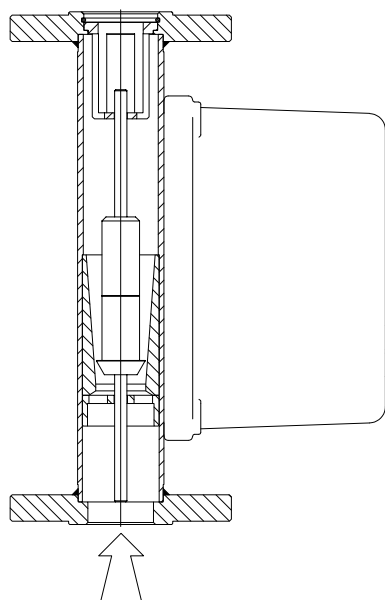


# METALLIC VARIABLE AREA FLOWMETER

## TMG Series



### DESCRIPTION

The Metallic Variable Area Flowmeter TMG Series consists in a vertical metal **cone** with a guided **float** inside with an internal magnet. As flow increases, the float, in equilibrium between weight force, buoyancy force, and fluid thrust, moves to a higher position, in order to increase the fluid's passage surface.

Outside the cone, not in contact with the fluid, there's a housing containing a **dial** indicator magnetically coupled to the float, which mirrors its position.

The instrument's scale is customized for each fluid and calculated using its operating process data: density, temperature, and pressure.

### FEATURES

- Cost-effective, direct measurement with no external power supply required
- Wide measurable flow ranges
- Suitable for gases and liquids, including viscous fluids
- Magnetic coupling overcomes limitations of glass flowmeters (corrosive or hazardous fluids, high temperatures and pressures)
- Replaceable float
- Easy installation and maintenance
- Complete production control fully integrated inside the company and highly competent local suppliers.
- Qualified welders and welding procedures compliant with ASME IX and EN ISO 15614.
- Completely customizable on client's needs thanks to the support of our technical and sales departments
- Over 60 years company experience with instruments installed worldwide

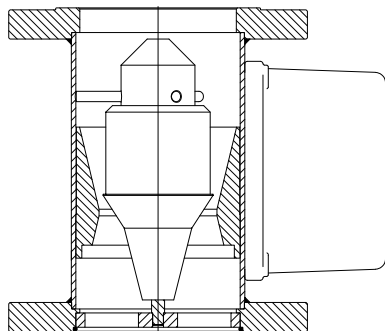
### APPLICATIONS

- Chemical and petrochemical
- Oil & Gas On and Off-shore
- Power plants
- Water treatment

### TECHNICAL SPECIFICATIONS

- Pressure rating up to ANSI2500, PN400
- Gaskets-free corrosion resistant design
- Accuracy  $\pm 1.5\%$  full scale value, the value varies with the viscosity, above 5 cP
- Repeatability  $\pm 0.2$
- Fluid's viscosity up to 200 cP
- Measuring range ratio 1-10, scale length  $\sim 100$  mm
- Fluid's temperature from  $-196$  to  $+400$  °C and over on request
- Ambient temperature from  $-40$  to  $+70$  °C and over on request
- Available in many materials, depending on the application
- Wide range of accessories





## MODELS

Measurement ranges for Series TMG are defined in steps by model. Flow rates in the table refer to water and air at normal conditions; values for other fluids or conditions are calculated by Officine Orobiche based on operating temperature, pressure, and density. Variations in these parameters will compromise the instrument calibration.

