Subindex for access via EtherCAT with Index 5005h.			
	More can be found in the according manual of your bus coupler.			

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	71h			06h
NUMBIT	1	Number diagnostic bits	08h			07h
		per channel				
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERRCH7 ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_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 parametrization

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present

Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 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 hardware interrupt lost Bit 7: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR CH1ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x:
		Bit 0: set at configuring/parameter assignment error
		 Bit 4 1: reserved Bit 5: set at hardware interrupt lost
		 Bit 6: set at measuring range underflow
		Bit 7: set at measuring range overflow
CH2ERR CH7ERR reserved	Byte	Bit 7 0
reserveu	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the μ s ticker at the moment of the diagnostic
	µs ticker	
	,	

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

031-1CB70 - AI 2x16Bit ±10V

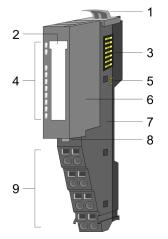
3.19 031-1CB70 - AI 2x16Bit ±10V

Properties

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

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

Structure



Status indication

RUN MF

> AI 0 AI 1

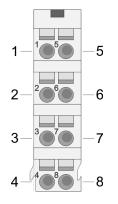
- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus4 LED status indica
- 4 LED status indication5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

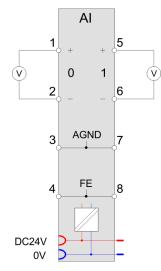
RUN green	MF red	Al x	Description
		х	Bus communication is OK Module status is OK
		х	Bus communication is OK Module status reports an error
		х	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
•		•	Error channel xSignal leaves measuring rangeError in parameterization

031-1CB70 - AI 2x16Bit ±10V

Pin assignment

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





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

I: Input

In-/Output area

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

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

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

Input area

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

Output area

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

3.19.1 Technical data

Current consumption/power lossImage: constant consumption from backplane busGo mAPower loss0.8 WTechnical data analog inputs2Number of inputs2Cable length, shielded00 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)20 mAVoltage inputs~Voltage inputs200 mANumber of inputs100 kΩUnrent consumption from load voltage L+ (without load)20 mAVoltage inputs~Voltage inputs-10 V +10 V 0 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.2%Departional limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Current inputs-Aux. input resistance (current range)-Input current ranges-Operational limit of current ranges-Current inputs-Current inputs-Operational limit of current ranges-Operational limit of current r	Order no.	031-1CB70
Current consumption/power loss60 mACurrent consumption from backplane bus60 mAPower loss0.8 WTechnical data analog inputs7Number of inputs20 on mCable length, shielded200 mRated load voltage00 MACurrent consumption from load voltage L+ (withou load)20 AQVoltage inputsMum in input resistance (voltage range)00 kQIni. input resistance (voltage range)100 kQOperational limit of voltage ranges+/0.2%Operational limit of voltage ranges-Saice error limit voltage ranges with SFU-Destruction limit voltage ranges-Mux. input resistance (current range)-Ourrent inputs-Current inputs-Current ranges-Operational limit of current ranges-Mux. input resistance (current ranges)-Operational limit of current ranges-Operational limit or current inputs (voltage)-Operational limit current inputs	Туре	SM 031
Current consumption from backplane bus60 mAPower loss0.8 WTechnical data analog inputs2Number of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)20 mAVoltage inputs✓Voltage inputs✓Min. input resistance (voltage range)200 kQInput voltage ranges-100 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage-Max. input resistance (current ranges)-Input outrent ranges-Operational limit of current ranges-Basic error limit voltage-Current inputs-Current inputs-Current inputs-Basic error limit voltage-Current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Operational limit of current ranges-Destruction limit current ranges-Basic error limit current ranges-Basic error limit current ranges-Destruction limit current ranges-Basic error limit current ranges-Basic error limit current ranges-Basic error limit current ranges-Basic eror limit current r	Module ID	040C 1543
Power loss 0.8 W Technical data analog inputs	Current consumption/power loss	
Technical data analog inputsImage: stand of the stand of	Current consumption from backplane bus	60 mA
Number of inputs2Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)20 mAVoltage inputs200 kQInin input resistance (voltage range)200 kQInput voltage ranges-10 V +10 VOperational limit of voltage ranges+-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Max. input resistance (current ranges)-Operational limit of voltage ranges with SFU-Destruction limit voltage-Current inputs-Operational limit of urger-Operational limit of urger-Basic error limit voltage-Operational limit of current ranges-Operational limit of urger-Operational limit of urger-Operational limit of urger-Operational limit of urger-Operational limit or urger-Operational limit or urgers-Operational limi	Power loss	0.8 W
Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)20 mAVoltage inputs~Voltage inputs200 kΩInput voltage ranges10 V +10 V 0 V +10 VOperational limit of voltage ranges+/0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges-Max. input resistance (current range)-Input current ranges-Operational limit of voltage ranges with SFU-Sacceror limit voltage-Operational limit of current ranges-Naz. input resistance (current range)-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Operational limit current inputs (electrical current)-Resistance inputs-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-	Technical data analog inputs	
Rated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)20 mAVoltage inputs~Min. input resistance (voltage range)200 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit current ranges-Operational limit current ranges-Operational limit current ranges-Resistance inputs-Resistance inputs-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Resistance inputs-Resistance inputs-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operatio	Number of inputs	2
Current consumption from load voltage L+ (without load)20 mAVoltage inputsMin. input resistance (voltage range)200 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-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-Operational limit of current ranges with SFU-Destruction limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Destruction limit current ranges <t< td=""><td>Cable length, shielded</td><td>200 m</td></t<>	Cable length, shielded	200 m
Voltage inputs✓Min. input resistance (voltage range)200 kΩInput voltage ranges-10 V +10 V0 V +10 V0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Basic error limit current ranges with SFU-Destruction limit current ranges-Residance ranges-Resistance inputs-Resistance inputs-Resistance inputs-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-	Rated load voltage	DC 24 V
Nine input resistance (voltage range)200 kΩInput voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction 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)-Destruction limit current inputs (electrical current)-Resistance ranges-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU <t< td=""><td>Current consumption from load voltage L+ (without load)</td><td>20 mA</td></t<>	Current consumption from load voltage L+ (without load)	20 mA
Input voltage ranges-10 V +10 V 0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Destruction limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Redical error limit current ranges-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance ranges-Qperational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit	Voltage inputs	\checkmark
Provide0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFUmax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Operational limit of current ranges-Resistance inputs-Resistance inputs-Resistance ranges-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-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ra	Min. input resistance (voltage range)	200 κΩ
Operational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFUmax. 30VCurrent 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-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Operational limit current ranges-Basic error limit current ranges-Basic error limit current ranges-Resistance inputs-Resistance inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destruction limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-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- </td <td>Input voltage ranges</td> <td>-10 V +10 V</td>	Input voltage ranges	-10 V +10 V
Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Operational limit of current ranges with SFU-Basic error limit 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-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-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-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- <tr <td="">Operational limit</tr>		0 V +10 V
Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Basic error limit current ranges-Basic error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges	Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance ranges-Qperational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor r	Operational limit of voltage ranges with SFU	-
Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-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 ranges-Resistance ranges-Operational limit of resistor ranges with SFU-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Opera	Basic error limit voltage ranges	+/-0.1%
Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-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 ranges-Resistance ranges-Operational limit of resistor ranges with SFU-Serier of limit current inputs (electrical current)-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU- <td>Basic error limit voltage ranges with SFU</td> <td>-</td>	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 inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Sperational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ra	Destruction limit voltage	max. 30V
Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges<	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 inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit	Max. input resistance (current range)	-
Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operati	Input current ranges	-
Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-	Operational limit of current ranges	-
Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor	Operational limit of current ranges with SFU	-
Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-	Basic error limit current ranges	-
Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-	Radical error limit current ranges with SFU	-
Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-	Destruction limit current inputs (voltage)	-
Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-	Destruction limit current inputs (electrical current)	-
Operational limit of resistor ranges - Operational limit of resistor ranges with SFU -	Resistance inputs	-
Operational limit of resistor ranges with SFU -	Resistance ranges	-
	Operational limit of resistor ranges	-
Basic error limit -	Operational limit of resistor ranges with SFU	-
	Basic error limit	-

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

Order no.	031-1CB70
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel

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

Order no.	031-1CB70
Isolation	
Between channels	
Between channels of groups to	
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 1 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.19.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	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	07h
					3107h	
CH0LL	2	Lower limit value channel 0	8000h	80h	3108h	08h
					3109h	
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	0Bh
					310Dh	
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh	0Ch
					310Fh	

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_	EN	Limit value
monite	orin	g

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 7 2: reserved

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

System SLIO

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
	0	 Bit 1, 0: Interference frequency suppression channel 0 00: deactivated 01: 60Hz 10: 50Hz Bit 3, 2: Interference frequency suppression channel 1 00: deactivated 01: 60Hz 10: 50Hz 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 = 27649 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27040
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		10384
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

Meas. range	Voltage	Decimal	Hex	Range	Formulas	
(funct. no.)	(U)	(D)				
0 10V	11.76V	32511	7EFFh	overrange	D = 27648 U	
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$	
(10h)	5V	13824	3600h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$	
	-1.76V	-4864	ED00h	underrange	27040	
0 10V	12.5V	20480	5000h	overrange	D = 16294 U	
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$	
(20h)	5V	8192	2000h		10	
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$	
	-2V	-3277	F333h	underrange	10564	

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 hardware interrupt is initialized.

3.19.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameterization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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.

Analog input

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

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 (high byte)
				05h (low byte)

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

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

PRIT	US	μs	ticker	
------	----	----	--------	--

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

µs-ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

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

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Hardware interrupt lost
- Power supply failed

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

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

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

ERR_A Diagnostic

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

MODTYP Module information

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

ERR_D Diagnostic

NUMCH Channels

Byte	: 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 hardware interrupt lost Bit 7: reserved 					

CHTYP Channel type	Byte	Bit 7 0
C	D	 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)

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

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

CH0ERR/CH1ERR Channel-specific	Byte	Bit 7 0
	0	 Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 4 1: reserved Bit 5: set at hardware interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow
CH2ERR CH7ERR	Bvte	Bit 7 0

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

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

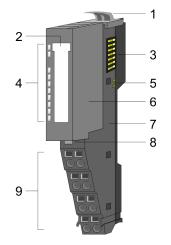
3.20 031-1CD30 - AI 4x16Bit 0...10V

Properties

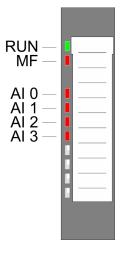
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Chap. 3.21 '031-1CD35 AI 4x16Bit 0...10V' page 247 with limited parameter set

Structure



Status indication



RUN	MF e red	Al x	Description
		х	Bus communication is OK Module status is OK
	•	х	Bus communication is OK Module status reports an error
		х	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
		•	Signal leaves measuring rangeError in parameterization
not relevant: X			

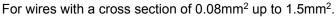
1 Locking lever terminal module

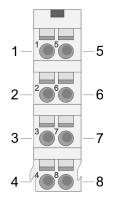
- 2 Labeling strip
- 3 Backplane bus4 LED status indica
- 4 LED status indication5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

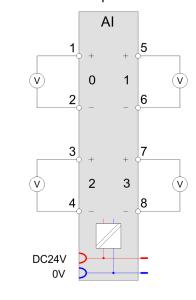
HB300 | SM-AIO | | en | 23-20

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

Pin assignment







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

I: Input

In-/Output area

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

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

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

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

Input area

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

Output area

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

3.20.1 Technical data

Module ID040D 1544Current consumption/power loss65 mACurrent consumption from backplane bus65 mAPower loss0.9 WTechnical data analog inputs7Number of inputs4Cable length, shieldedDC 24 VCurrent consumption from load voltage L+ (without load)25 mACurrent consumption from load voltage L+ (without load)20 NAVoltage inputs200 kQCurrent consumption from load voltage L+ (without load)20 NAVoltage inputs00 kQUnin input resistance (voltage ranges)0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges-Mux. input resistance (current range)-Mux. input resistance (current ranges)-Operational limit of current ranges-Mux. input resistance (current ranges)-Operational limit of current ranges-Mux. input resistance (current ranges)-Operational limit of current ranges-Operational limit of current ranges-Destruction limit current ranges-Radical error limit current ranges-Radical error limit current ranges-Destruction limit current ranges-Radical error limit current ranges-Radical error limit current ranges-Radical error limit current ranges-Radical	Order no.	031-1CD30
Current consumption/power loss 65 mA Current consumption from backplane bus 65 mA Power loss 0.9 W Technical data analog inputs - Number of inputs 4 Cable length, shielded 000 m Cable length, shielded 020 V Current consumption from load voltage L+ (without load) 25 mA Voltage inputs 200 kQ Min. input resistance (voltage range) 200 kQ Voltage ranges 01 V +10 V Operational limit of voltage ranges with SFU - Basic error limit voltage ranges with SFU - Destruction limit voltage ranges with SFU - Max. input resistance (current ranges) - Operational limit of current ranges - Not current ranges - Operational limit of current ranges - Operational limit of current ranges with SFU - Destruction limit current ranges with SFU	Туре	SM 031
Current consumption from backplane bus 65 mA Power loss 0.9 W Technical data analog inputs - Number of inputs 4 Cable length, shielded 200 m Rated load voltage DC 24 V Current consumption from load voltage L+ (without load) 25 mA Voltage inputs - Voltage inputs 00 kQ Deperational limit of voltage ranges 00 kQ Operational limit of voltage ranges with SFU - Destruction limit voltage ranges with SFU - Destruction limit voltage ranges +/-0.1% Raki input resistance (current range) - Max. input resistance (current ranges) - Operational limit of current ranges - Querent ranges - Querent ranges - Current inputs - Current ranges - Destruction limit voltage ranges with SFU - Querent ranges - Racical error limit current ranges with SFU - Destruction limit current ranges with SFU -	Module ID	040D 1544
Power loss0.9 WTechnical data analog inputs4Number of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs~Voltage inputs00 kQOperational limit of voltage ranges00 V+10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Operational limit of voltage ranges with SFU-Destruction limit voltage ranges+/-0.1%Current inputs-Current inputs-Current inputs-Current ranges-Destruction limit of current ranges-Input current ranges-Operational limit of current ranges-Current inputs-Current inputs-Current inputs-Current ranges-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU- <td>Current consumption/power loss</td> <td></td>	Current consumption/power loss	
Technical data analog inputsImage: state inputsNumber of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs200 kQVoltage inputs00 kQInput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Current ranges-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of urrent ranges-Current inputs-Current inputs-Operational limit of current ranges-Operational limit of current ranges-Operational limit of urrent ranges with SFU-Operational limit of urrent ranges-Operational limit of urrent ranges-Radical error limit current ranges with SFU-Destruction limit current ranges-Destruction limit current ranges with SFU-Destruction li	Current consumption from backplane bus	65 mA
Number of inputs4Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputsVoltage inputs200 kΩInni, input resistance (voltage range)00 kΩInput voltage ranges0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Current inputs-Current ranges-Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage-Current ranges-Operational limit of current ranges-Basic error limit current ranges with SFU-Operational limit of current ranges with SFU-Destruction limit current ranges wit	Power loss	0.9 W
Cable length, shielded200 mRated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs✓Win. input resistance (voltage range)200 kΩInput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges+/-0.1%Current inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Input current ranges-Operational limit of current ranges-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Operational limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with S	Technical data analog inputs	
Rated load voltageDC 24 VCurrent consumption from load voltage L+ (without load)25 mAVoltage inputs✓Win. input resistance (voltage range)200 kΩInput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction limit voltage ranges+/-0.1%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-Radical error limit current ranges with SFU-Operational limit of current ranges-Operational limit of current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current ranges with SFU-Destruction limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destructional limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of	Number of inputs	4
Current consumption from load voltage L+ (without load)25 mAVoltage inputsWin. input resistance (voltage range)200 kΩOperational limit of voltage ranges0 V +10 VOperational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Current inputs-Current inputs-Current ranges-Operational limit of current ranges-Current limit current ranges-Operational limit current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges-Resistance inputs-Resistance inputs-Operational limit of current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges with SF	Cable length, shielded	200 m
Voltage inputs·Min. input resistance (voltage range)200 kΩInput voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Destruction 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 voltage-Operational limit of current ranges-Radical error limit current ranges with SFU-Basic error limit current ranges-Redical error limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance ranges-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic	Rated load voltage	DC 24 V
Numerical200 kΩInput resistance (voltage range)0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFU-Querent 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-Operational limit current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (leectrical current)-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit	Current consumption from load voltage L+ (without load)	25 mA
Input voltage ranges0 V +10 VOperational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges with SFU-Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational 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)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destruction limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Destruction limit of resistor ranges-Op	Voltage inputs	\checkmark
Operational limit of voltage ranges+/-0.2%Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltage ranges with SFUmax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges-Sasic error limit current ranges-Operational limit of current ranges-Operational limit of current ranges-Operational limit of current ranges-Basic error limit current ranges-Operational limit of current ranges-Redical error limit current ranges-Resistance inputs-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Destruction limit current inputs (electrical current)-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Operational limit of resis	Min. input resistance (voltage range)	200 kΩ
Operational limit of voltage ranges with SFU-Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-Operational limit of current ranges-Radical error limit current ranges with SFU-Destruction limit current ranges-Radical error limit current ranges-Resistance inputs-Resistance inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit current inputs (voltage)-Destruction limit current inputs (voltage)-Operational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Stance ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit-Stance ranges-Operational limit of resistor ranges with SFU-Basic error limit-Destruction limit of resistor ranges with SFU-Destruction limit of resistor ranges with SFU- <td>Input voltage ranges</td> <td>0 V +10 V</td>	Input voltage ranges	0 V +10 V
Basic error limit voltage ranges+/-0.1%Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-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 inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Sesistance ranges-Operational limit of resistor ranges with SFU-Basic error limit current inputs (soltage)-Current inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges-Basic error limit-Basic error lim	Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges with SFU-Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit 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-Qperational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basis error limit current inputs (voltage)-Destruction limit current inputs (voltage)-Destruction limit current inputs (voltage)-Qperational limit of resistor ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic err	Operational limit of voltage ranges with SFU	-
Destruction limit voltagemax. 30VCurrent inputs-Max. input resistance (current range)-Input current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges with SFU-Destruction limit current ranges-Destruction limit current ranges-Radical error limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit current inputs (electrical current)-Destruction limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Basic error	Basic error limit voltage ranges	+/-0.1%
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 inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit current inputs (electrical current)-Basic error limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Operational limit of resistor ranges with SFU-Basic error limit-Basic erro	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 inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Saic error limit current inputs (electrical current)-Resistance inputs-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Saic error limit-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-Saic error limit-Operational limit of resistor ranges with SFU-Operational limit of resistor	Destruction limit voltage	max. 30V
Input current ranges-Operational limit of current ranges-Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Seater ron limit current inputs (electrical current)-Resistance ranges-Operational limit of resistor ranges with SFU-Seater ron limit of resistor ranges with SFU <td< td=""><td>Current inputs</td><td>-</td></td<>	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 inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit- <td>Max. input resistance (current range)</td> <td>-</td>	Max. input resistance (current range)	-
Operational limit of current ranges with SFU-Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Destruction limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit	Input current ranges	-
Basic error limit current ranges-Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit-	Operational limit of current ranges	-
Radical error limit current ranges with SFU-Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-Basic error limit-	Operational limit of current ranges with SFU	-
Destruction limit current inputs (voltage)-Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges with SFU-Operational limit of resistor ranges with SFU-Basic error limit-	Basic error limit current ranges	-
Destruction limit current inputs (electrical current)-Resistance inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-	Radical error limit current ranges with SFU	-
Resistance inputs-Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-	Destruction limit current inputs (voltage)	-
Resistance ranges-Operational limit of resistor ranges-Operational limit of resistor ranges with SFU-Basic error limit-Constructional limit of resistor ranges with SFU-Constructional limit of resistor ranges with SFU <t< td=""><td>Destruction limit current inputs (electrical current)</td><td>-</td></t<>	Destruction limit current inputs (electrical current)	-
Operational limit of resistor ranges - Operational limit of resistor ranges with SFU - Basic error limit -	Resistance inputs	-
Operational limit of resistor ranges with SFU - Basic error limit -	Resistance ranges	-
Basic error limit	Operational limit of resistor ranges	-
	Operational limit of resistor ranges with SFU	-
Basic error limit with SFU -	Basic error limit	-
	Basic error limit with SFU	-

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

Order no.	031-1CD30
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	

Analog input

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Order no.	031-1CD30
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 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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 ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	10h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
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
CH2FN	1	Function number channel 2	10h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	10h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

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

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

DIAG_EN Diagnostic inter-

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 2: Limit value monitoring channel 2 (1: on) Bit 3: Limit value monitoring channel 3 (1: on) Bit 7 4: reserved

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
ц, с.рр (с. с)	0	 Bit 1, 0: Interference frequency suppression channel 0 Bit 3, 2: Interference frequency suppression channel 1 Bit 5, 4: Interference frequency suppression channel 2 Bit 7, 6: Interference frequency suppression channel 3 00: deactivated 01: 60Hz 10: 50Hz 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.

0 ... 10V

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11.76V	32511	7EFFh	overrange	D = 27648 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D = 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

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

CHxUL CHxLL Upper limit value Lower limit value channel x

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

3.20.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/parameteriza- tion	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	 Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 2: Limit overflow channel 2 Bit 3: Limit overflow channel 3 Bit 7 4: reserved

PRIT_UL Limit underflow

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

Byte	Bit 7 0
0	Bit 0: Limit underflow channel 0
	Bit 1: Limit underflow channel 1
	Bit 2: Limit underflow channel 2
	Bit 3: Limit underflow channel 3
	Bit 7 4: reserved

PRIT_US µs ticker

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

µs ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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 parametrization

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

ERR_D	Diagnostic
-------	------------

Byte	Bit 7 0
0	 Bit 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 hardware interrupt lost Bit 7: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		Bit 0: set at configuring/parameter assignment error
		Bit 4 1: reserved
		Bit 5: set at hardware interrupt lost
		Bit 6: set at measuring range underflow
		Bit 7: set at measuring range overflow

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

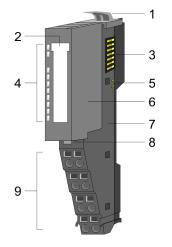
3.21 031-1CD35 - AI 4x16Bit 0...10V

Properties

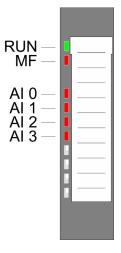
The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog inputs
- Suited for sensors with 0 ... 10V
- Diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Schap. 3.20 '031-1CD30 AI 4x16Bit 0...10V' page 236 with extended parameter set

Structure



Status indication

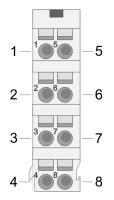


RUN	MF e red	Al x	Description	
		х	Bus communication is OK Module status is OK	
	•	х	Bus communication is OK Module status reports an error	
		х	Bus communication is not possible Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
	_		Error channel x	
		•	Signal leaves measuring rangeError in parameterization	
not relevant: X				

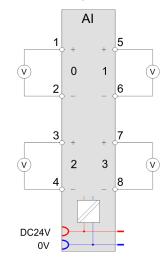
- 1 Locking lever terminal module
- 2 Labeling strip3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

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

Pin assignment



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



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

I: Input

In-/Output area

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

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

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

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

Output area

Input area

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

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

3.21.1 Technical data

Order no.	031-1CD35
Туре	SM 031
Module ID	0413 15C4
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	✓
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-

Analog input

Order no.	031-1CD35
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-

System SLIO

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

Order no.	031-1CD35
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-
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
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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 suppression	00h	01h	3100h	01h
CH0FN	1	Function number channel 0	10h	80h	3101h	02h
CH1FN	1	Function number channel 1	10h	81h	3102h	03h
CH2FN	1	Function number channel 2	10h	82h	3103h	04h
CH3FN	1	Function number channel 3	10h	83h	3104h	05h

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 0
0	 Bit 1, 0: Interference frequency suppression channel 0 Bit 3, 2: Interference frequency suppression channel 1 Bit 5, 4: Interference frequency suppression channel 2 Bit 7, 6: Interference frequency suppression channel 3 00: deactivated 01: 60Hz 10: 50Hz 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 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D 16284 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

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.

