



# VM-04

## High-Precision Gear-Wheel Volume Sensor for Viscous Fluids



## Features

- / For viscosities above 1 cSt
- / Excellent price to performance ratio
- / Cast or st. steel versions available
- / Accuracy better than 0.3% of MV
- / High resolution
- / Pressure-proof up to 400 bar
- / Convenient dim. for assembly

## Description:

The VM-04 series of the flowmeters measuring sensor consists of a pair of toothed wheels which is driven by the flow of fluid according to the working principle of a gear-wheel pump. The bearing for the measuring sensor is designed as a radial or axial sliding contact bearing. The gear-wheel movement is scanned by means of two magneto-resistive sensors which are phase displaced by 90° and hermetically separated from the measuring chamber. The two-channel scanning enables a higher resolution of measurement and detection of direction of flow by means of suitable electronic devices. Optionally, all devices can be supplied with an explosion-proof design with separate switching amplifier. The gear-wheel flowmeter VM-04 is outstanding due to its low resistance to flow and especially low sound level.

## Application:

Due to their excellent accuracy of measurement along with high resolution, these devices are especially suited for use in test beds for measuring small and least volumes of flow. Some of the areas of deployment are:

- Measurement of consumption
- Controlling filling operations
- Dosing oils and chemicals
- Measurement of flow for paints and varnishes
- Ratio regulation for polyol and isocyanate



# Versions and Ranges:

Sealing material	Series	FKM	EPDM	FEP	FFKM
Ambient temperature		-15...+80°C	-30...+80°C	-30...+80°C	-15...+80°C
Medium temperature for standard version	1,2,6,7,8	-15...+120°C	-30...+120°C	-30...+120°C	-15...+120°C
	3,4,5	-15...+80°C	-30...+80°C	-30...+80°C	-15...+80°C
Medium temperature for high temperature version	1,2,6,7,8	-15...+150°C	-30...+150°C	-30...+150°C	-15...+150°C
	3,4,5	on request	on request	on request	on request
Medium temperature for high temp. PLUS version	1,2,6,7,8	-15...+150°C	not available	-30...+220°C*	-15...+220°C*
	3,4,5	not available	not available	not available	not available
Medium temperature for EX-Version	1,2,6,7,8	-15...+80°C	-30...+80°C	-30...+80°C	-15...+80°C
	3,4,5	-15...+80°C	-30...+80°C	-30...+80°C	-15...+80°C

\*max. 200°C for VM-04.2

## Technical Specifications:

<b>Viscosity range /</b>	1...1,000,000 mm <sup>2</sup> /s
<b>Pressure drop /</b>	depending on viscosity and usage rate of the device, max. permissible pressure drop 16 bar
<b>Materials /</b>	
Series 1-4 and 7:	Housing EN-G75-400-15, measuring element 1.7139
Series 5, 6 and 8:	Housing st. steel 1.4404 meas. element st. steel 1.4462
<b>Electronics /</b>	
Standard:	2 sensors, phase displaced for detection of direction
Ex-Version:	with separate switching amplifier
<b>Supply voltage /</b>	12...30 VDC, polarity-reversal-proof
<b>Output signal /</b>	rectangular impulses, PNP (NPN on request), ≥ 0,8 U <sub>B</sub> , scan ratio 1:1 (± 15%)
<b>Protection class /</b>	IP 65 DIN 40050
<b>Power consumption /</b>	0.9 W <sub>max</sub>
<b>Impulse offset between channels /</b>	90° ± 30°
<b>Output rating/channel /</b>	0.3 W <sub>max</sub> short circuit protected

