KRACHT®
FLUID TECHNOLOGY AND SYSTEMS

VC
GEAR TYPE FLOW METERS

EN

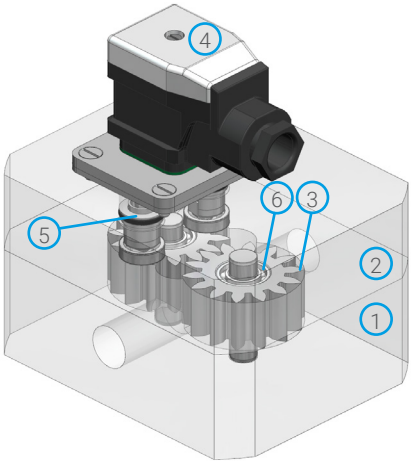
KRACHT®

FLUID TECHNOLOGY AND SYSTEMS

Content

General

Construction

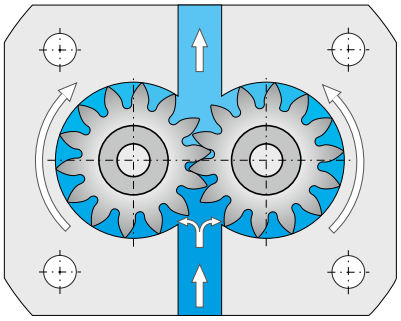


1 Housing
2 Cover
3 Gear
4 Plug
5 Sensor
6 Bearing

General product characteristics

- High-precision measurements with excellent repeatability
- Maximal measurement resolution if used with encoder
- IO-Link technology available
- Analogue technology available
- Wide measurement ranges with appropriate design sizes
- Application-optimised specification
- Low pressure drop
- Any flow direction
- Wide temperature range
- High working pressure
- Low noise emission
- Highly-dynamic measurements
- Explosion-proof versions ATEX/IECEx
- Electronics in EMV-compliant design
- RoHS-compliant

Function



Consisting of two high-precision gears, the measuring unit is driven by the liquid flow based on the displacement principle. The gears run in an almost contactless manner in the measuring chamber. The bearing consists of ball and plain bearings.

Thanks to the measuring principle, there is no need for settling sections on the inlet and outlet side so that machines/plants can be designed to be more compact. All moving parts are lubricated by the measuring medium.

The gear movement is scanned in a contactless manner by the lid-mounted sensors. During the rotation of the measuring unit by one tooth pitch, a signal is generated per sensor that corresponds to the so-called geometric tooth volume V_{gz}. The dual-channel scanning facilitates a higher measuring resolution and detection of the direction of flow.

Alternatively available encoder specifications deliver maximal measurement resolution.

Approvals

	Description	Country
CE	EU compliance – EMV – Pressure equipment – RoHS	European Union
EAC	EAC EMV guideline	Eurasian Economic Community
	GOST metrology, measurement technology	Russia
IO-Link	IO-Link	International

General

Versions

Standard version

The standard versions come with an integrated pre-amplifier which converts the pulses from the magnetic sensors into square-wave signals which are then computed by an electronics into specific measurement values.

The optionally available remote-electronics version is designed to handle extreme temperature ranges.

Encoder version with maximised measurement resolution

Compared with standard sensors, encoders are capable of generating considerably more pulses, thus increasing measurement resolution by orders of magnitude. Encoder-equipped SVC flow meters generate up to 2 500 pulses per revolution and can recognise the direction of flow.

Encoders, like the standard versions, send square-wave signals to the electronics.

IO-Link version with internal calculation of measured values

VC flow meters with IO-Link technology are based on standard VCs with one or two sensors. Unlike standard or encoder versions which always send a square-wave signal to the electronics, IO-Link devices have the added capability of internally computing concrete measurement values. Therefore, these flow meters lend themselves for use in classic PLC and in IO-Link infrastructures.

Please see page 14 for details.

Analogue version

VC flow meters from the analogue series provide an analogue 4 … 20 mA current signal that can be processed by many control and measuring devices. The analogue signal is used to determine the flow rate. In addition, VC devices with two sensors are able to transmit the flow direction via an additional digital signal.

Detailed information can be found on page 16.

Technical data

General characteristics

Type of connection	Plate mounting (P) / Pipe connection (R)
Mounting position	Any
Flow direction	Any
Maximum permissible pressure loss	16 bar
Viscosity	… 2 500 000 mm^2/s

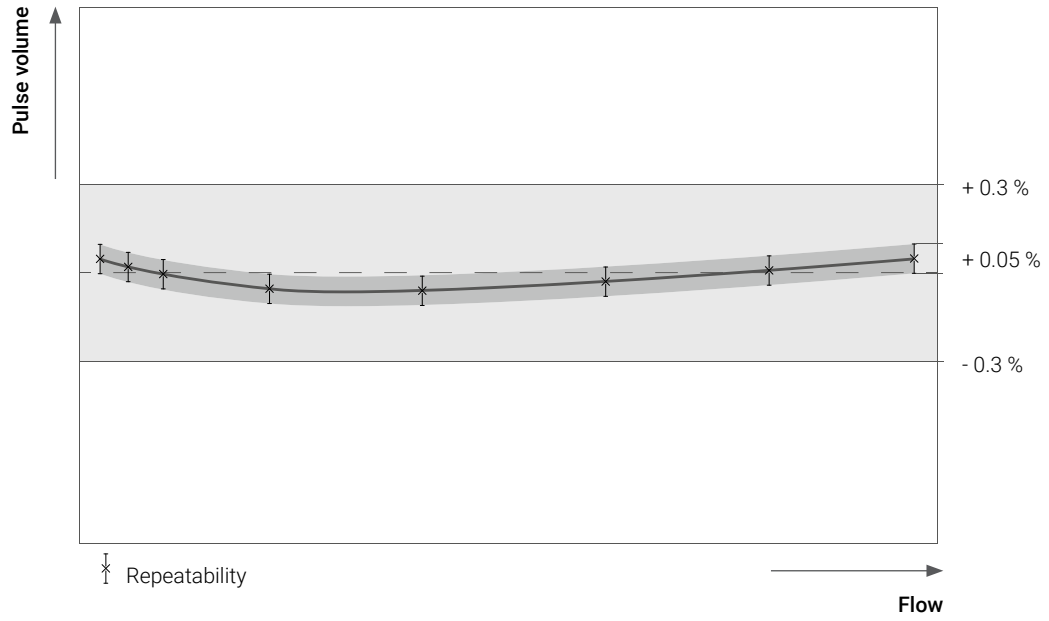
Nominal sizes / Geometric tooth volumes

Nominal sizes	0.025	0.04	0.1	0.2	0.4	1	3	5	12	16
Geometric tooth volumes in cm^3	0.025	0.040	0.100	0.245	0.400	1.036	3.000	5.222	12.000	16.000

Accuracy characteristics

- The indicated measurement accuracy refers to the pulse volume, i.e. the percentage variance applies to the latest measurement value.
- The measurement accuracy is up to +/- 0.3% of the measured value by default.
- Repeatability is +/- 0.05% in stable conditions.
- The measurement accuracy tests performed can be traced to DAkkS (Deutsche Akkreditierungsstelle, German Accreditation Body).
- The measurement accuracy characteristics indicated by KRACHT is confirmed by DAkkS.
- A calibration is possible on request. The result of this calibration will be documented in the form of a measurement accuracy characteristic.

Typical measurement accuracy characteristic



Technical data

Application examples

Specifications (type key ID for bearing and material)	- Bearings - Housing materials - Gear materials	Typical media	Typical media characteristics	Typical application of the flow/volume measurement
K1	- Ball bearing - Spheroidal cast iron GJS-400 - Steel	Oil Braking fluid Diesel	Lubricating fluids Low to medium viscosity	Hydraulic systems Test bench construction Cylinder stoke measurement
C1	- Ball bearing, high tolerance - Spheroidal cast iron GJS-400 - Steel	Gear oil	Lubricating fluids Medium viscosity	Oil filling (Metering systems)
G1	- Carbide plain bearing - Spheroidal cast iron GJS-400 - Steel	Offset ink Polyol Isocyanate Glue Resin Silicone	Lubricating fluids Medium to high viscosity	Consumption measuring (Printing machines)
G2	- Carbide plain bearing - Stainless steel - Stainless steel	Polyol Isocyanate Glue Resin Silicone	Poor lubricating fluids Medium to high viscosity	Ratio control (2-Component systems)
K2	- Ball bearing - Stainless steel - Stainless steel	Clear varnish Cavity sealing wax	Lubricating fluids Low to medium viscosity	Dosing control (Paint-spray lines) Test bench construction
H2	- Hybrid ball bearing - Stainless steel - Stainless steel	Urea (adBlue) Solvents Petrol	Poor lubricating fluids Low viscosity	Flow measurement (Paint-spray lines) Test bench construction Dosing
K3	- Ball bearing - Spheroidal cast iron GJS-600 - Steel	Oil Braking fluid Diesel	Lubricating fluids Low viscosity	Applications of up to 480 bar for nominal sizes 3, 5, 12 and 16
K4	- Ball bearing - Aluminium - Stainless steel	Oil Diesel Water	Low viscosity	Flow measurement

Technical data

Specifications

Specifications (type key ID for bearing and material)	K1	K2	G1	G2	C1	H2	K3	K4
Bearings	ball bearing	ball bearing	carbide plain bearing	carbide plain bearing	ball bearing (high clearances)	hybrid ball bearing	ball bearing	ball bearing
Housing materials	spheroidal cast iron GJS-400-15	stainless steel 1.4404	spheroidal cast iron GJS-400-15	stainless steel 1.4404	spheroidal cast iron GJS-400-15	stainless steel 1.4404	spheroidal cast iron GJS-600	aluminium 3.2315
Gear materials	steel 1.7131	stainless steel 1.4462	steel 1.7131	stainless steel 1.4462	steel 1.7131	stainless steel 1.4462	steel 1.7131	stainless steel 1.4462
Types of connection	P	P / R	P	P / R	P	P / R	P	R
Permissible particle size in pumped medium	20 µm	20 µm	30 µm	30 µm	30 µm	20 µm	20 µm	20 µm
Media temperatures* in °C	-40 … 210	-60 … 210	-40 … 80	-40 … 80	-40 … 210	-40 … 210	-40 … 210	-10 … 80
Maximum pressures in bar								
0.025 · 0.04 · 0.1 · 0.2 · 0.4 · 1 · 12 · 16	480	480	480	480	480	480	480	200
3 · 5	350	350	350	350	350	-	480	-

* Plate mounting (P) / Pipe connection (R)
** See selection guide on page 11

Available electronics versions

Integrated electronics	Standard	•	•	•	•	•	•	•	•
	High-temperature	•	•	-	-	•	•	•	-
	ATEX/IECEx	•	•	•	•	•	•	•	•
	IO-Link	•	•	•	•	•	•	•	•
	Analogue	•	•	•	•	•	•	•	•
	Encoder	•	-	•	-	-	-	-	-
Remote electronics	High-temperature PLUS	•	•	-	-	-	•	•	-
	ATEX/IECEx High-temperature PLUS	•	•	-	-	-	•	•	-
	Low-temperature	-	•	-	-	-	-	-	-

Measuring range

Nominal sizes	Starting points in l/min	Measuring ranges in l/min							
0.025	0.001	0.008 … 2	0.008 … 2	-	0.02 … 2	-	0.008 … 2	-	-
0.04	0.004	0.02 … 4	0.02 … 4	-	-	-	0.02 … 4	-	-
0.1	0.008	0.04 … 8	0.04 … 8	0.04 … 8	0.04 … 8	-	0.04 … 8	-	-
0.2	0.01	0.16 … 16	0.16 … 16	0.16 … 16	0.16 … 16	0.16 … 16	0.16 … 16	-	0.2 … 12
0.4	0.01	0.2 … 40	-	0.2 … 30	0.2 … 30	-	-	-	-
1	0.02	0.4 … 80	0.4 … 80	0.3 … 60	0.3 … 60	0.4 … 80	0.4 … 80	-	-
3	0.03	0.6 … 160	0.6 … 160	0.6 … 100	0.6 … 100	0.6 … 160	-	0.6 … 160	-
5	0.04	1 … 250	1 … 250	1 … 160	1 … 160	1 … 250	-	1 … 250	-
12	0.1	-	-	-	-	-	-	2 … 600	-
16	0.2	-	-	-	-	-	-	3 … 700	-

Technical data

Resolution standard, IO-Link and analogue versions

Nominal sizes	0.025	0.04	0.1	0.2	0.4	1	3	5	12	16
Resolutions in pulse/l*	40 000.00	25 000.00	10 000.00	4 081.63	2 500.00	965.25	333.33	191.50	83.33	62.50

* Resolution can be quadrupled by using both measurement channels (see signal behaviour on page 15).

