Operating instructions

BVC0002EN

Gear type flow meter VC 0,025 ... VC 16

BVC0002EN-D0025420002_03

Englisch

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1 General points

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the gear type flow meter **VC 0,025 ... VC 16**.

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

The structure of the type designation and a more detailed description of the individual series and nominal sizes can be found in the chapter 3 “Device description” and in the chapter 4 “Technical data”.

If you have any questions about this operating manual, please contact the manufacturer.

1.2 Manufacturer´s address

Kracht GmbH

Gewerbestraße 20

DE 58791 Werdohl

phone: +49 (0) 23 92 / 935-0

fax: +49 (0) 23 92 / 935-209

email: info@kracht.eu

web: www.kracht.eu

1.3 Intended use

The gear type flow meter is a measuring device for the continual flow measurement of combustible and non-combustible fluids. The different series allow use with different viscosities and lubricating ablilities.

The device has been designed for operation with fluids. Dry operation is not permitted. The medium must guarantee a minimum lubrication.

Operation is only permitted within the specified enviromental and ambient conditions.

Use in explosive areas is **not** permissible.

It must be guaranteed that the medium is compatible with the materials used in the device (see "Overview of series and materials" in the chapter 4 “Technical data”). The chemical competence is necessary for this. Be careful with ethylene oxide and/or other catalytic and/or exothermic and/or self-decomposing materials! Please consult the manufacturer in cases of doubt.

The device may only be used when its materials are resistant to mechanical and/or chemical influences or corrosion under the respective operating conditions.

A filter must be installed if required to avoid the device blocking on account of contaminants.

The device may only be operated when closed and must not be exposed to any impermissible vibrations.

The maximum permissible operating data listed in the chapter 4 “Technical data” must always be observed.

Deviations from the above-mentioned data and operating conditions require express approval by the manufacturer and/or are specified on the type plate.

Type plates or other references on the device must not be removed nor made unlegible or unrecognisable.

In cases of noncompliance, all warranty and manufacturer responsibility shall be void.

2 Safety

2.1 Safety instructions and symbols

The safety notices in these operating instructions are marked with caution symbols.
Non-compliance can lead to hazards for people and the device.
In addition, the safety instructions are marked with signal words. They have the meanings as explained below:
Caution: Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.
Warning: Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.
Danger: Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.

Notice: Flagging of notices to prevent property damage.

Flagging of special user tips and other especially useful or important information.

2.2 Personnel qualification and training

The personnel designated to install, operate and maintenace the device must be properly qualified. This can be through training or specific instruction. Personnel must be familiar with the contents of this operating manual.

2.3 General safety instructions

The operational safety of the device delivered is only guaranteed when it is used for the intended purpose (see chapter 1 “General points”).
The limit values given must never be exceeded (see chapter 4 “Technical data”).
National regulations concerning accident preventation and health and safety at work must be observed, as well as internal regulations laid down by the operator, even of these are not specifically mentioned in this manual.
The operator must ensure that this operating manual is accessible to the staff responsible at all times.

2.4 Hazard statements

DANGER

Danger due to breakage or squirting fluids!

If the device is blocked it acts like a closed gate. The pressure level that occure in this case can result in damage to the device and to up or down-stream plant elements. Breakage can lead to parts flying around uncontrolled or to fluids squirting out which can lead to accidents and severe injuries or even result in death.

- A pressure relief valve or other kind of over-pressure safeguard must be installed before the device.The pressure relief device must be dimensioned so that entire delivery volume can be conducted through with the lowest possible pressure or pressureless.
- Do **not** put the device into operation without a pressure relief device.

DANGER

Danger due to pressure loaded lines.

When working on pressure loaded lines, uncontrolled or squirting fluids can lead to accidents and severe injuries or even result in death.

- Always depressurize all lines during all work on the unit and before disassembly.

DANGER

Danger due to breakage or squirting fluids!

Using unsuitable connections and lines can lead to breakage. Parts flying around uncontrolled or squirting fluids can lead to accidents with severe injuries or even lead to death.

- Use only connections and lines approved for the expected pressure range.
- Comply with each manufacturer's regulations.

