

*Fig. 1 · Media 5 with limit switches, attached valve block and operating pressure gauge*

## **Mounting and Operating Instructions**

**EB 9519 EN**

Edition November 2010



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**WARNING!**

Devices intended to measure gaseous oxygen are labeled  
**"Oxygen! Keep free of oil and grease!"**



*The manufacturer has cleaned and assembled all devices for oxygen service under special conditions. When replacing parts that come into contact with gaseous oxygen, e.g. range springs, wear appropriate gloves and make sure that the parts do not get into contact with oil or grease. When returning devices for oxygen service for repair, the sender assumes full responsibility that the devices are handled to meet all requirements stipulated by VBG 62 or similar regulations until they are handed over to the manufacturer. Otherwise, SAMSON AG does not accept any responsibility.*



- ▶ *The device must be installed, started up and serviced by fully trained and qualified personnel only, observing the accepted industry codes and practices.  
Make sure employees or third persons are not exposed to any danger. All safety instructions and warnings in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be observed.*
- ▶ *Any hazards that could be caused at the meter by the medium and the operating pressure in the instrument are to be prevented by appropriate measures. Make sure that the instrument is only used where temperatures and operating pressure do not exceed the sizing data specified in the order.*
- ▶ *When mounted on vessels in which hazardous area conditions of Zone 0 are to be expected, the Media 5 Differential Pressure and Flow Meter without limit switches may be used to measure flammable gases and liquids provided that the operator observes the relevant regulations on the measurement of flammable gases and liquids of Zone 0. This means measuring instruments suitable for connection to Zone 0 may be installed provided that:
 
  - 1.) *The pipes connecting the instruments have been sized and installed according to the German Technical Regulations for Flammable Liquids TRbF 50 or*
  - 2.) *Flame arresters or endurance burning flame arresters have been installed in the two measuring lines.**Whether you have to install flame arresters or endurance burning flame arresters depends on the conditions on site. It is, however, preferable to install endurance burning flame arresters. You are required to contact the appropriate regulatory authority to agree on the necessary measures. Note that it is the operator's responsibility to meet the requirements specified in 1.) and 2.) and that SAMSON AG does not assume any responsibility if the operator fails to do so.**
- ▶ *Proper shipping and appropriate storage are assumed.*
- ▶ **Note!** *Devices with the CE mark meet the requirements specified in the Directive 94/9/EC and the Directive 89/336/EEC.  
The Declaration of Conformity is available on request.*

## Technical data

Media 5 Differential Pressure and Flow Meter											
Nominal range	mbar	0 to 60	0 to 100	0 to 160	0 to 250	0 to 400	0 to 600	0 to 1000	0 to 1600	0 to 2500	0 to 3600
Measuring span	Min.	40 to 60	50 to 100	80 to 160	125 to 250	200 to 400	300 to 600	500 to 1000	800 to 1600	1250 to 2500	1800 to 3600
	Max.										
Nominal pressure	PN 50, overloadable on one side up to 50 bar										
Indicator	Ø 160 mm										
Performance	Reading linear to the differential pressure										
Conforming error	< ±2.5 %	< ±1.6 % (including hysteresis)									
Sensitivity	< ±0.5 %	< 0.25 %									
Effect of static pressure	< 0.03 %/1 bar										
Limit switches	Max. 3 alarm contacts A1, A2 and A3 acc. to EN 60947-5-6										
Control circuit	Rating according to the connected switching amplifier acc. to EN 60947-5-6, e.g. KFA6-SR2-Ex2.W										
Proximity switch	Type SC3,5-NO-BU, see T 9550 EN for further details When used for hazardous areas corresponding to PTB 99 ATEX 2219 X										
Switching accuracy	< ±2 %										
Range of inversion, approx.	< 0.6 %										
Use of Media 5 with gaseous oxygen											
max. temperature	+60 °C										
max. oxygen pressure	30 bar										
Perm. ambient temperature range	-40 to +80 °C · With oxygen: -40 to +60 °C										
Perm. storage temperature range	-40 to +100 °C										
Degree of protection	IP 54/IP 65 <sup>1)</sup>										
Weight, approx.	Without valve block: 3.0 kg · Valve block: 5.0 kg										

Materials	
dp cell	Brass (CW617N) or CrNi steel
Measuring diaphragm and seals	ECO <sup>1)</sup>
Range springs	
Diaphragm plates and function parts	CrNi steel
Lever	
Housing of indicating unit	Polycarbonate

<sup>1)</sup> Special version

## 1 Design and principle of operation

The Media 5 Differential Pressure and Flow Meter is used to measure and indicate the differential pressure or derived measuring variables for gases and liquids. Typical applications are, for example, liquid level measurement on pressure vessels, differential pressure measurement between flow and return flow, pressure drop measurement on valves and filters as well as flow rate measurement according to the differential pressure method.