Resolution encoder versions

Nominal sizes	Sensor resolutions* in pulse/rev	Pulse volumes in cm^3/pulse	Resolutions in pulse/l	Measured value resolutions 4-fold** in pulse/l	Max. pulse frequencies in Hz
0.04	512	0.001484	673 684	2 694 737	44 912
	2 500	0.000304	3 289 474	13 157 896	219 298
0.2	512	0.006699	149 271	597 084	39 806
	2 500	0.001372	728 863	2 915 452	194 363
1	512	0.028328	35 301	141 204	47 067
	2 500	0.005802	172 366	689 464	229 822

* More sensor resolutions available on request
** Resolution with both measuring channels and 4-fold evaluation

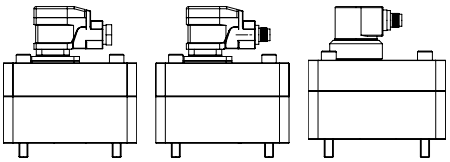
Sound pressure levels

Nominal sizes	0.025	0.04	0.1	0.2	0.4	1	3	5	12	16
Sound pressure levels in dB (A)	≤ 60	≤ 60	≤ 60	≤ 60	≤ 70	≤ 70	≤ 70	≤ 72	≤ 80	≤ 80

Technical data

Temperature compatibility of sealing elements and electronics

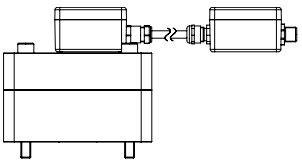
Versions with integrated electronic (Hirschmann / IO-Link / Analogue / Encoder)



	Electronic versions	Standard	Reduced supply voltage 12 V	High-temperature	ATEX/IECEx	IO-Link	Without pre-amplifier	Encoder (only K1/G1)	Analogue
	Type key ID	S	R	H	X	L	V	E	A
		Medium temperatures in °C							
Sealing materials	FKM	-40 … 120		-40 … 150	-15 … 80	-40 … 80	-40 … 120	-20 … 80	-40 … 80
	EPDM				-30 … 80				
	FEP				-30* … 80				
	FFKM	-15 … 120		-15 … 150	-15 … 80		-15 … 120	-15 … 80	-15 … 80

		Ambient temperatures in °C
VC versions	Standard	-40 … 80
	IO-Link	-40 … 50 (higher temperatures on request)
	ATEX/IECEx	FKM -15 … 60 EPDM -30 … 60 FEP* -30 … 60 FFKM -15 … 60
	Analogue	-40 … 60 for U_B > 15 V -40 … 80 for U_B < 15 V

Versions with remote electronic



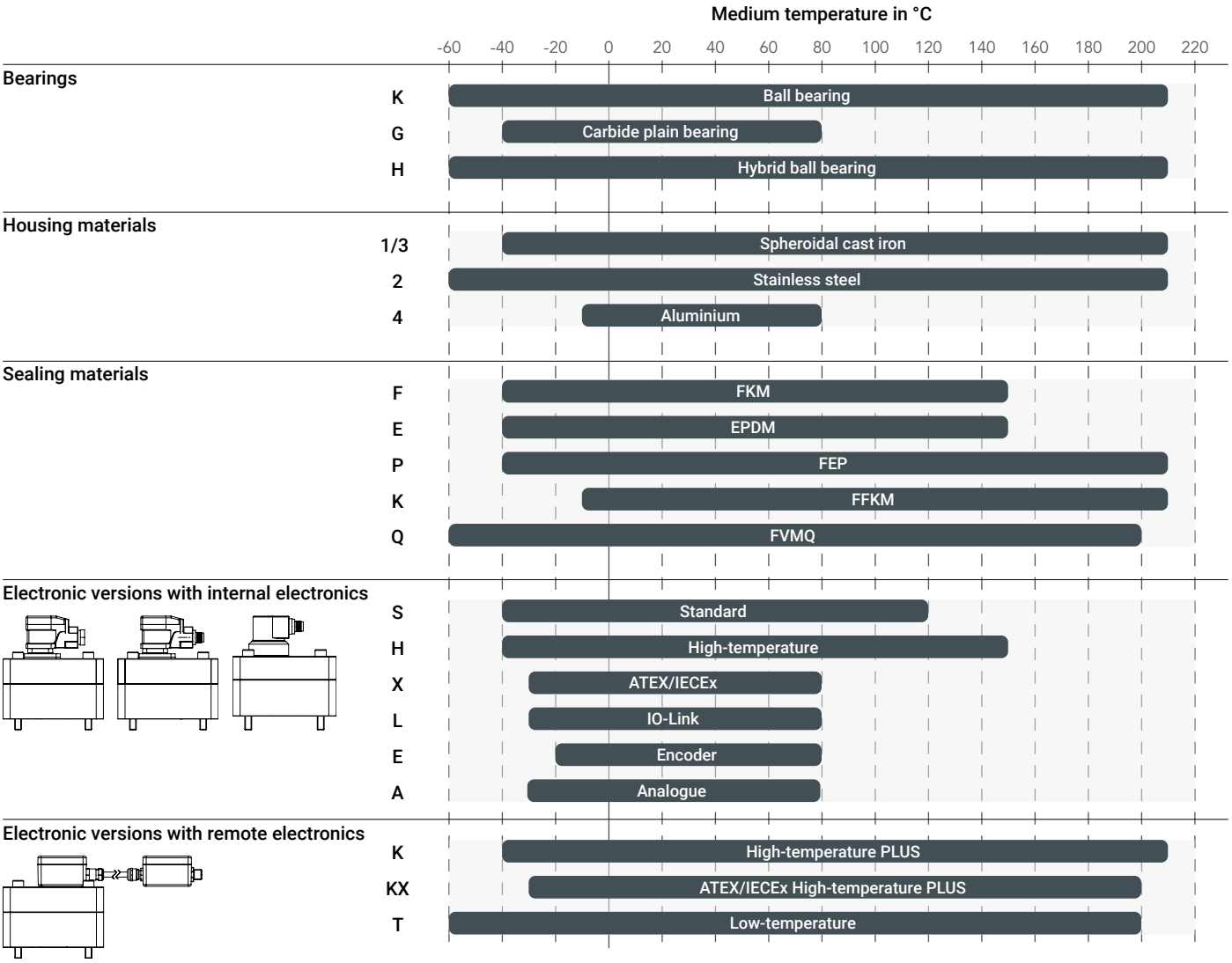
	Electronic versions	High-temperature PLUS	ATEX/IECEx High-temperature PLUS	Low-temperature
	Type key ID	K	KX	T
		Medium temperatures in °C		
Sealing materials	FKM	–		
	EPDM	–		
	FEP	-40 … 210	-30* … 180	–
	FFKM	-15 … 210	-15 … 200	–
	FVMQ	–		-60 … 200

		Ambient temperatures in °C
VC versions	Standard	-60 … 150 for VC -40 … 80 for remote electronic
	ATEX/IECEx	FKM -15 … 60 EPDM -30 … 60 FEP* -30 … 60 FFKM -15 … 60

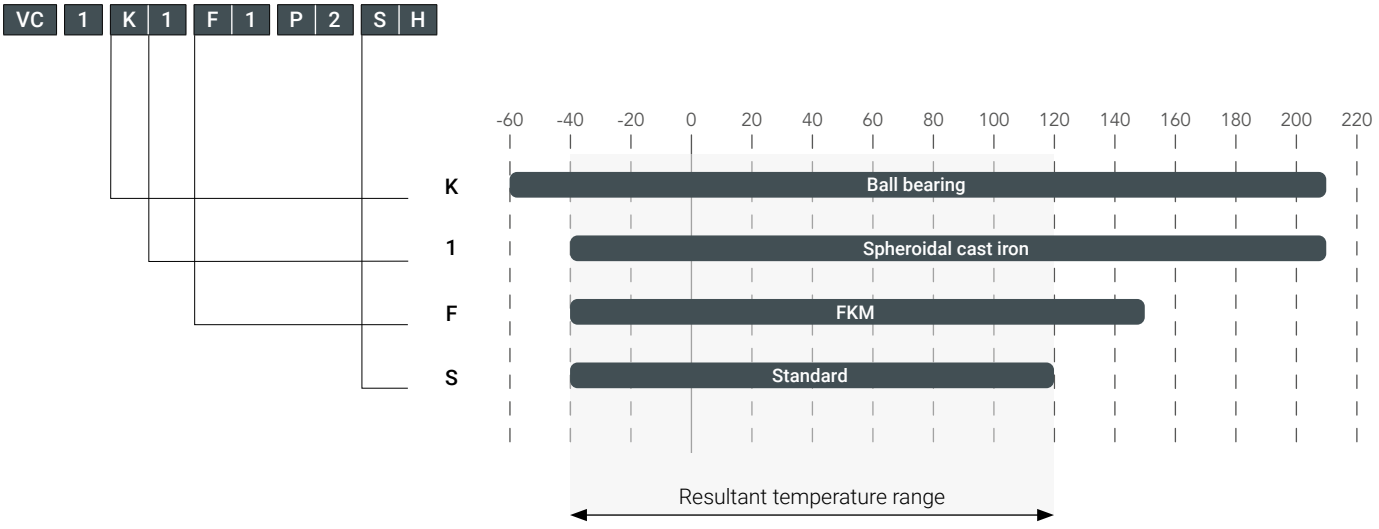
* Devices produced up to and including 2019 can be used at temperatures of up to -15 °C

Technical data

Selection guide



Example: determination of temperature range



Technical data

Electrical parameters for standard versions

Number of measuring channels	1 or 2
Working voltage U_B	10 … 30 V
Pulse amplitude U_A	≥ 0.8 U_B
Pulse with symmetric output signal	Square duty factor/channel 1:1 +/- 15 %
Signal output	PNP / NPN / Push-Pull
Pulse offset between the two channels	90 ° +/- 30 °
Power requirement $P_{b\ max}$	0.9 W
Output power / Channel $P_{a\ max}$	0.3 W short circuit-protected
Protection rating	IP 65

Electrical parameters for encoder versions

Number of measuring channels	2
Working voltage U_B	11 … 30 V
Pulse amplitude U_A	Min_{High} ≥ U_B - 3 V Max_{Low} ≤ 2.5 V
Pulse with symmetric output signal	Square, duty factor/channel 1:1 +/- 15%
Signal output	Push-Pull
Pulse offset between the two channels	90 ° +/- 30 °
Maximum load	+/-30 mA
Power consumption	Standard 45 mA Maximum 150 mA
Protection rating	IP 65

Electrical parameters for IO-Link versions

	IO-Link mode	**SIO mode**
Number of measuring channels	1 or 2	
Working voltage U_B	12 … 24 V	
Pulse amplitude U_A	Min_{High} ≥ U_B - 2 V Max_{Low} ≤ 2 V	
Pulse with symmetric output signal	–	Square, duty factor/channel 1:1 +/- 15 %
Signal output	Push-Pull I_{max} 25 mA	
Pulse offset between the two channels	–	90 ° +/- 30 °
Power requirement $P_{b\ max}$	2 W	
Protection rating	IP 65	

Electrical parameters for analogue versions

Number of measuring channels	1 or 2
Working voltage U_B	10 … 30 V DC (Reverse polarity protection up to 30 V DC)
Maximum load analogue output	793 Ω at 24 V DC
Maximum current digital output	100 mA (short circuit-protected)
Power requirement $P_{b\ max}$	1.4 W (without analogue and digital output)
Output signals	Analogue output 0 … 24 mA (Measuring range 4 … 20 mA) Digital output High > U_B – 3 V Low < 3 V
Protection rating	IP 65

Type key

VC	1	K	1	F	1	P	2	S		H
1	2	3	4	5	6	7	8	9	10	11

1 Product	
VC	Gear type flow meter

2 Nominal sizes
0.025 · 0.04 · 0.1 · 0.2 · 0.4 · 1 · 3 · 5 · 12 · 16

3 Bearings			
K	**H**	**C**	**G**
Ball bearing	Hybrid ball bearing	Ball bearing, high tolerance	Carbide plain bearing

4 Materials			
1	**2**	**3**	**4**
Housing: Spheroidal cast iron GJS-400 Gears: Steel	Housing: Stainless steel Gears: Stainless steel	Housing: Spheroidal cast iron GJS-600 Gears: Steel	Housing: Aluminium Gears: Stainless steel (only nominal size 0.2)

5 Sealings				
F	**E**	**P**	**K**	**Q**
FKM	EPDM	FEP	FFKM	FVMQ

6 Surfaces	
1	Standard (coated)
3	Without coating

7 Connection types	
P	Plate mounting
R	Pipe connection

8 Sensor technologies		Notes
2	2 sensors	
1	1 sensor	
3	Without sensors	
4	2 sensors vibration-proof/condensation-proof	
5	Encoder only nominal sizes 0.04 · 0.2 · 1	only with 9: **E**

9 Electronic versions (pre-amplifier)		Voltage	Media temperature	Conversion	Notes
S	Standard	24 V	-40 … 120 °C	internal	
H	High-temperature	24 V	-40 … 150 °C	internal	
K	High-temperature PLUS	24 V	-40 … 210 °C	external	
T	Low-temperature	24 V	-60 … 200 °C	external	
X	ATEX/IECEx (isolating switching amplifier to be ordered separately)		-30 … 80 °C	internal	only with 11: **H**
KX	ATEX/IECEx High-temperature PLUS		-30 … 200 °C	external	only with 11: **V**
R	Reduced supply voltage	12 V	-40 … 120 °C	internal	
L	IO-Link	12 … 24 V	-40 … 80 °C	internal	
V	Without pre-amplifier		-40 … 120 °C		
E	Encoder	11 … 30 V	-20 … 80 °C	internal	
A	Analogue	10 … 30 V	-40 … 80 °C	internal	only with 11: **F**

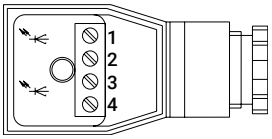
10 Cable lengths	
	Without cable between flow meter and electronic
2	With 2 m cable
5	With 5 m cable
10	With 10 m cable

11 Electrical connections (Connector and pre-amplifier case)		
H	Appliance socket (Hirschmann)	standard
M	Appliance socket (Hirschmann)	with M12x1, 4-pole connection
F	Appliance socket (Hirschmann)	with M12x1, 5-pole connection
K	Aluminium connection box	with M12x1, 4-pole connection
C	Aluminium connection box	with Cannon plug KPTC
E	Aluminium connection box	with M12x1, 4-pole connection, external electronics can be disconnected
V	Without	
512	Encoder with 512 pulse/rev	with M12x1, 4-pole connection
2 500	Encoder with 2 500 pulse/rev	with M12x1, 4-pole connection

Electronics

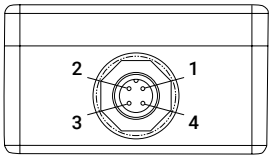
Electrical connections

Standard and high-temperature versions



1: U_B (brown)
2: Channel 1 (green)
3: Channel 2 (yellow)
4: 0 Volt (white)

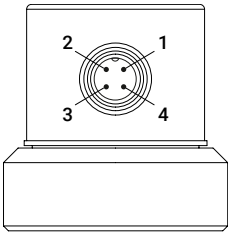
High-temperature PLUS and low-temperature versions



1: U_B (brown)
2: Channel 1 (white)
3: 0 Volt (blue)
4: Channel 2 (black)

Connection plug arrangement (M12x1 / 4-pole round connector)

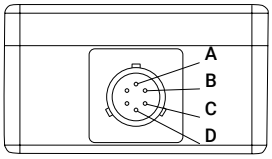
Encoder versions



1: U_B
2: Channel 1
3: 0 Volt
4: Channel 2

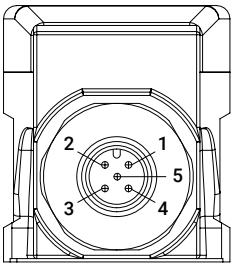
Connection plug arrangement (M12x1 metal / 4-pole round connector)

Cannon versions



A: U_B (brown)
B: Channel 1 (green)
C: Channel 2 (yellow)
D: 0 Volt (white)

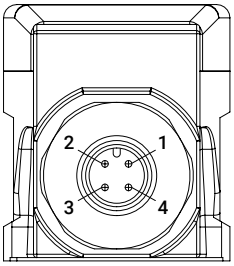
Analogue versions



1: U_B (brown)
2: Analogue output (white)
3: 0 Volt (blue)
4: Digital output (black)
5: Digital input (grey)

Connection plug arrangement (M12x1 metal / 5-pole round connector)

IO-Link versions



	IO-Link mode	SIO mode
1: brown	U_B	
2: white	I/Q	Channel 1
3: blue	0 Volt	
4: black	C/Q	Channel 2

