Ultrasonic flow-meter
BAMOFLONIC

776-01 /1

Hardware V 2.1 / Software V 1.29

USER MANUAL

Ultrasonic flow-meter
BAMOFLONIC

DEB

16-03-2021 M-776.01-EN-AH

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SUMMARY

1.   PRECAUTIONS

- The operation of the instrument must be compliant and strictly limited to the applications, as mentioned below.
- Installation, commissioning and maintenance of the flowmeter must be carried out by qualified technicians.
- The power supply must be in conformity with specifications listed in the table "Technical features".
- Disconnect all sources of power from the device during interventions or maintenance tasks.

2.   APPLICATIONS

- Flow measurement on conductive and non-conductive liquids in various industries, cosmetic and food applications.
  Examples: Demineralized water, liquid cosmetic creams, acidic or basic liquids, etc.

BAMO Mesures cannot be held liable for any damage from inappropriate use or due to modifications of the instrument.

3.   DESCRIPTION

BAMOFLONIC is an ultrasonic flow-meter based on the phase difference approach, proportional to the flow-rate.
This technology makes it possible to measure conductive or non-conductive liquids.
Important: The liquid must be homogeneous and clear.

BAMOFLONIC is designed according the directive EN 61010
(VDE 0411 "Safety specifications for electrical measuring, control and laboratory equipment")

4.   TECHNICAL FEATURES

Power supply	24 V DC / 3.6 W
Outputs	1 Digital output to set as one of: pulse output (from 0.1 to 3000 ml/pulse), empty pipe alarm, reverse flow alarm, dosing function or alarm min. / max. flow-rate.
	1 Analogue output: 0/4-20 mA, to set up on site
Display	Numerical, back-lighted screen
Electrical connections	5-pin connector M12 (supplied)
Accuracy	± 2 % of reading and ± 3 mm/s (± 6 mm/s with DN10)
Repeatability	≤ 0,5 %
Liquid temperature	0... +80 °C for Version PPSU, ND 10 to 25
	0... +50 °C for Version PE-HD, DN 32
Pressure	16 bar max. at 20 °C (ND10 & 15)
	10 bar max. at 20 °C (ND 20 & 25)
	7 bar max. at 20°C (ND 32)
Protection	IP 67
Fittings	BSP
	PVC Union (as accessories)
	Other on request: Smooth tube, Clamp DIN 11864
Wet parts material	PPSU (Polyphenylsulfone) ND 10 to 25; Sealing: 2 EPDM gaskets
	PE-HD = Polethylene (ND 32); Sealing: EPDM

Options

Digital input	To start dosing through an external contact, 8-pin connector M12 is necessary
Accuracy	±1 % of reading and ± 3 mm/s; for ND10: ± 6 mm/s
Remote interface	Access to all engineering parameters (USB/RS485 and software) or remote display unit

EC Conformity: The instrument meets the legal requirements of the current European Directives

Accessories:
- Kit of PVC fittings for solvent welding
- Interfacing relay (NPN & PNP interfaces) for contact output

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5. PRINCIPLE OF MEASUREMENT

The ultrasonic flow measurement is based on the phase difference approach. Two sensors, emitters/receivers, opposite from each other, alternatively transmit and receive ultrasonic signals. With liquid static, no flow, both sensors receive the transmitted ultrasonic signals in the same phase. With flowing liquid, there is a phase shift. It differs when measured in direction of the flow than when measured against it. 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-rate.

$$\varphi_- = \frac{wL}{c - v}$$

$$\varphi_+ = \frac{wL}{c + v}$$

Emitteur/ Receiver

Receiver/ Emitter
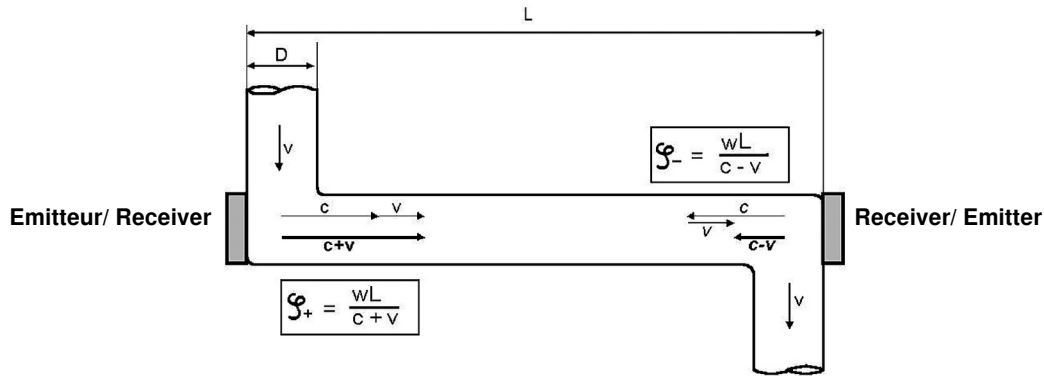
$$v \approx K * (\varphi_- - \varphi_+)$$

L: Length of measuring tube
K: Factor
D: Diameter of measuring pipe
v: Flow velocity
c : Sound velocity in the liquid
φ_+ φ+: Phase with the flow
φ_- φ-: Phase against the flow

Fig. 1: Ultrasonic flow measurement principle

6. INSTALLATION

Upper fitting –> OUTLET
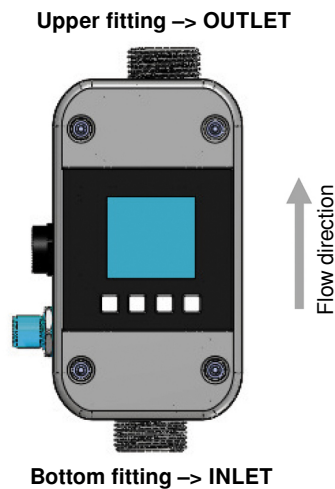

Flow direction

Bottom fitting –> INLET

Fig. 2: Installation direction

Caution
An arrow on the body of BAMOFLONIC shows the flow direction to respect.

For fastest response, it is important to have a distance between BAMOFLONIC and the tank as short as possible.
Accurate measurement can only be assured, if the pipe is completely filled and the liquid does not outgas.
For dosing applications it is recommended to install the BAMOFLONIC as close as possible to the dosing valve, since cross-section of soft pipes increases with the pressure; This may lead to repeatable differences.

- Be sure the flow keeps laminar and no cavitation occurs.
- Depending on the measured liquid it can be helpful to have enough back pressure on the outlet of BAMOFLONIC to avoidcavitations.
- Insure all mechanical connections are tight.

Caution
Absolutely avoid usage of Teflon tape for sealing.

Particles present in the flow stream may result in measurement errors.

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Important:
When using pump, BAMOFLONIC must be installed in flow direction on the pressure side (after the pump). Check the maximum pressure specification of the BAMOFLONIC.

