ibaMS32xDI-24V

Input module for digital signals

Manual

Issue 2.0

Measurement Systems for Industry and Energy

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

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

Copyright notice

Certification

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

Further international customary standards and directives have been observed.

CE

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Issue	Date	Revision	Chapter	Author	Version HW / FW
2.0	08-2023	Scope of delivery, ibaPDA GUI			

Table of contents

1 About this manual

In this manual, you learn a lot about the design of the ibaMS32xDI-24V device and how to use and operate it. You can find a general description of the iba-modular system and further information about the design of the central units and how to use and operate them in separate manuals.

Note

The documentation for the iba-modular system is part of the data medium “iba Software & Manuals”. The documentation is also available at www.iba-ag.com in the download area.

- **Central units**
  The manuals of the ibaPADU-S-IT-16 central units and ibaPADU-S-CM contain the following information:
  - Scope of delivery
  - System requirements
  - Description of the device
  - Mounting/Demounting
  - Start-up
  - Configuration
  - Technical data
  - Accessories
- **Modules**
  The manuals for the single modules contain specific information about the module. There are the following information classes:
  - Short description
  - Scope of delivery
  - Product characteristics
  - Configuration
  - Description of the functions
  - Technical data
  - Connection diagram

1.1 Target group

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

1.2 Notations

In this manual, the following notations are used:

Action	Notations
Menu command	Menu *Logic diagram*
Call of menu command	*Step 1 – Step 2 – Step 3 – Step x* Example: Select menu *Logic diagram – Add – New logic diagram*
Keys	<Key name> Example: <Alt>; <F1>
Press keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Button name> Example: <OK>; <Cancel>
File names, Paths	„File name“, „Path” Example: „Test.doc“

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:

- By an electric shock!
- Due to the improper handling of software products which are coupled to input and output procedures with control function!

If you do not observe the safety instructions regarding the process and the system or machine to be controlled, there is a risk of death or severe injury!

⚠ WARNING

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

⚠ CAUTION

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

Note

A note specifies special requirements or actions to be observed.

Tip

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

Other documentation

Reference to additional documentation or further reading.

2 Introduction

The ibaMS32xDI-24V module is member of the iba-modular system. The modular concept is designed on the basis of a backplane. You can plug on this backplane not only the CPU, but also up to 4 input/output modules. The power supply of the I/O modules is provided by the backplane bus. The module offers 32 digital inputs.

In brief

- ❑ I/O module for the iba-modular system
- ❑ 32 digital inputs
- ❑ Galvanically isolated groups of 4 signals each
- ❑ Input level ±48 V
- ❑ Sampling rate up to 40 kHz, freely adjustable
- ❑ Debounce filter
- ❑ Rugged design, easy mounting
- ❑ Certification according to CE

Fields of application

Capturing digital input signals in the fields:

- ❑ Power generation and distribution
- ❑ Power factor compensation plants
- ❑ Test benches
- ❑ Condition Monitoring

3 Scope of delivery

After unpacking, check the delivery for completeness and possible damages.

The scope of delivery comprises:

- ❑ ibaMS32xDI-24V device
- ❑ 4 x 12-pin multi-pin connector (contact spacing 3.81 mm)
- ❑ Data medium „iba Software & Manuals“ (only for single delivery)

4 Safety instructions

4.1 Proper use

The device is an electrical apparatus. It is only allowed to use the device for the following applications:

- ❑ Measurement data acquisition
- ❑ Automation of industrial plants
- ❑ Applications with iba products (ibaPDA, ibaLogic etc.)

The device is only to be applied as shown in the Technical Data.

4.2 Special safety instructions

⚠ DANGER

Strictly observe the operating voltage range (see Technical Data)!

Never use damaged measuring cables!

Measuring cables must NOT be attached or detached to/from the device under voltage!

⚠ WARNING

Modules must NOT be attached or detached to/from the rack under voltage!

Switch off the central unit or disconnect power supply before attaching/detaching the modules.

⚠ WARNING

This is a Class A device. This equipment may cause radio interference in residential areas. In this case, the operator will be required to take appropriate measures.

Important note

Do not open the device! Opening the device will void the warranty!

Note

Clean the device only on the outside with a dry or slightly damp and statically discharged cloth.

5 System Requirements

5.1 Hardware

- ❑ Central unit: ibaPADU-S-IT-2x16 or ibaPADU-S-CM (version 02.10.001 or later)
- ❑ Backplane unit, e. g. ibaPADU-B4S

5.2 Software

- ❑ ibaPDA version 6.34.0 or later
- ❑ ibaLogic-V5 version 5.0.2 or later

Note

The use of ibaLogic-V5 requires the central unit ibaPADU-S-IT-2x16. If the module is used with the predecessor ibaPADU-S-IT-16, only ibaLogic-V4 can be used.

6 Mounting, Connecting, Dismounting

⚠ CAUTION

Works on the device must NOT be done when it is under voltage! Always disconnect the central unit from the power supply!

Note

Mount one or more modules on the right next to the central unit (slot X2 to X5 can be freely selected).

6.1 Mounting

1. Disconnect the central unit from the power supply.
2. Remove the cover from the backplane bus, to which the module should be attached.
3. Attach the device to the backplane bus and press it firmly against the backplane.
4. Secure the device with the fixing screws.

Important note

Always screw tight the device and the modules. If you do not screw it tight, connecting or disconnecting the connectors for the inputs and outputs might cause damages.

6.2 Connecting

Note

The backplane unit and the device must be connected to a protective conductor.