## Ordering Codes:

<b>Order number</b>	<b>VM-04.</b>	<b>3.</b>	<b>1.</b>	<b>F.</b>	<b>PS.</b>	<b>3.</b>	<b>S.</b>	<b>0</b>
<b>VM-04 Gear Volume Sensor</b>								
<b>Operating ranges /</b> 2...16 = as per table 3								
<b>Series /</b> 1...8 = as per table 2								
<b>Sealing /</b> F = Viton E = EPDM P = FEP, Viton core with PTFE mantle K = FFKM								
<b>Connection type /</b> PS = with assembly plate, connection sideways PU = with assembly plate, connection at bottom R = without assembly plate, connection sideways (Series 5, 6 and 8 only)								
<b>Process connection /</b> 2 = G 1/8"-female (operating range 2 only)* 3 = G 3/8"-female (operating ranges 3 and 4 only) 4 = G 1/2"-female (operating ranges 5 and 6 only) 6 = G 1"-female (operating ranges 7 and 8 only) 8 = G 1 1/2"-female (operating range 9 only) 9 = SAE flange 1 1/2"-female (operating range 12-16 only)								
<b>Elektronics version /</b> S = standard H = high-temperature version (Series 1, 2, 6, 7 and 8 only) H+ = high-temperature-Plus version, with separate amplifier (series 1, 2, 6, 7 and 8 only) X = intrinsically safe with separate switching amplifier (EEx ia IIC)								
<b>Options /</b> 0 = none 1 = please specify in detailed text								
* for operating range 2 with connecting plate the thread size is G 3/8"-female								

## Versions (Table 1):

Depending on the application and media, the VM-04 is available in 8 different series:

Series	Material	min. Viscosity (mm <sup>2</sup> /s)	Accuracy (% of MV)	Media properties		Particle size	Connection
				Viscosity	Lubrication		
1	EN-G75-400-15	20	± 0.3	low	well	20 µm max.	Plate mounting
2	EN-G75-400-15	50	± 0.5	middle	well	30 µm max.	Plate mounting
3	EN-G75-400-15	100	± 1.0	high	well	50 µm max.	Plate mounting
4	EN-G75-400-15	100	± 0.5	middle	low	30 µm max.	Plate mounting
5	st. steel 1.4404	100	± 0.5	middle	low	30 µm max.	Plate mounting or direct thread
6	st. steel 1.4404	20	± 0.3	low	well	20 µm max.	Plate mounting or direct thread
7	EN-G75-400-15	20	± 1	low	bad	20 µm max.	Plate mounting
8	st. steel 1.4404	20	± 1	low	bad	20 µm max.	Plate mounting or direct thread

## Application Examples (Table 2):

Series	Application example	Media	Bearing	Bearing tolerance
1	flow measurement and counting	lubrication oils	ball bearing	small
2	filling	gear oils	ball bearing	expanded
3	consumption measurement	offset paint	bronze sliding bearing	big
4	ratio regulation	Polyol + Isocyanat	carbide metal sliding bearing	expanded
5	dosing	clear varnish	carbide metal sliding bearing	expanded
6	flow measurement	solvents	ball bearing made of st. steel	small
7/8		solvents	hybrid bearing	small

## Ranges in l/min (Tab. 3):

Startup l/min	Type	Series							
		1	2	3	4	5	6	7/8	
0.001	VM-04.2	0.008...2	-	-	-	0.02...2*	0.008...2	0.008...2	
0.004	VM-04.3	0.02...4	-	-	-	-	0.02...4	0.02...4	
0.008	VM-04.4a	0.04...8	-	-	0.04...8	-	0.04...8	0.04...8	
0.01	VM-04.4	0.16...16	0.16...16	-	0.16...16	0.16...16	0.16...16	0.16...16	
0.01	VM-04.5	0.2...40	-	-	0.2...30	0.2...30	-	-	
0.02	VM-04.6	0.4...80	0.4...80	0.6...40	0.3...60	0.3...60	0.4...80	0.4...80	
0.03	VM-04.7	0.6...160	0.6...160	-	0.6...100	0.6...100	0.6...160	-	
0.04	VM-04.8	1...250	1...250	1.2...80	1...160	1...160	1...250	-	
0.1	VM-04.12	2...600	-	-	-	-	-	-	
0.2	VM-04.16	3...700	-	-	-	-	-	-	

