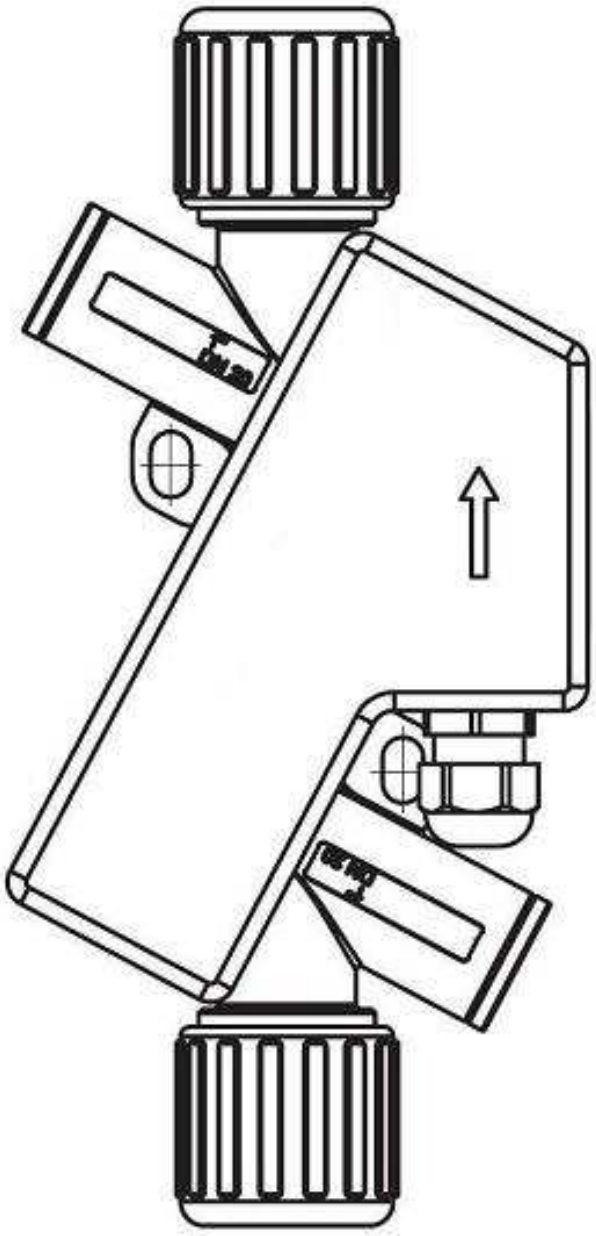
BA 008E/FM400i/01.11

Valid starting from
Hardware V 2.0
Software V 1.25

Flowmax® 400i

Ultrasonic flow metering / dosing device

Operating manual



MIB GmbH
Messtechnik & Industrieberatung

General safety instructions

Warning!

Please always observe the following safety instructions!

Intended use

- The flow meter Flowmax 400i may only be used for measuring the flow of pure, homogeneous liquids.
- The volume flow meter Flowmax 400i is built operationally safe according to the latest state of the art and takes the relevant regulations according to EN 61010 (corresponds to VDE 0411 "Safety specifications for electrical measurement, control and laboratory devices“) into consideration.

  Please pay attention to the safety instructions with the following pictograms in these operating instructions:

  
  Note!

  
  Attention!

  Warning!
- The manufacturer cannot be held liable for any damage from inappropriate or unintended use. Conversions and/or changes to the flow meter may only be made, if they are expressly admissible according to these operating instructions.

Personnel for installation, commissioning and operation

- Assembly, electronic installation, commissioning and maintenance of the flow meter must be carried out by qualified personnel authorized by the operator of the plant. The qualified personnel must have read and understood these operating instructions and must follow its instructions.
- The installer has to ensure that the flow meter is correctly connected according to the electric connection diagrams.

Technological progress

The manufacturer reserves the right to adapt the technological specifications to state of the art technological developments without special prior notice. Further information about the latest updates and potential additions to these operating instructions are available from MIB.

