

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 Nm³/h ... 30 Nm³/h
- Accuracy:
 - Model 2100: 3.5% (q₀=50%)
 - Model 2150: 3% (q₀=50%)
 - Models 2300 / 2340: 1.6% (q₀=50%)
- Connections:
 - 2100 / 2150 / 2300: ¼" BSP / NPT
 - 2340: ½" 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



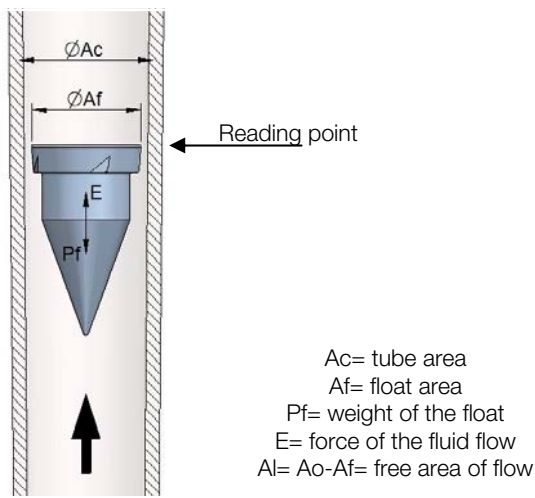
Working principle

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

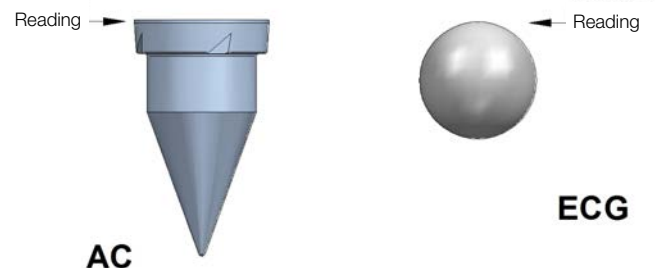
Operation

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

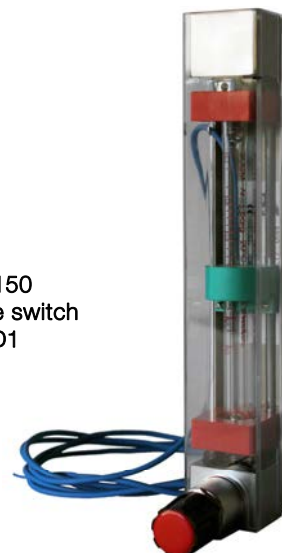
Limit switches and accessories

- 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



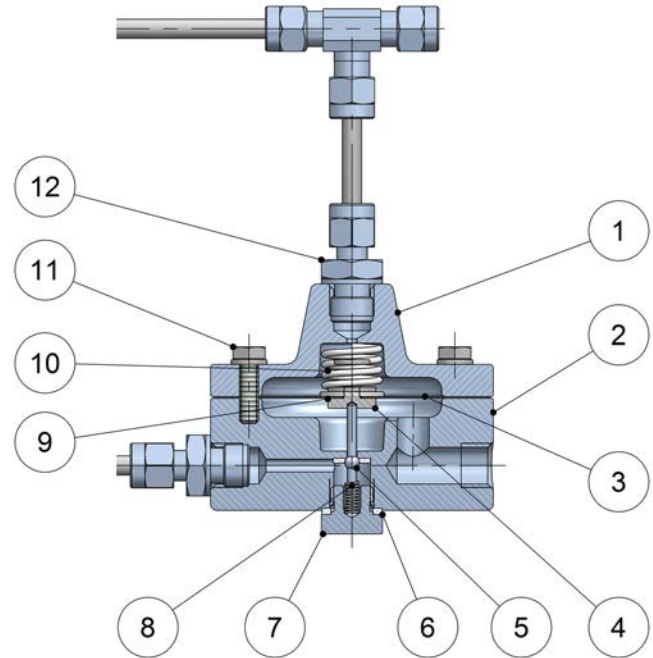
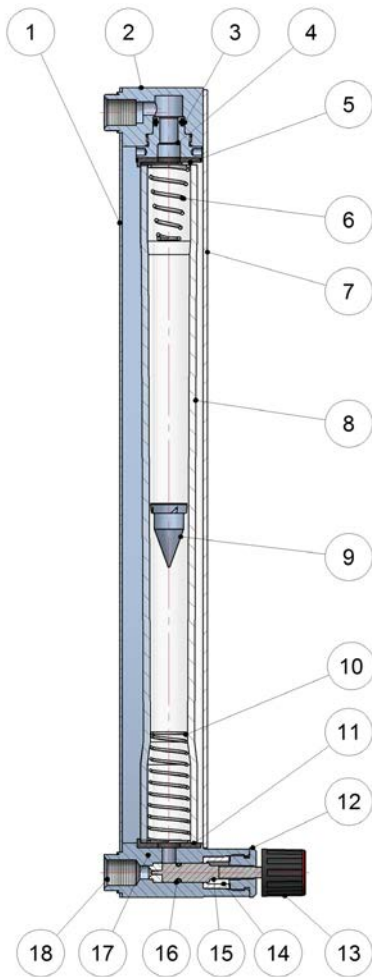
Model 2150
with inductive switch
20-AMD1



