ibaPADU-4-AI-U

Input module with 4 fast analog voltage inputs

Manual

Issue 1.0

Measurement and Automation Systems

Manufacturer

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

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

Protection note

Windows® is a label and registered trademark of the Microsoft Corporation. Other product and company names mentioned in this manual can be labels or registered trademarks of the corresponding owners.

Certification

The device is certified according to the European standards and directives. This device corresponds to 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
1.0	07/23/13	First edition			

Table of contents

1 About this manual

This manual describes the construction, the use and the operation of the device ibaPADU-4-AI-U.

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

The following designations are used in this manual:

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!

⚠ 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.

Important note

Note if some special features must be observed, for example exceptions from the rule.

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 ibaPADU-4-AI-U compact device has been developed for capturing and recording fast analog signals. The sampling rate can be adjusted freely up to 100 kHz max. The device offers 4 electrically isolated voltage inputs. The measuring ranges of these inputs are adjustable in several stages from ±250 mV up to ±24 V.

Antialiasing filters limit the bandwidth of the input signal in order to reduce disturbances. A digital filter can be activated per channel together with an analog antialiasing filter. The digital antialiasing filter is adjusted automatically to the configured sampling rate.

The signals are converted internally and are available via the fiber optics (FO) interface. By means of the ibaPDA-V6 online-data acquisition software, you can choose and configure the signals conveniently. The communication between ibaPDA and ibaPADU-4-AI-U is handled by the bidirectional fiber optic protocol 32Mbit Flex, which requires an I/O card from the ibaFOB-D generation, e. g. ibaFOB-2io-D.

In brief

- ❑ 4 electrically isolated analog inputs
- ❑ Input signal level ±250 mV; ±500 mV; ±1 V; ±2.5 V; ±5 V; ±10 V; ±24 V, can be adjusted for each channel
- ❑ 16 bit resolution
- ❑ Sampling rate of 100 kHz max. freely adjustable in a point-to-point connection (if connected in a ring topology with 32Mbit Flex, max. sampling rate is 40 kHz)
- ❑ Real parallel measured value acquisition by an A/D converter per channel
- ❑ Antialiasing filters can be activated
- ❑ ibaNet protocol 32Mbit Flex (FO)
- ❑ Rugged design, easy mounting

3 Scope of delivery

After unpacking check the completeness and intactness of the delivery.

The scope of delivery includes:

- ❑ ibaPADU-4-AI-U device
- ❑ 2-pin connector for power supply
- ❑ 12-pin connector for connecting the analog signals
- ❑ Manual

4 Safety instructions

4.1 Designated use

The device is electrical equipment. It may be used only in the following applications:

- ❑ Measurement data logging and analysis
- ❑ Applications of ibaSoftware products (ibaPDA-V6)

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

4.2 Special advices

Important note

Do not open the device!

There are no serviceable parts inside the device.

Opening the device will void the warranty.

Note

Cleaning

To clean the device, use a dry or slightly moistened cloth. A note specifies special requirements or actions to be observed.

5 System requirements

5.1 Hardware

For operation

- ❑ Power supply 24 V DC ±10%

For parametrization of the device and for measuring:

- ❑ PC with the following minimum equipment
  - One free PCI, PCI Express or ExpressCard slot (Notebook).
  - At least 512 MB RAM
  - 4 GB free memory on the hard drive for measurement values

  For further information about PC equipment, please see http://www.iba-ag.com.
- ❑ A FO input card of the ibaFOB-D type:
  - ibaFOB-io-D / ibaFOB-io-Dexp
  - ibaFOB-2io-D / ibaFOB-2io-Dexp
  - ibaFOB-2i-D / ibaFOB-2i-Dexp with ibaFOB-4o-D add-on module
  - ibaFOB-4i-D / ibaFOB-4i-Dexp with ibaFOB-4o-D add-on module
  - ibaFOB-io-ExpressCard (for Notebooks)
- ❑ FO cable (bidirectional)

