ibaM-4AI-5A-150A-AC

Input module for analog signals

Manual

Issue1.0

Measurement Systems for Industry and Energy

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Version	Date	Revision	Author	Version SW
1.0	04-2024	First issue	ms, st	1.02.003

Contents

1 About this documentation

This documentation describes the design, application and operation of the device *ibaM-4AI-5A-150A-AC*.

Note

Observe this danger sign:

In all cases where this danger sign is displayed, refer to the manual to find out more about the nature of the potential hazards and the measures that must be taken to avoid them.

1.1 Target group

This documentation is aimed at qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded as professional if he/she is capable of assessing safety and recognizing possible consequences and risks on the basis of his/her specialist training, knowledge and experience and knowledge of the standard regulations.

1.2 Notations

In this manual, the following notations are used:

Action	Notation
Menu command	Menu *Logic diagram*
Calling the menu command	*Step 1 – Step 2 – Step 3 – Step x* Example: Select the menu *Logic diagram – Add – New function block*.
Keys	<Key name> Example: <Alt>; <F1>
Press the keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Key name> Example: <OK>; <Cancel>
Filenames, paths	`Filename`, `Path` Example: `Test.docx`

1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

Danger!

The non-observance of this safety information may result in an imminent risk of death or severe injury:

- Observe the specified measures.

Warning!

The non-observance of this safety information may result in a potential risk of death or severe injury!

- Observe the specified measures.

Caution!

The non-observance of this safety information may result in a potential risk of injury or material damage!

- Observe the specified measures

Note

A note specifies special requirements or actions to be observed.

Tip

Tip or example as a helpful note or insider tip to make the work a little bit easier.

Other documentation

Reference to additional documentation or further reading.

2 Introduction

Modular concept

The I/O module described in this documentation is part of the ibaMAQS modular measurement system.

The modular system consists of a central unit (*ibaM-DAQ* processor module or the *ibaM-COM* communication module), which can be combined with up to 15 different I/O modules. Modules are available for discrete input and output signals as well as for special technological features.

The I/O modules do not require their own power supply since they are powered via the module-module interface. The operating status of the module as well as the status of the individual channels are indicated by LEDs.

ibaM-4AI-5A-150A-AC

The *ibaM-4AI-5A-150A-AC module* is designed for power monitoring applications and can sample at up to 500 kHz. The module has two A/D converters per channel, which can be automatically switched and combined in a single measuring range.

Overview of the most important features:

- Input module with 4 analog current inputs
- For nominal currents of 5 A AC
- Use in power generation and distribution
- General current measurement
- Grid frequency measurement
- Galvanically isolated analog inputs
- 24 bit resolution
- Sampling rate 100 kHz or 500 kHz, switchable
- Timebase min. 10 µs or 2 µs, freely adjustable
- Analog and digital filters per channel
- 2 A/D converters per channel
- Nominal measuring range ±15 A
- Measurable transient overload range ±225 A
- Protection class (EN 61010-1): CAT III 600 V; CAT IV 300 V; Pollution degree 2
- Rugged housing, easy installation

3 Scope of delivery

After having unpacked the delivery, please check it for completeness and possible damage. The scope of delivery comprises:

- *ibaM-4AI-5A-150A-AC* device
- 2x 4-pin connector with spring terminals

4 Safety and other instructions

Note

Work on the system, as well as mounting and dismounting, must only be carried out by trained and qualified specialists.

Careful working methods and compliance with safety measures when working with electrical devices of all types must be observed.

Note

Observe this danger sign:

In all cases where this danger sign is displayed, refer to the manual to find out more about the nature of the potential hazards and the measures that must be taken to avoid them.

4.1 Intended use

The device is an electrical apparatus. It must only be used for the following applications:

- Measurement data acquisition and analysis
- Applications of software products (*ibaPDA*, *ibaLogic* etc.) and hardware products from iba AG.

The device must only be used as specified in the *Technical data* chapter, and is designed and approved for continuous operation.

Danger!

Electric shock

The device is only designed for electrical measured variables as specified in the "Technical data" chapter!

If the device is used or operated in a manner other than specified in the *Technical data* chapter, the protection supported by the device may be impaired.

This applies in particular to the permissible operating and environmental conditions and voltages outside the corresponding CAT protection classes.

Caution!

This module is specially designed and developed for the use or input-side connection of protection transformers and for an input current/nominal current of 5 A AC.

Even if this module can measure higher currents for short periods (150 A AC for 1 s per minute), it is still only designed for a continuous current load of 15 A DC.

The use of protection transformers always involves a conceptual switch-off or protection of the measuring circuit in the event of an overcurrent on the protection transformer side.

If currents are measured by standard transducers or current transformers or directly at the inputs, this module may only be operated if the measuring circuit is fused up to a continuous current of 15 A AC.

4.2 Special safety instructions

Danger!

Operation

- The system must only be operated in a fire protection housing in accordance with IEC 61010-1.
- The system must only be operated with a mounted end cover.
- The external power supply/power supply unit for supplying the central unit and thus for the complete system must be tested for use with this system in accordance with IEC 61010.
- Modules from this system must only be operated with a central processing unit from this system.
- The supply voltage for this system must only be fed from this system via a central unit.
- In addition to their own current consumption from the supply voltage via the module-module interface, the central units and the modules also pass on the supply voltage for other connected modules, so that the module-module interfaces may have to carry the maximum specified total current of the system.
- Only a maximum of 15 modules may be installed next to the central unit.

