



Thermal Mass Flow Meter for Gases



measuring
•
monitoring
•
analysing

KES



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

55



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KOBOLD Messring GmbH
Nordring 22-24
D-65719 Hofheim/Ts.
Head Office:
+49(0)6192 299-0
+49(0)6192 23398
info.de@kobold.com
www.kobold.com

Field of application

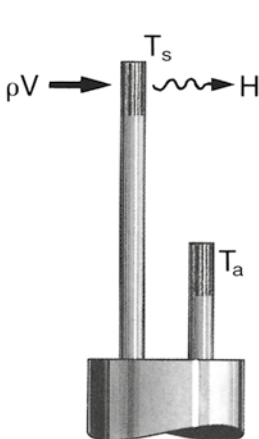
The KES type series thermal mass flow meters measure the flow of gases, independent of variations in process pressure and temperature.

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 Nm³/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

Rugged industrial version

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 for 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... 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 data**

Types of gases:	all types of non aggressive gases
Accuracy:	±1 % of full scale + 0.5 % of reading (at 0 ... 50 °C and 0.3 ... 2 bar rel.)
Repeatability:	±0.2 % of full scale
Temperature coefficient:	±0.04 % of reading/°C within ±25 °C of calibration value ±0.06 % of reading/°C between ±25 ... ±50 °C of calibration value
Pressure coefficient:	0.3 %/ bar for air
Response time:	200 ms (upto indication of 63 % of the real flow rate)
Medium temperature:	-10 ... +80 °C
Ambient temperature:	0 ... 50 °C
Max. pressure:	8 bar (KES-1)
Electronic housing:	Aluminium, powder coated

Wetted parts

Probe material:	Stainless steel 1.4401
Sensorspitze:	Stainless steel 1.4301 with glass ceramic sensor
Indication:	2 x 12-digit LC-display, backlit
Counte:	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)
Power supply:	18 - 30 V _{DC} , max. 625 mA
Protection:	IP 65

Order details insert version (Example: **KES-1 010 K N3 4**) Indication

Immersion length	Model		Display	Output	Real gas calibration
	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}	without = Standard air A = Argon, Carbon dioxide, Helium, Nitrogen
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			

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 data

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% of full scale +0.5% of reading	Electronic housing:	Aluminium, powder coated
Repeatability:	±0.2% of full scale	Wetted parts:	Stainless steel 316L (1.4435)
Temperature coefficient:	±0.04 % of reading/°C within ±25 °C of calibration value ±0.06 of reading/°C between ±25 ... ±50 °C of calibration value	Indication:	2x12-digit LC-display, backlit
Pressure coefficient:	0,3%/bar for air	Counter:	7-digit, with reset
Response time:	1 s (upto indication of 63 % of the real flow rate)	Alarm output:	relay, max. 400 V _{AC} /DC, 140 mA
Medium temperature:	-10 ... +175 °C	Analogue output:	0-5 V _{DC} (min. 1000 Ω) or 4-20 mA (max. 700 Ω)
Ambient temperature:	-20 ... +50 °C	Power 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	Real gas calibration	Corelation calibration with air
	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}	without = standard air A = Argon, carbon dioxide, Helium, Nitrogen B = Biogas*, Methane, Propane H = Hydrogen	K = Biogas*, Methane, Propane
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				

* 60 % Methane, 40 % Carbon dioxide

Order details inline-Version (Example: KES-4 N08 K N3 4)

Connection	Model		Indication	Output	Real gas calibration	Corelation calibration with air
	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}	without = standard air A = Argon, carbon dioxide, Helium, Nitrogen B = Biogas*, Methane, Propane H = Hydrogen	K = Biogas*, Methane, Propane
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 N2H R				
Special connection	KES-4 XXX K	KES-4 XXX R				

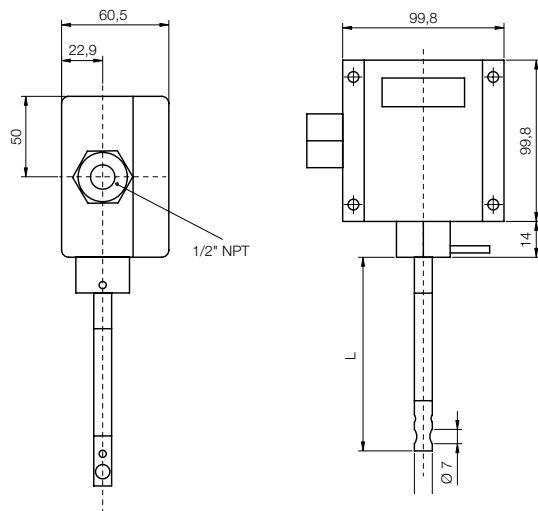
When placing an order, please specify detailed service conditions (type of gas, flow rate, pressure, temperature etc.).
The connections are also available in DIN-flanges (KES-4D) and ANSI-flanges (KES-4A).

