Indicating Electric Two-wire Transmitter for Differential Pressure

Media 4A – 2-Wire
Type 5014

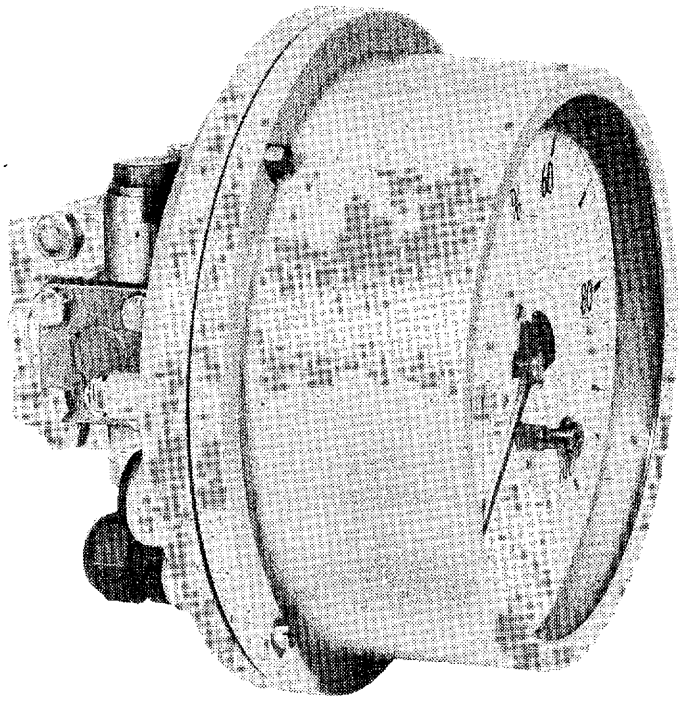


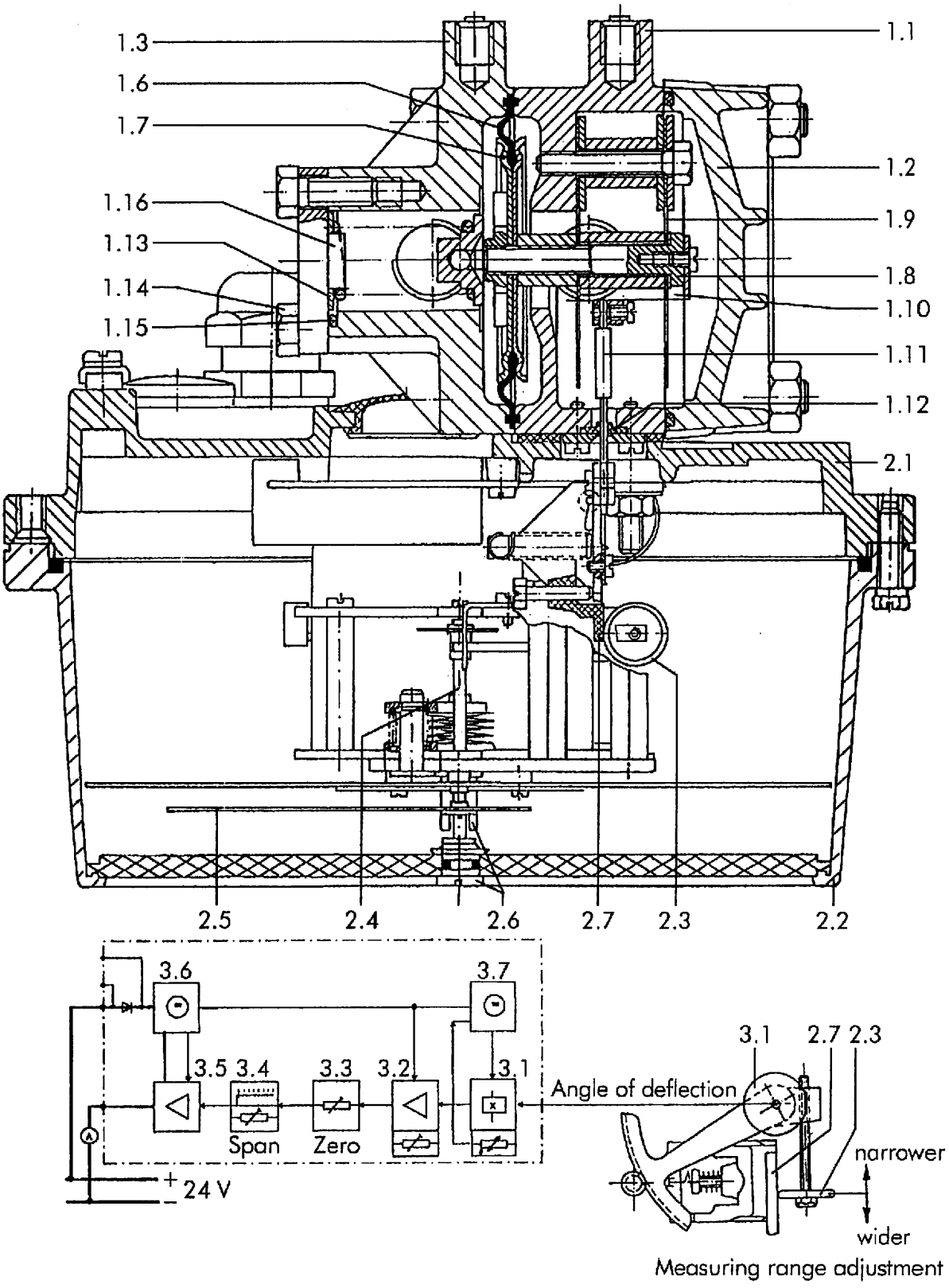
Fig. 1 · Media 4A – 2-wire

1. Design and principle of operation

The Media Type 4A – 2-Wire Indicator is designed for differential pressure and liquid level measurement in industrial plants and building installations. For connection of the indicator to measuring and control equipment, the measured values are converted into standardized DC current signals.
When used in combination with the Type 5024 Power Supply and Indicator Unit, the device is e.g. suitable for monitoring the liquid level in a vessel via LCD and limit contacts.
It basically consists of a differential pressure cell with a measuring diaphragm and a measuring spring and an indicator case comprising a pointer gear mechanism, a transmitter unit, and a scale.
Depending on its application, accessories have to be used, such as condensation chambers, shut-off valves and fittings, or valve blocks (shut-off and equalizing valves).

Edition March 1993

Mounting and operating instruction
EB 9525 E



1 Differential pressure cell

1.1 Case
1.2 High pressure cap
1.3 Low pressure cap
1.4 Spring plate
1.5 Measuring spring
1.6 Measuring diaphragm
1.7 Diaphragm plates
1.8 Diaphragm shaft
1.9 Guide springs
1.10 Transmission strip
1.11 Lever
1.12 Gasket
1.13 Disk(s)
1.14 Screw
1.15 O-ring
1.16 Spring guide

2 Indicating unit

2.1 Lower part of case
2.2 Upper part of case
2.3 Feeler roll
2.4 Gear mechanism
2.5 Pointer
2.6 Zero adjustment screw