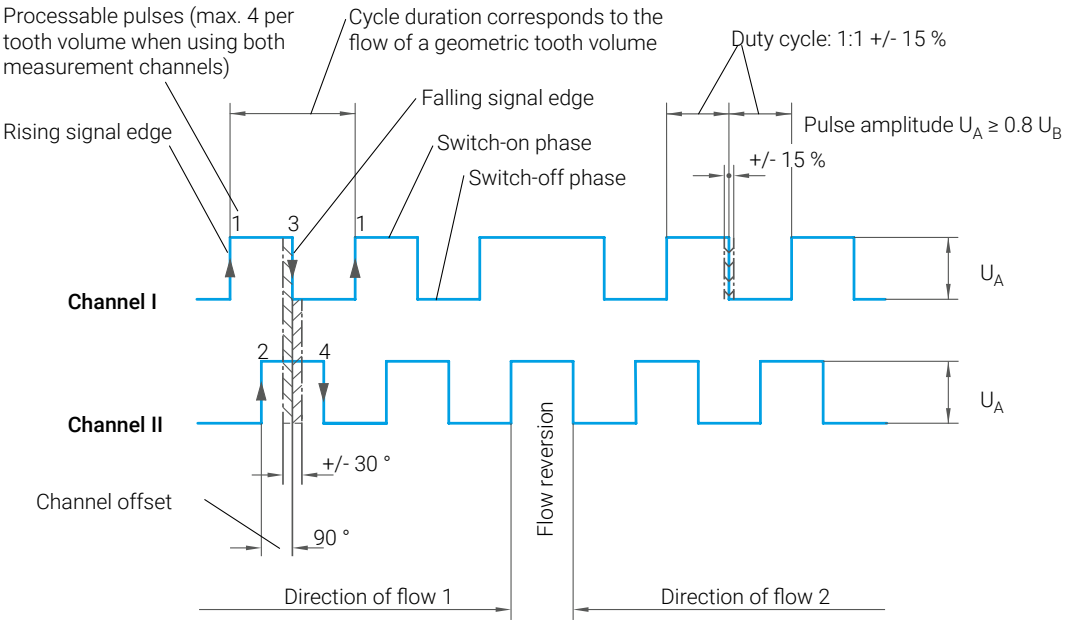
Connection plug arrangement (M12x1 metal / 4-pole round connector)

Electronics

Signal characteristics (standard, high-temperature, encoder, IO-Link versions in SIO mode)

Signal behaviour

The pre-amplifier generated square-wave signal enables application specific resolutions. Standard resolution means that the electronics will process one pulse from a channel/sensor per cycle time (rising signal edge in channel I). In contrast, the 4-fold evaluation uses the maximal pulse rate per cycle time, allowing for a resolution that is four time as high as in the standard evaluation. All characteristics of the signal (rising and falling signal edge of both sensors/channels) are exploited in the evaluation.



Electronics

Analogue versions

General

In addition to a digital signal indicating the flow direction, analogue technology enables an analogue 4 ... 20 mA current signal to be provided for flow rate determination. A VC with two sensors and a digital input on the evaluation electronics are required for digital flow direction determination.

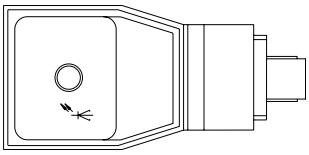
The 4 ... 20 mA range can be adapted to the application-specific measuring range.

Analogue technology has been specially developed for common analogue current inputs of controllers or measuring devices.

Characteristics:

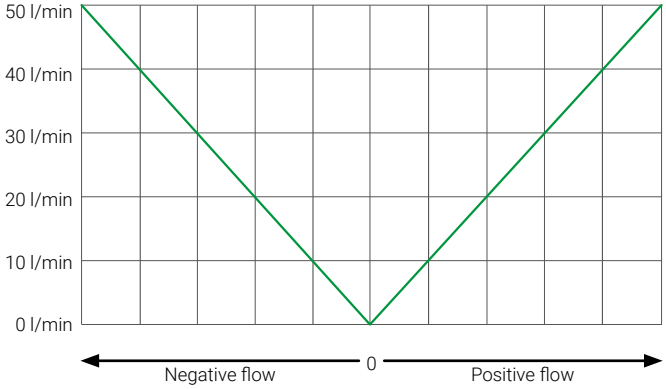
- Individualisation of the measuring range possible
- Universal application possibilities
- 16 bit resolution
- Cable break detection
- Display of flow rate and direction by proportional LED behaviour on the device

Connection plug



Signal behaviour

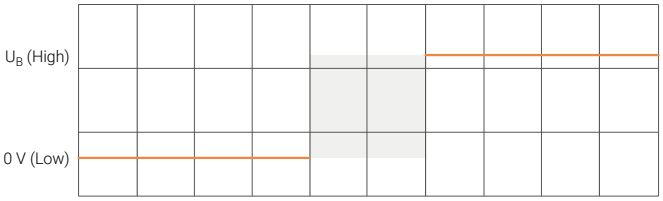
Actual flow rate



Analogue signal
based on a defined measuring range of 8 to 40 l/min

A Maximum flow exceeded
B Measurable flow range
C Minimum flow not reached

Digital signal



Below the minimum flow rate, the digital signal is undefined.

LED behaviour

	LED behaviour proportionally dependent on flow rate	
Blue	Continuous	Negative flow Maximum flow exceeded
Blue / Green	Flashing	Negative flow Flow within the measuring range
Green	Continuous	No measurable flow
Green / Red	Flashing	Positive flow Flow within the measuring range
Red	Continuous	Positive flow Maximum flow exceeded

Electronics

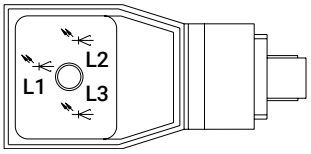
IO-LINK versions

General

Thanks to its international standardisation (IEC 61131-9), the IO-Link technology offers a point-to-point connectivity with continuous monitoring between any desired control layer and the VC-IO-Link assembly. Handling and startup is made easy by the associated IODD file (IO Device Description) strongly simplified.

The VC-IO-Link assembly directly delivers all measured values with units. In the preset SIO mode (standard input output), the volume counter gives squarewave signals if the IO-Link mode is not enabled by an IO-Link master. This guarantees downward compatibility of the VC-IO-Link assembly with the standard square-wave signal (see page 15).

Connection plug

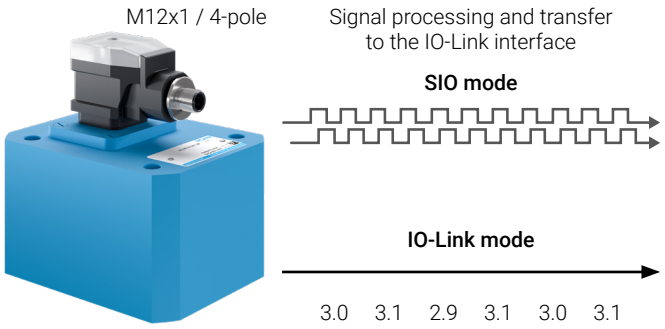


	IO-Link mode	SIO mode
L1 green	Flashing at 1/s	Continuous light, ready for operation
L2 red	Channel 1 gear detected = LED on gear not detected = LED off	
L3 red	Channel 2 gear detected = LED on gear not detected = LED off	

Technical characteristics

Manufacturer ID	0x0524
Device ID	0x000001
Name of manufacturer	Kracht GmbH
IO-Link connection plug	V1.1
Bit rate	COM3 / 230.4 kbit/s
Minimum cycle time	500µs
SIO mode supported	Yes
Use of indexed service data (IS DU)	Yes
Data storage (DS) possible	Yes

Communication of the assembly



SIO mode
- Same output of the two square-wave signals as in standard pre-amplifier

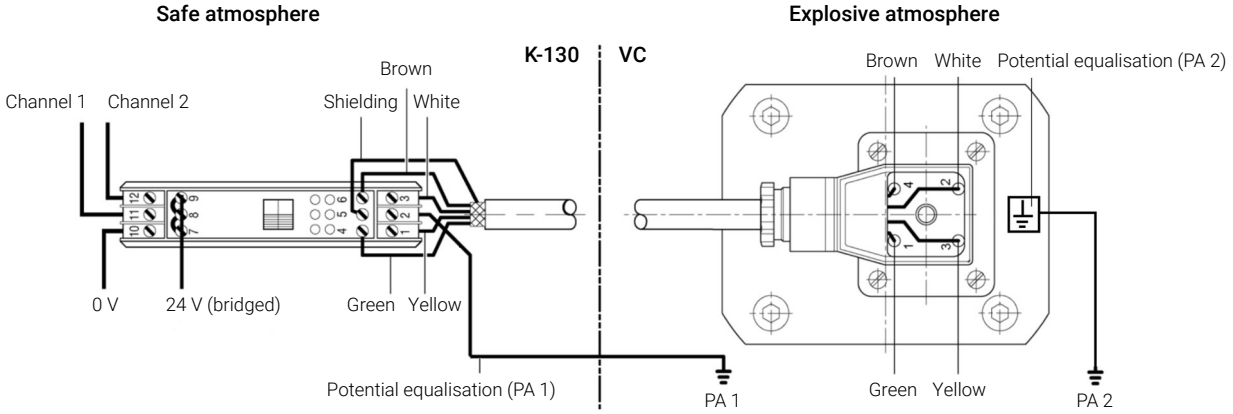
IO-Link mode
Signal output as described in IODD according to the following units:
- number of pulses
- litres

...

Explosion-proof version (ATEX/IECEx)

General

- All gear type flow meters are available as explosion-proof versions according to ATEX and IECEx certification.
- The explosion-proof version consists of the gear type flow meter (intrinsically safe electric gear) and the switching amplifier K 130 (accessory electric gear). This layout meets the ignition protection type "intrinsic safety".
- The gear type flow meter is installed in the explosive atmosphere.
- The switching amplifier K 130 is assembled in the safe atmosphere.
- The gear type flow meter is electrically connected with the switching amplifier. The switching amplifier analyses the sensor signals coming from the gear type flow meter and converts them into square-wave signals.
- It is prohibited to deploy the gear type flow meter in explosive atmospheres without switching amplifier.
- The cable between the gear type flow meter and switching amplifier may be up to 400 m long.
- The switching amplifier features LEDs to monitor for line breakage / short circuit, channel switching state, and voltage supply.



BVS 17 ATEX E 106 X / BVS 17.0088X **CML 16 ATEX 2014X / IECEx CML 16.0011**

Notes
This drawing only serves as an example for the connection of the sensors to the isolating switching amplifier K 130. Observe the applicable standards when assembling a plant in an explosive atmosphere.
Ignition protection marking (device-dependent)
Ⓔx II 2G Ex ia IIC T4 Gb
Ⓔx II 2D Ex ia IIIC T135 °C Db

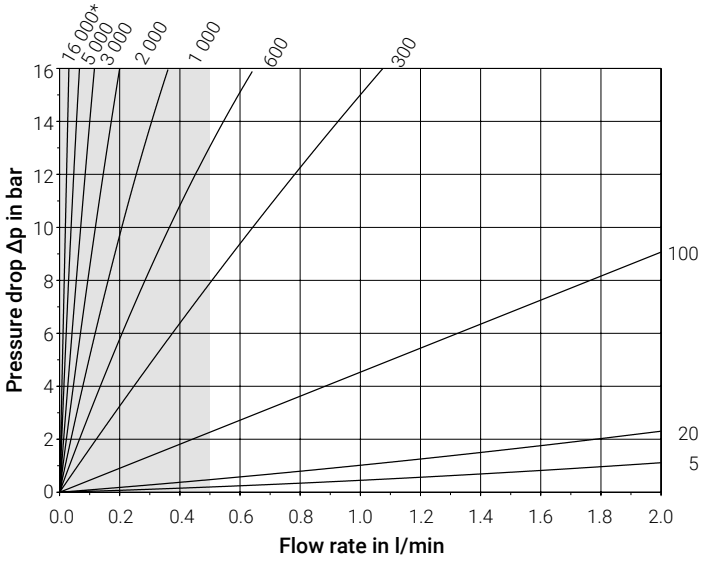
Switching amplifier K-130 technical characteristics

Supply	
Supply voltage terminal 7 (L+), terminal 10 (L-)	DC 24 Volt +/- 20 %
Output (not intrinsically safe) / nominal data terminals 9, 12, 8, 11	
Electronic outputs	Electrically isolated via photocoupler
Signal level 1-signal	Output voltage > 15 V
Signal level 0-signal	Output voltage ≤ 5 V
Ambient conditions	
Low threshold temperature	248 K (-25 °C)
High threshold temperature	333 K (+60 °C)
Mechanics	
Dimensions	114.5 x 99 x 22 mm
Mounting	Can be snapped on to 35 mm sectional rail, DIN EN 60715

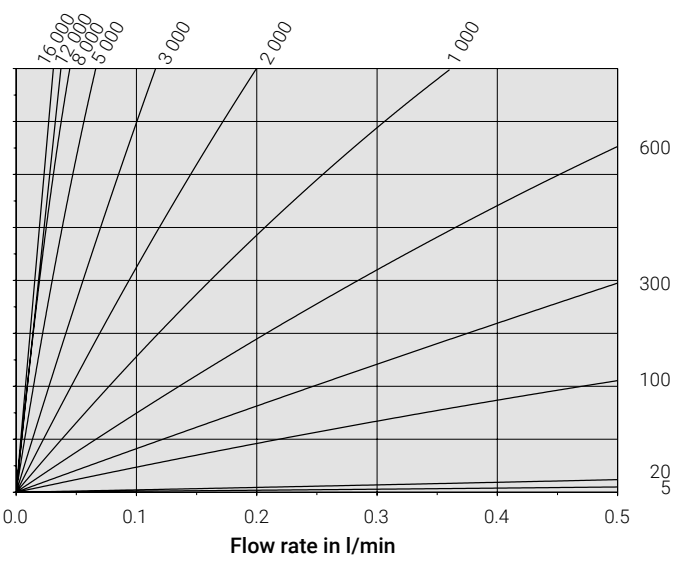
Pressure drop diagrams

Ball-bearing versions / Parameter: Viscosity in mm²/s

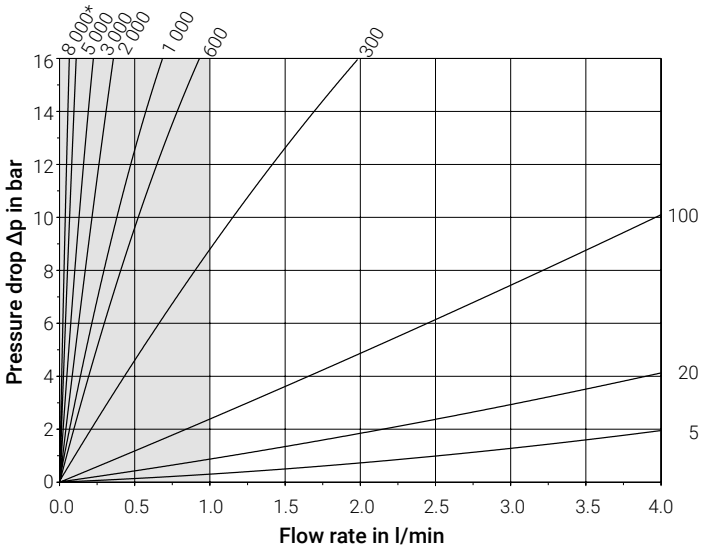
VC 0.025



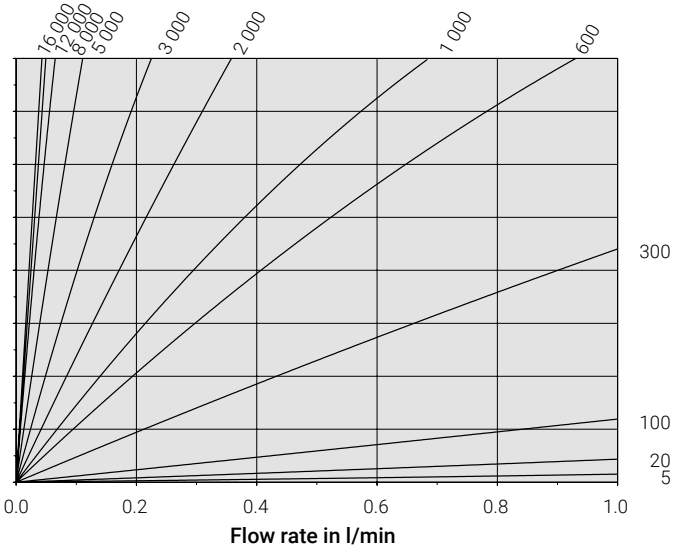
VC 0.025 (section)



