ibaPACO-4

Pulse Counter for Frequency Measurement

Manual

Issue 2.3

Measurement and Automation Systems

Manufacturer

iba AG

Koenigswarterstr. 44

90762 Fuerth

Germany

Contacts

Main office	**+49 911 97282-0**
Fax	**+49 911 97282-33**
Support	**+49 911 97282-14**
Engineering	**+49 911 97282-13**

E-Mail: iba@iba-ag.com

Web: www.iba-ag.com

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

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

Protection note

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

Certification

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

Table of contents

1 About this manual

This manual describes the construction, the use and the operation of the device ibaPACO-4.

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 Designations

The following designations are used in this manual:

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

1.3 Used symbols

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

⚠ DANGER

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

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

⚠ WARNING

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

⚠ CAUTION

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

Note

A note specifies special requirements or actions to be observed.

Important note

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

Tip

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

Other documentation

Reference to additional documentation or further reading.

2 Scope of delivery

After unpacking check the completeness and intactness of the delivery.

The scope of delivery includes:

- ❑ Device ibaPACO-4
- ❑ 2-pin Phoenix power plug
- ❑ Manual
- ❑ All necessary Phoenix terminal blocks (spring loaded terminal blocks) for connecting the input signals

3 Safety instructions

3.1 Designated use

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

- ❑ Automation of industrial systems
- ❑ Measurement data logging and analysis
- ❑ Applications of ibaSoftware products (ibaPDA, ibaLogic etc.)

⚠ WARNING

The device may not be operated in mains supply circuits!

3.2 Special advices

Important note

Each input circuit can be modified and the switches inside the device can be used to change the characteristics of each individual input.
However opening the device and modifying the input circuit (see chapter 7.3) is at the customers own risk.

4 Introduction

The device ibaPACO-4 (PArallel COunter) is designed for frequency and counter acquisition purposes for frequencies up to 200 kHz. The device exists of two parts; a Counter unit and a Digital unit.

The digital unit of the ibaPACO-4 contains 8 digital inputs.

The counter unit consists of 4 independent counters. Each counter can be individually configured as frequency counter, SSI Slave, signed frequency counter or up/down counter input.

If you need non-standard inputs, please specify the input voltage and the frequency range when ordering an ibaPACO-4 device or contact iba-Benelux BVBA.
Also specify the requested inputs as well.

The device is ideally suited for the following applications:

- ❑ Process frequency acquisition
- ❑ Digital data acquisition
- ❑ Trouble Shooting and error detection

5 Mounting and dismounting

5.1 Mounting

Locate the DIN-rail mounting clip on the rear side of the device. Place the device on the DIN rail so that the top part of the mounting clip engages the top part of the rail appropriately. Slowly push down and in so that the bottom part of the mounting clips snaps onto the bottom edge of the rail and firmly fixes the device to the DIN-rail.

Then connect power supply (correct polarity!), the counter and/or digital signal connections and the fiber optic cable(s). Shield if required.

5.2 Dismounting

Disconnect all external connections from the device.

Grasp the device with one hand firmly on the top side. With your free hand, grasp the bottom of the device so that your index and middle fingers rest on the grounding screw. Lightly push down with the hand on the top side of the device and simultaneously pull forward with your other hand. With this action, the device should free itself from the DIN-rail.

6 System prerequisites

In order to use the ibaPACO-4 device for data acquisition you need at least one of the further components or systems:

6.1 Hardware

- ❑ IBM-PC compatible computer with at least one of the following cards:
  - ibaFOB-io, ibaFOB-2i, ibaFOB-2io or ibaFOB-4i (models –S, -X or –D)
- ❑ Laptop computer with
  - ibaCom-PCMCIA-F, copper based RS485 interface (or optic transmission via FO-A adaptor)
  - ibaFOB-io-ExpressCard, transmission via FO
- ❑ PLC-system with
  - ibaLink-SM-64-IO (input)
  - ibaLink-SM-128V-i-2o (input)

6.2 Software

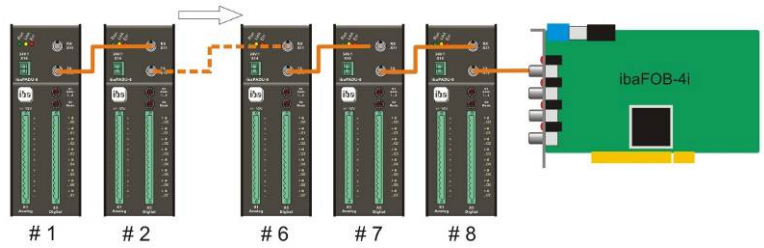
For data acquisition, recording or process control the following software application is required:

- ibaPDA-V6.24.0 or higher

7 System integration

The ibaPACO-4 device is normally connected in a straight line topology to their respective ibaFOB-cards. Another possibility is to cascade the ibaPACO-4 device with other ibaPACO-4 or ibaPADU devices. This can be done by connecting the outputs of the devices with the input of the following devices until all devices are interconnected and the last device is connected to the ibaFOB-card. All addresses (1...8) within a chain must be unique. (See also chapter 8.2. Device view, operating elements and connectors where the location of the address switch S1 is illustrated)

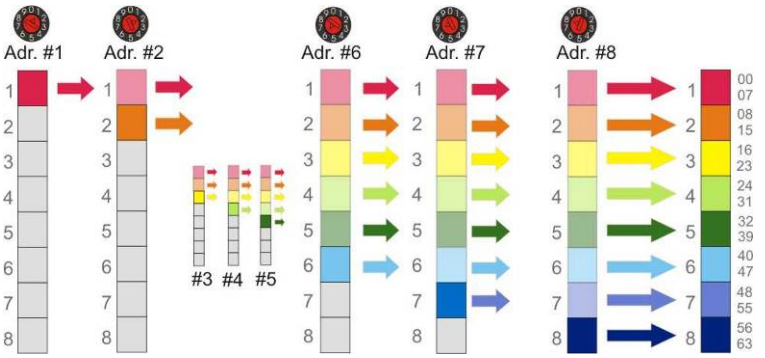
Example



Up to eight devices in a line structure.

Every device must be set to a unique station address from 1 to 8.

If two devices carry the same address the subsequent device in the fiber optic link overwrites the content of the previous device.



The image, left, shows the principle of the data packages in an ibaFOB-telegram.
Each box contains 4 counter values + 8 digital Signals. The device address determines where the data are placed in the telegram. Therefore, the position of a device in the chain is independent of the address setting.

8 Device description

8.1 Properties

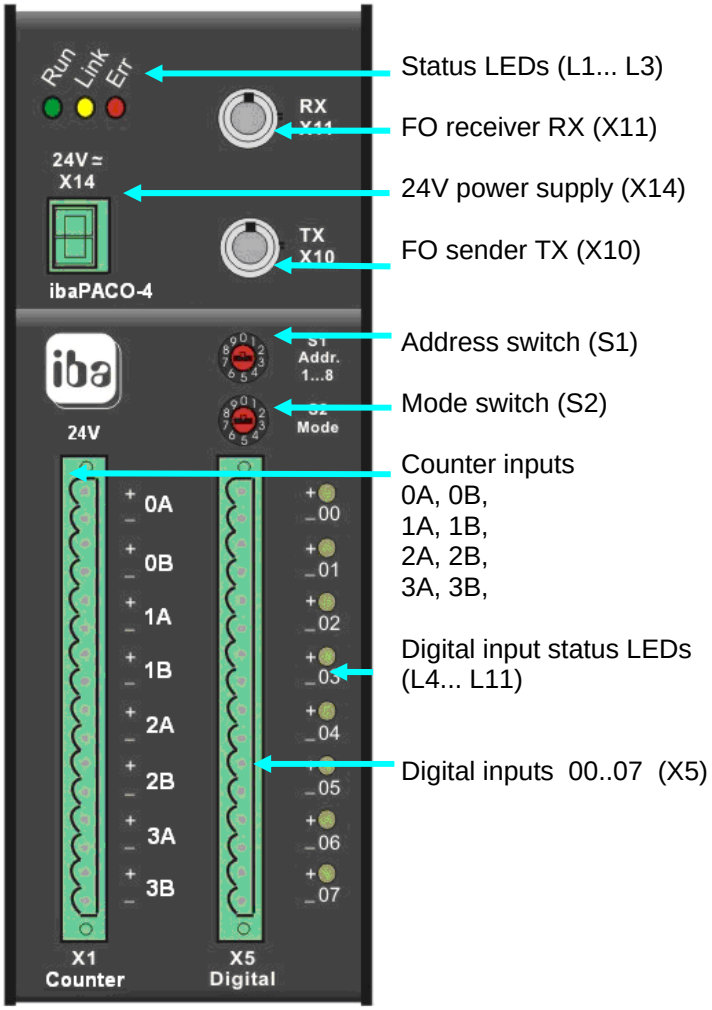
- ❑ Power supply 24V DC
- ❑ Rugged mechanical and electrically shielded metal case (with DIN-rail mount or 19“ rack mount)
- ❑ 3 LEDs (Run, Link, Error)
- ❑ One fiber optic input and one output to transmit the signals and for daisy chaining multiple devices.
- ❑ 4 counter modes (28 bits):
  - Frequency
  - SSI-Slave
  - Signed frequency
  - Up/Down (quadrature mode)

Each counter input has 2 inputs galvanically isolated against each other and against the digital ground.