2.7 Measuring range plate

3 Transmitter

3.1 Sensor with resistor
3.2 Measuring amplifier
3.3 Potentiometer for fine adjustment
3.4 Rotary switch and potentiometer for coarse and fine adjustment of span
3.5 Output stage
3.6 Constant-voltage source
3.7 Constant-current source

Fig. 2 · Sectional drawing and functional diagram

The differential pressure $\Delta p = p_1 - p_2$ produces a force at the measuring diaphragm (1.6) that is balanced by the measuring spring (1.5). The deflection of diaphragm (1.6) and lever (1.11), which is proportional to the differential pressure sensed, is transmitted from the pressure cell to an elastic disk (1.12) and then via the range plate (2.7) and the adjustable feeler roll (2.3) to the pointer gear mechanism.
In the transmitter unit, the pointer deflection proportional to the differential pressure is transmitted to a solenoid system, thus changing the magnetic field, which then causes a change in voltage in a HALL sensor (3.1). The succeeding circuitry converts this voltage into a standardized DC current signal between 4 and 20 mA.
The span and thus the upper range value (pointer deflection) can be preset at a 7-position rotary switch. Fine adjustment of zero and span takes place at two potentiometers.
In case of a pointer deflection of 270° (rotary switch at position •), the output signal can be changed to 20 to 4 mA by turning a range plug 180°.

1.1 Versions

Media 4A – 2-Wire Type 5014-0...
Two-wire transmitter for differential pressure. Output signal 4 to 20 mA (20 to 4 mA), power supply 24 V DC from a two-wire system.