Accessories for Insert version Model

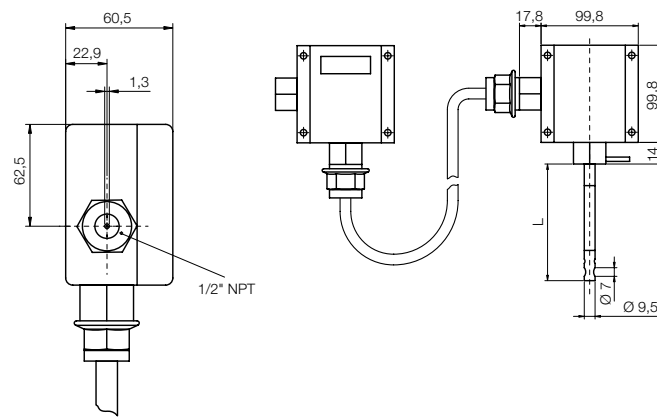
Model	Description
KES-ZE20N25	Compression fitting ¾" with 1" NPT male
KES-ZE20W00	Weldolet with ¾" compression fitting

Dimensions [mm]

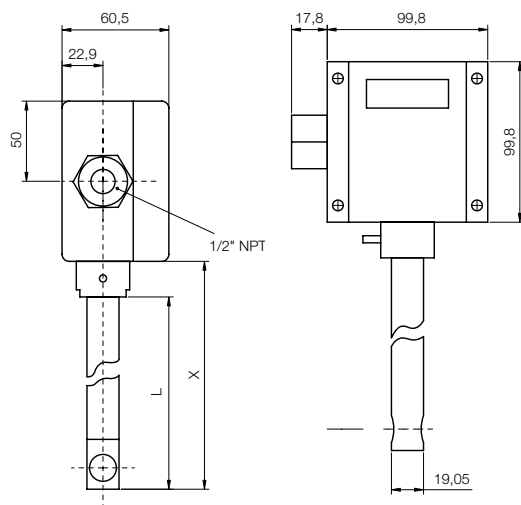
KES-1



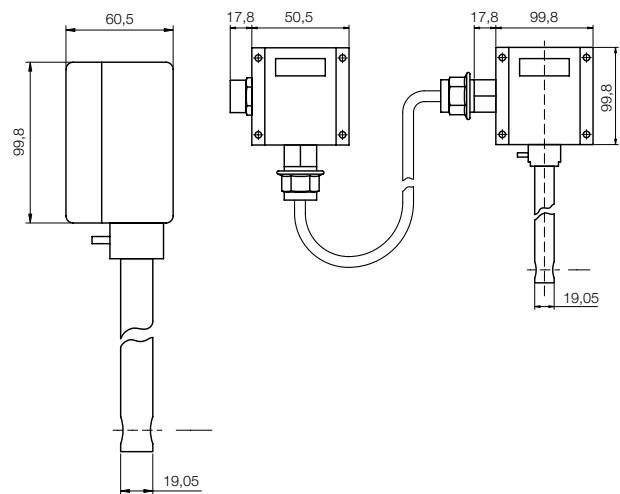
Separate version



KES-3

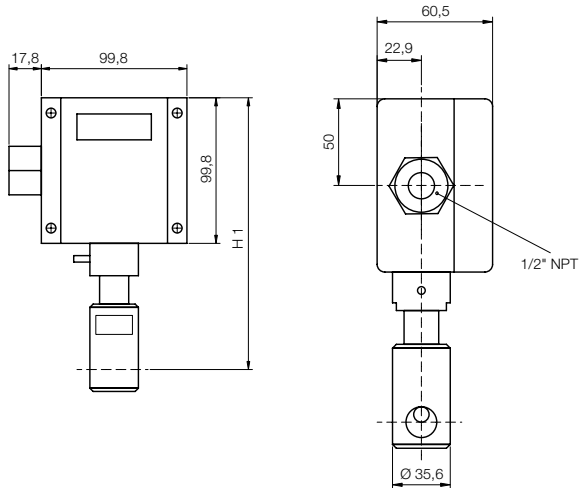


Separate version

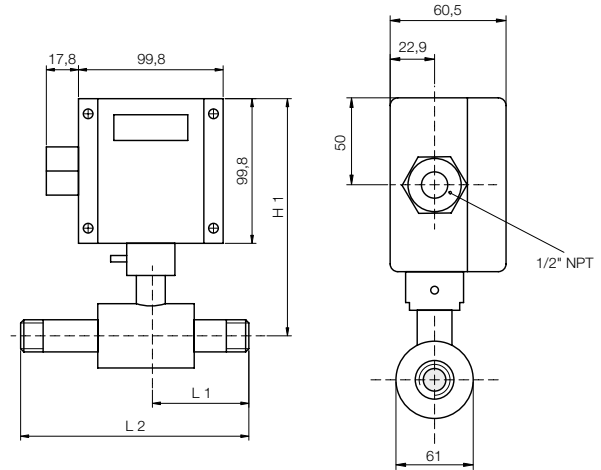


Dimensions [mm]