**Table B**

| CONNECTIONS<br>Ømin | WATER |                    | AIR  |                                   | ΔP [mbar] |
|---------------------|-------|--------------------|------|-----------------------------------|-----------|
|                     | CODE  | FLOW RATE<br>[L/h] | CODE | FLOW RATE<br>[Nm <sup>3</sup> /h] |           |
| 15 (1/2")           | A58   | 1.0 - 10           | B58* | 0.03 - 0.30                       | 60        |
|                     | A59   | 1.6 - 16           | B59* | 0.05 - 0.50                       | 60        |
|                     | A01   | 2.5 - 25           | B01  | 0.08 - 0.80                       | 50        |
|                     | A02   | 4.0 - 40           | B02  | 0.12 - 1.20                       | 55        |
|                     | A03   | 6.3 - 63           | B03  | 0.2 - 2.0                         | 55        |
|                     | A04   | 10 - 100           | B04  | 0.3 - 3.0                         | 35        |
|                     | A05   | 16 - 160           | B05  | 0.5 - 5.0                         | 35        |
|                     | A06   | 25 - 250           | B06  | 0.75 - 7.50                       | 35        |
|                     | A07   | 40 - 400           | B07  | 1.2 - 12.0                        | 30        |
|                     | A08   | 63 - 630           | B08  | 2 - 20                            | 30        |
|                     | A09   | 100 - 1'000        | B09  | 3 - 30                            | 35        |
| 25 (1")             | A10   | 100 - 1'000        | B10  | 3 - 30                            | 40        |
|                     | A11   | 160 - 1'600        | B11  | 5 - 50                            | 40        |
|                     | A12   | 250 - 2'500        | B12  | 7.5 - 75                          | 45        |
|                     | A13   | 400 - 4'000        | B13  | 12 - 120                          | 45        |
|                     | A14   | 600 - 6'000        |      |                                   | 75        |
| 50 (2")             | A15   | 630 - 6'300        | B15  | 20 - 200                          | 45        |
|                     | A16   | 1'000 - 10'000     | B16  | 30 - 300                          | 40        |
|                     | A17   | 1'600 - 16'000     | B17  | 50 - 500                          | 40        |
|                     | A18   | 2'500 - 25'000     |      |                                   | 45        |
| 80 (3")             | A19   | 2'500 - 25'000     | B19  | 75 - 750                          | 45        |
|                     | A20   | 4'000 - 40'000     | B20  | 120 - 1'200                       | 45        |
|                     | A21   | 6'300 - 63'000     |      |                                   | 80        |
| 100 (4")            | A22   | 6'300 - 63'000     |      |                                   | 70        |
|                     | A23   | 10'000 - 100'000   |      |                                   | 100       |

Instruments with the flow self-regulator can have connections with smaller diameters, see the relevant chapter.

\*Supplied only with dampener

## OTHER INSTRUMENTS

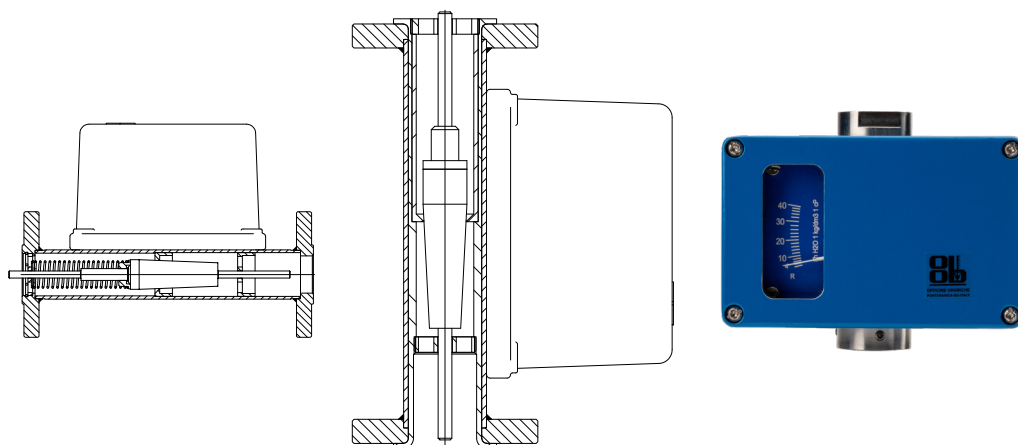
Since the Variable Area principle relies on gravity, the TMG Series (except RV/TMG version) is suitable only for upward vertical flow. The Metallic Flowmeter **TMO Series** replaces gravity with a spring force, making it suitable for horizontal installation.

For lower flow rate, the Metallic Variable Area Flowmeter **TMS Series** can measure down to 0.1 L/h of water or 3 NL/h of air.

For highly corrosive fluids, the Metallic Variable Area Flowmeter **TMN Series** has a simpler geometry that allows it to be manufactured in special materials, like titanium or nickel alloys), and it can even be PTFE-lined.

Officine Orobiche manufactures also transparent glass variable area flowmeters, which are more economical and allow visual fluid inspection.