Danger!

Duty of care

Take care when working on the system and always check that the system and the modules themselves are in perfect condition, as well as ensuring that they are properly installed and correctly attached to the DIN rail.

If damage to cables, devices, supplies or enclosures is detected before commissioning or during operation, the system must not be put into operation or must be taken out of operation immediately.

Warning!

Mounting and dismounting / Disconnection from the grid
Work on the device or system may only be carried out when the power is switched off!

Due to the modular concept of this system, modules connected in series with this module can also carry dangerous voltages.

All energized components of all modules in the system must therefore be disconnected from the grid before mounting and dismounting.

In addition to disconnecting the power supply at the system's central unit, the signal plugs and connections of all modules in the system must also be de-energized or disconnected from the grid.

Caution!

A suitable disconnecting device for this system must be available and disconnect all energized components of this system.

This disconnecting device must include a switch or circuit breaker that is easily accessible at a suitable location in the vicinity and is also clearly marked as a disconnecting device for this system.

Caution!

Measuring cable

- Do not use damaged measuring cables!
- Do not connect or disconnect measuring cables when the device is connected to the power!
- Measuring cables must be suitable for the measurement category and voltage, and must have a length of smaller than 10 m.

Caution!

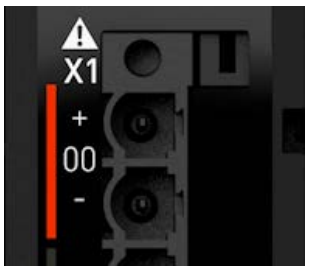
You must only connect one conductor to each terminal connection.

Several individual conductors, whether single-wired or fine-wired, are not permitted.

Only connectors classified by iba may be used for connecting conductors.

Caution!

If the display of an analog input lights up red, the input signal is outside the displayable and permissible nominal ange.



The actual current at the input is higher than the permitted current.

Note

Do not open the device! Opening the device results in a loss of warranty!

Note

The device does not require any special cleaning or maintenance!

However, if you want to carry out an inspection or recalibration, return the device to iba.

5 System requirements

Hardware
ibaMAQS central unit

- *ibaM-DAQ* processor module or *ibaM-COM* communication module

Software

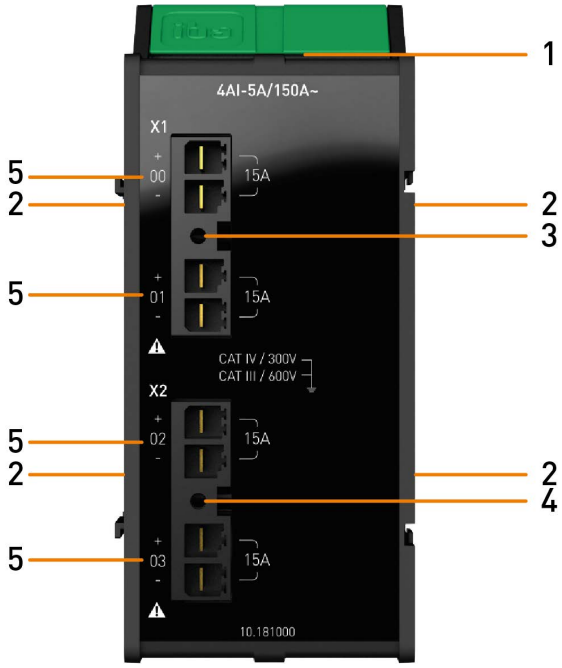
- ibaPDA version 8.6.0 or higher

Firmware

- ibaMAQS version 1.02.004 or higher

6 Device description

6.1 View



1 Module status display

2 Contacts module-module interface

3 Connector analog input X1

4 Connector analog input X2

5 Display analog inputs

6.2 Display elements

Colored LEDs on the device indicate the state of the device and of the analog inputs.

6.2.1 Module status

Color	Status	Description
--	off	Down, no power supply
Green	on	Ready for operation
	flashing slowly	Device is booting
	flashing quickly	Update is running
Red	on	Error, reset

6.2.2 Analog input status

Color	Status	Description
--	off	Channel inactive Channel active and no input signal received, or input signal received but not measurable (<1% of nominal upper range value)
Green	on	Channel active and measurable input signal received
Red	on	Channel active and input signal outside the permissible nominal measuring range

6.3 Analog inputs

6.3.1 Filters

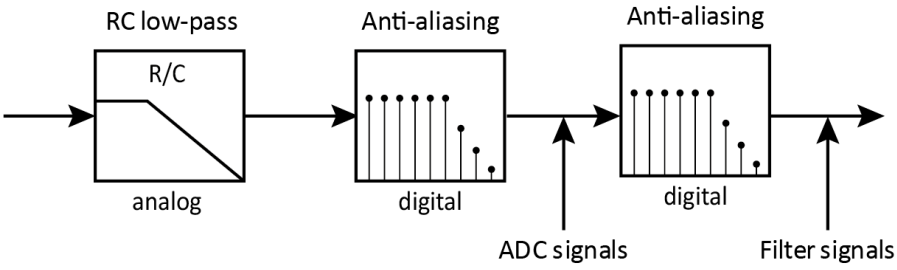
The following filters are available for each channel:

Filter type	Order	Cut-off frequency	ADC signals	Filter signals
R/C low-pass	1st	150 kHz	x	x
Digital anti-aliasing filter (FIR)	-	0.45 x ADC sampling rate Over sampling = 32 x ADC sampling rate	x	x
Digital anti-aliasing filter (Elliptic/Cauer)	10th	0.45 / timebase		x

ADC sampling rate = A/D converter sampling rate
Timebase = Configured timebase or update time in *ibaPDA*

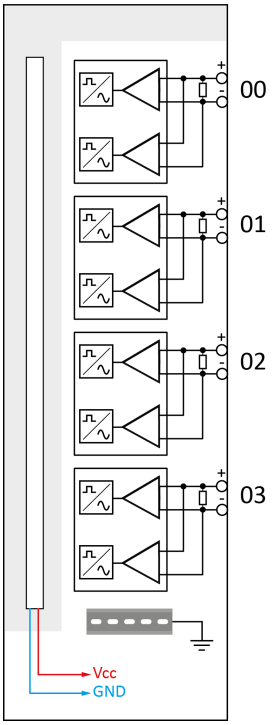
ADC signals = Acquired signals after A/D converter
Filter signals = Acquired signals after additional digital filter (see also filter section)

Filter section:



6.3.2 Connection diagram, pin assignment

A total of 4 input signals, each bipolar and electrically isolated, can be connected here (0 ... 3). Each channel is connected using a two-wire system.



Pin assignment

Connector	Pin	Connection
X1	1	Analog input 00 +
	2	Analog input 00 -
	3	Analog input 01 +
	4	Analog input 01 -
X2	1	Analog input 02 +
	2	Analog input 02 -
	3	Analog input 03 +
	4	Analog input 03 -

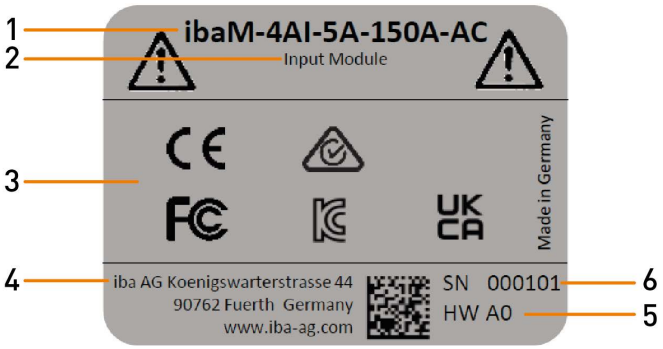
Caution!

Measuring cable

- Do not use damaged measuring cables!
- Do not connect or disconnect measuring cables when the device is connected to the power!
- Measuring cables must be suitable for the measurement category and voltage, and must have a length of smaller than 10 m.

6.4 Type label

The type label provides the following information:



1	Product name	4	Manufacturer
2	Module type	5	Hardware version
3	Certifications, Standards	6	Serial number

7 Mounting and dismounting

Danger!

Operation

- The system must only be operated in a fire protection housing in accordance with IEC 61010-1.
- The system must only be operated with a mounted end cover.
- The external power supply/power supply unit for supplying the central unit and thus for the complete system must be tested for use with this system in accordance with IEC 61010.
- Modules from this system must only be operated with a central processing unit from this system.
- The supply voltage for this system must only be fed from this system via a central unit.
- In addition to their own current consumption from the supply voltage via the module-module interface, the central units and the modules also pass on the supply voltage for other connected modules, so that the module-module interfaces may have to carry the maximum specified total current of the system.
- Only a maximum of 15 modules may be installed next to the central unit.

The modular system is designed as follows and is to be mounted on the DIN rail:

- Central unit on the far left
- Up to 15 modules to the right of the central unit
- End cover on the far right to protect the contacts

Make sure that the modules

- are properly secured to the DIN rail and
- are correctly positioned in the side guide rails.

Check the correct fitting of the modules after mounting by a visual inspection.

Note

An end cover is included in the scope of delivery of the central unit.

The end cover is also available as an accessory or spare part from iba.

Installation clearances

Ensure a minimum clearance of the entire system of 30 mm upwards and downwards and 10 mm to the right and left for sufficient ventilation of the device.

7.1 Disconnection from the grid

To enable safe, hazard-free work on the system, all live components in the system must be disconnected from the grid.

Warning!

Mounting and dismounting / Disconnection from the grid
Work on the device or system may only be carried out when the power is switched off!

Due to the modular concept of this system, modules connected in series with this module can also carry dangerous voltages.

All energized components of all modules in the system must therefore be disconnected from the grid before mounting and dismounting.

In addition to disconnecting the power supply at the system's central unit, the signal plugs and connections of all modules in the system must also be de-energized or disconnected from the grid.

Caution!

