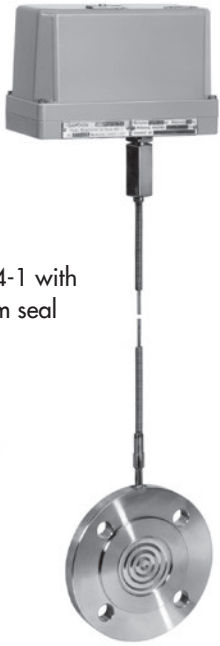
MOUNTING AND OPERATING INSTRUCTIONS

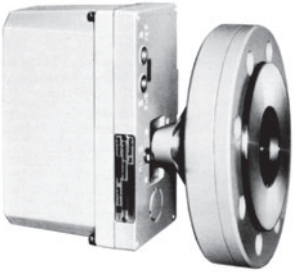
EB 7540 EN

Translation of original instructions

Type 3804-1



Type 3804-1 with diaphragm seal



Type 814

Type 3804-1 Pneumatic Transmitter, Type 3804-1 Pneumatic Transmitter with Diaphragm Seal and Type 814 Pneumatic Transmitter

Edition February 2020

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 (aftersalesservice@samsongroup.com).

The mounting and operating instructions for the devices are included in the scope of delivery. The latest documentation is available on our website at ***www.samsongroup.com > Service & Support > Downloads > Documentation***.

Definition of signal words

⚠ DANGER

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

⚠ WARNING

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

NOTICE

Property damage message or malfunction

Note

Additional information

Tip

Recommended action

1 General safety instructions

– The device must be mounted, started up or serviced by fully trained and qualified personnel only; the accepted industry codes and practices are to be observed. Make sure employees or third parties are not exposed to any danger.
– All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up, and maintenance, must be strictly observed.
– 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.
– To ensure appropriate use, only use the device in applications where the operating pressure and temperatures do not exceed the specifications used for sizing the device at the ordering stage.
– The manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
– Any hazards that could be caused in the valve by the process medium, operating pressure or by moving parts are to be prevented by taking appropriate precautions.
– Proper transport, storage, installation, operation and maintenance are assumed.

i ***Information on Pressure Equipment Directive***

Classification according to European Pressure Equipment Directive 2014/68/EU: the devices are classified in Article 4.3 (sound engineering practice).
Devices with diaphragm seal can only be used for Fluid Group 2 according to Article 13 in Pressure Equipment Directive 2014/68/EU.

2 Design and principle of operation

Type 3804-1
The transmitters are used to measure pressure with measuring spans from 0.016 to 20 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 fed to the pneumatic booster (17) and flows through the throttle (1) and the nozzle (15) and hits the flapper plate (14). When the pressure p of the process medium increases, the balance beam (9) starts to move and the flapper (14) becomes 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 as well.

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 (no longer available since November 2018)
This version has a lower range value which can be adjusted by the spring (18). The spring version allows the continuous adjustment of the lower range value to positive effective pressures.

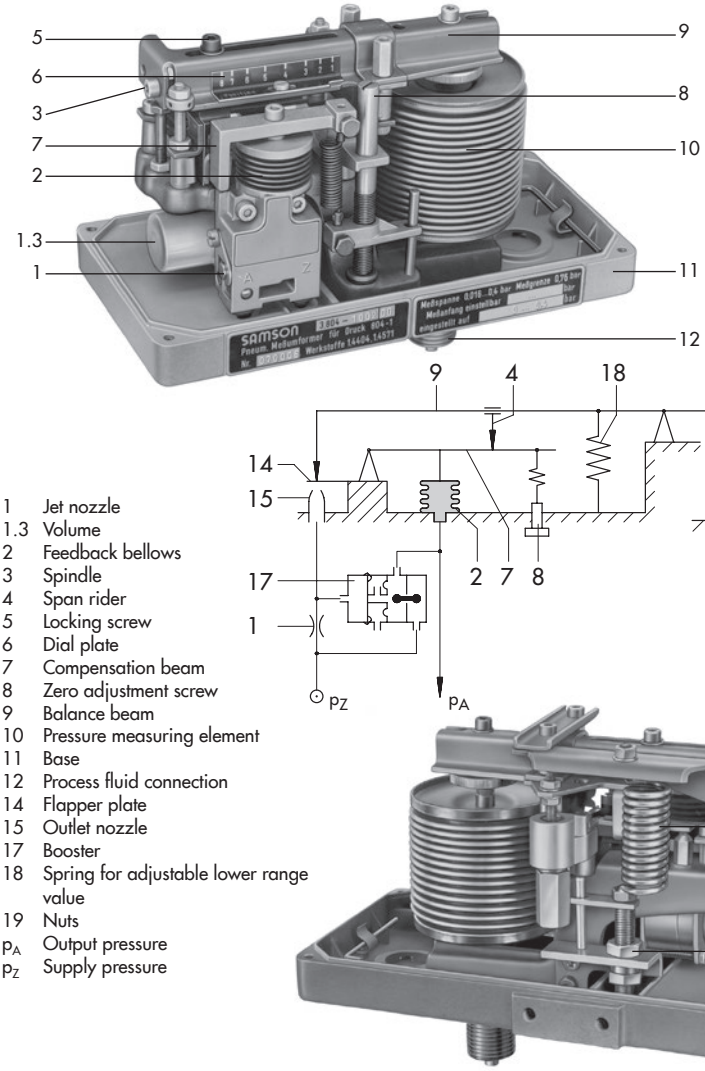
By using a different spring version, the transmitter can also be used for negative pressure measurement.