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1. Planning information

1.1 Areas of application

The flow measurement device Flowmax 400i is in particular suited for measuring dynamic events in pipes and tubes. Liquids are measured. It is used among others in

- Chemicals supply for controlling, logistics, monitoring
- Hook-up-boxes for controlling, logistics, monitoring
- Production machinery for control and monitoring of formulas
- Valve control for continuous release of liquid volumes
- Supply with de-ionized water
- Very dynamic processes with dosing times of below 1 second

It has the following characteristics:

- No movable parts and therefore no wear
- High repeatability
- Easy to clean
- Safe manipulation
- Compact design
- Integrated detection of empty conduits
- Integrated dosing function with possibility of pre-setting and adjusting amounts
- Excellent chemical resistance

1.2 Measuring principle

It usually takes more energy to swim against the flow than with the flow. The ultrasonic flow measurement according to the phase-difference procedure is based on this simple physical fact:
Two sensors that are located opposite from each other alternatingly transmit and receive ultrasonic signals. With medium at standstill both sensors receive the transmitted ultrasonic signals in the same phase, i.e. without phase difference. With medium flowing there is a phase shift. It differs when measured in direction of the flow from when measured against the direction of the flow. This phase difference is directly proportional to the flow rate.
The flow rate and the known diameter of the pipe are used to determine the flow volume.

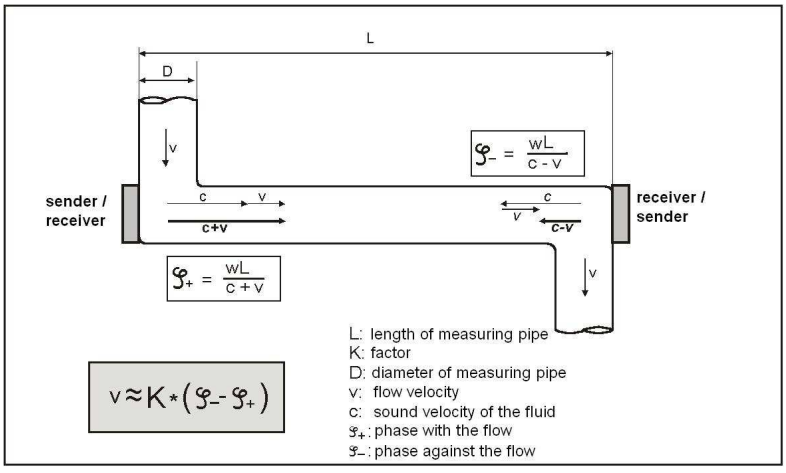


Fig. 1: Presentation of the principle of ultrasonic flow measuring

1.3 Operational safety

Comprehensive self-tests ensure highest possible operational safety.

The protection class is IP 65.

Flowmax 400i meets the general EMC immunity requirements according to CE, EN 50081-2, and EN 50082-2.

Concerning the low voltage directive Flowmax 400i meets the safety requirements according to EN 60601-1.

Note:
Flowmax 400i is available with different connection versions. Therese are:10-wire Teflon cable (lengths 5m), M12x1 5-pin plug, M12x1 8-pin plug. Depending on the connection configuration not all functions described in this manual are available. The function volume of the every flow meter is described in the function table, chapter “2.3 Electrical wiring” (page 7) or on the nameplate.


Note!

1.4 Dosing function

Dosing can basically be realized in two ways:

1. Flowmax 400i as dosing device (dosing control via Flowmax 400i)

   Flowmax 400i does the entire dosing control. The dosing quantity (e.g. 400 ml) is pre-set in the Flowmax 400i via the digital interface with the operating software. Dosing starts, as soon as line start of dosing is wired to 24 V, e.g. via a pushbutton. Flowmax 400i will now open the dosing valve via the output configured for it. When the pre-set dosing quantity is reached, the dosing valve is closed via the above output. The 2nd output can be used independently for signaling of empty pipe detection, limit control, pulse output or signaling negative flow.

2. Flowmax 400i as flow meter (dosing control via dosing equipment)

   The dosing equipment is responsible for the entire dosing control. Therefore, the dosing quantity is fixed in the dosing equipment control during commissioning by pre-selecting the meter pulses. Dosing starts, when the relevant pushbutton of the dosing equipment is pushed. The control will now open the dosing valve. From now on Flowmax 400i will send a voltage pulse to the control for each volume unit that has flown through (e.g. per 1ml). When the pre-selected impulse quantity is reached, the control closes the dosing valve. In this case, output 1 is used to send out pulses, output 2 is independently usable for empty pipe detection, limit control or signaling negative flow.

