



ibaM-F0-210

Fiber optic interface module for ibaNNet 32Mbit

Manual

Issue 1.5

Measurement Systems for Industry and Energy

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

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

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1 About this documentation

This documentation describes the design, application and operation of the device *ibaM-FO-2IO*.

1.1 Target group

This documentation is aimed at qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded 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 <i>Logic diagram</i>
Calling the menu command	<i>Step 1 – Step 2 – Step 3 – Step x</i> Example: Select the menu <i>Logic diagram – Add – New function block</i> .
Keys	<Key name> Example: <Alt>; <F1>
Press the keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Key name> Example: <OK>; <Cancel>
Filenames, paths	<i>Filename, Path</i> Example: <i>Test.docx</i>

1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

Danger!



The non-observance of this safety information may result in an imminent risk of death or severe injury:

- Observe the specified measures.
-

Warning!



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

- Observe the specified measures.
-

Caution!



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

- Observe the specified measures
-

Note



A note specifies special requirements or actions to be observed.

Tip



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

Other documentation



Reference to additional documentation or further reading.

2 Introduction

The *ibaM-FO-2IO* interface module belongs to the ibaMAQS (Modular Acquisition System). This module is used to connect additional iba devices that communicate via the ibaNet fiber optic cable. The 32Mbit Flex and 32Mbit ibaNet protocols are supported.

Note



With the *ibaM-DAQ* processor module, only one *ibaM-FO-2IO* module is currently supported. Two *ibaM-FO-2IO* modules can be used with the *ibaM-COM* communication module.

At a glance

- Connection of classic iba devices via fiber optics
- Supports the 32Mbit Flex and 32Mbit ibaNet protocols
- 2 independent fiber optic interfaces with one input and one output each
- Different sampling rates can be set per interface (up to 100 kHz)
- LEDs for each input channel indicating operating status, link status, and errors

Operating modes

The following table provides an overview of the available operating modes, transmission rates, number of signals, sampling time, and typical devices.

Protocol	Max. number of signals per FO link	Sampling time	Typical devices
Single fiber input-only modes			
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)			
32Mbit Flex	variable ¹⁾	≥10 μs	ibaPADU-S-CM
Single fiber output-only modes (output link required)			
32Mbit	Not yet supported by software.		

Besides the hardware parameters, the usability of the interface module and peripheral devices in combination with a particular operating mode also depends on the iba software application. Not every iba software application supports all operating modes or modules.

¹⁾ Example: Payload transmission of 64 bytes at 25 μs sampling time or 3100 bytes at 1 ms

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

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

■ = OK, -- = not supported

3 Scope of delivery

After having unpacked the delivery, please check it for completeness and possible damage. The scope of delivery includes:

- *ibaM-FO-2IO* module

4 Safety and other instructions

Note



Work on the system, as well as mounting and dismounting, must only be carried out by trained and qualified specialists.

Careful working methods and compliance with safety measures when working with electrical devices of all types must be observed.

Note



Observe this danger sign:



In all cases where this danger sign is displayed, refer to the manual to find out more about the nature of the potential hazards and the measures that must be taken to avoid them.

4.1 Intended Use

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

- Measurement data acquisition and analysis
- Applications of software products (*ibaPDA*, *ibaLogic*, etc.) and hardware products from iba AG.

The device must only be used as specified in the *Technical data* chapter, and is designed and approved for continuous operation.

Danger!



Electric shock

If the device is used or operated in a manner other than specified in the *Technical data* chapter, the protection supported by the device may be impaired.

4.2 Special safety instructions

Danger!



Operation

- The system must only be operated in a fire protection housing in accordance with IEC 61010-1.
- The system must only be operated with a mounted end cover.
- The external power supply/power supply unit for supplying the central unit and thus for the complete system must be tested for use with this system in accordance with IEC 61010.
- Modules from this system must only be operated with a central processing unit from this system.
- The supply voltage for this system must only be fed from this system via a central unit.
- In addition to their own current consumption from the supply voltage via the module-module interface, the central units and the modules also pass on the supply voltage for other connected modules, so that the module-module interfaces may have to carry the maximum specified total current of the system.
- Only a maximum of 15 modules may be installed next to the central unit.

Danger!



Duty of care

Take care when working on the system and always check that the system and the modules themselves are in perfect condition, as well as ensuring that they are properly installed and correctly attached to the DIN rail.

If damage to cables, devices, supplies or enclosures is detected before commissioning or during operation, the system must not be put into operation or must be taken out of operation immediately.

Warning!**Mounting and dismounting / Disconnection from the grid**

Work on the device or system may only be carried out when the power is switched off!

Due to the modular concept of this system, modules connected in series with this module can also carry dangerous voltages.

All energized components of all modules in the system must therefore be disconnected from the grid before mounting and dismounting.

In addition to disconnecting the power supply at the system's central unit, the signal plugs and connections of all modules in the system must also be de-energized or disconnected from the grid.

Caution!

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

This disconnecting device must include a switch or circuit breaker that is easily accessible at a suitable location in the vicinity and is also clearly marked as a disconnecting device for this system.

Note

Do not open the device! Opening the device results in a loss of warranty!

Note

The device does not require any special cleaning or maintenance!
However, if you want to carry out an inspection, return the device to iba.

5 System requirements

Hardware

ibaMAQS central unit

- *ibaM-DAQ* processor module or *ibaM-COM* communication module

Software

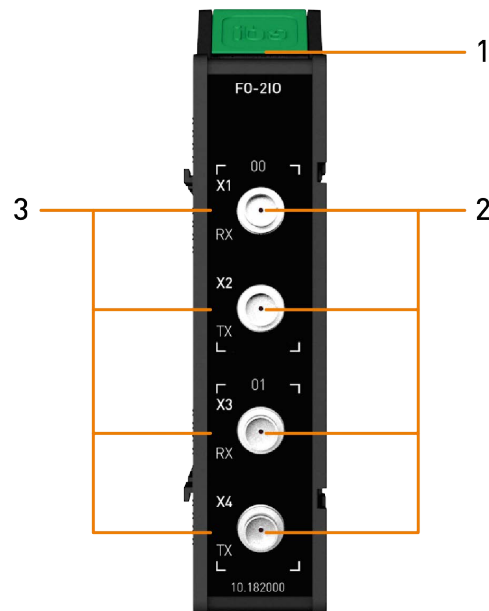
- *ibaPDA* version 8.6.0 or higher

Firmware

- ibaMAQS version 01.01.001 or higher

6 Device description

6.1 View



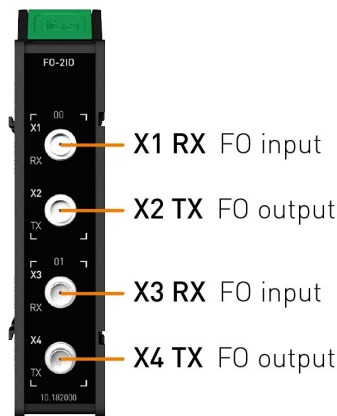
- 1 Module status display
- 2 Connectors fiber optic cable
 - X1 RX FO input link 0
 - X2 TX FO output link 0
 - X3 RX FO input link 1
 - X4 TX FO output link 1
- 3 Display FO connection

6.2 Display elements

6.2.1 Module status

Color	Status	Description
--	off	Down, no power supply
Green	on	Ready for operation
	flashing slowly	Device is booting
	flashing quickly	Update is running
Red	on	Error, reset

6.2.2 FO interfaces



Colour	Status	Description
--	off	TX: No protocol will be sent
Green	on	RX: Communication status OK Selected and detected protocol match TX: Telegrams are being sent
	flashing	RX: Detected and selected protocol do not match

6.3 Fiber optic connections

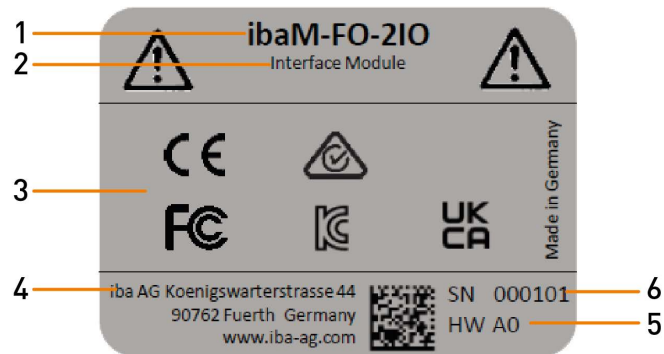
The two ibaNet interfaces each consist of one fiber optic input (RX) and one fiber optic output (TX):

- X1 RX (FO input) + X2 TX (FO output)
- X3 RX (FO input) + X4 TX (FO output)

The module supports the 32Mbit Flex and 32Mbit ibaNet protocols.