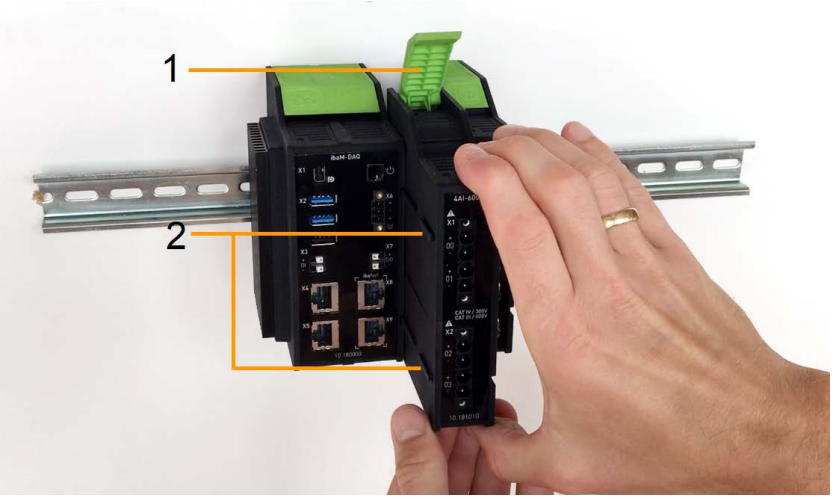
A suitable disconnecting device for this system must be available and disconnect all energized components of this system.

This disconnecting device must include a switch or circuit breaker that is easily accessible at a suitable location in the vicinity and is also clearly marked as a disconnecting device for this system.

7.2 Modules

Mounting

- Shut down the system and/or switch off the power supply.
- Disconnect the power supply and the entire system from the mains as instructed in chapter ↗ *Disconnection from the grid*, page 19.
- Remove the end cover, if present.
- Lift the green lever of the module upwards.
- Push the module backwards along the guide rails onto the DIN rail.
- Push down on the green lever.
- To protect the side contacts from dirt and damage, install the end cover on the last module.
- Switch on the power supply.
- Start the system.



1 Green lever for locking and releasing the modules

2 Guide rails

Dismounting

- Shut down the system and/or switch off the power supply.
- Disconnect the power supply and the entire system from the mains as instructed in chapter ↗ *Disconnection from the grid*, page 19.
- Remove all connections from the module that is to be dismounted.
- If you want to dismount the module on the far right, first remove the end cover. This is mounted again on the last module on the right after the module has been dismounted.
- Grasp the module at the top and bottom with one hand and lift the green lever upwards to release the lock on the DIN rail.
- Pull the module forward along the guide rails.
- Push down on the lever.

7.3 End cover

The rightmost module is terminated on the right side with the end cover ibaM-CoverPlate.

Mounting

- Push this end cover along the guide rail until the cover snaps into place.

Dismounting

- Push this end cover forward along the guide rail.

7.4 Connector connection technology

Caution!

You must only connect one conductor to each terminal connection.

Several individual conductors, whether single-wired or fine-wired, are not permitted.

Only connectors classified by iba may be used for connecting conductors.

Connection technology	Push-in			
Clamping range	0.5 - 6 mm²			
Conductor cross-section				
Single-wired	0.5 - 6 mm²			
Fine-wired	0.5 - 6 mm²			
With wire end ferrule	0.5 - 6 mm²			
With wire end ferrule/ collar	0.5 - 6 mm²			
Stripping length				
Cross-section	1.5 mm²	2.5 mm²	4 mm²	6 mm²
Single-wired	12 mm			
Fine-wired				
With wire end ferrule	12 mm			
With wire end ferrule/ collar	15 mm	14 mm		
Recommended cables				
Single-wired	H05V-U; H07V-U			
Fine-wired	H05V-K; H07V-K			
Screwdriver blade	0.6 mm x 3.5 mm			
Tightening torque plug	0.2 - 0.3 Nm			

Caution!

Measuring cable

- Do not use damaged measuring cables!
- Do not connect or disconnect measuring cables when the device is connected to the power!
- Measuring cables must be suitable for the measurement category and voltage, and must have a length of smaller than 10 m.

8 ibaPDA integration

With *ibaPDA* you can search for devices in the network and configure them for operation in the network, but *ibaPDA* can also be used to configure, acquire and record the analog and digital signals of the connected terminals, and output them.

Modules from the ibaMAQ system can only be operated at an ibaMAQS central unit, either at the processor module *ibaM-DAQ* or communication module *ibaM-COM*. Configure the respective central unit before adding further modules.

Other documentation

Please read the description and configuration of the modules *ibaM-DAQ* or *ibaM-COM* in the corresponding device manuals.

8.1 Adding modules

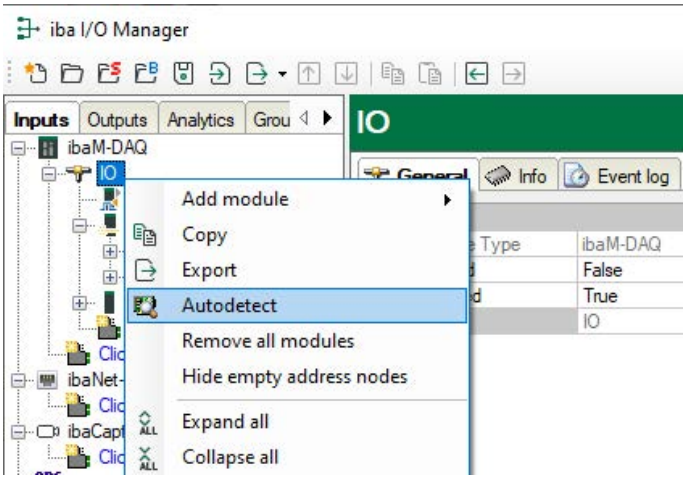
There are several ways to add modules in *ibaPDA*:

- Automatically
- Manually / offline

The procedure is described using the example of the processor module *ibaM-DAQ*.