Type 3804-1 with diaphragm seal
Devices with diaphragm seal can only be used for Fluid Group 2 according to Article 13 in Pressure Equipment Directive 2014/68/EU.

The process medium to be measured in the Type 3804-1 with diaphragm seal does not come into contact with the measuring element. The pressure produced by the medium is transmitted by a separating diaphragm and a filler liquid to the measuring element.

Type 814 (not available since October 2011)
Flanged transmitter with a diaphragm measuring element for operating pressures from 0 to 6 bar. This transmitter is largely identical to the Type 3804-1.

Replacement device on request



1 Jet nozzle
1.3 Volume
2 Feedback bellows
3 Spindle
4 Span rider
5 Locking screw
6 Dial plate
7 Compensation beam
8 Zero adjustment screw
9 Balance beam
10 Pressure measuring element
11 Base
12 Process fluid connection
14 Flapper plate
15 Outlet nozzle
17 Booster
18 Spring for adjustable lower range value
19 Nuts
p_A Output pressure
p_Z Supply pressure

Fig. 1: *Transmitter and principle of operation*

3 Installation

3.1 Mounting

➔ See Fig. 5 and Fig. 6.

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.

For measurement of liquids or vapors, mount the transmitter at the same height as the pipe. Otherwise an additional static pressure could occur which would falsify the results.

When gases or air are used as the process medium, mount the device above pressure tapping point (Fig. 2).

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 usual mounting position is in the horizontal position with the base (11) facing downward. The unit can, however, be mounted in the upright position (standing on its side).

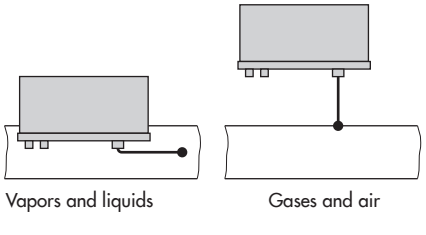


Fig. 2: *Installation*

The mounting plate has additional holes for wall mounting which match the holes in the transmitter.

When mounted in the upright position, the connections for supply air **Z** and output **A** must be located at the bottom.

3.2 Pneumatic connections

The air connections are marked **Z** (supply air) and **A** (output). They are designed as a bore with ⅛ NPT or G ⅛ thread. Customary fittings for pipes or plastic hoses can be used.

i ***Note***

The supply air is dry as well as free of oil and dust. Read the maintenance instructions for upstream pressure reducing stations. Blow through all air pipes and hoses thoroughly before connecting them.

3.3 Process fluid connection

Type 3804-1

Transmitters with a metal bellows (up to 100 bar span) have a G ½ B process fluid connection according to DIN EN 837.

Accessories:

Gasket according to DIN EN 837-1 made of:

– Copper (item no. 8521-0512)
– Vulcanized fiber (item no. 8521-0513)

Install a hand-operated shut-off valve in the pipeline between the pressure tapping point and the transmitter to shut off the process

medium from the transmitter for adjustment or maintenance work.

Type 3804-1 with diaphragm seal

Make sure that the connecting tube from the measuring flange to the process medium connection is not bent or twisted.

Do not damage or shorten the pipe under any circumstances.

Roll up excess pipe to form a ring. The smallest permissible bending radius is 50 mm.

Mount the transmitter at the same height as the pressure tapping point.

Any differences in height will affect the measuring results and need to be corrected with the zero screw, especially in the case of small measuring spans.

