



Thermal Mass Flow Meter for Gases



measuring
•
monitoring
•
analysing



- Direct mass flow rate measurement of gases
- Measuring accuracy: $\pm 1.0\%$ f. s. + 0.5% m. v.
- p_{\max} PN 16, t_{\max} 175 °C
- Fast response time
- No moving parts
- Analogue output and alarm contact



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Model:
KES



Field of application

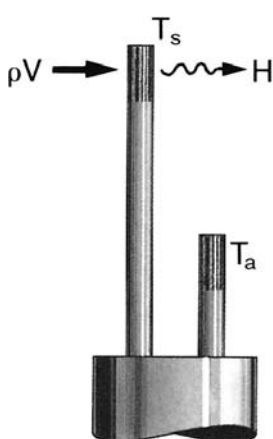
The KES type series thermal mass flow meters measure the flow of gases, independent of variations in process pressure and temperature.

The flow meters are available in different versions for pipe nominal sizes from 1/4" to DN 200, pressures up to 16 bar and gas temperatures up to 175 °C.



Theory of operation

The KES probe consists of 2 sensors: a temperature sensor for sensing gas temperature, and a sensor for measuring flow velocity. This sensor element is heated by the control electronics to a constant temperature difference with respect to the medium temperature



Energy is transferred to the flowing medium - causing increased current flow through the sensor. The electrical energy required to maintain the sensor at a constant temperature is proportional to the mass flow of the gas.

As the amount of energy transferred is determined by the number of gas molecules flowing past the sensor, the system measures the direct mass rate of flow independent of variations in pressure and temperature.

Measuring ranges

Flow velocity m/s (at 0° C, 1.013 bar absolute)

Medium	min.	max.
Air	0...4.7	0...94
Ammonia	0...4.4	0...88
Argon	0...6.6	0...132
Carbon dioxide	0...4.9	0...98
Carbon monoxide	0...4.8	0...96
Chlorine	0...4.0	0...81
Biogas	0...4.0	0...81
Ethane	0...3.7	0...73
Ethylene	0...2.9	0...57
Freon 12	0...1.7	0...33
Helium	0...2.9	0...58
Hydrogen	0...2.2	0...44
Hydrogen fluoride	0...4.7	0...94
Hydrogen Sulphide	0...3.8	0...75
Methane	0...3.8	0...75
Natural gas	0...3.8	0...75
Nitrogen	0...4.7	0...93
Oxygen	0...4.7	0...93
Propane	0...1.7	0...34
Propylene	0...2.0	0...39
Sulphur dioxide	0...3.3	0...65

Equation for calculating the flow rate:

$$Q = 900 \cdot \pi \cdot v \cdot ID^2$$

Q = flow rate in m³_N/h (1.013 bar abs., 0° C)

v = flow velocity in m/s

ID = inside diameter of line in m

π = 3.1415

Available models

Standard version

with ceramic sensors, for non-aggressive gases such as: air, N₂, Argon, CO, CO₂

- KES-1... insert version with 3/8" stem
- KES-2... inline version for 1/4" to 3/4" pipe nominal sizes

Rugged industrial version

with stainless-steel enclosed sensors, for all gases against which the stainless-steel enclosed sensor is resistant. Maximum medium temperature 175 °C.

- KES-3... insert version with 3/4" stem
- KES-4... inline version DN 8 to DN 200

Evaluation electronics

The smart microprocessor-based evaluation electronics provides an analogue output proportional to the flow velocity. The KES-1.../-2... version is fitted with an additional alarm contact; and the KES-3.../-4... version with an interval contact. The electronics may be manually adjusted with buttons, or via an RS-232 serial port with optional Windows™ software.