- ❑ 8 digital inputs, galvanically isolated against each other and against digital ground with eight status LEDs
- ❑ Standard sampling rate for ibaPACO-4 is 1000 Hz.
- ❑ Operates in the so called F-Mode, using a data transmission rate of 3.3 Mbit/s for fiber optic communication.
- ❑ Service port for (later) firmware updates
- ❑ Parallel measuring via fiber optical output or RJ11 jack and ibaCom-PCMCIA-F card is supported for the ibaPACO-4 device.

8.2 Device view, operating elements and connectors

Front



Status LEDs (L1... L3)

FO receiver RX (X11)

24V power supply (X14)

FO sender TX (X10)

Address switch (S1)

Mode switch (S2)

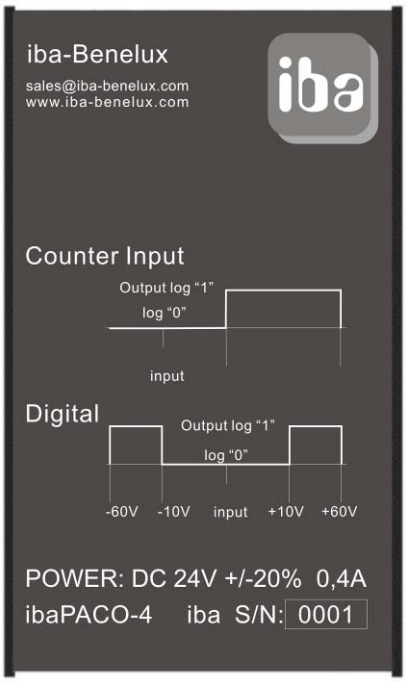
Counter inputs
0A, 0B,
1A, 1B,
2A, 2B,
3A, 3B,

Digital input status LEDs
(L4... L11)

Digital inputs 00..07 (X5)

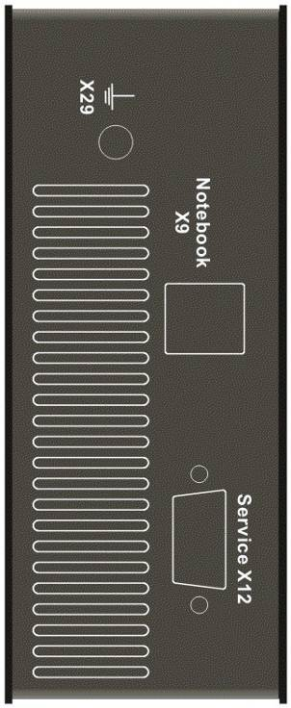
Top

Serial number and email address



Bottom

Service interface, 9-pin D-Sub (X12)
RJ11 notebook connector jack (X9)



8.2.1 Power supply connector X14

A non stabilized DC voltage between 18 V and 32 V DC is to be connected here.

Pin	Meaning (X14)
1	+24 V
2	0 V

8.2.2 Fiber optic input X11 (RX) and output X10 (TX)

The two connectors (ST type) serve to connect the device to the fiber optic bus.

The X10 output has all data of the device itself and – in case of a daisy chain – the data from all previous devices. Chaining is done when X10 of a device is connected to X11 of the next device. The last output must then be connected to a fiber optic input of the ibaFOB-card (or ibaLink-SM-card if used as I/O expander). Connecting and disconnecting of devices on the fiber optic links is allowed at all times. Interrupting the fiber optic link leads to missing data for the time period of the interruption.

8.2.3 Device address switch (S1)

S1 is used to set the device address (1...8). (See chapter 7)

8.2.4 Device mode switch (S2)

S2 sets the device mode and must be **set to 1**. All other positions are invalid and lead to malfunction of the device.

Switch S2	Mode	Meaning
	1	ibaPACO-4 device mode

8.2.5 L4...L11; Status LEDs for digital inputs

LED	Status	Meaning
Ln : (green)	On	Digital input = on (log „1“, TRUE)
	Off	Digital input = off (log „0“, FALSE)

1 n = 4..11 (4 represents digital input 00; 11 digital input 07)

8.2.6 Run, Link and Error LED indicators

LED	Status	Indication
L1: Run (green)	Blinking	power is on and device is healthy
	Off	insufficient power or device failure
L2: Link (yellow)	On	data is being received on FO-input
	Off	no incoming data stream; link broken or previous device in the chain defect or not active
L3: Error (red)	On	device error
	Off	device healthy, automatically resets when error condition ends

8.2.7 Counter and digital connector pinning

		Freq. counter inputs	SSI slave inputs	Signed frequency counter inputs	UP/down counter inputs	UP/down counter with N/G inputs
Pin / connector		**X1**	**X1**	**X1**	**X1**	**X1**
1	Counter **0**	+ A0	+ Data 0	+ A0	+ A0	+ A0
2		- A0	- Data 0	- A0	- A0	- A0
3		+ B0 (not used)	+ Clk 0	+ B0	+ B0	+ B0
4		- B0 (not used)	- Clk 0	- B0	- B0	- B0
5	Counter **1**	+ A1	+ Data 1	+ A1	+ A1	+ N0
6		- A1	- Data 1	- A1	- A1	- N0
7		+ B1 (not used)	+ Clk 1	+ B1	+ B1	+ G0
8		- B1 (not used)	- Clk 1	- B1	- B1	- G0
9	Counter **2**	+A2	+ Data 2	+A2	+A2	+A2
10		- A2	- Data 2	- A2	- A2	- A2
11		+ B2 (not used)	+ Clk 2	+ B2	+ B2	+ B2
12		- B2 (not used)	- Clk 2	- B2	- B2	- B2
13	Counter **3**	+ A3	+ Data 3	+ A3	+ A3	+ N2
14		- A3	- Data 3	- A3	- A3	- N2
15		+ B3 (not used)	+ Clk 3	+ B3	+ B3	+ G2
16		- B3 (not used)	- Clk 3	- B3	- B3	- G2

	Digital inputs
Pin / connector	**X5**
1	+ DI 00
2	- DI 00
3	+ DI 01
4	- DI 01
5	+ DI 02
6	- DI 02
7	+ DI 03
8	- DI 03
9	+ DI 04
10	- DI 04
11	+ DI 05
12	- DI 05
13	+ DI 06
14	- DI 06
15	+ DI 07
16	- DI 07

8.2.8 Service interface (X12)

A 9-pin D-SUB port, found on the bottom side of the device is dedicated to load new firmware on the device. For loading new firmware from a PC into the device you'll need a standard V.24 interface cable.

Note

Please contact iba regarding loading new firmware. You will get the required files and further information about the loading procedure.

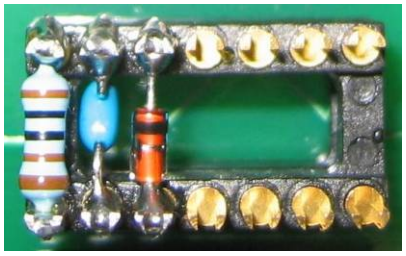
Important note

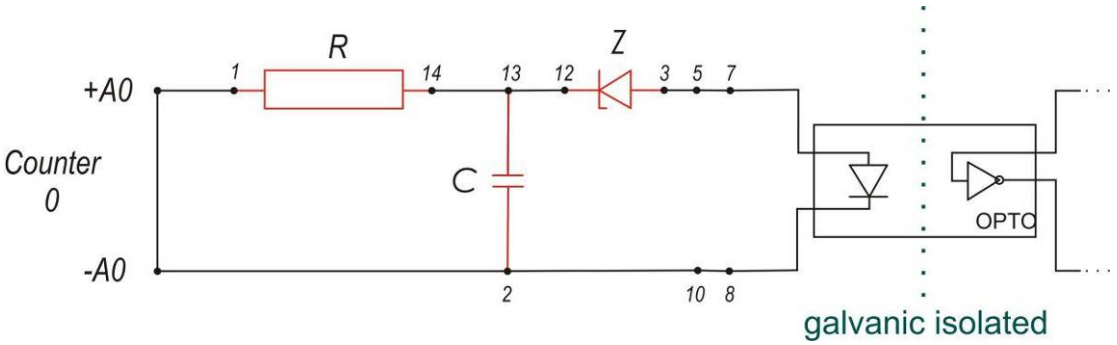
In normal operation mode the V.24-cable must not be connected!

