

Differential Pressure and Flow Meter

Media 5

SAMSON



Media 5 with limit switch, mounted valve block and pressure gauge for operating pressure

Translation of original instructions

Mounting and Operating Instructions

EB 9519 EN

Edition April 2016

CE

Note on these mounting and operating instructions

These mounting and operating instructions assist you in mounting and operating the device safely. The instructions are binding for handling SAMSON devices.

- For the safe and proper use of these instructions, read them carefully and keep them for later reference.
- If you have any questions about these instructions, contact SAMSON's After-sales Service Department (aftersaleservice@samson.de).



The mounting and operating instructions for the devices are included in the scope of delivery. The latest documentation is available on our website (www.samson.de) > Product documentation. You can enter the document number or type number in the [Find:] field to look for a document.

Definition of signal words



DANGER!

Hazardous situations which, if not avoided, will result in death or serious injury



NOTICE

Property damage message or malfunction



WARNING!

Hazardous situations which, if not avoided, could result in death or serious injury



Note:

Additional information



Tip:

Recommended action

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1 Safety instructions

- The device is to be mounted, started up or operated only by trained and experienced personnel familiar with the product. According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Any hazards that could be caused in the device by the process medium or operating pressure are to be prevented by taking appropriate precautions. To ensure appropriate use, only use the device in applications where the operating pressure and temperatures do not exceed the specifications used at the ordering stage.
- The Media 5 Differential Pressure and Flow Meter without limit switches may be used to measure flammable gases and liquids in which hazardous area conditions of Zone 0 are to be expected. This means that measuring instrument suited for the connection to Zone 0 can be installed, provided:
 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. However, endurance burning flame arresters are preferably to be installed. You are required to contact the appropriate regulatory authority to agree on the necessary measures.

The operator is responsible for meeting the above specified requirements specified (1 and 2). SAMSON AG does not assume any responsibility if the operator fails to do so.

- Proper shipping and storage are assumed.
- Devices with a CE marking fulfill the requirements of the Directive 2004/94/EU (ATEX) and the Directive 89/336/EEC. This EU declaration of conformity can be provided on request.

2 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 application include liquid level measurement on pressure vessels, differential pressure measurement between flow and return flow pipes, 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 dial plate.

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

The movement 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 (see Fig. 6) is used to adjust the pointer according to the scale value.

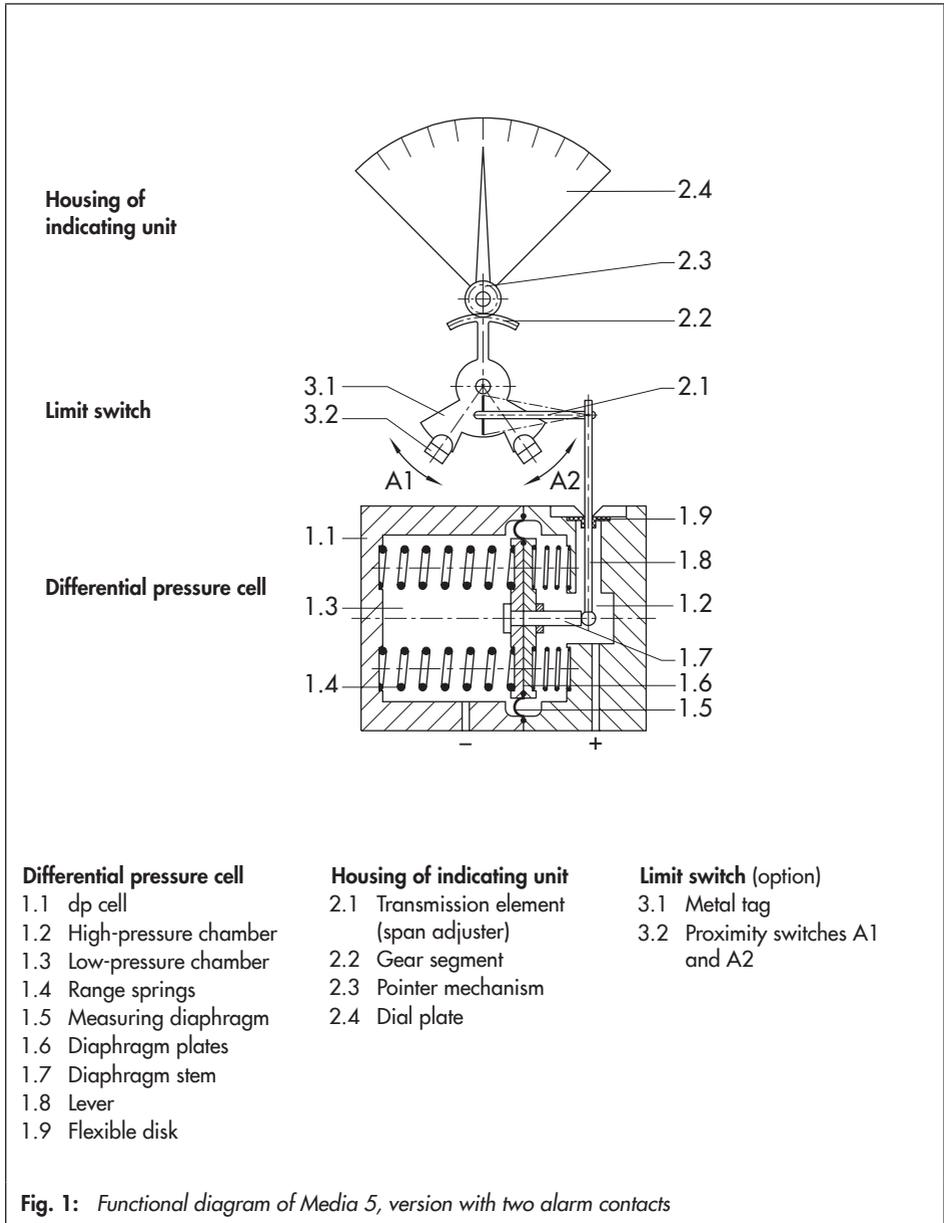
The differential pressure is shown linear on the dial plate and the flow rate is shown as a square root graduation.