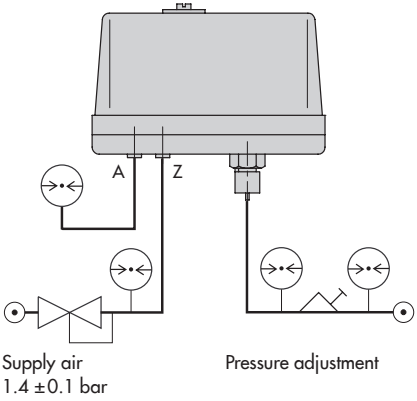


Fig. 3: *Test setup*

4 Operation

4.1 Zero point calibration

Before putting the transmitter into service, check the zero adjustment. This adjustment can be performed without removing the cover.

Set the supply pressure at **Z** to 1.4 bar.

At an input pressure is 0 bar (process fluid connection open), a pressure gauge connected to the transmitter output (connection **A**) must read 0.2 bar.

If this is not the case, insert a screwdriver through the hole in the cover and adjust the zero screw (8) until this specified pressure is reached.

4.2 Adjusting the measuring span on the test bench

If a particular measuring span has been specified on ordering the unit, the transmitter is delivered accordingly.

When no span has been specified, the transmitter is delivered set to the maximum measuring span.

For a more accurate adjustment, the setup of the test arrangement as shown is necessary.

1. Remove 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 Table 1 on page 11. The table can also be found in the inside of the device cover.

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

i ***Note***

Only adjust the span rider when no pressure is applied to the process fluid connection.

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

5. Adjust the zero 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.

   Tighten the locking screw (5) after checking the zero adjustment once again.

➔ The transmitter is ready for use.

4.3 Type 3804-1 with adjustable lower range value

For a transmitter fitted with a spring (18) for 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 at the nuts (19) until the pressure gauge connected to the transmitter output **A** reads 0.2 bar when the inlet pressure is 0 bar.
2. Set the measuring span as described in section 4.2.
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 between 0 and 0.5 bar as described in section 4.2.
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 at the nuts (19) until the pressure gauge connected to the transmitter output **A** reads 0.2 bar when the inlet pressure is 0 bar.
2. Set the measuring span as described in section 4.2.
3. Determine the lower range value by tensioning the spring and 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 4.2.
2. Create a negative pressure of –0.4 bar at the input of the transmitter.
3. Tension the spring (18) by tightening the nuts (19) until the output pressure reads 0.2 bar.
4. Adjust the input pressure to the upper range value of +0.6 bar. The output pressure must read 1 bar.

   If this is not the case, correct the measuring range.

Table 1: *Assignment of scale markings and measuring span*

	Measuring span							
	0.016 to 0.4 bar		**0.25 to 6 bar**		**0.8 to 20 bar**		**4 to 100 bar**	
Item	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

5 Maintenance

5.1 Air supply

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

i Note

Check the air filter and separator installed in the upstream air reducing station regularly. If necessary, clean them.

5.2 Checking zero

Zero must be checked every six months and, if necessary, corrected as described in section 4.1.

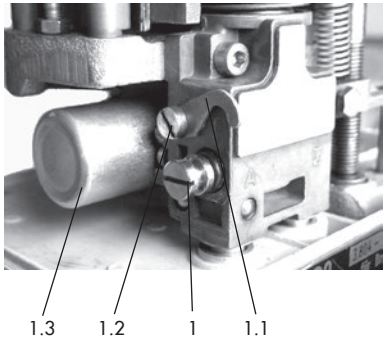
5.3 Cleaning the throttles

Clean the throttles every six months as follows:

Unfasten screw (1.2), push up the catch (1.1) and pull out the jet nozzle (1).

Push a wire (0.25 mm) into the holes of the jet throttle and reinsert the jet throttle.

Unscrew and remove the volume chamber (1.3). Push a wire (0.25 mm) into the hole and screw back in the volume chamber.



1 Jet nozzle
1.1 Catch
1.2 Screw
1.3 Volume chamber

Fig. 4: *Jet nozzle*

6 Technical data and dimensions

Note

The listed technical data also include the discontinued versions. Currently available versions are listed in Data Sheets ▶ T 7540 and ▶ T 7550.

