ibaM-4AI-150V-AC

Input module for analog signals

Manual

Issue1.0

Measurement Systems for Industry and Energy

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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded completely so that the full compliance is not guaranteed. However, the information in this publication is updated regularly. Required corrections are contained in the following regulations or can be downloaded on the Internet.

The current version is available for download on our web site http://www.iba-ag.com.

Issue	Date	Revision	Author	Version HW/FW
1.0	04-2025	First issue	ms, st	1.01.001

Certification

The product is certified according to the European standards and directives. This product meets the general safety and health requirements.

Other international and national standards were observed.

Contents

1 About this documentation

This documentation describes the design, application and operation of the device *ibaM-4AI-150V-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 About ibaM-4AI-150V-AC

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-150V-AC

The *ibaM-4AI-150V-AC* module is designed for power monitoring applications and can sample at up to 500 kHz.

Overview of the most important features:

- Input module with 4 analog voltage inputs
- Use in power generation and distribution
- General voltage measurement
- Grid frequency measurement
- Galvanically isolated analog inputs
- 24 bit resolution
- A/D converter sampling rate of 500 kHz
- Timebase min. 2 µs, freely adjustable
- Analog and digital filters per channel
- Measuring range ± 312 V
- Protection class (EN 61010-1): CAT III 150 V; Pollution degree 2
- Rugged housing, easy installation

3 Scope of delivery

After unpacking, check that the delivery is complete and undamaged.

The scope of delivery includes:

- *ibaM-4AI-150V-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.

4.2 Special safety instructions

Danger!

Operation

- The system must only be operated permanently connected and not touchable, only in a building (in-door) and only 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 61010-1.
- 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.
- The supply may only be provided via an energy-limited circuit in accordance with IEC 61010-1 and must either include a fuse that trips after 120 s at the latest in the event of an overcurrent greater than 4 A or limit the total current of the system to 4 A.
- 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!

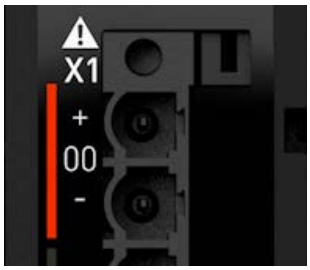
You must only connect one conductor to each terminal connection.

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 range.



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

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.

Note

Calibration

If the device is used or operated in the manner specified in the *Technical data* chapter, a calibration interval of 4 years is recommended for the analog input channels.

The date of the last calibration can be found in *ibaPDA* and there in the system information on the *Info* tab of the central processing unit.

5 System requirements

Hardware
ibaMAQS central unit

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

Software

- ibaPDA v8.10.0 or higher

Firmware

- ibaMAQS v1.04.001 or higher

6 Mounting and dismounting

Danger!

Operation

- The system must only be operated permanently connected and not touchable, only in a building (in-door) and only 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 61010-1.
- 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.
- The supply may only be provided via an energy-limited circuit in accordance with IEC 61010-1 and must either include a fuse that trips after 120 s at the latest in the event of an overcurrent greater than 4 A or limit the total current of the system to 4 A.
- 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.

6.1 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!

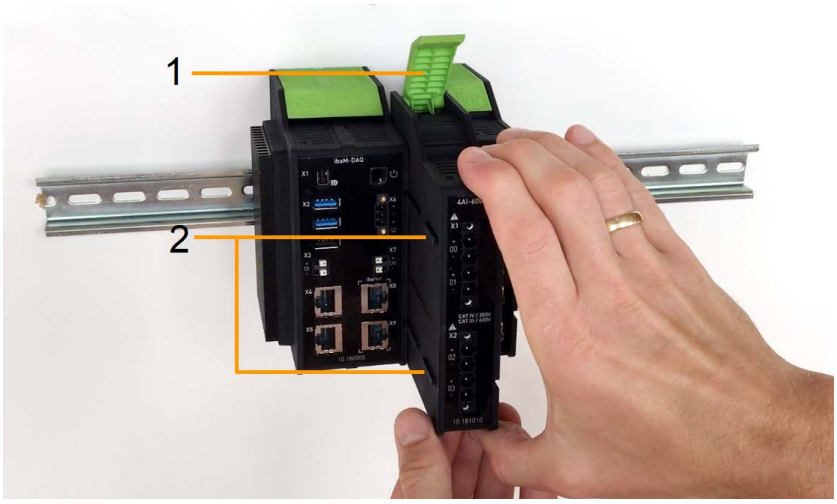
A suitable disconnecting device for this system must be available and disconnect all energized components of this system.