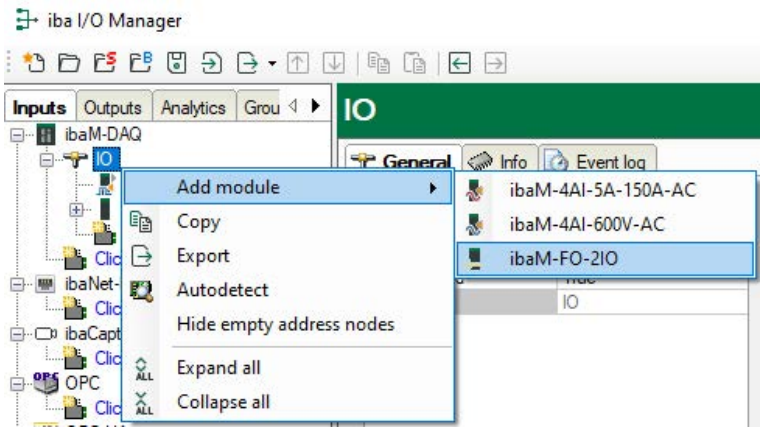
8.1.1 Automatically

Select the "IO" link in the I/O Manager. Right-click on the link to open a submenu. Select "Autodetect". If *ibaPDA* detects the device automatically, the device and the connected modules are listed in the module tree.



8.1.2 Manually / offline

Modules can also be added manually. Right-click on the "IO" link and select *Add module*. Select the desired modules from the list.



An offline configuration makes it possible, for example, to export a module configuration without existing or connected modules or to save the entire I/O configuration of the I/O Manager.