6.4 Type label

The type label provides the following information:



1 Name

2 Module type

3 Standards

4 Manufacturer

5 Hardware version

6 Serial number

7 Mounting and dismounting

Danger!



Operation

- The system must only be operated in a fire protection housing in accordance with IEC 61010-1.
- The system must only be operated with a mounted end cover.
- The external power supply/power supply unit for supplying the central unit and thus for the complete system must be tested for use with this system in accordance with IEC 61010.
- Modules from this system must only be operated with a central processing unit from this system.
- The supply voltage for this system must only be fed from this system via a central unit.
- In addition to their own current consumption from the supply voltage via the module-module interface, the central units and the modules also pass on the supply voltage for other connected modules, so that the module-module interfaces may have to carry the maximum specified total current of the system.
- Only a maximum of 15 modules may be installed next to the central unit.

The modular system is designed as follows and is to be mounted on the DIN rail:

- Central unit on the far left
- Up to 15 modules to the right of the central unit
- End cover on the far right to protect the contacts

Make sure that the modules

- are properly secured to the DIN rail and
- are correctly positioned in the side guide rails.

Check the correct fitting of the modules after mounting by a visual inspection.

Note



An end cover is included in the scope of delivery of the central unit.
The end cover is also available as an accessory or spare part from iba.

Installation clearances

Ensure a minimum clearance of the entire system of 30 mm upwards and downwards and 10 mm to the right and left for sufficient ventilation of the device.

7.1 Disconnection from the grid

To enable safe, hazard-free work on the system, all live components in the system must be disconnected from the grid.

Warning!



Mounting and dismounting / Disconnection from the grid

Work on the device or system may only be carried out when the power is switched off!

Due to the modular concept of this system, modules connected in series with this module can also carry dangerous voltages.

All energized components of all modules in the system must therefore be disconnected from the grid before mounting and dismounting.

In addition to disconnecting the power supply at the system's central unit, the signal plugs and connections of all modules in the system must also be de-energized or disconnected from the grid.

Caution!



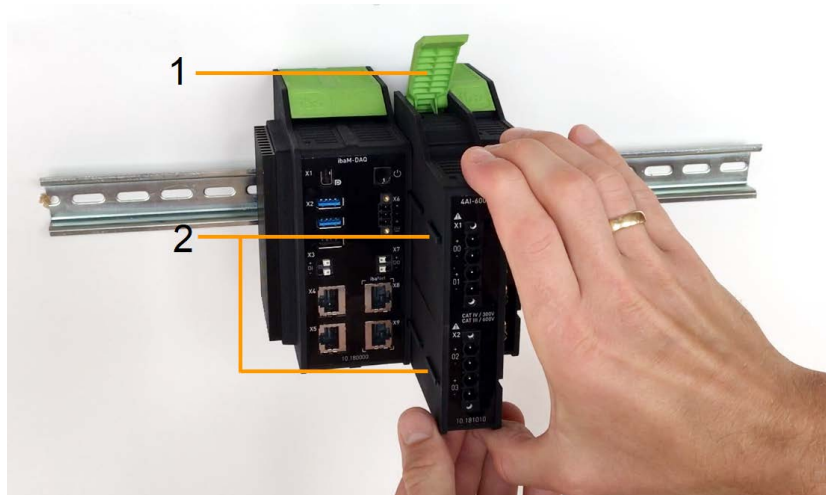
A suitable disconnecting device for this system must be available and disconnect all energized components of this system.

This disconnecting device must include a switch or circuit breaker that is easily accessible at a suitable location in the vicinity and is also clearly marked as a disconnecting device for this system.

7.2 Modules

Mounting

- Shut down the system and/or switch off the power supply.
- Disconnect the power supply and the entire system from the mains as instructed in chapter [↗ Disconnection from the grid](#), page 18.
- Remove the end cover, if present.
- Lift the green lever of the module upwards.
- Push the module backwards along the guide rails onto the DIN rail.
- Push down on the green lever.
- To protect the side contacts from dirt and damage, install the end cover on the last module.
- Switch on the power supply.
- Start the system.



- 1 Green lever for locking and releasing the modules
- 2 Guide rails

Dismounting

- Shut down the system and/or switch off the power supply.
- Disconnect the power supply and the entire system from the mains as instructed in chapter [↗ Disconnection from the grid, page 18](#).
- Remove all connections from the module that is to be dismantled.
- If you want to dismount the module on the far right, first remove the end cover. This is mounted again on the last module on the right after the module has been dismantled.
- Grasp the module at the top and bottom with one hand and lift the green lever upwards to release the lock on the DIN rail.
- Pull the module forward along the guide rails.
- Push down on the lever.

7.3 End cover

The rightmost module is terminated on the right side with the end cover ibaM-CoverPlate.

Mounting

- Push this end cover along the guide rail until the cover snaps into place.

Dismounting

- Push this end cover forward along the guide rail.

7.4 Connection technology fiber optics

The connections for the fiber optic cables are designed as simplex ST connectors.

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 [➤ Example for FO budget calculation](#), page 41.

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 [➤ Technical data](#), page 38 under „ibaNet interface“.

Note



In addition to conventional multimode cable types OM1 (62.5/125 μm) and OM2 (50/125 μm), the other cable types OM3, OM4 and OM5 of the 50/125 μm fiber can also be used.

8 ibaPDA integration

With *ibaPDA* you can search for devices in the network and configure them for operation in the network, but *ibaPDA* can also be used to configure, acquire and record the analog and digital signals of the connected terminals, and output them.

Modules from the ibaMAQ system can only be operated at an ibaMAQS central unit, either at the processor module *ibaM-DAQ* or communication module *ibaM-COM*. Configure the respective central unit before adding further modules.

Other documentation



Please read the description and configuration of the modules *ibaM-DAQ* or *ibaM-COM* in the corresponding device manuals.

8.1 Adding modules

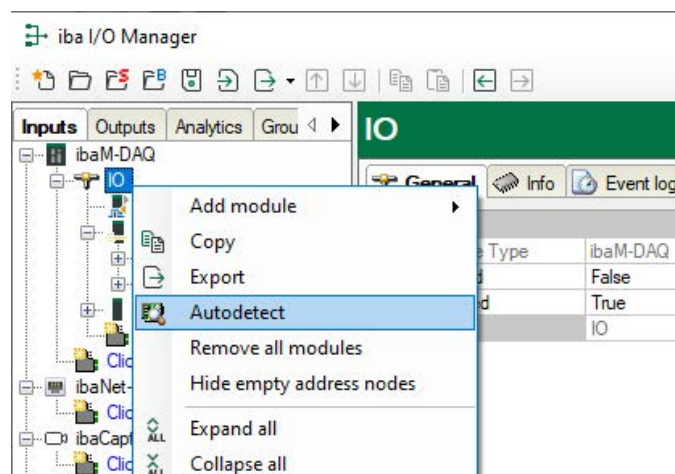
There are several ways to add modules in *ibaPDA*:

- Automatically
- Manually / offline

The procedure is described using the example of the processor module *ibaM-DAQ*.