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.

6.2 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 15.
- 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 15.
- 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.

6.3 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.

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.

6.4 Connection technology connector

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	0.08 - 2.5 mm²				
Conductor cross-section					
Single-wired	0.5 - 1.5 mm²				
Fine-wired	0.5 - 2.5 mm²				
With wire end ferrule	0.5 - 2.5 mm²				
With wire end ferrule/collar	0.5 - 2.5 mm²				
Stripping length					
Cross-section	0.5 mm²	0.75 mm²	1 mm²	1.5 mm²	2.5 mm²
Single-wired	10 mm				
Fine-wired					
With wire end ferrule	10 mm				
With wire end ferrule/collar	12 mm				n/a
Recommended cables					
Single-wired	H05V-U; H07V-U				
Fine-wired	H05V-K; H07V-K				
Screwdriver blade	0.6 mm x 3.5 mm				

Caution!

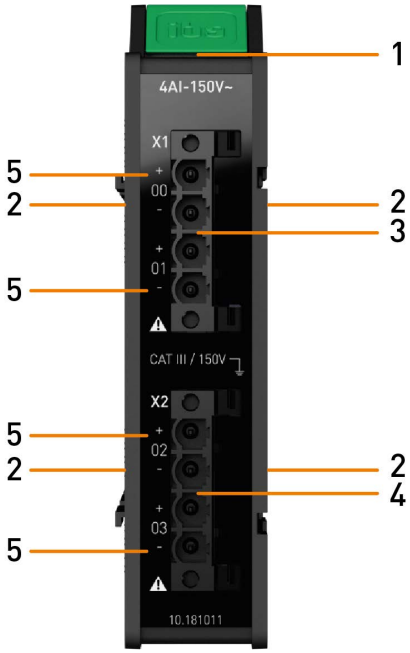
Measuring cable

- 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.

7 Device description

Here you will find views and descriptions of the *ibaM-4AI-150V-AC* device.

7.1 View



1 Module status indicator

2 Contacts module-module interface

3 Connector analog inputs X1

4 Connector analog inputs X2

5 Analog input indicators

7.2 Indicating elements

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

7.2.1 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

7.2.2 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 measuring range or greater than the maximum permissible voltage based on the corresponding CAT protection class

7.3 Analog inputs

Here you will find information on filters and connections for the analog inputs.

7.3.1 Filters

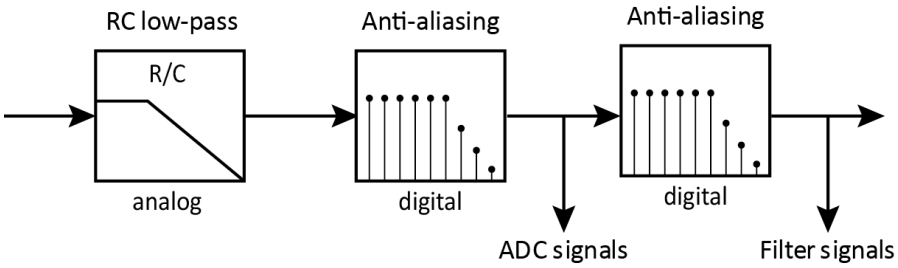
The following filters are available for each channel:

Filter type	Order	Cut-off frequency	ADC signals	Filter signals
R/C low-pass	1st	150 kHz	x	x
Digital anti-aliasing filter (FIR)	84th	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*