For other types of flows gauges, Officine Orobiche manufacture a whole range of Primary Flow Elements that includes Orifice Plates, Orifice Plate Assemblies, Meter Runs, Flow Nozzles, Venturi Tubes, Venturi Cone Meters, Wedge Meters and Multiport Averaging Pitot Tubes.



TMO Series

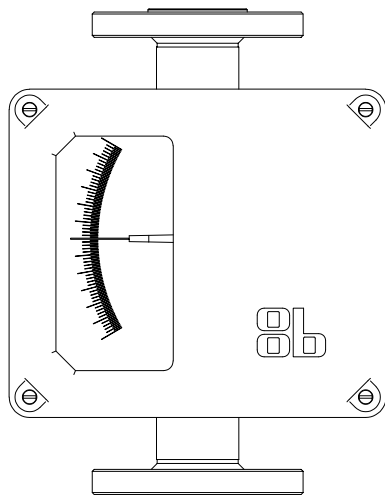
TMN Series

TMS Series

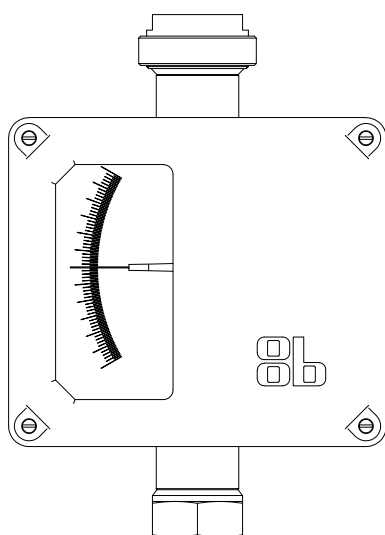
## MATERIALS

Due to magnetic coupling, the instrument's body can only be made from non-ferromagnetic materials. The standard version is made of **dual-grade SS 316/316L**. On request it can be manufactured with the materials in the following table or more others.

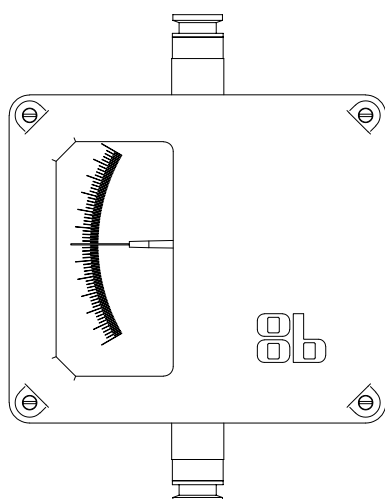
| CODICE | MATERIALE              |
|--------|------------------------|
| J o JL | SS 316/316L dual grade |
| HC     | Alloy C276             |
| MO     | Alloy 400              |
| 825    | Alloy 825              |
| 625    | Alloy 625              |
| 20     | Alloy 20               |
| F44    | Super aust. UNS S31254 |
| TI     | Titanio                |



Flanged



Threaded



Tri-Clamp

## CONNECTIONS

The TMG Series Metallic Flowmeter can be supplied with the following process connections or others on request:

- **Flanged**
  - ANSI B16.5
  - EN 1092/1
- **Threaded**
  - NPT-F or NPT-M
  - GAS-F or GAS-M
- DIN 11851 (Hygienic)
- Tri-clamp (BS4825)

Table A

| CODE | CONNECTIONS   |
|------|---------------|
| A    | Flanges ANSI  |
| E    | Flanges EN    |
| U    | Flanges UNI   |
| D    | DIN Hygienic  |
| T    | Tri-Clamp     |
| G    | Threads GAS-F |
| N    | Threads NPT-F |
| X    | Others        |

## HOUSING

Instrument's housing is available in painted die-cast **aluminum** or **SS 316L**.

For versions with electrical accessories it's available in **IP66** version or **explosion-proof Ex d IP68** version for classified areas.

|                              | ALLUMINIUM | SS316L |
|------------------------------|------------|--------|
| STANDARD<br>IP66             |            |        |
| EXPLOSION-PROOF<br>IP68 Ex d |            |        |

When electrical accessories are present, the housing has a PG11, 1/2" NPT, or ISO M20x1.5 entry. On request it can be supplied with an additional entry, reductions, or cable glands as accessories.