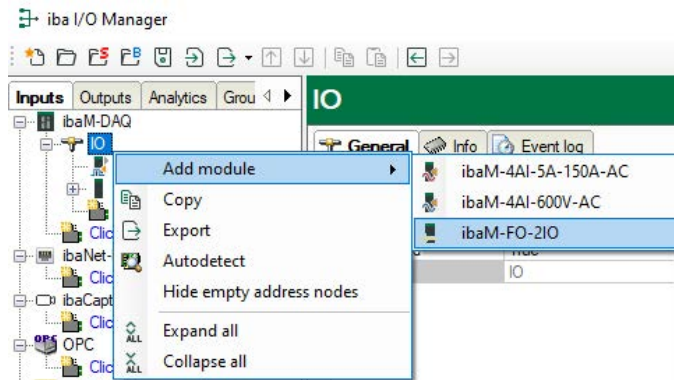
8.1.1 Automatically

Select the "IO" link in the I/O Manager. Right-click on the link to open a submenu. Select "Autodetect". If *ibaPDA* detects the device automatically, the device and the connected modules are listed in the module tree.



8.1.2 Manually / offline

1. If *ibaPDA* does not detect the module automatically, then you can also add the module manually.
2. Right-click on the *IO bus* link.
3. Select *Add module* and select the desired modules from the list.

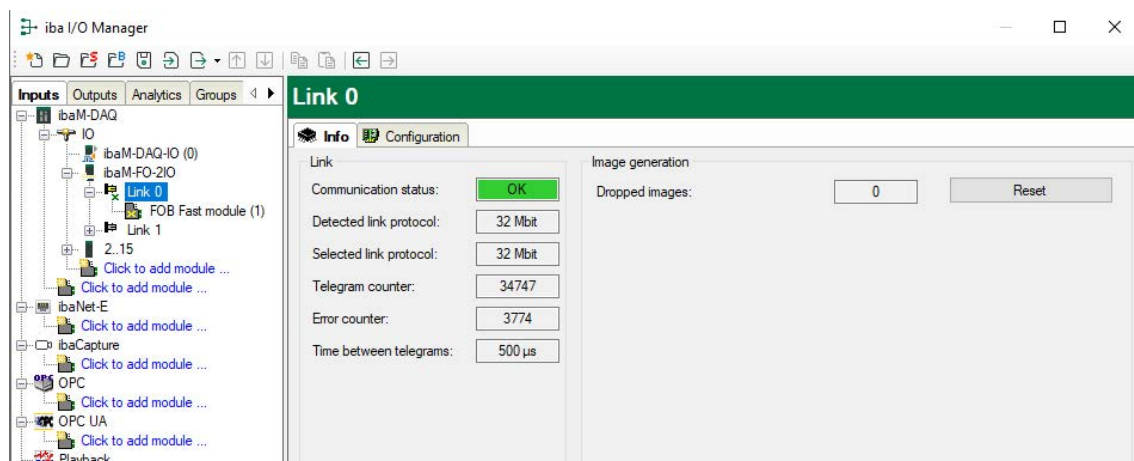


4. To configure the module, see the following chapter.
5. Click <Apply> or <OK> to apply the new configuration.

8.2 Module configuration

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

8.2.1 32Mbit



When you click on a module link in the tree structure, you will see information about this link. In the "Info" tab, information about the FO communication is displayed on the left. The displayed information will depend on the current protocol on the FO link.

"Link" area**Communication status**

OK if the FO communication works properly. 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 connected to the link.

Detected protocol

This is the transmission protocol detected by the module. This can be 32Mbit, 32Mbit Flex or "?" (no device connected).

Selected protocol

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

Telegram counters

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 (process image). An image is a collection of bytes that are transmitted from the module to the computer via the bus. This image contains all data of the measured signals on that link.

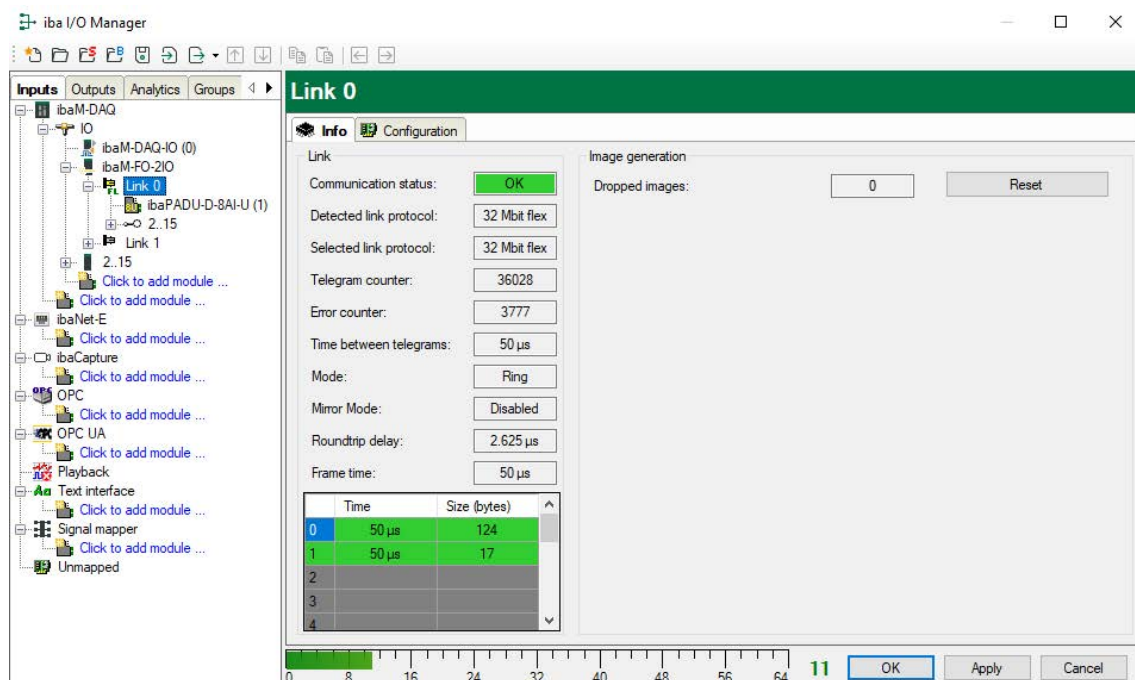
Dropped images

This counter indicates how many images were dropped due to an overload of the communication bus used by the modules. This can occur, for example, if the bus is already occupied with data from too many analog modules with high sampling rates. In this case, consider whether the sampling rate of the modules can be reduced or whether modules must be relocated to another system.

<Reset>

The button <Reset> resets all counters.

8.2.2 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 *ibaM-FO-2IO* correspond to the address set by the rotary switch on the connected device.

Additional items are:

"Link" area

Time between telegrams

Time between two telegrams measured by the *ibaM-FO-2IO* module. 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 module is configured as a master or slave system. For a description of mirror mode, see chapter [Mirror mode with 32Mbit Flex](#), page 25.

Roundtrip delay

Telegram cycle in the closed FO ring. The time depends on the number of 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 timebase set for the connected devices. 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 corresponding address 1–15

8.2.2.1 Mirror mode with 32Mbit Flex

In mirror mode multiple *ibaPDA* systems can receive the data from the same 32Mbit Flex devices at the same time. For this purpose, one *ibaPDA* system is configured as the master. The master system is the only one that can configure the connected Flex devices. The other *ibaPDA* systems are configured as slaves and can only acquire the data from the Flex devices, but not change the configuration.

The master *ibaPDA* system requires a bidirectional fiber optic link to receive and send data to the Flex devices. The slave *ibaPDA* only needs a single fiber optic link to receive data from the Flex devices and the device configuration.