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

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

Name	Bytes	Function	Default	DS	IX	SX
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 parametrization

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

CHTYP Cha	nnel type
-----------	-----------

Byte	Bit 7 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

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

NUMPIT Discuss action hits		
NUMBIT Diagnostic bits	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	-	
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1
		Bit 2: set at error in channel group 2
		 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3
		 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
		Bit 3: set at error in channel group 3
CHOERR CH3ERR		 Bit 3: set at error in channel group 3 Bit 7 4: reserved
CH0ERR CH3ERR Channel-specific	Byte	Bit 3: set at error in channel group 3
CH0ERR CH3ERR Channel-specific	Byte 0	 Bit 3: set at error in channel group 3 Bit 7 4: reserved

•	
	Bit 0: set at configuring/parameter assignment error
	Bit 5 1: reserved
	Bit 6: set at measuring range underflow
	Bit 7: set at measuring range overflow

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US	µs ticker
---------	-----------

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

µs ticker

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

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

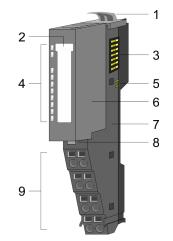
3.22 031-1CD40 - AI 4x16Bit 0(4)...20mA

Properties

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

- 4 analog inputs
- Suited for sensors with 0 ... 20mA;
 4 ... 20mA with external supply
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution
- Schap. 3.23 '031-1CD45 AI 4x16Bit 0(4)...20mA' page 268 with limited parameter set

Structure

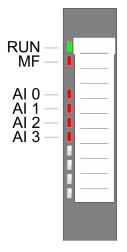


- Locking lever terminal module
- 2 Labeling strip

1

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

Status indication

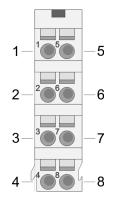


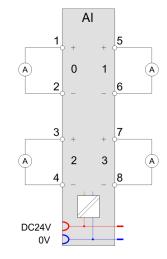
RUN	MF red	Al x	Description	
•		х	Bus communication is OK Module status is OK	
	•	х	Bus communication is OK Module status reports an error	
		х	Bus communication is not possible Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
•		•	Error channel xSignal leaves measuring rangeError in parameterization	
not relevant: X				

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

Pin assignment

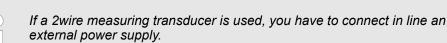
For wires with a cross section of 0.08mm² up to 1.5mm².





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

I: Input



In-/Output area

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

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

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

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

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

Input area

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

Output area

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

3.22.1 Technical data

Order no.	031-1CD40
Туре	SM 031 - Analog input
Module ID	0412 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	\checkmark
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

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

Order no.	031-1CD40
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermocouple ranges	-
Basic error limit thermocouple ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 μs all channels
Noise suppression for frequency	>80dB (UCM<4V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	\checkmark
Between channels and power supply	✓

Analog input

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

Order no.	031-1CD40
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-
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
Net weight	60 g
Weight including accessories	60 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.22.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	31h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CHOUL	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
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch
CH2FN	1	Function number channel 2	31h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	31h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

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

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 2: Limit value monitoring channel 2 (1: on) Bit 3: Limit value monitoring channel 3 (1: on) Bit 7 4: reserved

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
quonoj oupprocenen (er e)	0	 Bit 1, 0: Interference frequency suppression channel 0 Bit 3, 2: Interference frequency suppression channel 1 Bit 5, 4: Interference frequency suppression channel 2 Bit 7, 6: Interference frequency suppression channel 3 00: deactivated 01: 60Hz 10: 50Hz
		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.

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

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 20mA	23.52mA	32511	7EFFh	overrange	D 27(40 I
Siemens	20mA	27648	6C00h	nominal range	$D = 27648 \cdot \frac{I}{20}$
S7 format	10mA	13824	3600h		•
(31h)	0mA	0	0000h		$I = D \cdot \frac{20}{27648}$
	-3.52mA	-4864	ED00h	underrange	2/048
0 20mA	25.00mA	20480	5000h	overrange	D 16294 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$
S5 format	10mA	8192	2000h		•
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens	20mA	16384	4000h	nominal range	D = 10584 + 16
S5 format	12mA	8192	2000h		16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

0(4) ... 20mA

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 hardware interrupt is initialized.

3.22.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parametrization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	 Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 2: Limit overflow channel 2 Bit 3: Limit overflow channel 3 Bit 7 4: reserved

PRIT_UL Limit	underflow
---------------	-----------

Byte	Bit 7 0
0	 Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 2: Limit underflow channel 2 Bit 3: Limit underflow channel 3 Bit 7 4: reserved

PRIT_US µs ticker

 Byte
 Bit 7 ... 0

 0 ... 1
 Value of the µs ticker at the moment of the diagnostic.

µs ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

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

The following errors are listed in the diagnostics data:

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

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

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

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

ERR_D	Diagnostic
-------	------------

Byte	Bit 7 0
0	 Bit 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 hardware interrupt lost Bit 7: reserved

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 4 1: reserved Bit 5: set at hardware interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow
CH4ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0

µs ticker

Byte 0...3

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

Value of the μs ticker at the moment of the diagnostic

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

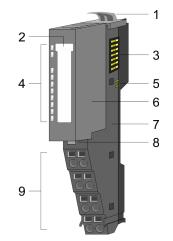
3.23 031-1CD45 - AI 4x16Bit 0(4)...20mA

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
- Schap. 3.22 '031-1CD40 AI 4x16Bit 0(4)...20mA' page 256 with extended parameter set

Structure

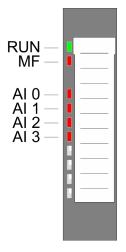


- Locking lever terminal module
- 2 Labeling strip

1

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

Status indication

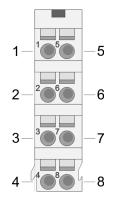


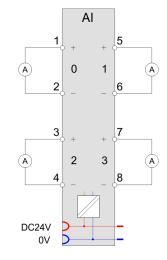
RUN	MF e red	Al x	Description		
		х	Bus communication is OK Module status is OK		
		х	Bus communication is OK Module status reports an error		
		х	Bus communication is not possible Module status reports an error		
		Х	Error at bus power supply		
Х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40		
•		•	Error channel xSignal leaves measuring rangeError in parameterization		
not relevant: X					

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

Pin assignment

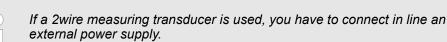
For wires with a cross section of 0.08mm² up to 1.5mm².





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

I: Input



In-/Output area

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

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

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

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

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

Input area

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

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 - Analog input
Module ID	0414 15C4
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	\checkmark
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

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

Order no.	031-1CD45
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermocouple ranges	-
Basic error limit thermocouple ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 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

Analog input

Order no.	031-1CD45
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-
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
Net weight	60 g
Weight including accessories	60 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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 (SFU)	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 frequency suppression (SFU)

Byte E	Bit 7 0
0 e	 Bit 1, 0: Interference frequency suppression channel 0 Bit 3, 2: Interference frequency suppression channel 1 Bit 5, 4: Interference frequency suppression channel 2 Bit 7, 6: Interference frequency suppression channel 3 00: deactivated 01: 60Hz 10: 50Hz 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.

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

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	27048
0 20mA	25.00mA	20480	5000h	overrange	D 16294 I
Siemens	20mA	16384	4000h	nominal range	$D = 16384 \cdot \frac{I}{20}$
S5 format	10mA	8192	2000h		
(41h)	0mA	0	0000h		$I = D \cdot \frac{20}{16384}$
	-4,00mA	-3277	F333h	underrange	10384
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		27648
	1.19mA	-4864	ED00h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$
Siemens S5 format	20mA	16384	4000h	nominal range	$D = 10384 \cdot \frac{16}{16}$
	12mA	8192	2000h		16
(40h)	4mA	0	0000h		$I = D \cdot \frac{16}{16384} + 4$
	0.8mA	-3277	F333h	underrange	

3.23.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

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

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

ERR D	Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		Bit 0: set at configuring/parameter assignment error

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_	US µs	ticker
-------	-------	--------

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

µs ticker

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

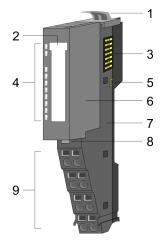
3.24 031-1CD70 - AI 4x16Bit ±10V

Properties

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

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

Structure



Status indication

RUN MF

AI 0

AI 1 AI 2 AI 3

- Locking lever terminal module Labeling strip
- 2 Labeling strip3 Backplane bus

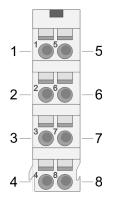
1

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

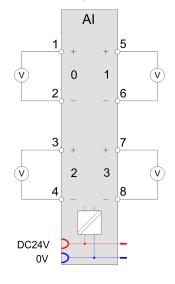
RUN	MF e red	Al x	Description
-		х	Bus communication is OK
		~	Module status is OK
_	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
		^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Signal leaves measuring rangeError in parameterization
not relevant:	Х		

031-1CD70 - AI 4x16Bit ±10V

Pin assignment



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



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.

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

Output area

Input area

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

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

3.24.1 Technical data

Order no.	031-1CD70
Туре	SM 031
Module ID	040E 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	\checkmark
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-

Analog input

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

Order no.	031-1CD70
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<35V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-

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

Order no.	031-1CD70
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

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

3.24.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
RES1	1	reserved	00h	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring ¹	00h	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	01h	3103h	04h
CH0FN	1	Function number channel 0	12h	80h	3104h	05h
RES7	1	reserved	00h	80h	3105h	06h
CHOUL	2	Upper limit value channel 0	7FFFh	80h	3106h 3107h	07h
CHOLL	2	Lower limit value channel 0	8000h	80h	3108h 3109h	08h
CH1FN	1	Function number channel 1	12h	81h	310Ah	09h
RES13	1	reserved	00h	81h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	81h	310Ch 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	81h	310Eh 310Fh	0Ch
CH2FN	1	Function number channel 2	12h	82h	3110h	0Dh
RES19	1	reserved	00h	82h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	82h	3112h 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	82h	3114h 3115h	10h
CH3FN	1	Function number channel 3	12h	83h	3116h	11h
RES25	1	reserved	00h	83h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	83h	3118h 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	83h	311Ah 311Bh	14h

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

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 0
0	 Bit 0: Limit value monitoring channel 0 (1: on) Bit 1: Limit value monitoring channel 1 (1: on) Bit 2: Limit value monitoring channel 2 (1: on) Bit 3: Limit value monitoring channel 3 (1: on) Bit 7 4: reserved

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
циолој опрриссион (ст. с)	0	 Bit 1, 0: Interference frequency suppression channel 0 Bit 3, 2: Interference frequency suppression channel 1 Bit 5, 4: Interference frequency suppression channel 2 Bit 7, 6: Interference frequency suppression channel 3 00: deactivated 01: 60Hz 10: 50Hz 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. 031-1CD70 - 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	27648	6C00h	nominal range	$D = 27048 \cdot \frac{10}{10}$
(12h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-5V	-13824	CA00h		27040
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	D 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(22h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-5V	-8192	E000h		10584
	-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 U
Siemens S7 format	10V	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{10}$
(10h)	5V	13824	3600h		10
	0V	0	0000h		$U = D \cdot \frac{10}{27648}$
	-1.76V	-4864	ED00h	underrange	27040
0 10V	12.5V	20480	5000h	overrange	D = 16294 U
Siemens S5 format	10V	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{10}$
(20h)	5V	8192	2000h		10
	0V	0	0000h		$U = D \cdot \frac{10}{16384}$
	-2V	-3277	F333h	underrange	10384

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 hardware interrupt is initialized.

3.24.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parametrization	-	Х	-
Measuring range overflow	-	Х	-
Measuring range underflow	-	Х	-
Limit overflow	Х	-	Х
Limit underflow	Х	-	Х
Diagnostic buffer overflow	-	Х	-
Communication error	-	Х	-
Hardware interrupt lost	-	Х	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt.

- A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
- With CANopen the hardware interrupt data a transferred via an emergency telegram.
- Operating with CPU, PROFIBUS and PROFINET the hardware 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 (high byte)
				05h (low byte)

PRIT_OL Limit overflow	Byte	Bit 7 0
	0	 Bit 0: Limit overflow channel 0 Bit 1: Limit overflow channel 1 Bit 2: Limit overflow channel 2 Bit 3: Limit overflow channel 3 Bit 7 4: reserved

PRIT_UL Limit underflow	Byte	Bit 7 0
	0	 Bit 0: Limit underflow channel 0 Bit 1: Limit underflow channel 1 Bit 2: Limit underflow channel 2 Bit 3: Limit underflow channel 3 Bit 7 4: reserved

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

PRIT_US µs ticker

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

µs ticker

In the SLIO module there is a 32 bit timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again. PRIT_US represents the lower 2 byte of the μ s ticker value (0 ... 2¹⁶-1).

Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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 parametrization

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

ERR_D	Diagnostic
-------	------------

Byte	Bit 7 0
0	 Bit 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 hardware interrupt lost Bit 7: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	 Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 4 1: reserved
		 Bit 5: set at hardware interrupt lost Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

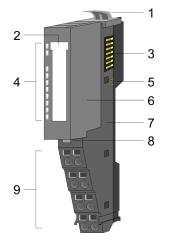
3.25 031-1LB90 - AI 2x16Bit TC

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 DC75V/AC50V between the inputs

Structure



Status indication

RUN MF

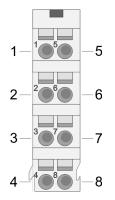
> AI 0 AI 1

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

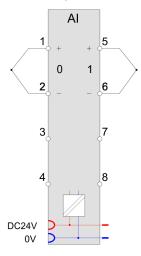
RUN green	MF	Al x	Description	
		x	Bus communication is OK	
		Λ	Module status is OK	
_	×		Bus communication is OK	
	-	^	Module status reports an error	
	_	N/	Bus communication is not possible	
	-	Х	Module status reports an error	
		Х	X Error at bus power supply	
х	ZHz	Х	X Error in configuration ఈ Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
		•	 Signal leaves measuring range Error in parameterization Wire break (if parameterized) 	
not relevant	:: X			

031-1LB90 - AI 2x16Bit TC

Pin assignment



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



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

I: Input



CAUTION!

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



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

Supplementation to the installation guidelines

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

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

In-/Output area

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

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

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

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

Output area

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

3.25.1 Technical data

Order no.	031-1LB90
Туре	SM 031
Module ID	040F 1543
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	10 ΜΩ
Input voltage ranges	-80 mV +80 mV
Operational limit of voltage ranges	±0.3%
Operational limit of voltage ranges with SFU	±0.1%
Basic error limit voltage ranges	±0.25%
Basic error limit voltage ranges with SFU	±0.05%
Destruction limit voltage	max. 20V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-

Analog input

Order no.	031-1LB90
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	\checkmark
Thermocouple ranges	type B
	type C
	type E
	type J type K
	type L
	type N
	type R
	type S
	type T
Operational limit of thermocouple ranges	Type E, L, T, J, K, N: ±2.5K / Type B, C, R, S: ±8.0K
Operational limit of thermocouple ranges with SFU	Type E, L, T, J, K, N: ±1.5K / Type B, C, R, S: ±4.0K
Basic error limit thermoelement ranges	Type E, L, T, J, K, N: ±2.0K / Type B, C, R, S: ±7.0K
Basic error limit thermoelement ranges with SFU	Type E, L, T, J, K, N: ±1.0K / Type B, C, R, S: ±3.0K
Destruction limit thermocouple inputs	max. 20V
Programmable temperature compensation	\checkmark

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

Order no.	031-1LB90	
External temperature compensation	\checkmark	
Internal temperature compensation	\checkmark	
Temperature error internal compensation	1 K	
Technical unit of temperature measurement	°C, °F, K	
Resolution in bit	16	
Measurement principle	Sigma-Delta	
Basic conversion time	84.2 ms (50 Hz) 70.5 ms (60 Hz) per channel	
Noise suppression for frequency	>90dB at 50Hz (UCM<10V)	
Status information, alarms, diagnostics		
Status display	yes	
Interrupts	yes	
Process alarm	no	
Diagnostic interrupt	yes, parameterizable	
Diagnostic functions	yes	
Diagnostics information read-out	possible	
Module state	green LED	
Module error display	red LED	
Channel error display	red LED per channel	
Isolation		
Between channels	-	
Between channels of groups to	-	
Between channels and backplane bus	\checkmark	
Between channels and power supply	-	
Max. potential difference between circuits	-	
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V	
Max. potential difference between Mana and Mintern (Uiso)	-	
Max. potential difference between inputs and Mana (Ucm)	-	
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V	
Max. potential difference between Mintern and outputs	-	
Insulation tested with	DC 500 V	
Datasizes		
Input bytes	4	
Output bytes	0	
Parameter bytes	10	
Diagnostic bytes	20	

Order no.	031-1LB90
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g
Weight including accessories	58 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

The indicated error limits are valid starting from the following temperatures:

- Thermoelement type T: -200 °C
- Thermoelement type K: -100 °C
- Thermoelement type B: +700 °C
- Thermoelement type N: -150 °C
- Thermoelement type E: -150 °C
- Thermoelement type R: +200 °C
- Thermoelement type S: +100 °C
- Thermoelement type J: -100 °C

3.25.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostics ¹	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition ¹	00h	00h	3101h	02h
TEMPCNF	1	Temperature system	00h	01h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	02h	01h	3103h	04h
CH0FN	1	Function number channel 0	C1h	80h	3104h	05h
CH1FN	1	Function number channel 1	C1h	81h	3105h	06h

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

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0			
0	 Diagnostic interrupt 00h: disabled 40h: enabled 			

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 7 2: reserved
	ue to the high sensitivity of the inputs, unused inputs should be deacti-

vated in the parametrization. Due to the high inputs should be deactivated in the parametrization. Due to the high input impedance, open inputs can be influenced by adjacent channels or due to the measuring method during wire break detection. Since the entire measuring range moves in the mV range, open-loop inputs can already cause measuring range overshoots.

TEMPCNF Temperature system	Byte	Bit 7 0
	0	 Bit 0, 1: Temperature system 00: °C 01: °F 10: K Bit 7 2: reserved

SUPR Interference frequency suppression	Byte	Bit 7 0
(SFU)	0	 Bit 0, 1: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 2: reserved

CHxFN Function number channel x

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

Voltage

-80 ... 80mV

Meas. range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
-80 80mV	94.07mV	32511	7EFFh	overrange	D 27649 U
Siemens S7 format	80mV	27648	6C00h	nominal range	$D = 27648 \cdot \frac{U}{80}$
(11h)	0V	0	0000h		
	-80mV	-27648	9400h		$U = D \cdot \frac{80}{27648}$
	-94.07mV	-32512	8100h	underrange	27048
-80 80mV	100mV	20480	5000h	overrange	
Siemens S5 format	80mV	16384	4000h	nominal range	$D = 16384 \cdot \frac{U}{80}$
(21h)	0V	0	0000h		
	-80mV	-16384	C000h		$U = D \cdot \frac{80}{16384}$
	-100mV	-20480	B000h	underrange	10384

Temperature

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

Measuring range	Measuring value	Measuring value	Measuring value in	Range
(funct. no.)	in °C	in °F	K	
-454 2372°F 0 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	(0.1°C/digit) 	(0.1°F/digit) 	(0.1K/digit) 	underrange
Type R:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	-1700	-2740	1032	underrange
Type S:	+20190	32766	22922	overrange
[PtRh-Pt]	-500 +17690	-580 32162	2232 20422	nominal range
-50 +1769°C -58 3216.2°F 223.2 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	-1700	-2740	1032	underrange
Туре Т:	+5400	10040	8132	overrange
[Cu-Cu-Ni]	-2700 +4000	-4540 7520	32 6732	nominal range
-270 +400°C -454 752°F 3.2 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)				underrange
Туре В:	+20700	32766	23432	overrange
[PtRh-PtRh]	0 +18200	320 27865	2732 20932	nominal range
0 +1820°C 32 2786.5°F 273.2 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	-1200	-1840	1532	underrange
Type C:	+25000	32766	23432	overrange
[WRe5-WRe26] 0 +2315°C 32 2786.5°F 273.2 2093.2K (B7h: ext. comp. 0°C)	0 +23150	320 27865	2732 20932	nominal range

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
(C7h: int. comp. 0°C)	-1200	-1840	1532	underrange
Туре Е:	+12000	21920	14732	overrange
[Ni-Cr - Cu-Ni]	-2700 +10000	-4540 18320	0 12732	nominal range
-270 +1000°C -454 1832°F 0 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)				underrange
Type L:	+11500	21020	14232	overrange
[Fe-Cu-Ni]	-2000 +9000	-3280 16520	732 11732	nominal range
-200 +900°C -328 1652°F 73.2 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)				underrange

3.25.3 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.

Analog input

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

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

 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 parametrization 	

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
enamer speeme	0	Channel-specific error: Channel x:
		 Bit 0: set at project engineering/parameterization error Bit 3 1: reserved Bit 4: set at wire break Bit 5: reserved Bit 6: set at measuring range underflow Bit 7: set at measuring range overflow

CH2ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US μs	ticker
------------	--------

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

µs ticker

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

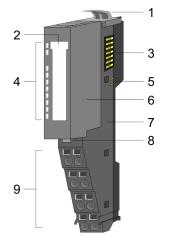
3.26 031-1LD80 - AI 4x16Bit R/RTD

Properties

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

- 4 analog inputs
- Suited for resistance-type sensors 0 ... 3000Ω and resistance temperature sensors Pt100, Pt1000, NI100, NI120 and NI1000
- Resistance measurement with 2, 3 and 4 wire
 (3 and 4 wire only via channel 0 respectively 1)
- Diagnostics function
- 16bit resolution

Structure



Status indication

RUN	MF e red	Al x	Description
		x	Bus communication is OK Module status is OK
•	•	x	Bus communication is OK Module status reports an error
	•	x	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
•		•	 Error channel x Signal leaves measuring range Error in parameterization Wire break (if parameterized)
not relevant: X			

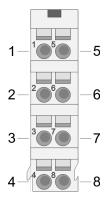
- Locking lever terminal module Labeling strip
- 2 Labeling strip3 Backplane bus

1

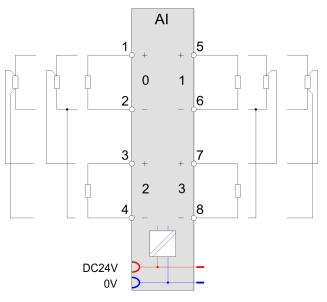
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

031-1LD80 - AI 4x16Bit R/RTD

Pin assignment



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



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

I: Input

2, 3, 4 wire measurement

At the pin assignment above you can see how the sensors are to be connected at 2, 3 respectively 4 wire measurement.