2. Assembly and installation

2.1 Installation instructions

The nameplate of Flowmax 400i shows an arrow symbolizing the direction of the flow measurement. The flow meter has to be installed in a way so that the flow-through is in direction of the arrow.

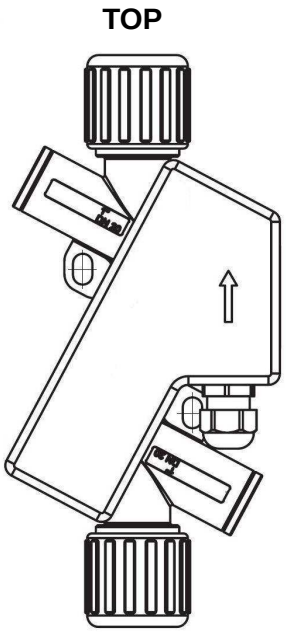


Fig. 2: Installation position of Flowmax 400i

For fastest possible gas detection the pipe distance between tank and Flowmax 400i should be kept as short as possible. Accurate measurement can only be guaranteed, if the pipe is completely filled and if it is ensured that the liquid does not outgas.

Notwithstanding it may be advantageous for dosing applications to place the Flowmax 400i as close as possible to the dosing valve, since tubes increase their cross-section depending on the system pressure. This may lead to repeatable differences.

Please note that it is absolutely necessary to have a back pressure of at least 0.3 bar rel. (corresponds to 3 m water column) at the outlet of the Flowmax 400i.

Solid matter particles that are carried along may result in measuring errors.

When using pumps, Flowmax 400i must be installed in flow direction behind the pump, on the pressure side, in order to ensure sufficient pressure. Regard the maximum pressure step of the Flowmax 400i.

For correct volume flow measurements straight and unobstructed inflow and outflow zones for Flowmax 400i have to be observed. Starting from the connection thread these have to be at least:

	3/8“	1/2“	3/4“	1“
Inflow zone	5 cm	5 cm	40 cm	100 cm
Outflow zone	0 cm	0 cm	20 cm	20 cm

2.2 Assembly of the flow meter

Flowmax 400i has two ears with 8 mm x 13 mm elongated holes (for dimensions see p. 13, technical specifications) for attachment to a fixed base. These elongated holes allow attachment to on-site constructions.

Note!

2.3 Electrical wiring

The flow meter must not be installed, wired or disassembled when live (operating voltage). For any of these activities interrupt power supply of Flowmax 400i.

Attention!

Connection configuration with outlets defined by manufacturer
The outlets may be re-programmed for specific applications

Pin	Function	Description
3	L-	Ground: 0 V
1	L+	Voltage supply: 18...30 VDC
2	Pulse output Q1 alternative: 1. Empty-pipe output 2. Dosing output 3. Limit-control output 4. Negative flow	Digital Output Q1 Freely adjustable ranging from 0.1 to 3000 ml/pulse in 0.1 ml/pulse steps, npn-Transistor, max. load 30V/100mA. Configurable output of 0V or 24V when pipe is empty. Configurable output of 0V or 24V via dosing-menu by FlowSoft. Configurable output of 0V or 24V when reaching upper or lower limit Configurable output of 0V or 24V when liquid flows in negative direction
4	Communication	Communication interface
5	Analog output QA	4....20mA; 0....20mA Example: 0l/min => 4mA 60l/min => 20mA Alert => 2mA (4-20mA, depending on the configured limits)

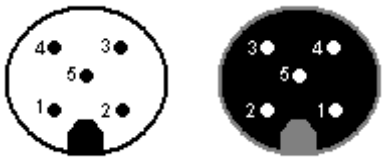


Fig.3: Pin code: Connection plug / socket

3. Commissioning

Attention: while commissioning take care to run the Basic Trim (FlowSoft Medium) with filled advice. Repeat this action until Phase-window and Receiving Amplitude reach a steady value.

3.1 Operation

If Flowmax 400i is used as volume flow meter for water or water-like liquids according to section 1.3.2, it will not require on-site manipulation, because the following parameters set by the manufacturer will guarantee optimum functionality (see calibration protocol). Notwithstanding the Flowmax 400i may also be supplied with customized settings. The coordination must be done with the purchase order.


Note!

If necessary, e.g. if viscosity and/or speed of sound deviate strongly from water, the pre-set parameters can be individually adjusted with the help of the integrated interface and the FlowSoft service software. This is always necessary when using Flowmax 400i as a dosing device according to section 1.3.1. This requires the USB to RS485-Converter Sonic.