Version with limit switch

The gear segment (2.2) supports the metal tags (3.1) and activates the limit switch unit by moving the metal tags into the adjustable proximity switches (3.2).

When the metal tag enters the inductive field of the associated proximity switch, it assumes a high resistance (contact open). When the metal tag leaves the inductive field, it assumes a low resistance (contact closed).

The switching function is triggered when the metal tag leaves or enters the proximity switches, depending on the setting of the contacts.



3 Technical data

Table 1: Technical data

All pressure in bar (gauge) · All errors and deviations are specified in % of the adjusted measuring span

Media 5 Differential Pressure and Flow Meter										
Measuring range in 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. in mbar max.	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
Nominal pressure	PN 50, overloadable on one side up to 50 bar									
Indicator	Ø 160 mm									
Characteristic	Reading linear to the differential pressure									
Deviation from terminal-based linearity	<±2.5 %	<±1.6 % including hysteresis								
Sensitivity	<±0.5 %	<0.25 %								
Effect of static pressure	<0.03 %/1 bar									
Limit switch	Max. 3 alarm contacts A1, A2 and A3 (limit switch) with inductive pick-up and LED according to EN 60947-5-6									
Control circuit	Values corresponding to connected isolating switch amplifier according to EN 60947-5-6, e.g. KFA6-SR2-Ex2.W									
Proximity switch	SJ3.5-N-LED, for hazardous areas according to PTB 99 ATEX 2219X									
Switching accuracy	<±2 %									
Dead band, approx.	<0.6 %									
Use of Media 5 with gaseous oxygen										
Max. temperature	+60 °C									
Max. oxygen pressure	50 bar									
Permissible ambient temperature range	-40 to +80 °C									
For oxygen	-40 to +60 °C									
Perm. storage temperature range	-40 to +100 °C									
Degree of protection according to IEC 60529	IP 54									
Weight	Approx. 3 kg without valve block · Approx. 5 kg with valve block									

Table 2: Materials

Media 5 Differential Pressure and Flow Meter		
Version	Standard version	
dp cell	CW617N (brass)	CrNi steel
Measuring diaphragm and seals	ECO ¹⁾	
Springs, diaphragm plates and functional parts, lever	CrNi steel	
Housing of indicating unit	Polycarbonate	

¹⁾ Other materials on request



Note:

The standard version of the Media 5 Differential Pressure and Flow Meter can be used to measure flammable gases and liquids in which hazardous area conditions of Zone 0 are to be expected. The relevant regulations on the measurement of flammable gases and liquids of Zone 0 must be observed.

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.



NOTICE

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



These versions are cleaned and assembled under special conditions. When replacing parts that come into contact with gaseous oxygen, e.g. range springs, wear suitable gloves and make sure that the parts do not come 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.

4 Installation

See Fig. 2 on page 11.

4.1 Arrangement of instruments for liquid level measurement

In arrangements as illustrated in the second schematic drawing, the additional height z is included in the measurement. As a result, this height must be as low as possible.

The dimension K (compensation height) illustrated in schematic drawing 3 can be as large as required by the conditions in the plant.

4.2 Arrangement of devices for flow rate measurement

The decision whether the meter is to be mounted above or below the measuring point or whether compensation chambers are required depends on the process medium and the specific conditions in the plant. The installation drawing shows standard and reverse installation. Standard installation is preferable in any case. Reverse installation can only be used when there is no other possibility, particularly for steam measurements. Refer to VDE/VDI 3512 Sheet 1 for details.

4.3 Indicating unit of Media 5

Make sure that the high-pressure line is connected to the high-pressure connection and the low-pressure line is to the low-pressure connection.

Special screw fittings are required to connect the differential pressure lines. Depending on the device arrangement, seal any connections left unused with stoppers or vent plugs.

Carefully clean the connections before attaching the differential pressure lines. Do not rinse the device with compressed air or pressurized water.

Mount the device to a pipe, wall or mounting plate free of vibration.

Use mounting part with clamp for pipe mounting to attach it to a vertical or horizontal pipe. Use a mounting part without clamp for wall mounting. A mounting bracket is required for panel mounting (see section 9).

