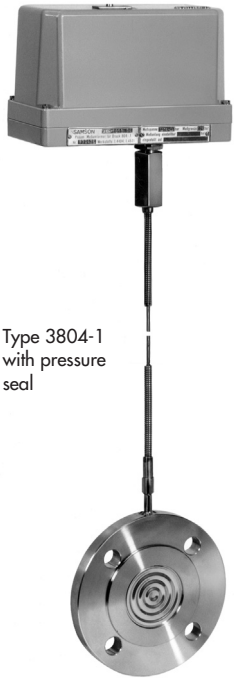
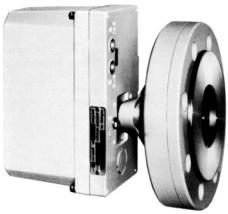
Pneumatic Transmitters for Pressure
Type 3804-1
Type 3804-1 with pressure seal
Type 814

Type 3804-1



Type 3804-1
with pressure
seal



Type 814

Fig. 1 · Pneumatic transmitters

Mounting and Operating Instructions

EB 7540 EN

Edition March 2010

Contents

Definitions of the signal words used in these instructions

NOTICE
NOTICE indicates a property damage message.

Note: *Supplementary explanations, information and tips*

General safety instructions

- *Assembly, start-up and operation of the device may only be performed 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 hazards due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- *Any hazards which could be caused by the pressure in the device are to be prevented by means of the appropriate measures.*
- *Proper transportation and storage are assumed.*

1 Design and principle of operation

Type 3804-1

The transmitters are used to measure pressure with measuring spans from 0.016 to 1000 bar and to convert the measured value into a pneumatic output signal from 0.2 to 1 bar.
The transmitters are designed according to the modular principle. The devices consist of a transmitter operating according to the force-balance principle and an easily replaceable measuring element.

The pressure p of the process medium produces a force at the measuring element (10) which is transmitted by the balance beam (9) and the moveable span rider (4) to the compensation beam (7). The system is balanced when the input force and the force resulting from the output air pressure p_A and the surface area of the feedback bellows (2) are in equilibrium.

The supply air is applied to the pneumatic booster (17) and flows through the throttle (1) and nozzle (15) and hits the flapper (14). When the pressure p of the process medium increases, the balance beam (9) starts to move and the flapper (14) gets closer to the nozzle (15). This causes the cascade pressure supplied to the booster (17) to increase, causing the output air pressure (p_A) supplied to the feedback bellows (2) to increase, too. This pressure increases until the force created at the feedback bellows (2) balances out the force created at the measuring element (10) and a new equilibrium is reached.

When the pressure p in the pressure measuring element (10) drops, the flapper (14) moves away from the nozzle (15). The cascade pressure and the output air pressure p_A also drop until a new equilibrium is reached, i.e. until the pneumatic output signal assumes a value proportional to the input pressure.

Type 3804-1 with adjustable lower range value

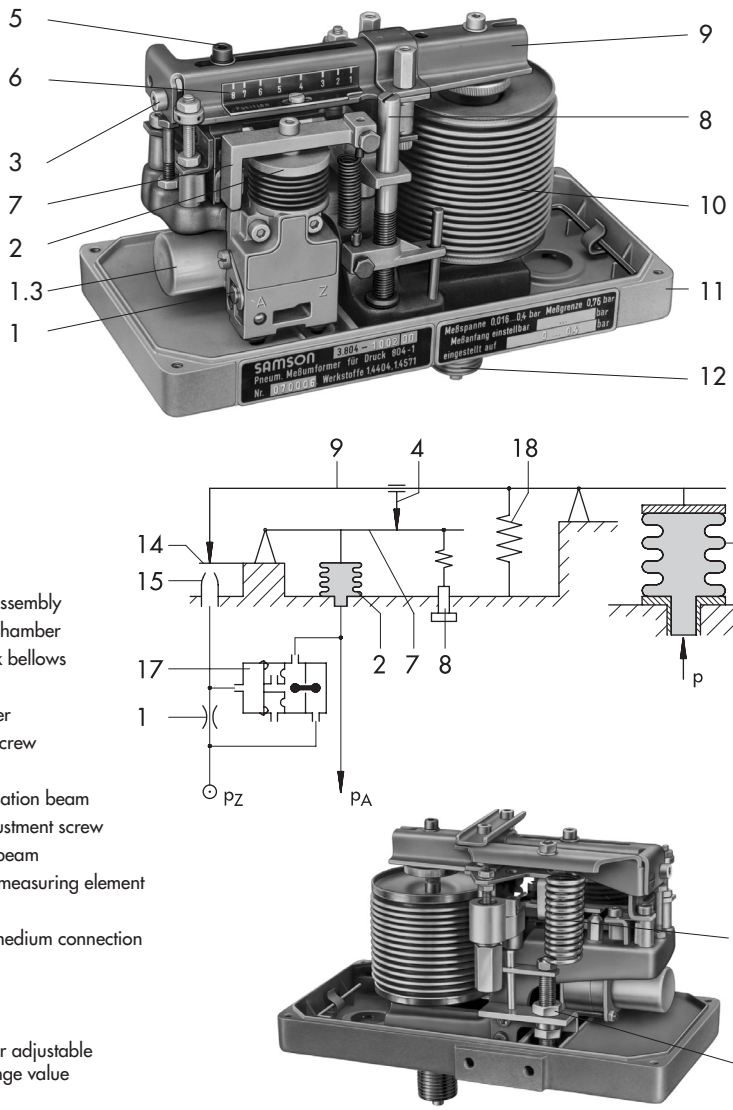
This version has a lower range value which can be adjusted by means of a spring (18). One spring version allows the continuous adjustment of the lower range value to positive effective pressures. By using a different spring version, the transmitter can also be used for negative pressure measurements.