Type 3804-1 Transmitter · All pressure specifications in p_e in bar, unless stated otherwise				
Measuring span, continuously adjustable	0.016 to 0.4 bar	0.25 to 6 bar	0.8 to 20 bar	4 to 100 bar
Upper measuring range value	0.76 bar	11.4 bar	38 bar	120 bar
Overloading	Ten times the adjusted span, however not exceeding			
	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 cm^3	12 cm^3	6.4 cm^3	4.7 cm^3
Supply air	1.4 ±0.1 bar (20 ±1.5 psi) · Air quality according to ISO 8573-1: 2010-04 · 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 to 1 bar (3 to 15 psi possible)			
Air consumption	0.15 m_n^3/h in steady state			
Max. air capacity	1 m_n^3/h			
Load characteristic	0.3 m_n^3/h per 3 % output signal change			
Characteristic	Linear			
Deviation from terminal-based linearity	<0.5 % (1 %) [1] with 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 on position 1 to 3 on the scale: <0.4 %/0.1 bar; 4 to 8: <0.25 %/0.1 bar on pressure change			
Effect of temperature	<0.03 %/K (at –20 to +120 °C)			
Effect of overload	Overload up to permissible value <1 %			
Permissible ambient temperature	–35 to +120 °C, lower temperatures on request			
Perm. storage temperature	–50 to +120 °C			
Degree of protection	IP54			

Version 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
Additional effect of temperature on adjustable lower range value up to ten times the adjusted measuring span: <0.05 %/K				

[1] Values in parentheses for ± measurement

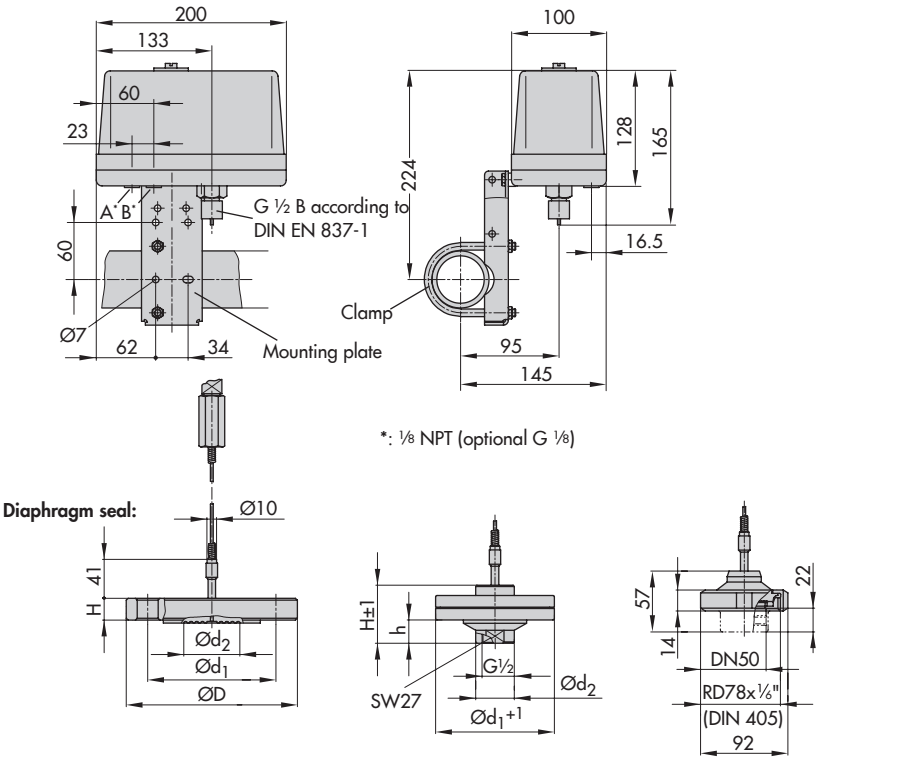
Materials · Material numbers according to DIN EN	
Metal bellows	1.4404
Spring bearings	1.4310
Span rider and rail	1.4034 hardened
Balance beam	Chromated steel
Booster gasket	Silicone rubber
O-rings	Fluorocarbon rubber (FKM/FPM)
Base and cover	Die-cast aluminum, plastic-coated
Booster and volume chamber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

Type 3804-1 Pneumatic Transmitter with Diaphragm Seal		
Measuring span	1 to 20 bar	16 to 100 bar
Overloading	Ten times the adjusted span, however not exceeding	
	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 according to ISO 8573-1: 2010-04 · 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 to 1 bar (3 to 15 psi)	
Air consumption	0.15 m_n^3/h in steady state	
Max. air capacity	1 m_n^3/h	
Load characteristic	0.3 m_n^3/h per 3 % output signal change	
Deviation from terminal-based linearity	<0.5 % with terminal-based conformity	
Hysteresis	<0.5 %	
Dead band	<0.05 %	
Effect of overload	Overload up to permissible value <1 %	
Permissible ambient temperature	–20 to +70 °C for transmitter	