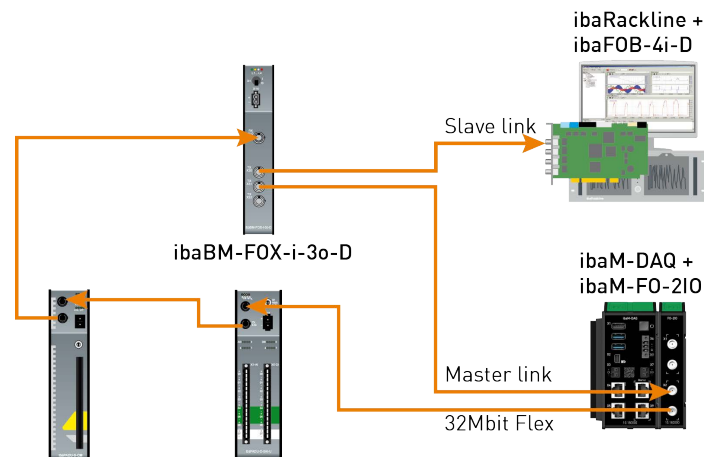
Note

The slave system cannot output data via fiber optics.

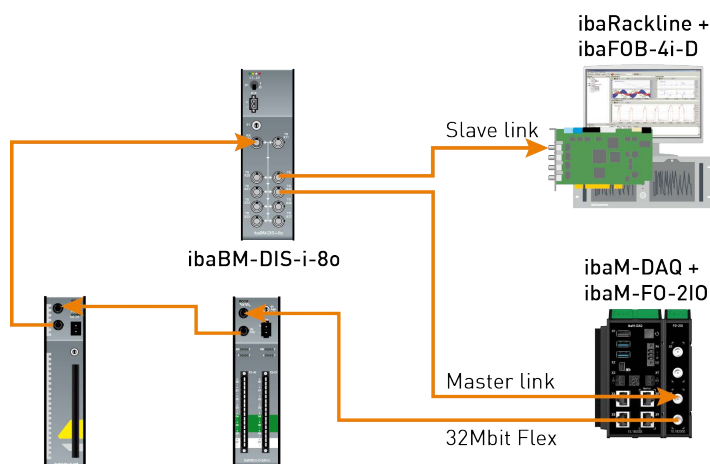
Possible connections

The fiber optic output on the last Flex device is connected to the fiber optic input on an *ibaBM-FOX-i-3o-D* device. One fiber optic output on the *ibaBM-FOX-3o-D* device is connected to a fiber optic input on the master *ibaPDA* system; another output is connected to an input on the slave *ibaPDA*.

This connection allows the slave *ibaPDA* to acquire data even when the master *ibaPDA* system has been shut down.

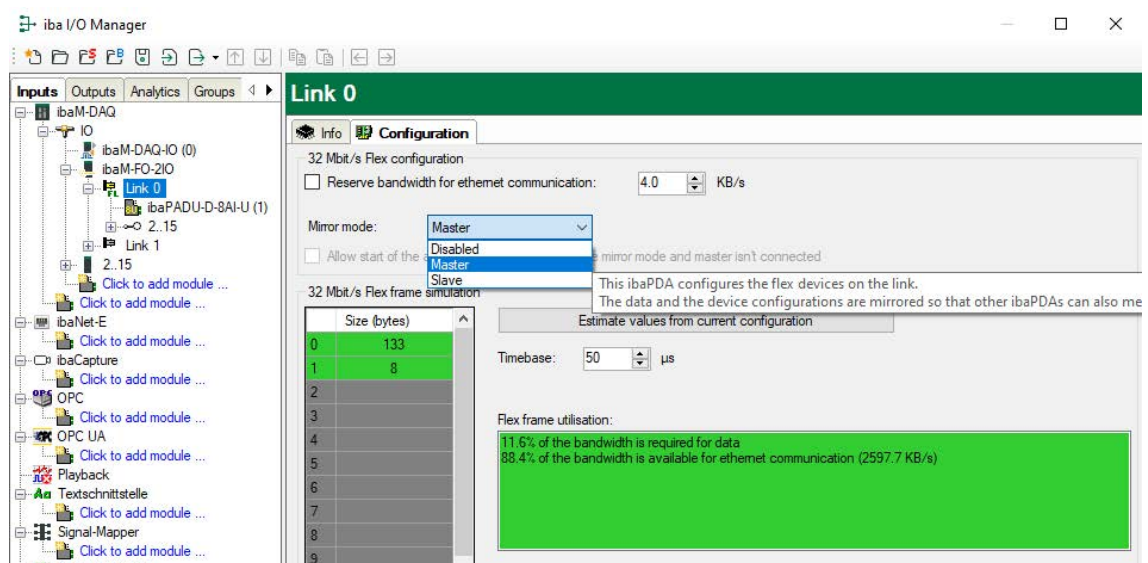


The example above with *ibaBM-DIS-i-8o* is similar to the example with *ibaBM-FOX-i-3o-D*. For this purpose, the *ibaBM-DIS-i-8o* device must be set to copy mode ($S1 = 0$).



Configuration in ibaPDA

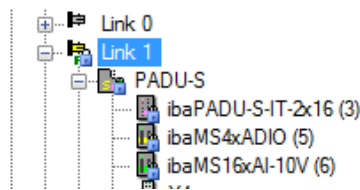
To configure the mirror mode, open the *Configuration* tab in the link view of the *ibaM-FO-2IO* module.



3 settings are available for the mirror mode:

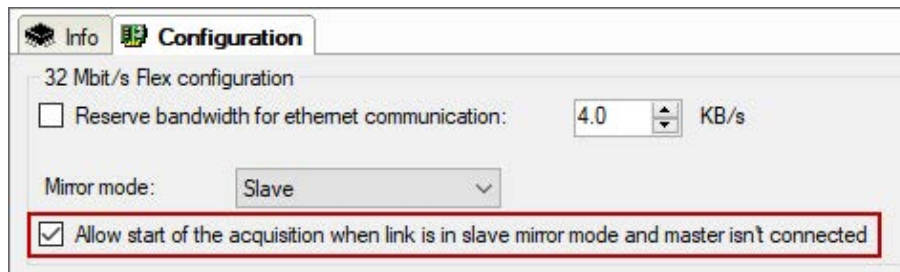
- **Disabled:** The data is not mirrored, therefore this *ibaPDA* system is the only one that can acquire data and configure the devices.
- **Master:** This *ibaPDA* system configures the Flex devices on this link. The data and the device configurations are mirrored so that other *ibaPDA* systems can also acquire the data.
- **Slave:** This *ibaPDA* system receives the device configuration from the master *ibaPDA* so that it can acquire the data configured by the master *ibaPDA*.

The slave *ibaPDA* can get the device configuration from the master *ibaPDA* by using the "auto-detect" function. A slave *ibaPDA* cannot change the device configuration. The slave *ibaPDA* displays the link and its modules in the signal tree with padlock 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 from the master within 6 s, *ibaPDA* will output an error message. If the option "Allow start of the acquisition when link is in slave mirror mode and master isn't connected" is enabled, then the acquisition will start anyway with the last configuration.

