![iba logo]

ibaFOB-D

Fiber Optic ibaNet Interface Board for PCI and PCI Express

Manual

Issue 2.1

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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.

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Certification

The product is certified according to the European standards and directives. This product meets the general safety and health requirements.
Further international customary standards and directives have been observed.

CE

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	Modifications	Chapter / page	Author	Version HW/FW
2.1	11-2023	Technical data (MTBF)			

Table of contents

1   About this manual

This manual describes design, application and operation of the ibaFOB-D board family (PCI and PCI Express) and its extension modules ibaFOB-4o-D (short and long).

PCI boards

1   ibaFOB-2i-D

2   ibaFOB-io-D

3   ibaFOB-2io-D

4   ibaFOB-4i-D
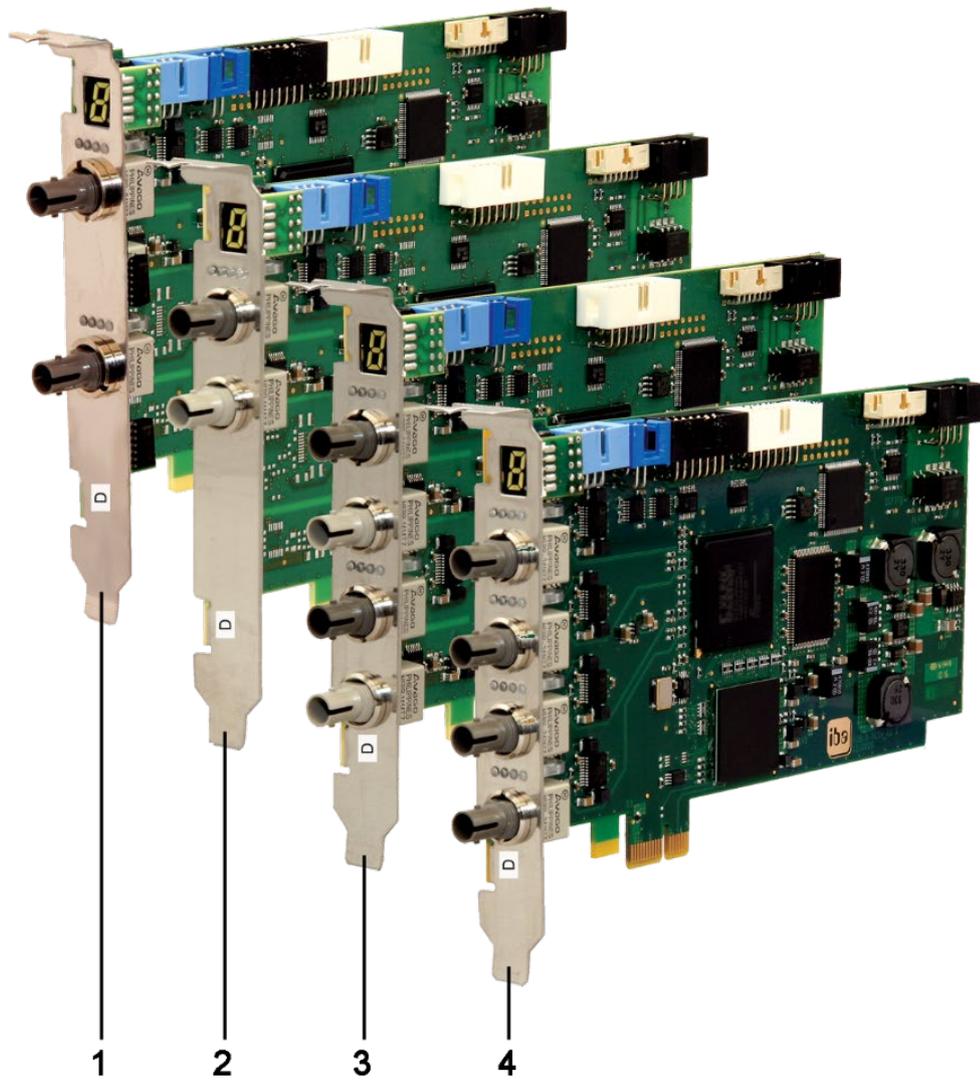
PCI Express boards (HW version A)

1   ibaFOB-2i-Dexp

2   ibaFOB-io-Dexp

3   ibaFOB-2io-Dexp
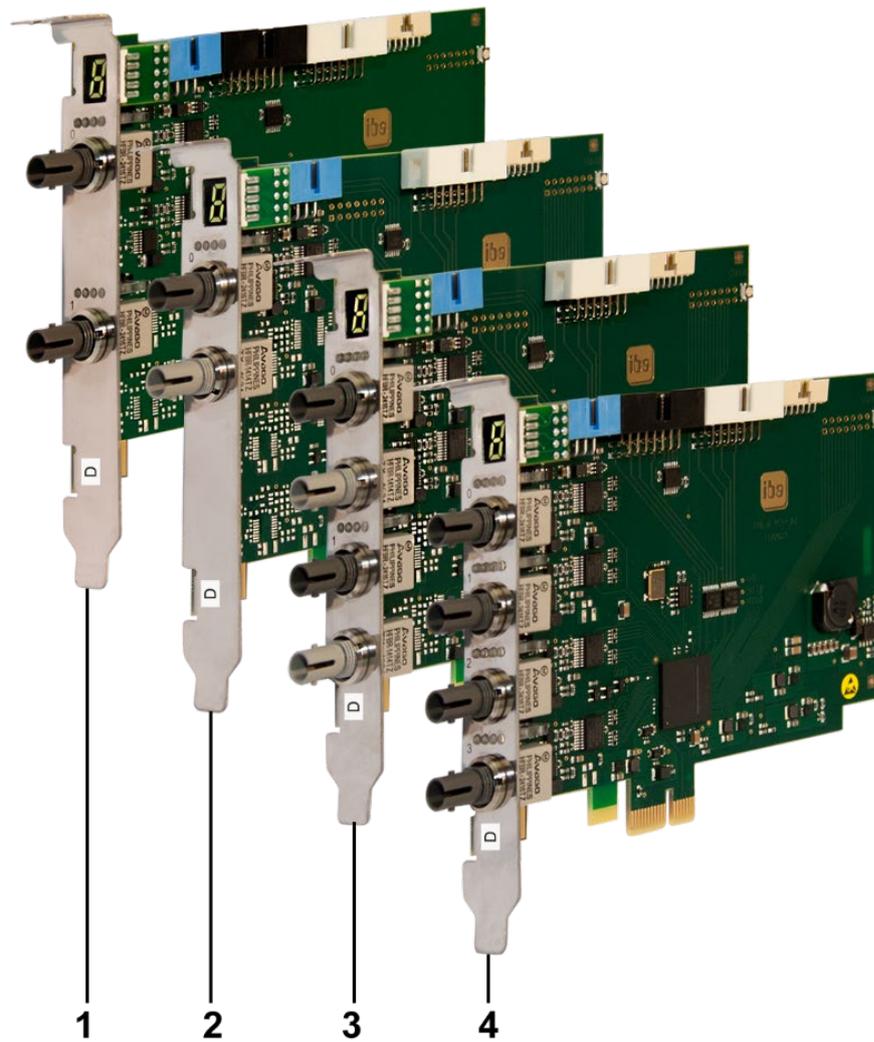
4   ibaFOB-4i-Dexp

PCI Express boards (HW version B)

1   ibaFOB-2i-Dexp

2   ibaFOB-io-Dexp

3   ibaFOB-2io-Dexp

4   ibaFOB-4i-Dexp
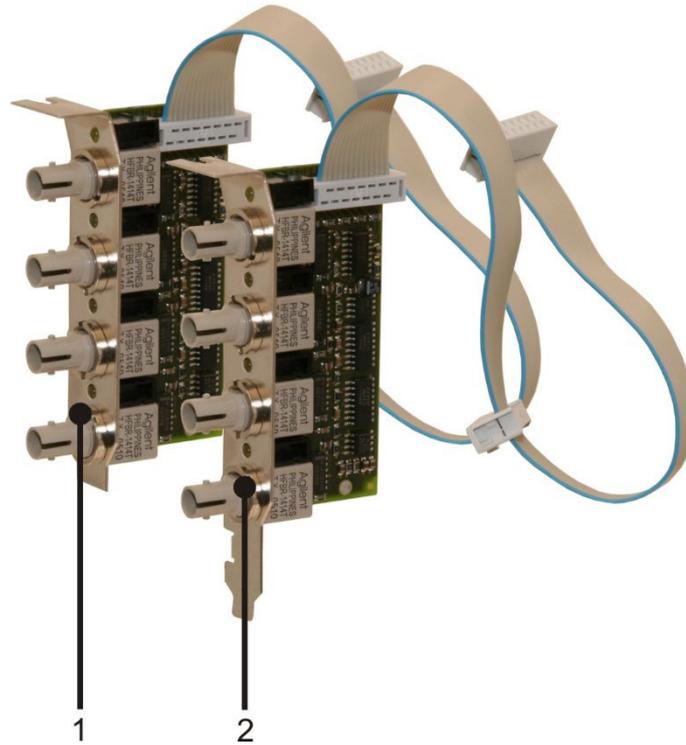
Extension modules

1 ibaFOB-4o-D rackline slot
   (output module with short slot plate for ibaRackline)

2 ibaFOB-4o-D-PCI
   (output module with long slot plate for standard PCI slot)

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	Notation
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   Safety and other advices

2.1   Intended application

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

❑   Automation of industrial systems

❑   Measurement data logging and analysis

❑   Applications of iba software products (ibaPDA, ibaLogic, etc.)

This board must only be connected to peripheral devices of iba AG or dedicated devices of other manufacturers.

Important note

The pass-through of the ibaFOB board family into virtual machines (VMs) is not supported, because additional latencies may result in loss of measurement data or firmware updates are not performed correctly and the ibaFOB board no longer functions as a result.

2.2   Conventional installation

This board must only be installed in IBM-PC compatible computers (PC).

2.3   Special safety advices

⚠ **DANGER**

Electric shock!

Switch off the PC and disconnect it from the mains power supply before opening!

⚠ **CAUTION**

Electrostatic discharge!

This board contains components which can be destroyed by electrostatic discharge. Before touching the board, make sure that your body is electrically discharged or work in a designated ESD protected area!

The standards for handling electrostatic sensitive devices (ESD) must be followed.

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.

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3   Scope of delivery

After unpacking, check the completeness and intactness of the delivery.

The scope of delivery includes:

❑ ibaFOB-D board or ibaFOB-Dexp board

❑ Flat ribbon synchronization cable

4   System requirements

4.1   Hardware

PC with at least:

❑ Multicore CPU 2 GHz or better

❑ 4 GB RAM or more

❑ 100 GB HDD

❑ 1 free PCI slot (32 bit or 64 bit) or PCIe 1.0-x1 compatible slot per board

4.2   Software

❑ ibaPDA version 7.3.2 or higher

❑ ibaQDR version 6.23.1 or higher

❑ ibaLogic-V4 / -V5

5   Device description

5.1   General application

The boards of the ibaFOB-D family are communication boards with ibaNet fiber optic links. The boards use the DMA technology (**DMA** = Direct Memory Access) for data transfer between board and computer. The mechanical design complies with standard PCI slots or PCI Express slots respectively.

The boards are the successor boards for the board models of the ibaFOB-S and ibaFOB-X families and are made to replace these former models completely.

The boards can be used to connect iba peripheral devices such as ibaPADU analog-digital-converters, ibaNet750 devices, ibaLink signal modules and ibaBM bus monitors to a standard or industrial PC. The boards can also be used for connecting an iba-system to automation devices of other manufacturers, e. g. ABB AC 800PEC or SIMATIC TDC-interface boards LO5/LO6.

The boards have different numbers of fiber optic inputs which can be operated in different communication modes depending on the connected devices.

The boards cover all current and former ibaNet communication protocols and thus can be used for processing of data from an old ibaPADU device (S/N <1000) and an ABB 800PEC high performance controller or a SIMATIC TDC LO6 board as well. Furthermore, the 5Mbit transmission mode is supported which enables the boards to be used for measuring fast signals (25 kHz) from an ibaPADU-8-ICP, ibaPADU-8-M or -16-M.

5.2   Device properties

❑ Full compliant PCI V2.2 board, supporting both 3.3 V and 5 V signal levels and supporting both 33 MHz and 66 MHz PCI bus clock speed

❑ PCI Express board: PCIe 1.0-x1 compatible slot (PCIe-x1, x4, x8, x16)

❑ Measurement data is written/read directly to/from PC memory without CPU intervention (PCI Bus Master DMA). This is a significant relief for the CPU load while data traffic is boosted.

❑ Independent fiber optic input channels

❑ All currently existing ibaNet link protocols are supported:

- 2Mbit (for ibaPADU devices with S/N < 1000)
- 3Mbit
- 5Mbit
- 32Mbit
- 32Mbit Flex

❑ 4 LEDs for each input channel indicating operational status, link status, data transmission rate and error

❑ 7-segment display for board-ID and indication of sync master board

❑ Expansion connector (white) for ibaFOB-4o-D module to mirror the inputs

❑ Expansion connector (black) for ibaFOB-4o-D to transmit analog and digital output signals. Possible applications: ibaLogic outputs or ibaPDA alarms and ibaPADU-8-M/-ICP bidirectional connection

❑ No jumpers or DIL switches, all parameters are software controlled

❑ Interrupt synchronization cable to connect multiple iba boards in one PC

❑ Firmware upgrade without uninstalling the board

5.3   Modes of operation

The table below gives an overview of the available operation modes, link speed, number of signals, data sampling time and typical devices:

Link speed	Max. number of signals per FO link	Sampling time	Typical device
Single fiber input-only modes			
2Mbit	32 INT + 32 Digital	≥1 ms	ibaPADU16/32 (old, S/N < 1000)
3Mbit	64 INT + 64 Digital	≥1 ms	ibaPADU8/16/32
	64 REAL + 64 Digital	≥1 ms	ibaLink-SM-64-i-o
5Mbit	8 INT + 8 Digital	≥50 µs	SIMATIC TDC LO5
32Mbit	64 INT + 64 Digital	≥50 µs	SIMATIC TDC LO6
	128 INT + 128 Digital	≥100 µs	SIMATIC TDC LO6
	512 REAL + 512 Digital	≥800 µs	ABB AC 800PEC (1 ms)
	DPM-S mode	≥800 µs	ibaBM-DPM-S (1 ms)
	8 x (64 INT + 64 Digital)	≥1 ms	ibaBM-COL-8i-o (1 ms)
Bidirectional fiber modes (output link required)			
5Mbit	8 INT + 8 Digital	≥40 µs	ibaPADU-8-M ibaPADU-8-ICP
32Mbit Flex	variable*	≥10 µs	ibaPADU-S-CM
Single fiber output-only modes (output link required)			
3Mbit	64 REAL + 64 Digital	≥1 ms	ibaNet750BM
32Mbit	Not supported by PC software yet		

*Example: payload transmission of 64 Byte at 25 µs sampling time or 3100 Byte at 1 ms.

Besides the mere hardware parameters the usability of board and devices in combination with a certain operational mode depends also on the iba software application.

Not all of iba application software products support all modes or boards at the time.

The following table shows the supported combinations of modes of operation and software applications:

Protocol	3Mbit		5Mbit		32Mbit		32Mbit Flex	
Transmission rate	3.3 Mbit/s		5 Mbit/s		32 Mbit/s		32 Mbit/s	
Sampling rate	1 Hz -1 kHz		0.5 kHz - 25 kHz		1.25 kHz - 20 kHz		0.5 kHz - 100 kHz	
Number of signals per FO link	64 A + 64 D		8A + 8D		512 A + 512 D (1 ms) 64 A + 64 D (50 µs)		Up to 4060 Bytes	
Application	**Input**	**Output**	**Input**	**Output**	**Input**	**Output**	**Input**	**Output**
ibaPDA	■	□ 1)	■	-	■	-	■	■
ibaLogic	■	■	-	-	■	■	-	-

■ = Ok, □ = possible, - = not supported

1) Alarm outputs (50 ms) via ibaFOB-4o-D, -io-D, -2io-D

Note

The boards are not supported by ibaScope and ibaLogic-V3. If you need spare boards for these software applications, please contact iba support.

5.4   Extension modules

Every ibaFOB-D board can be extended by up to 2 output modules ibaFOB-4o-D. These extension modules are available in 2 different designs:

❑   Short, for ibaRackline computers (special housing slots)

❑   Long for standard PCI slots or PCIe slots 1.0-x1 compatible

The extension modules should be connected by a flat ribbon cable with the board. Depending on the intended function the module should be plugged into the appropriate connector.

❑   Mirroring the optical inputs
The optical input channels are mirrored on the output channels, with almost no delay. Thus, other iba systems equipped with ibaFOB input boards can be supplied with the same measured data.

❑   Outputs of application software
In this case the ibaFOB-D board operates in duplex mode, i. e. signals can be received and transmitted independently. With ibaPDA you are able to use the alarm outputs, with ibaLogic you are able to use these output channels as output resources.