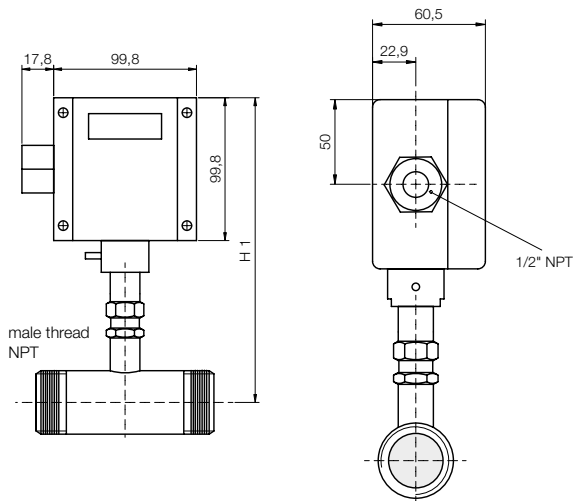
KES-4 N08 K



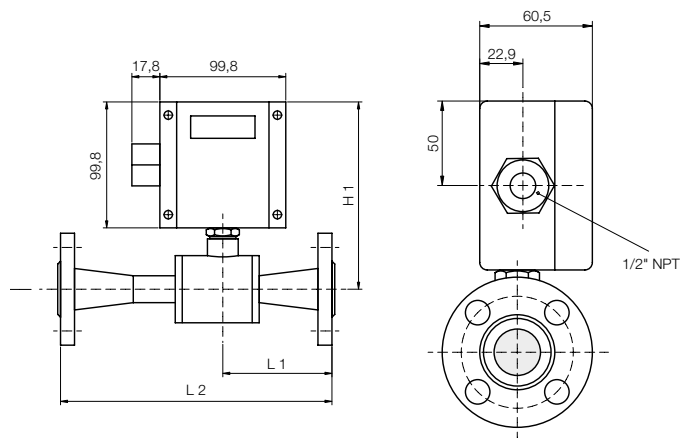
KES-4 N15/N20



KES-4 N25 and larger



KES-4 A15/A20



Dimensions for NPT

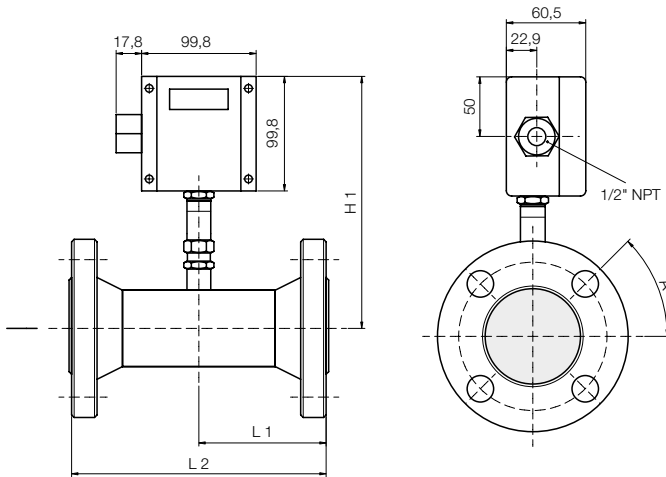
Size [inch]	H1 [mm]	L1 [mm]	L2 [mm]
1/4"	213.6	-	-
1/2"	197.9	55.9	165.1
3/4"	197.9	55.9	177.8
1"	227.8	38.1	88.9
1.5"	227.8	57.2	133.4
2"	227.8	88.9	190.5
3"	227.8	101.6	254
4"	228.1	101.6	304.8
6"	278.9	152.4	457.2
8"	329.7	203.2	609.6

Dimensions for ANSI-flange 150 LB

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

Dimensions [mm]

KES-4 A25 and larger



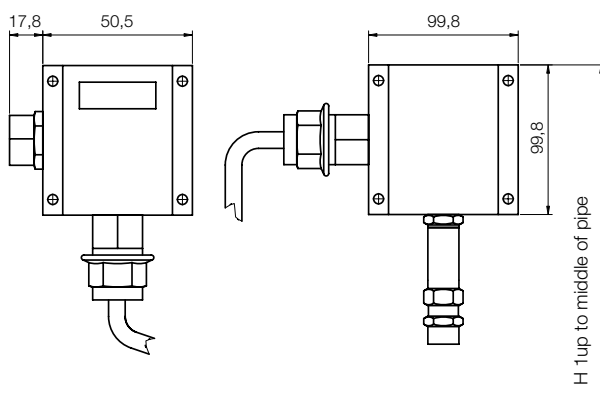
Dimensions for ANSI-flange 150 LB

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

Dimensions for DIN-flange PN16

Size	H1 [mm]	L1 [mm]	L2 [mm]
DN25	210.8	80.1	188.0
DN40	226.1	91.7	188.0
DN50	256.5	84.8	180.3
DN80	251.5	105.2	259.1
DN100	254.0	116.1	320.0
DN150	299.7	172.0	480.1
DN200	353.1	215.1	619.8

KES-4 separate version



Dimensions for separate version

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