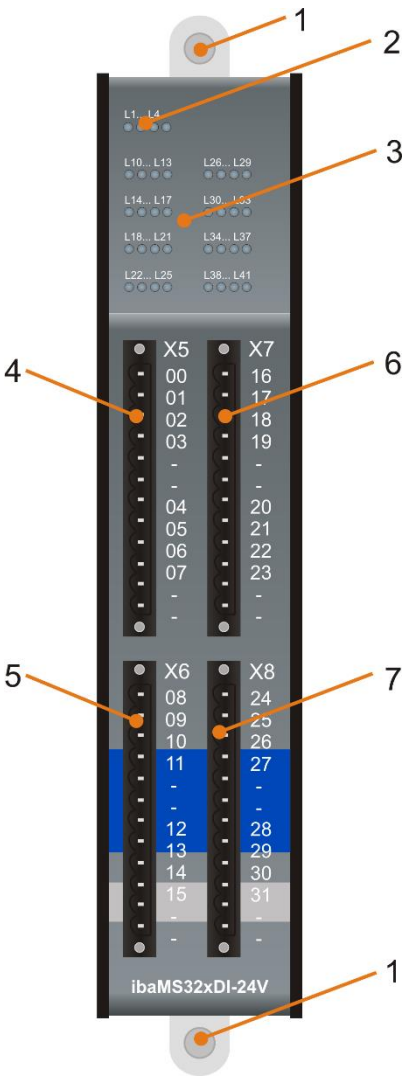
1. Connect all cables.
2. If all required cables are connected, connect the central unit to the power supply.
3. Switch on the central unit.

6.3 Dismounting

1. Disconnect the central unit from the power supply.
2. Remove all cables.
3. Remove the both fixing screws on the upper and the lower side of the device.
4. Pull the device straight from the backplane.
5. Put the cover on the backplane bus.

7 Device description

7.1 View



1 Fixing screws
2 Operating status indicators L1 to L4
3 Status LEDs L10 to L41 of the digital inputs 00 to 31
4 Connector X5 for digital inputs 00 to 07
5 Connector X6 for digital inputs 08 to 15
6 Connector X7 for digital inputs 16 to 23
7 Connector X8 for digital inputs 24 to 31

7.2 Indicating elements

The operating status of the device and the status of the analog inputs are shown by colored status LEDs.

7.2.1 Operating status

LED	Status	Description
L1: green	Flashing / On	Device is working
	Off	Device is not working (switched off)
L2: yellow	On	Access to the backplane bus
L3: white	-	-
L4: red	Off	Normal status, no faults
	Flashing	Device failure

Important note

When the LED L4 indicates a failure, please contact the iba support.

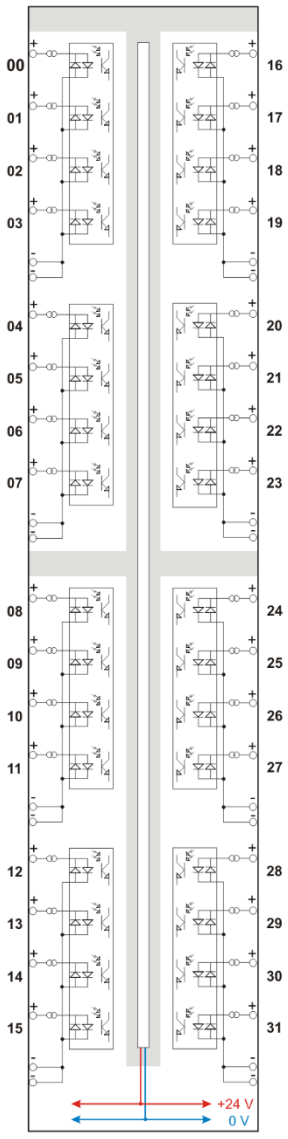
7.2.2 Status of digital inputs

LED per channel	Status	Description
L10 … L41 green	Off	No signal, logical 0
	On	Signal ok, logical 1

7.3 Digital inputs X5 to X8

7.3.1 Connection diagram / Pin assignment

Here, you can connect 32 input signals (0…31), each bipolar and electrically isolated. Each channel is connected by means of two-wire connection. Due to the reverse polarity protection, the measuring signal is indicated logically correct, even if the connection is polarity-reversed.



Pin assignment

X5: Pin	Connection	LED
1	Digital input 00	L10
2	Digital input 01	L11
3	Digital input 02	L12
4	Digital input 03	L13
5	GND	
6	GND	
7	Digital input 04	L14
8	Digital input 05	L15
9	Digital input 06	L16
10	Digital input 07	L17
11	GND	
12	GND	

X7: Pin	Connection	LED
1	Digital input 16	L26
2	Digital input 17	L27
3	Digital input 18	L28
4	Digital input 19	L29
5	GND	
6	GND	
7	Digital input 20	L30
8	Digital input 21	L31
9	Digital input 22	L32
10	Digital input 23	L33
11	GND	
12	GND	

X6: Pin	Connection	LED
1	Digital input 08	L18
2	Digital input 09	L19
3	Digital input 10	L20
4	Digital input 11	L21
5	GND	
6	GND	
7	Digital input 12	L22
8	Digital input 13	L23
9	Digital input 14	L24
10	Digital input 15	L25
11	GND	
12	GND	

X8: Pin	Connection	LED
1	Digital input 24	L34
2	Digital input 25	L35
3	Digital input 26	L36
4	Digital input 27	L37
5	GND	
6	GND	
7	Digital input 28	L38
8	Digital input 29	L39
9	Digital input 30	L40
10	Digital input 31	L41
11	GND	
12	GND	

7.3.2 Debounce filters

For the eight digital inputs, there are four debounce filters for each. These can be chosen and configured for each signal independently. You have got the following filters at your disposal:

- ❑ „Off“ (without filter)
- ❑ „Stretch rising edge“
- ❑ „Stretch falling edge“
- ❑ „Stretch both edges“
- ❑ „Delay both edges“

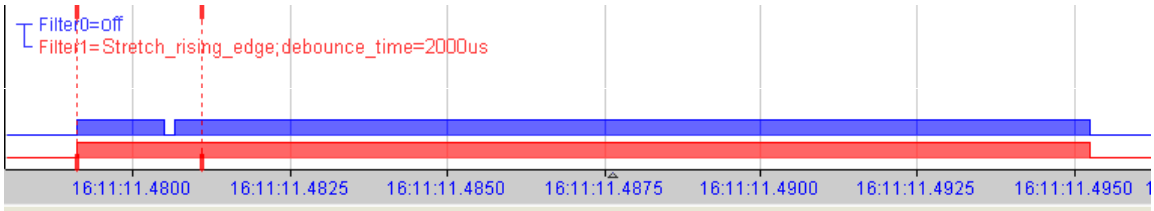
For each filter, a debounce time has to be defined in µs. This debounce time can have a value between [1µs…65535µs].