## TRASMETTER

The TMG Series flowmeter can be equipped with a **4–20 mA**, Fieldbus, or Profibus transmitter inside the housing. The 4–20 mA analog signal can be overlaid with a HART digital signal. For classified areas, an intrinsically safe Ex i version is available.

A four digits LCD loop-powered **display** can be placed, on the instrument's scale, that shows the 4-20 mA signal value in percentage. This configuration combines the dial mechanical indication with the display analogic one.

The following table resume the various configurations:

Table D

| CODE | TRASMITTER          |
|------|---------------------|
| T0   | No transmitter      |
| T1   | Standard 4-20 mA    |
| T2   | 4-20 mA Ex i        |
| T3   | 4-20 mA HART 7      |
| T4   | 4-20 mA HART 7 Ex i |
| TF   | Foundation Fieldbus |
| TP   | PROFIBUS            |

The code shows an additional “+D” if it comes with the Display.

## SWITCHES

The TMG Series Flowmeter can be supplied with one or more bistable switches: **Reed type** (30 VDC 0.1 A) or **NAMUR type** (8 VDC 0.01 A).

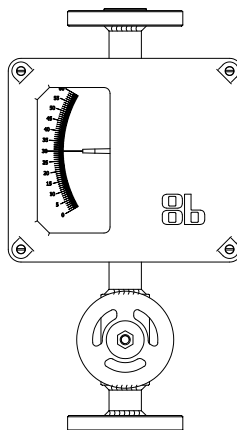
Table E

| CODICE | INTERRUTTORE |
|--------|--------------|
| C1     | n°1 Reed     |
| C2     | n°2 Reed     |
| C3     | n°1 NAMUR    |
| C4     | n°2 NAMUR    |

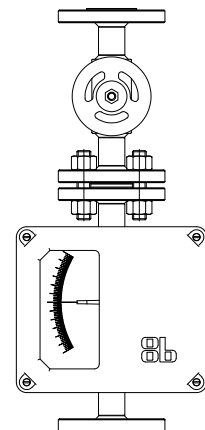
## VALVES

The TMG Series flowmeter can be supplied with an **integrated inlet** needle or globe/needle valve.

On request the valve can be supplied in outlet position but not integral with the flowmeter's body, otherwise it wouldn't be possible to remove the float for maintenance.



Integral inlet valve



Mounted outlet valve

## FLOW SELF-REGULATOR

The instrument can be manufactured with a flow self-regulator that maintains the flow constant in case of pressure variations.

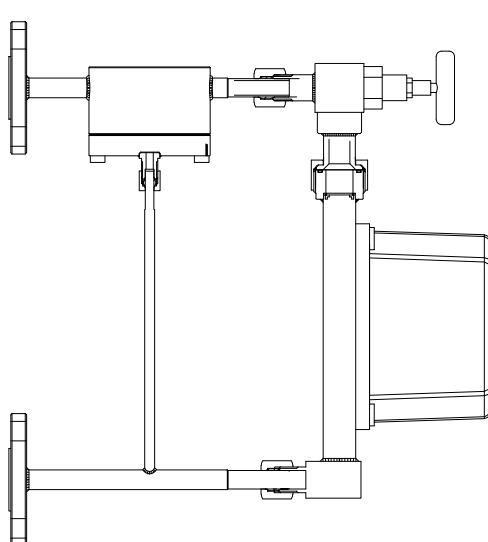
- Inlet regulator: variable inlet pressure, constant outlet (only for gas)
- Outlet regulator: constant inlet pressure, variable outlet (for both gas or liquid)

Three sizes are available based on instrument's flow rate.