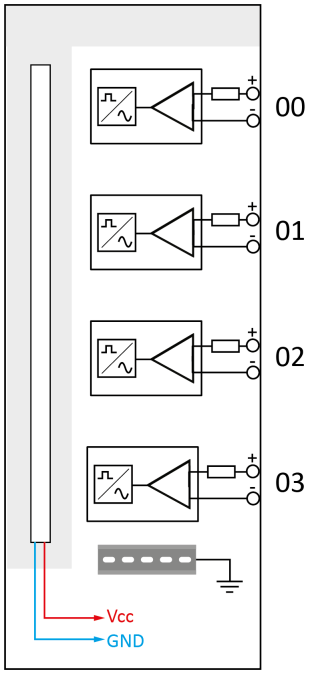
ADC signals = Acquired signals after A/D converter
Filter signals = Acquired signals after additional digital filter (see also filter section)

Filter section:



7.3.2 Connection diagram, pin assignment

A total of 4 input signals can be connected here (0 ... 3), each of which must be bipolar and electrically isolated. 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 -

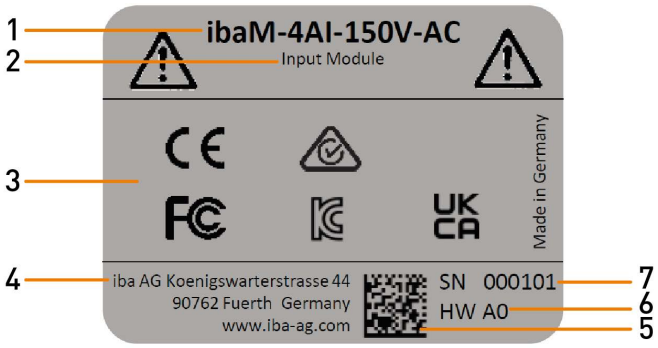
Caution!

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.

7.4 Type label

The type label provides the following information:



1	Product name	5	DataMatrix code (iba internal)
2	Module type	6	Hardware version
3	Certifications, Standards	7	Serial number
4	Manufacturer		

8 Confguration in ibaPDA

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*:

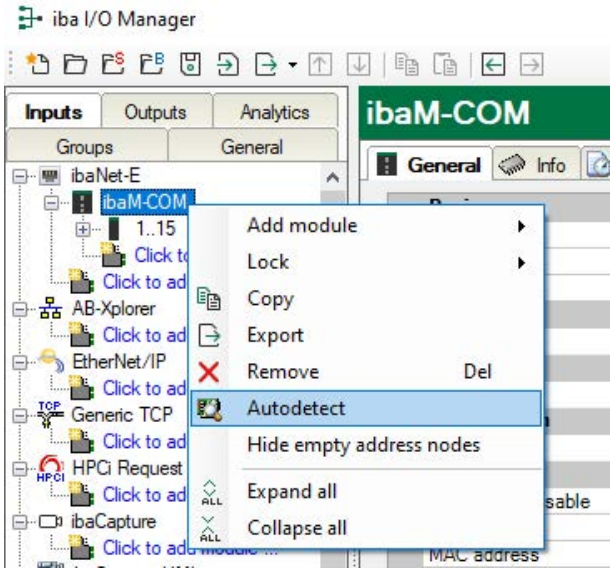
- Automatically
- Manually / offline

The procedure is described using the example of the communication module *ibaM-COM*.

8.1.1 Adding module automatically

1. Select the "ibaM-COM" link in the I/O Manager.
2. Right-click on the link to open a submenu.
3. Select *Autodetect*.

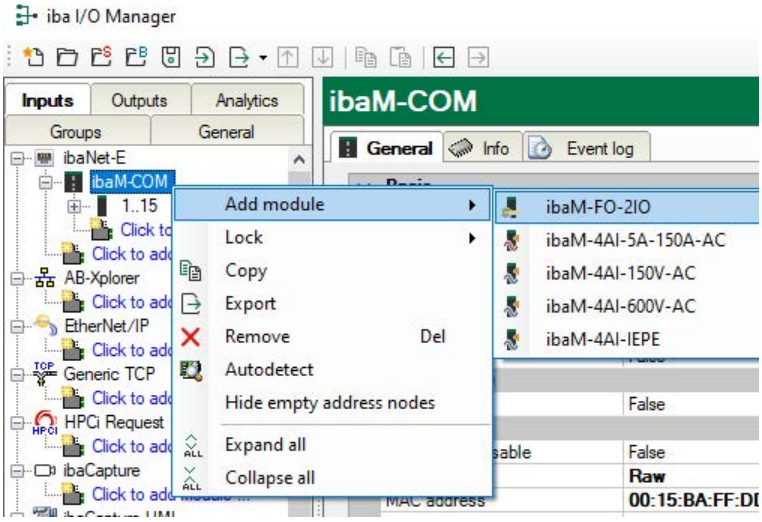
→ If *ibaPDA* detects the device automatically, the device and the connected modules are listed in the module tree.