\*Accuracy ± 3%; linear Accuracy ± 1.5%

## Parameters (Tab. 4):

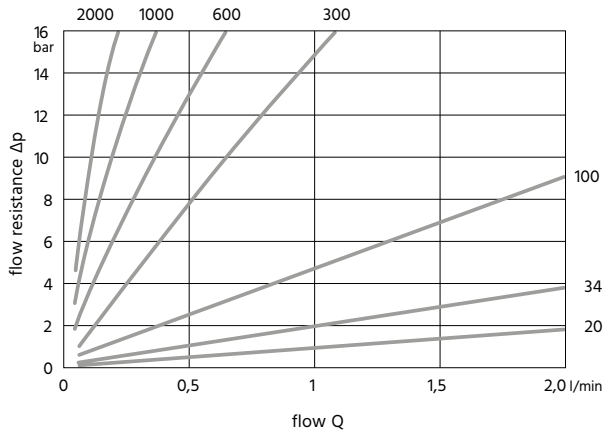
Type	max. Pressure	Pressure Peaks	SPL in dB(A)	Resolution pulses/l
VM-04.2	400 bar	480 bar	< 60	40,000
VM-04.3	400 bar	480 bar	< 60	25,000
VM-04.4a	400 bar	480 bar	< 60	10,000
VM-04.4	400 bar	480 bar	< 60	4,081.63
VM-04.5	400 bar	480 bar	< 70	2,500
VM-04.6	400 bar	480 bar	< 70	965.25
VM-04.7	315 bar	350 bar	< 70	333.33
VM-04.8	315 bar	350 bar	< 72	191.5
VM-04.12	400 bar	480 bar	< 80	83.33
VM-04.16	400 bar	480 bar	< 80	62.50



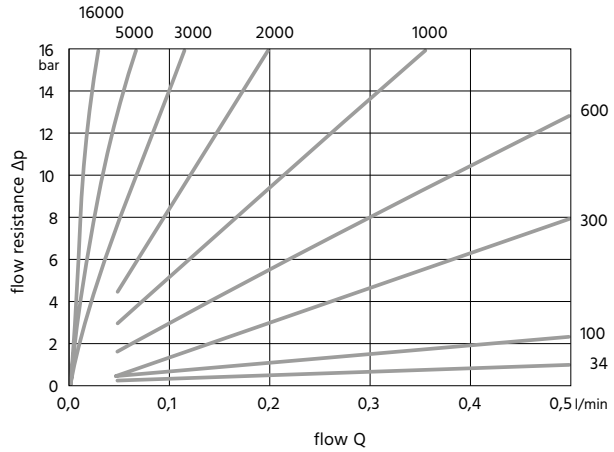
# Flow resistance VM-04:

Series 1, 2, 6, 7, 8 – Parameter: Viscosity (mm<sup>2</sup>/s)

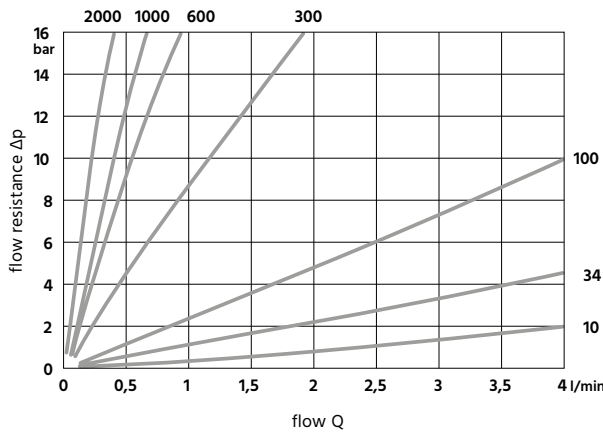
Operating range 2



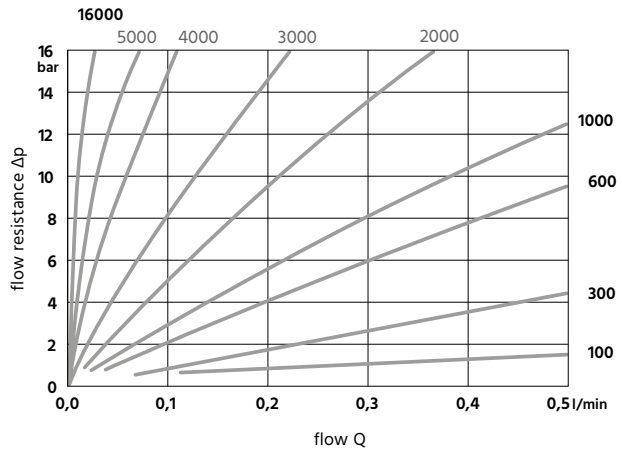
Operating range 2 (Ausschnitt)