Type 3804-1 with pressure transmitting sealing element

In the Type 3804-1 with pressure transmitting sealing element, the process medium to be measured does not come into contact with the measuring element. The pressure produced by the medium is transmitted through a separating diaphragm and a barrier liquid to the measuring element.

Type 3804-1

Flanged transmitter with a diaphragm measuring element for operating pressures from 0 to 6 bar. This transmitter is similar to Type 3804-1.



1 Throttle assembly
1.3 Volume chamber
2 Feedback bellows
3 Spindle
4 Span rider
5 Locking screw
6 Scale
7 Compensation beam
8 Zero adjustment screw
9 Balance beam
10 Pressure measuring element
11 Base
12 Process medium connection
14 Flapper
15 Nozzle
17 Booster
18 Spring for adjustable lower range value
19 Nuts

Fig. 2 · Transmitters and principle of operation

2 Installation

2.1 Mounting

(see dimensional drawings on pages 12 and 15)

The transmitter is mounted to a 2" pipe as close as possible to the pressure tapping point using the mounting plate, clamp and two nuts and bolts supplied with the unit.
It can also be mounted on a wall with the mounting plate.
On measuring liquids or vapors, the transmitter should be mounted at the same height as the pipe, otherwise an additional static pressure could occur which would falsify the results.
On measuring gases or air, the transmitter should be mounted above the pressure tapping point (Fig. 3).
In case of high medium temperatures or a poorly insulated pipe, make sure that the ambient temperature at the transmitter does not exceed +120 °C.
The standard mounting position is horizontal with the base (11) facing downwards. The unit can, however, be mounted in the vertical position (standing on its side).

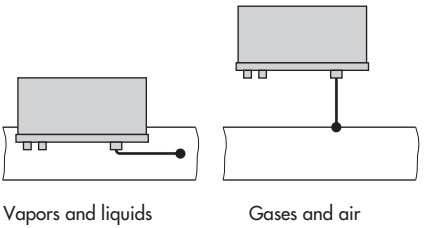


Fig. 3 · Installation

The mounting plate has additional holes for wall mounting which match the holes in the transmitter.
When mounted in the vertical position, the connections for supply air **Z** and output **A** must be at the bottom.
The zero point always needs to be readjusted if the unit is mounted in the vertical position.

2.2 Pneumatic connections

The air connections are marked **Z** (supply air) and **A** (output).

The connections are ⅛ NPT or G⅛ threaded holes.
The customary fittings for pipes or plastic hoses can be used.

NOTICE
The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.
Blow through all air tubes and hoses thoroughly prior to connecting them.

2.3 Process medium connection

Type 3804-1
Transmitters with a metal bellows (up to PN 100) have a G ½ B process medium connection according to DIN EN 837-1.

Accessories:
Flat gasket acc. to DIN EN 837-1 made of
– Copper, order no.: 8521-0512
– Vulcanized fiber, order no.: 8521-0513

Install a hand-operated shut-off valve in the pipeline between the pressure tapping point and the transmitter to be able to shut off the process medium from the transmitter for adjustment or maintenance work.