Off

The measured input signal is transferred without filtering.

„Stretch rising edge“

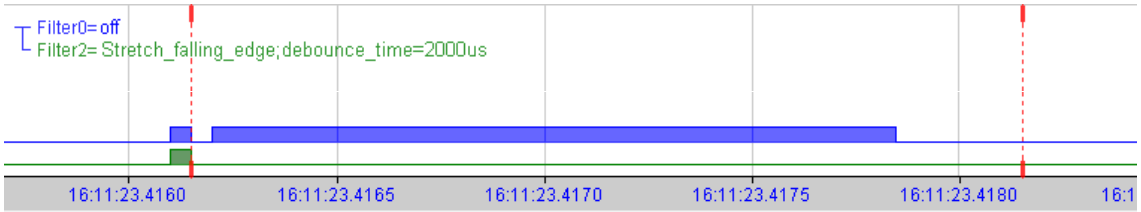
With the first rising edge, the input signal (red) switches to logical 1 and keeps this value for the defined debounce time. Thereafter, the channel is transparent again and waits for the next rising edge.



SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1
Filter0= off	1.4	11.4	0.002000	1.00	1.00	0.00
Filter1= Stretch_rising_edge;debounce_time=2000us	1.4	11.4	0.002000	1.00	1.00	0.00

„Stretch falling edge“

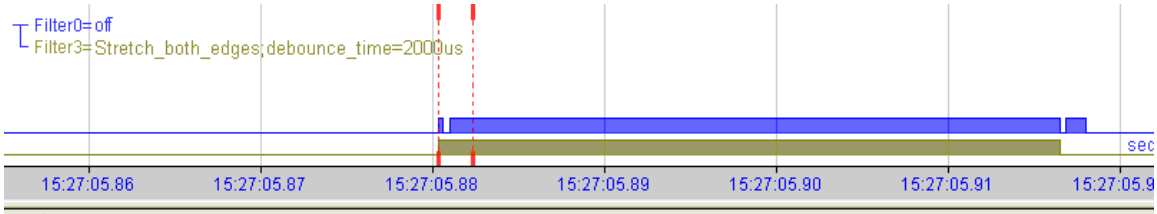
With the first falling edge, the output signal (green) switches to logical 0 and keeps this value for the defined debounce time. Thereafter, the channel is transparent again and waits for the next falling edge.



SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1
Filter0= off	23.4	23.4	0.002000	0.00	0.00	0.00
Filter2= Stretch_falling_edge;debounce_time=2000us	23.4	23.4	0.002000	0.00	0.00	0.00

„Stretch both edges“

With the first edge, the output signal (ocher) follows the initial signal (blue) and keeps the logical level for the duration of the defined debounce time. Thereafter, the channel is transparent again and waits for the next edge – be it rising or falling.

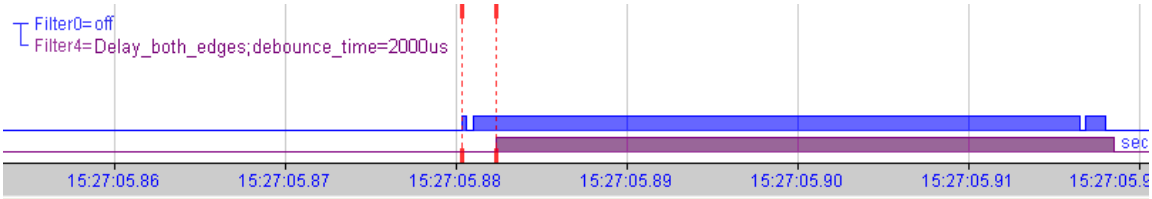


SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1	Unit
Filter0= off	:05.	:05.	0.0020	1.00	1.00	0.00	
Filter3= Stretch_both_edges;debounce_time=2000us	:05.	:05.	0.0020	1.00	1.00	0.00	

„Delay both edges“

Beginning with the first edge, the output signal (purple) blocks the input and keeps the logical value of the edge for the duration of the defined debounce time. Thereafter, the

channel is transparent again, directly assumes the logical level of the input signal and waits for the next edge – be it rising or falling.



SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1	Unit
Filter0= off	:05	:05	0.0020	1.00	1.00	0.00	
Filter4=Delay_both_edges;debounce_time=2000us	:05	:05	0.0020	0.00	1.00	1.00	

8 Start-up / Update

Important note

Installing an update can take some minutes. Please do not switch off the device when an update is running. This might damage the device.

8.1 Auto-Update

After having mounted the module and applied the voltage to the central unit, the central unit detects the modules and checks the software version.

The central unit has a so called “overall release version“. This version contains the current software version of the central unit as well as the software versions of the modules. You can find the “overall release version“ on the website of the central unit on the „firmware“ tab.

When the software version of a module does not match the “overall release version“ of the central unit, the central unit does an automatic up- or downgrade of the module. Thereafter, the module is ready to be used.

Important note

The “overall release version“ contains all modules developed up to the date of release of this firmware and the corresponding software versions. If a module cannot be detected, yet (i.e. it is more recent than the firmware version of the CPU), this module is ignored and outlined in red on the web interface.

In this case, a new update file has to be installed for the “overall release version“. If you want to get the current update file, please contact the iba support.

8.2 Overall Release Version

The „overall release version“ provides information about the software version of the entire iba-modular system. You can find it on the website of the central unit or in the I/O Manager of ibaPDA.

Important note

If you require support, specify the „overall release version“.

8.3 Update

An update can be installed in two different ways.

- ❑ Web interface (only with ibaPADU-S-IT-2x16)
- ❑ ibaPDA

No matter which of the both ways you choose to install an update: the progress of the update is shown by the LEDs L5 … L8. Beginning with L5, the LEDs are flashing one after another, at first in orange and then in green and at a slower rate. When the update is finished, the device will be rebooted.