4.4 Differential pressure lines

Install the differential pressure lines (pipes with 12 mm outside diameter) as shown in Fig. 3. Observe the proper sequence. Use appropriate screw fittings to ensure that the lines do not leak.

Install line sections, which would usually run horizontally, with a constant downward slope of at least 1:20, starting the slope either at the orifice plate or at the point where venting is possible. The smallest permissible bending radius is 50 mm. Thoroughly flush the differential pressure lines before connecting them to the device. Make sure that the high-pressure line is connected to the high-pressure connection and the low-pressure line to the low-pressure connection.

Liquid level measurement

Illustration with SAMSON valve block

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

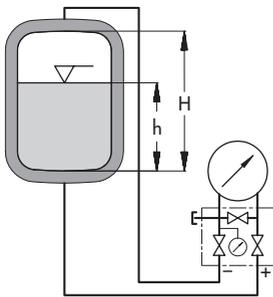


Diagram 1

Measurements in cryogenic systems (liquefied gases)

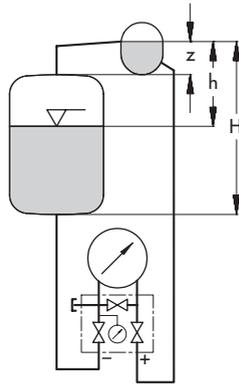


Diagram 2

Measurement on pressure vessels with condensing or non-condensing pressure cushion

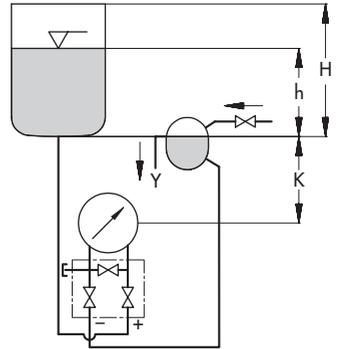


Diagram 3

Measurements on open vessels with the meter located in a low position

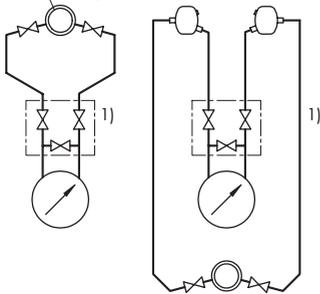
Flow rate measurement

Measurement of liquids

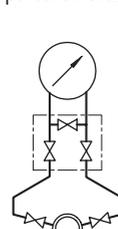
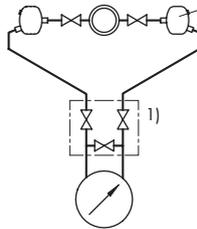
Measurement of steam

Measurement of gases

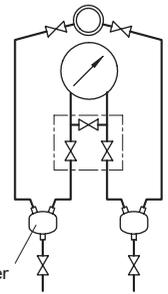
Orifice flange (orifice plate assembly)



Compensation chamber



Separation chamber



Installation

Standard

Reverse

Standard

Standard

Reverse

¹⁾ SAMSON valve blocks can be mounted upside down to ensure the assignment of plus (+) to plus (+) and minus (-) to minus (-) remains unchanged.

Fig. 2: Arrangement of devices

4.5 Orifice flange (orifice plate assembly)

The direction of flow must correspond to the arrow on the orifice plate. Unobstructed pipe sections are required upstream and downstream of the orifice plate assembly. For the orifice tubes delivered by SAMSON, these sections are ensured by the weld-on calibration pipes. For orifice flanges, the unobstructed pipe section upstream of the orifice plate is specified in the order confirmation. Make sure the orifice plate assembly as well as the gaskets are properly aligned with the pipe-line.

Do not install any control valves that constantly change the operating state of the process medium (e.g. manually operated control valves or temperature regulators) upstream of the orifice plate assembly. The operating state must match the conditions calculated during sizing as closely as possible. It is, however, favorable to install equipment that

keep the operating state constant (e.g. pressure regulators) upstream of the assembly.

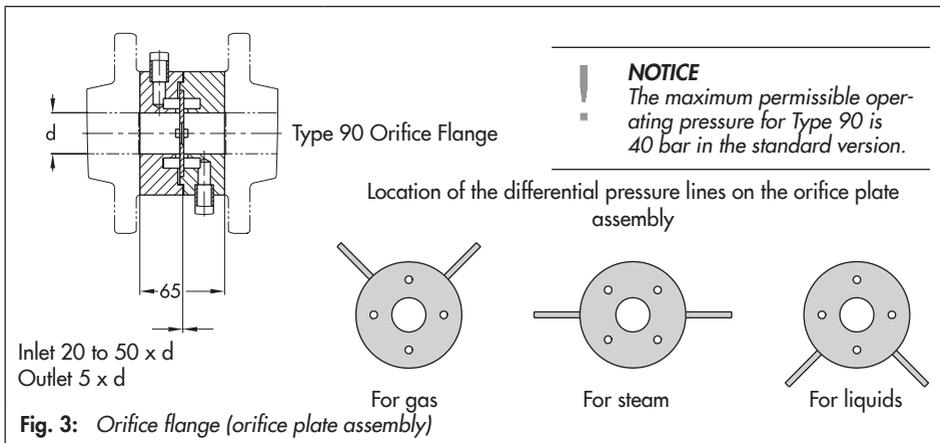
4.5.1 Accessories

We recommend installing a shut-off valve in the differential pressure lines as well as an equalizing valve. They can be used to shut off both differential pressure lines and to bypass the indicating unit when checking zero.