Media 4A – 2-Wire Type 5014-1...
Version as above, but also suitable for use in hazardous locations. **Input circuit in type of protection EEx ib IIC T6.**

1.2 Technical Data

Differential pressure meter										
Measuring span	max. mbar	60	100	160	250	400	600	1000	1600	2500
	min. mbar	40	60	100	160	250	400	600	1000	1600
Nominal pressure		PN 40, overloadable up to 40 bar on one side								
With measuring diaphragm for spans of 40 to 600 mbar, 250 to 1600 mbar or 1600 to 2500 mbar										
Volume of dp-cell		High pressure chamber: approx. 80 cm^3, low pressure chamber: approx. 25 cm^3								
Displacement volume		max. 9 cm^3 (with min. span: 5 cm^3)								
Scale Division of scale on request:		Scale 270°, scale length approx. 300 mm 0 to 100 % linear for any linear measured variables								
Characteristic		Indicated values linear to differential pressure								
Terminal based non-conformity		< ±2.5 %	< ±1.6 % (incl. hysteresis)							
Sensitivity		< 0.5 %	< 0.25 %							
Effects in % of span		static pressure: < 0.03 % / 1 bar								
Degree of protection		IP 54								
Total weight		approx. 3.6 kg								
Transmitter		5014-0				5014-1				
Two-wire system		Input 0 to 270° pointer deflection Output 4 to 20 mA or 20 to 4 mA								
Permissible load		$R_B = U_S - 12\ V / 20\ mA$								
Output circuit		—				intrinsically safe				
Power supply		Two-wire system 24 V Voltage range 12 to 45 V–				12 to 25 V– only in combination with an intrinsically safe circuit				
Span		130° to 270° pointer deflection, adjustable with rotary switch and potentiometer								
Characteristic		linear								
Pick-off accuracy		±0.25 % of upper range value								
Environmental conditions perm. ambient temperature: perm. storage temperature:		–20 to +70 °C –30 to +85 °C				max. 60 °C temperature class T6 max. 70 °C temperature class T5				

All pressures in bar
Note: All errors and deviations in % of adjusted span

2. Installation

2.1 Indicator

Mount device **free from vibrations** to tube, wall or mounting plate. For mounting to vertical or horizontal tubes, use mounting part with clamp. For wall mounting, use mounting part without clamp (see dimensional drawing chap. 6).

In case of panel-mounting (panel-cut out Ø 170, min. Ø 165, hole Ø 180 mm), remove upper part of housing and mount lower housing with measuring cell to the panel as shown in the dimensional drawing on page 10.

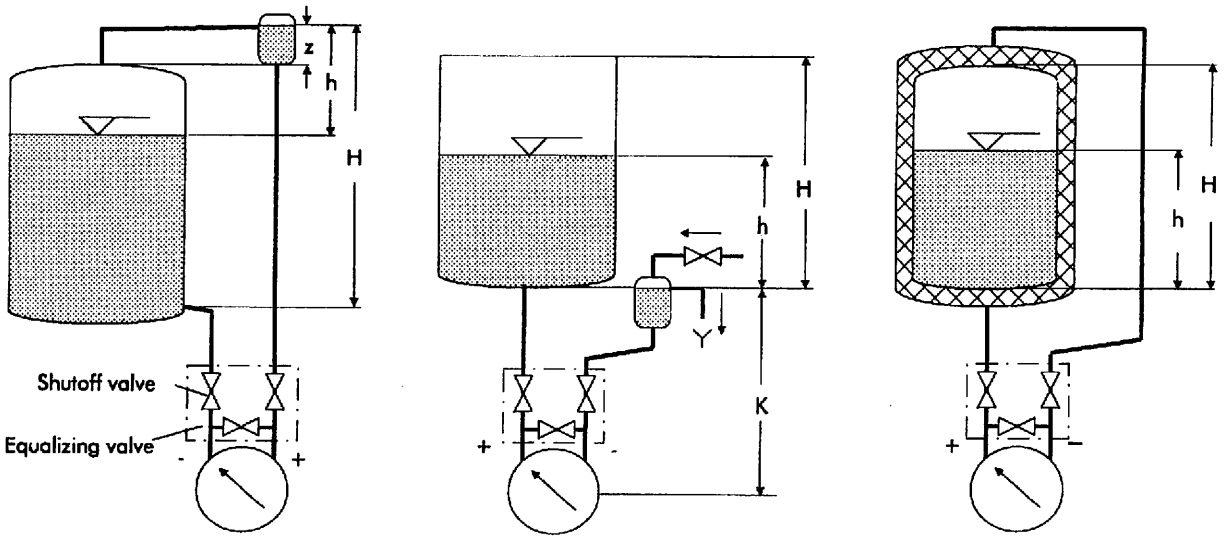
Note: For connection of the differential pressure lines, use cutting ring connectors. Depending on the instrument version used, the free connections must be sealed with screw or vent plugs (see chap. 5).

