ibaMS4xUC0

I/O module with 4 counter inputs and digital inputs and outputs

Manual

Issue 2.0

Measurement Systems for Industry and Energy

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

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

Certification

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

Further international customary standards and directives have been observed.

CE

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

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

Table of contents

1 About this manual

In this manual, you learn a lot about the design of the ibaMS4xUCO device and how to use and operate it. You can find a general description of the iba-modular system and further information about the design of the central units and how to use and operate them in separate manuals.

Note

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

The documentation of the iba-modular system comprises the following manuals:

- **Central units**
  The manuals of the central units, e.g. ibaPADU-S-IT-2x16 and ibaPADU-S-CM, contain the following information:
  - Scope of delivery
  - System requirements
  - Description of the device
  - Mounting/Demounting
  - Start-up
  - Configuration
  - Technical data
  - Accessories
- **Modules**
  The manuals for the single modules contain specific information about the module. There are the following information classes:
  - Short description
  - Scope of delivery
  - Product characteristics
  - Configuration
  - Description of the functions
  - Technical data
  - Connection diagram

1.1 Target group

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

1.2 Notations

In this manual, the following notations are used:

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

1.3 Used symbols

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

⚠ DANGER

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

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

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

⚠ WARNING

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

⚠ CAUTION

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

Note

A note specifies special requirements or actions to be observed.

Tip

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

Other documentation

Reference to additional documentation or further reading.

2 Introduction

The ibaMS4xUCO module is member of the iba-modular system. The modular concept of the iba-modular system is designed on the basis of a backplane. You can plug on this backplane not only the CPU, but also up to 4 input/output modules. The power supply of the I/O modules is provided by the backplane bus.

In brief

- ❑ I/O module for the iba-modular system
- ❑ Counter module with 4 inputs
  - Galvanically isolated, single ended
  - 50 MHz (20 ns); 32 bit resolution
  - Max. input signal level:
    TTL 5 V (Transistor Transistor Logic)
    HTL 24 V (High Threshold Logic)
  - Sampling rate up to 40 kHz, freely adjustable
- ❑ 8 digital inputs
  - Input signal 24 V DC
- ❑ 4 digital outputs
  - Quad root, P switch
  - Switching frequency up to 40 kHz, freely adjustable
  - Short-circuit limitation
- ❑ Rugged design, easy mounting
- ❑ Certification according to CE

Fields of application

- ❑ Period measurements
- ❑ Frequency measurements
- ❑ Test benches
- ❑ SSI Slave
- ❑ Sony roll gap encoder

3 Scope of delivery

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

The scope of delivery comprises:

- ❑ ibaMS4xUCO device
- ❑ 1 x 37-pole Sub-D connector
- ❑ 1 x 16-pin multi-pin connector
- ❑ 1 x 6-pin multi-pin connector
- ❑ Data medium „iba Software & Manuals“ (only with individual delivery)

4 Safety instructions

4.1 Intended use

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

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

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

4.2 Special safety instructions

⚠ DANGER

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

Never use damaged measuring cables!

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

⚠ WARNING

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

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

⚠ WARNING

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

Important Note

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

Note

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

5 System requirements

5.1 Hardware

- ❑ Central unit: ibaPADU-S-IT-2x16 or ibaPADU-S-CM (version 02.12.004 or later)
- ❑ Back plane unit, e. g. ibaPADU-B4S

5.2 Software

- ❑ ibaPDA version 6.38.0 or later
- ❑ ibaLogic-V5 version 5.0.5 or later

Note

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

6 Mounting, Connecting, Dismounting

⚠ CAUTION

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

Note

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

6.1 Mounting

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

Important note

Always screw tight the device and the modules. Otherwise, plugging or unplugging the connectors for the inputs/outputs can cause damage.

6.2 Connecting

Note

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

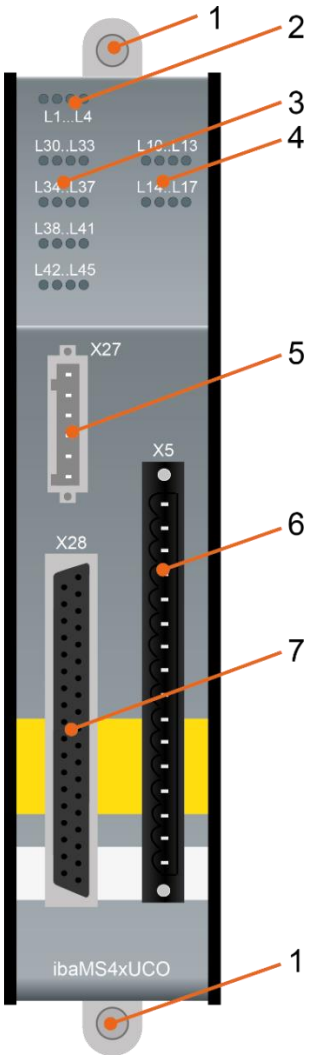
1. Connect all cables.
2. If all required cables are connected, connect the central unit to the power supply.
3. Switch on the central unit.

6.3 Dismounting

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

7 Device description

7.1 Views



1 Fixing screws

2 Operating status indicators L1…L4

3 Indicators of counter inputs and digital outputs L30… L45

4 Indicators of digital inputs L10…L17

5 Connector for digital outputs X27

6 Connector for digital inputs X5

7 Sub-D connector counter inputs X28

7.2 Indicating elements

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

7.2.1 Operating status L1 … L4

LED	Color	Status	Description
L1	Green	Off	Device is not working (switched off)
		Flashing / On	Device is working
L2	Yellow	On	Access to the backplane bus
L3	White	-	-
L4	Red	Off	Normal status, no faults
		Flashing	Device failure

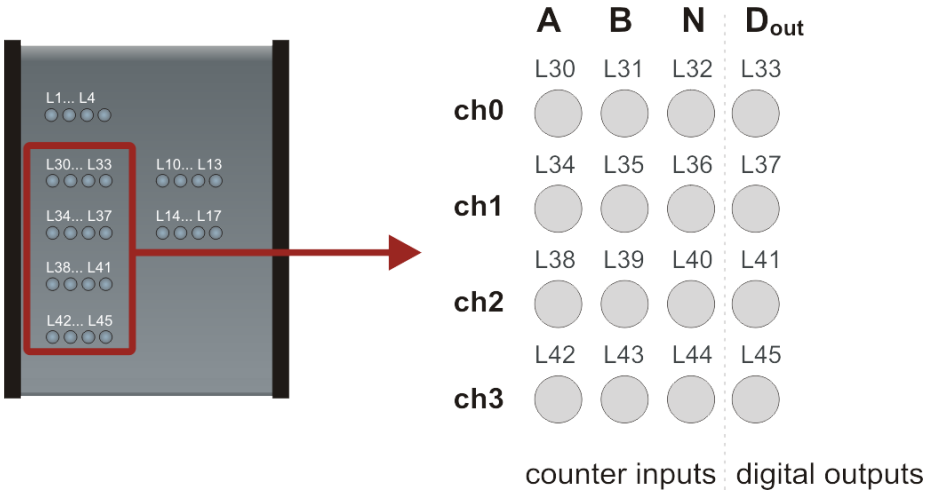
Important note

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

7.2.2 Counter inputs / digital outputs L30…L45

4 LEDs belong to each channel. A LED can be green, red, yellow or off.

The LEDs 1, 2 and 3 (from left to right) indicate the status of the A, B and N input, LED 4 indicates the status of the digital output.



Status	Counter inputs
Off	no signal, logical 0 / rotary encoder mode „0: deactivated“
Green	signal ok, logical 1
Yellow	signal not used
Red	channel failure

Status*	Digital outputs
Off	no signal, logical 0
Green	signal ok, logical 1
Yellow	Load voltage is missing (per channel root) or overcurrent (channel root switched off)

*If an output is deactivated with ibaPDA, the corresponding LED remains off.

7.2.3 Digital inputs L10…L17

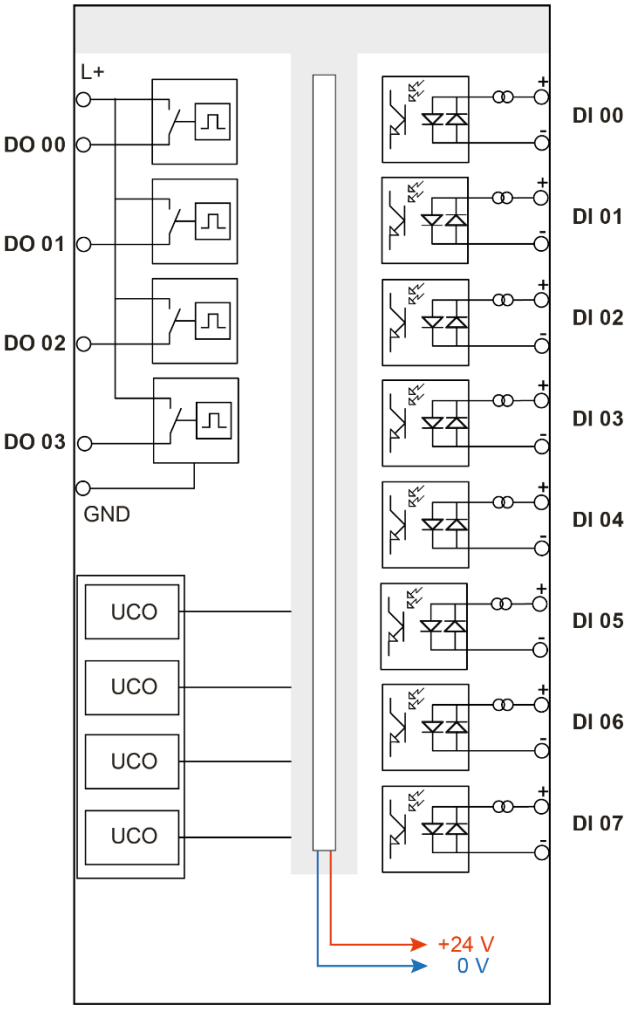
The green LEDs show if the digital input is active or not.

LED	Status	Description
L10 … L17	Off	No signal, logical 0
	On	Signal ok, logical 1

7.3 Connection diagram

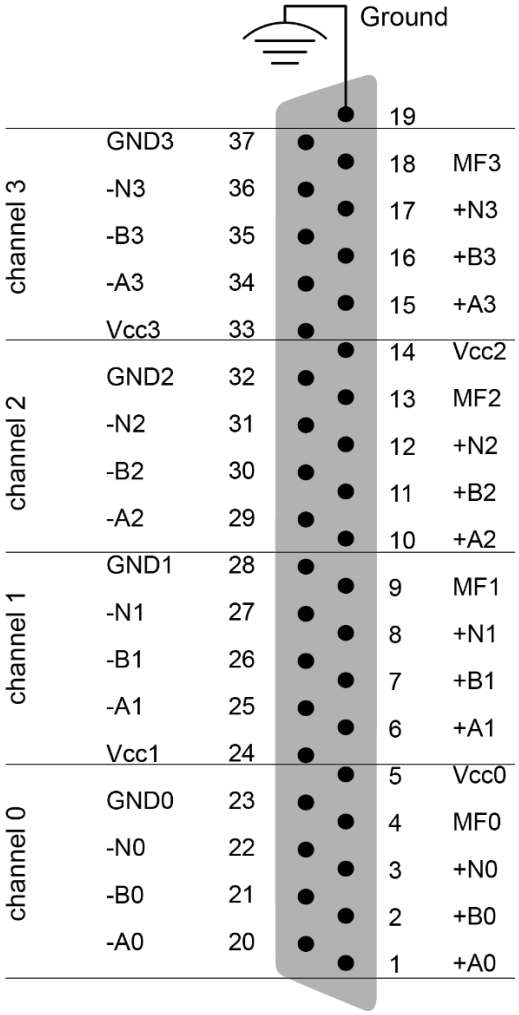
The module provides 3 channel groups:

- Digital outputs (top left)
- Counter inputs (on the bottom left)
- Digital inputs (right)



7.4 Counter inputs X28

7.4.1 Pin assignment



Pin assignment (socket front view)

7.4.2 Channel signals

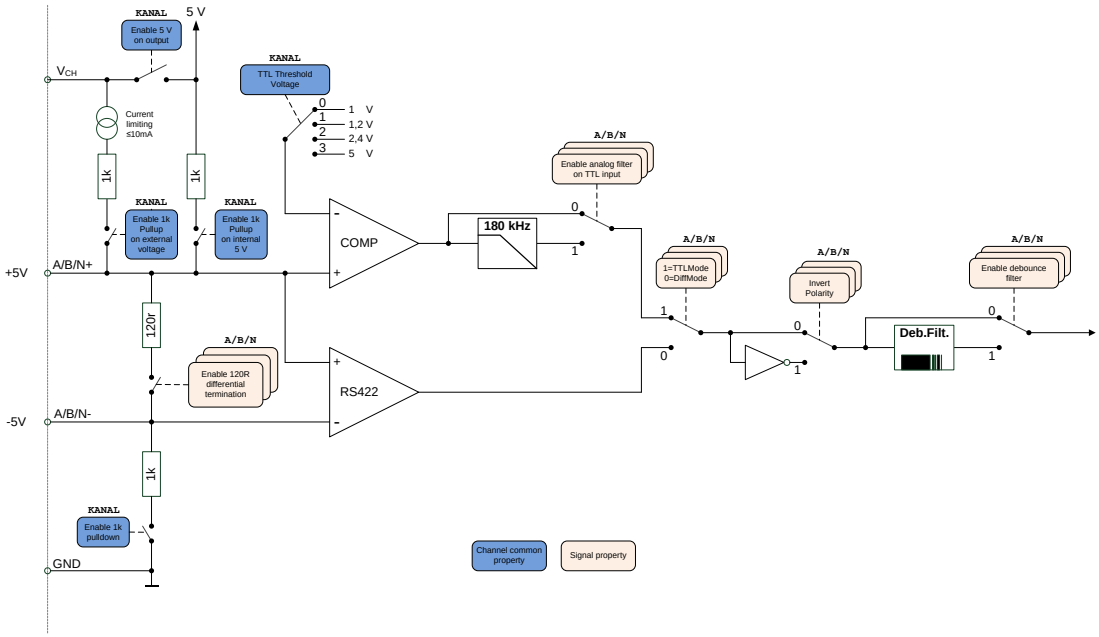
9 signals per channel are available. Their meaning varies depending on the used rotary encoder and the mode.

Signal	Description
A+	Main signal 1
A-	Differential signal to A+
B+	Main signal 2, can also be enable-signal for A
B-	Differential signal to B+
N+	Reset signal for counter
N-	Differential signal to N+
MF	Multifunctional input, can be used as alarm input (e.g.)
V_{CC}	Encoder/channel supply, can supply both (configured as output) the connected encoder and (configured as input) the channel
GND	Ground connection for encoder/channel supply

7.4.3 Wiring (Circuit diagram)

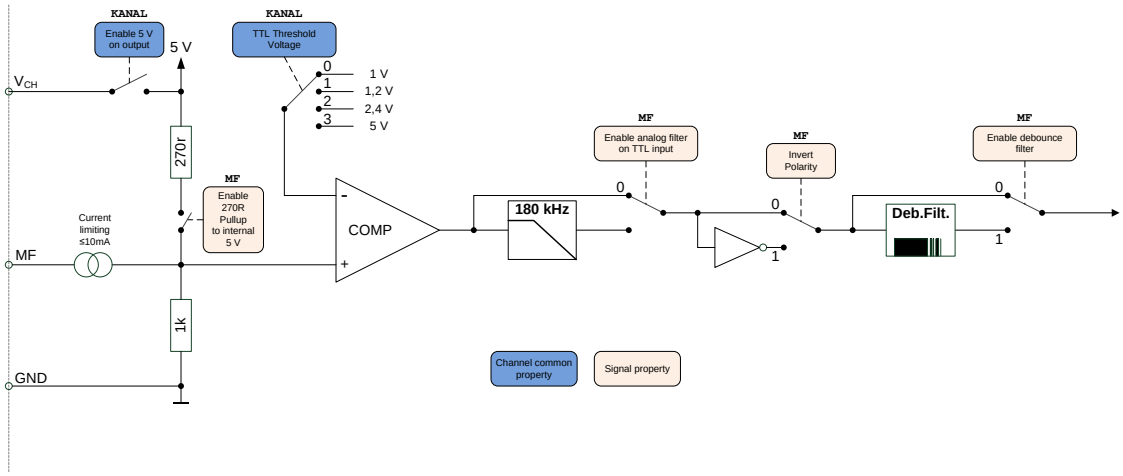
The following figures show the wiring of the signals A, B, N and MF. The blue colored switches show settings which apply across all channels, the yellow colored switches apply to a single signal A, B, N or MF. That means that parameters of the blue switches apply to the A/B/N signals and to the MF signal.

A / B / N



Schematic channel wiring A / B / N

MF



Schematic channel wiring MF

Setting	Applys to Signal	Description
Enable 5 V on output	channel (A, B, N, MF)	Enables 5V power supply on V_{CC}.
TTL Threshold Voltage	channel (A, B, N, MF)	Adjusts the threshold for the detection of logical „0“ and logical “1“ (only when TTL mode is active).
Enable 1k Pullup on external voltage	channel (A, B, N)	Enables the 1 kΩ pullup resistor on external voltage V_{CC}.
Enable 1k pulldown	channel (A, B, N)	Enables the 1 kΩ pulldown resistor.
Enable 1k Pullup on internal 5 V	channel (A, B, N)	Enables the 1 kΩ pullup resistor on internal 5 V.
Enable 120R differential termination	A / B / N	Enables the 120 Ω termination resistor between the positive and negative signal. Can also be used as pulldown resistor together with 1 kΩ pulldown for TTL mode.
Enable analog filter on TTL input	A / B / N / MF	Enables the 180 kHz RC low-pass filter. (only when TTL mode is active).
1=TTLMode 0=DiffMode	A / B / N	Switch between differential and single-ended signal.
Invert Polarity	A / B / N / MF	Inverts signal polarity.
Enable debounce filter	A / B / N / MF	Enables one of the debounce filters, see chapter 7.6.2.
Enable 270R Pullup to internal 5 V	MF	Enables the 250 Ω pullup resistor to internal 5 V.

Important note

The figures of the channel wiring only show the physical layout of a channel and what is technically possible. Depending on the rotary encoder type, fixed values are assigned to the switch settings.

7.4.4 Theory

This chapter describes the internal calculation methods and the corresponding parameters.

The following table gives an overview of the possible settings and the range of functions. Individual items are described in the following chapters.

	Analysis regulation	1: Pulse counter		2: Period / frequency		3: Pulse width / duty cycle	4: Up/down counter
	Mode	D[1]	Q	D	Q	Direct	Quadrature
Signal edge	pos. A	○[2]	●	○	●	High level	●
	neg. A	○	●	○	●		●
	pos. B	High level	●	High level	●		●
	neg. B		●		●		●
Function	„Divide by 4“						○
	„Reset on N“	○	○				○
	„B as qualifier“	○		○			

7.4.4.1 „Direct mode“ / „Quadrature mode“

There are basically two counting modes:

- ❑ „Direct mode“
- ❑ „Quadrature mode“

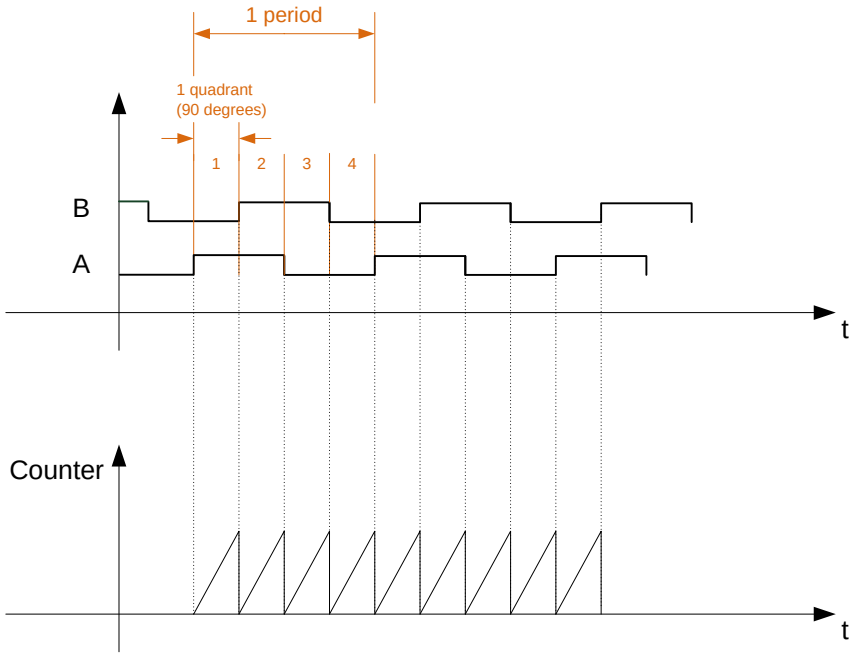
„Direct mode“

In “direct mode”, only the edges of the A signal are counted. The following options are possible: the rising edge, the falling edge or both edges may be counted. The B signal may be used as enable signal, see chapter 7.4.4.2.

