Dosch Messapparate GmbH · Kamenzer Damm 85 · D-12249 Berlin

98P Flow Sensor

Operating and Installation Manual

Dosch
Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 72 01 53-0
Fax
+49 (0)30 72 01 53-61

Mail
vertrieb@dosch-gmbh.de
Homepage
www.dosch-gmbh.de

AG Berlin-Charlottenburg
92 HRB 13892
Geschäftsführer/CEO
Martin Dosch, Sven Dosch

USt.-IdNr./Vat No.
DE 136 747 116

Gegründet 1933
von Ing. Adolf Dosch

Berliner Sparkasse IBAN DE77 1005 0000 1260 0050 00 SWIFT BELADEBEXXX

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Table of contents:

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1. General

1.1. Symbols

Hazard warning (Caution, observe documentation)
ISO 3864, no. B.3.1

W A R N I N G

This equipment should only be installed and operated after *qualified personnel* has made sure that during normal operation or in case of malfunction no potential dangers emanate the equipment or parts thereof. Danger of serious injuries and/or considerable damages in case of improper installation. The manufacturer is not responsible for these injuries/ damages.

Safe and faultless operation of this equipment requires proper transport, correct storage, assembly and installation as well as attentive operation and maintenance.

Unless stated otherwise, Dosch Sensors are designed for static loads according to AD2000 and EN13480 respectively. They are not designed for external static loads.

1.2. General Note

For the sake of clarity this manual does not contain detailed information about all types of products and cannot take every conceivable case of installation, operation or maintenance into consideration. Please contact us directly for further information or in case of problems, which are not sufficiently explained in this manual.
May we draw your attention to the fact that the contents of the manual are not part of a previous or existing agreement, approval or legal relationship or an amendment thereof. All obligations of Dosch GmbH result from the purchase contract, which also contains the entire and solely valid warranty agreement. These contractual warranty conditions are neither extended nor restricted by the contents of the manual.

1.3. Qualified Personnel

are persons familiar with the installation, assembly, commissioning and operation of the product and who have the appropriate qualifications for their activities such as:

- Training, instruction or authorization to operate and maintain devices/systems according to the standards of safety technology for pressure components.
- Training or instruction in maintaining and operating appropriate protective equipment according to safety standards.
- First Aid training.

**** Caution:** Before installation and operation the pipework and process data must be checked against the specifications on type label and delivery note. Only the specifications on the type label of the equipment apply.*

Deployment In Explosive Environs

Applicable national standards and regulations are to be complied with if the equipment is deployed in potentially explosive atmospheres.

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2. Incoming Goods Inspection

Any shipment leaving Dosch GmbH is inspected to the best of our knowledge and with great care. Nevertheless, it is necessary for the customer to crosscheck as soon as possible after receipt of the delivery. Only then legitimate claims can be settled quickly and without further dispute.

Check upon receipt of goods:

- consistency of type label (see below)/ type code and delivery note;
- consistency of delivered and ordered version, especially correct sensor length, sensor material and component materials, as far as possible;
- consistency of the scope of delivery with the order confirmation;
- documentation (operating manual, flow calculation (see below), drawings, etc.).

Pressure Differential Calculation for 98P Sensors

Date	8 November 2010			
Customer				
Project	41320001			
Tag no./measuring point				
Process				
Pipe and sensor data				
Pipe cross section	round			
SDF sensor type no.	SDF22			
Inner diameter (cold)	250mm			
Wall thickness	4mm			
Insulation	0mm			
Pipe material	carbon steel (St37 or similar)			
k factor (cold)	0.6522			
Design and calculation criteria				
Type of medium	air			
Calculation	according to current volume flow			
State and process variables				**Unit**
Temperature	15	45	15	°C
Absolute pressure	100.3	100.3	100.3	kPa abs.
Cinematic viscosity	1.5e-05	1.8e-05	1.5e-05	m2/s
Operating volume flow	2700	1800	1800	m3/h
Operating density	1,225	1,1	1,225	kg/m3
k factor (warm)	0.6522	0.6522	0.6522	
Inner diameter (warm)	250.0	250.1	250.0	mm
Expansion number	0.9996	0.9999	0.9998	
Flow velocity	15.28	10.18	10.19	m/s
Reynolds number	256393	144213	170929	
Results				
Calculated pressure differential	3.36	1,34	1,49	mbar
Remaining pressure loss	0.39	0.16	0.17	mbar

set point for differential pressure transmitter

Figure 1:

Pressure Differential Calculation

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3. Installation Instructions

