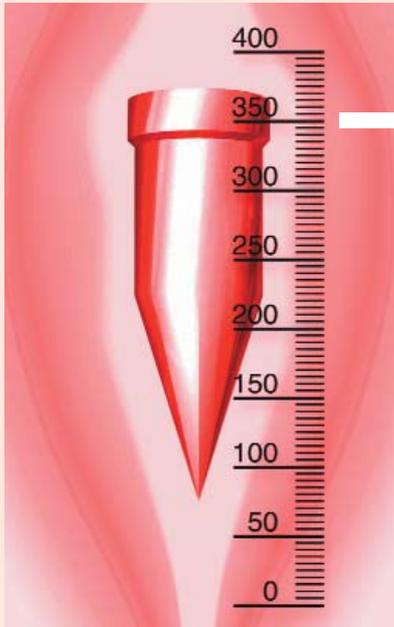


## Variable area flowmeters



### Variable area flowmeters

- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Level measuring instruments
- Communications technology
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature



## Variable area flowmeters

### There's no alternative to reliability

That's why variable area flowmeters from KROHNE offer not only the maximum possible accuracy but also maximum reliability.

A wealth of experience and an intelligent quality assurance system enables us to place our VA meters in applications inaccessible to other manufacturers such as nuclear power stations where safety is critical.

### So play it safe - Flowmeters from KROHNE

#### The KROHNE strategy

KROHNE is at home in almost all plants and processes, as well as in all corners of the world. Being a global player, we are able to react at any time to the widest variety of requests by our customers.

We are in the most important committees and industry groups, which enables us to recognize - and often help set - industry trends.

Our strategy aims at making it easy for the customer to do business with KROHNE by offering the best products at the best overall conditions and coupled with the best consultation, service and support that the industry has to offer.

KROHNE - easy to work with.

### Technical features

Flowmeters operating on the float principle are suitable for both liquids and gases. This method is inexpensive yet highly accurate and reliable.

Benefits of variable area flowmeters:

- Accurate measurement even at very low flow rates
- Standard rangeability of 10 : 1 (ratio of full-scale to lower limit value)
- Suitable for low operating pressures
- Minimal pressure losses
- Local indication without the need for auxiliary power
- Can be used even with short or no straight inlet/outlet runs
- Essential components easily replaced
- Exact calculations to VDI codes.



**Choosing the right flowmeter**

Variable-area flowmeters are fitted with measuring cones made of glass or metal.

- **The glass measuring cone** allows direct viewing of the process liquid and direct reading of the flow.
- **The metal measuring cone** is used for difficult operating conditions
  - pressure
  - temperature
  - corrosion resistance

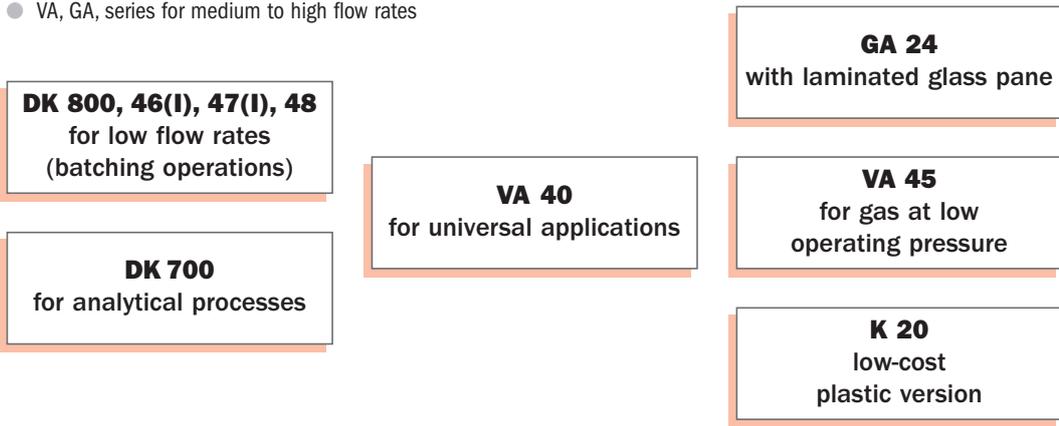
As direct readings are not possible, these are equipped with a mechanical, electromechanical or electronic display.

