



# Viscosity-Compensated Flowmeters and Switches

for viscous liquids



measuring  
•  
monitoring  
•  
analysing

VKM



- Measuring range:  
oil 0.01 - 0.07 ... 8 - 80 l/min
- Basic accuracy:  
± 4 % of full scale
- $p_{\max}$  350 bar,  $t_{\max}$  100 °C
- Viscosity range:  
1 ... 540 mm<sup>2</sup>/s
- Connection: G 1/4 ... G 1 female  
1/4" ... 1" NPT female
- Material: brass, stainless steel



S2

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### Description

The KOBOLD flowmeters and switches model VKM have a spring-loaded float, which slides within a cylindrical measuring tube and has an integral orifice which is believed to be unique.

This and other design features means that it has for the first time become possible to create a flowmeter and switch which fully compensates for viscosity and to a large extent for density even with very low flows. The float of these patented devices contains a permanent magnet which actuates a potential free bistable reed contact mounted outside the flow thus ensuring hermetic separation between the medium and the electrical contact system. The contact is embedded within a height-adjustable plastic housing to prevent damage to the contacts by mechanical action or aggressive atmospheres.

As the medium enters the instrument the float rises. Once its magnetic field reaches the contact tips of the reed switch the contact closes. As the flow increases the float rises further until it reaches its stop. This prevents the float from going beyond the contact range of the magnetic operating tube, that is, the contact remains closed thus ensuring bistable switching.

### Viscosity Compensation

If the viscosity changes from 1 mm<sup>2</sup>/s to 540 mm<sup>2</sup>/s the indicated value is still accurate within ±5%, even with very low flows, for example, 0.1 l/min.

Comparable devices, for instance conventional float-type flowmeters, are, if the viscosity changes to such an extent, subject to indicating errors up to 2500%, especially with comparable low flows. Other instruments with spring-loaded floats, which are allegedly viscosity compensated, still produce indicating errors of more than 500% with the same change in viscosity and a flow of 0.1 l/min.

Thanks to the virtually perfect viscosity compensation and good density compensation the flowmeters and switches of the latest generation are suitable both for water and highly viscous oil, without having to change the scale and without readjustment. This constitutes an extremely important advance especially in the critical area of oil lubrication circuits where measurement and switching are necessary at changing media temperatures.

### Applications

- Lubrication circuits
- Paper-making machines
- Machine tools
- Oil lubrication circuits
- Hydraulics
- Extruding plant
- Printing presses

### Technical Details

Body:	VKM- x1...: brass, nickel-plated VKM- x2...: stainless steel 1.4301
Screwed fitting:	VKM- x1...: brass, nickel-plated VKM- x2...: stainless steel 1.4301
Float:	VKM- x1...: brass, nickel-plated VKM- x2...: stainless steel 1.4301
Orifice:	stainless steel 1.4310
Spring:	stainless steel 1.4310
Magnet:	oxide ceramics
Seals:	VKM-x1...: NBR VKM-x2...: FPM
Max. temperature:	+100 °C
Max. pressure:	VKM- x1...: 250 bar VKM- x2...: 350 bar
Installation position:	any
Basic accuracy:	± 4 % of full scale (with a viscosity of 105 mm <sup>2</sup> /s)
Measuring error due to change in viscosity:	for changes in viscosity within 1...540 mm <sup>2</sup> /s the additional deviation is ± 5 % of full scale max.
Viscosity range:	1... 540 mm <sup>2</sup> /s VKM-xx01 (70... 400 mm <sup>2</sup> /s)

