1. Design and principle of operation
The instrument is used for measuring the differential pressure, the flow rate and the liquid level in industrial plants and building services. When used in conjunction with an orifice plate as differential pressure pick-up, the instrument indicates the flow rate.
The Media 4 Indicator consists essentially of the differential pressure cell with measuring diaphragm and measuring spring, and the indicating unit with pointer mechanism and scale. For application as flowmeter in addition to the indicating instrument, an orifice plate assembly (orifice flange or orifice tube) is necessary. In addition, accessories such as condensation chambers, shut-off valves or valve blocks (multi-way single spindle valves) can be used.

Edition November 1993

Mounting and operating instructions

EB 9505 E
The differential pressure $\Delta p = p_1 - p_2$ produced by the orifice plate creates a force on the measuring diaphragm (1.6) which is balanced by the measuring spring (1.5). The deflection of the diaphragm (1.6) and the lever (1.11), which is proportional to the differential pressure, is transferred from the pressure cell to the flexible gasket (1.12) and transmitted to the gear mechanism via the range plate (2.7) and the adjustable feeler roll (2.3). The indication for the flow rate $Q$ to 100 % is quadratic due to the relationship of the flow rate $Q$ and the differential pressure $\Delta p$ according to the equation:

$$Q = K \cdot \sqrt{\Delta p}$$
2. Installation

2.1 Arrangement of the equipment

The basic arrangement of the equipment used is shown in the schematics below. The decision whether the flowmeter is to be fastened above or below the point of measurement or whether condensation chambers are to be installed depends on the type of process fluid and on the site conditions. The installation schematics show the normal and the reversed installation position. Normal installation is preferred; only when there is no other choice, especially in steam measurements, reversed installation should be employed. It is recommended to consult the VDE/VDI Regulation 3512, Sheet 1, for further details.

In liquid level measurements according to the bottom left-hand schematic 1, the additional height "z" is included in the measurement; therefore, it must be kept to a minimum. The dimension "K" (compensating height, schematic 2) may be selected to suit the installation conditions.

Fig. 3 - Installation schematics
2.2 Orifice plate assembly
(Orifice flange or orifice tube)

The direction of flow must correspond to the
attached arrow. An undisturbed length of
straight pipe is required upstream and down-
stream from the orifice plate assembly (see
Fig. 4 and 5). The orifice tubes supplied have
these pipe runs welded on. In the case of or-
ifice flanges, the smooth length of pipe up-
stream from the orifice plate is indicated in the
confirmation of order. The orifice plate as-
semblies and the gaskets must not be displaced
eccentrically relative to the piping.

Control valves that continuously vary the con-
dition of the process fluid, e.g. manually op-
erated control valves or temperature controllers,
must not be installed upstream of the orifice
plate assembly. The actual condition should
 correspond to the calculated condition as
closely as possible. On the other hand, con-
trollers that keep the condition constant, e.g.
pressure controllers upstream from the meas-
uring facility, exercise a favourable influence.

2.3 Differential pressure lines

The differential pressure lines should have
tubes with an OD of 12 mm, the arrange-
mament should be carried out according to Fig. 3
and Fig. 6. For good sealing of the pressure lines,
compression-type connections should be used
(section 5). Pipe runs that would normally be
installed horizontally should be mounted with
a steady slope of not less than 1:20, i.e. sloping
downward from the orifice plate or from
the point that allows venting.

The minimum bending radius shall not be less
than 50 mm.

Before the differential pressure lines are con-
connected to the instrument they shall be flushed
thoroughly.

2.4 Media 4 Indicator

Prior to installation, compare the operating
data with that of the differential pressure pick-
up. Make sure that the high pressure line is
connected to the high pressure connection

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Fig. 4 - Orifice flange Type 90

Fig. 5 - Orifice tube Type 91

Dimensions orifice tube

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>DN</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>32</th>
<th>40</th>
<th>50</th>
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</thead>
<tbody>
<tr>
<td>Overall length</td>
<td>$L$</td>
<td>550</td>
<td>700</td>
<td>900</td>
<td>1100</td>
<td>1300</td>
<td>1500</td>
</tr>
<tr>
<td>Inlet length</td>
<td>$L_1$</td>
<td>381</td>
<td>501</td>
<td>651</td>
<td>801</td>
<td>1001</td>
<td>1201</td>
</tr>
<tr>
<td>Mounting ring Diameter D</td>
<td>$D$</td>
<td>89</td>
<td>92</td>
<td>99</td>
<td>119</td>
<td>129</td>
<td>139</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. kg</td>
<td>4.0</td>
<td>4.5</td>
<td>5.5</td>
<td>8.5</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

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Fig. 6 - Arrangement of dif-
ferential pressure lines on or-
ifice plate assembly

For gas
For steam
For liquids

4
and that the low pressure line is connected to the low pressure connection.

**Attention:** For connecting the differential pressure lines, compression-type connections are necessary. Moreover, the free process fluid connections of the differential pressure cell must be closed by screw or vent plugs (see accessories section 5).