3.1. General Note

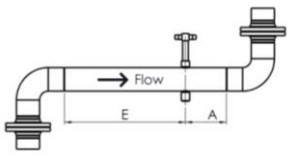
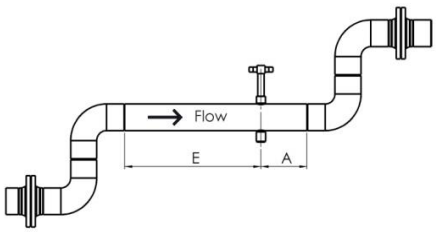
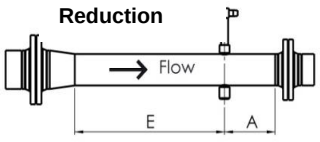
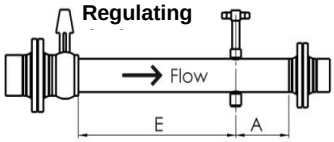
During installation observe applicable national regulations, especially:

- Pressure Equipment Directive 2014/68/EU (if applicable);
- related standards, such as AD2000 or DIN EN 13480 (if applicable);
- Machine Directive 2006/42/EG (if applicable);
- depressurise pipework and/or channel before installation/disassembly;
- clean pipework if toxic/harmful media are present before installation/disassembly.

3.2. Determine installation location

Find the longest straight part of pipework or channel and divide this into upstream and downstream distance respectively according to the table below.

Required calming sections

Pipe run	Upstream	Downstream
	7*ID	3*ID
	10*ID	3*ID
Reduction 	7*d	3*ID
Regulating 	20*ID	5*ID

The indicated upstream and downstream distances are reference values. They can be shortened by "intelligent" installation. What does „intelligent installation" mean?

Example 1: **Sensor installation downstream of elbow**
The flow profile mainly deforms in the plane of the elbow. Therefore the sensor should be installed in the same plane in order to detect the variations in velocity at the individual measuring points.

Example 2: **Correct installation is not possible at the measuring point due to structural conditions**
This can be remedied by correction of the 98P sensor's k factor. This is done by means of a testing instrument (e.g. a pitostatic tube) to determine the flow velocity at the sensor's installation location and comparison with the displayed value at the stationary measuring equipment. In case of deviations the application-specific k factor must be calculated from the calculation formulae and the measuring equipment must be re-parameterised. Find details in a special application report, if required.

For more information contact our consulting and commissioning service.

Table 1:
Required Upstream And Downstream Sections

Pay attention to interferences existing upstream and downstream of the selected installation location. Passive elements (e.g. elbows) cause less interference than active elements (e.g. fans). Gradual changes in the pipe run (elbows with large radii, reductions according to DIN) are more favourable than abrupt changes (corners, T-sections). Contact the manufacturer or responsible sales engineer, if the required straight run is not available!

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3.3. Determine installation position

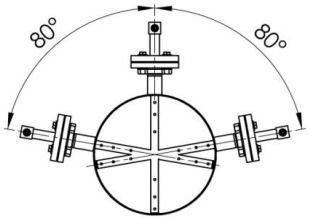
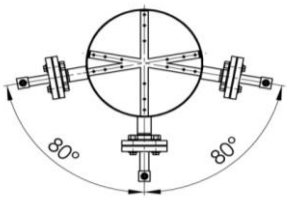
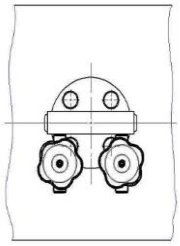
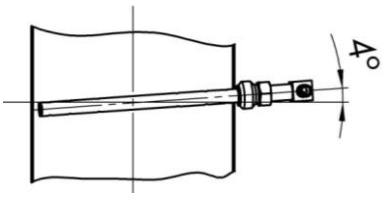
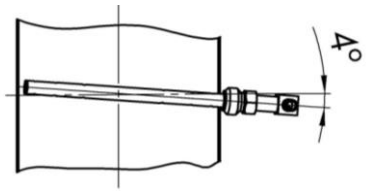
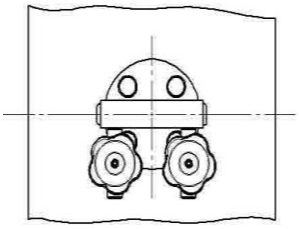
Gases	Liquids	Steam
for horizontal pipe run		
		
Sensor installation upward between -80° and +80° position	Sensor installation downward between -80° and +80° position	Sensor installation always level
for vertical pipe run		
		
Slightly inclined installation between 0° and 4° of sensor to enable the condensate to flow away from the sensor head back into the process.	Slightly declined installation between 0° and 4° of sensor to enable air or gas bubbles to return into the process (incline opposite to gases).	Sensor installation always level
Height offset calculation of end support for vertical pipe run		
Deviation between: 0° 1° 2° 3° 4°	 0mm 0,017 x $Ø_{outer}$ 0,035 x $Ø_{outer}$ 0,052 x $Ø_{outer}$ 0,070 x $Ø_{outer}$	On same height as installation component!