„Quadrature mode“

In “quadrature mode”, all 4 edges or quadrants of the A and B signal are counted. The following scheme shows the internal period calculation.

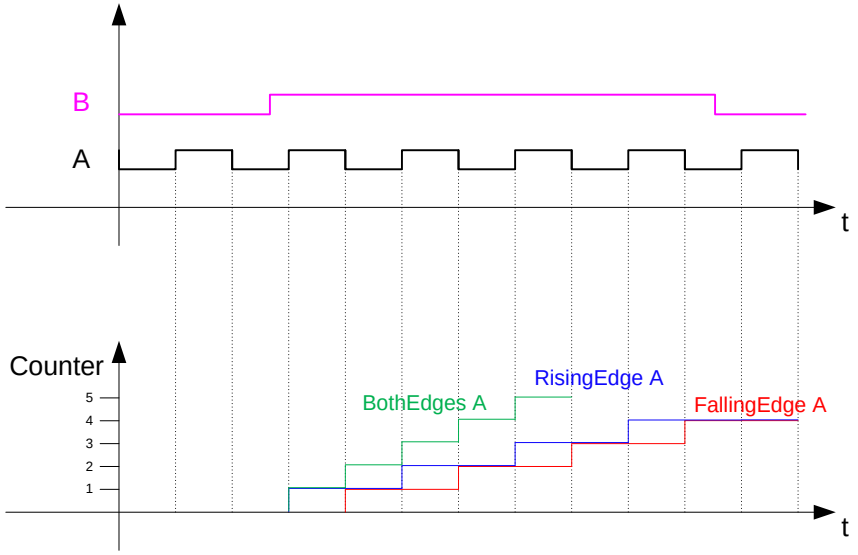
[1] D= „direct mode“; Q=“quadrature mode“
[2] „○“ = optional; „●“ = preset; „▬“ = not active



„Quadrature mode“

7.4.4.2 „B as qualifier“

The high level of the B signal may be used as enable signal in „direct mode“.



„B as qualifier“

Only when B = logical ‚1’, the relevant edges will be counted.

7.4.4.3 Pulse counter

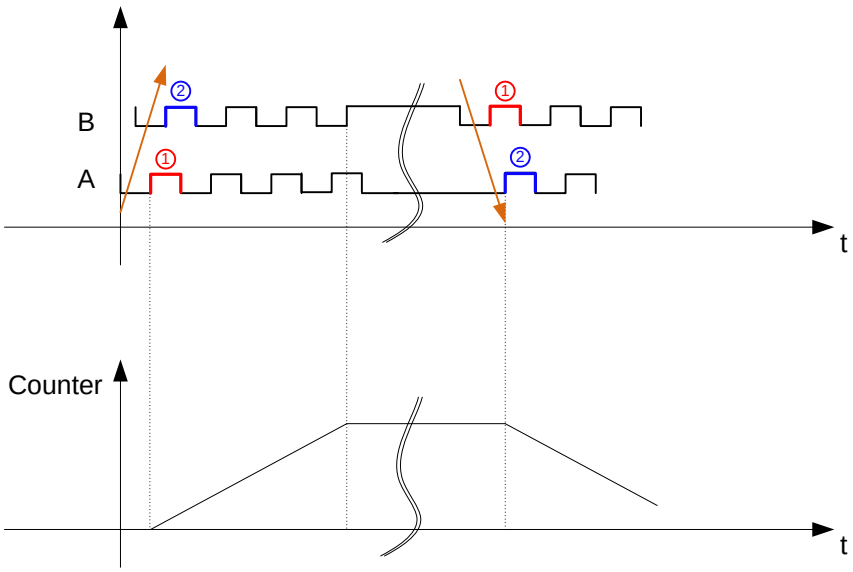
The way of counting the edges depends on the counting mode (“direct mode” / “quadrature mode”). It is possible to select the edges to be counted or to use an enable signal (see “B as qualifier”).

Moreover, the N signal may be used as reset signal (see “Reset on N”).

7.4.4.4 Up/down counter

The Up/down counter uses always the “quadrature mode”, where all 4 edges are counted, see figure “Quadrature mode”.

The phase offset between A and B signal determines the counting direction. If the high-level of the A signal is before the B signal (typically 90° phase offset), then the channel counts up (UpCounter). If the high-level of the B signal is before the A signal, then the channel counts down (DownCounter).



Theory: UpDownCounter

„Divide by 4“

Due to the “quadrature mode”, the counter is incremented by 4 (all 4 edges are counted).

For this case, the “divide by 4” function can be activated in order to divide the counter reading by 4.

7.4.4.5 Period / frequency calculation

The period and frequency calculation is based on an internal 50 MHz quartz. Its clock cycles are counted when the first activated edge occurs until the next activated edge follows. The counter will be reset and restarts counting.

The period time results from the counted 50 MHz clock cycles k multiplied by the quartz cycle time of 20 ns.

$$T = k \cdot 20ns$$

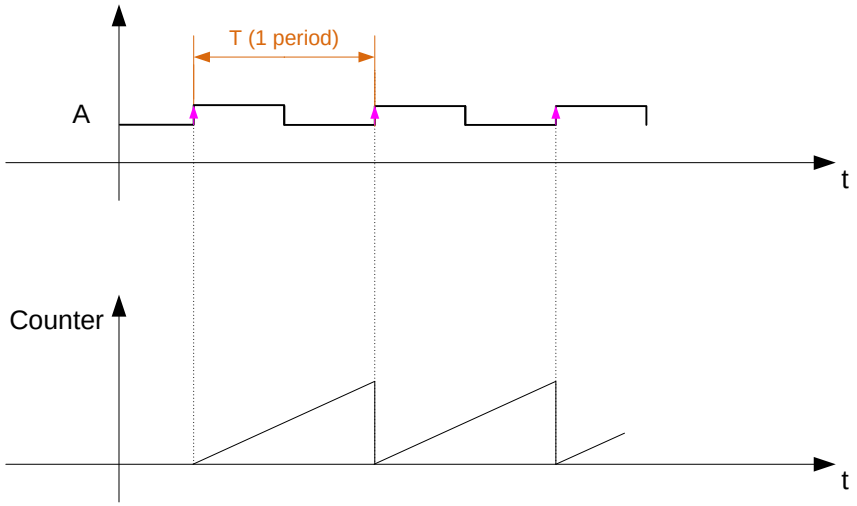
The reciprocal of the cycle time is the frequency f.

$$f = \frac{1}{T}$$

Note

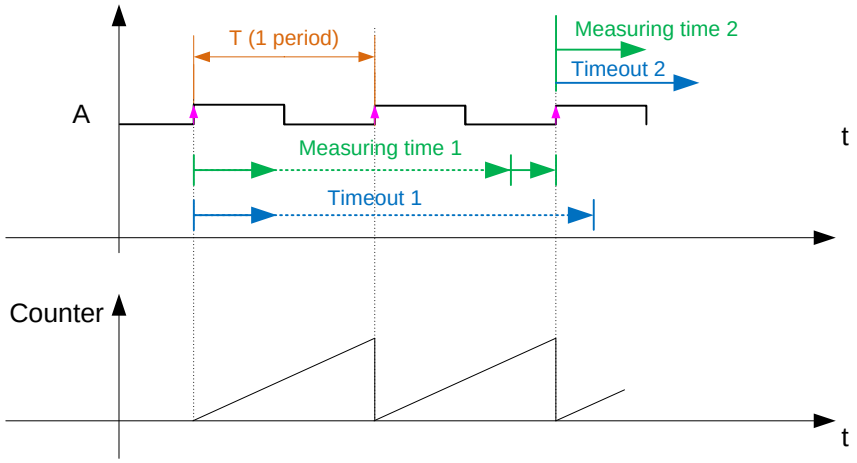
When using the „quadrature mode“, the measured frequency increases by a factor of 4, the period decreases by a factor of 4.

The following scheme shows the period/frequency calculation, when only the positive edge of the A signal is counted.



Theory: period / frequency

Beginning with firmware version 02.12.004, additional measuring parameters can be configured: minimum measuring time, required periods and timeout.



Period / frequency with minimum measuring time and timeout

The minimum measuring time specifies the time period after which the measured frequency value is updated. The frequency measurement starts at the first rising edge and ends when a rising edge happens after the minimum measuring time has elapsed. Since several periods may be passed during the measuring time, the frequency is averaged over the measured periods. In addition, a number of periods can be defined over which the average is calculated. If the number of required periods has not been reached during minimum measuring time, then the measuring time is extended until the required number of periods is reached. This means, both conditions (minimum measuring time and required periods) have to be met, then the frequency value is updated.

When a timeout is configured, measuring can be interrupted if, for example, a rising edge cannot be detected during measuring time. The timeout starts with the minimum measuring time, but must be longer than the minimum measuring time. When the measuring

time exceeds the timeout then the frequency will be set to „0“. Measuring starts again with the next rising edge. The timeout is not active, when it is set to „0“.

With the default settings, measuring is carried out as depicted in the figure above. Default values are:

- Minimum measuring time = 0 µs
- Required periods = 1
- Timeout = 0 µs.

In “quadrature mode”, the period is measured between the activated edges. When using the “quadrature mode”, the measured results need to be converted as follows:

$f = f_{meas} : 4$

$T = T_{meas} * 4$

The measured frequency may be converted into the unit „revolution per minute“ by using a virtual module, see chapter 11.4.1.

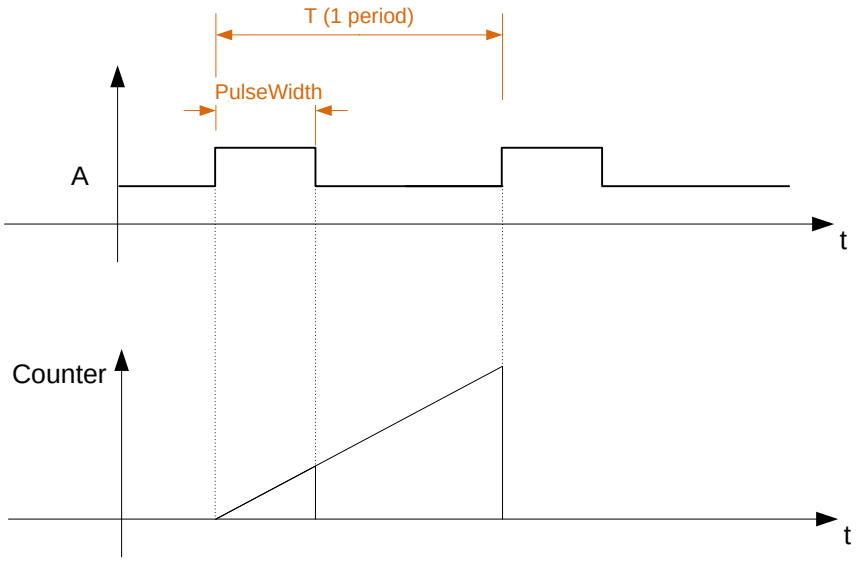
7.4.4.6 Pulse width / duty cycle

When measuring the pulse width, the 50 MHz clock cycles of the internal quartz oscillator are counted as for the period time. The pulse width τ results from the counted 50 MHz clock cycles multiplied by the quartz cycle time of 20 ns.

The ratio between the pulse width and period time is referred to as duty cycle D.

$$D = \frac{\tau}{T}$$

The following scheme illustrates the used terms.

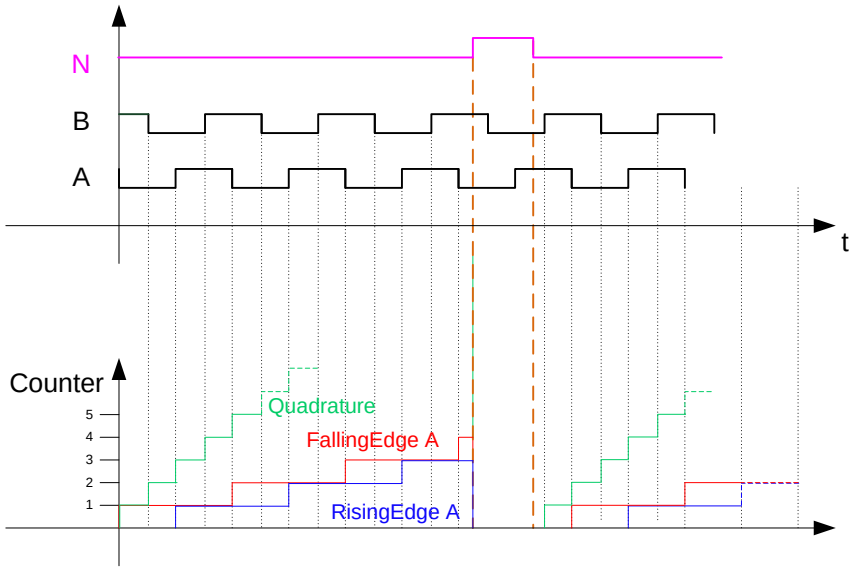


Theory: pulse width / duty cycle

When a timeout is configured, measuring can be interrupted if a measuring pulse cannot be detected. When the measuring time exceeds the timeout then the period will be set to the maximum and pulse and duty cycle will be set to „0“. The timeout is not active, when it is set to „0“.

7.4.4.7 „Reset on N“

When “Reset on N” is activated, then the (up/down) counter is set to zero, as long as the N signal is on a high level, see the following scheme.



Theory: counter, up/down counter, Reset on N

7.4.5 Modes / Analysis regulations (in general)

One mode / one analysis regulation can be selected per channel. Depending on the mode, the digital input signals (A, B, N) are interpreted and processed in different ways. Hence, different analog input values are available for the system.

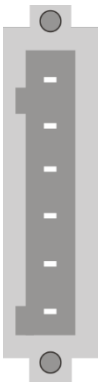
Depending on the mode, one or three different values are available, see the following table:

Mode	Calculated input values		Description
	Signal name	Type	
0: Deactivated	-	-	Channel is deactivated
1: Pulse Counter	EdgeCounter	DINT	Counts pulses in two different ways: - „Direct mode“ B signal serves as A-signal-enable, i.e. only when B = log’1’ then the edge of A is detected. One or both edges of A can be counted. -„Quadrature mode“ All 4 edges can be counted (pos.A, neg.A, pos.B, neg.B). In both counting modes the counter can be reset with N = 1. („Reset on N“).

2: Period / frequency	PeriodTime ABDirection Frequency	DINT DINT REAL	Period and frequency are measured in two ways: - „Direct mode“ B signal serves as A-signal-enable, i.e. only when B = log'1' then the edge of A is detected. One or both edges of A can be counted. - „Quadrature mode“ Alle 4 edges (pos.A, neg.A, pos.B, neg.B) can be counted. The measured frequency increases by a factor of 2 or 4 with two or four active edges. The period decreases by a factor of 2 or 4. The period is measured between the activated edges. PeriodTime is the period duration in ns. ABDirection (only in „quadrature mode“) ABDirection = 0 ➔ A-pulse before B-pulse ABDirection = 1 ➔ B-pulse before A-pulse Frequency is given in Hz.
3: Pulse width / duty cycle	 PeriodTime PulseWidth DutyCycle	 DINT DINT REAL	Refers solely to signal A. PeriodTime is the period duration in ns. PulseWidth is the positive pulse width of A. DutyCycle is the duty factor between high- and low-level (DutyCycle[0..1])
4: Up/down counter	UpDown-Counter	DINT	Counts the edges according to the „**quadrature mode**“. Counts all 4 edges of A and B (pos.A, neg.A, pos.B, neg.B). When A-pulse is before B-pulse the analysis counts up, when B-pulse is before A-pulse it counts down. The counter can be reset with N = 1 („Reset on N“) The value can internally be automatically divided by factor 4 („Divide by 4“).
5: SSI Slave receiver	Data	DINT	An already connected SSI encoder (Synchronous Serial Interface) can be acquired when connected in parallel. The absolute position can be acquired with the DATA input.
6: SSI Master receiver	Data	DINT	An SSI encoder can be directly connected (P2P). The clock frequency (CLOCK) is provided by the module. The absolute position can be acquired with the DATA input.

7.5 Digital outputs X27

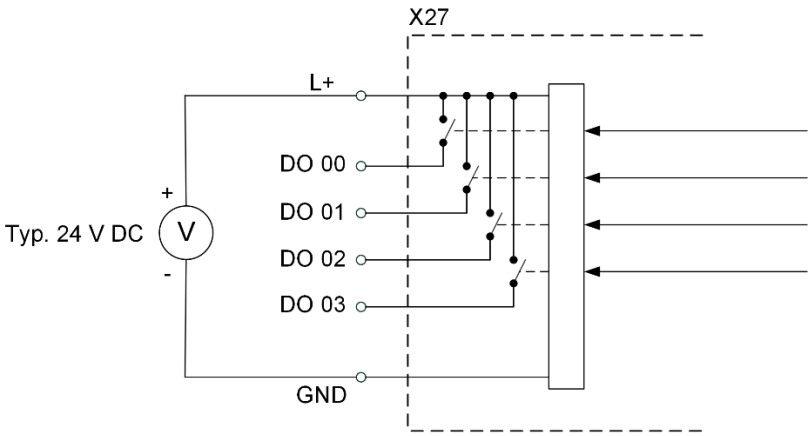
7.5.1 Pin assignment



Pin	Connection	LED
1	Load voltage L+	
2	Digital output 00	L33
3	Digital output 01	L37
4	Digital output 02	L41
5	Digital output 03	L45
6	Load voltage GND	

7.5.2 Circuit diagram

The digital outputs are high switches or P switches between the applied load voltage L+ and the 4 digital outputs [0..3] with common root.



7.5.3 Protective function

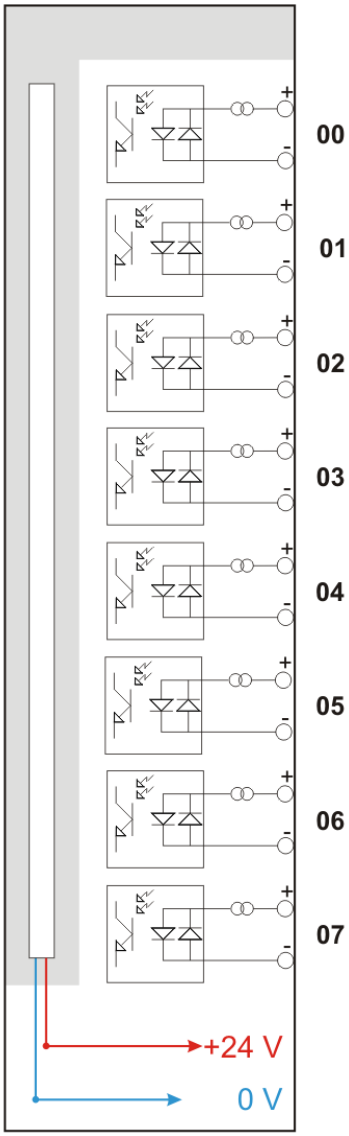
The output channels provide a self-protection function in order to avoid damages to the device under fault conditions in the load circuit as far as possible. Each load current of all 4 channels per channel root is monitored. The protected range begins when the value is higher than approx. 0.6 A per channel. It may happen, that the channel is already switched-off at this value, i. e. all output signals of this root are set to logical 0.

In this case, status signals report the error status to the iba applications. The errors can be reset by the application, but only when the error does not physically exist any longer.

7.6 Digital inputs X5

You can connect 8 input signals (0…7), each bipolar and electrically isolated. Each channel is connected by means of a two-wire connection. Due to the reverse polarity protection, the measuring signal is indicated logically correct, even if the connection is polarity-reversed.

7.6.1 Pin assignment



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

7.6.2 Debounce filters

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

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

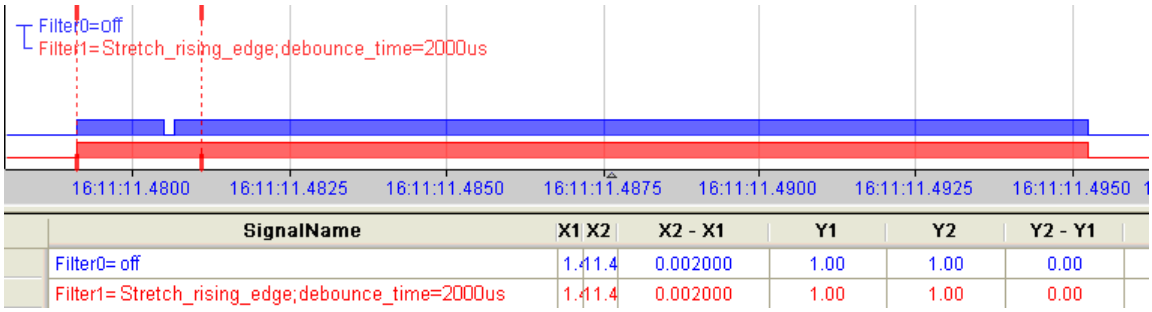
For each filter, a debounce time has to be defined in µs. This debounce time can have a value between [1µs…65535µs].

