

ibaMAQS

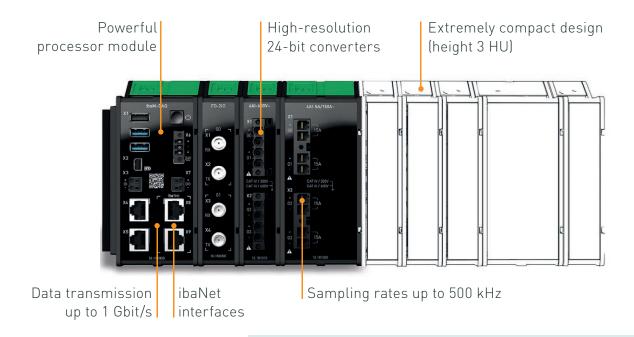
Modular measurement system – Acquire and analyze signals synchronously and precisely



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Precise acquisition of processes with the innovative measurement system ibaMAQS

With the ibaMAQS modular system, iba has raised the bar in the field of measurement technology. This flexible system enables user-specific solutions and is both scalable and perfectly tuned for demanding tasks. It impresses with extremely easy handling, 24-bit resolution, calibrated A/D converters, individual electrical isolation per channel and fast, synchronous data acquisition.



At a glance

- > Modular system for the acquisition and processing of measurement signals
- > Deterministic acquisition of different data types, such as sensor, machine, vibration, energy data, etc.
- > Decentralized, local and synchronous data acquisition
- High-precision synchronization with ibaNet
- > Suitable for direct acquisition from machines
- > Quick module change, DIN-rail mounting
- > In the final state, a wide range of modules can be combined as required
- > Data transfer over Ethernet with standard network components

Maximum flexibility for diverse applications



Modular concept

The ibaMAQS modular measurement system can be perfectly adapted to the requirements of different measurement applications. The system offers the greatest possible flexibility coupled with exceptional technical innovations.

One processor module 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.

At the same time, the system can be flexibly extended at any time as requirements grow. The scalable system thus offers a high level of investment security and meets the most challenging requirements.

Universal processor module that can be used as an edge device

The ibaM-DAQ processor module is an extremely compact ibaPDA system that can function as a stand-alone device. Thanks to its compact design, ibaM-DAQ is ideal for use close to the process or plant – and wherever

only limited space is available. In addition to the synchronous acquisition and storage of the measurement data, ibaM-DAQ is able to aggregate the data and calculate characteristic values on-board. These characteristic values can also be stored locally or forwarded to other systems. Thanks to the numerous network interfaces, ibaM-DAQ can be integrated into any IT structures.

Technology-specific solutions can be realized in combination with other iba applications, such as ibalnSpectra or ibalnCycle, whereby ibaM-DAQ assumes an important role as an edge device. For detailed information, please refer to page 10.

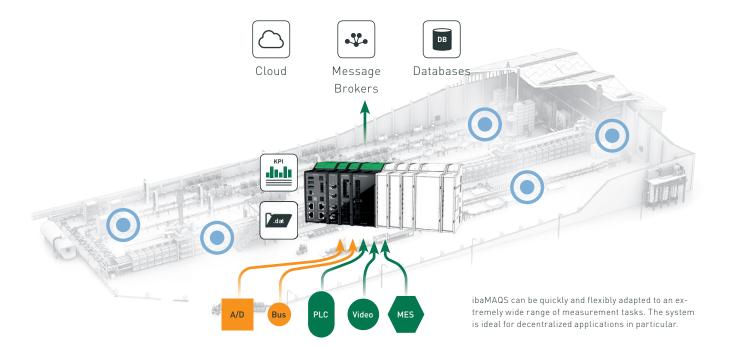
With the ibaM-F0-210 interface module you can couple additional iba devices via fiber optics and thus continue to integrate your existing iba systems. The 32Mbit Flex and 32Mbit ibaNet protocols are supported.

Deterministic, highly synchronous data acquisition

A significant advantage of the ibaMAQ system is the deterministic and highly synchronous measurement data acquisition of the different signal sources. The interface module ibaM-F0-2I0 acts as internal clock generator and thus ensures a highly precise acquisition of measurement data.

Typical use cases

- ➤ Decentralized measurement data acquisition for local applications, e.g., test stands, injection molding machines, small plants, etc.
- ➤ Measurements on mobile equipment, e.g., cranes, special vehicles, etc.
- Measurement applications in electrical power engineering:
 TFR, PQU
- > NVH measurement
- > Vibration analysis
- > Coupling of highly dynamic sensor data



Synchronous acquisition is not only possible via fiber optics, but also via Ethernet with the ibaNet protocol ibaNet-E. If the ibaNet-E devices are then connected via the ibaNet interfaces, highly synchronous data acquisition is possible, which is required for example for fast TFR applications and applications in the energy sector.

Specific modules extend the scope of functions

In the course of the expansion of ibaMAQS, additional I/O modules, bus sniffers as well as special technology modules will be added step by step, which will continuously extend the system's application spectrum.

Communication module for standard applications

The ibaM-COM communication module is available for applications which do not require local measured value processing and recording. It is used instead of the processor module and allows to transmit decentrally acquired measured values to central ibaPDA sys-

tems deterministically in time via Ethernet (ibaNet-E). Several decentralized systems can be acquired synchronously with a common sampling frequency.

An output from a central ibaPDA system via decentralized distributed I/O systems is also possible. The configuration is performed uniformly from the central ibaPDA system (pluq and play).

When using the communication module, no processor module is required.

Wide range of modules

The I/O modules of the system will cover all important signal types in the final state, such as analog and digital inputs and outputs, counter inputs and vibration signals. Special modules for acquiring measurements from current and voltage transformers are available for medium and high-voltage technology applications.

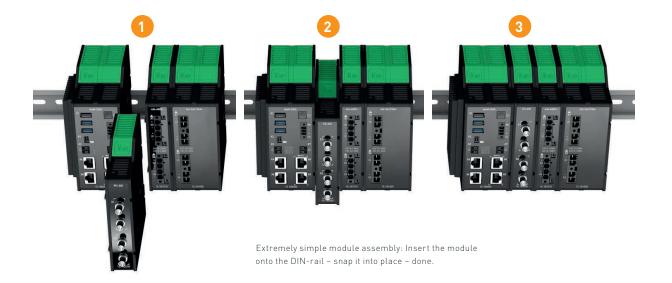
The number of measuring channels per module is deliberately kept small to ensure optimum scalability.

