

## Glass tube flowmeters Series 2000



### Variable area flowmeter for low flows of liquids and gases

- Short mounting length and compact construction, especially indicated for control panels
- Easy installation. No straight pipe run required before or after the flowmeter
- Vertical mounting with upwards flow, rear connections and horizontal inlet and outlet
- Accurate needle valve for flow regulation included (optional without regulating valve)
- Scales calibrated in l/h, l/min, %, etc
- Flow rate:
  - Water: 0.1 l/h ... 1000 l/h
  - Air: 1 Nm<sup>3</sup>/h ... 30 Nm<sup>3</sup>/h
- Accuracy:
  - Model 2100: 3.5% ( $q_0=50\%$ )
  - Model 2150: 3% ( $q_0=50\%$ )
  - Models 2300 / 2340: 1.6% ( $q_0=50\%$ )
- Connections:
  - 2100 / 2150 / 2300: 1/4" BSP / NPT
  - 2340: 1/2" BSP / NPT
- Materials:
  - Flow tube: borosilicate glass
  - Wetted parts: EN 1.4404 (AISI 316L)
  - Float: EN 1.4404 (AISI 316L), aluminium, glass, plastic, ceramic
- Local indication
- Options:
  - 1 or 2 limit switches
  - Constant flow regulators RCA or RCD



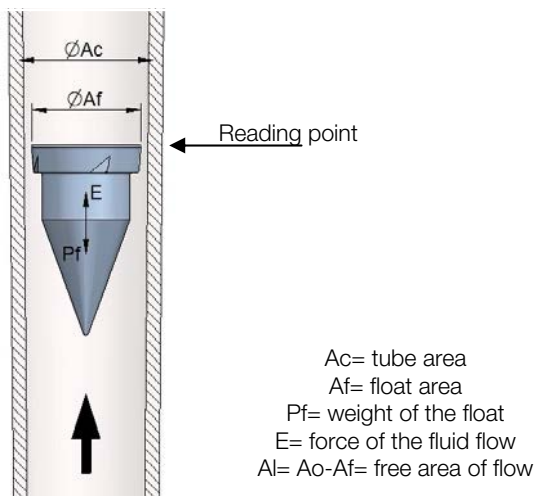
## Working principle

The 2000 series flowmeters work according to variable area principle, which is obtained by a float that moves inside a borosilicate glass tapered tube.

The fluid flows up through the tapered tube forcing the float to a position with sufficient free area to enable the flow to pass, where there is an equilibrium of forces:

- E = force of the fluid flow
  - Pf = weight of the float
  - Al = free area of flow
- (Al = Ac, tube area, - Af, float area)

Each position of the float corresponds to a value of flow rate.



## Applications

- Control panels and pilot plants
- Measurement and control in machinery
- Research and control laboratories
- Water treatment and cooling systems
- Control of gas burners and treatment ovens
- Chemical, pharmaceutical and cosmetic industry
- Control of level with RCD regulators

## Models

- 2100 flow tube length 100 mm
- 2150 flow tube length 150 mm
- 2300 flow tube length 300 mm
- 2340 flow tube length 300 mm

## Technical data

- Accuracy, acc. to VDI/VDE 3513 sheet 2 ( $q_G=50\%$ ):
  - 2100: 3.5%
  - 2150: 3%
  - 2300 / 2340: 1.6%
- Direct scales in engineering units or %
- Scale range: 10:1

- Fluid temperature: -20°C ... +80°C
- Ambient temperature: -20°C ... +80°C
- Working pressure: 15 bar max.
- Connections:
  - 2100 / 2150 / 2300: 1/4" BSP / NPT
  - 2340: 1/2" BSP / NPT
- Regulating valve:
  - Mounted on the inlet in applications for liquid and gas at atmospheric pressure
  - Mounted on the outlet in applications for pressurized gas

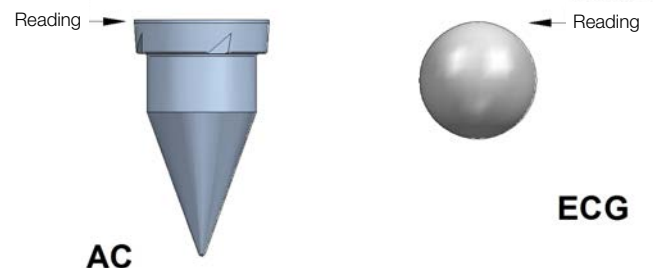
## Operation

- Vertical with upwards flow, with rear connections and horizontal inlet and outlet