8.3 ibaPACO-4 input circuit

In order to acquire an accurate measurement of the counter, an input circuit is implemented internally in the ibaPACO-4 device. This will prevent disturbances which may be present on the input signal to affect the output. The input circuit is soldered with discrete components on a forked 14 pins DIP removable socket (see picture and schematics).

8.3.1 Default 24 V input circuit





By default the counter input is suited for pulses with a nominal voltage of 24 V.

Important note

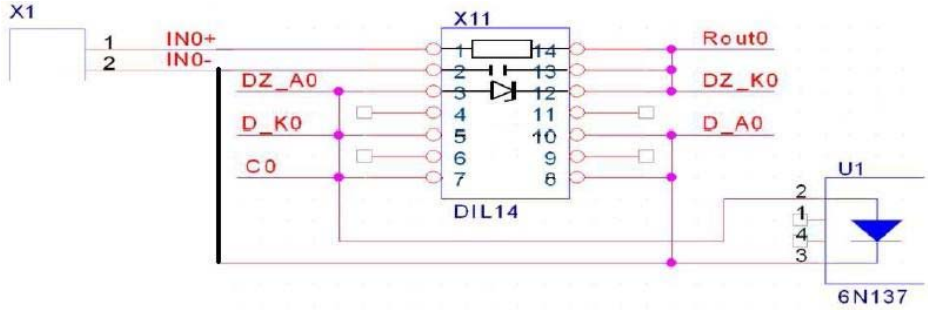
An additional diode (e.g. 1N4148) needs to be added between pin 2 (Anode) and 13 (Cathode) when a pulse generator with a “totem pole output” is used. This kind of pulse generator is mostly used with long transmission lines.

Default input circuit components:

Component	Value
R	1kΩ
C	4,7nF
Z	12V
Component	**Type**
Opto-coupler	6N137

The input circuit contains a low-pass filter, using the components listed above the maximum input frequency is approximately 100 kHz.

Below you can see the schematic of the input circuit, leaving the customer the ability to adapt the input circuit to its own needs.

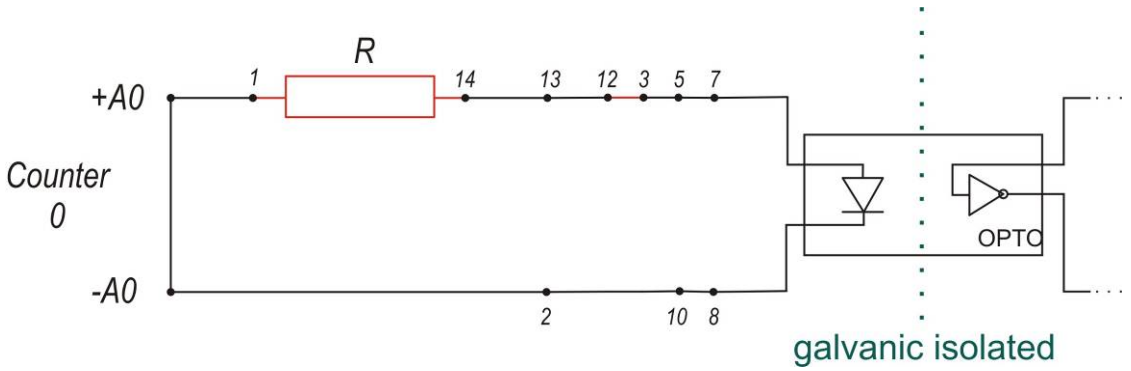


⚠ CAUTION

You can manipulate the input circuit, although it is not recommended.

Opening the device and modifying the input circuit is at the customer's own risk.

8.3.2 Default 5V input circuit



Default input circuit components:

Component	Value
R	470 Ω
Component	**Type**
Opto-coupler	6N137

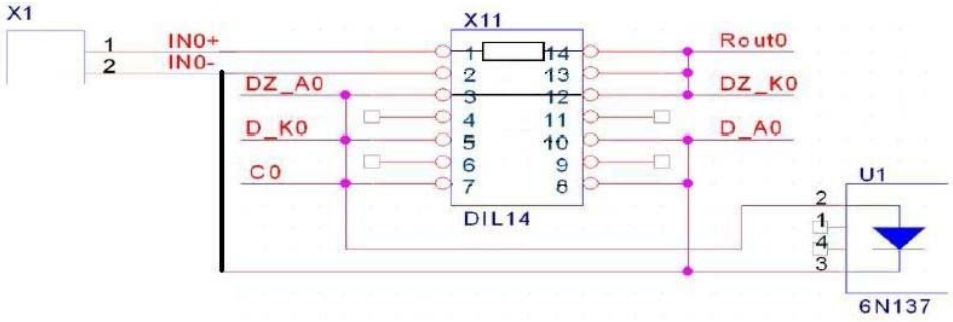
Important note

An additional capacitor (e.g. 4,7nF) can be added between pin 2 and 13 when a “filthy” signal is used.

Important note

An additional diode (e.g. 1N4148) needs to be added between pin 2 (Anode) and 13 (Cathode) when a pulse generator with a “totem pole output” is used. This kind of pulse generator is mostly used with long transmission lines.

The input circuit contains a low-pass filter, using the components listed above the maximum input frequency is approximately 200 kHz.



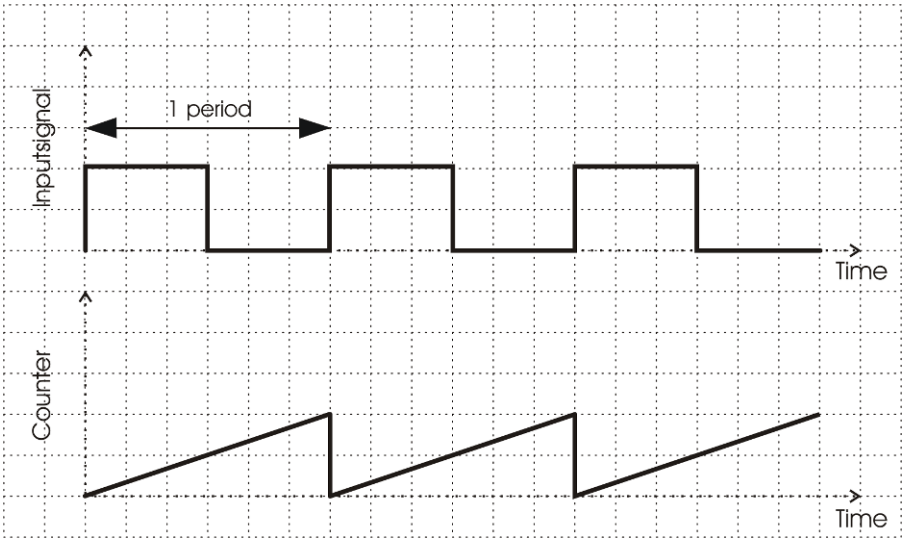
8.4 Theory of operation of the frequency counter input

8.4.1 Period measurement

The method which is applied in the ibaPACO-4 device to calculate frequency is to measure the time T between two consecutive rising edges (the period) and then compute the frequency f as the reciprocal of this time period T:

$f = \frac{1}{T}$ (Where T is the period)

The measurement of the time between two consecutive occurrences is done by a counter module which is incremented by a 50 MHz clock (fClock). At the end of every period the counter value is sent to ibaPDA. The calculation of the frequency itself is done within ibaPDA. This principal is shown in the picture below.



In order to make the measurement more accurate, the integration time can be extended over several periods. This can be done by changing the integration factor, so the calculation update is initiated every 2nd, 4th, 8th or 16th rising edge. More information on how to set up the integration factor is provided in chapter 8.8.2.