Type 3804-1 with pressure transmitting sealing element
Make sure that the connecting tube from the measuring flange to the process medium connection is not bent or twisted.
Under no circumstances should the pipe be damaged or shortened.
Neatly coil up any excess pipe. The smallest permissible bending radius is 50 mm.

Install the transmitter at the same height as the pressure tapping point.
Any differences in height affect the measuring results and need to be corrected with the zero adjustment screw, especially in the case of small measuring spans.

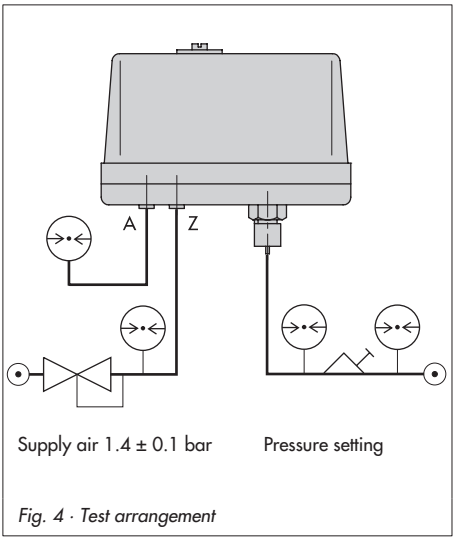


Fig. 4 · Test arrangement

3 Operation

3.1 Zero point correction

Prior to putting the transmitter into service, always check the zero point adjustment. You can perform this adjustment without removing the cover.
Set the supply air pressure at **Z** to 1.4 bar. At an input pressure is 0 bar (process medium connection open), a pressure gauge connected to the transmitter output (connection **A**) must indicate 0.2 bar.
Should this not be the case, insert a screwdriver through the hole in the cover and adjust the zero adjustment screw (8) until this pressure is reached.

3.2 Adjusting the measuring span on the test bench

If a particular measuring span was specified on ordering the unit, the transmitter is set accordingly at the factory.
When no span has been specified, the transmitter is delivered set to the maximum measuring span.
For a more accurate adjustment, the set-up of the test arrangement as shown in Fig. 4 is necessary.

1. Take off the cover.
2. Connect a supply air of 1.4 ± 0.1 bar to supply air input **Z** and connect a pressure gauge to the pneumatic output **A**.

A scale (6) with scale divisions from 1 to 8 on the left side of the balance beam can be used for preliminary adjustment.

The upper measuring range values are assigned to the various scale markings which can be found in the table on page 9 (the table is also cast onto the inside of the cover).

3. Use the Allen key (SW3) stored on the base (11) to undo the locking screw (5).
4. Place the key onto the hexagonal socket of the spindle (5) and adjust the span rider until the locking screw (5) is in position over the required number on the scale (6).

NOTICE
Only adjust the span rider when no pressure is applied to the process medium connection!

Tighten the locking screw and then unscrew it approximately a ¼ turn (to allow fine adjustments to be made later).

5. Adjust the zero adjustment screw (8) with an inlet pressure of 0 bar until the pressure gauge reading at the output indicates 0.2 bar.
6. Use a pressure regulator to apply the maximum pressure of the required measuring range to the transmitter input. When the adjustment is correct, the test pressure gauge at connection **A** must read exactly 1 bar.
   If this is the case, tighten the locking screw (5) after checking the zero adjustment once again.

The transmitter can now be put into service.

3.3 Type 3804-1 with adjustable lower value range

For a transmitter fitted with a spring (18) for a adjustable lower range value, the measuring span is adjusted as follows:

Positive adjustment of the lower range value:

1. Relieve the spring for adjustable lower range value of tension until the pressure gauge connected to the transmitter output **A** reads 0.2 bar when the inlet pressure is 0 bar.
2. Adjust the measuring range as described in section 3.2.
3. Determine the lower range value by tensioning the spring and check the upper range value.

Example:
Required measuring range 0.6 to 1.1 bar, resulting in a measuring span of 0.5 bar.

1. Adjust the measuring range from 0 to 0.5 bar as described in section 3.2.
2. Apply the lower range value of 0.6 bar pressure to the input.
3. Tension the spring (18) by tightening the nuts (19) until the output pressure reaches 0.2 bar.
4. Adjust the input pressure to the upper range value of 1.1 bar. The output pressure must read 1 bar. If this is not the case, correct the measuring range.