For correct measurements, straight and unobstructed upstream and downstream pipe lengths must be respected:

Nominal diameter	ND 10	ND 15	ND 20	ND 25
Upstream distance	10 cm	30 cm	40 cm	40 cm
Downstream distance	0cm	5 cm	10 cm	20 cm

Always make sure that the maximum torque of the nuts for the hydraulic connections is not overtightened.
We recommend to use the delivered seals and a maximum torque depending on the diameter:

Nominal diameter	ND 10	ND 15	ND 20	ND 25
Torque max.	2 N.m	3 N.m	4 N.m	6 N.m

Important:
PPSU (Polyphenylsulfone) has a limited resistance against UV rays; Do not mount BAMOFLONIC in direct sunlight.

The flowmeter is mounted into piping using a mechanical connection.
For best measuring performance the BAMOFLONIC should be mounted vertically.
It is not recommended to install the flowmeter after a dosing-valve where it may run empty and cause a measurement gap on the next batch.
To avoid bubbles in the liquid, the BAMOFLONIC should be installed on the pressure side of the pump.

If it is not possible to mount the flowmeter vertically, then mount the instrument in a location where the pipe will be filled at all times.
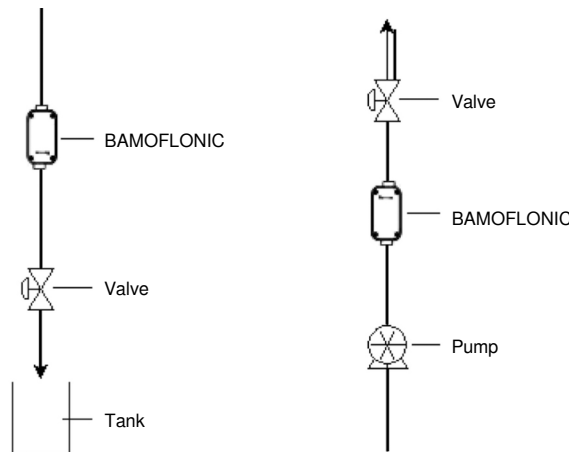The best measuring result is reached, when bubbles are unable to go through the BAMOFLONIC.

Fig. 3: Mounting examples

For CIP applications, it is necessary to completely drain the piping.
We recommend mounting the flowmeter in the vertical position.
If the flowmeter is mounted horizontally the internal geometry of the instrument will result in stagnate liquid.
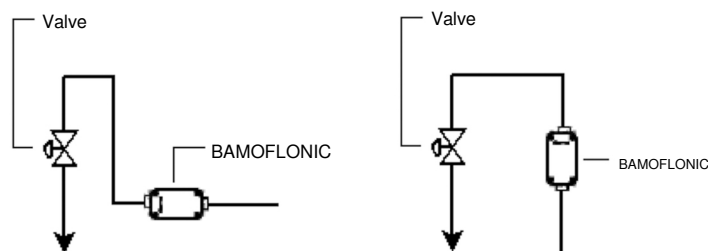

Fig. 4: Installation

Vibrations and mechanical strains can reduce the measurement accuracy of the instrument; It is nevertheless possible to fix the instrument as shown in Fig. 5

The flowmeter must not be affected by mechanical strains from piping system, otherwise it may be damaged.

Important :
The flow meter must be installed without mechanical strain on the existing piping system. When mounting, take into consideration the offset of 5 mm between of inlet and outlet of the flowmeter (see § 5.1).
No respect of instructions may result damaging the instrument and liquid leaks may occur.
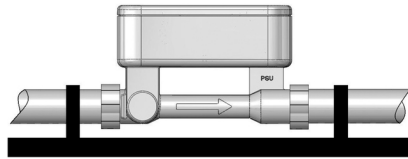

Fig. 5: Mounting

Applications with liquids above 60 °C:
To preserve the electronic components and minimize possible damages, in horizontal mounting with temperature > at 60 °C, it is recommended to keep the BAMOFLONIC control unit below the piping.
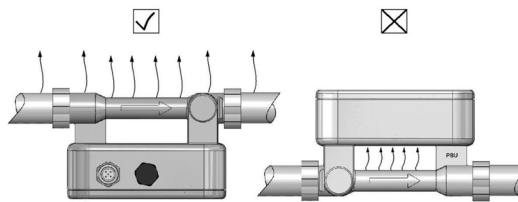

Fig. 6: Mounting with liquid temperature above 60 °C

7.   ELECTRICAL CONNECTIONS

Make sure that the power is turned off before installing, removing or wiring the BAMOFLONIC

Connector configuration:
The outputs may be re-set for specific applications.

Connector (socket)

Connector (plug)

Fig. 7: 5-pin connector

7.1   5-Pin connector:

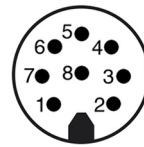| PIN n°	Function	Description
1	24 V DC	Power supply 18 ... 30 V DC
2	Pulse output Q1	Digital output signal Q1
		Adjustable from 0.1 to 3000 ml/pulse
	Alternatives:	Steps of 0.1 ml/pulse; NPN transistor, max. load 30 V /100 mA
		The max. voltage must be lower than the supply voltage
	1. Empty-pipe output	To set as 0 V or 24 V: when pipe is empty
	2. Dosing output	To set as 0 V or 24 V
	3. Upper or lower limit	To set as 0 V or 24 V: when reaching or upper or lower limit
	4. Negative flow	To set as 0 V or 24 V: when liquid flows in reverse direction
3	GND	Ground: 0 V
4	Communication	Communication interface
5	Analogue output QA	QA = 4-20 mA ; 0-20 mA
		Example: 0 l/min => 4 mA
		36 l/min => 20 mA (acc. diam.)
		Empty tube/ Alarm => 3.5 mA

7.2   8-Pin connector:

Connector configuration:
The outputs may be re-set for specific applications.

