

1. Design and principle of operation

The Differential Pressure and Flow Meter Media 4K measures the differential pressure in industrial plants and domestic services. When used as a differential pressure meter in with a combined orifice plate, the instrument indicates the rate of flow (flow meter). Whenever an adjustable limit value is reached, contact-making is achieved by means of proximity switches.

The indicating unit, Media 4K, essentially consists of a differential pressure measuring-

cell containing a measuring diaphragm and a measuring spring, plus the indicating unit (gauge) comprising pointer mechanism and dial.

When used as a flow meter, an orifice plate assembly (primary element consisting of orifice flange or orifice tube) is necessary in addition to the indicating unit.

In addition, different accessories must be used, depending on the application: Condensation chambers, shut-off valves or valve blocks (shut-off and equalizing valve).

The differential pressure $\Delta p = p_1 - p_2$ (or the pressure drop at the orifice plate) produces a force on the measuring diaphragm (3). This force is balanced by the measuring spring (2). The deflection of the measuring diaphragm (3) and lever (7), which is proportional to the differential pressure, is led out of the pressure chamber by way of a flexible disc (4) and is transmitted to the pointer mechanism (9) via the measuring range plate (5) and the adjustable feeler role (8).

By means of the zero adjuster (14, Fig. 1), the pointer can be adjusted in accordance with the scale value.

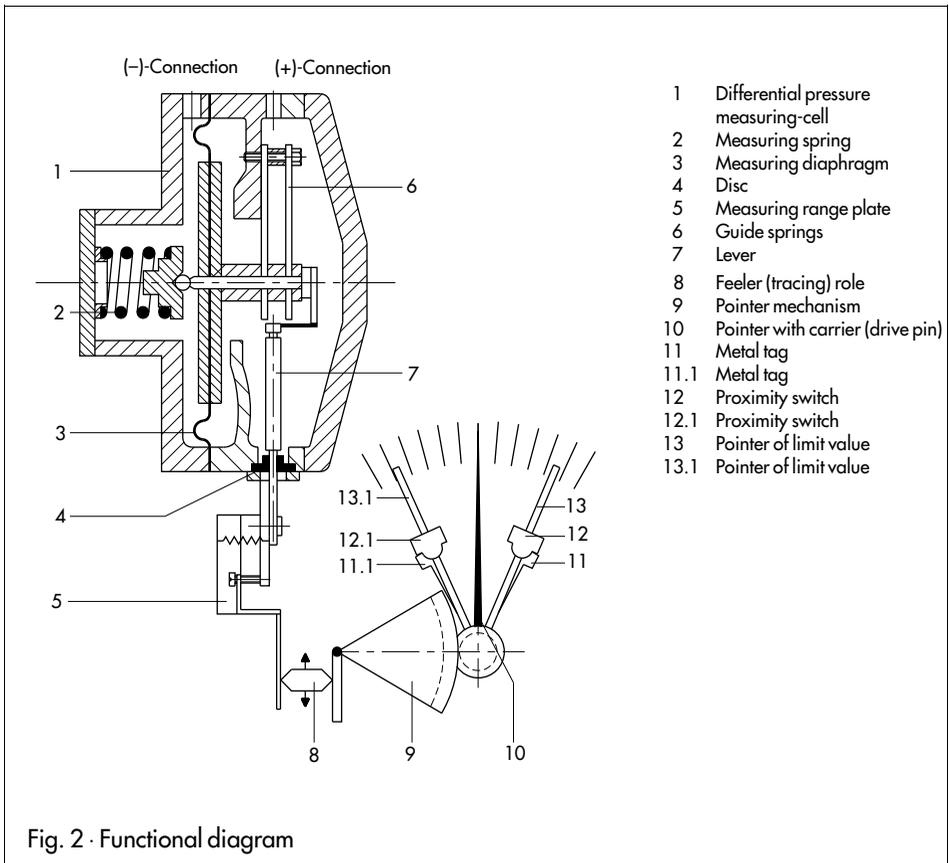
The scale indication is linear for the differential pressure and quadratic (squared) for the rate of flow, due to the relationship between the rate of flow Q and pressure drop p in the equation $Q = K \cdot \sqrt{\Delta p}$.

Limit switches:

The limit switch unit is actuated when the metal tags (11 and 11.1) enter the pick-up field of the proximity switches (12 and 12.1) of the limit-value pointers (13 and 13.1). Movement is via the pointer shaft.

If the metal tag enters the pick-up field of the associated proximity switch, the switch becomes highly resistive. If the tag leaves the field, the proximity switch becomes low resistive. This function corresponds analogous to that of a mechanical-type switching contact.