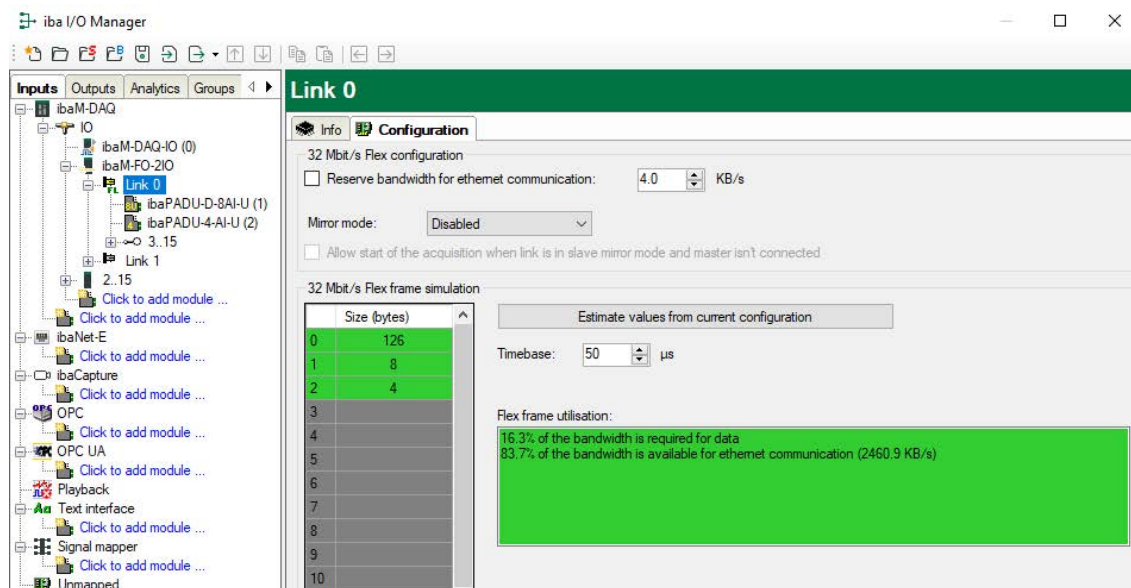


If the master *ibaPDA* changes the configuration while the slave *ibaPDA* is acquiring data, then the slave will automatically restart the acquisition.

8.2.2.2 Telegram size calculation with 32Mbit Flex

The data volume per participant is dynamically allocated in a Flex ring and is calculated by *ibaPDA*. The data volume depends on the number of analog and digital signals configured in *ibaPDA* and the smallest timebase configured in the ring.

For easy estimation, *ibaPDA* provides a simulator (32 Mbit/s Flex packet simulation) which calculates the data size per participant that can be transmitted via fiber optic link using the 32Mbit Flex protocol. The simulator is accessed via the *Configuration* tab.



The data volume (in bytes) of each device in the Flex ring and the timebase for the data acquisition in the ring (in μs) is needed for the calculation.

The values can be entered manually or retrieved automatically from the current configuration either by clicking the <Estimate values from current configuration> button or by selecting the corresponding link of the *ibaM-FO-2IO* module in the module tree.

The devices in the Flex ring and the corresponding data volumes are listed in the table on the left. Address 0 is reserved for the Ethernet channel and is not editable.

The "Flex frame utilization" section shows how much bandwidth is still available. The color of the display changes to reflect the utilization rate in the Flex ring.

- Green: OK
- Orange: Bandwidth for the Ethernet channel < 3 kB/s
- Red: Too much data configured.

The data values obtained automatically are estimated first. When the configuration is applied by clicking <OK> or <Apply>, the actual data sizes are shown on the *Info* tab.

If too much data is configured, you can either reduce the number of signals to be measured or increase the timebase.

Simulation of the data load

Even if no devices have been connected and configured, the calculation of the telegram size can be used to calculate the expected data load in advance. However, an *ibaM-FO-2IO* module should be available in the system.

Open the I/O Manager in *ibaPDA*, click on the link of the module 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 volume (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.

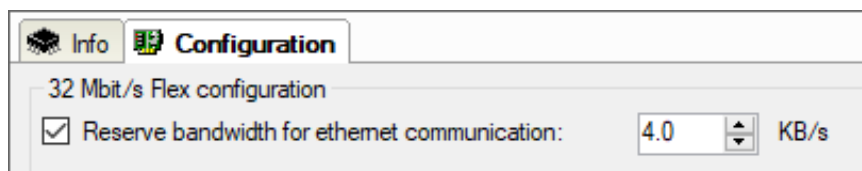
In this way, you can estimate whether the planned number of signals can be processed on one Flex link or if you should use an additional Flex link.

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

Reserve bandwidth for Ethernet communication

The Ethernet channel (address 0) is used to transmit configuration data, to communicate with the web interface if necessary, and in particular with *ibaBM-DP* to display the Profibus diagnostics. If many devices are configured with a lot of signals, it is possible that only the minimum size of 1 kB/s is reserved for the Ethernet channel. This is often insufficient and the Profibus diagnostics may not be displayed as a result or communication with the web interface may become 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 diagnostics.



8.2.3 Configuration of output modules

8.2.3.1 Introduction

For a number of devices, it is possible to transmit signals from *ibaPDA* to a device via the output channel. These output signals are primarily intended to signal events, or to trigger alarms or alerts. 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-D* with WAGO output terminals or an *ibaPADU-S-CM* device with one or more output modules.

For *ibaMAQS*, you need an *ibaM-FO-2IO* module.

Below you will find a list of the modules that can be used for digital and analog outputs.

Interface module	Output modules	Comment
ibaM-FO-2IO	<ul style="list-style-type: none"> ■ 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-D ■ Generic Flex 	Only available if the link is 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.

Most current devices, such as *ibaBM-DP*, only support the output function in 32Mbit Flex mode. In pure 32Mbit mode, no output modules are available.

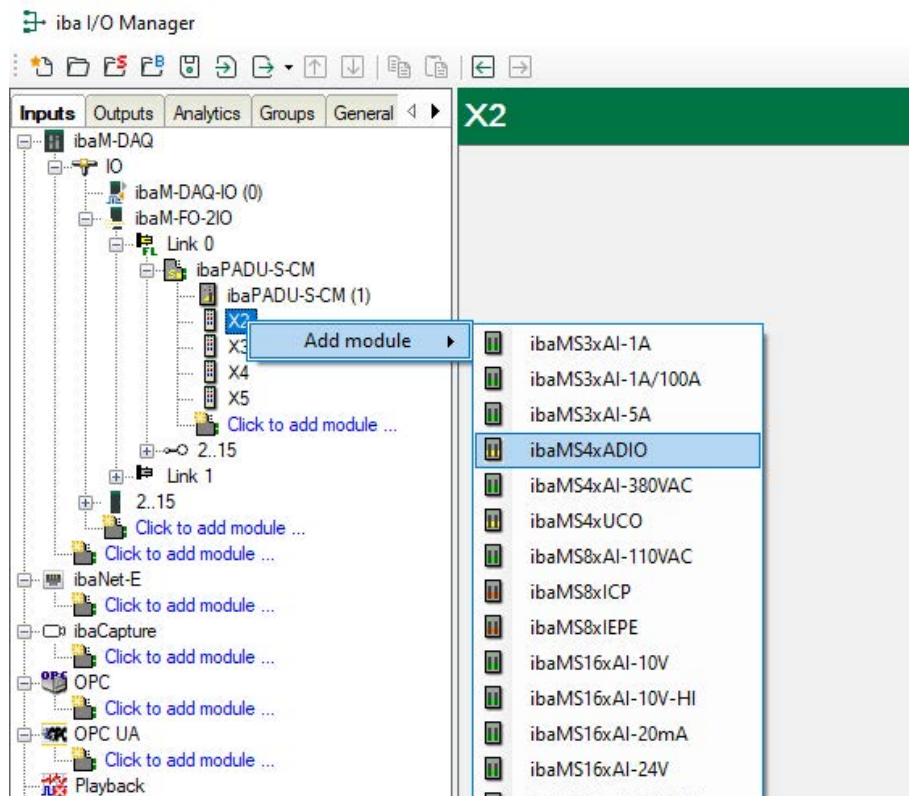
8.2.3.2 Systems with 32Mbit Flex mode

For device configurations that operate in 32Mbit Flex mode, all modules are shown 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.

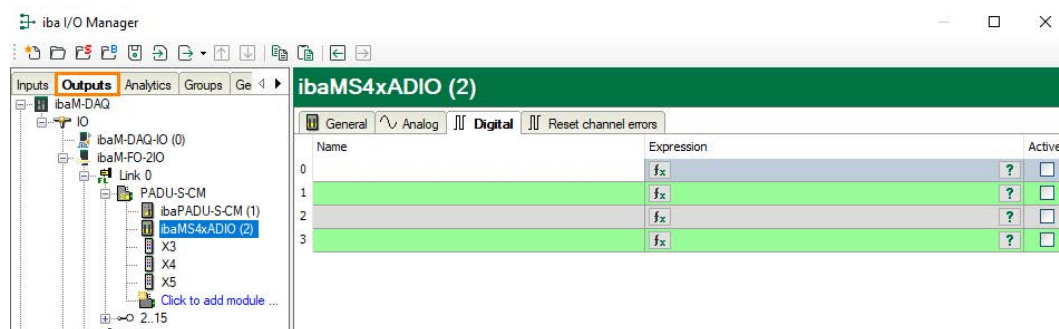
Modules, such as a mixed module with digital and analog inputs and outputs as shown in this example (*ibaMS4xADIO*), can be added both in the *Inputs* and the *Outputs* tab.