DANGER

Danger due to breakage or squirting fluids!

Using damaged connections and lines can cause parts to fly around uncontrolled or fluids to squirt out, which can lead to accidents and severe injuries or even result in death.

- Immediately replace damaged connections, pipes and hose lines.

DANGER

Danger due to electric voltage!

Danger of death due to electric shock.

- Follow the special safety regulations during all work on electrical installations.
- Only allow electricians to work on electrical systems.

WARNING

Danger due to hazardous fluid!

Danger of death upon contact with hazardous fluids and when inhaling vapours from these liquids.

- Comply with the safety data sheets and regulations on handling the hazardous liquids!
- Collect and dispose leaks of hazardous materials so that no hazards arise for people or the environment.
- Comply with national and international rules at the place of installation.
- Wear suitable protective clothing.

WARNING

Danger due to falling and or loads falling over!

Due to the size and weight of the unit, accidents can occur resulting in severe injuries or death during transport and shipping.

- Compliance with applicable industrial safety requirements is mandatory.
- Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
- Attach lifting trackle only to suitable points (see table 5.1).
- Attach the lifting tackle in such a manner that it cannot slip.
- Secure the device so that toppling over and falling down is impossible.
- Always avoid jerks, impacts and strong vibrations during transportation.
- Never walk under suspended loads, never work under suspended loads.
- To prevent damage to the device, be extremely cautious when shipping or transporting.
- Wear suitable protective clothing.

CAUTION

Danger due to hot surfaces!

When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- At medium temperatures above 60 °C, take measures against unintended contact.
- Wear safety gloves.

CAUTION

Danger due to hot surfaces!

When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

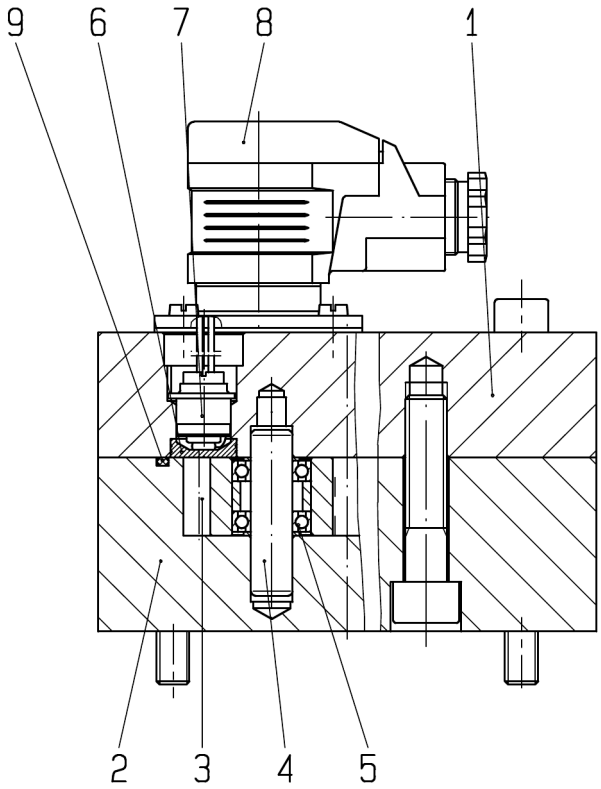
- When the medium temperature is over 48 °C, let the device cool off.
- Wear safety gloves.

3 Device description

3.1 Basic construction and function

The basic construction of the individual VC series is shown in the diagram blow using series 1 and 2 as examples.

There are two gearwheels inside the VC housing that are supported with low friction. They are driven by the fluid during operation. This gearwheel movement is scanned indictively by two sensors in the cover, and transformed into electrical signals. There is a pressure-resistant-a-magnetic divider between the sensor space and measuring chamber. These signals are forwarded to the display device connected.



** Series 1, 2, 6, 7, 8: Ball bearing*
Series 3, 4, 5: Plain bearing (not shown)

1. Cover
2. Housing
3. Gear
4. Bearing pin
5. Bearing *
6. A-magnetic divider
7. Sensor
8. Device plug
9. O-Ring

3.2 Type key

Ordering example						
VC	**0,2**	**F**	**1**	**P**	**S**	**/...**
1.	2.	3.	4.	5.	6.	7.