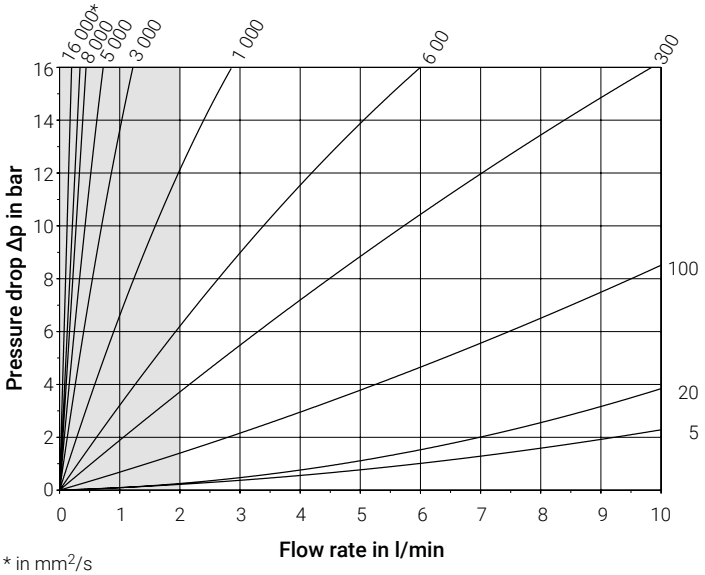
VC 0.04



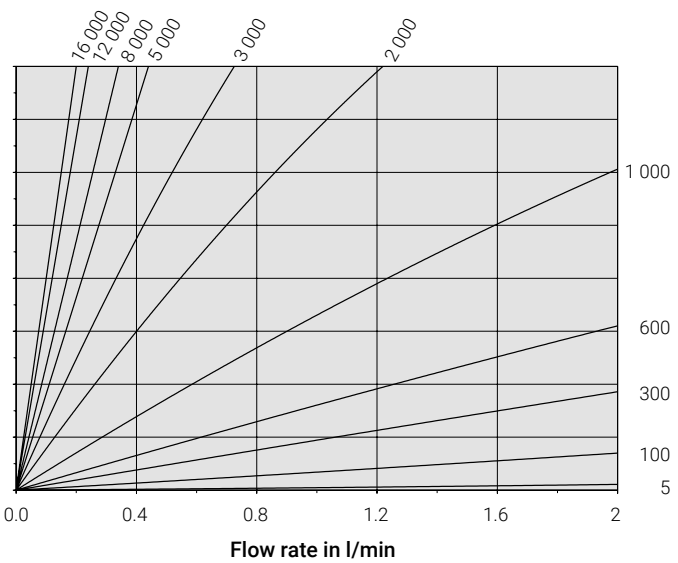
VC 0.04 (section)



VC 0.1



VC 0.1 (section)

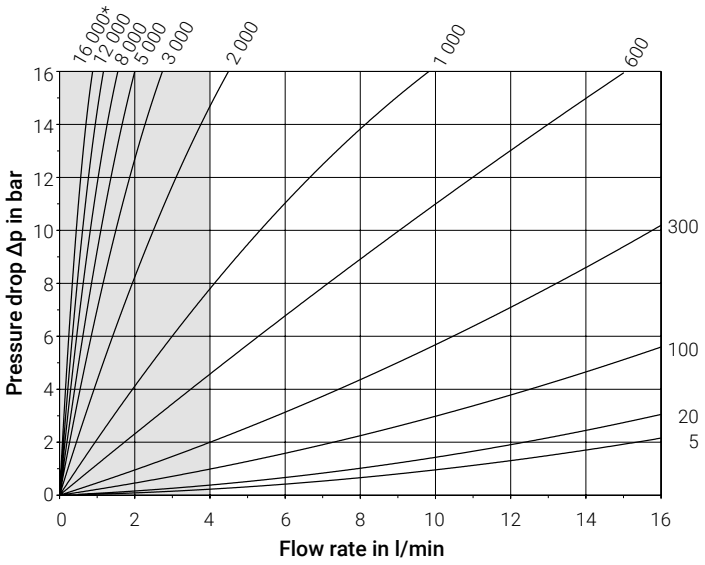


* in mm²/s

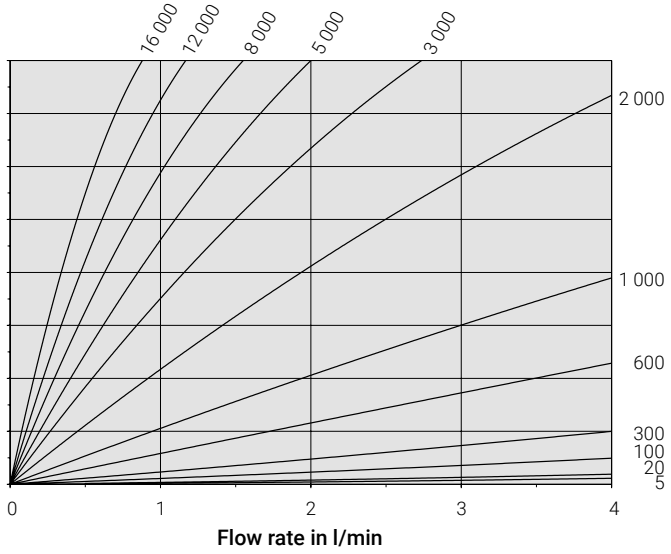
Pressure drop diagrams

Ball-bearing versions / Parameter: Viscosity in mm^2/s

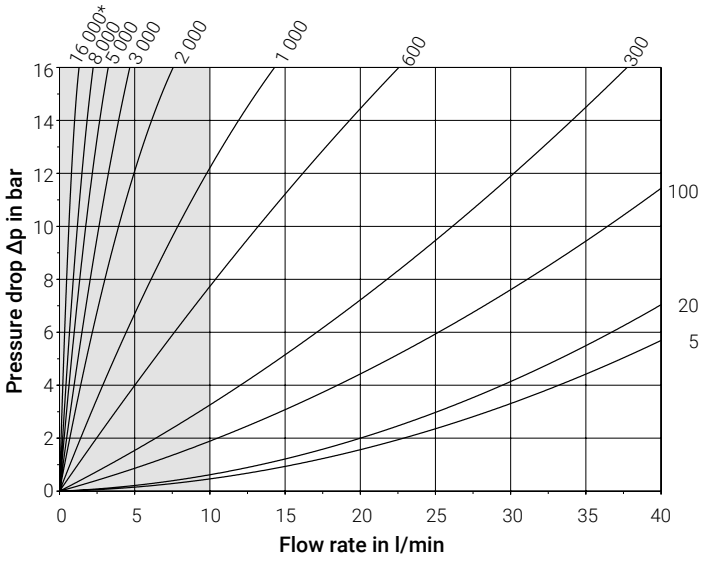
VC 0.2



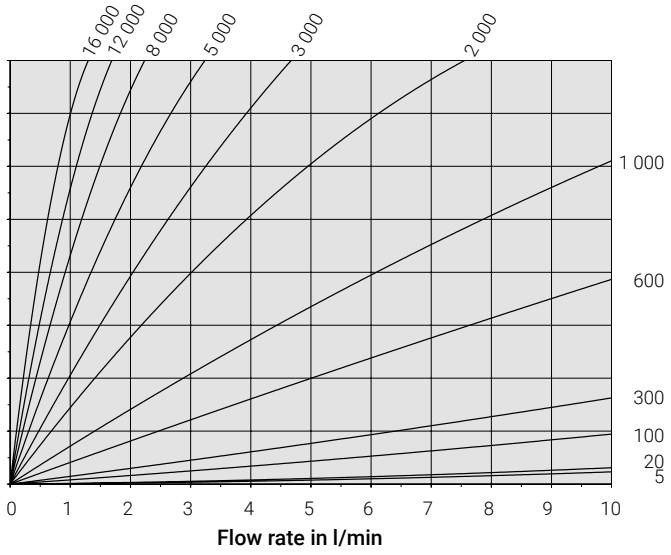
VC 0.2 (section)



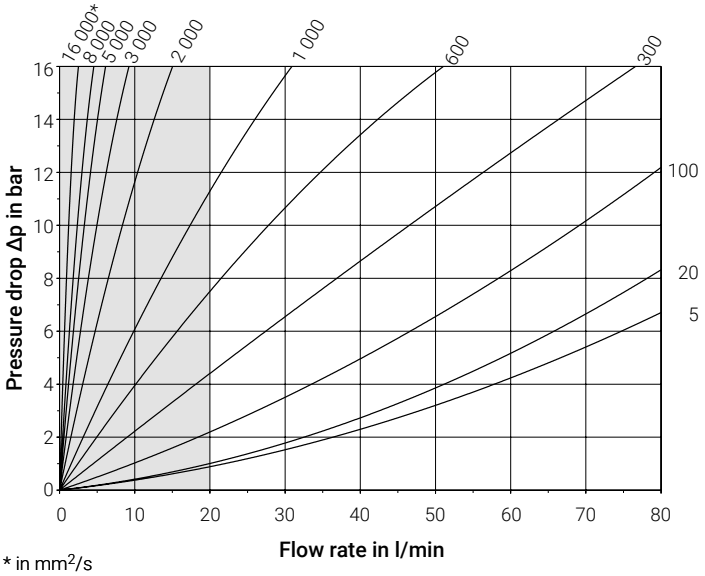
VC 0.4



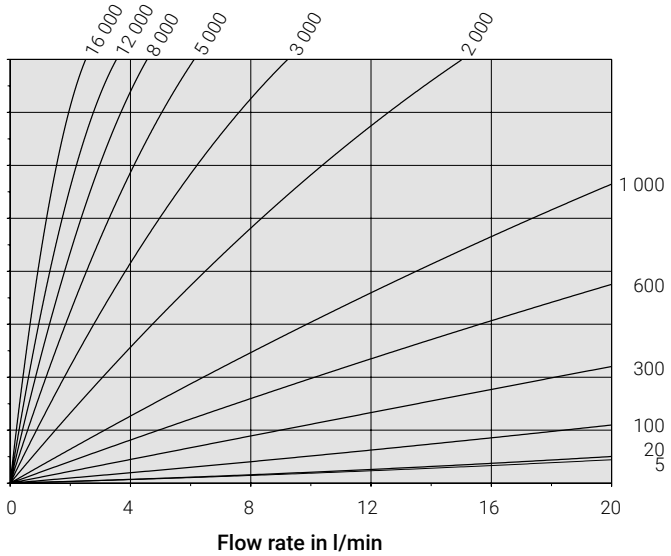
VC 0.4 (section)



VC 1



VC 1 (section)