4.5.2 Valve block

A valve block comprising three valves (see Fig. 4) is available. It is bolted directly to the bottom of the dp cell.

When measuring the flow rate of liquids and gases, the SAMSON valve block can also be mounted upside down. As a result, the assignment of plus (+) to plus (+) and minus (-) to minus (-) remains unchanged. Due to this reverse installation, the pressure gauge connection cannot be used anymore and must be sealed with an O-ring and a G 1/2 - LH screw cap.



4.5.3 Shut-off and equalizing valves

As an alternative to the SAMSON valve block, the two shut-off valves as well as the bypass valve/equalizing valve can also be installed as illustrated in Fig. 5.

4.5.4 Compensation chambers

Compensation chambers that establish a constant liquid column are required when measuring steam. When measuring liquids, they are only required when the indicating unit is mounted above the measuring point. For gas measurements, separation chambers are required for condensate separation when the indicating unit is installed below the measuring point.

4.5.5 Accessories for connection

The devices are delivered without screw fittings (oxygen versions are protected against contamination by four NBR blanking plugs). Required screw fittings, screw plugs or vent screws as well as screw joints with restrictions to dampen medium-induced vibration (particularly when measuring gases) must be ordered separately.



Tip:
The screw fittings and SAMSON valve blocks with their associated order numbers are listed in Data Sheet ► T 9555.

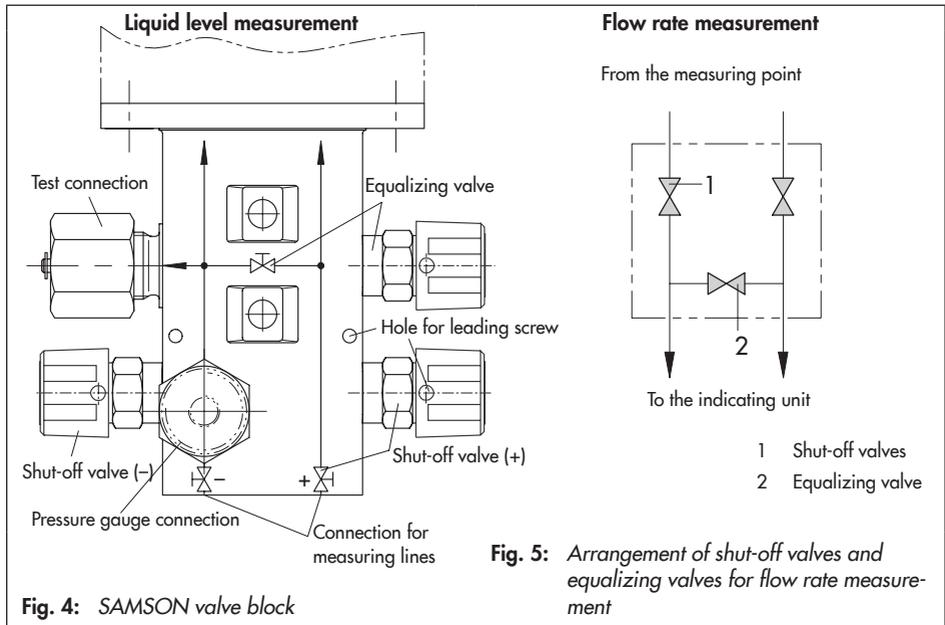


Fig. 4: SAMSON valve block

Fig. 5: Arrangement of shut-off valves and equalizing valves for flow rate measurement

5 Start-up

See Fig. 2, Fig. 3, Fig. 4 and Fig. 5.

5.1 Flow rate measurement

For steam measurement

Make sure that the steam does not have direct contact with the measuring diaphragm of the device. To prevent this, screw off the differential pressure lines below the shut-off valves or valve block and fill the device with water.

Alternatively, make sure the shut-off and equalizing valves or valve block are shut off and wait approx. 20 min after start up of the plant (steam in the system) until condensate has collected in the differential pressure lines above the valve and up to the orifice plate.

1. Open the high-pressure line.
2. Close the equalizing valve or bypass of the valve block.
3. Open the low-pressure line.
4. Wait a while. Open both vent screws of the dp cell one after the other until the escaping condensate is free of bubbles. Retighten the screws.

Vent the compensation chambers in the same way.

Lightly tap the housing of the indicating unit or the compensation chambers to help let the air escape.

5. Check zero as described in section 6.2 and put the device back into operation.



Note:

When using reverse installation (with the device mounted above the measuring point), the differential pressure lines may partly get drained when depressurizing the system.

When starting up the system again, vent the measurement setup to allow it to fill with condensate.

For liquid measurement

1. Slowly open the high-pressure line.
2. Close the equalizing valve or bypass of the valve block.
3. Open the low-pressure line.
4. Undo the vent screw on the dp cell until all the air has escaped. Retighten the screw.
5. Check zero as described in section 6.2 and put the device back into operation.

