

ibaM-4AI-IEPE

Input module for IEPE vibration sensors

Manual

Ausgabe 1.3

Messsysteme für Industrie und Energie

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The current version is available for download on our website www.iba-ag.com and can be found in the iba Help center docs.iba-ag.com.

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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.

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1 About this documentation

This documentation describes the design, application and operation of the device *ibaM-4AI-IEPE*.

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 addresses qualified professionals, who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded as trained specialist personnel if they are capable of assessing the work assigned to them and identifying possible risks based on their specialist training, knowledge, experience and awareness of the applicable 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-IEPE

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-IEPE

The *ibaM-4AI-IEPE* module is designed for the acquisition of mechanical vibrations with IEPE vibration sensors. Different input modes can be set in *ibaPDA* for each channel for the analog inputs:

- IEPE input with 1 Hz or 0.1 Hz high-pass filter
- 24 V AC input
- 24 V DC input

Overview of the most important features:

- Input module with 4 analog inputs
- Constant current source 4 mA for sensors
- Typical for IEPE sensors
- Detection of broken line and short circuit
- Galvanically isolated analog inputs
- 24 bit resolution
- Sampling rate A/D converter 100 kHz
- Timebase 10 µs to 1 ms, freely adjustable
- Analog and digital filters per channel
- Rugged housing, easy installation

The maximum number of *ibaM-4AI-IEPE* modules on a processor or communication module is not limited. A maximum of 15 of these modules can be operated on one of the two central units.

3 Scope of delivery

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

The scope of delivery includes:

- *ibaM-4AI-IEPE* device
- 2x 6-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 and the function itself may be impaired.

This also applies to the permissible operating and environmental conditions.

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!



Permanent measuring voltage

The device is non-destructive for permanent measuring voltages up to 60 V DC.

The device can be destroyed at voltages from 60 V DC and device safety can no longer be guaranteed.

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!
- Connecting and disconnecting measuring cables when the device is connected to the power is prohibited!
- Measuring cables must be suitable for the input signal to be measured and for a continuous measuring voltage of up to DC 60 V.

For information on the maximum length of the measuring cable, see chapter ↗ *Connector connection technology, page 18*.

Caution!

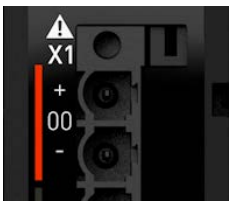
You must only connect one conductor to each terminal connection.

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* version 8.15.0 or higher

Firmware

- ibaMAQS version 01.08.001 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!



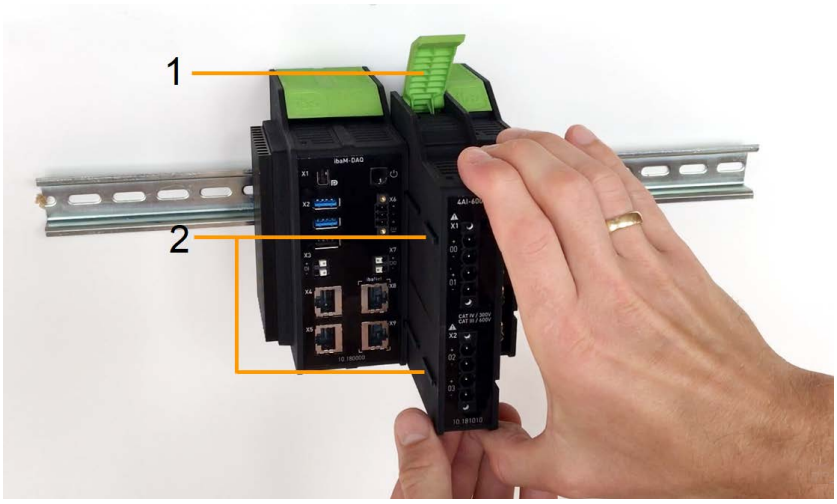
A suitable disconnecting device for this system must be available and disconnect all energized components of this system.

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 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	0.13 - 3.31 mm²				
Conductor cross-sections					
Single-wired	0.2 - 2.5 mm²				
Fine-wired	0.2 - 2.5 mm²				
With wire end ferrule	0.25 - 2.5 mm²				
With wire end ferrule/collar	0.25 - 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!
- Connecting and disconnecting measuring cables when the device is connected to the power is prohibited!
- Measuring cables must be suitable for the input signal to be measured and for a continuous measuring voltage of up to DC 60 V.

Note on the maximum sensor cable length for IEPE modes

The maximum length of the sensor cable depends on various factors, including the set sampling rate. The following formula can be used to estimate the maximum length.

$$l_{max} = \frac{I_{iepe}}{2 * \pi * f_s * C * U}$$

f_s Sampling rate [Hz]

C Capacity [F/m]

U Maximum output voltage of the sensor [V]

I_{iepe} Power supply for IEPE evaluation electronics [A]

Sample calculation

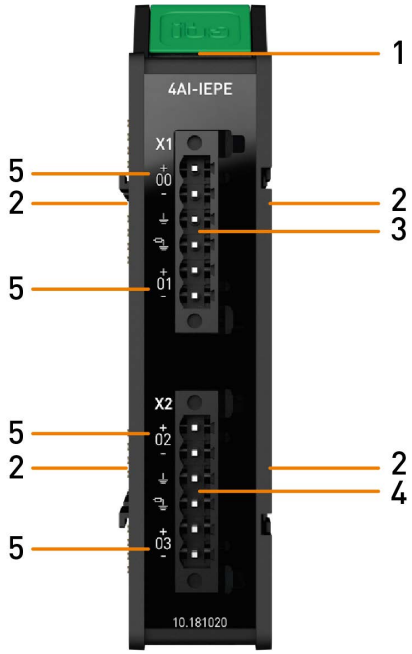
Cable LAPP Unitronic FD CP (TP) plus 1x2x0.75mm²	C = 70 nF/km -> 70 pF/m
Sensor IMI Piezotronics Type 601A01	U = 5 V
Evaluation electronics iba AG (IEPE module)	I_{iepe} = 4 mA
Set sampling rate	f_s = 40000 Hz

Result: l_{max} = 45,5 m

7 Device description

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

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 State of analog inputs

Color	Status	Description
Input modes 24V DC and 24V AC		
--	off	channel inactive channel active and no input signal received, or input signal received but not measurable (<1% of full scale value)
Green	on	channel active and measurable input signal received
Red	on	channel active and input signal outside the measuring range
Input modes IEPE 0.1Hz and IEPE 1Hz		
--	off	channel inactive
Green	on	channel active and measurable input signal present
Red	on	channel active, but no sensor connected channel active, sensor connected, but broken line
Red	flashing	channel active, sensor connected, but short circuit