### Contacts

#### Optional with VKM-1..., VKM-3...

Electrical connection:	2 m cable (VKM-...F.) for all other types: connector DIN EN 175301-803
Electrical switching values:	N/O contact max. 250V <sub>AC/DC</sub> /1.5A/100W/100VA changeover contact max. 250V <sub>AC/DC</sub> /1A/30W/60VA N/O contact and changeover contact (cCSAus) max. 230V <sub>DC</sub> /0.26A/60W, 60V <sub>DC</sub> /1A/60W, max. 240V <sub>AC</sub> /0.42A/100W, 100V <sub>AC</sub> /1A/100W N/O contact (EX): II 2G Ex mb IIC T6 Gb II 2D Ex mb IIIC T80°C Db IP67 max. 250V <sub>AC</sub> /1.5A/100VA
Hysteresis:	approx. 3.5 mm float movement
Ex range:	ATEX-Zone 1 as »simple apparatus« or with N/O contact Ex
Protection:	IP 65 (electrical contact) IP 54 (side indicator)



**Order Details**

**Viscosity-compensated flow switches model: VKM-1...**

Measuring range l/min oil	Pressure loss Δ P [bar] at rated flow*		Brass	Stainless steel	Contact	Connection		Option special connection	Flow direction
	min.	max.							
0.01...0.07**	0.02	1.0	VKM-1101...	VKM-1201...	...R0... = 1 N/O contact	..R08 = G ¼	..N08 = ¼ NPT	0 = without option B = outlet female thread inlet BVB manifold	B = from bottom T = from top L = from left R = from right
0.1...0.45	0.03	0.8	VKM-1102...	VKM-1202...	...U0... = 1 changeover contact				
0.2...1.2	0.05	1.1	VKM-1103...	VKM-1203...	...F0... = 1 Ex N/O contact	..R08 = G ¼	..N08 = ¼ NPT		
0.5...2	0.07	1.2	VKM-1104...	VKM-1204...	...C0... = 1 N/O contact (cCSAus)	..R15 = G ½	..N15 = ½ NPT		
0.8...3.4	0.05	0.9	VKM-1105...	VKM-1205...	...D0... = 1 changeover contact (cCSAus)	..R15 = G ½	..N15 = ½ NPT		
3...9	0.05	0.8	VKM-1106...	VKM-1206...	...RR... = 2 N/O contacts	..R20 = G ¾	..N20 = ¾ NPT		
4...14	0.08	1.1	VKM-1107...	VKM-1207...	...UU... = 2 changeover contacts	..R20 = G ¾	..N20 = ¾ NPT		
5...20	0.05	1.1	VKM-1108...	VKM-1208...	...CC... = 2 N/O contacts (cCSAus)	..R25 = G 1	..N25 = 1 NPT		
4...40	0.1	0.4	VKM-1109...	VKM-1209...	...DD... = 2 changeover contacts (cCSAus)	..R25 = G 1	..N25 = 1 NPT		
5...55	0.15	1.1	VKM-1110...	VKM-1210...					
7...70	0.15	1.1	VKM-1111...	VKM-1211...					
8...80	0.15	1.1	VKM-1112...	VKM-1212...					

\* Pressure loss refers to water \*\* Viscosity range 70...400 mm<sup>2</sup>/s

**Viscosity-compensated flowmeter model: VKM-2...**

Measuring range l/min oil	Pressure loss Δ P [bar] at rated flow*		Brass	Stainless steel	Contact	Connection		Option special connection	Flow direction
	min.	max.							
0.01...0.07**	0.02	1.0	VKM-2101...	VKM-2201...	...00... = without contact	..R08 = G ¼	..N08 = ¼ NPT	0 = without option B = outlet female thread inlet BVB manifold	B = from bottom T = from top L = from left R = from right
0.1...0.45	0.03	0.8	VKM-2102...	VKM-2202...					
0.2...1.2	0.05	1.1	VKM-2103...	VKM-2203...		..R08 = G ¼	..N08 = ¼ NPT		
0.5...2	0.07	1.2	VKM-2104...	VKM-2204...		..R15 = G ½	..N15 = ½ NPT		
0.8...3.4	0.05	0.9	VKM-2105...	VKM-2205...		..R15 = G ½	..N15 = ½ NPT		
3...9	0.05	0.8	VKM-2106...	VKM-2206...		..R20 = G ¾	..N20 = ¾ NPT		
4...14	0.08	1.1	VKM-2107...	VKM-2207...		..R20 = G ¾	..N20 = ¾ NPT		
5...20	0.05	1.1	VKM-2108...	VKM-2208...		..R25 = G 1	..N25 = 1 NPT		
4...40	0.1	0.4	VKM-2109...	VKM-2209...		..R25 = G 1	..N25 = 1 NPT		
5...55	0.15	1.1	VKM-2110...	VKM-2210...					
7...70	0.15	1.1	VKM-2111...	VKM-2211...					
8...80	0.15	1.1	VKM-2112...	VKM-2212...					