Connector on the instrument (socket)

Connector (plug)

Fig. 8 : 8-Pin connector

PIN n°	Function	Description
1	24 V DC	Power supply 18 ... 30 V DC
2	Digital output Q1	Digital output signal Q1
		To set as PNP or NPN, max. load 100 mA*
	Alternatives:	The max. voltage must be lower than the supply voltage
	1. Pulse output	Adjustable from 0.1 to 3000 ml/pulse; Steps of 0.1 ml/pulse
	2. Empty-pipe output	To set as 0 V or 24 V: when pipe is empty
	3. Dosing output	To set as 0 V or 24 V
	4. Upper or Lower Limit output	To set as 0 V or 24 V: when reaching or upper or lower limit
	5. Negative flow	To set as 0 V or 24 V: when liquid flows in reverse direction
3	GND	Ground: 0 V
4	Digital output Q2	Digital output signal Q2
		To set as PNP or NPN, max. load 100 mA*
	Alternatives:	The max. voltage must be lower than the supply voltage
	1. Empty-pipe output	To set as 0 V or 24 V: when pipe is empty
	2. Dosing output	To set as 0 V or 24 V
	3. Pulse output	Adjustable from 0.1 to 3000 ml/pulse; Steps of 0.1 ml/pulse
	4. Upper or Lower Limit output	To set as 0 V or 24 V: when reaching or upper or lower limit
	5. Negative flow	To set as 0 V or 24 V: when liquid flows in reverse direction
5	Analogue output QA	4-20 mA ; 0-20 mA
		Example: 0 l/min => 4 mA
		36 l/min => 20 mA (acc. diam.)
		Empty tube/ Alarm => 3.5 mA
6	Communication	Serial, RS 485
7	Digital input I1	Digital input I1
	1. Dosing output	Starts the dosage by a rising edge of 24 V
	2. Set Offset	The Offset is set by a rising edge of 24 V
	3. Reset counter	Reset of the counter by a rising edge of 24 V
	4. Creeping flow off	The filter is disabled while maintaining 24V at the input.
8	Shielding	EMC Safety
*: it applies for Q1 + Q2 ≤ 100mA		

Caution
Only operate the flow-meter BAMOFLONIC within the operating limits stipulated on product label and operating manual.
Any use outside specifications may result in irreversible damages.

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8. COMMISSIONING

The BAMOFLONIC used as volume flow-meter with a liquid such as water, does not require calibration on site.
The measurement parameters for water are calibrated at the factory.

Settings for liquids whose viscosity and sound speed differ significantly from water, can be done via the indicator or the PC software.
It is necessary when using the BAMOFLONIC as a dosing device.

Under certain conditions, the following parameters can be modified:
- Digital output Q1, function and behavior
- Analog output QA, function and behavior
- Flow range, for which shall apply 4...20 mA
- Low flow-rate suppression filter
- Pulse weight
- Optimization of measurement curve with up to 8 interpolation values

9. DISPLAY, END-USER INTERFACE

BAMOFLONIC displays measurement in real time and all menus for settings.
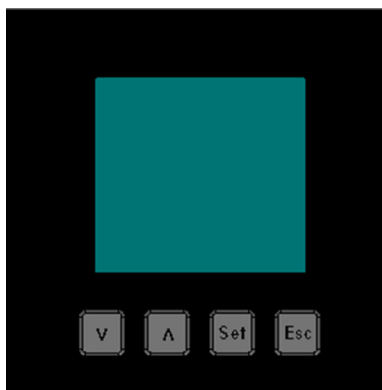Only 4 keys are used to navigate and for settings.

Fig. 9: Control keypad / Display

Pressing the "Set" key opens the main menu; Access to set up options with arrow keys.
Example: Set the max. value assigned to the analog output.
Go to "Analog Output - Upper limit": Use the arrow keys to change value and press "Set" to confirm.
To return to level in the menu, press the key "Esc".

The access to change the settings is password protected.
The default password is: 41414

Entering the code allows the changes during 30 minutes.
With the exception of the Diagnostic and Dosing functions, if no action is taken on control buttons within 200 seconds, the device will exit the change mode and return to the consultation mode automatically.
The parameters can be changed via the programming interface of the indicator.
(Functions of digital output Q2 and digital input I1 are only accessible on the version with an 8-pin plug)
BAMOFLONIC blind version has the same functions as the version with display, but parameters can only be displayed on the screen and modified via the programming interface of the indicator.

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10. MENU STRUCTURE

Language
- --> Deutsch
- --> Español
- --> Français
- --> English

Dosing
- --> Dosing Quantity -->> Input
- --> Stop
- --> Start
- --> Dosing time -->> Input

Media (liquid)
- --> Set offset
- --> 1-Point- Correction
- --> Creeping Flow
    - -->> Lag Creeping Flow -->>> Input
    - -->> Value Creeping Flow -->>> Input
- --> Basic Trim
- --> Water

General adjustment
- --> Reset Counter
- --> Hysteresis
- --> Lower limit
- --> Upper limit
- --> Pulse value
- --> Total Counter
- --> Counter

Display
- --> Units
    - -->> ml/s + L
    - -->> L/h + L
    - -->> L/min + m³
    - -->> Gal/min + Gal
    - -->> L/min + L
- --> Filter for Display
    - -->> On
    - -->> Off
- --> Rotate Display
    - -->> 0°
    - -->> 270°
    - -->> 180°
    - -->> 90°
- --> Flashing
    - -->> On
    - -->> Off

Analogue output QA
- --> Function
    - -->> 4–20 mA
    - -->> Off
    - -->> 0–20 mA
- --> Filter
    - -->> Weak
    - -->> Medium
    - -->> Strong
    - -->> Disabled
- --> Output value
    - -->> Flow
    - -->> PID Controller
    - -->> Speed of Sound
    - -->> Temperature
- --> Min. Range -->> Input
- --> Max. Range -->> Input

Digital output Q1
- ––> Function
  - ––>> Pulse Output
  - ––>> Off
  - ––>> Dosing
  - ––>> Negative flow
  - ––>> Lower limit
  - ––>> Upper limit
  - ––>> Empty pipe
- ––> Logic
  - ––>> PNP Normal Open
  - ––>> NPN Normal closed
  - ––>> NPN Normal Open
  - ––>> PNP Normal Closed

Digital output Q2
- ––> Function
  - ––>> Empty pipe
  - ––>> Pulse Output
  - ––>> Off
  - ––>> Dosing
  - ––>> Negative flow
  - ––>> Lower Limit
  - ––>> Upper Limit
- ––> Logic
  - ––>> PNP Normal Open
  - ––>> NPN Normal closed
  - ––>> NPN Normal Open
  - ––>> PNP Normal closed

Digital input I1
- ––> Off
- ––> Reset Counter
- ––> Dosing
- ––> Creeping Flow Off
- ––> Set offset

Diagnostic
- ––> Serial Number
  - ––>> S/N:
- ––> Version
  - ––>> SW–Ver:
  - ––>> DE–Ver:
  - ––>> HW–Ver:
- ––> Testing flow
  - ––>> Set flow
  - ––>> Stop
  - ––>> Start
- ––> Values
  - ––>> VST:
  - ––>> Ph F
  - ––>> Amplitude
  - ––>> TOF:
  - ––>> R Flow:
  - ––>> Temp:
- ––> PCK
  - ––>> PcK1:
  - ––>> PcK2:
  - ––>> PcK3:
  - ––>> PcK4:
  - ––>> PcK5:
  - ––>> PcK6:
- ––> Status
  - ––>> Flag0:
  - ––>> Flag1:
  - ––>> Flag2:
  - ––>> PuMo:
- ––> Pump Mode
  - ––>> On
  - ––>> Off

11.   FUNCTIONS AND DEFAULT SETTINGS

11.1 Language

Choose between: Deutsch, English, Español, Français

11.2 Dosing

Access to the dosing function for a manual set-up of dosing parameters.
The dosing can be started and stopped with the "Start" and "Stop" functions.