Important note

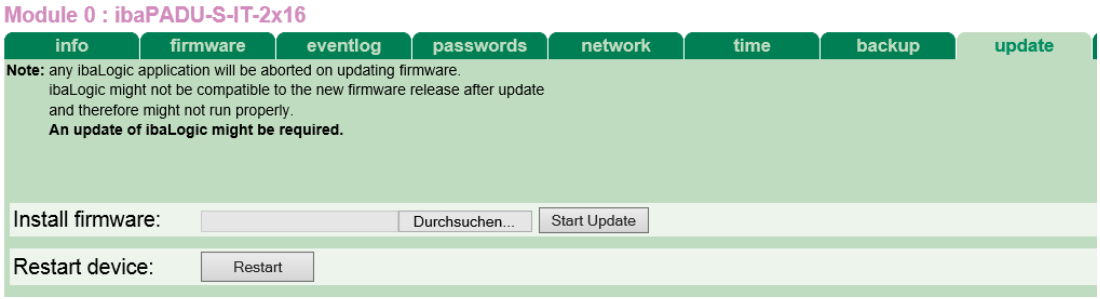
When updating the iba-modular system, a possible autostart of the ibaLogic PMAC is deactivated and the existing ibaLogic-V5 application deleted. Furthermore, an update of the ibaLogic-V5 software (ibaLogic Clients) might be necessary.

8.3.1 Update via web Interface

Important note

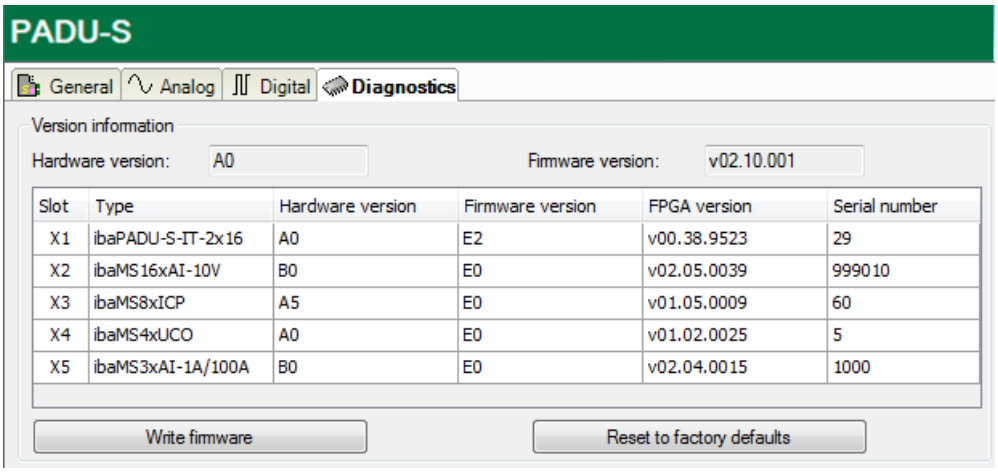
The web interface is available only with the central unit ibaPADU-S-IT-2x16.

- ❑ Start the website of the iba-modular system in your browser and select the central unit.
- ❑ On the “update“ tab, click on the <Browse…> button and choose the <padusit2x16_ v[xx.yy.zzz].iba> update file.
- ❑ By clicking on <Start Update>, you start the update.



8.3.2 Update via ibaPDA

- ❑ Open the ibaPDA I/O Manager and choose your iba-modular system in the tree structure.
- ❑ On the “Diagnostics“ tab, click on the <Write firmware> button and choose the „padusit2x16_v[xx.yy.zzz].iba“ or „paduscm_v[xx.yy.zzz].iba“ update file.
- ❑ You start the update by clicking on <OK>.



8.4 Module Information / Diagnostics

8.4.1 Diagnostics

Important information about the iba-modular system, like hardware version, firmware version, FPGA version and serial number is displayed in the “Diagnostics” tab. Open the ibaPDA I/O Manager and choose your iba-modular system in the tree structure (see also the figure above).

8.4.2 Web interface

On the module website, general information about the module is only displayed. You cannot change the values.

Important note

The web interface is only available with the central unit ibaPADU-S-IT-2x16.

8.4.2.1 „info“ tab

The „info“ tab displays general information and technical specifications of the I/O module.

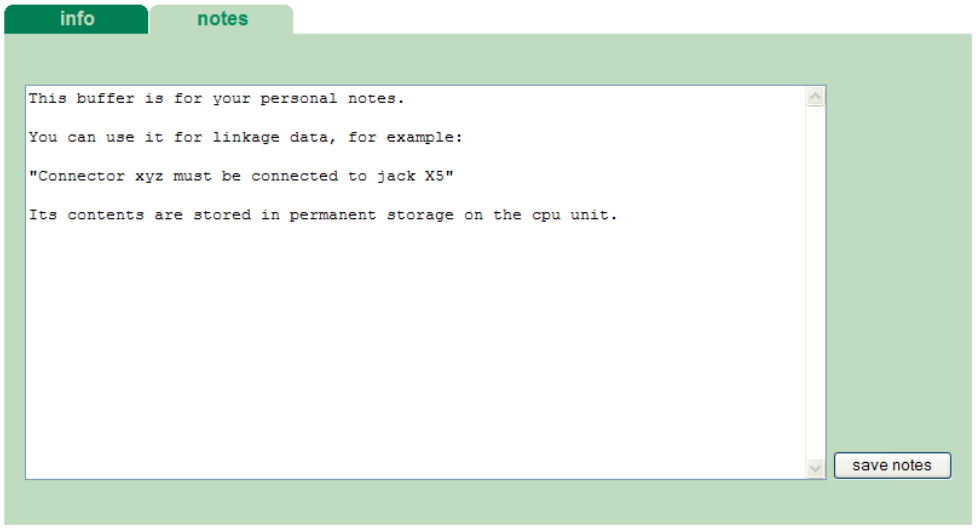
info | notes

Serial number	000003	
Hardware version	D2	
Firmware version	E1	
Process-IO		
digital input channels	32	
design	isolated groups of 4 channels	
nominal input voltage	+/-24	V DC
maximum input voltage	+/-60	V DC
logical 0 threshold	> -6 ... < +6	V DC
logical 1 threshold	< -10 ... > +10	V DC
input current	1	mA
sampling rate	max. 40	kHz
frequency range	0 ... 20	kHz

8.4.2.2 „notes“ tab

On the “notes“ tab, you can enter notes, e.g. for notes on wiring or on recording of changes.