You're sure to find a measuring device in this product range to suit your specific requirements.

Measuring devices are available for low operating pressures, high flow rates, for batching operations, for the food industry, and for analytical processes.

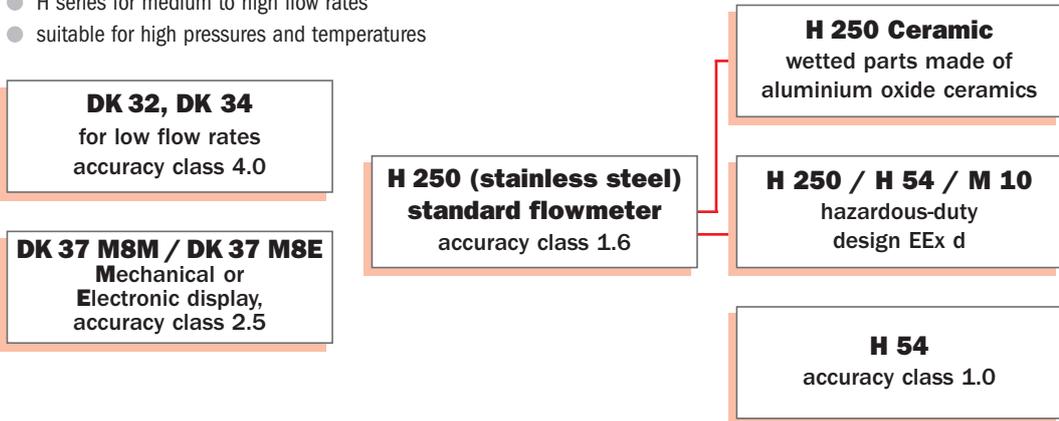
**Glass measuring cones**

- The DK Glass series for low to medium flow rates
- VA, GA, series for medium to high flow rates



**Metal measuring cones**

- DK Metal series for low to medium flow rates
- H series for medium to high flow rates
- suitable for high pressures and temperatures





## Accuracy

In conformity with VDI/VDE 3513, Sh. 2, accuracy for variable area flowmeters is defined by various accuracy classes. The following total errors are permitted as a factor of the flow rate, measured as % of measured value or % of full-scale range.

For accuracy classes 1 to 4, our instruments are calibrated with water or air followed by conversion to customer-specified operating data and instrument scaling. Accuracy class 0.4 requires calibration at actual flowing conditions.

Accuracy class	0.4		1.0		1.6		2.5		4.0	
	Total error %	Flow rate %	Measured	Full-scale	Measured	Full-scale	Measured	Full-scale	Measured	Full-scale
100	0.400	0.400	1.000	1.000	1.600	1.600	2.500	2.500	4.000	4.000
90	0.411	0.370	1.028	0.925	1.644	1.480	2.569	2.313	4.111	3.700
80	0.425	0.340	1.063	0.850	1.700	1.360	2.656	2.125	4.250	3.400
70	0.443	0.310	1.107	0.775	1.771	1.240	2.768	1.938	4.429	3.100
60	0.467	0.280	1.167	0.700	1.867	1.120	2.917	1.750	4.667	2.800
50	0.500	0.250	1.250	0.625	2.000	1.000	3.125	1.563	5.000	2.500
40	0.550	0.220	1.375	0.550	2.200	0.880	3.438	1.375	5.500	2.200
30	0.633	0.190	1.583	0.475	2.533	0.760	3.958	1.188	6.333	1.900
20	0.800	0.160	2.000	0.400	3.200	0.640	5.000	1.000	8.000	1.600
10	1.300	0.130	3.250	0.325	5.200	0.520	8.125	0.813	13.000	1.300

### Extract from VDI/VDE Code 3513 Sheet 2

Each accuracy class is related to an error range which may not be exceeded at any point in the measuring range.