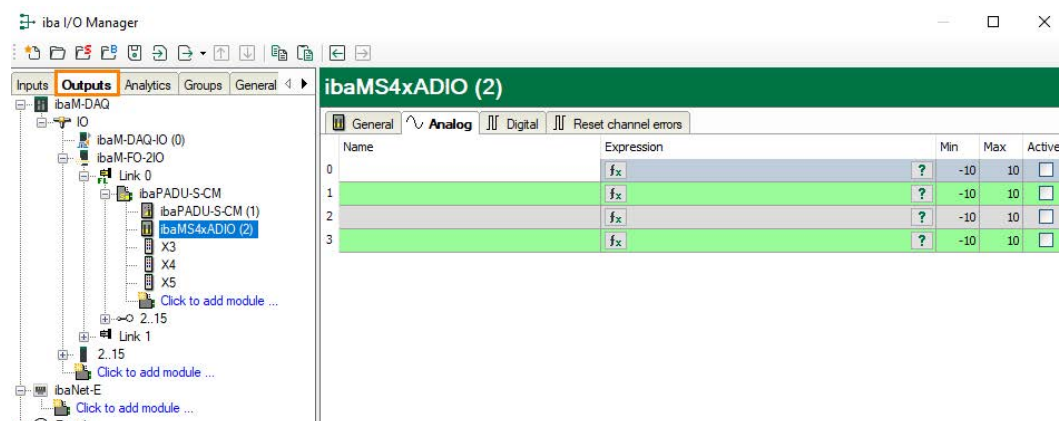
To configure the output signals, you must select the *Outputs* tab.

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

Digital output signals in the *Digital* tab:



Analog output signals in the *Analog* tab:



Note



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

Digital diagnostic signals from an output module:

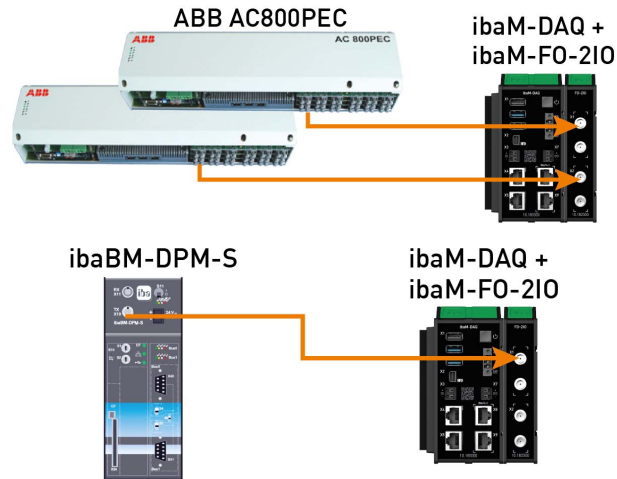
The screenshot shows the 'iba I/O Manager' window. On the left, a tree view displays the hardware configuration, including 'IO', 'Link 0', 'Link 1', and various modules like 'ibaM-DAQ', 'ibaM-FO-2IO', 'ibaPADIU-S-CM', and 'ibaMS4xADIO (2)'. The 'Digital' tab is selected for the 'ibaMS4xADIO (2)' module. The main area displays a table of digital diagnostic signals.

Name	Debounce filter	Debounce time (µs)	Active
Digital inputs			
Output channel active			
4 Analog output channel 0 active			<input checked="" type="checkbox"/>
5 Analog output channel 1 active			<input checked="" type="checkbox"/>
6 Analog output channel 2 active			<input checked="" type="checkbox"/>
7 Analog output channel 3 active			<input checked="" type="checkbox"/>
8 Digital output channel 0 active			<input checked="" type="checkbox"/>
9 Digital output channel 1 active			<input checked="" type="checkbox"/>
10 Digital output channel 2 active			<input checked="" type="checkbox"/>
11 Digital output channel 3 active			<input checked="" type="checkbox"/>
Output channel error state			
12 Analog output channel 00...03 error state			<input type="checkbox"/>
13 Digital output channel 00...03 supply voltage error			<input type="checkbox"/>
14 Digital output channel 00...03 overcurrent error			<input type="checkbox"/>

9 System integration

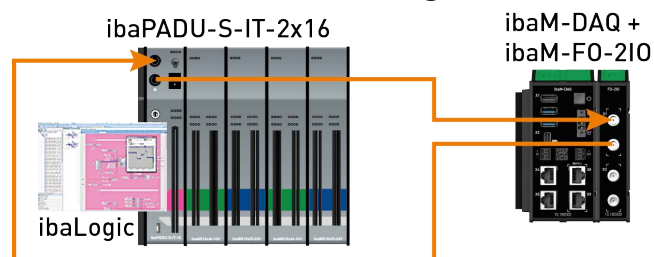
9.1 Example applications for ibaM-FO-2IO

Operation with ibaPDA and 32Mbit protocol



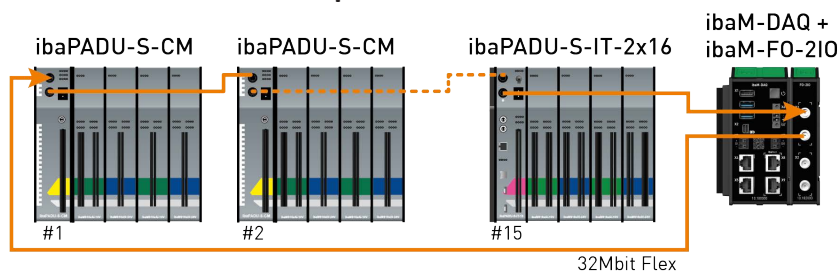
ibaNet protocol	32Mbit
Sampling rate	1 kHz
Sampling time	1 ms
Peripheral devices	ABB AC 800PEC with ibaNet output module SIMATIC TDC with LO5A interface board ibaBM-DPM-S (Profibus monitor), etc.

Operation with ibaPDA and ibaPADU-S-IT-2x16 / ibaLogic



ibaNet protocol	32Mbit Flex
Sampling rate	40 kHz
Sampling time	25 μ s
Peripheral devices	ibaPADU-S-IT-2x16 with ibaLogic and ibaMS modules

Operation with ibaPDA and 32Mbit Flex protocol



ibaNet protocol	32Mbit Flex
Sampling rate	up to 100 kHz
Sampling time	$\geq 10 \mu\text{s}$
Peripheral devices	ibaPADU-S-IT-2x16 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 one ring), ibaPADU-4-AI-U, etc.

9.2 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.

9.2.1 Data volume 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 volume and the sampling rate can be selected in a flexible way. The transferred data volume per cycle depends on the sampling rate. Generally, the following applies: The less data that is transferred, the higher 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 $10 \mu\text{s}$ 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 lower 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 subsampling is carried out in *ibaPDA*. Data which is not relevant for the configured sampling rate is dropped by *ibaPDA*.