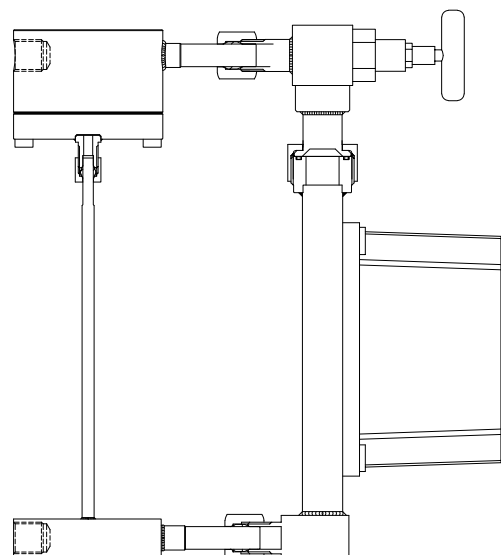
**Table F**

| CODE | SELF-REGULATOR | CONNECTIONS Ømin | AIR MAX FLOW RATE |
|------|----------------|------------------|-------------------|
| RPJU | Outlet Small   | 1/4"             | 3 Nm3/h           |
| RPJE | Inlet Small    |                  |                   |
| RGJU | Outlet Medium  | 1/2"             | 20 Nm3/h          |
| RGJE | Inlet Medium   |                  |                   |
| RXJU | Outlet Large   | 1/2"             | 120 Nm3/h         |
| RXJE | Inlet Large    |                  |                   |

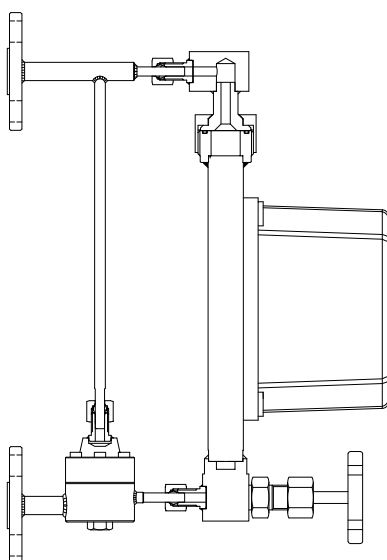
When the instrument mounts the Self-Regulator, the connections layout is Side-Side.



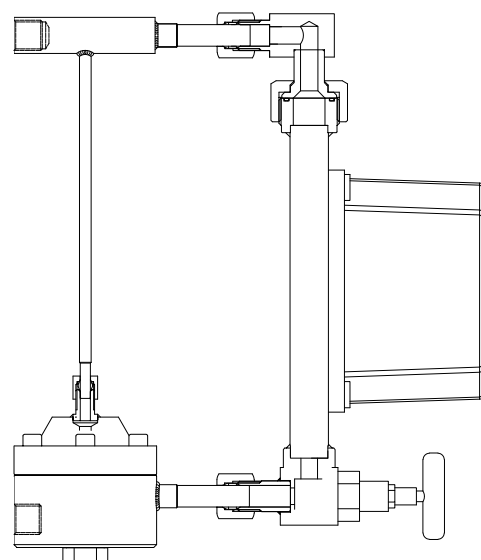
Flanged Outlet Self-Regulator



Threaded Outlet Self-Regulator



Flanged Inlet Self-Regulator



Threaded Inlet Self-Regulator

## RV/TMG

For **high flows** or **large pipe** diameters, the TMG Series Flowmeter can be mounted as a derivated flowmeter on an RV Series diaphragm.

The diaphragm introduces a pressure drop proportional to the flow value. The flowmeter is connected to two diaphragm's pressure taps, and its float is positioned to a height proportionally to the pressure drop, showing the flow value with the coupled dial.

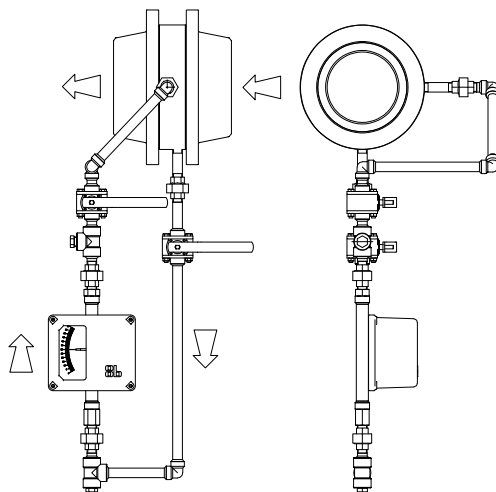
This combination is also available for horizontal or downward flow.