\* Pressure loss refers to water \*\* Viscosity range 70...400 mm<sup>2</sup>/s

**Viscosity-compensated flowmeters and switches model: VKM-3...**

Measuring range l/min oil	Pressure loss Δ P [bar] at rated flow*		Brass	Stainless steel	Contact	Connection		Option special connection	Flow direction
	min.	max.							
0.01...0.07**	0.02	1.0	VKM-3101...	VKM-3201...	...R0... = 1 N/O contact	..R08 = G ¼	..N08 = ¼ NPT	0 = without option B = outlet female thread inlet BVB manifold	B = from bottom T = from top L = from left R = from right
0.1...0.45	0.03	0.8	VKM-3102...	VKM-3202...	...U0... = 1 changeover contact				
0.2...1.2	0.05	1.1	VKM-3103...	VKM-3203...	...F0... = 1 Ex N/O contact	..R08 = G ¼	..N08 = ¼ NPT		
0.5...2	0.07	1.2	VKM-3104...	VKM-3204...	...C0... = 1 N/O contact (cCSAus)	..R15 = G ½	..N15 = ½ NPT		
0.8...3.4	0.05	0.9	VKM-3105...	VKM-3205...	...D0... = 1 changeover contact (cCSAus)	..R15 = G ½	..N15 = ½ NPT		
3...9	0.05	0.8	VKM-3106...	VKM-3206...	...RR... = 2 N/O contacts	..R20 = G ¾	..N20 = ¾ NPT		
4...14	0.08	1.1	VKM-3107...	VKM-3207...	...UU... = 2 changeover contacts	..R20 = G ¾	..N20 = ¾ NPT		
5...20	0.05	1.1	VKM-3108...	VKM-3208...	...CC... = 2 N/O contacts (cCSAus)	..R25 = G 1	..N25 = 1 NPT		
4...40	0.1	0.4	VKM-3109...	VKM-3209...	...DD... = 2 changeover contacts (cCSAus)	..R25 = G 1	..N25 = 1 NPT		
5...55	0.15	1.1	VKM-3110...	VKM-3210...					
7...70	0.15	1.1	VKM-3111...	VKM-3211...					
8...80	0.15	1.1	VKM-3112...	VKM-3212...					