- With every channel a 2 wire measurement may be performed.
- 3 wire measurement is only possible via the channels 0 and 1.
 - Please consider with 3 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.
- 4 wire measurement is only possible via the channels 0 and 1.
 - The measurement current for channel 0 is applied at pin 1 and 2. The measurement for channel 0 happens at pin 3 and 4. The analog value for channel 0 is represented in input word 0.
 - The measurement current for channel 1 is applied at pin 5 and 6. The measurement for channel 1 happens at pin 7 and 8. The analog value for channel 1 is represented in input word 1.
 - Please consider with 4 wire measurement that the corresponding channel is always deactivated in the parametrization. The corresponding channel of channel 0 is channel 2 and of channel 1 is channel 3. Not used channels must always be de-activated in the parametrization.

In-/Output area

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

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

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

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

Output area

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

3.26.1 Technical data

Order no.	031-1LD80
Туре	SM 031 - Analog input
Module ID	0410 1544
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	-
Max. input resistance (current range)	-

Analog input

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

Input current ranges - Operational limit of current ranges with SFU - Basic error limit current ranges with SFU - Basic error limit current ranges with SFU - Resistance inputs - Resistance inputs - Resistance ranges - Operational limit of 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 + Basic error limit - Operational limit of resistor ranges with SFU + Destruction limit resistance inputs # Resistance thermometer inputs - Resistance thermometer ranges PI100 Ni100 Ni100	Order no.	031-1LD80
Operational limit of current ranges - Basic error limit current ranges - Radical error limit current ranges with SFU - Destruction limit current inputs (voltage) - Resistance inputs - Resistance ranges 060 Ohm 0600 Ohm 600 Ohm 0600 Ohm	Input current ranges	-
Basic error limit current ranges - Radical error limit current ranges with SFU - Destruction limit current inputs (voltage) - Resistance inputs Resistance inputs Resistance ranges Operational limit of resistor ranges +/ 0.4 % Operational limit of resistor ranges with SFU +/ 0.2 % Basic error limit +/ 0.2 % Basic error limit resistance inputs max. 24V Resistance thermometer ranges P1100 Ni100 Ni100 Ni100 Ni100 Ni100 Ni100 SFU +/ 0.2 % Basic error limit thermoresistor ranges +/ 0.4 % Operational limit of resistance inputs max. 24V Resistance thermometer ranges P1100 Ni100 Ni100 Ni100 Ni100 Ni100 Ni100 SFU Basic error limit thermoresistor ranges with SFU Furthermocouple inputs - Furthermoresistor ranges +/ 0.2 % Basic error limit thermocoupl	Operational limit of current ranges	-
Radical error limit current inputs (voltage) - Destruction limit current inputs (electrical current) - Resistance inputs ✓ Resistance ranges 0600 0hm 0600 0hm 0600 0hm 0600 0hm 0600 0hm 0600 0hm 0600 0hm 0	Operational limit of current ranges with SFU	-
Destruction limit current inputs (voltage) - Destruction limit current inputs (electrical current) - Resistance inputs - Resistance ranges 0600 Ohm 0600 Ohm 1600 Ohm <td>Basic error limit current ranges</td> <td>-</td>	Basic error limit current ranges	-
Destruction limit current inputs (electrical current) - Resistance inputs - Resistance ranges 0600 Ohm 03000 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 resistance inputs max. 24V Resistance thermometer inputs - Resistance thermometer ranges P1100 Ni100 Ni100 Ni100 Ni100 Ni100 Ni100 Ni100 Ni100 SFU +/- 0.1 % Basic error limit thermoresistor ranges +/- 0.2 % Basic error limit for fesistance thermometer ranges +/- 0.1 % Destruction limit of resistance thermometer ranges +/- 0.1 % Basic error limit thermoresistor ranges with SFU +/- 0.1 % Destruction limit resistance thermometer ranges +/- 0.1 % Basic error limit thermoresistor ranges with SFU +/- 0.1 % Destruction limit resistance thermometer ranges	Radical error limit current ranges with SFU	-
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Resistance ranges Resistance ranges Resistance ranges Resistance ranges O 60 Ohm O 3000 Ohm O 3000 Ohm O 3000 Ohm O 3000 Ohm Operational limit of resistor ranges H- 0.4 % C.2 % Basic error limit H +- 0.2 % C.2 % C	Destruction limit current inputs (electrical current)	-
Operational limit of resistor ranges +- 0.4 % Operational limit of resistor ranges with SFU +- 0.2 % Basic error limit +- 0.2 % Basic error limit with SFU +- 0.1 % Destruction limit resistance inputs max. 24V Resistance thermometer inputs ✓ Resistance thermometer ranges Pt100 Ni100 Ni120 Ni100 Ni20 Destruction limit resistance thermometer ranges +- 0.2 % Basic error limit thermoresistor ranges with SFU +- 0.4 % Operational limit of resistance thermometer ranges Ni100 Ni100 Ni20 Ni100 Ni20 Ni100 Ni20 Ni100 Ni20 SFU sc Destruction limit terroresistor ranges with SFU +- 0.2 % Basic error limit thermoresistor ranges with SFU +- 0.1 % Destruction limit resistance thermometer inputs max. 24V Thermocouple inputs - Destruction limit of thermocouple ranges - Operational limit of thermocouple ranges -	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. 24VResistance thermometer inputs✓Resistance thermometer rangesPt100Pt1000Ni100Ni100Ni120Ni1000Ni100Operational limit of resistance thermometer ranges+/- 0.4 %Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.2 %Destruction limit resistance thermometer ranges+/- 0.2 %Basic error limit thermoresistor ranges with SFU-Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit thermocouple ranges-Operational limit thermocouple ranges- </td <td>Resistance ranges</td> <td>0 600 Ohm</td>	Resistance ranges	0 600 Ohm
Action+/- 0.2 %Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24VResistance thermometer inputs✓Resistance thermometer rangesPt100N100Ni120N100Ni100Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.4 %Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.1 %Destruction limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit of thermocouple ranges-Destruction limit of thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit of thermocouple ranges-Destruction limit of thermocouple ranges-Destruction limit of thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit of thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit fremocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-<	Operational limit of resistor ranges	+/- 0.4 %
Basic error limit with SFU+/- 0.1 %Destruction limit resistance inputsmax. 24VResistance thermometer inputs✓Resistance thermometer rangesPt100Pt100Ni100Ni100Ni100Ni100Ni120Operational limit of resistance thermometer ranges+/- 0.4 %Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges with SFU+/- 0.1 %Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit resistance thermometer inputs-Basic error limit thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit resistance thermometer inputs-Thermocouple inputs-Destruction limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges-Persor limit thermocouple inputs-Persor limit thermocouple inputs-Persor limit thermocouple inputs-Persor limit thermocouple inputs<	Operational limit of resistor ranges with SFU	+/- 0.2 %
Destruction limit resistance inputsmax. 24VResistance thermometer inputsResistance thermometer inputsPt100Resistance thermometer rangesPt1000Ni100Ni100Ni100Ni100Operational limit of resistance thermometer ranges+/- 0.4 %Operational limit of resistance thermometer ranges+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.1 %Destruction limit resistance thermometer inputsmax. 24VDestruction limit of thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit of thermocouple ranges-Seic error limit thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit thermocouple ranges-Seic error limit thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit thermocouple ranges-Seic error limit thermocouple ranges-Pertortion limit thermocouple ranges-Pertortion limit thermocouple ranges-Seic error limit thermocouple ranges-Destruction limit thermocouple inputs-Pertortion lim	Basic error limit	+/- 0.2 %
Resistance thermometer inputsResistance thermometer rangesPt100 Pt1000 Ni100 Ni100 Ni100Operational limit of resistance thermometer ranges// 0.4 %Operational limit of resistance thermometer ranges with SFU// 0.2 %Basic error limit thermoresistor ranges// 0.2 %Basic error limit thermoresistor ranges// 0.1 %Destruction limit of thermocouple ranges// 0.2 %Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit of thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit thermocouple ranges-Destruction limit thermocouple ranges-Destruction limit thermocouple ranges-Basic error limit thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit thermocouple ranges-Basic error limit thermocouple ranges-Destruction limit thermocouple inputs-Destruction limit thermocouple inputs- <tr< td=""><td>Basic error limit with SFU</td><td>+/- 0.1 %</td></tr<>	Basic error limit with SFU	+/- 0.1 %
Resistance thermometer ranges Resistance thermometer ranges P11000 P11000 Ni100 Ni100 Ni100 Operational limit of resistance thermometer ranges P4- 0.4 % P0- 2 % P0-	Destruction limit resistance inputs	
APt1000Ni100Ni100Ni120Ni100Operational limit of resistance thermometer ranges+/- 0.4 %Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.2 %Basic error limit thermoresistor ranges with SFU+/- 0.1 %Destruction limit resistance thermometer inputsmax. 24VThermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Destruction limit thermocouple ranges-Operational limit of thermocouple ranges-Operational limit thermocouple ranges-<	Resistance thermometer inputs	\checkmark
Operational limit of resistance thermometer ranges with SFU+/- 0.2 %Basic error limit thermoresistor ranges+/- 0.2 %Basic error limit thermoresistor ranges with SFU+/- 0.1 %Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges with SFU-Perstruction limit thermocouple inputs-Programmable temperature compensation-	Resistance thermometer ranges	Pt1000 Ni100 Ni120
SFUImage: series of the series of	Operational limit of resistance thermometer ranges	+/- 0.4 %
Basic error limit thermoresistor ranges with SFU+/- 0.1 %Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges with SFU-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Postruction limit thermocouple inputs-Pogrammable temperature compensation-		+/- 0.2 %
Destruction limit resistance thermometer inputsmax. 24VThermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges with SFU-Operational limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Basic error limit thermoresistor ranges	+/- 0.2 %
Thermocouple inputs-Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Basic error limit thermoresistor ranges with SFU	+/- 0.1 %
Thermocouple ranges-Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple ranges with SFU-Programmable temperature compensation-	Destruction limit resistance thermometer inputs	max. 24V
Operational limit of thermocouple ranges-Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Thermocouple inputs	-
Operational limit of thermocouple ranges with SFU-Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Thermocouple ranges	-
Basic error limit thermocouple ranges-Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Operational limit of thermocouple ranges	-
Basic error limit thermocouple ranges with SFU-Destruction limit thermocouple inputs-Programmable temperature compensation-	Operational limit of thermocouple ranges with SFU	-
Destruction limit thermocouple inputs - Programmable temperature compensation -	Basic error limit thermocouple ranges	-
Programmable temperature compensation -	Basic error limit thermocouple ranges with SFU	-
	Destruction limit thermocouple inputs	-
External temperature compensation -	Programmable temperature compensation	-
	External temperature compensation	-

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

Order no.	031-1LD80
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	°C, °F, K
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	84.2 ms (50 Hz) 70.5 ms (60 Hz) per channel
Noise suppression for frequency	>80dB at 50Hz (UCM<6V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	\checkmark
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 6 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	-
Output voltage (typ)	-
Output voltage (rated value)	-
Short-circuit protection	-
Binding of potential	-

Order no.	031-1LD80
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
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

3.26.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
DIAG_EN	1	Diagnostic ¹	00h	00h	3100h	01h
WIBRK_EN	1	Wire break recognition ¹	00h	00h	3101h	02h
TEMPCNF	1	Temperature system	00h	01h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	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 ²	82h	3106h	07h
CH3FN	1	Function number channel 3	50h ²	83h	3107h	08h

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

2) with 2 channel operation FFh

DIAG_EN Diagnostic interrupt

Byte	Bit 7 0
0	 Diagnostic interrupt 00h: disabled 40h: enabled

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	 Bit 1, 0: Temperature system 00: °C 01: °F 10: K Bit 7 2: reserved

SUPR Interference fre- quency suppression (SFU)	Byte	Bit 7 0
	0	 Bit 1, 0: Interference frequency suppression 01: 60Hz 10: 50Hz Bit 7 2: reserved
CHxFN Function number channel x		ing there are the measuring ranges with corresponding function number 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
2 wire: NI120 ¹	+400°C	+4000	overrange
(54h)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	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
3 wire: NI120 ¹	+400°C	+4000	overrange
(5Ch)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	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

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
	-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
4 wire: NI120 ¹	+400°C	+4000	overrange
(64h)	-80 +320°C	-800 +3200	nominal range
	-100°C	-1000	underrange
2 wire: 0 60Ω			overrange
(70h)	0 60Ω	0 32767	nominal range
			underrange
2 wire: 0 600Ω			overrange
71h)	0 600Ω	0 32767	nominal range
			underrange
2 wire: 0 3000Ω			overrange
72h)	0 3000Ω	0 32767	nominal range
			underrange
3 wire: 0 60Ω			overrange
78h)	0 60Ω	0 32767	nominal range
			underrange
3 wire: 0 600Ω			overrange
(79h)	0 600Ω	0 32767	nominal range
			underrange
3 wire: 0 3000Ω			overrange
7Ah)	0 3000Ω	0 32767	nominal range
			underrange
$1 \text{ wire: } 0 \dots 60 \Omega$			overrange
80h)	0 60Ω	0 32767	nominal range
			underrange
1 wire: 0 600 Ω			overrange
(81h)	0 600Ω	0 32767	nominal range
			underrange
4 wire: 0 3000Ω			overrange

Measuring range	Measuring value	Signal range	Range
(funct. no.)			
(82h)	0 3000Ω	0 32767	nominal range
			underrange
2 wire: 0 60Ω			overrange
(90h)	0 60Ω	0 6000	nominal range
			underrange
2 wire: 0 600Ω			overrange
(91h)	0 600Ω	0 6000	nominal range
			underrange
2 wire: 0 3000 Ω			overrange
(92h)	0 3000Ω	0 30000	nominal range
			underrange
3 wire: 0 60Ω			overrange
(98h)	0 60Ω	0 6000	nominal range
			underrange
3 wire: 0 600Ω			overrange
(99h)	0 600Ω	0 6000	nominal range
			underrange
3 wire: 0 3000 Ω			overrange
(9Ah)	0 3000Ω	0 30000	nominal range
			underrange
4 wire: 0 60Ω			overrange
(A0h)	0 60Ω	0 6000	nominal range
			underrange
4 wire: 0 600Ω			overrange
(A1h)	0 600Ω	0 6000	nominal range
			underrange
4 wire: 0 3000 Ω			overrange
(A2h)	0 3000Ω	0 30000	nominal range
			underrange
2 wire: 0 60Ω	70.55Ω	32511	overrange
(D0h)	0 60Ω	0 27648	nominal range
			underrange
2 wire: 0 600Ω	705.5Ω	32511	overrange
(D1h)	0 600Ω	0 27648	nominal range
			underrange

Measuring range (funct. no.)	Measuring value	Signal range	Range
2 wire: 0 3000 Ω	3528Ω	32511	overrange
(D2h)	0 3000Ω	0 27648	nominal range
			underrange
3 wire: 0 60Ω	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
			underrange
3 wire: 0 3000 Ω	3528Ω	32511	overrange
(DAh)	0 3000Ω	0 27648	nominal range
			underrange
4 wire: 0 60Ω	70.55Ω	32511	overrange
(E0h)	0 60Ω	0 27648	nominal range
			underrange
4 wire: 0 600Ω	705.5Ω	32511	overrange
(E1h)	0 600Ω	0 27648	nominal range
			underrange
4 wire: 0 3000Ω	3528Ω	32511	overrange
(E2h)	0 3000Ω	0 27648	nominal range
			underrange

1) Supported by 031-BD80 from version 03V54 and 031-1LD80 from version 02V26.

The version information can be found on the outer packaging or via the website of the corresponding head module.

3.26.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

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	Α	Diagnos	tic

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 parametrization

MODTYP Module informa-	
tion	

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error
	Bit 7 5: reserved

CHTYP Channel type

CHERR Channel error

Byte
0

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

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

Byte	Bit 7 0
0	Bit 0: set at error in channel group 0
	Bit 1: set at error in channel group 1
	Bit 2: set at error in channel group 2
	Bit 3: set at error in channel group 3
	Bit 7 4: reserved

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

System SLIO

DIAG_US µs ticker

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

µs ticker

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

031-1PAxx - Al1x 3Ph 230/400V

3.27 031-1PAxx - Al1x 3Ph 230/400V

Properties

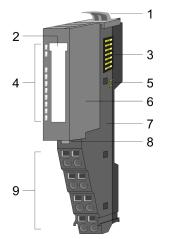
The following modules are available:

- 031-1PA00: Al1x 3Ph 230/400V 1A
- 031-1PA10: Al1x 3Ph 230/400V 5A

The modules allow the measurement of electric data for counting energy and power measurement. Here, the voltage measurement of the individual phases is done directly (or indirectly via voltage transformers) and the current measurement indirectly via current transformers. When 5A current transformers are used, energy measurement can only be performed on devices in 3-phase operation. When 1A current transformers are used, the measurement inputs can be fed from the same phase.

- Retentive storage of the energy values
- Diagnostic function
- Resolution of the measured value 24bit
- The following measurands can be found in 4-quadrant operation:
 - Voltage, current
 - Electrical power
 - Electrical work
 - Harmonics
 - Phase shift $\cos \varphi$
 - Frequency

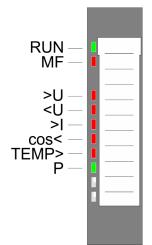
Structure



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

031-1PAxx - Al1x 3Ph 230/400V

Status indication



LED		Description		
RUN	green	Bus communication is OK		
		off: Error at bus power supply		
	- rod	Module status reports an error		
	red	Bus communication is not possible		
MF		off: Module status is OK		
	red	Flashes: Error in configuration		
	2Hz	🌣 Chap. 2.12 'Trouble shooting - LEDs' page 40		
>U		Voltage in the parametrized range		
20	red	Voltage limit value exceeded		
		Voltage in the parametrized range		
<u< td=""><td>rad</td><td>Voltage limit value undershot</td></u<>	r ad	Voltage limit value undershot		
	red	(omitted in 1-phase operation)		
~1		Current in the parametrized range		
>	red	Current limit value exceeded		
		Phase shift $\cos \phi$ in the parametrized range		
cos<	no d	Phase shift $\cos \varphi$ limit value undershot		
	red	(omitted in 1-phase operation)		
		Temperature in the parametrized range		
TEMP>	red	Temperature limit value exceeded		
		P: Proportional power		
Ρ	Z green	blinks with increasing frequency proportional to the active power at 20 pulses/Wh. The current transformer factor is not considered.		
If the limit value is exceeded, the corresponding LED lights up. After the				

If the limit value is exceeded, the corresponding LED lights up. After the acknowledgment of the 'status bits' the corresponding LED goes out again.

031-1PA10 🄄 'Status bits' page 339

031-1PA00 🌣 'Status bits' page 343

Pin assignment

For wires with a core cross-section of 0.08mm^2 up to 1.5mm^2 . The measurement of current respectively voltage is done indirectly by current respectively voltage transformers. \Leftrightarrow Chap. 3.27.4 'Connection' page 328

	—5
2-20 ⁶	—6
3-307	-7
4-4-8-6	-8

Pos.	Function	Туре	Description
1	L1	I	Voltage measurement L1
2	L2	I	Voltage measurement L2
3	L3	I	Voltage measurement L3
4	Ν	I	Voltage measurement N
5	I _{L1}	I	Current measurement IL1
6	I _{L2}	I	Current measurement IL2
7	I _{L3}	I	Current measurement IL3
8	I _N	I	Current measurement I _N

I: Input



DANGER!

Please observe safety instructions!

With the energy measurement modules only AC voltages 230/400 V and currents can be measured. Please observe the safety instructions when handling an energy measuring module! \Leftrightarrow *Chap. 3.27.2 'Safety precautions' page 322*

In-/Output area

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

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

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

Input area	Addr.	Name	Byte	Function	IX	SX
	+0	B0 B3	4	Header byte 0 3	6401h/s	01h
	+4	D00 D11	12	User data input byte 0 11	6401h/s+1	02h

Output area

Addr.	Name	Byte	Function	IX	SX
+0	B0 B3	4	Header byte 0 3	6401h/s	01h
+4	D00 D11	12	User data output byte 0 11	6401h/s+1	02h

& Chap. 3.27.7 'Process data communication' page 343

3.27.1 Technical data

3.27.1.1 031-1PA10

Order no.	031-1PA10
Туре	SM 031
Module ID	0884 2880
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.9 W
Rated load voltage	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	-
Isolation	
Between channels	-
Insulation tested with	AC 2200 V
Energy measurement	
Number of channels for measuring	1* 13 phases U/I
Voltage measuring range	0300 V each phase
Coupling voltage measurement	directly or transformer
Current range	05 A each phase
Coupling current measurement	Transformer
Frequency range	4664 Hz
Measurement accuracy	1 %

Order no.	031-1PA10
Available measurement	Active energy
	Temperature
	Frequency
	Voltage RMS
	Current RMS
	Active power
	Reactive power
	Apparent power
	Cos phi
	Harmonic voltage RMS Harmonic current RMS
A diveteble limite	
Adjustable limits	Voltage RMS min/max Current RMS min/max
	Cos phi min
	Temperature max.
	Frequency min/max
Datasizes	
Input bytes	16
Output bytes	16
Parameter bytes	30
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
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	-
KC certification	-

The *Measurement accuracy* ±1 % is maintained from:

Measurand	Measuring range
Voltage	$230~V\pm15\%$
Current	Current at measuring input $(I_{L1L3} - I_N) 0 \dots 5A$
Cos φ	Current at measuring input $(I_{L1L3} - I_N) \ge 100 \text{mA}$
Power	Current at measuring input $(I_{L1L3} - I_N) \ge 2mA$
Active energy	Current at measuring input $(I_{L1\ldots L3}$ - $I_N) \geq 2mA$

3.27.1.2 031-1PA00

Order no.	031-1PA00
Туре	SM 031
Module ID	0882 2880
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.9 W
Rated load voltage	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	-
Isolation	
Between channels	-
Insulation tested with	AC 2200 V
Energy measurement	
Number of channels for measuring	1* 13 phases U/I
Voltage measuring range	0300 V each phase
Coupling voltage measurement	directly
Current range	01 A each phase
Coupling current measurement	Transformer
Frequency range	4664 Hz

Order no.	031-1PA00
Measurement accuracy	1 %
Available measurement	Active energy
	Temperature
	Frequency
	Voltage RMS
	Current RMS
	Active power
	Reactive power
	Apparent power
	Cos phi
	Harmonic voltage RMS Harmonic current RMS
Adjustable limits	Voltage RMS min/max
	Current RMS min/max
	Cos phi min
	Temperature max.
	Frequency min/max
Datasizes	
Input bytes	16
Output bytes	16
Parameter bytes	28
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	-
KC certification	-

031-1PAxx - AI1x 3Ph 230/400V > Safety precautions

The *Measurement accuracy* ±1 % is maintained from:

Measurand	Measuring range
Voltage	$230~V\pm15\%$
Current	Current at measuring input $(I_{L1L3} - I_N) 0 \dots 1A$
Cos φ	Current at measuring input $(I_{L1L3} - I_N) \ge 100 \text{mA}$
Power	Current at measuring input $(I_{L1L3} - I_N) \ge 2mA$
Active energy	Current at measuring input $(I_{L1L3} - I_N) \ge 2mA$

3.27.2 Safety precautions

Please note!