"Dosing quantity"	Adjustable up to 3,500 litres (Default value = 0 litre)
"Dosing time"	Range: 0 up to 30,000 s; by step of 0.1 s; Accuracy +0/-1 s (Default value: 3 s)

2 possibilities:

1) – BAMOFLONIC is used as a dosing device (dosing control by BAMOFLONIC)
BAMOFLONIC fully controls the dosing sequence.
A dosing volume (for example 400 ml) is declared through the menu, via the key board.
Dosing starts as soon as the digital loop input is connected to 24 V.
BAMOFLONIC opens the dosing valve via the output configured for this purpose.
When the preset volume is reached, the dosing valve closes.
The dosing sequence is started and stopped using the user menu.

3) – BAMOFLONIC is used as a flow meter (control of the dosing by a dosing equipment)
The dosing equipment controls the entire dosing function.
The volume is set during the commissioning of dosing equipment, by pre-selecting the pulse counter.
Dosing starts, when the relevant pushbutton of the dosing equipment is pushed.
The dosing equipment opens the dosing valve.
From now on BAMOFLONIC will send a pulse to the equipment for each unit of volume (e.g. each 1ml).
When the preset dosing volume is reached, the dosing equipment closes the valve.

Caution
End-user has to provide an emergency stop and an overfilling stop to prevent hazardous situations. Both safety devices must perform safe shut down of pumps and closing of valves.

11.3 "Media"

Different media can be managed in the sub menu "Media". By using the sub-menu "1-point- Correction" it is possible to correct in % the flow-rate measurement.

"Set Offset"
In the sub menu "Set Offset" it is possible to set the actual offset of the flow-meter. This function is used when the pipe is fully filled with liquid and without flow.

"1-point- Correction"	Adjustment from -50% up to +50% by step of 0,1% (Default value: 0%)

This correction factor adjusts the flow-rate display according properties of the liquid.

"Creeping Flow"
This function excludes measurements in a narrow band at and above zero where measuring inaccuracy is too high. Factory setting is at a reference value relative to the cross section of the flow-meter.

This factor works with an hysteresis of -25 %.

Example: Creeping Flow = 0.6 l/min
When flow-rate will be less than 0.45 l/min, the analogue output and totalizer will be disabled.
When flow-rate will be back to and over 0.6 l/min, the analogue output and totalizer will be operating.

Setting ranges   0.0 ... 20 l/min, by step of 0.006 l/min
Default values   0.3 l/min for ND 10 (⅜")
                        0.9 l/min for ND 15 (½")
                        3.5 l/min for ND 20 (¾")
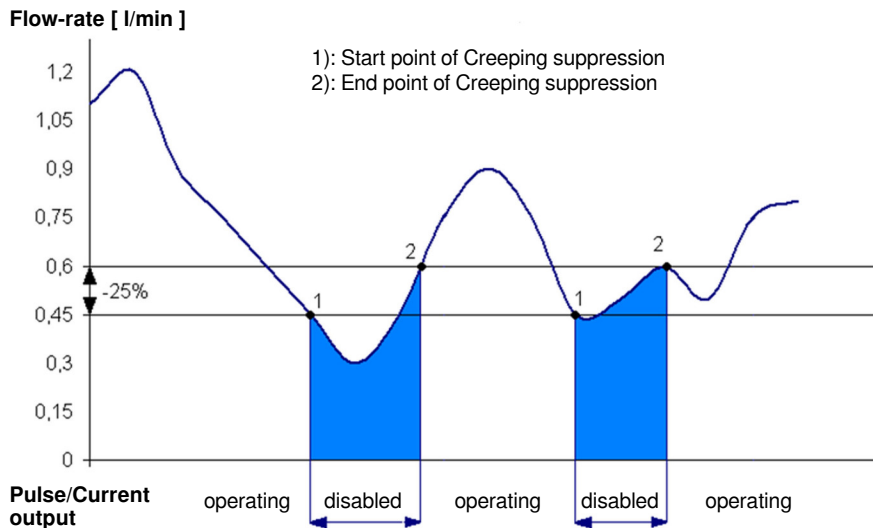   5.0 l/min for ND 25 (1")

Fig. 10: Function of creeping suppression illustrated with 0.6 l/min

"Lag Creeping Flow"
To delay the activation of function Creeping suppression.
Example: "Lag Creeping Flow" = 2 seconds
Setting range   0... 99.9 s ; by step of 0.1 s
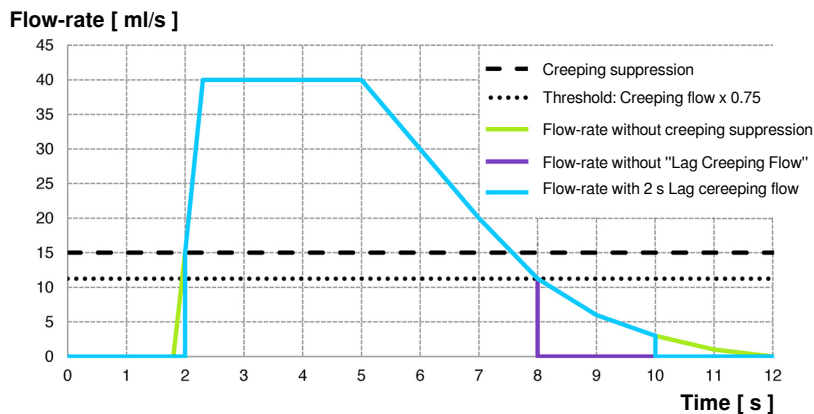   *(Default value: 0.5 s)*

Fig. 11 : Effect of Function "Lag Creeping Flow"

"Basic Trim"
This function starts a self-diagnostic to optimize all important parameters. It runs during about 1 minute.
This function is used only with full pipe and no flow.
When performed, the message "Done" is displayed. If an error occured, the display shows "Error".

Important:
Self-diafnostic: To be perfectly carried out, the flowmeter must be full of liquid and the flow must be zero. If an error is detected the display indicates "Error", otherwise it shows "Done".

"Water"
This function allows you to reset back the parameters related to water.

11.4 Standard parameters

"Reset Counter"
The volume counter can be reset.
Caution, the values of the counter accidentally erased are definitely lost.