The following parameters may be changed to settings suitable for the individual conditions:

- Digital output 1 (Q1)
- Digital output 2 (Q2)
- Analog output QA
- Flow range, for which shall apply 4...20 mA
- Pulse value
- Creeping suppression
- Dosing input
- Optimization of measurement curve with up to 8 interpolation values (medium matrix)
- Among others, see FlowSoft operating instructions

3.2 Functionalities of flow meter and default settings

Digital output Q1

Digital output 1 may be used as pulse output, empty pipe detection, for switching dosing valve or limit control. By using FlowSoft it is possible to switch between npn and pnp-transistor logic. In case of inductive load a freewheeling diode has to be connected parallel to the coil. For detailed information see section 5.2 Technical specifications.

Note!

Flowmax 44i npn-out connected to a counter

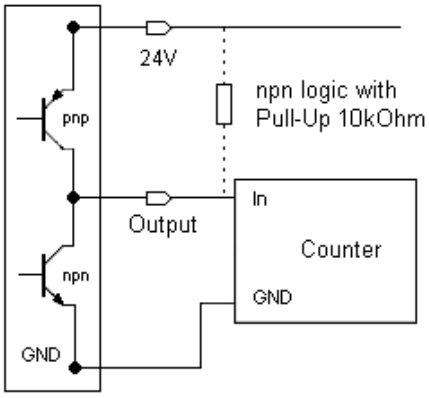


Fig.4: Connecting output 1 to external counter

Setting area: off, pulse output, empty pipe, dosing output, lower limit, upper limit, negative flow

Digital output Q2

Digital outputs 2 may be used as pulse output, empty pipe detection, for switching dosing valve, limit control or flow direction control. See chapter 2.3 table connection.

Note!

The npn or pnp logic can be chosen . When the output is connected to a inductive consumer a free-wheeling diode has to be installed parallel to the load. For detailed information see section 5.2 Technical specifications.

Flowmax 44i pnp-out connected to a relay

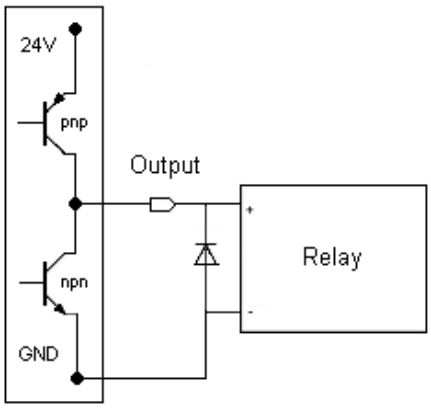


Fig.5: Connecting output 2 to relay

Setting area: off, pulse output, empty pipe, dosing output, lower limit, upper limit, negative flow

Analog output QA

The analog output is available as current output 4-20mA or 0-20mA. Type depending on purchase order. As a standard it comes with current output 4-20mA. It can also be switched off with by using FlowSoft operating software. This reduces the need of current of the Flowmax 400i.

The current output outputs flows from 0 to 22mA as measure for the flow or the state of the measuring pipe.

The values here signify for 4-20mA configuration:

- 20 mA the upper limit of the relevant measuring area
- 4 mA the lower limit of the relevant measuring area
- 3,8mA undershoot the lower limit
- 22 mA overshoot the upper limit
- 2 mA empty pipe


Note!

Upper and lower limit parameters can be set freely within the type-specific measuring areas of the device. By default zero flow is set at 4 mA and the respective maximum flow is set at 20 mA. For detailed information see section 5.2 Technical specifications.

Setting range: 0-20mA, 4-20mA, off


Attention!

When current output is used make sure the load is not higher than 500Ohm. A higher load may cause the device can not provide the maximum current of 22mA.

Pulse value

This determines for what flow volumes an output pulse will be emitted.


Attention!

Choose configuration such as to neither exceed the maximum output frequency of the Flowmax 400i (10kHz) nor the maximum input frequency of the control.

Example: 2,0 ml/Pulse

This means: a pulse is emitted every 2.0 ml.
Setting range: 0,1...3000,0 ml/Pulse, in 0,1 ml/Pulse steps
Default setting: 1,0 ml/Pulse

Creeping suppression

The creeping suppression serves the purpose of excluding flows from the measurement that can evolve through convection in a narrow frame around zero, even with a closed valve. At the factory, the creeping suppression is set at a reasonable standard value in relation to the cross-section of the flow meter.

