FLS F6.60
MAGMETER FLOW SENSOR

The new F6.60 and F6.63 are flow meters without moving mechanical parts which can be applied for the measurement of dirty liquids so long as they are conductive and homogeneous.
The F6.60 family can provide three different options: frequency output to be connected to FLS flow monitors, 4-20 mA output for long distance transmission and PLC connection and the new volume pulse output freely settable.
The insertion magmeter family is provided with an USB interface and a dedicated software (freely downloadable from FLS web site) which allows to easily set by a PC all parameters according to specific installation requirements (as full scale and cut off).
The specific design allows an accurate flow measurement over a wide dynamic range in pipe sizes from DN15 (0.5”) to DN600 (24”).

APPLICATIONS

- Water and waste water treatment
- Raw water intake
- Industrial water distribution
- Textile industry
- Pools, spas and aquariums
- HVAC
- Processing and manufacturing industry
- Sea water applications

MAIN FEATURES

- No moving parts, no wear, maintenance free
- High mechanical resistance
- Accurate measurement of dirty liquids
- Pipe size range: from DN15 (0,5”) to DN600 (24”)
- Adjustable Flow Rate Range
- Low pressure drop
- User Settable Operating Parameters
- 4-20 mA, frequency or volumetric pulse output
- Bi-directional flow measurement selectable
- Special versions for salt-water applications (high concentrations of chlorides like sea water) and for high temperature conditions

TECHNICAL DATA

General

• Pipe Size Range: DN15 to DN600 (0.5” to 24”)
Please refer to Installation Fitting section for more details
• Max Flow Rate Range:
- F6.60: from 0,05 to 8 m/s
- F6.63: from 0,15 to 8 m/s
• Full Scale: 8 m/s (26.24 ft/s)
• Linearity: ± 1% of reading + 1,0 cm/s
• Repeatability: ± 0.5% of reading
• Enclosure: IP65
• Materials:
- case: PC/ABS
- gasket: EPDM
• Wetted Materials:
- sensor body: 316L SS/PVDF; 316L SS/ PEEK; CuNi alloy/PVDF
- o-rings: EPDM or FPM
- electrodes: 316L SS or CuNi alloy

Electrical

• Power Supply:
- 12 to 24 VDC ± 10% regulated (reverse polarity and short circuit protected)
- maximum current: consumption: 250 mA
- protective earth: < 10 Ω
• Current output:
- 4-20 mA, isolated
- max. loop impedance: 800 Ω @ 24 VDC - 250 Ω @ 12 VDC
- positive or negative flow indication
• Solid State Relay output:
- user selectable as MIN alarm, MAX alarm, Volumetric, Pulse Out, Window alarm, Off
- optically isolated, 50 mA MAX sink, 24 VDC MAX pull-up voltage
- max pulse/min: 300
- hysteresis: User selectable
• Open Collector output (Frequency):
- Ttype: Open Collector NPN
- frequency: 0 – 800 Hz
- max. Pull-up Voltage: 24 VDC
- max. Current: 50 mA, current limited
- compatible with M9.02, M9.50, M9.07 and M9.10 (only F6.63)
• Open Collector output (Direction not available on F6.63):
- type: Open Collector NPN
- max. Pull-up Voltage: 24 VDC
- max. Current: 50mA, current limited
- flow direction:
0 VDC arrow-wise
+ VDC anti arrow-wise