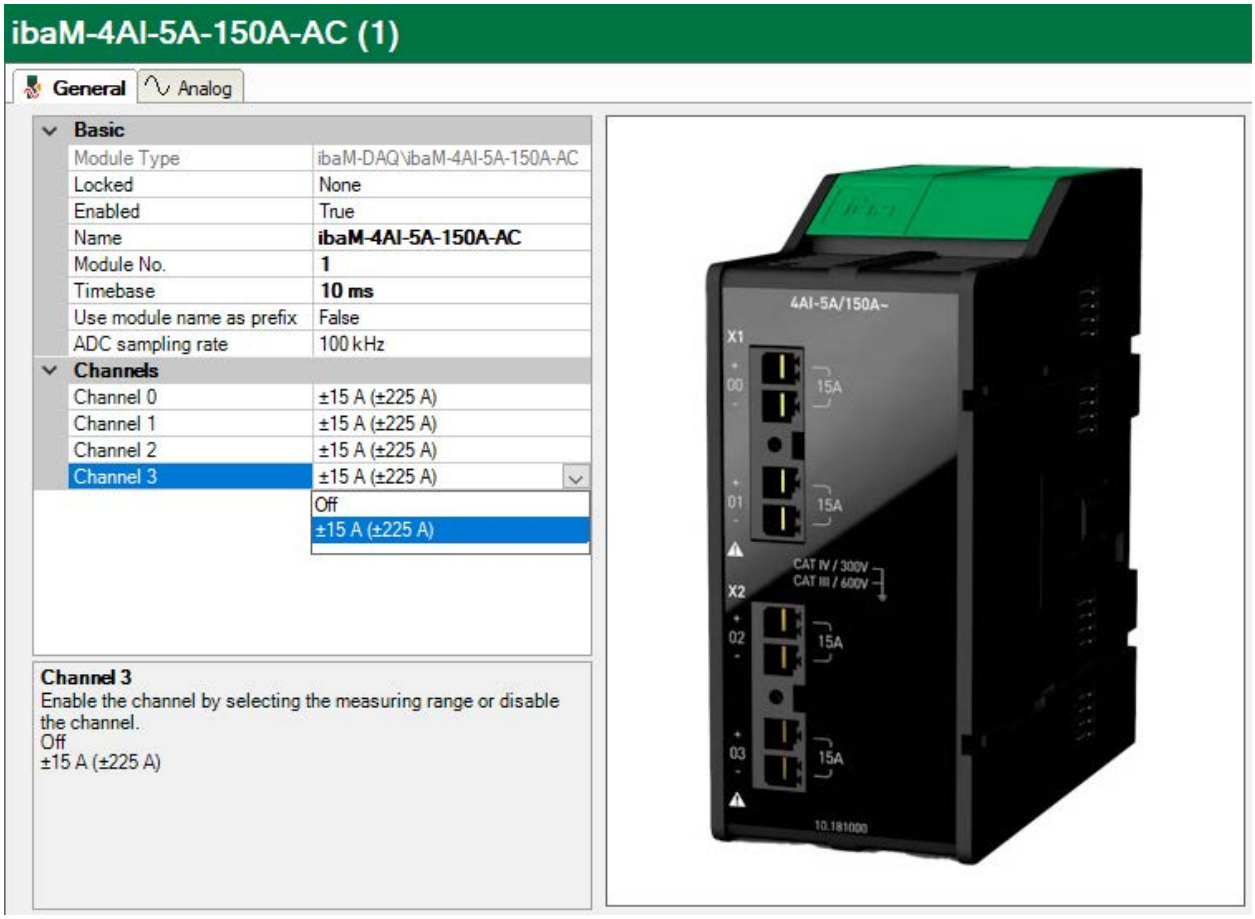
Other documentation

For detailed information, refer to the corresponding device manuals.

8.2 Module configuration

If the module is displayed correctly, carry out the configuration as described below.

8.2.1 General tab



Basic settings

Module Type (information only)
Indicates the type of the current module.

Locked
You can lock a module to avoid unintentional or unauthorized changing of the module settings.

Enabled
Enable the module to record signals.

Name
You can enter a name for the module here.

Comment
You can enter a comment or description of the module here. This will be displayed as a tooltip in the signal tree.

Module No.
This internal reference number of the module determines the order of the modules in the signal tree of *ibaPDA* client and *ibaAnalyzer*.

Timebase
All signals of the module are sampled on this timebase.

Use module name as prefix
This option puts the module name in front of the signal names.

ADC sampling rate
Sampling rate of the A/D converter

- 100 kHz (default)
- 500 kHz

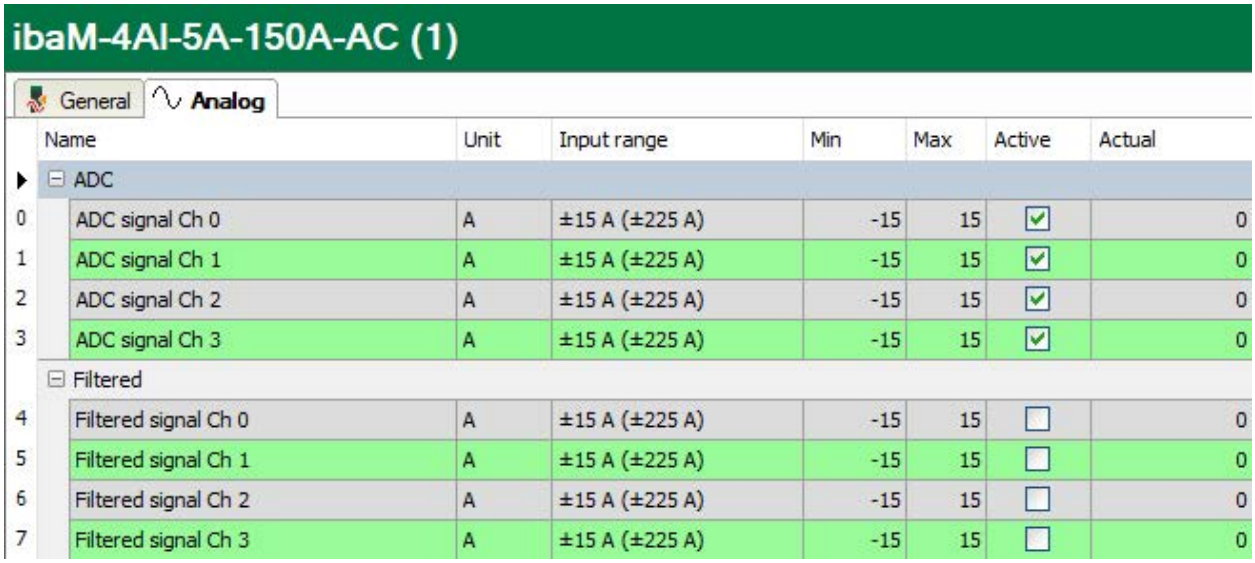
Channels

Channel x
Enable the channel by selecting the measuring range or disable the channel in the drop-down menu.

- Off: Channel is disabled
- ±15 A (±225 A) (default)

8.2.2 Analog tab

The *Analog* tab lists the analog signals in two groups. The *ADC* group contains the ADC signals directly after the A/D converter, while the *Filtered* group contains the filter signals with the additional digital anti-aliasing filter.



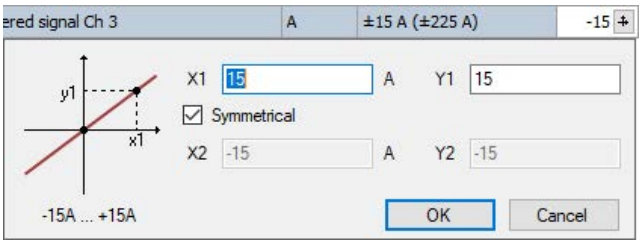
	Name	Unit	Input range	Min	Max	Active	Actual
	ADC						
0	ADC signal Ch 0	A	±15 A (±225 A)	-15	15	☑	0
1	ADC signal Ch 1	A	±15 A (±225 A)	-15	15	☑	0
2	ADC signal Ch 2	A	±15 A (±225 A)	-15	15	☑	0
3	ADC signal Ch 3	A	±15 A (±225 A)	-15	15	☑	0
	Filtered						
4	Filtered signal Ch 0	A	±15 A (±225 A)	-15	15	☐	0
5	Filtered signal Ch 1	A	±15 A (±225 A)	-15	15	☐	0
6	Filtered signal Ch 2	A	±15 A (±225 A)	-15	15	☐	0
7	Filtered signal Ch 3	A	±15 A (±225 A)	-15	15	☐	0

Name
You can enter a signal name here, as well as two comments, by clicking on the  icon in the *Name* field.