Data exchange in all directions

In addition to the hardware modules, ibaMAQS offers a wide range of Ethernet-based communication protocols for use with the ibaM-DAQ processor module. Thanks to the integrated ibaPDA software, both ibaNet and standard Ethernet interfaces are available.

Using a variety of different protocols, the latter enable data exchange with most PLC and automation systems as well as with a number of databases, cloud providers and message brokers. ibaM-DAQ can both send and receive data. Standard protocols such as OPC DA, OPC UA, SNMP, TCP, UDP, MQTT and other cloud interfaces cover virtually all requirements.

Special protocols, such as IEC 61850 for intelligent protection devices in power engineering, enable data acquisition in industry-specific systems. Manufacturer-specific protocols are also available for communication with selected measurement systems, e.g., temperature scanners, 3D scanners, etc.



High-precision acquisition

With a resolution of 24 bits for A/D conversion, the I/O modules are also equipped for very demanding measurement tasks. In addition, the modules offer calibrated A/D converters and galvanically isolated channels. All channels are sampled in parallel and synchronously; the sampling rate can be freely set up to 500 kS/s for some modules.

For more information on the modules, see page 15.

Smart mechanics

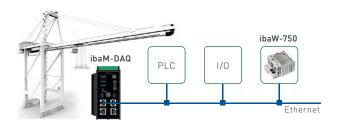
ibaMAQS combines high functionality with an innovative mechanical concept in an extremely compact design. During development, the focus was on ensuring easy handling and quick mounting or replacement of the modules.

The modules are simply plugged onto a DIN-rail and are immediately mechanically and electronically connected thanks to the innovative module connection technology. The integrated lever can be used to release the connection again and to remove or replace the module.

The order of the modules does not matter. The only requirement is that one processor or communication module must always be located on the left at the start of each row – it really couldn't be simpler. Easy assignment and readability of the channels is ensured thanks to the clear labeling as well as the status and diagnostic displays. Depending on the module, errors such as broken wire or short circuit are also displayed.

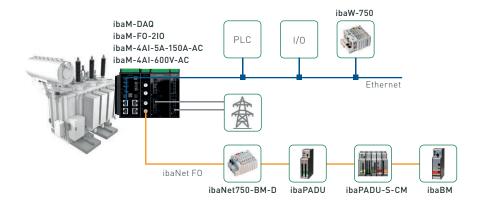


Application examples



Data acquisition on mobile plants

- Applications with Ethernet-based I/Os
- Standard Ethernet protocols
- ibaNet-E
- Use of existing network infrastructure
- Direct access to different control systems
- Connection to the WAGO 750 I/O system via ibaW-750
- > Internal recording and KPI calculation
- Applications in cranes, locomotives, specialpurpose vehicles

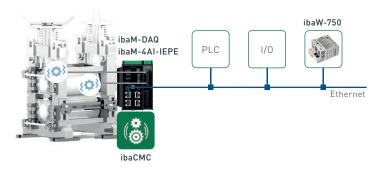


Local acquisition of fast signals

- Applications with Ethernet-based I/Os as above
- ➤ Sampling rates of up to 500 kHz with voltage and current modules in power monitoring applications
- ➤ Connection of existing iba devices by means of ibaM-F0-2IO via ibaNet FO with the 32Mbit and

32Mbit Flex protocols

- ➤ Sampling rates of up to 100 kHz via FO, depending on the iba device
- ➤ Applications on test benches, special-purpose machines, in the energy sector, etc.



Condition Monitoring with ibaCMC

- → Applications with Ethernet-based I/Os as above
- Synchronous recording of vibration and process
- Sampling rates up to 100 kHz from vibration sensors
- Integrated calculation of condition monitoring parameters
- Condition Monitoring Center ibaCMC for configuration, long-term trending, alarming and automated reports

ibaNet-E – the deterministic protocol for isochronous acquisition



For data acquisition over Ethernet, iba has specially developed the ibaNet-E transmission protocol. It enables fast, efficient and deterministic communication between the acquisition computer and other components involved.

You can use your cost-effective standard Ethernet cabling and standard network infrastructure for data communication. Complex, special fiber-optic cabling is no longer required with the new system.

With ibaNet-E, different applications can be realized, such as data acquisition from multiple data sources and distribution of the data to different acquisition systems to create redundancy. Multiple connections per device with different sampling rates enable the simultaneous connection of different acquisition systems; for example, at the production and control level.

ibaNet-E at a glance

- Automatic device detection
- > Module configuration via ibaPDA
- > Deterministic transmission of measurement data
- > Use of the (existing) Ethernet infrastructure
- > Scalable in terms of cost and performance
- > Transmission of buffered data
- Synchronized sampling; (relative) time synchronization of ibaPDA over Ethernet
- Support of virtual machines

Fast transmission

The transfer rate over Ethernet is significantly higher than via ibaNet fiber optics, which max out at 32 Mbit/s. Up to 750 Mbit/s data throughput can be achieved in a dedicated ibaNet network.

ibaNet-E supports two deterministic acquisitions. Synchronous sampling up to 1 ms is possible with ibaNet-E using standard components, and up to 1 µs with a dedicated ibaNet-E network using the ibaN-2E interface card. Information on the ibaN-2E card can be found on page 24.

Integration in ibaPDA

You can conveniently configure the system in the ibaPDA software – either at the processor module itself or at a network computer. A novel device-search feature enables automatic detection if the device is located in the same LAN as the ibaPDA computer.

ibaPDA synchronizes all devices connected to it with an accuracy of up to one microsecond, thus enabling isochronous measurement of several decentralized, distributed I/O systems over Ethernet.

Diverse range of modules

The ibaMAQS system offers a wide range of different modules to meet the requirements of a broad range of applications.

The following modules are already available: ibaM-DAQ, ibaM-COM, ibaM-FO-2IO and the I/O modules ibaM-4AI-5A-150A-AC, ibaM-4AI-600V-AC, ibaM-4AI-

150V-C and ibaM-4AI-IEPE. Subsequently, additional I/O modules as well as interface and technology modules are scheduled.



The modules at a glance

Processor, communication module	I/O modules	Infrastructure
ibaM-DAQibaM-COM	 ibaM-4AI-5A-150A-AC ibaM-4AI-600V-AC ibaM-4AI-150V-AC ibaM-4AI-IEPE ibaM-4AI-UI ibaM-8DI ibaM-2DI-CNT ibaM-8DO ibaM-4AO 	➤ ibaM-F0-2I0 ➤ ibaN-2E
(available, planned)	A analog O output D digital UI voltage/curren I input CNT counter	t

ibaM-DAQ

- > Intelligent processor module for stand-alone data acquisition
- Local data acquisition with full ibaPDA functionality
- > Data storage in the device
- > Data transfer over Ethernet
- > Extremely compact design for on-site installation
- > Extensive process and output connectivity
- > Automatic calculation of meaningful KPIs within the device
- > ibaPDA basic license for 64 signals included, upgrade possible



High-precision measurement – autonomous and flexible

The ibaM-DAQ processor module offers an integrated ibaPDA system, a powerful CPU and hard disk for storing the measurement data, as well as two interfaces each for standard Ethernet and ibaNet-E.