Liquid level measurement

Observe start-up (Fig. 4).

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

**Note:**

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

In cryogenic applications, the process medium circulates during measurement when the equalizing valve is opened, causing the valve block to ice up.

6 Operation

6.1 Zero calibration

The devices are calibrated before delivery. However, after installation, we recommend performing a zero calibration to take the pressure conditions on site in the plant into account.

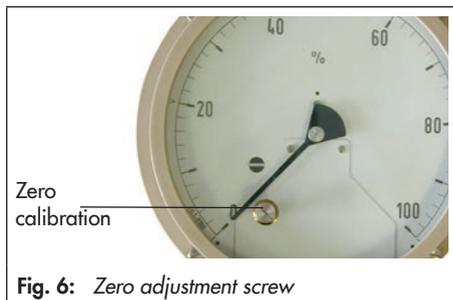


Fig. 6: Zero adjustment screw

As a result, errors caused by the mounting position or static pressure are eliminated.

**Note:**

On performing a zero calibration, the equalizing valve on the valve block must be open and all filled differential pressure lines must have the correct filling level.

Use the adjustment screw for zero calibration to perform a zero calibration.

1. Remove housing cover, if necessary. In this case, loosen the four hex screws and lift off the cover.
2. Use a screwdriver to place the pointer in the zero position.
3. Replace on the housing cover and fasten it.

6.2 Checking zero

Zero can also be checked while the system is running, provided the differential pressure lines are equipped with shut-off and equalizing valves.

1. Close the shut-off valve in the high-pressure line.
2. Open the equalizing valve.
3. Close the shut-off valve in the low-pressure line to allow the pressures to equalize in the dp cell.

The pointer must indicate zero.

If this is not the case, readjust the zero screw (Fig. 6) until zero position is reached.

To start-up:

1. Open the low-pressure line.
2. Close the equalizing valve.
3. Slowly but gradually open the high-pressure line all the way.

The device is in operation again.

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

6.3 Water drainage

When measuring gas, drain condensed water from the separation chambers from time to time.

Close valves in the differential pressure lines (valve block) before opening the drain plugs.

6.4 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.

The device is delivered with the measuring range specified in the order. This means that, subsequently, it can only be modified continuously up to approx. 50 % of the maximum measuring span.

For best results, adjust it on the test bench (Fig. 7, top).

Adjusting zero and checking the measuring range:

1. Unfasten the housing cover.
2. Adjust zero in the depressurized measuring chamber using the zero adjustment screw (see section 6.2).
3. Apply pressure to the high-pressure measuring chamber until the pointer indicates 100 % while the low pressure connection is open.
4. Read off the adjusted pressure value at the pressure gauge. It corresponds to the current end value of the measuring range.
5. Disconnect the pressure again.

Correcting and modifying the measuring range:

1. Insert an Allen key or a 3 mm ball end hex tool at the side behind the dial plate 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 6.2.
4. Pressurize measuring chamber again until the pointer indicates the end value.
5. Check the end value of the measuring range on the pressure gauge.

If it does not correspond with the required measuring range, repeat adjustment procedure until zero and end value are properly adjusted.



Note:

You are adjusting a moving part. Therefore, adjust carefully and do not use any force. Do not exert any pressure with the screwdriver in the axial direction. If the spring is mispositioned while adjusting the measuring range and is 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.

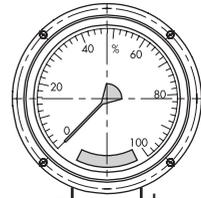


NOTICE

The test medium must be free of oil and grease when the device is used to measure oxygen.

Process medium: gaseous oxygen · Max. temperature: +60 °C, max. oxygen pressure: 50 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.



Supply air reducing station with oil filter and test pressure gauge

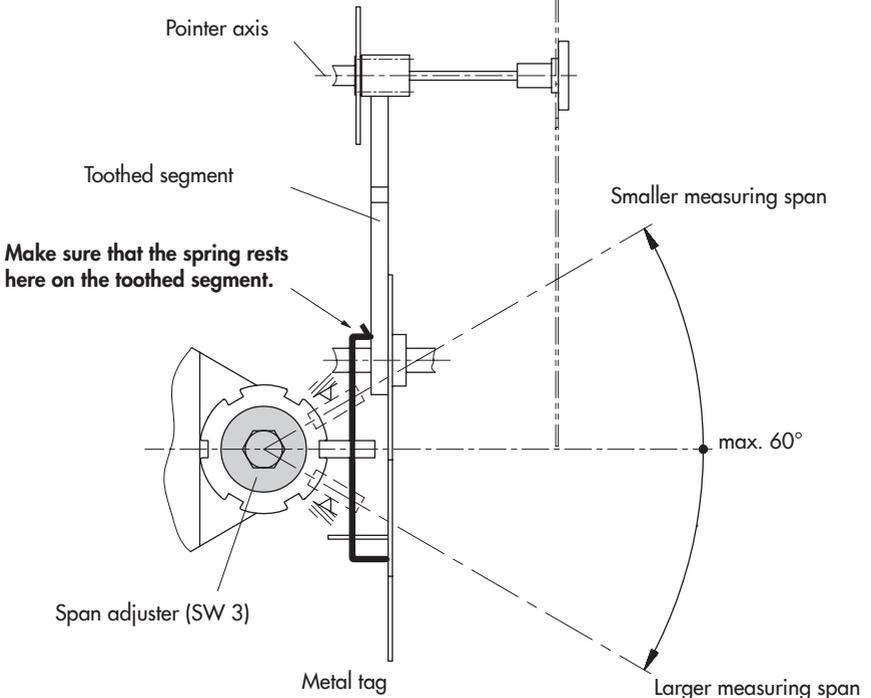
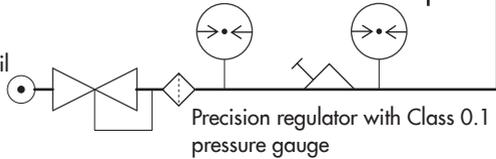


