



Figure 1 TM Gardex flow meter

Application

The TM Gardex flow meter is a robust device for measuring and monitoring the flow of liquid and gaseous media in any flow direction. The measured value is indicated on a scale, and is optionally available via contact switches or a current output. Standard scales are available for liquids with a density of 1 kg/l (62.43 lbs/cu.ft). The accuracy corresponds to $\pm 3\%$ of the full-scale value. When selecting the size, it is recommendable for the normal flow (operating point) to be approx. 75% of the maximum flow listed in Table (see 9 Technical data).

Special Features

- Product scale for liquids and gases
- Simple installation resulting from rugged sandwich design
- Can be optionally fitted with limit contact and remote transmitter.

Design and Mode of Operation

The sensor of the TM Gardex flow meter consists of a baffle plate with balance beam and operates according to the TM Gardex, design deflection method (Figure 2).

The baffle plate (b) causes a back-pressure in the medium, and the balance beam (c) is deflected. This movement is transmitted via the beam to the indicator mechanism (e) using a bellows bushing (d). A gear unit (f) converts the deflection of the balance beam into a rotary movement of the pointer (h).

The pointer movement is damped by an eddy-current brake (g). The bellows bushing isolates the measured medium from the display unit.

Connection and Installation Instructions

The flow meter can be used for any flow direction and in any mounting position. However, because of the possibility of contamination of the bellows, installation with the indicator pointing downwards should be avoided. The desired flow direction must already be specified when ordering so that the weight of the sensor (baffle plate) can be taken into consideration in the calibration. Subsequent changing of the flow direction may result in larger inaccuracies and may necessitate a subsequent correction of the zero point.

The calibration is carried out at defined conditions of the medium. Deviations in the density, pressure or temperature of gases, or changes in the density or viscosity of liquids, result in errors. It is therefore essential to observe the calibration conditions which are specified on the scale. Therefore the measured medium, density and viscosity at operating temperature and pressure must be specified when ordering. With gases, it is additionally necessary to specify the exact pressure reference point (pressure above atmospheric or absolute pressure).

To avoid oscillations of the baffle plate when measuring gases, the full static pressure must be applied to the device. The valve must therefore be installed downstream of the flow meter. The position of the valve is unimportant when measuring liquids. The recommended inlet and outlet pipe sections must always be provided.

The ring (sandwich design) is installed, centred and screwed tight together with the corresponding gaskets between two flanges of the pipeline. The arrow on the device indicates the flow direction for the medium.

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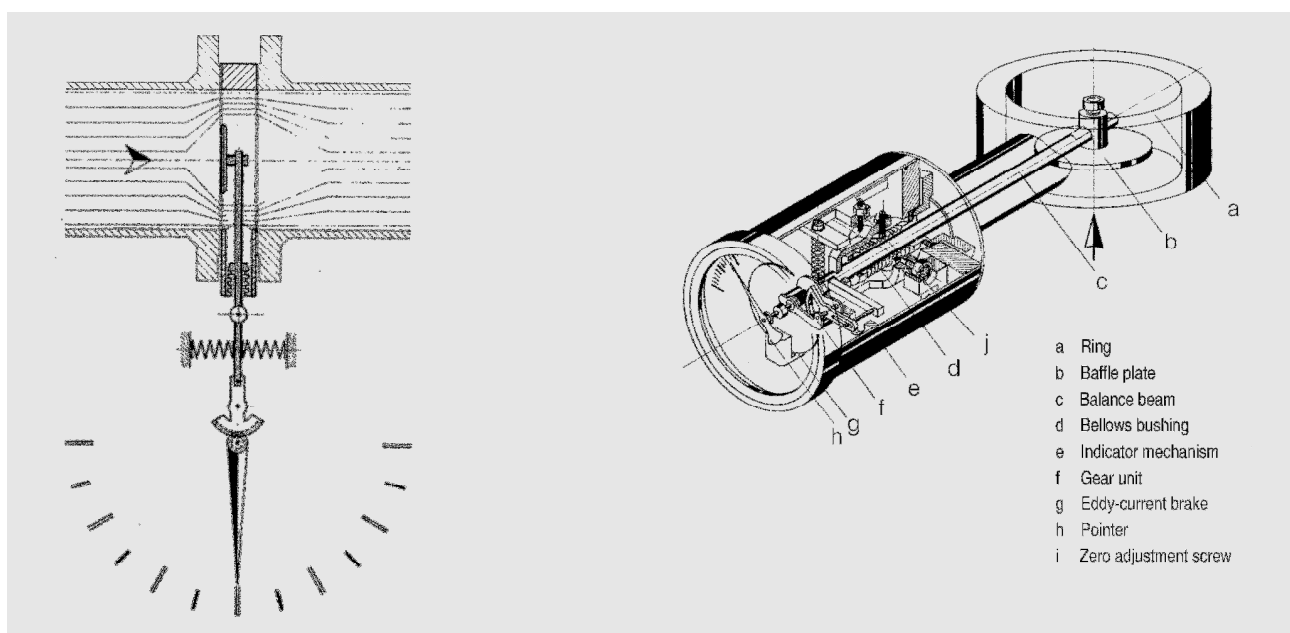