Attention!

There are higher tolerances below the standard default settings, see also section 5.2, measurement errors!

The creeping suppression works with a hysteresis of ± 25%.

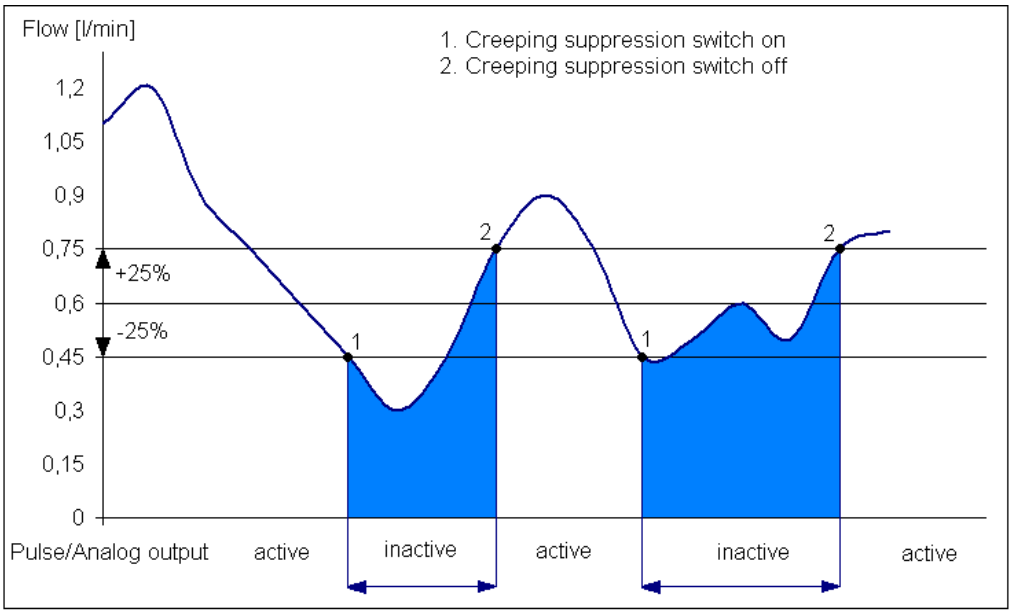


Fig.6: Function of the creeping suppression illustrated with 0.6 l/min

Example: Creeping suppression = 0,6 l/min
If the flow rate is lower than 0.45 l/min the pulse output/analog output becomes inactive. If the flow rate exceeds 0.75 l/min a pulse is output again and added to the quantity counter. Similarly, a value is transmitted to the analog output again.

Note!

Setting range: 0,0...20 l/min, in 0,006 l/min steps
Default settings: 0,09 l/min for 3/8”
0,3 l/min for 1/2”
0,9 l/min for 3/4”
1,2 l/min for 1”

Digital input

Flowmax 400i has a digital input that is programmable to following functions: dosing input, set offset, creeping suppression inactive. In order to start a dosing process, wiring to 24V DC is required. The condition is the configuration of the dosing parameters with the FlowSoft service software via the USB to RS485 Converter Sonic.

Dosing input is debounced so that re-start is not possible during a running dosing process. After changing configurations via FlowSoft a restart of the device is needed to activate the function.

3.3 Overview of default settings

Function	Default settings
Digital output 1(Q1)	Pulse output
Digital output 2(Q2)	Empty pipe detection
Digital input	No function assigned
Analog output QA	Current output
Current output	4-20mA
	6 l/min at 3/8“ 24 l/min at 1/2“ 60 l/min at 3/4“ 120 l/min at 1“
Pulse value	1 ml/pulse
Creeping suppression	0.09 l/min at 3/8“ 0.3 l/min at 1/2“ 0.9 l/min at 3/4“ 1.2 l/min at 1“

3.4 General Information

Please check the following before switching on the flow meter for the first time:


Note!

- Check the electrical connections and cable allocations
- Check the installation position of the flow meter. Are the direction of the arrow on the name plate and the actual flow direction in the pipe congruent?
- Is the measurement pipe completely filled with fluid?