With the energy measurement modules only AC voltages 230/400V and currents can be measured. Please note when using an energy measurement module the following safety instructions:



No use in EX-zone permitted!

This device is not certified for applications in explosive environments (EX-zone)!



Do not exchange phase and neutral connections!

Operation of the energy measuring module with phase (L1, L2 or L3) at N' (pin 4) is not permitted!



DANGER!

Connection and module exchange only without power!

- Before you start to work on at the module for installation or maintenance, you have to disconnect it from the main power source, i.e. the power line is to be switched off (possibly remove fuses)!
- The electronic module may only be replaced on power off!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!
- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).



DANGER!

Provide overvoltage protection!

The module is designed for overvoltage category II. Provide a corresponding overvoltage protection in the supply lines (phases and neutral) so that a hazard to persons by touching on the low voltage side is excluded.

031-1PAxx - AI1x 3Ph 230/400V > Safety precautions



Provide touch protection!

DANGER!

Provide a touch protected wiring of the measurement including the measuring transformers and mark it with the according warnings!



DANGER! No use with System SLIO safety modules!

The simultaneous use of energy measurement modules and System SLIO safety modules on the backplane bus is not permitted!



Use only with terminal module 001-0AA40!

Please consider that the electronic module of the energy measurement modules may only be used at the terminal module 001-0AA40!



DANGER!

Line voltage max. 400V!

The line voltage at a voltage connector must not exceed 400V!



All phases of one supply grid!

Please note that the phases to be measured must be from the same supply grid!



CAUTION!

Do not exchange current and voltage connections!

Please note when connecting, that the current and voltage paths are not exchanged! The module will be destroyed by directly connecting one phase to a low-resistance current connector!



CAUTION!

Consider the maximum current for current transformers!

Depending on the energy measuring module used, the following maximum current limits for the current transformers must be considered:

- 031-1PA00: max. 1A
- 031-1PA10: max. 5A

Please also consider the data sheet of your current transformer!



CAUTION!

Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!

031-1PAxx - AI1x 3Ph 230/400V > Safety precautions



CAUTION!

Note characteristics of voltage transformers!

- Please note that the use of a voltage transformer is only supported by the energy measurement module 031-1PA10!
- Please consider the data sheet and the safety instructions of your voltage transformer!

Interruption of the DC 24V power section supply!

When using energy measurement modules, the DC 24V power section supply of the further backplane bus is interrupted. By installing a power module after an energy measurement module, the DC 24V power section supply at the backplane bus can be continued.



Reset energy counters after installation!

As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measurement is not interrupted by STOP or RESET of the CPU respectively the bus coupler. After installing the module the energy counters should be reset by CMD-Frame. & Chap. 3.27.7.4.5 CMD Frame' page 352



- As long as no parameters have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the parameters stored in the module.
- After transferring the parameters to the module the status bits are reset and the measurement is interrupted for a short time!
- Please note when at least one phase is de-activated, the parameters PF_MIN and VRMS_MIN are ignored and set to "0".
- On error in the parametrization the MF LED blinks and you receive an error message.
 Chap. 3.27.7.2 'Status communication' page 345

3.27.3 Basics	
3.27.3.1 Terms	
Measurand	A <i>measurand</i> is a physical quantity that can be measured such as current, voltage or temperature.
	🌣 Chap. 3.27.6.1 'Measurands - 031-1PA10' page 335
	& Chap. 3.27.6.2 'Measurands - 031-1PA00' page 339
Measured value	A <i>measured value</i> is a value of a measurand, which is determined by measurement or by calculation.
ID	In the module each <i>measurand</i> one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .
DS-ID	As soon as the module is supplied by the DC 24V power section supply, the measure- ment is started and the counting of the energy counters is continued with the retentive stored counter values. The measured values of all the measurands are stored in the module with one record set ID <i>DS-ID</i> . The following must be observed:
	All measured values with the same DS-ID come from the same measurement and are consistent.
	By specifying the DS-ID you can address the individual measured values of the same measurement.
	The <i>DS-ID</i> covers the values 1 15.
	To refresh the measured values the DS-ID is to be incremented by 1. The value 15 must be followed by 1.
	■ If the <i>DS-ID</i> is incremented and there is still no new value available, the current value is returned. Here the energy measurement module reports an error. <i>Schap. 3.27.7.2 Status communication' page 345</i>
	DS-ID = 0 - Auto increment mode
	With DS-ID = 0 there is a request with auto increment mode. Here the module always returns the current measured value. As soon as a new measured value is available, here the DS-ID is incremented by one within the values 1 15. If there is no new measured value available, the DS-ID is not changed. Here the energy measurement module reports an error. Schap. 3.27.7.2 'Status communication' page 345
	 The uniqueness of a measured value always consists of the <i>ID</i> of the measurand and the <i>DS-ID</i>.
Frame	In the module you can combine some measurands to one data package (Frame), which is transferred in one step. One data package consists of 12byte user data. Considering the data length of 12 bytes, you can define the content of a frame by specifying the <i>ID</i> of the measurands. Up to 256 frames may be configured (<i>Frame 0 Frame 255</i>). The following must be observed:
	The definition of Frame 1 to Frame 255 happens by the command Set_Frame. Schap. 3.27.7.4.3 'Set Frame' page 348.
	■ <i>Frame 0</i> with the corresponding measurands can exclusively be specified by the parametrization. <i>⇔ Chap. 3.27.5 'Parameter data' page 330</i>
	■ With telegram type Zero Frame the data package of Frame 0 can be accessed. After the start-up of the module there are automatic Zero Frame requests as long as the process data communication comes from the head module. Schap. 3.27.7.4.4 'Read Frame' page 350

031-1PAxx - Al1x 3Ph 230/400V > Basics

FR-ID

When defining frames by means of 'Set Frame', via the FR-ID these are assigned to a number between 0 ... 255. By specifying the FR-ID you can request the corresponding frame.

Data type

In the following the data types are listed, which are used in the module. The length is to be considered particularly by the definition of *Frames*.

Data type	Length in byte	Description
UINT_8	1	Integer 8bit
UINT_16	2	Integer 16bit
UINT_32	4	Integer 32bit
INT_8	1	Signed integer 8bit
INT_16	2	Signed integer 16bit
INT_32	4	Signed integer 32bit
FLOAT	4	32bit floating point IEEE 754

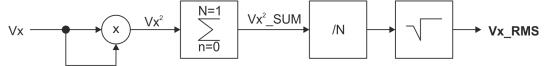
3.27.3.2 **Principle of measurement**

Calculation of the effective values of current and voltage

- For 3phase AC low-voltage networks the nominal voltage corresponds to the RMS voltage U_{RMS} e.g. 230V_{RMS} as star voltage between one of the three phase conductors (L1, L2 or L3) and the neutral conductor N.
- The module is used for detecting the current and voltage values and the energy values of all 3 phases. Here, the module measures the real effective value (True RMS) of voltages and currents.
- The sampling rate of the digitally processed measured values is 2.7 kHz. The time interval for the calculation of the actual values is 200 ms. This results in an evaluation window of the measured data of 540 measured values, which can be requested at any time.

Voltage measurement

Averaging



- 1. The square of the currently measured voltage Vx is calculated.
 - ⇒ Vx²
- **2.** The sum of Vx^2 is calculated via the time interval $n = 0 \dots n = N-1$. $\Rightarrow Vx^2 SUM$
- **3.** Vx^2 *SUM* is divided by *N* the number of measurements.
- **4.** From the result of the division, the square root is drawn.
 - ⇒ AverageVx_RMS

Current measurement For current measurement you have to use external current transformers!

031-1PAxx - Al1x 3Ph 230/400V > Basics



CAUTION! Consider the maximum current for current transformers!

Depending on the energy measuring module used, the following maximum current limits for the current transformers must be considered:

- 031-1PA00: max. 1A
- 031-1PA10: max. 5A

Please also consider the data sheet of your current transformer!



CAUTION!

Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!
- Please note that the overall accuracy of the assembly of measuring module and current transformers depends on the accuracy class of the transformers.
 - The transformer factor is retentive stored and taken into account while counting.
 - A change of the transformer factor is taken immediately recognized. Current counter values are not changed, new values are added.
 - When the transformer factor was changed, current counter values are not changed, new values are added considering the new factor.

Calculating power, energy To calculate the effective power P, each time synchronous sample value of the currents and voltages are used. In this case, phase shifts between the currents and voltages are considered. The energy is calculated from integration of the power by time.



For the power is valid:

- Positive sign (+): Consumed respectively received power
- Negative sign (-): Fed in power

Determine frequency The *frequency* of the phases is determined by a zero crossing detection of the sampled signals and calculating from the frequency.

Apparent power

 $S = U \times I$ The apparent power S is calculated from the product of effective current I_{eff} and effective voltage U_{eff} . With the apparent power you get the total power of a power grid.

Reactive power

 $Q = U x I x \sin \varphi$

With AC voltage supplied, any electrical device generates an electromagnetic field. By AC voltage, the magnetic field is regularly built and removed. Because the power to build a field is returned to the grid as it is being removed, this power is called "reactive power". Reactive power oscillates between consumer and producer generator and pollutes the power grids. The reactive power is the product of current and voltage at a reactance.

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Reactances are all types of coils and capacitors. If these are connected to an AC voltage, they can absorb energy and release it phase-shifted as reactive power. The reactive power results of the phase-shift between current and voltage of the inductance respectively capacitance. With a pure ohmic resistance current and voltage are in the same phase, therefore, a purely resistive resistor has no reactive component.

 $\bigcirc \qquad \text{The formula } Q = U \times I \times \sin \varphi \text{ applies only to purely sinusoidal currents.}$

Active power

$P = U x I x \cos \varphi$	The <i>active power P</i> is the effectively used power. This is the part without phase shift between voltage and current and refers to a resistive load.
Calculation of the power factor $\cos \phi$ (phi)	In real networks energy consumers / producers typically are not purely ohmic. There is a phase shift between current and voltage. The $\cos \varphi$ is a measure of the phase shift between current and voltage of the basic frequency of the corresponding phase. The <i>total</i> $\cos \varphi$ is calculated by dividing <i>total active power P</i> and <i>total apparent power S</i> .
Harmonics	Harmonics are oscillations of the voltages and currents, whose frequency is an integer multiple of the basic frequency. The 1. harmonic is the basic frequency or mains frequency, nominally 50Hz or 60Hz. The level of harmonics is a measure for the network quality. Harmonics or harmonic oscillations are caused by equipment with non-linear characteristics such as transformers, fluorescent lamps and power electronic equipment such as rectifiers and thyristors. The non-sinus-shaped currents of these consumers cause the net interference voltages, which distorts the nominal line voltage. During parametrization you can specify the level of the harmonic. With this frequency the <i>'harmonic'</i> current and voltage values are filtered.

3.27.4 Connection

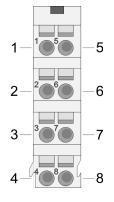


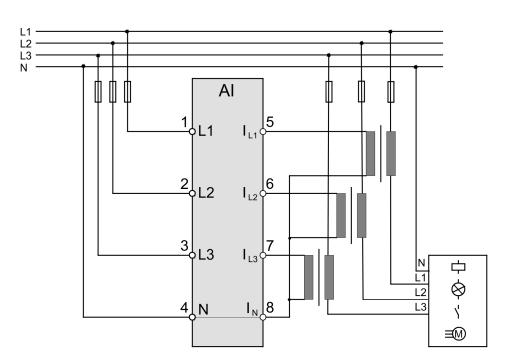
Please observe safety instructions!

With the energy measurement modules only AC voltages 230/400 V and currents can be measured. Please observe the safety instructions when handling an energy measuring module! \Leftrightarrow *Chap. 3.27.2 'Safety precautions' page 322*

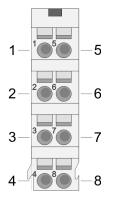
031-1PAxx - AI1x 3Ph 230/400V > Connection

Connection via current transformer

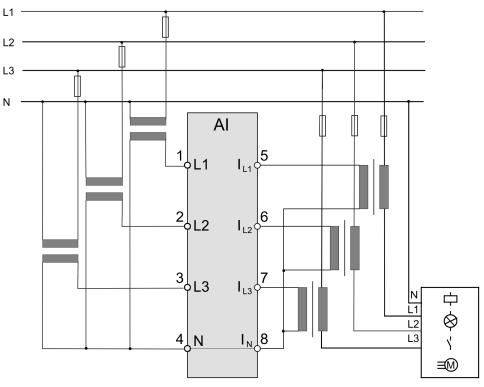




Connection via current- / voltage transformer



Please note that the use of a voltage transformer is only supported by the energy measurement module 031-1PA10!



031-1PAxx - Al1x 3Ph 230/400V > Parameter data

System SLIO

3.27.5 Parameter data

- 3.27.5.1 Parameter 031-1PA10
 - 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.

IDx	Name	Data type	Description	Description Default (dec.)		IX	SX
1	CFG	UINT_8	Choice of phases and data formats	0	80h	3100h	01h
2	F0V1	UINT_8	Frame 0: Value 1 (IDx)	1	81h	3101h	02h
3	F0V2	UINT_8	Frame 0: Value 2 (IDx)	9		3102h	03h
4	F0V3	UINT_8	Frame 0: Value 3 (IDx)	13		3103h	04h
5	F0V4	UINT_8	Frame 0: Value 4 (IDx)	12		3104h	05h
6	F0V5	UINT_8	Frame 0: Value 5 (IDx)	0		3105h	06h
102	IRMS_MAX ¹	UINT_32	Current upper limit [mA] Range of values: 0 25000000	01	82h	3106h 3109h	07h
104	VRMS_MAX	UINT_16	Voltage upper limit [V] Range of values: 0 30000	260	83h	310Ah 310Bh	08h
105	VRMS_MIN	UINT_16	Voltage lower limit [V] Range of values: 0 30000	200		310Ch 310Dh	09h
106	PF_MIN	UINT_8	Cos φ lower limit [0.01] Range of values: 0 100	30	84h	310Eh	0Ah
107	T_MAX	UINT_16	Temperature upper limit [0.01 °C] Range of values: 0 20000	7000	85h	310Fh 3110h	0Bh
108	F_MAX	UINT_16	Frequency upper limit [0.01 Hz] Range of values: 0 20000	5100		3111h 3112h	0Ch
109	F_MIN	UINT_16	Frequency lower limit [0.01 Hz] Range of values: 0 20000	4900		3113h 3114h	0Dh
111	WANDLER_I	UINT_16	Current transformer factor Range of values: 1 5000	1		3115h 3116h	0Eh
112	WANDLER_U	UINT_16	Voltage transformer factor Range of values: 1 300	1		3117h 3118h	0Fh
113	HARM	UINT_8	Harmonic number <i>& 'Harmonics' page 328</i> Range of values: 1 30	1	86h	3119h	10h

The parameters are transferred in big-endian format (byte order: high byte, low byte).

1) Parameter is to be defined. (value: >0).

 As long as no parameters have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the parameters stored in the module.

- After transferring the parameters to the module the status bits are reset and the measurement is interrupted for a short time!
- Please note when at least one phase is de-activated, the parameters PF_MIN and VRMS_MIN are ignored and set to "0".
- On error in the parametrization the MF LED blinks and you receive an error message.
 Chap. 3.27.7.2 'Status communication' page 345

Data type

🔄 'Data type' page 326

CFG

Bit	Name	Description	Default
0	reserved		0
1	Write Protect ¹	 Write protection bit for parameterization via Web server 0: Write Protect de-activated 1: Write Protect activated Please see the following note! 	1 ¹
2	reserved		0
3	Phase 1	Measurement phase L1 O: Measurement is activated I: Measurement is de-activated	0
4	Phase 2	Measurement phase L2 O: Measurement is activated 1: Measurement is de-activated	0
5	Phase 3	Measurement phase L3 0: Measurement is activated 1: Measurement is de-activated 	0
6	Data type	 Data type of the measured values in the user data 0: Integer (INT) 1: 32bit floating point (FLOAT) DIN IEEE 754 	0
7	Byteorder	 Data type of the measured values in the user data 0: Big-Endian: Byte order: high byte, low byte 1: Little-Endian: Byte order: low byte, high byte 	0

1) Access to the 'Write Protect' parameter is only possible via the Web server of the head module (not via GSD or GSDML).

¹⁾ Write Protect

The parameter 'Write Protect' is only relevant, if the module is connected to a head module with an integrated Web server. If the module is parameterized via the Web server 'Write Protect' must be set to "0", otherwise the changed parameters will not be used! **F0V1 ... F0V5** In the module you can combine some measurands to one data package (Frame), which is transferred in one step. \Leftrightarrow *'Frame' page 325*

By specifying the *ID* of the corresponding measurand, via *F0V1* ... *F0V5* the data areas of Frame 0 can be defined. Please note that here the user data length of 12 bytes is not exceeded. \Leftrightarrow *Chap. 3.27.6.1 'Measurands - 031-1PA10' page 335*

- Range of values: 0 ... 41
 - Default:

- F0V1: 1 (active energy consumer)
- F0V2: 9 (total active power)
- F0V3: 13 (total cos φ)
- F0V4: 0
- F0V5: 0

3.27.5.2 Parameter - 031-1PA00

- 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.

IDx	Name	Data type	Description	Default (dec.)	DS	IX	SX
1	CFG	UINT_8	Choice of phases and data formats	0	80h	3100h	01h
2	F0V1	UINT_8	Frame 0: Value 1 (IDx)	1	81h	3101h	02h
3	F0V2	UINT_8	Frame 0: Value 2 (IDx)	9		3102h	03h
4	F0V3	UINT_8	Frame 0: Value 3 (IDx)	13		3103h	04h
5	F0V4	UINT_8	Frame 0: Value 4 (IDx)	12		3104h	05h
6	F0V5	UINT_8	Frame 0: Value 5 (IDx)	0		3105h	06h
102	IRMS_MAX ¹	UINT_32	Current upper limit [mA]	0 ¹	82h	3106h	07h
			Range of values: 0 25000000			3109h	
104	VRMS_MAX	UINT_16	Voltage upper limit [V]	260	83h	310Ah	08h
			Range of values: 0 500			310Bh	
105	VRMS_MIN	UINT_16	Voltage lower limit [V]	200		310Ch	09h
			Range of values: 0 500			310Dh	
106	PF_MIN	UINT_8	Cos ϕ lower limit [0.01]	30	84h	310Eh	0Ah
			Range of values: 0 100				
107	T_MAX	UINT_16	Temperature upper limit [0.01 °C]	7000	85h	310Fh	0Bh
			Range of values: 0 20000			3110h	
108	F_MAX	UINT_16	Frequency upper limit [0.01 Hz]	5100		3111h	0Ch
			Range of values: 0 20000			3112h	
109	F_MIN	UINT_16	Frequency lower limit [0.01 Hz]	4900		3113h	0Dh
			Range of values: 0 20000			3114h	

031-1PAxx - Al1x 3Ph 230/400V > Parameter data

IDx	Name	Data type	Description	Default (dec.)	DS	IX	SX
111	WANDLER_I	UINT_16	Current transformer factor Range of values: 1 5000	1		3115h 3116h	0Eh
112	HARM	UINT_8	Harmonic number & <i>'Harmonics'</i> <i>page 328</i> Range of values: 1 30	1	86h	3117h	0Fh
Tho no	ramotore are transf	orrod in hig and	ian format (byte order: high byte, low h	(vito)			

The parameters are transferred in big-endian format (byte order: high byte, low byte).

1) Parameter is to be defined. (value: >0).

_	As long as no parameters have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the parameters stored in the module.
_	After transferring the parameters to the module the status bits are reset and the measurement is interrupted for a short time!
-	Please note when at least one phase is de-activated, the parameters PF MIN and VRMS MIN are ignored and set to "0".

 On error in the parametrization the MF LED blinks and you receive an error message. Schap. 3.27.7.2 'Status communication' page 345

Data type

🄄 'Data type' page 326

031-1PAxx - Al1x 3Ph 230/400V > Parameter data

CFG

Bit	Name	Description	Default
0	reserved		0
1	Write Protect ¹	 Write protection bit for parameterization via Web server 0: Write Protect de-activated 1: Write Protect activated Please see the following note! 	1 ¹
2	reserved		0
3	Phase 1	Measurement phase L1 0: Measurement is activated 1: Measurement is de-activated 	1
4	Phase 2	Measurement phase L2 O: Measurement is activated 1: Measurement is de-activated	1
5	Phase 3	Measurement phase L3 0: Measurement is activated 1: Measurement is de-activated 	1
6	Data type	 Data type of the measured values in the user data 0: Integer (INT) 1: 32bit floating point (FLOAT) DIN IEEE 754 	0
7	Byteorder	 Data type of the measured values in the user data 0: Big-Endian: Byte order: high byte, low byte 1: Little-Endian: Byte order: low byte, high byte 	0

1) Access to the 'Write Protect' parameter is only possible via the Web server of the head module (not via GSD or GSDML).

¹⁾ Write Protect

The parameter 'Write Protect' is only relevant, if the module is connected to a head module with an integrated Web server. If the module is parameterized via the Web server 'Write Protect' must be set to "0", otherwise the changed parameters will not be used!