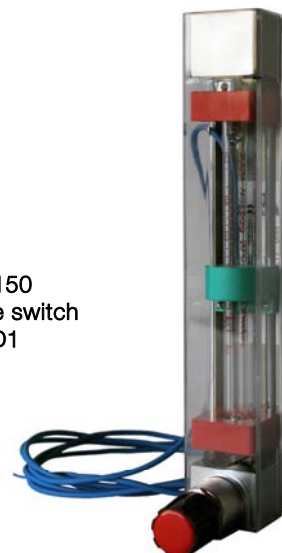
## Limit switches and accessories

- 20-AMD1 ... 2: 1 or 2 adjustable inductive switches (EN 60947-5-6 NAMUR relay on request)
- 20-AMO1 ... 2: 1 or 2 adjustable optical switches (with amplifier relay in an aluminium housing)
- 20-AMR1 ... 2: 1 or 2 adjustable reed switches
- Constant flow regulator:
  - RCA: Changes of pressure on the inlet and constant pressure on the outlet
  - RCD: Changes of pressure on the outlet and constant pressure on the inlet

## Float types



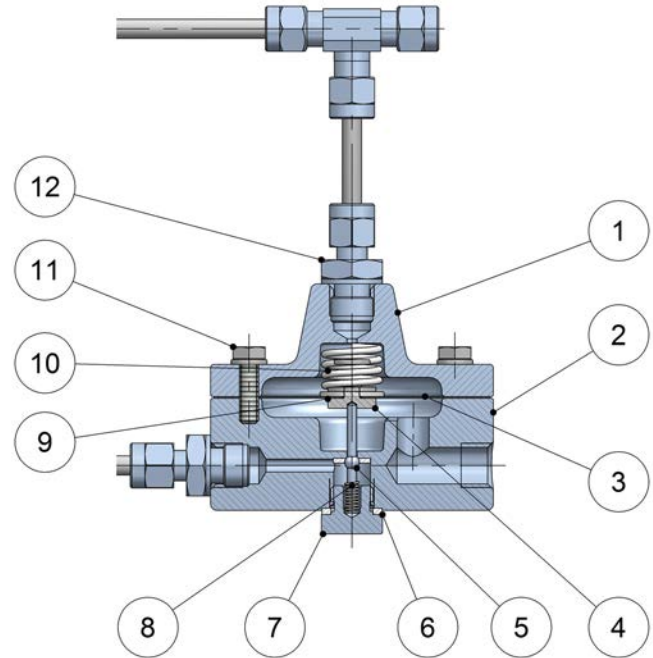
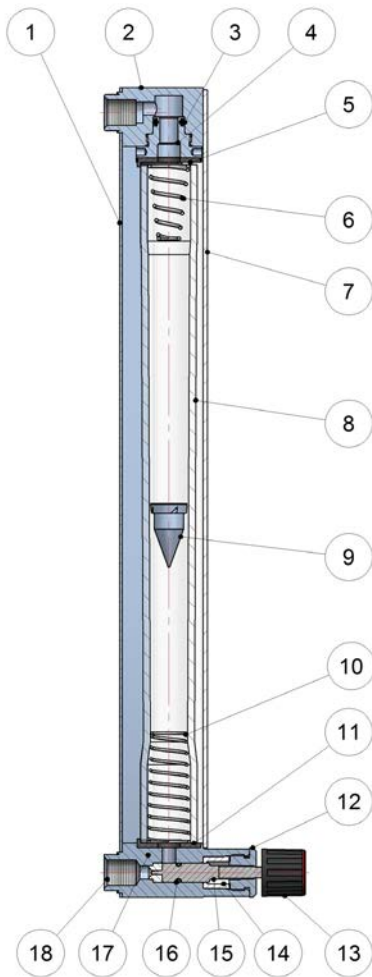
Model 2150  
with inductive switch  
20-AMD1



# Glass tube flowmeters

## Series 2000

### Materials



#### 2100 / 2150 / 2300 / 2340

| N° | Description             | Materials                                   |
|----|-------------------------|---|
| 1  | Frame                   | EN 1.4404 (AISI 316L)                       |
| 2  | Upper connector         | EN 1.4404 (AISI 316L)                       |
| 3  | Piston gasket           | NBR / VITON® / EPDM                         |
| 4  | Piston                  | EN 1.4404 (AISI 316L)                       |
| 5  | Upper tube gasket       | NBR / VITON® / EPDM                         |
| 6  | Upper float stop        | EN 1.4319 (AISI 302)                        |
| 7  | Protection              | Polycarbonate *                             |
| 8  | Flow tube               | Borosilicate glass<br>EN 1.4404 (AISI 316L) |
| 9  | Float                   | Glass / Ceramic<br>Plastic / Aluminium      |
| 10 | Lower float stop        | EN 1.4319 (AISI 302)                        |
| 11 | Lower tube gasket       | NBR / VITON® / EPDM                         |
| 12 | Lower / valve connector | EN 1.4404 (AISI 316L)                       |
| 13 | Valve knob              | Plastic                                     |
| 14 | Valve guide             | PTFE  |
| 15 | Valve shaft             | EN 1.4404 (AISI 316L)                       |
| 16 | Valve gaskets           | NBR / VITON® / EPDM                         |
| 17 | Valve seat              | PTFE  |
| 18 | Lower connector         | EN 1.4404 (AISI 316L)                       |