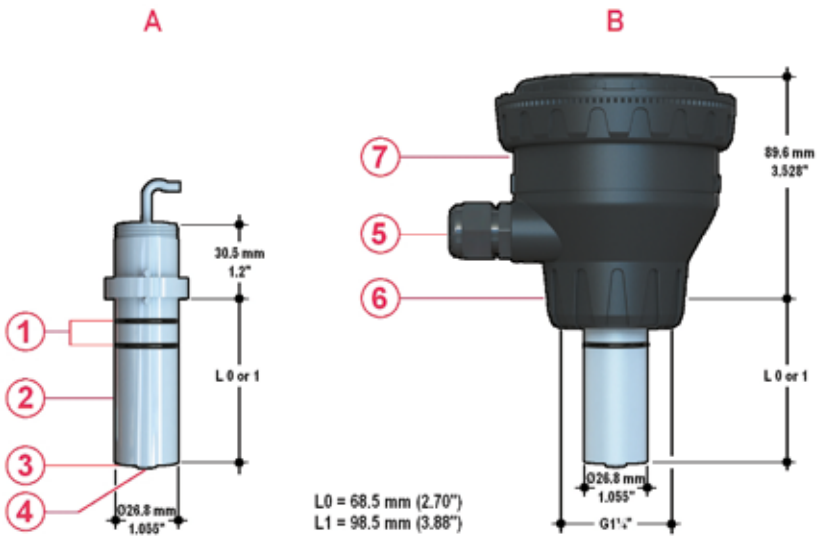
Enviromental

• Storage Temperature: -30°C to +80°C (-22°F to 176°F)
• Ambient Temperature: -20°C to +70°C (-4°F to 158°F)
• Relative Humidity:0 to 95% (non-condensing)
• Fluid conditions:
- homogeneous liquids, pastes or slurries, also with solid content
- min electrical conductivity: 20 µS
- temperature:
PVDF bottom version: -10 °C to +60 °C (14 °F to 140 °F)
PEEK bottom version: -10 °C +150 °C (14 °F to 302 °F)
• Max. operating pressure:
- 16 bar @ 25°C (232 psi @ 77°F)
- 8.6 bar @ 60°C (124 psi @ 140°F)

Standards & Approvals

• Manufactured under ISO 9001
• Manufactured under ISO 14001
• CE
• RoHS Compliant
• GOST R

DIMENSIONS



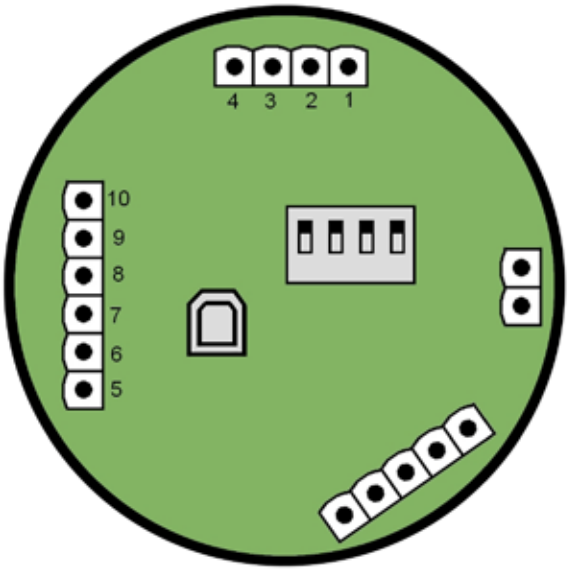
A Sensor body
B F6.60 Magmeter

1 O-Ring (EPDM or FPM)
2 Sensor body (316L SS or CuNi)
3 Isolation Plate (PVDF or PEEK)
4 Electrodes (316L SS or CuNi)

5 Cable Gland
6 ABS cap for installation into fittings
7 Electronic box

WIRING CONNECTIONS

Rear Terminal View



1	+VDC
2	+LOOP
3	-LOOP
4	-VDC

Power supply

10	-FREQ
9	+FREQ
8	-DIR
7	+DIR
6	COM
5	NO

Digital Output

ORDERING DATA

F6.60.XX Magmeter Flow Sensor

Part No.	Version	Power supply	Length	Main wetted materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.60.09	Blind	12 - 24 VDC	L0	316L SS/ PVDF/ EPDM	IP65	0,05 – 8 m/s bi-directional	950
F6.60.10	Blind	12 - 24 VDC	L0	316L SS/ PVDF/ FPM	IP65	0,05 – 8 m/s bi-directional	950
F6.60.11	Blind	12 - 24 VDC	L1	316L SS/ PVDF/ EPDM	IP65	0,05 – 8 m/s bi-directional	1000
F6.60.12	Blind	12 - 24 VDC	L1	316L SS/PVDF/FPM	IP65	0,05 – 8 m/s bi-directional	1000
F6.60.33	Blind	12 - 24 VDC	L0	CuNi/ PVDF/ EPDM	IP65	0,05 – 8 m/s bi-directional	950
F6.60.34	Blind	12 - 24 VDC	L0	CuNi/ PVDF/ FPM	IP65	0,05 – 8 m/s bi-directional	950
F6.60.35	Blind	12 - 24 VDC	L1	CuNi/PVDF/EPDM	IP65	0,05 – 8 m/s bi-directional	1000
F6.60.36	Blind	12 - 24 VDC	L1	CuNi/ PVDF/ FPM	IP65	0,05 – 8 m/s bi-directional	1000
F6.60.38	Blind	12 - 24 VDC	L0	316L SS/ PEEK/ FPM	IP65	0,05 – 8 m/s bi-directional	950
F6.60.40	Blind	12 - 24 VDC	L1	316L SS/ PEEK/ FPM	IP65	0,05 – 8 m/s bi-directional	1000