Prior to connecting the differential pressure lines, clean the connections carefully. Under no circumstances must the instrument be flushed with compressed air or pressurized water.

At the point of installation, fasten the instrument to the pipe, wall or mounting plate free of vibrations. For mounting on vertical or horizontal pipe, use the mounting device with clamp; for wall mounting, use mounting device without clamp (see dimension drawing section 6).

For panel mounting (panel cutout Ø 170, min. Ø 165, hole circle Ø 180 mm). Unscrew closing cover and fasten rear cover with measuring cell to panel using four countersunk screws M4.

2.5 Accessories

2.5.1 Shut-off and equalizing valve

We recommend that both a shut-off valve and also an equalizing valve be installed in the differential pressure lines. Three or five valves can be combined in a valve block as accessories, used to shut off the two differential pressure lines and for the short-circuit switch on the indicating unit for checking the zero point. For a valve block containing five valves, additional lines can be connected for blast and flushing the measuring system (see Fig. 7 for valve arrangement).

2.5.2 Condensation chambers

Condensation chambers for forming a constant liquid column are required for measuring steam. For liquids, these are only required if the indicating unit is mounted above the point of measurement.

These are required for measuring gas as separation chambers to cut off condensate whenever the indicating unit is mounted below the point of measurement.

3. Start-up

3.1 Steam flow measurement

The steam should not directly contact the measuring diaphragm of the instrument. Therefore, unscrew the differential pressure lines below the shut-off valve or valve block in the closed position, and fill the instrument with water.

Or, after starting the system (steam applied) and, with the shut-off valve or valve block, wait approximately 20 minutes until condensate fills the differential pressure lines above the valve up to the orifice. First open the high-pressure line, then close the equalizing valve or valve block bypass and open the lower-pressure line. Wait a short period of time, then open the vent plugs of the measuring cell one after the other until condensate escapes free of bubbles and screw plugs tight again. In the same manner, vent condensation chamber. Slightly tapping against the casing of the flowmeter or the condensation chamber facilitates the escape of air.

Subsequently check zero adjustment as described in section 4.1 and place the instrument into service again.

**Note:**

In the case of reversed installation, i.e. measuring instrument installed above the point of measurement, the pressure lines may drain partly when pressure is removed from the system. Upon new plant start-up, the measuring system will have to be vented so that it fills up again with condensate.

3.2 Liquid flow measurement

Place the instrument into service by slowly opening the multi-way single-spindle valve. If a valve block is installed instead of a single-spindle valve, first open the high pressure pipe, then close the valve block by-pass and open the low pressure pipe. Open the vent plugs of the measuring cell until the air has escaped; then tighten the plugs again.

Subsequently check zero adjustment at the measuring cell as described in section 4.1 and place the instrument into service again.
4. Operation

4.1 Check zero adjustment (Fig. 2)

If the differential pressure lines are provided with shut-off and equalizing valves, the zero point can also be checked when the system is being operated.
First close the shut-off valve on the low-pressure side, then open equalizing valve and then close shut-off valve on the high-pressure side, producing a pressure balance in the instrument. The pointer must be positioned at zero. Otherwise, adjust the zero adjustment screw (2.6) until the zero position is reached.
To place into service, consequently first open the high-pressure line and then close the equalizing valve. Finally, slowly, but evenly, open the low-pressure line until it stops. The instrument is in service again.
If a valve block is installed, open the valve block bypass and close the high-pressure line (open in reverse order).

4.2 Draining

In gas flow measurements, condensate must be drained from the condensing chamber from time to time. Prior to opening the drain plugs, close the valves in the differential pressure lines (valve block).

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4.3 Adjustment of measuring span/measuring range

The measuring span of the differential pressure flowmeter is determined by the measuring cell (three versions, different measuring diaphragms (1.6) and guide spring (1.9) on the one hand, and by the measuring spring (1.5) installed on the other hand. The version of the measuring diaphragm and guide spring are printed on the nameplate.
The instrument is set by the manufacturer to the measuring range specified in the order, and the measuring range can be changed subsequently only within the range permitted by the measuring spring installed.
The measuring span can be adjusted continuously up to 60% of the maximum measuring span. When a different span is to be adjusted, the measuring spring (1.5) must be exchanged. See instrument serial plate and Table 3.

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

Adjustment should preferably be made on the test bench.
Unscrew the casing front section and apply a pressure to the measuring cell that corresponds to the required upper range value. Then adjust the feeler roll (2.3) at the measur-