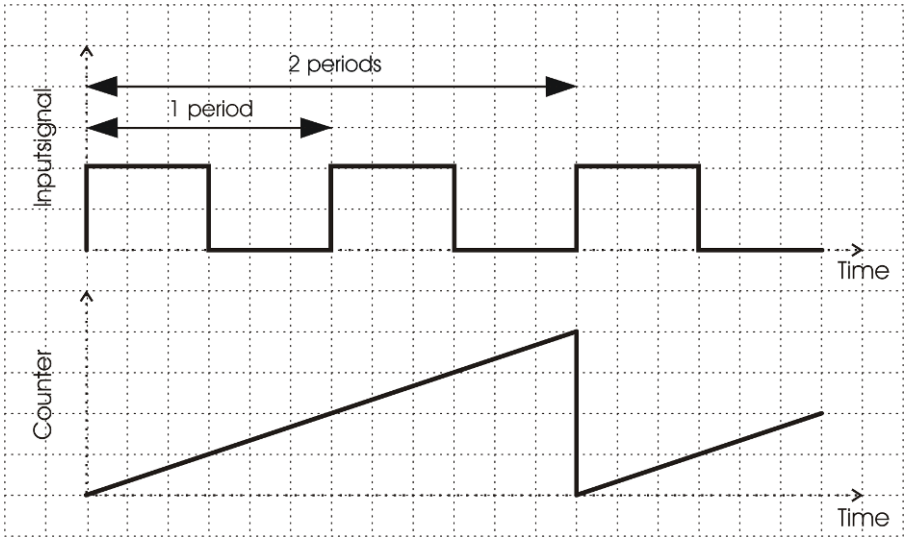
All this can be easily explained by an example. In the figure below an input signal of 1 kHz is represented. Assuming the integration factor is set to 2, a new counter value will be sent every 2ms to ibaPDA.

$T_{input} = 1ms$

$T_{counter} = 2 * 1ms = 2ms$

$T_{clock} = \frac{1}{50Mhz} = 20ns$

$Counter = \frac{2ms}{20ns} = 100.000$



ibaPDA gets always a counter value which is normalized to an integration factor of 16. So the counter value needs to be adapted by the ibaPACO-4 device to correspond with 16 periods of the input signal.

$$Output_{toibaPDA} = Counter * 8 = 100.000 * 8 = 800.000$$

$$f_{input} = \frac{1}{(\frac{Output}{16}) * 20ns} = \frac{1}{(\frac{800.000}{16}) * 20ns} = 1kHz$$

Note

Only f_{input} is calculated within ibaPDA, all preceding operations are done in the iba-PACO-4 device hardware.

8.4.1.1 Supported frequency range

The internal counter is a 28 bit value, so the usage of low frequencies could result in an overflow.

The measurement resolution is $T_{clock} = 20ns$ with a maximum count value of 268435456, therefore the maximum time interval (period) that can be measured is about 5 s.

Considering the integration factor setting, the lowest possible input frequency is about 0,2Hz * Integration factor.

$$Integration\ Factor * T_{max} = Counter_{max} * T_{clock} = 268435456 * 20\text{nsec} \approx 5\text{sec}$$

$$T_{max} \approx \frac{5\text{sec}}{Integration\ Factor}$$

$$F_{min} \approx \frac{1}{T_{max}} \approx 0{,}2Hz * Integration\ Factor$$

The maximum input frequency is limited to approximately 100 kHz. This is caused by the low pass filter that is present in the input circuit.

8.4.1.2 Input frequency and integration factor value

The integration factor improves the precision of the calculation but it also decreases the calculation update time. Therefore a compromise has to be made between the calculation update and the precision of the calculation. In the table below some input frequencies and integration factors are listed together with their corresponding refresh period, counter value end error rate.

Input frequency [Hz]	Integration factor	Refresh period [ms]	Counter	Error [%]
1	2	2000	100000000	0.000002
1	4	4000	200000000	0.000001
1	8	8000	400000000	0.0000005
1	16	16000	800000000	0.00000025
100	2	20	1000000	0.0002
100	4	40	2000000	0.0001
100	8	80	4000000	0.00005
100	16	160	8000000	0.000025
100000	2	0.02	1000	0.2
100000	4	0.04	2000	0.1
100000	8	0.08	4000	0.05
100000	16	0.16	8000	0.025

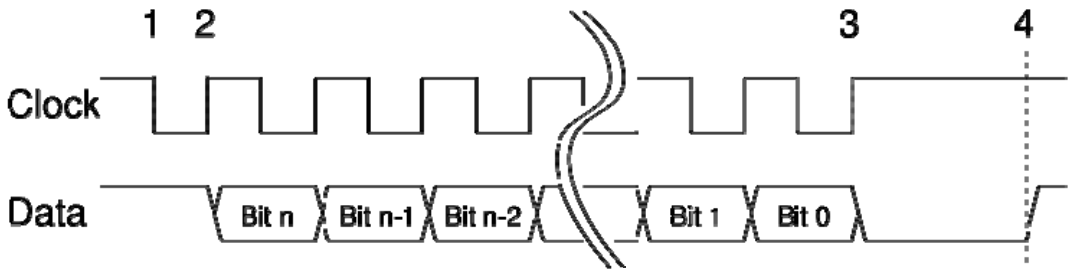
8.5 Theory of operation of the SSI slave input

SSI stands for Synchronous Serial Interface.
The synchronous serial Interface is used in single-turn- as well as in multi-turn- encoders. The outstanding features of the synchronous serial interface represent a technological quantum leap in absolute encoder interfaces compared with the traditional parallel and asynchronous serial data transmission modes:

- ❑ Low conventional component count
- ❑ Irrespective of the encoder resolution, only 4 data and clock lines are required
- ❑ Secure data output in single step Gray code
- ❑ Electrical isolation of the encoders from the controllers through opto-couplers
- ❑ Easy translation of Gray code into Binary
- ❑ Data transmission between the encoder and the controller is synchronized by the controller clock signal
- ❑ The information from several encoders can be stored simultaneously without additional connections
- ❑ Depending on the transmission distance, baud rates of up to 1.5 MHz can be achieved

The ibaPACO-4 device works as an SSI Slave: this means the ibaPACO-4 device listens to an existing SSI network between a controller (SSI Master) and the encoder. The SSI Master sends a clock signal to the encoder. Encoder data are sent out synchronously with the clock back to the SSI Master.

The data is sent by the encoder on the rising edge of the clock signal. On the falling edge the ibaPACO-4 device reads the data.



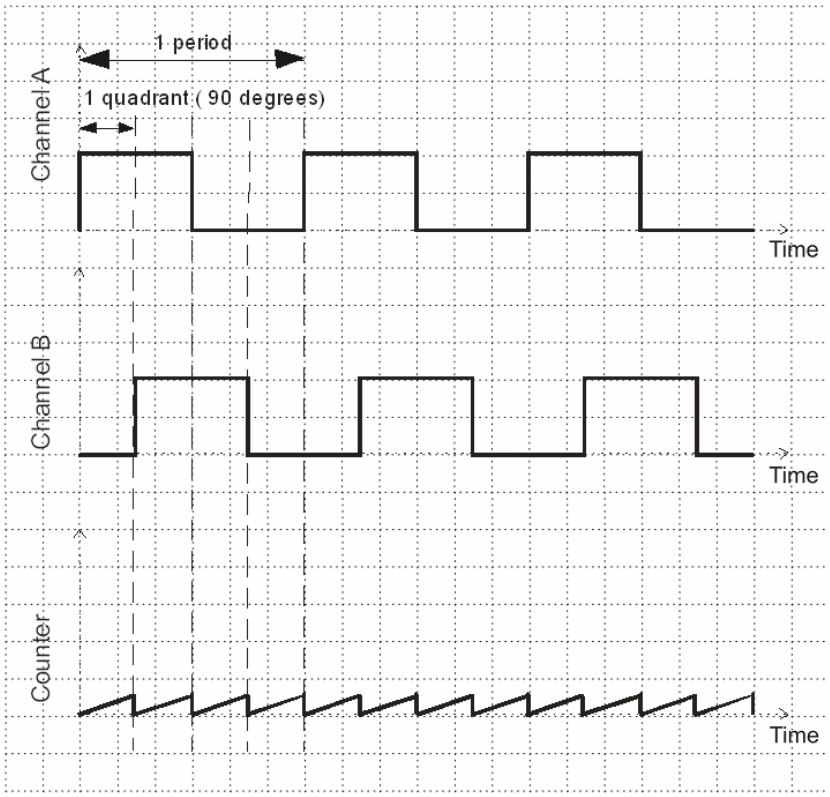
After the data has been read from the serial data line, the ibaPACO-4 device converts the binary or gray value towards a 28 bits signal. If the encoder uses a parity bit, the ibaPACO-4 device will remove the parity bit from the serial data.