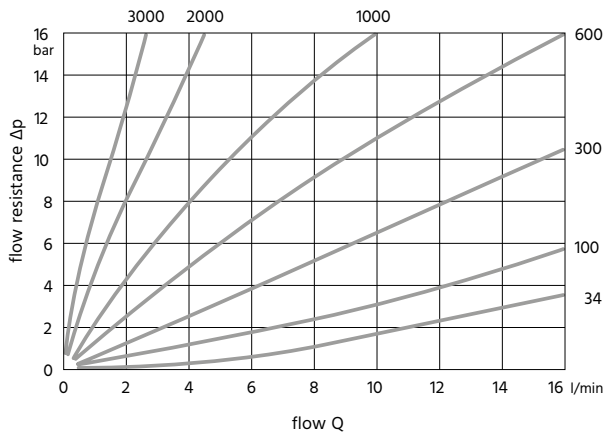
Operating range 3



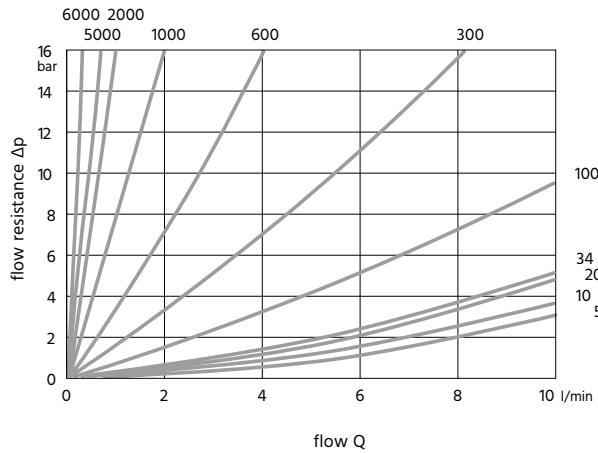
Operating range 3 (Ausschnitt)