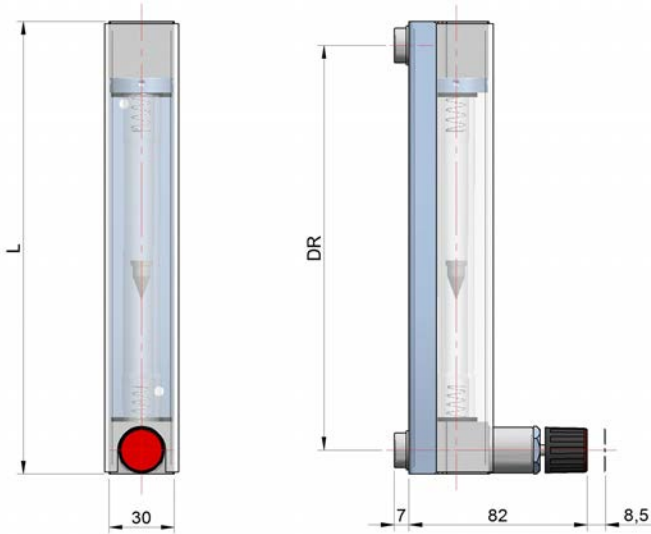
#### Constant flow regulator RCD / RCA

| N° | Description      | Materials             |
|----|------------------|-----------------------|
| 1  | Membrane body    | EN 1.4404 (AISI 316L) |
| 2  | Valve body       | EN 1.4404 (AISI 316L) |
| 3  | Membrane         | NBR / PTFE / VITON®   |
| 4  | Valve guide      | EN 1.4404 (AISI 316L) |
| 5  | Regulating valve | EN 1.4404 (AISI 316L) |
| 6  | Gasket           | NBR / PTFE            |
| 7  | Spring support   | EN 1.4404 (AISI 316L) |
| 8  | Valve spring     | EN 1.4319 (AISI 302)  |
| 9  | Membrane disk    | EN 1.4404 (AISI 316L) |
| 10 | Membrane spring  | EN 1.4319 (AISI 302)  |
| 11 | Screws           | EN 1.4401 (AISI 316)  |
| 12 | Connector union  | EN 1.4401 (AISI 316)  |