Whenever the limit value is exceeded in either direction, the carrier moves the metal tag out of the proximity switch. Thus, the corresponding contact switches the control circuit via the subsequent switching amplifier (transistor relay).



1.1 Technical data

| | | | | | | | | | | |
|---|---|--------------------------------|-----|-----|-----|-----|-----|------|------|------|
| Differential pressure meter | With measuring diaphragm for measuring spans from 40 to 600 mbar, 250 to 1600 mbar or 1600 to 2500 mbar | | | | | | | | | |
| Measuring span mbar | Max. | 60 | 100 | 160 | 250 | 400 | 600 | 1000 | 1600 | 2500 |
| | Min. | 40 | 60 | 100 | 160 | 250 | 400 | 600 | 1000 | 1600 |
| Nominal pressure | PN 40, unilaterally overloadable up to 40 bar | | | | | | | | | |
| Volumes within the measuring chamber | Upstream (+ high-pressure) chamber: Approximately 80 cm ³ downstream (- low-pressure) chamber: Approximately 25 cm ³ | | | | | | | | | |
| Displacement volume | Maximum 9 cm ³ (at smallest measuring span: 5 cm ³) | | | | | | | | | |
| Indication Scale division, on request | Scale 270°, scale length approximately 300 mm 0 to 100 % linear or squared for any linear measuring quantities, for quantities according to an equation, curve or table | | | | | | | | | |
| Performance | Indication linear to differential pressure | | | | | | | | | |
| Deviation of characteristic | <±2.5 % | <±1.6 % (including hysteresis) | | | | | | | | |
| Sensitivity | <0.5 % | <0.25 % | | | | | | | | |
| Influence in % of the measuring span | Static pressure: <0.03 %/1 bar | | | | | | | | | |
| Inductive limit switches | Limit-value pointer with inductive pick-off, min. limit value distance: 12 % of the scale length | | | | | | | | | |
| Proximity switch | SJ 3.5 N or SJ 3.5 SN | | | | | | | | | |
| Switching accuracy | <±2.8 % | <±2 % | | | | | | | | |
| Reverse span, approx. | <0.8 % | <0.6 % | | | | | | | | |
| Control circuit | Values corresponding to the subsequent switching amplifier (transistor relay) | | | | | | | | | |
| Temperature range | Permissible ambient temperature: SJ 3.5 N = -25 to +70 °C, SJ 3.5 SN = -40 to +100 °C | | | | | | | | | |
| Degree of protection | IP 54 according to DIN 40 050 | | | | | | | | | |
| Approximate weight | 3.5 kg | | | | | | | | | |

| Materials | | | | | |
|---|------------------------------|--|------------------|-----------|----------------|
| Measuring diaphragm | Case, heads and spring plate | Measuring and guide springs | Diaphragm plates | Lever | Indicator case |
| ECO | Cu Zn 40 Pb | WN 1.4310 | WN 1.4571 | WN 1.4310 | Polycarbonate |
| Special version measuring-cell with stainless steel housing | | Housing and heads: A 351 CF8M, spring plate: WN 1.4301 | | | |



WARNING

This differential pressure and flow meter may only be assembled, commissioned and operated by experienced personnel familiar with such procedures. Proper shipping and appropriate storage are always assumed.

Take appropriate measures to prevent any danger from occurring on the measuring apparatus caused by the flow or process medium (or the system pressure)!