Technical details

Types of gases: all types of non aggressive gases
 Accuracy: $\pm 1\%$ f.s. + 0.5% of meas. value (at 0...50°C and 0.3...2 bar rel.)
 Repeatability: $\pm 0.2\%$ f.s.
 Temperature coefficient: $\pm 0.04\%$ of meas. value /°C within $\pm 25^\circ\text{C}$ of calibration value
 $\pm 0.06\%$ of meas. value /°C between $\pm 25\text{...}\pm 50^\circ\text{C}$ of calibration value
 Pressure coefficient: 0.3% / bar for air
 Response time: 200 ms (upto indication of 63% of the real flow rate)
 Temperature of medium: $-10\text{...}+80^\circ\text{C}$
 Ambient temperature: 0...50°C
 Max. pressure: 8 bar (KES-1); 10 bar (KES-2)
 Electronic housing: Aluminium, powder coated

Wetted parts
 Probe material: Stainless steel 1.4401
 Tip of sensor: Stainless steel 1.4301 with glass coating
 Indication: 2x12-position LCD-display, backlit
 Counter: 8-digit, with reset
 Alarm output: Relay, max. 42 V_{AC/DC}, 140 mA
 Analogue output: 0-5 V_{DC} (min. 1000 Ω)
 or 4-20 mA (max. 700 Ω)
 Supply voltage: 18-30 V_{DC}, max 625 mA
 Protection: IP 65

Order details insert version (example: KES-1 010 K N3 4)

Immersion length	Model		Indication	Output
	Compact version	Separate version		
95 mm	KES-1 010 K	KES-1 010 R	N3 = without display D3 = LC-display	4 = 4-20 mA 5 = 0-5 V _{DC}
152 mm	KES-1 015 K	KES-1 015 R		
229 mm	KES-1 023 K	KES-1 023 R		
330 mm	KES-1 033 K	KES-1 033 R		
Special length max. 610 mm	KES-1 XXX K	KES-1 XXX R		

Order details inline version (example: KES-2 N08 K N3 4)

Connection	Model		Indication	Output
	Compact version	Separate version		
1/4 NPT female	KES-2 N08 K	KES-2 N08 R	N3 = without display D3 = LC-display	4 = 4-20 mA 5 = 0-5 V _{DC}
1/2 NPT female	KES-2 N15 K	KES-2 N15 R		
3/4 NPT female	KES-2 N20 K	KES-2 N20 R		

When placing an order, please specify detailed service conditions (type of gas, flow rate, pressure, temperature etc.).

Accessories for Insert version

Model	Description
KES-ZE10N15	Compression fitting 3/8" with 1/2 NPT male
KES-ZE10W00	Weldolet with 3/8" compression fitting



Technical details

Types of gases:	almost all types of gases compatible to stainless steel 316L	Max. pressure:	8 bar (KES-3); PN 16 (KES-4)
Accuracy:	±1% f.s. + 0.5% of meas. value	Electronic housing:	Aluminium, powder coated
Repeatability:	±0.2% f.s.	Wetted parts:	Stainless steel 316L (1.4435)
Temperature coefficient:	±0.04% of meas. value/°C within ±25°C of calibration value ±0.06 of meas. value/°C between ±25...±50°C of calibration value	Indication:	2x12-position LCD-indication, backlit
Pressure coefficient:	0.3% / bar for air	Counter:	8-digit, with reset
Response time:	1 s (upto indication of 63% of the real flow rate)	Alarmoutput:	Relay, max. 400 V _{AC/DC} , 140 mA
Temperature of medium:	-10...+175°C	Analogue output:	0-5 V _{DC} (min. 1000 Ω) or 4-20 mA (max. 700 Ω)
Ambient temperature:	-20...+50°C	Voltage supply:	18-30 V _{DC} , max 625 mA
		Protection:	IP 65

Order details insert version (example: KES-3 015 K N3 4)

Immersion length	Model		Indication	Output
	Compact version	Separate version		
152 mm	KES-3 015 K	KES-3 015 R	N3 = without display D3 = LC-display	4 = 4-20 mA 5 = 0-5 V _{DC}
229 mm	KES-3 023 K	KES-3 023 R		
330 mm	KES-3 033 K	KES-3 033 R		
457 mm	KES-3 046 K	KES-3 046 R		
610 mm	KES-3 061 K	KES-3 061 R		
914 mm	KES-3 091 K	KES-3 091 R		
Special length max. 1000 mm	KES-3 XXX K	KES-3 XXX R		