Fig. 7: Test arrangement and modifying the measuring range

7 Version with limit switch

7.1 Electrical connection

The alarm contacts A1, A2, and A3 of the indicator must be connected to an isolating switch amplifier for power supply connection as illustrated in Fig. 8.

The listed maximum values in the table apply concerning the connection of proximity switches to certified intrinsically safe circuits in the type of protection Ex ia IIC T6 (PTB 99 ATEX 2219 X):

Table 3: Technical data for limit switch in type of protection Ex ia IIC T6 (PTB 99 ATEX 2219 X)

Circuit	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 μ H			250 μ H		
Temperature class	T6	T5	T4	T6	T5	T4
	73 °C	88 °C	100 °C	66 °C	81 °C	100 °C

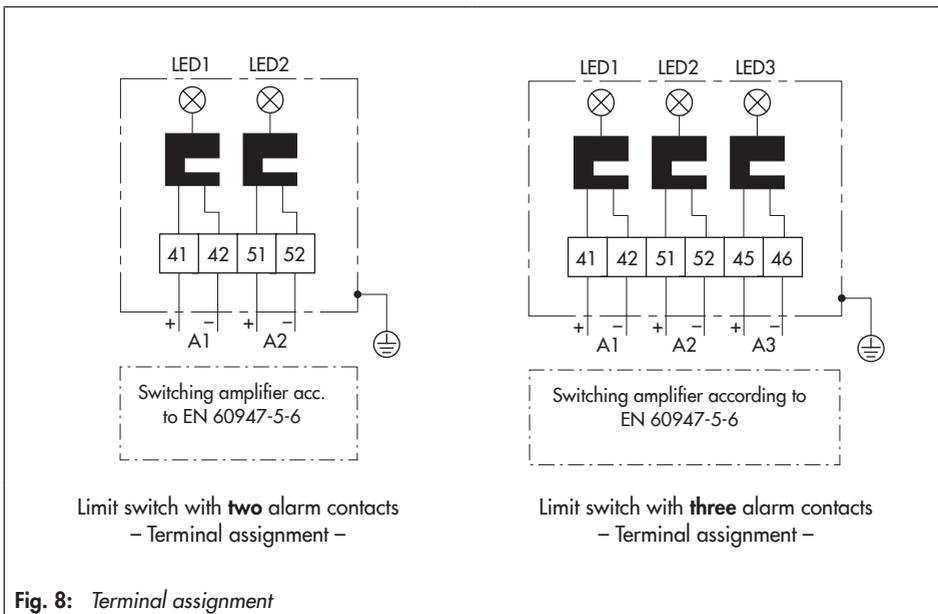


Fig. 8: Terminal assignment

7.2 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 a minimum or maximum contact, contact is made when the tag moves into or out of the proximity switch. See Overview of functions for alarm contacts on page 20.

For a more accurate adjustment (test bench), pressurize the measuring chamber to check if the alarm signal is released at the required 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.

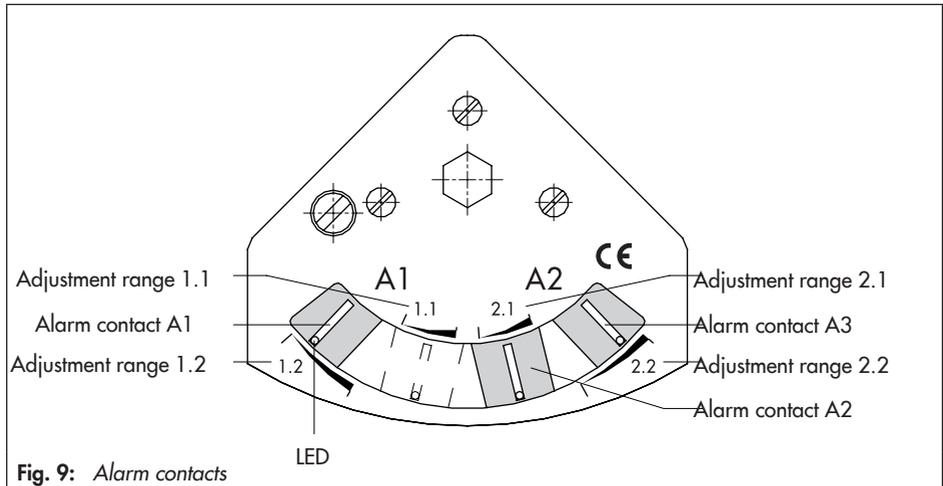


Fig. 9: Alarm contacts

Proximity switches with normally closed function

Metal tag outside the 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 ≥ 3 mA