7.3 Analog inputs

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

7.3.1 Filters

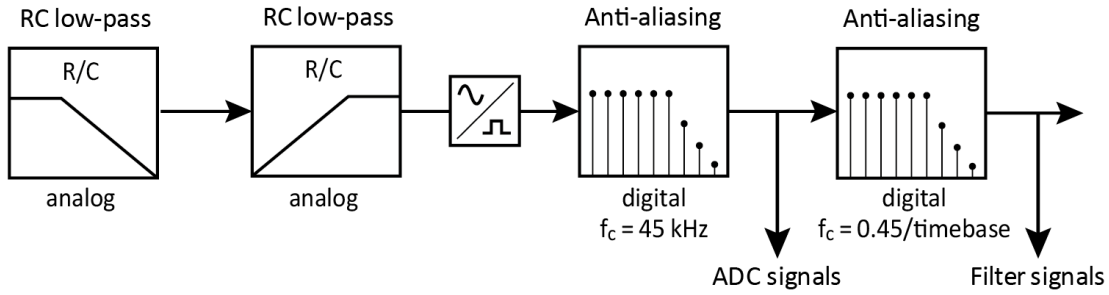
In modes IEPE 0.1Hz and IEPE 1Hz there are the following filters for each channel:

Filter type	Ord.	Cutoff frequency	ADC signals	Filter signals
R/C low-pass	1st	50 kHz	x	x
R/C high-pass	1st	1 Hz or 0.1 Hz (digital); switchable	x	x
Digital anti-aliasing filter (FIR)	84th	cutoff frequency = 0.45 x ADC sampling rate oversampling = 32 x ADC sampling rate	x	x
Digital anti-aliasing filter (Elliptic/Cauer) or Digital anti-aliasing filter (Butterworth) Switchable	10th 2nd	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:

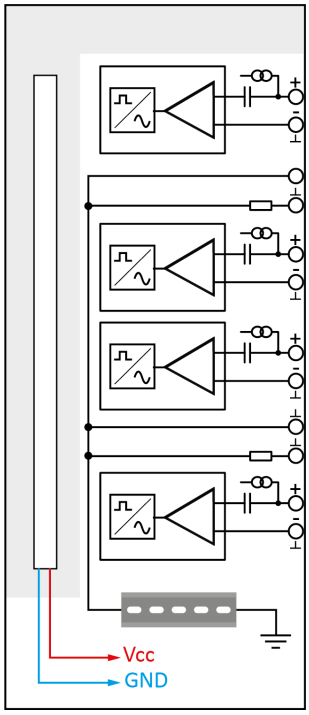


In modes 24V DC and 24V AC there are the following filters for each channel:

Filter type	Ord.	Cutoff frequency	ADC signals 24V DC	ADC signals 24V AC	Filter signals
R/C low-pass	1st	50 kHz	x	x	x
R/C high-pass	1st	1 Hz	--	x	x
Digital anti-aliasing filter (FIR)	84th	cutoff frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate	x	x	x
Digital anti-aliasing filter (Elliptic/Cauer) or Digital anti-aliasing filter (Butterworth) Switchable	10th 2nd	0.45 / timebase	--	--	x

7.3.2 Connection diagram, pin assignment

4 input signals can be connected here (0 ... 3), each of which must be bipolar plus ground. Each channel is connected using a two-wire system.



Pin assignment

Connector	Pin	Connection
X1	1	analog input 00 +
	2	analog input 00 -
	3	GND
	4	GND 50 Ω
	5	analog input 01 +
	6	analog input 01 -
X2	1	analog input 02 +
	2	analog input 02 -
	3	GND
	4	GND 50 Ω
	5	analog input 03 +
	6	analog input 03 -

Note

Please note that the pin assignment of the *ibaM-4AI-IEPE* module from the ibaMAQ system differs from that of the *ibaMS8xIEPE* module from the previous iba modular system.

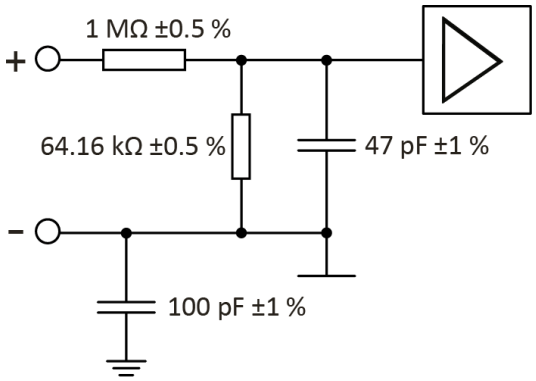
Caution!

Measuring cable

- Do not use damaged measuring cables!
- Connecting and disconnecting measuring cables when the device is connected to the power is prohibited!
- Measuring cables must be suitable for the input signal to be measured and for a continuous measuring voltage of up to DC 60 V.

Circuit diagram 24V DC/AC

The input circuit diagram of one channel is shown here as an example.



7.3.3 Grounding recommendation

The shield of a connected sensor should always be connected to the analog inputs of the *ibaM-4AI-IEPE* device and grounded on one side only. The stripped shield is connected as short as possible via a corresponding ground pin (GND) of the connectors.

The system must be grounded via the DIN rail.

Note

The *ibaM-4AI-IEPE* device together with the system should not be positioned near drives and frequency converters.

7.3.4 Error signals and status signals

Error signals and status signals are available as status functions. The table below shows the availability of the status signals and error signals in the various input modes:

	IEPE 0.1Hz/1Hz	24V AC	24V DC
Status signal			
Data valid	x	x	x
Error signal			
Broken line	x	-	-
Shorted	x	-	-

The error and status signals are switched off by default. The signals are activated by switching on the diagnostics in the general module tab. See also ↗ *General tab, page 31*.

7.3.4.1 Data valid

The “Data valid” signal indicates (True) when the oscillation process of the corresponding channel has ended.

If the measured incoming values are processed further before this point, the resulting values may be distorted.

If there is an error during IEPE operation (broken line, short circuit), the signal will change to False.

7.3.4.2 Broken line

In addition to a broken line, the signal also indicates when no IEPE sensor is connected.

A broken line is detected if the sensor’s supply voltage exceeds 20 V. The “Broken line” error signal becomes *True* with a delay of 10 seconds.

If the sensor’s supply voltage decreases below 20 V, this error state will automatically be reset and the signal will change to *False* with a delay of 10 seconds.

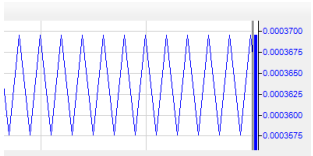
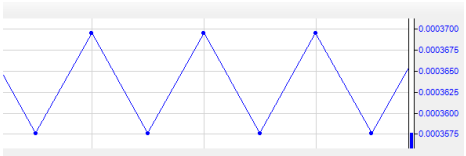
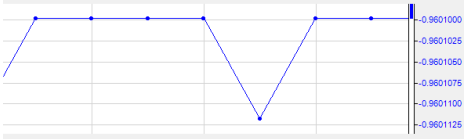
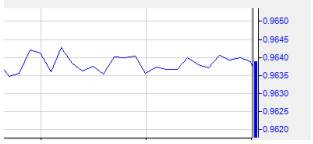
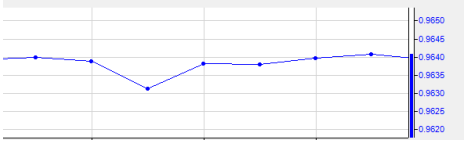
7.3.4.3 Shorted

In the event of a short circuit, this error signal will be set to *True* with a delay of 10 seconds.