2. Installation

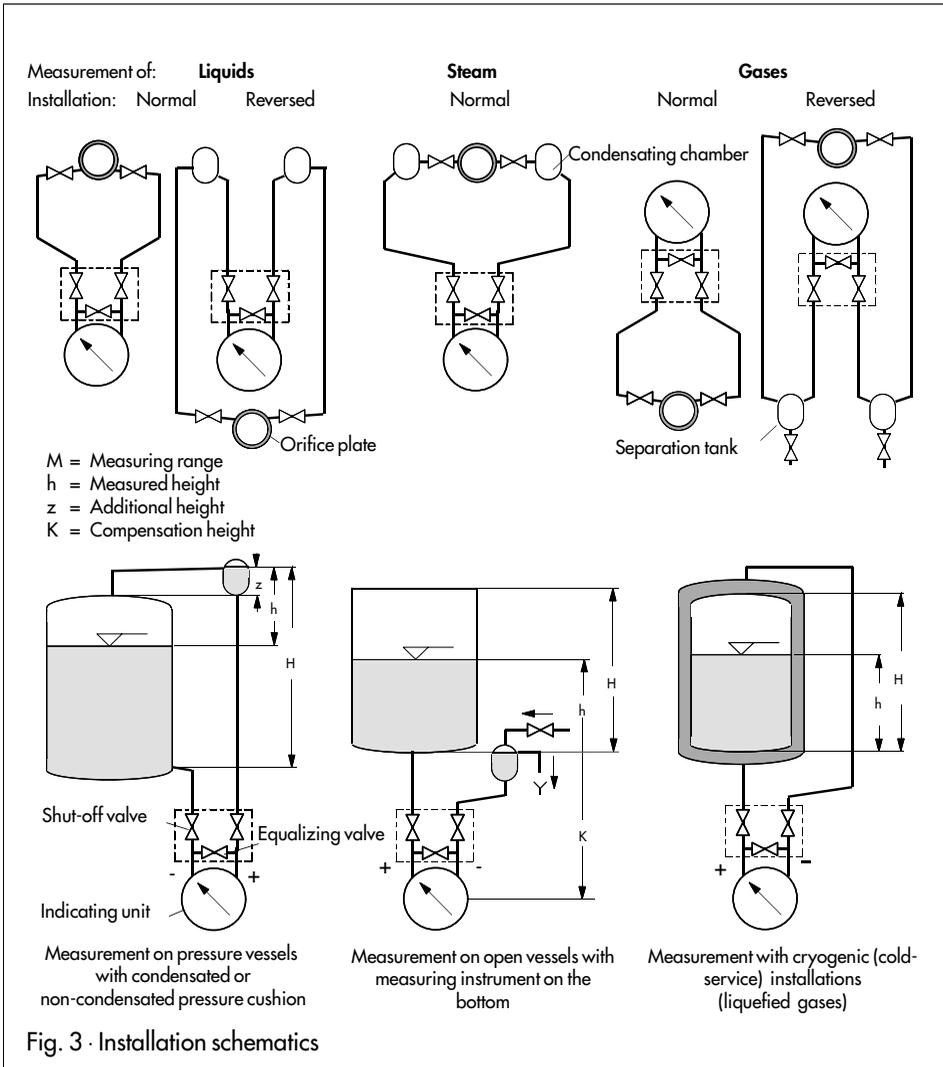
2.1 Arrangement of the instruments

The basic arranging sequence of the instruments is depicted in the following installation schematic. Whether the instrument is to be secured above or below the point of measurement (gauging point) or whether equalizing tanks are to be installed depends on the type of process fluid and the local conditions.

Normal and reversed installation are shown in the installation schematic. Normal installation is always to be preferred! Only use

reversed installation when there is no other alternative, especially when **measuring steam**. Further details can be found in the publication **VDE/VDI 3512, Part 1**.

For measuring the liquid level according to the first schematic shown in the bottom left, the additional height z must be included in the measurement. Therefore, keep it as small as possible. The dimension K (compensation height, schematic 2) can be selected as large as desired, in accordance with the installation conditions.



2.2 Orifice plate assembly (dp pick-up)

(orifice flange or orifice tube, Figs. 4.1, 4.2)

The direction of flow must coincide with the attached arrow. An undisturbed, straight length of pipe is required at the inlet and outlet side of the orifice plate assembly.

With the orifice tubes supplied by SAMSON, these pipe lengths are ensured through the welded-on calibrated pipes. With orifice flanges, the smooth length of pipe preceding the orifice plate is specified in the Confirmation of Order.

The orifice plate assembly and, also, the seals must not be eccentrically displaced relative to the pipeline. Never install control valves that continuously vary the operating state of the process medium upstream of the orifice plate assembly; e.g., manually operated valves or temperature regulators/controllers. The operating state is expected to correspond to the calculated state as close as possible. In contrast, regulators which do not vary the operating state (e.g., pressure regulators) prove to be advantageous upstream of the measuring facility.

2.3 Differential pressure lines

Install the differential pressure lines with a pipe of 12 mm external diameter according

to Fig. 3. IMPORTANT: Always arrange correctly as shown in Fig. 6! The use of compression-type fittings (Fig. 5) will ensure tight sealing of the lines.

Pipe runs which, in normal cases, would be placed horizontally are to be installed with a slope of at least 1:20, sloping from the orifice plate or the point enabling ventilation.

The minimum bending radius must not fall below 50 mm.

Thoroughly flush through the differential pressure lines before connecting them to the instrument.

2.4 Indicating unit, Media 4K

Compare the operating data to that of the orifice plate assembly in advance to assembling! Make certain that the upstream (+ high-pressure) and the downstream (- low-pressure) lines are connected to the corresponding inlet and outlet connections.