"Hysteresis"
Limit values can be set with an hysteresis.
Purpose is to avoid frequent switching of relays when the flow fluctuates around the limit.
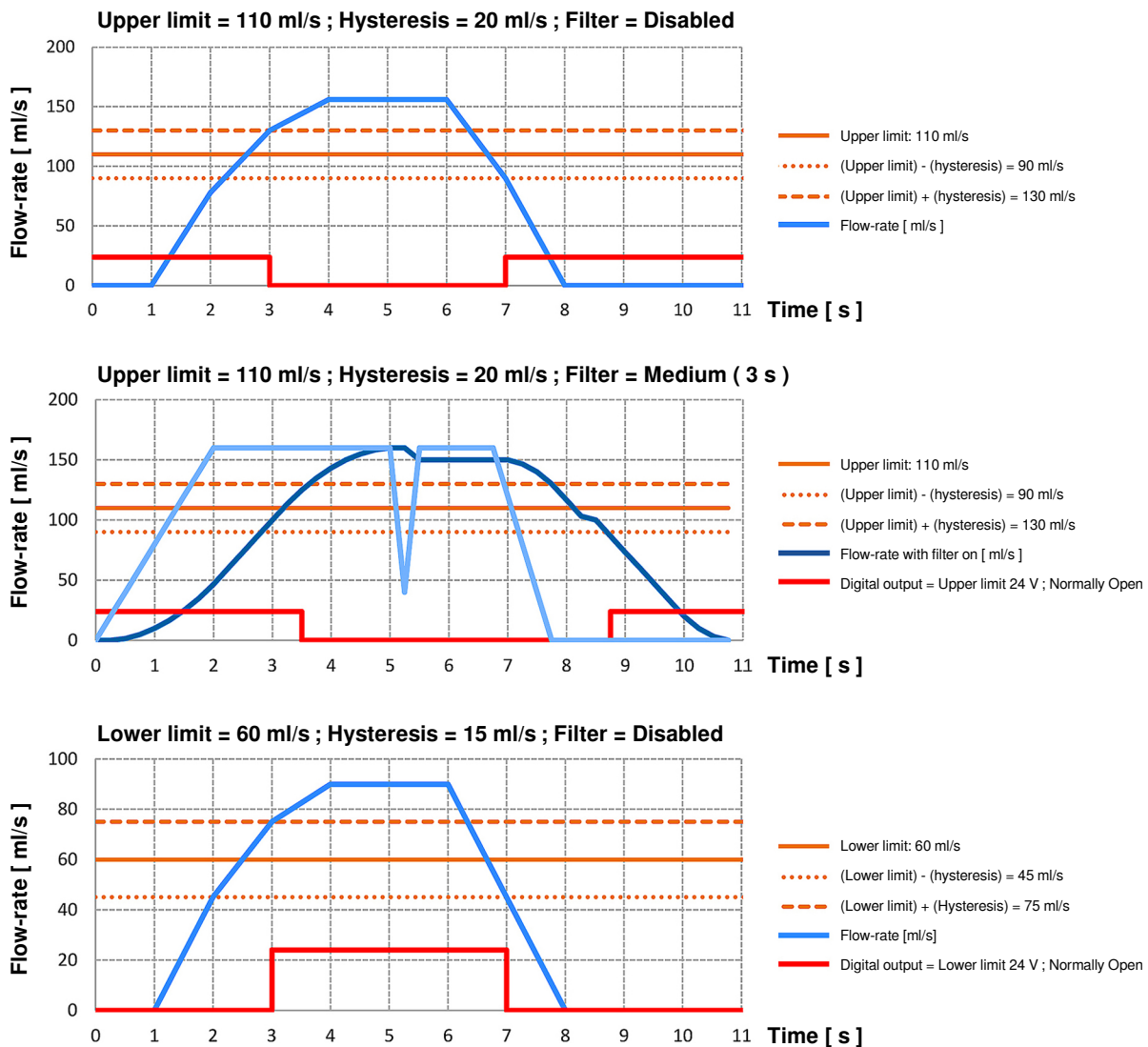

Fig. 12: Effect of the function "Hysteresis"

Setting range   0... 8 000 ml/s; by step of 0.01 ml/s
                       (Default value: 0)

"Lower limit"
This function is used to set the Lower limit for digital output.
Setting range   0... 8 000 ml/s; by step of 0.01 ml/s
                    (Default value: 0)

"Upper limit"
This function is used to set the Upper limit for digital output (ND10 = 350 ml/s ; ND15 = 600 ml/s ; ND20 = 1000 ml/s ; ND25 = 4000 ml/s)
Setting range   0... 8 000 ml/s ; by step of 0.01 ml/s
                    (Default value: according the Nominal Diameter)

"Pulse value"
This chapter discusses the settings for the pulse output.
The set value (weight of pulse) must not exceed the Max. output frequency (10 kHz) of the BAMOFLONIC, nor the Max. input frequency of the connected control unit.

Example: Weight of pulse: 2.0 ml/pulse (1 pulse each 2.0 ml)
Setting range   0.1 ... 3,000.0 ml/pulse; by step of 0.1 ml/pulse
                    (Default value: 1.0 ml/pulse)

Flow-rate [ml/s]	Weight of pulse [ml/pulse]	Frequency [Hz]	Period [s]	Pulse duration	
1	1	1	1	0.5 s	500ms
100	1	100	0.01	0.005 s	5ms
1000	0.1	10000	0.0001	0.00005 s	0.05 ms
100	10	10	0.1	0.05 s	50ms
0.5	10	0.05	*20*	*1s*	1000ms

In the last case, a pulse of 1s is emitted every 20 s.

"Total counter"
Totalizer can be displayed in the menu. Unit is m³.
This counter is unidirectional and can therefore differs from the daily counter.
Totalizer can not be set to zero; Not possible to reset it.

"Counter"
The daily counter is the one that appears by default on screen. The unit corresponds to each set.

a) Daily amount [l]			b) Daily amount [m³]			c) Daily amount [US Gal]		
From	Up to	Resolution	From	Up to	Resolution	From	Up to	Resolution
0.000	14000	0.001	0.000	14000	0.001	0.000	14000	0.001
14000	28000	0.002	14000	28000	0.002	14000	28000	0.002
28000	56000	0.004	28000	56000	0.004	28000	58000	0.004
56000	112000	0.008	56000	112000	0.008	58000	112000	0.008
112000	225000	0.016	112000	225000	0.012	112000	225000	0.016
225000	445000	0.032	225000	461204	0.032	225000	460000	0.032
445000	1000000	0.064				445000	1000000	0.064

a) Once the counter has reached 1,000,000 litres, it automatically begins to count up from zero.
b) Once the counter has reached 461,204 m³ it automatically begins to count up from zero.
c) Once the counter has reached 1,000,000 Gal it automatically begins to count up from zero.

Totalizer runs without possibility to reset.

11.5 Display

"Units"
BAMOFLONIC is able to show flow-rate & volume in different units: ml/s & l ; Gal/min & Gal ; l/min & l ; l/min & m³.
Above: First appears the unit for flow-rate.
Then the associated unit for the volume.

"Filter for the display"
The displayed flow-rate can additionally be filtered.
This filter is an average over the last 16 seconds; It is activated and disabled via the menu.