With its independent 1 Gbit/s Ethernet interfaces, ibaM-DAQ can be connected to two independent networks. This allows ibaM-DAQ, for example, to connect to the IT business networkand the PLC network. ibaNet-E-capable devices can be integrated via the ibaNet interfaces, separate from the standard Ethernet.

Operation and configuration as on the PC

A monitor, mouse, and keyboard can be connected to ibaM-DAQ and can be operated as conveniently as an ibaPDA system running on a PC. Moreover, they can also be operated from an ibaPDA client connected via the network.

Users can easily configure their measuring task in the software – and can use the full scope of ibaPDA functions. The data recording can start automatically with the acquisition or be controlled by trigger signals.

Data storage in the device

An internal SSD provides local storage for recorded data. If required, disk space can be expanded by connecting an external hard drive to the USB interface or to a NAS. Recorded data can be transferred via a network connection and can be further processed and analyzed with the license-free ibaAnalyzer software – independently of ibaM-DAQ.

Time synchronization

For global time synchronization, all time sources supported by ibaPDA (DCF77, PTP) as well as NTP can be used. The time is buffered by means of an internal battery.

Monitoring and alarm

A digital input and output are available on the processor module. The latter can be configured as an alarm output, for example. The input can be used to initiate a safe shutdown of the device, for example, from a back-up battery digital signal.

Use of additional iba devices via fiber optics

The ibaM-F0-210 module offers the functionality of the proven ibaF0B-io boards and supports the 32Mbit Flex and 32Mbit ibaNet protocols. If corresponding iba devices are already available or if no suitable ibaMAQS modules are available for certain tasks, then devices like the ibaPADU family, iba bus monitors or system interfaces can be connected to ibaMAQS via the ibaM-FO-210.

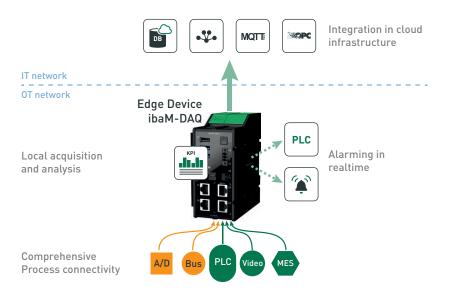
Licenses included

ibaM-DAQ is available with an ibaPDA basic license for up to 64 signals and two data stores.

In addition, ibaM-DAQ includes further licenses. With the license ibaPDA-Interface-PLC-Xplorer, ibaM-DAQ has direct access to different PLC systems. The access to the PLC systems is established via standard interfaces of the systems without additional hardware for measured value acquisition.

The ibaPDA-OPC-UAServer+ license allows you to operate the OPC UA server integrated in the ibaPDA system, making all signals configured in ibaPDA available to other systems.

With the included ibaPDA-Data-Store-MQTT-16 license, signal data can be streamed to an MQTT broker.



Collect data on the edge device, process it autonomously and automatically

ibaM-DAQ as edge device

In the course of digitalization, automation or operational technology (OT) and information technology (IT) are increasingly converging. ibaM-DAQ can play an important role as an edge device.

The device acts as an interface between hardware-oriented acquisition in the OT sector and the processing and analysis function in the IT sector.

For superordinate systems, the data is also permanently available and traceable in the form of high-resolution raw data and/or aggregated characteristic values.

All software tools needed for these tasks are available with ibaPDA and ibaAnalyzer in the device.

Free analysis included

For the evaluation of the measurement data, the free analysis tool ibaAnalyzer¹ can run directly on the ibaM-DAQ device or be used on a separate computer.

User-specific characteristics

Once the evaluation requirements have been defined, the analysis rule can be saved and reused at any time. Analyses can also be started and performed automatically. Characteristic values, so-called KPIs, can be calculated automatically and on a user-specific basis from the high-resolution data. During the following analysis, a drill-down to the raw data is possible at any time in order to enable a root cause analysis in case of any deviations.

Connect to a database with ibaAnalyzer-DB

If the data needs to be processed in a database, measurement data can be loaded into a database with ibaAnalyzer-DB. It is also possible to analyze data from a database with this application. The main database formats are supported, like Microsoft SQL-Server, Oracle, IBM DB2-UDB, MySQL, PostgreSQL, Microsoft Access.

Direct writing to databases/clouds

Time-based data can also be written directly from ibaPDA to databases/clouds. For this purpose, special data stores subject to licensing are available. Currently, ibaPDA supports interfaces to SAP HANA database/cloud, Oracle, SQL Server, Azure SQL, MySQL, MariaDB, PostgreSQL, Apache Kafka, MQTT as well as Siemens MindSphere.

Integration in SNMP monitoring

The ibaM-DAQ device can be integrated into a company-wide network management system via the SNMP interface (Simple Network Management Protocol) in ibaPDA. In this case, ibaPDA acts as an SNMP server and supports the SNMP protocols V1, V2c and V3.

Diagnostic information about the status of the ibaPDA system can be used in the SNMP server with the base license. If you wish to publish any acquired data in the SNMP server, the ibaPDA-SNMP-Server+ license is required.