8.6 Theory of operation of the signed frequency counter input

The method which is applied in the ibaPACO-4 device to calculate signed frequency is to measure the time t between two consecutive edges of the signals A and B, then compute the frequency f as the reciprocal of this time period t:

$f = \frac{1}{t}$ (Where t is the time measured between the two edges)

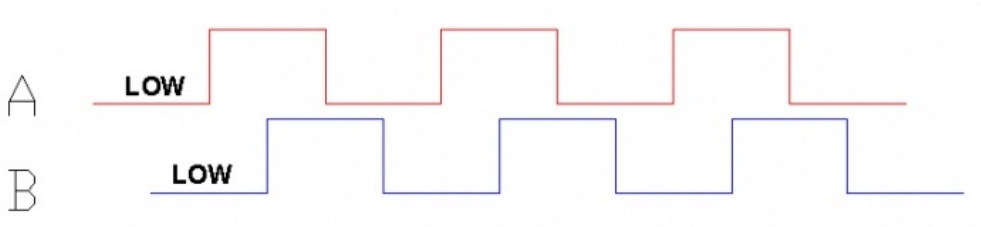
The measurement of the time between two consecutive occurrences is done by a counter module. At the end of every quadrant the counter value is sent to ibaPDA. The calculation of the frequency itself is done within ibaPDA. This principal is shown in the picture below.



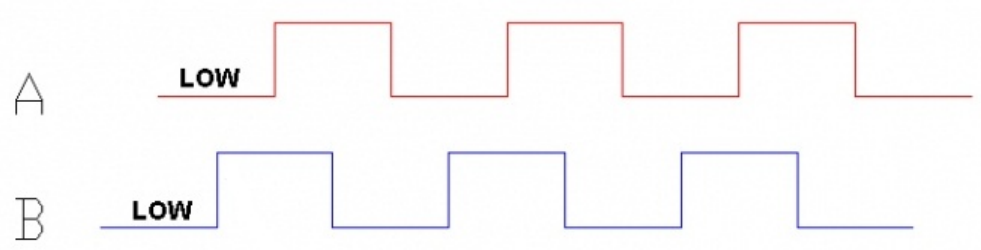
In order to make the measurement more accurate, the integration time can be extended over several quadrants of a period. This can be done by changing the integration factor, so the calculation update is initiated every 1st, 2nd, 4th or 8th rising period. More information on how to set up the integration factor is provided in chapter 8.8.2.

Since we want to measure a signed frequency, the sign needs to be determined by the input channels A and B.

The frequency is determined as a positive time value when Channel B is 90 degrees in anti-phase with Channel A.



The frequency is determined as a negative time value when Channel A is 90 degrees in anti-phase with Channel B.



Note

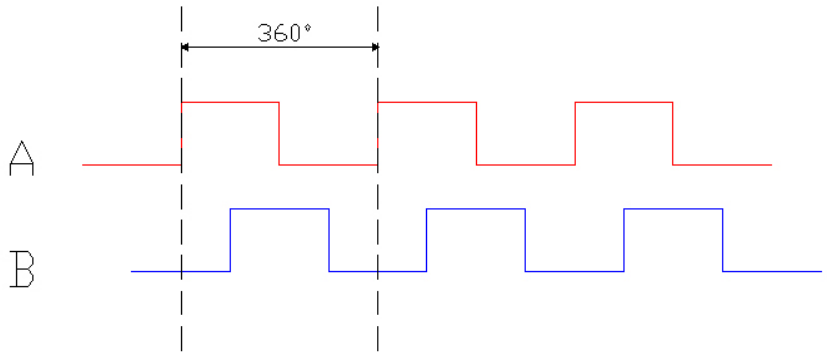
Only f is calculated within ibaPDA, all preceding operations are done in the ibaPACO-4 device hardware.

The maximum input frequency depends on the input circuit, with the standard 24V input circuit the maximum input frequency is limited to approximately 100 kHz. This is caused by the low pass filter that is present in the input circuit.

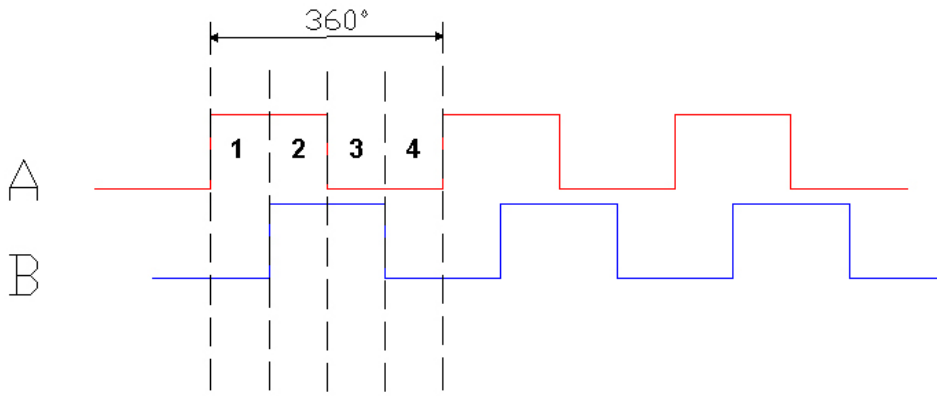
The integration factor improves the precision of the calculation but it also decreases the calculation update time. Therefore a compromise has to be made between the calculation update and the precision of the calculation.

8.7 Theory of operation of the up/down counter input

The method which is applied in the ibaPACO-4 device for the UP/DOWN counter is based on the quadrature method. This means that the signals need to be, in quadrature, shifted by 90 electrical degrees from each other. There are 360 electrical degrees in one pulse period as can be seen in the picture below.



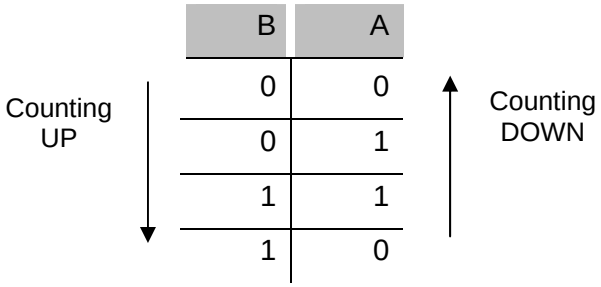
The edge separation for an optical quadrature encoder between any two adjacent edges is ideally 90 electrical degrees. Since there are four 90 degree periods in a standard 360 electrical degree cycle, this amount of separation is referred to as being in quadrature.



To be able to use the input channels A and B within an up/down counter, there needs to be decided when the counter will count up or count down.

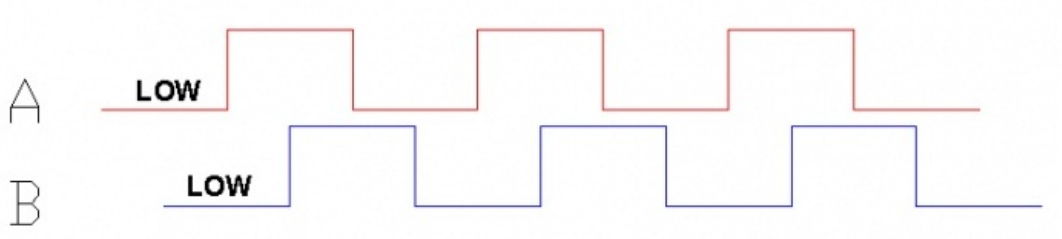
The ibaPACO-4 device will determine the counting direction depending on the next edge. For each rising or falling edge the ibaPACO-4 device will compare the current state with the previous state of Channel A and Channel B. When the Channel combination changes from for example ‘00’ to ‘01’, the ibaPACO-4 device will count up. If the value changed from for example ‘00’ to ‘10’, the ibaPACO-4 device would count down.

This means that the ibaPACO-4 determines on each edge which counting direction should be used.