Order details inline version (example: KES-4 N08 K N3 4)

Connection	Model		Indication	Output
	Compact version	Separate version		
¼ NPT female	KES-4 N08 K	KES-4 N08 R	N3 = without display D3 = LC-display	4 = 4-20 mA 5 = 0-5 V _{DC}
½ NPT male	KES-4 N15 K	KES-4 N15 R		
¾ NPT male	KES-4 N20 K	KES-4 N20 R		
1 NPT male	KES-4 N25 K	KES-4 N25 R		
1 ½ NPT male	KES-4 N40 K	KES-4 N40 R		
2 NPT male	KES-4 N50 K	KES-4 N50 R		
3 NPT male	KES-4 N80 K	KES-4 N80 R		
4 NPT male	KES-4 N1H K	KES-4 N1H R		
6 NPT male	KES-4 N1F K	KES-4 N1F R		
8 NPT male	KES-4 N2H K	KES-4 v2H R		
Special connection	KES-4 XXX K	KES-4 XXX R		

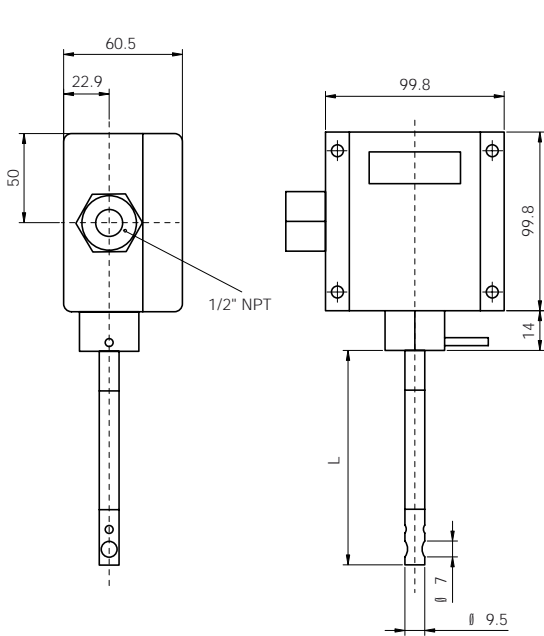
When placing an order, please specify detailed service conditions (type of gas, flow rate, pressure, temperature etc.). The connections are also available in DIN-flanges (KES-4D) and ANSI-flanges (KES-4A).

Accessories for Insert version

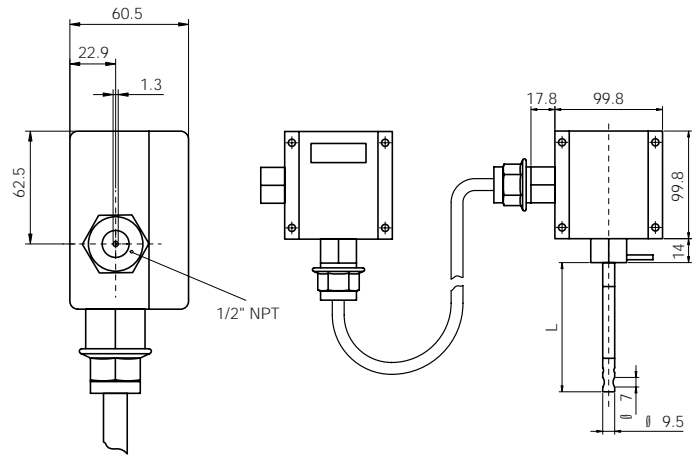
Model	Description
KES-ZE20N25	Compression fitting ¾" with ½ NPT male
KES-ZE20W00	Weldolet with ¾" Compression fitting