Metal tag inside the 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 ≤ 1 mA

Overview of functions for alarm contacts

Table 4: Overview of functions for two alarm contacts A1 and A2

Overview of functions	Adjustment ranges			
	Min. contact (gas withdrawal)		Max. contact (tank filling)	
Alarm contacts	A1	A2	A1	A2
Metal tag inside	1.2	2.1	1.1	2.2
Metal tag outside	1.1	2.2	1.2	2.1

Table 5: Overview of functions for three alarm contacts A1, A2 and A3

Overview of functions	Adjustment ranges		
	Two min. contacts (gas withdrawal)		One max. contact (tank filling)
Alarm contacts	A1	A2	A3
Activation when metal tag inside field	1.2	2.1	2.2

Switching points

Min. contact with decreasing reading

Max. contact with increasing reading

7.3 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. Unfasten the housing cover.

2. Unscrew the two dial plate screws (2) and remove the cover plate. Retighten dial plate screws.



Note:

Before mounting the contact unit, 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.

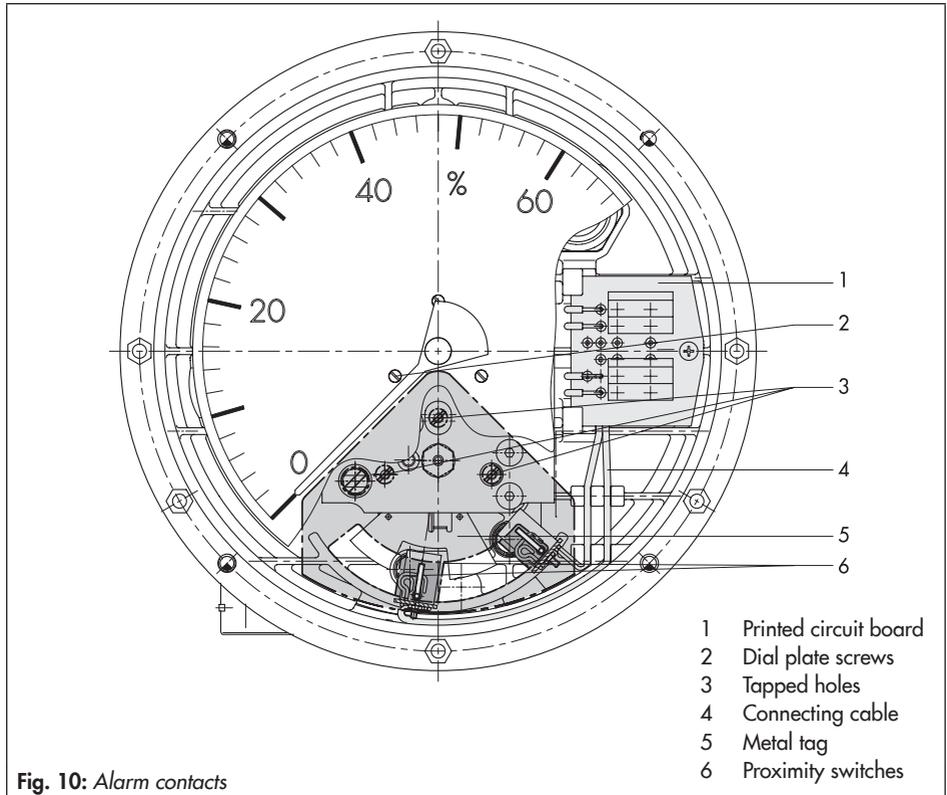


Fig. 10: Alarm contacts

3. Insert the contact unit in the measuring unit, ensuring that the spacer sleeves are aligned with the three tapped holes (3) of the indicating unit.
4. Insert M3 screws. Fasten the contact unit, ensuring that the tag can move into the proximity switches without making contact.
5. Place connecting cables (4) in the ducts of the indicating unit housing.
6. Slide the printed circuit board (1) into the bracket and tighten it.
7. Replace the screw plug on the bottom of the housing with the M20 x 1.5 cable gland.
8. Perform electrical wiring as described in section 7.1 and adjust the contacts as described in section 7.2.
9. Place on the housing cover and fasten it.

8 Dial faces

Dial versions (see ► T 9545)

In addition to the dial plates according to EN 837 shown in Fig. 11, the dial faces can be designed in various indication ranges and sizes:

- With linear or square root graduation
- Customized inscriptions
- A maximum of four attachable dial plates supplied with the meter for various media and applications
- Units, such as m³, kg, liter, %, mmWS, inchH₂O, mbar, bar, m³/h, kg/min, etc.
- Others customized details

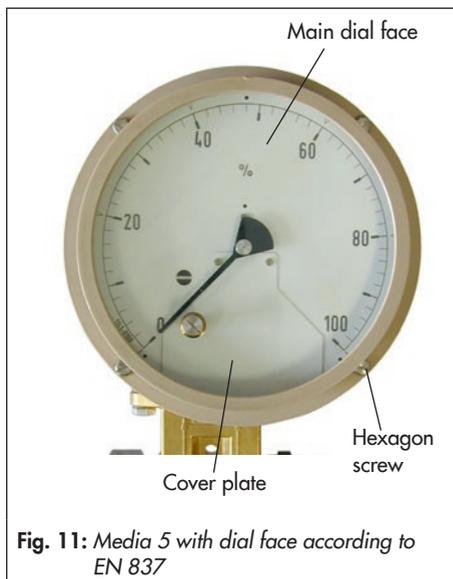


Fig. 11: Media 5 with dial face according to EN 837

This allows, for example, customized dials for filling level measurement to be calculated based on the tank geometry data.