Version with adjustable lower range value		
Lower range value (adjustable)	0 to 18 bar	0 to 90 bar
Additional effect of temperature	<0.2 %/10 K	
Diaphragm seal		
Upper part fastened to separating diaphragm and capillary tube		
Process fluid connection Tapped hole G ½	PN 100, 250	
DIN flange, DN 50	PN 40, 6, 100, 160 and 250	
Permissible ambient temperature	–40 to +150 °C	
Materials · Material numbers according to DIN EN		
Process fluid connection	1.4571	
Separating diaphragm	1.4435	
Upper part	1.4404	
Clamping flange, nuts, bolts	Zinc-plated steel	
Hygienic coupling, DN 50	DIN 11851, PN 10, 1.4435	

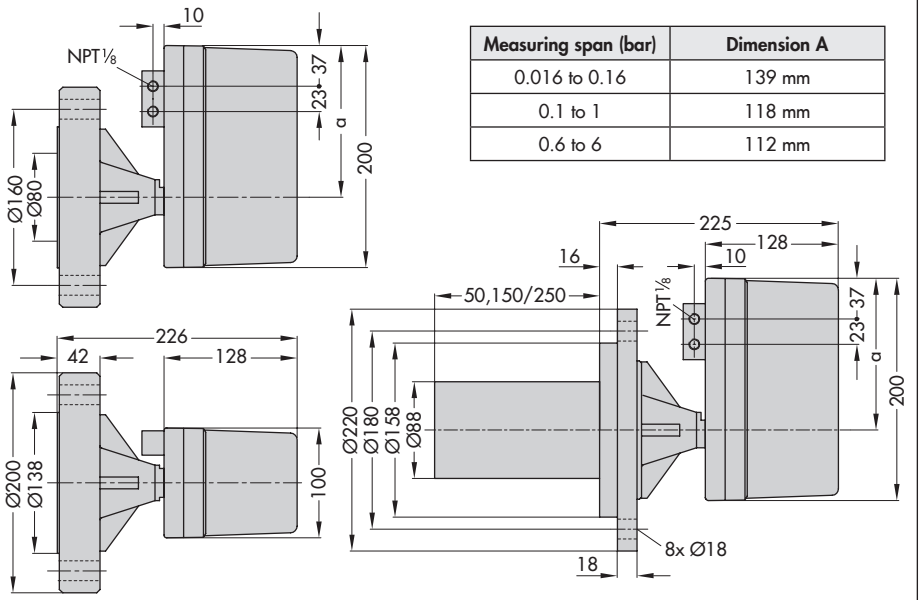
Type 814 Transmitter (not available since October 2011) All pressure specifications in pe in bar, unless stated otherwise			
Process fluid connection	DN 80		
Flange	PN 10/40		
Measuring span	0.016 to 0.16 bar	0.1 to 1 bar	0.6 to 6 bar
Upper measuring range value	0.3 bar	1.9 bar	11.4 bar
Overloadable up to	1.5 bar	3 bar	12 bar
Lower 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 according to ISO 8573-1: 2010-04 · 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 to 1 bar (3 to 15 psi)		
Air consumption	0.15 m_n^3/h in steady state		
Max. air capacity	1 m_n^3/h		
Load characteristic	0.3 m_n^3/h per 3 % output signal change		
Deviation from terminal-based linearity	<0.5 % with terminal-based conformity		

Hysteresis	<0.3 % · 0.4 % with measuring spans ≤0.04 bar
Dead band	<0.1 %
Influence of power supply	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
Effect of overload	For an 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 %/K
Permissible ambient temperature	–10 to +120 °C
Max. operating temperature at the process fluid connection	–100 to +150 °C
Weight, approx.	10.5 kg
Materials · Material numbers according to DIN EN	
Housing, upper part	1.4571
Separating diaphragm	1.4571
Connecting flange	EN-JS 1049



Diaphragm seal · Dimensions in mm · Weight							
	PN	D	d1	d2	h	H	kg
Connection Tapped hole G ½	100	–	90	30	8.5	56	4.6
	250	–	108	30	2.5	56	6.2
Connection 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

Fig. 5: *Dimensions of Type 3804-1 · Dimensions in mm*



Measuring span (bar)	Dimension A
0.016 to 0.16	139 mm
0.1 to 1	118 mm
0.6 to 6	112 mm

Fig. 6: *Dimensions of Type 814 (PN 10/40, DN 80) · Dimensions in mm*

EB 7540 EN

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