This permissible maximum error range is the sum of the following two partial errors:

1st partial error:  $\frac{3}{4}$  of the figure specified as the accuracy class equals the error as a percentage of the measured value

2nd partial error:  $\frac{1}{4}$  of the figure specified as the accuracy class equals the error as a percentage of the full-scale range

For a specific measured value, the total error F in flow units can be calculated according to the following formula:

$$F = \left( \frac{3}{4} M + \frac{1}{4} E \right) \frac{K}{100}$$

M measured value in flow units

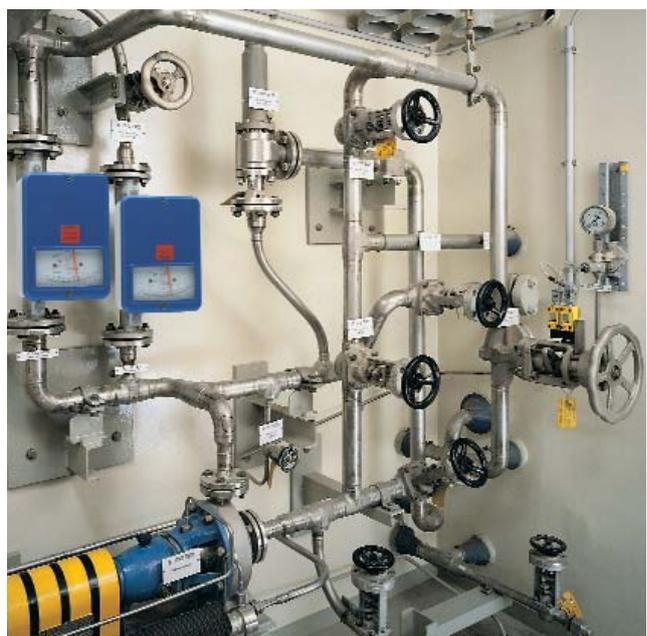
E full-scale value in flow units

K figure specified as the accuracy class

## Accessories

Apart from the various instrument types and materials offered, additional options are also available to equip the instruments for special applications.

The available accessories, e.g. limit switches, remote data transmission system or panel mounting sets, are described in the individual flowmeter data sheets.



**Glass cone flowmeters**

**GA 24**  
Heavy-duty (rotating connections)



**VA 40**  
Various connections for universal applications



<b>Measurable flowrates</b>			
Water	min.	0.04 l/h (0.011 US GPH)	0.04 l/h (0.011 US GPH)
	max.	10 000 l/h (2642 US GPH)	10 000 l/h (2642 US GPH)
Air	min.	0.0007 m <sup>3</sup> /h (0.00044 SCFM)	0.0007 m <sup>3</sup> /h (0.00044 SCFM)
	max.	310 m <sup>3</sup> /h (192 SCFM)	310 m <sup>3</sup> /h (192 SCFM)
<b>Calibration conditions</b>			
Water		20°C (68°F)	20°C (68°F)
Air		1.013 bar abs., 20°C (14.7 psia, 68°F)	1.013 bar abs., 20°C (14.7 psia, 68°F)
<b>Accuracy class</b>		1.0 (Option 0.4)	1.0
<b>Operating data</b>			
Max. pressure		10 bar (145 psig)	10 bar (145 psig)
Max. temperature		120°C (248°F)	100°C (212°F)
<b>Materials</b>			
Metering cone		glass	glass
Other wetted parts		grey cast iron/stainless steel/PTFE	PVDF/stainless steel, Hastelloy, PTFE, TFM
Gaskets		Neoprene/PTFE	Buna, Viton, EPDM
<b>Connection</b>		Flanges DN 15 ... 50 ANSI 1/2" ... 2"	threaded pipe connection G 3/8 ... G 2 tube nozzle 15 ... 52 mm (0.6" ... 2") Flanges DN 15 ... 50 (1/2" ... 2") Pipe connections in the food industry
<b>Connection dimension</b>		500 mm (19.69")	Type V screw connection 375 mm (14.76") Type S tube nozzle DN 15: 400 mm (15.8") DN 25: 450 mm (17.7") Type F flange connection 425 mm (16.7") Type A aseptic DN 15: 375 mm (14.76") DN 40, DN 50: 400 mm (1 1/2", 2": 15.8")
<b>Limit switches</b>		max. 2	max. 2