Off

The measured input signal is transferred without filtering.

„Stretch rising edge“

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



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

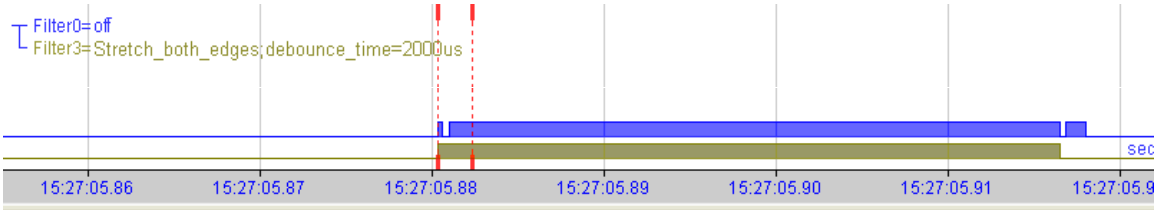
„Stretch falling edge“

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

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

„Stretch both edges“

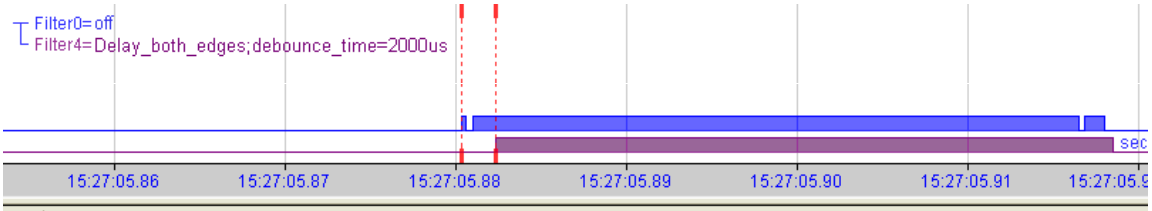
With the first edge, the output signal (ocher) follows the initial signal (blue) and keeps the logical level for the duration of the defined debounce time. Thereafter, the channel is transparent again and waits for the next edge – be it rising or falling.



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

„Delay both edges“

Beginning with the first edge, the output signal (purple) blocks the input and keeps the logical value of the edge for the duration of the defined debounce time. Thereafter, the channel is transparent again, directly assumes the logical level of the input signal and waits for the next edge – be it rising or falling.



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

8 Start-up / Update

Important note

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

8.1 Auto-Update

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

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

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

Important note

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

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

8.2 Overall Release Version

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

Important note

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

8.3 Update

An update can be installed in two different ways.

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

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

Important note

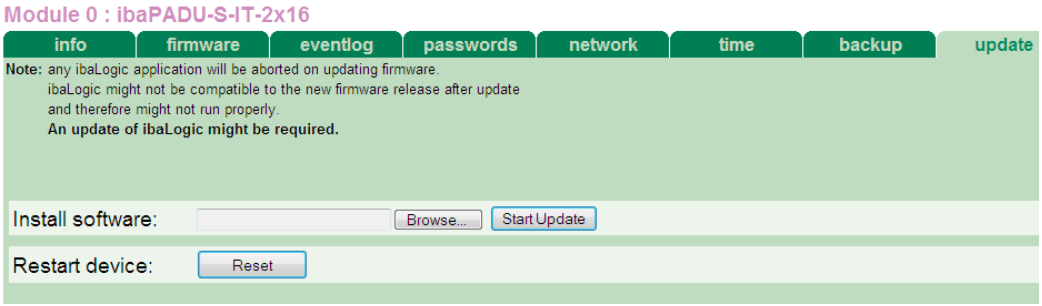
When updating the iba-modular system, a possible autostart of the ibaLogic PMAC is deactivated and the existing ibaLogic-V5 application deleted. Furthermore, an update of the ibaLogic-V5 software (ibaLogic Clients) might be necessary.

8.3.1 Update via web interface

Important note

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

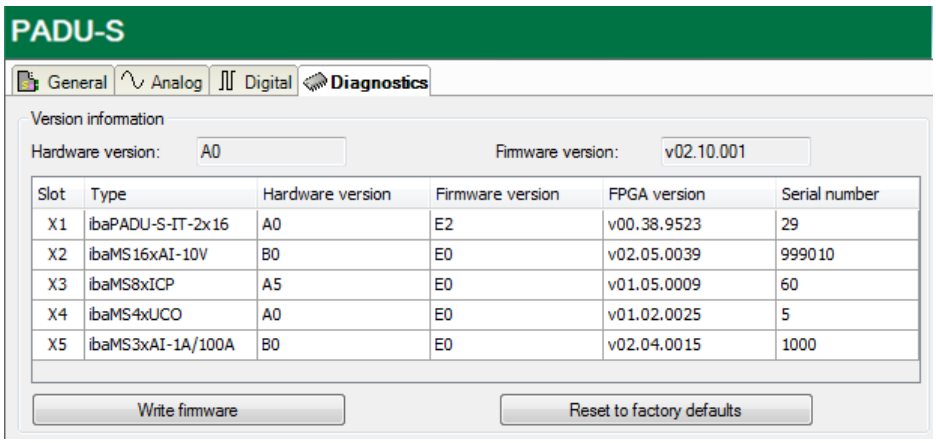
Start the website of the iba-modular system in your browser and select the central unit. On the “update“ tab, click on the <Browse…> button and choose the <padusit2x16_ v[xx.yy.zzz].iba> update file. By clicking on <Start Update>, you start the update.



8.3.2 Update via ibaPDA

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

You start the update by clicking on <OK>



8.4 Module Information / Diagnostics

8.4.1 Diagnostics in ibaPDA

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

8.4.2 Web interface

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

Important note

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

8.4.2.1 „info“ tab

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

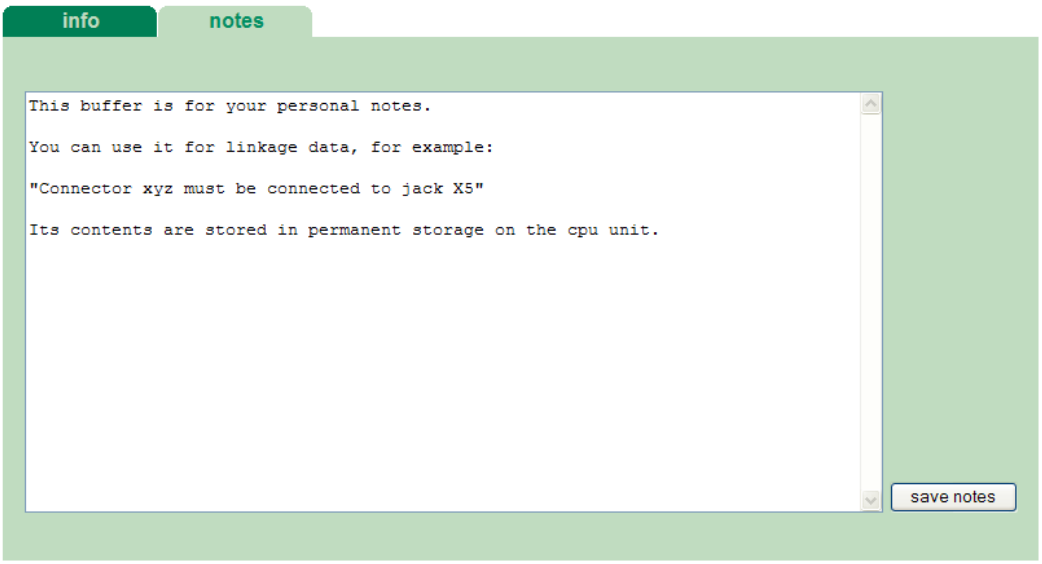
info | notes

Serial number	000005	
Hardware version	A2	
Firmware version	E5	
Process-IO		
counter channels	4	
design	isolated channels for incremental or absolute (SSI) encoders	
configuration	encoder parameter file (xml)	per channel
input signals	A+,A- / B+,B- / N+, N-	per channel
input signal level	5(TTL) / 24(HTL)	V
input circuit	differential / single ended	
resolution	32	bits
sampling rate (counter)	50	MHz
sampling rate (system)	max. 40	kHz
digital input channels	8	
design	isolated channels	
nominal input voltage	+/-24	V DC

8.4.2.2 „notes“ tab

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

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



9 iba Applications

The described modes and analysis regulations are displayed differently in ibaLogic-V5 and ibaPDA. ibaPDA scales the calculated analog value to the target value with the appropriate SI unit. The signal designations can be found in the related chapters.

9.1 Encoder parameter file

A so called encoder parameter file in xml format has to be available on the central unit so that the encoder and the available modes can be detected and configured.

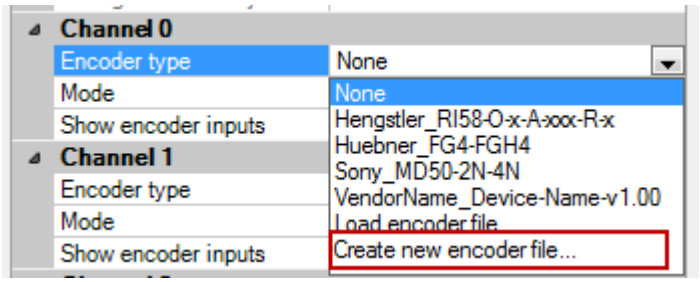
9.1.1 Creation of an encoder parameter file

There are two ways to create an encoder parameter file:

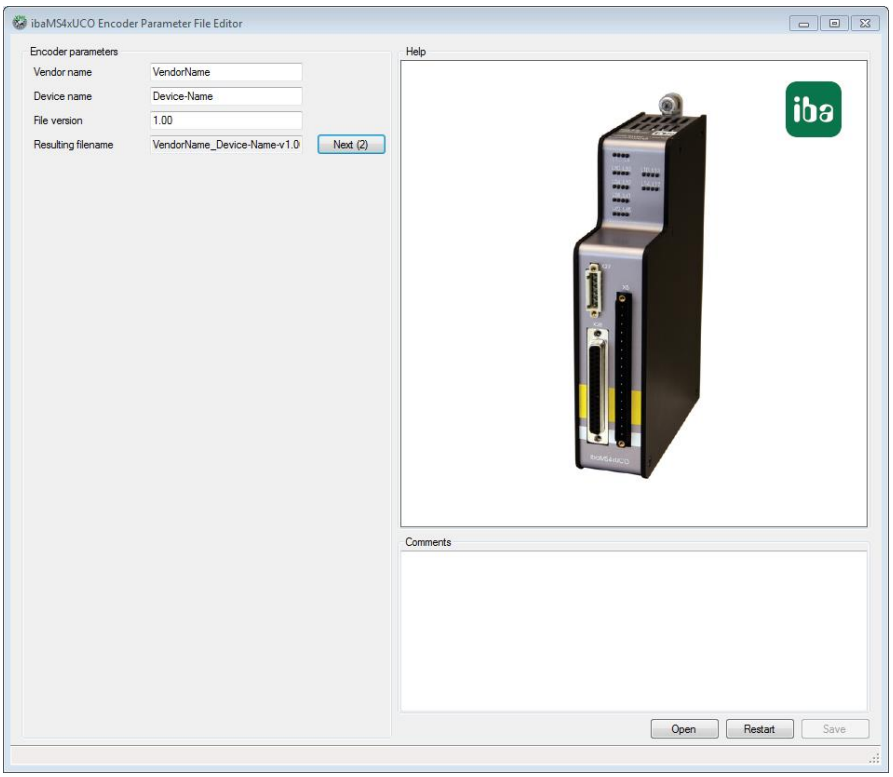
- An encoder parameter file can be manually created. For this purpose, a template may be used which is available on the data medium “iba Software & Manuals” (02_iba_Hardware\ibaMS4xUCO\EncoderParameterFiles-XML\Template\). The description of the encoder parameter file can be found in chapter 11.3.
- iba recommends using the encoder parameter file editor (short: EPF editor), which can be started in ibaPDA. The EPF editor is described hereinafter. The EPF editor is also available as separate software tool, free of charge. Please contact the iba support.

9.1.1.1 Encoder parameter file editor

The EPF editor can be started in ibaPDA by selecting the ibaMS4xUCO module in the I/O manager and then clicking the option “Create new encoder file…” on the “General” tab in the encoder type field.



The EPF editor starts showing the following window:



The EPF editor consists of 3 parts:

❑ Encoder parameters

Here, you can enter the vendor name, a device name (encoder type) and a version number. The encoder parameter file name is a combination of these entries according to this syntax:

VendorName_DeviceName_vx.yz.xml

In this area, you may also configure further settings in the following configuration steps.

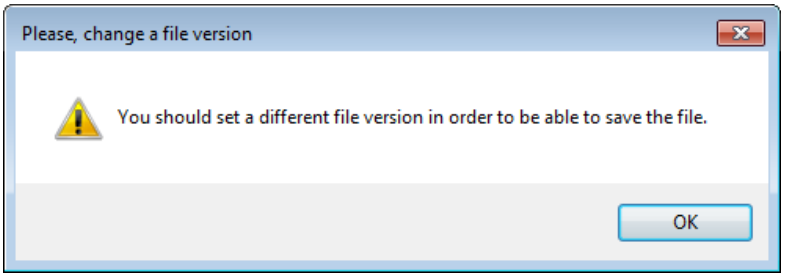
❑ Help

Explanations and notes regarding the configuration settings are displayed automatically in this area. Depending on the cursor position the display changes accordingly.

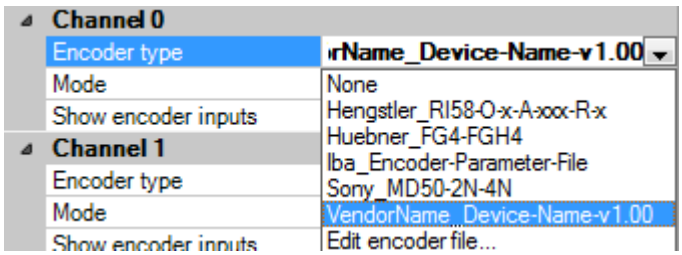
❑ Comments

The comments entered here will be saved with the file. Depending on the respective setting, comments are available by default.

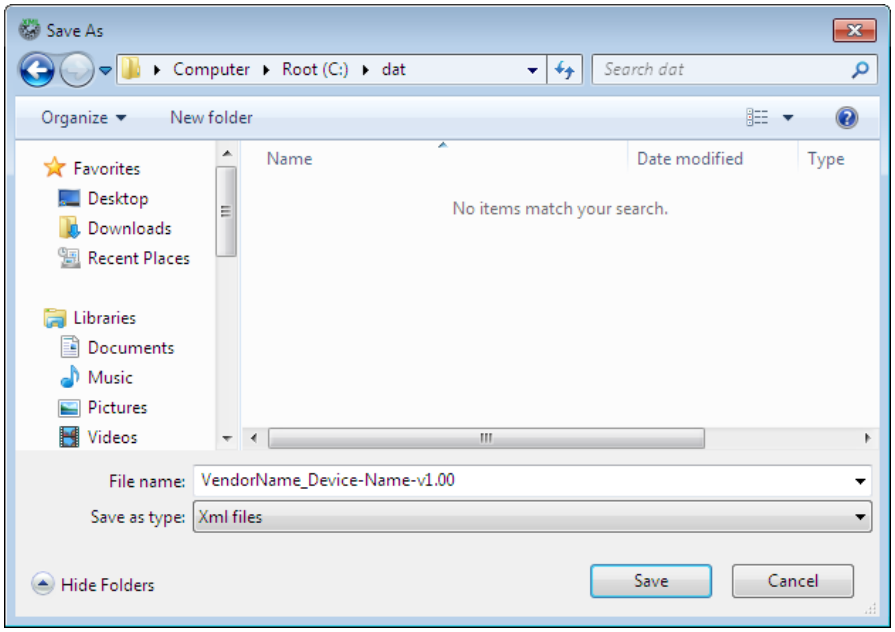
An existing encoder parameter file can be opended with the <Open> button. If you change the file, it can only be saved with a new version number.



The encoder parameter file can be saved using the <Save> button. The file is automatically saved in the respective ibaPDA directory. It appears in the drop-down list of the ecnoder type and is preselected.

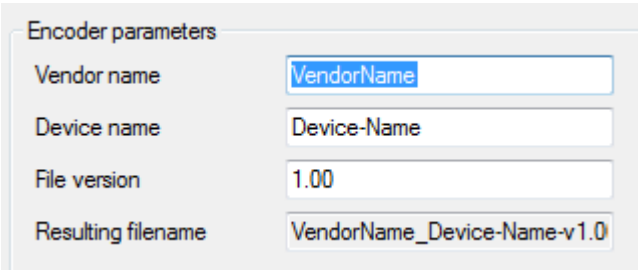


In addition, an external storage location can be specified, e. g. for later use with ibaLogic.

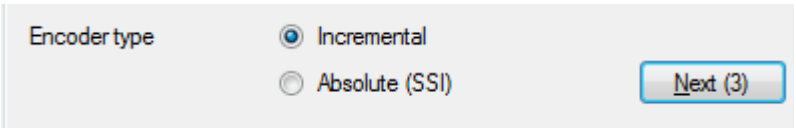


9.1.1.2 Proceeding

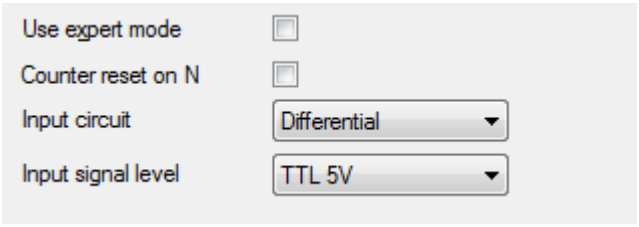
1. Enter vendor name, device name and file version in the corresponding text fields and click <Next>.



2. Select the encoder type, incremental or absolute, and click <Next>.



3. In the following step, you can select further settings, like “counter reset on N”, input circuit and input signal level.



It is also possible to enable the expert mode. In expert mode, you can configure all settings. If expert mode is active, it is not possible to undo this. You can only restart the editor and cancel all settings.

Note

The expert mode is recommended only for experienced users.

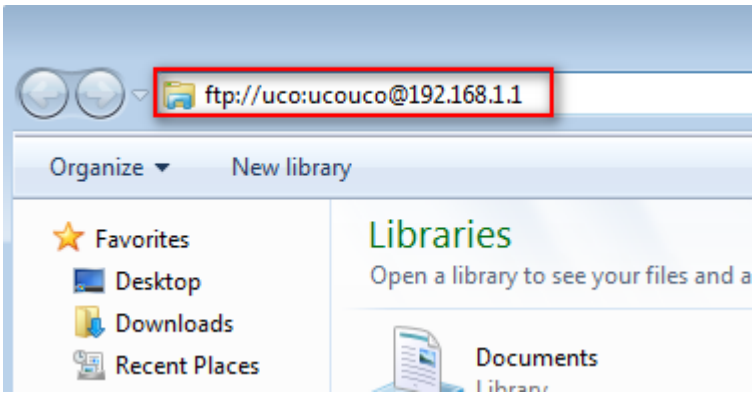
4. All further configuration options are described in the help window or explained in the manual, see chapter 7.4.

With <Open> you can open an existing configuration file, using the <Save> button you can save a new or modified encoder parameter file, with <Restart> all settings will be reset and the EPF editor will be restarted.