Negative adjustment of the lower range value:

1. Relieve the spring for adjustable lower range value of tension over the nuts (19) until the pressure gauge connected to the transmitter output **A** indicates 0.2 bar when the inlet pressure is 0 bar.
2. Adjust the span as described in section 3.2.
3. Determine the lower range value by tensioning the spring. Check the upper range value.

Example:
Required measuring range –0.4 to +0.6 bar, resulting in a measuring span of 1 bar.

1. Adjust the measuring range between 0 and 1 bar as described in section 3.2.
2. Create a negative pressure of –0.4 bar at the input of the transmitter.
3. Tension the spring (18) over the nuts (19) until the transmitter output **A** indicates 0.2 bar.
4. Adjust the input pressure to the upper range value of +0.6 bar. The output pressure reading must be 1 bar.
   If this is not the case, correct the measuring range.

Assignment of scale markings and measuring spans

	Measuring span							
	0.016...0.4 bar		**0.25...6 bar**		**0.8...20 bar**		**4...100 bar**	
Pos.	bar	psi	bar	psi	bar	psi	bar	psi
1	0.016	0.23	0.25	3.5	0.8	11.6	4	57
2	0.025	0.35	0.4	5.7	1.3	19	6	85
3	0.04	0.57	0.6	8.5	2	29	10	142
4	0.06	0.85	1.0	14	3.2	46	16	228
5	0.1	1.4	1.6	23	4.8	70	25	356
6	0.16	2.3	2.5	35	8	116	40	570
7	0.25	3.5	4	57	12.8	186	63	895
8	0.4	5.7	6	85	20	290	100	1420

4 Maintenance

4.1 Air supply

The transmitter is usually maintenance-free, however, the air supply should be checked occasionally. The proper functioning of the transmitter can only be guaranteed when clean instrumentation air is used for the supply air.

Note: *Check the air filter and separator of the pressure reducing station connected upstream of the transmitter at regular intervals.*

4.2 Zero point check

Check the zero point every six months, and if necessary, correct it as described in section 3.1.

4.3 Cleaning the throttles

Clean the throttles every six months as following:
Unfasten screw (1.2), push up the catch (1.1) and pull out the throttle assembly (1).

Push a wire (0.25 mm) into the holes of the throttle assembly and then reinsert the throttle assembly.
Unscrew and take out the volume chamber (1.3). Push a wire (0.25 mm) into the hole and then screw back in the volume chamber.

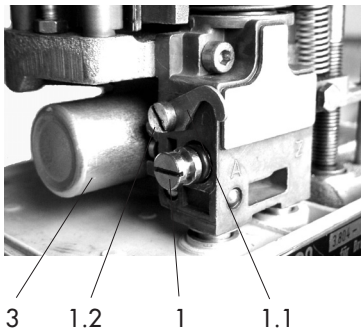


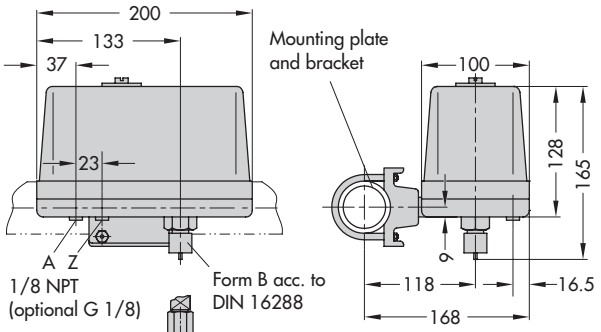
Fig. 5 · Throttle assembly

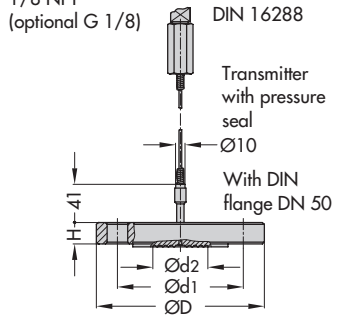
5 Technical data and dimensional drawings