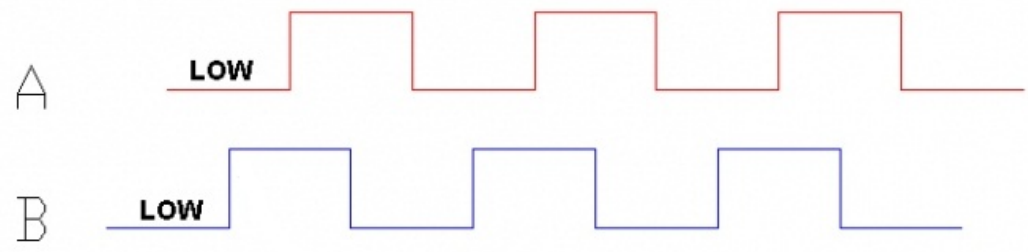


B	A
0	0
0	1
1	1
1	0

Counting up:

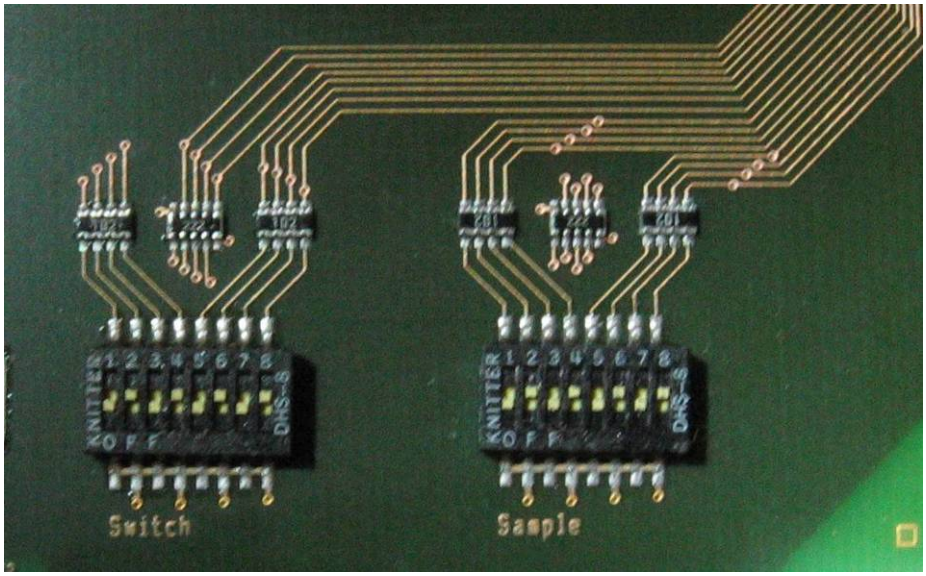


Counting down:



8.8 DIP switch configuration

Internally the ibaPACO-4 device contains 2 DIP switches (*Switch* and *Sample*) which affect the mode of operation.



8.8.1 "Switch" DIP switch

This switch is used to set up the mode for each of the 4 counter inputs.

Switch	Meaning
1 & 2	Mode Counter 0
3 & 4	Mode Counter 1
5 & 6	Mode Counter 2
7 & 8	Mode Counter 3

Depending on the state of the switches, two for each counter input, the counter mode can be set to a certain mode per counter input. In the table below all the possible combinations are shown.

Switch pair		Integration factor
OFF	OFF	Frequency counter
OFF	ON	SSI Slave
ON	OFF	Signed Frequency counter
ON	ON	Up/Down counter

Note

On the picture in chapter 8.8, all counters are set to SSI Slave mode.

8.8.2 “Sample” DIP switch

This switch is used to set up the parameters for each of the 4 counter inputs depending on the selected mode with the “Switch” DIP switch.
In the table below an overview is shown of the switch assignment.

Switch	Meaning
1 & 2	Parameterization counter 0
3 & 4	Parameterization counter 1
5 & 6	Parameterization counter 2
7 & 8	Parameterization counter 3

Depending on the state of the switches, two for each channel, the integration factor for the frequency counter, signed frequency counter or the counter parameterization for SSI slave can be set to a certain value. In the table below all possible combinations are shown.

Switch pair		Frequency counter	SSI slave	Signed freq. counter	Up/down counter
OFF	OFF	2 periods integration	Binary without parity	1 periods integration	Settings N/G pulses See 8.8.2.1
OFF	ON	4 periods integration	Gray without parity	2 periods integration	
ON	OFF	8 periods integration	Binary with parity	4 periods integration	
ON	ON	16 periods integration	Gray with parity	8 periods integration	

Note

On the picture in chapter 8.8, all counters are set to SSI Slave mode and as parameter “Gray without parity”

Note

By default the integration factor of each channel in frequency counter mode is set to 16 periods.

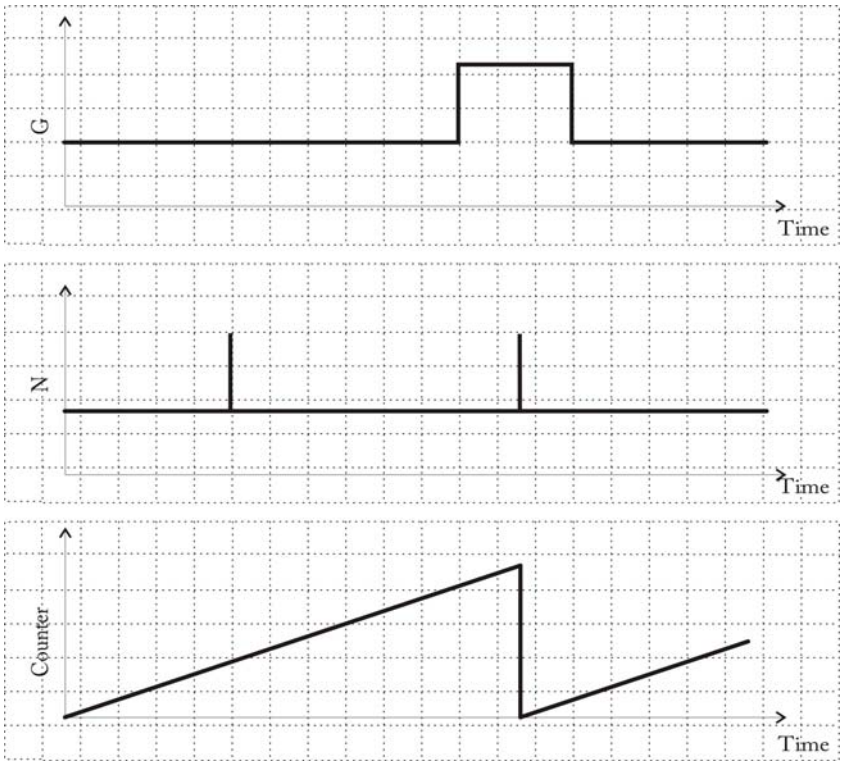
⚠ CAUTION

You can manipulate these DIP switches, although it is not recommended.

Opening the device and modifying the DIP switches is at the customers own risk.

8.8.2.1 N/G pulse settings

When using the ibaPACO-4 device in the up/down counter mode, the counters 0 and 1 and/or 2 and 3 can be combined to use the N and G signals. The N input is typically used to reset the counter with the N signal coming from the incremental encoder. The Gate (G) is used to enable the reset via the N signal. When these signals are used, the next counter input is not available for other functions.



The up/down counter is configured depending on the state of the “sample switch” switch.

In the table below an overview is shown of the possible settings applied by the “sample switch”.

Sample Switch Setting		Meaning	
Counter 0	**Counter 2**		
1	5	Level of N	OFF: When N=1, resets the counter as long as N=1 (level) ON: When N=1, the reset occurs on the rising edge of N
2	6	Active N/G	OFF: The N/G pulses are not used ON: The N/G pulses are used on the next counter input
3	7	Polarity N	OFF: positive ON: negative
4	8	Polarity G	OFF: positive ON: negative

⚠ CAUTION

The G pulse needs to be logical one (True) when a reset of the counter is required by the use of the N pulse.

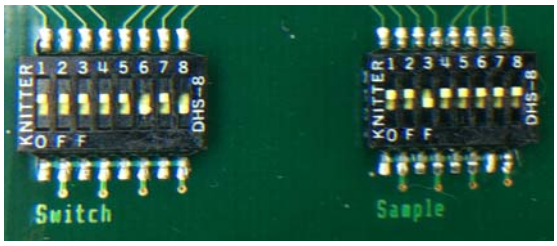
Note

When G is not used, the polarity of G should be set to negative (ON) and leave the input unconnected.

The first up/down counter with N and or G pulses should be wired on the ibaPACO-4 as followed:

- Counter input 0 is used to connect the A (0A) and B (0B) signals
- Counter input 1 is used for the N (1A) and G (1B) signals.