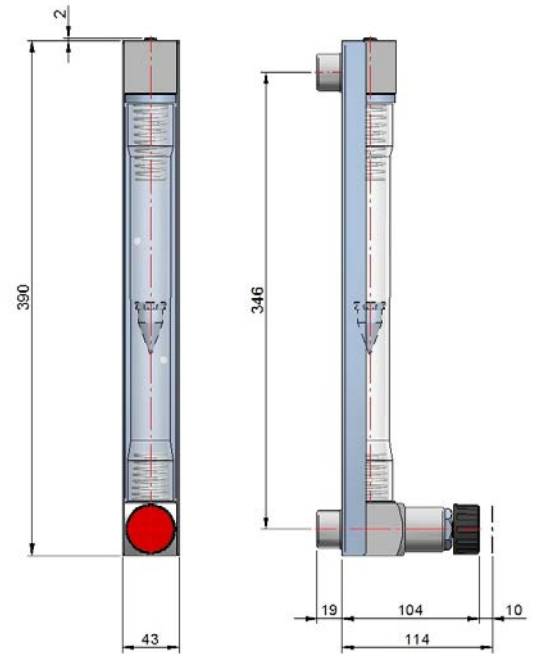
\* Model 2340, without protection

## Dimensions

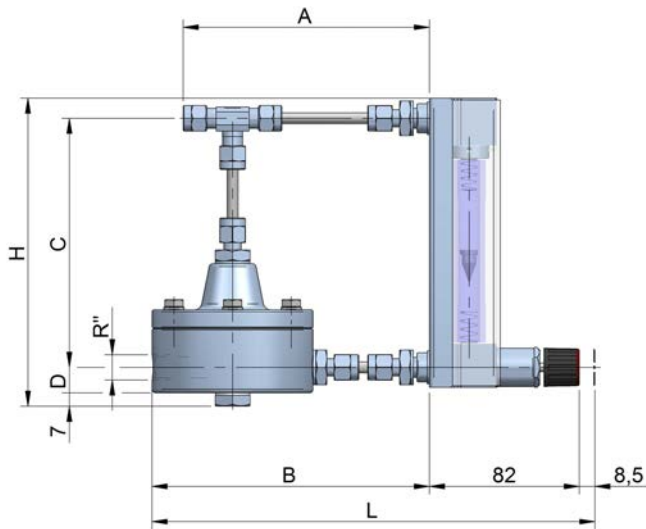
### Models 2100 / 2150 / 2300



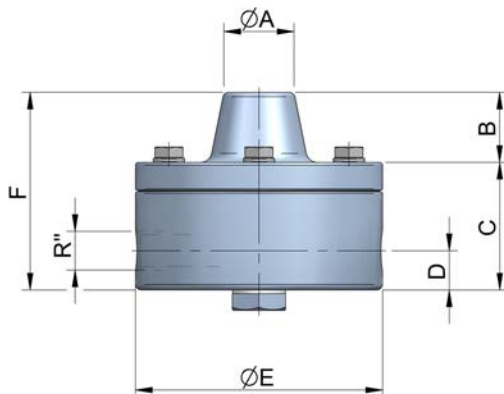
### Model 2340



### Series 2000 with constant flow regulator



### Constant flow regulator



All dimensions in mm

### Flowmeter

| Model | DR  | L   | R''<br>BSP/NPT | Weight<br>kg |
|-------|-----|-----|----------------|--------------|
| 2100  | 136 | 158 | ¼"             | 0.70         |
| 2150  | 186 | 208 | ¼"             | 0.85         |
| 2300  | 336 | 358 | ¼"             | 0.85         |
| 2340  | 346 | 390 | ½"             | 1.80         |

### Flowmeter + constant flow regulator

| Model | Flow rate<br>l/h water * | A   | B   | C   | D  | H   | L   | R''<br>BSP/NPT |
|-------|--------------------------|-----|-----|-----|----|-----|-----|----------------|
| 2100  | ≤ 10-100                 | 150 | 170 | 136 | 13 | 172 | 266 | ¼"             |
| 2150  |                          |     |     | 186 |    | 222 |     |                |
| 2300  | ≤ 25-250                 | 150 | 170 | 336 | 13 | 372 | 266 |                |
| 2340  | ≤ 60-630                 | 180 | 200 | 346 | 18 | 397 | 320 | ½"             |

\* Also for air equivalent flows, according to chart on page 5

### Constant flow regulator

| Model | R''<br>BSP/NPT | ØA | B  | C  | D  | ØE  | F  | Weight<br>kg |
|-------|----------------|----|----|----|----|-----|----|--------------|
| RCA   | ¼"             | 35 | 11 | 52 | 13 | 88  | 63 | 2,5          |
| RCD   |                |    |    |    |    |     |    |              |
| RCA * | ½"             | 40 | 16 | 65 | 18 | 100 | 81 | 3            |
| RCD * |                |    |    |    |    |     |    |              |

\* for flowmeter model 2340

# Glass tube flowmeters

## Series 2000

### Flow ranges

| Model N°          | Tube length (mm) | Flow scales, float type ECG |          |                                |          |          |          | ΔP mbar |
|-------------------|------------------|-----------------------------|----------|--------------------------------|----------|----------|----------|---------|
|                   |                  | l/h water                   |          | NI/h air<br>1.013 bar abs 20°C |          |          |          |         |
|                   |                  | AISI 316L<br>(EN 1.4404)    | GLASS    | AISI 316L<br>(EN 1.4404)       | GLASS    | PLASTIC  | CERAMIC  |         |
| <b>Model 2100</b> |                  |                             |          |                                |          |          |          |         |
| C110/0001         | 100              | 0.1-1                       | 0.05-0.5 | 4-40                           | 1-15     | 1-11     | 2-20     | 5       |
| C110/0002         |                  | 0.2-2.5                     | 0.1-1    | 8-80                           | 4-40     | 2-16     | 6-60     | 10      |
| C111/0005         |                  | 0.5-5                       | 0.2-2    | 15-160                         | 7-70     | 2-25     | 10-100   | 15      |
| C111/0010         |                  | 1-10                        | 0.4-4    | 30-350                         | 10-210   | 10-110   | 30-260   | 20      |
| C111/0016         |                  | 1.6-16                      | 0.6-6    | 40-490                         | 20-250   | 10-140   | 30-330   | 35      |
| C112/0025         |                  | 2.5-25                      | 1-10     | 80-840                         | 40-420   | 20-270   | 50-560   | 40      |
| C113/0040         |                  | 4-40                        | 1.6-16   | 120-1200                       | 70-700   | 40-420   | 80-880   | 45      |
| C114/0060         |                  | 6-60                        | 2-20     | 200-2200                       | 100-1200 | 70-800   | 150-1500 | 50      |
| C115/0100         |                  | 10-100 *                    | 4-40     | 300-3500                       | 150-1800 | 100-1100 | 200-2400 | 55      |
| <b>Model 2150</b> |                  |                             |          |                                |          |          |          |         |
| C210/0001         | 150              | 0.1-1                       | 0.05-0.5 | 3-30                           | 1-12     | 1-10     | 2-15     | 5       |
| C210/0002         |                  | 0.2-2.5                     | 0.1-1    | 10-110                         | 4-40     | 2-16     | 6-60     | 10      |
| C211/0005         |                  | 0.5-5                       | 0.2-2    | 15-180                         | 8-80     | 3-30     | 10-110   | 15      |
| C211/0010         |                  | 1-10                        | 0.4-4    | 30-350                         | 15-180   | 10-100   | 20-230   | 20      |
| C211/0016         |                  | 1.6-16                      | 0.6-6    | 50-510                         | 25-260   | 10-150   | 30-340   | 35      |
| C212/0025         |                  | 2.5-25                      | 1-10     | 80-830                         | 40-440   | 20-270   | 50-540   | 40      |
| C213/0040         |                  | 4-40                        | 1.6-16   | 130-1300                       | 70-700   | 40-440   | 80-880   | 45      |
| C214/0060         |                  | 6-60                        | 2-20     | 150-2100                       | 100-1100 | 70-740   | 100-1400 | 50      |
| C215/0100         |                  | 10-100 *                    | 4-40     | 300-3600                       | 150-1900 | 100-1200 | 100-2400 | 55      |