"Rotate the display"
The display rotates by steps of 90° (0°, 270°, 180°, 90°)

"Flashing"
Display flashes in case of an error; This function is disabled through the menu.

11.6 Analogue output QA

Standard version of BAMOFLONIC comes with a current output of 4-20 mA. It can be set as a 0-20 mA current output.
The current output varies from 0 to 22.6 mA according the flow-rate or the condition of flow measurement.

Default values for a signal 4-20 mA:

20 mA	–> for upper limit of measurement
4 mA	–> –> for lowest limit of measurement
3.5 mA	–> "Empty pipe"

When current output is used, the load must not be higher than 500 Ohm.
Higher load prevents the device from providing the maximum current of 22.6 mA.

Features of analogue output:
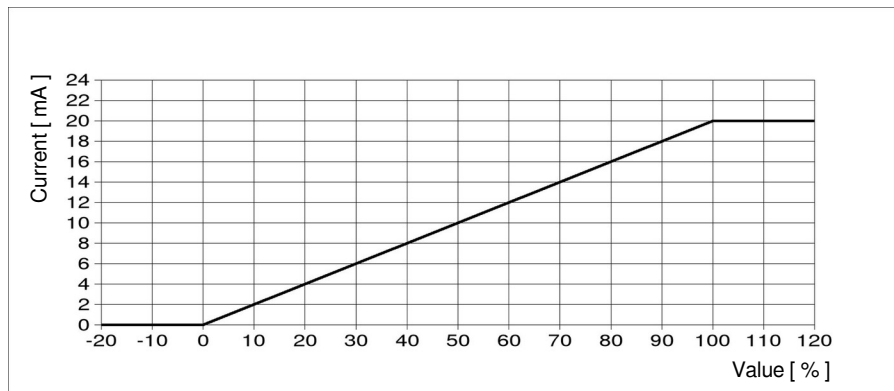For the following graphic "min Range" is used for 0 %; "max Range" is used for 100 %

Fig 13: Current output 0 ... 20 mA

Values	Current [mA]
Lowest than 0 %	0
0% (Min. of scale)	0
0to 100 %	Linear interpolation from 0 to 20 mA
100 % (Max. of scale)	20
Above 100 %	20

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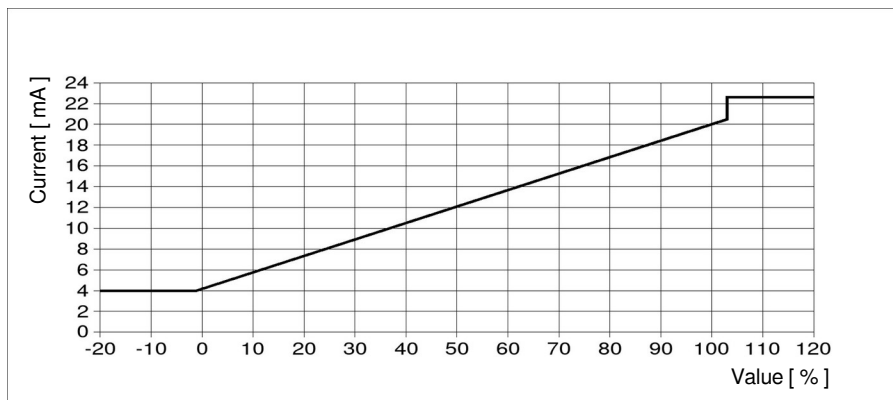
Fig 14: Current output 4-20 mA

Values	Current [mA]
Empty tube	3.5
Lowest value (-1.2 %)	3.8
From -1.2 to 0 %	Linear interpolation from 3.8 to 4 mA
0% (Min. of scale)	4
From 0 to 100 %	Linear interpolation from 4 to 20 mA
100 % (Max. of scale)	20
From 100 to 103 %	Linear interpolation from 20 to 20.5mA
Above 103 %	22.6

"Filter"
The function "Filter" averages the analog output signal.
Possible settings: "Weak" (low) or "Medium" or "Strong" (high) or "Off"; Default value = Weak
Analogue output signal reacts faster to signal changes when filter is set to "Weak"; Whereas signal reacts slower when filter is set to "Strong".
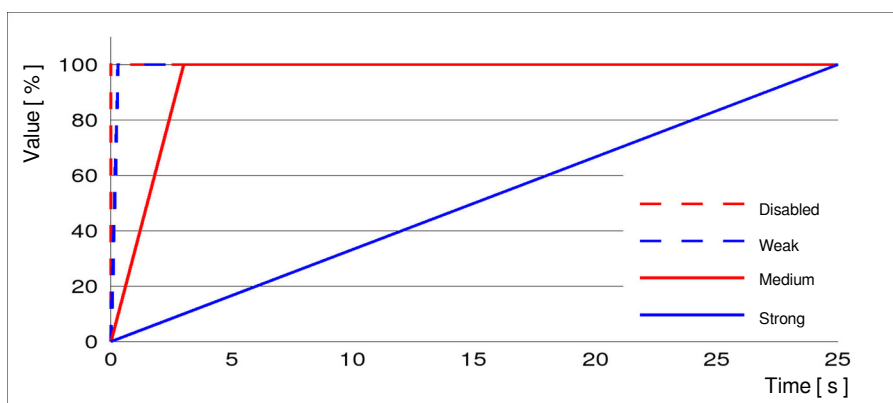
Fig 15: Response time with filter

Filter	100 %
Disabled	16 ms
Weak	0.3 s
Medium	3 s
Strong	30 s

"Output value"
In the menu all output values are visible. The optional features are only available when they are ordered with the instrument.

Functions	Flow
	PID regulation PID (Option)
	Sound speed (Option)
	Temperature
	(Default = Flow-rate)

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"Flow-rate"
Flow-rate is measured through the analogue output.

"PID Regulation"
OPTION: On the current output, it is possible to realize a flow control. For setting the parameters (target flow, proportional gain, integral gain and differential gain) PC softare interface is necessary.

"Sound speed"
OPTION:

"Temperature"
The integrated thermocouple is not in direct contact with the fluid; It is used to calculate the expansion of the body. The sensor is influenced by the ambient temperature.
Temperature response time varies according its lieue of fitting inside the body.