F0V1 ... F0V5

In the module you can combine some measurands to one data package (Frame), which is transferred in one step. § 'Frame' page 325

By specifying the *ID* of the corresponding measurand, via *F0V1* ... *F0V5* the data areas of Frame 0 can be defined. Please note that here the user data length of 12 bytes is not exceeded. \Leftrightarrow *Chap.* 3.27.6.2 '*Measurands - 031-1PA00*' page 339

- Range of values: 0 ... 41
- Default:
 - F0V1: 1 (active energy consumer)
 - F0V2: 9 (total active power)
 - F0V3: 13 (total cos φ)
 - F0V4: 0
 - F0V5: 0

031-1PAxx - Al1x 3Ph 230/400V > Measurands

3.27.6 Measurands

3.27.6.1 Measurands - 031-1PA10

Data type INT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	UINT_32	1Wh ¹	0	4 294 967 295
2	Counter: Active energy producer	UINT_32	1Wh ¹	0	4 294 967 295
3	Counter: Active energy L1 consumer	UINT_32	1Wh ¹	0	4 294 967 295
4	Counter: Active energy L1 producer	UINT_32	1Wh ¹	0	4 294 967 295
5	Counter: Active energy L2 consumer	UINT_32	1Wh ¹	0	4 294 967 295
6	Counter: Active energy L2 producer	UINT_32	1Wh ¹	0	4 294 967 295
7	Counter: Active energy L3 consumer	UINT_32	1Wh ¹	0	4 294 967 295
8	Counter: Active energy L3 producer	UINT_32	1Wh ¹	0	4 294 967 295
9	Total active power	INT_32	1mW	-2 147 483 647	2 147 483 647
10	Total reactive power	INT_32	1mW	-2 147 483 647	2 147 483 647
11	Total apparent power	INT_32	1mW	-2 147 483 647	2 147 483 647
12	Frequency	UINT_16	0.01Hz	4600	6400
13	Total Cos ϕ^2	INT_8	0.01	-100	100
14	Temperature	INT_16	0.01°C	-2500	8500
15	Active power L1	INT_32	1mW	-715 827 882	715 827 882
16	Reactive power L1	INT_32	1mW	-715 827 882	715 827 882
17	Total power L1	INT_32	1mW	-715 827 882	715 827 882
18	Voltage L1	UINT_32	1mV	0	30 000 000
19	Current L1	UINT_32	1mA	0	25 000 000
20	$Cos \phi L1^2$	INT_8	0.01	-100	100
21	Harmonic voltage L1	UINT_32	1mV	0	30 000 000
22	Harmonic current L1	UINT_32	1mA	0	25 000 000
23	Active power L2	INT_32	1mW	-715 827 882	715 827 882
24	Reactive power L2	INT_32	1mW	-715 827 882	715 827 882
25	Total power L2	INT_32	1mW	-715 827 882	715 827 882
26	Voltage L2	UINT_32	1mV	0	30 000 000
27	Current L2	UINT_32	1mA	0	25 000 000
28	$Cos \phi L2^2$	INT_8	0.01	-100	100
29	Harmonic voltage L2	UINT_32	1mV	0	30 000 000
30	Harmonic current L2	UINT_32	1mA	0	25 000 000
31	Active power L3	INT_32	1mW	-715 827 882	715 827 882
32	Reactive power L3	INT_32	1mW	-715 827 882	715 827 882
33	Total power L3	INT_32	1mW	-715 827 882	715 827 882
34	Voltage L3	UINT_32	1mV	0	30 000 000
35	Current L3	UINT_32	1mA	0	25 000 000

031-1PAxx - AI1x 3Ph 230/400V > Measurands

Data type Unit Min. value Max. value
INT_8 0.01 -100 100
UINT_32 1mV 0 30 000 000
UINT_32 1mA 0 25 000 000
UINT_32 0 4 294 967 295
UINT_32 0 4 294 967 295
UINT_32

1) The display resolution of the energy meter is 1Wh x WANDLER_I x WANDLER_U (current transformer factor x voltage transformer factor). & Chap. 3.27.5.1 'Parameter - 031-1PA10' page 330

2) The measuring accuracy of the Cos ϕ is maintained from a minimum current of 100mA x WANDLER_I (current transformer factor).

Tolerance	See Technical data 🌣 Chap. 3.27.1.1 '031-1PA10' page 318
ID	Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .
Data type	∜ 'Data type' page 326
Max. Total power	 The max. Total power for 3 phases is ±2 147 483 647mW (INT_32) 3 * Umax * WANDLER_U * Imax * WANDLER_I If the Total power is exceeded by ±2 147 483 647mW (INT_32), the max value is output.
Overflow energy meter	 0xXX112233 XX: not used 11: Overflow phase L1 22: Overflow phase L2 23: Overflow phase L3

- 33: Overflow phase L3

031-1PAxx - AI1x 3Ph 230/400V > Measurands

Measurands Data type FLOAT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
2	Counter: Active energy producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
3	Counter: Active energy L1 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
4	Counter: Active energy L1 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
5	Counter: Active energy L2 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
6	Counter: Active energy L2 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
7	Counter: Active energy L3 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
3	Counter: Active energy L3 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
9	Total active power	FLOAT	1W	-2.147484 x 10 ⁶	2.147484 x 10 ⁶
10	Total reactive power	FLOAT	1W	-2.147484 x 10 ⁶	2.147484 x 10 ⁶
11	Total apparent power	FLOAT	1W	-2.147484 x 10 ⁶	2.147484 x 10 ⁶
12	Frequency	FLOAT	10Hz	4.600 x 10 ³	6.400 x 10 ³
13	Total Cos φ ²	FLOAT	10	-0.01	1.0
14	Temperature	FLOAT	10°C	-2.500 x 10 ³	8.500 x 10 ³
15	Active power L1	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
16	Reactive power L1	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
17	Total power L1	FLOAT	1W	-7.158278 x 10⁵	7.158278 x 10⁵
18	Voltage L1	FLOAT	1V	0	3.0 x 10 ⁴
19	Current L1	FLOAT	1A	0	2.5 x 10 ⁴
20	$\cos \phi L1^2$	FLOAT	10	-0.01	1.0
21	Harmonic voltage L1	FLOAT	1V	0	3.0 x 10 ⁴
22	Harmonic current L1	FLOAT	1A	0	2.5 x 10 ⁴
23	Active power L2	FLOAT	1W	-7.158278 x 10⁵	7.158278 x 10⁵
24	Reactive power L2	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
25	Total power L2	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
26	Voltage L2	FLOAT	1V	0	3.0 x 10 ⁴
27	Current L2	FLOAT	1A	0	2.5 x 10 ⁴
28	$\cos \phi L2^2$	FLOAT	10	-0.01	1.0
29	Harmonic voltage L2	FLOAT	1V	0	3.0 x 10 ⁴
30	Harmonic current L2	FLOAT	1A	0	2.5 x 10 ⁴
31	Active power L3	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
32	Reactive power L3	FLOAT	1W	-7.158278 x 10⁵	7.158278 x 10⁵
33	Total power L3	FLOAT	1W	-7.158278 x 10 ⁵	7.158278 x 10⁵
34	Voltage L3	FLOAT	1V	0	3.0 x 10 ⁴
35	Current L3	FLOAT	1A	0	2.5 x 10 ⁴
36	$\cos \phi L3^2$	FLOAT	10	-0.01	1.0

031-1PAxx - AI1x 3Ph 230/400V > Measurands

ID	Description	Data type	Unit	Min. value	Max. value
37	Harmonic voltage L3	FLOAT	1V	0	3.0 x 10 ⁴
38	Harmonic current L3	FLOAT	1A	0	2.5 x 10 ⁴
39	Overflow energy meter consumer Is incremented by 1 in case of overflow of the energy meter (ID = 1)	FLOAT		Overflow energy me effective	eter is at FLOAT not
40	Overflow energy meter producer Is incremented by 1 in case of overflow of the energy meter (ID = 2)	FLOAT		Overflow energy me effective	eter is at FLOAT not
41	Status bits 🔄 'Status bits' page 339	UINT_32			
1) The display resolution of the energy meter is 1Wh x WANDLER_I x WANDLER_U (current transformer factor x voltage transformer factor). $\%$ Chap. 3.27.5.1 'Parameter - 031-1PA10' page 330					

2) The measuring accuracy of the Cos φ is maintained from a minimum current of 100mA x WANDLER_I (current transformer factor).

Tolerance	See Technical data & Chap. 3.27.1.1 '031-1PA10' page 318
ID	Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .
Data type	♦ 'Data type' page 326
Max. Total power	 The max. Total power for 3 phases is ±2.147484 x 10⁶W (FLOAT) 3 * Umax * WANDLER_U * Imax * WANDLER_I If the Total power is exceeded by ±2.147484 x 10⁶W (FLOAT), the max value is output.

Status bits

With status bits you get information about limit violations.

- The limit values can be defined via the parametrization. ♦ Chap. 3.27.5.1 'Parameter - 031-1PA10' page 330
- The status bits are refreshed together with the other measurement values, as soon as the DS-ID is incremented.
- Set bits of status bits remain set as long as they are acknowledged. 3.27.7.4.5 'CMD Frame' page 352.
 - By acknowledging the status bits, the corresponding LEDs for exceeding the limit value will be deleted again.
- Byte order: high byte, low byte (at big endian)

Byte	Description
0	 0: de-activated, 1: activated Bit 0: Voltage at phase L2 below limit value (L2: VRMS_MIN) Bit 1: Voltage at phase L3 below limit value (L3: VRMS_MIN) Bit 2: Voltage at phase L1 above limit value (L1: VRMS_MAX) Bit 3: Voltage at phase L2 above limit value (L2: VRMS_MAX) Bit 4: Voltage at phase L3 above limit value (L3: VRMS_MAX) Bit 5: Temperature above limit value (T_MAX) Bit 6: Frequency below limit value (F_MIN) Bit 7: Frequency above limit value (F_MAX)
1	 0: de-activated, 1: activated Bit 0 0: deleted via CMD Frame (0x04) 1: if there was a RESET of the module. This happens after PowerON. Bit 1: Current at phase L1 above limit value (L1: IRMS_MAX) Bit 2: Current at phase L2 above limit value (L2: IRMS_MAX) Bit 3: Current at phase L3 above limit value (L3: IRMS_MAX) Bit 4: Efficiency cos φ phase L1 below limit value (L1: PF_MIN) Bit 5: Efficiency cos φ phase L2 below limit value (L2: PF_MIN) Bit 6: Efficiency cos φ phase L3 below limit value (L3: PF_MIN) Bit 7: Voltage at phase L1 below limit value (L1: VRMS_MIN)
2, 3	reserved

3.27.6.2 Measurands - 031-1PA00

Data type INT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	UINT_32	1Wh ¹	0	4 294 967 295
2	Counter: Active energy producer	UINT_32	1Wh ¹	0	4 294 967 295
3	Counter: Active energy L1 consumer	UINT_32	1Wh ¹	0	4 294 967 295
4	Counter: Active energy L1 producer	UINT_32	1Wh ¹	0	4 294 967 295
5	Counter: Active energy L2 consumer	UINT_32	1Wh ¹	0	4 294 967 295
6	Counter: Active energy L2 producer	UINT_32	1Wh ¹	0	4 294 967 295
7	Counter: Active energy L3 consumer	UINT_32	1Wh ¹	0	4 294 967 295
8	Counter: Active energy L3 producer	UINT_32	1Wh ¹	0	4 294 967 295

031-1PAxx - Al1x 3Ph 230/400V > Measurands

ID	Description	Data type	Unit	Min. value	Max. value
9	Total active power	INT_32	1mW	-3 750 000	3 750 000
10	Total reactive power	INT_32	1mW	-3 750 000	3 750 000
11	Total apparent power	INT_32	1mW	-3 750 000	3 750 000
12	Frequency	UINT_16	0.01Hz	4600	6400
13	Total Cos ϕ^2	INT_8	0.01	-100	100
14	Temperature	INT_16	0.01°C	-2500	8500
15	Active power L1	INT_32	1mW	-1 250 000	1 250 000
16	Reactive power L1	INT_32	1mW	-1 250 000	1 250 000
17	Total power L1	INT_32	1mW	-1 250 000	1 250 000
18	Voltage L1	UINT_32	1mV	0	300 000
19	Current L1	UINT_32	1mA	0	5 000 000
20	$\cos \phi L1^2$	INT_8	0.01	-100	100
21	Harmonic voltage L1	UINT_32	1mV	0	300 000
22	Harmonic current L1	UINT_32	1mA	0	5 000 000
23	Active power L2	INT_32	1mW	-1 250 000	1 250 000
24	Reactive power L2	INT_32	1mW	-1 250 000	1 250 000
25	Total power L2	INT_32	1mW	-1 250 000	1 250 000
26	Voltage L2	UINT_32	1mV	0	300 000
27	Current L2	UINT_32	1mA	0	5 000 000
28	$\cos \phi L2^2$	INT_8	0.01	-100	100
29	Harmonic voltage L2	UINT_32	1mV	0	300 000
30	Harmonic current L2	UINT_32	1mA	0	5 000 000
31	Active power L3	INT_32	1mW	-1 250 000	1 250 000
32	Reactive power L3	INT_32	1mW	-1 250 000	1 250 000
33	Total power L3	INT_32	1mW	-1 250 000	1 250 000
34	Voltage L3	UINT_32	1mV	0	300 000
35	Current L3	UINT_32	1mA	0	5 000 000
36	$\cos \phi L3^2$	INT_8	0.01	-100	100
37	Harmonic voltage L3	UINT_32	1mV	0	300 000
38	Harmonic current L3	UINT_32	1mA	0	5 000 000
39	Overflow energy meter	UINT_32		0	4 294 967 295
	Is incremented by 1 in case of overflow of the energy meter (ID = 1)				
40	Overflow energy meter	UINT_32		0	4 294 967 295
	Is incremented by 1 in case of overflow of the energy meter (ID = 2)				
41	Status bits 🔄 'Status bits' page 343	UINT_32			

2) The measuring accuracy of the Cos ϕ is maintained from a minimum current of 5mA x WANDLER_I (current transformer factor).

031-1PAxx - Al1x 3Ph 230/400V > Measurands

Tolerance	See Technical data & Chap. 3.27.1.2 '031-1PA00' page 320
ID	Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .
Data type	♦ 'Data type' page 326
Max. Total power	 The max. Total power for 3 phases is ±75 000 000 000mW 3 * Umax * Imax * WANDLER_I = e.g.: 3 * 100V * 1A * 5000 If the Total power is exceeded by ±75 000 000 000mW, the max value is output.
Overflow energy meter	 0xXX112233 XX: not used 11: Overflow phase L1 22: Overflow phase L2

33: Overflow phase L3

_

Measurands Data type FLOAT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
2	Counter: Active energy producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
3	Counter: Active energy L1 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
4	Counter: Active energy L1 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
5	Counter: Active energy L2 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
6	Counter: Active energy L2 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
7	Counter: Active energy L3 consumer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
8	Counter: Active energy L3 producer	FLOAT	1Wh ¹	0	5.497558 x 10 ⁸
9	Total active power	FLOAT	1W	-3.75 x 10 ⁶	3.75 x 10 ⁶
10	Total reactive power	FLOAT	1W	-3.75 x 10 ⁶	3.75 x 10 ⁶
11	Total apparent power	FLOAT	1W	-3.75 x 10 ⁶	3.75 x 10 ⁶
12	Frequency	FLOAT	10Hz	4.600 x 10 ³	6.400 x 10 ³
13	Total Cos φ ²	FLOAT	10	-0.01	1.0
14	Temperature	FLOAT	10°C	-2.500 x 10 ³	8.500 x 10 ³
15	Active power L1	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
16	Reactive power L1	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
17	Total power L1	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
18	Voltage L1	FLOAT	1V	0	3.0 x 10 ⁴
19	Current L1	FLOAT	1A	0	2.5 x 10 ⁴
20	$Cos \phi L1^2$	FLOAT	10	-0.01	1.0
21	Harmonic voltage L1	FLOAT	1V	0	3.0 x 10 ⁴

ID	Description	Data type	Unit	Min. value	Max. value
22	Harmonic current L1	FLOAT	1A	0	2.5 x 10 ⁴
23	Active power L2	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
24	Reactive power L2	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
25	Total power L2	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
26	Voltage L2	FLOAT	1V	0	3.0 x 10 ⁴
27	Current L2	FLOAT	1A	0	2.5 x 10 ⁴
28	$\cos \phi L2^2$	FLOAT	10	-0.01	1.0
29	Harmonic voltage L2	FLOAT	1V	0	3.0 x 10 ⁴
30	Harmonic current L2	FLOAT	1A	0	2.5 x 10 ⁴
31	Active power L3	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
32	Reactive power L3	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
33	Total power L3	FLOAT	1W	-1.25 x 10 ⁶	1.25 x 10 ⁶
34	Voltage L3	FLOAT	1V	0	3.0 x 10 ⁴
35	Current L3	FLOAT	1A	0	2.5 x 10 ⁴
36	$\cos \phi L3^2$	FLOAT	10	-0.01	1.0
37	Harmonic voltage L3	FLOAT	1V	0	3.0 x 10 ⁴
38	Harmonic current L3	FLOAT	1A	0	2.5 x 10 ⁴
39	Overflow energy meter consumer	FLOAT			eter is at FLOAT not
	Is incremented by 1 in case of overflow of the energy meter (ID = 1)			effective	
40	Overflow energy meter producer	FLOAT		Overflow energy me	eter is at FLOAT not
	Is incremented by 1 in case of overflow of the energy meter $(ID = 2)$			enecuve	
41	Status bits 🄄 'Status bits' page 343	UINT_32			
1) The display resolution of the energy meter is 1Wh x WANDLER_I (current transformer factor). & Chap. 3.27.5.2 'Parameter - 031-1PA00' page 332					

1) The display resolution of the energy meter is 1Wh x WANDLER_I (current transformer factor). 🗞 Chap. 3.27.5.2 'Parameter - 031-1PA00' page 332

2) The measuring accuracy of the Cos ϕ is maintained from a minimum current of 100mA x WANDLER_I (current transformer factor).

Tolerance	See Technical data & Chap. 3.27.1.2 '031-1PA00' page 320
ID	Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> .
Data type	♦ 'Data type' page 326
Max. Total power	 The max. Total power for 3 phases is ±3.75 x 10⁶mW (FLOAT) 3 * Umax * Imax * WANDLER_I = e.g.: 3 * 100V* 1A * 30 If the Total power is exceeded by ±3.75 x 10⁶mW (FLOAT), the max value is output.

Status bits

With status bits you get information about limit violations.

- The limit values can be defined via the parametrization. ♦ Chap. 3.27.5.2 'Parameter - 031-1PA00' page 332
- The status bits are refreshed together with the other measurement values, as soon as the DS-ID is incremented.
- Set bits of status bits remain set as long as they are acknowledged by 3.27.7.4.5 'CMD Frame' page 352.
 - By acknowledging the *status bits*, the corresponding LEDs for exceeding the limit value will be deleted again.
- Byte order: high byte, low byte (big endian)

Byte	Description
0	0: de-activated, 1: activated Bit 0: Voltage at phase L2 below limit value (L2: VRMS_MIN) Bit 1: Voltage at phase L3 below limit value (L3: VRMS_MIN) Bit 2: Voltage at phase L1 above limit value (L1: VRMS_MAX) Bit 3: Voltage at phase L2 above limit value (L2: VRMS_MAX) Bit 4: Voltage at phase L3 above limit value (L3: VRMS_MAX) Bit 5: Temperature above limit value (T_MAX) Bit 6: Frequency below limit value (F_MIN) Bit 7: Frequency above limit value (F_MAX)
1	 0: de-activated, 1: activated Bit 0 0: deleted via CMD Frame (0x04) 1: if there was a RESET of the module. This happens after PowerON. Bit 1: Current at phase L1 above limit value (L1: IRMS_MAX) Bit 2: Current at phase L2 above limit value (L2: IRMS_MAX) Bit 3: Current at phase L3 above limit value (L3: IRMS_MAX) Bit 4: Efficiency cos φ phase L1 below limit value (L1: PF_MIN) Bit 5: Efficiency cos φ phase L2 below limit value (L2: PF_MIN) Bit 6: Efficiency cos φ phase L3 below limit value (L3: PF_MIN) Bit 7: Voltage at phase L1 below limit value (L1: VRMS_MIN)
2, 3	reserved

3.27.7 Process data communication

Overview

During runtime the communication with the module happens via telegrams in the process image. Here you have the following possibilities:

- Read measured value
- Define Frame with measurands
- Read Frame with measured values
- Send control command

3.27.7.1 Structure

```
Telegram
```

The communication takes place via the I/O area of the head module. The head module sends via the output area a request telegram to the module. This responds with the requested data within the input area of the head module. Depending on the used head module this may take several cycles to complete, until the data are received in the input area. To ensure the consistency of all measured values, which originate from the same measurement, are stored in the module under one *DS-ID*. \Leftrightarrow *DS-ID* page 325

For input and output data the telegram has a length of 16byte and the following structure:

Byte	Function
B0	B0: Header byte 0
	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: Telegram type & Chap. 3.27.7.4 'Telegram type' page 346 Bit 7: 0 fix reserved
B1	B1: Header byte 1
	 ID of the measurand (1 41) Each measurand one <i>ID</i> is assigned. The access to the measured value of a measurand happens by means of the corresponding <i>ID</i> <i>©</i> Chap. 3.27.6.1 'Measurands - 031-1PA10' page 335 <i>©</i> Chap. 3.27.6.2 'Measurands - 031-1PA00' page 339
B2	B2: Header byte 2
	 Bit 3 0: Data set ID (<i>DS-ID</i>) of the measured value (1 15) The measured values of one measurement are accessible in the module via one <i>DS-ID</i>. Bit 7 4: Length of the user data (1 12) Depending on the telegram type, here up to 12 byte user data can be found.
B3	B3: Header byte 3 - Common status & Chap. 3.27.7.3 'Common status' page 345
D00	D00 D11: User data
	User data for data to be sent and received
D11	Length of user data are specified from D00 D11: On error no user data are transferred i.e. the length of the user data is 0 and the module returns an error ID.
	Range of values: 0 12

3.27.7.2 Status communication

Via the header byte (bit 3 ... 0) the status of the communication can be determined. On error no user data are transferred i.e. the length of the user data is 0. Please note that low error IDs are overridden by higher error IDs.

Status	Designation
0x00	OK (no error)
0x01	Error: Record set could not be refreshed
0x02	Error: DS-ID
0x03	Error: Telegram length
0x04	Error: <i>Frame</i> too big
0x05	Error: <i>Frame</i> not defined
0x06	Error: Measurand not available
	 Schap. 3.27.6.1 'Measurands - 031-1PA10' page 335 Chap. 3.27.6.2 'Measurands - 031-1PA00' page 339
0x07	Error: 'CMD Frame' - Command could not be executed
0x08	Error: 'Set Frame' - Frame definition is not valid (Set Frame)
0x09	Error: Telegram type not available - invalid request
0x0A	Error: Parameter - the last parameter set was not valid
0x0E	External error - Please contact our support
0x0F	Internal error: Due to a temporary disturbance during the processing of the measurement data, they could not be refreshed. If this error occurs more often, please contact our hotline.

3.27.7.3 Common status

With this byte you get an overview of possible error messages:

- Bit 0: Frequency *F_MAX* exceeded
- Bit 1: Frequency F_MIN undershot
- Bit 2: Temperature *T_MAX* exceeded
- Bit 3: Voltage VRMS_MAX exceeded
- Bit 4: Voltage *VRMS_MIN* undershot
- Bit 5: Efficiency *PF_MIN* undershot
- Bit 6: Current *IRMS_MAX* exceeded
- Bit 7: reserved

Detailed information about an error can be found in the Status bits:

- 031-1PA10 Status bits' page 339
- 031-1PA00 'Status bits' page 343

3.27.7.4 Telegram type

By specifying the *Telegram type* the content of the responded data is defined. The following telegram types are available:

Туре	Designation	Page
0x00	'Zero Frame': Accessing Frame 0	Ե 346
0x10	'Read Value': Read the measured value of a measurand	⊗ 346
0x20	<i>'Read Frame'</i> : Read a previously defined data package (Frame)	♦ 350
0x30	'Set Frame': Define the data areas of a data package (Frame)	⊗ 348
0x40	'CMD Frame': Send a command	⊗ 352
0x60 ¹	'Read Param': Read Parameter	⊗ 355
1) This telegram t	voe is not supported by the energy measurement module 031-1PA00	

1) This telegram type is not supported by the energy measurement module 031-1PA00.

3.27.7.4.1 Zero Frame

This telegram type is the same as the telegram type '*Read Frame*' & *Chap. 3.27.7.4.4* '*Read Frame*' page 350 applied at *Frame 0*. After the start-up of the module there are automatic *Zero Frame* requests as long as the process data communication comes from the head module.

