PTF

FLOWSENSORS

SM Automation

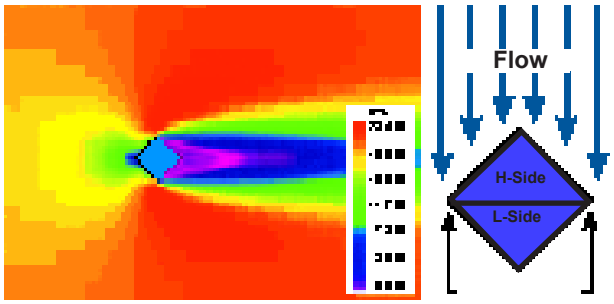
PTF-Flowsensor

Special features
- Low flow resistance and therefore low energy costs
- Low mounting costs
- Extremely high long-term accuracy
- Extremely insensitive to contamination
- Low weight with extreme stability due to innovative construction
- Short upstream and downstream lines

The characteristic PTF sensor shape

To get a constant “k-factor” over a wide flow range the profile has to be designed in such a way to achieve a fixed separation point of the fluid at the sensors circumference. This may be realized by using a rectangular shape which will be installed into the pipe with its diagonal axis transverse to the flow direction.

The shape of the PTF flow sensors which was achieved after an optimized design with regard to flow dynamics and manufacturing techniques is shown in the figure below with the separate point at the profile being clearly visible.



Operating principle

The function of the PTF flow sensor is based on the generation of a differential pressure by retardation of a line within the fluid stream until standstill as it is known from the pitostatic tube. In accordance with the rule of constant energy the kinetic energy of this stream line is converted to potential (pressure) energy. This causes an increase in pressure at the point of fluid stoppage. At a second sensing point where a stoppage of the flow lines will be avoided, the static pressure within the pipe is obtained. The pressure difference will be determined by directing the high pressure to the H-side of the LDP500 and the low pressure to its L-side. This differential pressure is proportional to the square of the flow velocity and depends on the density of the medium. The PTF flow sensor deviates from the ”pure doctrine” of the pitot tube because the low pressure is less than the static pressure. Compared with the pitostatic tube the PTF sensor produces a larger differential pressure at the same flow velocity. This difference will be compensated by a correction factor, the so called “k-factor”.

Based on the equation for differential pressure sensors (acc. to Bernoulli)

$$\Delta p = \frac{\rho}{2}\left(\frac{\omega}{k}\right)^2 \qquad \omega = \frac{4\ V_h}{\pi\ D^2}$$

Differential pressure transmitter LDP500

The differential pressure transmitter series LDP500 has remarkable features for the use with PTF-Flowsensors:
- 0,075% accuracy (optional 0,04%)
- Minimum span of 1 mbar available
- Integrated square root output function

You will find more information about the LDP500 series in the respective product brochures or on our web site under www.5M-Automation.com.

Technical Specifications

Nominal diameter :	DN 32 - 2500 (ANSI on inquiry)
Nominal pressure :	up to PN 40 (up to PN 400 on inquiry)
Temperature :	-50° C to +900° C according to material
Sensor material :	Stainless Steel . 1.4571, 1.4539, Titan, PVC, Hastelloy B/C,
Mounting parts :	St. 37.2, other on inquiry acc. to material of the pipe
Mounting connection:	welding connection to pipe
Connection:	Flange acc. to DIN, BS, ASA-Standards or cutting ring
Accuracy:	≤ 1,0% of flow
Repeatability:	± 0,1 % of actual value
Measuring relation:	10 : 1

Selection of the suitable sensor type

The sensor model **PTF-10** completely covers the small diameter range from DN32 (11/4") to DN125 (5"). Its very narrow profile with edge dimensions of 12 mm avoids significant cross section reductions at the measuring point and therefore also offers an economical alternative to standard flow measuring procedures in this application field.
Inner dimensions (in mm):

35, 40, 50, 65, 80, 100, 125

The sensor type **PTF-22** is the standard sensor for diameters of 125 (5") to 1500mm (60").
It is the right choice for most industrial applications. The various differential pressure connections allow the sensor to be adapted for all possible applications
Inner dimensions (in mm):