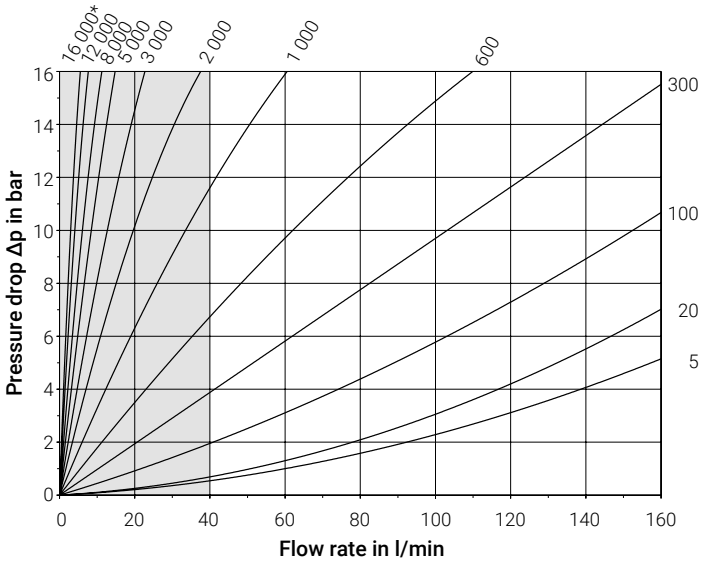


* in mm^2/s

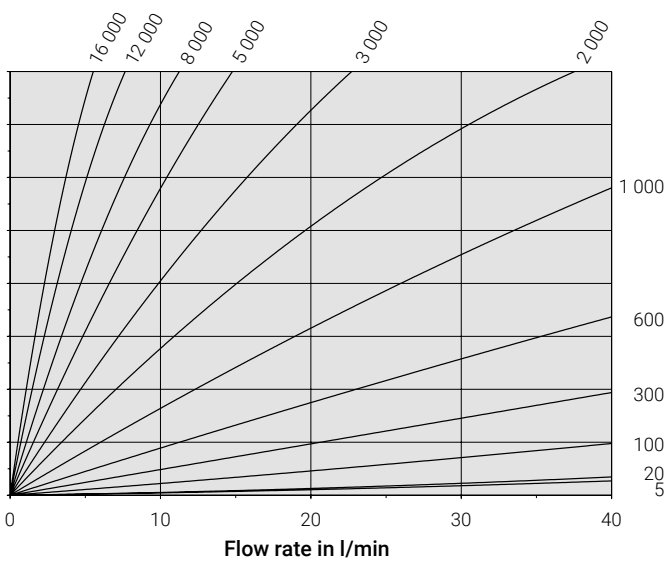
Pressure drop diagrams

Ball-bearing versions / Parameter: Viscosity in mm²/s

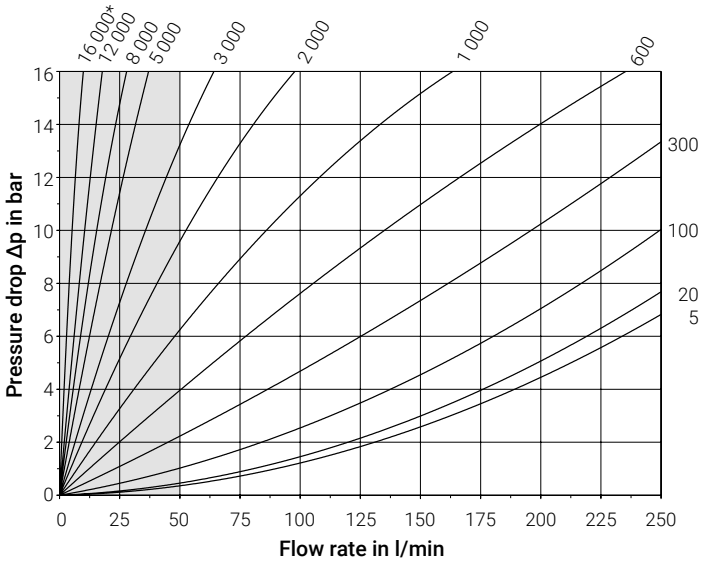
VC 3



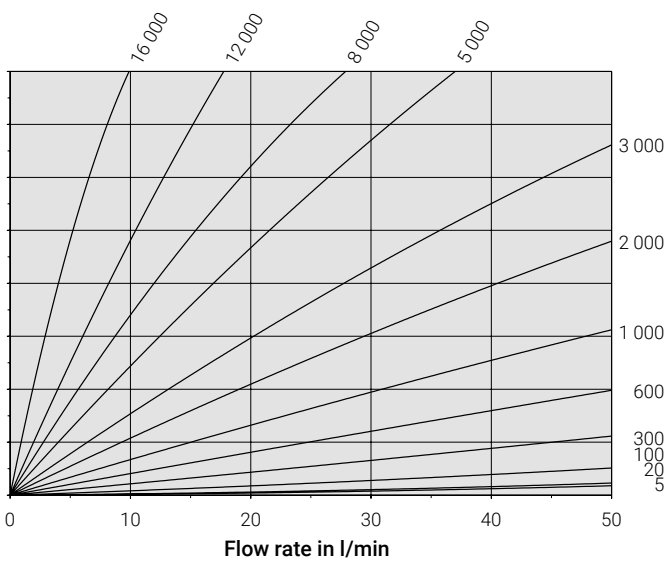
VC 3 (section)



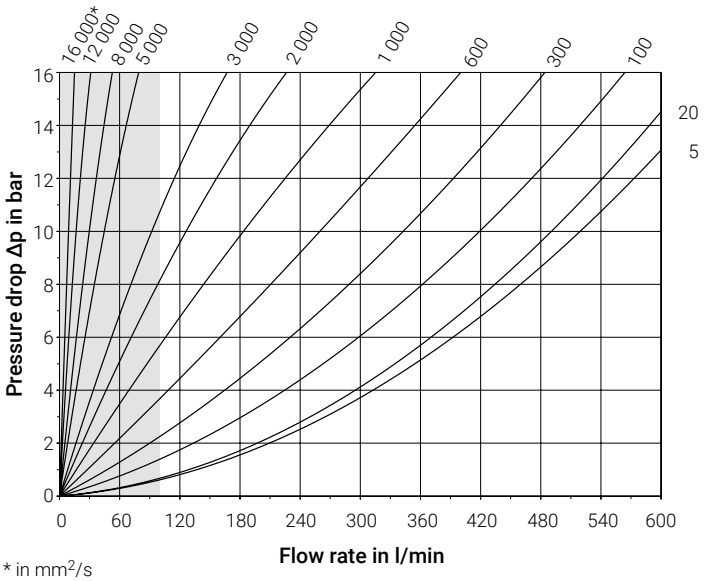
VC 5



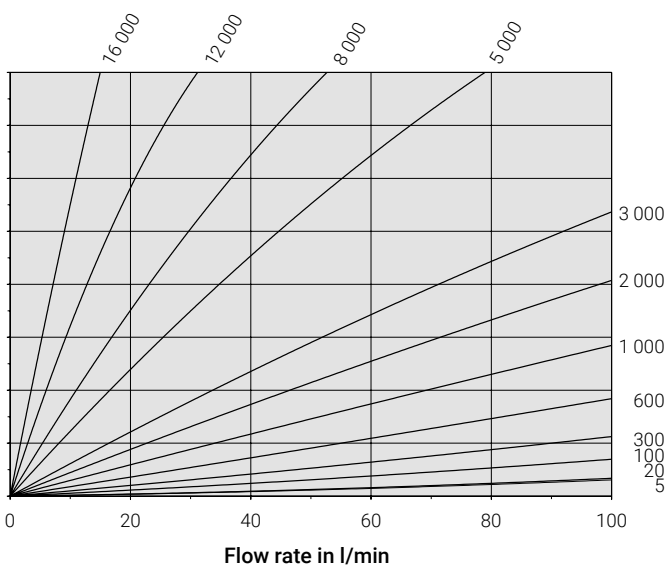
VC 5 (section)



VC 12



VC 12 (section)

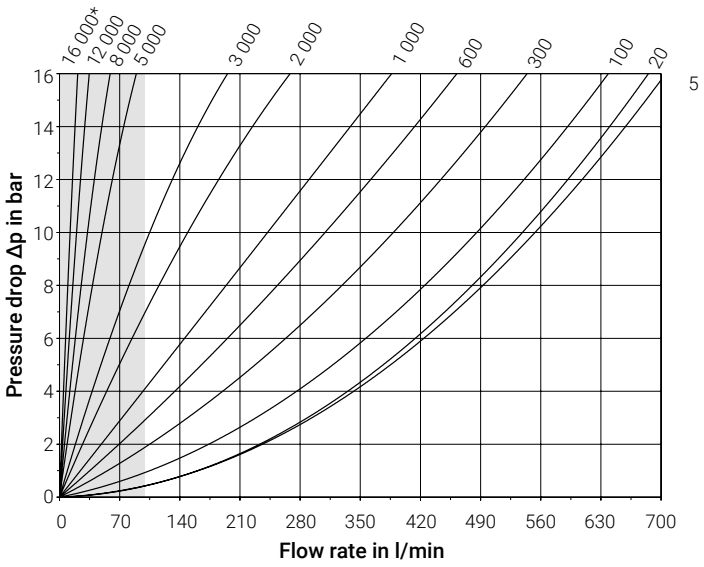


* in mm²/s

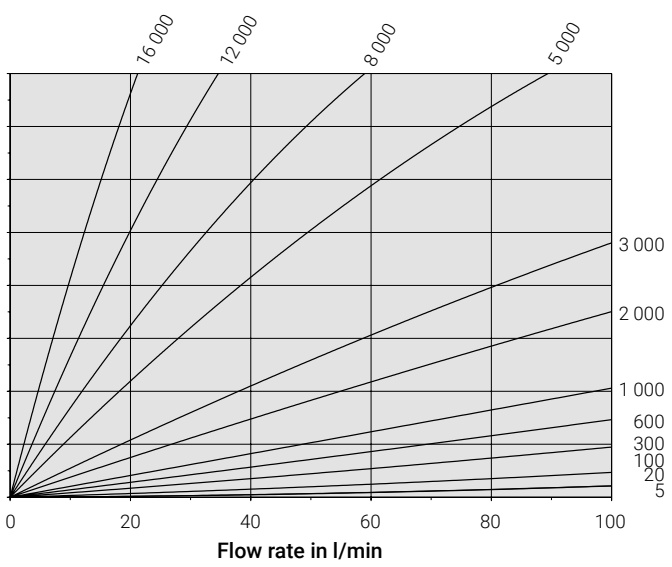
Pressure drop diagrams

Ball-bearing versions / Parameter: Viscosity in mm^2/s

VC 16



VC 16 (section)

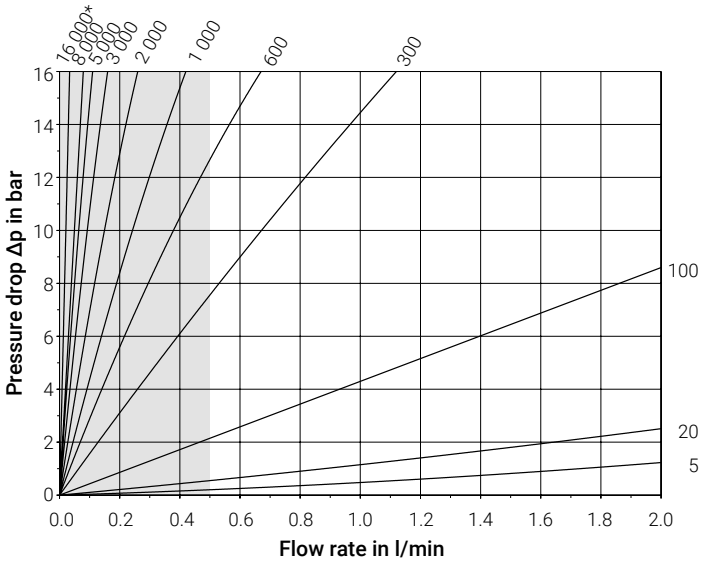


* in mm^2/s

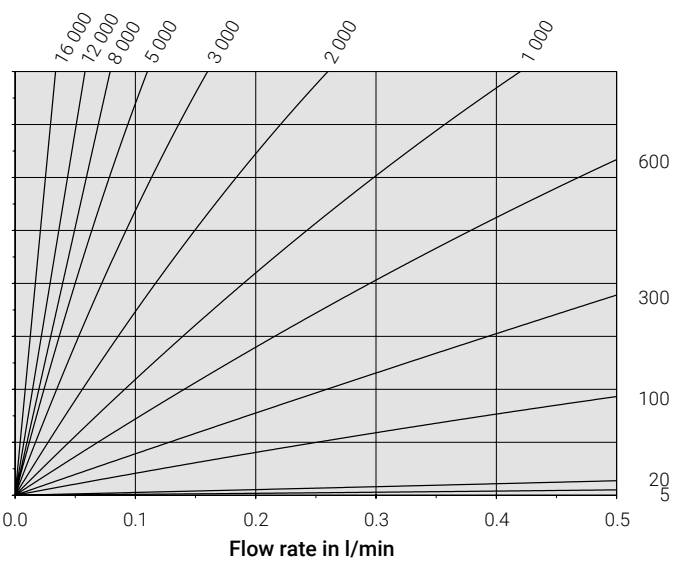
Pressure drop diagrams

Plain-bearing versions / Parameter: Viscosity in mm^2/s

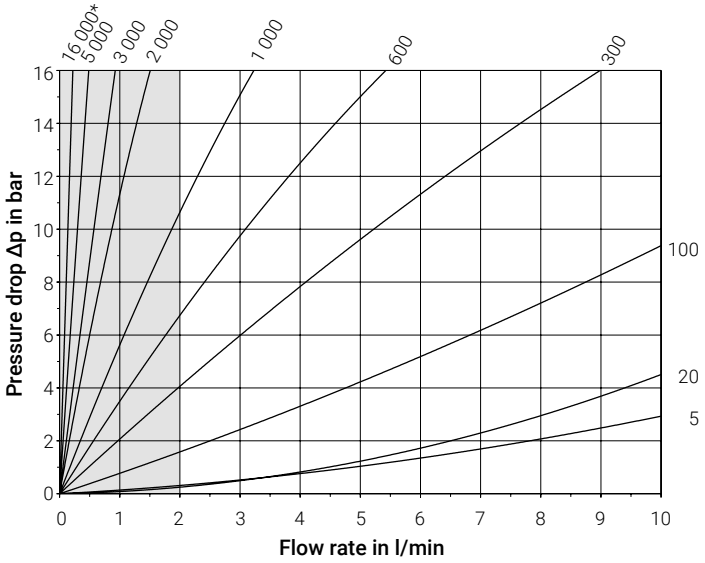
VC 0.025



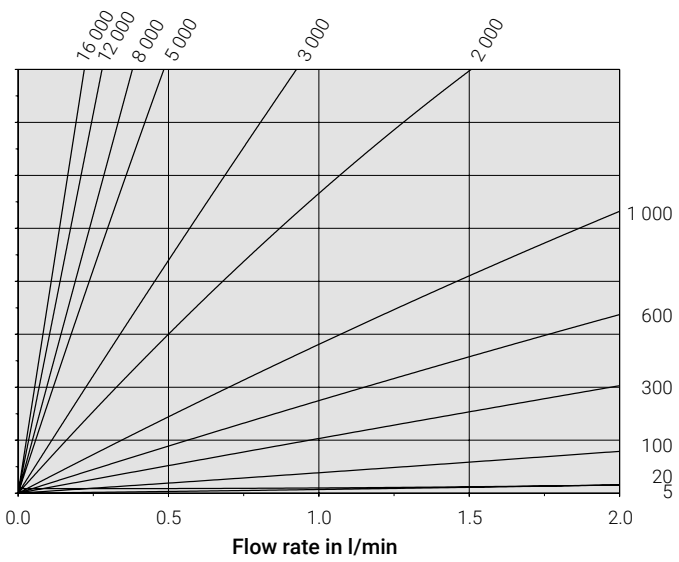
VC 0.025 (section)



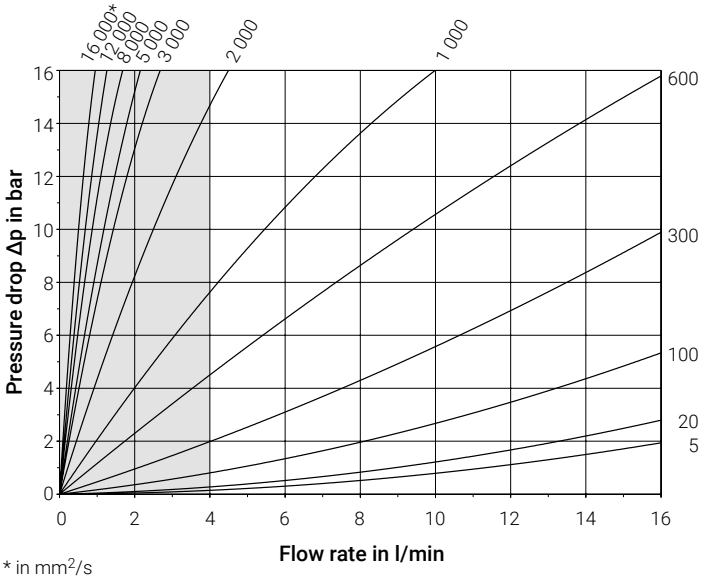
VC 0.1



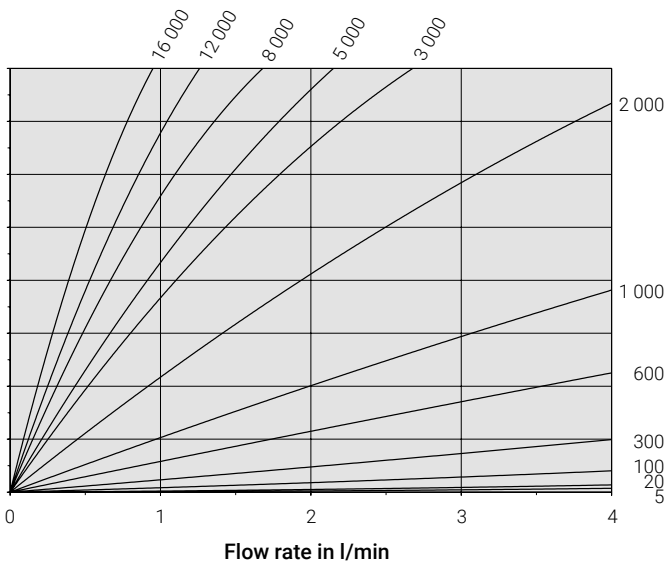
VC 0.1 (section)