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 EN 1.4404 (AISI 316L)
9	Float	Glass / Ceramic 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)

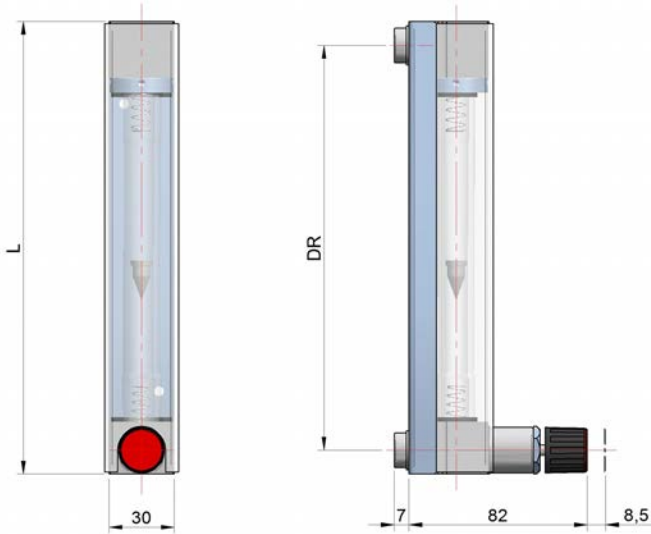
Constant flow regulator RCD / RCA

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)