¹¹

Technical data ibaM-DAQ

Short description	
Name	ibaM-DAQ
Module label	ibaM-DAQ
Description	processor module for stand-alone data acquisition
Order number	10.180000
Processor unit	
Processor	Intel Atom x7-E3950 4x 1.6 GHz (2.0 GHz boost)
Operating system	Windows 10 IoT Enterprise x64 LTSC 2021/v21H2 (Long-Term Servicing Version)
Main memory	8 GB
Flash memory	solid state drive 512 GB
Clock	buffered by battery, (3 V, lithium BR2032)
Module-module inte	rface
Number	1
Connection technol.	2x 8 sliding contacts
No. of modules	15
Bandwidth	1 Gbit/s; together with ibaNet and I/O interfaces
Ethernet interface	
Number	2
Connection technology	2 RJ45 socket; 1GbE, Base-T
ibaNet interface	
Number	2
Design	Copper
Protocol	ibaNet-E
Bandwidth	1 Gbit/s; together with module-module and I/O interfaces
Connection technology	2 RJ45 socket; 1GbE, Base-T, switched
Cable length (P2P)	max. 100 m
Cable type	min. Cat.6a, S/FTP
I/O interface	
Digital input	
Number	1
Design	malus missellus is a late of masterate of
Design	galvanically isolated, protected against reverse polarity, single ended
Input signal	
J	against reverse polarity, single ended
Input signal	against reverse polarity, single ended 24 V DC
Input signal Max. input voltage	against reverse polarity, single ended 24 V DC ±60 V permanent
Input signal Max. input voltage Signal level log. 0	against reverse polarity, single ended 24 V DC ±60 V permanent > -6 V; < +6 V
Input signal Max. input voltage Signal level log. 0 Signal level log. 1 Hysteresis	against reverse polarity, single ended 24 V DC ±60 V permanent > -6 V; < +6 V < -10 V; > +10 V none
Input signal Max. input voltage Signal level log. 0 Signal level log. 1	against reverse polarity, single ended 24 V DC ±60 V permanent > -6 V; < +6 V < -10 V; > +10 V none 1 mA, constant
Input signal Max. input voltage Signal level log. 0 Signal level log. 1 Hysteresis Input current	against reverse polarity, single ended 24 V DC ±60 V permanent > -6 V; < +6 V < -10 V; > +10 V none

Electrical isolation	
Channel - system	functional isolation: 1 kV AC
Connection technology	2-pin socket, push-in, pitch 5 mm, conductor max. 1.5 mm ²
Additional function	shutdown
Digital output	
Number	1
Design	galvanically isolated; solid-state DC switch
Switching voltage max.	200 V DC; protection against surge voltages
Switching current max.	350 mA (permanent), overcurrent protection
Switching delay	< 2 ms (at 100 mA)
OFF resistance (log. 0)	> 100 MΩ
ON resistance (log. 1)	$<$ 3,75 Ω (at 100 mA)
Electrical isolation	
Channel - system	functional isolation: 1 kV AC
Connection technology	2-pin socket, push-in, pitch 5 mm, conductor max. 1.5 mm ²
Supply	
Power supply	24 V DC SELV; 4 A; UPS recommended
Voltage range	21.6 V 26.4 V DC
Current consumptio	n (max.)
ibaM-DAQ stand-alone	0.7 A
ibaM-DAQ with modules	4 A
Electrical isolation	
Supply - system	none
Connection technology	3-pin multi-pin connector, pitch 3.81 mm
Connector	included in delivery; push-in, conductor max. 1.5 mm², protected against reverse polarity, screw connection
Further interfaces, o	perating and indicating elements
Indicators	LEDs for operation, channel states and errors
Switch	1 momentary switch for ON/OFF
Graphics	1 Mini-DisplayPort (4K/UHD)
USB	3 (1x USB 2.0; 2x USB 3.0)
Operating and enviro	onmental 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 Cooling	DIN rail according to EN 50022 (TS 35, DIN Rail 35)

12 available in a later firmware version

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
Certifications / standards	CE, C-Tick, UKCA, FCC, KC, IEC 61010-1, IEC 61000-6-5 interface range 4
Pollution degree	2
MTBF ³ (+25 °C)	317,489 hours / 36 years
Dimensions	
w x h x d	69 mm x 133 mm x 120 mm
Height, lever open	160 mm
Height, lever open Height units	160 mm 3

Installation clearances		
top / bottom	30 mm / 30 mm	
left / right (system)	10 mm / 10 mm	
Mounting position	vertical, lever up	
Weight / incl. pack- aging	0.55 kg / 0.78 kg	
Licenses		
Design	WIBU CmDongle (USB; internal)	
ibaPDA	ibaPDA-64 with 2 data stores ibaPDA-Interface-PLC-Xplorer ibaPDA-0PC-UA-Server+ ibaPDA-Data-Store-MQTT-16	

ibaM-COM

- > Communication module for the ibaMAQS modular system
- Data acquisition with ibaPDA
- > Data transfer over Ethernet / ibaNet-E



The ibaM-COM communication module can be used as an alternative to the ibaM-DAQ processor module to build up a module set. In contrast to ibaM-DAQ, ibaM-COM does not offer an integrated ibaPDA system. The module is designed for applications that do not require local measured value processing and recording as with ibaM-DAQ.

ibaM-COM allows the transmission of decentrally acquired measured values via Ethernet to a central ibaPDA system.

ibaPDA systems with widely branched I/O peripherals can be built up in this way. In addition to measurement data acquisition, ibaM-COM is also used for communication in the output direction as well as for configuration of

the individual modules with the ibaPDAI/O-Manager. Thanks to the two ibaNet connections, the iba network can be extended from module node to module node.

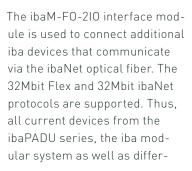
Since the communication via ibaNet-E also uses a computer's standard network interface, I/O, bus and technological modules can also be used by a virtual ibaPDA server.

Short description	
Name	ibaM-COM
Module label	ibaM-COM
Description	communication module for the ibaMAQS modular system
Order number	10.180010
Module-module inte	rface
Number	1
Connection technology	2x 8 sliding contacts
No. of modules	15
ibaNet interface	
Number	2
Design	copper
Protocol	ibaNet-E
Connection technology	2 RJ45 socket; 1GbE, Base-T, switched
Cable length (P2P)	max. 100 m
Cable type	min. Cat.6a, S/FTP
Supply	
Power supply	24 V DC SELV; 4 A; external buffer module recommended
Voltage range	21.6 V 26.4 V DC
Power consumption	(max.)
ibaM-COM	0,18 A
ibaM-COM with modules	4 A
Electrical isolation	
Supply - system	none

Connection technology	3-pin multi-pin connector, pitch 3.81 mm
Connector	included in delivery; push-in, conductor max. 1.5 mm², protected against reverse polarity, screw connection
Further interfaces, o	perating and indicating elements
Indicators	LEDs for operation and errors
Operating and enviro	onmental 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	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
Certifications / standards	CE, C-Tick, UKCA, FCC, IEC 61010-1, IEC 61000-6-5 interface range 4
Pollution degree	2
Dimensions	
w x h x d	28 mm x 133 mm x 120 mm
Height, lever open	160 mm
Height units	3
Installation clearance	es
top / bottom	30 mm / 30 mm
left / right (system)	10 mm / 10 mm
Mounting position	vertical, lever up
Weight / incl. packaging	0.25 kg / 0.55 kg

ibaM-F0-210

- > Interface module for ibaNet 32Mbit
- > Connection of classic iba devices via fiber optics
- > Supports the 32Mbit Flex and 32Mbit ibaNet protocols
- 2 independent fiber optic interfaces with one input and one output each
- > Different sampling rates can be set per interface



ent bus modules (ibaBM-DP, ibaBM-PN, etc.) can be connected to ibaMAQS. Users who already have these iba devices can integrate them into a new ibaMAQS.