When the indicator is used for level measurement in vessels (Fig. 3), it must be arranged below the liquid level to be measured. The pressure line for the higher pressure must be connected to the high pressure chamber of the device.
In case of an arrangement like the one illustrated in Fig. 3 (left), the additional hight z is included in the measurement. Therefore, it must be kept as small as possible and must be considered when adjusting zero.
The dimension K (compensation hight) depicted in Fig. 3 (middle) can be chosen as large as necessary.

2.2. Differential pressure lines

The signal pressure lines must be tubes with a 12 mm external Ø and must be run as shown in Fig. 3. Proper arrangement is absolutely necessary. Line sections that would normally run horizontally have to be run with a continuous slope of at least 1:20, actually downward from a point that allows venting of the system.
The smallest bend radius must not be less than 50 mm.
Before connecting the differential pressure lines to the device, they have to be flushed out thoroughly.
Make sure that the high pressure line connects to the high pressure connection and the low pressure line to the low pressure one.

M = Measuring range
h = Measured height
z = Additional height
K = Compensating height



Measurements at pressure vessels with condensing or non-condensing steam

Measurements at open vessels with the meter installed below the vessel

Measurements in cryogenic services (liquefied gas)

Fig. 3 · Schematic installation arrangements, e.g. liquid level measurement

2.2.1 Shut-off and equalizing valves

It is advisable to install one shut-off valve in each differential pressure line and, in addition, one equalizing valve in a conduit connecting the two lines. Combinations of 3 or 5 valves as valve blocks are available as accessories. They have the function of shutting off the two differential pressure lines and short-circuiting the lines at the indicator to check zero. A valve block with 5 valves allows connection of additional lines for blowing through or flushing out the measuring system. For valve arrangements see Fig. 5.

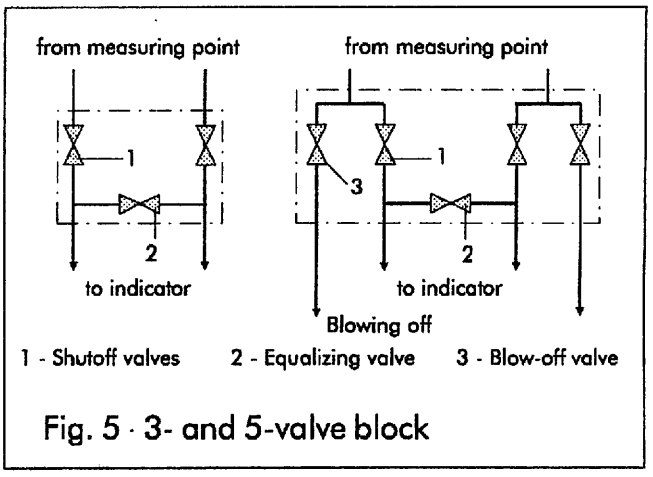


Fig. 5 · 3- and 5-valve block

2.2.2 Condensation chambers

Condensation chambers are necessary for maintaining a constant liquid column when steam is measured. When measuring liquids, they are only necessary when the indicator is located above the measuring point.
In case of gas measurements, condensation chambers are needed as **separation chambers** to collect condensate when the indicator is arranged below the measuring point.

2.3 Electrical connections

Terminal assignment is shown in Fig. 4 or on the PCB.
In order to check the output signal while adjusting zero and span, it is possible to connect an ammeter to the terminals 81 and 82. Prior to this, however, the jumper plugs at the terminals have to be removed.
The supply voltage is, as a rule, 24 V DC. When considering the line resistances, the voltage at the differential pressure transmitter terminals must not fall below 12 V or exceed 45 V DC.
With devices designed for the use in hazardous locations, the regulations for electrical installations according to VDE 0165 must be observed.

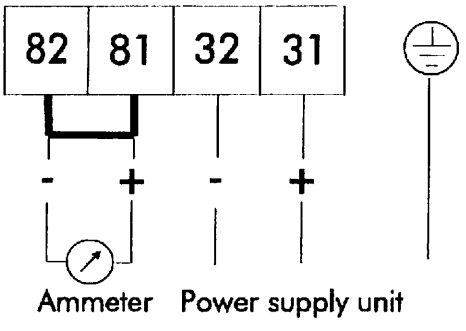


Fig. 4 · Electrical connection

3. Start-up

Slowly open shut-off valves to fill the system. In case of **steam measurement**, remove differential pressure lines below the shut-off valves and the equalizing valve or the valve block and fill pressure chambers with water.
Then, check zero as described in chapter 4.1 and take device into operation again.
When **measuring liquids**, first open the high pressure line. Subsequently, close the equalizing valve or the short-circuit line of the valve block respectively and open the low pressure line. Loosen vent screw at the differential pressure cell to remove the air from the cell. As soon as the air has escaped, tighten plug.
Afterwards, check zero at the pressure cell as described in chapter 4.1 and take device into operation again.