Dimensions

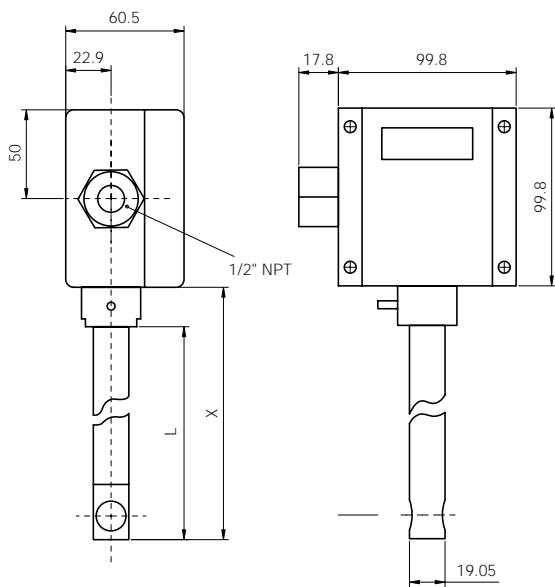
KES-1



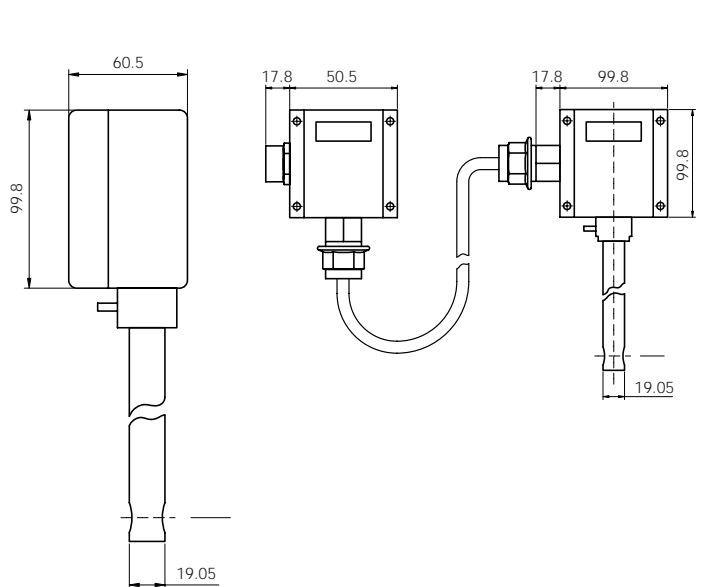
Separate version



KES-3

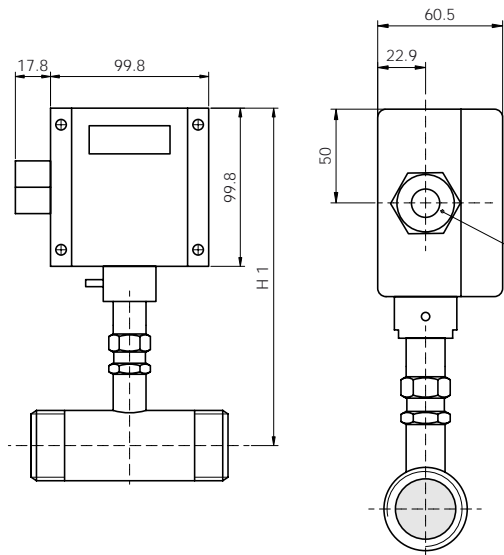


Separate version

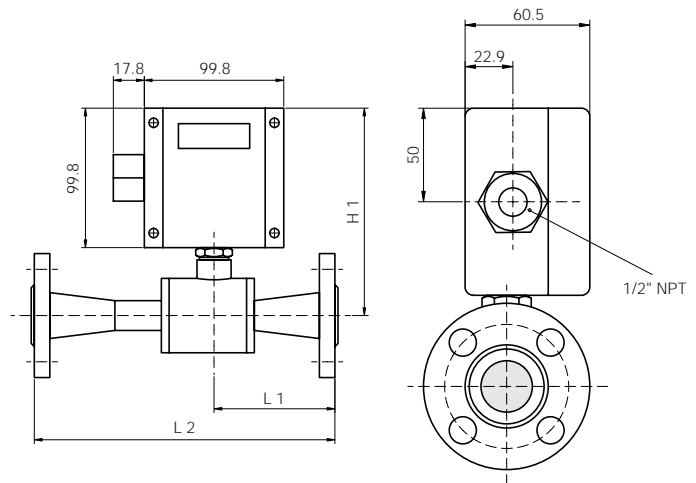


Dimensions

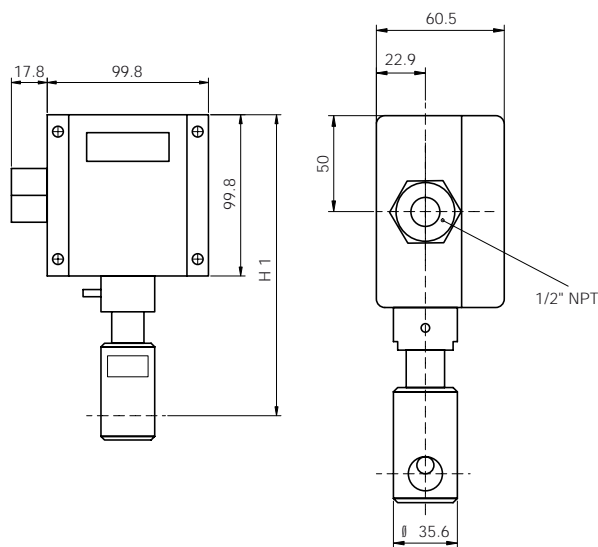
KES-4 N08 K



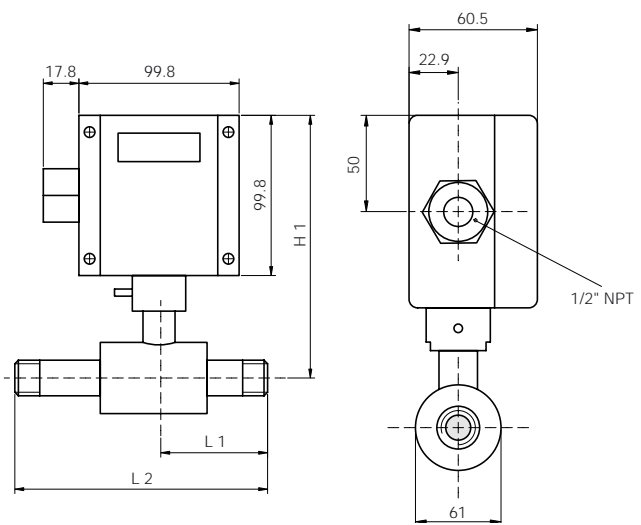
KES-4 N15 / N20