\* Also available with AC float

| Model N°          | Tube length (mm) | Flow scales, float type AC, except Glass float type ECG |        |                                |            |        |        | ΔP mbar |
|-------------------|------------------|---|--------|--------------------------------|------------|--------|--------|---------|
|                   |                  | l/h water   |        | NI/h air<br>1.013 bar abs 20°C |            |        |        |         |
|                   |                  | AISI 316L<br>(EN 1.4404)                                | GLASS  | AISI 316L<br>(EN 1.4404)       | ALUMINIUM  | PVC    | PTFE   |         |
| <b>Model 2300</b> |                  |   |        |                                |            |        |        |         |
| C311/0025         | 300              | 2.5-25  | 1-10   | 120-860                        | 60-490     | 40-340 | 40-370 | 55      |
| C311/0040         |                  | 4-40  | 1.6-16 | 150-1300                       | 80-800     | 50-530 | 50-630 | 80      |
| C311/0060         |                  | 6-60  | 2-20   | 150-2000                       | 100-1100   | 60-800 | 60-900 | 110     |
| C312/0100         |                  | 10-100  |        | 300-3000                       | 180-1800   |        |        | 130     |
| C312/0160         |                  | 16-160  |        | 490-4900                       | 300-2900   |        |        | 160     |
| C312/0250         |                  | 25-250  |        | 770-7700                       | 460-4600   |        |        | 180     |
| <b>Model 2340</b> |                  |   |        |                                |            |        |        |         |
| C313/0400         |                  | 40-400  |        | 1200-12000                     | 740-7300   |        |        | 90      |
| C313/0630         |                  | 60-630  |        | 1900-19000                     | 1100-11000 |        |        | 200     |
| C313/1000         |                  | 100-1000  |        | 3000-30000                     | 1800-18000 |        |        | 300     |

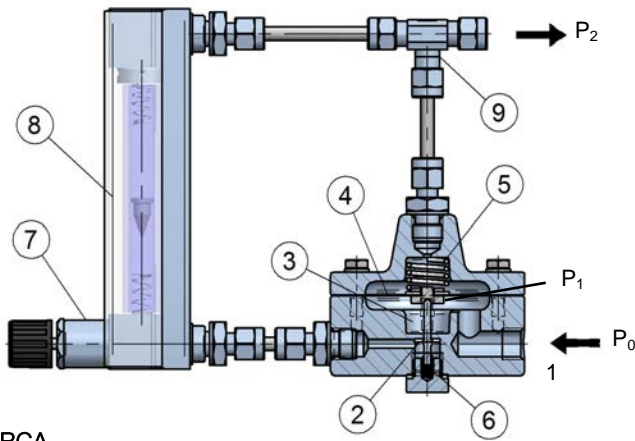


## Constant flow regulator

The 2000 series flowmeters are built to incorporate the RCA / RCD regulators, which allow keeping a constant flow when working pressure on the inlet or on the outlet are not constant.

In applications for gases, model RCA is used in installations where inlet pressure changes and outlet pressure or counter pressure is constant, while model RCD is used in installations where inlet pressure is constant and outlet pressure or counterpressure changes. For liquids, model RCA is the commonly used.