5.2 Software

- ❑ ibaPDA-V6 beginning with version 6.31.0

6 Mounting and dismounting

6.1 Mounting

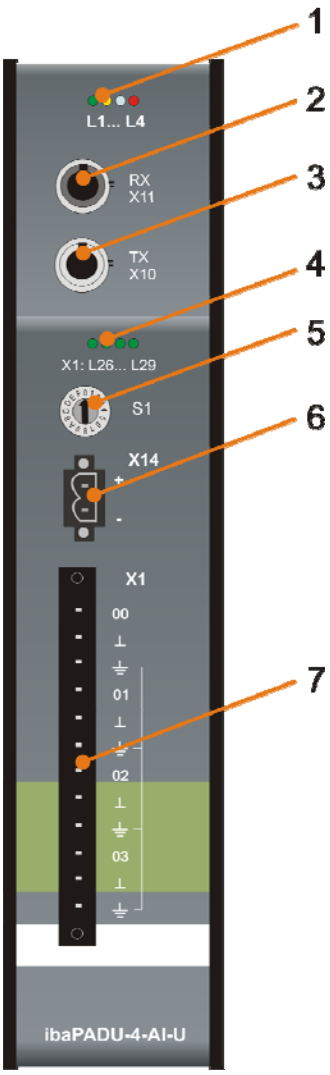
1. Locate the DIN rail mounting clip on the rear side of the device. Slowly push down and in so that the bottom part of the mounting clips snaps onto the bottom part of the rail and firmly fixes the device to the DIN rail.
2. Connect the 24 V DC power supply to the termination shown on the device. Ensure that the polarity is correct prior to applying power. Then connect the device to the ibaPDA system via a bidirectional FO cable.

6.2 Dismounting

1. Disconnect all external connections from the device.
2. Grasp the device with one hand firmly on the top side. With your free hand, grasp the bottom of the device and push it lightly down.
3. After that pull the device and lift it up. With this action, the device should free itself from the DIN rail.

7 Device description

7.1 Device view



(1) Operating state display
(2) FO input (RX) X11
(3) FO output (TX) X10
(4) Status LEDs of analog channels
(5) Rotary switch S1
(6) Power supply terminal X14
(7) Analog inputs X1

Figure 1: Front view

Top view

Figure 2: Top view

Manufacturer:	iba AG
Support:	iba@iba-ag.com
Web:	www.iba-ag.com
Power supply:	24 V DC ±10% / 0.4 A
Product name:	ibaPADU-4-AI-U

7.2 Indicator elements

Operating state

LED	Status	Description
L1: (green)	off	no power
	blinking slowly	ready for operation
	blinking fast	Firmware update active
	on	device is booting
L2: (yellow)	on	TCP/IP telegrams detected
L3: (white)	off	No 32Mbit Flex signal detected
	blinking (rotary switch S1 ≠ 0)	32Mbit signal detected, but it is not a valid 32Mbit Flex signal
	on	32Mbit Flex signal detected
L4: (red)	off	device functioning properly
	blinking	failure, internal applications do not run
	on	device is defect, contact the iba support

Status of analog inputs

LED per channel	Status	Description (approx. values)
L26 … L29	off	voltage < ±1% of the selected input range
	green	voltage ±1% ... ±90% of the selected input range
	yellow	voltage ±90% ... ±100% of the selected input range
	red	voltage > ±100% of the selected input range

7.3 Operating elements

7.3.1 Fiber optic cable connectors RX / TX

X11: Fiber optic reception interface (RX)

X10: Fiber optic transmission interface (TX)

Data is transmitted in 32Mbit Flex mode. ibaPDA-V6 requires a fiber optic card of the ibaFOB-D family to receive and transmit data.

The fiber optic ports and transmitters are the physical base for a simple send-and-receive connection to an ibaFOB card. The ports are designed for cables with 62.5/125 µm multi-mode fibers and ST couplings which are available at iba too.

7.3.2 Rotary switch S1

Up to 15 devices can be connected in a ring topology with 32Mbit Flex. The address of the device in a ring is set by the S1 rotary switch.

Device number within the cascade	Rotary switch position
not allowed	0
Device 1	1
Device 2	2
⋮	⋮
Device 14	E
Device 15	F

❑ Delivery status: rotary switch position 1

7.3.3 Power supply

The device requires an external DC 24 V ±10% power supply (unregulated) and should be operated at a maximum of 0.4 A. The operating voltage should be run through the provided 2-pin Phoenix threaded coupling connector. If desired, you can order DIN rails or plug-in power supply units from iba.