5.5   Front view
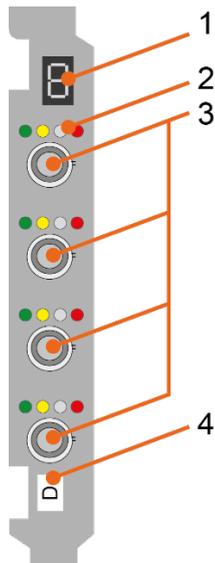
1   7-segment display

2   4 LEDs for link status

3   Fiber optic inputs

4   ID label of ibaFOB boards*

*This ID label is used to distinguish the individual ibaFOB board types. The following ID label indicates the following board types:

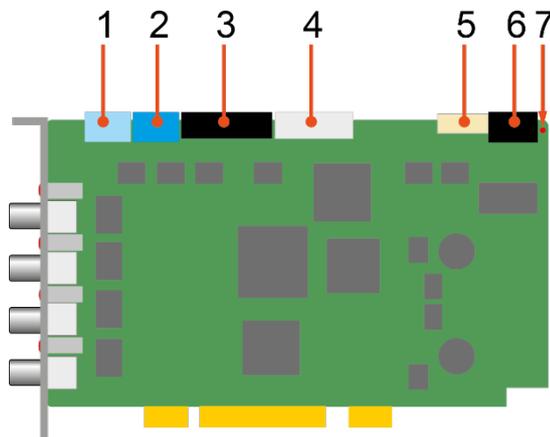D: ibaFOB-D and ibaFOB-Dexp

TDC:ibaFOB-TDC and ibaFOB-TDCexp

SD: ibaFOB-SD and ibaFOB-SDexp

PC: ibaFOB-PlusControl

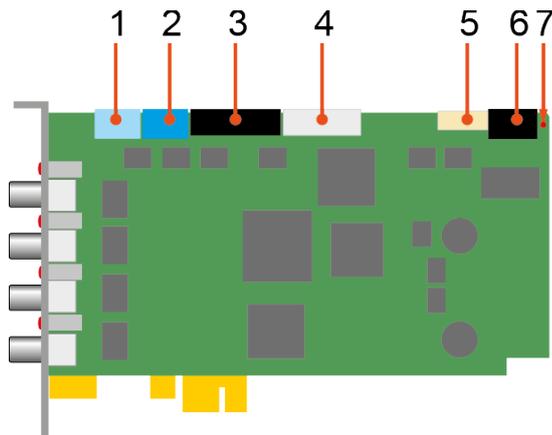## 5.6   Additional board connectors

PCI boards

Example ibaFOB-4i-D

1   SYNC: synchronization of iba boards (Sync-IRQ connector)

2   +5V: power supply for Sync-i/Sync-o

3   TX-OUT: ibaFOB-4o-D (outputs)

4   TX-MIRROR: ibaFOB-4o-D (mirrored inputs)

5   JTAG: service interface

6   DCF77 & ALARM: spare connector, prepared for future extensions

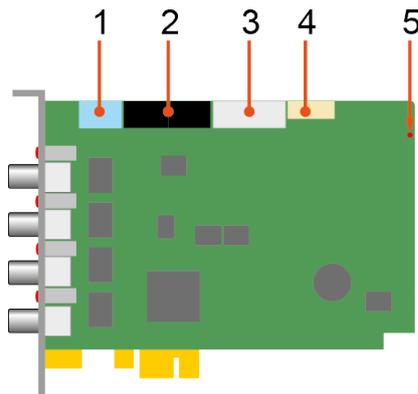7   ALARM STATUS: debug LED

PCI Express boards (HW version A)

Example ibaFOB-4i-Dexp

1   SYNC: synchronization of iba boards (Sync-IRQ connector)

2   +5V: power supply for Sync-i/Sync-o

3   TX-OUT: ibaFOB-4o (outputs)

4   TX-MIRROR: ibaFOB-4o (mirrored inputs)

5   JTAG: service interface

6   DCF77 & ALARM: spare connector, prepared for future extensions

7   ALARM STATUS: debug LED

PCI Express boards (HW version B)

Example ibaFOB-4i-Dexp

1   SYNC: synchronization of iba boards (Sync-IRQ connector)

2   TX-OUT: ibaFOB-4o (outputs)

3   TX-MIRROR: ibaFOB-4o (mirrored inputs)

4   SERVICE: service interface

5   STATUS: debug LED

Maximum distance of fiber optic connections

The maximum distance of fiber optic connections between 2 devices depends on various influencing factors. This includes, for example, the specification of the fiber (e.g. 50/125 µm, 62.5/125 µm, etc.), or the attenuation of other components in the fiber optic cable plant such as couplers or patch panels.

However, the maximum distance can be estimated on the basis of the output power of the transmitting interface (TX) or the sensitivity of the receiving interface (RX). A model calculation can be found in chapter 12.4.

The specification of the transmitter's output power and the receiver's sensitivity of the fiber optic components installed in the device can be found in chapter 12.1 "Technical data" under "ibaNet interface".

5.7   Status display of fiber optic inputs

LED	Status	Description
Green (Run)	Flashing	Power is on and the channel is functioning properly
	OFF	Controller stopped (hardware failure)
Yellow (Link Slow)	ON	Receiving 2Mbit, 3Mbit or 5Mbit telegrams on this channel, link correctly configured
	Flashing	Receiving 2Mbit, 3Mbit or 5Mbit telegrams on this channel, but link configured for another protocol 32Mbit Flex mode: TCP/UDP telegram detected via FO (flashing unsteady)
	OFF	No 2Mbit, 3Mbit or 5Mbit telegram detected
White (Link Fast)	ON	Receiving 32Mbit or 32Mbit Flex telegrams on this channel, link correctly configured
	Flashing	Receiving 32Mbit or 32Mbit Flex telegrams on this channel, but link configured for another protocol
	OFF	No 32Mbit or 32Mbit Flex telegram detected
Red (Error)	ON	Watchdog alarm
	Flashing	Running the "Golden FPGA Flash Rescue mode"
	OFF	Normal state

5.8   7-segment display

The 7-segment display shows the following information:

❑ Horizontal segment only: Board not initialized

❑ Numbers 0 to 7:   Board ID after board was initialized

❑ The decimal point in the display indicates whether the board is configured to be:

▪ An internal interrupt master (dot is on) or

▪ An external interrupt master (dot is blinking) or

▪ An interrupt slave (dot is off)

5.9   Debug LED

This multicolor LED on the board is for debug and service purposes only.

LED	Status	Description
Debug	Green	Board is running and ok
	Red	Watchdog alarm or other error

5.10   Status display on outputs (extension modules)

On top of each FO connector one LED indicates the status of the link.[*]

LED	Status	Description
OFF	OFF	Computer out of operation or extension module not connected with ibaFOB-D board
Yellow	Flickering	No outputs available No fiber optic outputs, i. e. no red laser light visible on output fiber
	Flashing evenly	Outputs available Red laser light visible on output fiber

[*]   Applies to all modes of operation

6   Mounting and dismounting

6.1   Safety advices

The following safety advices apply when handling the board:

⚠ DANGER

Electric shock!

Switch off the PC and disconnect it from the mains power supply before opening!

⚠ CAUTION

Electrostatic discharge!

This board comprises components which can be destroyed by electrostatic discharge. Before touching the board make sure that your body is electrically discharged or works in a designated ESD protected area!

The standards for handling electrostatic sensitive devices (ESD) must be followed.

6.2   Mounting

Note

In order to take advantage of the plug and play function be sure that ibaPDA V6.21.0 (V6.23.1 for PCIe), respectively ibaLogic has been installed before inserting the board. Otherwise, Windows will not recognize the board.
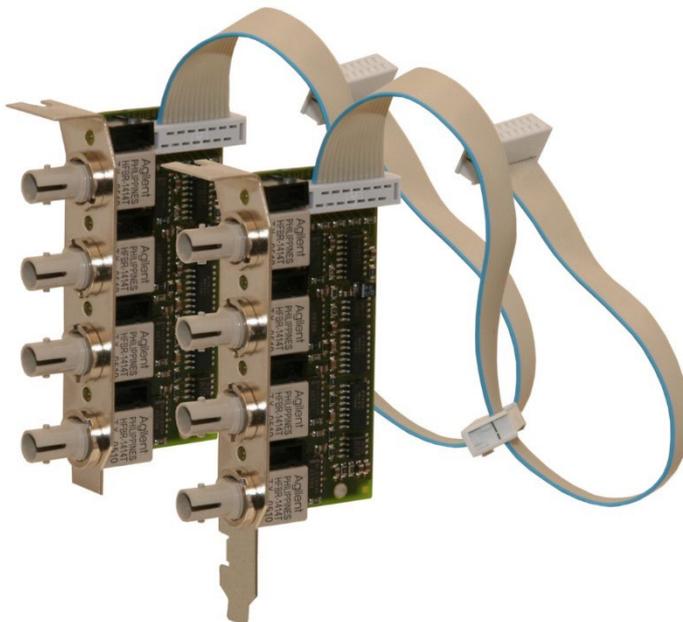
1. Shut down the PC.
2. Switch off the power supply of the PC.
3. Unplug the mains power line.
4. Open the PC so you can reach the PCI(e) slots.
5. Take the board carefully out of the package.
6. Grab the board at the front plate and the rear upper corner. Do not touch the contacts.
7. Plug in the board carefully into a free PCI(e) slot.

Tip

In order to avoid damaging the board press on the top of the metal front plate and on the top edge of the board when pushing the board down into the slot.

Do NOT press on the plugs along the top edge on the board. They might brake off.

8. Fix the board to the housing of the PC. If more than one iba PCI(e) board is installed connect all boards with one another by the flat ribbon cable (sync cable).
9. Close the PC.
10. Plug in the power line.
11. Switch on the power supply of the PC.
12. Start the PC.

6.3   Dismounting

1. Shut down the PC.

2. Switch off the power supply of the PC.

3. Unplug the mains power line.

4. Open the PC so you can reach the PCI(e) slots.

5. Unplug external connections

6. Release the fixing screw.

7. Unplug the board carefully out of the slot. Store the board in an appropriate container.

8. Close the PC.

9. Plug in the power line.

10. Switch on the power supply of the PC.

11. Start the PC.

6.4   Connecting an ibaFOB-4o-D module

If you connect an ibaFOB-4o-D extension module to the board you can either mirror the incoming data or use output features of iba software applications ibaPDA or ibaLogic.
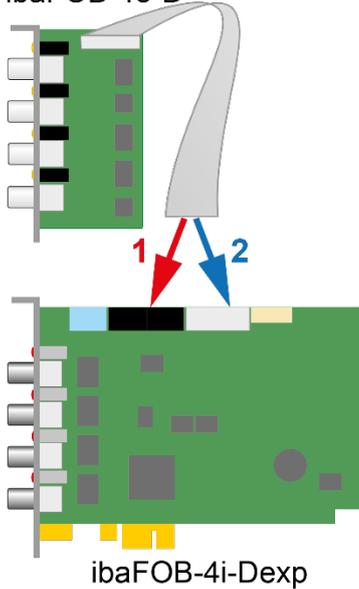
In mirror mode the incoming data stream is copied without significant delay to the output channels.

It is possible to use both modes at the same time by using 2 ibaFOB-4o-D modules.

Which function you can use is determined by the plug on the board the module is connected with.

ibaFOB-4o-D

ibaFOB-4i-Dexp

1-black: ibaFOB-4o-D (outputs)

2-white: ibaFOB-4o-D (mirrored inputs)

Installation procedure:

1. Shut down the PC.

2. Switch off the power supply of the PC.

3. Unplug the mains power line.

4. Open the PC so you can reach the PCI(e) boards.

5. Choose the appropriate connector on the board and plug in the connector of the module.

6. Mount the module on a short slot in the housing using the fixing screws. Plug the connector of the extension module to the black or white connector depending on which function you want to use.

Continue:

7. Close the PC.

8. Plug in the power line.

9. Switch on the power supply of the PC.

10. Start the PC.

Important note!

After the first restart of the computer after the installation of the extension module there is no message indicating new hardware. The extension modules are controlled and administered by the ibaFOB-D board only.

Within the ibaPDA I/O-Manager it is indicated on which port the extension module is connected (marked green).
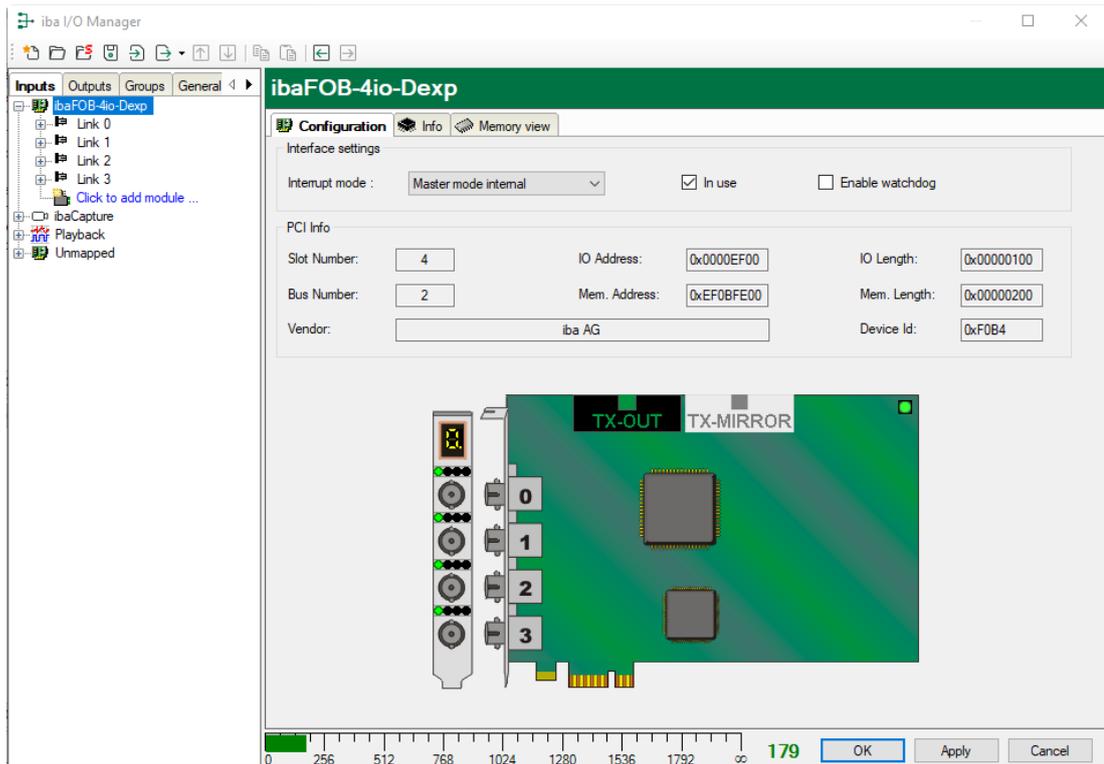
7   Driver installation

The ibaFOB-D and ibaFOB-Dexp boards can be installed in the Windows operating system via plug and play.

> **i**
>
> **Note**
>
> For information on installing the board on an older Windows system, such as Windows XP, refer to one of the previous versions of this manual. Please contact the iba support.

With Windows versions 7 and higher, the process is automated as far as possible.

After the board has been plugged in and the computer has been started, the board is usually detected automatically and the drivers are installed. During this process, various messages appear in the Windows taskbar.

To check whether the board has been detected and the drivers installed, open the Device Manager in the Windows Control Panel.
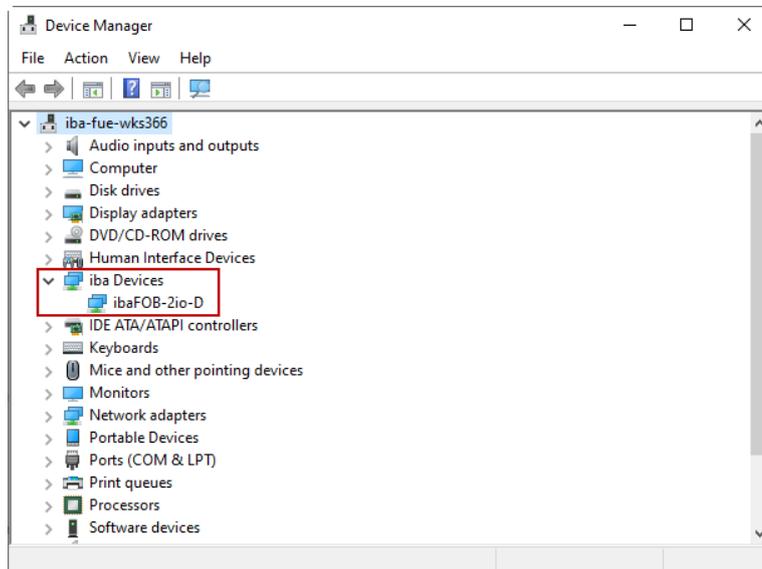
A node *iba Devices* must be displayed and below it the corresponding board (here *FOB-2io-D*).
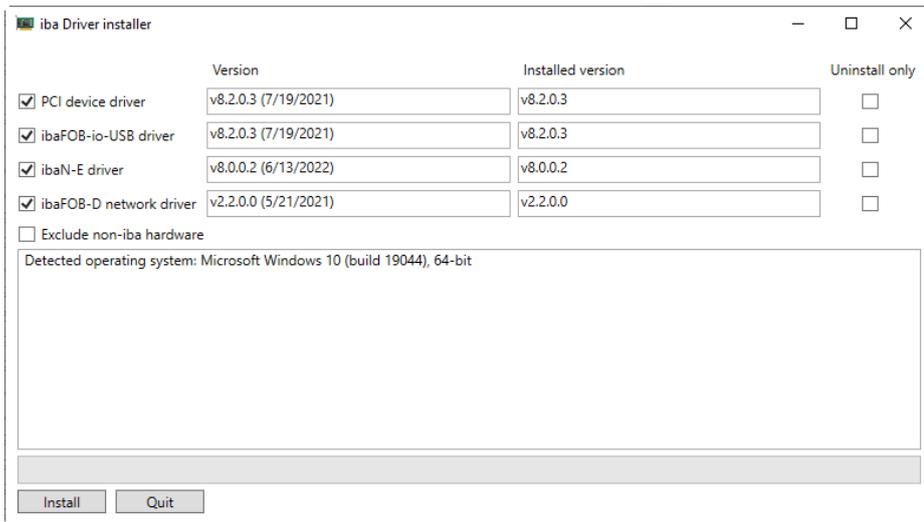
If the board has not been detected automatically, execute the function *Scan for hardware changes* in the Device Manager.