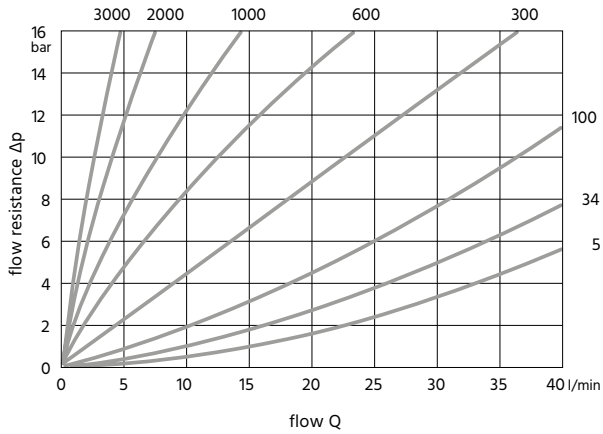
Operating range 4



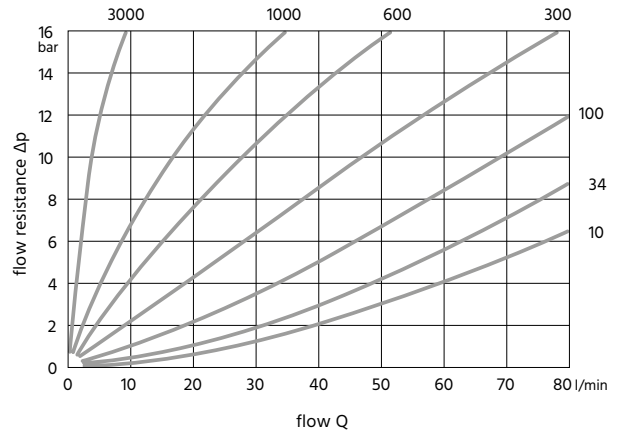
Operating range 4a



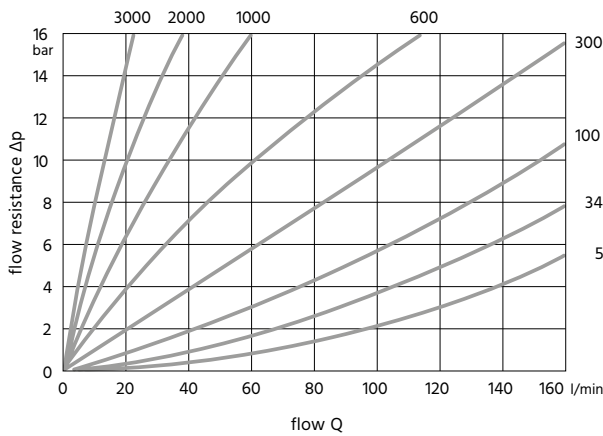
**Operating range 5**



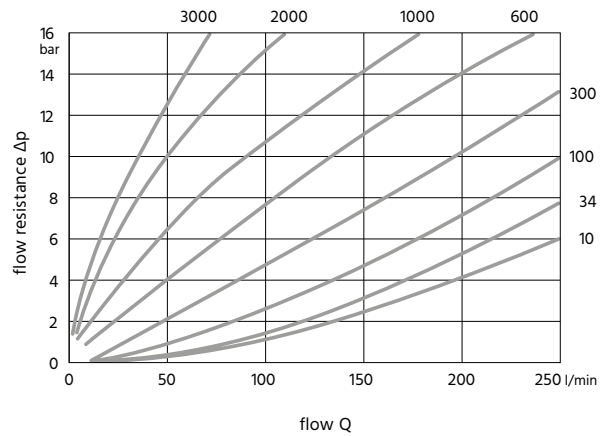
**Operating range 6**



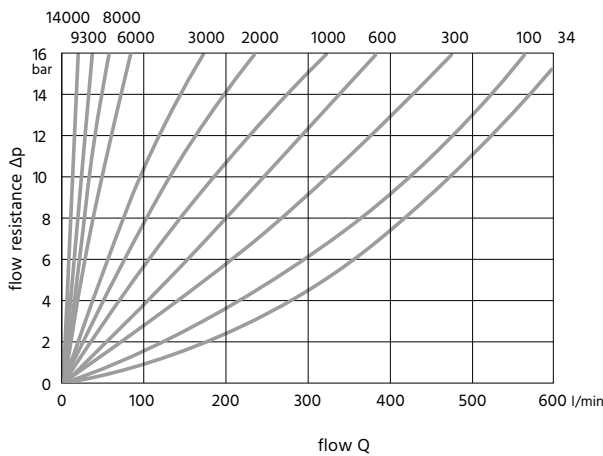
**Operating range 7**



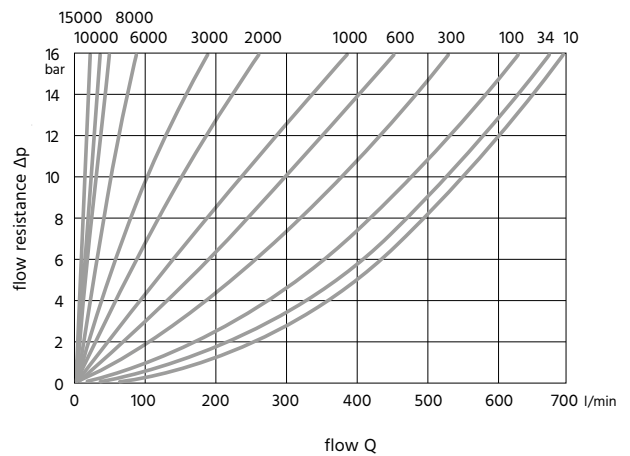
**Operating range 8**



**Operating range 12**



**Operating range 16**

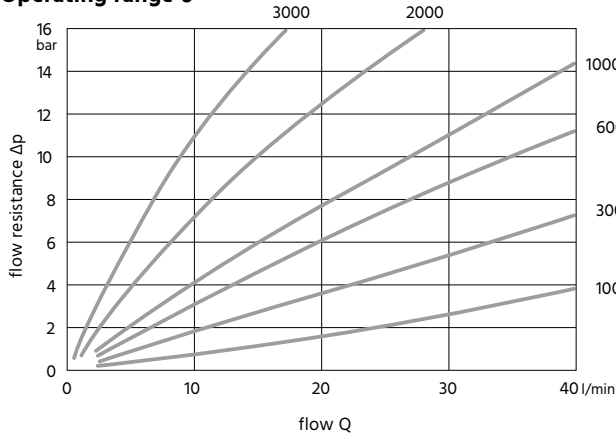




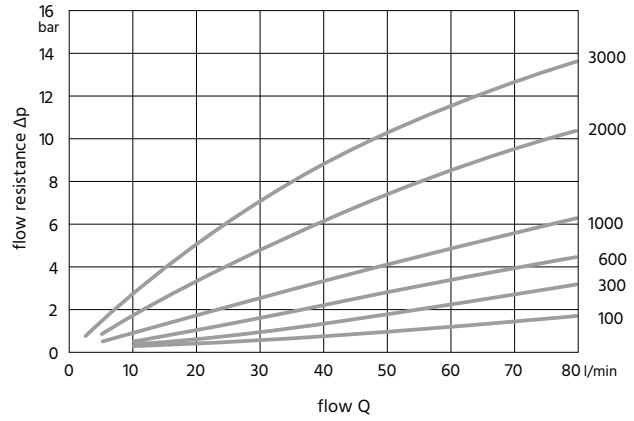
# Flow resistance VM-04:

Series 3 – Parameter: Viscosity (mm<sup>2</sup>/s)