The device comprises a differential pressure cell including a measuring diaphragm and range springs as well as an indicating unit including a pointer mechanism and scale.

The differential pressure  $\Delta p = p_1 - p_2$  produced by the orifice plate creates a force on the measuring diaphragm (1.5) which is balanced by the range springs (1.4).

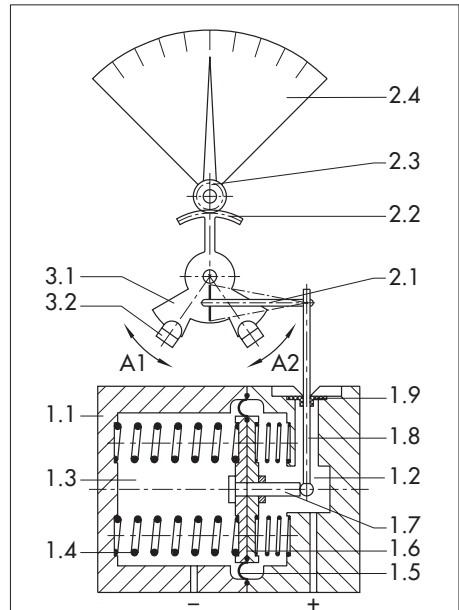
The deflection of the measuring diaphragm and lever (1.8), which is proportional to the differential pressure, is routed from the pressure chamber by a flexible disk (1.9) and transmitted to the pointer mechanism (2.3) over the adjustable transmission element (2.1). The zero adjuster (Fig. 1) allows you to adjust the pointer according to the scale value.

The scale is linear for differential pressure and squared for flow rate.

### Version with limit switches:

The toothed segment (2.2) carries the metal tags (3.1) and actuates the limit switch unit by moving the tags into the adjustable proximity switches (3.2). If the tag enters the pick-up field of the associated proximity switch, the

switch becomes highly resistive (contact open). If the tag leaves the field, the proximity switch becomes lowly resistive (contact closed). The switching function is activated when the tag moves into or out of the proximity switch depending on the contact settings.



1 Differential pressure cell	2 Indicating unit
1.1 dp cell	2.1 Transmission element
1.2 High-pressure chamber	2.2 Toothed segment
1.3 Low-pressure chamber	2.3 Pointer
1.4 Range springs	2.4 Scale
1.5 Measuring diaphragm	<b>3 Limit switch (optional)</b>
1.6 Diaphragm plates	3.1 Metal tags
1.7 Diaphragm stem	3.2 Alarm contacts
1.8 Lever	A1 and A2
1.9 Flexible disk	

Fig. 2 · Functional diagram

## 2 Installation

### 2.1 Arrangement of instruments for liquid level measurement

The second schematic drawing in Fig. 3 (middle, top row) includes the additional height  $z$  in the measurement. Therefore, keep it as small as possible.

Dimension  $K$  (compensation height, see schematics on the top right) can be as large as desired depending on the installation requirements on site.

### 2.2 Arrangement of instruments for flow rate measurement

The decision whether the device needs to be secured above or below the point of measurement, or whether equalizing tanks must be installed, depends on the type of process fluid and the local conditions. The installation schematics on page 7 show standard and reverse installation. Standard installation is always preferable. Only choose **reverse installation** when there is no alternative, especially when **measuring steam**. For further detail, we recommend referring to VDE/VDI 3512 Part 1.

### 2.3 Media 5 indicating unit

Make sure the high-pressure (plus) and low-pressure (minus) lines are connected to the corresponding inlet and outlet connections.

**Note!** You will need screw joints to connect the differential pressure lines. In addition, the unused instrument connections (open) must be fitted with plugs or vent plugs, depending

on how the instruments are arranged (also see section 3.4)

Carefully clean the process connections before connecting the differential pressure lines. Do not purge the device with compressed air or pressurized water.

Attach the device at the place of installation to the pipe, wall or mounting plate free of vibrations.

For attachment to vertical or horizontal pipes, use a fastening element with clamp. For wall mounting, use a fastening element without clamp (see dimensional drawing on page 18).

For panel mounting (panel cut-out  $\text{Ø}165^{+5}$ ; hole circle 180 mm), unscrew the cover and attach the case bottom including the measuring cell to the panel using four M4 hex bolts.

### 2.4 Differential pressure lines

Install the differential pressure lines with an external pipe diameter of 12 mm as illustrated in Fig. 3. It is essential that the correct arrangement is selected.

The use of screw joints ensures tight sealing of the lines.