Table 2:
Determine installation position (illustrations apply for 98P G sensors (threaded joint) as well as 98P F sensors (flange), 98P-Y sensors (weld-in sensors), 98P DF sensors (steam sensors)

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3.4. Orientation 98P Flow Sensor

98P flow sensors are symmetric. For this reason it is irrelevant which of the perforated sensor sides faces the flow. In addition the connections are marked with “+” /”-“ . The design of the sensors ensures that the connections are always on the same level. The sensors must be installed with the engraved letters normally readable (in upright position).

Alignment tolerances for 98P sensors considering points 3.2. and 3.3.:

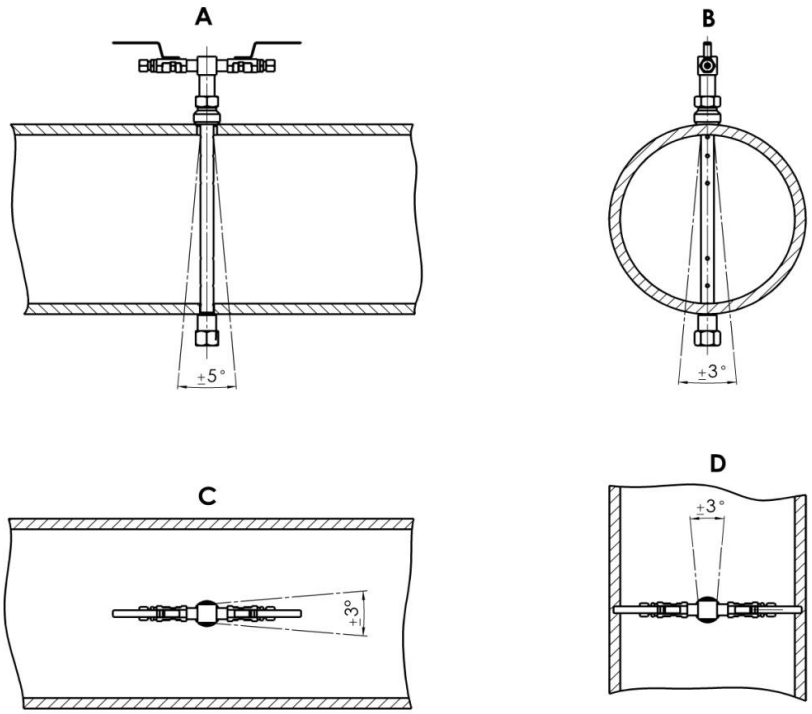

Figure 2:
Alignment Tolerances for 98P Sensors (A: axial orientation, B: radial orientation, C: orientation to flow direction in horizontal pipe run, D: orientation to flow direction in vertical pipe run). Observe for steam sensors points C and D in section 3.6.1.

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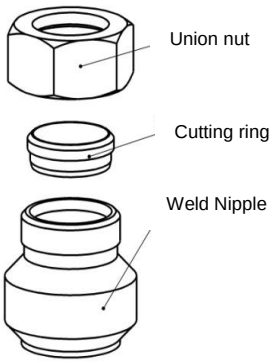
3.5. Mounting Installation Components (Main Bearing)

3.5.1. 98P (Cutting Ring Installation Component)

The pipe wall must be drilled to D_M (see Table 3) at the installation location. Before inserting the weld-in connection screw on the screw-down nut but remove the cutting ring to avoid tension due to heat. Now insert the mounting piece, tack-weld it and align perpendicular to pipe axis. After finishing the weld around the mounting piece, insert the cutting ring and secure the union nut until tight.



Necessary torque (T_A) according to
ISO 9974-1/ISO 6149-1/DIN 3852-T1-Form X/
DIN 3852-T3-Form W (metric thread)
of installation component for 98PG:

- 98PG1..: $T_A \approx 150$ Nm
- 98PG2..: $T_A \approx 330$ Nm
- 98PG3..: $T_A \approx 650$ Nm

(Above values only for reference and must be observed for every application!)

Figure 3: Cutting Ring Installation Component

3.5.2. 98P (Flange Installation Component)

The pipe wall must be drilled or welded to D_F (see Table 3) at the installation location. Then place the flange on the pipe and tack-weld. Align the flange perpendicular to pipe axis. Attach the flange to enable functional sensor installation. The alignment of the flange drill holes must correspond with Figure 5. Now finish the weld of the installation flange.