Type 3804-1 Transmitter	All pressure specifications in p_e in bar, unless otherwise stated			
Measuring span continuously adjustable	0.016 to 0.4 bar	0.25 to 6 bar	0.8 to 20 bar	4 to 100 bar
Measuring limit	0.76 bar	11.4 bar	38 bar	150 bar
Overloadable up to	Ten times the adjusted measuring span, however, not more than:			
	1.5 bar	25 bar	50 bar	200 bar
Ultimate strength up to	8 bar	60 bar	100 bar	250 bar
Pressure measuring element	Metal bellows			
Volume of measuring element	115 cm³	12 cm³	6.4 cm³	4.7 cm³
Supply air	1.4 ± 0.1 bar (20 ± 1.5 psi); Air quality acc. to ISO 8573-1, edition 2001: Max. particle size and density: Class 4; Oil content: Class 3, pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected			
Output pressure	0.2...1 bar (3...15 psi possible)			
Air consumption	0.15 m_n^3/h in steady-state condition			
Max. air capacity	1 m_n^3/h			
Load characteristic	0.3 m_n^3/h per 3 % change in output signal			
Characteristic	Linear			
Deviation from conformity	0.5 % (1 %)[1] terminal-based conformity			
Hysteresis	< 0.2 % (0.4 %)[1], with measuring spans up to approx. 0.06 bar: < 0.3 % (0.6 %)[1]			
Dead band	< 0.05 %			
Effect of supply air ± 0.1 bar	For measuring spans with markings on the scale 1 to 3: < 0.4 % / 0.1 bar · 4 to 8: < 0.25 % / 0.1 bar change in pressure			
Effect of temperature	< 0.03 %/K (at –20 to +120 °C)			
Overload effect	Overload on permissible value <1 %			
Perm. ambient temperature	–35 to +120 °C, lower temperatures on request			
Perm. storage temperature	–50 to +120 °C			
Degree of protection	IP 54			
Transmitter with adjustable lower range value				
Lower range value adjustable	–0.36 to –0.04 bar	–1 to –0.6 bar		
	–0.04 to 0.04 bar	–0.6 to 0.6 bar	–1 to 2 bar	–1 to 10 bar
	0.04 to 0.36 bar	0.6 to 5.4 bar	2 to 18 bar	10 to 90 bar
Add. effect of temperature on adjustable lower range value by up to ten times of the adjusted measuring span: < 0.05 %/K				

[1] Specifications in parentheses ( ) apply to ± measurement

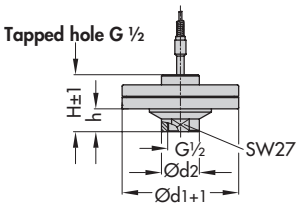
Materials · Material number according to DIN EN	
Metal bellows	1.4404
Spring bearings	1.4310
Span rider and rail	1.4034, hardened
Balance beam	Steel, chromated
Booster gasket	Silicone rubber
O-rings	Fluorosilicone rubber (FPM, FKM)
Base and cover	Die-cast aluminum, plastic-coated
Booster and volume chamber	Aluminum, chromated

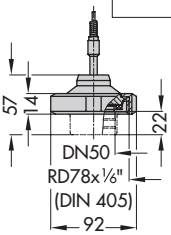




Transmitter for pressure · Dimensions in mm · Weights

Connection	PN	D	d_1	d_2	h	H	kg
Tapped hole G ½	100		90	30	8.5	56	4.6
	250		108	30	2.5	56	6.2
DIN flange DN 50	40	165	125	59		20	6.5
	63	180	135	59		26	8.3
	100	195	145	59		28	9.7
	160	195	145	59		30	10.2
	250	200	150	59		38	12.2



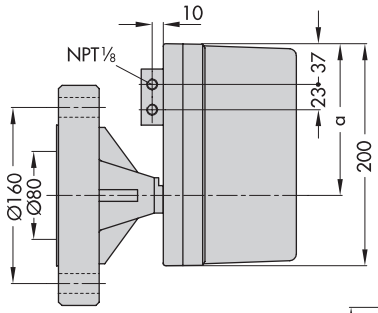


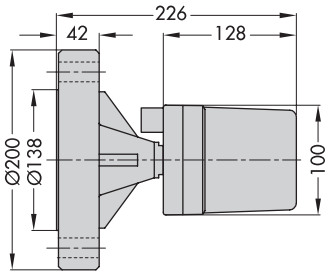
Hygienic coupling DN 50
acc. to DIN 11851 (approx. 0.8 kg)