\* Pressure loss refers to water \*\* Viscosity range 70...400 mm<sup>2</sup>/s



## Viscosity-Compensated Flowmeters and Switches Model VKM

### Order Details

#### Viscosity-compensated flowmeter with evaluating electronics model: VKM-7...

Measuring range l/min oil approx.	Pressure loss $\Delta P$ [bar] at rated flow*		Brass	Stainless steel	Output	Connection		Flow direction
	min.	max.						
0.01...0.063**	0.02	1.0	VKM-7101...	VKM-7201...	...K04... = combination indication 100 - 240 V <sub>AC/DC</sub> , ±10% (50-60 Hz)  ...K34... = combination indication 10 - 40 V <sub>DC</sub> , 18-30 V <sub>AC</sub> 50/60 Hz	..R08 = G ¼	..N08 = ¼ NPT	B = from bottom  T = from top  L = from left  R = from right
0.1...0.4	0.03	0.8	VKM-7102...	VKM-7202...		..R08 = G ¼	..N08 = ¼ NPT	
0.2...1.1	0.05	1.1	VKM-7103...	VKM-7203...		..R08 = G ¼	..N08 = ¼ NPT	
0.5...1.8	0.07	1.2	VKM-7104...	VKM-7204...		..R15 = G ½	..N15 = ½ NPT	
0.8...3.1	0.05	0.9	VKM-7105...	VKM-7205...		..R15 = G ½	..N15 = ½ NPT	
3...8.1	0.05	0.8	VKM-7106...	VKM-7206...		..R20 = G ¾	..N20 = ¾ NPT	
4...12.6	0.08	1.1	VKM-7107...	VKM-7207...		..R20 = G ¾	..N20 = ¾ NPT	
5...18	0.05	1.1	VKM-7108...	VKM-7208...		..R25 = G 1	..N25 = 1 NPT	
4...36	0.1	0.4	VKM-7109...	VKM-7209...		..R25 = G 1	..N25 = 1 NPT	
5...50	0.15	1.1	VKM-7110...	VKM-7210...		..R25 = G 1	..N25 = 1 NPT	
7...63	0.15	1.1	VKM-7111...	VKM-7211...	..R25 = G 1	..N25 = 1 NPT		
8...72	0.15	1.1	VKM-7112...	VKM-7212...	..R25 = G 1	..N25 = 1 NPT		

\* Pressure loss refers to water    \*\* Viscosity range 70 ... 400 mm<sup>2</sup>/s

#### Viscosity-compensated flowmeter with compact electronics model: VKM-8...

Measuring range l/min oil approx.	Pressure loss $\Delta P$ [bar] at rated flow*		Brass	Stainless steel	Output	Connection		Flow direction
	min.	max.						
0.01...0.063**	0.02	1.0	VKM-8101...	VKM-8201...	...C0R... = compact electronic 24 V <sub>DC</sub> , 2 x PNP  ...C0M... = compact electronic 24 V <sub>DC</sub> , 2 x NPN  ...C4P... = compact electronic 24 V <sub>DC</sub> , 4-20 mA, 1 x PNP  ...C4N... = compact electronic 24 V <sub>DC</sub> , 4-20 mA, 1 x NPN	..R08 = G ¼	..N08 = ¼ NPT	B = from bottom  T = from top  L = from left  R = from right
0.1...0.4	0.03	0.8	VKM-8102...	VKM-8202...		..R08 = G ¼	..N08 = ¼ NPT	
0.2...1.1	0.05	1.1	VKM-8103...	VKM-8203...		..R08 = G ¼	..N08 = ¼ NPT	
0.5...1.8	0.07	1.2	VKM-8104...	VKM-8204...		..R15 = G ½	..N15 = ½ NPT	
0.8...3.1	0.05	0.9	VKM-8105...	VKM-8205...		..R15 = G ½	..N15 = ½ NPT	
3...8.1	0.05	0.8	VKM-8106...	VKM-8206...		..R20 = G ¾	..N20 = ¾ NPT	
4...12.6	0.08	1.1	VKM-8107...	VKM-8207...		..R20 = G ¾	..N20 = ¾ NPT	
5...18	0.05	1.1	VKM-8108...	VKM-8208...		..R25 = G 1	..N25 = 1 NPT	
4...36	0.1	0.4	VKM-8109...	VKM-8209...		..R25 = G 1	..N25 = 1 NPT	
5...50	0.15	1.1	VKM-8110...	VKM-8210...		..R25 = G 1	..N25 = 1 NPT	
7...63	0.15	1.1	VKM-8111...	VKM-8211...	..R25 = G 1	..N25 = 1 NPT		
8...72	0.15	1.1	VKM-8112...	VKM-8212...	..R25 = G 1	..N25 = 1 NPT		

\* Pressure loss refers to water    \*\* Viscosity range 70 ... 400 mm<sup>2</sup>/s

**Model VKM-8...**

Indication: 3-digit LED  
 Switching output: semiconductor PNP or NPN  
 Analogue output: 4-20 mA, 3-wire  
 max. 500 Ω, linear  
 Power supply: 24 V<sub>DC</sub> ± 20 %  
 Max. temperature: +80 °C  
 Electr. connection: connector M12x1

**Model VKM-7...**

With this version our proven evaluating electronics ADI (see also data sheet ADI-1) in a field housing are fitted to the flowmeter.