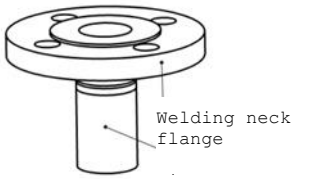


Figure 4: Flange Installation Component

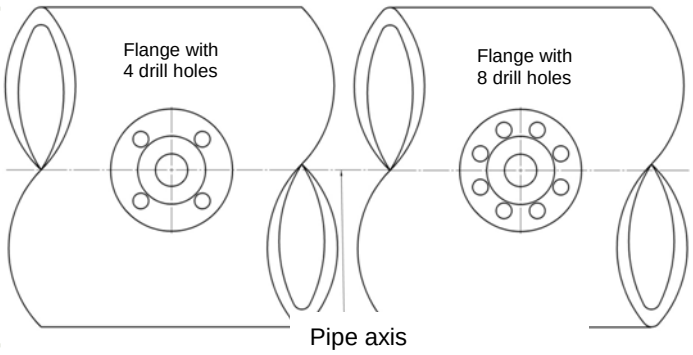


Figure 5: Alignment Of Flange Installation Component

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3.5.3. 98P (Weld-In Installation Component)

The pipe wall must be drilled to D_S (see Table 3) at the installation location. Now insert the welding sleeve, tack-weld and align perpendicular to pipe axis. After finishing the weld around the sleeve insert the sensor, align and tack-weld. Now finish the weld.

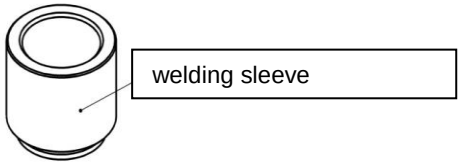

Figure 6:
Weld-In Installation Component
(Welding Sleeve)

Sensor Type	Weld-In Connection (G)	Flange Installation Component (F)	Welding Sleeve (Y)
98P*G***1.	D_M = 21mm (1)	-	
98P*F***1.	-	D_F = 17mm (1)	
98P*Y***1.			D_S = 20 mm (1)
98P*G***2.	D_M = 37 mm (1)	-	
98P*F***2.	-	D_F = 38 mm (2)	
98P*Y***2.			D_S = 33 mm (3)
98P*G***3.	D_M = 53 mm (1)	-	
98P*F***3.	-	D_F = 44 mm (2)	
98P*Y***3.			D_S = 43 mm (3)
98P*F***5.	-	D_F = 83 mm (2)	

Table 3: Bore Diameters

For pressure stages from PN63 the bore diameter D_F of the flange installation component corresponds with the inner diameter of the used welding neck flange. For welding sleeves the bore diameter D_S is 2mm greater (special designs may include deviating bore diameters)!

(1) Bore diameters apply for the installation of sensors with cutting ring installation. Please contact us for drill hole sizes for directly welded sensors above (98P-Y: regularly used for high pressure)!
(2) Bore diameters apply for sensors with flange installation up to and including PN40. Above pressure stage PN 40 the bore diameters correspond with the inner diameters of the used flange according to DIN EN 1092.
(3) Borediameter are relevant for probes up to PN 40. Above PN 40 or for special design the bore diameter and have to be clarified with DOSCH.

3.5.4. End Support Installation

Follow the installation steps below if the sensor is fitted with an **end support**:
First determine the installation location of the end supports; it is positioned exactly opposite the mounting component.

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Recommended procedure for locating the opposite point:
First mark the centre of the installation component to be installed on the pipe. Then pass a tape of at least 30mm width and appropriate length tightly around the pipe and align it in such way that after one turn it exactly covers the first layer. Start by holding one end of the tape to the point marked on the pipe. Mark the tape at the point, which after one turn is directly adjacent to the marked centre of the installation component. The distance from the start of the tape to this point is equal to the outer diameter of the pipe. Remove the tape and determine the centre between the start of the tape and the point marked on the tape, and mark the centre of the tape. Place the tape again around the pipe as described above. The point marked last on the tape (centre) is the position exactly opposite the installation component. Finally you only have to transfer this point to the pipe. If there is no tape available you can also use a cord to determine the diameter. In this case it is important to check the axial alignment of the cord by measuring the distance to the next flange.

Now install the installation component as described above.
Then drill or weld a respective hole at the opposite point (see above). Find the required diameter in the following Table:

Sensor Type	Closed End Support	End Support With Cap	End support With Flange
98P1.	17mm (1)	N/A	N/A
98P2.	30mm (1)	30mm (1)	38mm (1)
98P3.	38mm (1)	38mm (2)	44mm (3)
98P5.	60mm (1)	N/A	83mm (3)

Table 4: Bore Diameter for End Support up to PN 40 EN 1092-

Notes:

For pressure stages from PN63 the bore diameters D_F of the flange installation components correspond with the inner diameter of the used welding neck flange!
For special designs the bore diameters may deviate and must be enquired separately.
This design can only be utilized up to a certain pressure stage (max. PN40 and depending on the temperature resistance of the sealant).

The end support is tack-welded to the pipe and aligned in such way, that the end support aligns with the previously welded installation component. This guarantees trouble-free insertion of the sensor without wedging.

Ensure that the drill hole in the pipe (**98P1**..=14mm, **98P2**..=26mm, **98P3**..=34mm and **98P5**..=54mm) is completely kept as full bore und weld the end support to the pipe.