4. Operation

4.1 Checking zero (Fig. 2)

If shut-off and equalizing valves are installed in the differential pressure lines, it is possible to check zero even when the plant is in operation.
First, close shut-off valve on the low pressure side of the device. Then, open equalizing valve and close shut-off valve on the high pressure side, so that a pressure equilibrium occurs in the device. The pointer must indicate zero. If not, readjust zero adjustment screw (2.6) until it does.
In order to take the device into operation, subsequently, open high pressure line, close equalizing valve, and finally slowly but continuously open low pressure line until it is fully open. Now the device is in operation again.
Should a valve block be installed in the system, open the short-circuit line of the valve block and close the high pressure line (open in the opposite order).

4.2 Span — Measuring range

The span of the differential pressure transmitter is determined, on the one hand, by the pressure cell (three versions, differing with respect to diaphragm (1.6) and guide spring (1.9)) and, on the other hand, by the built-in measuring spring (1.5). The respective diaphragm and guide spring models used are indicated on the name plate.
The device comes with a measuring range adjusted as ordered by the customer. At a later date, this range can only be changed within certain limits determined by the built-in measuring spring.
Span is infinitely adjustable to as much as 60 % of the max. span.
If for some reason a different span is necessary, change the measuring spring (1.5). For this purpose, see name plate of the device and the following table.

4.2.1 Adjusting and changing the measuring range (Fig. 2)

The measuring range should be adjusted at the testing stand.
Remove the upper part of housing and apply a pressure to the high pressure side of the pressure cell that corresponds to the desired upper range value.
Then, move feeler roll (2.3) on range plate (2.7) up or down until the pointer (2.5) shows the highest value on the scale.
Remove pressure. Now the pointer must return to zero. Correct zero at the adjustment screw (2.6).
Afterwards, again apply a pressure corresponding to the upper range value to the pressure cell and readjust feeler roll until the pointer indicates the upper range value.
Repeat these adjustments, if necessary, until zero and upper range value correspond to the desired measuring range.

Measuring chamber	Measuring range (mbar)		Measuring spring		
	min.	max.	Wire-Ø mm	Length ±0,1 mm	Order no.
1 Diaphragm 0.4/52 Guide spring 0.5	0 to 40	0 to 60	1.2	34.4	1400-5871
	0 to 60	0 to 100	1.2	32.7	1400-5872
	0 to 100	0 to 160	1.8	32.2	1400-5873
	0 to 160	0 to 250	2.25	32	1400-5874
	0 to 250	0 to 400	2.5	31.9	1400-5875
	0 to 400	0 to 600	2.8	31.7	1400-5876
2 Diaphragm 0.4/70 Guide spring 0.8	0 to 250	0 to 400	2.25	32.4	1400-5879
	0 to 400	0 to 600	2.5	32.2	1400-5880
	0 to 600	0 to 1000	3	31.8	1400-5881
	0 to 1000	0 to 1600	3.4	31.6	1400-5882
3 Diaphragm 0.6/70 Guide spring 0.8	0 to 1600	0 to 2500	3.6	31.6	1400-5885

Part	Designation	Order no.
1.13	Disks	1400-5653
1.15	O-ring 22 x 2 — ECO	8421-0080

4.2.2 Changing the measuring range by replacing the measuring spring
(Fig. 2 and 6)

Adjustments to be made at the testing stand only.

Should a measuring range be necessary that cannot be adjusted with the built-in measuring spring, select the appropriate spring from the following table. Only springs that correspond to the respective pressure cell (see name plate) can be replaced. For this purpose, proceed as follows:
Remove upper part of housing (2.2) and adjust zero at the corresponding adjustment screw (2.6). Remove screws (1.14) and remove spring plate (1.4), guide spring (1.16), measuring spring (1.5), and disk(s) (1.13) from the low pressure side of the pressure cell. Insert new spring (1.5) and fasten spring plate with two screws (1.14). Check zero. Any deviations may be corrected by adding disks of different sizes (order no, see table). For this purpose, the spring plate must be removed each time a new disk is added. Once having set zero, firmly fasten spring plate. Make sure the O-ring (1.15) is located properly. Replace it, if necessary.
Adjust measuring range as described in chap. 4.2.1.