If the short circuit is eliminated and the sensor correctly re-connected, this error state will automatically be reset and the signal will change to *False* with a delay of 10 seconds.

7.3.5 Signal behavior in the event of a broken line or short circuit

In the event of a broken line or a short circuit, the signals typically show the following behavior:

	Signal graph	Signal graph (enlarged)
IEPE 1Hz broken line		
IEPE 0.1Hz broken line		
IEPE 1Hz short circuit		
IEPE 0.1Hz short circuit		

Conclusion

Short circuit: A short circuit causes noise in the signal graph.

Broken line: In the event of a broken line, the input is only “noisy” by 1 bit at a time, so that the signal trend shows the behavior illustrated above.

7.3.6 Statistical values

Calculations of statistical values are available as additional functions. The calculation of the statistical values of a module is based on the ADC signals. The statistical values are all calculated according to the same calculation interval. The calculation interval can be set in *ibaPDA* in 1 ms steps in the range 10 ms to 5000 ms. The calculation is performed in blocks.

General characteristic values:

Characteristic value	Description
Minimum	minimum of the input signal
Maximum	maximun of the input signal
Average	arithmetic average of the input signal
Root Mean Square (RMS)	mean square value (effective value) of the input signal
Peak	maximum or minimum value (absolute)
Peak-to-Peak	difference between the largest value and the lowest value
Crestfactor	Crest factor (ratio of maximum to RMS) of the input signal
Used Range	peak-to-peak in relation to the measuring range

Bandpass-filtered characteristic values
Six bandpass filters per channel are available for the bandpass-filtered characteristic values. The bandwidth of the BP filters must be at least 50 Hz.

When IEPE mode is set, the characteristic values within a filter are calculated by default for acceleration or can be switched to velocity.

In 24V mode, calculations are either not integrated or are performed with switchable integration.

Characteristic value	Description
Root Mean Square (RMS)	mean square value (effective value) of the input signal
Peak-to-Peak	difference between the largest value and the lowest value
Crestfactor	Crest factor (ratio of maximum to RMS) of the input signal

7.3.7 TEDS

Some IEPE sensors contain an internal EEPROM that stores essential information for sensor identification. This information is based on TEDS technology, where TEDS stands for “Transducer Electronic Data Sheet.” TEDS complies with the IEEE-1451 standard.

ibaM-4AI-IEPE supports TEDS sensors with a 0-wire connection and DS2430A and DS2431 type EEPROMs.

The TEDS is divided into three areas of information:

- General information

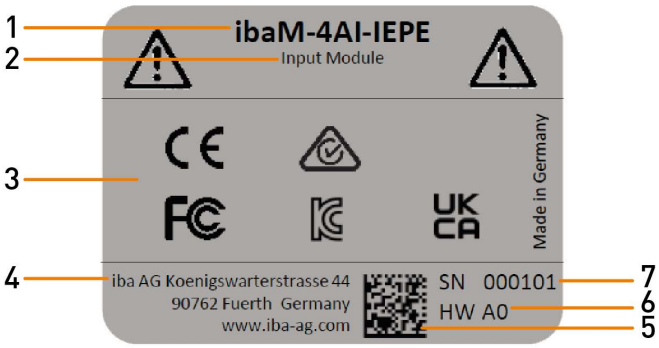
  Manufacturer, model number, version, serial number of the sensor
- Standard

  Sensor-specific data
- Calibration

  Sensor calibration data

7.4 Type label

The type label provides the following information:



1	Product name	5	Data matrix 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*:

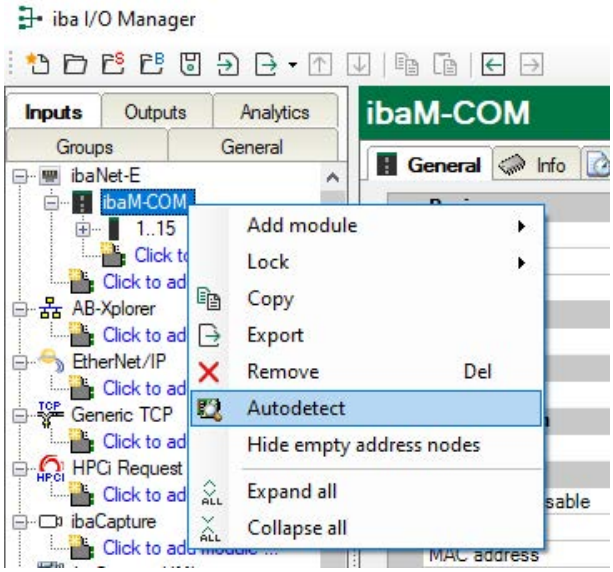
- Automatically
- Manually / offline

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*.

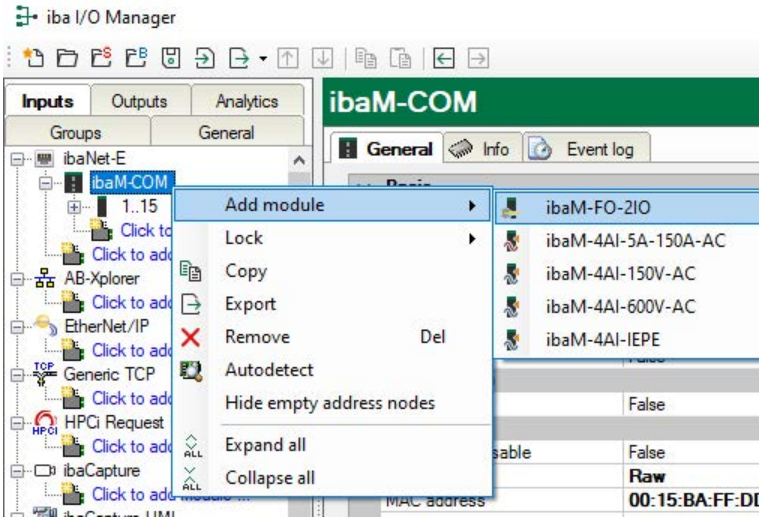
→ If *ibaPDA* detects the device automatically, the device and the connected modules are listed in the module tree.



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.