NOTE:

To connect the differential pressure lines, compression-type fittings are required. In addition, the unused (open) connections of the instrument must be provided with plugs or vent plugs, depending on how the instruments are to be arranged (see also "Accessories" in section 5).

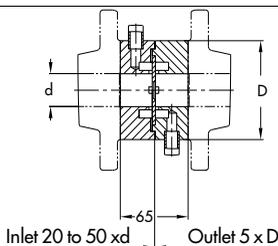


Fig. 4.1 · Orifice Flange Type 90

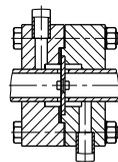
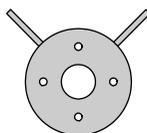
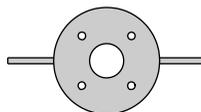


Fig. 4.2 · Orifice Tube Type 91

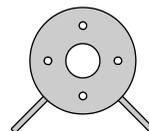
Fig. 4.3 · How the differential pressure lines are arranged on the orifice plate assembly (primary element)



For gas



For steam



For liquids

Carefully clean the process connections before connecting the differential pressure lines. Never flush through the instrument with compressed air or pressurized water!

At the place of installation, secure the instrument to the tube, wall or mounting plate **free of vibrations**. Use a mounting component with a clamp for attachment to vertical or horizontal tubes. Use a mounting component "without" a clamp for mounting to walls (see dimensional drawing, section 6). For panel mounting (panel cut-out \varnothing 170, min. \varnothing 165; hole circle \varnothing 180 mm). Unscrew the case cover, and secure the rear cover with measuring-cell to the panel using four countersunk screws M4.

2.4.1 Electrical connection

This procedure involves connecting the limit switches of the indicator to a control unit. Depending on whether the version has one or two proximity switches, control devices of PEPPERLUND FUCHS are recommended.

For one switch — WE 77/Ex1,
 For two switches — WE 77/Ex2.

Terminal connections are depicted in Fig. 5.

How the different limit switches function is shown in the table on page 10.

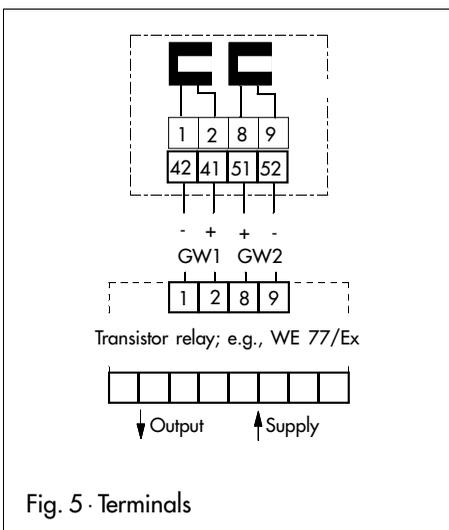


Fig. 5 · Terminals

2.5 Accessories

2.5.1 Shut-off and equalizing valve

It is good practice to install both a shut-off valve and, in addition, an equalizing valve in the differential pressure lines.

A valve block (manifold) with three or five combined valves is available as an accessory. The valves are used to shut-off both of the differential pressure lines and for short-circuit switching on the indicating unit for checking zero. Lines can be additionally connected to valve blocks with five combined valves to blow out and flush through the measuring system. Fig. 6 shows how the valves are to be placed.

2.5.2 Condensation chambers

Condensation chambers for maintaining a constant liquid column are required when steam is to be measured. In liquid measurement, they are needed only when the indicating unit is arranged at the point of measurement.

When measuring gas, they are required as **separation tanks** to cut off the condensate when the indicating unit is arranged below the point of measurement.

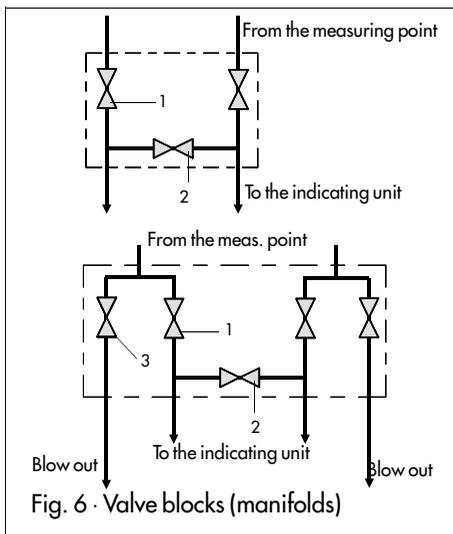


Fig. 6 · Valve blocks (manifolds)

3. Commissioning

3.1 For steam measurement

The steam should never directly contact the working diaphragm of the instrument.