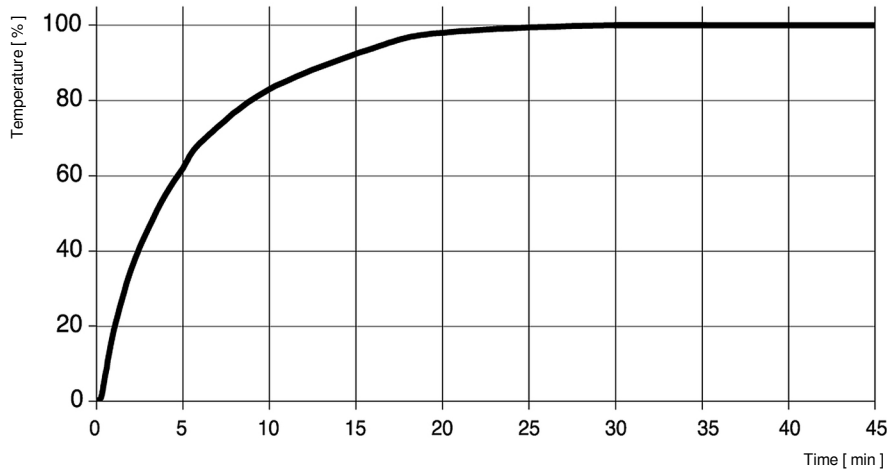Response time after a significant evolution of temperature (Disabled filter):

Fig. 16: Thermocouple response time

Ambient temperature influence:

Liquid Temp. x 0.7	+	Ambient Temp. x 0.3	= Measured Temp.
40 °C x 0.7	+	20 °C x 0.3	= 34 °C
40 °C x 0.7	+	30 °C x 0.3	= 37 °C
40 °C x 0.7	+	40 °C x 0.3	= 40 °C
60 °C x 0.7	+	20 °C x 0.3	= 48 °C

"Min. Range"
The value is set or at 0 mA, or at 4 mA.
Setting range   0... 8000 ml/s (or °C, or m/s), by step of 0.01
                       (Default value = 0 ml/s)

"Max. Range"
The value is set at 20 mA.

Setting range   0... 8000 ml/s (or °C, or m/s), by step of 0.01
                       Default value = Max. flow-rate of the instrument (Depends of fittings -ND-)
                       ND 10 = 350 ml/s
                       ND 15 = 600 ml/s
                       ND 20 = 1000 ml/s
                       ND 25 = 4000 ml/s

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11.7 Digital Outputs Q1 and Q2

The output Q2 is available only with the equipment featured with 8 pins connector.

Each output is activated when the supply is less than 16 V. During an overload or short circuit, the output is disabled within 100 µs, then becomes actuated within 2 s.

Functions   Pulses
Disabaled
Dosing
Negative flow
Low limit
High limit
Empty pipe
(Default value for Q1 = Pulse output)
(Default value for Q2 = Empty pipe)

NPN- or PNP- Logic can be selected.
Functions   PNP normally open (N.O.)
NPN normally closed (N.C.)
NPN normally open (N.O.)
PNP normally closed (N.C.)
(Default values for Q1 and Q2 = PNP N.O.)

Empty pipe output	Empty pipe	Full pipe	
NPN N.C.	High resistance	0V	
NPN N.O.	0V	High resistance	
PNP N.C.	High resistance	24 V	
PNP N.O.	24 V	High resistance	

Pulse output	Empty pipe	Full pipe; No flow	Full pipe; existing flow
NPN N.C.	0V	0V	High resistance
NPN N.O.	0V	0V	High resistance
PNP N.C.	High resistance	High resistance	24 V / Pulse
PNP N.O.	High resistance	High resistance	24 V / Pulse

High limit output	Below lower limit	Between the limits	Above upper limit
NPN N.C.	High resistance	High resistance	0V
NPN N.O.	0V	0V	High resistance
PNP N.C.	High resistance	High resistance	24 V
PNP N.O.	24 V	24 V	High resistance

Low limit output	Below lower limit	Between the limits	Above upper limit
NPN N.C.	0V	High resistance	High resistance
NPN N.O.	High resistance	0V	0V
PNP N.C.	24 V	High resistance	High resistance
PNP N.O.	High resistance	24 V	24 V

Dosing output	Starting dosage	During dosage	Before/After dosing
NPN N.C.	High resistance	High resistance	0V
NPN N.O.	High resistance	0V	High resistance
PNP N.C.	High resistance	High resistance	24 V
PNP N.O.	High resistance	24 V	High resistance

Caution
When using dosing function, the output must not be set up as Normally Closed.
If the dosing output is set as N.C., the valve will stay open after the dosing batch.

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Important:
To connect to an inductive load, such as an external relay, an additional diode must be installed in parallel with the load to prevent damages.
With a high impedance input counter and high speed counting, it is necessary to include a resistor to have clean edges.
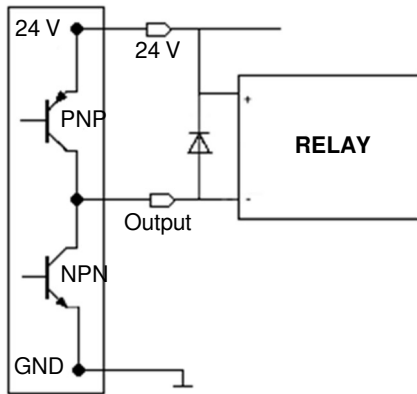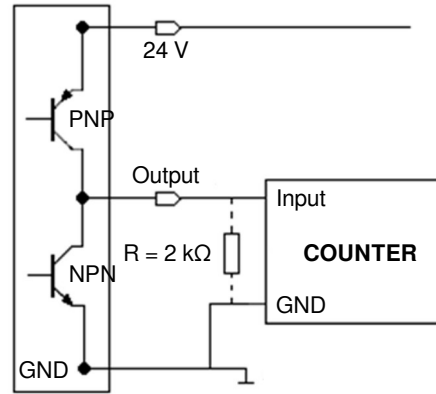

Fig. 17: Connections to a relay

Fig. 18: Connections to an external counter

11.8 Digital input I1

Digital input I1 is available only on version supplied with a 8-pin connector.

The instrument has a digital input that is programmable for the following functions:
Counter reset, Dosing, Min. flow-rate diasabled, Offset settings.
To start a dosing process, a 24 V DC power supply is required.
The status of the dosing parameters or modifications can be done via user display keyboard or through the interface software on PC.

Functions   Disabled
                                 Reset Counter
                                 Dosing
                                 Creeping Flow Off
                                 Set Offset
                                 (Default value = Disabled)

The dosing input is locked so that a re-start is not possible during a running dosing process.

Available input functions:

	Set Offset	Creeping flow Off	Dosing	Reset Counter	Off
0V	–	–	–	–	–
24 V	Rising edge:	Status:	Rising edge:	Rising edge:	–
	0-> 24 V	Deactivating	0-> 24 V	0-> 24 V	
	Set offset (*)	Creeping Flow	Start dosing	Counter is reset	

(*): It runs only in no-flow condition.

Offset settings function can only be operated when there is no flow in the meter. If offset is performed while the liquid is flowing, an offset drift will cause measurement deviations.
If the Flowmax shows an offset drift caused by a wrong offset setting, run the function "Set Offset" or "Basic Trim" again with filled flowmeter and no flow.

11.9 Diagnostic

The sub menu "Diagnostic" shows the software/hardware version and other helpful values for analysis.