3.27.7.4.2 Read Value

With 'Read Value' all the measured values can be requested.

Request

Byte	Value	Description
B0	0x10	 Bit 3 0: Error code (not relevant) Bit 6 4: 001 Telegram type '<i>Read Value</i>' Bit 7: 0 fix reserved
B1		■ <i>ID</i> of the measurand. 🤄 <i>ID'</i> page 325
B2		Bit 7 4: Length user data (0)
		Bit 3 0: Data set ID <i>DS-ID</i> of the measured value to be read. ' <i>DS-ID</i> ' page 325
B3	0x00	Common status (not relevant).
D00	- 1	User data (not relevant).
D11		

Response

Byte	Value	Description
B0	0x10	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: 001 Telegram type 'Read Value' Bit 7: 0 fix reserved
B1		ID of the measurand from the request.
B2	B2	Bit 7 4: Length of the user data with measured values in byte.
		Bit 3 0: <i>DS-ID</i> of the measured value from the request, which was read.
B3		Common status & Chap. 3.27.7.3 'Common status' page 345
D00		User data with the requested measured value
	-	 depending on the parameterized data format Byte order: high byte, low byte (big endian)
D11		 Byte order: low byte, high byte (little endian)

Example '*Read Value*' In the example with *ID* = 14 the temperature of the module for *DS-ID* = 1 is requested.

Request

Byte	Value	Description
B0	0x10	Telegram type 'Read Value'.
B1	0x0E	ID of the measurand. 🔄 'ID' page 325
B2	0x01	DS-ID of the measured value to be read (DS-ID = 1). \Leftrightarrow 'DS-ID' page 325
B3	0x00	Common status (not relevant).
D00	-	User data (not relevant).
D11		

Byte	Value	Description
B0	0x10	Telegram type 'Read value' from the request.
B1	0x0E	ID of the measurand from the request.
B2	0x21	Length of the user data here temperature 2 byte.
		DS-ID of the measured value from the request, which was read.
B3	0x00	Common status: OK & Chap. 3.27.7.3 'Common status' page 345
D00	0x00	User data with the requested temperature e.g. 35°C.
D01	0x23	

3.27.7.4.3 Set Frame

Overview

In the module you can combine some measurands to one data package (Frame *Frame' page 325*), which is transferred in one step . With *'Set Frame'* a Frame can be built.

Request

Byte	Value	Description
B0	0x30	 Bit 3 0: Error code (not relevant) Bit 6 4: 011 Telegram type 'Set Frame' Bit 7: 0 fix reserved
B1		■ <i>FR-ID</i> of the Frame to be set. \$ ' <i>FR-ID'</i> page 326
B2		Bit 7 4: Length user data: 1 byte each measurand
		Bit 3 0: <i>DS-ID</i>
B3	0x00	Common status (not relevant).
D00		Ibyte each measurand regarding that the measured values do not exceed the total length of 12byte. Here, the format of the measured values is taken into account (depending on the parameterized data type: INT or FLOAT).
D11		♦ Chap. 3.27.6 'Measurands' page 335 ♦ 'Data type' page 326

Byte	Value	Description	
В0	0x30	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: 011 Telegram type 'Set Frame' Bit 7: 0 fix reserved 	
B1		FR-ID of the Frame from the request.	
B2		Bit 7 4: Length of the user data (0).	
		Bit 3 0: <i>DS-ID</i>	
B3		Common status & Chap. 3.27.7.3 'Common status' page 345	
D00	1	User data (not relevant).	User data (not relevant).
D11			

Example 'Set Frame'

Here a Frame with *FR-ID* 0x01 is defined. The Frame contains the following measurands:

- ID: 03: Counter: Active energy L1 (consumer)
- ID: 13: total cos φ
- ID: 12: Frequency

Request

Byte	Value	Description
B0	0x30	Telegram type 'Set Frame'.
B1	0x01	FR-ID of the Frame to be read (FR-ID = 1). § 'FR-ID' page 326
B2	0x30	Bit 7 4: Length user data (3).
		Bit 3 0: data set ID DS-ID of the measurands (0).
B3	0x00	Common status (not relevant).
D00	0x03	User data with the ID of the measurands.
D01	0x0D	
D02	0x0C	
D03	-	Remaining user data are not relevant.
D11		

Byte	Value	Description
B0	0x30	Telegram type 'Set Frame' from the request.
B1	0x01	FR-ID of the Frame from the request.
B2	0x00	Bit 7 4: Length of the user data (0).
		Bit 3 0: data set ID DS-ID of the measurands (0).
B3	0x00	Common status: OK & Chap. 3.27.7.3 'Common status' page 345
D00	-	User data (not relevant).
D11	-	

3.27.7.4.4 Read Frame Overview In the module you can combine some measurands to one data package (Frame & 'Frame' page 325), which is transferred in one step.

With 'Read Frame' a Frame can be requested.

Request

Byte	Value	Description
B0	0x20	 Bit 3 0: Error code (not relevant) Bit 6 4: 010 Telegram type '<i>Read Frame</i>' Bit 7: 0 fix reserved
B1		■ <i>FR-ID</i> of the Frame to be read. 🤄 <i>FR-ID</i> page 326
B2	0x00	Bit 7 4: Length of the user data is 0.
		■ Bit 3 0: <i>DS-ID</i> of the measured value to be read. ♦ <i>'DS-ID' page 325</i>
B3	0x00	Common status (not relevant).
D00		User data (not relevant).
D11		

Byte	Value	Description
B0	0x20	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: 010 Telegram type 'Read Frame' Bit 7: 0 fix reserved
B1		FR-ID of the Frame from the request.
B2		Bit 7 4: Length of the user data with measured values in byte
		Bit 3 0: <i>DS-ID</i> of the measured value from the request, which was read.
B3		Common status & Chap. 3.27.7.3 'Common status' page 345
D00		User data with the requested Frame with measured values.
		 Depending on the parameterized data format.
D11		

Example 'Read Frame' In the example the previously via 'Set Frame' defined FR-ID (0x01) is requested with the following measurands:
ID: 03: Counter: Active energy L1 (consumer): 4byte
ID: 13: total cos φ: 1byte

ID: 12: Frequency 2byte

Request

Byte	Value	Description	
B0	0x20	Telegram type <i>'Read Frame'</i>	
B1	0x01	FR-ID of the Frame to be read (FR-ID = 1). ఈ 'FR-ID' page 326	
B2	0x01	Bit 7 4: Length of the user data (0).	
		Bit 3 0: <i>DS-ID</i> of the measured value to be read (<i>DS-ID</i> = 1). § <i>'DS-ID'</i> page 325	
B3	0x00	Common status (not relevant).	
D00	-	User data (not relevant).	
D11			

Byte	Value	Description			
B0	0x20	Telegram type <i>'Read value'</i> from the request.			
B1	0x01	FR-ID of the Frame from the request			
B2	0x71	Bit 7 4: Length of the Frame with measured values (7)			
		Bit 3 0: <i>DS-ID</i> of the measured value from the request (1).			
B3	0x00	Common status: OK & Chap. 3.27.7.3 'Common status' page 345			
D00	0x00	Counter: Active energy L1 (consumer): 500kWh			
D01	0x07				
D02	0xA1				
D03	0x20				
D04	0x5A	Total cos φ: 0.9			
D05	0x13	Frequency: 50Hz			
D06	0x88				
D07	-	Remaining user data are not relevant.			
D11					

3.27.7.4.5 **CMD Frame**

With 'CMD Frame' you can send control commands to the module. This can trigger various actions or be used for reading and writing of control registers. The following control commands are available:

- Reset the energy counter
- Reset the status bits
- Request the firmware version
- Read holding register (not 031-1PA00)
- Write counter values respectively set the active energy meters L1 - L3 (not 031-1PA00)



Please note that energy values must always be written in INTEGER format, even if you have set the module to FLOAT mode.

Request

Byte	Value	Description			
В0	0x40	Bit 3 0: Error code (not relevant) Bit 6 4: 100 Telegram type <i>'CMD Frame'</i> Bit 7: reserved			
B1		 CMD-ID of the control command, which is to be executed: 0x01: Reset of all energy counters 0x03: Reset the status bits 0x04: Request the firmware version 0x06¹: Read holding register 0x07¹: Write in active energy meter 			
B2		 Bit 7 4: Length of the user data depending on <i>CMD-ID</i>: 0x01: Reset of all energy counters (length user data: 0byte) 0x03: Reset the status bits (length user data: 4byte) 0x04: Request the firmware version (length user data: 0byte) 0x06¹: Read holding register (length user data: 0byte) 0x07¹: Write in active energy meter (length user data: 6byte) 			
		Bit 3 0: Data set ID <i>DS-ID</i> of the measured value (3 7).			
B3	0x00	Common status (not relevant).			
D00 D11	-	 User data depending on <i>CMD-ID</i> 0x01: Reset of all energy counters (user data: not relevant) 0x03: Reset the status bits (user data: 4byte with the corresponding set bits) 0x04: Request the firmware version (user data: not relevant) 0x06¹: Read holding register (user data: not relevant) 0x07¹: Write in active energy meter <i>ID</i> (1byte) of the measured value (<i>ID</i> 3 8) Overflow counter (1byte) New value (4byte) 			

1) This is not supported by the energy measurement module 031-1PA00.

System SLIO

Response

Byte	Value	Description		
B0	0x40	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: 100 Telegram type 'CMD Frame' Bit 7: 0 fix reserved 		
B1		CMD-ID from the request.		
B2		 Bit 7 4: Length of the user data depending on <i>CMD-ID</i>: 0x01: Reset of all energy counters (length user data: 0byte) 0x03: Reset the status bits: (length user data: 4byte) 0x04: Request the firmware version (Length user data: 10byte) 0x06¹: Read holding register 0x07¹: Write in active energy meter 		
		Bit 3 0: <i>DS-ID</i> (not relevant)		
B3		Common status & Chap. 3.27.7.3 'Common status' page 345		
D00 D11		 User data depending on <i>CMD-ID</i>: 0x01: Reset of all energy counters (user data: nothing) 0x03: Reset the status bits: (User data: 4byte with the corresponding set bits) 0x04: Request the firmware version (user data: 10byte with the version information) 0x06¹: Read holding register 0x07¹: Write in active energy meter <i>ID</i> (1byte) of the measured value (<i>ID</i> 3 8) Overflow counter (1byte) New value (4byte) Byte order: high byte, low byte (big endian) Byte order: low byte, high byte (little endian) 		
1) This is not support	ed by the energy mean			

Firmware version

- Byte 2... 0: Firmware version
- Byte 5 ... 3: Protocol version
 - Byte 3: Major _
 - _ Byte 4: Minor
 - Byte 5: Revision
- Byte 9 ... 6: Measuring chip version
 - Byte 6: Day
 - Byte 7: Month
 - Byte 8: Year (hundreds)
 - Byte 9: Year (one)

Write in active energy meter (not 031-1PA00)

- Setting active energy meters L1 L3 (consumers, producers)
- Byte 0: ID of the measured value to be written (*ID*: 3 ... 8).
- Byte 1: Overflow counter
- Byte 5 ... 2: New measured value

Example 'CMD Frame' In this example all the status bits are reset.

Request

Byte	Value	Description		
B0	0x40	Telegram type <i>'CMD Frame'</i>		
B1	0x03	MD-ID: Reset the status bits		
B2	0x40	eset the status bits: (length user data: 4byte)		
B3	0x00	Common status (not relevant).		
D00	0xFF	User data: Reset the status bits		
D01	0xFF			
D02	0xFF			
D03	0xFF			

Byte	Value	Description		
B0	0x40	Telegram type <i>'CMD Frame'</i> from the request.		
B1	0x03	CMD-ID from the request.		
B2	0x40	ength of the user data from the request.		
B3	0x00	Common status: OK 🖔 Chap. 3.27.7.3 'Common status' page 345		
D00	0xFF	User data from the request.		
D01	0xFF			
D02	0xFF			
D03	0xFF			

3.27.7.4.6 Read Param



This telegram type is not supported by the energy measurement module 031-1PA00.

With 'Read Param' (0x60) the parameters can be read via the process image.

Request

Byte	Value	Description			
В0	0x60	 Bit 3 0: Error code (not relevant) Bit 6 4: 110 Telegram type <i>'Read Param'</i> Bit 7: reserved 			
B1		IDx of the parameter to be read. 5 <i>Chap. 3.27.5 'Parameter data' page 330</i>			
B2		Bit 7 4: Length user data (0)			
		Bit 3 0: Data set ID <i>DS-ID</i> (relevant for one time reading).			
B3		Common status (not relevant).			
D00		User data (not relevant).			
D11					

Byte	Value	Description		
B0	0x60	 Bit 3 0: Status communication & Chap. 3.27.7.2 'Status communication' page 345 Bit 6 4: 110 Telegram type 'Read Param' Bit 7: reserved 		
B1		IDx of the read parameter.		
B2		Bit 7 4: Length of the user data (0)		
		Bit 3 0: Data set ID DS-ID		
B3		Common status & Chap. 3.27.7.3 'Common status' page 345		
D00		Parameter value that was read.		
D11				

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3.27.7.5 Example

Communication

Here the communication and the query of the status bits (ID = 41) are described on an example.

No.	Request	Response	Description
1	0x10 0x01 0x03 0x00		An <i>ID</i> and <i>DS-ID</i> is requested: e.g.: M 1-3
			M (ID)-(DS-ID)
3		0x10 0x01 0x43 0x01 (4 byte data)	M 1-3 indicates frequency exceeded.
4	0x10 0x29 0x03 0x00		Query the status bits M 41-3.
5		0x10 0x29 0x43 0x05 0x00 0x00 0x80 0x00	Frequency exceeded and temperature exceeded is reported.
6	0x10 0x29 0x04 0x00		Query the status bits M 41-4.
7		0x10 0x29 0x44 0x05	The status bit were refreshed ($ID = 41$) and temperature exceeded is reported.
		0x00 0x00 0xA0 0x00	perature exceeded is reported.
8	0x40 0x03 0x45 0x00 0x00 0x00 0xA0 0x00		Reset the status bits (frequency exceeded and temperature exceeded).
9		0x40 0x03 0x45 0x00	Status bits have been reset.
		0x00 0x00 0xA0 0x00	
10	0x10 0x29 0x05 0x00		Query the status bits M 41-5.
11		0x10 0x29 0x45 0x00	Status bits have been reset.
		0x00 0x00 0x20 0x00	Temperature exceeded is reported.

3.27.8 Error messages and diagnostics

3.27.8.1 Status and error messages

Common status	🗞 Chap. 3.27.7.3 'Common status' page 345
Status communication	& Chap. 3.27.7.2 'Status communication' page 345
Status bits	053-1PA10 & 'Status bits' page 339

053-1PA00 Status bits' page 343

3.27.8.2 Diagnostic data

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

The following errors are listed in the diagnostics data:

Error in configuration / parametrization

031-1PAxx - Al1x 3Ph 230/400V > Error messages and diagnostics

- 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	03h			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 CH7ERR	5	reserved	00h			0Dh 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 parametrization

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

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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

Byte
0

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

NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of the module (here 03h)

CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel 0 Bit 1: set at error in channel 1 Bit 2: set at error in channel 2 Bit 7 3: reserved

CHxERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x
		 Bit 0: set at configuration / parametrization error Bit 7 1: reserved

CH3ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

System SLIO

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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 System SLIO module there is a timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again.

3.27.9 Product specific handling blocks

The product specific blocks can be found as library download file in the 'Download Center' of www.yaskawa.eu.com under 'Controls Library' 'Device Specific - SW90LS0MA'. The library is available as packed zip file. As soon as you want to use product specific blocks you have to import them into your project. More information can be found in the manual for your block library. The following blocks are used for communication:

Blocks	Symbol	Description
UDT 325	EM_DATA_R1	Data structure for FB 325
FB 325	EM_COM_R1	Communication with 031-1PAxx for energy metering



More information about the usage of these blocks can be found in the manual "Device Specific - SW90LS0MA" at www.yaskawa.eu.com in the 'Download Center' under 'Controls Library'.

Functionality

- The energy measuring module is used to measure the energy of a 3-phase connection. In addition to voltage, current and phase, the module determines many other measurands . Chap. 3.27.6 'Measurands' page 335
- Limit values can be parametrized for some measurands. When exceeding or falling below corresponding interrupt status bits are set. The module supports several commands (CMD). For example, interrupt status bits can be reset hereby.
- With the function block FB 325 and the associated data structure of type UDT 325, you can read energy measured values and interrupt status bits of the energy measurement module and commands can be executed on the module. In this case, the FB 325 communicates via the cyclic I/O data (16 bytes each) of the module, which must be specified accordingly when FB 325 is called.
- The real request interface is realized via the data structure of the type UDT 325. As a result, a simple control and evaluation, for example via a touch panel is possible.

Analog value

Analog output 4

4.1 General								
Cabling for analog signals	You must only use screened cable when you are connecting analog signals. These cables reduce the effect of electrical interference. The screen of the analog signal cable should be grounded at both ends. In situations with different electrical potentials, it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.							
Connecting loads and actuators	You can use the analog output modules to supply loads and actuators with current or voltage.							
	 Please take always care of the correct polarity when connecting actuators! Please leave the output clamps of not used channels disconnected and set the output type of the channel to "deactivated" in the hardware configurator from Siemens. 							
Parameterization	The parameterization via CPU, PROFIBUS and PROFINET happens by means of record sets (DS). The corresponding record set number may be found at the respective module description. Here also the indices (IX) respectively subindices (SX) for CANopen respectively EtherCAT are listed.							
Diagnostic functions	 The modules have diagnostics capability. The following errors may release a diagnostic: Error in parameterization Short-circuit recognition Wire-break recognition 							
	Alternated blinking of the channel error LEDs The alternate blinking of the channel error LEDs of channel 0 and 1 indi- cates a watchdog error due to a system overload. Restart with a power cycle your system. If the error occurred again, check configuration and circuit and adjust them if necessary. If the error persists, please contact							

4.2 Analog value

Analog value representa-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. The analog values are displayed as a fixed-point number in the two's complement.

Resolution	Analog value															
	High byte (byte 0)								Low byte (byte 1)							
Bit number	15	14	14 13 12 11 10 9 8							6	5	4	3	2	1	0
Resolution	SG	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	27	2 ⁶	2 ⁵	24	2 ³	2 ²	2 ¹	20
12Bit	SG	Analog value (word)									Х	Х	Х			
15Bit	SG	SG Analog value (word)														

our support.

tion

Output ranges and function numbers

 Resolution
 With a resolution of 12bit plus sign bit, the least significant bits (3bit) are not relevant.

 Sign bit (SG)
 The algebraic sign bit is represented by Bit 15. Here it is essential:

 Bit 15 = "0": → positive value

 Bit 15 = "1": → negative value

4.3 Output ranges and function numbers

General In the following there are the output ranges listed with function number, which were supported by the corresponding analog module. The here listed formulas allow you to transform a value (digital value) to an analog value and vice versa.

Output ranges	Voltage

0 ... 10V

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

Output ranges and function numbers

±10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	U = D r 10
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		11
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		10
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	II = D r 10
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		II
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		10
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

Output ranges

Current

0 ... 20mA

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

Output ranges and function numbers

4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas	
(funct. no.)	(I)	(D)				
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$	
Siemens	20mA	27648	6C00h	nominal range	27648	
S7 format	12mA	13824	3600h		$D = 27648 \text{ m}^{I-4}$	
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$	
	0mA	-6912	E500h	underrange		
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$	
Siemens	20mA	16384	4000h	nominal range	16384	
S5 format	12mA	8192	2000h		D = 16284 r $I-4$	
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$	
	0mA	-4096	F000h	underrange		

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

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

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

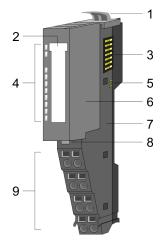
5

6

7 8

9

Structure



Status indication

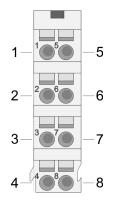
RUN — 1 ____ MF — 1 ____ AO 0 — 1 ____

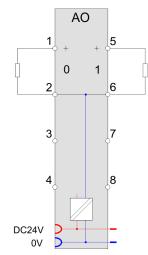
RUN	MF <mark></mark> red	AO x	Description			
-		х	Bus communication is OK			
-		~	Module status is OK			
_	-	х	Bus communication is OK			
-	-	^	Module status reports an error			
	-	х	Bus communication is not possible			
	-	^	Module status reports an error			
		Х	Error at bus power supply			
Х	2Hz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40			
			Error channel x			
			Overload, short-circuitError in parameterization			
not relevant:	Х					

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

Pin assignment

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





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

System SLIO

4.4.1 Technical data

Order no.	032-1BB30
Туре	SM 032
Module ID	0501 25D8
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Current consumption from load voltage L+ (without load)	35 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 rated load voltage	-
Voltage output short-circuit protection	\checkmark
Voltage outputs	\checkmark
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	1.5 ms
Settling time for capacitive load	2 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels
Substitute value can be applied	no

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

Order no.	032-1BB30
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g

Analog output

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

Order no.	032-1BB30
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.4.2 Parameter data

DS - Record set for access via CPU, PROFIBUS and PROFINET

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h

SHORT_	EN	Short-circuit
recognit	ion	

Byte	Bit 7 0
0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 7 2: reserved

CHxFN Function number channel x

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

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

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

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		II
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is limited to 0V.		underrange	10	
0 10V	12,5V	20480	5000h	overrange	$U = D x \frac{10}{16384}$
Siemens	10V	16384	4000h	nominal range $U = D \times \frac{163}{163}$	
S5 format	5V	8192	2000h		IJ
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is limited to 0V.		underrange	10	

0 ... 10V

4.4.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic Byte Bit 7 0	
0 Bit 0: set at module fa Bit 1: set at internal er Bit 2: set at external e Bit 3: set at channel e Bit 4: set at external a Bit 6 5: reserved Bit 7: set at error in pa	rror error rror nuxiliary supply missing

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR Channel specific	Byte	Bit 7 0
Channel Specific	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved
CH2ERR CH7ERR reserved	Byte	Bit 7 0
reserveu	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the µs ticker at the moment of the diagnostic
	µs ticker	
		m SLIO module there is a timer (μ s ticker). With PowerON the timer starts h 0. After 2 ³² -1 μ s the timer starts with 0 again.
	counting wit	

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

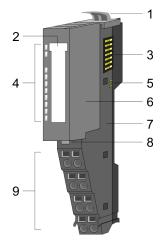
4.5 032-1BB40 - AO 2x12Bit 0(4)...20mA

Properties

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

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

Structure



Status indication

RUN — MF — AO 0 — AO 1 —

RUN	MF	AO x	Description
		х	Bus communication is OK Module status is OK
	•	x	Bus communication is OK Module status reports an error
	•	х	Bus communication is not possible Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
•		•	Error channel xError in parameterizationWire break (if parameterized)
not relevant: X			

- Locking lever terminal module
- 2 Labeling strip

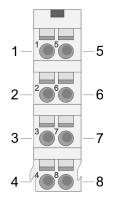
1

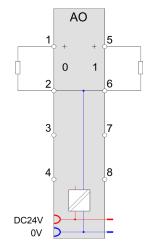
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module8 Locking lever ele
 - Locking lever electronic module
- 9 Terminal

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

Pin assignment

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





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

System SLIO

4.5.1 Technical data

Order no.	032-1BB40
Туре	SM 032
Module ID	0502 25D8
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Current consumption from load voltage L+ (without load)	15 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 rated load voltage	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	\checkmark
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.4% +/-0.5%
Basic error limit current ranges	+/-0.2% +/-0.3%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels

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

Order no.	032-1BB40
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g

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

Order no.	032-1BB40
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.5.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h

WIBRK_EN Wire-break recognition

You also can activate the wire-break recognition for the current output range 0 ... 20mA. To ensure a safe wire-break recognition, the decimal value for the output is \geq 100.