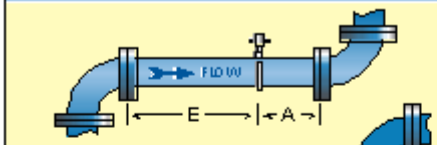
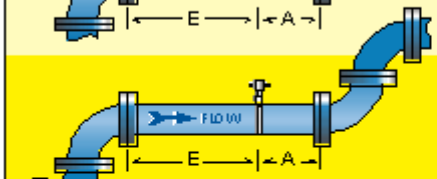
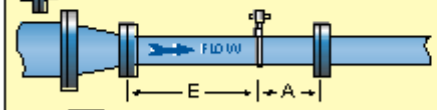
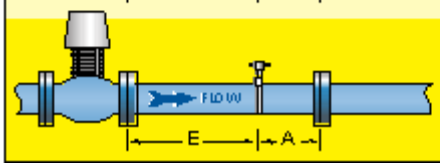
125, 150, 200, 250, 300, 400, 500, 600, 750, 900, 1.000, 1.250, 1.500

The sensor type **PTF-32** is preferably used within the diameter range from 400 (16") to 2500 mm (100"). This sensor combines a high degree of insensitivity to contamination and condensation with the economy of the PTF-22 sensor.
Inner dimensions (in mm):

400, 500, 600, 700, 800, 900, 1.000, 1.250, 1.500, 1.750, 2.500

Required steadying zones

The correct installation point is the longest straight section of the pipe. Divide this part in the relation of 2 :1 for the up- and down stream lines. Pay attention to the perturbing action which could occure in front or behind the selected installation part of the pipe. Passive elements (e.g.: pipe bends) disturb less than active ones (e.g. blowers). Harmonic changes of the pipe run (pipe bends with a large radius, necking) are better than abrupt or less harmonic changes (edges, steps).

Pipe run	Up-stream	Down-stream
	7 x ID	3 x ID
	10 x ID	3 x ID
	7 x ID	3 x ID
	20 x ID	3 x ID

Protection of the probe against vibration stress

The danger of damaging the sensor by resonance vibrations can be avoided by means of the following rules-of-thumb:

1. In liquid media hydraulic damping by the medium is sufficient to avoid sympathetic vibrations; in gases and steams with very high flow velocities (differential pressure approximately 1/3 of the permitted differential pressure shown in the table to the right) the danger of sympathetic vibrations can be minimized by selecting an appropriate sensor type.

2. Sensors with end support are more stable than sensors without end support.

3. Sensors touching the opposite pipe wall (with welded coupling) are better suited than suspended (flange) sensors.

4. Thick profiles are more stable than thinner profiles.

Due to ambiguous marginal conditions exact calculations are senseless for practical application.

Nominal Diameter (mm)	maximum differential pressure (kPa)						
		without end support	with end support	without end support	with end support	without end support	with end support

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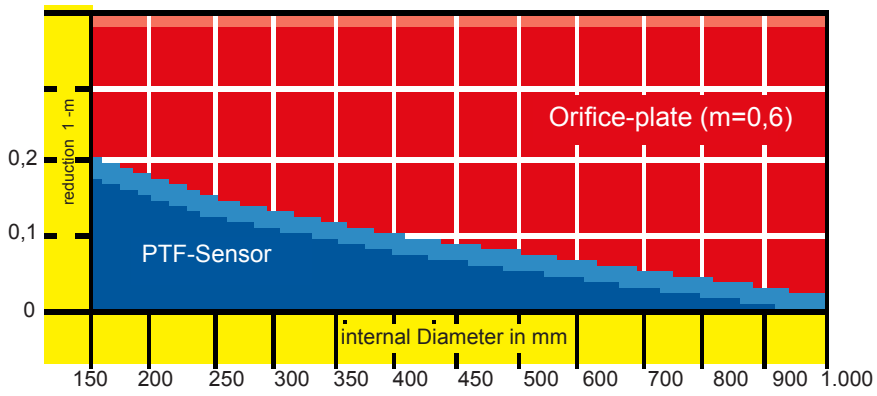
Advantages of the PTF-Probe