Unit
The unit “A” is preset.

Input range
Displays the input range, based on the setting on the *General* tab.

Min/Max
You can define an upper and lower limit for the measuring range here. The analog voltage level of the upper and lower limit is assigned to a physical variable. The dialog box is opened by clicking on the cross.



This scaling initially relates to the nominal measuring range. Due to the automatic switching to the overload range, the scaling is also valid over the entire measurable range.

Active
You can enable or disable the signal here.

Actual
Displays the current measured value.

You can show or hide additional columns using the context menu (right-click in the header).

9 Technical data

Danger!

Electric shock

The device is only designed for electrical measured variables as specified in the "Technical data" chapter!

If the device is used or operated in a manner other than specified in the *Technical data* chapter, the protection supported by the device may be impaired.

This applies in particular to the permissible operating and environmental conditions and voltages outside the corresponding CAT protection classes.

Brief description			
Product name	ibaM-4AI-5A-150A-AC		
Module label	4AI-5A/150A~		
Description	Input module with 4 analog current inputs		
Order number	10.181000		
Module-module interface			
Number	2		
Connection technology	4x 8 sliding contacts		
Analog inputs			
Number	4		
Design	Galvanically isolated, single ended, 2 A/D converters per channel		
Input signal / nominal current	5 A AC		
Resolution	24 bit (Delta-Sigma)		
ADC sampling rate	100 kHz	500 kHz	switchable
Timebase (update time)	min. 10 µs	min. 2 µs	freely adjustable
Filters			
ADC signal			
analog	R/C low-pass, 1st order, 150 kHz		
digital	Anti-aliasing filter (FIR); Cut-off frequency = 0.45 x ADC sampling rate; Oversampling = 32 x ADC sampling rate		
Filter signal[1)]			
Like ADC signal, in addition			

[1)] For the filter signals, a maximum timebase (update time) of 1 ms is recommended for correct operation of these filters, even though an even higher timebase (update time) can be set in the ibaPDA configuration.

digital	Anti-aliasing filter (Elliptic/Cauer); 10th order; Cut-off frequency = 0.45 / timebase
Protection factor / overload current	30 x nominal current
Nominal measuring range	±15 A
Measurable overload range[2)]	-225 A … -15 A / +15 A … +225 A
Input current max.	15 A DC; permanent
In overload range	150 A AC; transient for 1 s per minute[3)]
Input voltage max.	CAT III 600 V; CAT IV 300 V; Pollution degree 2
Measuring shunt	2.0 mΩ
Accuracy (+25 °C)	
Nominal measuring range	< 0.1 % of double nominal measuring range end value
Overload range[4)]	< 0.1 % of double overload range end value
Electrical isolation	
Channel - channel	Basic insulation: CAT III 600 V
Channel - system	Reinforced insulation: CAT III 600 V
Connection technology	2x 4-pin pin header, pitch 7.62 mm
Connector	2x enclosed; push-in, conductor max. 6 mm², locking lever (latching), reverse polarity protection, lockable, screw-on, without jumper; For information on the conductor and stripping length, see chapter ↗ *Connector connection technology*, page 21. Order number: 52.000051
Additional functions	
Phasor measurement unit[5)]	Integrated
Grid frequency measurement (10 Hz ... 80 Hz)[6)]	Interval: 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Current consumption	
Own consumption	0.3 A
Input/output current	max. 4 A
Other interfaces, operating and indicating elements	
Indicators	LEDs for operation, channel states and errors

[2)] Recalibration is recommended after the occurrence of currents in the overload range, as a permanent variation in the measured values may occur.
[3)] Recalibration is recommended after the occurrence of currents in the overload range, as a permanent variation in the measured values may occur.
[4)] Recalibration is recommended after the occurrence of currents in the overload range, as a permanent variation in the measured values may occur.
[5)] Only available on release of ibaM-PQU
[6)] Available in a later firmware version

Operating and environmental conditions	
Temperature range	
Operation	14 °F to 131 °F (-10 °C to +55 °C)
Storage	-13 °F to 185 °F (-25 °C to +85 °C)
Mounting	On grounded DIN rail according to EN 50022 (TS 35, DIN rail 35)
Cooling	Passive
Relative humidity	15 % … 95 % (indoor), no condensation
Operating altitude	0 … 2000 m above sea level
Protection type	according to IP20; without test certificate according to IEC 60529
Certifications / Standards	CE, C-Tick, UKCA, FCC
Dimensions	
w x h x d	56 mm x 133 mm x 120 mm
Height, lever open	160 mm
Height units	3
Installation clearances	
Top / bottom	30 mm / 30 mm
Left / right (system)	10 mm / 10 mm
Installation position	Vertical, lever up