VC 0.2



VC 0.2 (section)

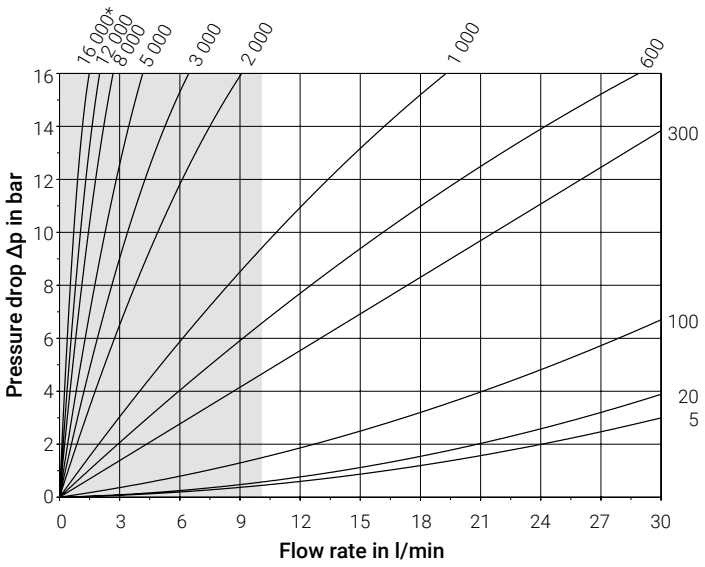


* in mm^2/s

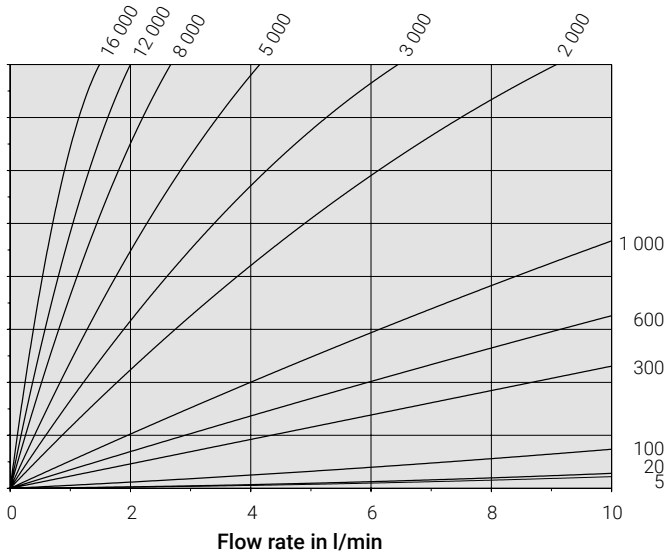
Pressure drop diagrams

Plain-bearing versions / Parameter: Viscosity in mm^2/s

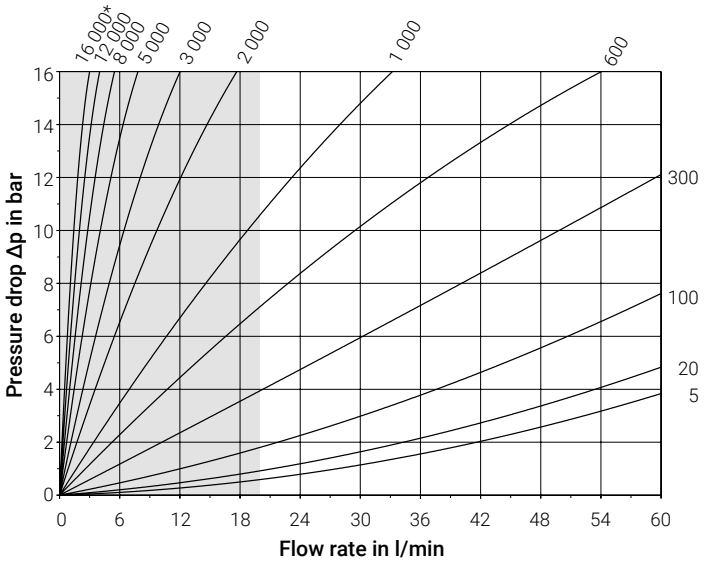
VC 0.4



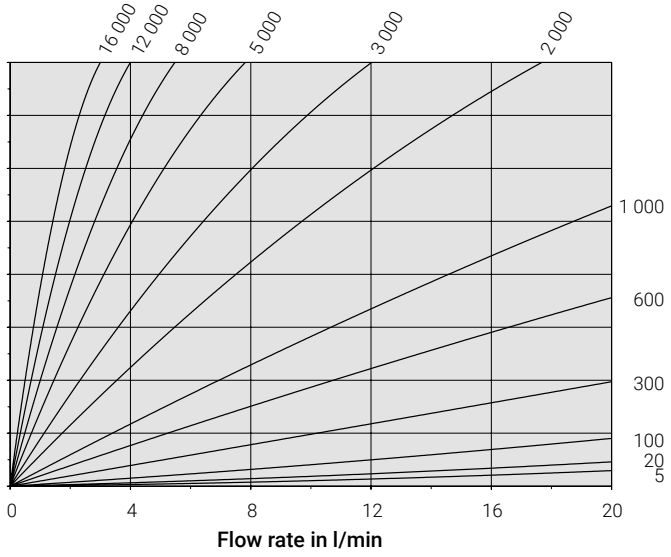
VC 0.4 (section)



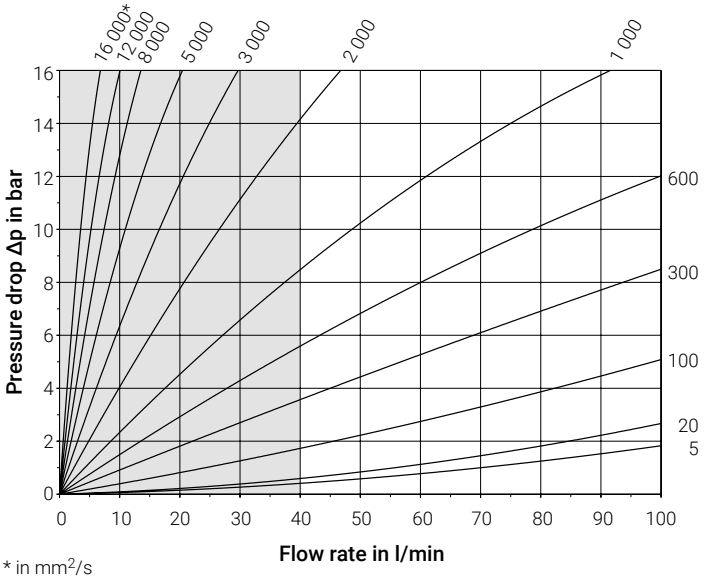
VC 1



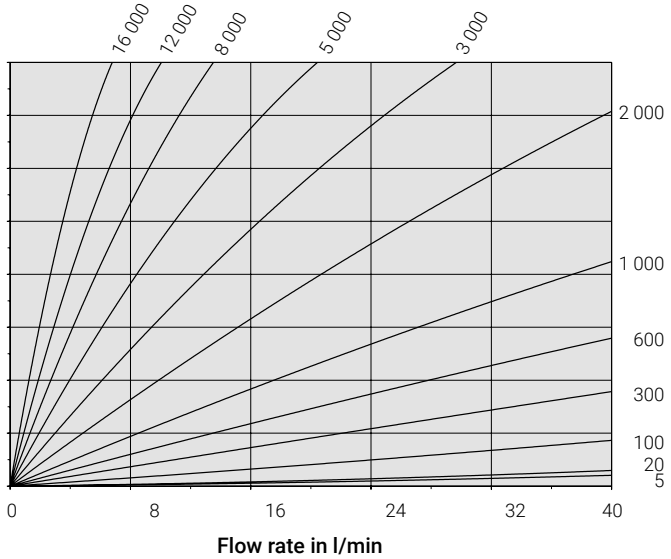
VC 1 (section)



VC 3



VC 3 (section)

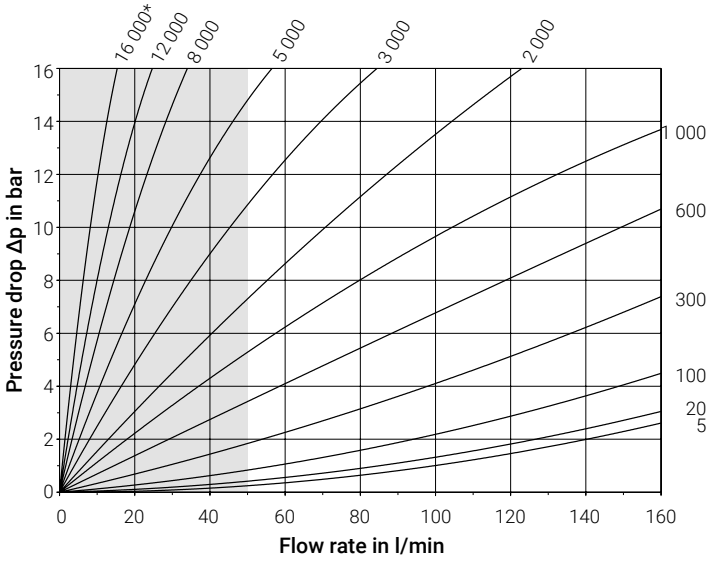


* in mm^2/s

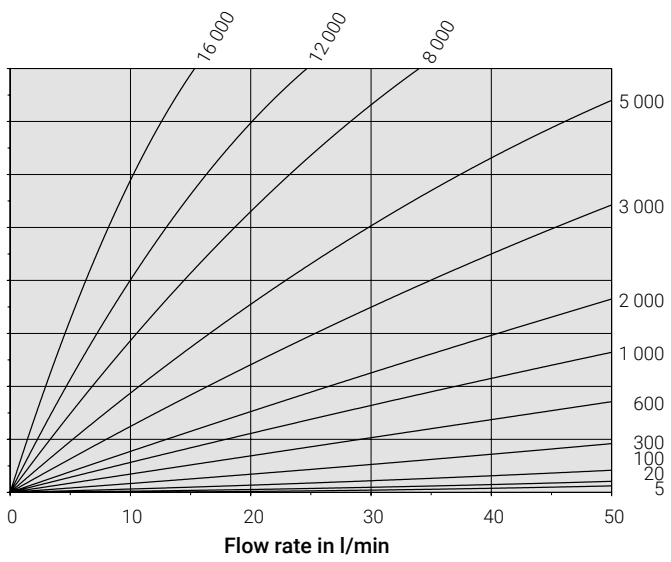
Pressure drop diagrams

Plain-bearing versions / Parameter: Viscosity in mm^2/s

VC 5



VC 5 (section)



* in mm^2/s

Dimensions

Spheroidal cast iron version with integrated electronic – plate mounting

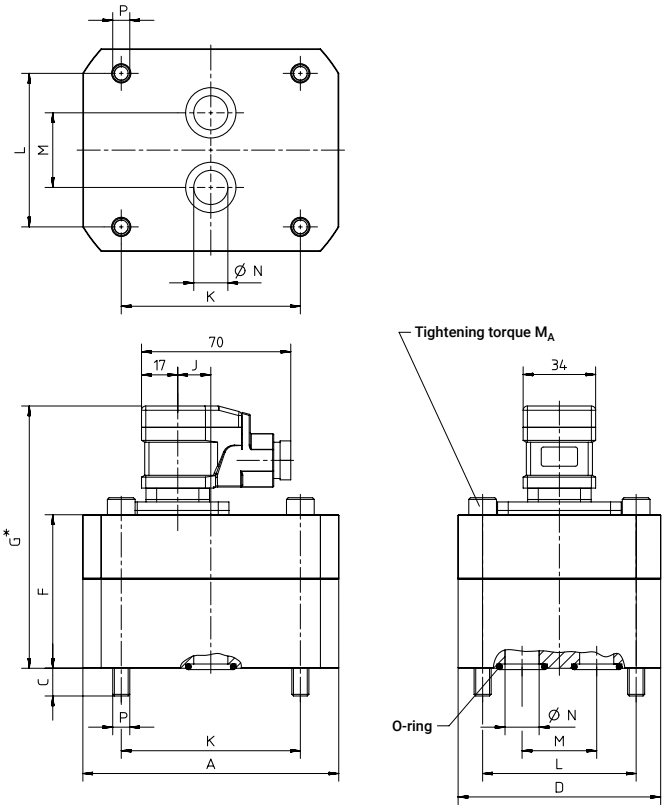
Nominal sizes	Dimensions											Tightening torque in Nm	Weights
	A	C	D	F	G*	J	K	L	M	N	P		
VC 0.025	85	10	60	50	101	-	70	40	20	6.7	M6	14	1.8
VC 0.04	85	9	60	56	107	-	70	40	20	6.7	M6	14	2.0
VC 0.04 / Encoder	85	12	60	48	95	9.65	70	40	20	6.7	M6	14	2.0
VC 0.1	85	10	60	55	106	-	70	40	20	9.0	M6	14	2.5
VC 0.2	85	13	60	57	108	-	70	40	20	9.0	M6	14	2.0
VC 0.2 / Encoder	85	13	60	57	104	10.80	70	40	20	9.0	M6	14	2.0
VC 0.4	100	17	90	63	114	-	80	38	34	16.0	M8	35	3.7
VC 1	120	13	95	72	123	15.50	84	72	35	16.0	M8	35	5.2
VC 1 / Encoder	120	16	95	69	116	18.20	84	72	35	16.0	M8	35	5.4
VC 3**	170	18	120	89	140	46.50	46	95	50	25.0	M12	120	9.0
VC 5**	170	22	120	105	156	46.50	46	95	50	25.0	M12	120	13.0

* plus 12 mm for high-temperature electronics version
plus 6 mm for ATEX/IECEx electronics version
** does not apply to K3 specification (see page 28)