Explanation of type key						
1.	**Product name**					
2.	**Nominal size**					
	V_{gz}	0,025 - 0,04 - 0,1 - 0,2 - 0,4 - 1 - 2 - 5 - 12 - 16 cm^3				
3.	**Seal**					
	F	FKM	**K**	FFKM	**A**	TFE/P (Aflas)
	E	EPDM	**N**	NBR	**S**	Silicone
	P	PTFE/FEP				
4.	**Serie**					
		1 , 2 , 3 , 4 , 5 , 6 , 7, 8				
5.	**Type of connection**					
	P	Plate structure	**R**	Pipe connection		
6.	**Electronics**					
	S	Standard (-30...120° C)	**V**	Without pre-amplifier (for plug-in display SD 1)		
	H	High temperature (-30...150 °C)	**X**	ATEX version* (-30...80 °C)		
	K	High temperature PLUS (-30...220 °C)	**KX**	High temperature PLUS ATEX version* (-30...200 °C)		
7.	**Special number for special versions**					
	See section 3.3 “Important special numbers”					
** The ATEX versions are described in separate operating manuals*						

3.3 Important special numbers

Special number	Serie	Description
55	**1 - 8**	Variant with aluminium terminal box, pre-amplifier VV12 and Cannon plug
71	**1 - 8**	Variant with Hirschmann plug with device socket according to DIN (M12x1)
74	**1 - 8**	Variant with Hirschmann plug and pre-amplifier VV12 for 12 V current supply to pre-amplifier
79	**1**	VC 3 and VC 5 for high-pressure version (400 bar)
155	**1**	VC 3 and VC 5 in high-pressure version (400 bar) with skydrol-resistant coating and aluminium terminal box with Cannon plug
156	**1**	Variant with skydrol-resistant coating and aluminium terminal box with Cannon plug
165	**1**	VC 5 for booster system

4 Technical data

4.1 General characteristics

General characteristics	
Construction	Geared motor
Material	See section 4.4 “Overview of the series and materials”
Connection type	Plate connection /Pipe thread
Installation position/Flow direction	Arbitrary
Ambient temperature ϑ	-30 ... 80 °C (seal variants E, P, N, S)
	-15 ... 80 °C (seal variants F, K)
	-10 ... 80 °C (seal variant A)

4.2 Overview nominal sizes VC 0,025 ... VC 16

Tab. 4.1: Nominal size VC 0,025 ... 0,4

Nominal size*		0,025	0,04	0,1	0,2	0,4
Geom. tooth volume	cm^3	0,025	0,04	0,1	0,245	0,4
Resolution	Imp/l	40000	25000	10000	4081,63	2500
Max. operating pressure	bar	400	400	400	400	400
Pressure peaks	bar	480	480	480	480	480
Pressure peak** for serie in l/min	1	0,008...2	0,02...4	0,04...8	0,16...16	0,2...40
	2	-	-	-	0,16...16	-
	3	-	-	-	-	-
	4	-	-	-	0,16...16	0,2...30
	5	0,02...2	-	-	0,16...16	0,2...30
	6	0,008...2	0,02...4	0,04...8	0,16...16	-
	7	0,008...2	0,02...4	0,04...8	0,16...16	-
	8	0,008...2	0,02...4	0,04...8	0,16...16	-
Sound pressure level L_{pA} db(A)		< 60	< 60	< 60	< 60	< 70

** See type key and type description on the device: VC ...*
*** The measuring range may be restricted at higher pumping medium viscolity.*