Example:



In the above picture, the following settings are applied:

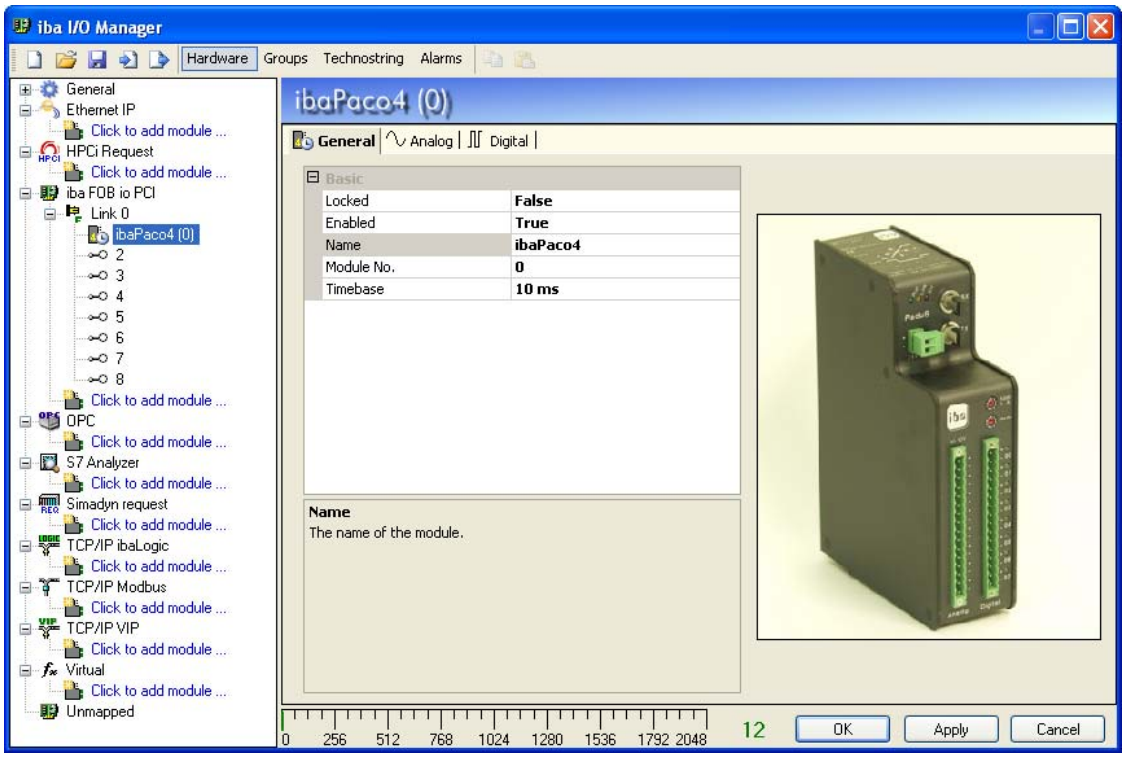
- ❑ Counter input 0 and counter input 1 are used as up/down counter with the N and G signals enabled with the following settings:
  - Level of N: Rising edge
  - Active: Yes
  - Polarity N: Positive
  - Polarity G: Negative
- ❑ Counter input 2 and counter input 3 are both used as signed frequency counters
  - Both are placed on 8 periods integrations

9 Configuration/engineering

9.1 Settings in ibaPDA-V6

9.1.1 I/O Manager, Hardware

The devices are connected via an ibaFOB card or ibaCom-PCMCIA-F card to the PC. In the I/O-manager dialog, section *Hardware*, you should add an ibaPACO-4 module to the corresponding FOB-PCI data interface.

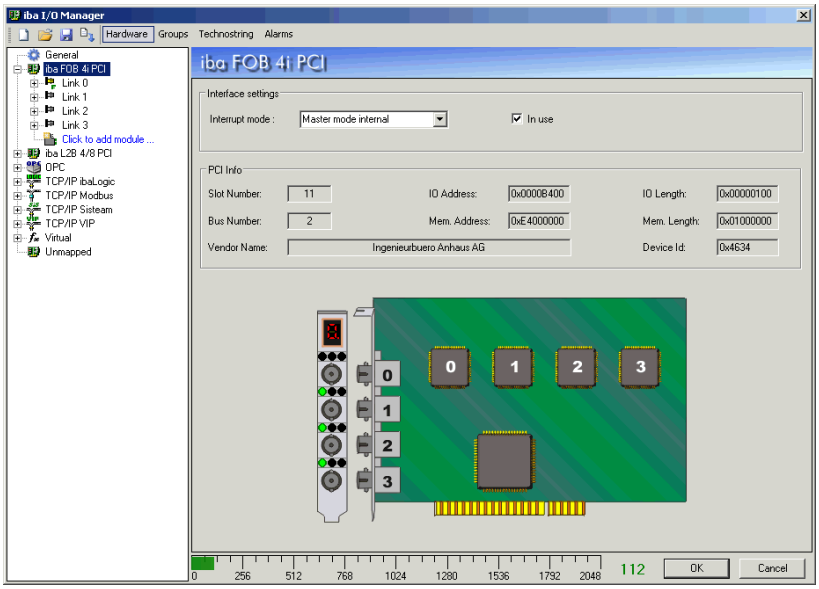


9.1.2 ibaPDA diagnostics, check of settings

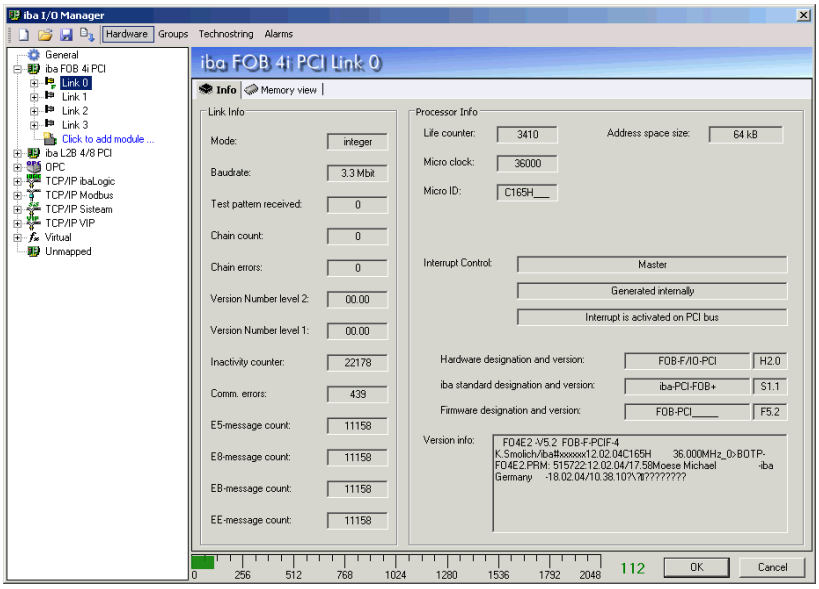
The correct function of the ibaFOB and/or ibaPACO-4 may be checked already in the I/O-manager. The interface card is automatically detected by the ibaPDA system. By means of the automatic detection function (*Autodetect*) the system detects the peripheral devices connected to the system at this time.

If the branch with the interface card is marked in the tree on the left side, you can see on the right side the view of the board showing the (four) processors which are assigned to the individual FO links. When using an ibaFOB-io card only one processor will be displayed. The graphic presentation is dynamically, i. e. the 7-segment display and the LEDs reflect the same status which can also be seen on the board itself.

Furthermore, the most important board addressing parameters and the vendor name are displayed too.



On the next tree level the view provides an overview about the communication parameters of all FO-links. A permanent change in Baudrate indicates that no telegram is received. This is either due to a missing or faulty fiber optic cable connection or to the fact that the voltage supply is not available for the device connected to the board.



You get further information about the connected devices when you click on the device module in the tree. In the right part of the dialog you will then get general information (see above) but also the signal tables for analog and digital signals beneath the corresponding tab. Moreover, the actual values are displayed in the tables.

Each channel of the ibaPACO-4 device can be set onto a different measuring mode: Frequency counter, SSI Slave, signed frequency counter or up/down counter mode.
The mode for each channel has to be set to the correct mode corresponding to the ibaPACO-4 device switch settings; otherwise the signals that are measured aren't correct.