F6.63.XX Magmeter Flow Sensor

Part No.	Version	Power supply	Length	Main wetted materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.63.09	Blind	12 - 24 VDC	L0	316L SS/ PVDF/ EPDM	IP65	0,15 - 8 m/s mono-directional	950
F6.63.10	Blind	12 - 24 VDC	L0	316L SS/ PVDF/ FPM	IP65	0,15 - 8 m/s mono-directional	950
F6.63.11	Blind	12 - 24 VDC	L1	316L SS/ PVDF/ EPDM	IP65	0,15 - 8 m/s mono-directional	1000
F6.63.12	Blind	12 - 24 VDC	L1	316L SS/PVDF/FPM	IP65	0,15 - 8 m/s mono-directional	1000
F6.63.33	Blind	12 - 24 VDC	L0	CuNi/ PVDF/ EPDM	IP65	0,15 - 8 m/s mono-directional	950
F6.63.34	Blind	12 - 24 VDC	L0	CuNi/ PVDF/ FPM	IP65	0,15 - 8 m/s mono-directional	950
F6.63.35	Blind	12 - 24 VDC	L1	CuNi/PVDF/EPDM	IP65	0,15 - 8 m/s mono-directional	1000
F6.63.36	Blind	12 - 24 VDC	L1	CuNi/ PVDF/ FPM	IP65	0,15 - 8 m/s mono-directional	1000
F6.63.38	Blind	12 - 24 VDC	L0	316L SS/ PEEK/ FPM	IP65	0,15 - 8 m/s mono-directional	950
F6.63.40	Blind	12 - 24 VDC	L1	316L SS/ PEEK/ FPM	IP65	0,15 - 8 m/s mono-directional	1000

INSTALLATION
& OPERATING GUIDELINES
FOR INSERTION FLOW SENSORS

INSTALLATION GUIDELINES

Insertion Technology Main Features

- All the insertion technology flow sensors are velocity-based flow measurement devices;
- The installation typically requires only a small hole in the pipe for sensor perpendicular mounting;
- Sensors dimension are not pipe size specific: almost independent from pipe cross section.

Flow Sensor Installation

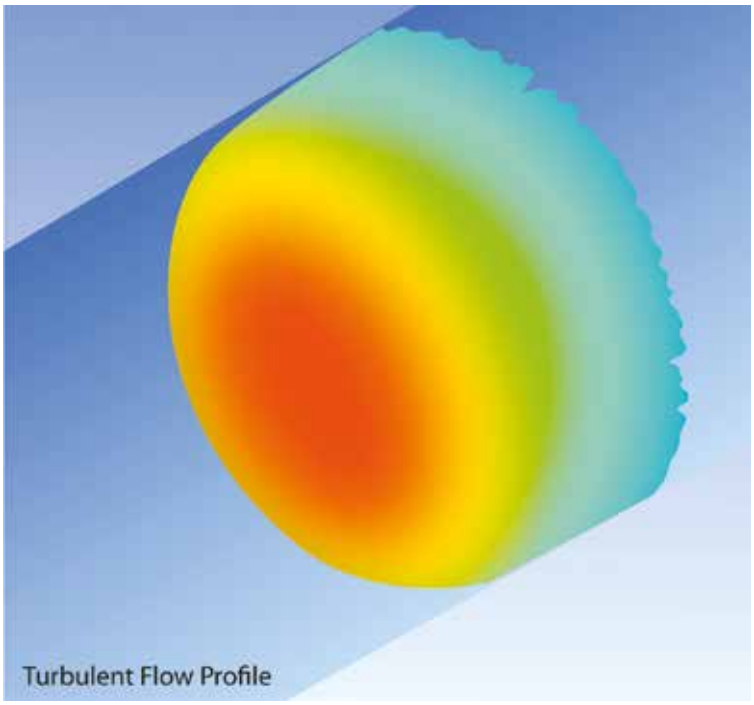
The placement of a flow meter is critical to get an accurate and reliable reading. For a flow meter proper performance it is necessary to check:
- Full pipe at every time;
- Uniform flow velocity into the pipe.