Tab. 4.2: Nominal size VC 1 ... 16

Nominal size*		1	3	5	5 /165	12	16
Geom. tooth volume	cm^3	1,036	3,000	5,222		12,0	16,0
Resolution	Imp/l	965,25	333,33	191,50		83,33	62,50
Max. operating pressure	bar	400	315 (400)***	315 (400)***	200	400	400
Pressure peaks	bar	480	350 (480)***	350 (480)***	240	480	480
Pressure peak** for series in l/min	1	0,4...80	0,6...160	1...250	1...160	2,0...600	2,5...700
	2	0,4...80	0,6...160	1...250	-	-	-
	3	0,6...40	-	1,2...80	-	-	-
	4	0,3...60	0,6...100	1...160	-	-	-
	5	0,3...60	0,6...100	1...160	-	-	-
	6	0,4...80	0,6...160	1...250	-	-	-
	7	0,4...80	-	-	-	-	-
	8	0,4...80	-	-	-	-	-
Sound pressure level L_{pA} db(A)		< 70	< 70	< 72	< 72	< 80	< 80

** See type key and type description on the device: VC ...*
*** The measuring range may be restricted at higher pumping medium viscolity.*
**** High-pressure version .../79*

NOTICE

Danger of device damage due to overload
A too high flow resistance Δp can cause mechanical damage on the device.

- The maximum pressure loos in the device may **not** exceed **16 bar**.

4.3 Permissible temperature of operating media

Tab. 4.3: Permissible temperature of operating media VC 0,025 ... 16, Serie 1, 2, 6, 7, 8 *

Seal variant	Version S (Standard) °C	Version H (High temperature) °C	Version K (High temperature PLUS) °C
F FKM	-15...120	-15...150	-15...150 (170)****
E EPDM **	-30...120	-30...130	-30...130
P PTFE/FEP	-30...120	-30...150	-30...220 (180) ***
N NBR	-30...100	-30...100	-30...100
A TFE/P (Aflas)	-10...120	-10...150	-10...200 (180) ***
S Silicone	-30...120	-30...130	-30...130
K FFKM	-15...120	-15...150	-15...220 (180) ***

** The temperature of the operating medium refers to mineral hydraulic fluids (e.g. HLP), other media can cause other operating temperature limits!*
*** Specification of operating media temperature refers to brake fluids (DOT3/DOT4).*
**** For VC 0,025 ... 0,1 (version K) the maximum permissible media temperature is 180 °C.*
***** Valid for VC 5 .../165 (version K)*

Tab. 4.4: Permissible temperature of operating media VC 0,025 ... 16, Serie 3, 4, 5 *

Seal variant	Version S (Standard) °C	Version H (High temperature) °C	Version K (High temperature PLUS) °C
F FKM	-15...80	-	-
E EPDM **	-30...80	-	-
P PTFE/FEP	-30...80	-	-
N NBR	-30...80	-	-
A TFE/P (Aflas)	-10...80	-	-
S Silicone	-30...80	-	-
K FFKM	-15...80	-	-

** The temperature of the operating medium refers to mineral hydraulic fluids (e.g. HLP), other media can cause other operating temperature limits!*
*** Specification of operating media temperature refers to brake fluids (DOT3/DOT4).*