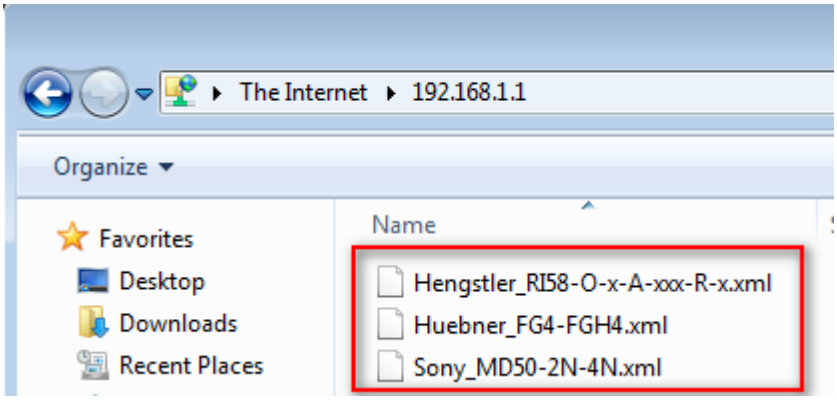
9.1.2 Upload the encoder parameter file to ibaPADU-S-IT-2x16

The encoder parameter file can be loaded onto the central unit via FTP, e. g. via the Windows file explorer:

1. Establish an Ethernet conection between central unit and computer.
2. Enter in the command line of the Windows file explorer:
   ftp://uco:ucouco@address of ibaPADU-S-IT>
   User: uco
   Password: ucouco



3. In the Windows file explorer, the appropriate directory will be opened on the central unit.



4. Copy the encoder parameter file to the directory.

9.2 Configuration in ibaPDA

9.2.1 Add a module

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

Note

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

Other documentation

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

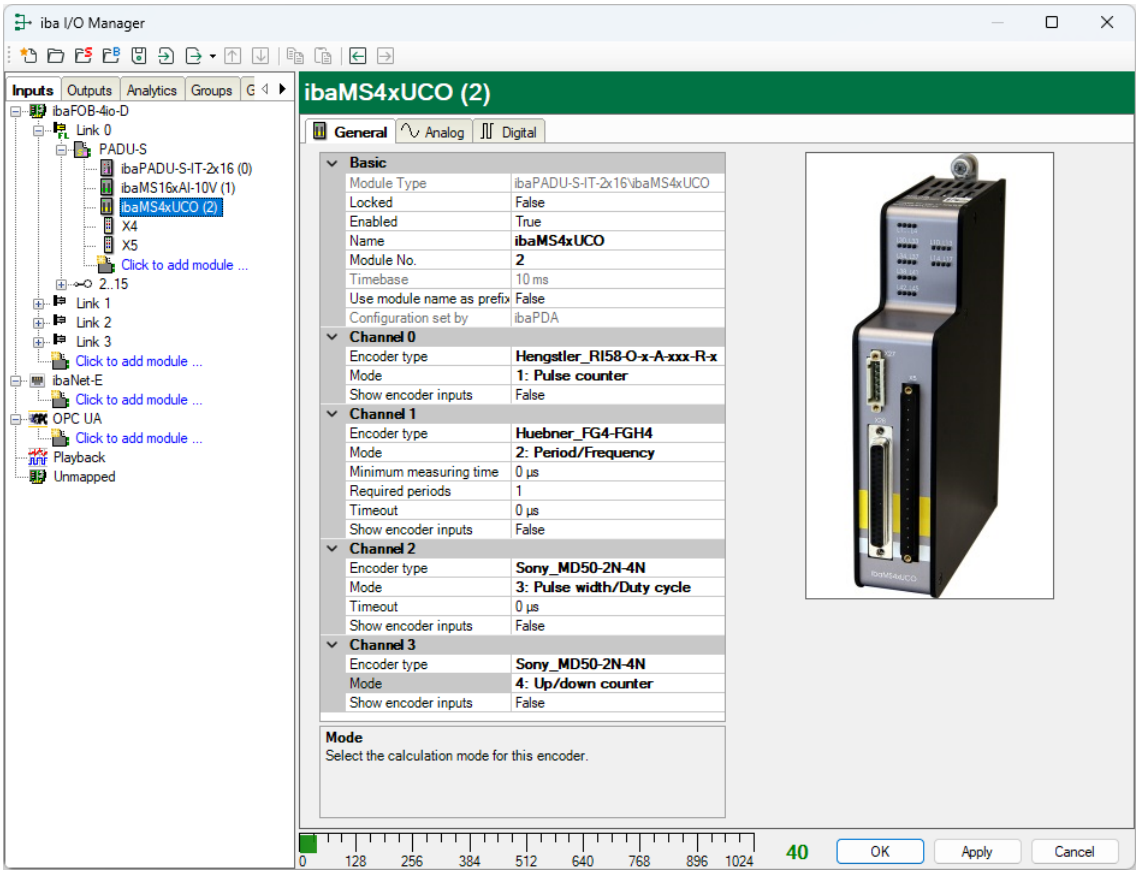
The ibaMS4xUCO module provides inputs and outputs. The input signals are configured in the “Hardware” menu of the I/O manager and the output signals in the “Outputs” menu.

9.2.2 Configuration of inputs and rotary encoders

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

Select the rotary encoders and configure the digital inputs in the „Hardware“ menu.

9.2.2.1 „Inputs“ tab - „General“ tab



Basic

❑ Module Type (information only)
Indicates the type of the current module.

❑ Locked
A module can be locked to avoid unintentional or unauthorized changing of the module settings.

❑ Enabled
Disabled modules are excluded from signal acquisition.

❑ Name
The plain text name should be entered here as the module designation.

❑ Module No.
Internal reference number of the module. This number determines the order of the modules in the signal tree of ibaPDA client and ibaAnalyzer.

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

❑ Use name as prefix
Puts the module name in front of the signal names.

❑ Configuration set by
This item is only visible when ibaPADU-S-IT-2x16 is used as central unit. When an embedded application has been started on ibaPADU-S-IT-2x16 (e. g. ibaLogic), then

ibaPDA cannot modify the configuration of the modules and signals. In this case the configuration is set by the embedded application. The following entries can be displayed:

- ibaPDA

	Configuration set by	ibaPDA

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

- Embedded application

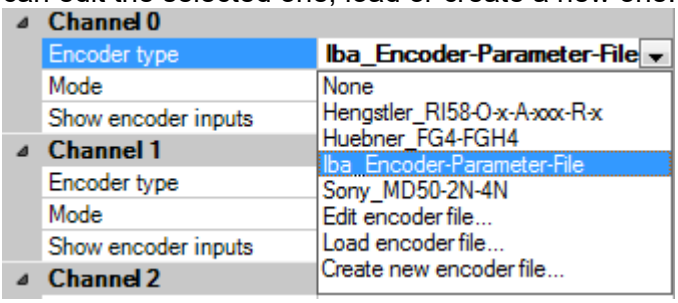
	Configuration set by	Embedded application
	Import signal names	False

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

Channel [0…3]

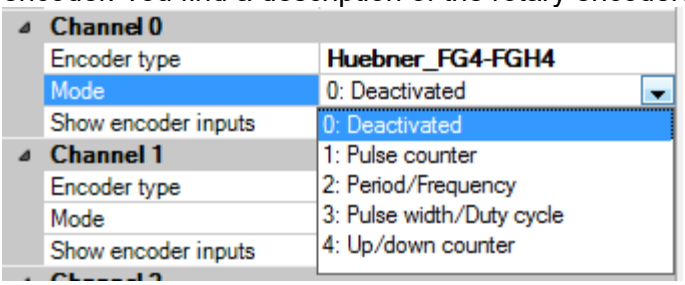
❑ Encoder type

Here, you can select an encoder type from the list of predefined rotary encoders, you can edit the selected one, load or create a new one.

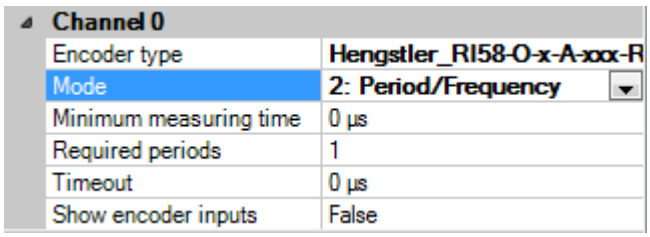


❑ Mode

Here, you can select the mode and analysis regulation depending on the selected rotary encoder. You find a description of the rotary encoders and the modes in the appendix.

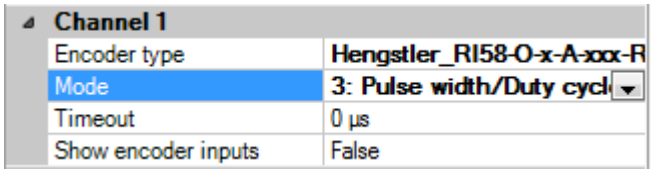


- In mode **2 (period/frequency)**, additional parameters are available: “minimum measuring time”, “required periods” and “timeout”. For a parameter description refer to chapter 7.4.4.5.



With the default settings, as shown in the figure above, the frequency will be measured at each period and timeout is not active.

- In mode **3 (pulse width/duty cycle)**, the parameter “timeout” is available. For a parameter description refer to chapter 7.4.4.6.



The timeout is not active in the default setting (= 0 µs).

❑ Show encoder inputs
True: the raw encoder digital inputs (A / B / N / MF) are displayed additionally in the “Digital” tab.
False: the raw encoder digital inputs (A / B / N / MF) are hidden.

9.2.2.2 „Inputs“ tab – „Analog“ tab

In the „Analog“ tab, you can select all analog signals provided by the module.

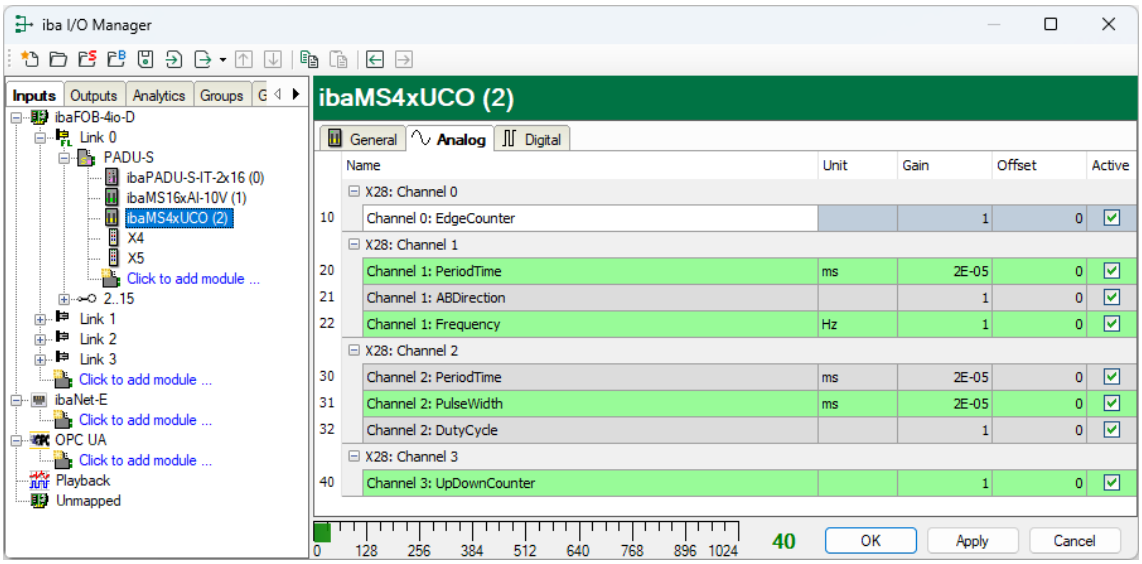
Note

Number and type of the analog signals depend on the selected encoder mode, see „General“ tab.

ibaPDA scales the calculated analog value to the target value with the appropriate SI unit, see the following table.

Mode	Type[3]	ibaPDA		
		Signal names	SI	Description
1: A/B Pulse counter	DINT	EdgeCounter	-	Number of the edges to be counted
2: Period / Frequency	DINT	PeriodTime	ms	Period in milliseconds
	DINT	ABDirection	-	„A before B“ or „B before A“
	REAL	Frequency	Hz	Frequency in Hz
3: Pulse width / Duty cycle	DINT	PeriodTime	ms	Period in milliseconds
	DINT	PulseWidth	ms	Pulse width in milliseconds
	REAL	DutyCycle	-	Pulse duty factor [0..1]
4: Up/down counter	DINT	UpDown-Coun-ter	-	Number of edges to be counted (up/down)

[3] Signal type



The following settings apply to the „Analog“ tab:

❑ Name

The signal names are predefined. You can enter two additional comments (click on the icon in the Name field).

❑ Unit

The units are predefined according to the signal type.

❑ Gain / Offset

Gradient (Gain) and y axis intercept (Offset) of a linear equation. You can convert a standardized value transferred without a unit into a physical value.

You can choose by Gain/Offset a conversion of the value. The value is then recorded with the physical unit.

For making the calculation of Gain/Offset easier, an auxiliary dialog appears when clicking on the co-ordinate cross in the „Gain“ or „Offset“ field. In this dialog, you only enter two points in the line equation. Gain and offset are then calculated automatically.

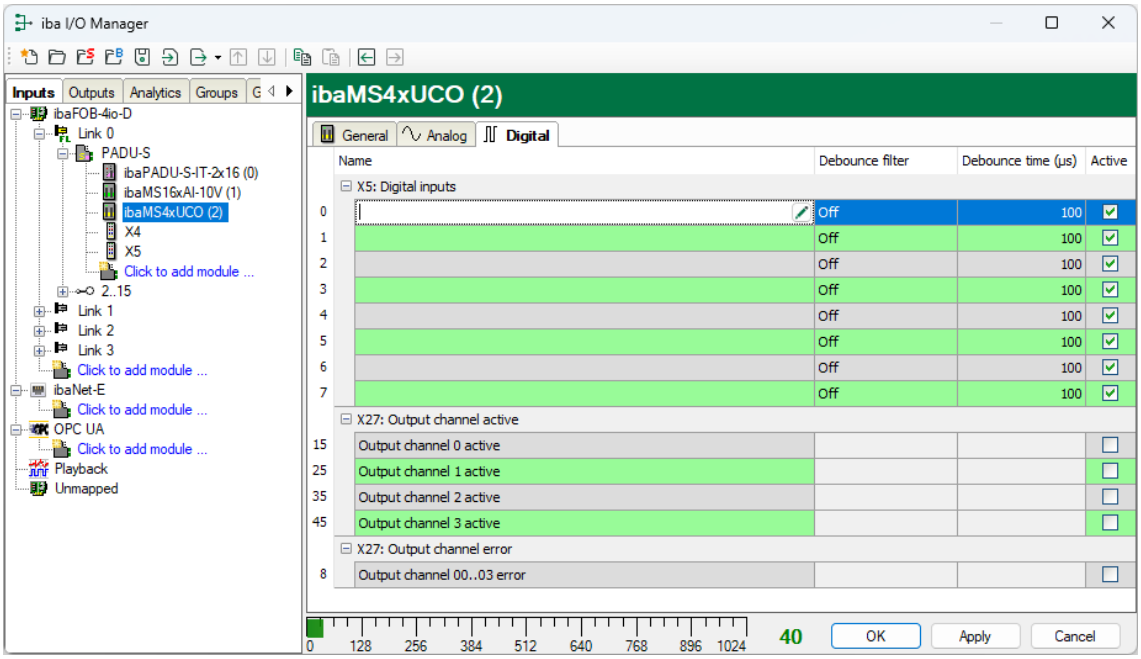
❑ Active

Enabling/disabling the signal.

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

9.2.2.3 „Inputs“ tab – „Digital“ tab

The following settings apply to the „Digital“ tab:

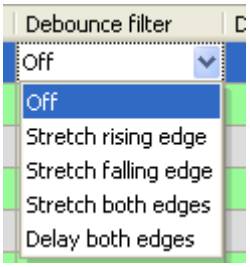


❑ Name

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

❑ Debounce filter

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



↗ See chapter 7.6.2 „Debounce filters“.

❑ Debounce time (µs)

Here, you can define the debounce time in µs

❑ Active

Enabling/disabling the signal.

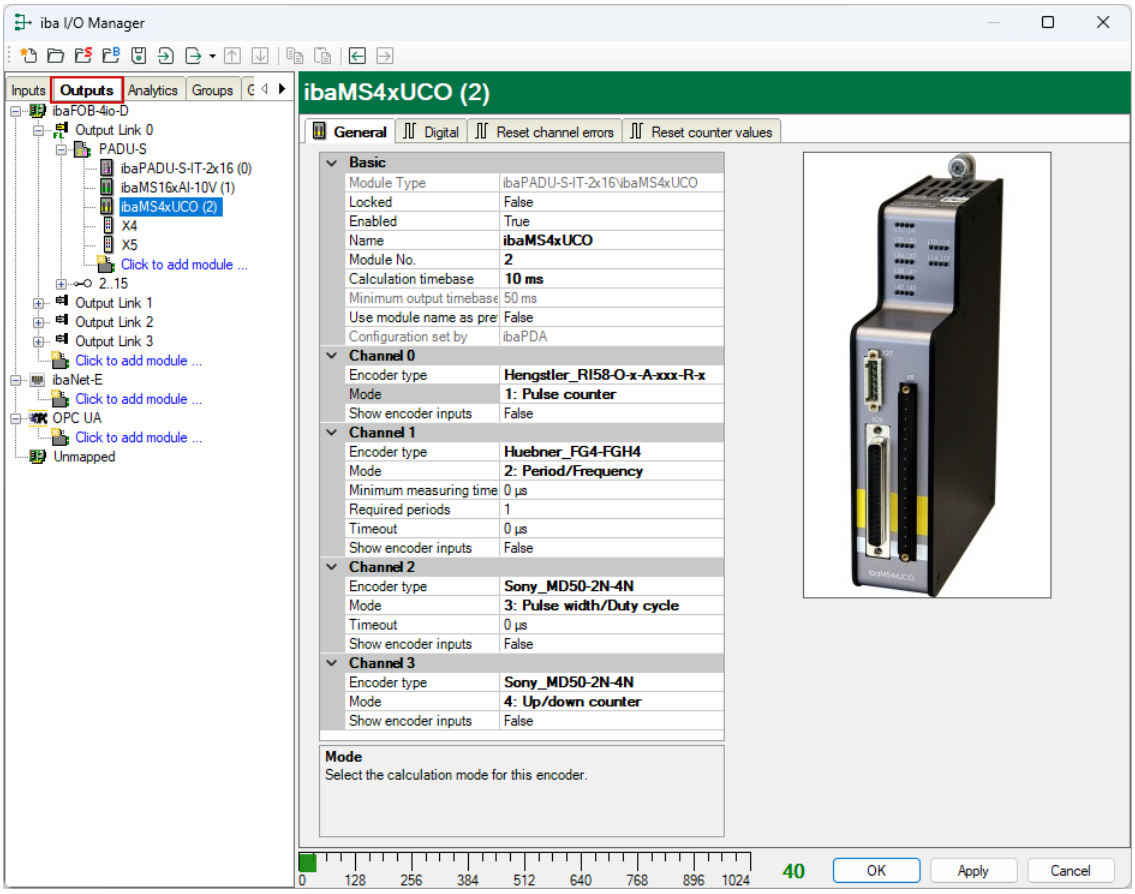
9.2.3 Configurations of outputs

The digital outputs are configured in the “Outputs” menu. Output signals can be triggered by means of virtual signals. Virtual signals can be defined with the expression builder in ibaPDA.

Other documentation

For a detailed description of the expression editor, see ibaPDA manual, chapter “Expression builder”.

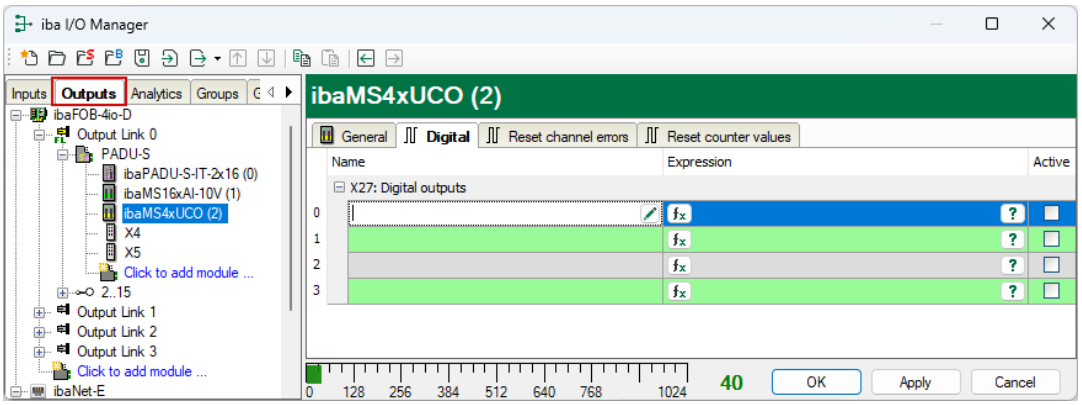
9.2.3.1 „Outputs“ tab – „General“ tab



All settings made in the General tab of the Outputs tab are also shown here, see also chapter 9.2.2.1.

9.2.3.2 Outputs Menu – „Digital“ tab

The following settings apply to the „Digital“ tab:



❑ Name

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

❑ Expression

By means of the expression editor signals can be assigned to the outputs or signals can be linked mathematically or logically.