If this method does not work either, you can try to install the drivers manually. ibaPDA must already be installed on the computer. Execute the file
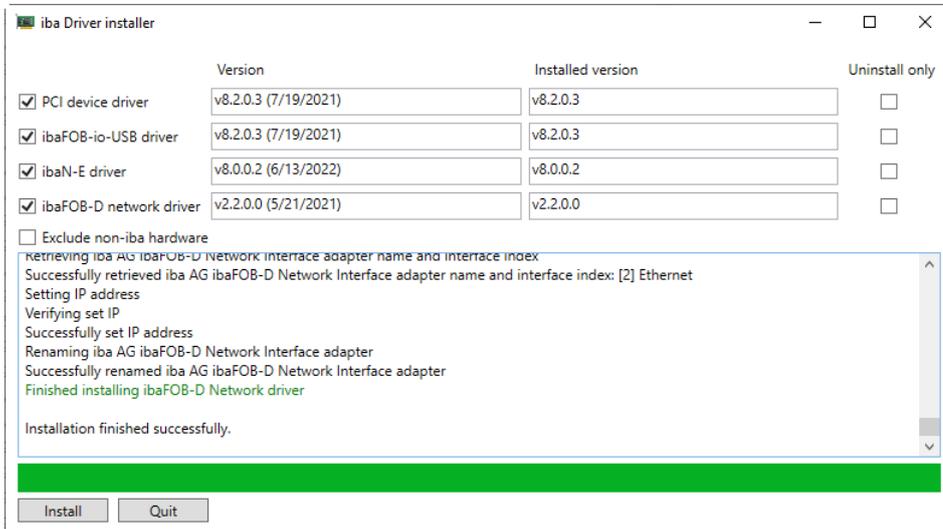
`c:\Program Files (x86)\iba\ibaPDA\Server\ibaDevDrvInstaller.exe`

and the following dialog box appears:

iba Driver installer			− □ ✕
	Version	Installed version	Uninstall only
☑ PCI device driver	v8.2.0.3 (7/19/2021)	v8.2.0.3	☐
☑ ibaFOB-io-USB driver	v8.2.0.3 (7/19/2021)	v8.2.0.3	☐
☑ ibaN-E driver	v8.0.0.2 (6/13/2022)	v8.0.0.2	☐
☑ ibaFOB-D network driver	v2.2.0.0 (5/21/2021)	v2.2.0.0	☐
☐ Exclude non-iba hardware			

Detected operating system: Microsoft Windows 10 (build 19044), 64-bit

| Install | Quit |

Click <Install> to start the installation.

If the installation is successful, this will be displayed clearly:

iba Driver installer			− □ ✕
	Version	Installed version	Uninstall only
☑ PCI device driver	v8.2.0.3 (7/19/2021)	v8.2.0.3	☐
☑ ibaFOB-io-USB driver	v8.2.0.3 (7/19/2021)	v8.2.0.3	☐
☑ ibaN-E driver	v8.0.0.2 (6/13/2022)	v8.0.0.2	☐
☑ ibaFOB-D network driver	v2.2.0.0 (5/21/2021)	v2.2.0.0	☐
☐ Exclude non-iba hardware			

Retrieving iba AG ibaFOB-D Network Interface adapter name and interface index
Successfully retrieved iba AG ibaFOB-D Network Interface adapter name and interface index: [2] Ethernet
Setting IP address
Verifying set IP
Successfully set IP address
Renaming iba AG ibaFOB-D Network Interface adapter
Successfully renamed iba AG ibaFOB-D Network Interface adapter
Finished installing ibaFOB-D Network driver

Installation finished successfully.

| Install | Quit |

---

i **Note**

If the manual installation is not successful, please contact the iba support.

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8   Configuration in ibaPDA

8.1   Configuration of the board

Up to 8 ibaFOB-D boards/ibaFOB-Dexp boards are supported simultaneously in ibaPDA, version 6.21.0/6.23.1 or higher.

In ibaPDA all the modules that could be added to ibaFOB-F, ibaFOB-S and ibaFOB-X boards can also be added to the ibaFOB-D board. The description is based on the example of the ibaFOB-2io-D board.

8.1.1   Board view – "Configuration" tab
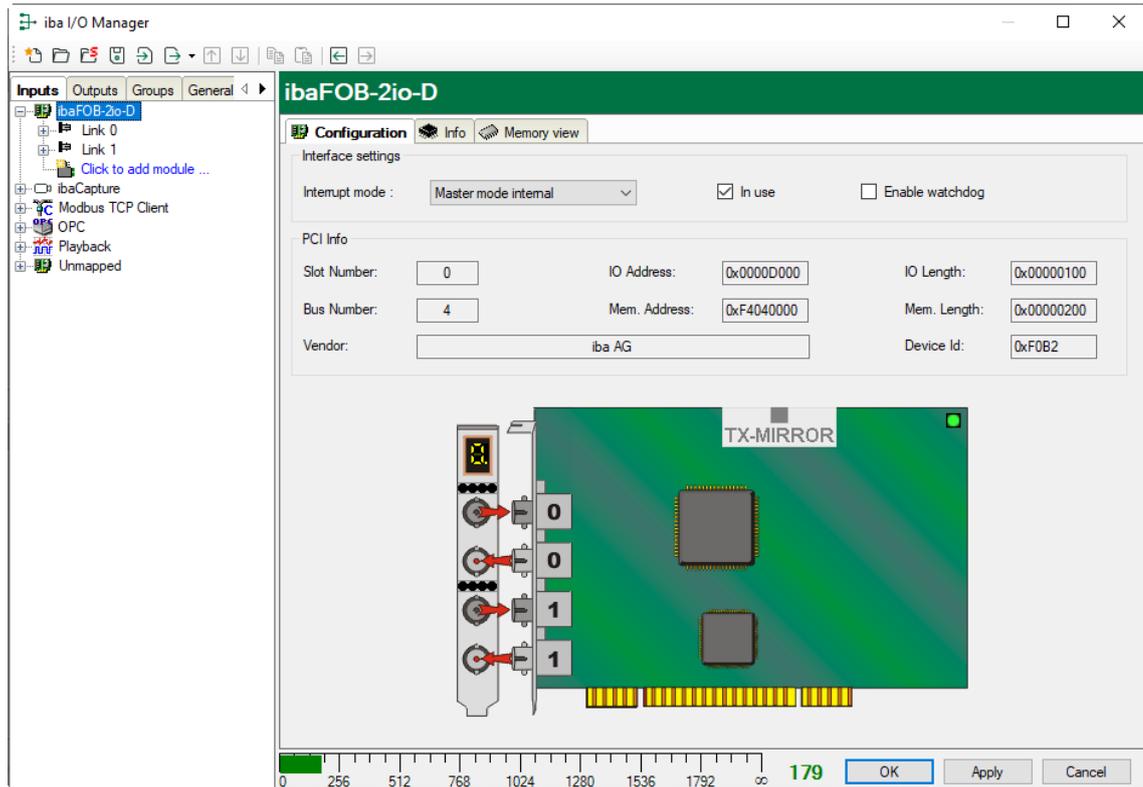
If you mark the node of the ibaFOB-2io-D interface (for example) in the tree view of the I/O Manager, a graphical representation of the board is on display in the dialog.

On the "Configuration" tab, you can setup the interrupt mode. Enable the "In use" option if you want to use this board with ibaPDA.

The board watchdog can also be enabled in order to monitor the function of the ibaPDA system by another system. If the watchdog is enabled then the board will generate an alarm telegram when the acquisition is not running for more than 2 seconds. The alarm telegram can only be used by the FO output channels (I/O Manager: "Outputs"). Therefore an extension module ibaFOB-4o or an ibaFOB-io- or 2io- board is required.

In case of an alarm, all output values will be set to 0 (zero) in the alarm telegram.

The alarm is also activated during the reset of the PC. When the alarm occurs then the red LEDs of all links will be lit and the debug LED will also have a red color.

8.1.2   Board view – "Info" tab
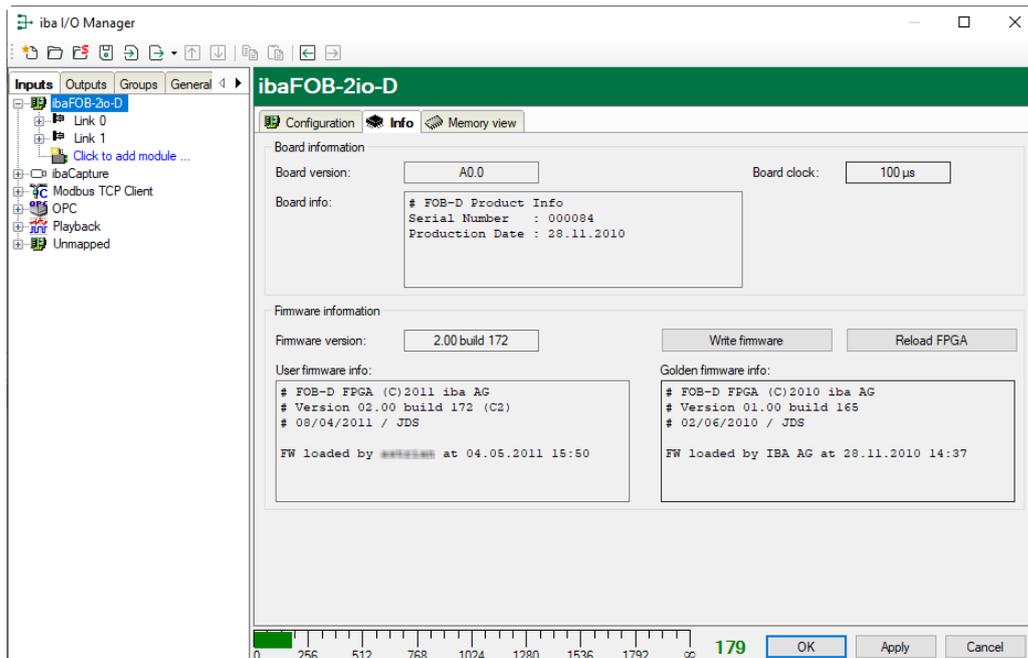
On the "Info" tab you can see information about the board and the loaded firmware. Functions for service and support, such as reloading the FPGA and updating the firmware are available on this tab.

|	
i	**Important note**
	A firmware update should only be performed after consulting the iba support.

By means of the <Write firmware> button, you open the "Firmware loader" dialog. Here you can select and load the correct file.
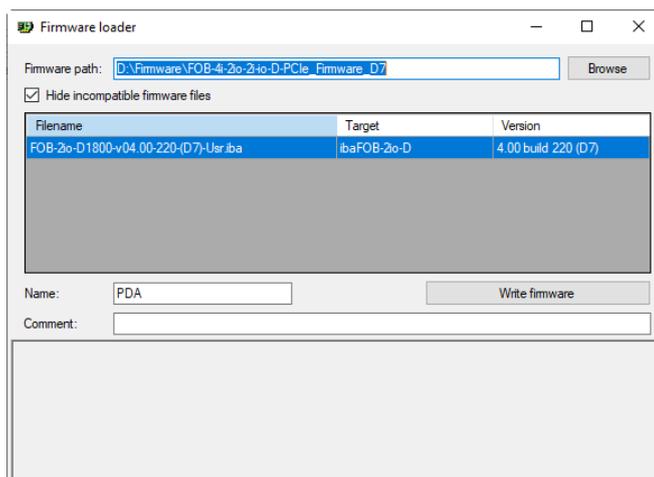
When you enter a directory path or use the <Browse> button, the table will show a list of firmware files found in that directory. You'll find the name of the file, the target board and the firmware version(s) in the file. The file can contain the user firmware or the factory (Golden) firmware or both. Normally the "Golden" firmware is only written at production time. Click the <Write firmware> button to load the firmware into the board.

8.1.3   Link view – 32 Mbit
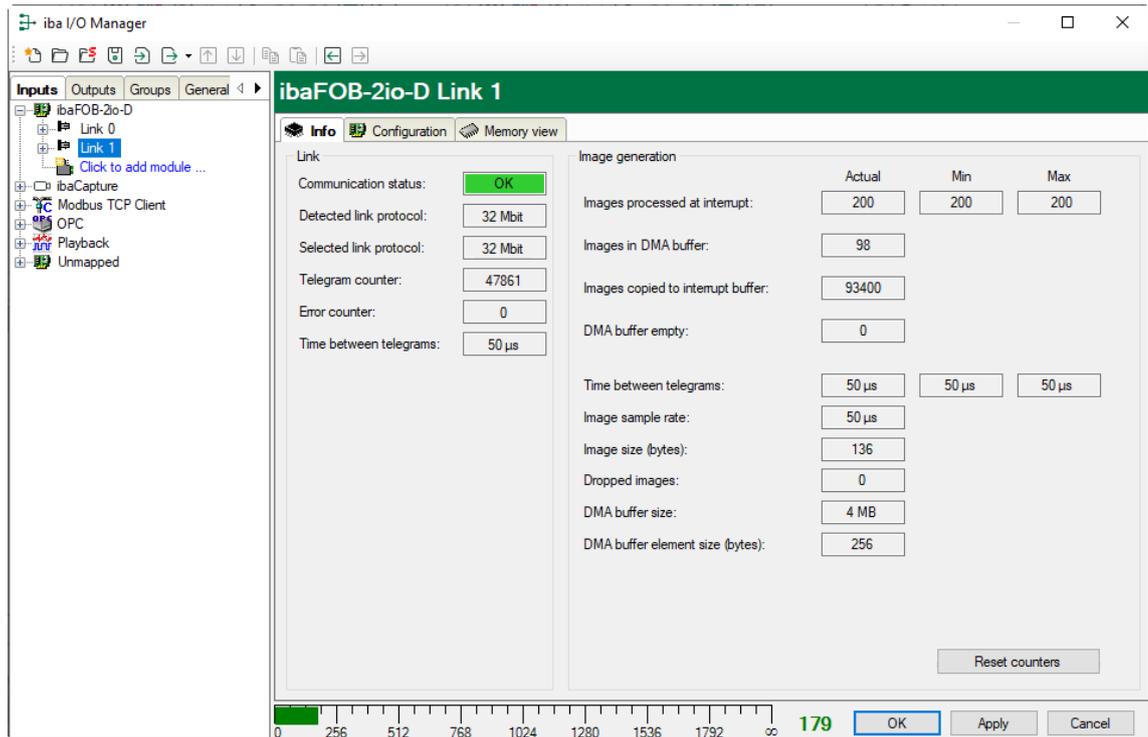
When you click on a link in the tree view then you get information about this link. In the "Info" tab, information about the FO communication is displayed in the left part. The displayed information will depend on the current protocol on the FO link.

"Link" area

❑ Communication status

OK when the FO communication is working well. This means that the telegrams that are being received correspond with the mode that is configured on the link. The link mode is determined by the module that is attached to the link, e.g. if an ibaPADU-8 module is configured then the link will be set in 3Mbit mode. If an ibaPADU-8-ICP module is configured then the link will be set in 5Mbit mode.

❑ Detected link protocol

This is the link protocol that the board detects. This can be 2Mbit, 3Mbit, 5Mbit, 32Mbit, 32Mbit Flex or "?" (No device connected).

❑ Selected link protocol

This is the link protocol set for this link. It is determined by the attached module.

❑ Telegram counter

Counter of correctly received telegrams

❑ Error counter

Counter of received telegrams that have errors (e.g. incorrect checksum)
If this counter changes, the FO communication does not work correctly.

❑ Time between telegrams

The time interval between the last 2 correctly received telegrams.

"Image generation" area

The information on the right side of the dialog describes the image generation. An image is a collection of bytes that the board writes into the PC system memory via DMA. This image contains all data of the measured signals on that link.

Here is a short description of the image generation information:

❑ Images processed at interrupt

These counters show how many images were available in the DMA buffer when the last interrupt fired. This value should normally correspond with the interrupt time divided by the image sampling rate.

❑ Images in DMA buffer

This is the number of images that are in the DMA buffer. This number should remain constant. If this number starts to increase, the system does not work correctly. This may happen if e.g. an interrupt is missed.

❑ Images copied to interrupt buffer

This counter shows how many images have been retrieved from the DMA buffer and have been processed by ibaPDA. This counter should count up continuously.

❑ DMA buffer empty

This counter increments each time the DMA buffer is empty when the interrupt fires. If this is the case, then the driver sets all signal values of the respective link to 0 (zero). This may happen if the FO link is disconnected.

❑ Time between telegrams

The time interval between the last 2 correctly received telegrams

This is the same value as the time in the FO communication information but the driver maintains the minimum and maximum values. There shouldn't be much difference between the minimum and maximum values.

❑ Image sample rate

The rate at which the board writes images to the DMA buffer. This should be faster or equal to the fastest time base of the modules connected to this link.

❑ Image size (bytes)

is the size of the image in bytes. If you multiply the image size with the image sample rate then you know how many bytes per second are transferred by this link over the PCI(e) bus.

❑ Dropped images

This counter increments when the board's DMA fifo is full and an additional image arrives. If this happens then something is seriously wrong. This means that the board is unable to transfer images over the PCI(e) bus.

❑ DMA buffer size

Size of the DMA buffer for this interface.

❑ DMA buffer element size

Size of the elements in the DMA buffer (in bytes).