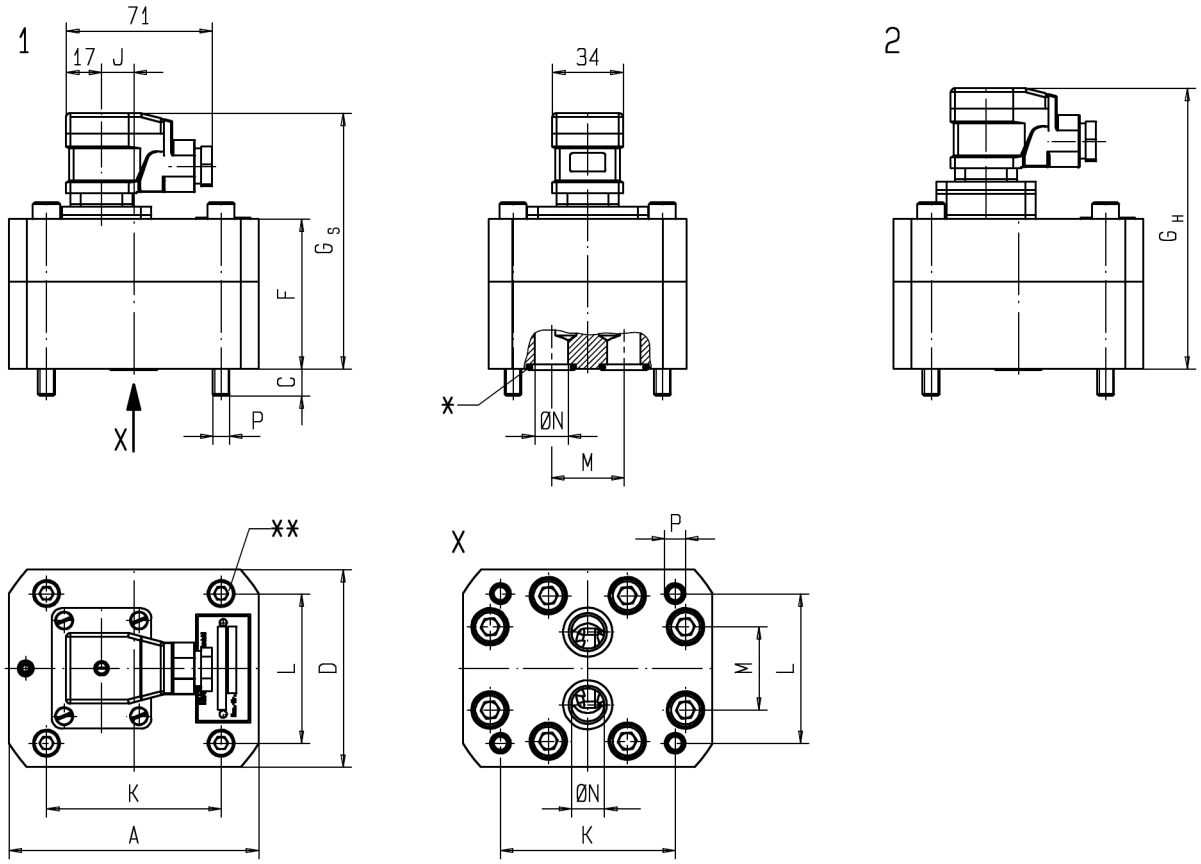
4.4 Overview of the series and materials

Serie		1	2	3	4
Material	Housing / cover	EN-GJS-400-15 (GGG40) VC 3/79, VC 5/79, VC 12 u. VC 16: EN-GJS-600-5 (GGG60)			
	Measuring unit	1.7139 (case-hardened steel)			
	Bearing	Anti-friction bearing steel		Sn-bronze	Carbide
	Seal *	FKM, EPDM, PTFE/FEP, NBR, TFE/P (Aflas), Silicone, FFKM			
Type of bearing		Ball bearing		Bronze plain bearing	Carbide plain bearing
Viscosity of the operating fluid in mm^2/s		1 ... 3000 (1 ... 5000)**	5 ... 5000	200 ... 500000	50 ... 5000
Lubricating properties of the operating fluid		good			poor
Permissible size of contaminants in operating fluid in µm		20 (50)**	30	50	30
** See type key and type description on the device: VC ...* *** Valid for VC 5 .../165*					

Serie		5	6	7	8
Material	Housing / cover	1.4404		EN-GJS-400-15	1.4404
	Measuring unit	1.4462		1.7139	1.4462
	Bearing	Carbide	Stainless steel	Anti-friction bearing steel / Ceramic spheres	
	Seal *	FKM, EPDM, PTFE/FEP, NBR, TFE/P (Aflas), Silicone, FFKM			
Type of bearing		Carbide plain bearing	Stainless steel ball bearing	Hybrid ball bearing	
Viscosity of the operating fluid in mm^2/s		50 ... 5000	1 ... 3000		
Lubricating properties of the operating fluid		poor	good	poor	
Permissible size of contaminants in operating fluid in µm		30	20		
** See type key and type description on the device: VC ...*					