Even older devices that still use the 3Mbit protocol can be used with the help of an ibaBM-COL-8i-o data concentrator.



This allows an ibaPDA system to be connected to a multitude of I/O devices that are not yet available as ibaMAQS modules.

The combination of ibaM-F0-2IO and ibaM-COM can be used to connect iba devices to virtual ibaPDA servers or to convert from fiber optic to Ethernet.

Short description	
Name	ibaM-F0-2I0
Module label	F0-2I0
Description	fiber optic interface module for ibaNet 32Mbit
Order number	10.182000
Module-module inte	rface
Number	2
Connection technol.	4x 8 sliding contacts
ibaNet interface	
Number	2
Design	optical fiber
Protocol	ibaNet 32Mbit Flex (bidirectional) ibaNet 32Mbit (fixed)
Data transfer rate	32 Mbit/s
Sampling rate	max. 100 kHz, freely adjustable, determined by partner
Connection tech- nology	$2x\ 2$ ST-connectors each for RX and TX; iba recommends the use of FO with multimode fibers of type 50/125 μm or $62.5/125\ \mu m$; cable length up to 2000 m possible without amplifier, depending on transmitter, receiver, FO and environment.
Transmitting interfac	e (TX)
Output power	50/125 μm F0 cable: -19.8 dBm to -12.8 dBm
	62.5/125 µm F0 cable: -16 dBm to -9 dBm
	100/140 µm FO cable: -12.5 dBm to -5.5 dBm
	200 μm F0 cable: -8.5 dBm to -1.5 dBm
Temperature range	-13 °F to 185 °F (-40 °C to +85 °C)
Light wavelength	850 nm
Laser class	class 1

Receiving interface (RX)		
Sensitivity ⁴	100/140 μm FO cable: -24 dBm to -10 dBm	
Temperature range	-13 °F to 185 °F (-40 °C to +85 °C)	
Supply		
Supply voltage	24 V DC via module-module interface	
Current consumption	n (max.)	
Own consumption		
Input/output current	4 A	
Other interfaces, op	erating and indicating elements	
Indicators	LEDs for operation and errors	
Operating and envir	onmental 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	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	
Certifications / standards	CE, C-Tick, UKCA, FCC, KC, IEC 61010-1, IEC 61000-6-5 interface range 4	
Pollution degree	2	
MTBF ⁵ (+25 °C)	1,659,212 hours / 189 years	
Dimensions		
w x h x d	28 mm x 133 mm x 131 mm	
Height, lever open	160 mm	
height units	3	
Installation clearanc	es	
top / bottom	30 mm / 30 mm	
left / right (system)	10 mm / 10 mm	
Mounting position	vertical, lever up	
Weight / incl. pack.	0.24 kg / 0.47 kg	

⁴ data for other FO cable diameters not specified

⁵ according to: Telcordia 4 SR332 (Reliability Prediction Procedure of Electronic Equipment; Issue Mar. 2016) and NPRD (Non-electronic Parts Reliability Data 2011)

The I/O modules

In the ibaMAQS system, up to 15 I/O modules can be combined as desired. The modules are suitable for high-resolution measurement applications with very fast sampling rates, in some cases up to 500 kHz. The signals from all I/O modules are acquired synchronously with the sampling clock.

The I/O modules do not require their own voltage 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.

Analog input modules

The analog input modules feature galvanically isolated, single-ended channels. Each channel is equipped with a high-resolution, calibrated 24-bit delta-sigma A/D converter.

All analog input modules have different input filters to eliminate noise and interfering signals. A first-order analog R/C low pass filter and a digital anti-aliasing filter (FIR) are permanently active. In addition, another digital anti-aliasing filter can be switched on.

The analog current and voltage modules are additionally able to measure the grid frequency per

channel. Frequencies between 10 Hz and 80 Hz are supported. In addition to the actual measured values, the grid frequency signals are available as separate signals in the signal tree in ibaPDA. They can be displayed, recorded and used for further calculations like any other signal.

Modules for applications in the energy sector

The modules ibaM-4AI-5A-150A-AC, ibaM-4AI-600V-AC and ibaM-4AI-150V-AC are designed for power-monitoring applications and support a max. sampling rate of 500 kHz. The ibaM-4AI-150V-AC module has one and the ibaM-4AI-600V-AC module has two measuring ranges, which can be changed manually by the user during configuration. The ibaM-4AI-5A-150A-AC module offers a nominal range of 5 A, but can also measure and display currents in overload up to 150 A.

I/O module with variable input ranges

The ibaM-4AI-UI analog input module processes both current and voltage signals in different ranges. The ranges for the current and voltage measurements can be configured in ibaPDA.

Special features of the IEPE module

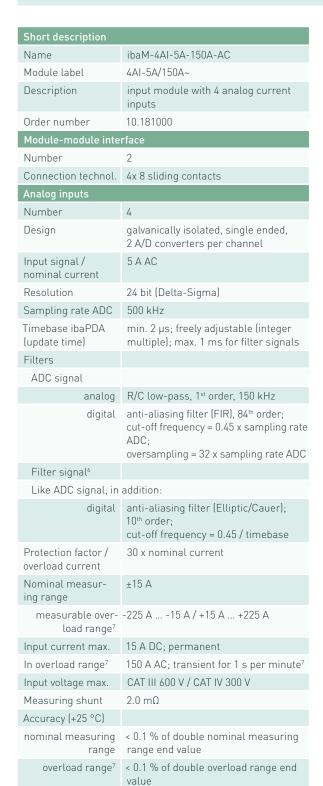
The IEPE module is designed for the acquisition of mechanical vibrations with IEPE vibration sensors in the fields of wind turbines, condition monitoring, test stands, bearing monitoring, etc. For the analog inputs, different input modes can be set in ibaPDA per channel: IEPE input (±10 V) with 1 Hz or 0.1 Hz high pass filter, 24 V AC input (AI), 24 V DC input (AI).

The module uses an R/C high pass filter, an analog anti-aliasing Butterworth filter and a digital anti-aliasing filter, which are permanently switched on.

The module features broken wire detection for the connected sensors and also indicates if no IEPE sensor is connected. In addition, a short circuit is detected and indicated via an LED.