7.4 Analog inputs X1

7.4.1 Filter

There are the following analog filters per channel:

Filter type	Order	Cut-off frequency	in addition / permanent
R/C low pass	1.	72 kHz	permanent
Antialiasing Butterworth	4.	50 kHz	in addition (can be activated only together)
Antialiasing digital	2 x 8.	1/3 of the adjusted sampling rate	

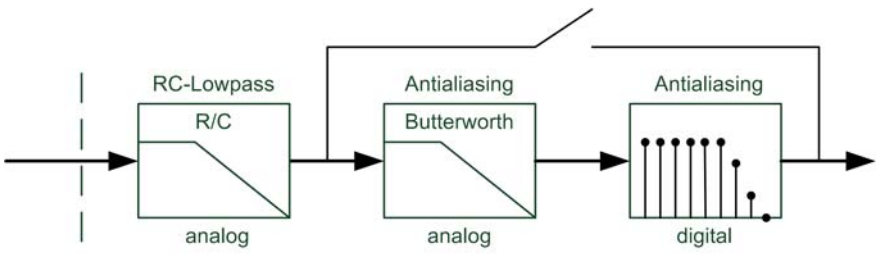


Figure 3: Filter sections

7.4.2 Connection diagram / pin assignment

Here, you can connect 4 input signals (0…3), each bipolar and electrically isolated. Each channel is connected by means of two-wire connection.

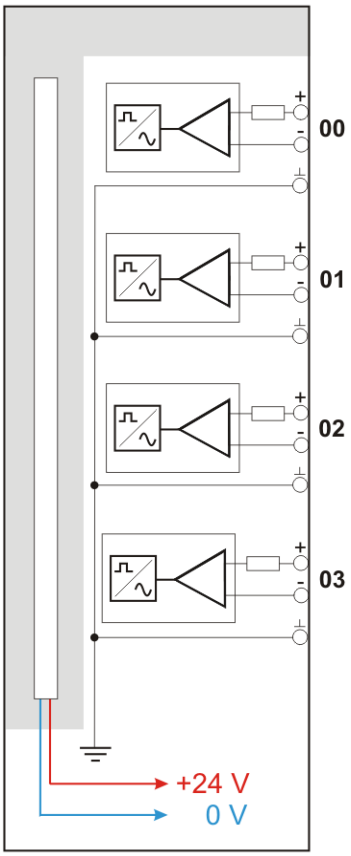


Figure 4: Connection diagram

Pin assignment

X1: Pin	Connection	LED
1	Analog input 00 +	L26
2	Analog input 00 –	
3	Analog input 00 ⏚	
4	Analog input 01 +	L27
5	Analog input 01 –	
6	Analog input 01 ⏚	
7	Analog input 02 +	L28
8	Analog input 02 –	
9	Analog input 02 ⏚	
10	Analog input 03 +	L29
11	Analog input 03 –	
12	Analog input 03 ⏚	

8 System integration

8.1 Point-to-point connection

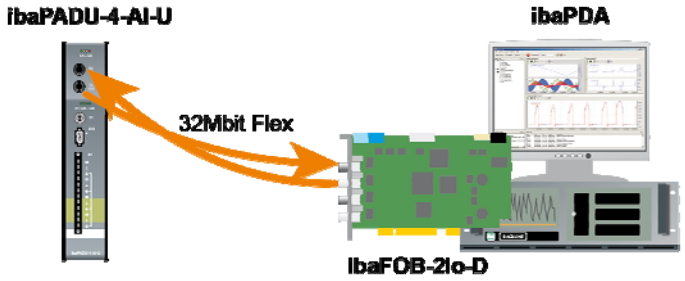


Figure 5: Point-to-point connection with ibaPDA PC

The device is connected to the ibaFOB-D card in the ibaPDA PC via a bidirectional FO line to transfer configuration and process data. ibaPDA detects automatically the connected device.

The maximum sampling rate of 100 kHz is only possible with a bidirectional point-to-point connection to ibaPDA. If several devices are to capture at 100 kHz, each device requires a bidirectional connection to an ibaFOB-D card.