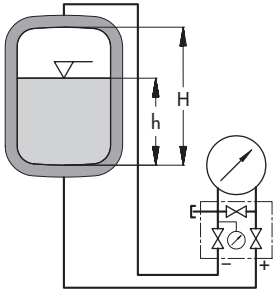
Pipework which would normally be routed horizontally, must be installed with a continuous slope of min. 1:20, sloping from the orifice plate or the point that enables venting. The minimum bending radius must not be below 50 mm.

Purge the differential pressure lines thoroughly before connecting them to the device.

**Liquid level measurement**

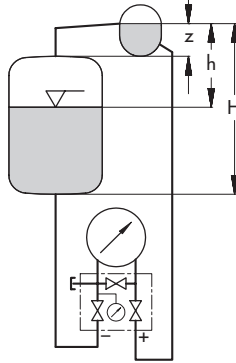
H Measuring range  
 h Measured height  
 z Additional height  
 K Compensation height

Illustration with SAMSON valve block



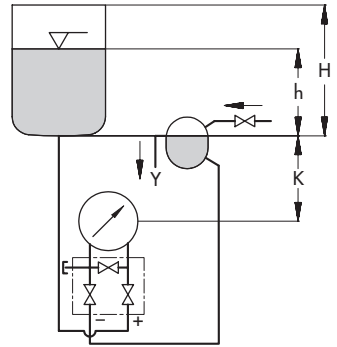
**Schematic drawing 1**

Measurements in cryogenic systems (liquefied gases)



**Schematic drawing 2**

Measurements on pressure vessels with condensing or non-condensing cushion



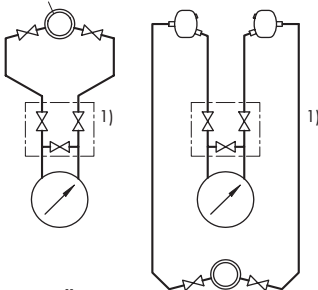
**Schematic drawing 3**

Measurements on open vessels with low-lying meter

**Flow rate measurement**

**Measuring liquids**

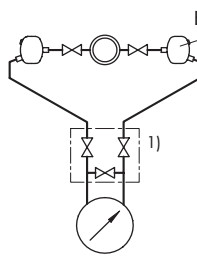
Orifice plate assembly



**Installation:**  
 Standard

Reverse

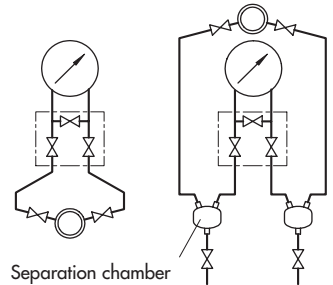
**Measuring steam**



Standard

**Measuring gases**

Equalizing tank



Separation chamber  
 Standard

Reverse

<sup>1)</sup> SAMSON valve blocks can be installed above the dp cell to match connections (+) to (+) and (-) to (-). Refer to section 3.

Fig. 3. Arrangement of devices

## 2.5 Orifice plate assembly

The process medium flows in the direction indicated by the 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 provided by the welded-on calibrated pipes. With orifice flanges, the smooth length of pipe preceding the orifice plate is specified in the order confirmation.

The orifice plate assembly as well as the seals must not be eccentrically displaced relative to the pipeline.

Do not install control valves which continuously vary the operating state of the process medium (e.g. manually operated valves or temperature regulators) upstream of the orifice plate assembly. The operating state is expected to correspond to the calculated state as exactly as possible.

In contrast, regulators which do not vary the operating state (e.g. pressure regulators)

prove to be advantageous upstream of the measuring instrument.

## 3 Accessories

We recommend to install both a shut-off valve and, additionally, an equalizing valve in the differential pressure lines. They are used to shut off the two differential pressure lines, as well as for short-circuit switching of the indicating unit for zero adjustment.

### 3.1 Valve block

A valve block (Fig. 5) with three combined valves is available as a SAMSON accessory. The valve block is directly flanged to the bottom side of the measuring cell.

On measuring the flow rate of liquids and gases, the SAMSON valve block can also be mounted upside down to allow the connections to be assigned properly, i.e. (+) to (+) and (-) to (-). However, the pressure gauge