8.1.4   Link view – 3/2Mbit
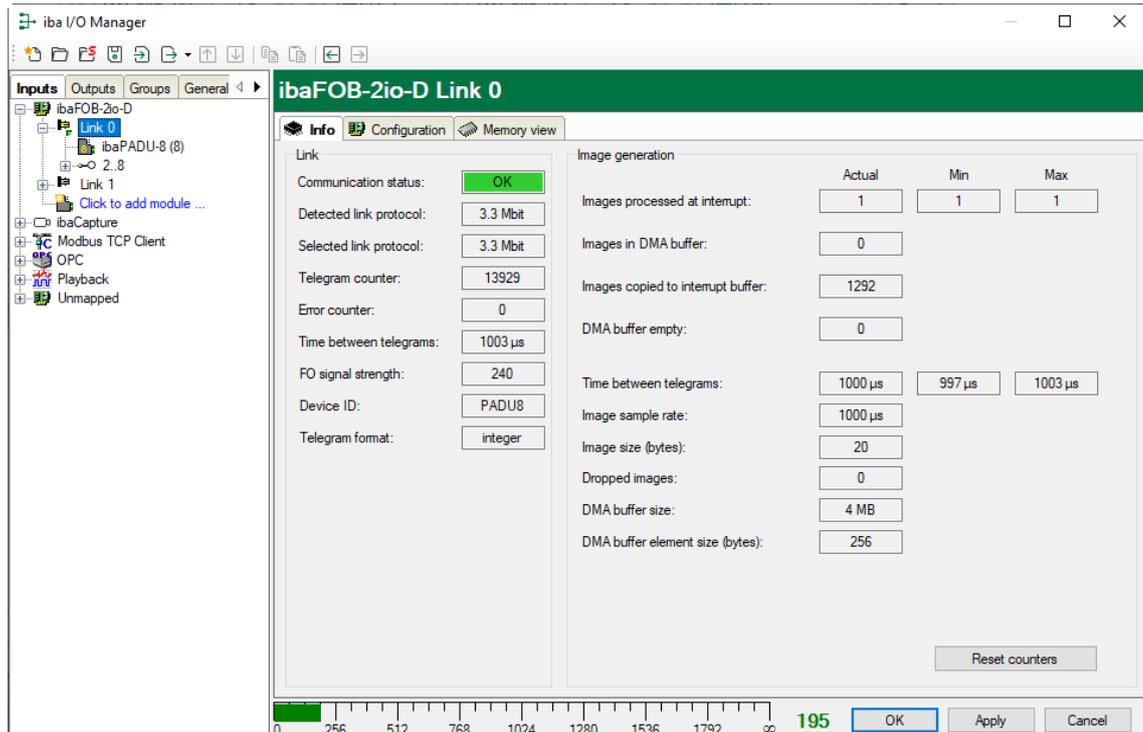
The screenshot above shows the information you see when the link is in 3Mbit mode. There are 3 items that are specific to 2Mbit and 3Mbit:

❑ FO signal strength
This is the difference between the maximum value and the minimum value received from the FO unit. This can be maximum 255. The higher this value the stronger the FO input signal.

❑ Device ID
This is the ID of the last device in the FO chain connected to this link.

❑ Telegram format
This is the format of the analog data that is transferred in the telegram. Possible formats are integer, real and S5 real.

In contrast to former interface boards ibaFOB-F, ibaFOB-S and ibaFOB-X there is an additional property in the general settings of modules for ibaPADU-16 and ibaPADU-32 devices, called "Link protocol". This property can be set to Auto, 2.0 Mbit/s or 3.3 Mbit/s. For older ibaPADU devices with serial numbers <1000 this property should be set to 2.0 Mbit/s.
For younger devices (serial number >1000) the setting should be 3.3 Mbit/s. You may also select "Auto". If it is set to "Auto" then the protocol will be determined automatically as soon as the acquisition has started. This will only work when the device is connected to the FO link at the time of start of the acquisition.

Furthermore, there is another difference to the previous ibaFOB boards concerning the module SM64. The system interface board ibaLink-SM-64-io can be put into a SIMATIC S5 system. The ibaLink-SM-64-io will then send S5 real instead of standard IEEE 754 real. The previous boards automatically converted S5 real into IEEE 754 real. The ibaFOB-4i-D has to be configured to do this. That is why ibaPDA needs to know the incoming telegram format. The link mode property is extended with the S5 real format when an ibaLink-SM-64-io board is connected to an ibaFOB-D board.

8.1.5   Link view – 5Mbit

The screenshot above shows the information you see when the link is in 5Mbit mode. Most items have been already explained for 3Mbit. Additional items are:
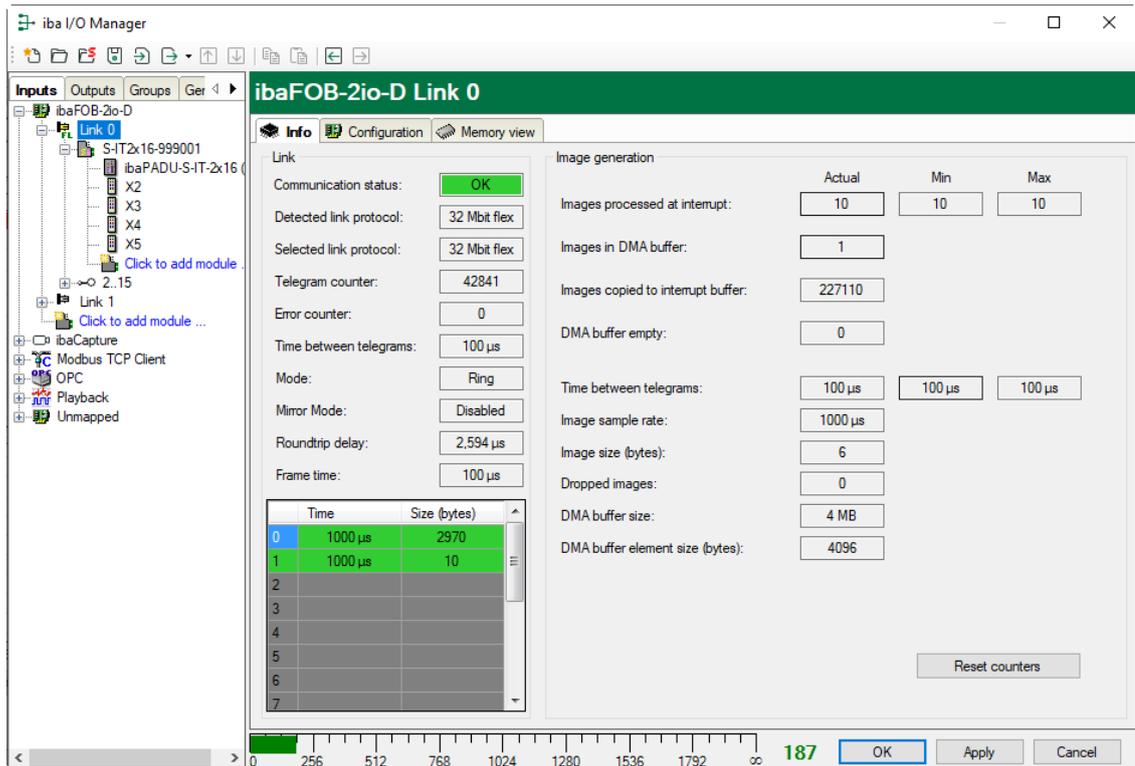
❑ Device firmware date
The firmware date of the connected device.

❑ Gain and filter table
The gains and filters that are configured in the device. This only applies to ibaPADU-8-ICP devices.

8.1.6   Link view – 32Mbit Flex

The screenshot above shows the information you see when the link is in 32Mbit Flex mode. Up to 15 devices can be connected in a ring topology per link. In the signal tree on the left side, the links 1 – 15 below the ibaFOB-D board correspond to the address set by the rotary switch at the connected device.

Additional items, which are specific to 32Mbit Flex:

"Link" area

❑ Time between telegrams
Time between two telegrams measured by the ibaFOB-D board. It should be equal to the configured frame time.

❑ Mode
Status of the connection mode
Ring: one or more devices (cascade) are bidirectionally connected and the FO ring is closed.
Open chain: Only the fiber optic input is connected to a device. The output is not connected or the FO ring is interrupted.

❑ Mirror mode
Indicates whether mirror mode is disabled or enabled. If mirror mode is enabled, the display shows whether the board is configured as master or slave system. Description of mirror mode see chapter 8.1.6.1.

❑ Roundtrip delay
Telegram cycle in the closed FO ring. The time depends on the number of the connected devices in the ring (approx. 2 µs per device).
Due to the roundtrip delay the data of the connected devices might be captured asynchronously (up to one telegram cycle).

❑ Frame time

Fixed cycle time the data frames are being sent. (Smallest configured timebase or 100 µs, when this timebase is an integer multiple of 100 µs. The timebase of all devices must be a multiple of the smallest timebase.)

❑ Table

The table shows the cycle time and the data size of the respective channel:

Row 0:   Ethernet channel

Rows 1-15: connected devices with the respective address 1-15

8.1.6.1 Mirror mode with 32Mbit Flex

The option "mirror mode" is available in ibaPDA version 6.32.0 or higher. The mirror mode allows multiple ibaPDA systems to acquire simultaneously the data of the same Flex devices. For this purpose, one ibaPDA system is configured as master. The master system is the only one that can configure the Flex devices. The other ibaPDA systems are configured as slaves and can only acquire the data of the Flex devices, but not change the configuration.

The master ibaPDA system requires a bidirectional fiber optic connection to receive and send data to the Flex devices. The slave ibaPDA only needs a single fiber optic connection to receive data from the Flex devices and the device configuration.
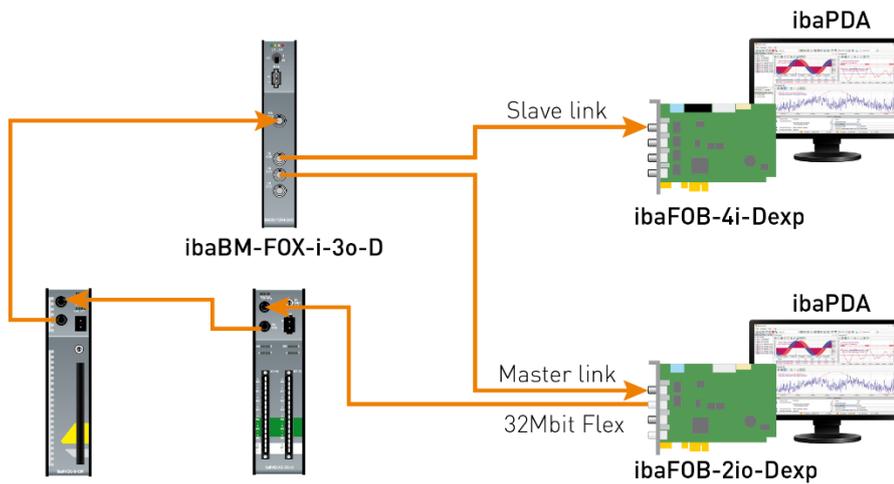
| **Note** |
| :--- |
| The slave system cannot output data via fiber optics. |

Possible connections
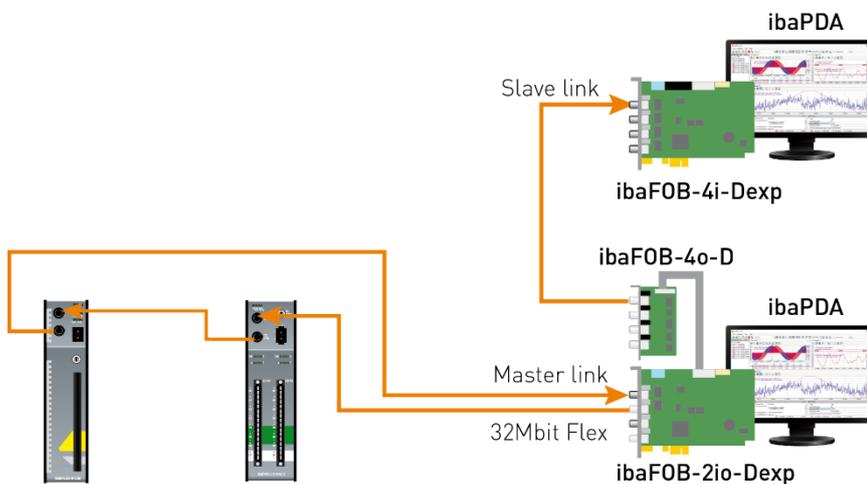
The data from the master is mirrored via an ibaFOB-4o-D output board, which is connected to the white connector of the ibaFOB-2io-D for mirror mode. See also chap. 5.6. The slave ibaPDA receives the data via an ibaFOB-D input board.

The fiber optic output of the last Flex device is connected to the input of an ibaBM-FOX-i-3o-D device. One output of ibaBM-FOX-i-3o-D is connected to an input of the master ibaPDA, another output is connected to an input of the slave ibaPDA.
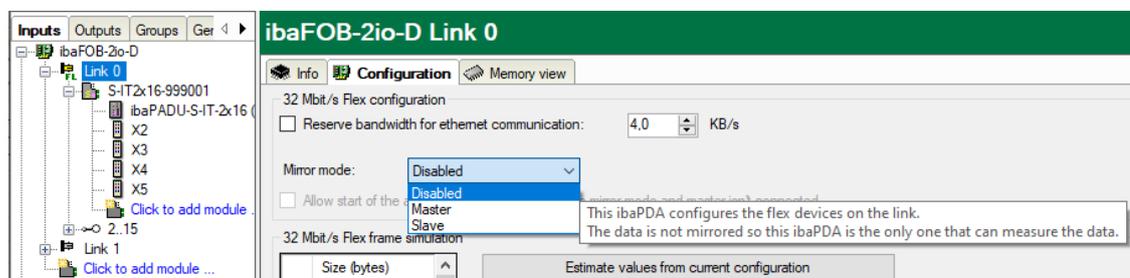
This connection allows the slave ibaPDA to acquire data even when the master ibaPDA has been shut down.
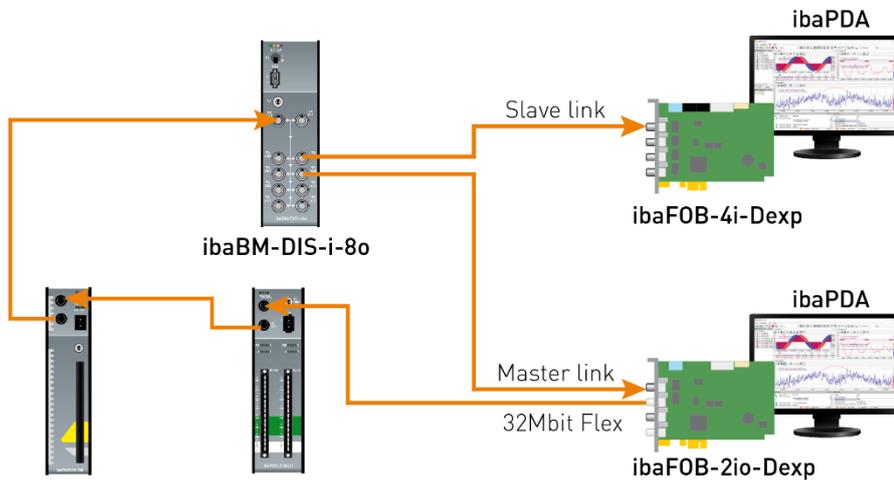
The example above with ibaBM-DIS-i-8o is similar to the example with ibaBM-FOX-i-3o-D. The ibaBM-DIS-i-8o device mode must be set to copy mode (S1 = 0).

Configuration in ibaPDA

Open the "Configuration" tab in the link view of the ibaFOB-D board to configure the mirror mode.


3 settings are available for mirror mode:

❑ **Disabled**: The data is not mirrored, so this ibaPDA system is the only one that can acquire data and configure the devices.

❑ **Master**: This ibaPDA system configures the Flex devices on the link. The data and the device configurations are mirrored so that other ibaPDA systems can also acquire the data.

❑ **Slave**: This ibaPDA system receives the device configuration from the master ibaPDA so that it can acquire data configured by the master ibaPDA.

The slave ibaPDA can get the device configuration from the master ibaPDA by using the "autodetect" function. A slave ibaPDA cannot change the device configuration. The slave ibaPDA shows the link and its modules in the signal tree with lock symbols.
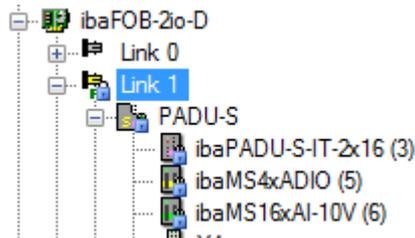
When the acquisition has been started on the slave ibaPDA, the slave waits until it receives the configuration from the master. If this configuration is different from the current configuration, the slave will load the new configuration.

If the slave doesn't receive a configuration within 6 s, an error message will be generated. When the option "Allow start of the acquisition when the link is in slave mirror mode and master isn't connected" is enabled, then the acquisition will start anyway with the last configuration.


When the master ibaPDA changes the configuration while the slave ibaPDA is acquiring then the slave will automatically restart.

8.1.6.2   Telegram size calculation with 32Mbit Flex

The data size per participant is dynamically allocated in a 32Mbit Flex ring. The data size is calculated by ibaPDA and it depends on the configured number of analog and digital signals and the smallest configured time base in the ring.