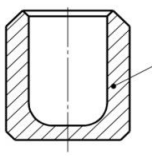
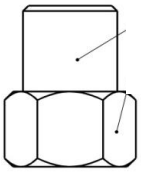
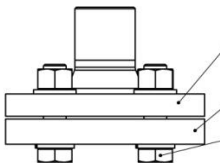
Overview Different End Support Versions		
Closed End Support (GG)	Pipe Thread With Cap (SC/SE)	Flanged End Support (GF)
 **Closed end support**	 **End Support** **End Support cap**	 **Flange End Support** **Blind flange with end support sleeve** **Bolts**

Table 5: Overview End support

Dosch Messapparate GmbH
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Recommended procedure for end support alignment:
After drilling insert the sensor or a straight pipe with respective outer diameter through the installation component already installed and loosely slide the end support over the projecting sensor end or pipe. Tack-weld it to the pipe after properly aligning the end support (do not wedge!). Remove the sensor or pipe, and complete the weld.

After installing the sensor cover the end support with the supplied cap or blind flange, depending on the version.

Mounting for retractable probes

Please ask for special instructions

3.6. Installation of “Standard” Sensors for Liquids and Gases

98PG
After all installation components and the end support (if required) are attached the sensor can be inserted in the union nut, which is screwed on the weldolet compressing the cutting ring. The flow direction arrow on the sensor head must be aligned with the flow direction. Two cases are to be differentiated. For installation without end support ensure that the sensor touches the opposite pipe wall. When installing with end support the sensor is inserted until the distance between the external pipe wall and the lower edge of the sensor head amounts to approx. 80mm (for 98P..1..) and 100mm (for 98P..2.. and 98P..3..) plus possibly present neck extension H. The sensor point reaches approx. 30mm into the end support. Finally the union nut is firmly tightened.

98PF
After all installation components and the end support (if required) are attached the sensor can be inserted after inserting a gasket between installation flange and sensor flange. The flow direction arrow on the sensor head must be aligned with the flow direction. Finally both flanges are bolted together.

98PY
After all installation components and the end support (if required) are attached the sensor can be inserted in the welding sleeve. The flow direction arrow on the sensor head must be aligned with the flow direction. Two cases are to be differentiated. For installation without end support ensure that the sensor touches the opposite pipe wall. The distance between the external pipe wall and the lower edge of the sensor head amounts to approx. 80mm (for 98P..1..), 100mm (for 98P..2.. and 98P..3..) or 120mm (for 98P..5..) plus possibly present neck extension H. When installing with end support the sensor is inserted until the distance between the external pipe wall and the lower edge of the sensor head amounts to 80mm (for 98P..1..), 100mm (for 98P..2.. and 98P..3..) or 120mm (for 98P..5..) plus possibly present neck extension H. The sensor point reaches approx. 30mm into the end support. Finally the sensor is welded to the welding sleeve.

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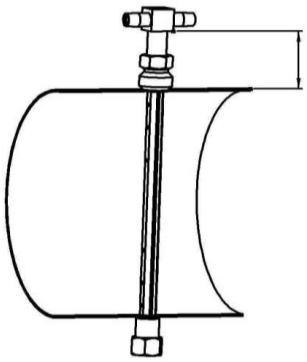
Figure 7:

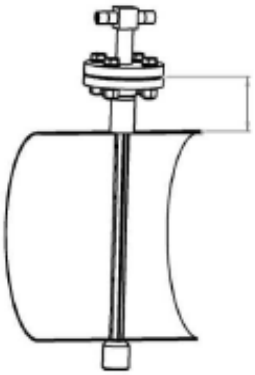
Neck Extension for 98PG Sensors



80 + H for 98PG.1.
100 + H for 98PG.2.
100 + H for 98PG.3.
H=Neck extension

Figure 8:

Neck Extension for 98PF Sensors



80 + H for 98PF.1.
100 + H for 98PF.2.
100 + H for 98PF.3.
120 + H for SDFF.5.
H=Neck extension

3.6.1 Steam Sensor Installation

Generally installation is similar as above. Observe the following particular characteristics.

- Ensure during installation that the condensate pots are installed on exactly the same level.
- Place a level on condensate pots or compact head for alignment.

See further information and details in chapter 5.