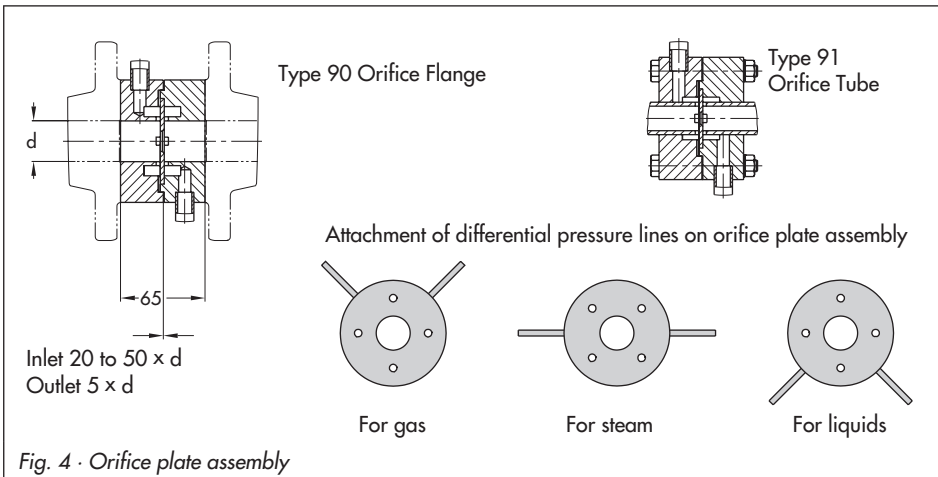


Fig. 4 · Orifice plate assembly



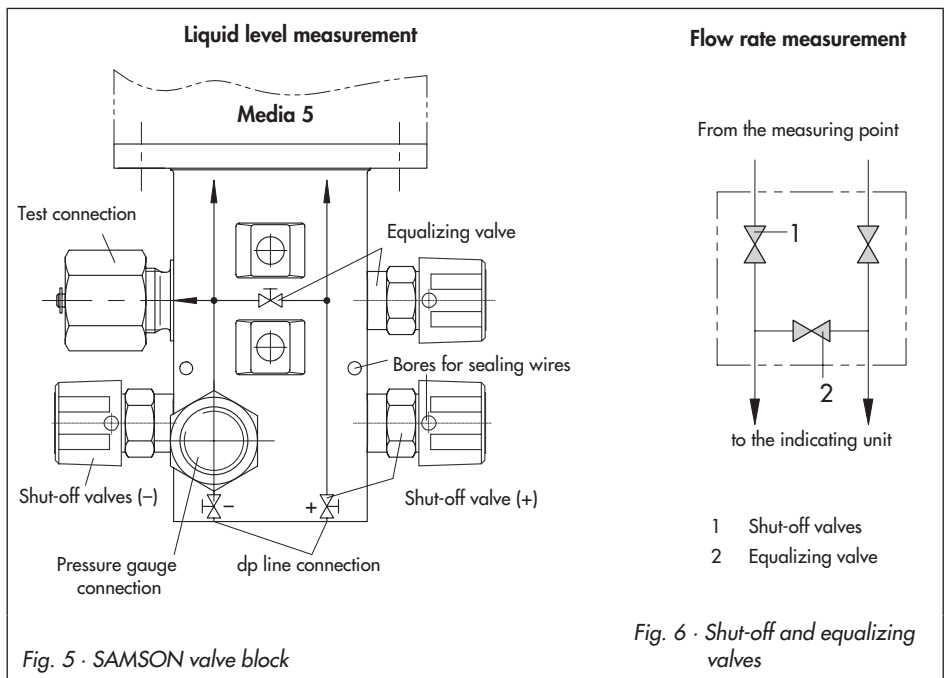
connection can no longer be used due to the reversed mounting and it must be sealed using an O-ring and screw cap G 1/2 - LH (see dimensional diagram in section 7).

### 3.2 Shut-off and equalizing valves

As an alternative to the SAMSON valve block, you can also install two shut-off valves as well as a bypass valve/equalizing valve as illustrated in Fig. 6.

### 3.3 Equalizing tanks

Equalizing tanks used to maintain a constant liquid column are required when measuring steam. In liquid measurement, they are only needed when the indicating unit is located above the point of measurement. When measuring gas, **separation chambers** are required to separate the condensate when the indicating unit is located below the point of measurement.



### 3.4 Accessories for connection

The devices are supplied without screw fittings (versions for oxygen are protected from contamination by means of four NBR screw plugs).

Required screw joints, drain or vent plugs as well as screw joints with orifice plates to dampen the vibrations caused by the measured medium (especially gas) must be ordered separately.

---

**Note!** *The screw glands as well as SAMSON valve blocks including order numbers are listed in Data Sheet T 9555 EN.*

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#### **WARNING!**

##### **Oxygen service**

*When the device is used for oxygen service, make sure that the dp cell and any SAMSON accessories (e.g. valve block) only come into contact with **gaseous** oxygen.*

---

## 4 Start-up

▶ See Fig. 5 for start-up.

### 4.1 Flow rate measurement

#### **For steam measurement**

The steam should never have direct contact with the measuring diaphragm of the device. Therefore, unscrew the differential pressure lines below the shut-off valves (or the valve block) and fill the instrument with water. Alternatively, wait approximately 20 minutes after start-up (steam switched on) with closed shut-off and equalizing valve or valve block until the condensate in the differential pressure lines rises above the valve up to the orifice plate.