KES-4 N25 and larger



KES-4 A15 / A20



Dimensions for NPT

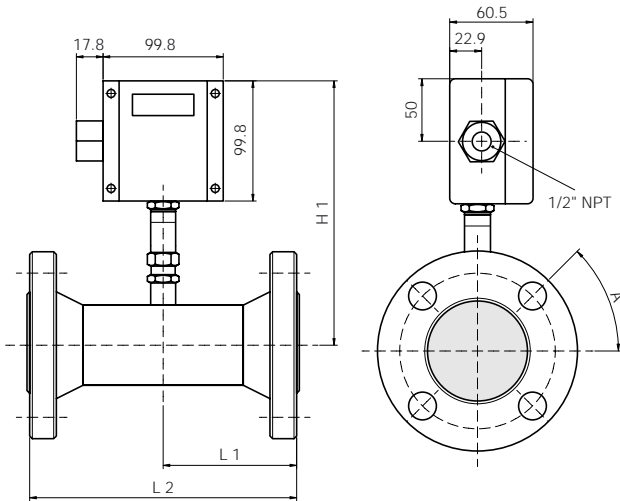
Size	H1 [mm]	L1 [mm]	L2 [mm]
1/4 inch	213.6	-	-
1/2 inch	197.9	55.9	165.1
3/4 inch	197.9	55.9	177.8
1 inch	227.8	38.1	88.9
1.5 inch	227.8	57.2	133.4
2 inch	227.8	88.9	190.5
3 inch	227.8	101.6	254
4 inch	228.1	101.6	304.8
6 inch	278.9	152.4	457.2
8 inch	329.7	203.2	609.6