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

- > Input module with 4 analog current inputs
- > Use in power generation and distribution
- > General current measurement
- > Grid frequency measurement





	1 (true
Electrical isolation	
Channel - channel	Basic insulation: CAT III 600 V
Channel - system	Reinforced insulation: CAT III 600 V
Connection technol.	2x 4-pin pin header, pitch 7.62 mm
Connector	2x included in delivery; push-in, conductor max. 6 mm², locking lever (latching), protected against reverse polarity, lockable, screw connection, without jumper
Additional functions	
Phasor Measure- ment Unit ⁸	integrated
Grid frequency measurem. (10 Hz - 80 Hz) ⁹	interval: 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Current consumption	n (max.)
Own consumption	0.16 A
Input/output current	4 A
Other interfaces, ope	erating and indicating elements
Indicators	LEDs for operation, channel states and errors
Operating and enviro	onmental 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
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 (+25 °C)	2.986,619 hours / 340 years
Dimensions	
wxhxd	56 mm x 133 mm x 120 mm
Height, lever open	160 mm
height units	3
Installation clearance	
top / bottom	30 mm / 30 mm
left / right (system)	10 mm / 10 mm
Mounting position	Vertical, lever up
Weight / incl. pack.	0.38 kg / 0.66 kg

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

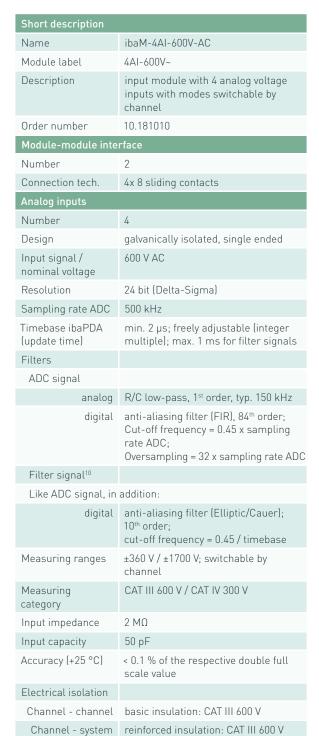
Recalibration is recommended after the occurrence of currents in the overload range, as a permanent variation in the measured values may occur.

 $^{^{\}rm 8}$ only available with release of ibaM-PQU

⁹ available in a later firmware version

ibaM-4AI-600V-AC

- > Input module with 4 analog voltage inputs
- > Use in power generation and distribution
- > General voltage measurement
- > Grid frequency measurement





	TO FORCE
Connection technol.	2x 4-pin pin header, pitch 7.62 mm
Connector	2x included in delivery, push-in, conductor max. 2.5 mm², locking clamp/ejection lever, protected against reverse polarity, lockable
Additional functions	
Phasor Measure- ment Unit ¹¹	integrated
Grid frequency measurement (10 Hz 80 Hz) ¹²	interval: 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Current consumption	ı (max.)
Own consumption	0.16 A
Input/output current	4 A
Other interfaces, ope	erating and indicating elements
Indicators	LEDs for operation, channel states and errors
Operating and enviro	onmental 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
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 (+25 °C)	3,452,457 hours / 394 years
Dimensions	
wxhxd	28 mm x 133 mm x 120 mm
Height, lever open	160 mm
height units	3
Installation clearance	es
top / bottom	30 mm / 30 mm
1.7	10 /10
left / right (system)	10 mm / 10 mm
	vertical, lever up

ibaM-4AI-150V-AC

- > Input module with 4 analog voltage inputs
- > Use in power generation and distribution
- > General voltage measurement
- > Grid frequency measurement



Short description	
Vame	ibaM-4AI-150V-AC
Module label	4AI-150V~
Description	input module with 4 analog voltage inputs
Order number	10.181011
Module-module inter	rface
Number	2
Connection tech.	4x 8 sliding contacts
Analog inputs	
Number	4
Design	galvanically isolated, single ended
nput signal / nominal voltage	AC 150 V
Resolution	24 bit (Delta-Sigma)
Sampling rate ADC	500 kHz
Timebase ibaPDA update time)	min. 2 µs; freely adjustable (integer multiple); max. 1 ms for filter signals
Filter	
ADC signal	
analog	R/C low-pass, 1 st order, typ. 150 kHz
digital	anti-aliasing filter (FIR), 84 th order; cut-off frequency = 0.45 x sampling rate ADC; oversampling = 32 x sampling rate ADC
Filter signal ¹³	. 3 3
Like ADC signal, in	addition:
digital	anti-aliasing filter (Elliptic/Cauer); 10 th order; cut-off frequency = 0.45 / timebase
Measuring range	±312 V
Measuring category	CAT III 150 V
nput impedance	
device switched off	250 kΩ
device switched on	251 kΩ
Input capacity	8,5 pF
Accuracy (+25 °C)	< 0.1 % of the respective double full scale value
Electrical isolation	
channel - channel	basic insulation: CAT III 150 V
channel - system	reinforced insulation: CAT III 150 V

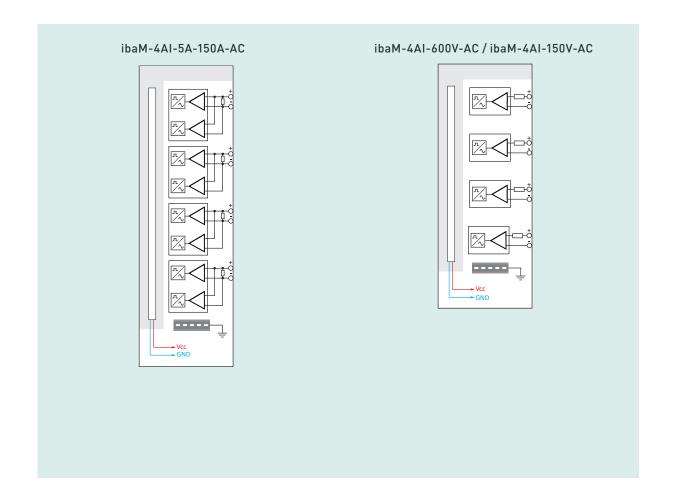
Connection technol.	2x 4-pin pin header, pitch 7.62 mm
Connector	2x included in delivery, push-in, conductor max. 2.5 mm², locking clamp/ejection lever, protected against reverse polarity, lockable
Additional functions	
Phasor Measure- ment Unit ¹⁴	integrated
Grid frequency measurement (10 Hz 80 Hz) ¹⁵	intervall: 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Current consumption	n (max.)
Own consumption	0.16 A
Input/output current	4 A
Other interfaces, ope	erating and indicating elements
Indicators	LEDs for operation, channel states and errors
Operating and enviro	onmental 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
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 (+25 °C)	3,529,809 hours / 402 years
Dimensions	
wxhxd	28 mm x 133 mm x 120 mm
Height, lever open	160 mm
height units	3
Installation clearance	es
top / bottom	30 mm / 30 mm
left / right (system)	10 mm / 10 mm
Mounting position	vertical, lever up
Weight / incl. pack.	0.26 kg / 0.52 kg

¹³ For the filter signals, the maximum time base in ibaPDA (update time) is limited to 1 ms for the correct operation of these filters.