8.1.2 Adding module manually / offline

Modules can also be added manually.

1. Right-click on the "ibaM-COM" link and select *Add module*.
2. 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.

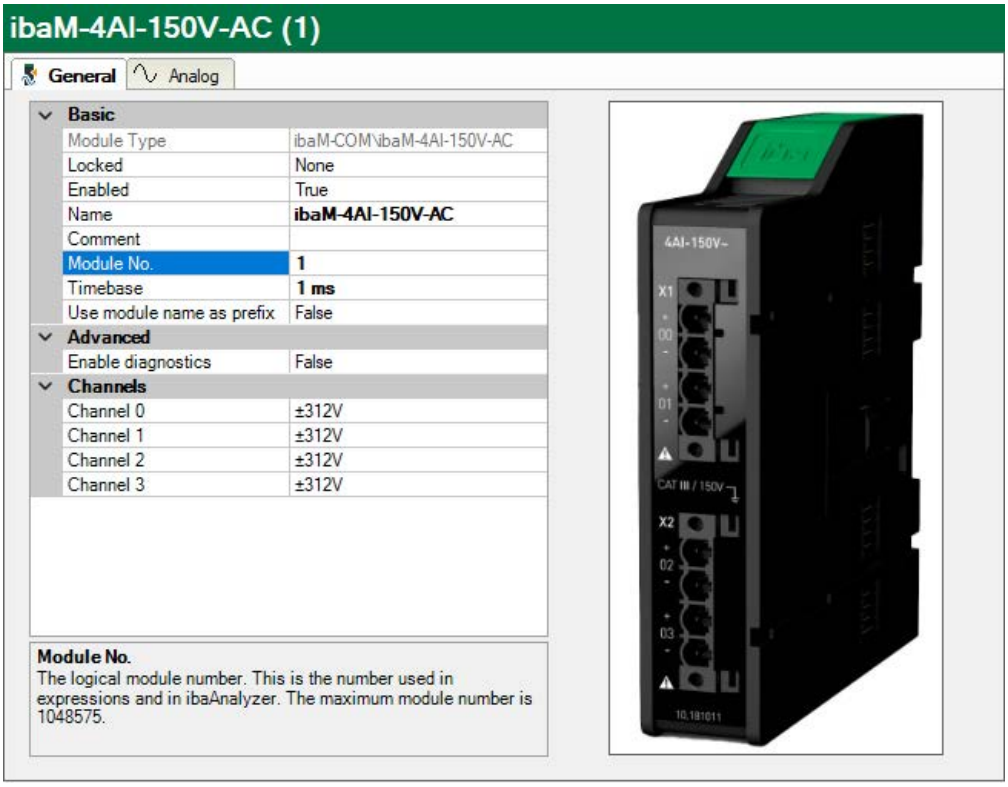
Other documentation

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 ibaM-4AI-150V-AC – 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.

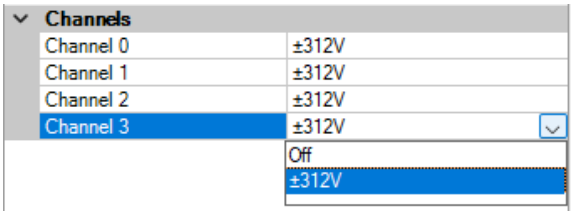
Advanced

Enable diagnostics
When you enable diagnostics (True), the *Diagnostics* tab is added. See chapter
↗ *ibaM-4AI-150V-AC – Diagnostics tab*, page 27.