❑ Active

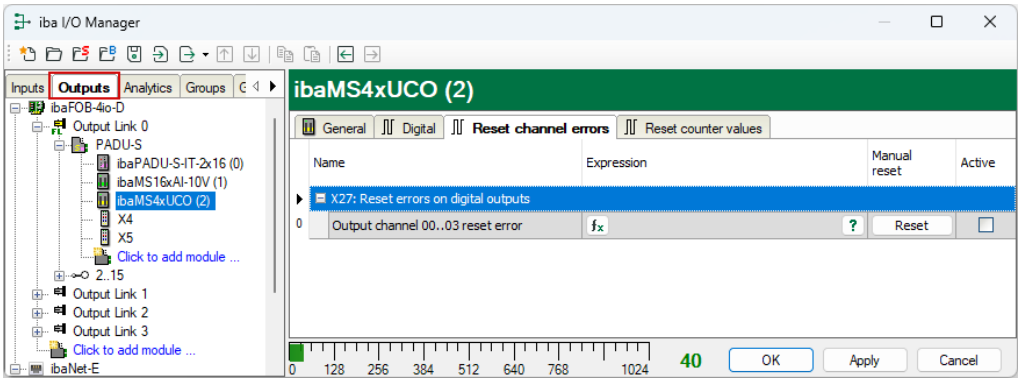
Enabling/disabling the signal.

9.2.3.3 Outputs menu - „Reset channel errors“ tab

There are two ways to reset hardware errors of the digital output root:

- Reset manually with the <Reset> button
- Reset automatically with an output signal

The following settings apply to the „Reset channel errors“ tab:



❑ Name

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

❑ Expression

By means of the expression editor you can configure an output signal to reset a hardware error.

❑ Active

Enabling/disabling the signal.

9.3 Configuration in ibaLogic-V5

Other documentation

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

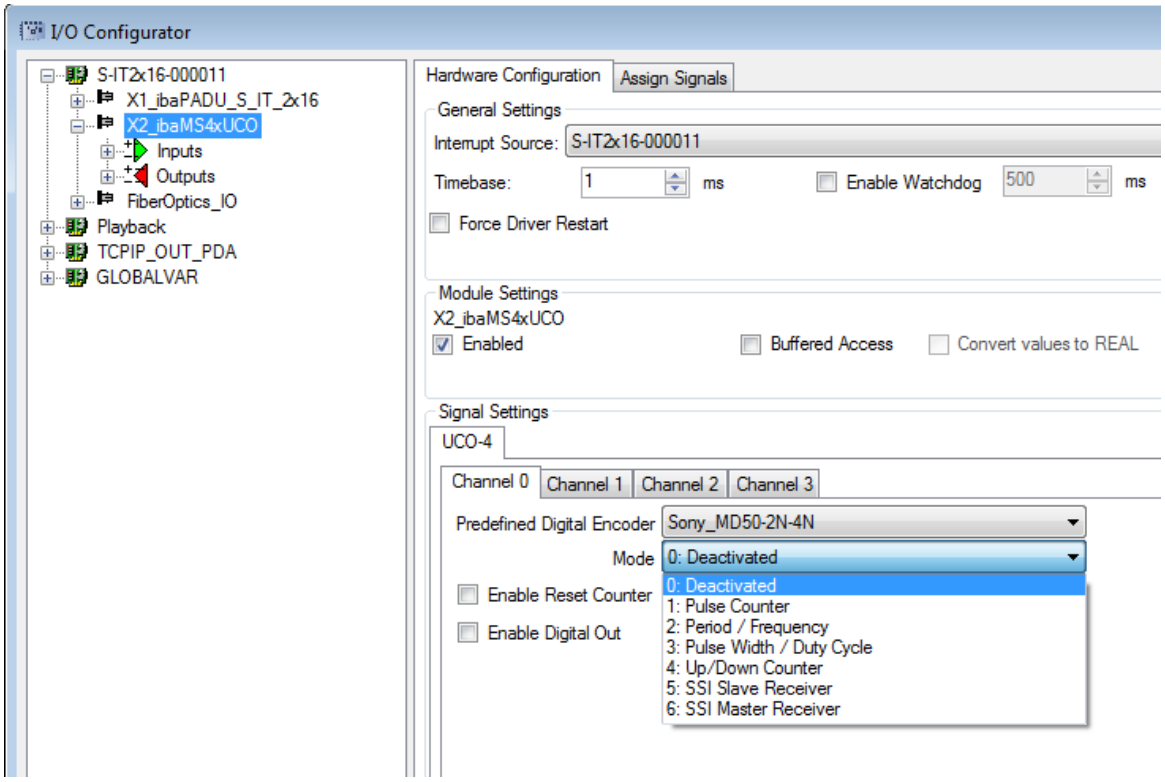
The signals can be configured in the I/O Configurator of ibaLogic. Open the I/O Configurator in the “Tools – I/O Configurator“ menu. When you click on the <Update hardware> button, then ibaLogic detects the module.

9.3.1 Rotary encoder configuration

The rotary encoder type (pre-configured digital encoder) and the corresponding analysis regulation (mode) can be chosen for each channel, see also chapter 7.4.5.

Note

The ibaMS4xUCO input signals are changing depending on the mode. If the rotary encoder or mode settings have been changed, the settings are only applied after a click on <OK> or >Apply>. Then the new input signals are available. The signals have to be reassigned.



9.3.2 Configuring signals

ibaMS4xUCO provides the following signal groups:

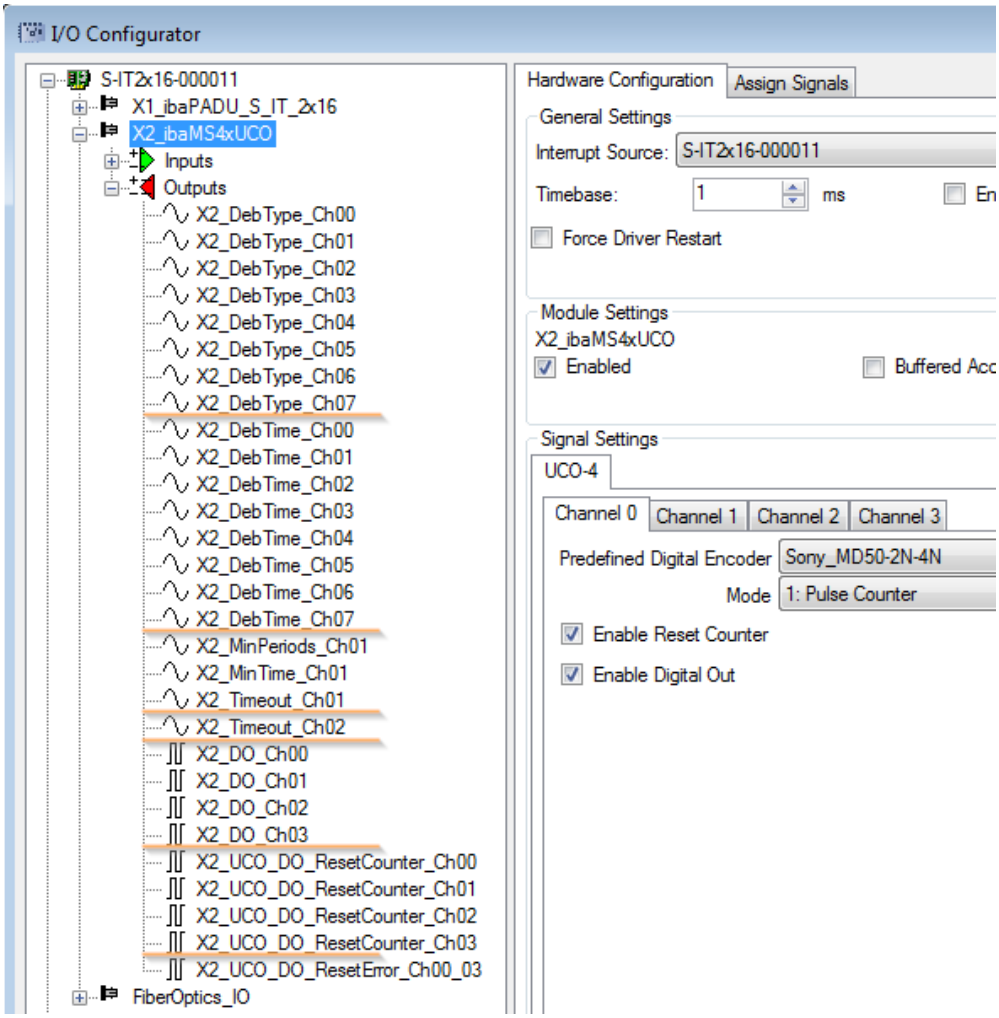
1. Digital outputs X27
2. Counter inputs X28
3. Digital inputs X5

The X27 digital outputs and the X5 digital inputs are permanently available and can be freely configured.

Note

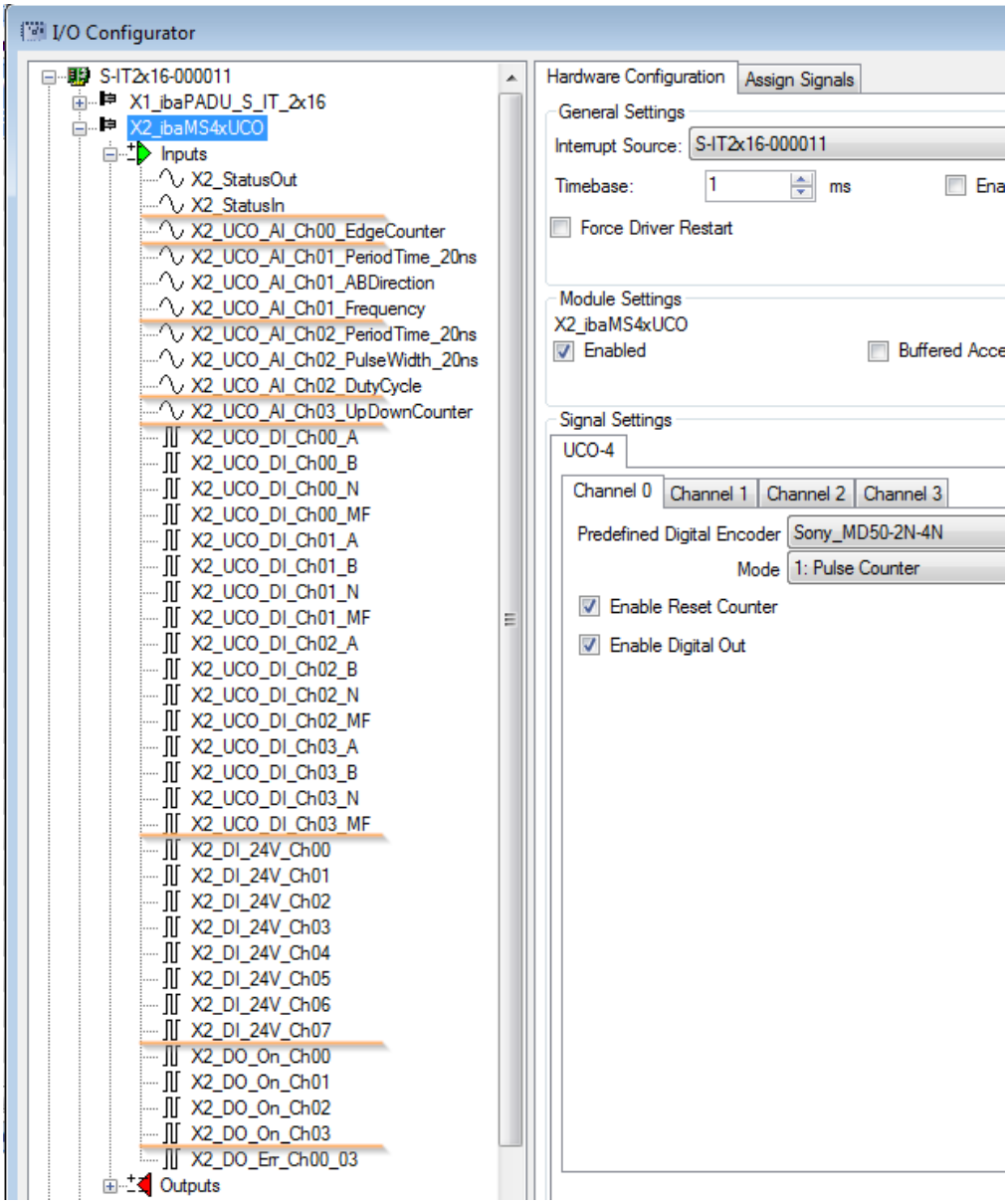
The number, type and name of the ibaMS4xUCO counter input signals depend on the selected mode, see chapter 9.3.1.

The output signals of the digital inputs and digital outputs are always available. Depending on the adjusted mode, additional output signals of the counter channels are available (MinPeriods_Ch[00…03], MinTime_Ch[00…03], Timeout_Ch[00…03]).



The “digital raw signals” of all channels are always present regardless of the mode.

Whereas the name and the type of the analog input signals (UCO_AI_Ch0[00…03]_[signal_name_depending_on_mode]) vary depending on the mode.



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

Note

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

Signal	Description
Inputs	
UCO_AI_Ch[00..03]_[mode]	Analog input signals (depending on mode), see chapter 7.4.5 and the following example. These signals result from the analysis of the digital input signals („raw signals“).
UCO_DI_Ch[00..03]_A UCO_DI_Ch[00..03]_B UCO_DI_Ch[00..03]_N UCO_DI_Ch[00..03]_MF	Digital input signals („raw signals“). This data is used for analysis.
DI_24V_Ch[00..07]	Digital input signals
StatusIn	Status information about the plugged input module (for output module without function): 0 = Module not initialized 1 = Module running >1 = Mistake (e.g. module cannot be initialized)
StatusOut	Status information about the plugged module (for input module without function): 0 = Module not initialized 1 = Module running >1 = Mistake (e.g. module cannot be initialized)
Outputs	
DO_Ch[00..03]	Digital output signals
DebType_Ch[00..07]	Debounce filter for digital input signals
DebTime_Ch[00..07]	Debounce time for the single digital input signal
MinPeriods_Ch[00..03]	Minimum number of periods to be measured for the corresponding digital input signal (only in mode 2)
MinTime_Ch[00..03]	Minimum measuring time to be measured for the corresponding digital input signal (only in mode 2)
Timeout_Ch[00..03]	Timeout for the corresponding digital input signal (only in mode 2 and 3)
Additional input signals for buffered access	
UCO_AI_Ch[00..03]_[Modus]_buf	Input buffer for analog input signals (depending on mode)
UCO_DI_Ch[00..03]_A_buf UCO_DI_Ch[00..03]_B_buf UCO_DI_Ch[00..03]_N_buf UCO_DI_Ch[00..03]_MF_buf	Input buffer for digital input signals („raw signals“) for analysis
DI_24V_Ch[00..07]_buf	Input buffer for digital input signals
BufferFillCount	Counter, when buffer is filled
BufferOverrun	Counter for buffer-overrun
Additional output signals for buffered access	
BufferSize	Buffersize
SubSampling	Subsampling of the signals

10 Technical Data

10.1 Main data

Short description	
Name	ibaMS4xUCO
Description	Counter module with 4 channels and digital inputs and outputs
Order number	10.124310
Power supply	
Power supply	24 V DC, internal via back plane
Power consumption max.	10 W
Interfaces, operating and indicating elements	
Indicators (LEDs)	4 LEDs for device status 16 LEDs for status of counters/digital outputs 8 LEDs for status of digital inputs
Electrical isolation	
Counter inputs - digital outputs	AC 1.5 kV
Counter inputs - digital inputs	AC 2.5 kV
Digital outputs - digital inputs	AC 2.5 kV
Operating and environmental conditions	
Temperature ranges	
Operation	32 °F … 122 °F (0 °C … 50 °C)
Storage/transport	-13 °F … 158 °F (-25 °C … 70 °C)
Mounting	Vertical, plugged into backplane bus
Cooling	Passive
Humidity class	F, no condensation
Protection class	IP20
Certification/Standards	EMC: IEC 61326-1 FCC part 15 class A
Dimensions (width x height x depth)	1.69 in x 8.43 in x 5.83 in (43 mm x 214 mm x 148 mm)
Weight / incl. box and documentation	1.54 lbs (0.7 kg) / 2.42 lbs (1.1 kg)

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

Unique Identifier: 10.124310 ibaMS4x-UCO

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

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

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

10.2 Counter inputs

Number	4
Design	Galvanically isolated, differential (DIF) or single ended (SE) for incremental encoder or absolute encoder (SSI)
In addition	Pullup, pulldown and termination resistors RS422 termination with 120 Ω Encoder supply 5 V DC / 100 mA
Configuration	Encoder parameter file (xml) per channel
Incremental encoder connection	
Functions	Pulse and up/down counter; measurement of period time, frequency, pulse width and duty cycle
DIF	RS422, 2-wire technology, TTL, HTL (only with external series resistors) Signals A+, A- / B+, B- / N+, N Quadrature encoder for 4-fold evaluation (in addition)
SE	2-wire technology, TTL, HTL Signals A / B / N R/C low-pass filter, 1st order, 180 kHz, in addition
Frequency range	0 Hz ... 500 kHz (SE) or 0 Hz ... 2 MHz (DIF)
Absolute encoder connection	
Functions	SSI master receiver for direct connection of an encoder SSI slave receiver for sniffing an existing encoder
SSI interface	Binary code, Gray code
SSI master receiver	RS422, 2-wire technology, TTL Signals: clock output (clock+ / clock-), data input (data+ / data-)
SSI slave receiver	RS422, 2-wire technology, TTL Signals: clock input (clock+ / clock-), data input (data+ / data-)
Max. clock frequency T_f	390 kHz
Data rate	T_f / 36

Multi-function input	
Functions	Input for additional alarm and status signals
Design	single ended, 2-wire technology, TTL, HTL Signal MF Current limitation 10 mA Auxiliary voltage 5 V DC, in addition R/C low-pass filter, 1st order 180 kHz, in addition
Resolution	32 Bit
Input signal	
TTL	5 V
HTL	24 V
Sampling rate counter inputs	50 MHz
Sampling rate system[4]	Up to 40 kHz, freely adjustable
Electrical isolation	
Channel-24Volt ground	AC 1.5 kV
Channel-channel/housing	AC 1.0 kV
Connector type	1x37-pin Sub-D connector; soldered terminal (0.8 mm² to 1.2 mm²), can be connected by screws, included in delivery

10.3 Digital inputs

Number	8
Design	Galvanically isolated, single ended, protected against reverse polarity
Input signal	24 V DC
Max. input voltage	±60 V permanent
Signal level	
log. 0	> -6 V; < +6 V
log. 1	< -10 V; > +10 V
Hysteresis	none
Input current	1 mA, constant
Debounce filter	Optional: 4 different operating modes
Sampling rate	Up to 40 kHz, freely adjustable
Frequency range	0 Hz to 20 kHz
Delay	Typ. 10 µs
Electrical isolation	
Channel – channel	AC 2.5 kV
Channel – housing/power supply	AC 2.5 kV
Connector type	1 x 16-pin multi-pin connector; clamp-type terminal (0.8 mm² to 2.5 mm²), screw connection, included in delivery