Full Pipe Condition

If the pipe is not full the flow meter will give inaccurate reading even if the sensor is always completely submerged.
Sensor will make the flow rate calculation on the assumption that the pipe is full, leading to overestimation of the flow. A pump intake or an outlet on the bottom of a tank does not necessary ensure the pipe always running full; air can be sucked by pumps or it could remain entrapped when the pipe was empty.
Anyway the flowmeter should be always situated in the lowest point of the pipe and there should be downstream the flowmeter a part of the pipe placed 1 x ID higher than where the flow meter is located.

Uniform Flow Velocity

Insertion flow meters measure the velocity of the liquid. It is important the velocity is uniform across the entire cross section of the pipe in the location of the sensor. Flow patterns are distorted both downstream and upstream of any disturbance.
In a pipe, liquid at the edge of the pipe moves slower than towards the center because of friction along the walls.
In a straight run of pipe, area with similar velocities can be depicted as concentric rings.



Pipe Location

- The six most common installation configurations shown in fig. 1 help in selecting the best location in the pipeline for paddlewheel flow sensor as well for magmeter flow sensor.
- The three configurations in fig. 2 ensure that the pipe is always full: for a correct measurement the sensor can NOT be exposed to air bubbles at any time.
- The three installations in Fig. 3 should be avoided unless you are absolutely sure the sensor is not exposed to air bubbles.
- In gravity-flow systems the connection to the tank must be designed so the level does not drop below the outlet: this to avoid pipe to draw air in from the tank causing a inaccurate measurement of sensor (see Fig. 4).
- For more information, please refer to EN ISO 5167-1.
- Always maximize distance between flow sensors and pumps.