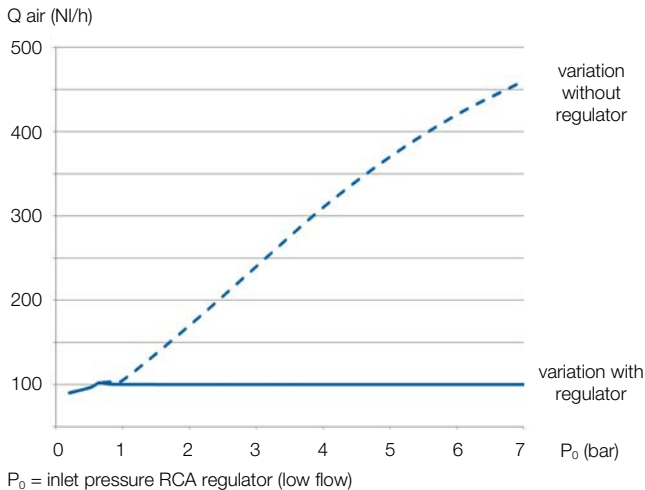
**Operation RCA regulator:** inlet pressure is variable and outlet pressure is constant. The fluid with variable inlet pressure enters through connection (1), passes the regulating valve (2) to the regulator chamber (3), where a new lower pressure  $P_1$  is created, acting on the membrane (4). The regulating valve (2) joined to the membrane (4) is initially open by the action of the



RCA

### Flow curves

The flow curves show the relationship between the inlet pressure  $P_0$  and the counter pressure  $P_2$  in the RCA regulator. The different flow rates are adjusted by means of the regulating valve (7) of the flowmeter. The counter pressure  $P_2$ , in this cases, corresponds to the atmospheric pressure.



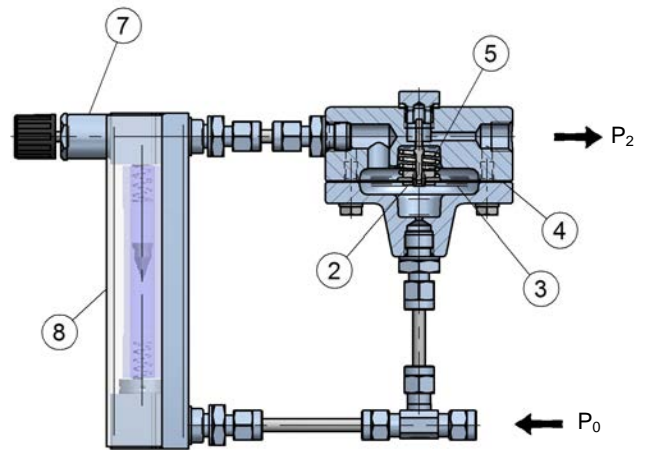
The dotted line shows the variation of flow without the action of the constant flow regulator. With constant flow regulator, variations of 100% in the inlet pressure  $P_0$  involve variations of flow of less than 1%.

regulating spring (5). After the fluid has passed through the regulator chamber (3), it passes through the flowmeter valve (7), then through the measuring tube (8), and goes out by the upper connection (9) against the constant outlet pressure  $P_2$  which also acts on the membrane (4).

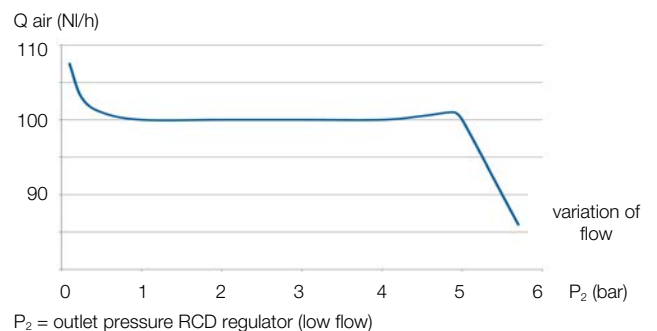
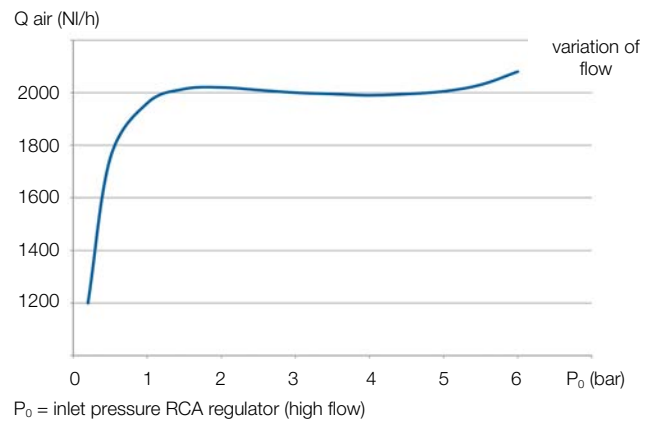
The springs (5 and 6) are built so that the valve (2) gets open when the inlet pressure  $P_0$  decreases and gets closed when  $P_0$  increases. This keeps a constant flow rate value through the regulating valve (7) of the flowmeter.