## Product Overview

### K 20 Economy version for machine monitoring



### Glass cone flowmeters

5 l/h (1.32 US GPH) 24 000 l/h (6340 US GPH)	<b>Measurable flowrates</b> Water min. max.
20°C (68°F)	<b>Calibration conditions</b> Water
2.5	<b>Accuracy class</b>
6 bar (87 psig) -10 ... 60°C (14 ... 140°F)	<b>Operating data</b> Max. pressure Max. temperature
polysulphone (PSU) stainless steel, EPDM	<b>Materials</b> Metering cone Other wetted parts Gaskets
screw connection G 1/2 to G 2	<b>Connection</b>
376 mm (14.80")	<b>Connection dimension</b>
max. 2	<b>Limit switches</b>

**Glass cone flowmeters**

**DK Glass series**  
**DK 800, DK 46(I), DK 47(I), DK 48**  
**Miniature flowmeter**



**DK 700**  
**Miniature flowmeter**  
**for analytical purposes**



<b>Measurable flowrates</b>			
Water	min.	0.04 l/h (0.011 US GPH)	0.25 l/h (0.059 US GPH)
	max.	160 l/h (42 US GPH)	40 l/h (10.6 US GPH)
Air	min.	5 l/h (0.00031 SCFM)	0.5 l/h (0.00031 SCFM)
	max.	5 000 l/h (3.1 SCFM)	1000 l/h (0.62 SCFM)
<b>Calibration conditions</b>			
Water		20°C (68°F)	20°C (68°F)
Air		1.2 bar abs., 20°C (17.4 psia, 68°F)	1.013 bar abs., 20°C (14.7 psia, 68°F)
<b>Accuracy class</b>		4.0, 2.5, 1.0	6.0, 4.0, 2.5
<b>Operating data</b>			
Max. pressure		10 bar (145 psig)	4 bar (58 psig)
Max. temperature		80 ... 100°C (176 to 212°F)	100°C (212°F)
<b>Materials</b>			
Metering cone		glass	glass
Other wetted parts		brass/stainless steel/PVDF	stainless steel/PVDF
Gaskets		Viton	Viton
<b>Connection</b>		1/4 NPT G 1/4	G 1/8 tube nozzle 6 mm (0.24")
<b>Connection dimension</b>		90 ... 325 mm (3.54 ... 12.79")	75 mm (2.95")
<b>Limit switches</b>		max. 2	-

## Product Overview

**DK 32 / DK 34**  
All-metal miniature flowmeter



**DK 37**  
All-metal miniature flowmeter



### Metal cone flowmeters

0.3 l/h (0.08 US GPM) 100 l/h (26.4 US GPM) (160 l/h [(42.3 US GPM) optional]) 1.6 l/h (0.42 US GPM) 3400 l/h (2.11 SCFM)	0.3 l/h (0.08 US GPM) 100 l/h (26.4 US GPM) (160 l/h [(42.3 US GPM) optional]) 1.6 l/h (0.42 US GPM) 3400 l/h (2.11 SCFM)	<b>Measurable flowrates</b> Water min. max. Air min. max.
20°C (68°F) 1.013 bar abs., 20°C (14.7 psia, 68°F)	20°C (68°F) 1.013 bar abs., 20°C (14.7 psia, 68°F)	<b>Calibration conditions</b> Water Air
4.0	2.5	<b>Accuracy class</b>
130 bar (1885 psig) 150°C (302°F)	130 bar (1885 psig) 180°C (356°F)	<b>Operating data</b> Max. pressure Max. temperature
stainless steel stainless steel PTFE/Viton	stainless steel stainless steel PTFE/Viton	<b>Materials</b> Metering cone Other wetted parts Gaskets
1/4 NPT DK 32 horizontal DK 34 vertical	1/4 NPT	<b>Connection</b>
90 mm (3.54") (DK 32) 110 mm (4.33") (DK 34)	125 mm (4.92")	<b>Connection dimension</b>
max. 2	max. 2 (DK 37 M8M only)	<b>Limit switches</b>
-	electronic, 4-20 mA (DK 37 M8E only) Ex-i current output HART®	<b>Data transfer</b>