8.2 Ring topology

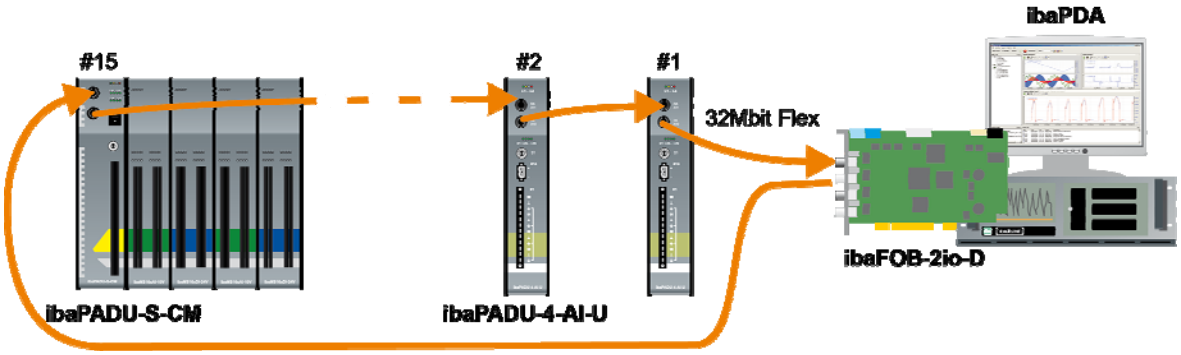


Figure 6: Ring topology

Up to 15 devices can be connected to a ring. Configuration and process data are transmitted in the ring.

Other 32Mbit Flex-enabled iba devices can be integrated into the ring as well. The devices in the ring are addressed via the S1 rotary switch.

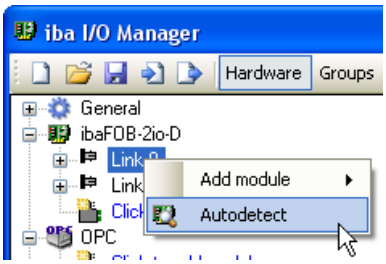
The amount of data per participant is allocated dynamically. According to the number of analog and digital signals configured in ibaPDA and the configured timebase the amount of data is calculated by ibaPDA. The maximum total data rate is determined by the fiber-optic links and must be divided through the number of devices and the amount of data per device. A reference value is approx. 3000 Bytes per ms (amount of data per analog channel: 2 Bytes). The devices can work with different cycle times, however the cycle time must be an integer multiple of the smallest cycle. If the maximum data rate is exceeded, ibaPDA displays an error message and recommends increasing the timebase or decreasing the amount of data. A sampling rate of 100 kHz cannot be adjusted in a ring, this is only possible with a point-to-point-connection.

9 Configuration in ibaPDA-V6

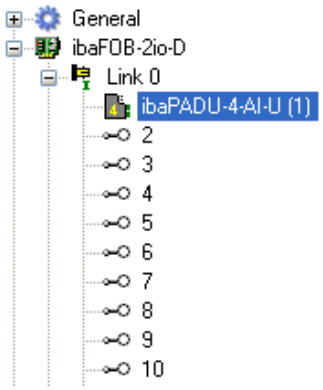
The ibaPADU-4-AI-U device requires ibaPDA-V6 version 6.31.0 or higher.

9.1 First steps

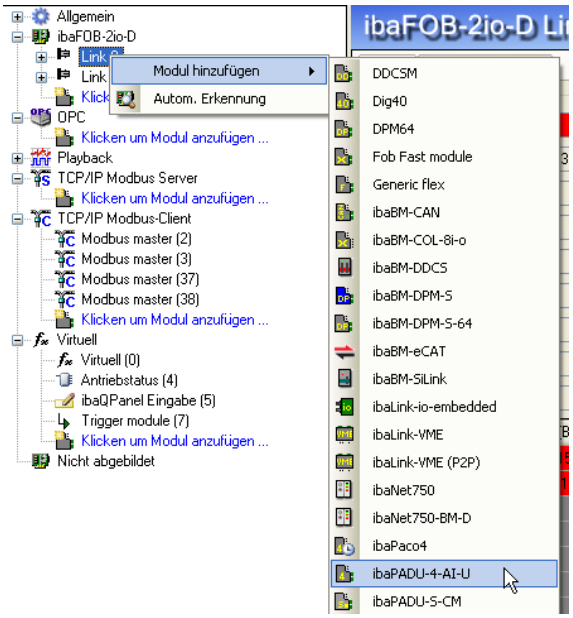
1. Start the ibaPDA client and open the I/O manager
2. Choose the correct ibaFOB-D input card in the signal tree (on the left hand side) and mark the link ibaPADU-4-AI-U is connected to. Right-click on the link and choose “Autodetect”.



ibaPDA recognizes the device automatically. The device will be listed in the signal tree.