¹⁴ only available with release of ibaM-PQU

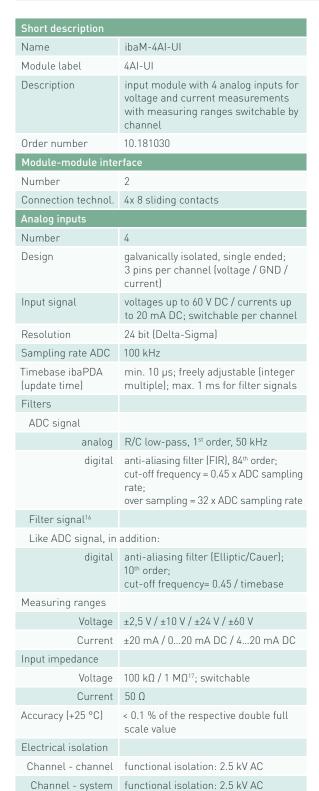
¹⁵ available in a later firmware version

Connection diagrams



ihaM-4AI-UI

- Input module with 4 analog inputs for voltage and current measurement
- > Different measuring modes switchable per channel
- > Expected availability in 2025





	n Wess
Connection technol.	2x 6-pin pin header, pitch 5 mm
Connector	2x included in delivery, push-in, conductor max. 2.5 mm², locking clamp/ejection lever, protected against reverse polarity, lockable
Status functions	
Current measure- ment	overrange/underrange; reversed polarity; broken cable
Additional functions	
Grid frequency measurement (10 Hz 80 Hz)	interval: 1 s / 10 s (according to IEC 61000-4-30)
Supply	
Supply voltage	24 V DC via module-module interface
Current consumption	n (max.)
Own consumption	0.16 A
Input/output current	max. 4 A
Other interfaces, ope	erating and indicating elements
Indicators	LEDs for operation, channel states and errors
Operating and enviro	onmental 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	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
Certifications / standards	CE, C-Tick, UKCA, FCC, IEC 61010-1, IEC 61000-6-5 interface range 4
Pollution degree	2
Dimensions	
DITTETISIONS	
w x h x d	28 mm x 133 mm x 120 mm
	28 mm x 133 mm x 120 mm 160 mm
wxhxd	
w x h x d Height, lever open	160 mm 3
w x h x d Height, lever open height units	160 mm 3
w x h x d Height, lever open height units Installation clearance	160 mm 3 es

¹⁶ For the filter signals, the maximum time base in ibaPDA (update time) is limited to 1 ms for the correct operation of these filters.

 $^{^{17}}$ 1 $M\Omega$ not possible in combination with $\pm 2.5~V$

ibaM-4AI-IEPE

- > Input module with 4 analog inputs
- Measurement of mechanical vibration by means of IEPE accelerometers



Short description	
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 inte	rface
Number	2
Connection technol.	4x 8 sliding contacts
Analog inputs	
Number	4
Design	galvanically isolated, single ended; additionally 2x GND and 2x GND with 50 Ω
Input signal	voltages up to 24 V DC / IEPE sensors; switchable by channel
Input modes	24V DC / 24V AC / IEPE 0.1Hz / IEPE 1Hz; switchable by channel
IEPE 0.1Hz/1Hz	integrated constant current source +4 mA (24 V DC)
Resolution	24 bit (Delta-Sigma)
Sampling rate ADC	100 kHz
Timebase ibaPDA (update time)	min. 10 µs; freely adjustable (integer multiple); max. 1 ms for filter signals
Filters	
ADC signal	
24V DC	
analog	R/C low-pass, 1 st order, 50 kHz
digital	anti-aliasing filter (FIR), 84th order; cut-off frequency = 0.45 x sampling rate ADC; oversampling = 32 x sampling rate ADC
24V AC	
analog	R/C low-pass, 1 st order, 50 kHz R/C high-pass, 1 st order, 1 Hz
digital	anti-aliasing filter (FIR), 84 th order; cut-off frequency = 0.45 x sampling rate ADC; oversampling = 32 x sampling rate ADC
IEPE 0.1Hz	
analog	R/C low-pass, 1 st order, 50 kHz
digital	R/C high-pass, 1st order, 0.1 Hz anti-aliasing filter (FIR), 84th order; cut-off frequency = 0.45 x sampling rate ADC;