1. Open the high-pressure (plus) line.
2. Close the equalizing valve/bypass of the valve block.
3. Open the low-pressure (minus) line.
4. Wait a moment before you continue by removing both vent plugs from the dp cell in succession until condensate escapes free of bubbles. Retighten screws. Vent the equalizing tanks in the same way. Lightly tap on the case of the indicating unit or the equalizing tanks to facilitate venting.
5. Check zero as described in section 5.1, and put the instrument back into service.

**CAUTION!**

*In case of reverse installation (measuring instrument above the point of measurement), the differential pressure lines could partially drain if the plant is relieved of pressure. When starting up again, the measuring arrangement must be vented so that it can refill with condensate.*

**For liquid measurement**

1. Open the high-pressure (plus) line by turning gradually.
2. Close the equalizing valve/bypass of the valve block.
3. Open the low-pressure (minus) line.
4. Remove the vent plug at the dp cell, allow the air to escape and retighten.
5. Check zero at the dp cell as described in section 5.1, and put the device back into service.

**4.2 Liquid level measurement**

► See Fig. 5 for start-up.

Proceed as for flow rate measurement (steps 1, 2, 3 and 5) for liquid level measurement.

**NOTICE**

*During measurement, make sure that the equalizing valve is closed and that the shut-off valves are open.*

**Note!** *For cryogenic applications, an open equalizing valve during measurement allows the medium to circulate, causing the valve block to freeze up.*

**5 Operation****5.1 Zero adjustment**

If the differential pressure lines are equipped with shut-off and equalizing valves, zero can even be checked during operation.

1. Close the plus side of the shut-off valve.
2. Open the equalizing valve.
3. Close the minus side of the shut-off valve so that pressure balance is obtained in the dp cell.

The pointer must indicate zero.

If this is not the case, readjust the zero screw (Fig. 1) until zero position is reached.

For start-up:

1. Open the minus line.
2. Close the equalizing valve.
3. Slowly but gradually open the plus line all the way.

The device is in operation again.

If a valve block is installed, proceed as described above.

**5.2 Draining**

For gas measurement, drain the condensate from the equalizing tank from time to time. Close the valves in the differential pressure lines (valve block) before opening the drain plugs.

### 5.3 Adjusting and modifying the measuring range

The measuring range of the differential pressure and flow meter is determined by the installed set of range springs. By default, the device is adjusted to the measuring range specified in the order. This means that, subsequently, it can only be modified continuously up to approx. 50 % of the max. measuring span.

► For best results, perform adjustment on the test bench (Fig. 7, top).

#### Adjusting zero and checking the measuring range:

1. Unscrew the case cover.
2. Adjust zero in the depressurized measuring chamber using the zero point adjuster (also refer to section 5.1).
3. To check the adjusted measuring range, apply pressure to the measuring chamber's plus side until the pointer indicates 100 % while the low pressure connection is open. Read off the adjusted pressure value from the pressure gauge. It corresponds to the current final value of the measuring range.
4. Depressurize again.

#### Correcting and modifying the measuring range:

1. Insert an Allen key or preferably a 3 mm ball end hex tool sideways behind the scale into the cone-shaped end of the span adjuster.
2. For adjustment, turn the span adjuster upwards or downwards. If you want to increase the measuring range, turn the Allen key downwards in the clockwise direction, a little further away from the fulcrum of the toothed segment.
3. Correct zero as described in section 5.1.
4. Pressurize measuring chamber again, until the pointer indicates the full-scale value.
5. Check the final value of the measuring range on the pressure gauge. Should it not correspond with the desired measuring range, repeat adjustment procedure until zero and final value are properly adjusted.

---

#### NOTICE

*You are adjusting a moving part. Therefore, adjust carefully and do not use any force. Do not apply any pressure with the screwdriver in axial direction. If the spring is mispositioned while adjusting the measuring range and is now located on the tag instead of the toothed segment, the pointer goes beyond the 100 % scale range and not to 0 % when there is an input pressure of 0 mbar. In this case, reposition the spring as shown in Fig. 7.*

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**WARNING!** For devices in **oxygen service**, make absolutely sure that the test medium is **free of oil and grease**. Use oil-free air or other gases, e.g. N<sub>2</sub>.

**Gaseous oxygen as the process medium**

Max. temperature: +60 °C, max. oxygen pressure: 30 bar

When the device is used for oxygen service, make sure that the dp cell and any SAMSON accessories only come into contact with **gaseous oxygen**.