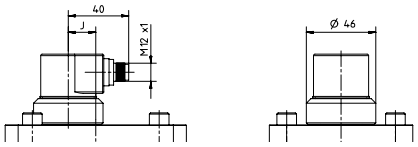
Available electronic versions (see page 8)

	Standard	High-temperature	ATEX/IECEx	IO-Link	Encoder	Analogue
VC 0.025 … 5	•	•	•	•	•	•

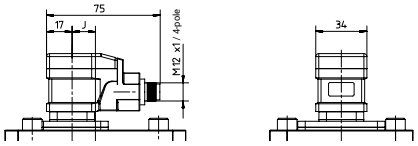
Version with Hirschmann connector



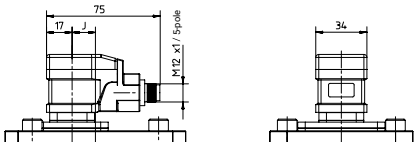
Version with encoder



Version with IO-Link connector



Version with analogue connector



Dimensions in mm / Weights in kg

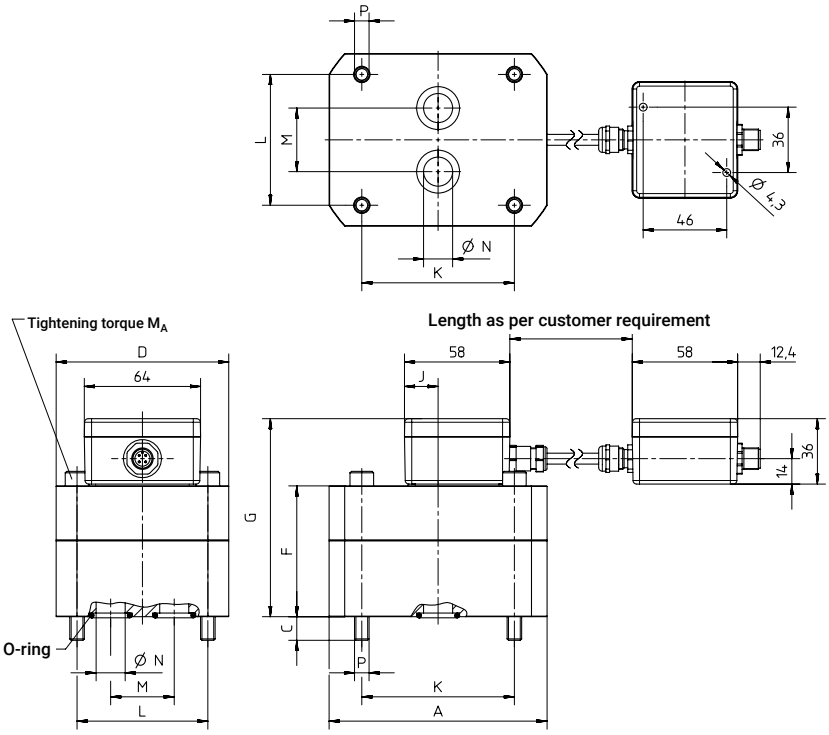
Dimensions

Spheroidal cast iron version with remote electronic – plate mounting

Nominal sizes	Dimensions											Tightening torque in Nm	Weights
	A	C	D	F	G	J	K	L	M	N	P		
VC 0.025	85	10	60	50	87	-	70	40	20	6.7	M6	14	1.8
VC 0.04	85	9	60	56	93	-	70	40	20	6.7	M6	14	2.0
VC 0.1	85	10	60	55	92	-	70	40	20	9	M6	14	2.3
VC 0.2	85	13	60	57	94	-	70	40	20	9	M6	14	2.0
VC 0.4	100	17	90	63	100	-	80	38	34	16	M8	35	3.7
VC 1	120	13	95	72	109	18.5	84	72	35	16	M8	35	5.2
VC 3	170	18	120	89	126	11.0	46	95	50	25	M12	120	9.0
VC 5	170	22	120	105	142	11.0	46	95	50	25	M12	120	13.0

Available electronic versions (see page 8)

	High-temperature PLUS	High-temperature PLUS ATEX/IECEx	Low-temperature
VC 0.025 … 5	•	•	-



Dimensions in mm / Weights in kg

Dimensions

Spheroidal cast iron version with integrated electronic – plate mounting – specification K3

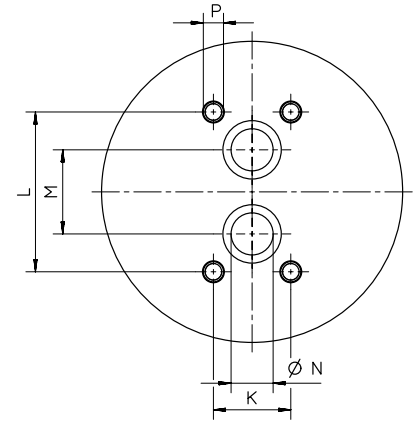
Nominal sizes	Dimensions										Tightening torque in Nm	Weights
	C	D	F	G*	J	K	L	M	N	P		
VC 3	23	179	99	150	46.5	46	95	50	25	M12	145	16.3
VC 5	22	179	115	166	46.5	46	95	50	25	M12	145	18.9
VC 12	44	249	168	219	78.0	120	140	70	38	M20	400	53.5
VC 16	38	249	184	235	78.0	120	140	70	38	M20	400	57.4

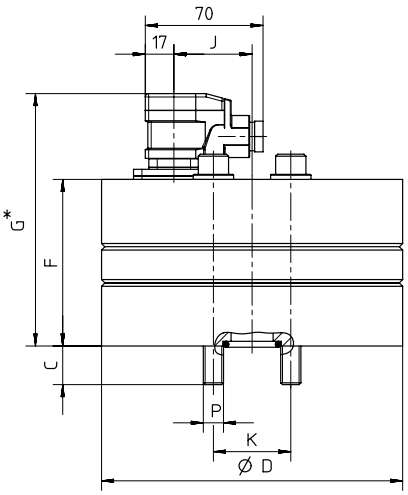
* plus 12 mm for high-temperature electronic version
plus 6 mm for ATEX/IECEx electronics version

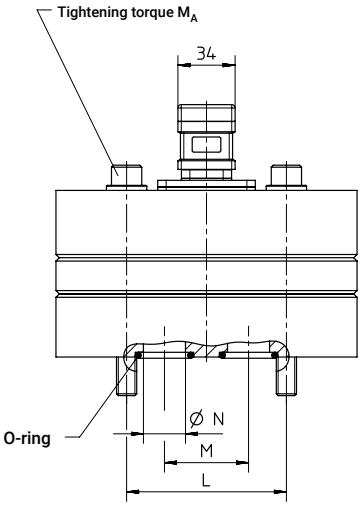
Available electronic versions (see page 8)

	Standard	High-temperature	ATEX/IECEx	IO-Link	Encoder	Analogue
VC 3 … 16	•	•	•	•	-	•

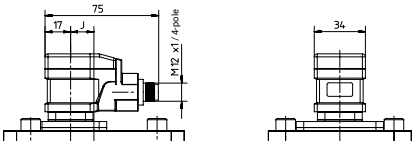
Version with Hirschmann connector



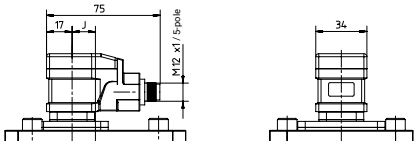




Version with IO-Link connector



Version with analogue connector



Dimensions in mm / Weights in kg

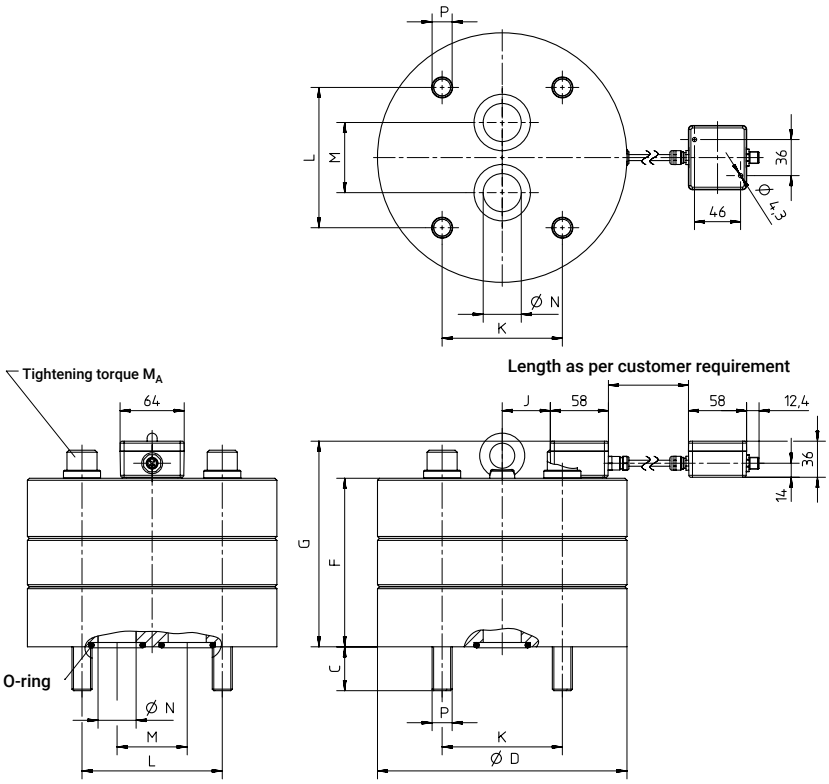
Dimensions

Spheroidal cast iron version with remote electronic – plate mounting – specification K3

Nominal sizes	Dimensions										Tightening torque in Nm	Weights
	C	D	F	G	J	K	L	M	N	P		
VC 3	23	179	99	136	-	46	95	50	25	M12	120	16.3
VC 5	22	179	115	152	11	46	95	50	25	M12	120	18.9
VC 12	44	249	168	205	48	120	140	70	38	M20	400	53.5
VC 16	38	249	184	221	48	120	140	70	38	M20	400	57.4

Available electronic versions (see page 8)

	High-temperature PLUS	High-temperature PLUS ATEX/IECEx	Low-temperature
VC 3 … 16	•	•	-



Dimensions in mm / Weights in kg

Dimensions

Stainless steel version with integrated electronic – plate mounting

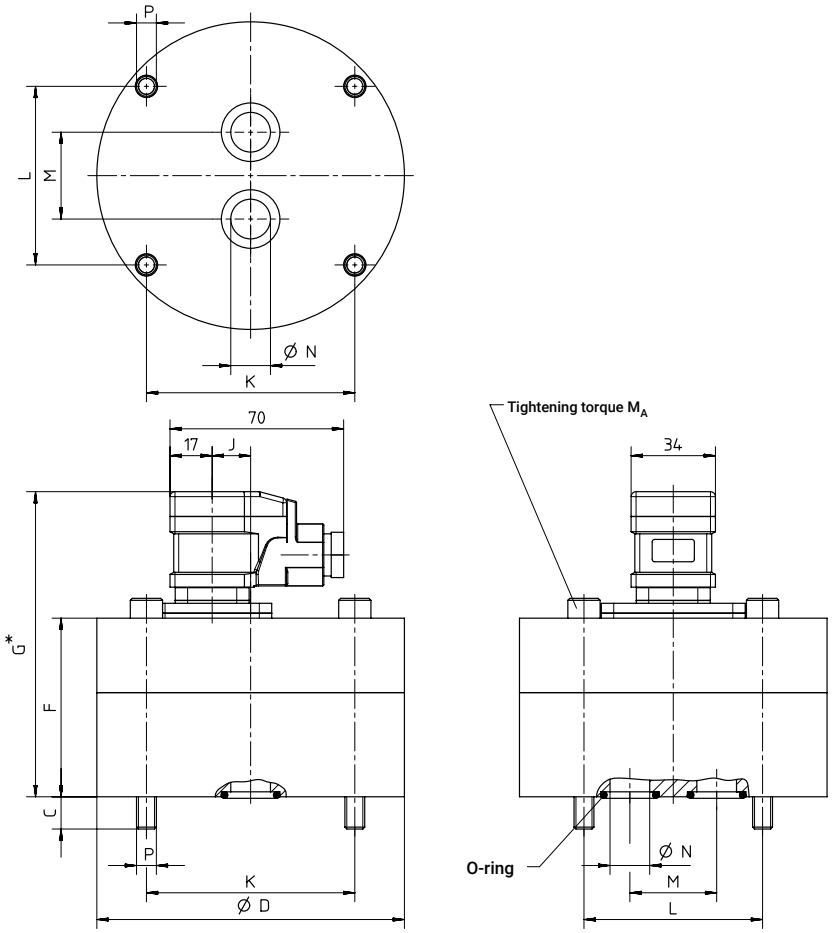
Nominal sizes	Dimensions										Tightening torque in Nm	Weights
	C	D	F	G*	J	K	L	M	N	P		
VC 0.025	10	94	55	106	-	70	40	20	6.7	M6	14	3.0
VC 0.04	9	94	56	107	-	70	40	20	6.7	M6	14	3.0
VC 0.1	10	94	55	106	-	70	40	20	9.0	M6	14	3.0
VC 0.2	13	94	57	108	-	70	40	20	9.0	M6	14	3.1
VC 0.4	17	118	63	114	-	80	38	34	16.0	M8	35	4.8
VC 1	13	124	72	123	15.5	84	72	35	16.0	M8	35	7.0
VC 3	18	170	89	140	46.5	46	95	50	25.0	M12	120	15.9
VC 5	22	170	105	156	46.5	46	95	50	25.0	M12	120	18.7

* plus 12 mm for high-temperature electronic version
plus 6 mm for ATEX/IECEx electronics version

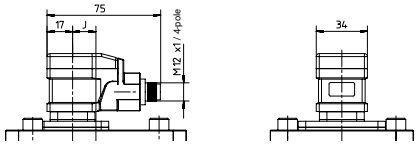
Available electronic versions (see page 8)

	Standard	High-temperature	ATEX/IECEx	IO-Link	Encoder	Analogue
VC 0.025 … 5	•	•	•	•	-	•