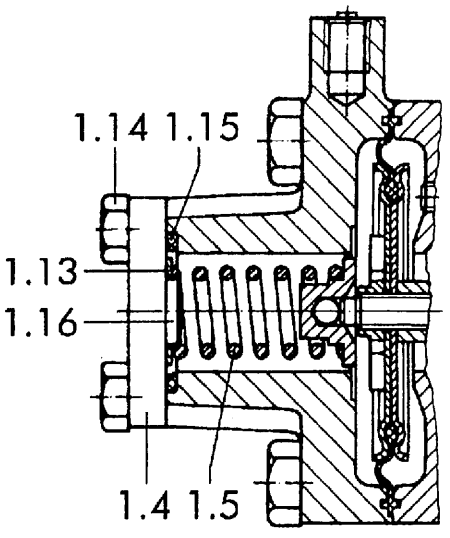


Fig. 6 · Measuring range spring

Note on devices for oxygen (O_2)
Devices suitable for measuring oxygen are identified with a corresponding label:
Oxygen! Keep free from oil and grease!
These models were assembled and flushed by the manufacturer under special operating conditions.
When replacing parts that are in contact with oxygen, e.g. measuring springs, it is absolutely necessary to wear special gloves.

4.3 Adjusting the output signal

4.3.1 Operating direction

For a pointer deflection between 0 and 270° (switch position •), the output signal range (operating direction >> or <>) can be 4 to 20 mA or 20 to 4 mA. This operating direction can be set with a 7-pin plug located on the side below the scale. The symbol on the plug indicates the currently adjusted direction, i.e. >> for 4 to 20 mA or <> for 20 to 4 mA. In order to select the operating direction, remove plug, turn it 180°, and reinstall it.

4.3.2 Adjusting zero and span (Fig. 7)

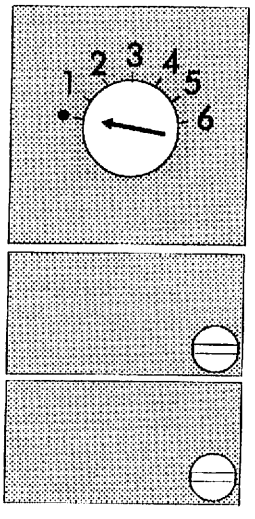
Zero is **fine adjusted** with the potentiometer **P2** (ZERO). It always refers to 4 mA. The **Span** (SPAN) and thus the upper range value can be **preset** in 7 steps at the rotary switch **S1**. The narrowest span corresponds to a pointer deflection of 130° with switch position 6 for 0 to 100 % differential pressure. Each following switch position enlarges the span by the factor 1.11, so that the maximum span corresponds to a pointer deflection of 270°.
Span is **fine adjusted** with the potentiometer **P2** (SPAN). This adjustment always refers to the value 20 mA.

Example:
With an indicator with a pointer deflection range of 0 to 270° for 0 to 100 % differential pressure, the output signal should pass through a range from 4 to 20 mA.
For adjustment of zero and span, connect a suitable power source to the terminals 31 and 32.

In order to check and monitor the output signal, remove the jumpers from the terminals 81 and 82 and connect a suitable ammeter.
At first, install the 7-pin plug to set the proper operating direction. In case of the example described above, the symbol >> must face upwards. If it does not, remove plug, turn it 180°, and reinstall it.

Adjusting zero:
Move pointer to zero (lower range value) by establishing a pressure equilibrium in the high and low pressure chamber. If necessary, correct zero at the zero adjustment screw (see chap. 4.1).
Correct the output signal at the potentiometer **P2** (ZERO) until the ammeter shows 4 mA.

Adjusting span:
Move pointer to the upper range value, either manually or by applying the corresponding differential pressure. Then, select the related range with the rotary switch **S1** (point-position at 270° pointer deflection).
Correct the output signal at the potentiometer **P1** (SPAN) until the ammeter shows 20 mA.
Since the adjustments of zero and span slightly influence each other, readjust them at the potentiometers until both values are correct.



Rotary switch S1 - Pointer deflection

• = 260 ... 270°
1 = 235 ... 260°
2 = 210 ... 235°
3 = 190 ... 210°
4 = 170 ... 190°
5 = 150 ... 170°
6 = 130 ... 150°