By clicking on <save notes>, the notes are permanently stored on the device.


info
notes
This buffer is for your personal notes.
You can use it for linkage data, for example:
"Connector xyz must be connected to jack X5"
Its contents are stored in permanent storage on the cpu unit.
save notes

9 iba Applications

9.1 Configuration in ibaPDA

You can configure the signals with the I/O Manager of ibaPDA. If the iba-modular system is already installed and you want to add a new module, click on „Read configuration from device“. The module will be detected automatically.

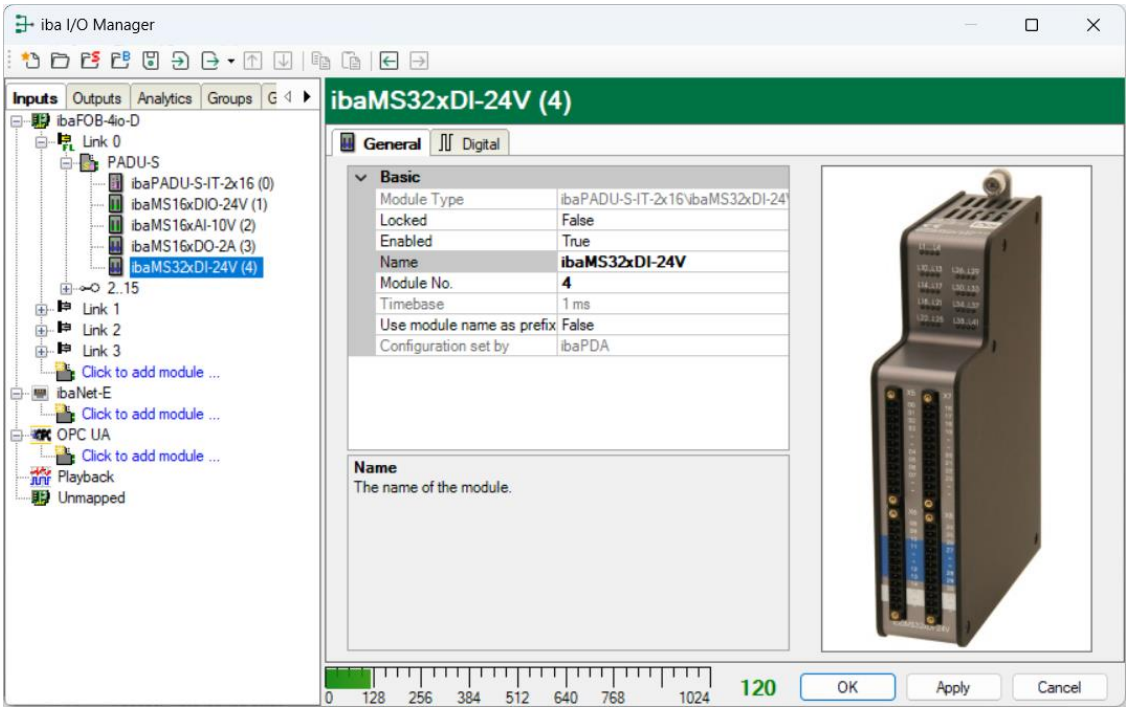
Note

The automatic detection requires a bidirectional FO connection from the ibaPDA computer to the central unit.

Other documentation

If you want to install the iba-modular system at first, refer to the manual of the central unit, chapter “Configuration with ibaPDA”.

If the module is detected, click on the module in the signal tree and the “General” tab appears.



Basic settings

❑ Module Type

Display of module type (read only)

❑ Locked

True: the module can only be changed by an authorized user.

False: the module can be changed by any user.

❑ Enabled
Data capturing for this module is enabled.

❑ Name
You can enter a name for the module.

❑ Modul No.
Consecutive module number assigned by ibaPDA for clearly referencing the signals, e.g. in expressions or ibaAnalyzer. The number can be changed by the user.

❑ Timebase
Timebase, specified in the PADU-S module.

❑ Use name as prefix
Prefix the signal names of this module with the module name.

❑ Configuration set by
This item is only visible when ibaPADU-S-IT-2x16 is used as central unit. When an embedded application has been started on ibaPADU-S-IT-2x16 (e. g. ibaLogic), then ibaPDA cannot modify the configuration of the modules and signals. In this case the configuration is set by the embedded application. The following entries can be displayed:

- ibaPDA

	Configuration set by	ibaPDA

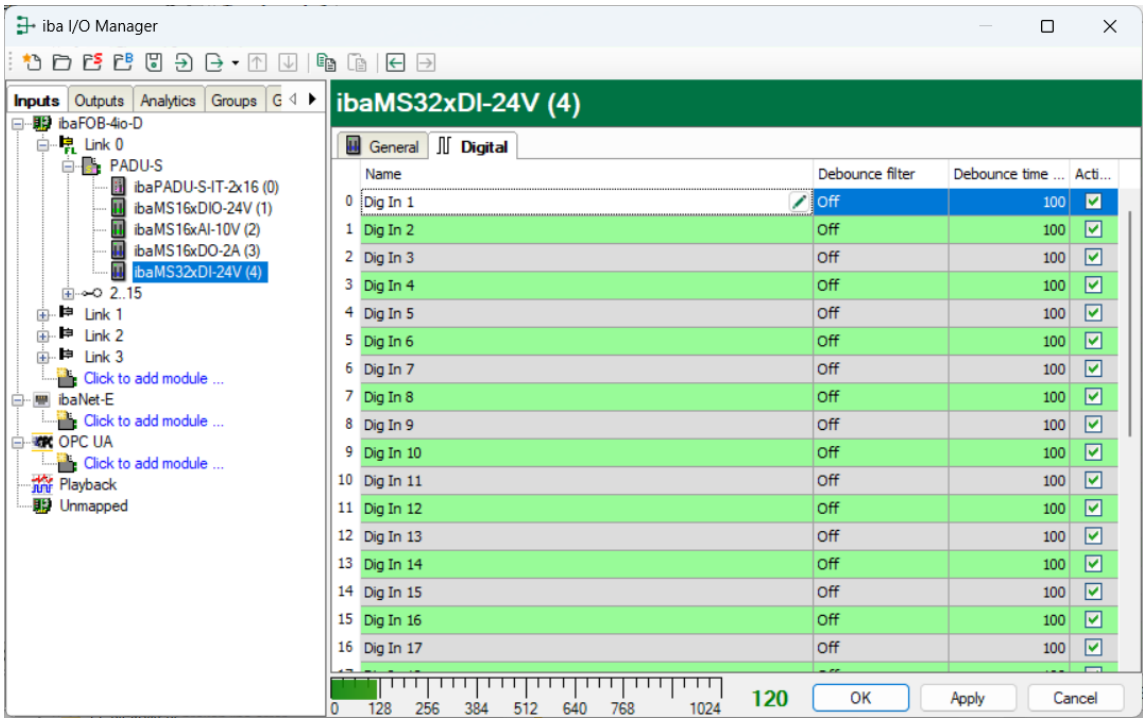
  When ibaPDA is displayed, an embedded application has not been started and the configuration can be set by ibaPDA.