Dimensions for ANSI-flange 150 LB

Size	L1 [mm]	L2 [mm]
1/2 inch	66	176.5
3/4 inch	70.6	192

Dimensions

KES-4 A25 and larger



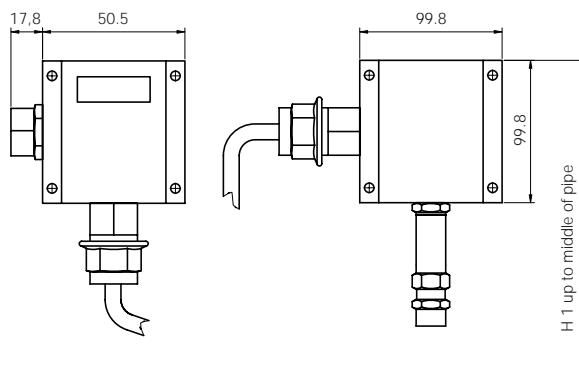
Dimensions for ANSI-flange 150 LB

Size	H1 [mm]	L1 [mm]	L2 [mm]	L2 [mm]
1 inch	161.3	91.4	188.0	45°
1.5 inch	186.7	96.5	190.5	45°
2 inch	186.7	88.9	190.5	45°
3 inch	212.1	101.6	254.0	45°
4 inch	212.1	101.6	304.8	22.5°
6 inch	237.5	152.4	457.2	22.5°
8 inch	262.9	203.2	609.6	22.5°

Dimensions for DIN-flange PN 16

Size	H1 [mm]	L1 [mm]	L2 [mm]
DN 25	210.8	80.1	188.0
DN 40	226.1	91.7	188.0
DN 50	256.5	84.8	180.3
DN 80	251.5	105.2	259.1
DN 100	254.0	116.1	320.0
DN 150	299.7	172.0	480.1
DN 200	353.1	215.1	619.8

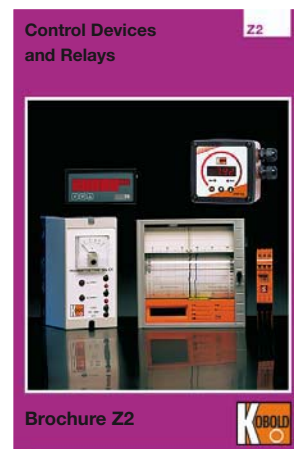
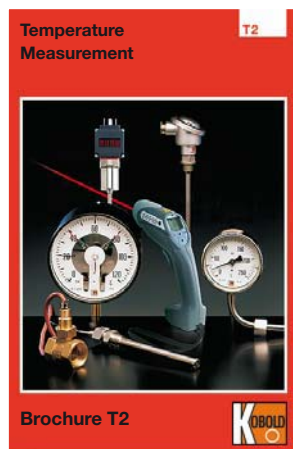
KES-4 separate version



Dimensions for separate version

Size	H1 [mm]
1/4 inch	159.5
1/2 inch	132.3
3/4 inch	132.3
1 inch	162.8
1.5 inch	162.8
2 inch	185.9
3 inch	211.3
4 inch	160.5
6 inch	211.3
8 inch	262.1

For pressure measuring technology please refer to our brochures »P1, P2 and P3«



For temperature measuring technology and control devices please refer to our brochures »T1, T2 and Z2«