P1
SPAN

Potentiometer

P2
ZERO

Fig. 7

5. Connection accessories

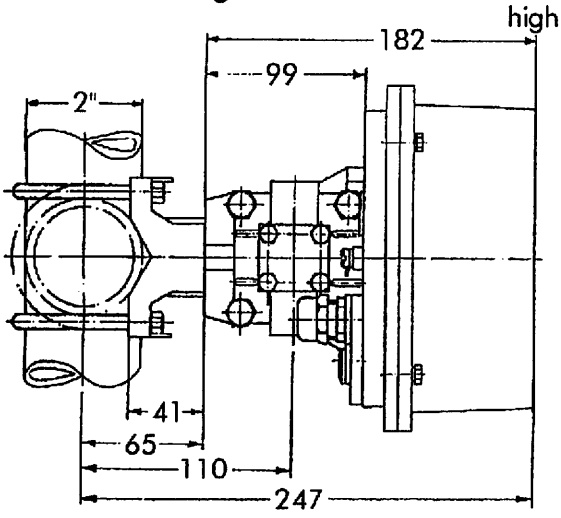
The devices are supplied without tube connections. Any necessary cutting ring connectors, screw or vent plugs as well as throttles for damping of any oscillations caused by the process medium (especially in case of gas measurements) must be ordered separately.

Number	Designation	Order no.	
		standard	washed for O_2
2	Connections for tube 12 Ø, steel	1400-5842	1400-5843
2	Connections for tube 12 Ø, stainless steel	1400-5844	1400-5845
2	Connections for tube 10 Ø, steel	1400-5846	1400-5847
2	Connections for tube 8 Ø, steel	1400-5860	1400-5861
2	Connections for tube 12 Ø, with throttle, steel	1400-5848	1400-5849
2	Connections for tube 8 Ø, with throttle, steel	1400-5850	1400-5851
2	Connections for tube 6 Ø, with throttle, steel	1400-5852	1400-5853
2	Connections with throttle (Special version for liquefied gas measurements)	—	1400-5858
2	Vent plugs, brass, with gaskets	1400-5654	1400-5658
2	Screw plugs, brass, with gaskets	1400-5655	1400-5659
1	Screw plug (half set), brass, with gasket	1400-5662	1400-5663
4	Gaskets	1400-5660	1400-5661
1	Mounting part for tube mounting	1400-5656	

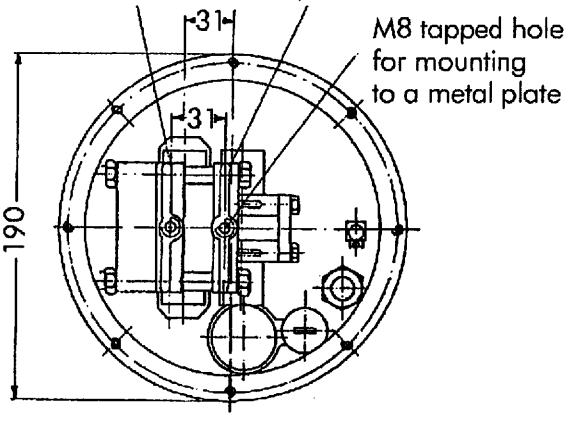
6. Dimensions in mm

Tube mounting — with mounting device and clamp for mounting to a horizontal or vertical 2"-tube.
Indicator with anti-burst device in the rear cover.
Wall mounting — without mounting part for attachment to a sheet metal plate or with mounting part for attachment to a wall.
Panel mounting — on option with 4 screws M5 or countersunk screws (M4 DN 963) and hexagon nuts M4.

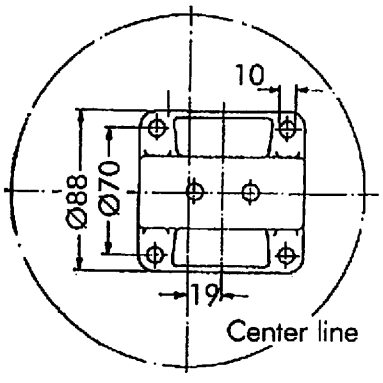
Tube mounting

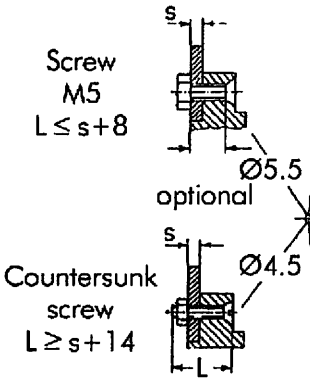


Process medium connections ISO 228/1-G3/8
high pressure connection
low pressure connection

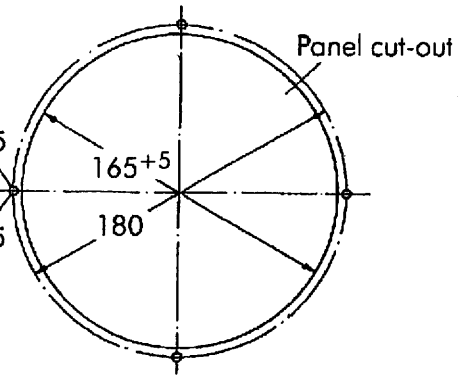


Wall mounting





Panel mounting



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(1) KONFORMITÄTSBESCHEINIGUNG

(2) PTB Nr. Ex-92.C.2019

(3) Diese Bescheinigung gilt [illegible]

Durchflußmesse[illegible] 5014-1.....