Dosch
Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 72 01 53-0
Fax
+49 (0)30 72 01 53-61

Mail
vertrieb@dosch-gmbh.de
Homepage
www.dosch-gmbh.de

AG Berlin-Charlottenburg
92 HRB 13892
Geschäftsführer/CEO
Martin Dosch, Sven Dosch

USt.-IdNr./Vat No.
DE 136 747 116

Gegründet 1933
von Ing. Adolf Dosch

Berliner Sparkasse IBAN DE77 1005 0000 1260 0050 00 SWIFT BELADEBEXXX

Dosch Messapparate GmbH · Kamenzer Damm 85 · D-12249 Berlin

4. Connect Pressure Differential Transmitter to Sensor

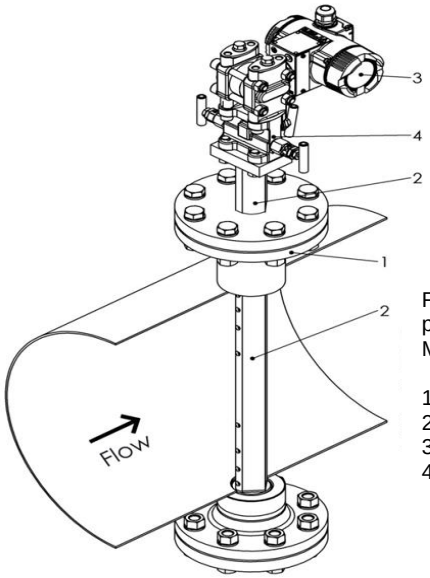
4.1 Sensor with Mounting Plate for Direct Transmitter Connection to the Sensor

The easiest and most cost-effective form of connecting sensor und transmitter is offered by sensors with mounting plate for the direct installation of the transmitter. For this a “sandwich” is made of sensor, 3- or 5-way manifold and transmitter, which are held by 8 screws (4 per side). Condition is that the permissible temperatures at the transducer membrane are not exceeded. The ⊕ side of the transmitter must be connected with the upstream side of the sensor, i.e. with the side in front of the direction of the arrow. Both sealing faces – between sensor and manifold and between manifold and transmitter – must be equipped with sealing rings in the provided grooves. These sealing rings are supplied.

The necessary seals are loosely included with the delivery.

The complete parts list for the start-up of the sensor must include:

- Sensor including the installation components for pipe installation
- 1 3-way manifold for direct installation at transmitter and sensor including all seals and screws
- 1 pressure differential transmitter (will be mounted directly to the sensor, additional support is not necessary)



Flow sensor with direct installed electric pressure difference transmitter and 3-way Manifold

1. Installation flange
2. 98P sensor
3. DP-transmitter
4. 3-way manifold

Figure 9:
Arrangement of direct mounted differential pressure transmitter on 3- or 5-way manifold (Caution: Follow previous instructions for installation position!)The sensor must be installed according to Table 2. Zero point balance of the transmitter must be executed before start-up. Both chambers must be under the same pressure. Close an upstream valve and open the middle valve for the pressure to be present at both chambers. See further procedure in the manual of the pressure differential transmitter manufacturer.

Dosch Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 7201 53-0
Fax
+49 (0)30 7201 53-61

Mail
vertrieb@dosch-gmbh.de
Homepage
www.dosch-gmbh.de

AG Berlin-Charlottenburg
92 HRB 13892
Geschäftsführer/CEO
Martin Dosch, Sven Dosch

USt.-IdNr./Vat No.
DE 136 747 116

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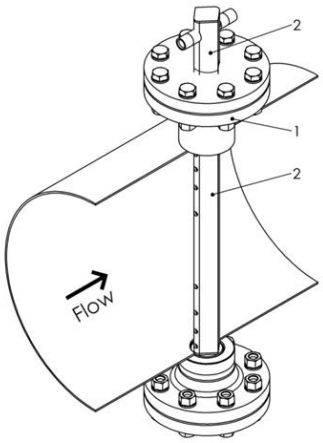
4.2. Sensor with connection nipples to connect the DP-Transmitter via Differential Pressure Tubing

The connection between sensor and remote installed transmitter is made via differential pressure tubes. Typically tubes are screwed to the sensor or manifold and transmitter. Generally screw joints with cutting ring or tensioning ring matching the selected pipe connections are used (e.g. ∅12mm or ∅14mm). The screw joints can be ordered from DOSCH GmbH. For higher pressure generally welding is recommended. For this we offer primary shut-offs with welding joints.

The complete parts list for the start-up of the sensor must include:

- Sensor including the installation components for pipe installation
- 2 pcs ball valves/shut-off valves for initial shut-off of the differential pressure pipes of the flow sensor (can be omitted for “depressurised” pipes)
- 2 pcs fittings each to align the primary shut-off connections of the 3- or 5-way manifold with the differential pressure pipe
- 1 pcs 3- or 5-way manifold for direct installation on the transducer with matching process connection including all seals and screws and necessary oval adapters
- 1 pcs of differential pressure transmitter with pipe or wall bracket
- Sufficient piping in proper tubing length

Please contact our responsible sale engineer or representative in case you wish start-up of the sensors by DOSCH GmbH.



Standard flow sensor for horizontal and vertical pipe run:
(e.g. process connection via 12mm pipe and tensioning ring screw joint; Ball valves with tensioning ring screw joint optional)
1. Installation flange
2. 98P sensor

Figure 10:
Arrangement for transmitter connection via differential pressure tubes (Caution: follow previous instructions for installation position!)