For this reason, unscrew the differential pressure lines below the shut-off valves (or of the valve block), and fill the instrument with water.

As an alternative method, wait approximately 20 minutes after commissioning the plant (steam switched on) with blocked shut-off and equalizing valves (or valve block) until condensate in the differential pressure lines rises above the valve up to the orifice plate.

Proceed first by opening the upstream line. Then close the equalizing valve (or the bypass of the valve block), and open the downstream line. Wait a short period of time, then remove both vent plugs of the measuring-cell, one after another, until condensate escapes free of bubbles, and firmly tighten screws again.

In the same manner, vent the equalizing tanks. Lightly tap the case of the indicator or the equalizing tanks to promote the escape of air.

Subsequently check zero as described in section 4.1, and put the instrument into service again.

NOTE

When installed reversibly (measuring instrument above the point of measurement), the differential pressure lines can partly drain when plant is relieved of pressure.

When re-commissioning, the measuring arrangement must be vented so that it can fill with condensate again.

3.2 For liquid measurement

First open the upstream line by gradually turning. Then close the equalizing valve (or the bypass of the valve block), and open the downstream line. Remove the vent plug at the

measuring-cell until the air has escaped. Then firmly tighten again.

Subsequently check zero at the measuring-cell as described in section 4.1, and put the instrument into service again.

4. Operation

4.1 Zero adjustment

If the differential pressure lines are provided with shut-off and equalizing valves, zero can be checked, even when the plant is being operated.

First close the downstream line of the shut-off valve. Then open the equalizing valve, and close the upstream line of the shut-off valve so that a balance of pressure is obtained in the instrument. The pointer must indicate zero. If it does not read zero, re-adjust the zero screw (14, Fig. 1) until the zero position is reached.

To commission, first open the upstream line. Then close the equalizing valve and, in the last step, slowly, but gradually, open the downstream line as far as possible. The instrument is in operation again!

For applications with an installed valve block, open the bypass of the valve block, and close the upstream line (open in reverse sequence).

4.2 Draining

When gases are measured, now and then drain condensate from the separation tanks. Close the valves in the differential pressure lines (valve block) prior to opening the drain plugs.

4.3 Measuring span — Measuring range

The measuring span of the differential pressure and flow meter is determined by, on one hand, the measuring chamber (three versions with different measuring diaphragm (3) and guide spring (6)) and, on the other hand, the installed measuring spring (2). The versions of measuring diaphragm and guide spring are noted on the nameplate.

The instrument is pre-adjusted, ex-factory, to the range specified in the order and can only be subsequently modified in the range permitted by installed measuring spring.

The measuring span can be continuously adjusted up to 60% of the maximum measuring span. If another span is to be adjusted, the measuring spring (2) must be exchanged. See also nameplate on the instrument and the table referring to the measuring ranges.

4.3.1 Adjusting and modifying the measuring range (Fig. 7)

For best results, adjust on the test bench.

Unscrew the case cover, and apply the pressure corresponding to the desired final value of the measuring range to the upstream connection of the measuring chamber. Then displace the feeler role (8) on the measuring range plate (5) upwards or downwards until the pointer (10) indicates the full-scale value.

Remove the pressure (pointer must return to zero again), and correct zero using the adjuster (14, Fig. 1).

Apply the pressure corresponding to the final value of the measuring range to the measuring chamber again, and re-adjust the feeler role again until the pointer indicates the final value.

If necessary, repeat this adjustment procedure until zero and the final value correspond to the desired measuring range.

4.3.2 Modifying the measuring range by exchanging the measuring spring (Fig. 8)

Adjust on the test bench only!

If the measuring range is to exceed that of the installed measuring spring, select the measuring spring required according to the measuring range table. Only the springs corresponding to the existing measuring chamber (see nameplate) can be exchanged. For this purpose, proceed as follows:

Unscrew the case cover, and adjust zero using the corresponding screw (14, Fig. 1).

Remove the screws (15), and take out the measuring plate (16), guide plate (17), measuring spring (2) and disc(s) (18) at the downstream connection of the chamber. The spring guide (20) remains in the case.

Install the new spring (2), and then secure the spring plate using two screws (15).

Check zero. Correct any deviation by inserting discs (18) of different thickness' (order number, see table). For this purpose, the spring plate must be unscrewed again each time.

When zero is reached, firmly screw on the spring plate, make certain that the O-ring (19) is located at the correct position; replace, if necessary.

Adjust the measuring range according to section 4.3.1.