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

CHxFN Function number channel x

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

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

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

0 ... 20mA

4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$
Siemens	20mA	27648	6C00h	nominal range	27648
S7 format	12mA	13824	3600h		D 27648 J-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	16384
S5 format	12mA	8192	2000h		D 16284 I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{1-4}{16}$
	0mA	-4096	F000h	underrange	

4.5.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	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	
■ Bit 6 5: res	ternal error kternal error nannel error kternal auxiliary supply missing

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR Channel-specific	Byte	Bit 7 0
channel-specific	0	Channel-specific error channel x
		 Bit 0: set at configuring/parameter assignment error Bit 3 1: reserved Bit 4: set at wire-break Bit 7 5: reserved
CH2ERR CH7ERR reserved	Byte	Bit 7 0
reserveu	0	reserved
DIAG_US µs ticker	Byte	Bit 7 0
	03	Value of the μ s ticker at the moment of the diagnostic
	µs ticker	
		m SLIO module there is a timer (µs ticker). With PowerON the timer starts h 0. After 2 ³² -1µs 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

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

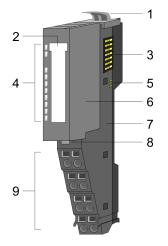
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6

7 8

9

Structure

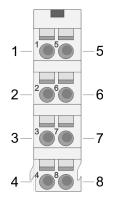


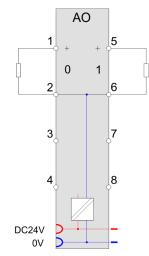
Status indication

RUN	MF <mark></mark> red	AO x	Description	
-		х	Bus communication is OK	
-		~	Module status is OK	
-	-	х	Bus communication is OK	
-		^	Module status reports an error	
	_	х	Bus communication is not possible	
	-	~	Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
			Overload, short-circuitError in parameterization	
not relevant: X				

Pin assignment

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





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

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

4.6.1 Technical data

Order no.	032-1BB70
Туре	SM 032
Module ID	0505 25D8
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
Voltage output short-circuit protection	\checkmark
Voltage outputs	\checkmark
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	3 ms
Settling time for capacitive load	3 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels

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

Order no.	032-1BB70
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g

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

Order no.	032-1BB70
Weight including accessories	58 g
Gross weight	73 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.6.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h

SHORT_EN	Short-circuit
recognition	

Byte	Bit 7 0
0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 7 2: reserved

CHxFN Function number channel x

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

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

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

0 ... 10V

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

±10V

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.

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic

	Byte	Bit 7 0
 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 parametrization 	0	 Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 6 5: reserved

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

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR	Byte	Bit 7 0
Channel-specific	0	 Channel-specific error channel x: Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved

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

µs ticker

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

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

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

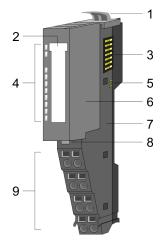
5

6

7 8

9

Structure



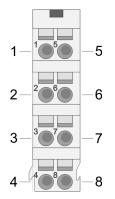
Status indication

RUN — I _ ____ MF — I _ ____ AO 0 — I _ ___ AO 1 — I _ ___ AO 2 — I _ ___ AO 3 — I _ ___

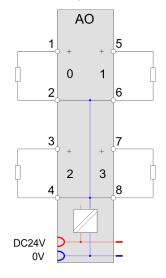
RUN	MF	AO x	Description
green	red	red	Description
		х	Bus communication is OK
		^	Module status is OK
		х	Bus communication is OK
	-	^	Module status reports an error
	-	v	Bus communication is not possible
	-	Х	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			 Overload, short-circuit
			Error in parameterization
not relevant:	Х		

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

Pin assignment



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



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area

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

Output area

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

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

4.7.1 Technical data

Order no.	032-1BD30
Туре	SM 032
Module ID	0503 25E0
Current consumption/power loss	
Current consumption from backplane bus	90 mA
Current consumption from load voltage L+ (without load)	35 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 rated load voltage	-
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
Substitute value can be applied	no

Analog output

Attau sinformation, alarms, diagnosticsstatus displayyesinterruptsnohorecess alarmnobiagnostic interruptnobiagnostic functionsyesbiagnostic functions functionsgene LEDconcert displayred LEDconcert displayred LEDconcert displayred LEDconcert displayselent EDconcert displayred LEDconcert displayred LEDconcert displayred LEDconcert displayselent EDconcert displayred LEDconcert displayred LEDconcert displayselent EDconcert displayselent EDconcert displayred LEDconcert displayred LEDconcert displayselent EDconcert display	Order no.	032-1BD30
status displayyesnohterruptsnoProcess alarmnoNonoNagnostic interruptnoNagnostic interruptyesNagnostic interruptgreen LEDSupply voltage displaygreen LEDSchumer or displayred LED per channelSchumer or displayred LED per channelSchumer or display-Steween channels-Setween channels of groups to-Setween channels and backplane bus-Setween channels and power supply-Aax. potential difference between niruuts-Aax. potential difference between niruuts and Mintern Uiso)C75 V/AC 50 VAax. potential difference between ninputs and Mana (Ucm)-Aax. potential difference between Mintern and outputs-Subation-Aax. potential difference between Mintern and outputs-Subation tested withDC 500 VAax. potential difference between Mintern and outputs-Subation tested with0Subation tested with0Subation tested with-Subation tested with0Subation tested with-Subation tested with-Subation tested with-Subation tested bytes-Subation tested with-Subation tested with-Subation tested with-Subation tested with-Subation tested bytes-Subation tested bytes-	Output data size	8 Byte
Index Index Process alarm no Process alarm no Diagnostic interrupt no Diagnostic functions yes Diagnostic functions green LED Diagnostic information read-out green LED Diagnostic functions red LED per channel Schannel error display red LED per channel Schannel error display - Schannel error display - Schannel error display red LED per channel Schannel error display - Schannel error display - Schannels - Schannels - Schannels and backplane bus - Velween channels and power supply - Atax. potential difference between inputs (Ucm) - Atax. potential difference between inputs and Mintern - Max. potential difference between inputs and Mintern - Schantic tested with DC 50 V/ AC 50 V Max. potential difference between inputs and Mintern - Schanterest withe -	Status information, alarms, diagnostics	
Process alarmnoDiagnostic interruptnoDiagnostic functionsyesDiagnostic functionspossiblepapply voltage displaygreen LEDBroup error displayred LED per channelSolation-Between channels-Between channels of groups to-Between channels and backplane bus-Between channels and power supply-Anx. potential difference between circuits-Anx. potential difference between inputs (Ucm)-Anx. potential difference between inputs and Mana (Ucm)-Ansx. potential difference between inputs and Mintern-Dubut bytes-Ansa. potential difference between inputs and Mintern-Dubut bytes-Answ. potential difference between inputs and Mintern-Answ. potential difference between inputs and Mintern-Answ. potential difference between inputs and Mintern-Dubut bytes-Ansa between the potential difference between inputs and Mintern-Ansa between the poten	Status display	yes
Nagoostic interruptnoDiagnostic functionsyesDiagnostic information read-outpossibleBupply voltage displaygreen LEDGroup error displayred LED per channelStationred LED per channelsolation-Selween channels-Between channels of groups to-Between channels and backplane bus-Solation-Ana. potential difference between circuits-Ana. potential difference between inputs (Ucm)-Ana. potential difference between inputs and Mintern-Atax. potential difference between Mintern and outputs-Atax. potential difference between Mintern-Diaputs bytes-Atarameter bytes-Atarameter bytes-Atarameter bytes-Atarameter b	Interrupts	no
Nagonostic functionsyesDiagnostics information read-outpossibleBupply voltage displaygreen LEDGroup error displayred LED per channelChannel error displayred LED per channelsolation-Between channels-Retween channels of groups to-Retween channels and backplane bus-Retween channels and power supply-Ana. potential difference between circuits-Ana. potential difference between inputs (Ucm)-Ana. potential difference between inputs and Mintern Uiso)DC 75 V/ AC 50 VAna. potential difference between inputs and Mintern Uiso)-Ana. potential difference between inputs and Mintern uiso)-Ana. potential difference between inputs and Mintern uiso)-Ana. potential difference between inputs and Mintern uiso)-Duptu bytes-Ana. potential difference between Mintern and outputs ansulation tested with-Duptu bytes0Duptu bytes0Duptu bytes-Duptu bytes-Anameter bytes10Duptu bytes-Diagnostic bytes-AtarialPE / PPE GF10AnutingProfile rail 35 mm	Process alarm	no
Answer Possible Bupply voltage display green LED Group error display red LED Channel error display red LED per channel Solation - Between channels - Retween channels of groups to - Retween channels and backplane bus - Retween channels and power supply - Aax. potential difference between circuits - Aax. potential difference between inputs (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between Mintern and outputs - Isolo D - Aax. potential difference between Mintern and outputs - Isolation tested with DC 500 V Duput bytes 0 Duput bytes 20 Parameter bytes 10 Diagnostic bytes 20 <tr< td=""><td>Diagnostic interrupt</td><td>no</td></tr<>	Diagnostic interrupt	no
green LED aroup error display red LED bhannel error display red LED per channel solation red LED per channel solation - between channels - between channels of groups to - between channels and backplane bus - between channels and power supply - Aax. potential difference between circuits - Aax. potential difference between inputs (Ucm) - Aax. potential difference between inputs and Mintern - Uiso) - Aax. potential difference between inputs and Mintern - Uiso) - Aax. potential difference between inputs and Mintern - Uiso) - Aax. potential difference between Mintern and outputs - Aax. potential difference between Mintern and outputs - Aax. potential difference between Mintern - Dubut bytes 0 Aax. potential difference between Mintern - Abax. potential difference between Mintern - Dubut bytes 0	Diagnostic functions	yes
Broup error displayred LEDChannel error displayred LED per channelSolation-Selween channels-Jetween channels of groups to-Jetween channels and backplane bus-Jetween channels and power supply-Jetween channels difference between inputs (Ucm)-Jetween channels difference between inputs and Mintern Uiso)-Juso-Juso-Jax. potential difference between inputs and Mintern Uiso)-Juso-Juso-Just-Ju	Diagnostics information read-out	possible
Annel error display red LED per channel solation - setween channels - setween channels of groups to - setween channels and backplane bus - setween channels and power supply - Aax. potential difference between circuits - Aax. potential difference between niputs (Ucm) - Aax. potential difference between mana and Mintern DC 75 V/ AC 50 V Viso) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mintern DC 75 V/ AC 50 V Viso) - Aax. potential difference between inputs and Mintern - Uiso) - Aax. potential difference between Mintern and outputs - Notuput bytes 0 Duput bytes 0 Duput bytes 20 Parameter bytes 10 Diagnostic bytes 20 Aterial PE / PPE GF10 Autring Profile rail 35 mm	Supply voltage display	green LED
solation Image: solation Between channels - Between channels of groups to - Between channels and backplane bus - Between channels and power supply - Aax. potential difference between circuits - Max. potential difference between inputs (Ucm) - Aax. potential difference between inputs (Ucm) - Aax. potential difference between inputs and Mintern DC 75 V/ AC 50 V Max. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mintern - Uiso) - - Max. potential difference between Mintern and outputs - nsulation tested with DC 500 V Atasizes DC 500 V Datasizes - nput bytes 0 Duput bytes 8 Parameter bytes 10 Diagnostic bytes 20 Material PPE / PPE GF10 Material Profile rail 35 mm	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 (Ucm) - Max. potential difference between inputs (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between inputs and Mana (Ucm) - Max. potential difference between Mintern and outputs - nsulation tested with DC 500 V Datasizes - nupt bytes 0 Dupt bytes 8 Parameter bytes 10 Diagnostic bytes 20 Material PE / PPE GF10 Materi	Channel error display	red LED per channel
Between channels of groups to-Between channels and backplane busBetween channels and power supplyAax. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern Uiso)DC 75 V/ AC 50 VMax. potential difference between inputs and Mana (Ucm)-Aax. potential difference between inputs and Mintern Uiso)-Max. potential difference between inputs and Mintern Uiso)-Data zotential difference between inputs and Mintern Uiso)-Data zotential difference between inputs and Mintern Uiso)-Data zotential difference between Mintern and outputs-DutatizesDC 500 VDatasizes-Input bytes0Dutput bytes8Dutput bytes10Diagnostic bytes20MaterialPPE / PPE GF10MaterialProfile rail 35 mm	Isolation	
detween channels and backplane bus✓Between channels and power supply✓Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern Uiso)DC 75 V/ AC 50 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 Mintern and outputs-Max. potential difference between Mintern and outputs-Mats. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-Mats. potential difference between Mintern and outputs-Difference between Mintern and outputs-Difference between Mintern and Outputs-Difference between Mintern and Outputs-Difference between Mintern and Outputs-Di	Between channels	-
detween channels and power supply✓Max. potential difference between circuits-Max. potential difference between inputs (Ucm)-Max. potential difference between Mana and Mintern Uiso)DC 75 V/ AC 50 VMax. 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 Diso-Max. potential difference between Mintern and outputs-Max. potential difference between Mintern and outputs-nsulation tested withDC 500 VDatasizes0Dutput bytes8Parameter bytes10Diagnostic bytes20Diagnostic bytes20MaterialPPE / PPE GF10MountingProfile rail 35 mm	Between channels of groups to	-
Aax. potential difference between circuits - Aax. potential difference between inputs (Ucm) - Aax. potential difference between Mana and Mintern Uiso) DC 75 V/ AC 50 V Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mana (Ucm) - Aax. potential difference between inputs and Mintern Uiso) - Aax. potential difference between Mintern and outputs - nsulation tested with DC 500 V Datasizes DC 500 V Datasizes 0 Parameter bytes 0 Diagnostic bytes 20 Material PPE / PPE GF10 Material Profile rail 35 mm	Between channels and backplane bus	\checkmark
Anax. potential difference between inputs (Ucm)-Aax. potential difference between Mana and Mintern Uiso)DC 75 V/ AC 50 VAax. potential difference between inputs and Mana (Ucm)-Aax. potential difference between inputs and Mintern Uiso)-Aax. potential difference between Mintern and outputs-Aax. potential difference between Mintern and outputs-Ans. potential difference between Mintern and outputs-Aax. potential difference between Mintern and outputs-Ans. potential difference between Mintern and Outputs-Anameter bytes0Anameter bytes-Anameter bytes-MaterialPPE / PPE GF10Mounting- <td>Between channels and power supply</td> <td>\checkmark</td>	Between channels and power supply	\checkmark
Aax. potential difference between Mana and Mintern Uiso)DC 75 V/ AC 50 VMax. potential difference between inputs and Mintern Uiso)-Aax. potential difference between inputs and Mintern Uiso)-Max. potential difference between Mintern and outputs nsulation tested with-DC 500 VDC 500 VDatasizes0Dutput bytes0Dutput bytes8Dutput bytes10Diagnostic bytes20MaterialPPE / PPE GF10MaterialPPE / PPE GF10	Max. potential difference between circuits	-
Uiso)Image: Advance of the set	Max. potential difference between inputs (Ucm)	-
Max. potential difference between inputs and Mintern Uiso)-Max. potential difference between Mintern and outputs-nsulation tested withDC 500 VDatasizes0nput bytes0Dutput bytes8Parameter bytes10Diagnostic bytes20HousingPPE / PPE GF10MaterialPOE for file rail 35 mm	Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Uiso)Image: Constant of the set of the se	Max. potential difference between inputs and Mana (Ucm)	-
Ansulation tested withDC 500 VDatasizesCInput bytes0Output bytes8Parameter bytes10Diagnostic bytes20NaterialPPE / PPE GF10NountingProfile rail 35 mm	Max. potential difference between inputs and Mintern (Uiso)	-
DatasizesAnput bytes0Dutput bytes8Parameter bytes10Diagnostic bytes20AterialPPE GF10MuntingProfile rail 35 mm	Max. potential difference between Mintern and outputs	-
nput bytes0Dutput bytes8Parameter bytes10Diagnostic bytes20Housing	Insulation tested with	DC 500 V
Dutput bytes 8 Parameter bytes 10 Diagnostic bytes 20 Housing PPE / PPE GF10 Nounting Profile rail 35 mm	Datasizes	
Parameter bytes 10 Diagnostic bytes 20 Housing PPE / PPE GF10 Mounting Profile rail 35 mm	Input bytes	0
Diagnostic bytes 20 Housing PPE / PPE GF10 Material Profile rail 35 mm	Output bytes	8
Housing PPE / PPE GF10 Nounting Profile rail 35 mm	Parameter bytes	10
Naterial PPE / PPE GF10 Nounting Profile rail 35 mm	Diagnostic bytes	20
Aounting Profile rail 35 mm	Housing	
-	Material	PPE / PPE GF10
lechanical data	Mounting	Profile rail 35 mm
	Mechanical data	

12.9 mm x 109 mm x 76.5 mm

61 g

61 g

Dimensions (WxHxD)

Weight including accessories

Net weight

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

Order no.	032-1BD30
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.7.2 Parameter data

DS - Record set for access via CPU, PROFIBUS and PROFINET

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h
CH2FN	1	Function number channel 2	10h	82h	3104h	05h
CH3FN	1	Function number channel 3	10h	83h	3105h	06h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 4: reserved

CHxFN Function number channel x

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

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

0 ... 10V

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

4.7.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	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 parametrization

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

ERR D	Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow 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	 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 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved
CH0ERR CH3ERR	Bvte	Bit 7 0

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs t	icker
--------------	-------

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

µs ticker

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

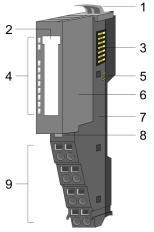
4.8 032-1BD40 - AO 4x12Bit 0(4)...20mA

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



Status indication

RUN MF

AO 0 AO 1 AO 2 AO 3

- Locking lever terminal module Labeling strip
- 3 Backplane bus

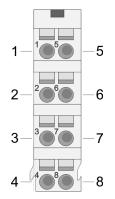
1 2

- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module8 Locking lever ele
 - Locking lever electronic module
- 9 Terminal

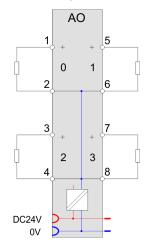
RUN	MF e red	AO x	Description
		х	Bus communication is OK
-		~	Module status is OK
_	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Error in parameterizationWire break (if parameterized)
not relevant:	Х		

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

Pin assignment



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



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

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

Output area

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

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

4.8.1 Technical data

Order no.	032-1BD40
Туре	SM 032
Module ID	0504 25E0
Current consumption/power loss	
Current consumption from backplane bus	90 mA
Current consumption from load voltage L+ (without load)	15 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 rated load voltage	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	\checkmark
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.4% +/-0.5%
Basic error limit current ranges	+/-0.2% +/-0.3%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	12
Conversion time	2 ms all channels

Analog output

Order no.	032-1BD40
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g

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

Order no.	032-1BD40
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.8.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h
CH2FN	1	Function number channel 2	31h	82h	3104h	05h
CH3FN	1	Function number channel 3	31h	83h	3105h	06h

WIBRK_EN Wire-break recognition

You also can activate the wire-break recognition for the current output range 0 ... 20mA. To ensure a safe wire-break recognition, the decimal value for the output is \geq 100.

Byte	Bit 7 0
0	 Bit 0: Wire-break recognition channel 0 (1: on) Bit 1: Wire-break recognition channel 1 (1: on) Bit 2: Wire-break recognition channel 2 (1: on) Bit 3: Wire-break recognition channel 3 (1: on) Bit 7 4: reserved

CHxFN Function number channel x

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

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

0 ... 20mA

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

4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D x \frac{16}{27648} + 4$
Siemens	20mA	27648	6C00h	nominal range	27648
S7 format	12mA	13824	3600h		D 27649 I-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D x \frac{16}{16384} + 4$
Siemens	20mA	16384	4000h	nominal range	16384
S5 format	12mA	8192	2000h		D 16284 I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{1-4}{16}$
	0mA	-4096	F000h	underrange	

4.8.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_	Α	Diad	ino	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 parametrization

MODTYP Module informa-	
tion	

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

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

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

Byte
0

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

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

Byte	Bit 7 0
0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2
	Bit 3: set at error in channel group 3Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		Bit 0: set at configuring/parameter assignment errorBit 3 1: reserved
		Bit 4: set at wire-breakBit 7 5: reserved

Bit 7 ... 0

DIAG_US µs ticker

CHERR Channel error

03	Value of the µs ticker at the moment of the diagnostic

µs ticker

Byte

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

4.9 032-1BD70 - AO 4x12Bit ±10V

Properties

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

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

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- **Diagnostics function**
- 12bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

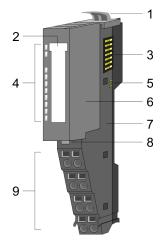
5

6

7 8

9

Structure



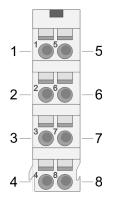
Status indication

RUN MF AO 0 AO 1 AO 2 AO 3

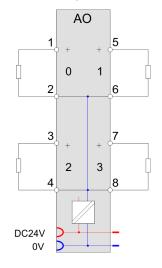
RUN	MF	AO x	Description
green	red	red	Description
		х	Bus communication is OK
			Module status is OK
	-	х	Bus communication is OK
	-	^	Module status reports an error
	-	x	Bus communication is not possible
	-		Module status reports an error
		Х	Error at bus power supply
x	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
		•	Overload, short-circuitError in parameterization
not relevant: X			

032-1BD70 - AO 4x12Bit ±10V

Pin assignment



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



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area

Output area

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

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

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

4.9.1 Technical data

Order no.	032-1BD70
Туре	SM 032
Module ID	0506 25E0
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
Voltage output short-circuit protection	\checkmark
Voltage outputs	\checkmark
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.3%
Basic error limit voltage ranges	+/-0.2%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	3 ms
Settling time for capacitive load	3 ms
Settling time for inductive load	-
Resolution in bit	12
Conversion time	2 ms all channels

Analog output

Order no.	032-1BD70
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	62 g

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

Order no.	032-1BD70
Weight including accessories	62 g
Gross weight	76 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.9.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h
CH2FN	1	Function number channel 2	12h	82h	3104h	05h
CH3FN	1	Function number channel 3	12h	83h	3105h	06h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 4: reserved

CHxFN Function number channel x

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

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

±10V

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

0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	$U = D x \frac{10}{27648}$
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{1}{27648}$
S7 format	5V	13824	3600h		IJ
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is limited		V.	underrange	10
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		IJ
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible	e, is limited to 0	V.	underrange	10

4.9.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic

Byte	Bit 7 0
0	 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 parametrization

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

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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	Byte	Bit 7 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
		Bit 7: reserved
NUMBIT Diagnostic bits	Byte	Bit 7 0
NUMBIT Diagnostic bits	Byte 0	
NUMBIT Diagnostic bits		Bit 7 0

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

CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved

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

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

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

µs ticker

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

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

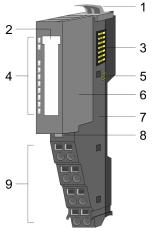
4.10 032-1CB30 - AO 2x16Bit 0...10V

Properties

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

- 2 analog outputs
- Suited for sensors with 0 ... 10V
- Diagnostics function
- 16bit resolution

Structure



Status indication

RUN	MF <mark></mark> red	AO x	Description
		х	Bus communication is OK
-		~	Module status is OK
_	_	х	Bus communication is OK
-	-	^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
		•	Overload, short-circuitError in parameterization
not relevant: X			

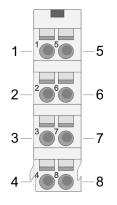
Locking lever terminal module

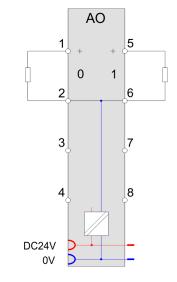
- Locking lever
 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

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

Pin assignment

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





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected



Input area

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

Output area

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

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

4.10.1 Technical data

Order no.	032-1CB30
Туре	SM 032
Module ID	0507 2558
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
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	-
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

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

Order no.	032-1CB30
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g

Analog output

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

Order no.	032-1CB30
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC 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
recognit	ion	

Byte	it 7 0				
0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 7 2: reserved 				

CHxFN Function number channel x

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

The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

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

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

0 ... 10V

4.10.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	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	D	 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 parametrization

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

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR	Byte	Bit 7 0
Channel specific	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved
CH2ERR CH7ERR	Byte	Bit 7 0
reserved	0	reserved
DIAG_US μs ticker	Byte	Bit 7 0
	03	Value of the μ s ticker at the moment of the diagnostic
	µs ticker	
		m SLIO module there is a timer (μ s ticker). With PowerON the timer starts
	counting wit	h 0. After 2^{32} -1µs the timer starts with 0 again.