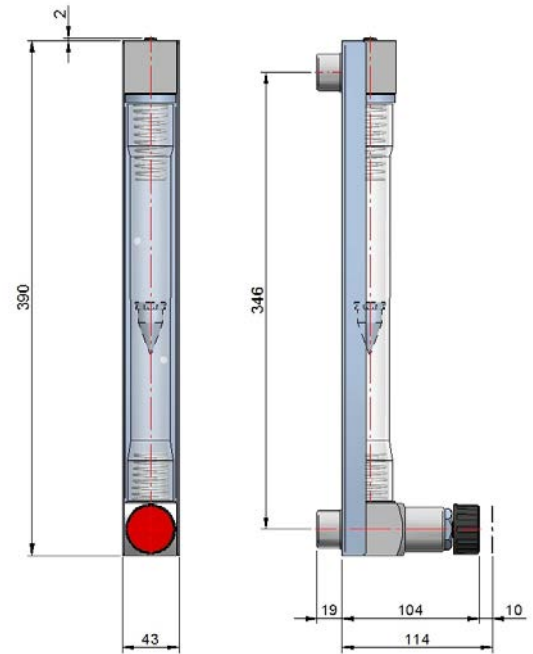
* Model 2340, without protection

Dimensions

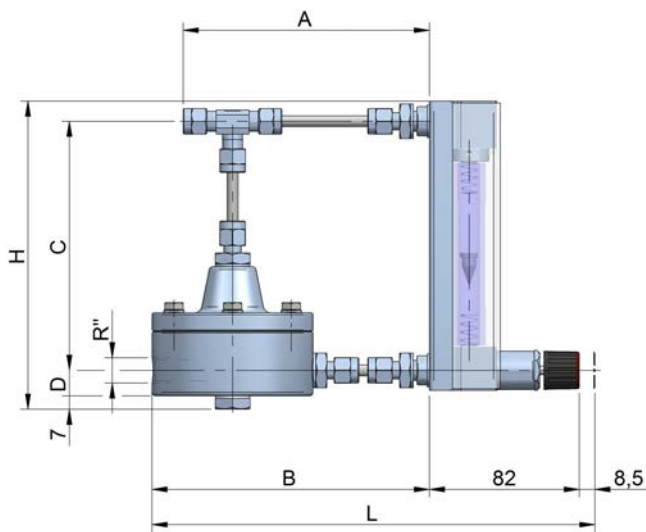
Models 2100 / 2150 / 2300



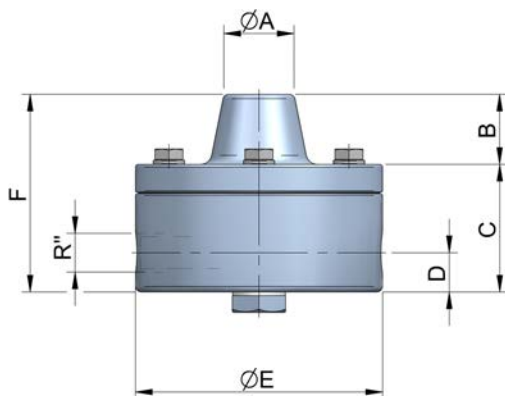
Model 2340



Series 2000 with constant flow regulator



Constant flow regulator



All dimensions in mm

Flowmeter

Model	DR	L	R" BSP/NPT	Weight 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 l/h water *	A	B	C	D	H	L	R" 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" BSP/NPT	ØA	B	C	D	ØE	F	Weight 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 1.013 bar abs 20°C				
		AISI 316L (EN 1.4404)	GLASS	AISI 316L (EN 1.4404)	GLASS	PLASTIC		CERAMIC
Model 2100								
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
Model 2150								
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

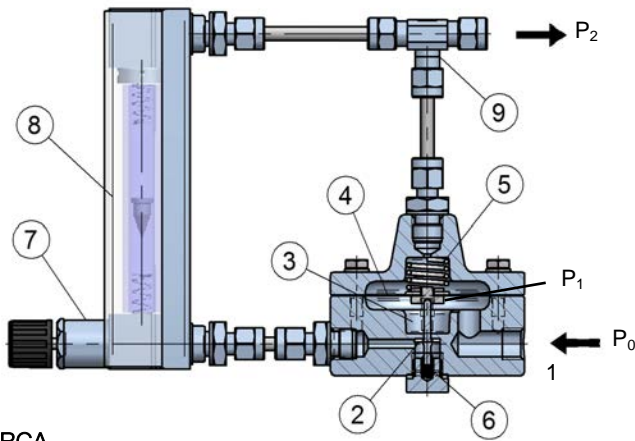
Model N°	Tube length (mm)	Flow scales, float type AC, except Glass float type ECG					ΔP mbar	
		l/h water		NI/h air 1.013 bar abs 20°C				
		AISI 316L (EN 1.4404)	GLASS	AISI 316L (EN 1.4404)	ALUMINIUM	PVC		PTFE
Model 2300								
C311/0025	300	2.5-25	1-10	120-860	60-490	40-340	40-370	55
C311/0040		4-40	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
Model 2340								
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.

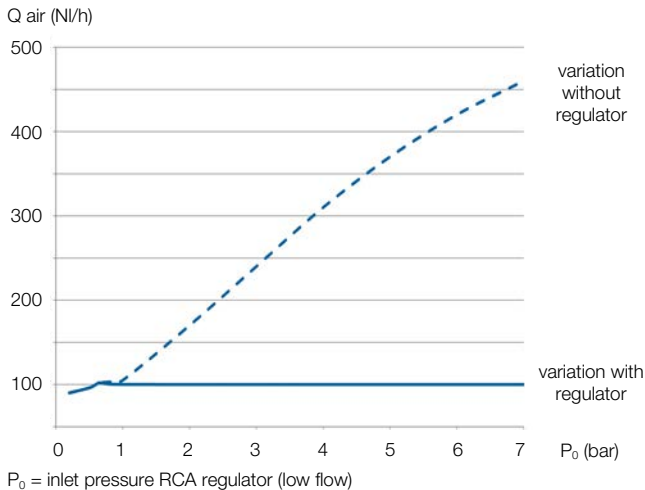
Operation RCA regulator: inlet pressure is variable and outlet pressure is constant. The fluid with variable inlet pressure enters through connection (1), passes the regulating valve (2) to the regulator chamber (3), where a new lower pressure P_1 is created, acting on the membrane (4). The regulating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