The diaphragm is available of carbon steel with an SS 316 plate or of other materials on request.

| PIPELINE Ø | EXTERNAL DIAPHRAGM Ø | MAX WATER FLOW |
|------------|----------------------|----------------|
| 100 (4")   | 162 mm               | 120 m3/h       |
| 125 (5")   | 192 mm               | 200 m3/h       |
| 150 (6")   | 218 mm               | 250 m3/h       |
| 200 (8")   | 273 mm               | 500 m3/h       |
| 250 (10")  | 328 mm               | 800 m3/h       |
| 300 (12")  | 375 mm               | 1000 m3/h      |
| 350 (14")  | 438 mm               | 1200 m3/h      |

The supply instrument can include only the flowmeter and the diaphragm or, on request, it can include:

- Shut-off valves
- A panel where mount the flowmeter
- Connections pipes kit



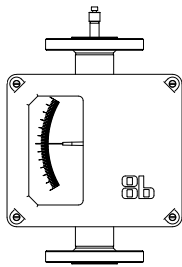
RV/TMG with all accessories



Panel mounted TMG with shut-off valves

## OTHER ACCESSORIES AND VARIATIONS

- Double scale
- Electric, steam, or self-heating cable tracing
- Insulation
- High-temperature version up to 450 °C (higher on request)
- Full-penetration welds with WN flanges
- Dampener to reduce float oscillation with gas fluids
- Connections curves and reducers
- Custom panels per customer design
- Standard Officine Orobiche or customer coatings
- Surge protector for electrical parts



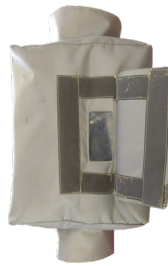
Dampener



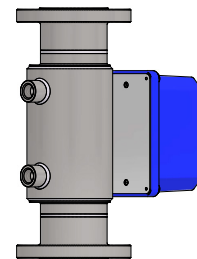
Outlet 90° curve



High temperature version



Cryogel insulation



Steam jacket tracing

## APPROVALS

On request the following approvals are available:

- PED 2014/68 UE
- ATEX II 2G Ex h IIC/IIB Tx Gb, II 2d Ex h IIIC Tx Db
- IECEx Ex h IIC T4 Gb / Ex h IIIC T100°C Db
- NACE MR-0175 or MR-0103
- EAC CU TR 012: 1 Ex h IIC Tx Gb
- Pattern Approval and Poverka for Russia exportation

For electrical accessories:

- ATEX Ex d or i
- IECEx Ex d
- IECEx Ex h ib IIC T4 Gb / Ex h ib IIIC T100°C Db
- EAC Ex d or i
- IEC 61508 SIL 2
- IEC 60529:1989 IP66
- ECAS Ex for UAE exportation

## SPARE PARTS

Our company database contains information about the instruments manufactured in 60 years, to request spare parts for an installed instrument state the F number written in the top-right of the tagplate:



The standard spare kit includes float, stopper and clipping, depending and they depend on the model (Table A).

## MODEL CODE

| TMG250 | A                         | BB                         | CCC                 | DD                   | EE              | FFFF                    | XX                     |
|--------|---------------------------|----------------------------|---------------------|----------------------|-----------------|-------------------------|------------------------|
|        | Connections type: Table A | Connections Ø min: Table B | Flow model: Table B | Transmitter: Table D | Switch: Table E | Self-regulator: Table F | Any possible variation |

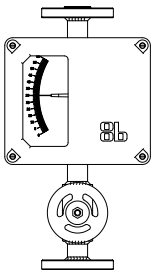
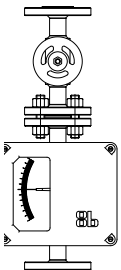
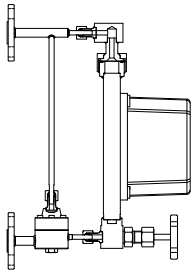
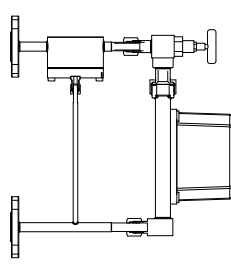
EE, FFFF, XX are present only when applicable.

**Example:** TMG250.A.15.A09.T0.RPJE.XX

To request a quotation please state:

- Fluid density
- Fluid type (liquid or gas)
  - For liquids: operating viscosity
  - For gas operating temperature and pressure
- Area classification (safe or classified)
- Design temperature and pressure
- Connection details (type, DN, rating)
- Material

For instruments with valves or self-regulators, the pressure should be measured as per the following table:

| Inlet valve                                                                         | Outlet valve                                                                        | Inlet self-regulator                                                                  | Outlet self-regulator                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |
| Outlet pressure                                                                     | Inlet pressure                                                                      | Outlet pressure                                                                       | Inlet pressure                                                                        |

Our technical and commercial departments are available to discuss any variation or customization not mentioned in this catalogue.