"Testing flow" For commissioning, a test flow can be adjusted by setting a test flow-rate between 0 and 3200 ml/s, by step of 0.1. In that case the flowmeter will behave as if the liquid is really flowing (even with empty pipe), then the outputs and display are operating.
To start the flow-test choose"Start"; Choose "Stop" to end the simulation or restart the device.

"Pump mode"
This mode can be switched on and off via the menu.
With pulsating flow (e.g. peristaltic or diaphagm pumps) the flowmeter adapts itself automatically. The flowmeter sets the display and analogue filters on "Strong".
If the pulsating flow stops, the device behaves again as its previous set.

11.10 Overview of default settings

Functions	Default settings
Pulse weight	1 ml/pulse
Q1, digital output	Pulse output: PNP (24 V) N.O.
Q2, digital output	Empty pipe: PNP (24 V) N.O.
I1, digital input	No function assigned
QA, current output	Flow-rate: 4-20 mA signal
	20 mA –> 21 l/min ; ND 10
	20 mA –> 36 l/min ; ND 15
	20 mA –> 60 l/min ; ND 20
	20 mA –> 240 l/min ; ND 25
Creeping suppression	0.3 l/min ; ND 10
	0.9 l/min ; ND 15
	3.5 l/min ; ND 20
	5.0 l/min ; ND 25

11.11 General information

Please check the following before powering the flowmeter for the first time:

Check the electrical connections, cable allocations and installation position of the flowmeter.
Direction of flow must correspond to the arrow direction engraved on the body.
- Be sure that the pipe is completely filled with fluid, and check the pressure in the piping

When everything has been checked and satisfying, switch on the power; After 15 minutes the BAMOFLONIC will reach the optimal accuracy.

12.   Replacement of existing BAMOFLONIC

- Switch off the power before to disconnect the instrument

Please note that after replacing the flowmeter:
   a) Specific programming of the previous flowmeter should entered into the new unit.
   b) When using the dosing function, set a quantity

12.1 Repair, hazardous substances

Before sending the BAMOFLONIC:

– IMPORTANT –
Clean all process chemicals from the device; Fully rinse the flow path and pay close attention to the process fittings.
This is particularly important, if the instrument was in contact with is health hazardous liquids.

Contact our technical department to obtain the "documents for return" to be sent together in the parcel for any requested support of our after-sales services ("descriptive report" and "certificate of decontamination").

These documents may be downloaded from our Web sites.

13.   ERROR MESSAGES

| Display text	Description	Display behavior
Empty pipe	No liquid in the pipe	Message & Display, flashing
Low voltage	Power supply voltage is less than 18 V; Outputs are disabled.	Message & Display, flashing
Short circuit	Load of digital output is over 100 mA; Outputs are disabled.	Message only
Lower limit	Flow-rate is below a set value when using limit control function Min.	Message only
Upper limit	Flow-rate is above a set value when using limit control function Max.	Message only
Sonic speed	Actual sonic speed out of acceptable range; Run "Basic trim" function	Message only
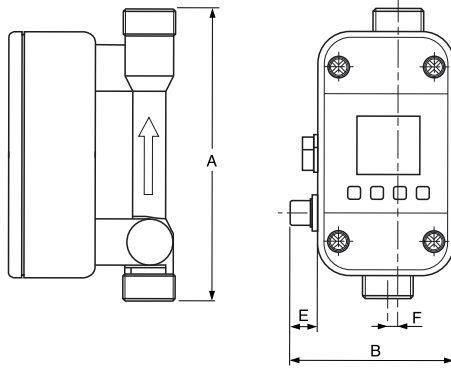
**Fittings
BSP or NPT
ND 10 to ND 25**
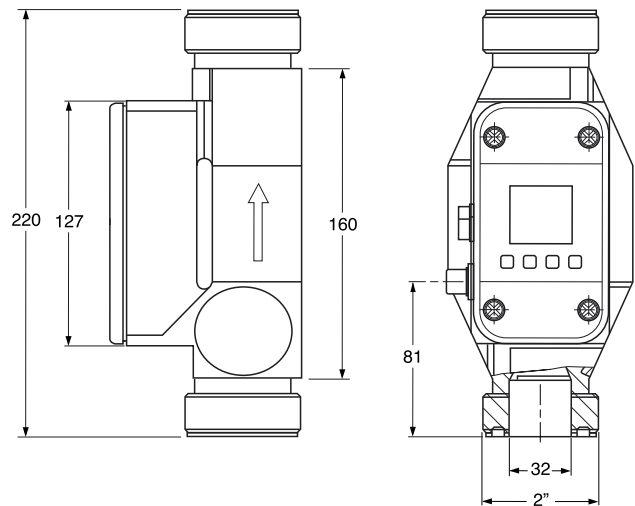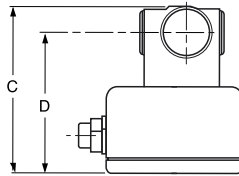
**Fittings
BSP or NPT
ND 32**
Mass: 1 kg
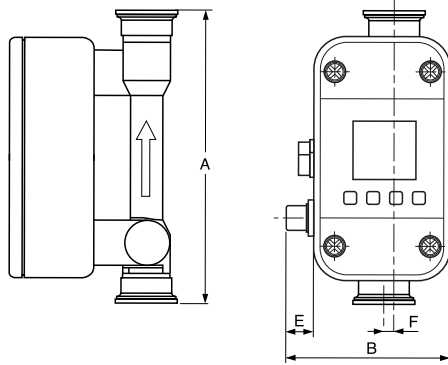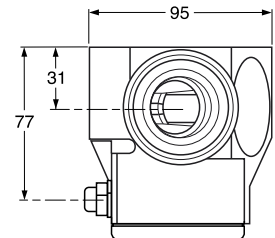
**Fittings
DIN 11864
⅜" ; ½" ; ¾" ; 1"**
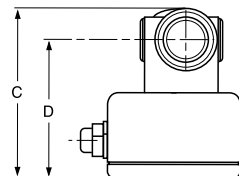
ND nominal Ø	Fittings	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Mass [kg]
10	½" BSP or NPT	147.0	84.0	83.0	70.5	15.0	5.0	0.332
15	¾" BSP or NPT	147.0	84.0	84.5	71.1	15.0	5.0	0.344
20	1" BSP or NPT	160.0	84.0	94.2	77.6	15.0	5.0	0.414
25	1 ¼" BSP or NPT	168.0	84.0	98.5	77.6	15.0	5.0	0.454
10 (⅜")	Clamp, DIN 11864	149.0	84.0	83.0	70.5	15.0	5.0	0.339
15 (½")	Clamp, DIN 11864	149.0	84.0	84.5	71.1	15.0	5.0	0.347
20 (¾")	Clamp, DIN 11864	162.0	84.0	94.2	77.6	15.0	5.0	0.429
25 (1")	Clamp, DIN 11864	170.0	84.0	98.5	77.6	15.0	5.0	0.469

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