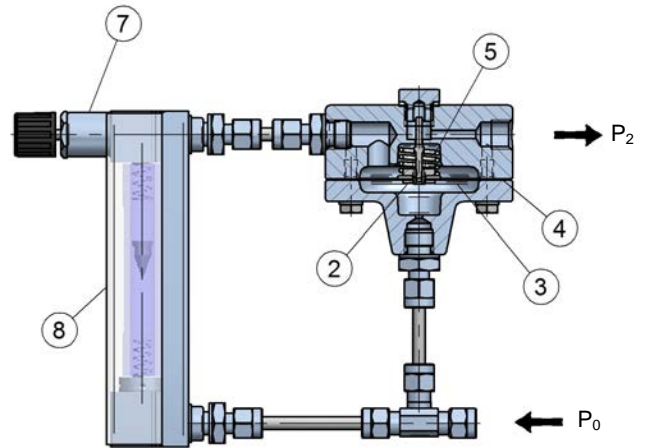
The dotted line shows the variation of flow without the action of the constant flow regulator. With constant flow regulator, variations of 100% in the inlet pressure P_0 involve variations of flow of less than 1%.

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).

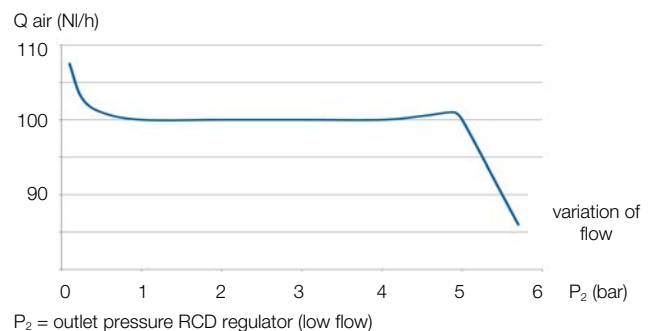
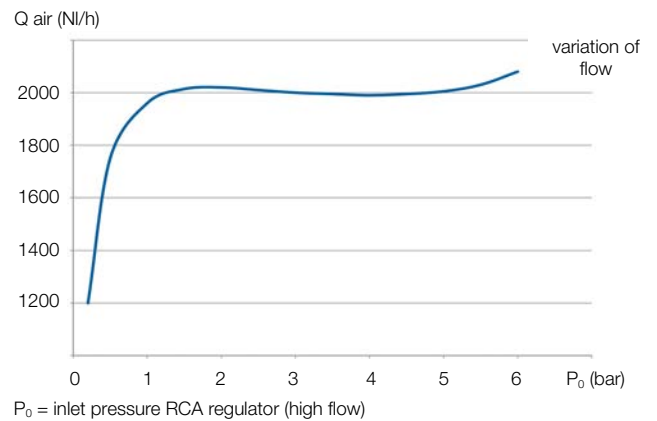
The springs (5 and 6) are built so that the valve (2) gets open when the inlet pressure P_0 decreases and gets closed when P_0 increases. This keeps a constant flow rate value through the regulating valve (7) of the flowmeter.

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



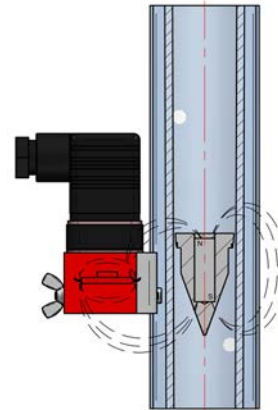
Limit switches

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)