Fig.1

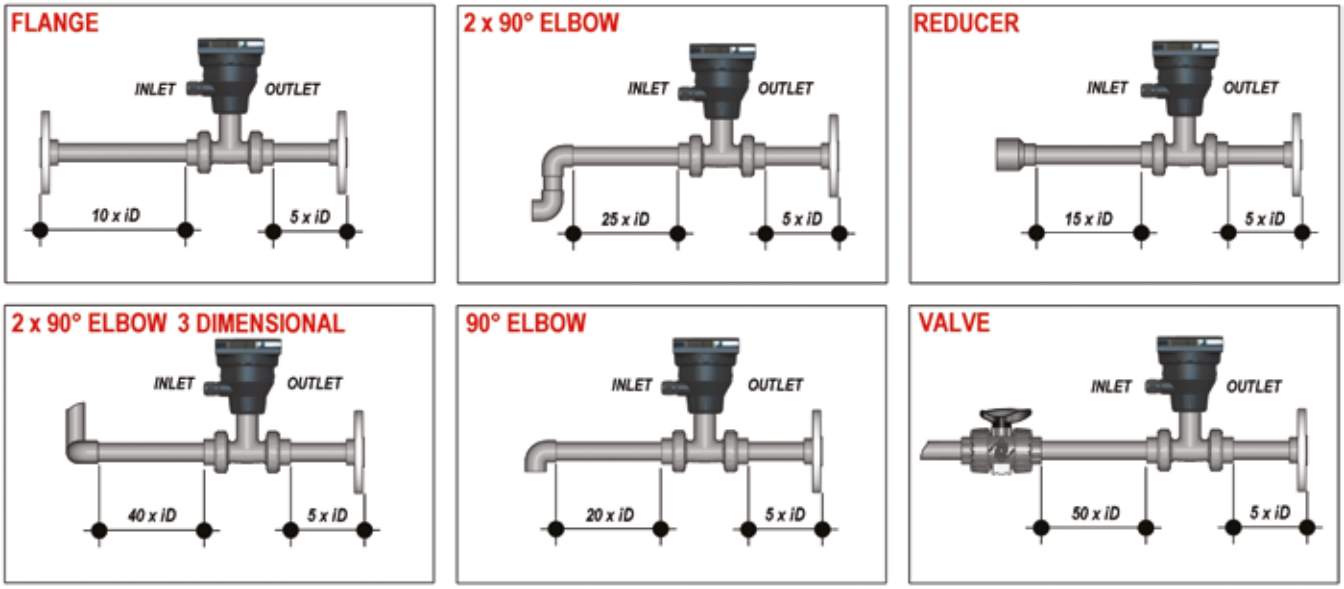


Fig.2

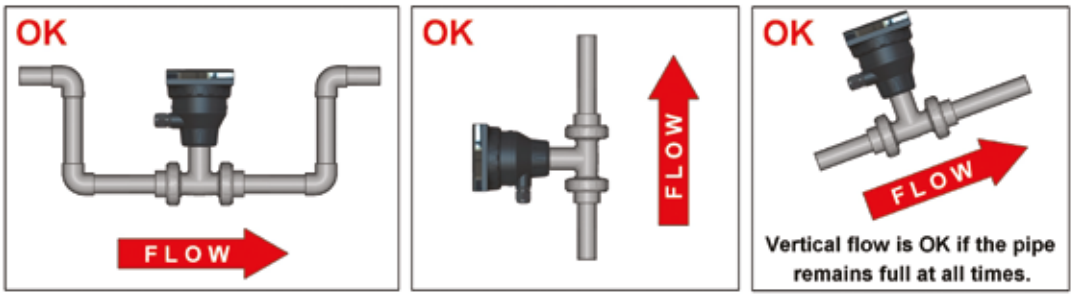


Fig.3

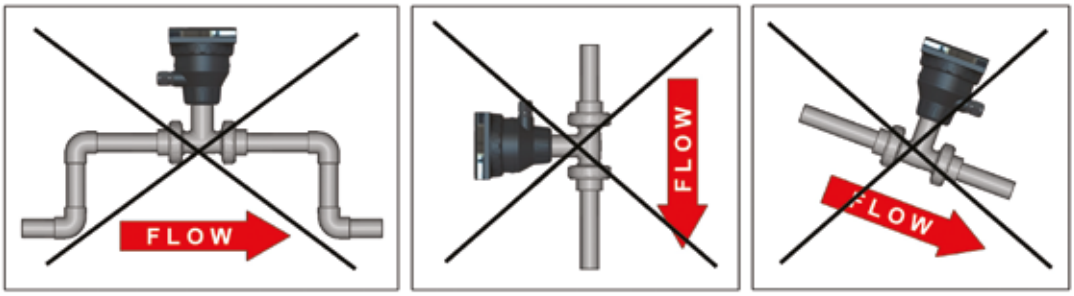
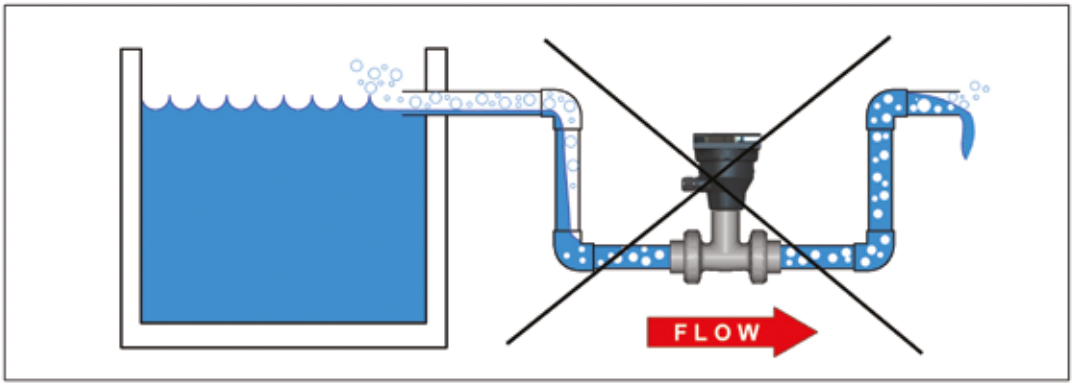


Fig.4



Mounting Positions

Measuring part of sensor (rotor for paddlewheel and pins for magmeter) should be positioned at 12% of ID where, basing on insertion theory, average velocity can be measured.
The reading accuracy of insertion flow sensors can be affected by:
- air bubbles;
- sediments;
- friction between shaft and bearings (only for paddlewheel).