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

4.11 032-1CB40 - AO 2x16Bit 0(4)...20mA

1 2

3

4

5

6

7 8

9

Properties

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

- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

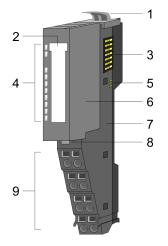
LED status indication

Electronic module

Terminal module

Terminal

Structure



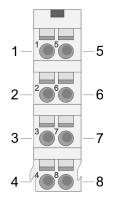
Status indication

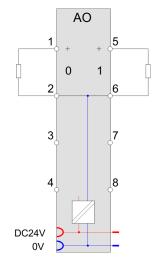
RUN	MF	AO x	Description	
_	_	X	Bus communication is OK	
-		Х	Module status is OK	
_		х	Bus communication is OK	
		^	Module status reports an error	
	-	х	Bus communication is not possible	
		^	Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
			Error in parameterizationWire break (if parameterized)	
not relevant:	not relevant: X			

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

Pin assignment

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





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3			not connected
4			not connected
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7			not connected
8			not connected

O: Output

Input area

Output area

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.

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

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

4.11.1 Technical data

Order no.	032-1CB40
Туре	SM 032
Module ID	050B 25D8
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Current consumption from load voltage L+ (without load)	15 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 rated load voltage	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	\checkmark
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA
	+4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Basic error limit current ranges	+/-0.1%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	16
Conversion time	400 μs all channels

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

Order no.	032-1CB40
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g

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

Order no.	032-1CB40
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.11.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h

WIBRK_	EN	Wire-break
recognit	ion	

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

0 ... 20mA

4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D \ x \ \frac{16}{27648} \ + \ 4$
Siemens	20mA	27648	6C00h	nominal range	27648
S7 format	12mA	13824	3600h		D 27648 J-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	16384
S5 format	12mA	8192	2000h		D 16284 I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{1-4}{16}$
	0mA	-4096	F000h	underrange	

4.11.3 Diagnostic data

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

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

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

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

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

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	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	
■ Bit 6 5: res	ternal error kternal error nannel error kternal auxiliary supply missing

MODTYP Module informa- Byte	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved

ERR_D Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

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

CHTYP Channel type	Byte	Bit 7 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			
	0	Number of diagnostic bits per channel (here 08h)			
NUMCH Channels	Byte	Bit 7 0			
	0	Number of channels of a module (here 02h)			
CHERR Channel error	Byte	Bit 7 0			
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved 			
CH0ERR / CH1ERR	Byte	Bit 7 0			
Channel-specific	0	Channel-specific error channel x			
		 Bit 0: set at configuring/parameter assignment error Bit 3 1: reserved Bit 4: set at wire-break Bit 7 5: reserved 			
CH2ERR CH7ERR	Byte	Bit 7 0			
reserved	0	reserved			
DIAG_US μs ticker	Byte	Bit 7 0			
	03	Value of the μ s ticker at the moment of the diagnostic			
	µs ticker				
	m SLIO module there is a timer (μ s ticker). With PowerON the timer starts				
	counting with 0. After 2^{32} -1µs the timer starts with 0 again.				

032-1CB70 - AO 2x16Bit ±10V

4.12 032-1CB70 - AO 2x16Bit ±10V

Properties

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

- 2 analog outputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

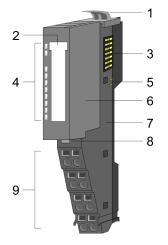
5

6

7 8

9

Structure



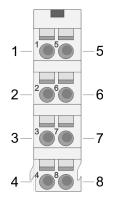
Status indication

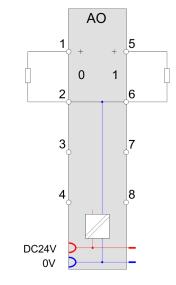
RUN	MF e red	AO x	Description	
_		X	Bus communication is OK	
		Х	Module status is OK	
_	_	х	Bus communication is OK	
	-	^	Module status reports an error	
	_	х	Bus communication is not possible	
	-	^	Module status reports an error	
		Х	Error at bus power supply	
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
			Overload, short-circuitError in parameterization	
not relevant: X				

032-1CB70 - AO 2x16Bit ±10V

Pin assignment

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





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

Output area

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

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

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

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

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

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

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
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
Voltage output short-circuit protection	\checkmark
Voltage outputs	\checkmark
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges	+/-0.1%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	300 µs
Settling time for capacitive load	3 ms
Settling time for inductive load	-
Resolution in bit	16
Conversion time	200 µs all channels

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

Order no.	032-1CB70
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g

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

Order no.	032-1CB70
Weight including accessories	60 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.12.2 Parameter data

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

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

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h

SHORT_	EN	Short-circuit
recognit	ion	

Byte	Bit 7 0
0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 7 2: reserved

CHxFN Function number channel x

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

032-1CB70 - AO 2x16Bit ±10V > Parameter data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	10 II - D - N
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		II
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		10
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		II
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		10
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		11
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is limited to 0V.			underrange	10
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible, is limited to 0V.		underrange	10	

±10V

032-1CB70 - AO 2x16Bit ±10V > Diagnostic data

4.12.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	02h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR CH7ERR	6	reserved	00h			0Ch 11h
DIAG_US	4	µs ticker	00h			13h

ERR_A Diagnostic

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 supp Bit 6 5: reserved Bit 7: set at error in parametrizatio	

032-1CB70 - AO 2x16Bit ±10V > Diagnostic data

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 02h)
	0	
CHERR Channel error	Dut	
	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 7 2: reserved
CH0ERR / CH1ERR	Byte	Bit 7 0
Channel-specific	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved

DIAG_US µs ticker

Byte	Bit 7 0
03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the System SLIO module there is a timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again.

4.13 032-1CD30 - AO 4x16Bit 0...10V

Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

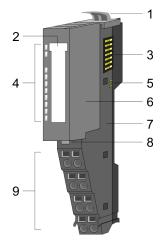
5

6

7 8

9

Structure



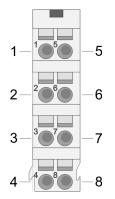
Status indication

RUN — 1 ____ MF — 1 ____ AO 0 — 1 ____ AO 1 — 1 ____ AO 2 — 1 ____ AO 3 — 1 ____

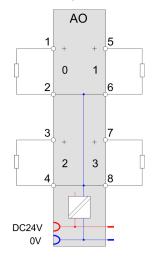
RUN	MF	AO x	Description	
green	red	red	Description	
		x	Bus communication is OK	
		^	Module status is OK	
		х	Bus communication is OK	
-	-	~	Module status reports an error	
		х	Bus communication is not possible	
	-	~	Module status reports an error	
		Х	Error at bus power supply	
Х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40	
			Error channel x	
			Overload, short-circuitError in parameterization	
not relevant: X				

032-1CD30 - AO 4x16Bit 0...10V

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area

No byte of the input area is used by the module.

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD30 - AO 4x16Bit 0...10V > Technical data

4.13.1 Technical data

Tuno	
Туре	SM 032
Module ID	0509 2560
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
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	-
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

Analog output

Order no.	032-1CD30
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	\checkmark
Between channels and power supply	\checkmark
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g

032-1CD30 - AO 4x16Bit 0...10V > Parameter data

Order no.	032-1CD30
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.13.2 Parameter data

DS - Record set for access via CPU, PROFIBUS and PROFINET

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	10h	80h	3102h	03h
CH1FN	1	Function number channel 1	10h	81h	3103h	04h
CH2FN	1	Function number channel 2	10h	82h	3104h	05h
CH3FN	1	Function number channel 3	10h	83h	3105h	06h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 4: reserved

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	U = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		II
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible, is limited to 0V.			underrange	10
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible	e, is limited to 0	V.	underrange	10

4.13.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	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 parametrization

MODTYP Module informa- tion	Byte	Bit 7 0
	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved

ERR D	Diagnostic

Byte	Bit 7 0
0	 Bit 2 0: reserved Bit 3: set at internal diagnostics buffer overflow Bit 4: set at internal communication error Bit 7 5: reserved

032-1CD30 - AO 4x16Bit 0...10V > Diagnostic data

CHTYP Channel type	Byte	Bit 7 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
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 2 1: reserved Bit 3: set at short-circuit to ground Bit 7 4: reserved

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µ	us ticker
-----------	-----------

Byte	Bit 7 0
03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the System SLIO module there is a timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again.

4.14 032-1CD40 - AO 4x16Bit 0(4)...20mA

1 2

3

4

5

6

7 8

9

Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with 0...20mA; 4...20mA

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

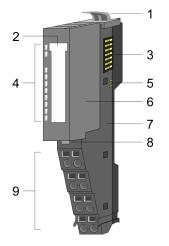
LED status indication

Electronic module

Terminal module

Terminal

Structure



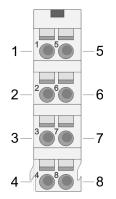
Status indication

RUN — I MF — I AO 0 — I AO 1 — I AO 2 — I AO 3 — I

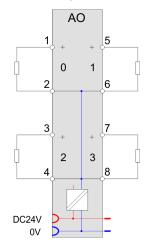
RUN	MF	AO x	Description
green	red	red	Description
		х	Bus communication is OK
		^	Module status is OK
	_	х	Bus communication is OK
		^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
Х	ZHz	х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			 Error in parameterization
			Wire break (if parameterized)
not relevant:	X		

032-1CD40 - AO 4x16Bit 0(4)...20mA

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area No byte of the input area is used by the module.

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD40 - AO 4x16Bit 0(4)...20mA > Technical data

4.14.1 Technical data

Order no.	032-1CD40
Туре	SM 032
Module ID	050C 25E0
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	•
Current outputs	\checkmark
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V
Output current ranges	0 mA +20 mA +4 mA +20 mA
Operational limit of current ranges	+/-0.2%
Basic error limit current ranges	+/-0.1%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	16
Conversion time	400 µs all channels

Analog output

Order no.	032-1CD40
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g

032-1CD40 - AO 4x16Bit 0(4)...20mA > Parameter data

Order no.	032-1CD40
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.14.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	80h	3102h	03h
CH1FN	1	Function number channel 1	31h	81h	3103h	04h
CH2FN	1	Function number channel 2	31h	82h	3104h	05h
CH3FN	1	Function number channel 3	31h	83h	3105h	06h

WIBRK_EN Wire-break recognition

Byte	Bit 7 0
0	 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



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!

032-1CD40 - AO 4x16Bit 0(4)...20mA > 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.

0 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
0 20mA	23.52mA	32511	7EFFh	overrange	L = D = 20
Siemens	20mA	27648	6C00h	nominal range	$I = D x \frac{20}{27648}$
S7 format	10mA	13824	3600h		7
(31h)	0mA	0	0000h		$D = 27648 \ x \ \frac{I}{20}$
	Not possible, is limited to 0mA.			underrange	20
0 20mA	25.00mA	20480	5000h	overrange	L D 20
Siemens	20mA	16384	4000h	nominal range	$I = D x \frac{20}{16384}$
S5 format	10mA	8192	2000h		,
(41h)	0mA	0	0000h		$D = 16384 \ x \ \frac{I}{20}$
	Not possible	e, is limited to 0	mA.	underrange	20

4 ... 20mA

Output range	Current	Decimal	Hex	Range	Formulas
(funct. no.)	(I)	(D)			
4 20mA	22.81mA	32511	7EFFh	overrange	$I = D x \frac{16}{27648} + 4$
Siemens	20mA	27648	6C00h	nominal range	27648
S7 format	12mA	13824	3600h		D 27648 J-4
(30h)	4mA	0	0000h		$D = 27648 \ x \ \frac{1-4}{16}$
	0mA	-6912	E500h	underrange	
4 20mA	24.00mA	20480	5000h	overrange	$I = D \ x \ \frac{16}{16384} \ + \ 4$
Siemens	20mA	16384	4000h	nominal range	$1 = D \times \frac{16384}{16384} + 4$
S5 format	12mA	8192	2000h		D 16384 I-4
(40h)	4mA	0	0000h		$D = 16384 \ x \ \frac{I-4}{16}$
	0mA	-4096	F000h	underrange	

4.14.3 Diagnostic data

So this module does not support interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)
- DS Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.
- IX Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
- SX Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnostic	00h	01h	2F01h	02h
MODTYP	1	Module information	15h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	Diagnostic	00h			05h
CHTYP	1	Channel type	73h			06h
NUMBIT	1	Number diagnostic bits per channel	08h			07h
NUMCH	1	Number of channels of a module	04h			08h
CHERR	1	Channel error	00h			09h
CH0ERR	1	Channel-specific error channel 0	00h			0Ah
CH1ERR	1	Channel-specific error channel 1	00h			0Bh
CH2ERR	1	Channel-specific error channel 2	00h			0Ch
CH3ERR	1	Channel-specific error channel 3	00h			0Dh
CH4ERR CH7ERR	4	reserved	00h			0Eh 11h
DIAG_US	4	µs ticker	00h			13h

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 parametrization

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

MODTYP Module informa-	Byte	Bit 7 0
tion	0	 Bit 3 0: module class 0101b analog module Bit 4: set at channel information present Bit 7 5: reserved
ERR_D Diagnostic	Byte	Bit 7 0
	0	 Bit 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	Byte	Bit 7 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	D (
Nomer Blaghoodo Sho	Byte	Bit 7 0
	0	Number of diagnostic bits per channel (here 08h)
NUMCH Channels	_	
	Byte	Bit 7 0
	0	Number of channels of a module (here 04h)
CHERR Channel error	Byte	Bit 7 0
	0	 Bit 0: set at error in channel group 0 Bit 1: set at error in channel group 1 Bit 2: set at error in channel group 2 Bit 3: set at error in channel group 3 Bit 7 4: reserved

CH0ERR CH3ERR Channel-specific	Byte	Bit 7 0
	0	Channel-specific error channel x:
		 Bit 0: set at configuring/parameter assignment error Bit 3 1: reserved Bit 4: set at wire-break Bit 7 5: reserved

032-1CD40 - AO 4x16Bit 0(4)...20mA > Diagnostic data

DIAG_US µs ticker

Byte	Bit 7 0
03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the System SLIO module there is a timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again.

032-1CD70 - AO 4x16Bit ±10V

4.15 032-1CD70 - AO 4x16Bit ±10V

Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

- 4 analog outputs
- Suited for sensors with ±10V, 0 ... 10V

Locking lever terminal module

DC 24V power section supply

Locking lever electronic module

- Diagnostics function
- 16bit resolution

Labeling strip

Backplane bus

LED status indication

Electronic module

Terminal module

Terminal

1 2

3

4

5

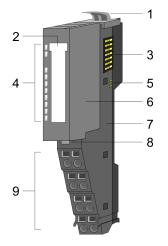
6

7

8

9

Structure



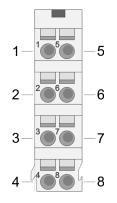
Status indication

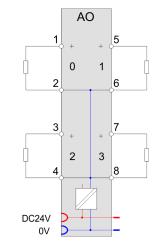
RUN	MF	AO x	Description
green	red 📕	red	
_		х	Bus communication is OK
-		~	Module status is OK
_	_	х	Bus communication is OK
-		^	Module status reports an error
	_	х	Bus communication is not possible
	-	^	Module status reports an error
		Х	Error at bus power supply
х	ZHz	Х	Error in configuration & Chap. 2.12 'Trouble shooting - LEDs' page 40
			Error channel x
			Overload, short-circuit
			Error in parameterization
not relevant:	Х		

032-1CD70 - AO 4x16Bit ±10V

Pin assignment

For wires with a cross section of 0.08mm² up to 1.5mm².





Pos.	Function	Туре	Description
1	AO 0	0	Channel 0
2	AGND	0	Ground channels
3	AO 2	0	Channel 2
4	AGND	0	Ground channels
5	AO 1	0	Channel 1
6	AGND	0	Ground channels
7	AO 3	0	Channel 3
8	AGND	0	Ground channels

O: Output

Input area No byte of the input area is used by the module.

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

- IX Index for access via CANopen with s = Subindex, depends on number and type of analog modules
- SX Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

032-1CD70 - AO 4x16Bit ±10V > Technical data

4.15.1 Technical data

Order no.	032-1CD70
Туре	SM 032
Module ID	050A 2560
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Current consumption from load voltage L+ (without load)	20 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 rated load voltage	-
Voltage output short-circuit protection	\checkmark
Voltage outputs	\checkmark
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V +10 V
	0 V +10 V
Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges	+/-0.1%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	300 µs
Settling time for capacitive load	3 ms
Settling time for inductive load	-
Resolution in bit	16
Conversion time	200 µs all channels

032-1CD70 - AO 4x16Bit ±10V > Technical data

Order no.	032-1CD70
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 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g

032-1CD70 - AO 4x16Bit ±10V > Parameter data

Order no.	032-1CD70
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.15.2 Parameter data

- DS Record set for access via CPU, PROFIBUS and PROFINET
- IX Index for access via CANopen
- SX Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
RES0	1	reserved	00h	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	80h	3102h	03h
CH1FN	1	Function number channel 1	12h	81h	3103h	04h
CH2FN	1	Function number channel 2	12h	82h	3104h	05h
CH3FN	1	Function number channel 3	12h	83h	3105h	06h

SHORT_EN Short-circuit recognition	Byte	Bit 7 0
	0	 Bit 0: Short-circuit recognition channel 0 (1:on) Bit 1: Short-circuit recognition channel 1 (1:on) Bit 2: Short-circuit recognition channel 2 (1:on) Bit 3: Short-circuit recognition channel 3 (1:on) Bit 7 4: reserved

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

032-1CD70 - AO 4x16Bit ±10V > Parameter data

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
±10V	11.76V	32511	7EFFh	overrange	10 II - D - x - 10
Siemens S format	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
(12h)	5V	13824	3600h		17
	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	-5V	-13824	CA00h		10
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V	12.5V	20480	5000h	overrange	10 III
Siemens S5 format	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
(22h)	5V	8192	2000h		II
	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	-5V	-8192	E000h		10
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

0 ... 10V

Output range	Voltage	Decimal	Hex	Range	Formulas
(funct. no.)	(U)	(D)			
0 10V	11,76V	32511	7EFFh	overrange	II = D r 10
Siemens	10V	27648	6C00h	nominal range	$U = D x \frac{10}{27648}$
S7 format	5V	13824	3600h		II
(10h)	0V	0	0000h		$D = 27648 \ x \ \frac{U}{10}$
	Not possible	e, is limited to 0	V.	underrange	10
0 10V	12,5V	20480	5000h	overrange	$U = D \times \frac{10}{10}$
Siemens	10V	16384	4000h	nominal range	$U = D x \frac{10}{16384}$
S5 format	5V	8192	2000h		II
(20h)	0V	0	0000h		$D = 16384 \ x \ \frac{U}{10}$
	Not possible	e, is limited to 0	V.	underrange	10

±10V

032-1CD70 - AO 4x16Bit ±10V > Diagnostic data

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.

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 parametrization

032-1CD70 - AO 4x16Bit ±10V > Diagnostic data

MODTYP Module informa-		
tion	Byte	Bit 7 0
	0	Bit 3 0: module class
		 0101b analog module Bit 4: set at channel information present
		 Bit 7 5: reserved
ERR D Diagnostic	Byte	Bit 7 0
_ 0	-	
	0	Bit 2 0: reservedBit 3: set at internal diagnostics buffer overflow
		Bit 4: set at internal communication error
		Bit 7 5: reserved
CHTYP Channel type	Byte	Bit 7 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
NUMBIT Diagnostic bits	Byte 0	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 0	Number of diagnostic bits per channel (here 08h) Bit 7 0
NUMCH Channels	0 Byte 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0
NUMCH Channels	0 Byte 0	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0
NUMCH Channels	0 Byte 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2
NUMCH Channels	0 Byte 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3
NUMCH Channels	0 Byte 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2
NUMCH Channels CHERR Channel error	0 Byte 0 0 0	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved
NUMCH Channels	0 Byte 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved
NUMCH Channels CHERR Channel error CH0ERR CH3ERR	0 Byte 0 0 0	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved
NUMCH Channels CHERR Channel error CH0ERR CH3ERR	0 Byte 0 0 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved
NUMCH Channels CHERR Channel error CH0ERR CH3ERR	0 Byte 0 0 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 2: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved Bit 7 9 Channel-specific error channel x: ■ Bit 0: set at configuring/parameter assignment error ■ Bit 2 1: reserved
NUMCH Channels CHERR Channel error CH0ERR CH3ERR	0 Byte 0 0 0 Byte	Number of diagnostic bits per channel (here 08h) Bit 7 0 Number of channels of a module (here 04h) Bit 7 0 ■ Bit 0: set at error in channel group 0 ■ Bit 1: set at error in channel group 1 ■ Bit 2: set at error in channel group 2 ■ Bit 3: set at error in channel group 3 ■ Bit 7 4: reserved

032-1CD70 - AO 4x16Bit ±10V > Diagnostic data

CH4ERR CH7ERR reserved	Byte	Bit 7 0
	0	reserved

DIAG_US µs ticker

Byte	Bit 7 0
03	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the System SLIO module there is a timer (μ s ticker). With PowerON the timer starts counting with 0. After 2³²-1 μ s the timer starts with 0 again.