3. Alternatively you can manually add the device. Right-click on the link of the ibaFOB-D card the device should be connected to. Select “Add module…” and then “ibaPADU-4-AI-U”.



The device will be listed in the signal tree.
Hold down the mouse button and drag the device to the address (link 1 – 15 below the device), the device address switch is set to.
Position 1 – F refers to address 1 – 15.

4. Make your settings in the ibaPADU-4-AI-U module of the I/O Manager:

9.2 ibaPADU-4-AI-U – „General“ tab

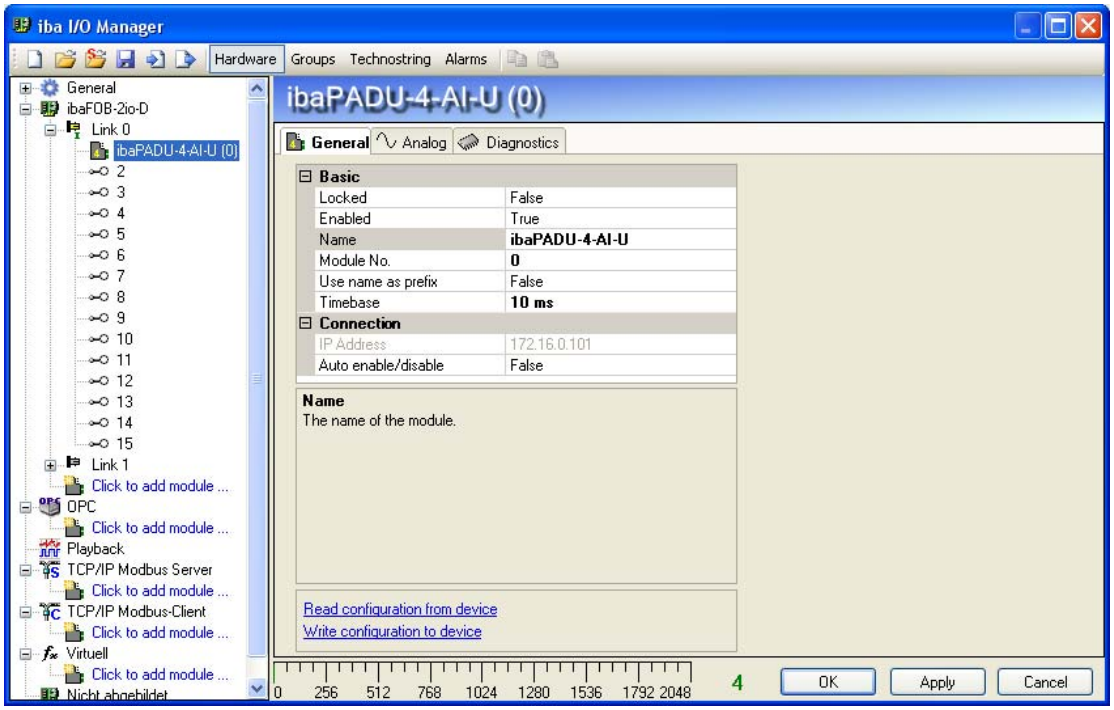


Figure 7: ibaPADU-4-AI-U – „General“ tab

Basic

- **Locked**
  A locked module can only be changed by an authorized user.
- **Enabled**
  Here, you can activate data capturing for this module (True).
- **Name**
  Here, you can enter a module name.
- **Module No.**
  Logical module number for clearly referencing the signals, e.g. when printing and in ibaAnalyzer. The ibaPDA gives numbers in chronological order, but the number can be changed by the user.
- **Use name as prefix**
  Prefix the signal names of this module with the module name.
- **Timebase**
  Timebase that is used for the device, given in ms. It is possible to define smaller timebases than defined in the general acquisition timebase. Cycle times down to 0.01 ms are possible.

Connection

- **IP Address**
  IP address or host name of the device (informative only).
- **Auto enable/disable**
  True: ibaPDA starts acquisition, although it cannot connect to the module.
  False: ibaPDA won't start acquisition, when it cannot connect to the module.

Further functions

- **Read configuration from device**
  Reading the configuration from the device.
- **Write configuration to device**
  Writing the configuration to the device.

The changed settings become valid by clicking on <OK> or <Apply>.