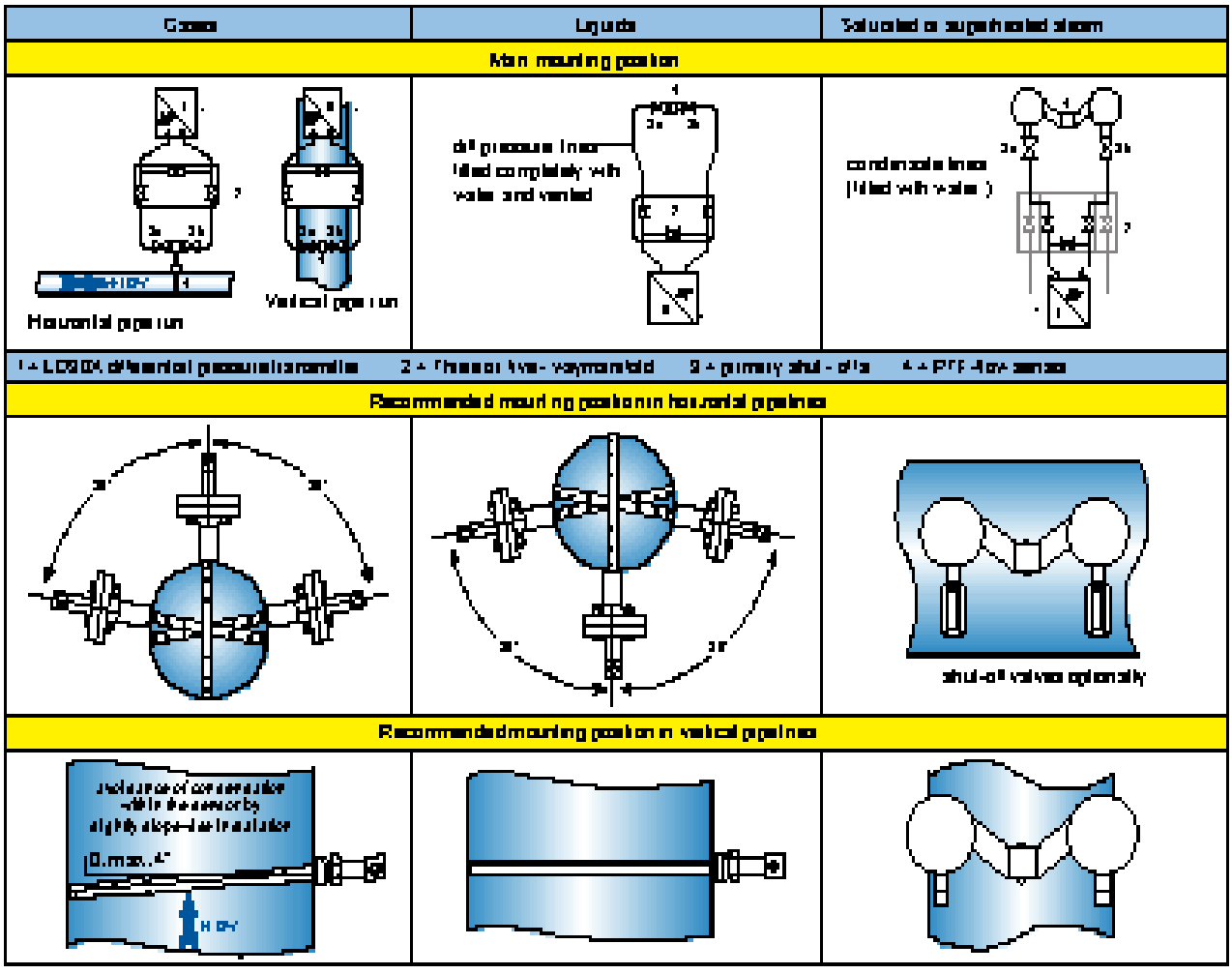
Pressure drop of a PTF-Probe in comparison to orifice plates

Each measurement probe inserted in the flow means a cross section reduction.The resulting increase of velocity leads to an increase in friction and therefore causes a pressure drop, which is only partly recovered.
The more the cross section is reduced, the higher is the pressure drop of a PTF-probe in comparison to orifice plates permanent pressure loss. Sudden reductions and - even more so - sudden enlargements of cross section additionally increase the devaluation of the flow energy. The figure below shows a comparison between cross section reduction with PTF sensors and standardized orifice plates.