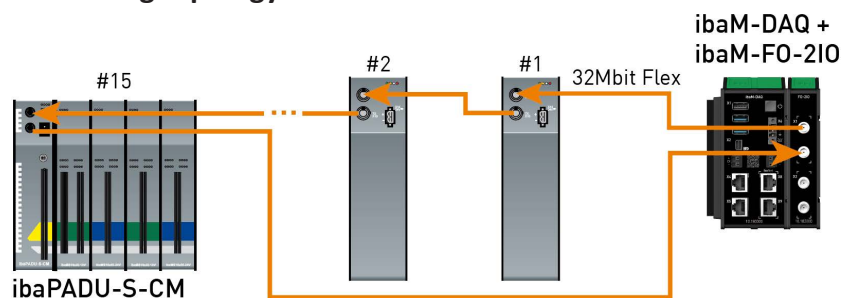
With 32Mbit Flex, up to 4060 bytes per cycle can be acquired and recorded depending on the sampling rate.

For the max. possible data volume of 4060 bytes, the maximum cycle time (timebase) is 1.4 ms. In the following table, you will find reference values for the relation between cycle time and the max. transferable data volume per cycle. If you require additional values, especially if several devices are connected in a Flex ring topology, iba recommends using the simulator integrated in *ibaPDA*, see chapter [Telegram size calculation with 32Mbit Flex](#), page 27.

Timebase	Max data volume
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 volumes represent the limit values for the overall data volume on a Flex ring that can be transferred via an FO link.

Cycle times in the 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.

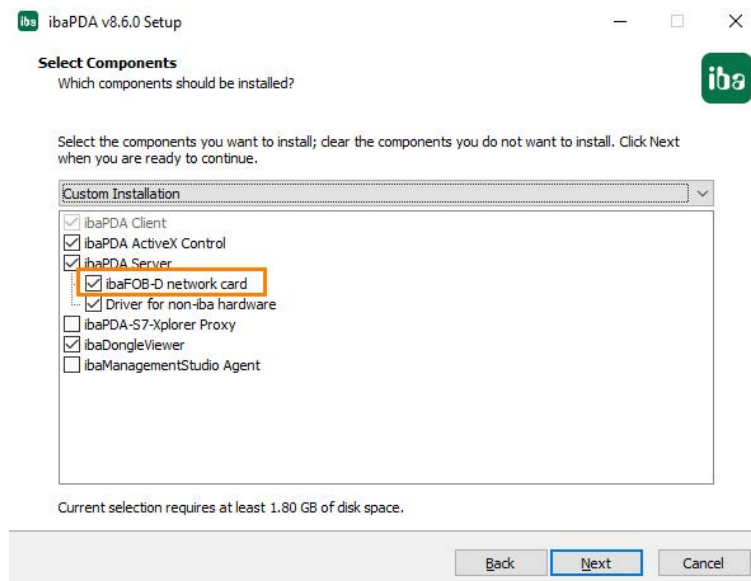
The individual devices in the ring can work with different cycle times. However, these cycle times must be an integer multiple of the smallest cycle. Example: Device #1 operates with a cycle time of 0.5 ms, device #2 with 1 ms, device #3 with 4 ms, etc. If the maximum data rate has been exceeded, *ibaPDA*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

The calculation of the maximum data volume 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 volume of data can be transferred. The data volume can only be increased if you increase the cycle time of the fastest device.

For more information about data volumes in the Flex ring, see chapter [Telegram size calculation with 32Mbit Flex](#), page 27.

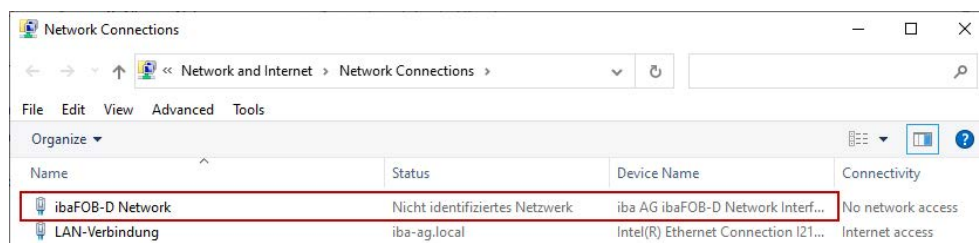
9.2.2 ibaFOB-D network

With *ibaPDA*, an ibaFOB-D network adapter is installed, which is used for communication with 32Mbit Flex devices.



Optionally, the installation of the driver can also be disabled in the installation wizard. For a custom installation, the file *ibaDevDrvInstaller.exe* is provided. You will find the file in the program directory of *ibaPDA*, in the "Server" subdirectory, 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 a 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 *ibaM-FO-2IO* module. There is only one network connection for all installed *ibaM-FO-2IO* modules installed in an ibaMAQ system.

9.2.3 IP addresses in the FOB-D network

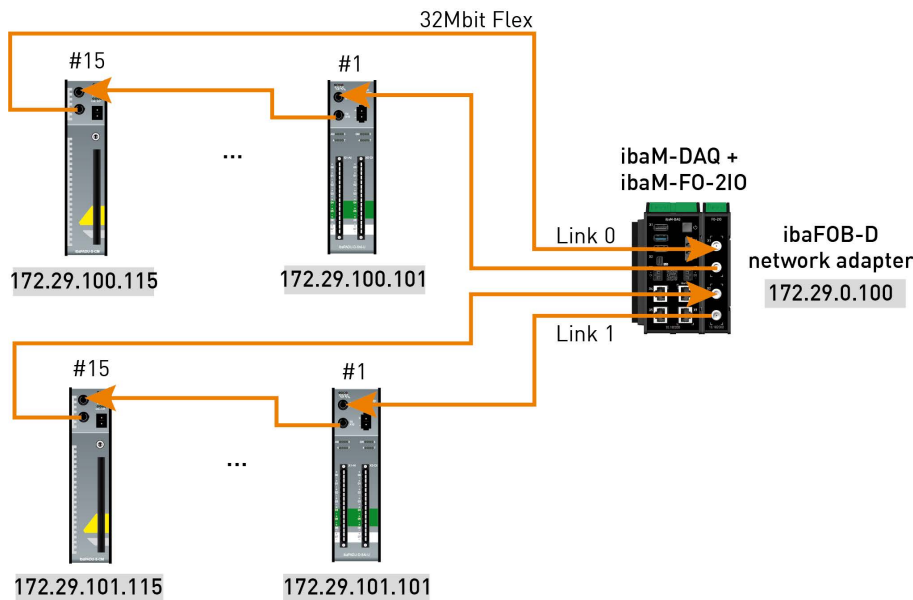
The Flex devices are identified via an IP address in the ibaFOB-D network. The IP address of the ibaFOB-D network adapter is by default: 172.29.0.100 and the subnet mask 255.255.0.0.

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

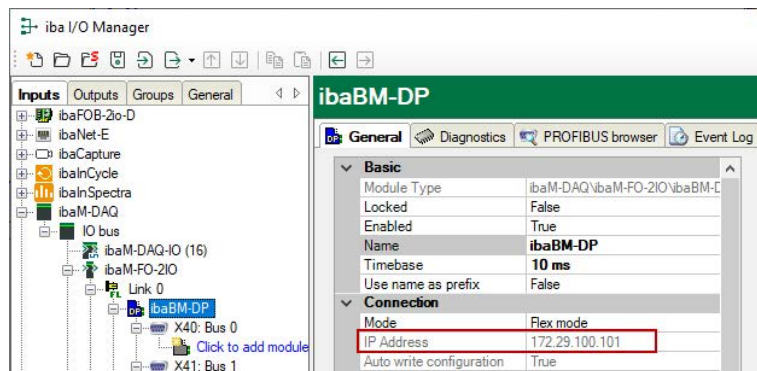
- The new IP address must also be a class B address
- The subnet mask must not be changed
- The last two octets 0.100 must not be changed.

In 32Mbit Flex mode, a fixed IP address is automatically assigned to each device in the Flex ring, which cannot be changed. The IP addresses of the connected 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 assigned automatically, starting from 100
- **Y** is the device address set via the address rotary switch + 100



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), all connected Flex devices must apply the *ibaPDA* configuration again (clicking on <OK> or <Apply>) in order to amend the first two octets of the new IP address. Otherwise the connection will be interrupted.

10 Technical data

Danger!