Channels

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

- Off: Channel is disabled
- +/-312 V (default)



8.2.2 ibaM-4AI-150V-AC – Analog tab

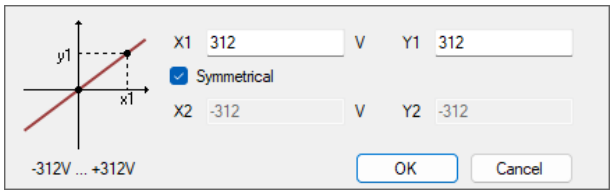
The *Analog* tab lists the analog signals in two groups. The *ADC* group contains the ADC signals directly after the A/D converter, while the *Filtered* group contains the filter signals with the additional digital anti-aliasing filter.

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

Unit
The unit “V” is preset.

Input range
Displays the input range.

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.



Active
You can enable or disable the signal here.

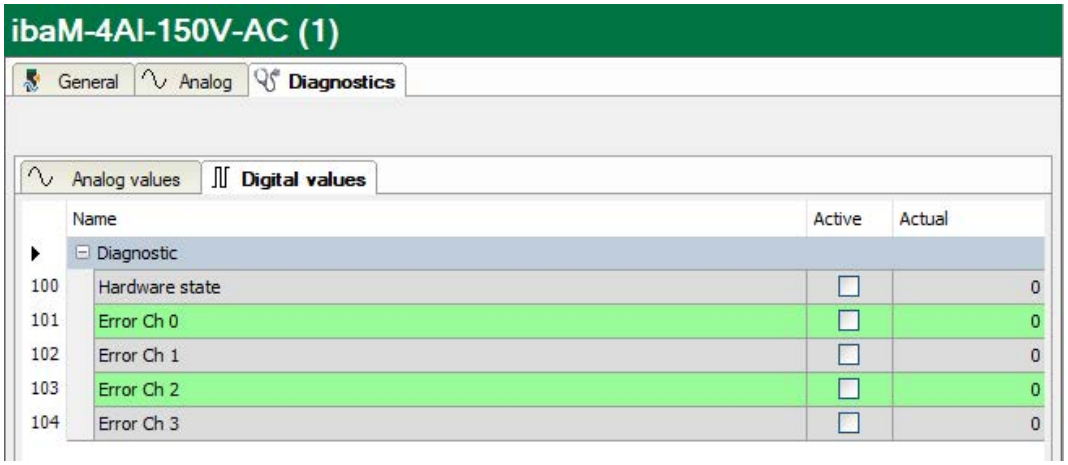
Actual
Displays the current measured value.

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

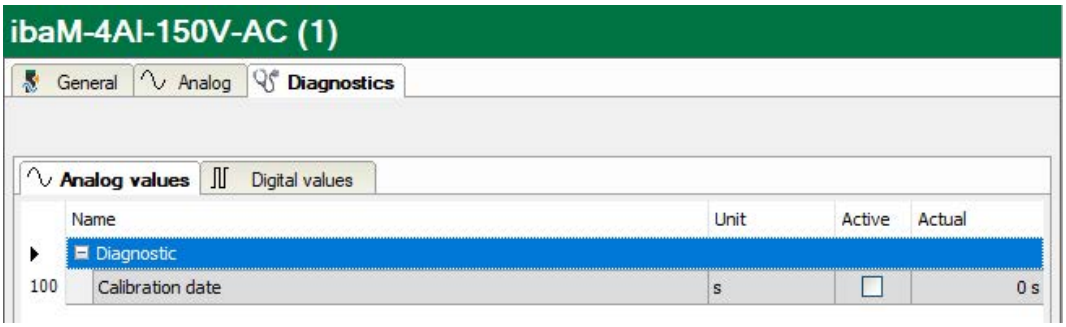
8.2.3 ibaM-4AI-150V-AC – Diagnostics tab

The *Diagnostics* tab shows the analog and digital diagnostic signals. The signals can be enabled individually.