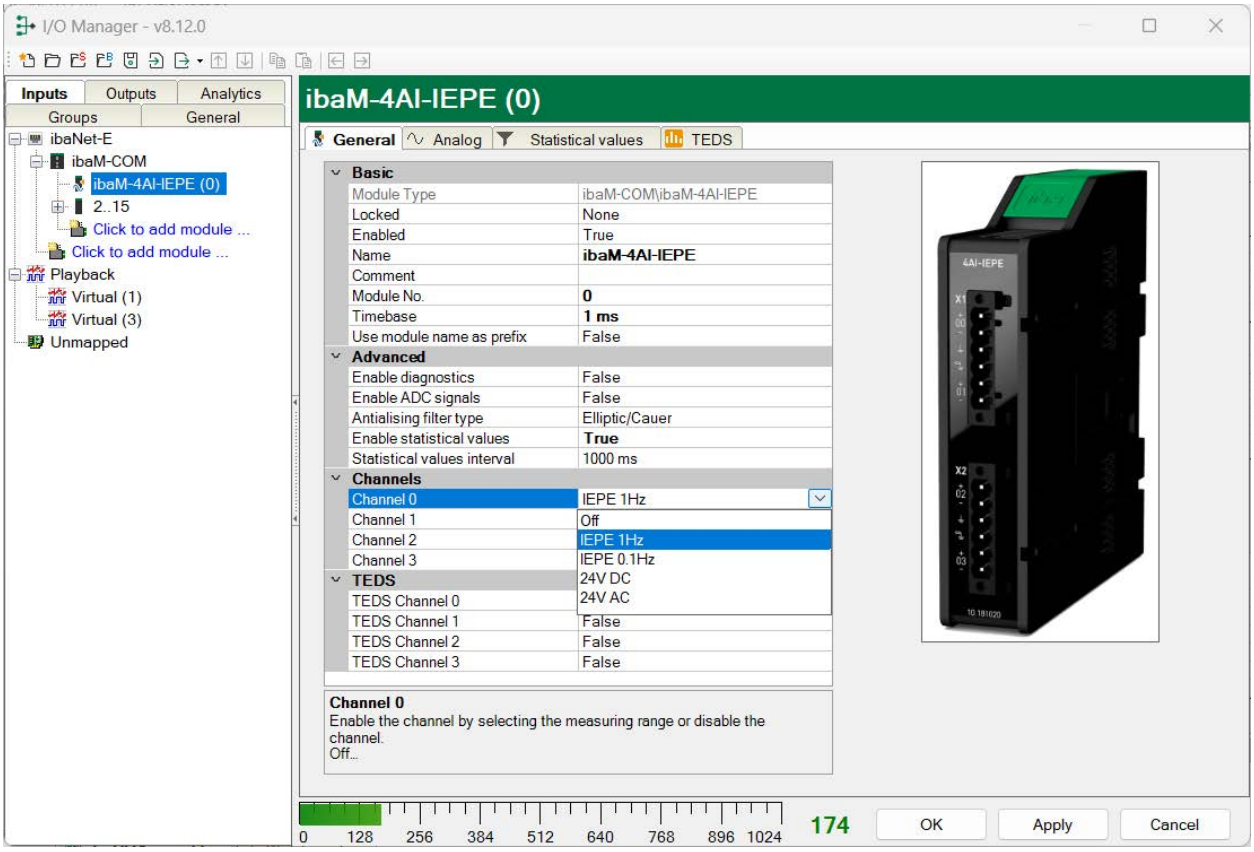
An offline configuration makes it possible, for example, to export a module configuration without existing or connected modules or to save the entire I/O configuration of the I/O Manager.

8.2 Module configuration

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

8.2.1 General tab

In the *General* tab, you can configure the basic settings and set the mode for each channel.



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.

Prefix signal names with module name
This option puts the module name in front of the signal names.

Advanced

Enable diagnostics
If you enable diagnostics (True), the *Diagnostics* tab is added. See ↗ *Diagnostics tab, page 34*.

Enable ADC signals
Enable and display ADC signals on the *Analog* tab.

Anti-aliasing filter type
Select the filter type for the anti-aliasing filter which is applied to the filtered signal. The available options are:

- Elliptic/Cauer 10th order
- Butterworth 2nd order

Enable statistical values
If you enable Statistical values, the *Statistical values* tab is added. The time base is 10 ms. See ↗ *Statistical values*, page 26.

In addition, the *Statistical values interval* field appears. Enter the calculation interval (in ms) for statistical values here. Valid range is 10 ms to 5000 ms. The interval for statistical values has no effect on the timebase (10 ms).

Channels

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

- Off
- IEPE 1Hz
- IEPE 0.1Hz
- 24V DC
- 24V AC

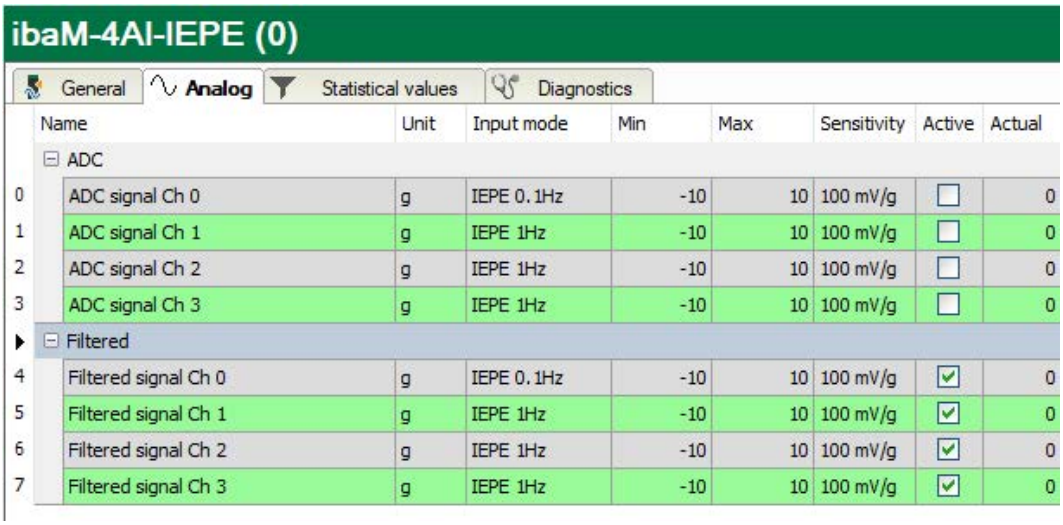
TEDS

TEDS Channel x
Enable TEDS (Transducer Electronic Data Sheet) identification for the respective channel.

TEDS identification can only be selected if the IEPE 0.1Hz or IEPE 1Hz mode has been selected for this channel. If the 24V DC or 24V AC modes are selected, the TEDS field for the respective channel remains grayed out.

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 mode	Min	Max	Sensitivity	Active	Actual
	ADC							
0	ADC signal Ch 0	g	IEPE 0.1Hz	-10	10	100 mV/g	☐	0
1	ADC signal Ch 1	g	IEPE 1Hz	-10	10	100 mV/g	☐	0
2	ADC signal Ch 2	g	IEPE 1Hz	-10	10	100 mV/g	☐	0
3	ADC signal Ch 3	g	IEPE 1Hz	-10	10	100 mV/g	☐	0
	Filtered							
4	Filtered signal Ch 0	g	IEPE 0.1Hz	-10	10	100 mV/g	☑	0
5	Filtered signal Ch 1	g	IEPE 1Hz	-10	10	100 mV/g	☑	0
6	Filtered signal Ch 2	g	IEPE 1Hz	-10	10	100 mV/g	☑	0
7	Filtered signal Ch 3	g	IEPE 1Hz	-10	10	100 mV/g	☑	0

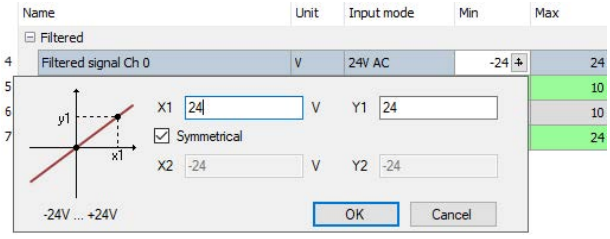
Name
You can enter a signal name here, as well as two comments, by clicking on the  icon in the *Name* field.