(4) der Firma [illegible]son AG
[illegible]6000 Fran[illegible]

(5) Die Bau[illegible]s elektr[illegible]n Betriebsmittels sowie die verschiedenen zulässigen Aus[illegible]ungen sind in der A[illegible] zu dieser Konformitätsbescheinigung festgelegt.

(6) Die [illegible]lisch-Techn[illegible]e Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 de[illegible]htlinie de[illegible] der Europäischen Gemeinschaften vom 18. Dezember 1975 (76/117/EWG) die [illegible]stimmung dieses elektrisch[illegible]etriebsmittels mit den harmonisierten Europäischen Normen

Elektrisc[illegible]ittel für exp[illegible] Bereiche

EN [illegible] 014:1977 [illegible]...A5 (VDE 0170/0171 Te[illegible]) Allgemeine Bes[illegible]ungen
EN [illegible]020:1977 [illegible]1...A2 (VDE 0170/0171 Te[illegible]87) Eigensicherh[illegible]"

nachdem d[illegible]triebsmitt[illegible]mit Erfolg einer Bauartprüfung [illegible] wurde. Die E[illegible]se dieser Bauartprüfun[illegible] in einem [illegible]rotoko[illegible]elegt.

(7) Das Betriebsm[illegible] mit dem [illegible] Kennzeichen zu versehen:

EEx ib IIC T6

(8) Der Hersteller ist da[illegible]antwortlich, daß jedes derart gekennzeichnete Be[illegible]mittel in seiner Bauart mit den in der Anlage [illegible]gen übereinstimmt und daß die vorgeschriebenen [illegible]

(9) Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6. Februar 1979 (79/196/EWG) gekennzeichnet werden.

Im Auftrag

A. Gruber
Techn.-Regierungsamtmann

Braunschweig, 23.03.1992

Prüfbescheinigungen ohne Unterschrift und ohne Dienststempel haben keine Gültigkeit.
Die Bescheinigungen dürfen nur unverändert weiterverbreitet werden.
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V 15-320007 · 12.86

V 13-733 320 17-7.88

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ANLAGE

zur Konformitätsbescheinigung PTB Nr. Ex-92.C.2019

Der Durchflußmesser Typ 5014-1..... dient zur Messung, Anzeige und Erfassung von Flüssigkeits-, Dampf- oder Gasmengen, die sich aus einer Differenzdruckmessung ableiten lassen.

Die Zuordnung zwischen maximal zulässiger Umgebungtemperatur und Temperaturklasse ist der folgenden Tabelle zu entnehmen.

Temperaturklasse	T6	T5
max. Umgebungstemperatur	60 °C	70 °C

Elektrische Daten

Signalstromkreis ..... (Klemmen 31 und 32) in Zündschutzart Eigensicherheit EEx ib IIC
nur zum Anschluß an bescheinigte eigensichere Stromkreise mit folgenden Höchstwerten:
U_o = 28 V
I_K = 115 mA
P = 1 W
Die wirksame innere Induktivität und Kapazität sind vernachlässigbar klein.

Prüfbuchse .... (Klemmen 81 und 82) nur zum kurzzeitigen Anschluß an erdfreie Prüfinstrumente ohne eigene Energiequelle.

Prüfungsunterlagen	unterschrieben am
1. Beschreibung (37 Blatt)	10.04.1991
2. Zeichnung Nr. 5014-1...R	10.04.1991
1150-6734 R	10.04.1991
1150-6732 R	10.04.1991
1150-6733 S	10.04.1991
1150-6735 S	10.04.1991
1150-6822 T	10.04.1991
1150-6820 T	10.04.1991
1150-6821 T	10.04.1991
1150-6823 T	10.04.1991
1150-6014 T - 1	10.04.1991
1150-6016 T - 3	10.04.1991
1150-6926 S	12.09.1991

Im Auftrag

A. Gruber
Techn.-Regierungsamtmann

Braunschweig, 23.03.1992

Blatt 1/1

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · D-60314 Frankfurt am Main
Postfach 10 19 01 · D-60019 Frankfurt am Main
Telefon (0 69) 4 00 90 · Telefax (0 69) 4 00 95 07

EB 9525 E