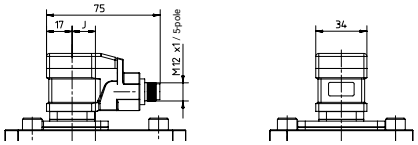
Version with Hirschmann connector



Version with IO-Link connector



Version with analogue connector



Dimensions in mm / Weights in kg

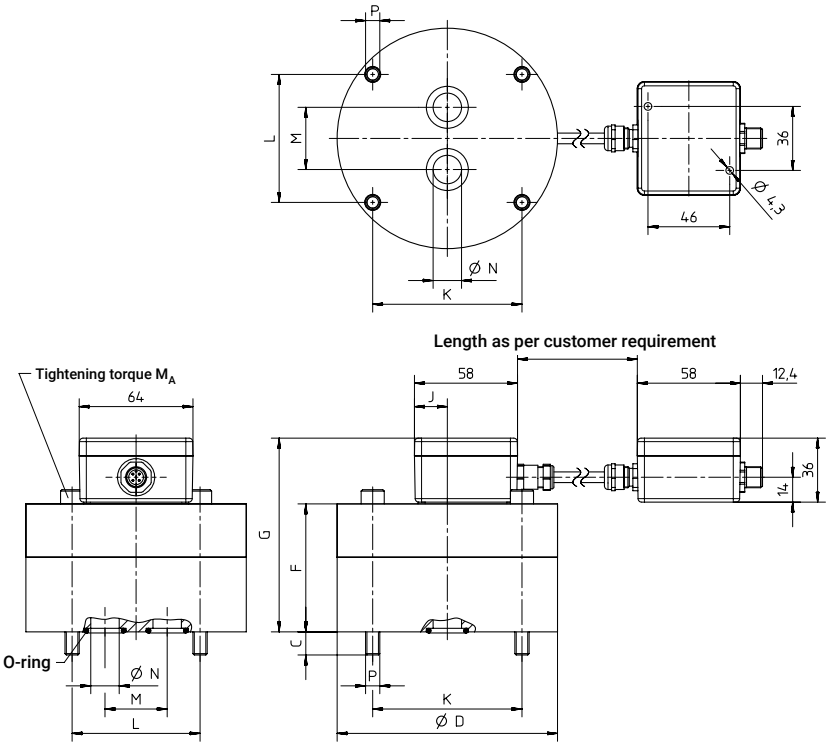
Dimensions

Stainless steel version with remote electronic – plate mounting

Nominal sizes	Dimensions										Tightening torque in Nm	Weights
	C	D	F	G	J	K	L	M	N	P		
VC 0.025	10	94	55	92	-	70	40	20	6.7	M6	14	3.0
VC 0.04	9	94	56	93	-	70	40	20	6.7	M6	14	3.0
VC 0.1	10	94	55	92	-	70	40	20	9.0	M6	14	3.0
VC 0.2	13	94	57	94	-	70	40	20	9.0	M6	14	3.1
VC 0.4	17	118	63	100	-	80	38	34	16.0	M8	35	4.8
VC 1	13	124	72	109	18.5	84	72	35	16.0	M8	35	7.0
VC 3	18	170	89	126	11.0	46	95	50	25.0	M12	120	15.9
VC 5	22	170	105	142	11.0	46	95	50	25.0	M12	120	18.7

Available electronic versions (see page 8)

	High-temperature PLUS	High-temperature PLUS ATEX/IECEx	Low-temperature
VC 0.025 … 5	•	•	•



Dimensions in mm / Weights in kg

Dimensions

Stainless steel version with integrated electronic – pipe connection

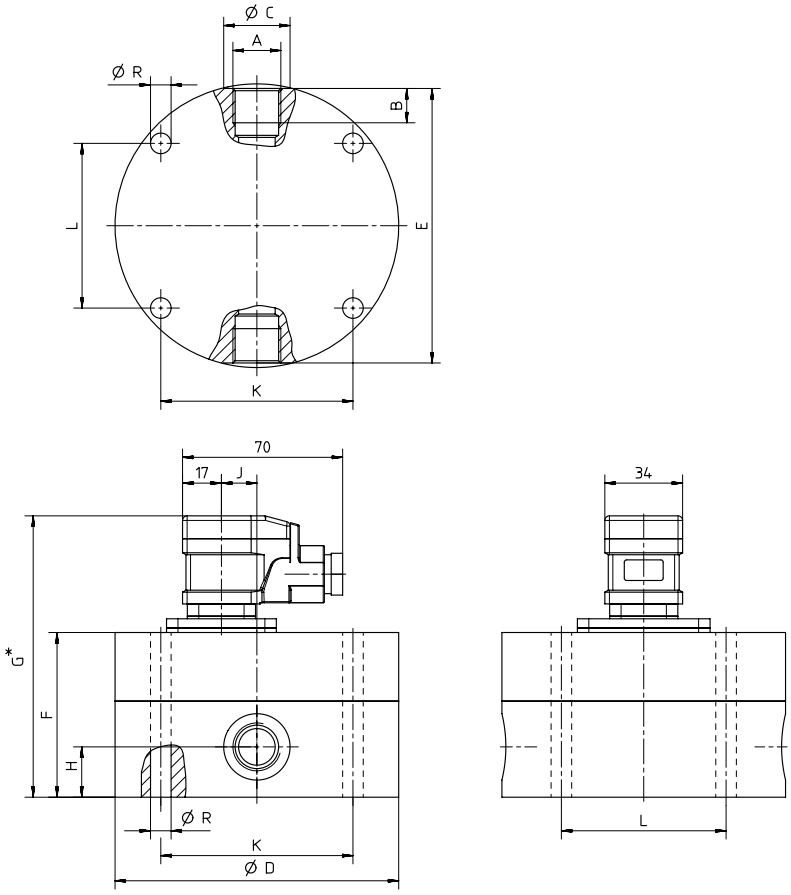
Nominal sizes	Dimensions												Weights
	A	B	C	D	E	F	G*	H	J	K	L	R	
VC 0.025	G1/8	9	17.0	94	90	55	106	15.0	-	70	40	6.7	3.0
VC 0.04	G1/4	13	21.0	94	90	56	107	15.0	-	70	40	6.7	3.0
VC 0.1	G3/8	13	25.0	94	90	55	106	15.0	-	70	40	6.6	3.0
VC 0.2	G3/8	13	25.0	94	90	57	108	16.0	-	70	40	6.5	3.1
VC 0.4	G1/2	15	29.0	118	114	63	114	17.5	-	80	38	9.0	4.8
VC 1	G1/2	15	29.0	124	120	72	123	22.0	15.5	84	72	9.0	7.0
VC 3	G1	19	51.5	170	162	89	140	30.0	46.5	46	95	13.0	15.9
VC 5	G1	19	42.0	170	162	105	156	30.0	46.5	46	95	13.0	18.7

* plus 12 mm for high-temperature electronic version
plus 6 mm for ATEX/IECEx electronics version

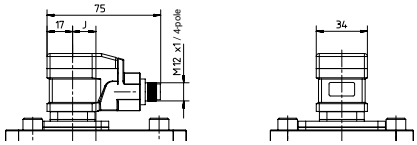
Available electronic versions (see page 8)

	Standard	High-temperature	ATEX/IECEx	IO-Link	Encoder	Analogue
VC 0.025 … 5	•	•	•	•	-	•

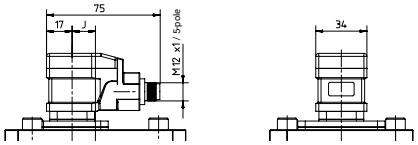
Version with Hirschmann connector



Version with IO-Link connector



Version with analogue connector



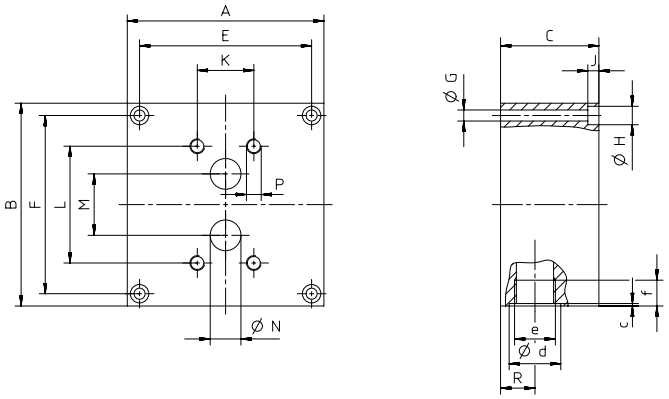
Dimensions in mm / Weights in kg

Dimensions

Connection plates (cast iron) with lateral threaded connection

Ordering code	Dimensions																		Weights
	e	A	B	C	E	F	G	H	J	K	L	M	N	P	R	c	d	f	
MVC 0.2 R3 B05*	G3/8	85	90	35	65	76	7	11	7	70	40	20	6.5	M6 - 14 deep	17.0	0.7	25	13	1.8
MVC 0.2 R3 C05*	G1/2	85	90	35	65	76	7	11	7	70	40	20	6.5	M6 - 14 deep	17.5	0.7	29	15	1.7
MVC 0.4 R1 C09	G1/2	100	110	37	86	96	7	11	7	80	38	34	16	M8 - 18 deep	18.5	0.7	29	15	2.7
MVC 0.4 R1 D09	G3/4	100	110	42	86	96	7	11	7	80	38	34	16	M8 - 18 deep	21.0	1.0	36	17	2.9
MVC 1 R2 C09	G1/2	100	120	37	80	106	7	11	7	84	72	35	12	M8 - 18 deep	17.5	0.7	29	15	2.9
MVC 1 R3 D05	G3/4	120	120	42	80	106	7	11	7	84	72	35	13	M8 - 18 deep	21.0	1.0	36	17	4.0
MVC 1 R2 E05	G1	100	120	65	80	106	7	11	8	84	72	35	13	M8 - 18 deep	32.5	1.0	42	19	4.9
MVC 5 R2 E05**	G1	160	165	80	140	145	9	15	9	46	95	50	25	M12 - 24 deep	28.0	1.0	42	19	14.0
MVC 5 R2 G09**	G1 1/2	170	165	100	140	145	9	15	9	46	95	50	25	M12 - 24 deep	42.0	1.0	58	23	17.8

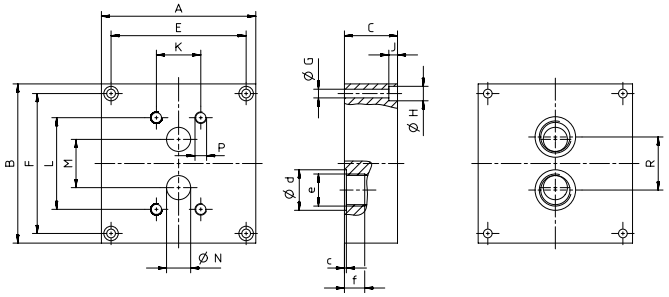
* Suitable for VC 0.025, VC 0.04, VC 0.1 and VC 0.2 as well as VC 0.2 with encoder
** Suitable for VC 3 and VC 5



Connection plates (cast iron) with rear threaded connection

Ordering code	Dimensions																		Weights
	e	A	B	C	E	F	G	H	J	K	L	M	N	P	R	c	d	f	
MVC 0.2 R3 B04*	G3/8	85	90	35	65	76	7	11	7	70	40	20	6.5	M6 - 14 deep	28	0.7	25	13	1.6
MVC 0.4 R1 C08	G1/2	100	110	37	86	96	7	11	7	80	38	34	16	M8 - 18 deep	46	0.7	29	15	2.5
MVC 0.4 R1 D08	G3/4	100	110	42	86	96	7	11	7	80	38	34	16	M8 - 18 deep	52	1.0	36	17	2.9
MVC 1 R2 C04	G1/2	100	120	37	80	106	7	11	7	84	72	35	12	M8 - 18 deep	50	0.7	29	15	2.7
MVC 5 R2 E04**	G1	160	165	55	140	145	9	15	9	46	95	50	25	M12 - 24 deep	55	1.0	42	19	9.6

* Suitable for VC 0.025, VC 0.04, VC 0.1 and VC 0.2 as well as VC 0.2 with encoder
** Suitable for VC 3 and VC 5



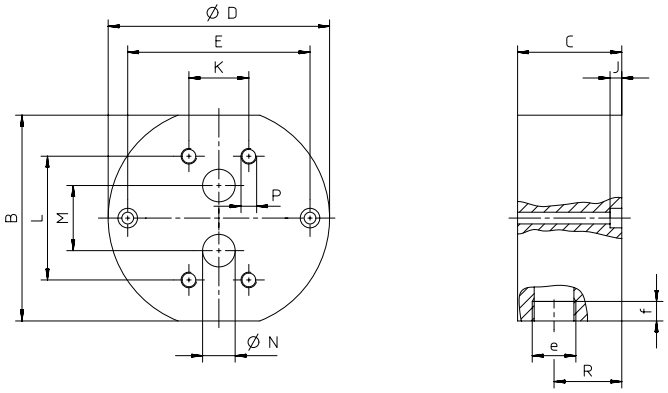
Dimensions in mm / Weights in kg

Dimensions

Connection plates (stainless steel) with lateral threaded connection

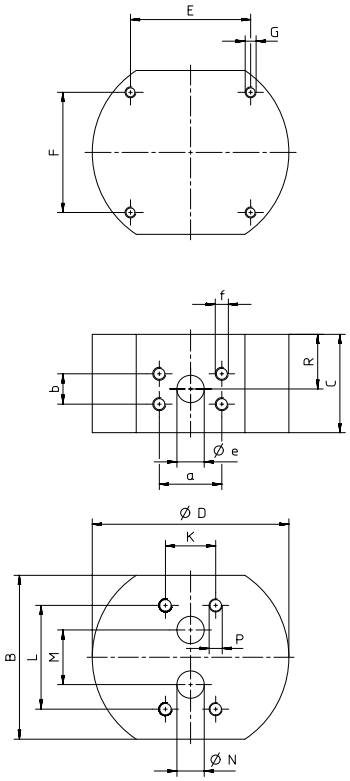
Ordering code	Dimensions															Weights
	e	B	C	D	E	G	H	J	K	L	M	N	P	R	f	
MVC 0.2 R4 B11*	G³⁄₈	85	35	94	75	7	11	7	70	40	20	6.5	M6 - 14 deep	18.0	13	1.7
MVC 1 R3 C11	G¹⁄₂	116	37	124	100	9	15	9	84	72	35	12.0	M8 - 18 deep	19.5	15	3.2
MVC 1 R2 D11	G³⁄₄	116	42	124	100	9	15	9	84	72	35	12.0	M8 - 18 deep	21.0	17	3.5
MVC 5 R2 E11**	G1	158	80	170	140	9	15	9	46	95	50	25.0	M12 - 24 deep	52.0	19	13.9
MVC 5 R2 G11**	G1¹⁄₂	158	105	170	140	9	15	9	46	95	50	25.0	M12 - 24 deep	63.0	23	17.9

* Suitable for VC 0.025, VC 0.04, VC 0.1 and VC 0.2 as well as VC 0.2 with encoder
** Suitable for VC 3 and VC 5



Connection plates (spheroidal cast iron) with lateral SAE flange connection for VC 3 and 5 in K3 specification and VC 12 and 16 in K1 specification

Ordering code	Dimensions																Weights
	B	C	D	E	F	G	K	L	M	N	P	R	a	b	e	f	
MVC 5 V1 E09	150	90	180	110	110	M8 - 24 deep	46	95	50	25	M12 - 24 deep	50	57.2	27.8	25	M12 - 24 deep	14.20
MVC 12 V1 G09	200	140	249	120	140	M10 - 20 deep	120	140	70	38	M20 - 45 deep	70	79.38	36.5	38	M16 - 25 deep	41.18



Dimensions in mm / Weights in kg

Notes

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