Figure 2 TM Gardex, design

Contact Assembly

Various contacts/remote transmitters are available:

- Magnet spring contacts as twin contacts
- Inductive contacts as single or twin contacts
- Current output.

Maintenance

No maintenance work is necessary.

Zero Correction

A corresponding correction can be made if the pointer zero is offset (e.g. resulting from a changed mounting position). The flow meter need not be dismantled to do this.

Remove the housing cover to the front by loosening the three screws and rotating. You can then adjust the zero point using the screw (j, Figure 3). It is recommendable to first bring the pointer into a positive indication, and to then turn it back until it rests properly on the limit pin.

It is recommendable to subsequently check the function. To do this, apply a flow to move the indicator up to 60 to 100 %. Alternatively, you can press in the bushing rod. With a zero flow, the pointer must again rest on the limit pin.

Note of Application

The operator of these measuring instruments is responsible for suitability, proper use and corrosion resistance of the used materials with regard to the measuring material. It must be ensured that the materials selected for the flow meter parts in contact with the medium are suitable for the used process media.

The flow meter may only be used within the pressure and voltage limits specified in the operating instructions. Before replacing the measuring tubes, check that the unit is free of hazardous media and pressures. Provide a touch guard for surface temperatures of >70 °C. This touch guard must be designed in a way that the max. allowable ambient temperature on the unit is not exceeded. The flow meter meets the requirements of the PED 97/23/EG, article 3, paragraph 3. Only use for gases of fluids group 1.

The max. allowable pressure for the nominal diameters DN 25 up to DN 150 is 10 or 16 bar, for the nominal diameter DN 200 10 bar, for the nominal diameter DN 250 6 bar and for the nominal diameter DN 300 4 bar.

Technical Data

Measuring principle	Baffle plate	
Input		
Measuring range	see table on page 4	
For liquids	0.4 to 1.350 m ³ /h / 1.76 to 5944 USgpm	
For gases	12 to 40.500 m ³ /h / 53 to 178.322 USgpm	
Dynamic range	1 : 5	
Dimension of measured variable	m ³ /h	
Max. permissible pressure		
DN 25 to DN 150 (1 to 6 inch)	16 bar (232 psi)	
DN 200 / 8 inch	10 bar (145 psi)	
DN 250 / 10 inch	6 bar (87 psi)	
DN 300 / 12 inch	4 bar (58 psi)	
Option: ANSI B 16.5		
Rated operation conditions		
Mounting position	vertical or horizontal	
Flow direction	no limitations	
Inlet and outlet pipe sections		
DN 25 to DN 150 / 1" to 6"	at least 5 D (with v <2.5 m/s (8.2 ft/s)). otherwise 10 D	
DN 200 to DN300 / 8" to 12"	at least 10 D (with v <2.5 m/s (8.2 ft/s)). otherwise 20 D	
Medium conditions		
Accuracy	±3 % of full-scale value; ±5 % of full-scale value with magnet spring contact and electric remote transmitter	
Temperature of medium	dependent on gasket material and version	
Standard version	≤90 °C / 194 °F	
With temperature shield	≤101 to 250 °C / ≤ 266 to 482 °F	
Viscosity limits		
Q _{max} [m ³ /h]	Q _{max} [USgpm]	Viskosität [mPa · s]
≤0.1	≤0.44	1.0
>0.1 to 0.5	>0.44 to 2.2	1.0 to 3.0
>0.5 to 3	>2.2 to 13	1.0 to 5.0
>3 to 10	>13 to 44	1.0 to 8.0
>10 to 25	>44 to 110	1.0 to 10
>25 to 50	>110 to 220	1.0 to 15
>50 to 100	>220 to 440	1.0 to 25
>100	>440	1.0 to 50
Design		
Ring connection	DN 25 to DN 300: DIN 2501 1" to 12": ANSI B 16.5 RF	
Material		
Indicator housing	Stainless steel Mat.-No. 1.4301 /304	
Ring and transverse pipe, baffle plate, balance beam, bellows and gasket	see table on page 4	
Degree of protection (indicator unit)		
Standard design	IP65	
Version with contact/remote transmitter	IP54	
Weight	see table on page 4	
Certificates and approvals		
Classification according to PED 97/23/EC	for gases of fluid group 1 and liquids of fluid group 1; complies with requirements of article 3, paragraph 3 (sound engineering practice SEP)	