The differential pressure between  $P_0$  and  $P_2$  must always be higher than 350-450 mbar depending on model, which is the minimum necessary for the correct performance of the springs (5 and 6).

**Operation RCD regulator:** constant pressure on the inlet and variable pressure on the outlet. These operate in a similar way, modifying the position of the regulating valve (7), according to the drawing below.



RCD



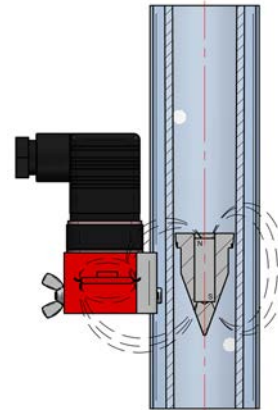
### Limit switches

#### Adjustable limit switch 20-AMR

(Flow rate from 10-100 l/h water and equivalent air ranges)

Bi-stable SPST reed switch, actuated by a magnet inside the float and mounted in a PVC enclosure. Requires magnetic float. The flowmeters with 20-AMR switch are supplied without plastic protection.

- 20-AMR1 ... 2: 1 ... 2 adjustable limit switches
- $I_{max}$ : 0,5 A ;  $V_{max}$ : 250 V ;  $P_{max}$ : 12 VA
- Hysteresis:  $\pm 5\%$  of full scale value
- Ambient temperature:  $-25^{\circ}\text{C} \dots +80^{\circ}\text{C}$
- Suitable for hazardous area, considered as "Simple apparatus"
- Available for models 2100 and 2150 (20-AMR switch), for 2300 (23-AMR switch) and for 2340 (24-AMR switch)



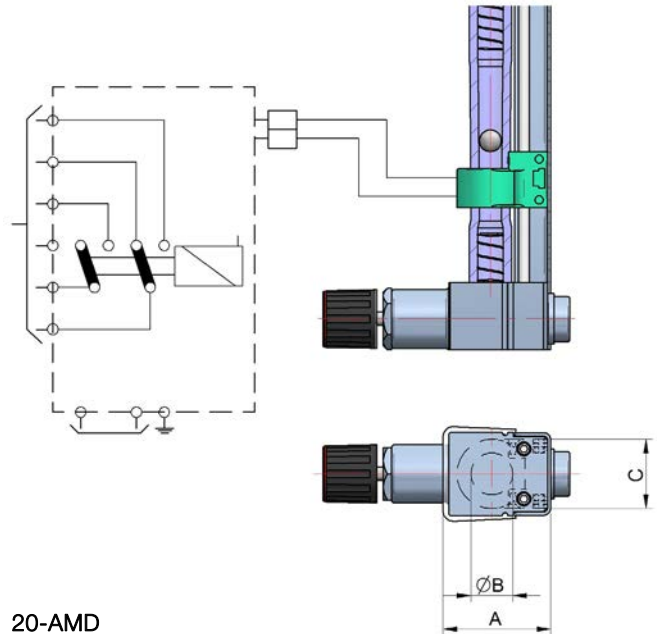
20-AMR

#### Adjustable limit switch 20-AMD

(Flow rate up to 6-60 l/h water and equivalent air ranges)

NAMUR (EN 60947-5-6) 3.5 mm slot type inductive detector activated by vane, mounted in the indicator housing. Suitable for AISI 316L float only.

- 20-AMD1 ... 2: 1 ... 2 adjustable limit switches
- Power supply: 8 VDC
- Ambient temperature:  $-25^{\circ}\text{C} \dots +70^{\circ}\text{C}$
- ATEX certificate Ex ia IIC T4...T6 Ga / Ex ia IIIC T85°C Da
- Available for models 2100 and 2150



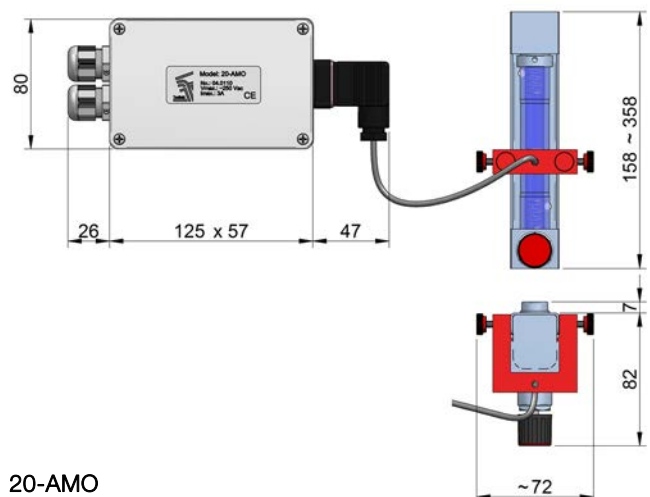
20-AMD

#### Adjustable limit switch 20-AMO

(Flow rate up to 25-250 l/h water and equivalent air ranges)

Infrared optical switch, actuated by the float when crossing the beam, mounted in a plastic enclosure and supplied together with control relay in an aluminium housing. Suitable for all float materials except glass. The flowmeters with 20-AMO switch are supplied without plastic protection.