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<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>Measuring range (mbar)</th>
<th>Measuring spring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min.</td>
<td>max.</td>
</tr>
<tr>
<td>Diaphragm 0.4/52</td>
<td>0 to 40</td>
<td>0 to 60</td>
</tr>
<tr>
<td>Guide spring 0.5</td>
<td>0 to 100</td>
<td>0 to 100</td>
</tr>
<tr>
<td></td>
<td>0 to 160</td>
<td>0 to 160</td>
</tr>
<tr>
<td></td>
<td>0 to 250</td>
<td>0 to 400</td>
</tr>
<tr>
<td></td>
<td>0 to 400</td>
<td>0 to 600</td>
</tr>
<tr>
<td></td>
<td>0 to 250</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Diaphragm 0.4/70</td>
<td>0 to 250</td>
<td>0 to 400</td>
</tr>
<tr>
<td>Guide spring 0.8</td>
<td>0 to 400</td>
<td>0 to 600</td>
</tr>
<tr>
<td></td>
<td>0 to 600</td>
<td>0 to 1000</td>
</tr>
<tr>
<td></td>
<td>0 to 1000</td>
<td>0 to 1600</td>
</tr>
<tr>
<td>Diaphragm 0.6/70</td>
<td>0 to 1600</td>
<td>0 to 2500</td>
</tr>
<tr>
<td>Guide spring 0.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part</th>
<th>Designation</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.13</td>
<td>Washers</td>
<td>1400-5653</td>
</tr>
<tr>
<td>1.15</td>
<td>O-ring 22 x 2 — ECO</td>
<td>8421-0080</td>
</tr>
</tbody>
</table>
ing range plate (2.7) upwards and downwards until the pointer (2.5) is on the full scale value. Remove the pressure; the pointer must return into the zero position; correct zero point with the adjuster (2.6). Apply again full load (upper range value) to the measuring cell and readjust feeler roll again until the pointer is on the scale end point. If necessary, repeat the adjustment procedure until zero point and end point correspond to the desired measuring range.

4.3.2 Changing the measuring range by exchanging the measuring spring
(Fig. 2 and 9)
Adjustment must be made on the test bench only.
If the measuring range is to exceed that of the built-in measuring spring, the measuring spring required shall be selected from the Table 3. Only the springs suiting the existing measuring cell (see serial plate) can be exchanged. Proceed as follows:
Unscrew closing cover (2.2) and set zero point with adjusting screw (2.6). Loosen screws (1.14) and remove the spring plate (1.4), spring guide measuring spring (1.5) and washer(s) (1.13) from the low pressure side of the measuring cell. Install a new spring (1.5) and fasten spring plate with two screws (1.14). Check zero position, correct deviation by installing washers of different thickness (for order number, see Table 3). For this purpose, the spring plate must be removed each time. When zero position is obtained, screw on the spring plate firmly; check O-ring (1.15) for proper position and replace, if necessary.
Adjust the measuring range as described in paragraph 4.3.1.

Note:
When the measuring range, which in flow measurements corresponds to the differential pressure, is changed, note that the flow rate reading also changes. In this case, a recalculation is required. Also, the aperture ratio
\[ m = \frac{d^2}{D^2} \]
of the orifice must be taken into consideration.

Note on O2-versions
Flowmeters used for O2 measurement must be free from any oil and grease (see label). These versions are assembled under special conditions and have been washed afterwards.
IMPORTANT
Use gloves when exchanging parts which have contact with oxygen (e.g. measuring springs).
5. Connection accessories

The instruments are delivered without process fluid connections. Required pressure-type connections, screw- and vent plugs or throttles for damping of any oscillations by the measured medium (specially for gas measurement) must be ordered separately.

<table>
<thead>
<tr>
<th>Q'ty</th>
<th>Designation</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 12 Ø, steel</td>
<td>1400-5842</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 12 Ø, stainless steel</td>
<td>1400-5844</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 10 Ø, steel</td>
<td>1400-5846</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 8 Ø, steel</td>
<td>1400-5860</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 12 Ø, with throttle, steel</td>
<td>1400-5848</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 8 Ø, with throttle, steel</td>
<td>1400-5850</td>
</tr>
<tr>
<td>2</td>
<td>Connections for tube 6 Ø, with throttle, steel</td>
<td>1400-5852</td>
</tr>
<tr>
<td>2</td>
<td>Special connections with throttle</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(version for comp. messer)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Vent plugs, brass, with gaskets</td>
<td>1400-5654</td>
</tr>
<tr>
<td>2</td>
<td>Screw plugs, brass, with gaskets</td>
<td>1400-5655</td>
</tr>
<tr>
<td>1</td>
<td>Screw plug (half set), brass, with gasket</td>
<td>1400-5662</td>
</tr>
<tr>
<td>4</td>
<td>Gaskets</td>
<td>1400-5660</td>
</tr>
<tr>
<td>1</td>
<td>Mounting device for tube mounting</td>
<td>1400-5656</td>
</tr>
</tbody>
</table>
6. Dimensions in mm

Tube mounting — with mounting device and clamp for attachment to a horizontal or vertical 2" tube.
Body with burst protection in the rear wall of the indicating unit casing.
Wall mounting — without mounting device for attachment to a sheet plate or, with mounting device, for attachment to a wall.
Panel mounting — optionally with four screws M5 or countersunk screws (M4 DIN 963) and hexagonal nut M4.

Tube mounting

Wall mounting

Panel mounting

Process fluid connections

(+)-high pressure connection

(-)-low pressure connection

M8-threaded holes for fastening to a sheet plate

Center line of the indicating unit