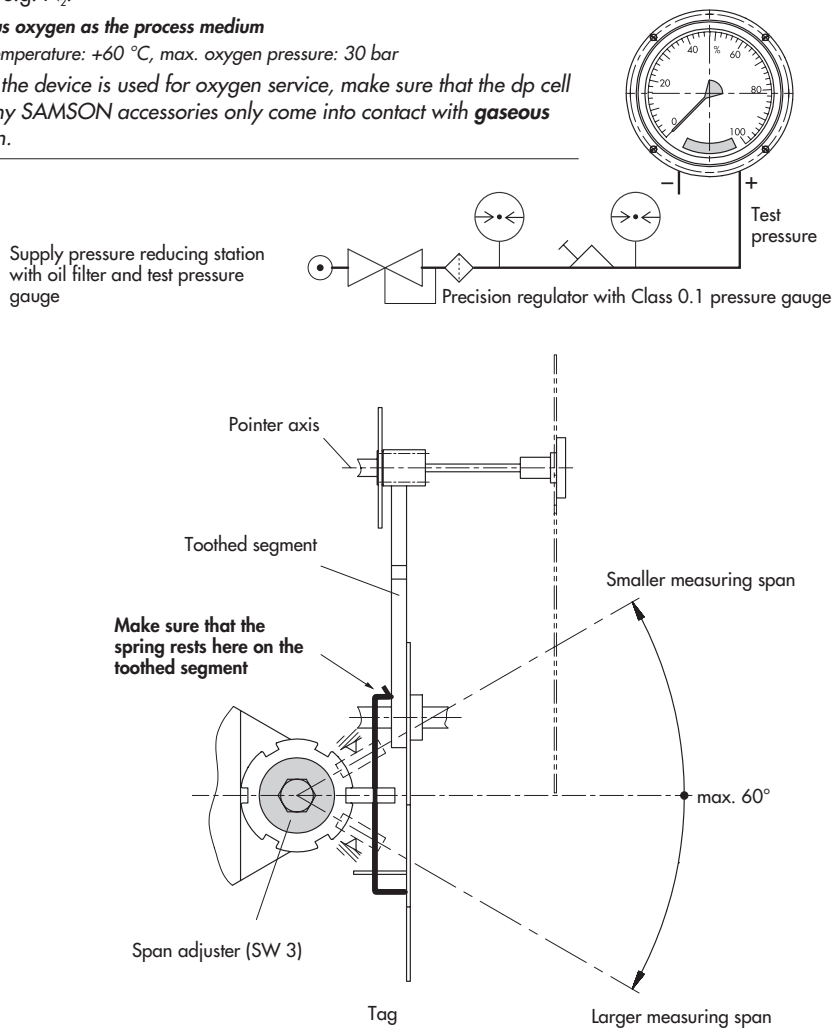


Fig. 7 · Test arrangement and modifying the measuring range

## 6 Version with limit switches

### 6.1 Electrical connection

Connect a switching amplifier to the alarm contacts A1, A2 and A3 of the pointer mechanism as illustrated in Fig. 8. The listed limits in the table apply concerning the connection of proximity switches to certified intrinsically safe circuits in the type of protection EEx ia IIC T6 (PTB 99 ATEX 2219 X):

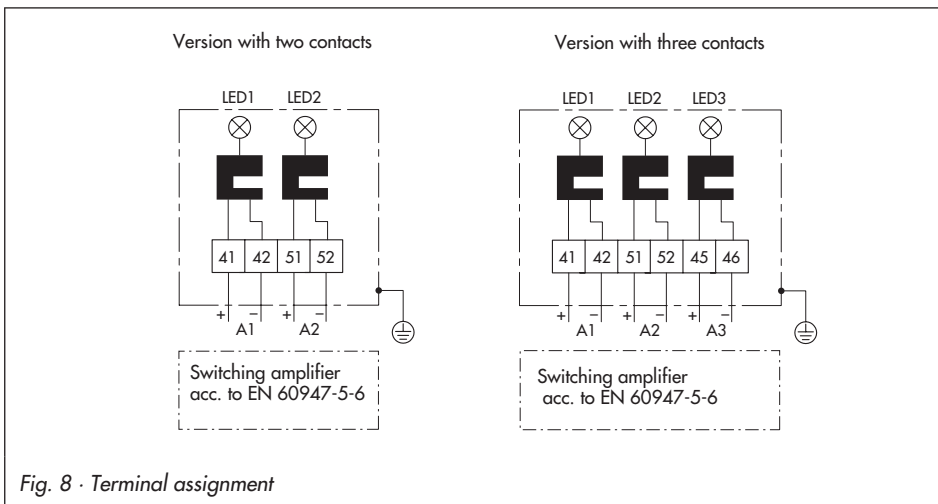
	Type 1			Type 2		
$U_i$	16 V			16 V		
$I_i$	25 mA			25 mA		
$P_i$	34 mW			64 mW		
$C_i$	50 nF			50 nF		
$L_i$	250 $\mu$ H			250 $\mu$ H		
Temp. class	T6	T5	T4	T6	T5	T4
	73 °C	88 °C	100 °C	66 °C	81 °C	100 °C

### 6.2 Adjusting the alarm contacts

The alarm contacts A1, A2 and A3 can be shifted in the assigned adjustment ranges 1.1 and 1.2 or 2.1 and 2.2 using a screwdriver.