Beginning with version 6.33.1, ibaPDA provides a simulator which calculates the data size that can be transmitted via fiber optics with 32Mbit Flex protocol. The simulator is in the Configuration tab in the link module.
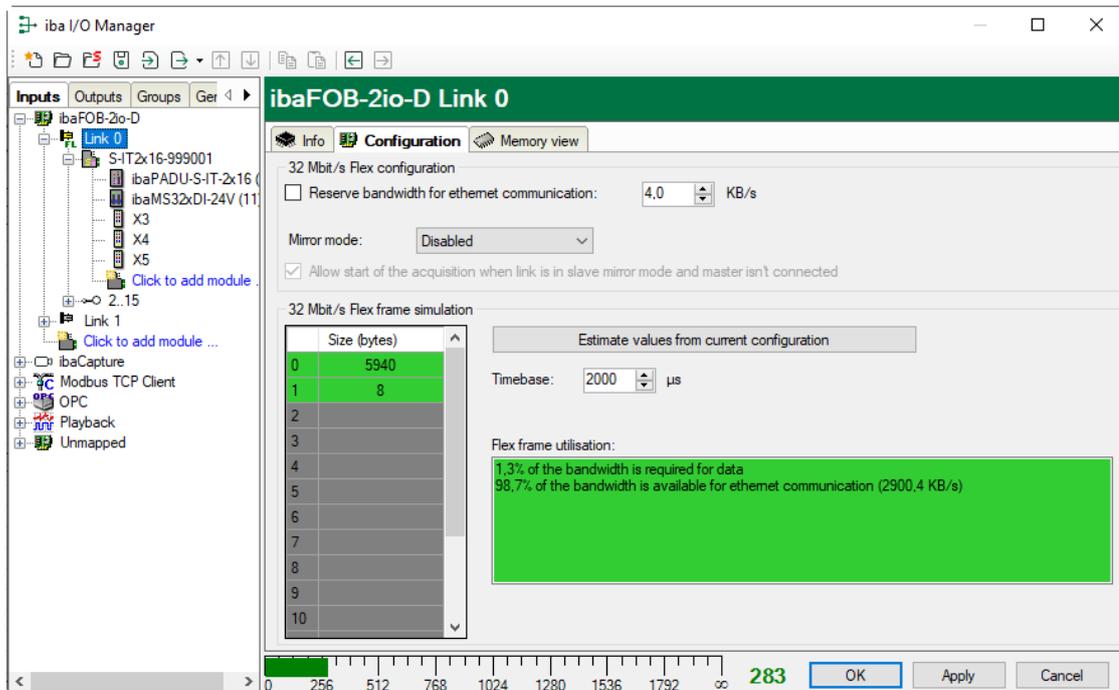
The data sizes in bytes of each device on the link and the timebase of the data acquisition on the link (in µs) is needed for the calculation.

The values can be manually entered or taken automatically from the current configuration, either with a click on the button <Estimate values from current configuration> or when the respective link of the ibaFOB board is marked in the module tree.

The devices in the Flex ring and the corresponding data sizes are listed in the grid on the left. Address 0 corresponds to the Ethernet channel and is not editable.

The section "Flex frame utilization" indicates how much of the bandwidth is still available. The color of the section changes with the utilization rate:

- Green: OK
- Orange: bandwidth for the Ethernet channel < 3 kB/s
- Red: too much data.

The values taken automatically are initially estimated. When the configuration is applied by a click on <OK> or <Apply> the actual data sizes are shown on the "Info" tab.

When too much data are configured, you may either decrease the number of signals to be measured or increase the timebase.

Simulation of the load

Even if no devices have been connected and configured, the calculation of the telegram size can be used for calculating the expected data load in advance. However, an ibaFOB-D or ibaFOB-io-ExpressBoard board should be available in the computer.

Open the I/O Manager in ibaPDA, click on the link of the board and select the "Configuration" tab.

Set the smallest planned sampling time in the "Timebase" field. Now, you can enter manually the planned or expected data amount (in Bytes) in the table rows 1 to 15. With every new entry, the result values in the "Flex frame utilization" field are re-calculated.

In this way, you can estimate if the planned number of signals can be processed on one Flex link or if you should use an additional Flex link.

Due to the large data amounts that are usually captured with ibaBM-DP, it makes sense in most cases to operate just one device on a 32Mbit Flex link.

Reserved bandwidth for Ethernet communication

The Ethernet channel (address 0) is used to transmit configuration data, to communicate with the web interface and especially with ibaBM-DP for the display of the Profibus diagnosis. If many devices are configured with a lot of signals, it may happen, that only the minimum size of 1 kB/s is reserved for Ethernet communication. This is not sufficient in many cases and may cause, that the Profibus diagnosis cannot be displayed or the communication with the web interface is very slow.

It is now possible to reserve a fixed bandwidth for the Ethernet channel with the option „Reserve bandwidth for ethernet communication". The default value of 4 kB/s is usually sufficient for configuration data and Profibus diagnosis.
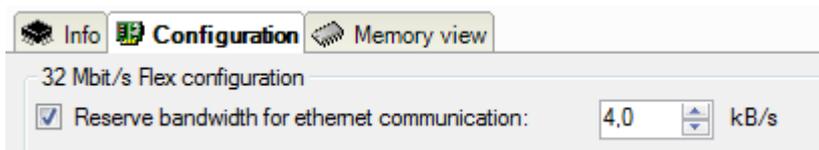
8.2 Configuration of output modules

8.2.1 Introduction

For a number of devices, it is possible to transmit signals from ibaPDA to a device via the FOB output channel. These output signals are mainly intended to signal events or to trigger alarms or warnings. Analog values can also be output. The configuration is carried out in ibaPDA in the I/O Manager.

On the device side, you need a device that is suitable for processing output signals, e.g. ibaNet750-BM with WAGO output terminals or an ibaPADU-S-CM device with one or more output modules.

An ibaFOB board with FO-output links is required on the computer side. The outputs are either the integrated outputs on the board (io and 2io) or the outputs when an extension module ibaFOB-4o (-PCI/-Rackline slot) is connected as an output board.

Below you find a list of the interface boards that can be used for digital and analog output and their corresponding output modules.

Interface board	Output modules	Note
ibaFOB-io-S, -X, -D/-Dexp (inkl. FOB-2io-, 4i+4o) ibaFOB-io-ExpressBoard ibaFOB-io-USB	▪ FOB alarm ▪ ibaNet750-BM	Only available when borad is plugged in FOB link in 3Mbit mode
ibaFOB-io-D/-Dexp (inkc. FOB-2io-, 4i+4o) ibaFOB-io-ExpressBoard ibaFOB-io-USB	▪ ibaPADU-S-CM ▪ ibaPADU-S-IT-2x16 ▪ ibaPADU-S-IT-16 ▪ HAICMON CMU ▪ ibaCMU-S ▪ ibaPQU-S ▪ ibaBM-DP ▪ ibaBM-PN ▪ ibaLink-io-embedded ▪ ibaLink-VME ▪ ibaNet750-BM/-BM-D ▪ Generic Flex	Only available when borad is plugged in FOB link in 32Mbit Flex mode

Which output modules you can use depends not only on the devices used but also on the communication mode used at the FO link.

In 3Mbit mode only the output modules "FOB alarm" and "ibaNet750-BM" (with corresponding output terminals) can be used.

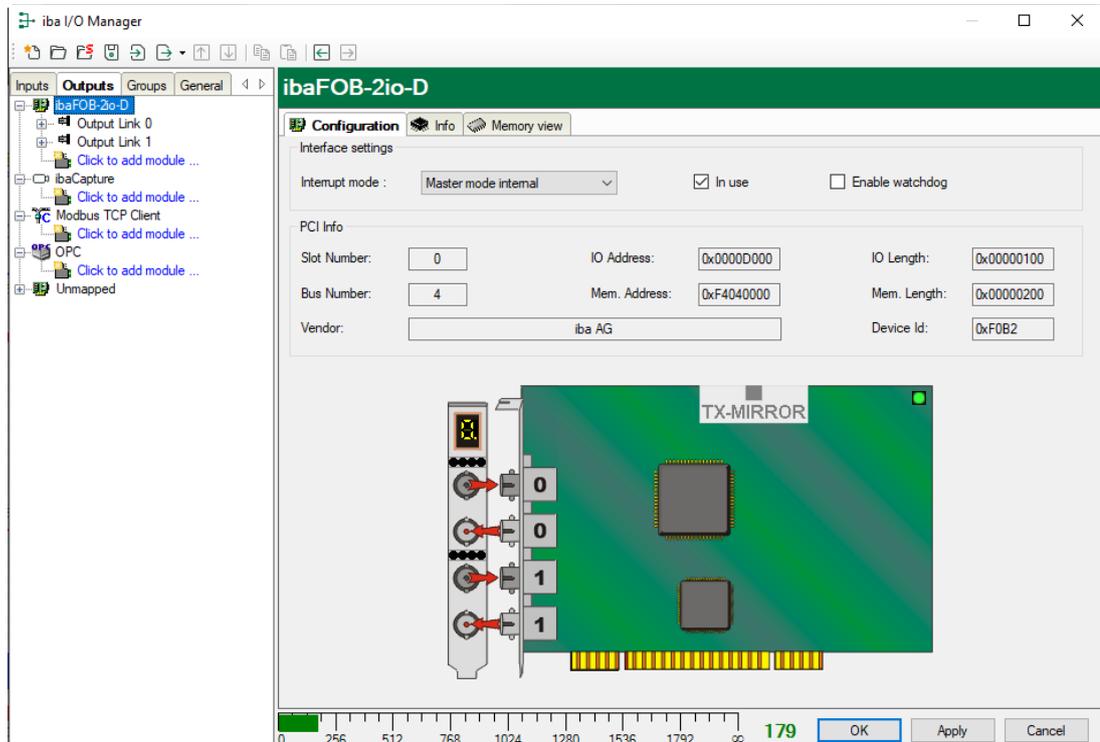Most current devices, such as ibaPADU-S-CM or ibaBM-DP, only support the output function in 32Mbit Flex mode.

In 32Mbit mode no output modules are available.

8.2.2   Configuration

In the I/O Manager, *Inputs* tab you can see the ibaFOB-D board and the configured input modules.
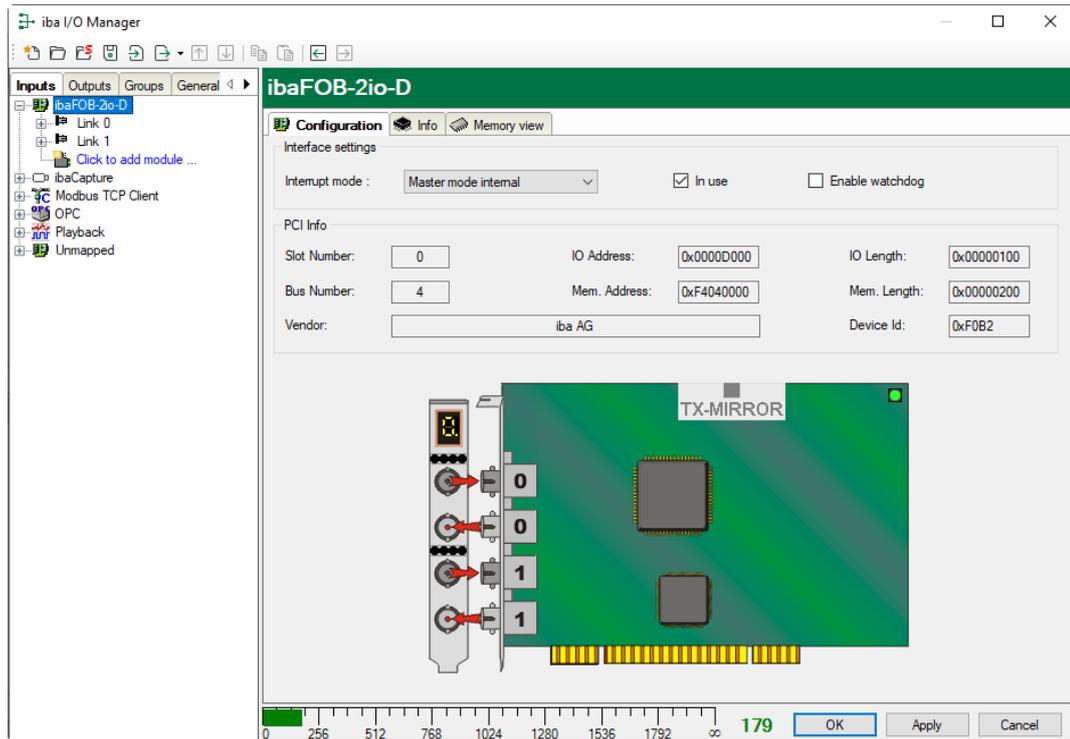
To configure the output links you have to switch to the *Outputs* tab in the I/O Manager.

Depending on the FO communication mode used (3Mbit or 32Mbit Flex) other configuration options are available.

8.2.3 Systems in 3Mbit mode

The output modules "ibaNet750-BM" and "FOB alarm" are available for selection in this mode. Up to 64 analog and 64 digital output signals can be configured for both modules.

Descriptions using the example of a "FOB alarm" module:

Each fiber optic output link can have a FOB alarm module assigned.
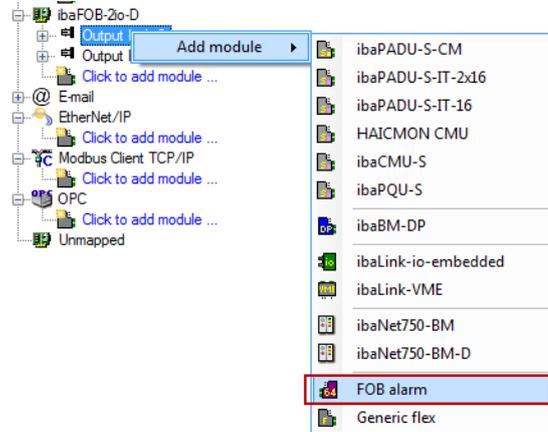
You can change the name of the FOB alarm module according to your needs. This provides the advantage of a clear assignment within the measuring system.

Output links without FOB alarm modules or with FOB alarm modules assigned but without any signals configured will be marked as disabled in the "Info" tab.
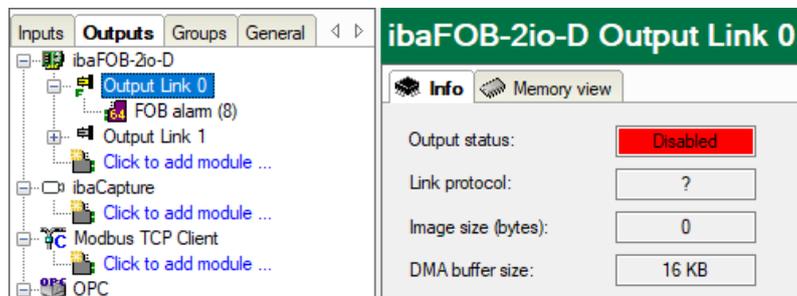
After the FOB alarm modules have been added the output signals (analog and/or digital) must be configured for each module.
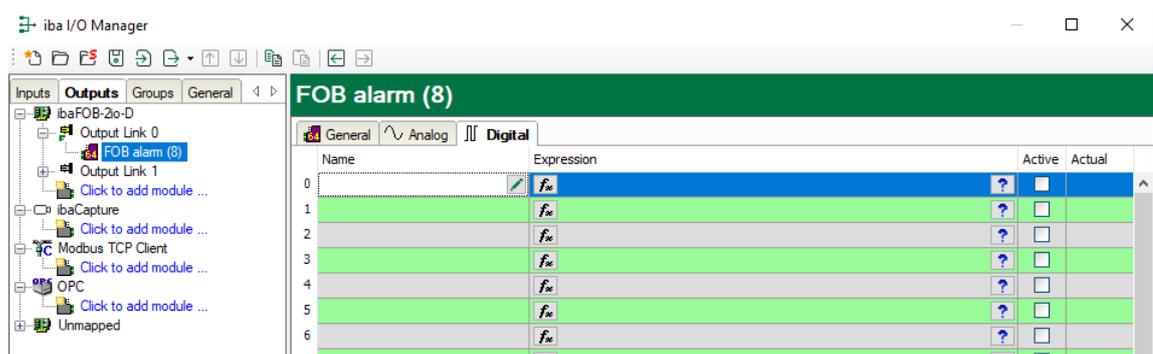
8.2.4   Systems with 32Mbit Flex mode

Device configurations working in 32Mbit Flex mode show all modules in the I/O Manager in both the *Inputs* tab and the *Outputs* tab.

Depending on which tab you are in, you can only configure either the input or output signals.

The configuration of the outputs is explained below using the iba modular system as an example.

Modules, like in this example a mixed module with digital and analog inputs and outputs (ibaMS4xADIO), can be added both in the *Inputs* tab and in the *Outputs* tab.
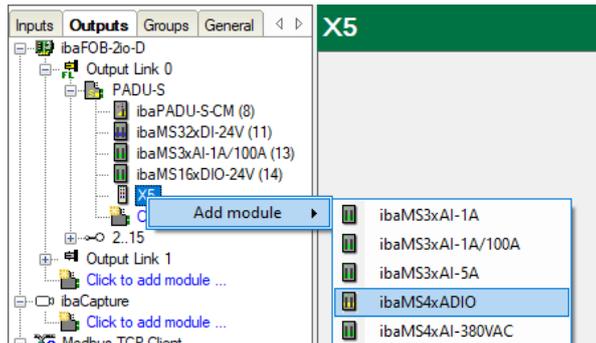
To configure the output signals, you must select the *Outputs* tab.