- Digital indication, 5-digit, Bargraph indication, 2 changeover contacts, Analogue output 0(4) - 20mA and 0 - 10V

**Important!**

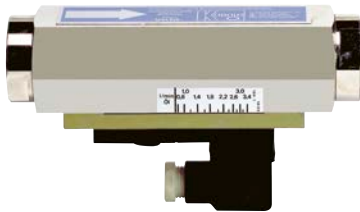
*The max. upper range values are approximately 10% lower than for other types.*

**VKM versions**

Five different versions are available

**VKM-1...**

Flow switches with 1 contact



**VKM-2...**

Flowmeters



**VKM-3...**

Flowmeters and switches with 1 contact



**VKM-7...**

Flowmeters with evaluating electronics



**VKM-8...**

Flowmeters with compact electronics



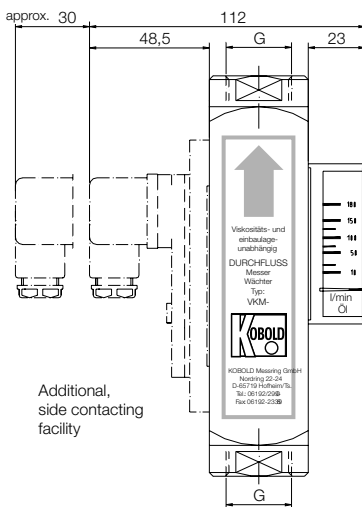
Dimensions

Model	Square [mm]	Length L Connection [mm]	AF Connection [mm]	Weight* [kg]
VKM-..01	40 x 40	162	36	1.7
VKM-..02	40 x 40	162	36	1.7
VKM-..03	40 x 40	162	36	1.7
VKM-..04	40 x 40	162	36	1.7
VKM-..05	40 x 40	162	36	1.7
VKM-..06	40 x 40	162	36	1.7
VKM-..07	40 x 40	162	36	1.7
VKM-..08	40 x 40	162	36	1.7
VKM-..09	40 x 40	162 (186.5)**	36 (41)**	1.7
VKM-..10	40 x 40	162 (186.5)**	36 (41)**	1.7
VKM-..11	40 x 40	162 (186.5)**	36 (41)**	1.7
VKM-..12	40 x 40	186.5	41	1.7

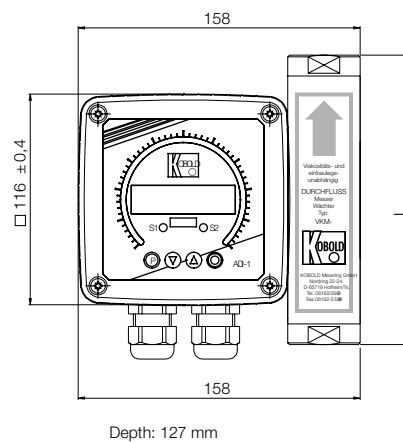
\* Weight valid for: VKM-1..., VKM-2...  
for model VKM-3... + 0.1 kg  
for model VKM-7... + 1.4 kg

\*\* with G 1 or 1" NPT

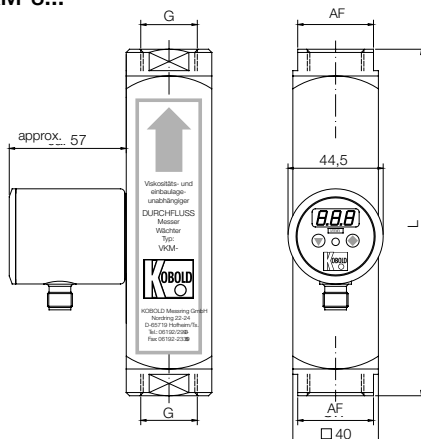
VKM-1..., VKM-2..., VKM-3...



VKM-7...



VKM-8...



VKM-..F0..