- Embedded application

	Configuration set by	Embedded application
	Import signal names	False

  When embedded application is displayed, the configuration of the modules and signals is set by the embedded application on the device. In this case it is possible to import user-defined signal names, which are configured in the embedded application, provided that the embedded application supports this function (Import signal names: True).
  The modules and signals configured by the embedded application cannot be configured in ibaPDA, they are displayed in gray in the respective fields.
  The configuration is read by ibaPDA and used for the acquisition. Modules and signals which are not displayed in gray can be used in ibaPDA.

The following settings apply to the “Digital” tab:

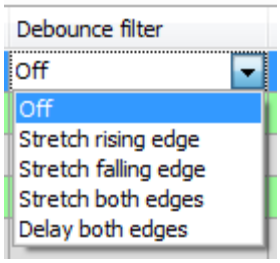


❑ Name

You can enter a name for the signal and two additional comments (click on the icon in the Name field).

❑ Debounce filter

In the dropdown menu, you can choose the operating mode for the debounce filter. You have got the following settings at your disposal: Off, stretch rising edge, stretch falling edge, stretch both edges, delay both edges.



↗ See chapter 7.3.2

❑ Debounce time (µs)

Here, you can define the debounce time in µs

❑ Active

Enabling/disabling the signal

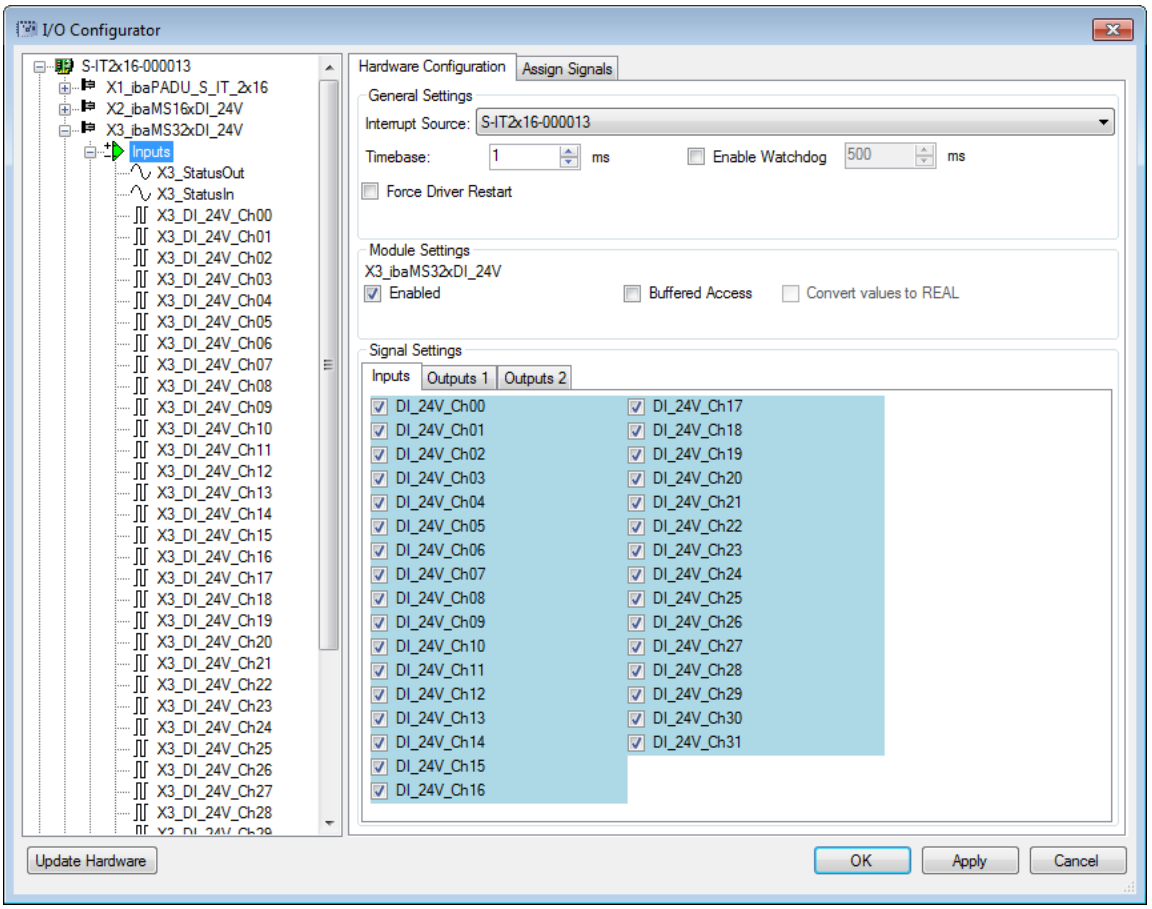
9.2 Configuration in ibaLogic-V5

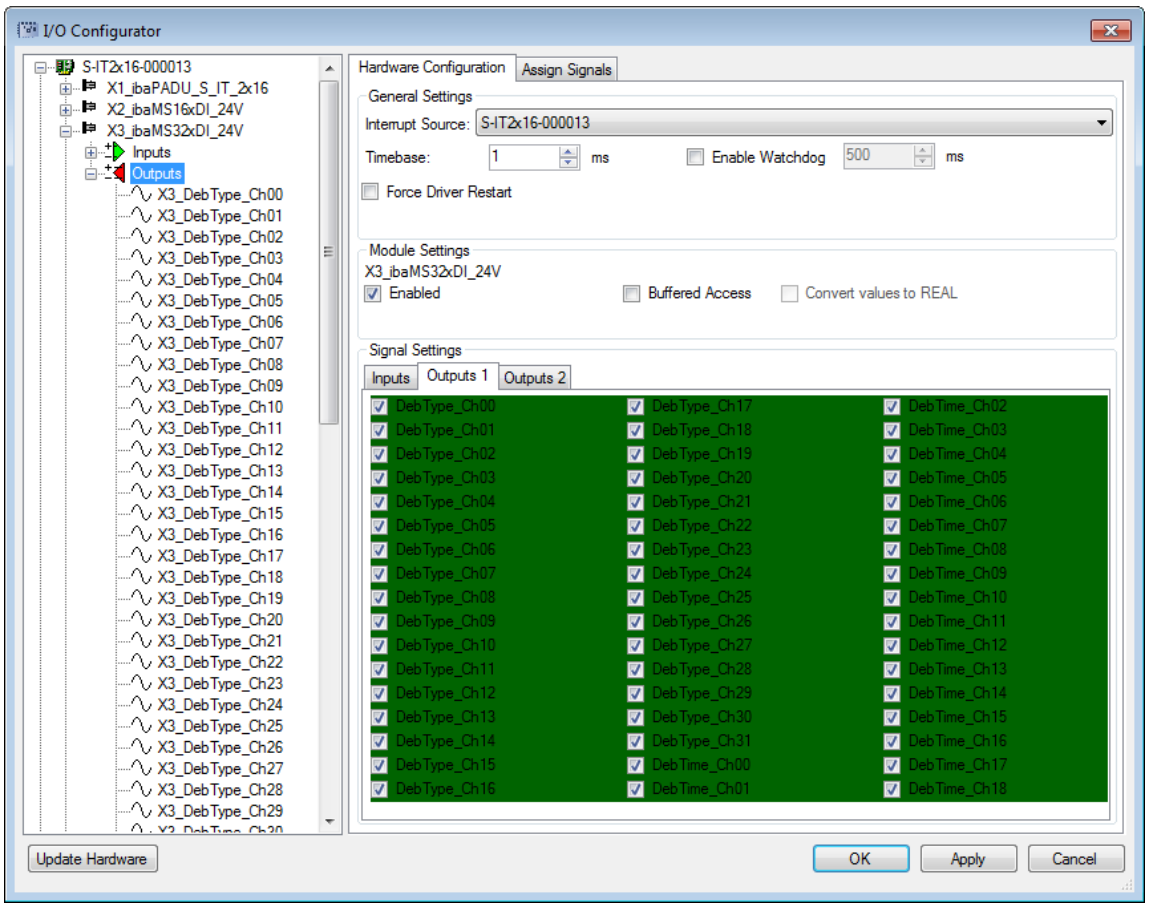
Other documentation

Combined with ibaLogic-V5, an ibaPADU-S-IT-2x16 device can be used to realize individual signal pre-processing or stand-alone applications. You find the basic way of proceeding description in the separate ibaPADU-S-IT-2x16 manual. This manual describes only the signals belonging to this module.

9.2.1 Configuring signals