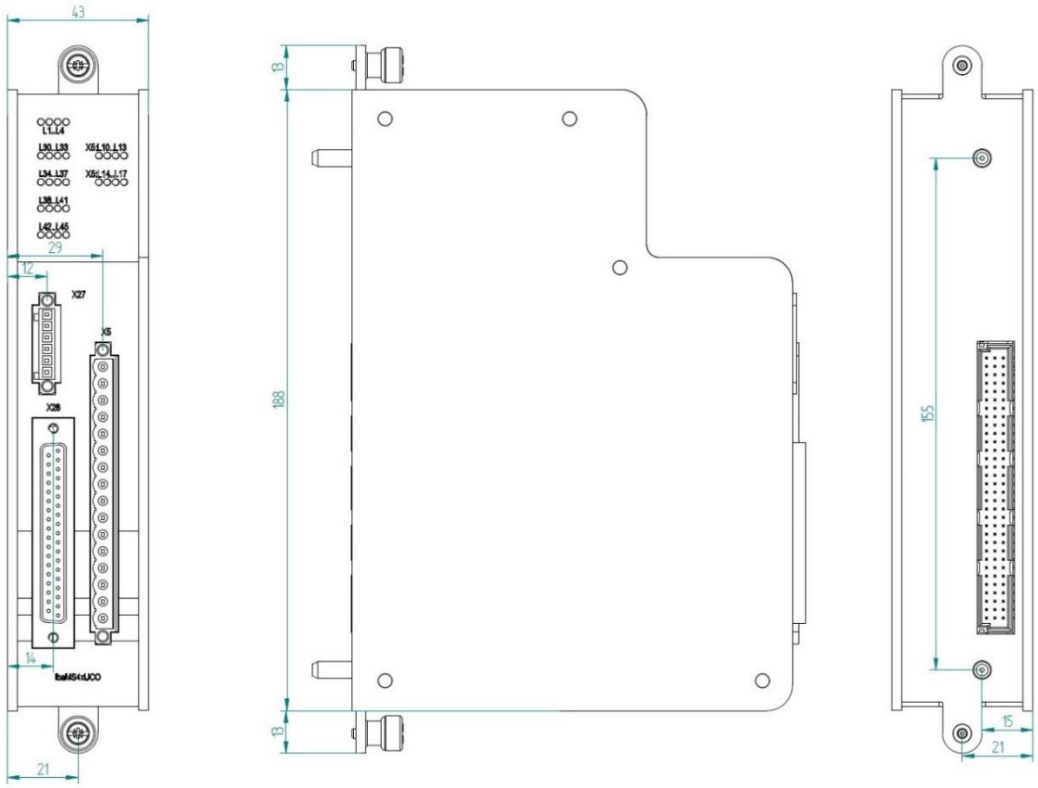
[4] valid for the entire system

10.4 Digital outputs

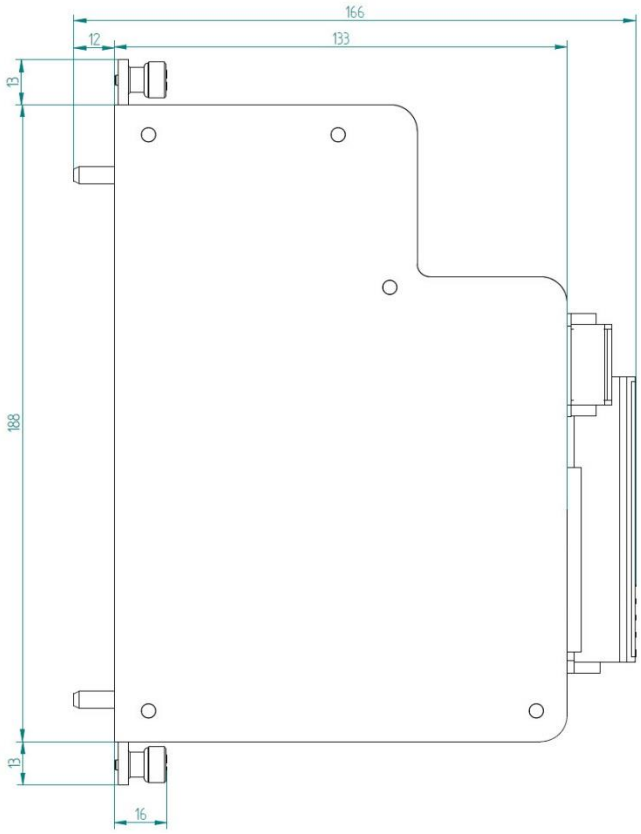
Number	4
Design	1 root with 4 outputs, P switch
Load voltage	24 V DC, external per root, protected against reverse polarity
Load voltage range	+10 V to +30 V
Switching voltage per channel	= load voltage
Switching current per channel	250 mA
Switching current range per channel	10 mA to 500 mA
Inductive load	Up to 200 mJ
Switching frequency	Up to 40 kHz[5], freely adjustable
Switching delay	
Switch-on delay (90% to 10%) Switch-off delay (10% to 90%)	< 10 µs < 10 µs at 24 V DC switching voltage with 100 Ω load
Electrical isolation	
Root-root Root-housing/power supply	AC 1.5 kV AC 1.5 kV
Connector type	1x6-pin multi-pin connector; clamp-type terminal (0.8 mm² to 2.5 mm²), screw connection, included in delivery
Protective functions	
Safe state	Channel root switched off
Current limitation	From approx. 0.6 A per channel The root switches to „safe state“, when connection is incorrect (resettable via software)

[5] deviating switching frequency with ibaLogic (up to 1 kHz) and ibaPDA (up to 20 Hz)

10.5 Dimension sheet



(Dimensions in mm)



Module dimensions with connectors (dimensions in mm)

11 Appendix

11.1 Supported rotary encoders

Note

The ibaMS4xUCO module supports various rotary encoders. Three of the rotary switches which are already implemented are described in the following by way of example.

The ibaMS4xUCO internal channel wirings refer to wirings (circuit diagrams) illustrated in chapter 7.4.3. Depending on the rotary encoder type, some switch settings are predefined. Signal paths, which are not active, are not illustrated / described. The circuit diagram in chapter 7.4.3 gives an overview. This chapter describes only active signal paths.

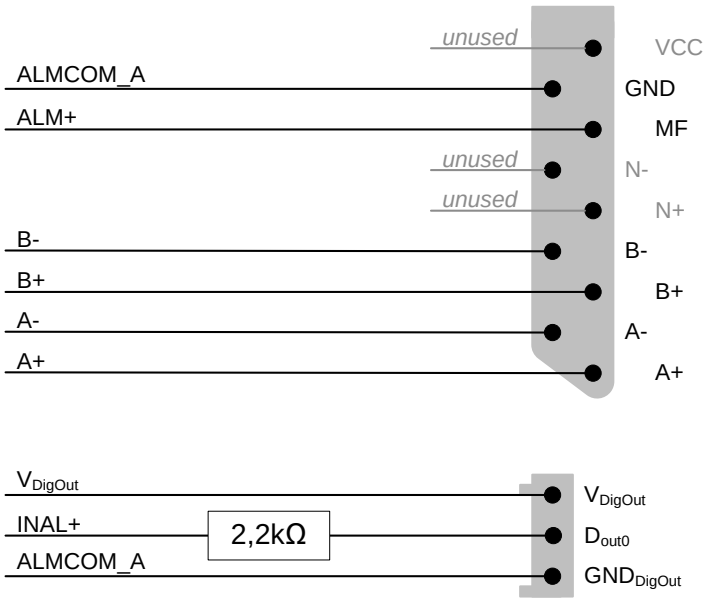
Further supported encoder types are constantly updated on the data medium „iba Software & Manuals“.

If you need further rotary encoders please contact the iba support.

Manufacturer	Rotary encoder
Sony	MD50-2N
	MD50-4N
Hübner	FG4
	FGH4
Hengstler	RI58-O-xAx-xxRx

11.1.1 Sony MD50-2N/-4N

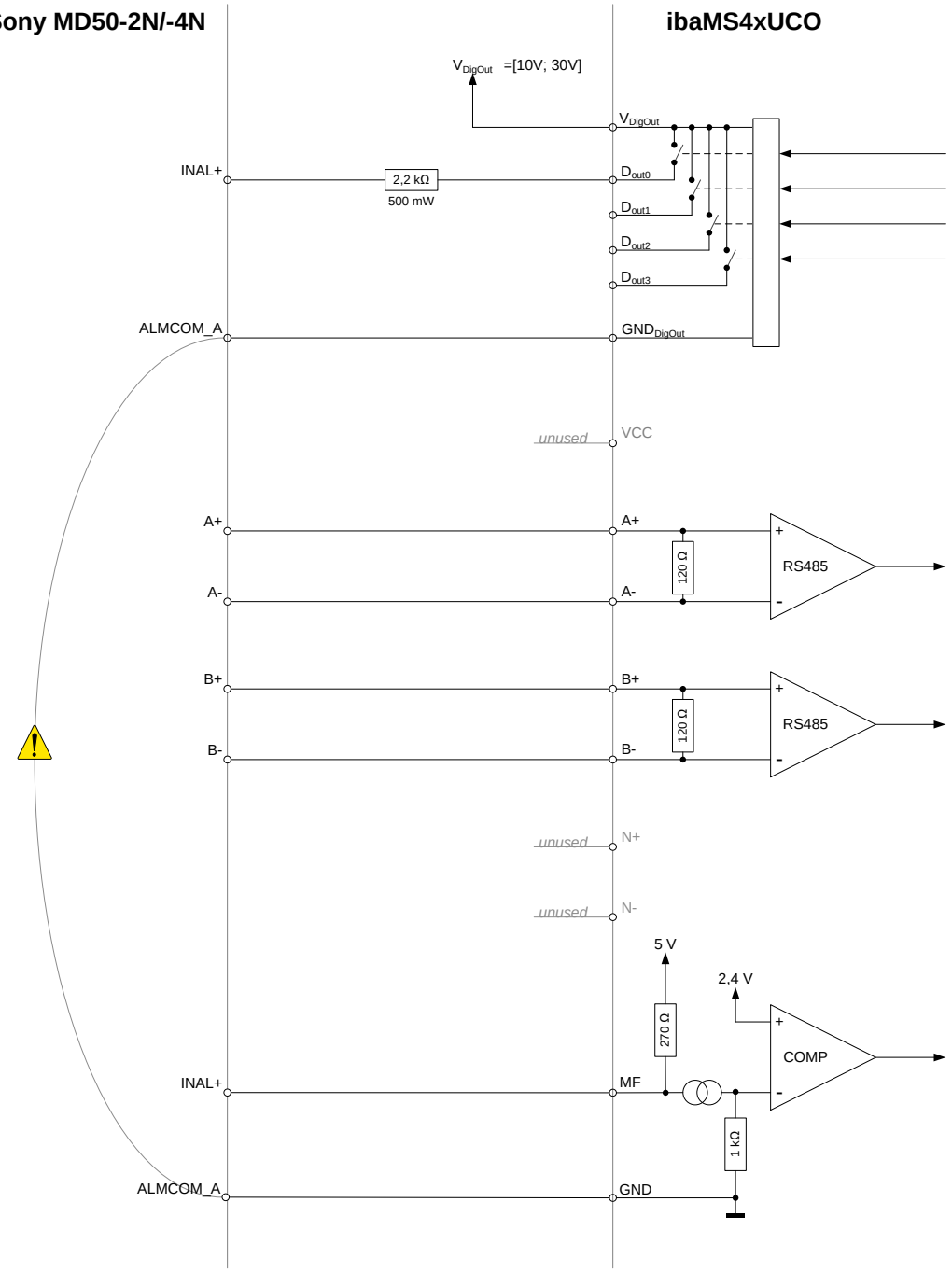
11.1.1.1 Pin assignment



11.1.1.2 Circuit diagram

The rotary encoder provides several alarm functions which are sent as alarm output signal „ALM+“ or „ALM_H+“ of the connector „PULSE OUT“. The MD50 internal opto-isolator PC817 (or similar) is connected to the signals MF and GND_{CH} of ibaMS4xUCO. The MD50 alarm output is typically open when an alarm is active.

The Sony MD50 rotary encoder is to be connected to ibaMS4xUCO as indicated below.



Connection Sony MD50-2N/-4N to ibaMS4xUCO

⚠ CAUTION

There is a ground loop between internal Sony MD50 „ALCOM_A“ ground and external „GND-Dout“ ground.

11.1.1.3 Modes / Analysis regulations

The following modes and analysis regulations are realized for the Sony MD50 rotary encoder:

Mode	Calculated input values		Description
	Signal name	Type	
0: Deactivated	-	-	Channel is deactivated
1: A/B Pulse counter	EdgeCounter	DINT	Counts pulses according to the „quadrature mode“ All 4 edges are counted (pos.A, neg.A, pos.B, neg.B) „Reset on N“ is not active
2: Period / frequency of A / B / AB pulses	PeriodTime ABDirection Frequency	DINT DINT REAL	Period and frequency are measured according to „quadrature mode“ All 4 edges (pos.A, neg.A, pos.B, neg.B) are processed, i. e. the measured frequency is four times as high as the real frequency, the period time decreases accordingly by factor 4. PeriodTime is the period duration in ns. ABDirection ABDirection = 0 ➔ A-pulse before B-pulse ABDirection = 1 ➔ B-pulse before A-pulse Frequency is given in Hz.
3: Pulse width / duty cycle of A	 PeriodTime PulseWidth DutyCycle	 DINT DINT REAL	Refers solely to signal A. PeriodTime is the period duration in ns. PulseWidth is the positive pulse width of A. DutyCycle is the duty factor between high- und low-level (DutyCycle[0..1])
4: Up/down Counter of A / B pulses	Counter	DINT	Counts edges according to the „quadrature mode“ Counts all 4 edges of A and B (pos.A, neg.A, pos.B, neg.B). When A-pulse is before B-pulse the analysis counts up, when B-pulse is before A-pulse it counts down. „Reset on N“ is not active „Divide by 4“ is not active

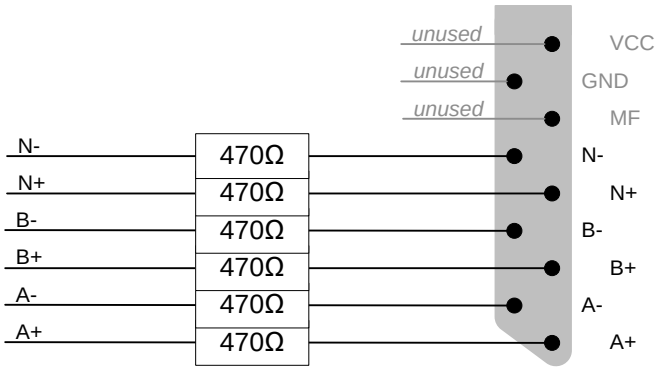
The following table shows the adjusted parameters.

	Analysis regulation	1: Pulse counter	2: Period / frequency	3: Pulse width / duty cycle	4: Up/down counter
	Mode	**Q**	**Q**	**D**irect	**Q**uadrature
Signal edge	pos. A	●[6]	●	High level	●
	neg. A	●	●		●
	pos. B	●	●		●
	neg. B	●	●		●
Function	„Divide by 4“				▬
	„Reset on N“	▬			▬
	„B as qualifier“				

[6] „○“ = optional; „●“ = preset; „▬“ = not active

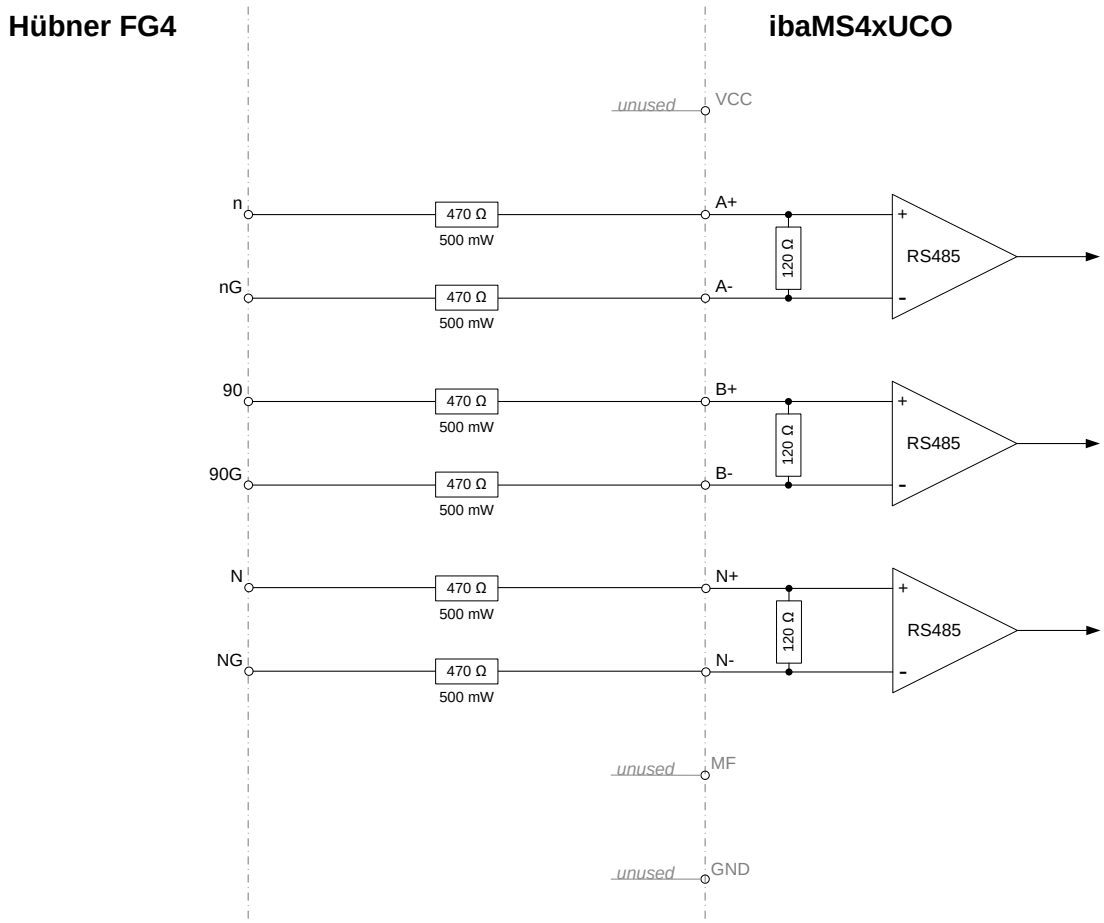
11.1.2 Hübner FG4/FGH4

11.1.2.1 Pin assignment



11.1.2.2 Circuit diagram

The Hübner FG4 rotary encoder is to be connected to ibaMS4xUCO as indicated below.



Connection Hübner FG4/FGH4 to ibaMS4xUCO

11.1.2.3 Modes / Analysis regulations

The following modes and analysis regulations are realized for the Hübner FG4 rotary encoder:

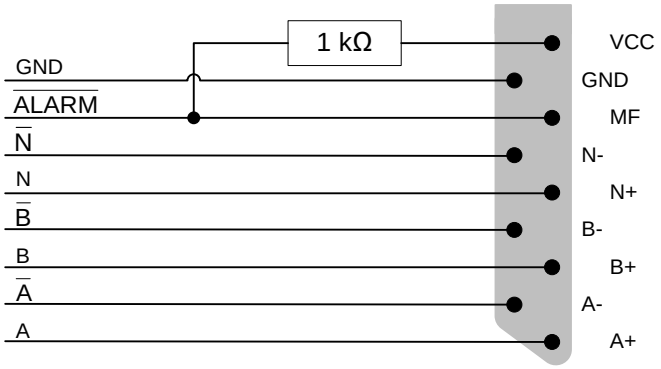
Mode	Calculated input values		Description
	Signal name	Type	
0: Deactivated	-	-	Channel is deactivated
1: A/B Pulse counter	EdgeCounter	DINT	Counts edges according to the „quadrature mode“ All 4 edges are counted (pos.A, neg.A, pos.B, neg.B) „Reset on N“ is not active
2: Period/frequency on A / B / AB pulses	PeriodTime ABDirection Frequency	DINT DINT REAL	Period and frequency are measured according to „quadrature mode“ All 4 edges (pos.A, neg.A, pos.B, neg.B) are processed, i. e. the measured frequency is four times as high as the real frequency, the period time decreases accordingly by factor 4. PeriodTime is the period duration in ns. ABDirection ABDirection = 0 ➔ A-pulse before B-pulse ABDirection = 1 ➔ B-pulse before A-pulse Frequency is given in Hz.
3: Pulse width / duty cycle on A	 PeriodTime PulseWidth DutyCycle	 DINT DINT REAL	Refers solely to signal A. PeriodTime is the period duration in ns. PulseWidth is the positive pulse width of A. DutyCycle is the duty factor between high- und low-level (DutyCycle[0..1])
4: Up/down counter on A / B pulses	UpDown-Counter	DINT	Counts edges according to the „quadrature mode“ Counts all 4 edges of A and B (pos.A, neg.A, pos.B, neg.B). When A-pulse is before B-pulse the analysis counts up, when B-pulse is before A-pulse it counts down. „Reset on N“ is not active. „Divide by 4“ is not active.

The following table shows the adjusted parameters.