Unit
The unit is preset.

Input mode
Displays the input mode, 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 lower or upper limit for the measuring range is only possible in both 24V modes.

The dialog box is opened by clicking on the cross.



Sensitivity
Specifies the sensitivity of the sensor.

Active
You can enable or disable the signal here.

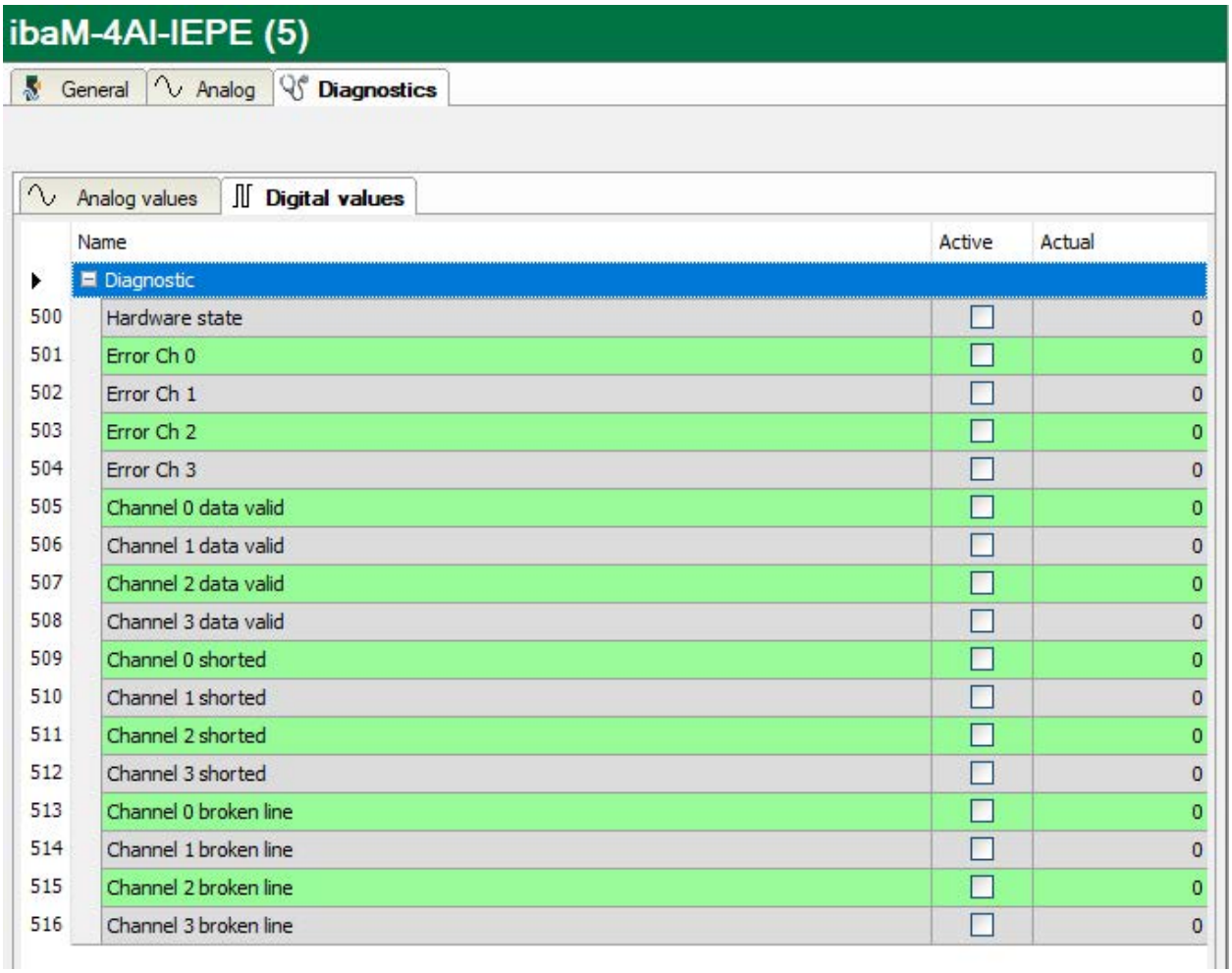
Actual
Displays the current measured value.