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Switching principle	magnet spring contact, twin contact
Connection	PG 9
Hysteresis	±3% of full-scale value
Degree of protection	IP 54
Ambient temperature	-20 to +70 °C (-4 to 158 °F)
Max. switching frequency	5/min
Max. rating	AC 250 V / 1 A / 50 VA DC 250 V / 1 A / 30 W rating data apply to resistive loads; a suppressor circuit is required for inductive loads

Switching principle	inductive contact, single contact, twin contact as option
Connection	PG 9
Rated voltage	DC 8V
Degree of protection	IP 65
Self-inductance	100 µH
Self-capacitance	30 nF
Ambient temperature	
Without EX protection	-20 to +70 °C (-4 to 158 °F)
With Ex protection T6	-20 to +55 °C (-4 to 131 °F)
Ex approval	Eex ia IIC T6

Switching principle	rotation angle transmitter (see Figure 3)
Connection	appliance plug with PG7
Rated voltage	DC 24V (-5 to +25%)
Self-capacitance	1 µF
Short-circuit current	max. 100mA
Output, three-wire system	0 to 20mA or 4 to 20mA
Load at 24 V	max. 750Ω
Ambient temperature	-20 to +80 °C (-4 to 176 °F)
Ex approval	none
Remark	to comply with EN 50082-2 (EMC), a screened cable must be used which is earthed at one end

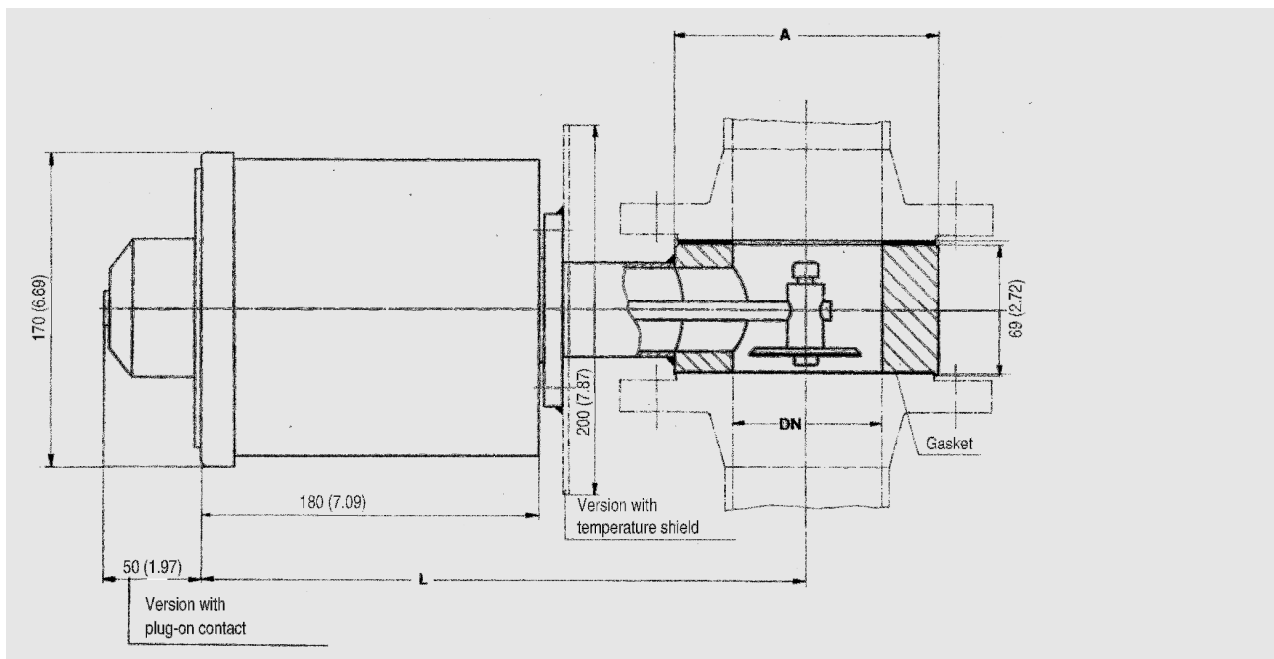


Figure 3 TM Gardex, dimensions in mm (inch)