The customized dial face is adapted to the specified application range.

8.1 Attachable dial plates

To all the indicator to be used for several applications, SAMSON offers exchangeable dial plates which are attached depending the application.

This way the indicator can be fitted with up to five different dial plates. In this case, to adapt indicator to a special application, place the attachable dial plate over the main dial face.

The associated attachable dial plates are stored behind the main dial face.

Inserting the attachable dial plate

1. To remove the housing cover, loosen the four hex screws.
2. Remove the housing cover.
3. Select suitable dial plate and push it over the front dial face. Use the three pins on the main dial face to position the dial plate.



Note:

A cover plate (if mounted) must **not** be removed.

For the version with limit switch, the contact unit must **not** be removed as well.

4. Place on the housing cover and fasten it.

9 Dimensions

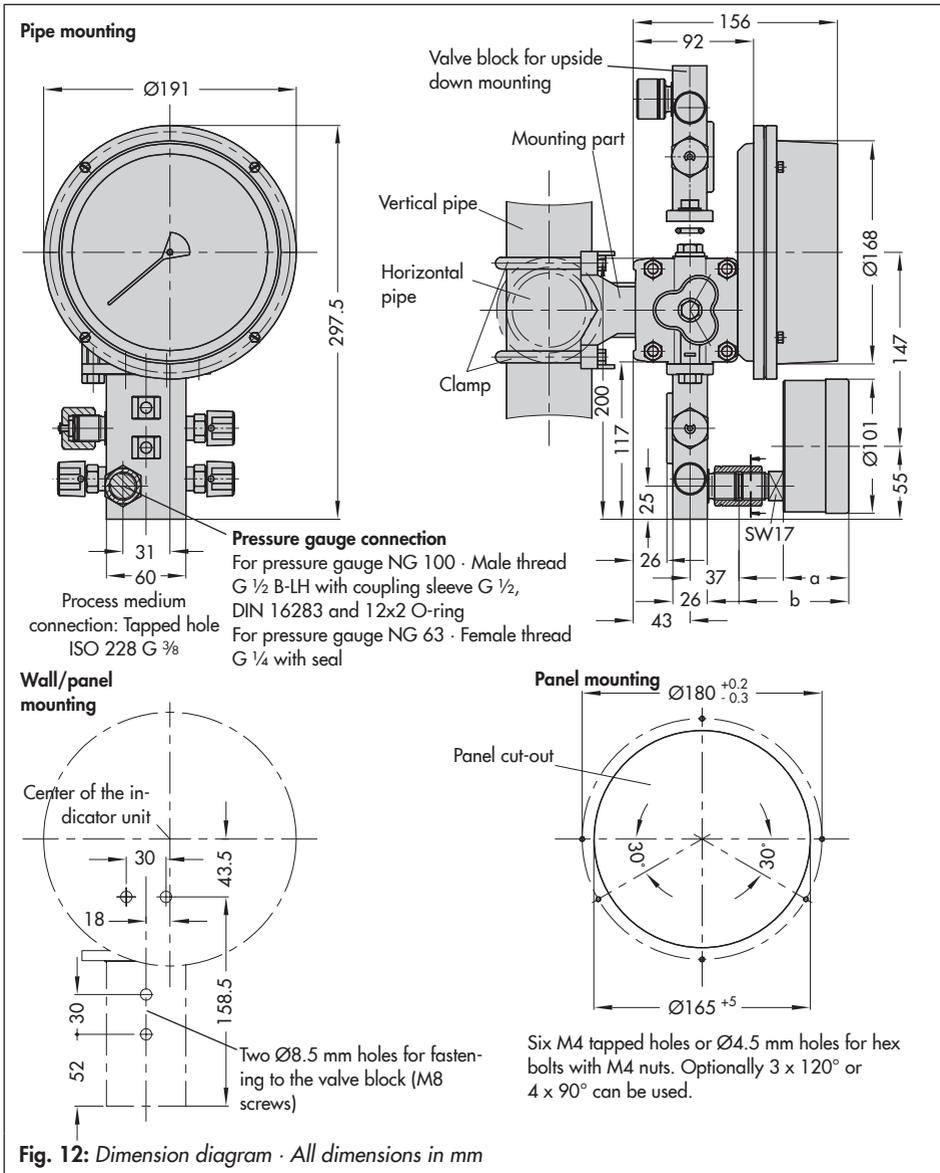


Fig. 12: Dimension diagram · All dimensions in mm



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