NOTE

When modifying the measuring range corresponding to the differential pressure in the flow measurement, be aware that flow indicator also will change. Re-calculation is required in this case.

The opening ratio of the orifice plate $m = d^2/D^2$ must also be taken into account.

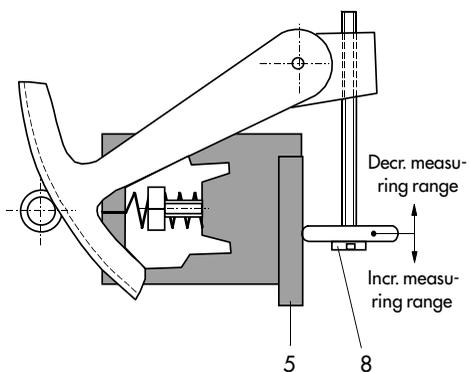
Note on instruments for oxygen (O₂)

Equipment used for measuring oxygen is provided with an adhesive label.

Oxygen! Keep free of oil and grease!

These versions are assembled by the manufacturer under special conditions and subsequently flushed.

Always wear suitable working gloves when exchanging parts which can come into contact with oxygen; e.g., measuring springs.



- 2 Measuring spring
- 5 Measuring range plate
- 8 Feeler (tracing) role
- 15 Screws
- 16 Spring plate
- 17 Guide plate
- 18 Discs
- 19 O-ring
- 20 Guide spring

Fig. 7 · Adjusting the measuring range

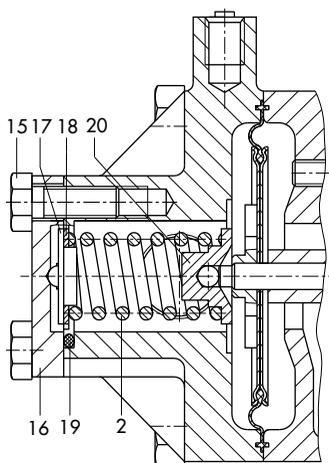
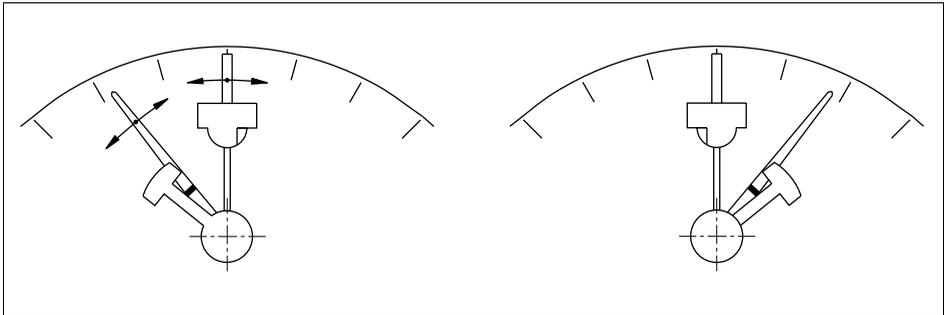
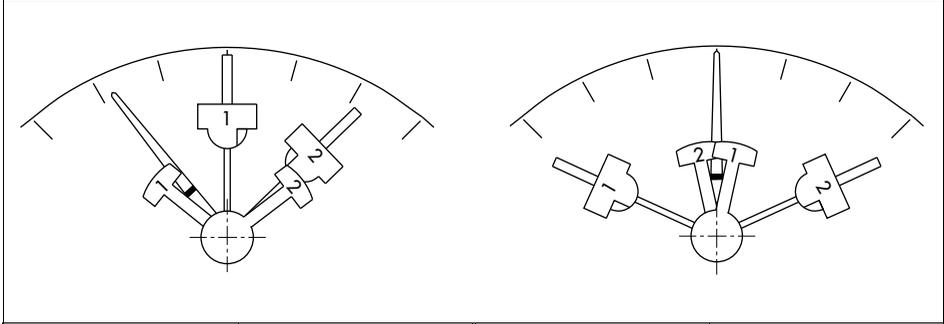