The sensor must be installed according to Table 2. Tubing should slope upwards to the DP-Transmitter for gases and slope downwards to transmitter for liquids (recommended minimum slope 10 degrees). Zero balance of the transmitter must be executed before start-up. Both chambers must be under the same pressure. Close an upstream valve and open the equalizer valve for the pressure to be present at both chambers. See further procedure in the manual of the pressure differential transmitter manufacturer.

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5. Specific Characteristics Steam Sensors

5.1. Description of the Measurement Set-Up and Specific Notes

98P flow sensors for steam are generally supplied with condensate pots (2) and mostly with pre-assembled shut-off valves. In standard sensors for steam the condensate pots are integrated in the compact head, which simplifies the alignment of the 98P sensor.
The sensors must always be installed horizontally.

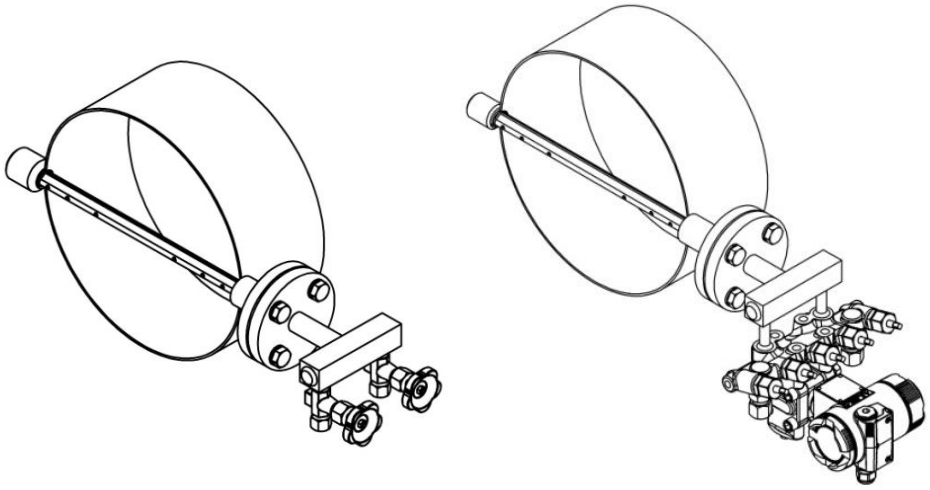

Figure 11:
Steam Sensor Illustration (98P)

Remote transmitter installation:
The connection between sensor and transmitter is made via compression fitting. Ensure that the compression fittings slope downwards over the entire distance towards the pressure differential transmitter. The steam condensates in the pipes and the condensate serves as a guard to avoid direct contact of steam to the electronics. Please note that these condensate water columns generate additional pressure at the measuring cell. They can distort the pressure differential measurement if the individual height of condensate columns are not exactly the same.
To ensure equal condensate height the 98P flow sensors are fitted with condensate pots, which are filled with condensate to a clearly defined height during normal operation.

Transmitter direct installation:
Steam sensors for direct installation of the pressure differential transmitter are always supplied with compact head and welded 5-way manifold. Horizontal alignment of the compact head can easily be checked with a level during installation. Due to low condensate receivers, the condensate pots integrated in the compact head must be filled with water before measuring start-up via the blow-off valves integrated in the 5-way manifold.

Dosch
Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 72 01 53-0
Fax
+49 (0)30 72 01 53-61

Mail
vertrieb@dosch-gmbh.de
Homepage
www.dosch-gmbh.de

AG Berlin-Charlottenburg
92 HRB 13892
Geschäftsführer/CEO
Martin Dosch, Sven Dosch

USt.-IdNr./Vat No.
DE 136 747 116

Gegründet 1933
von Ing. Adolf Dosch

Berliner Sparkasse IBAN DE77 1005 0000 1260 0050 00 SWIFT BELADEBEXXX

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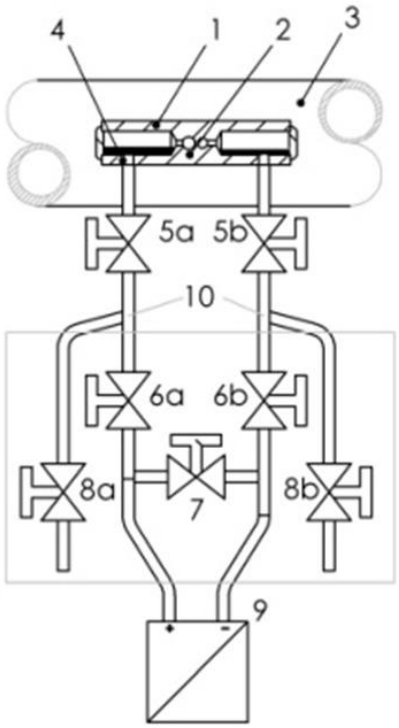
Steam
horizontal
pipe direction