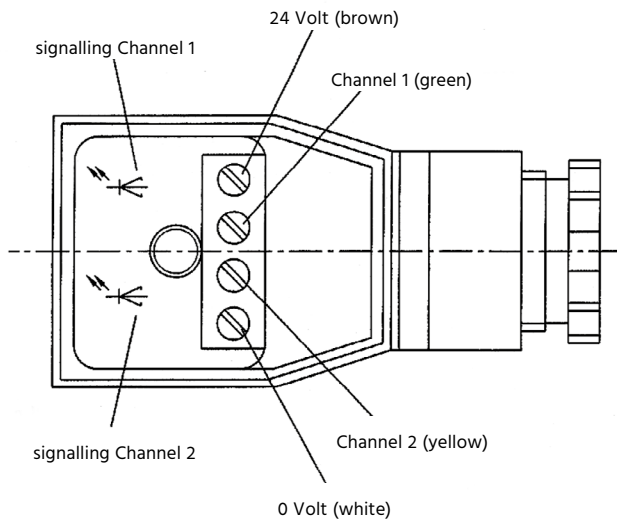
Operating range 6



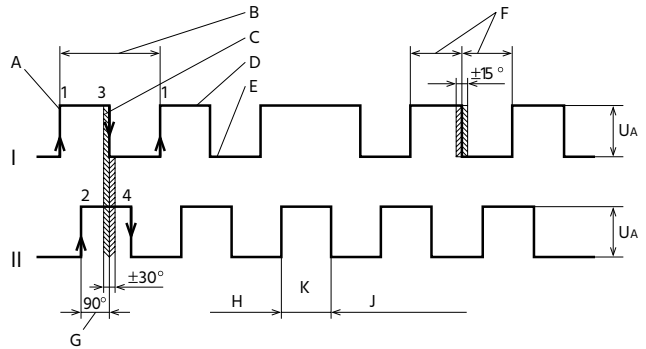
Operating range 8



## Electric Cable Connection VM-04:



## Signal Pattern VM-04:



### Channel I

- A rising flank
- B one impulse (corresponds to the throughput of a geometrical tooth-volume  $V_{gz}$ )
- C falling flank
- D switch on phase
- D switch off phase
- F scan ratio  $1:1 \pm 15\%$

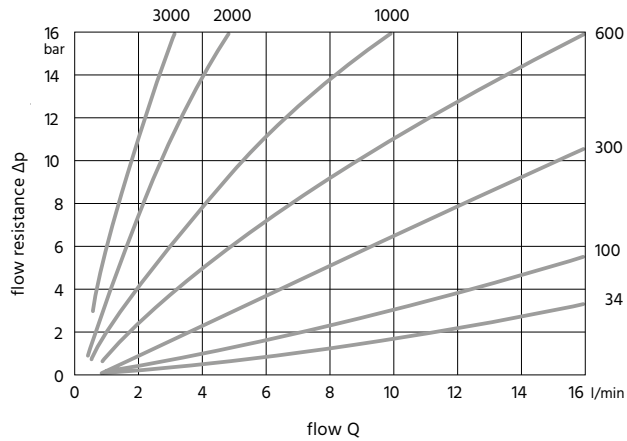
### Channel II

- G channel displacement
- H flow direction 1
- K reversal of direction of rotation
- H flow direction 2