Fig. 8 · Exchanging the measuring

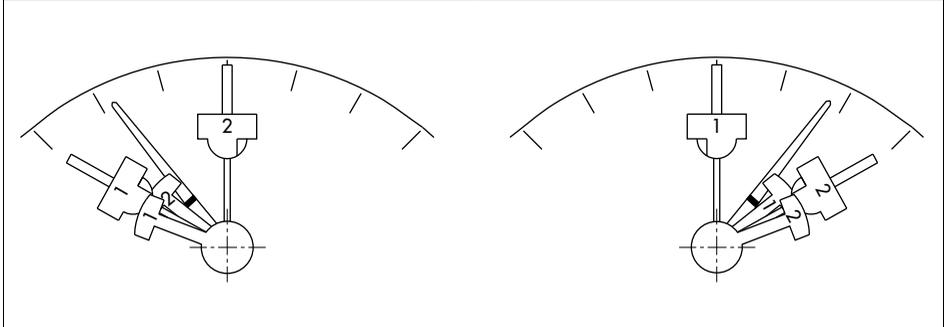
| Measuring chamber | Measuring range mbar | | Measuring spring | | |
|--|------------------------------------|-----------|------------------|----------------|--------------|
| | Minimum | Maximum | Wire ø mm | Length ±0.1 mm | Order number |
| 1 Diaphragm 0.4/52 Guide spring 0.5 | 0 to 40 | 0 to 60 | 1.2 | 34.4 | 1400-5871 |
| | 0 to 60 | 0 to 100 | 1.6 | 32.7 | 1400-5872 |
| | 0 to 100 | 0 to 160 | 1.8 | 32.2 | 1400-5873 |
| | 0 to 160 | 0 to 250 | 2.25 | 32 | 1400-5874 |
| | 0 to 250 | 0 to 400 | 2.5 | 31.9 | 1400-5875 |
| | 0 to 400 | 0 to 600 | 2.8 | 31.7 | 1400-5876 |
| 2 Diaphragm 0.4/70 Guide spring 0.8 | 0 to 250 | 0 to 400 | 2.25 | 32.4 | 1400-5879 |
| | 0 to 400 | 0 to 600 | 2.5 | 32.2 | 1400-5880 |
| | 0 to 600 | 0 to 1000 | 3 | 31.8 | 1400-5881 |
| | 0 to 1000 | 0 to 1600 | 3.4 | 31.6 | 1400-5882 |
| 3 Diaphragm 0.6/70 Guide spring 0.8 | 0 to 1600 | 0 to 2500 | 3.6 | 31.6 | 1400-5885 |
| Part | Designation | | | | Order number |
| 18 | Discs, set of different thickness' | | | | 1400-5653 |
| 19 | O-ring 22x2 - ECO | | | | 8421-0080 |



| | | | |
|---|----------------------|---|----------------------|
| Version A | Order no.: 1089-0961 | Version B | Order no.: 1080-0962 |
| Increasing actual value display: Metal tag inside Decreasing actual value display: Metal tag outside | | Increasing actual value display: Metal tag outside Decreasing actual value display: Metal tag inside | |



| | | | |
|--|----------------------|--|----------------------|
| Version C | Order no.: 1089-0963 | Version D | Order no.: 1080-0960 |
| Metal tags outside when switching point is reached | | Metal tags inside when switching point is reached | |
| Increasing actual val. display: Metal tag 1 inside, 2 outside Decreasing actual val. display: Metal tag 2 inside, 1 outside | | Increasing actual val. display: Metal tag 1 outside, 2 inside Decreasing actual val. display: Metal tag 2 outside, 1 inside | |



| | | | |
|---|----------------------|---|----------------------|
| Version E | Order no.: 1089-0964 | Version F | Order no.: 1080-0965 |
| Increasing actual value display: Metal tags 1 a.2 inside Decreasing actual value display: Metal tags 1 a.2 outside | | Increasing actual value display: Metal tags 1 a.2 outside Decreasing actual value display: Metal tags 1 a.2 inside | |

Proximity switches with opening function NC (Normally Closed)

| | |
|-------------------|--|
| Metal tag outside | Switching signal "on"(L-signal of the proximity switch)= Contact closed or output activated. Proximity switch highly resistive=undamped. Power consumption ≥ 3 mA. |
| Metal tag inside | Switching signal "off"(0- signal of the proximity switches)= Contact opened or output disabled. Proximity switch highly resistive= damped. Power consumption ≤ 1 mA. |

4.4 Switching function — Adjusting the switches (after connecting to the transistor relay, section 2.4.1)

Slide the switch indicator (or the red switch indicators) such that they point to the value at which contact-making is desired on the dial.

For a finer adjustment (test bench), the measuring chamber is to be applied with pressure in order to check whether the contact-making occurs at the desired indicated value by the movement of the instrument pointer.

If necessary, correct the position of the red switch pointer accordingly.

4.5 Exchanging the limit switch unit

The limit switches can only be exchanged as a complete, switch unit.

To exchange the unit, first unscrew the case cover, then the cover plate with the type designation.

Remove the three mounting screws on the scale. Incline the switch unit, turn the pointer (10), and lift out the switch unit below the pointer.