Digital values:



Analog values:



Meaning of the signals:

Name	Meaning
Hardware state	live bit to indicate the hardware status (1 Hz)
Error Ch x	hardware error in channel x
Calibration date	32-bit value that represents the seconds since 1970. This number can be converted to text using a virtual signal: *ConvertUnixTimeToText()*

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-150V-AC
Module label	4AI-150V~
Description	Input module with 4 analog voltage inputs
Order number	10.181011
Module-module interface	
Number	2
Connection technology	4x 8 sliding contacts
Analog inputs	
Number	4
Design	Galvanically isolated, single ended
Input signal / nominal voltage	150 V AC
Resolution	24 bit (Delta-Sigma)
ADC sampling rate	500 kHz
ibaPDA timebase (update time)	min. 2 µs; freely adjustable (integer multiple); max. 1 ms for filter signals
Filter	
ADC signal	
Analog	R/C low-pass, 1st order, typ. 150 kHz
Digital	Anti-aliasing filter (FIR), 84th order; cut-off frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate
Filter-Signal[1)]	
Like ADC signal, in addition	
Digital	Anti-aliasing filter (Elliptic/Cauer); 10th order; Cut-off frequency = 0.45 / timebase

[1)] For the filter signals, the maximum timebase in ibaPDA (update time) is limited to 1 ms for the correct operation of these filters.

Measuring range	±312 V
Measuring category	CAT III 150 V
Input impedance	
Device switched off	250 kOhm
Device switched on	252 kOhm
Input capacity	8.5 pF
Accuracy (+25 °C)	< 0.1 % of the respective double full scale value
Electrical isolation	
Channel-channel	Basic isolation: CAT III 150V
Channel-system	Enhanced isolation: CAT III 150V
Connection technology	2x 4-pin header, pitch 7.62 mm
Connectors	2x enclosed; push-in, conductor max. 2.5 mm2, locking lever (latching), protected against reverse polarity, lockable; For information on the conductor and stripping length, see chapter ↗ *Connection technology connector*, page 18; Order number: 52.000050
Additional functions	
Phasor measurement unit[2)]	Integrated
Grid frequency measurement (10 Hz ... 80 Hz)[3)]	Interval 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Power consumption (max.)	
Own consumption	0.16 A
Input/output current	4 A
Other interfaces, operating and indicating elements	
Indicators	LEDs for operation, channel states, and errors
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 m … 2000 m above sea level
Protection type	according to IP20; without test certificate according to IEC 60529

[2)] Only available on release of ibaM-PQU module
[3)] Available in a later firmware version

Certifications / Standards	CE, C-Tick, UKCA, FCC, IEC 61010-1, IEC 61010-2-030, IEC 61000-6-5 interface range 4
Pollution degree	2
MTBF[4] (+25 °C)	3,529,809 hours / 402 years
Dimensions	
w x h x d	28 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
Weight / incl. packaging	0.26 kg / 0.52 kg