When everything has been checked and the relevant conditions are met switch on power supply.

Now, Flowmax 400i is operational!

4. Exchange of measuring device


Attention!

- Switch off power supply before disconnecting the electrical connections.

- Please note that after exchanging the flow meter

a) potentially the programming of the previous flow meter should be taken on.
b) a SET quantity has to be set when using the dosing function.


Note!

If a change of the configuration of the device is necessary, the FlowSoft programming software and a USB to RS485-Converter as well as a PC are required (see section 6. Accessories).

Repair, hazardous substances

Before sending the flow meter Flowmax 400i to MIB for repair, the following measures have to be taken:

- Remove any adhering residues of the medium. Fully rinse measuring pipe. Please pay special attention to the area of the process fittings to which residues of the medium to be measured may adhere. This is particularly important, if the medium to be measured is health hazardous.

  Not or just insufficient cleaned devices will be returned to the sender for cleaning without having been checked.


Attention!

- Please send a note with the flow meter with a precise description of the error, the application as well as the physical-chemical properties of the medium to be measured.

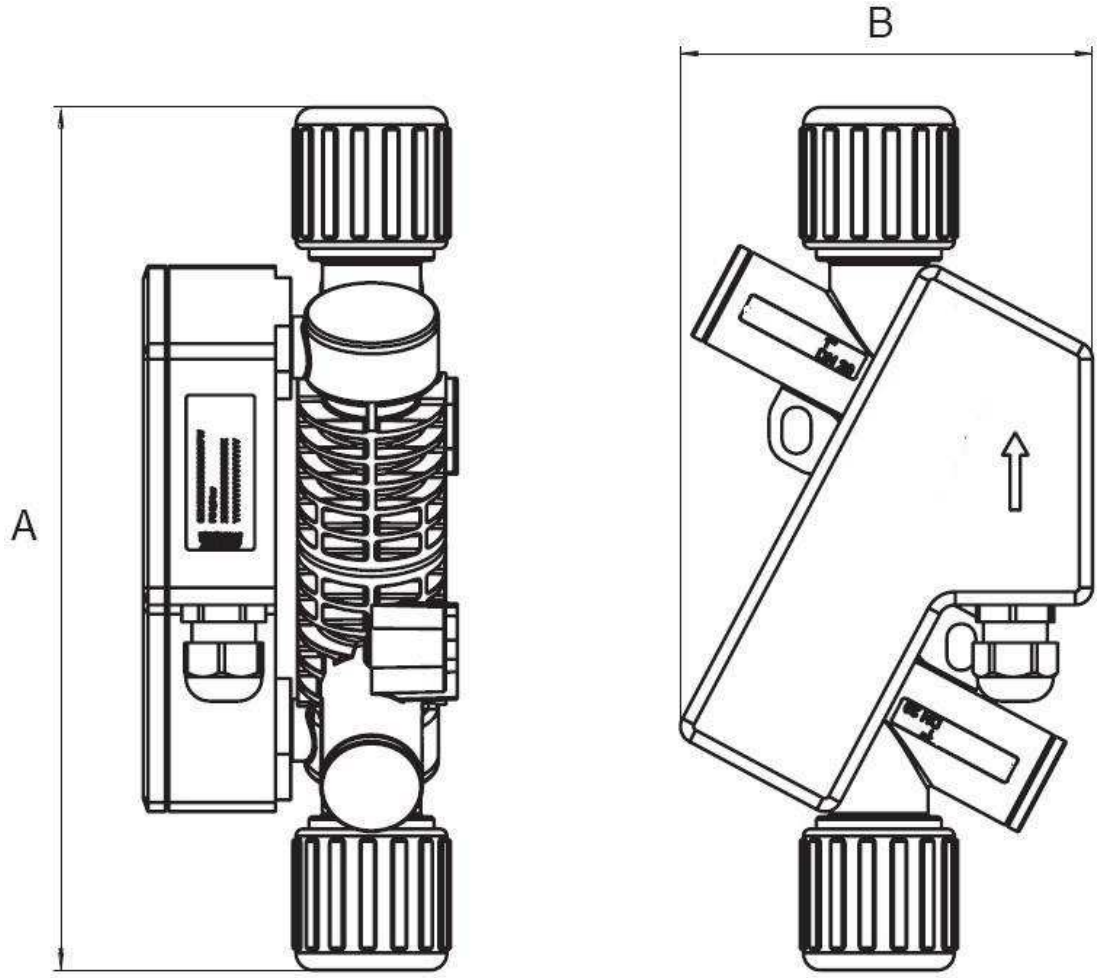
The owner of the flow meter will be charged for costs incurred because of inadequate cleaning of the flow meter, for potential disposal or personal injury such as chemical burns etc.