Electric shock

If the device is used or operated in a manner other than specified in the *Technical data* chapter, the protection supported by the device may be impaired.

Short description	
Name	ibaM-FO-2IO
Module label	FO-2IO
Description	Fiber optic interface module for ibaNet 32Mbit
Order number	10.182000
Module-module interface	
Number	2
Connection technology	4x 8 sliding contacts
ibaNet interface	
Number	2
Design	Optical fiber
Protocol	ibaNet 32Mbit Flex (bidirectional) ibaNet 32Mbit (fixed)
Data transfer rate	32 Mbit/s
Sampling rate	up to 100 kHz, freely adjustable, determined by partner
Connection technology	2x 2 ST-connectors each for RX and TX; iba recommends the use of FO with multimode fibers of type 50/125 µm or 62.5/125 µm; For information on cable length, see chapter ↗ Example for FO budget calculation , page 41
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
	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
Laser class	Class 1

Receiving interface (RX)	
Sensitivity ²⁾	100/140 µm FO cable: -24 dBm to -10 dBm
Temperature range	-40 °F to 185 °F (-40 °C to 85 °C)
Power supply	
Supply voltage	24 V DC via module-module interface
Current consumption	
Own consumption	0.1 A
Input/output current	max. 4 A
Further interfaces, operating and indicating elements	
Indicators	LEDs for operation and errors
Operating and environmental conditions	
Temperature range	
Operation	14 °F to 131 °F (-10 °C to +55 °C)
Storage	-13 °F to 185 °F (-25 °C to +85 °C)
Mounting	on DIN rail according to EN 50022 (TS 35, DIN Rail 35)
Cooling	passive
Relative humidity	15 % ... 95 % (indoor), no condensation
Operating altitude	0 ... 2000 m above sea level
Protection type	according to IP20; without test certificate according to IEC 60529
Certifications / Standards	CE, C-Tick, UKCA, FCC, KC, IEC 61010
MTBF ³⁾	1,659,212 hours / 189 years
Dimensions	
Width x height x depth	28 mm x 133 mm x 131 mm
Height with open lever	160 mm
Height units	3
Installation clearances	
Bottom / top	30 mm / 30 mm
Left / right (system)	10 mm / 10 mm
Mounting position	vertical, lever up
Weight / incl. packaging	0.24 kg / 0.47 kg

²⁾ data for other FO cable diameters not specified

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

Supplier's Declaration of Conformity

47 CFR § 2.1077 Compliance Information

Unique Identifier: 10.182000, ibaM-FO-2IO**Responsible Party - U.S. Contact Information**

iba America, LLC

370 Winkler Drive, Suite C

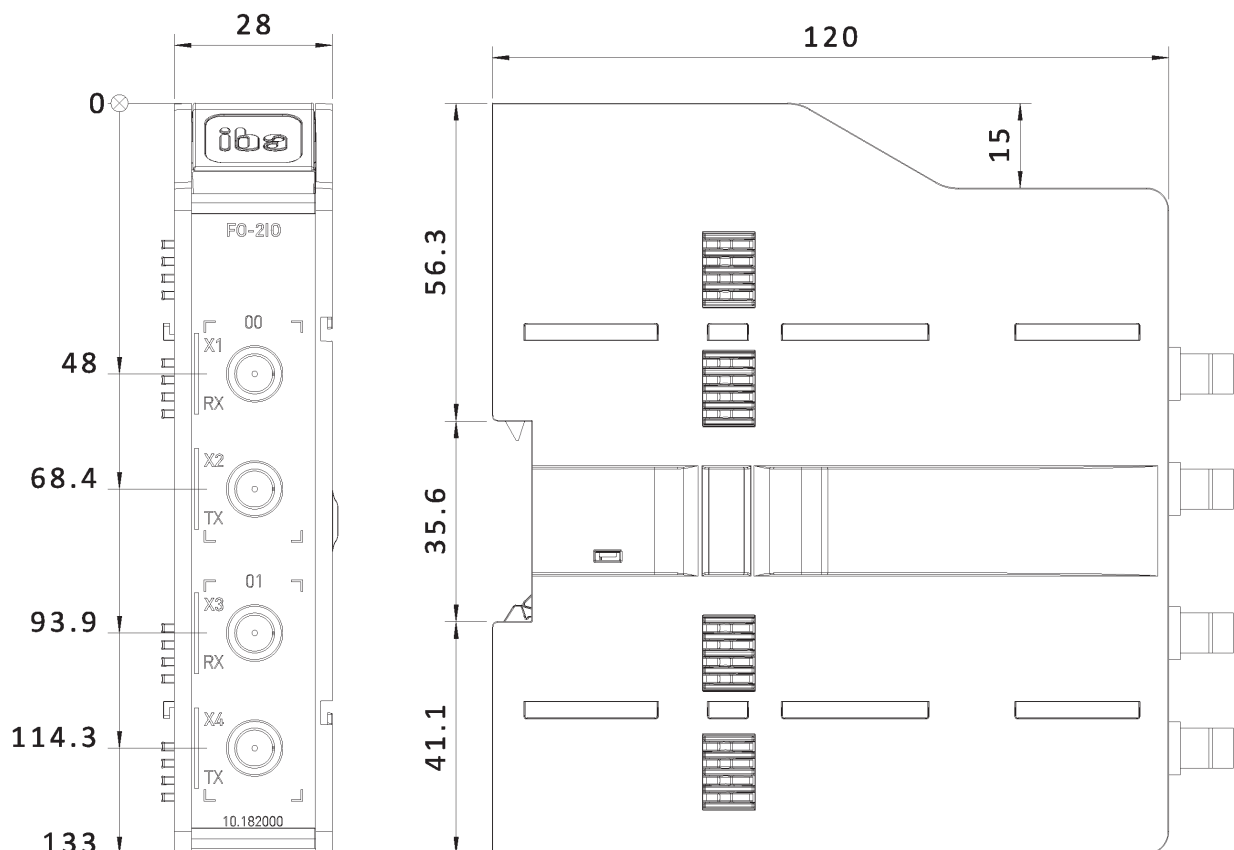
Alpharetta, Georgia

30004

(770) 886-2318-102

www.iba-america.com**FCC Compliance Statement**

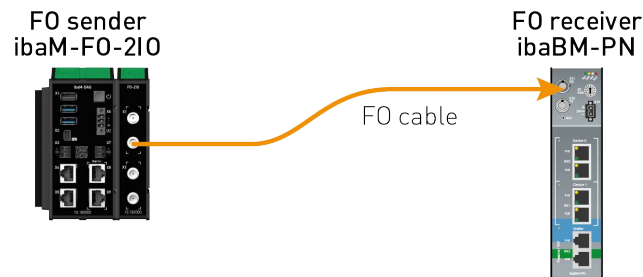
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

10.1 Dimensions

ibaM-FO-2IO dimensions, dimensions in mm

10.2 Example for FO budget calculation

A fiber optic link from an *ibaM-FO-2IO* module (FO transmitter) to an *ibaBM-PN* device (FO receiver) is used as an example.



The example refers to a P2P 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 relevant device manual in the chapter "Technical data" under "ibaNet interface".

ibaM-FO-2IO specification

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

ibaBM-PN specification

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

Specification FO cable

Refer to the data sheet for 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 ibaM-FO-2IO -> ibaBM-PN in the best case:

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

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

Calculation for the example ibaM-FO-2IO -> ibaBM-PN in the worst case:

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

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

Note

When connecting several devices as a daisy chain or as a ring (e.g., *ibaPA-DU-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 reduced distance (by approx. 30–40%) must be expected.

Note

In addition to conventional multimode cable types OM1 (62.5/125 µm) and OM2 (50/125 µm), the other cable types OM3, OM4 and OM5 of the 50/125 µm fiber can also be used.

11 Support and contact

Support

Phone: +49 911 97282-14

Email: support@iba-ag.com

Note



If you need support for software products, please state the number of the license container. For hardware products, please have the serial number of the device ready.

Contact

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