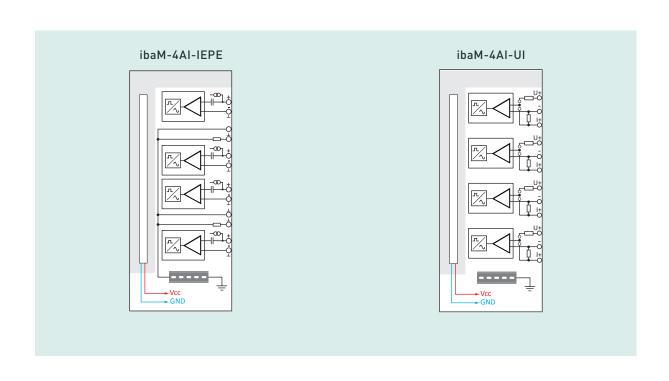
oversampling = 32 x sampling rate ADC

IEPE 1Hz	
analog	R/C low-pass, 1 st order, 50 kHz
digital	R/C high-pass, 1st order, 1 Hz anti-aliasing filter (FIR), 84th order; cut-off frequency = 0.45 x sampling rate ADC; oversampling = 32 x sampling rate ADC
Filter signal ¹⁸	1 3 1 3
24V DC/AC / IEP	E 0.1Hz/1Hz
Like ADC signal, in addition:	
digital	anti-aliasing filter (Elliptic/Cauer); 10 th order; cut-off frequency = 0.45 / timebase and/or anti-aliasing filter (Butterworth), 2 nd order; cut-off 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 impedance 24V DC/AC	1 ΜΩ
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 technol.	2x 6-pin pin header, pitch 5 mm
Connector	2x included in delivery, push-in, conductor max. 2.5 mm², locking clamp/ejection lever, protected against reverse polarity, lockable
Sensor cable length	up to 30 m at 100 pF/m cable capacitance and a bandwidth of used signals up to 50 kHz
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	100 ms 5000 ms, freely adjustable (in 1 ms steps)
Signal	ADC signal
Sampling	ADC sampling rate
General characteristic values	
Characteristic values	Min, Max, Avg, Peak, Peak-to-Peak, aRMS, Crest factor, used range
Bandpass filtered characteristic values ¹⁹	
Number	6 bandpass filters per channel; each freely adjustable
Bandpass filter	Butterworth, 4 th order
Characteristic values	vRMS, vPeak-to-peak, vCrest factor and/or aRMS, aPeak-to-peak, aCrest factor; switchable
TEDS ¹⁶ (according to IEEE-1451)	
Design	0-wire
Supported EEPROMs	DS2430A, DS2431
Supply	
Supply voltage	24V DC via module-module interface
Current consumption	(max.)
Own consumption	0.19 A
Input/output current	4 A

Other interfaces, operating and indicating elements	
Indicators	LEDs for operation, channel states and errors
Operating and enviro	onmental 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	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
Certifications / standards	CE, C-Tick, UKCA, FCC, KC, IEC 61010-1, IEC 61010-2-030, IEC 61000-6-5 interface range 4
Pollution degree	2
MTBF (+25 °C)	2.661.404 Stunden / 303 Jahre
Dimensions	
wxhxd	28 mm x 133 mm x 120 mm
Height, lever open	160 mm
height units	3
Installation clearanc	es
top / bottom	30 mm / 30 mm
left / right (system)	10 mm / 10 mm
Mounting position	vertical, lever up
Weight / incl. pack- aging/connector	0.24 kg / 0.50 kg

Connection diagrams



The PC connection for high-precision data acquisition with ibaNet-E



The ibaN-2E PCIe card allows high-precision, time-synchronized signal transmission and acquisition over Ethernet. It provides a powerful interface for integrating ibaNet-E-capable devices into the iba system.

Ethernet-based data acquisition

The ibaN-2E card enables ibaNet-E-capable devices to be connected to a standard or industrial computer via Ethernet with ibaPDA. Thanks to the special ibaNet-E transmission protocol, measurement data can be acquired deterministically and with high precision. ibaNet-E-capable devices from iba can be connected either via a dedicated ibaNet-E network or via a standard Ethernet network.

Fast sampling with dedicated ibaNet-E network

The ibaN-2E card can be used in conjunction with ibaM-COM and ibaM-DAQ devices to set up a dedicated ibaNet-E network, enabling deterministic and synchronous sampling at up to 1 µs²⁰. The data throughput corre-

At a glance

- PCIe interface card for connecting ibaNet-E- capable devices to computers via Ethernet
- > Optimized for iba data acquisition via Ethernet
- > Connection via standard Ethernet or dedicated ibaNet-E network
- High-precision, synchronous data acquisition with up to 1 µs possible in the dedicated ibaNet-E network with ibaM-COM systems

sponds approximately to the total bandwidth of a network interface.

Connection via standard Ethernet

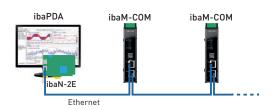
If a standard Ethernet network is used, measurement data can also be acquired from other ibaNet-E participants, such as ibaW-750. Sampling then is carried out synchronously at up to 1 ms and with a lower guaranteed data throughput.

Interfaces with switch function

The two 1 GbE network interfaces of the ibaN-2E card are designed as RJ45 (copper) and with a switch function. Up to 4 ibaN-2E cards can be inserted into a computer and synchronized with each other.

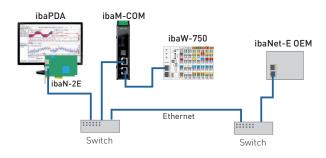
Examples of system integration

Measurement data acquisition with ibaM-COM via dedicated ibaNet-E network



- > Connection via dedicated ibaNet-E network
- Daisy chain
- Synchronous sampling up to 1 μs
- > Bandwidth 750 Mbit/s

Measurement data acquisition via standard Ethernet



- > Connection via standard Ethernet network
- > Daisy chain, star; incl. switches
- > Synchronous sampling typ. 1 ms
- > Bandwidth 500 Mbit/s

Technical data

Short description	
Name	ibaN-2E
Description	PCI Express card for ibaNet-E connections
Installation height	Standard
Order number	11.114000
ibaNet interface	
Number	2; switched
Design	copper
ibaNet protocol	ibaNet-E / ibaNet-E HP
Data throughput per network	interface in the dedicated ibaNet-E
Requirements:	
ibaNet-E participant	ibaM-COM; max. 10
Topology	daisy chain
Data path / transport protocol	MAC
Data throughput with ibaNet-E HP	750 Mbit/s
Synchronous sampling	up to 1 µs
Data throughput per	interface via standard Ethernet
Requirements:	
ibaNet-E participant	ibaM-COM, ibaW-750, ibaNet-E OEM devices
Topology*	daisy chain, star; incl. switches
Data path / transport protocol	MAC, IPv4
Data throughput with ibaNet-E	typ. 500 Mbit/s
Synchronous sampling	typ. 1 ms

Connection technology	2 RJ45 socket; 1GbE, Base-T
Cable length (P2P)	max. 100 m
Cable type	min. Cat. 6a, S/FTP
ibaPDA computer	
Number of ibaN-2E	max. 4
Data throughput of one ibaN-2E card	750 Mbit/s
Data throughput of all ibaN-2E cards	1,600 Mbit/s
Supply	
Power supply	via PCle bus
Further interfaces, o	perating and indicating elements
Indicators	LEDs for operation and errors; 7 segment display
Operating and enviro	onmental conditions
Temperature range	
Operation	32 °F to 131 °F (0 °C to +55 °C)
Storage	-13 °F to 185 °F (-25 °C to +85 °C)
Mounting	
PCIe slot	lane x1 or higher
PCIe Gen	v2.x
Architecture	x64
Operating system	from Windows 10
Cooling	passive
Certifications / standards	CE, C-Tick, UKCA, FCC, KC
MTBF (+25 °C)	5,938,264 hours / 677 years
Dimensions (w x h x d)	21.6 mm x 120.8 mm x 143.4 mm
Weight, incl. pack- aging	0.18 kg

^{*} Network components such as switches, but also the utilization of the standard network, can additionally have a negative impact on transmission quality and typical synchronous sampling.



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