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

Unique Identifier: 10.181011, ibaM-4AI-150V-AC

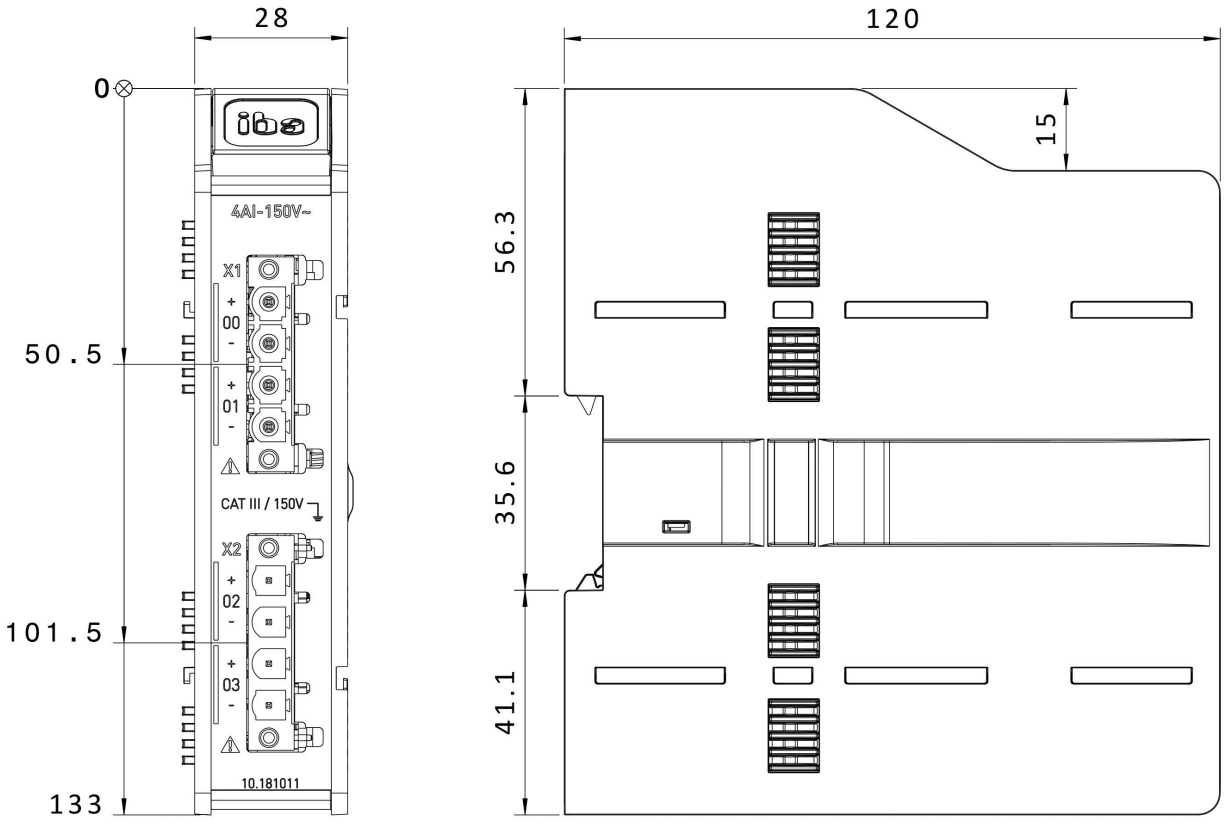
Responsible Party - U.S. Contact Information
iba America, LLC
370 Winkler Drive, Suite C
Alpharetta, Georgia
30004

(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.

[4] MTBF (mean time between failure) determined according to Telcordia 4 SR332 (Reliability Prediction Procedure of Electronic Equipment; Issue Mar. 2016) and NPRD (Non-electronic Parts Reliability Data 2011)

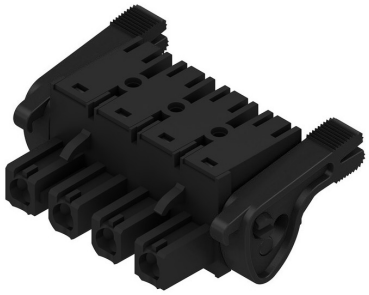
9.1 Dimensions



ibaM-4AI-150V-AC dimensions, in mm

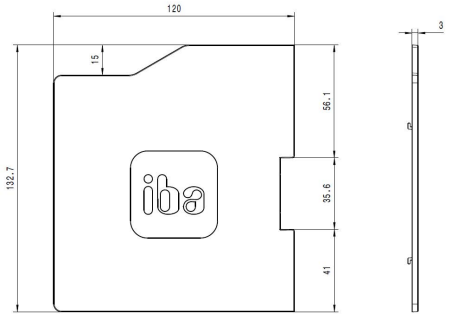
10 Accessories

Connector for analog inputs



Short description	
Name	4-Pin Terminal Block MAQS-PM RM7.62 Push-In LR
Description	4-pin socket connector/connector for analog inputs, push-in, lockable
Order number	52.000050

End cover for MAQS modules



Short description	
Name	ibaM-CoverPlate
Description	End cover for MAQS modules
Order number	10.180020
Design	
Dimensions (w x h x d)	3 mm x 132.7 mm x 120 mm
Weight	0.05 kg

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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