Supplier's Declaration of Conformity
47 CFR § 2.1077 Compliance Information

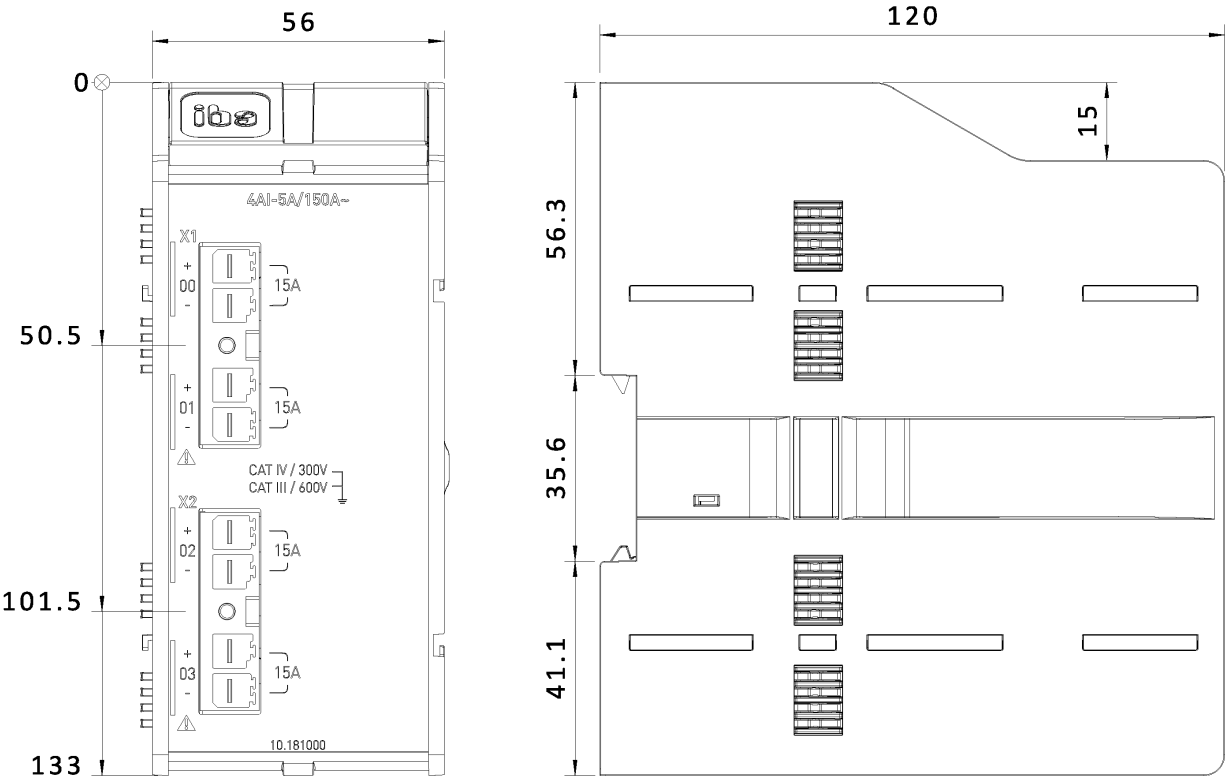
Unique Identifier: 10.181000, ibaM-4AI-5A-150A-AC

Responsible Party - U.S. Contact Information
iba America, LLC
370 Winkler Drive, Suite C
Alpharetta, Georgia
30004

(770) 886-2318-102
www.iba-america.com

FCC Compliance Statement
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

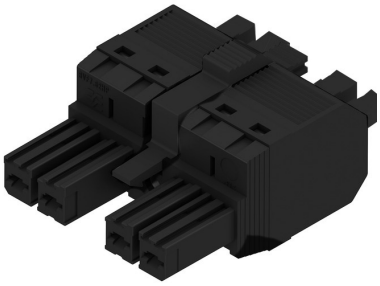
9.1 Dimensions



ibaM-4AI-5A-150A-AC dimensions, in mm

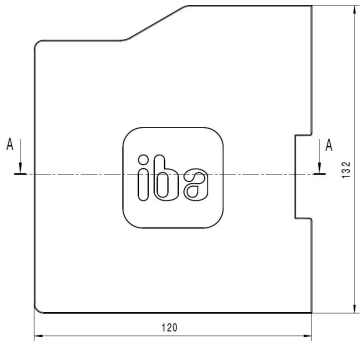
10 Accessories

Connector for analog inputs



Short description	
Product name	MAQS / GEH / M5A Stecker AI
Description	4-pin socket connector/connector for analog inputs, push-in, lockable, screw-on
Order number	52.000051

End cover for MAQS modules



Short description	
Name	ibaM-CoverPlate
Description	End cover for MAQS modules
Order number	90.000663
Design	
Dimensions (w x h x d)	3 mm x 132 mm x 120 mm

11 Support and contact

Support

Phone: +49 911 97282-14

Email: support@iba-ag.com

Note

If you need support for software products, please state the number of the license container. For hardware products, please have the serial number of the device ready.

Contact

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please refer to our web site:

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