Depending on the module type, you can define analog and/or digital output signals here.
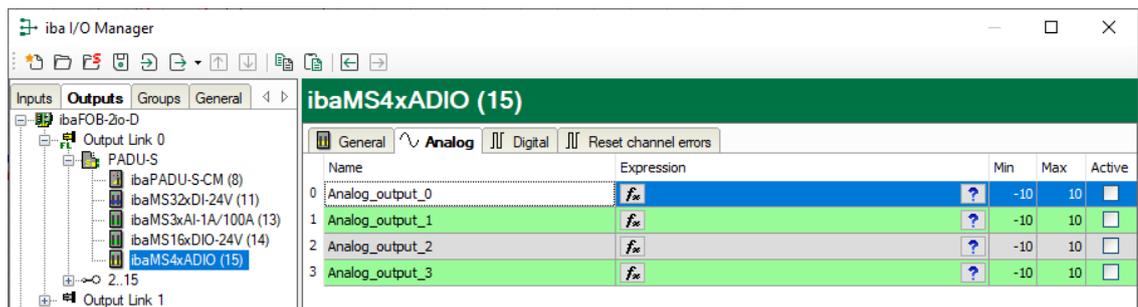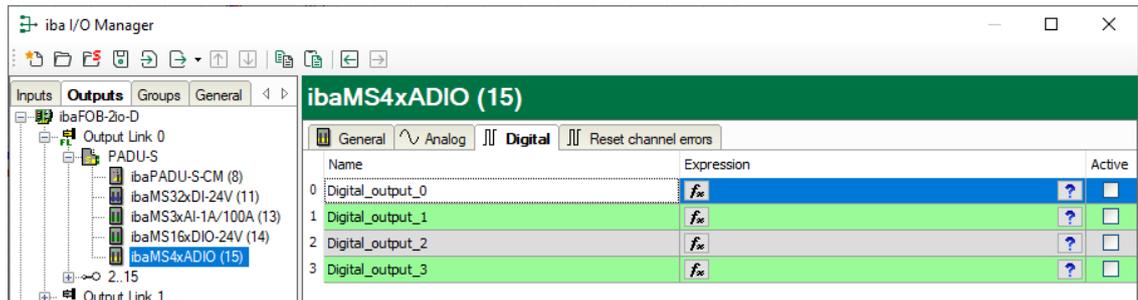
Note

Some device modules, which are only intended for outputs, also offer digital diagnostic signals in the *Inputs* tab. You can use these signals to monitor the output function.

9 Synchronization of more than one iba board

9.1 Important information

ℹ	**Important information!**

Important information!

A bad or missing sync-connection may lead to inconsistent data blocks. This would affect the data integrity and data correlation!

Each board is delivered with a synchronization cable (sync cable) for connecting up to 6 boards. Unused plugs of the cable can left unconnected and must not be terminated.

If you plug in or unplug PCI/PCIe boards this may change the PCI/PCIe configuration of the PC. This can affect the signal or I/O configuration of the system because the ID of the boards may change.

In that case move the fiber optic cables to the correct board.

Always save your system configuration before changing hardware components.

9.2 Procedure

You should perform the following steps after you've installed the PCI board:

1. Connect all iba boards with the synchronization cable using the light blue plugs, see chapter 5.6.
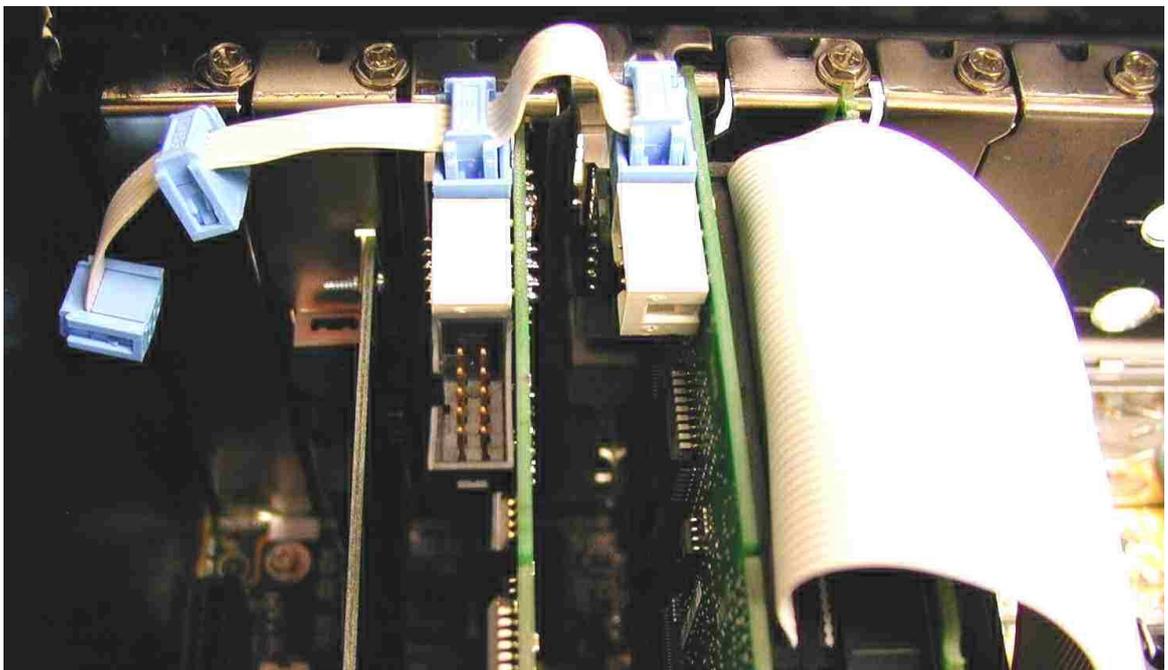
2. Close the PC.

3. Plug in the power line.

4. Switch on the power supply of the PC.

5. Start the PC.

10 System integration

10.1 Sample applications for ibaFOB-D

10.1.1 Operation for data acquisition

Transmission mode (FO)
3Mbit (input)
Sample rate
1 kHz
Sample time
1 ms
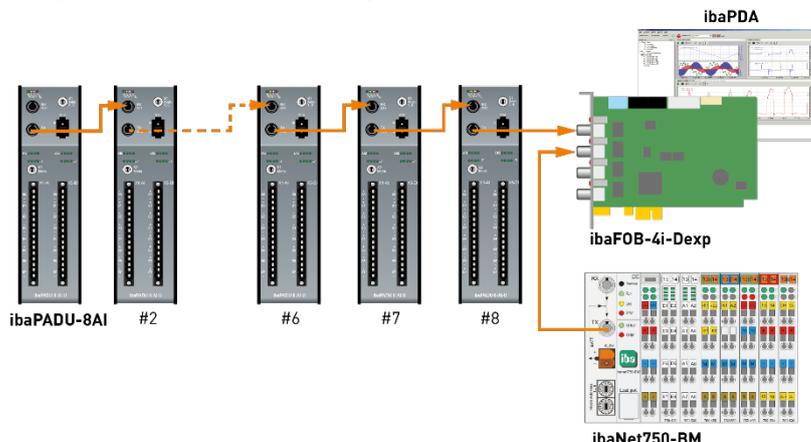
Peripheral devices	Applications
All ibaPADU, ibaDig-40, ibaBM-DDCSM, ibaBM-SLM, ibaBM-DPM-S ibaLink-SM-64-io, ibaLink-SM-64-SD16, ibaLink-SM-128V-i-2o, ibaLink-MBII-io, etc.	ibaPDA ibaQDR ibaLogic

10.1.2 Operation with ibaPDA and 32Mbit transmission mode

Transmission mode (FO)
32Mbit
Sample rate
1 kHz
Sample time
1 ms
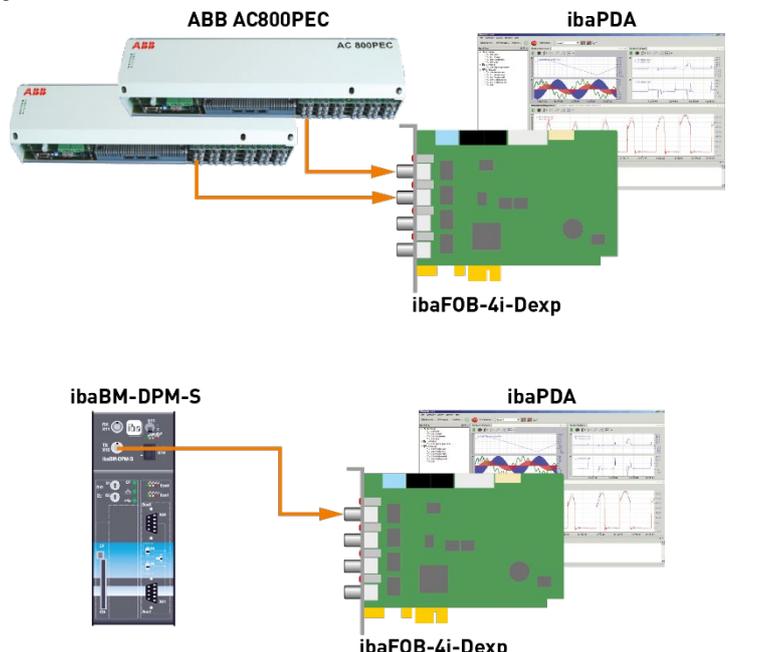
Peripheral devices	Applications
ABB AC 800PEC with ibaNet-output module SIMATIC TDC with LO5A or LO6 interface board ibaBM-DPM-S (Profibus-Monitor), etc.	ibaPDA ibaQDR

10.1.3   Operation with ibaPDA and ibaPADU-S-IT
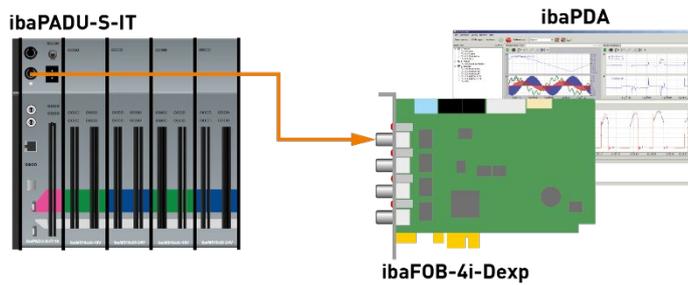
Transmission mode (FO)
32Mbit
Sample rate
20 kHz
Sample time
50 µs

Peripheral devices	Applications
ibaPADU-S-IT with ibaMS modules	ibaPDA

10.1.4   Operation with ibaPDA and 32Mbit Flex protocol
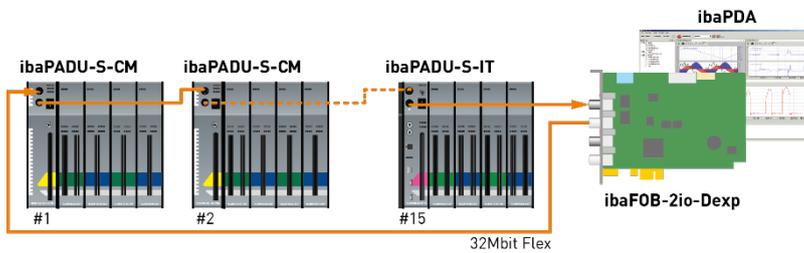
Transmission mode (FO)
32Mbit Flex
Sample rate
Up to 100 kHz
Sample time
≥ 10 µs

Peripheral devices	Applications
ibaPADU-S-IT or ibaPADU-S-CM with ibaMS modules, ibaBM-DDCS, ibaBM-SiLink, ibaBM-eCAT, ibaBM-DP, ibaBM-PN, ibaPADU-D-8AI-U/-8AI-I (up to 15 devices can be cascaded in a ring), ibaPADU-4-AI-U, etc.	ibaPDA, ibaQDR

10.1.5   Process control with ibaLogic
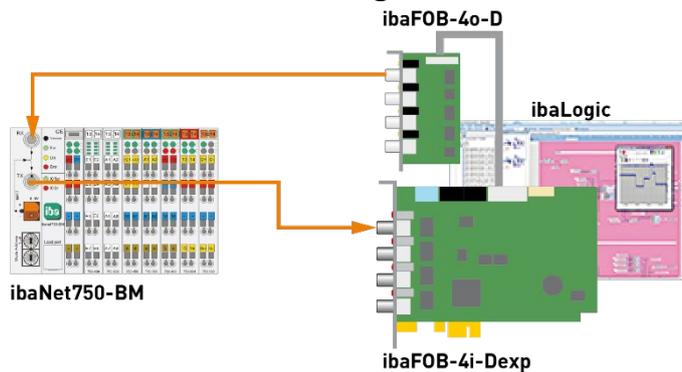
Transmission mode (FO)
3Mbit (input) 3Mbit (output)
Sample rate
0.5 kHz
Sample time
2 ms

Peripheral devices	Applications
All ibaPADU, ibaNet750-BM ibaDig-40, ibaBM-DDCSM, ibaBM-SLM, ibaLink-SM-64-io, ibaLink-SM-64-SD16, ibaLink-SM-128V-i-2o, ibaLink-VME, etc.	ibaLogic

Transmission mode (FO)
32Mbit (input) 32Mbit (output)
Sample rate
0.5 kHz to 20 kHz
Sample time
2 ms to 50 µs
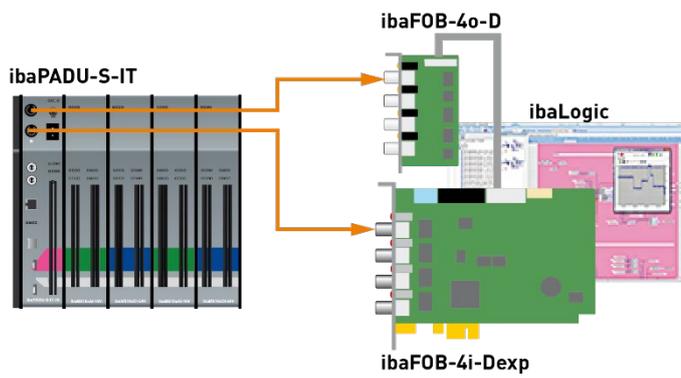
Peripheral devices	Applications
ibaPADU-S-IT with ibaMS modules, ibaBM-DPM-S, ibaNet750-BM-D, ibaLink-VME, etc.	ibaLogic

10.2   Special topologies with ibaFOB-D

10.2.1   Operation with ibaBM-COL-8i-o

The device ibaBM-COL-8i-o concentrates the data streams of up to 8 ibaNet fiber optic inputs with 3/2Mbit into one (fiber optic) output with 32Mbit.

The number of ibaFOB input boards can be significantly reduced by replacement in this way for existing systems with many ibaNet peripheral devices. The cleared PCI/PCIe slots can be used for more iba input boards.

Furthermore, this technique provides access to the fast communication for elder devices.
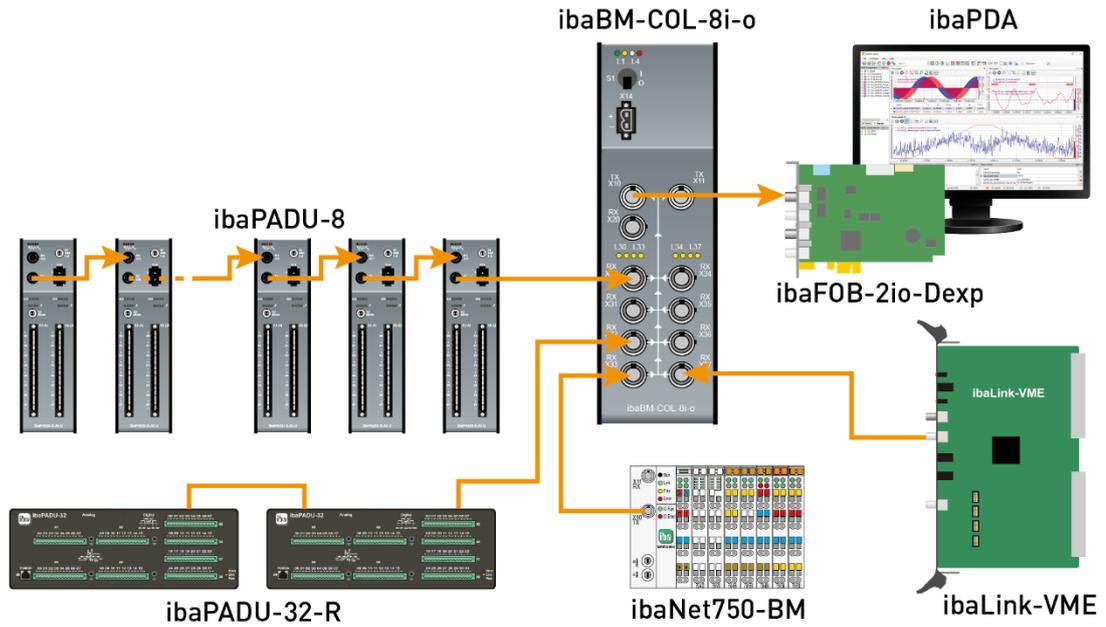
10.2.2 Operation with ibaBM-COL-8i-o and ibaBM-DIS-i-8o

By using the data distributor ibaBM-DIS-i-8o in combination with the data concentrator ibaBM-COL-8i-o you can distribute e.g. the output signals of an ibaLogic system from one FO output link to several lines of devices, such as ibaNet750, and collect and merge the signals coming from these devices to be used as input signals for the ibaLogic system.

The number of ibaFOB input boards can be significantly reduced by replacement in this way for existing systems with many ibaNet peripheral devices. The cleared PCI/PCIe slots can be used for more iba input boards.