- 20-AMO1 ... 2: 1 ... 2 adjustable limit switches
- $I_{max}$ : 1 A ;  $V_{max}$ : 220 VAC / 50Hz
- Hysteresis:  $\pm 5\%$  of full scale value
- Ambient temperature:  $-10^{\circ}\text{C} \dots +80^{\circ}\text{C}$
- Power supply: 220 VAC / 50Hz or 24 VDC
- Available for models 2100, 2150 and 2300



20-AMO

## Applications

### Measurement of hydrostatic level

The measurement of hydrostatic by means of bubbling can be used for both open and pressurized tanks.

In open tanks (fig. 1), the probe (not supplied) is fed a constant flow of air or neutral gas at a constant pressure and flow rate, regulated by the flowmeter series 2000+RCD. By means of a manometer (not supplied), the height of the liquid in the tank is measured. This height is equal to the pressure (mmH<sub>2</sub>O) in the probe. The measuring system is made up of:

- Probe for level measurement mounted in the tank
- Pressure gauge (or manometer) scaled in mmH<sub>2</sub>O
- Series 2000 flowmeter with RCD regulator

In case of pressurized tanks (fig. 2), two probes are required. These are connected to a differential pressure gauge (or manometer) that indicates the height of the liquid in the tank. The measuring system is made up of:

- 2 probes for level measurement mounted in the tank
- Differential pressure gauge (or manometer) scaled in mmH<sub>2</sub>O
- 2 series 2000 flowmeters with RCD regulators

### Measurement of variation of density

The system described above has other practical applications such as measurement of variation of density. If two probes, a differential pressure gauge and two RCD regulators are used, the measurement of density is independent of the level changes.

As shown in fig. 3, the probes are mounted just below the minimum level, and with a difference of height between both that depends on the liquid density, required precision and differential pressure gauge accuracy. The pressure variation for the same level or height differential is a function of the variations on liquid density. The system sensitivity is given as a function of the height H or pressure differential. The most usual level differential is 200 mm between pressure inlets, since that allows measuring variations of 0.1 g/cm<sup>3</sup> with a good accuracy.

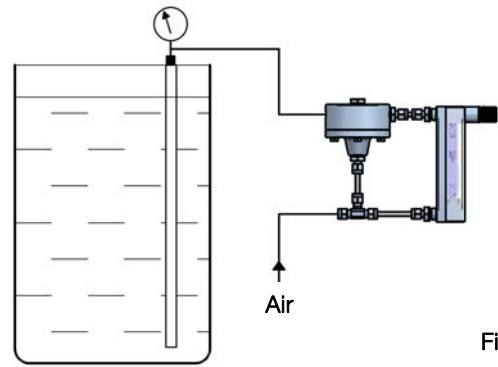


Fig. 1

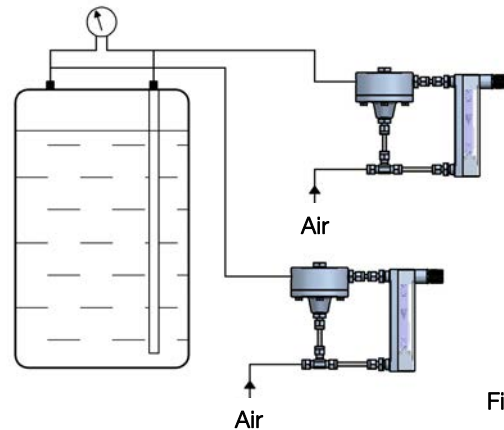


Fig. 2

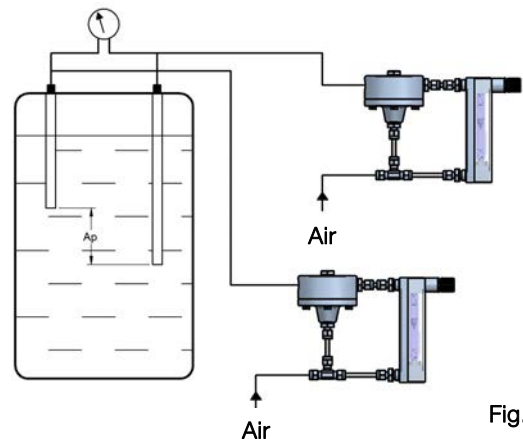


Fig. 3

**TECFLUID**  
The art of measuring

**WISAG**

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