The signals can be configured in the I/O Configurator of ibaLogic-V5. Open the I/O Configurator in the “Tools – I/O Configurator“ menu. When you click on the <Update hardware> button, then ibaLogic detects the module.





If “Buffered Access“ is enabled, you can see additional input and output signals.

Note

You need to apply the “Buffered Access“ by clicking on the <Apply> button. Only then, you will see additional signals in the signal tree that can be configured as output or input resources.

Signal	Description
Signals In	
DI_24V_Ch[00…31]	Digital input signals
StatusIn	Status information about the plugged input module (for output module without function): 0 = Module not initialized 1 = Module running >1 = Mistake (e.g. module cannot be initialized)
StatusOut	Status information about the plugged module (for input module without function): 0 = Module not initialized 1 = Module running >1 = Mistake (e.g. module cannot be initialized)
Signals Out	
DebType_Ch[00…31]	Debounce filter for digital signals
DebTime_Ch[00...31]	Debounce time for the single digital signal

Additional signals for buffered access	
BufferFillCount	Counter, when buffer is filled
BufferOverrun	Counter for Buffer-overrun
Additional output signals for buffered access	
BufferSize	Buffersize
SubSampling	Subsampling of the signals

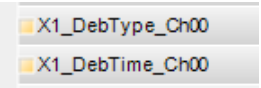
9.2.2 Configuring the debounce filter

If you want to use debounce filters, these are made as configuration output and configured as Off-task connector (OTC) or function block.

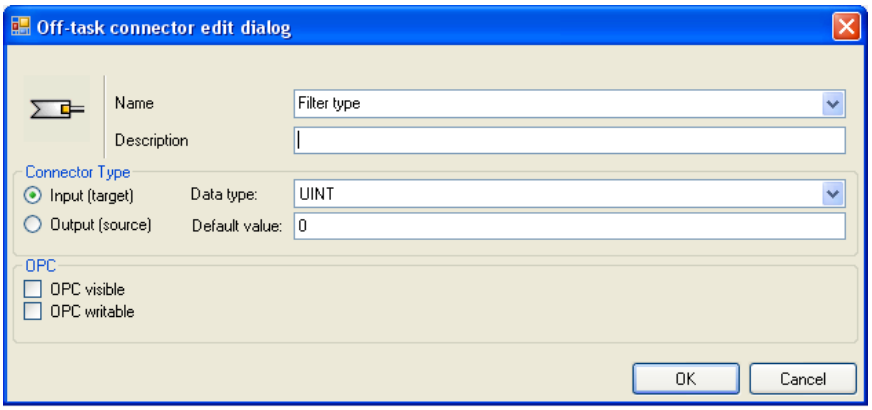
Meaning of the outputs:

DebounceTypex: debounce filter for digital signals
DebounceTimeUsx: debounce time for the single digital signal

First, drag the output signals defined in the I/O configurator to the margin of the programming surface, in this example “X1_DebType_Ch00” and “X1_DebTime_Ch00” for the digital input 0.