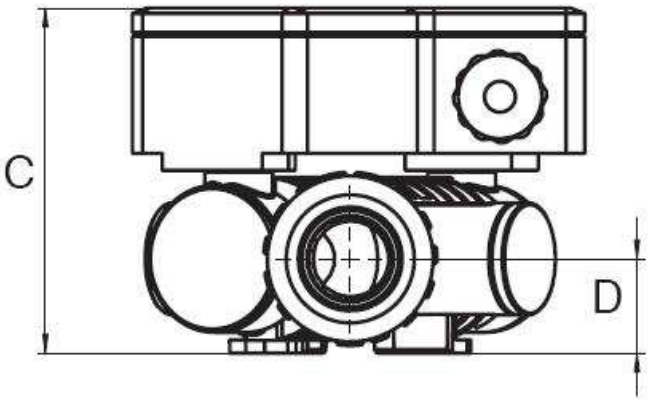

Attention!

In order to be able to process your repair order fast and smoothly it is important that you name a contact person including phone and fax number as well as e-mail address, who is able to answer potential technical questions of our service and support staff.

5. Technical specifications

5.1 Dimensions and weight





Nominal width	Length A [mm]	Width B [mm]	Height C [mm]	Height of axis D [mm]	Weight [kg]
3/8"	218,0	120,0	79,0	16	1,1
1/2"	219,5	120,0	79,0	16	1,1
3/4"	227,0	120,0	82,0	19	1,1
1"	251,0	120,0	91,5	25	1,3

5.2 Technical specifications

Housing

Nominal diameters	3/8“, 1/2“, 3/4“, 1“
Connection	Flare
Medium temperature	0...+60℃
Protection class	IP 65
Pressure nominal	PN 6
Material	all parts in contact with medium made of PFA Flare nut: PVDF or PFA Electronics housing: PP

Electronics

Power supply	18...30VDC, 3,6W
Connection	10-wire Teflon cable (5m), plug 8 pins, plug 5 pins
Ambient temperature	-20....+60℃
Current output QA	0/4...20 mA Lower- and upper limit adjustable, Ground connected to supply ground Error Signal according to NAMUR NE43
Digital output Q1 /2	via transistor npn- and pnp-logic max. 30V/100mA output voltage according to DIN 19240: ≤5V means LOW ≥12V means HIGH Short cut resistant Frequency 0....10kHz
Data interface	Data interface for parameterize
Measurement error	± 1% v.M ± 3 mm/s Reference conditions (VDE/VDI 2642)
Measuring ranges	3/8“: 0.....6 l/min 1/2“: 0.....24 l/min 3/4“: 0.....60 l/min 1“ : 0…120 l/min
Repeatability:	0.5%

The measuring system Flowmax 400i complies with the EMC requirements EN 50081 parts 1/2 as well as EN 50082 parts 1/2. It is in conformity with the requirements of the EC directives and has the CE label.

*The flow range limits correspond to a flow speed of ~3m/s with Flowmax 400i of size 3/8“, ~6m/s with Flowmax 400i of sizes ½“, ¾“ und 1“

6. Accessories

Flowview 2i

Evaluation and management unit for up to 2 ultrasonic volume flow meters Flowmax
Ordercode 908760

To connect a Flowmax 400i to a Flowview 2i a Flowmax-Plug is needed.

Flowview 10S

Evaluation and management unit for up to 10 ultrasonic volume flow meters Flowmax
Ordercode 908751

To connect a Flowmax 400i to a Flowview 2i a Flowmax-Plug is needed.

Flowmax-Plug
To connect a Flowmax 400i to a Flowview 10S or Flowview 2i use a Flowmax-Plug.

Ordercode 507330

USB-to-RS485-Converter Sonic

Interface converter from USB to RS485 with spring terminal connection for quick-connection of Flowmax 400i and **FlowSoft / part 1**, PC software for configuration of ultrasonic volume flow meter Flowmax 400i
Ordercode 908726

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