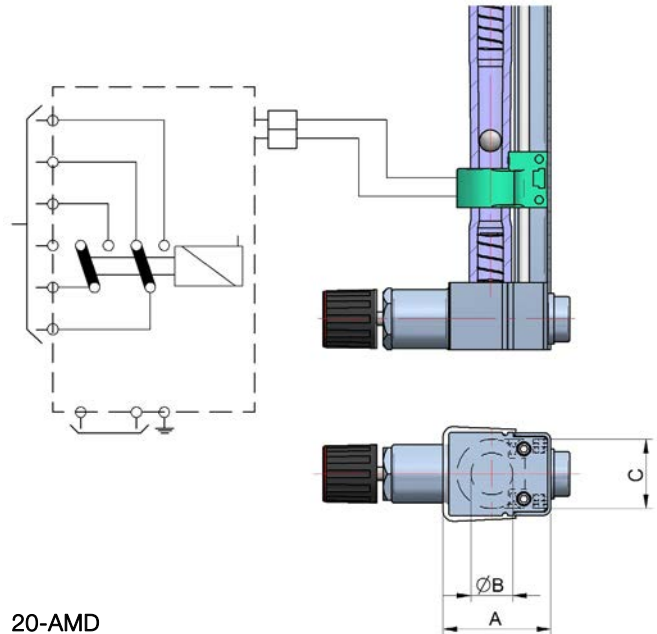
20-AMR

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



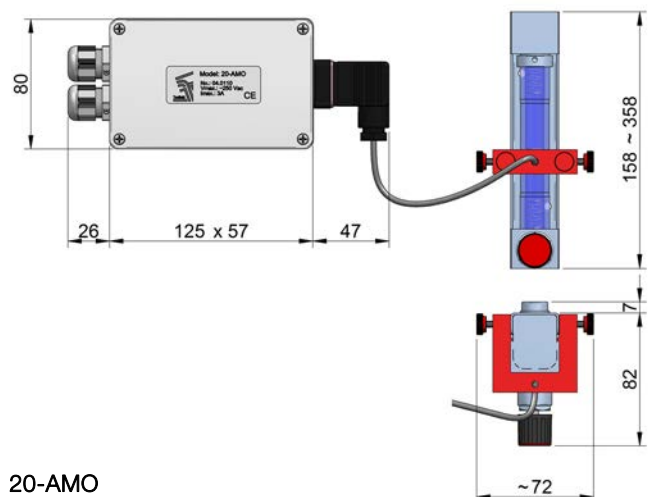
20-AMD

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 (mmH₂O) in the probe. The measuring system is made up of:

- Probe for level measurement mounted in the tank
- Pressure gauge (or manometer) scaled in mmH₂O
- 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 mmH₂O
- 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/cm³ with a good accuracy.

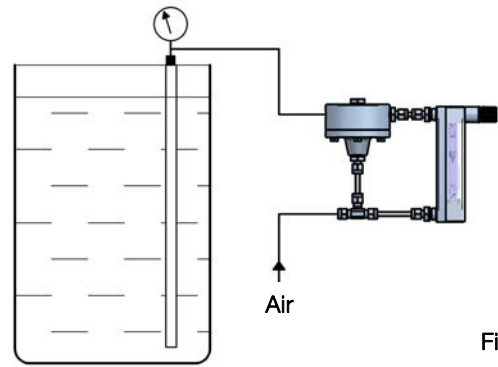


Fig. 1

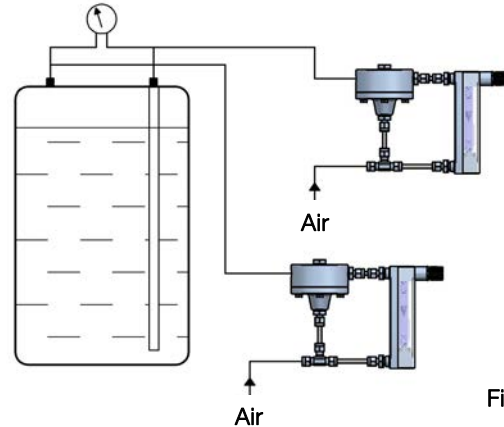


Fig. 2

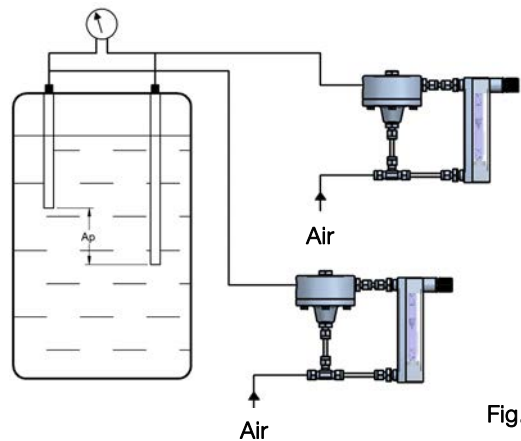


Fig. 3

TECFLUID
The art of measuring

Tecfluid S.A.
Narcís Monturiol 33
08960 Sant Just Desvern
Barcelona
Tel: +34 93 372 45 11
Fax: +34 93 473 44 49
tecfluid@tecfluid.com
www.tecfluid.com

MARKETED BY:
MALEMA
Malema Sensors
Tel: 561-995-0595
Fax: 561-995-0622
Email: malema@malema.com
www.malema.com

Quality Management System ISO 9001 certified by **Applus[®]**

Pressure Equipment Directive 97/23/CE certified by **Lloyds Register**

ATEX European Directive 94/9/CE certified by **LOM**