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[info@officineorobiche.it](mailto:info@officineorobiche.it)



## TMS100 SERIES METALLIC FLOWMETERS



# OFFICINE OROBICHE

## TECHNICAL FEATURES

- Measuring tube in AISI 316
- Float and wetted parts in AISI 316
- Magnetic of reading transmission
- Aluminium housing IP 65
- Vertical mounting with rising flow
- Measuring range 1/10
- Scale 40 mm.
- Accuracy:  $\pm 5\%$  full scale value
- Connections: 1/2" GAS-F or NPT-F
- Weight: ~ 200 gr

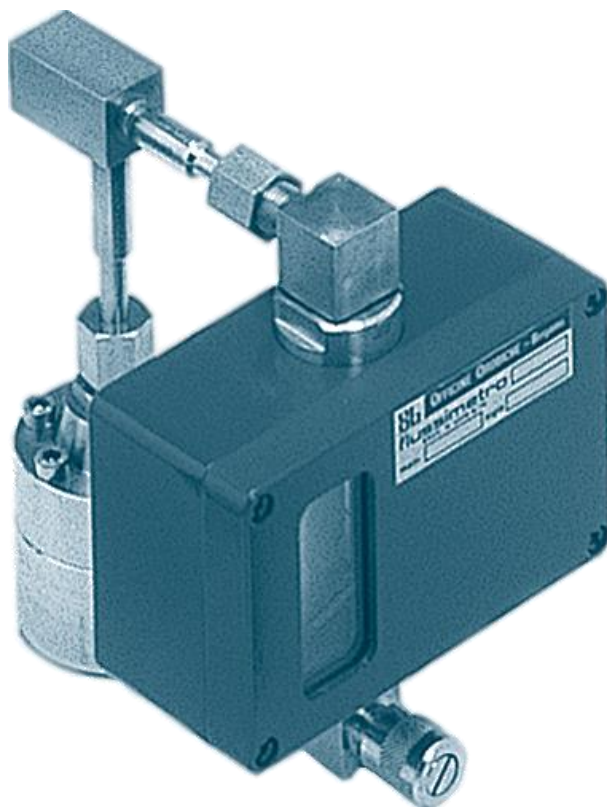
## OPERATING CONDITIONS

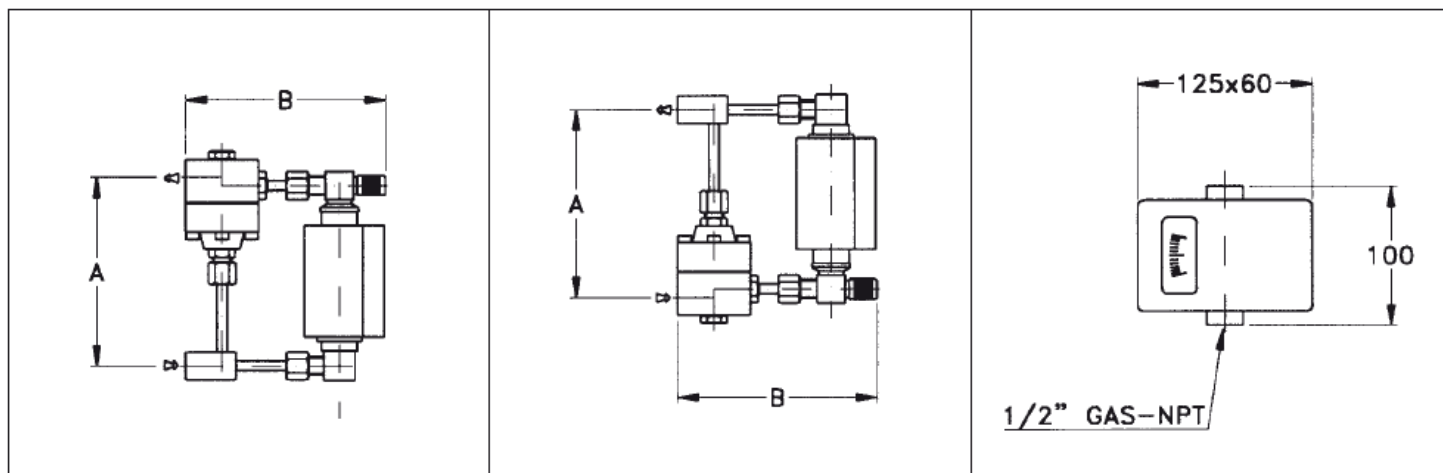
- Max pressure 150 Bar
- Max temperature 150° C
- Viscosity: 1CPS