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

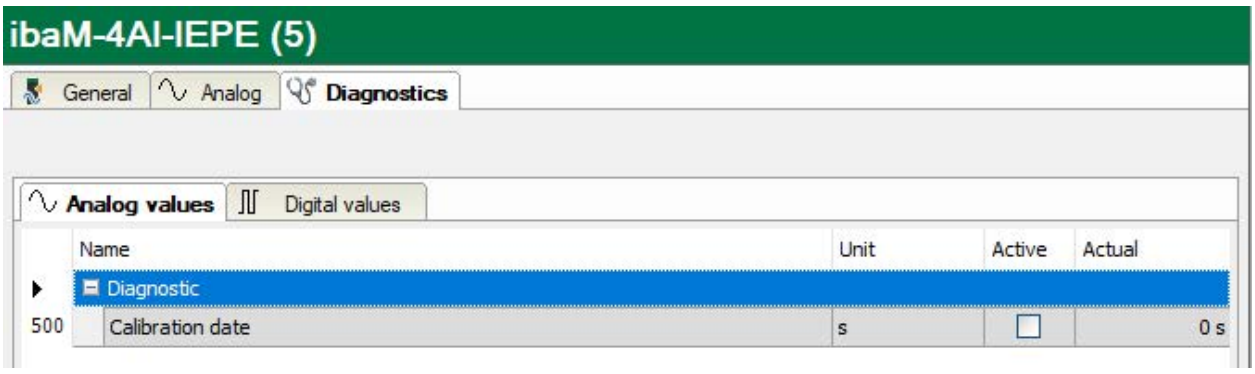
8.2.3 Diagnostics tab

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

Digital values



Analog values



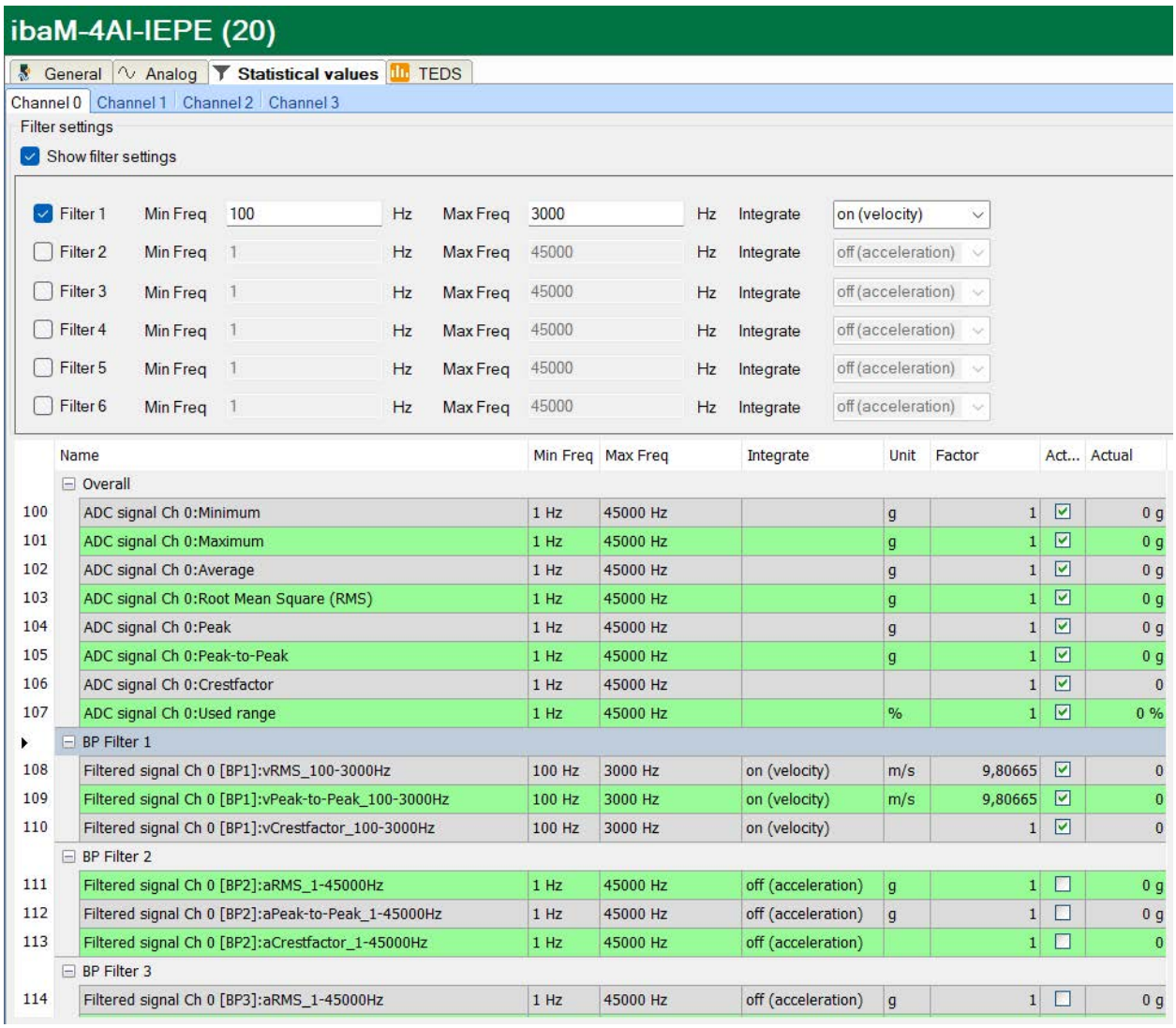
The meaning of the signals:

Name	Meaning
Hardware state	live bit to indicate the hardware status (1 Hz)
Error Ch x	hardware error in channel x
Channel x data valid	see chapter ↗ *Error signals and status signals*, page 25
Channel x shorted	
Channel x broken line	
Calibration date	32-bit value that represents the seconds since 1970. This number can be converted to text using a virtual signal: *ConvertUnixTimeToText()*

8.2.4 Statistical values tab

If you have enabled *Statistical values* in the *General* tab, the *Statistical values* tab appears. The calculated statistical values are available as signals in the *Statistical values* tab. See also chapter ↗ *Statistical values*, page 26.

The signals are grouped by channel in the *Channel 0* to *Channel 3* tabs and can be activated individually.



Filter settings
In the *Filter settings* section, you can enable the display of the filter settings for the bandpass filter. You can define 6 bandpass filters by entering the lower and upper limits of the frequency range. The bandwidth must be at least 50 Hz. You can also select the mode (velocity or acceleration).

A description of the bandpass-filtered characteristic values can be found in chapter ↗ *Statistical values*, page 26.

Name
The signal name is preset. It consists of the channel name and the statistical value. The frequency range is specified for signals with bandpass filters.

Min / Max Freq
Display of the lower or upper frequency.

Integrate
Off = acceleration values are output

On = velocity values are output

Unit
The unit can be selected using the drop-down list.

Factor
In IEPE mode, the value changes depending on the selected unit.

Active
You can enable/disable the signal here.

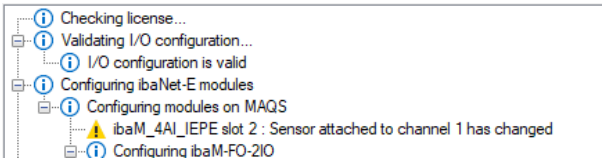
Actual
Display of the currently measured value.

You can display or hide additional columns using the context menu (right mouse click in the heading line).

8.2.5 TEDS tab

The *TEDS* tab displays the information from the TEDS.

If TEDS identification is enabled, *ibaPDA* checks whether the corresponding TEDS sensor is still connected each time data acquisition is started. If this is not the case, a message will be displayed during validation.



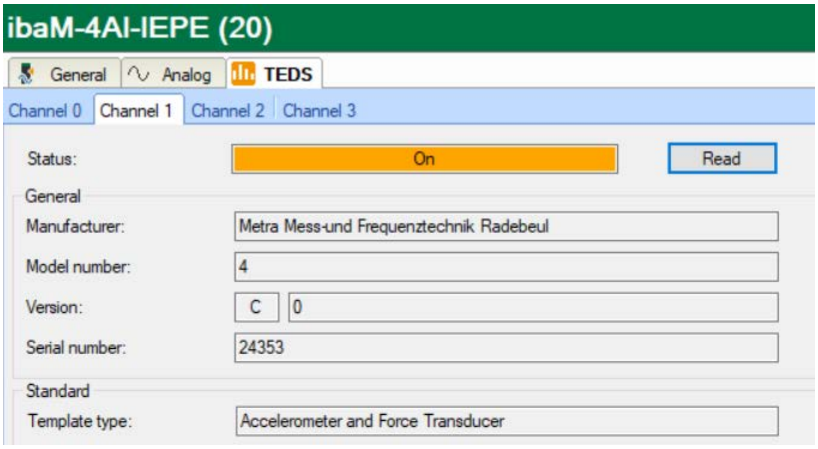
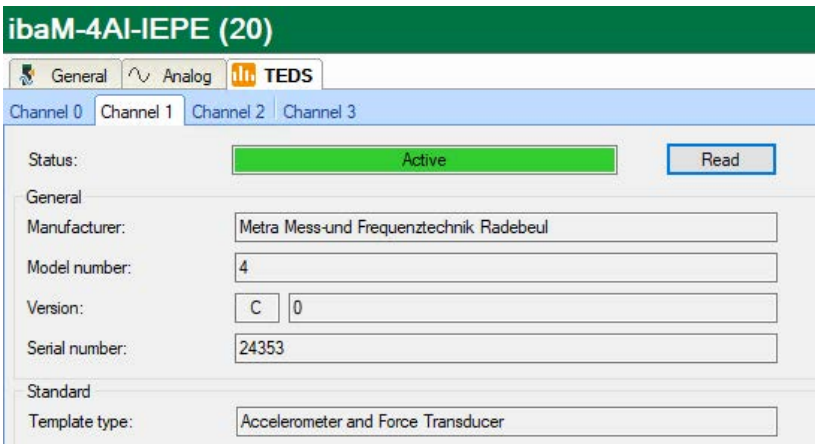
While data acquisition is in progress, it is not possible to read the sensor data manually.