Create a new Off-task connector in the programming window, assign a meaningful name to the connector, e.g. “Filter type” and choose “Input” and Data type “UINT” under the Connector type option.



Meaning of the default values for the debounce filter:

0 Debounce filter switched off

1 Stretch rising edge

2 Stretch falling edge

3 Stretch both edges

4 Delay both edges

↗ You find the explanations of the settings in chapter 7.3.2 „Debounce filters“.

Now, connect the OTC and the signal on the margin of the programming surface.

Create a new OTC, assign a meaningful name, e.g. debounce time and choose “Input” as type. Enter the debounce time in µs in the “Default value“ field. The value can be 65535 at max.

Now, connect the OTC and the signal on the margin of the programming surface.

10 Technical Data

10.1 Main data

Short description	
Name	ibaMS32xDI-24V
Description	Input module with 32 digital inputs
Order number	10.124210
Power supply	
Power supply	DC 24 V, internal via backplane bus
Power consumption	up to 8 W
Indicating elements	
Indicators (LEDs)	4 LEDs for device status 32 LEDs for status of the digital inputs
Operating and environmental conditions	
Temperature ranges	
Operation	2 °F to 122 °F (0 °C to 50 °C)
Storage/transport	-13 °F to 158 °F (-25 °C to 70 °C)
Installation position	Vertical, plugged into backplane bus
Cooling	Passive
Humidity class	F, no condensation
Protection class	IP20
Certification/Standards	EMC: IEC 61326-1 FCC part 15 class A
MTBF[1]	1.140.726 hours / 130 years
Dimensions and weight	
Dimensions (Width x height x depth)	1.69 in x 8.46 in x 5.91 in (43 mm x 215 mm x 150 mm)
Weight (incl. packaging and documentation)	approx. 2.43 lbs (1.1 kg)

[1] MTBF (Mean time between failure) according to Telcordia 3 SR232 (Reliability Prediction Procedure of Electronic Equipment; Issue 3 Jan. 2011) and NPRD (Non-electronic Parts Reliability Data 2011)

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

Unique Identifier: 10.124210 ibaMS32xDI-24V

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

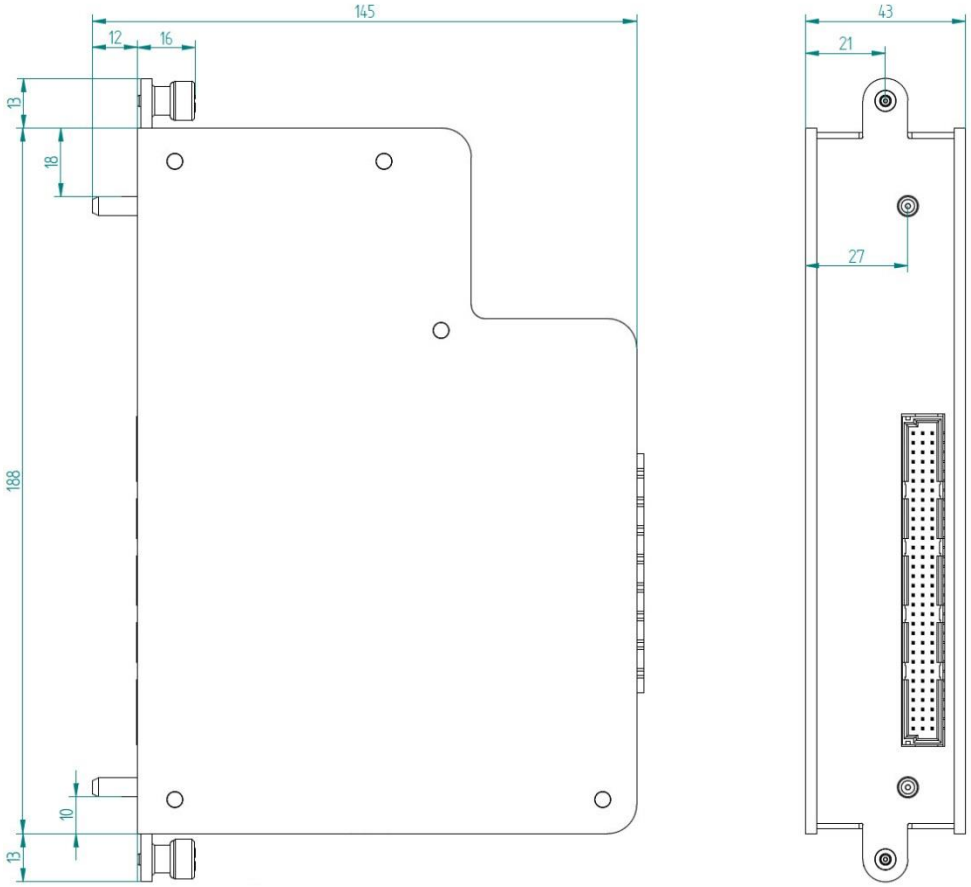
(770) 886-2318-102
www.iba-america.com

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.

10.2 Digital inputs

Digital inputs	
Number	32
Design	Galvanically isolated, 8 separated groups of 4 inputs with commom root each, protected against reverse polarity
Input signal	24 V DC
Max. input voltage	±48 V permanent
Signal level log. 0	> -6 V; < +6 V
Signal level log. 1	< -10 V; > +10 V
Hysteresis	Typ. 1 V
Input current	1 mA, constant
Debounce filter	Optional: 4 different operating modes
Sampling rate	Up to 40 kHz, freely adjustable
Frequency range	0 Hz to 20 kHz
Delay	Typ. 10 µs
Electrical isolation	
Root - root	AC 1,5 kV
Root - housing/power supply	AC 1,5 kV
Connector type	4 x 12-pin multi-pin connector; screw-type terminal (0,14 mm^2 to 1,5 mm^2), screw connection, included in delivery

10.3 Dimensions



(dimensions in mm)

11 Support and contact

Support

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Note

If you require support, specify the serial number (iba-S/N) of the product.

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