	Analysis regulation	1: Pulse counter	2: Period / frequency	3: Pulse width / duty cycle	4: Up/down counter
	Mode	Q	Q	Direct	Quadrature
Signal edge	pos. A	●[7]	●	High level	●
	neg. A	●	●		●
	pos. B	●	●		●
	neg. B	●	●		●
Function	„Divide by 4“				▬
	„Reset on N“	▬			▬
	„B as qualifier“				

11.1.3 Hengstler RI58-O-xAx-xxRx

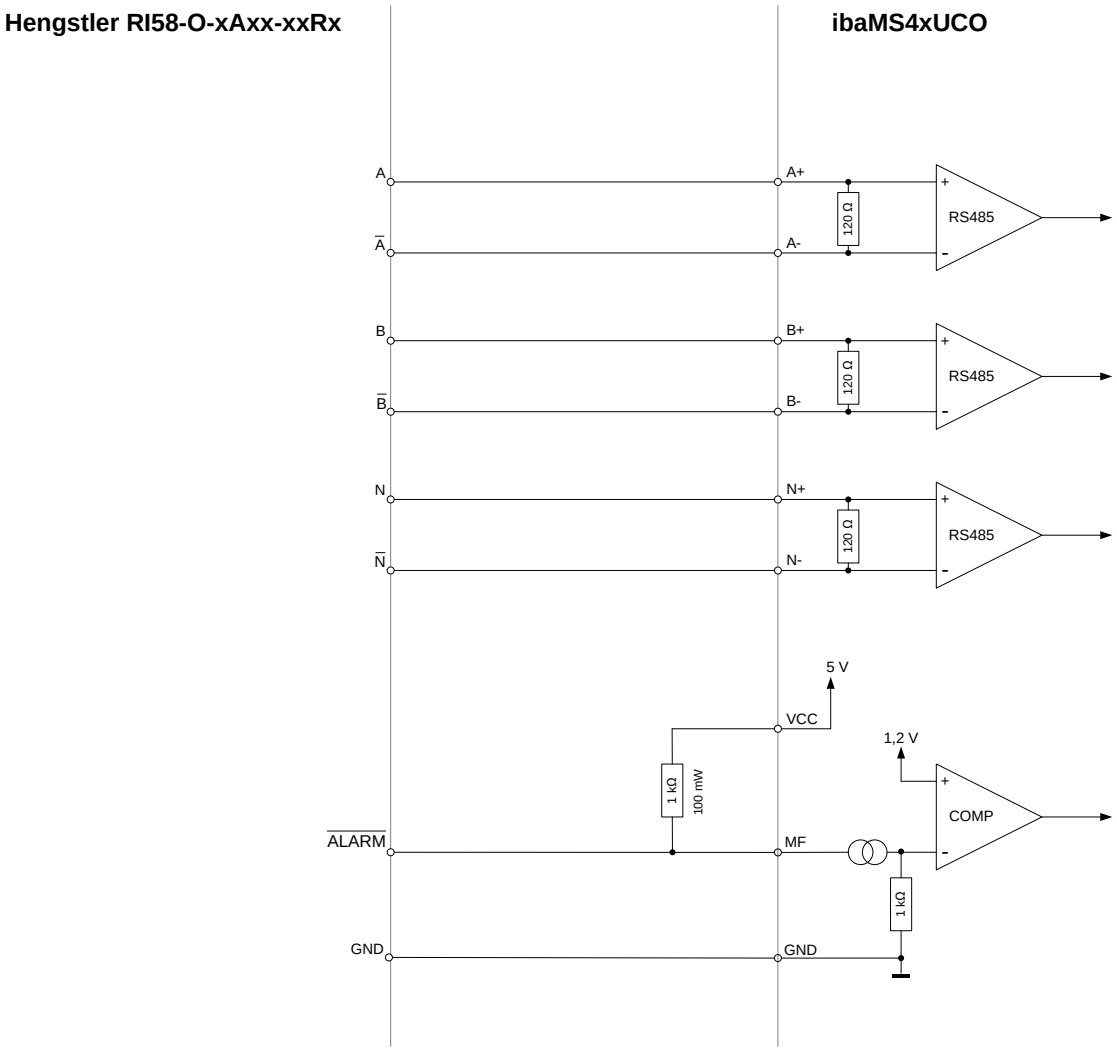
11.1.3.1 Pin assignment



11.1.3.2 Circuit diagram

The Hengstler RI58-O rotary encoders provide an alarm function. They are to be connected as indicated below.

[7] „○“ = optional; „●“ = preset; „▬“ = not active



Hengstler RI58-O-xAx-xxRx connection to ibaMS4xUCO

11.1.3.3 Modes / Analysis regulations

The following modes and analysis regulations are realized for the Hengstler RI58-O-xAx-xxRx rotary encoder:

Mode	Calculated input values		Description
	Signal name	Type	
0: Deactivated	-	-	Channel is deactivated
1: A/B Pulse counter	EdgeCounter	DINT	Counts edges according to the „quadrature mode“ All 4 edges are counted (pos.A, neg.A, pos.B, neg.B) „Reset on N“ is active

2: Period/frequency on A / B / AB pulses	PeriodTime ABDirection Frequency	DINT DINT REAL	Period and frequency are measured according to „quadrature mode“ All 4 edges (pos.A, neg.A, pos.B, neg.B) are processed, i. e. the measured frequency is four times as high as the real frequency, the period time decreases accordingly by factor 4. PeriodTime is the period duration in ns. ABDirection ABDirection = 0 ➔ A-pulse before B-pulse ABDirection = 1 ➔ B-pulse before A-pulse Frequency is given in Hz.
3: Pulse width / duty cycle on A	PeriodTime PulseWidth DutyCycle	DINT DINT REAL	Refers solely to signal A. PeriodTime is the period duration in ns. PulseWidth is the positive pulse width of A. DutyCycle is the duty factor between high- und low-level (DutyCycle[0..1])
4: Up/down counter of A / B pulses	Counter	DINT	Counts edges according to the „quadrature mode“ Counts all 4 edges of A and B (pos.A, neg.A, pos.B, neg.B). When A-pulse is before B-pulse the analysis counts up, when B-pulse is before A-pulse it counts down. „Reset on N“ is active „Divide by 4“ is not active

The following table shows the adjusted parameters:

	Analysis regulation	**1: Pulse counter**	**2: Period / frequency**	**3: Pulse width / duty cycle**	**4: Up/down counter**
	Mode	**Q**	**Q**	**D**irect	**Q**uadrature
Signal edge	pos. A	●[8]	●	High level	●
	neg. A	●	●		●
	pos. B	●	●		●
	neg. B	●	●		●
Function	„Divide by 4“				▬
	„Reset on N“	●			●
	„B as qualifier“				

[8] „○“ = optional; „●“ = preset; „▬“ = not active

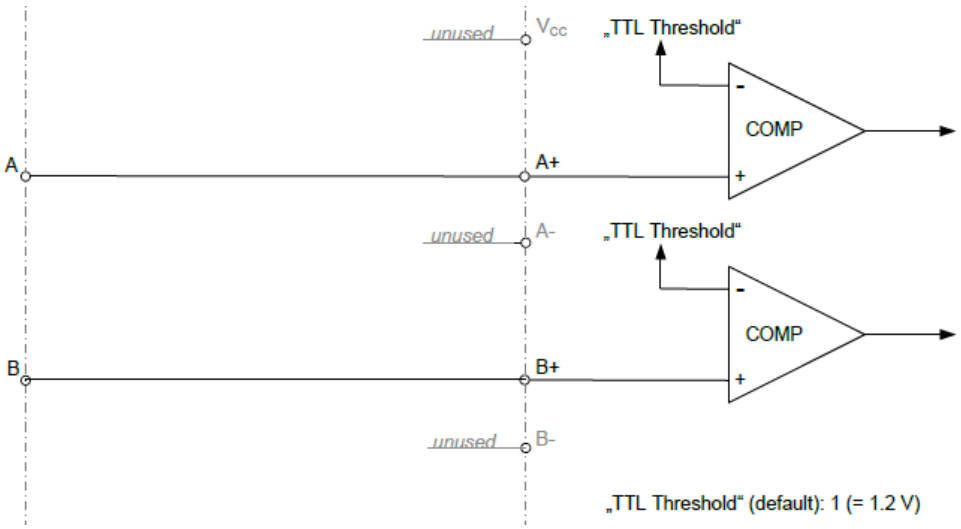
11.2 Connection modes

The following connection modes are only examples and have to be adapted to the respective encoder data sheet of the manufacturer.

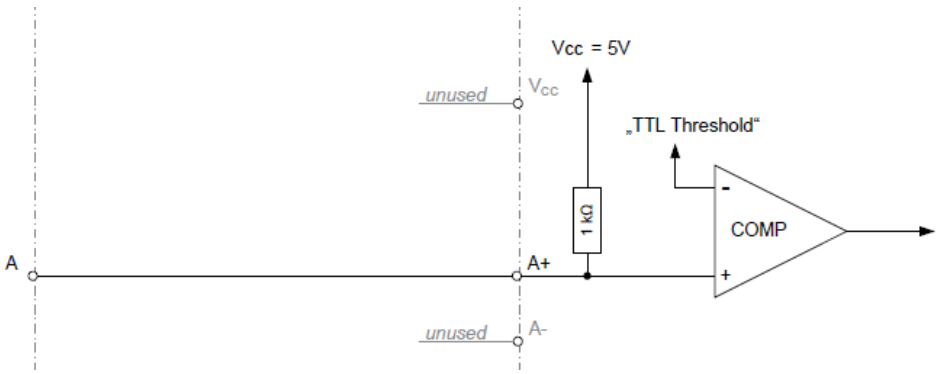
11.2.1 Incremental encoder

11.2.1.1 Single ended („SE“) TTL

Usually, the output circuit of the rotary encoder is designed as **push-pull amplifier**. In this case, the ibaMS4xUCO module is connected as follows:



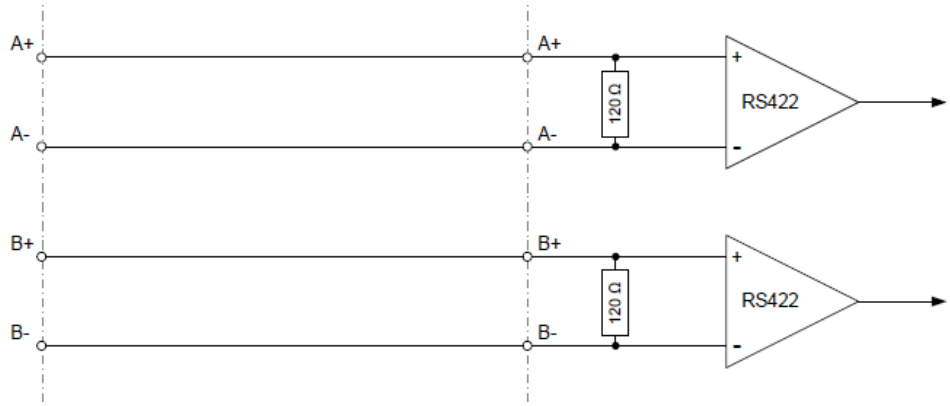
In case the output circuit is an **open collector**, the ibaMS4xUCO module has to supply the required voltage.
For TTL, this can be done using the internal encoder supply (5 V):



You have to do the following entries in the encoder parameter file (XML):

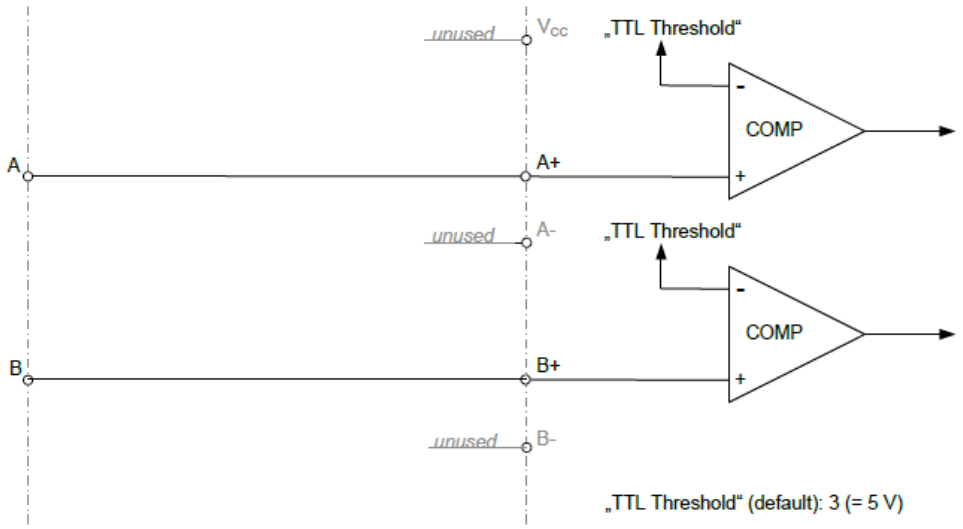
```
<Property Name="Enable5V0ut" Value="false" ReadOnly="true"/>
<Property Name="EnablePullUpInt" Value="true" ReadOnly="true"/>
<Property Name="EnablePullUpExt" Value="false" ReadOnly="true"/>
```

11.2.1.2 Differential („DIF“) TTL

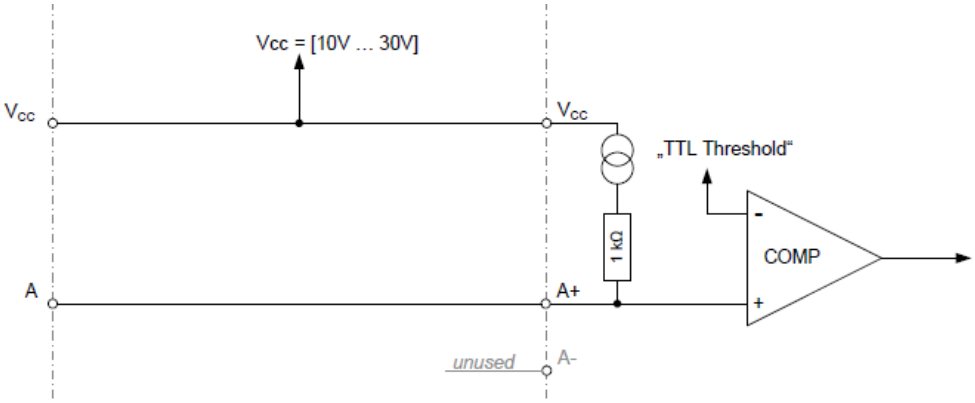


11.2.1.3 Single ended („SE“) HTL

Usually, the output circuit of the rotary encoder is designed as **push-pull amplifier**. In this case, the ibaMS4xUCO module is connected as follows:



In case the output circuit is an **open collector**, the ibaMS4xUCO module has to supply the required voltage.
For an HTL connection, an external voltage supply (typ. 24 V) is required:

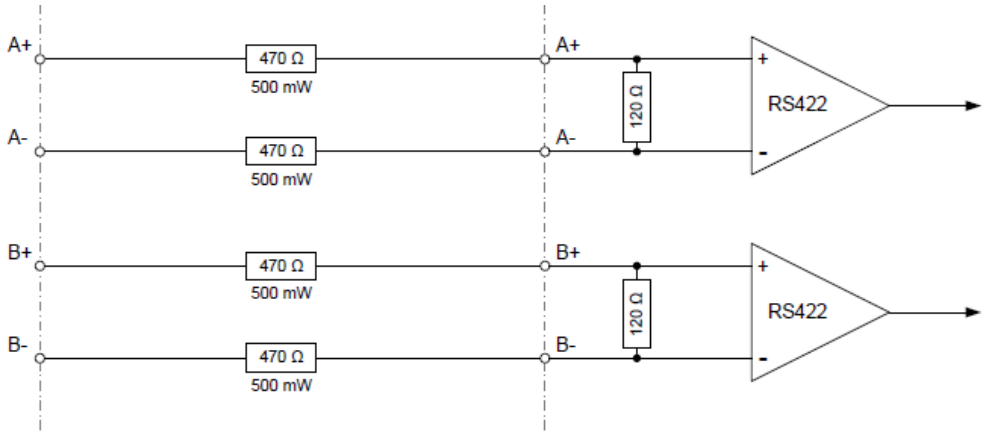


You have to do the following entries in the encoder parameter file (XML):

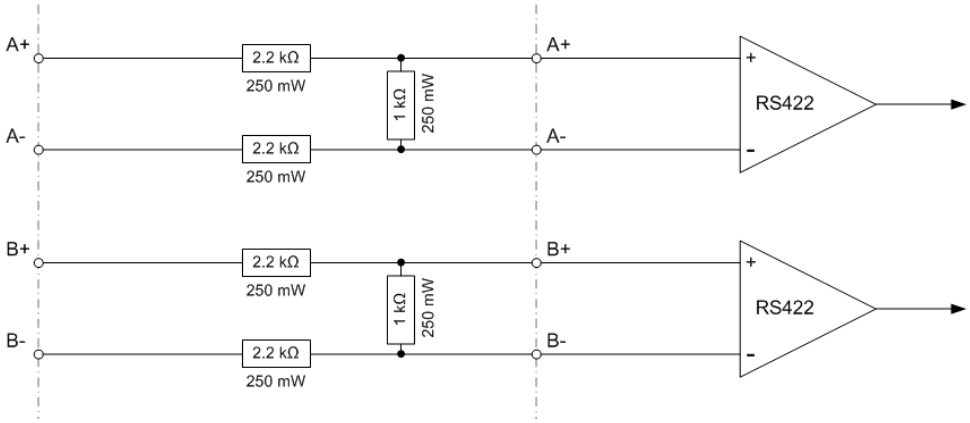
```
<Property Name="Enable5V0ut" Value="false" ReadOnly="true"/>
<Property Name="EnablePullUpInt" Value="false" ReadOnly="true"/>
<Property Name="EnablePullUpExt" Value="true" ReadOnly="true"/>
```

11.2.1.4 Differential („DIF“) HTL

As the differential counter inputs of the ibaMS4xUCO module are designed for TTL, the appropriate series resistors have to be inserted into the signal circuits (here for V_{max} = 30 V):



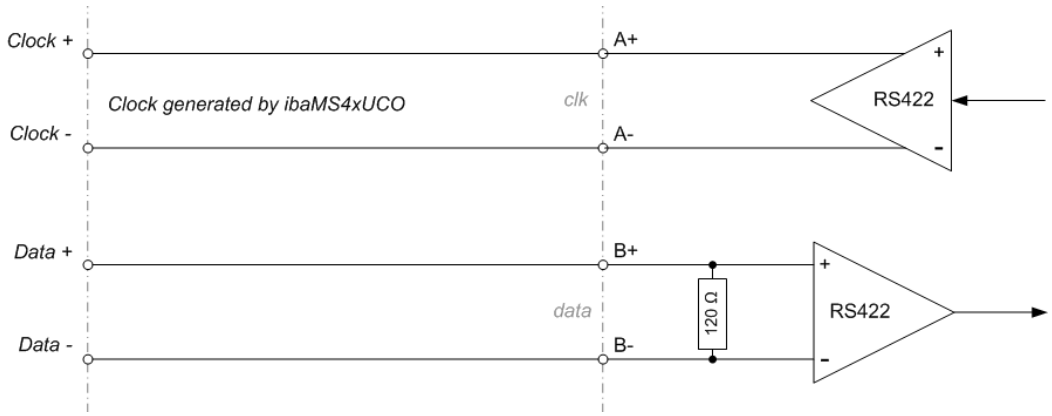
In case you don’t need termination – e. g. you want to connect to an existing system – but have a HTL level (V_{max} = 30 V) you have to insert another appropriate series resistors into the signal circuit.



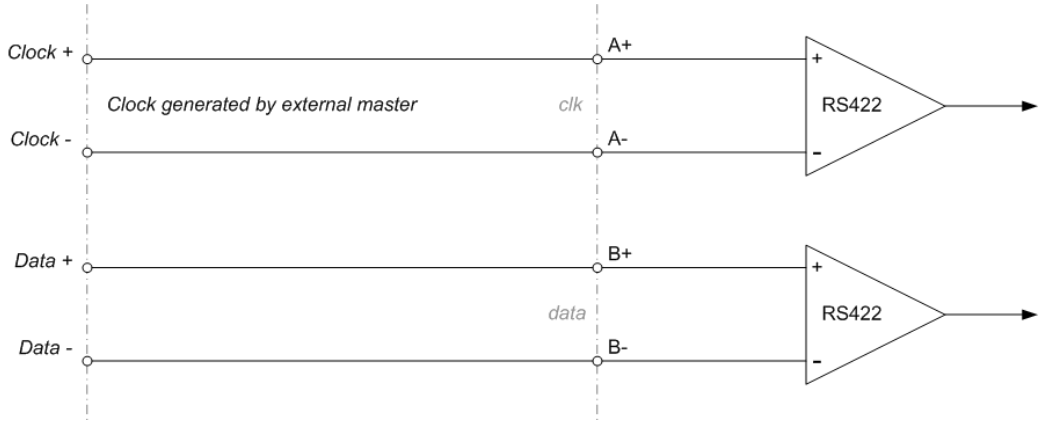
11.2.2 Absolute encoder (SSI)

An absolute encoder (SSI) is only intended as differential („DIF“) and as TTL.