The TEDS data is only read and compared. Data, especially calibration data, is not automatically transferred to the *ibaPDA* configuration.

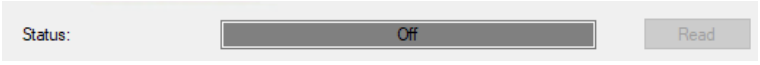
The display can change colors or show messages depending on different conditions:

- Selected mode for this channel
- Enabling TEDS identification
- Sensor with or without TEDS

Displays in IEPE mode

Display	Description
	Sensor without TEDS or no sensor connected TEDS identification not enabled
	Sensor without TEDS or no sensor connected TEDS identification enabled
	Sensor with TEDS connected TEDS identification not enabled Manual reading of TEDS information possible with <Read>
	Sensor with TEDS connected TEDS identification enabled Manual reading of TEDS information possible with <Read>

Display in 24V mode



8.3 Module information

For information on the individual modules connected to the IO bus, see the Info tab on the central unit.

Select the central processing unit module in the I/O Manager—either *ibaM-DAQ* or *ibaM-COM*—and choose the *Info* tab. In the *System information* section, you will find a table containing details such as module type, hardware version, calibration date, firmware version, serial number, and status.

Module	Type	Hardware version	Calibration date	Firmware version	Serial number	Status
0	ibaM-DAQ	A4	Not required	A05.002	000165	Error
1	ibaM-FO-2IO	A1	Not required	A01.005 ⚠	000105	OK
2	ibaM-FO-2IO	A1	Unknown ⚠	A01.006	000160	OK
3	ibaM-4AI-UI	A3	2025-06-25	A01.001	000110	OK
4	ibaM-4AI-600V-AC	A4	2024-02-21	A04.004	000116	OK
5	ibaM-4AI-600V-AC	A4	2024-02-20	A04.004	000111	Missing

Meaning of the following columns:

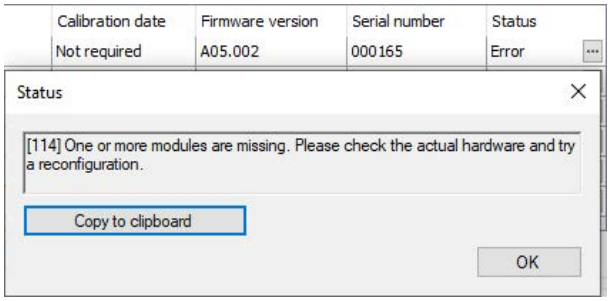
Calibration date
The following information can be displayed in the *Calibration date* column:

- Not required: The module does not need to be calibrated.
- Unknown: The state of the calibration cannot be determined.

  In this case, restart the device or the IO bus. If “Unknown” continues to be displayed, contact the iba support.
- YYYY-MM-DD: Date of last calibration (in year-month-day format)

Firmware version
If the firmware version of a module does not match the version included in the firmware package or if no firmware is included for this module in the firmware package, an exclamation mark appears.

Status
If an error is displayed here, click <...> to see information about the cause of the error.



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 and the function itself may be impaired.

This also applies to the permissible operating and environmental conditions.

Danger!



Permanent measuring voltage

The device is non-destructive for permanent measuring voltages up to 60 V DC.

The device can be destroyed at voltages from 60 V DC and device safety can no longer be guaranteed.

9.1 Main data

Short description

Product name	ibaM-4AI-IEPE
Module label	4AI-IEPE
Description	input module with 4 analog inputs for voltage measurements and IEPE sensors with modes switchable by channel
Order number	10.181020

Module-module interface

Number	2
Connection technology	4x 8 sliding contacts

Supply

Supply voltage	24 V DC via module-module interface
Power consumption (max.)	
Own consumption	0.19 A; incl. sensor supply
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 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, KC Safety: IEC 61010-1, IEC 61010-2-030, IEC 61000-6-5 interface range 4 Vibration: IEC 60068-2-6, IEC 60068-2-64, IEC 60068-2-27
Pollution degree	2
MTBF[1)]	2,661,404 hours / 303 years
Dimensions	
Width x height x depth	28 mm x 133 mm x 120 mm
Height with open lever	160 mm
Height unit	3
Installation clearances	
Top / bottom	30 mm / 30 mm
Left / right (system)	10 mm / 10 mm
Mounting position	vertical, lever up
Weight / incl. packaging/connector	0.24 kg / 0.50 kg

9.2 Analog inputs

Analog inputs

Number	4
Design	galvanically isolated, single ended; additionally 2x GND and 2x GND with 50 Ω

[1)] according to Telcordia Issue 4 (SR332) and Reliability Prediction Procedure of Electronic Equipment (Issue Mar. 2016)

Sampling method	parallel
Input signal	voltages up to 24 V DC / IEPE sensors; switchable per channel
Input modes	24V DC / 24V AC / IEPE 0.1Hz[2] / IEPE 1Hz; switchable per channel
Sensor supply in IEPE mode	+4 mA (24 V DC); integrated constant current source
Resolution	24 bit (Delta-Sigma)
ADC sampling rate	100 kHz
ibaPDA timebase (update time)	min. 10 µs; freely adjustable (integer multiple); max. 1 ms in case of filter signals[3]
Conversion time	not relevant; excluded during data acquisition
Filters	
ADC signal	
24V DC	
Analog	R/C low-pass, 1st order, 50 kHz
Digital	anti-aliasing filter (FIR), 84th order; cutoff frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate
24V AC	
Analog	R/C low-pass, 1st order, 50 kHz R/C high-pass, 1st order, 1 Hz
Digital	anti-aliasing filter (FIR), 84th order; cutoff frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate
IEPE 0.1Hz[4]	
Analog	R/C low-pass, 1st order, 50 kHz
Digital	R/C high-pass, 1st order, 0.1 Hz anti-aliasing filter (FIR), 84th order; cutoff frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate
IEPE 1Hz	
Analog	R/C low-pass, 1st order, 50 kHz
Digital	R/C high-pass, 1st order, 1 Hz anti-aliasing filter (FIR), 84th order; cutoff frequency = 0.45 x ADC sampling rate; oversampling = 32 x ADC sampling rate

[2] In IEPE 0.1Hz mode, a system-related DC offset occurs in the measured signal due to the 1st order digital R/C high-pass filter with a cutoff frequency of 0.1 Hz.

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

[4] In IEPE 0.1Hz mode, a system-related DC offset occurs in the measured signal due to the 1st order digital R/C high-pass filter with a cutoff frequency of 0.1 Hz.