Cross section reduction with use of PTF sensors and orifice plates

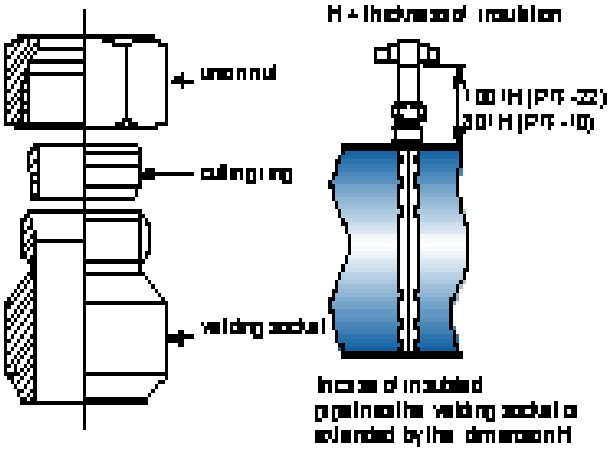
Handling of PTF sensors in various applications



Mounting

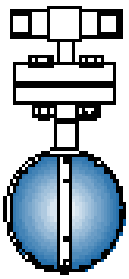
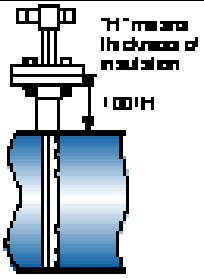
Welding coupling

The standard technology for installation of the PTF sensors of the series ”10” and ”22” consists of welding sockets with cutting ring joint. Due to their extreme pressure resistance of 100 bar (1500psi) at 20°C (68°F) (security factor 4!!) they replaced so-called ”security screw joints”. They consist of a small number of components and therefore offer the most economical possibility for secure and quick mounting of a PTF sensor into a pipeline. Because of its axial flexibility the sensor tip usually touches the opposite pipe wall. This increases the resistance of the sensor to bending and vibratory stresses. For installation in very hot media end supports are recommended to avoid a deformation of the sensor due to thermal expansion.



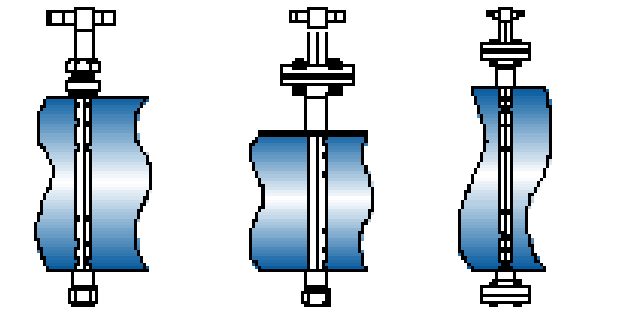
Single-ended flanged nipple

Installation of the PTF sensors by means of a mounting flange in a pipe socket welded to the pipeline is the standard technology for the series ”32” and “50”. For sensors with smaller pipe diameters the flange connection can also be recommended as an easily mastered mounting variant. For very high static pressure, flanges are the only possible sensor mounting variant. The table below shows the standard dimensions, other dimensions can be supplied on request.

Sensor type	PTF-10	PTF-22	PTF-32
Standard flange DIN (PN16)	DN15	DN32	DN32
ANSI-Flange (Option)	1"	1 1/4"	1 1/4"
			

End support variants

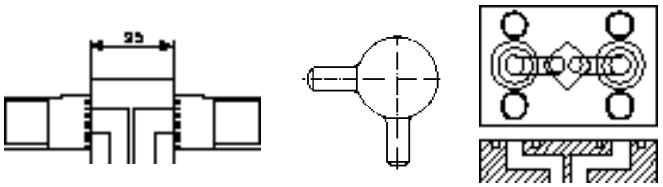
To support the sensor against mechanical deformation and vibratory stresses an additional support may be required at the sensor tip. For a sensor with end support an estimated bending reduced by factor 11 is assumed compared to standard versions. The end support version depends on the selected sensor.
Standard end supports consist of a movable veering in the form of a welding bush with screw cap. In special application cases flange end supports may be necessary.



Accessories, Transmitters and Control equipment

Pressure Connections

Various models of welding nipples, flange mounting plates and pipe ends are available. For steam applications condensate vessels with welding nipple are included as standard.



Shut-Off Elements, Manifolds

To give the user a complete solution Smar offers a wide range of shut-off elements together with the PTF Flow sensors. It includes ball valves, shut-off valves, 3-way valves and multiway valves. They are available in different materials and pressure rates.

Transmitters

5M-Automation offers a wide range of transmitters. The LDP500 Series measures differential, gauge and absolute pressure.

Also a field proven transmitter for temperature measurement with high accuracy and optional digital display is offered, head mounted and rail mounted type of temperature transmitters are available.

In addition we offer transmitters for density, humidity viscosity and control valves.

Please contact us for more details.

5M Automation

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