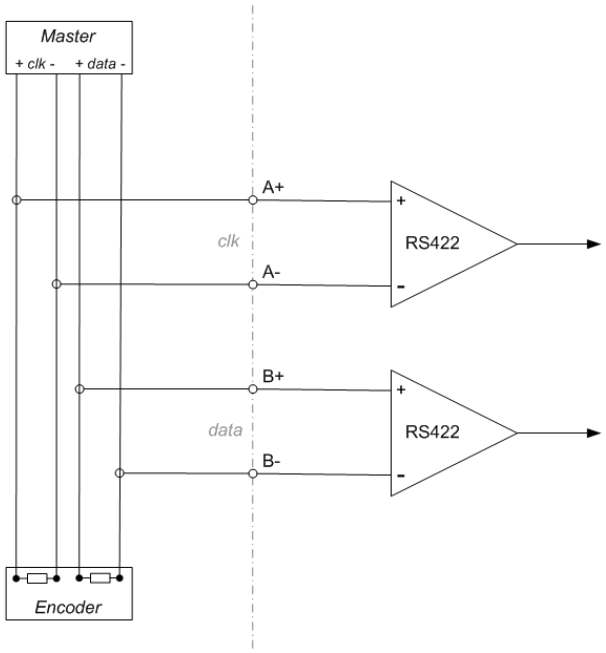
11.2.2.1 SSI master receiver



11.2.2.2 SSI slave receiver



The "slave receiver" function is usually used to be able to listen to an already existing SSI absolute encoder:



Therefore, connected terminating resistors can lead to an incomplete line termination. For this reason, no terminating resistors are connected in this connection example.

11.3 Overview of the encoder parameter file

In the encoder parameter file, the encoder specific parameters, which are based on the manufacturer specific data sheet, are entered.

The encoder parameter file is created as XML file and contains the following three sections:


```
<?xml version="1.0" encoding="utf-8"?>
<Device Version="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<!-- general encoder information -->
        <Properties Name="DeviceInfo">
                <Property Name="VendorName" Value="Vendor"/>
                <Property Name="DeviceName" Value="Encoder-Name"/>
                <Property Name="FileVersion" Value="1.0"/>
                <Property Name="CheckSum" Value="0;0;0;0;0;0;0;0;0;0;0;0;0;0;0;0"/>
        </Properties>
<!-- encoder mode information -->
        <Properties Name="Mode0">
                <Property Name="Mode" Value="0" ReadOnly="false"/>
        </Properties>
        <Properties Name="Mode1">
        <Properties Name="Mode2">
        <Properties Name="Mode3">
        <Properties Name="Mode4">
        <Properties Name="Mode5">
        <Properties Name="Mode6">
<!-- IO configuration -->
        <Properties Name="Signals">
                <!-- Channel Properties (Mode independent) -->
                <Property Name="TTLThreshold" Value="3" ReadOnly="true"/>
                <Property Name="Enable5VOut" Value="false" ReadOnly="true"/>
                <Property Name="EnablePullUpInt" Value="false" ReadOnly="true"/>
                <Property Name="EnablePullUpExt" Value="true" ReadOnly="true"/>
                <Property Name="EnablePullDown" Value="false" ReadOnly="true"/>
                <Property Name="AsyncMode" Value="false" ReadOnly="false"/>
                <Property Name="NoSafeOutput" Value="false" ReadOnly="false"/>
                <!-- Digital Signal Properties (Mode dependent) -->
                <!-- Signal A -->
                <Property Name="Use_A" Value="true" ReadOnly="true"/>
                <Property Name="SingleEnded_A" Value="false" ReadOnly="true"/>
                <Property Name="EnableTermination_A" Value="true" ReadOnly="true"/>
                <Property Name="InvertPolarity_A" Value="false" ReadOnly="true"/>
```

The only property which is always configured, is the „Value“ property”.
All the other properties remain unchanged.

11.3.1 Section 1: General encoder information

```
<!-- general encoder information -->
    <Properties Name="DeviceInfo">
        <Property Name="VendorName" Value="Vendor"/>
        <Property Name="DeviceName" Value="Encoder-Name"/>
        <Property Name="FileVersion" Value="1.0"/>
        <Property Name="CheckSum" Value="0;0;0;0;0;0;0;0;0;0;0;0;0;0;0;0"/>
    </Properties>
```

- ❑ VendorName:
  - Name of the encoder manufacturer (freely selectable)
  - May only contain letters; no spaces allowed.
- ❑ DeviceName:
  - Name of the encoder type (freely selectable)
  - May only contain letters, numbers and minus („-„), no spaces allowed.

Note

The file name of the encoder parameter file derives from DeviceName and VendorName (file extension .xml).

The two character strings under “Value” have to be adopted to the file name 1:1 and have to be connected using an underline („_“):

Syntax: VendorName_DeviceName.xml

Example: Sony_MD50-2N-4N.xml

- ❑ FileVersion:
  In case a versioning is wanted, a freely selectable version number can be edited here.
- ❑ CheckSum:
  Currently unused

11.3.2 Section 2: Encoder modes

Mode 0	concerns all connected encoder versions,
Modes 1 - 4	concern all incremental encoders,
Modes 5 and 6	concern all absolute encoders (SSI)

Depending on the encoder version that is connected, it is recommended to delete the modes that are not currently used from the XML file.

However, mode 0 always has to remain available in both encoder versions.

11.3.2.1 Mode 0: Disabled

```
<Properties Name="Mode0">
        <Property Name="Mode" Value="0" ReadOnly="false"/>
</Properties>
```

The 0 mode describes an encoder that is connected, but disabled. This entry should not be changed and also not be commented out.

11.3.2.2 Mode 1: Pulse counter

```
<Properties Name="Mode1">
        <Property Name="Mode" Value="1" ReadOnly="false"/>
        <Property Name="ResetOnN" Value="true" ReadOnly="true"/>
        <Property Name="QuadratureMode" Value="true" ReadOnly="true"/>
        <Property Name="UseRisingEdgeA" Value="true" ReadOnly="true"/>
        <Property Name="UseFallingEdgeA" Value="true" ReadOnly="true"/>
        <Property Name="UseRisingEdgeB" Value="true" ReadOnly="true"/>
        <Property Name="UseFallingEdgeB" Value="true" ReadOnly="true"/>
</Properties>
```

- Mode:
  The number of the respective mode
- ResetOnN:
  True – resets the counter if there is a high-level on N.
- QuadratureMode:
  - True – counting regulation according to the „quadrature mode“ (all four edges are being counted)
  - False – counting regulation according to the „direct mode“ (only the rising edge of A is being counted).
- UseFalling/RisingEdgeA/B:
  - True – the respective edge is being used for the counting procedure.
  - For the „quadrature mode“, all four edges have to be enabled.
  - For the „Direct Mode“, only „UseRisingEdgeA“ is enabled (optionally, see chapter “B as qualifier”)

11.3.2.3 Mode 2: Period / frequency calculation

```
<Properties Name="Mode2">
        <Property Name="Mode" Value="2" ReadOnly="false"/>
        <Property Name="QuadratureMode" Value="true" ReadOnly="true"/>
        <Property Name="UseRisingEdgeA" Value="true" ReadOnly="true"/>
        <Property Name="UseFallingEdgeA" Value="true" ReadOnly="true"/>
        <Property Name="UseRisingEdgeB" Value="true" ReadOnly="true"/>
        <Property Name="UseFallingEdgeB" Value="true" ReadOnly="true"/>
</Properties>
```

For a description, please see mode1 (pulse counter).

11.3.2.4 Mode 3: Pulse width / duty cycle calculation

```
<Properties Name="Mode3">
        <Property Name="Mode" Value="3" ReadOnly="false"/>
</Properties>
```

- Mode:
  The number of the respective mode

11.3.2.5 Mode 4: Upcounter / Downcounter

```
<Properties Name="Mode4">
        <Property Name="Mode" Value="4" ReadOnly="false"/>
        <Property Name="ResetOnN" Value="true" ReadOnly="true"/>
        <Property Name="DivideCounterBy4" Value="false" ReadOnly="true"/>
</Properties>
```

- Mode:
  The number of the respective counter
- ResetOnN:
  True - resets the counter if there is a high-level on N.
- DivideCounterBy4:
  Due to the enabled counting regulations according to the „quadrature mode“, the counter value can be divided automatically by 4 using “True”.

11.3.2.6 Mode 5: SSI slave receiver

```
<Properties Name="Mode5">
        <Property Name="Mode" Value="5" ReadOnly="false"/>
        <Property Name="SSIClockTime" Value="10" ReadOnly="true"/>
        <Property Name="SkipParity" Value="false" ReadOnly="true"/>
        <Property Name="GrayDecode" Value="false" ReadOnly="true"/>
</Properties>
```

- Mode:
  The number of the respective mode
- SSIClockTime:
  Pause detection between the cycles, min. twice the cycle
  1: 5.12 µs
  2: 2 * 5.12 µs = 10.24 µs
  x: x * 5.12 µs
- SkipParity:
  Skips parity bit; do not use this option
- GrayDecode:
  - False: Decoding according to SSI-Binary
  - True: Decoding according to SSI-Gray

11.3.2.7 Mode 6: SSI Master receiver

```
<Properties Name="Mode6">
        <Property Name="Mode" Value="6" ReadOnly="false"/>
        <Property Name="SSIClockNumber" Value="13" ReadOnly="true"/>
        <Property Name="SSIClockPeriod" Value="2" ReadOnly="true"/>
        <Property Name="SkipParity" Value="true" ReadOnly="true"/>
        <Property Name="GrayDecode" Value="true" ReadOnly="true"/>
</Properties>
```

- Mode:
  The number of the respective mode
- SSIClockNumber:
  Bit width / resolution of the SSI data (e.g..: „13“ = 13 Bit resolution)
- SSIClockPeriod:
  Master clock of the SSI
  1: 2.56 µs
  2: 2 * 2.56 µs = 5.12 µs
  x: x * 2.56 µs
- SkipParity:
  Skips parity bit; do not use this option
- GrayDecode:
  - False: Decoding according to SSI-Binary
  - True: Decoding according to SSI-Gray

11.3.3 Section 3: IO configuration

```
<!-- IO configuration -->
    <Properties Name="Signals">
        <!-- Channel Properties (Mode independent) -->
        <Property Name="TTLThreshold" Value="3" ReadOnly="true"/>
        <Property Name="Enable5VOut" Value="false" ReadOnly="true"/>
        <Property Name="EnablePullUpInt" Value="false" ReadOnly="true"/>
        <Property Name="EnablePullUpExt" Value="true" ReadOnly="true"/>
        <Property Name="EnablePullDown" Value="false" ReadOnly="true"/>
        <Property Name="AsyncMode" Value="false" ReadOnly="false"/>
        <Property Name="NoSafeOutput" Value="false" ReadOnly="false"/>
        <!-- Digital Signal Properties (Mode dependent) -->
        <!-- Signal A -->
        <Property Name="Use_A" Value="true" ReadOnly="true"/>
        <Property Name="SingleEnded_A" Value="false" ReadOnly="true"/>
        <Property Name="EnableTermination_A" Value="true" ReadOnly="true"/>
        <Property Name="InvertPolarity_A" Value="false" ReadOnly="true"/>
        <Property Name="EnableAnalogFilter_A" Value="false" ReadOnly="false"/>
        <Property Name="FilterMode_A" Value="0" ReadOnly="false"/>
        <Property Name="FilterTime_A" Value="1000" ReadOnly="false"/>
        <Property Name="SafeOutputValue_A" Value="false"/>
        <!-- Signal B -->
        <Property Name="Use_B" Value="true" ReadOnly="true"/>
        <Property Name="SingleEnded_B" Value="false" ReadOnly="true"/>
        <Property Name="EnableTermination_B" Value="true" ReadOnly="true"/>
        <Property Name="InvertPolarity_B" Value="false" ReadOnly="true"/>
        <Property Name="EnableAnalogFilter_B" Value="false" ReadOnly="false"/>
        <Property Name="FilterMode_B" Value="0" ReadOnly="false"/>
        <Property Name="FilterTime_B" Value="1000" ReadOnly="false"/>
        <Property Name="SafeOutputValue_B" Value="false"/>
        <!-- Signal N -->
        <Property Name="Use_N" Value="false" ReadOnly="true"/>
        <Property Name="SingleEnded_N" Value="false" ReadOnly="true"/>
        <Property Name="EnableTermination_N" Value="true" ReadOnly="true"/>
        <Property Name="InvertPolarity_N" Value="false" ReadOnly="true"/>
        <Property Name="EnableAnalogFilter_N" Value="false" ReadOnly="false"/>
        <Property Name="FilterMode_N" Value="0" ReadOnly="false"/>
        <Property Name="FilterTime_N" Value="1000" ReadOnly="false"/>
        <Property Name="SafeOutputValue_N" Value="false"/>
        <!-- Signal MF -->
        <Property Name="Use_MF" Value="false" ReadOnly="true"/>
        <Property Name="EnablePullup_MF" Value="true" ReadOnly="true"/>
        <Property Name="InvertPolarity_MF" Value="false" ReadOnly="true"/>
        <Property Name="EnableAnalogFilter_MF" Value="true" ReadOnly="false"/>
        <Property Name="FilterMode_MF" Value="0" ReadOnly="false"/>
        <Property Name="FilterTime_MF" Value="1000" ReadOnly="false"/>
        <!-- Signal General Purpose Dig out -->
        <Property Name="SafeOutputValue_Dig" Value="false"/>
    </Properties>
```

For an overview of the wiring, please also see chap. 7.4.3

- „SE“: single ended
- „DIF“: differential

11.3.3.1 Channel properties (mode independent)

```
<!-- Channel Properties (Mode independent) -->
<Property Name="TTLThreshold" Value="3" ReadOnly="true"/>
<Property Name="Enable5VOut" Value="false" ReadOnly="true"/>
<Property Name="EnablePullUpInt" Value="false" ReadOnly="true"/>
<Property Name="EnablePullUpExt" Value="true" ReadOnly="true"/>
<Property Name="EnablePullDown" Value="false" ReadOnly="true"/>
<Property Name="AsyncMode" Value="false" ReadOnly="false"/>
<Property Name="NoSafeOutput" Value="false" ReadOnly="false"/>
```

- TTLThreshold:
  Only for „SE“, detection between log. „0“ and log. „1“.
  - 0: 1 V
  - 1: 1.2 V - default for TTL (5 V)
  - 2: 2.4 V
  - 3: 5 V - default for HTL (24 V)
- Enable5VOut:
  Internal encoder supply 5 V DC connected to external V_{cc}
- EnablePullUpInt:
  Only for „SE“ and open collector connection, internal supply (V_{cc} = 5 V) 1 kOhm pullup (only A, B, N) connected
- EnablePullUpExt:
  Only for „SE“ and open collector connection, external supply (V_{cc} = 24 V) 1 kOhm pullup (only A, B, N) connected
- EnablePullDown:
  1 kOhm pulldown resistor connected (only A, B, N); however, usually always “false”
- AsyncMode:
  Does not have any function; however, always needs to be „false“ and has to be commented in
- NoSafeOutput:
  Does not have any function; however, always needs to be „false“ and has to be commented in

11.3.3.2 Digital signal properties (mode dependent) – Signal A,B,N

```
<!-- Digital Signal Properties (Mode dependent) -->
<!-- Signal A -->
<Property Name="Use_A" Value="true" ReadOnly="true"/>
<Property Name="SingleEnded_A" Value="false" ReadOnly="true"/>
<Property Name="EnableTermination_A" Value="true" ReadOnly="true"/>
<Property Name="InvertPolarity_A" Value="false" ReadOnly="true"/>
<Property Name="EnableAnalogFilter_A" Value="false" ReadOnly="false"/>
<Property Name="FilterMode_A" Value="0" ReadOnly="false"/>
<Property Name="FilterTime_A" Value="1000" ReadOnly="false"/>
<Property Name="SafeOutputValue_A" Value="false"/>
```

- Use_A:
  Channel enabled
- SingleEnded_A:
  Switching „SE“ – „DIF“
- EnableTermination_A:
  Only for „DIF“, 120 Ohm termination between A+ and A-
- InvertPolarity_A:
  Inverts signal polarity
- EnableAnalogFilter_A:
  Only for „SE“, enables analog RC low pass filter with 180 kHz
- FilterMode_A:
  Enables debounce filter
  - 0: Off (without filter)
  - 1: Stretch rising edge
  - 2: Stretch falling edge
  - 3: Stretch both edges
  - 4: Delay both edges
- FilterTime_A:
  Debounce time of the enabled debounce filter, in µs [1 µs … 65535 µs]
- SafeOutputValue_A:
  Does not have any function; however, always needs to be „false“and has to remain commented in

11.3.3.3 Digital signal properties (mode dependent) – signal MF

The MF channel is only designed for a single ended (“SE”) connection.

```
<!-- Signal MF -->
<Property Name="Use_MF" Value="false" ReadOnly="true"/>
<Property Name="EnablePullup_MF" Value="true" ReadOnly="true"/>
<Property Name="InvertPolarity_MF" Value="false" ReadOnly="true"/>
<Property Name="EnableAnalogFilter_MF" Value="true" ReadOnly="false"/>
<Property Name="FilterMode_MF" Value="0" ReadOnly="false"/>
<Property Name="FilterTime_MF" Value="1000" ReadOnly="false"/>
```

- Use_MF:
  Channel enabled
- EnablePullUp_MF:
  Only for open collector connection, internal supply (V_{cc} = 5 V) 1 kOhm pullup (only A, B, N) connected
- Only for open collector connection,
  internal supply (V_{cc} = 5 V) 250 Ohm pullup connected
- InvertPolarity_MF:
  Inverts signal polarity
- EnableAnalogFilter_MF:
  Enables the analog RC low-pass filter with 180 kHz
- FilterMode_MF:
  Enables debounce filter
  - 0: Off (without filter)
  - 1: Stretch rising edge
  - 2: Stretch falling edge
  - 3: Stretch both edges
  - 4: Delay both edges
  - FilterTime_MF:
    Debounce time of the enabled debounce filter, in µs [1 µs … 65535 µs]

11.3.3.4 Digital signal properties (mode dependent) – signal “Dig out”

```
<!-- Signal General Purpose Dig out -->
<Property Name="SafeOutputValue_Dig" Value="false"/>
```

- SafeOutputValue_Dig:
  Does not have any function; however, always needs to be „false“ and has to be commented in

11.4 Tips

The following calculations require the number of pulses of the encoder (pulses per revolution). This is specified in the data sheet of the encoder.

The specified number of pulses, however, always refers to a measurement in "direct mode".

If the measurement is carried out in "quadrature mode" (higher accuracy), a factor of 4 for the number of pulses must be taken into account in all calculations. Otherwise the result of the calculations below is in "quadrature mode" either too large or too small by a factor of 4.

11.4.1 Speed calculation

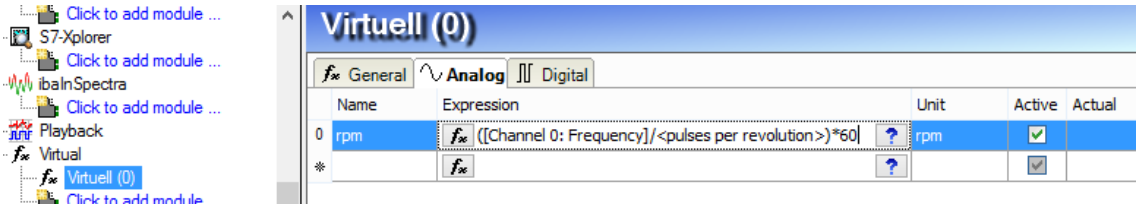
With incremental encoders, a measured frequency may be converted into speed using a virtual module in ibaPDA. For information about creation and handling of virtual modules, refer to the ibaPDA manual.

This is the expression for calculating the speed in a virtual module:

```
Revolutions/second = ([measured frequency] / <pulses per revolution>)
```

or

```
Revolutions/minute = ([measured frequency] / <pulses per revolution>) *
60
```



11.4.2 Distance calculation

With incremental encoders, measured pulses can be converted into a distance using a virtual module in ibaPDA. For information about creation and handling of virtual modules, refer to the ibaPDA manual.

If a distance is to be calculated using the number of pulses, not only the pulses per revolution of the encoder must be known, but also the radius or circumference of the measuring wheel.

```
<pulses per revolution>
```

```
<circumference of the measuring wheel> = π * < diameter of the measuring
wheel>
```

The expression for the calculation is as follows:

```
Distance per pulse = <circumference of the measuring wheel> / < pulses
per revolution>
```

Or

```
Distance = (circumference of the measuring wheel> * <pulses>) / <pulses
per revolution>
```

The unit of the distance (cm, inches, etc.) results from the given unit of the measuring wheel circumference.

However, if you want to know the required pulses for a certain distance, you have to take the following approach:

```
Pulses per distance = (<distance> / <circumference of the measuring wheel>) * <pulses per revolution>
```

Note

The resolution (pulses per revolution) of the rotary encoder is important for distance measurement.

This has to be determined in advance. The resolution depends on the circumference of the measuring wheel and the required measuring accuracy.

```
<circumference of the measuring wheel> = π * <diameter of the measuring wheel>
```

```
<measuring accuracy>
```

Resolution:

```
<pulses per revolution> = <circumference of the measuring wheel> / <measuring accuracy>.
```

12 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

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For contact data of your regional iba office or representative please refer to our web site **www.iba-ag.com.**