1 Sensor
2 Compact head
3 Steam pipe
4 Tubing connection
5 Initial shut-off
6 Pressure differential valves
7 Counterbalance valves
8 Blow-off valves
9 Transmitter
10 Instrument tubing

Figure 12:
Measurement Set-Up Steam Sensors

See the typical pipework and shut-off valve array between sensor and pressure differential transmitter in the measurement set-up. In real life valve combinations 6, 7, 8 are combined in multi-manifold. For cost efficiency often the blow-off valves are omitted. In this case valve combination 6a, 6b, 7 is achieved with a 3-way manifold. If in addition blow-off valves 8a, 8b are desired, then a 5-way manifold is deployed.
To protect the transmitter from thermal overload ensure that steam does not contact the measuring cell. This is achieved with so-called condensate guards (water columns from condensated steam). The transmitter is generally installed with sufficient distance below the sensor.

Dosch
Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 7201 53-0
Fax
+49 (0)30 7201 53-61

Mail
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5.2. Steam Measurement Start-Up

Ensure before measurement start-up that all connections are leak-proof and the impulse pipes and condensate containers are filled.
Fill with water via the blow-off valves if a 5-way manifold is used. The valves upstream of the transmitter must initially be closed. Filling is only permitted if the water pressure is higher than the steam pressure; otherwise steam can escape. For this reason generally only fill if the steam piping is depressurized. Filling is only possible if primary shut-offs, if present, are open.

For steam sensors with remote installed pressure differential transducer alternatively the accruing condensate can be used for filling. However, this method is time-consuming. After installation close all valves initially. Condensate collects in the condensate container. Open the primary shut-offs after a while for the condensate to run into the impulse pipes. After some more waiting open the pressure differential valves of the manifold and the cooled condensate reaches the measurement cell. After the condensate containers have filled again zero balancing can be carried out (first close the pressure differential valves and then open the equalizer valve) and the measurement can be started.

Dosch
Messapparate GmbH
Kamenzer Damm 85
D-12249 Berlin

Fon
+49 (0)30 72 01 53-0
Fax
+49 (0)30 72 01 53-61

Mail
vertrieb@dosch-gmbh.de
Homepage
www.dosch-gmbh.de

AG Berlin-Charlottenburg
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Geschäftsführer/CEO
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6. Troubleshooting

Pos.	*Trouble*	*Possible Cause*
	Sensor	
1	No or too low pressure differential	- Sensor not installed in flow direction
		- Pressure differential connections between sensor and transducer reversed (upstream side of sensor not connected to “+” transmitter chamber and downstream side of sensor not connected to “-” transmitter chamber)
		- Primary shut-off “+” and/or “-” side not open
		- Equalizer valve not closed
		- Leaks in pressure differential pipework
		- Sensor(s)/ drill holes plugged
		- Upstream and downstream distances too short (see table 1)
		- Air bubbles in sensor head / differential pressure tube or transducer (see also pos. 3 / *for steam and liquid measurements*)
		- Condensate in sensor head/ differential pressure pipe or transducer (see also pos. 4 / *for gas measurement*)
		- Sensor not completely with all drill holes inside the free pipe diameter
		- Condensate pots not aligned at equal height (different condensate column heights, *only for steam measurement*)
2	Measurement range exceeded	- Upstream and downstream distances too short (see table 1)
		- Primary shut-off in differential pressure tube of “-” side not open
		- Sensor(s)/ drill holes blocked
		- Sensor not completely with all drill holes inside the pipe diameter
		- Condensate pots not aligned on equal height (different condensate column heights, see page 20, *only for steam measurement*)
3	Trapped air in sensor/ differential pressure pipe and/or transmitter *(for liquid measurement)*	- Faulty installation of 98P-sensor or differential pressure transmitter
		- Incorrect bleeding (see user manual pressure differential transmitter)
		- Differential pressure tubes installed without proper sloping (*for steam and liquid measurements*)
		- Transmitter not installed below sensor (*for steam and liquid measurements*)
4	Condensate formation in sensor/ differential pressure pipe and/or transmitter *(for gas measurements)*	- Faulty installation of 98P sensor
	Pressure differential-Transmitter	
5	No or wrong output signal	- Faulty installation of differential pressure transmitter (see user manual pressure differential transmitter)
		- Wrong wiring transmitter (see user manual pressure differential transmitter)
		- Transmitter incorrectly parameterised (see pressure differential calculation flow sensor)
		- No zero balance of transmitter
		- Measurement cells damages from direct contact with hot condensate/ steam (*only for steam measurement*)

We are aware that this list cannot be complete. Please contact us directly if problems occur, which are not included in this list.
(subject to technical changes/Illustrations may contain options)