9.3 ibaPADU-4-AI-U – "Analog" tab

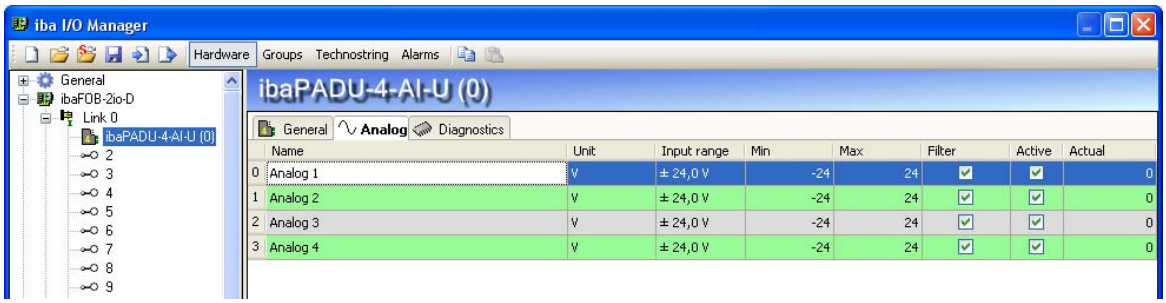
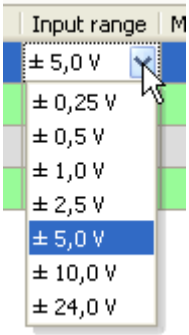
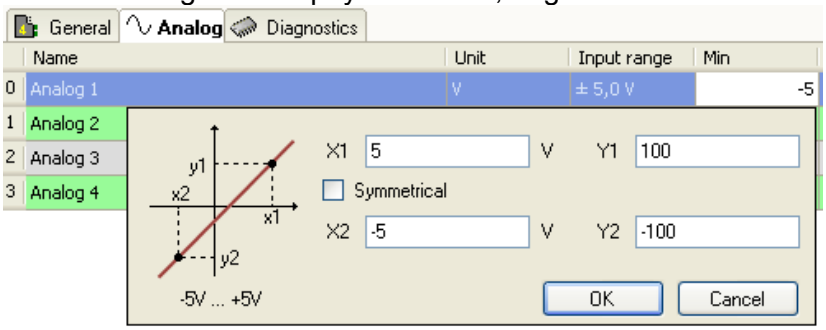


Figure 8: ibaPADU-4-AI-U – „Analog" tab

- **Name**
  Assign a meaningful name to each signal and you can enter additionally two comments when clicking on the symbol in the field "Name".
- **Unit**
  Here, you can enter the physical unit of the analog value, default value is "V".
- **Input range**
  You can select the input range for each signal from a drop-down menu.



- **Min**
  You can define a lower limit for the measuring range. The analog normalized value of -5 V is assigned to a physical value, e. g. -100 V.



- **Max**
  Here, you can define an upper limit for the measuring range. The analog normalized value of +5 V is assigned to a physical value, e. g. +100 V.

- **Filter**
  You can activate the antialiasing filters (analog + digital).

- **Active**
  The signal will be measured when active.

- **Actual**
  Displays the actual value of the signal (only available when the measurement is already running with the specified configuration).

- Further columns can be shown or hidden by using the context menu (right mouse click in the table header).

9.4 PADU-4-AI-U – „Diagnostics“ tab

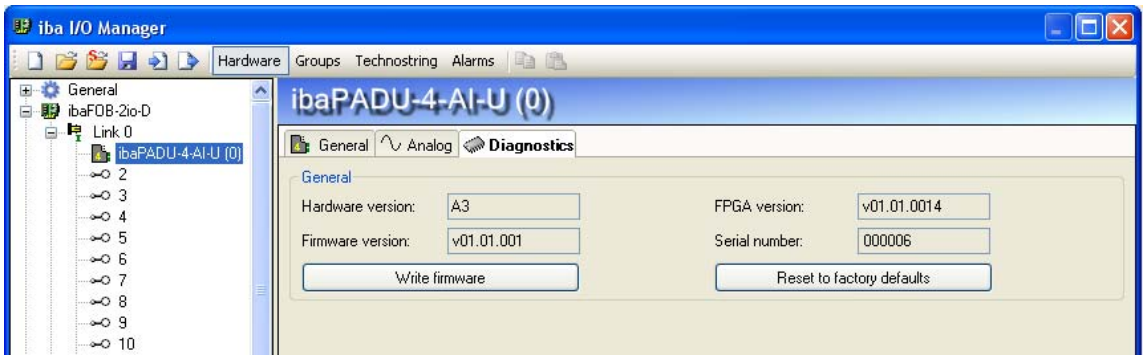


Figure 9: ibaPADU-4-AI-U –„Diagnostics“ tab

Here, you find information about the hardware version, firmware version, FPGA version and the serial number of your device.