**Variable area flowmeters with metal cone**

**H 250/RR/M 9**  
Stainless steel  
Metal cone flowmeter



**H 250/C/M9**  
Ceramic/PTFE



<b>Measurable flowrates</b>			
Water	min.	2.5 l/h (0.66 US GPM)	2.5 l/h (0.66 US GPM)
	max.	100 000 l/h (26 425 US GPM)	40 000 l/h (10 570 US GPM)
Air	min.	0.07 m <sup>3</sup> /h (0.043 SCFM)	0.18 m <sup>3</sup> /h (0.11 SCFM)
	max.	600 m <sup>3</sup> /h (372.2 SCFM)	350 m <sup>3</sup> /h (217 SCFM)
<b>Calibration conditions</b>			
Water		20°C (68°F)	20°C (68°F)
Air		1.013 bar abs., 20°C (14.7 psia, 68°F)	1.013 bar abs., 20°C (14.7 psia, 68°F)
<b>Accuracy class</b>		1.6	2.5
<b>Operating data</b>			
Max. pressure		16 ... 100 bar (232 ... 1450 psig)	16 ... 40 bar (232 ... 580 psig)
Max. temperature		300°C (572°F)	250°C (482°F)
<b>Materials</b>			
Metering cone		stainless steel	stainless steel
Other wetted parts		stainless steel/Hastelloy	PTFE, ceramic Al <sub>2</sub> O <sub>3</sub>
Gaskets		-	PTFE (flange)
<b>Connection</b>			
		Flanges DN 15 ... 100 ANSI 1/2" ... 4"	Flanges DN 15 ... 100 ANSI 1/2" ... 4"
<b>Connection dimension</b>		250 mm, 300 mm (9.84", 11.81")	250 mm (9.84")
<b>Limit switches</b>		max. 2	max. 2
<b>Data transfer</b>			
		electrical Ex-i current output HART® (4 ... 20 mA) Profibus PA	electrical Ex-i current output HART® (4 ... 20 mA) Profibus PA

## Product Overview

**H 250 / H 54 / M 10**  
Metal cone flowmeter  
EEx d design



**H 54**  
Metal cone flowmeter



### Variable area flowmeters with metal cone

2.5 l/h (0.66 US GPM) 100 000 l/h (26 425 US GPM) 0.07 m <sup>3</sup> /h (0.043 SCFM) 600 m <sup>3</sup> /h (372.2 SCFM)	1.6 l/h (0.42 US GPM) 150 000 l/h (39 640 US GPM) 0.04 m <sup>3</sup> /h (0.025 SCFM) 3 000 m <sup>3</sup> /h (1861 SCFM)	<b>Measurable flowrates</b> Water min. max. Air min. max.
20°C (68°F) 1.013 bar abs., 20°C (14.7 psia, 68°F)	20°C (68°F) 1.013 bar abs., 20°C (14.7 psia, 68°F)	<b>Calibration conditions</b> Water Air
1.0 - 2.5	1.0	<b>Accuracy class</b>
16 ... 100 bar (232 ... 1450 psig) 300°C (572°F)	16 ... 100 bar (232 ... 1450 psig) 400°C (752°F)	<b>Operating data</b> Max. pressure Max. temperature
stainless steel stainless steel/Hastelloy, PTFE, ceramic	stainless steel stainless steel/Hastelloy B+C	<b>Materials</b> Metering cone Other wetted parts
Flanges DN 15 ... 150 ANSI 1/2" ... 6"	Flanges DN 15 ... 150 ANSI 1/2" ... 6"	<b>Connection</b>
250 ... 500 mm (9.84" ... 19.68")	500 ... 600 mm (19.68 ... 23.62")	<b>Connection dimension</b>
Binary outputs, pulse output, reset input	max. 2	<b>Limit switches</b>
Ex-i current output HART® (4 ... 20 mA)	electrical Ex-i current output HART® (4 ... 20 mA)	<b>Data transfer</b>