Remove the dial plate and label. Unscrew terminal base on the rear cover.

Secure the terminal bracket of the new switch unit on the rear cover.

Secure the dial plate using a screw (top center).

Align the web of the zero shaft of the new switch unit in accordance with the slot in the shaft of the indicating mechanism.

Re-position the red switch indicator completely to the right and left. Then lightly place on the switch unit. Turn the instrument pointer, inclining the switch unit until it is situated below the pointer and can be screwed to the scale.

Attach the cover plate and screw tight.

Adjust zero and switch according to sections 4.1. and 4.4

5. Accessories

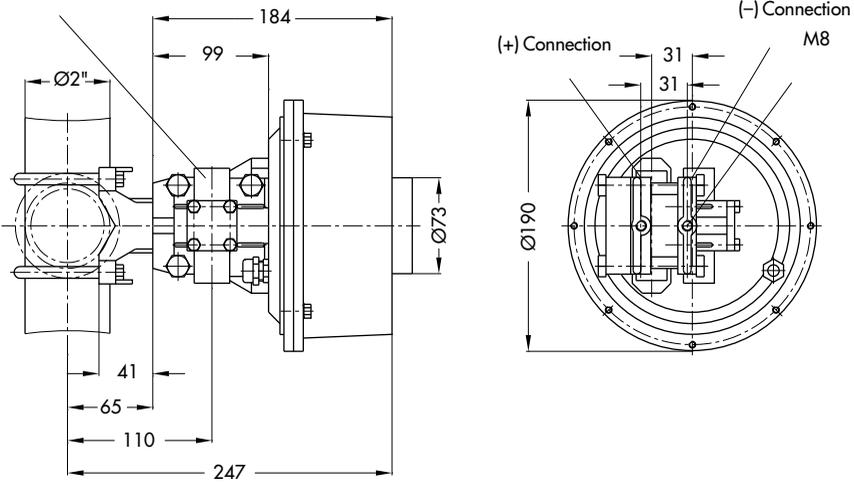
The instruments are supplied without screw fittings. The following items required must be separately purchased:

Compression-type fittings, drain or vent plugs and screw joints with orifice plates (restrictions) for damping oscillation caused by the measuring medium (especially with gas measurements).

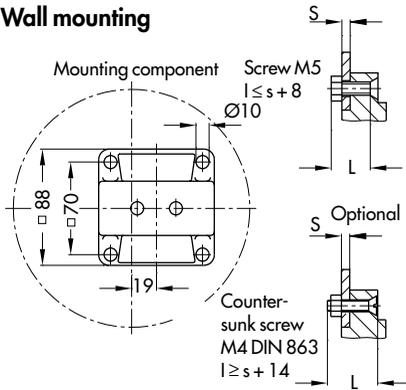
| Qty | Designation | Order number | |
|-----|---|--------------|---------------------------|
| | | Normal | Rinsed for O ₂ |
| 2 | Screw joints for tube ø12, steel | 1400-5842 | 1400-5843 |
| 2 | Screw joints for tube ø12, stainless steel | 1400-5844 | 1400-5845 |
| 2 | Screw joints for tube ø10, steel | 1400-5846 | 1400-5847 |
| 2 | Screw joints for tube ø8, steel | 1400-5860 | 1400-5861 |
| 2 | Screw joints for tube ø12, with orifice restrictor, steel | 1400-5848 | 1400-5849 |
| 2 | Screw joints for tube ø8, with orifice restrictor, steel | 1400-5850 | 1400-5851 |
| 2 | Screw joints for tube ø6, with orifice restrictor, steel | 1400-5852 | 1400-5853 |
| 2 | Vent plugs, brass, with gaskets | 1400-5654 | 1400-5658 |
| 2 | Drain plug, brass, with gaskets | 1400-5655 | 1400-5659 |
| 1 | Drain plug (half set), brass, with O-ring | 1400-5662 | 1400-5663 |
| 4 | O-rings | 1400-5660 | 1400-5661 |
| 1 | Mounting component for tube mounting | 1400-5656 | |

6. Dimensions in mm

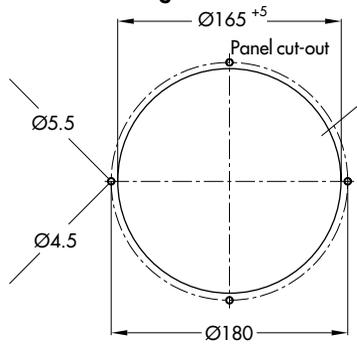
Tube mounting (with mounting component)



Wall mounting



Panel mounting



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