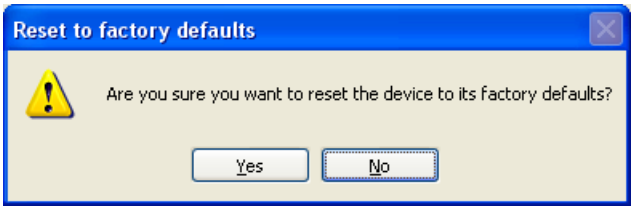
- **Write firmware**
  Using this button you can install a firmware update. Select the update file „padu4_v[xx.yy.zzz].iba “ in the browser and start the update with <OK>.

Important note

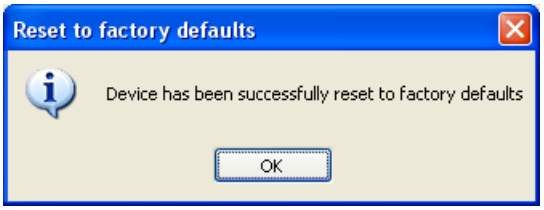
The update may take approx. 30 s and must not be interrupted. After an update the device will be automatically rebooted.

❑ **Reset to factory defaults**

Using this button all settings are reset to factory defaults after having confirmed the following request with <Yes>.



After the reset the following message appears and the device will be automatically rebooted.



10 Technical Data

Manufacturer	iba AG, Germany
Order no.	10.121000
Description	Input module with 4 fast analog voltage inputs
Analog inputs	
Number	4
Design	Galvanically isolated, single ended
Resolution	16 bit
Filter	R/C low pass 72 kHz (permanent) Analog antialiasing filter 4th order Butterworth 50 kHz and digital antialiasing filter, cutoff frequency 1/3 of the adjusted sampling rate, can be activated only together
Input level	±250 mV; ±500 mV; ±1 V; ±2.5 V; ±5 V; ±10 V; ±24 V
Input impedance	100 kΩ
Sampling rate	Max. 100 kHz, freely adjustable
Frequency range	0 Hz … 50 kHz
Accuracy	< 0.1 % of total measuring range (±1 V; ±2.5 V; ±5 V; ±10 V; ±24 V) < 0.5 % of total measuring range (± 250 mV; ±500 mV)
Electrical isolation	
Channel-channel	AC 1.5 kV
Channel-housing/power supply	AC 1.5 kV
Connector type	12-pin multi-pin connector (Phoenix); 3.81 mm clamp-type terminal (0.14 mm² bis 1.5 mm²) screw connection, included in delivery
Power supply, interfaces, indicators	
FO connectors	2 ST connector (62.5 µm / 125 µm)
FO cable	Up to 2000 m, without repeater
ibaNet protocol	32Mbit Flex (bidirectional), can be used simultaneously for data, settings and service (e. g. updates)
Power supply	24 V DC (±10%)
Power consumption	Up to 10 W

Indicators	4 LEDs for device status 4 LEDs for status of analog inputs
Operating and environmental conditions	
Cooling	Passive
Operating temperature	32 °F to 122 °F (0 °C to 50 °C)
Storage temperature	-13 °F to 149 °F (-25 °C to 65 °C)
Transport temperature	-13 °F to 149 °F (-25 °C to 65 °C)
Mounting	DIN-rail mounting, vertical
Installation height	Up to 2000 m
Humidity class (DIN 40040)	F, no condensation
Protection class	IP20
Standards	EMC: EN 61326-1 FCC part 15 class A
Dimensions and weight	
Dimensions (w x h x d)	1.46 in x 7.40 in x 5.71 in (37 mm x 188 mm x 145 mm)
Weight (incl. box and documentation)	approx. 2.42 lb (1.1 kg)

11 Support and contact

Support

Phone: +49 911 97282-14

Fax: +49 911 97282-33

E-Mail: support@iba-ag.com

Note

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

Contact

Headquarters

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Fax: +49 911 97282-33
Email: iba@iba-ag.com
Contact: Mr. Harald Opel

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