Measuring Ranges, Pressure Losses and Dimensions (Liquids and Gases)

Nom. diameter of pipe	Full-scale value for water [m ³ /h]			Full-scale value for air [m ³ /h]			min. inlet pressure [bar]	Pressure loss *) [mbar]	PN 10/16 Dimensions [mm]	
DN	Measuring range			Measuring range					L	A
	small	medium	large	small	medium	large				
25	2	4	6	60	120	180	0.6	270 - 380	280	71
40	3	9	15	90	270	450	0.5	100 - 250	295	92
50	9	27	45	270	810	1350	0.4	50 - 150	305	106
65	12	36	60	360	1080	1800	0.4	50 - 150	315	126
80	18	54	90	540	1620	2700	0.4	50 - 150	325	142
100	30	90	150	900	2700	4500	0.4	50 - 150	330	162
125	55	160	270	1650	4875	8100	0.4	50 - 150	345	192
150	70	205	345	2100	6225	10350	0.3	40 - 120	365	217
200	120	360	600	3600	10800	18000	0.3	40 - 120	390	273
250	200	585	975	6000	17625	29250	0.3	40 - 120	425	327
300	270	810	1350	8100	24300	40500	0.3	40 - 120	450	377 (PN 10) 385 (PN 16)

Measuring Ranges, Pressure Losses and Dimensions (Liquids and Gases)

Nom. diameter of pipe	Full-scale value for water [Usgpm]			Full-scale value for air [Usgpm]			min. inlet pressure [psi]	Pressure loss *) [psi]	PN 10/16 Dimensions [inch]	
inch	Measuring range			Measuring range					L	A
	small	medium	large	small	medium	large				
1	8,8	17,6	26	264	528	793	8.7	3.9 - 5.5	11.02	2.80
1½	13,2	40	66	396	1189	1981	7.25	1.45 - 3.6	11.61	3.62
2	40	119	198	1189	3566	5944	5.8	0.73 - 2.2	12.01	4.17
2½	53	159	264	1585	4755	7925	5.8	0.73 - 2.2	12.40	4.96
3	79	238	396	2378	7133	11888	5.8	0.73 - 2.2	12.80	5.59
4	132	396	660	3963	11888	19814	5.8	0.73 - 2.2	12.99	6.38
5	242	704	1189	7265	21465	35664	5.8	0.73 - 2.2	13.58	7.56
6	308	903	1519	9246	27409	45571	4.4	0.58 - 1.74	14.37	8.54
8	528	1585	2642	15851	47552	79254	4.4	0.58 - 1.74	15.35	10.75
10	881	2576	4293	26418	77603	128788	4.4	0.58 - 1.74	16.73	12.87
12	1189	3566	5944	35664	106993	178322	4.4	0.58 - 1.74	17.72	14.84 (PN 10) 15.16 (PN 16)

Standard measuring ranges for liquid (p = 1 kg/l (62.43 lbs/cu.ft), viscosity 1 mPa s (1 cp)) and air (Pe= 0 bar above atmospheric, T = 0 °C (32 °F)) (dynamic range 1:5) *) The pressure loss defines the range from the small to the large measuring range.

TM Gardex Versions

Version	Type 1	Type 2	Type 3	Type 4	Type 5
Ring / transverse pipe	Steel	Stainless steel		Steel	
	DN 25 to 40 (1 to 1½") ST-37	Mat.-No. 1.4571/316Ti	DN 25 to 40 (1 to 1½")	ST-37	
	DN 50 to 65 (2 to 2½") ST-52.3		DN 50 to 65 (2 to 2½")	ST-52.3	
	DN 80 (3") and above ST-37		DN 80 (3") and above	ST-37	
Liner			Hard rubber		Hastelloy C
Baffle plate, balance beam, bellows	Stainless steel, Mat. No. 1.4571/316Ti		Stainless steel, Mat No. 1.4571/316Ti	Hastelloy C	Hastelloy C
Gasket (between transverse pipe flange and cast housing)	Perbunan up to 90 °C (194 °F) Viton up to 160 °C (320 °F) Klinger SIL C 4500 up to 250 °C (482 °F)		Perbunan up to 90 °C (194 °F) Viton up to 90 °C (194 °F)		PTFE up to 160 °C (320 °F)