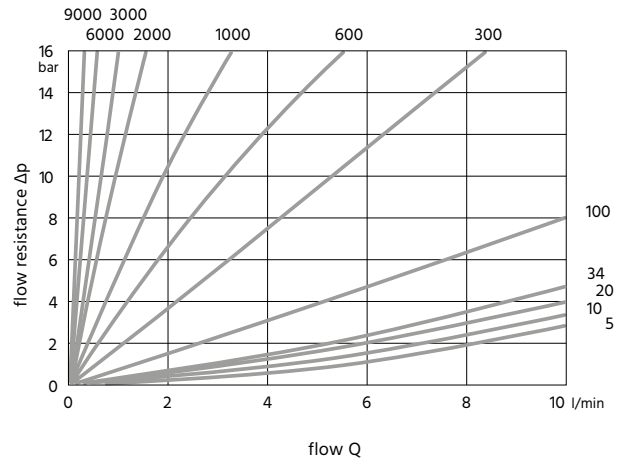
# Flow resistance VM-04:

Series 4, 5 – Parameter: Viscosity (mm<sup>2</sup>/s)

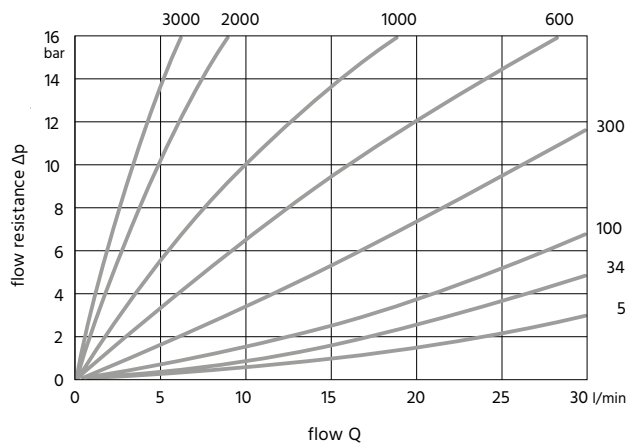
**Operating range 4**



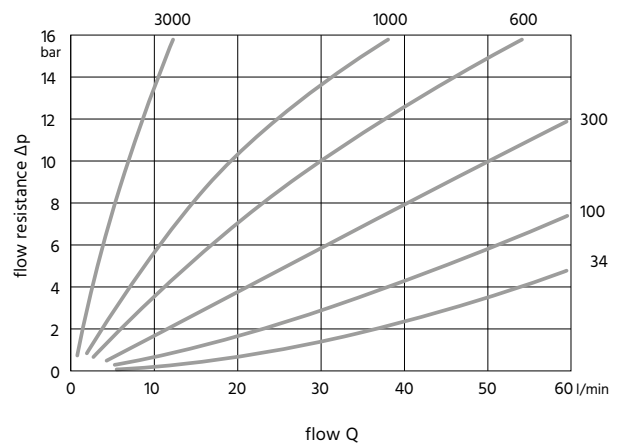
**Operating range 4a**



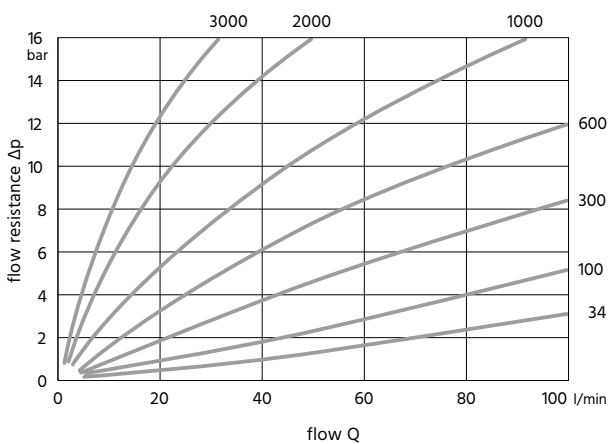
**Operating range 5**



**Operating range 6**



**Operating range 7**



**Operating range 8**