Furthermore, this technique provides access to the fast communication for elder devices.
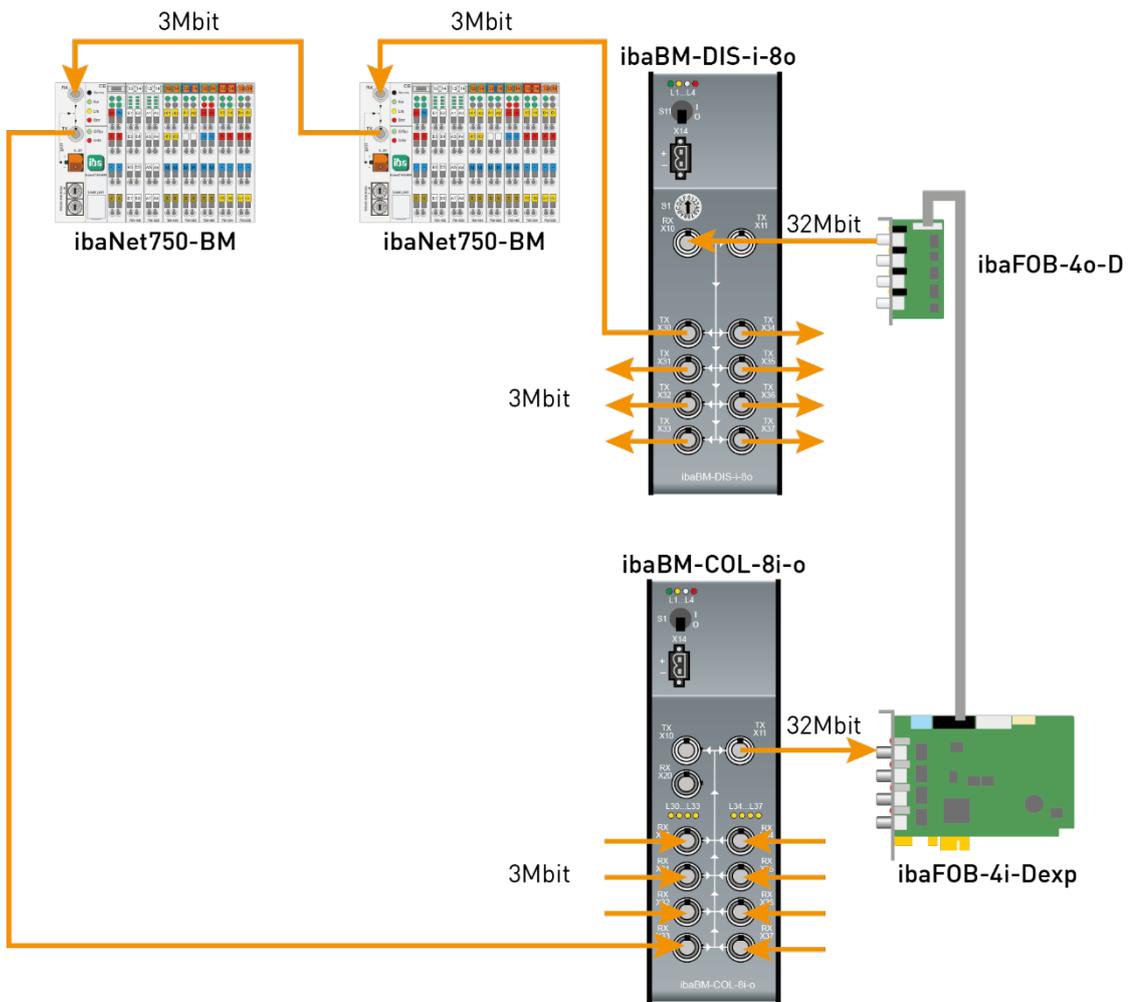
10.2.3   Operation with ibaBM-DIS-i-8o in output mode

If signals out of an ibaPDA or ibaLogic system should be transmitted to ibaPADU-8-o devices over fiber optic cable you can supply up to 8 lines of output devices (3Mbit) with data by using ibaFOB-D and ibaBM-DIS-i-8o. In case of using ibaPADU-8-o you can connect up to 8 devices in a daisy-chain on each output link of the ibaBM-DIS-i-8o (up to a total of 64 devices). Only 1 FO output of an ibaFOB-D board is needed.
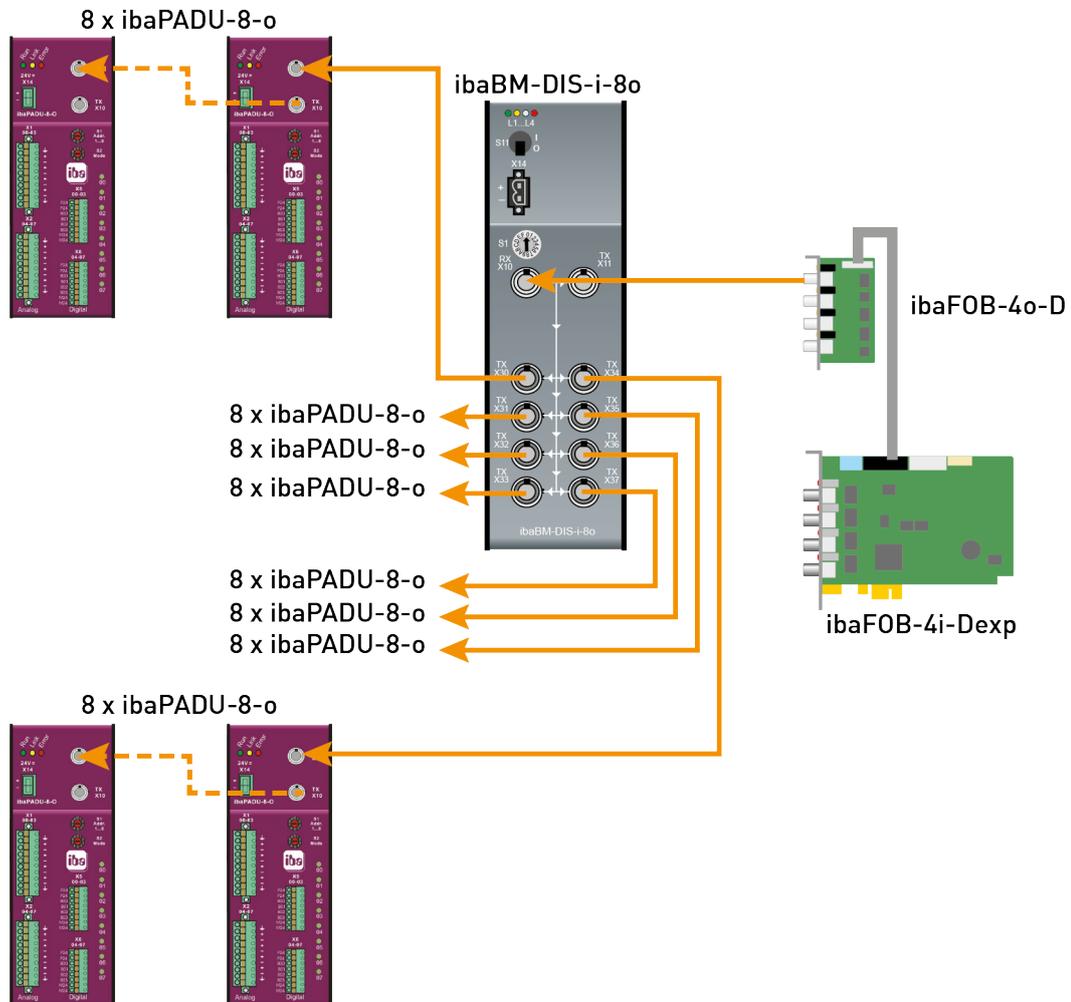
11   32Mbit Flex protocol and ibaFOB-D network

The ibaNet 32Mbit Flex protocol (referred to as "Flex protocol") is a manufacturer specific data transfer protocol by iba AG. This protocol serves to transfer measurement and configuration data via FO connections between different iba devices. The PC boards of the ibaFOB-D/ibaFOB-Dexp and ibaFOB-io-ExpressBoard series, the ibaFOB-io-USB adapter as well as some devices for data acquisition support this protocol.

11.1   Data amount and sampling rate

The Flex protocol works with a data transfer rate of 32 Mbit/s and supports up to 15 "Flex-capable" devices connected in a ring topology.

With 32Mbit Flex, the data amount and the sampling rate can be selected in a flexible way. The data amount transferred per cycle depends on the sampling rate. Generally, the following applies: The less data are transferred, the higher is the possible sampling rate.

For the signals to be measured, sampling rates of 500 Hz to 100 kHz can be realized, which correspond to a timebase from 10 µs up to 2 ms. The maximum sampling rate also depends on the acquisition device and can be found in the device manual. In ibaPDA you can select even smaller sampling rates down to 1 Hz. This corresponds to a timebase of 1000 ms. In this case, the timebase in the Flex ring is set to 2 ms and in ibaPDA a subsampling is carried out. Data which is not relevant for the configured sampling rate is disboarded by ibaPDA.

With 32Mbit Flex, up to 4060 Bytes per cycle can be acquired and recorded depending on the sampling rate.

For the max. possible data amount of 4060 Bytes, the cycle time (timebase) is up to 1.4 ms. In the following table, you find reference values for the relation between cycle time and the max. transferable data amount per cycle. If you want to get more values, especially if several devices are connected in a Flex ring topology, iba recommends using the simulator integrated in ibaPDA, see chapter 8.1.6.2.

Timebase	Max data amount
1.4 ms	4060 Bytes
1.0 ms	3100 Bytes
0.5 ms	1540 Bytes
0.025 ms	64 Bytes

The following data types are supported: BYTE, WORD, DWORD, INT, DINT, FLOAT and DOUBLE in Big/Little Endian format. These data amounts represent the limit values for the overall data amount on a Flex ring that can be transferred via an FO link.

Cycle times in the 32Mbit Flex ring topology
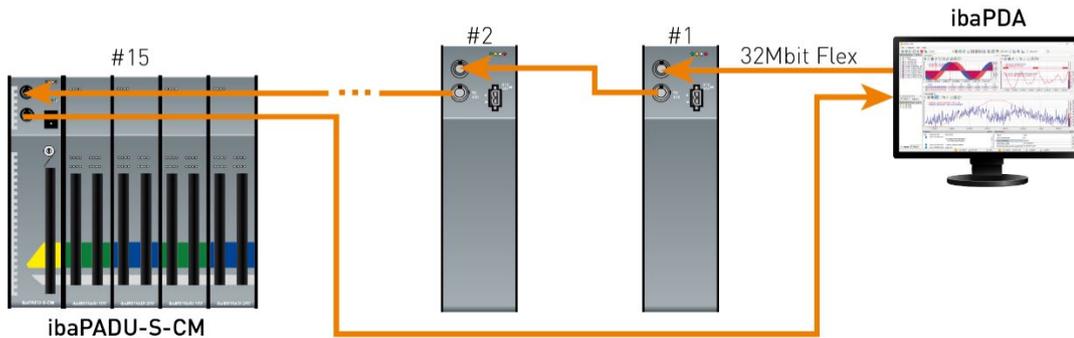
ibaPDA automatically detects the devices in the Flex ring topology and determines the max. possible sampling rate, depending on the type and the number of devices.

The devices in the ring topology are addressed via the rotary switch for the device address.

The individual devices in the ring can work with different cycle times. However, these cycle times have to be an integer multiple of the smallest cycle. Example: Device #1 works at a cycle of 0.5 ms, device #2 with 1 ms, device #3 with 4 ms, etc. If the maximum data rate has been exceeded, ibaPDA issues an error message with the indication that the timebase has to be increased or the data amount has to be lowered.

The calculation of the maximum data amount depends on the fastest device in the ring topology. This means: If you increase the cycle time of slow devices in the ring topology, this does not mean that a higher amount of data can be transferred. Only if you increase the cycle time of the fastest device, also the data amount can be increased.

↗ More information about data size in the Flex ring, see chap. 8.1.6.2

11.2   ibaFOB-D Network

Beginning with ibaPDA version 6.26.0 or higher, an ibaFOB-D network adapter will be optionally installed.
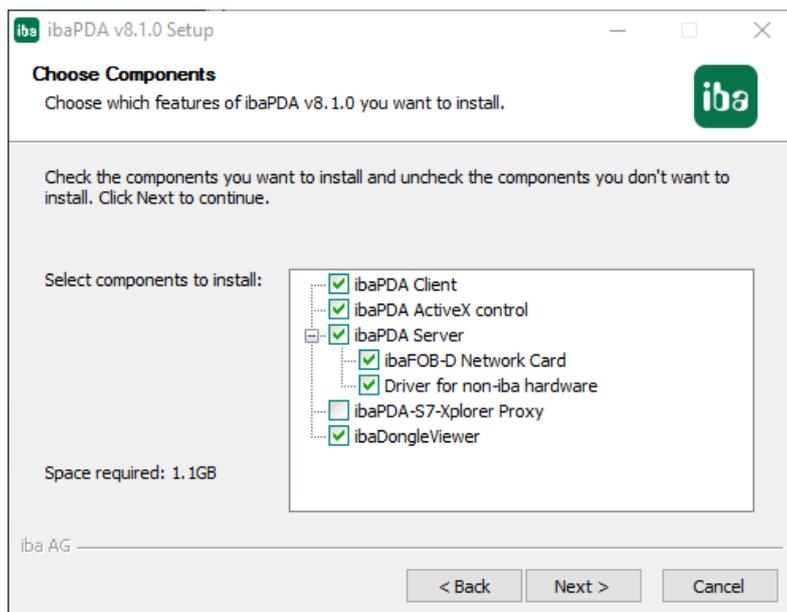
Optionally, the installation of the driver can also be disabled in the installation wizard. For an individual installation the file *ibaFobDNetworkInstall.exe* is available. You find the file in the program directory of ibaPDA, in the subdirectory "Server", e.g. `C:\Programs\iba\ibaPDA\Server`.

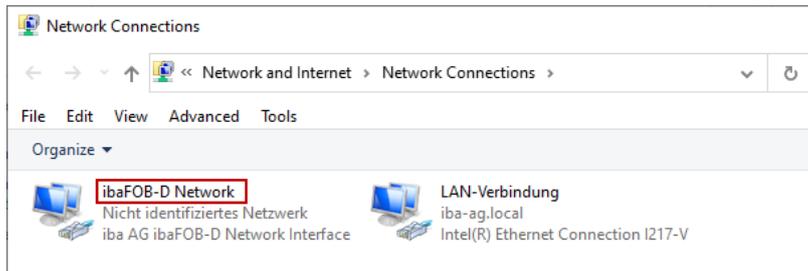If this option is selected, a network connection, the so called ibaFOB-D network, will be installed. The ibaFOB-D network is displayed as network connection in the Windows control panel.

This network connection is required in 32Mbit Flex mode to communicate via TCP/IP with other Flex devices that are also connected via an ibaFOB-D board. There is only one network connection for all ibaFOB-D boards installed in an ibaPDA computer.

11.2.1   IP Addresses in the ibaFOB-D network

The Flex devices are identified via an IP address in the ibaFOB-D network. The IP address of the ibaFOB-D network adapter is by default: 172.29.0.100 and the subnet mask 255.255.0.0.

If this IP address is already used in a network, it may be changed in accordance with the following rules:

- The new IP address must also be a class B address
- The subnet mask must not be changed
- The last two octets 0.100 must not be changed.

In 32Mbit Flex mode, a fixed IP address is automatically assigned to each device in the Flex ring, which cannot be changed. The IP address of the Flex devices consists of 4 octets (W.V.X.Y) and is assigned according to the following rules:

- **W.V** are the first two octets of the IP address of the ibaFOB-D network adapter (by default 172.29)
- **X** is the board number (display of the ibaFOB-D board in the computer) *10 + link number, the device is connected to
- **Y** is the device address set with address rotary switch + 100

Examples
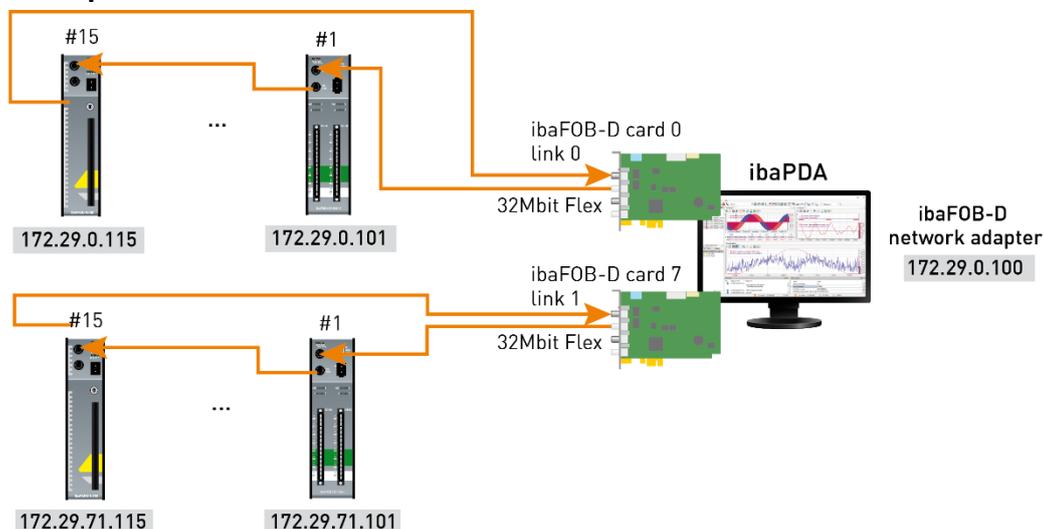
The IP address of the Flex devices is shown in the I/O Manager in the General tab and cannot be changed.
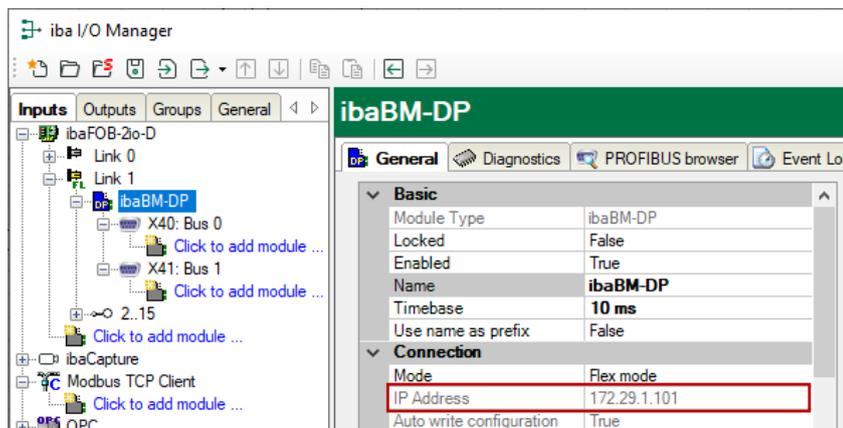
Changing the IP address of the ibaFOB-D network adapter

When the IP address of the ibaFOB-D network adapter has been changed (only the first two octets are allowed), the connected Flex devices have to apply again the configuration in ibaPDA by clicking on <OK> or <Apply> in order to apply the new IP address (the first two octets). Otherwise the connection will be interrupted.