Depending on the selected function as minimum or maximum contact, contact is made when the tag moves into or out of the proximity switch. Also see the table (functions) on page 15.

- For a more accurate adjustment (test bench), pressurize the measuring chamber to check if the alarm signal is released at the desired scale value through the movement of the tag (check the LED of the proximity switch). If necessary, correct the position of the alarm contact accordingly.



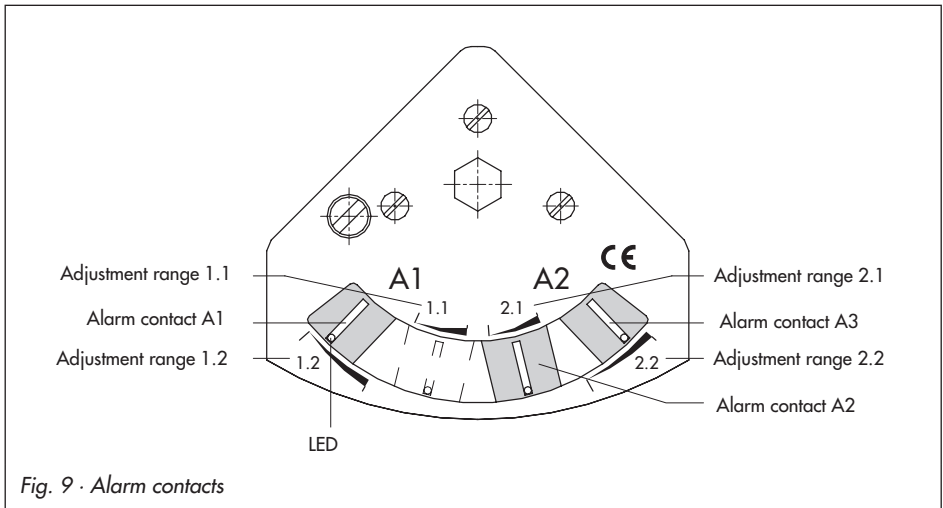


Fig. 9 · Alarm contacts

Functions	Version with two alarm contacts				Version with three alarm contacts			
	A1	A2	A1	A2	A1	A2	A1	A2
Alarm contact	A1	A2	A1	A2	A1	A2	A1	A2
Proximity switch for	Gas tapping Min. contact		Tank filling Max. contact		Gas tapping Two min. contacts		Tank filling Two max. contacts	
Contact made when	Adjustment ranges							
Tag moves <b>in</b>	1.2	2.1	1.1	2.2	1.2	2.1	2.2	
Tag moves <b>out</b>	1.1	2.2	1.2	2.1	Switching points: Min. contacts when reading falls Max. contacts when reading rises			
<b>Promixity switches with normally closed (NC) function</b>								
Tag outside inductive field LED on	Switching signal "ON" (L signal of the proximity switch) - Function: Contact closed or output effectively conducting Low resistance (undamped), power consumption $\geq 3$ mA							
Metal tag inside inductive field LED off	Switching signal "OFF" (0 signal of the proximity switch) - Function: Contact open or output effectively non-conducting High resistance (damped), power consumption $\leq 1$ mA							

### 6.3 Retrofitting/replacing the contact unit

The contacts can only be retrofitted or replaced as a complete unit.

Contact unit with two alarm contacts:

Order no.: 1400-8839, 1400-9999

Contact unit with three alarm contacts:

Order no.: 1400-8840

1. Unscrew the case cover.
2. Unscrew the two scale screws (2), remove the cover plate with the type designation and retighten scale screws.

#### NOTICE

Before assembly, position the alarm contacts A1 and A2 in such a way that one of them rests in the recess of the metal tag and the other one to the side of the tag.