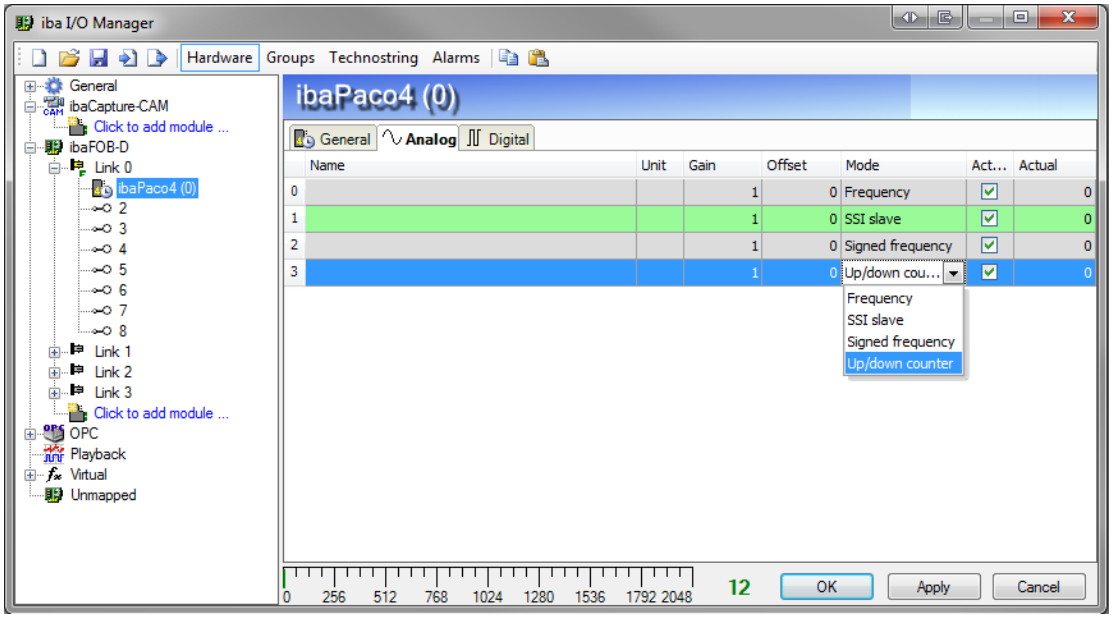
If set to **frequency counter mode** or **signed frequency mode**:
If the actual value is 0, no signal is applied to this counter input or the frequency of the input signal is too low (counter overflow in the ibaPACO-4 device). If the actual value is NaN (Represents a value that is not a number), the actual counter value coming from the ibaPACO-4 device, is 0. This indicates an error condition: please check the address switch S1 and verify also that the mode switch S2 is set to position 1.

If set to **SSI slave mode**:

The actual value shown is directly the 28bit values coming from the SSI Encoder.
If the encoder has less than 28 bits the value is left-padded with zeros.

If set to **up/down counter**:

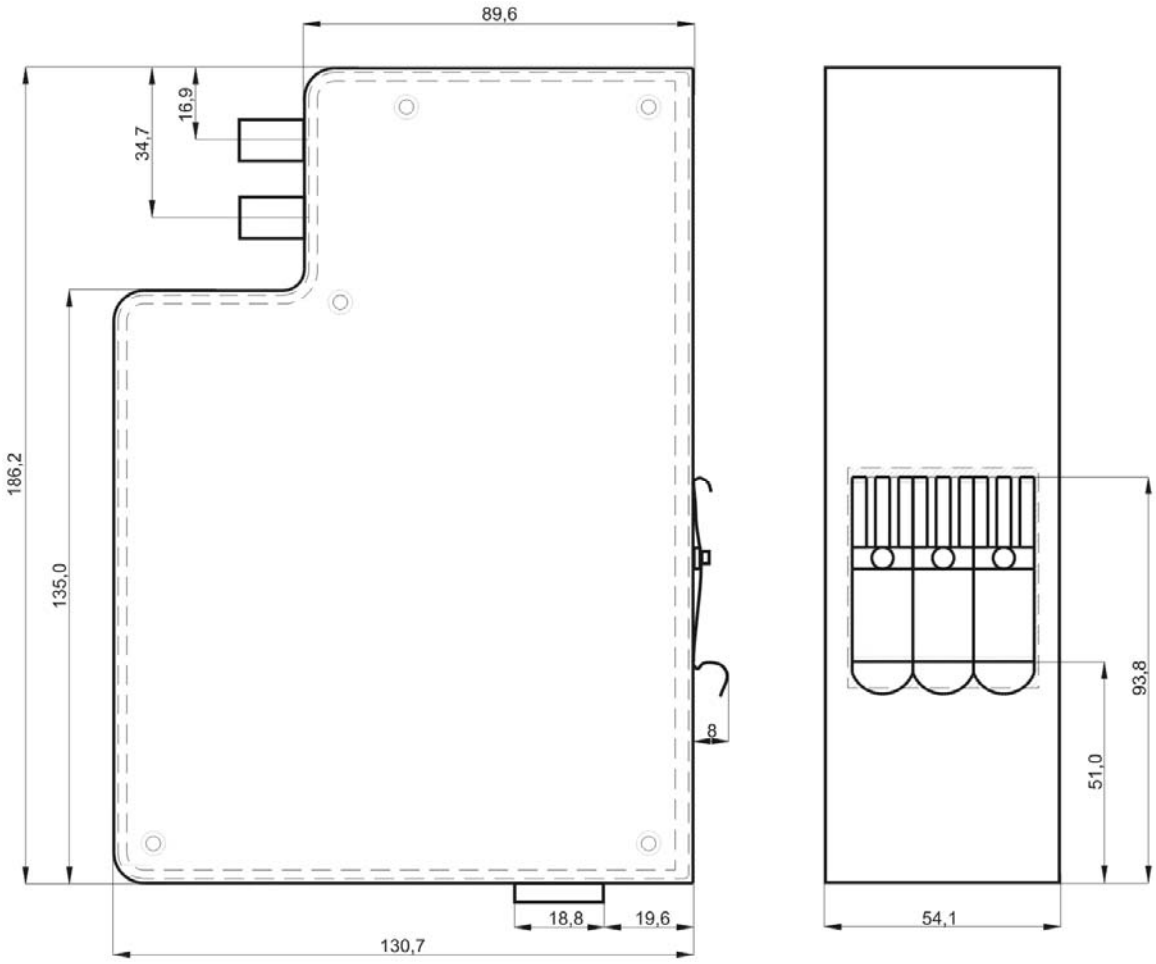
The actual value shown is the counter value which is transmitted from the ibaPACO-4 to ibaPDA. This value will only be reset by a power up of the ibaPACO-4 device.



10 Technical data

Order no.	10.120900
Mechanical stability and test parameters (all 3 axes):	DIN IEC 68-2-6; 1 g rms 90 Min @ 0..250Hz / axis2 g rms 90 Min @ 0..250Hz / axis
EMI test parameters:	EN 55011 (Class A); EN61000-4-6 (Class 3); EN61000-4-3/ENV 50204 (Class 3)
Operating temperature:	0 °C to 50 °C (32 °F…122 °F)
Storage temperature:	-25 °C to 70 °C (-13 °F…158 °F)
Transport temperature:	-25 °C to 70 °C (-13 °F…158 °F)
Cooling:	Self cooling
Humidity Class:	F, no condensation
Protection Class:	IP20
FO-cable Coupling	62,5/125 µm ST Lean
Maximum length of fiber optic cable between devices without repeater	2000 m (6560 ft)
Mounting	DIN rail snap in mount
Power supply	24 DC +/-20 % non-stabilized.
Power/Current consumption (no load)	typ. 300 mA, max. 400 mA $I_{OFF->ON}$ approx. 1A
Dim. (W x H x D) [mm] [inch]	54 x 194 x 155 2.1 x 7.6 x 6.1
Weight (incl. box and manual) [g]	1050
Counter inputs	
Number	4
Resolution	28 Bit
Frequency response	(see 8.4.1.1)
Input level / type	$U_{nominal}$ +24 V U_{min} -10V U_{max} +30V (other voltages on demand)
Input impedance	R = 2.4 kΩ / 10 mA at 24 V input standard. (Depending on the applied input circuit)
Sampling rate	1 kHz (1000 samples/s)
Galvanic isolation	Channel/Channel/Digital Ground 1.5 kV
Binary inputs	
Number	8
Input level	U_N +/-24 V; U_{max}+/-60 V; I_{max} 1 mA Switching level: log 0; < +/-9 V; log 1; > +/-10 V;
Sampling	Simultaneously sampled with counter inputs
Galvanic isolation	Channel/Channel/Digital Ground 1.5 kV

Dimensional drawing ibaPACO-4



Dimensions given in mm

11 Support and contact

Support

Phone: +49 911 97282-14

Fax: +49 911 97282-33

E-Mail: support@iba-ag.com

Note

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

Contact

Headquarters

iba AG
Koenigswarterstr. 44
90762 Fuerth
Germany
Phone: +49 911 97282-0
Fax: +49 911 97282-33
Email: iba@iba-ag.com
Contact: Mr. Harald Opel

Regional and Worldwide

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

www.iba-ag.com.