12   Technical data

12.1   Main data ibaFOB-D/ibaFOB-Dexp

Short description				
Designation		ibaFOB-D/ibaFOB-Dexp		
Description		PCI and PCI Express boards with FO connectors for ibaNet connections		
Name	**Order no.**	**Name**	**Order no.**	**FO connectors**
ibaFOB-4i-D	11.115700	ibaFOB-4i-Dexp	11.118000	4 x Input
ibaFOB-2i-D	11.115710	ibaFOB-2i-Dexp	11.118030	2 x Input
ibaFOB-2io-D	11.115800	ibaFOB-2io-Dexp	11.118010	2 x Input 2 x Output
ibaFOB-io-D	11.115810	ibaFOB-io-Dexp	11.118020	1 x Input 1 x Output

ibaNet interface		
FO connector type		ST connectors for RX and TX; iba recommends the use of FO with multimode fibers of type 50/125 µm or 62.5/125 µm; For information on cable length, see chap. 12.4.
ibaNet protocols		2Mbit, 3Mbit, 5Mbit, 32Mbit, 32Mbit Flex
Transmitting interface (TX)		Valid for ibaFOB-io-D, ibaFOB-2io-Dexp, ibaFOB-io-Dexp
Output power	50/125 µm FO cable	-19.8 dBm to -12.8 dBm
	62.5/125 µm FO cable	-16 dBm to -9 dBm
	100/140 µm FO cable	-12.5 dBm to -5.5 dBm
	200 µm FO cable	-8.5 dBm to -1.5 dBm
Temperature range		-40 °F to 185 °F (-40 °C to 85 °C)
Light wavelength		850 nm
Receiving interface (RX)		Valid for ibaFOB-io-D, ibaFOB-2io-Dexp, ibaFOB-io-Dexp, ibaFOB-4i-D, ibaFOB-2i-D, ibaFOB-4i-Dexp, ibaFOB-2i-Dexp
Sensitivity[1]	62.5/125 µm FO cable	-33.2 dBm to -26.7 dBm
Temperature range		-40 °F to 185 °F (-40 °C to 85 °C)

Supply and indicators	
Power supply	3.3 V or 5.0 V over PCI bus; or 12 V over PCIe 1.0-x1 compatible slot
Bus clock	33 MHz or 66 MHz / 2.5 Gbit/s (PCIe)
Power consumption	PCI & PCIe, HW version A: typ. 4.2 W HW version B: typ. 3 W
Indicators	4 LED per FO connector (state of communication) 7 segment display

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[1] Data for other FO cable diameters not specified

Environmental conditions

Temperature ranges	
Operation	32 °F to 122 °F (0 °C to 50 °C)
Storage/transport	-13 °F to 158 °F (-25 °C to 70 °C)
Mounting	PCI slot for 32 bit or 64 bit or PCIe 1.0-x1 compatible slot (x1, x4, x8, x16)
Cooling	Passive
Standards	FCC part 15 class A
MTBF	
ibaFOB-4i-D (11.115700)[2]	5,903,038 hours / 673 years
ibaFOB-2io-Dexp (11.118010)[3]	10,693,045 hours / 1220 years
Assembly dimension (d x h)	
PCI board 32 Bit	6.69 in x 3.82 in (170 mm x 97 mm)
PCI Express board HW version A	6.69 in x 3.98 in (170 mm x 101 mm)
PCI Express board HW version B	5.20 in x 3.98 in (132 mm x 101 mm)
Weight (incl. box and documentation)	Approx. 0.44 lb (200 g)

12.2   Main data Extension module

Short description

Designation	ibaFOB-4o-D	
Description	Extension module for ibaFOB-D for mirroring of FO inputs or for active FO outputs	
Name	**Order no.**	**FO connectors**
ibaFOB-4o-D rackline slot (short design for ibaRackline)	11.116200	4 x Outputs
ibaFOB-4o-D-PCI (long design for PCI slot)	11.116201	4 x Outputs
Connectors		
FO connector type	4 ST connectors for TX; iba recommends the use of FO with multimode fibers of type 50/125 µm or 62.5/125 µm; For information on cable length, see chap. 12.4	
ibaNet protocols	2Mbit, 3Mbit, 5Mbit, 32Mbit, 32Mbit Flex	
Indicator	1 LED for status per connection	
Transmitting interface (TX)		
Output power	50/125 µm FO cable	-19.8 dBm to -12.8 dBm
	62.5/125 µm FO cable	-16 dBm to -9 dBm

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[2] According to: Telcordia Issue 3 SR232 (Reliability Prediction Procedure of Electronic Equipment; Issue 3 Jan. 2011) and NPRD (Non-electronic Parts Reliability Data 2011)

[3] According to: Telcordia Issue 4 SR332 (Reliability Prediction Procedure of Electronic Equipment; Issue Mar. 2016) und NPRD (Non-electronic Parts Reliability Data 2011)

	100/140 µm FO cable	-12.5 dBm to -5.5 dBm
	200 µm FO cable	-8.5 dBm to -1.5 dBm
Temperature range	-40 °F to 185 °F (-40 °C to 85 °C)	
Light wavelength	850 nm	

Environmental conditions

Temperature ranges	
Operation	32 °F to 122 °F (0 °C to 50 °C)
Storage/transport	-13 °F to 158 °F (-25 °C to 70 °C)
Mounting	PCI slot in a PC or special housing slots in ibaRackline
Cooling	Passive
Standards	FCC part 15 class A
MTBF	
ibaFOB-4o-D (11.116200)[4]	35,869,731 hours / 4094 years
Assembly dimension (d x h)	1.46 in x 2.95 in (37 mm x 75 mm)
Weight (incl. box and documentation)	Approx. 0.33 lb (150 g)

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

Unique Identifier:

11.115710	ibaFOB-2i-D
11.115800	ibaFOB-2io-D
11.115810	ibaFOB-io-D
11.116200	ibaFOB-4o-D rackline-slot
11.116201	ibaFOB-4o-D-PCI
11.118000	ibaFOB-4i-Dexp
11.118010	ibaFOB-2io-Dexp
11.118020	ibaFOB-io-Dexp
11.118030	ibaFOB-2i-Dexp

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.

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[4] According to: Telcordia Issue 3 SR232 (Reliability Prediction Procedure of Electronic Equipment; Issue 3 Jan. 2011)
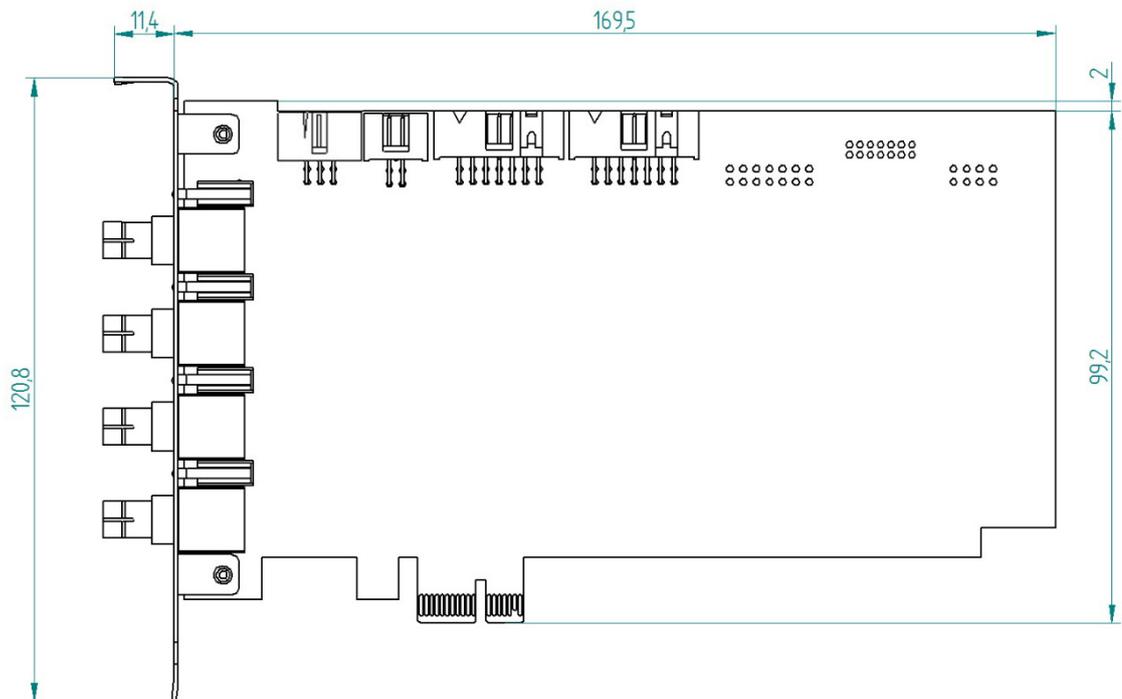
12.3 Dimension sheet
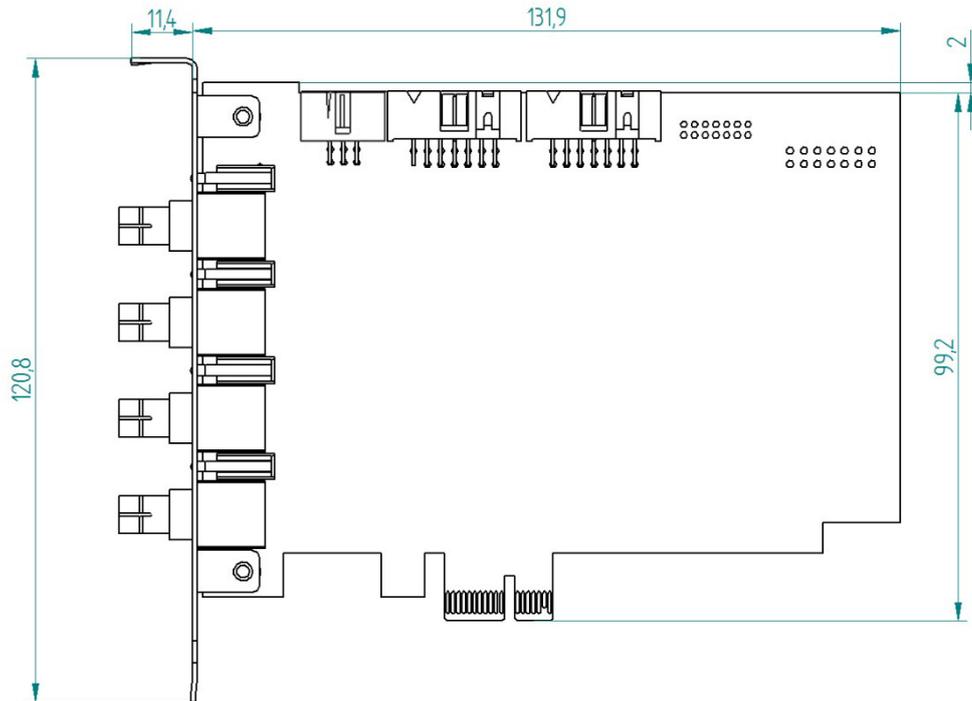
12.3.1 PCI board
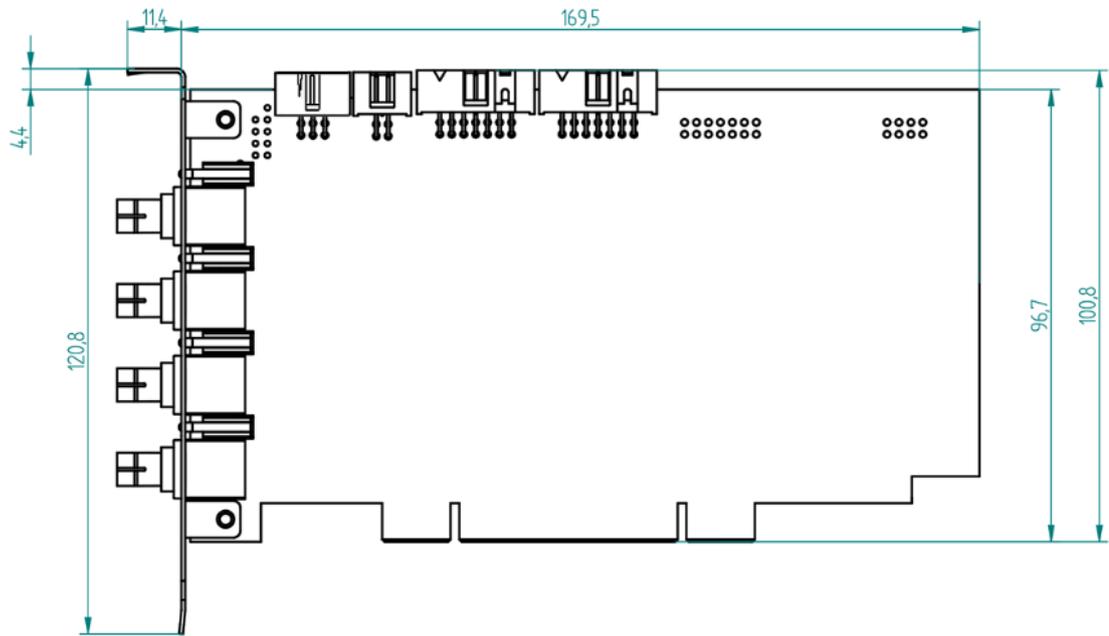
Example ibaFOB-4i-D (dimensions in mm)

12.3.2 PCI Express board (HW version A)

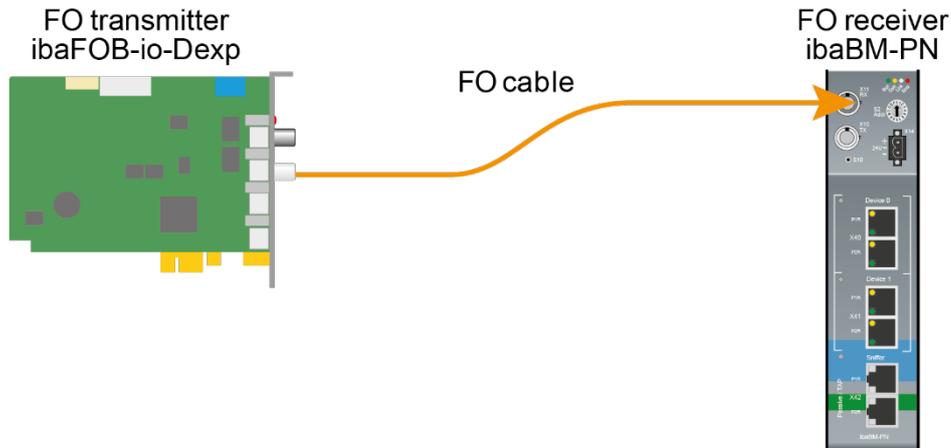Example ibaFOB-4i-Dexp (dimensions in mm)

12.3.3   PCI Express board (HW version B)

Example ibaFOB-4i-Dexp (dimensions in mm)

12.4   Example for FO budget calculation

As an example, an FO connection from an ibaFOB-io-Dexp card (FO transmitter) to an ibaBM-PN device (FO receiver) is used.

The example refers to a point-to-point connection with an FO cable of type 62.5/125 µm. The light wavelength used is 850 nm.

The range of the minimum and maximum values of the output power or receiver sensitivity depends on the component and, among other things, on temperature and aging.

For the calculation, the specified output power of the transmitting device and on the other side the specified sensitivity of the receiving device must be used in each case. You will find the corresponding values in the respective device manual in the chapter "Technical data" under "ibaNet interface".

Specification ibaFOB-io-Dexp:

Output power of FO transmitting interface		
FO cable in µm	Min.	Max.
62.5/125	-16 dBm	-9 dBm

Specification ibaBM-PN:

Sensitivity of FO receiving interface		
FO cable in µm	Min.	Max.
62.5/125	-30 dBm	

Specification FO cable

To be found in the data sheet of the fiber optic cable used:

FO cable	62.5/125 µm
Connector loss	0.5 dB connector
Cable attenuation at 850 nm wavelength	3.5 dB / km

Equation for calculating the FO budget (A_{Budget}):

$$A_{Budget} = |(P_{Receiver} - P_{Sender})|$$

$P_{Receiver}$ = sensitivity of FO receiving interface

P_{Sender} = output power of FO transmitting interface

Equation for calculating the fiber optic cable length (l_{Max}):

$$l_{Max} = \frac{A_{Budget} - (2 \cdot A_{Connector})}{A_{Fiberoptic}}$$

$A_{Connector}$ = connector loss

$A_{Fiberoptic}$ = cable attenuation

Calculation for the example ibaFOB-io-Dexp -> ibaBM-PN in the best case:

$$A_{Budget} = |(-30\ dBm - (-9\ dBm))| = 21 dB$$

$$l_{Max} = \frac{21 dB - (2 \cdot 0.5 dB)}{3.5\ \frac{dB}{km}} = 5.71 \text{km}$$

Calculation for the example ibaFOB-io-Dexp -> ibaBM-PN in the worst case:

$$A_{Budget} = |-30\ dBm - (-16\ dBm)| = 14 dB$$

$$l_{Max} = \frac{14 dB - (2 \cdot 0.5 dB)}{3.5\ \frac{dB}{km}} = 3.71 \text{km}$$

Note

When connecting several devices as daisy chain (e.g. ibaPADU-8x with 3Mbit) or as ring (e.g. ibaPADU-S-CM with 32Mbit Flex), the maximum distance applies to the section between two devices. The FO signals are re-amplified in each device.

Note

When using fiber optics of the 50/125 µm type, a distance reduction of approx. 30-40% must be expected.

13   Support and contacts

Support

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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.

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For contact data of your regional iba office or representative please refer to our web site

www.iba-ag.com.