Filter signal[5]	
24V DC/AC / IEPE 0.1Hz[6]/1Hz	
Like ADC signal, in addition	
Digital	anti-aliasing filter (Elliptic/Cauer), 10th order; cutoff frequency = 0.45 / timebase; or anti-aliasing filter (Butterworth), 2nd order; cutoff frequency = 0.45 / timebase; switchable
Measuring ranges	
24V DC/AC	±24 V
IEPE 0.1Hz/1Hz	±10 V (at ~160 Hz and BIAS voltage ~12 V DC)
Input gain IEPE	none
Input resistance 24V DC/AC	
Device switched off	1.0 MΩ
Device switched on	1.1 MΩ
Input capacity	107 pF
Accuracy (+25 °C)	
24V DC	< 0.1 % of the double full scale value
24V AC	< 2 % of the double full scale value
IEPE 0.1Hz/1Hz	< 0.1 % of the double full scale value
Electrical isolation	
Channel - channel	functional isolation: 2.5 kV AC
Channel - system	functional isolation: 2.5 kV AC
Connection technology	2x 6-pin pin header, pitch 5 mm
Connector	2x included in delivery; 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 ↗ *Connector connection technology*, page 18; Order number: 52.000052
Sensor cable length	The maximum length of the sensor cable depends on various factors, including the configured sampling rate. For the corresponding calculation formula, see chapter ↗ *Connector connection technology*, page 18.

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

[6] In IEPE 0.1Hz mode, a system-related DC offset occurs in the measured signal due to the 1st order digital R/C high-pass filter with a cutoff frequency of 0.1 Hz.

Status functions

Input modes	
24V DC/AC	data valid
IEPE 0.1Hz/1Hz	data valid, broken line, short circuit

Additional functions

Statistical values	
Input modes	24V DC/AC / IEPE 0.1Hz/1Hz
Calculation basis	
Interval	10 ms … 5000 ms, freely adjustable (in 1 ms steps)
Calculation	in blocks
Signal	ADC signal
Sampling	ADC sampling rate
General characteristic values	
Characteristic values	Min, Max, Avg, Peak, Peak-to-Peak, RMS, Crestfactor, used range
Bandpass-filtered characteristic values	
Number	6 bandpass filters per channel; each freely adjustable
Bandpass filter	Butterworth, 4th order
Bandwidth (min.)	50 Hz
Characteristic values	
24V DC/AC	RMS, Peak-to-Peak, Crestfactor; can be integrated
IEPE 0.1Hz/1Hz	vRMS, vPeak-to-Peak, vCrestfactor or aRMS, aPeak-to-Peak, aCrestfactor; switchable
TEDS (according to IEEE-1451)	
Design	0-wire
Supported EEPROMs	DS2430A, DS2431

9.3 Declaration of conformity

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

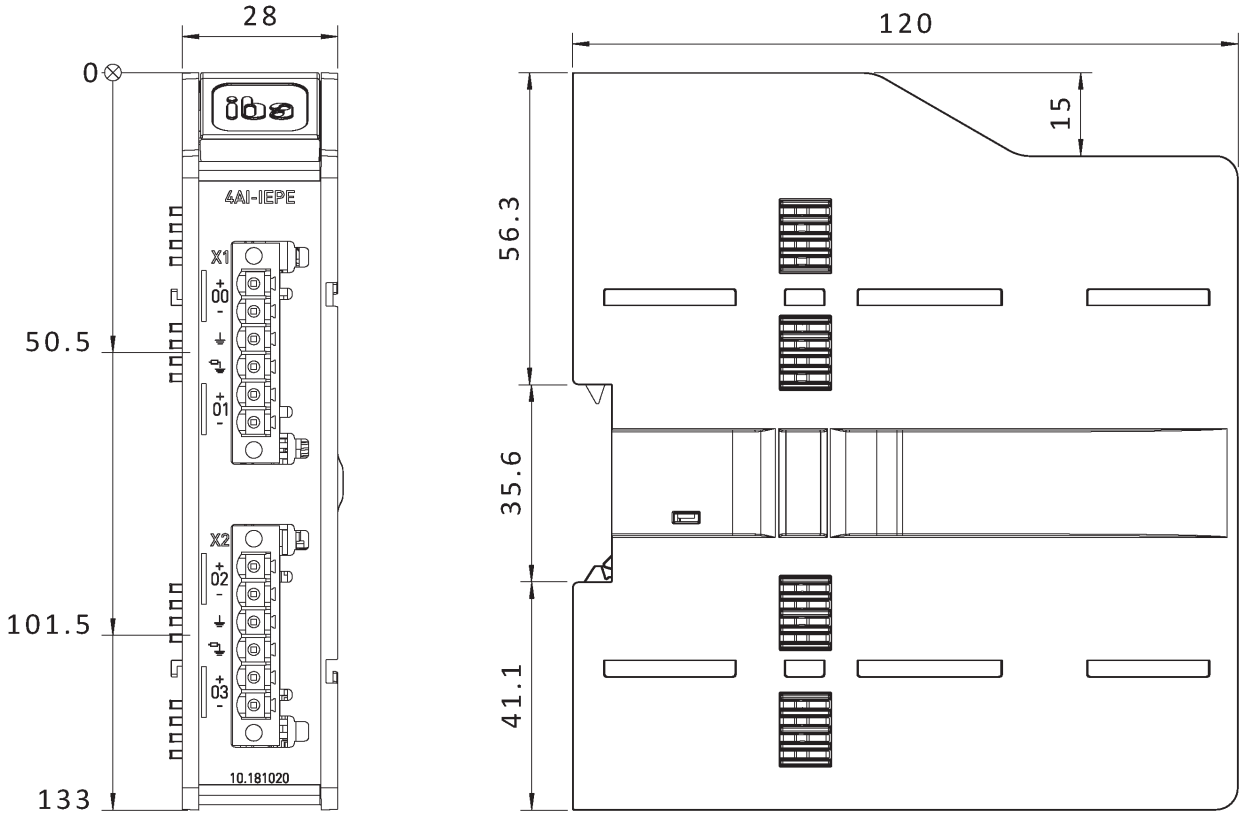
Unique Identifier:
10.181020 ibaM-4AI-IEPE

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.

9.4 Dimensions



ibaM-4AI-IEPE dimensions, in mm

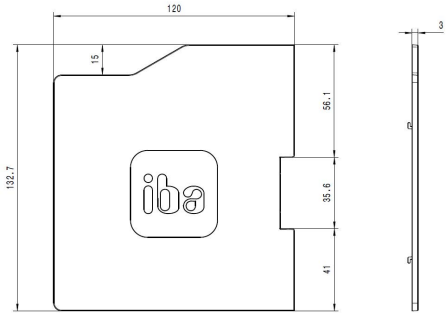
10 Accessories

Connector for analog inputs



Short description	
Name	6-Pin Terminal Block MAQS-IO RM5.00 Push-In LR
Description	6-pin female header/connector for analog inputs, push-in, lockable
Order number	52.000052

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.

Product Security Incident Response Team (PSIRT)

Current advisories: www.iba-ag.com/en/security

Email: psirt@iba-ag.com

Contact

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Regional and worldwide

For contact data of your regional iba office or representative
please refer to our website:

www.iba-ag.com