In a horizontal pipe runs, the mounting position to get the best performances is at a 45° angle (*Fig. 3*) to avoid air bubbles as well sediments. Vertical position (*Fig. 2*) can be chosen in case air bubbles are not present. Do not mount the sensor on the bottom of the pipe (*Fig. 1*) if sediments are likely. Do not mount paddlewheel at 90° otherwise friction can affect measurement. Except last consideration about 90° installation, all previous evaluations are valid for magmeter sensor also. Installation in a vertical pipe runs can be done fixing any orientation. Upward flow is preferred to ensure full pipe.

Fig. 1

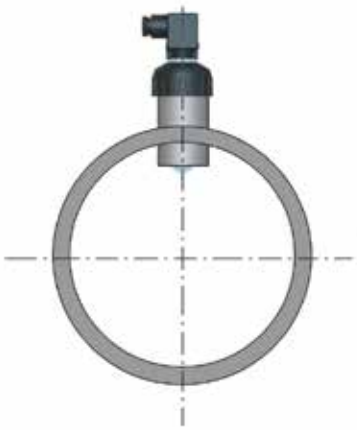


Fig. 2

Fig. 3

K-Factor

K factor is a conversion value which has to be fixed in order to convert sensor output (frequency) to a flow rate.
K factor depends on ID of pipe where sensor has been installed and, as each pipe has a specific wall thickness, in general it's necessary to know pipe size (external diameter), pipe material and all info which can determine internal diameter.
Provided k- factors are referred to water so in case sensors are applied to measure a different liquid (with a different viscosity and/or density) a recalibration on-site can be needed using a secondary standard.

Maximize sensor performances

In order to get the maximum accuracy, a recalibration using a reference value of flow rate could help to evaluate a fine tuning of k-factor in according with specifications of installation site. This procedure is strongly suggested when sensors are applied to measure a different liquid than water and in case distances reported into EN ISO 5167-1 can't be respected in the installation.

OPERATING GUIDELINES

Paddlewheel Flow Sensors

Rotor and shaft are in direct contact with the fluid. Since the paddle will spin at a velocity that is directly proportional to the rate of flow, these components will wear over time. Rotors which have operated at high velocity will tend to wear more than units operated at low velocities. Because every fluid has different characteristics, it is difficult to estimate the life expectancy of these components. The chemical compatibilities of each wetted component to the chemical being measured should be considered to choose the best material option. Axles and paddles can be easily replaceable in order to maintain better performances. Avoid using paddlewheel flowmeters for measuring very dirty fluid, or liquids with rocks or pebbles that could break or damage the rotor or the axle.
Solids could affect sensor response also modifying friction of shaft. Don't use paddlewheel in case liquid contains fibers.
A neglected paddlewheel will in time have degraded accuracy. Even if in case liquid contains solids we suggest to apply a magmeter, you can use a paddlewheel but in such case it's strongly suggested to plan a cleaning procedure of wetted parts periodically. For cleaning procedure use detergent or chemicals compatible with wetted materials.

Magmeter Flow Sensor

In general magmeter flow sensor doesn't need a specific maintenance.
In case magmeter is used to measure a very dirty liquid it can be suggested to clean periodically the device with a cloth slightly dampened with water or a liquid compatible with the materials of the device and cloth.
Dirty electrodes may cause measurement inaccuracy. Do not use abrasive materials to take maintenance.

Hot tap Insertion Flowmeters

The use of hot tap instrumentation is suggested for installation in pressurized pipes and when it is impossible to stop the flow rate into the pipeline.
Hot tap version is available for magmeter, paddlewheel and turbine sensors.
Previous advices are valid for these versions also.
The sensors designed for hot tap installation are suitable also for pipes with a diameter larger than the maximum covered by traditional sensors (typically DN600/24").
Hot tap sensors have to be combined with hot tap fitting only.