Type 3804-1 Transmitter with pressure transmitting sealing element (other data same as Type 3804-1)		
Measuring span	1 to 20 bar	16 to 100 bar
Overloadable up to	Ten times the adjusted measuring span, however, not more than:	
	50 bar	200 bar
Ultimate strength up to	100 bar	250 bar
Pressure measuring element	Metal bellows	
Supply air	1.4 ± 0.1 bar (20 ± 1.5 psi); Air quality acc. to ISO 8573-1, edition 2001: Max. particle size and density: Class 4; Oil content: Class 3, pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected	
Output pressure	0.2...1 bar (3...15 psi)	
Air consumption	0.15 m_n^3/h in steady-state condition	
Max. air capacity	1 m_n^3/h	
Load characteristic	0.3 m_n^3/h per 3 % change in output signal	
Deviation from conformity	< 0.5 % terminal-based conformity	
Hysteresis	< 0.5 %	
Dead band	< 0.05 %	
Overload effect	Overload on permissible value < 1 %	
Perm. ambient temperature	–20 to +70 °C for the transmitter	
Transmitter with adjustable lower range value		
Lower range value, adjustable	0 to 18	0 to 90
Additional effect of temperature	< 0.2 %/10 °C	
Pressure transmitting sealing element		
Process medium connection		
Tapped hole G ½	PN 100, 250 or 600	
DIN flange DN 50	PN 40, 6, 100, 160 or 250	
Top section with separating diaphragm and connecting tube attached		
Perm. ambient temperature	–40 to +150 °C · Up to +300 °C on request	
Materials · Material number according to DIN EN		
Process medium connection	1.4571, on request: Steel, Hastelloy B or C, Monel, nickel, tantalum lining or PTFE (up to 220 °C and PN 40)	
Separating diaphragm	1.4571, on request: Steel, Hastelloy B or C, Monel, nickel, tantalum lining or PTFE (up to 220 °C and PN 40)	
Bonnet	1.4571	
Clamping flange, nuts, bolts	Steel (zinc-coated) · Special version 1.4571	
Hygienic coupling DN 50	DIN 11851, PN 10, 1.4300	

Type 814 Transmitter	All pressure specifications in p_e in bar, unless otherwise stated		
Process medium connection	DN 80		
Flange	PN 10/40		
Measuring span	0.016 to 0.16 bar	0.1 to 1 bar	0.6 to 6 bar
Measuring limit	0.3 bar	1.9 bar	11.4 bar
Overloadable up to	1.5 bar	3 bar	12 bar
Lower measuring range value adjustable from	0 to 0.14 bar	0 to 0.9 bar	0 to 5.4 bar
Pressure measuring element	Metal diaphragm		
Supply air	1.4 ± 0.1 bar (20 ± 1.5 psi); Air quality acc. to ISO 8573-1, edition 2001: Max. particle size and density: Class 4; Oil content: Class 3, pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected		
Output pressure	0.2...1 bar (3...15 psi)		
Air consumption	0.15 m_n^3/h in steady-state condition		
Max. air capacity	1 m_n^3/h im		
Load characteristic	0.3 m_n^3/h per 3 % change in output signal		
Deviation from conformity	< 0.5 % terminal-based conformity		
Hysteresis	< 0.3 %, with measuring spans ≤ 0.04 bar 0.4 %		
Dead band	< 0.1 %		
Effect of supply air	For measuring spans with markings on the scale 1 to 3: 0.4 % / 0.1 bar change in pressure 4 to 8: ≤ 0.25 % / 0.1 bar change in pressure		
Overload effect	On overload to ten times of the adjusted measuring span (however, not over the permissible maximum values): ≤ 1 %		
Effect of temperature	< 0.03 %/K with adjustable lower range value: ≤ 0.05 %/°C		
Perm. ambient temperature	–10 to +120 °C		
Perm. operating temperature at process medium connection	–100 to +150 °C		
Weight, approx. kg	10.5		
Materials			
Housing, top section	1.4571		
Separating diaphragm	1.4571, (Hastelloy C on request)		
Connecting flange	EN-JS 1049		

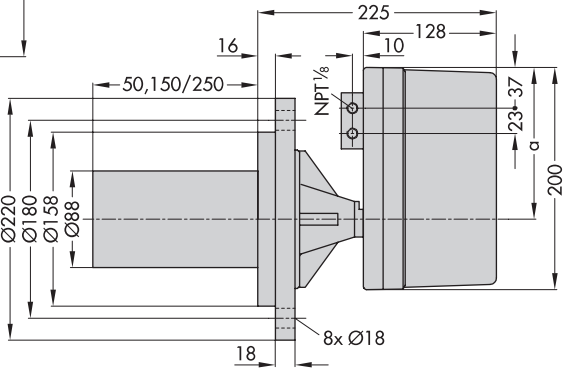
Type 814 · Version PN 10/40, DN 80





Measuring span bar	Dimension a
0.016 to 0.16	139
0.1 to 1	118
0.6 to 6	112

Special version with projecting diaphragm
PN 10/16, DN 100



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