## OPTIONS - ACCESSORIES

- Flanged connections, axial and/or square
- Min. or max. contact with inductive bistable sensor, NAMUR type
- Output on connector with PG7
- Built-in control valve
- Self-regulator of flow range in input or output with connections:
  - 1/4" up to 3.000 NI/h of air
  - 1/2" up to 6.000 NI/h of air
- Self-regulator in input (RE), is used with variable pressure in input and constant in output (this last value has to be used in the calculation).
- Self-regulator in output (RU), is used with variable pressure in output and constant in input (this last value has to be used in the calculation).

**REMARK=** The self-regulator isn't applicable for water





| Ref . | Self -regulator (1/4") | Self -regulator (1/2") |
|-------|------------------------|------------------------|
| A mm  | 135                    | 149                    |
| B mm  | 145                    | 330                    |

## SCHEDULE OF FLOW RANGES

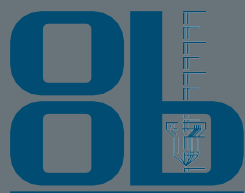
| CODE | FLOW RANGE FOR WATER<br>sg= 1 cps= 1 (l/h) | CODE | FLOW RANGE FOR AIR<br>(NI/h) | PD max<br>(mbar) |
|------|--------------------------------------------|------|------------------------------|------------------|
| A10  | 0,1 - 1                                    | B10  | 3 - 30                       | 15               |
| A16  | 0,16 - 1,6                                 | B16  | 5- 50                        | 15               |
| A25  | 0,25 - 2,5                                 | B25  | 8 - 80                       | 15               |
| A40  | 0,4 - 4                                    | B40  | 12 - 120                     | 15               |
| A01  | 0,6 - 6,3                                  | B01  | 20 - 200                     | 18               |
| A02  | 1 - 10                                     | B02  | 30 - 300                     | 18               |
| A03  | 1,6 - 16                                   | B03  | 50 - 500                     | 18               |
| A04  | 2,5 - 25                                   | B04  | 80 - 800                     | 18               |
| A05  | 4 - 40                                     | B05  | 120 - 1.200                  | 18               |
| A06  | 6,3 - 63                                   | B06  | 200 - 2.000                  | 18               |
| A07  | 10 - 100                                   | B07  | 300 - 3.000                  | 25               |
| A08  | 16 - 160                                   | B08  | 500 - 5.000                  | 25               |
| A09  | 20 - 200                                   | B09  | 600 - 6.000                  | 20               |

## HOW TO ORDER

Example: TMS100 - G - B07 - C0 - S1 - RPJE - XX

|        |                                                                                                           |
|--------|-----------------------------------------------------------------------------------------------------------|
| TMS100 | model                                                                                                     |
| G      | Threaded connections 1/2" GAS-F                                                                           |
| N      | Threaded connections 1/2" NPT-F                                                                           |
| B07    | flow range 300 - 3.000 NI/h of air 20°C, 1 Bar (if different from standard, put the code "x" and specify) |
| C0     | without alarm                                                                                             |
| C1     | an inductive bistable sensor                                                                              |
| S1     | Built-in control valve 1/4" (max 100l/h of water 1800 NI/h of air)                                        |
| S2     | Built-in control valve 1/2"                                                                               |
| RPJE   | self-regulator 1/4" ss 316 in input                                                                       |
| RGJE   | self-regulator 1/2" ss 316 in input                                                                       |
| RPJU   | self-regulator 1/4" ss 316 in output                                                                      |
| RGJU   | self-regulator 1/2" ss 316 in output                                                                      |
| XX     | speciality to be described separately (ex. housing in inox)                                               |

In case of fluid different from water please specify the type of fluid precising: specific gravity, viscosity, temperature, pressure, at the operating conditions.



**OFFICINE OROBICHE**

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