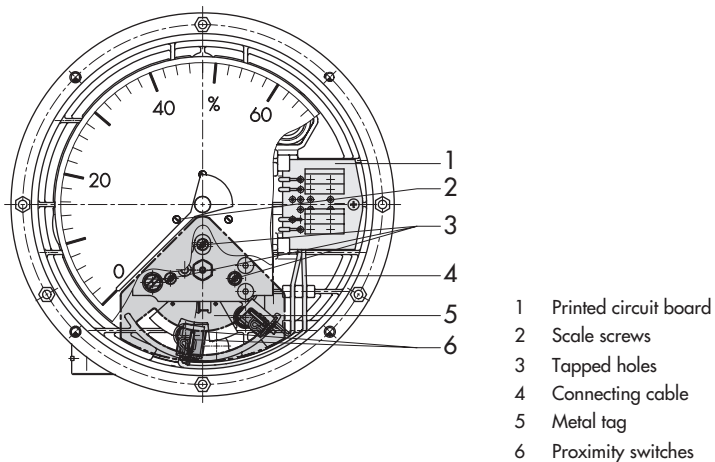


Fig. 10 · Retrofitting the alarm contacts



3. Insert the contact unit in the measuring unit, so that the distancers are aligned with the three tapped holes (3) of the scale.
4. Insert M3 screws. Tighten contact unit, allowing the tag to move into the proximity switches without making contact.
5. Place connecting cable (4) in the ducts of the indicating unit case.
6. Insert printed circuit board (1) in the holding bracket and screw tight.
7. Replace the cap on the case bottom with the M20 x 1.5 cable gland.
8. Establish electrical connection as described in section 6.1. Adjust the contacts as described in section 6.2.
9. Attach cover plate and screw tight.

## 7 Dimensions in mm

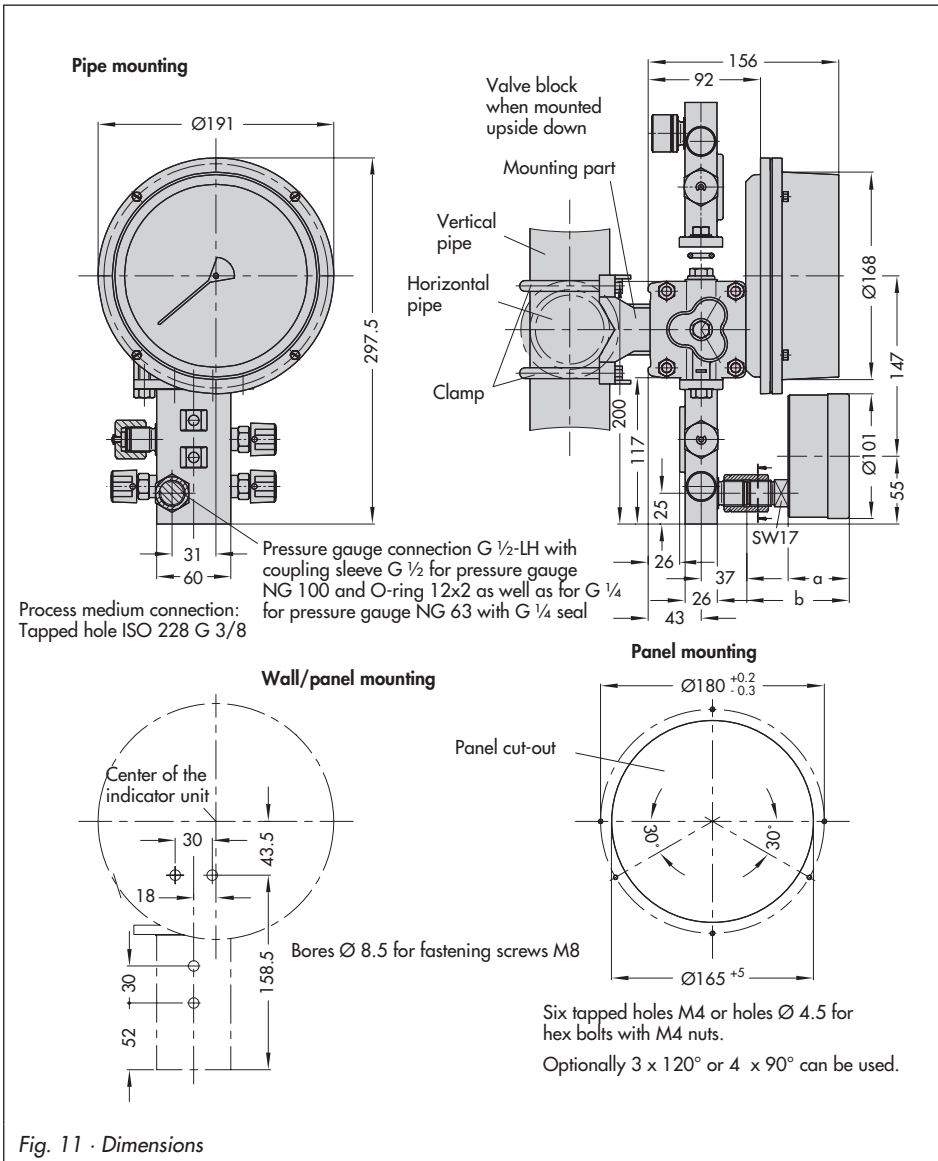


Fig. 11 · Dimensions





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