4.5 Dimensions and weights

4.5.1 Serie 1, 2, 3, 4, 7; Type of connection P; Version S, H; VC 0,025...VC 5

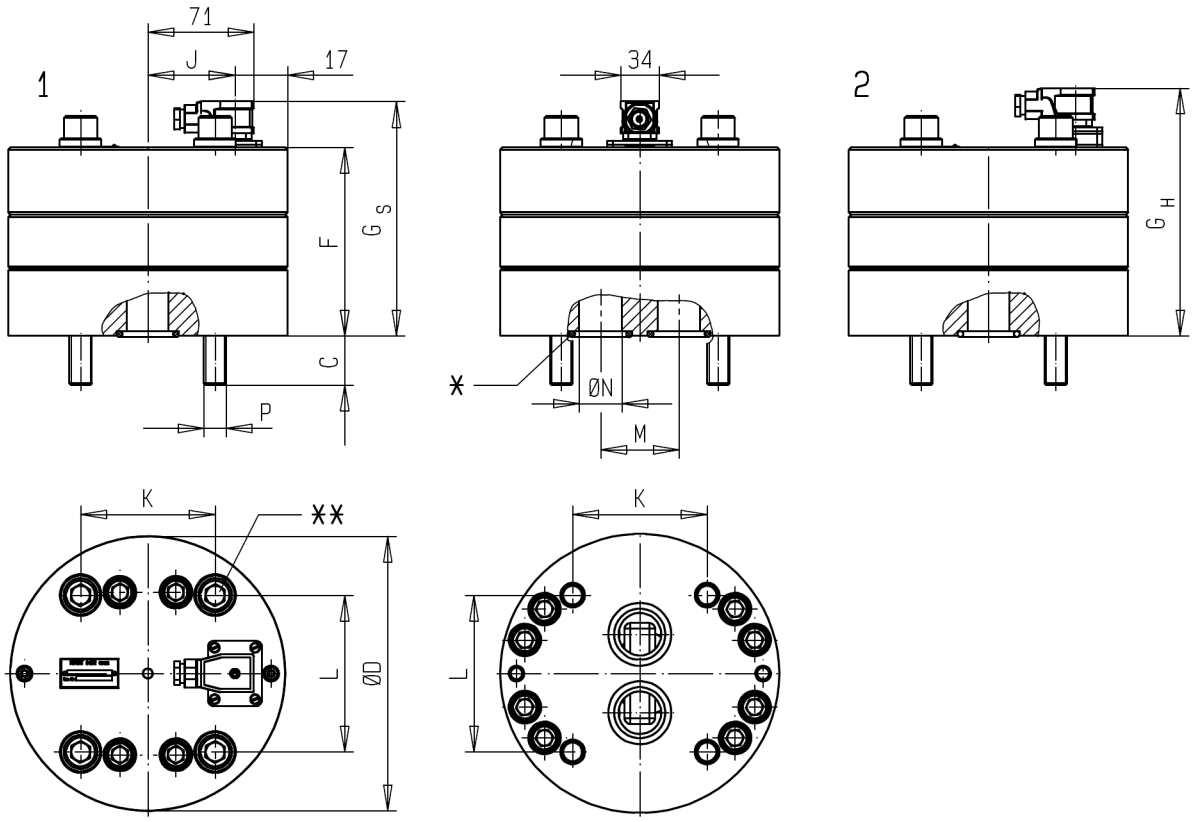


1 = Version S
2 = Version H

* = O-rings
** = Tightening torque M_A
X = Connection side

Nominal size VC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	1, 7	1, 7	1	1, 2, 4, 7	1, 4	1, 2, 3, 4, 7	1, 2, 4	1, 2, 3, 4
Weight in kg	1,8	2	2,3	2	3,7	5,2	9	13
Tightening torque in Nm	14	14	14	14	35	35	120	120
Dimensions								
A	85	85	85	85	100	120	170	170
C	10	9	10	13	17	13	18	22
D	60	60	60	60	90	95	120	120
F	50	56	55	57	63	72	89	105
G_S	101	107	116	108	114	123	140	156
G_H	114	120	129	121	127	136	153	169
J	-	-	-	-	-	15,5	46,5	46,5
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
M	20	20	20	20	34	35	50	50
N	6,5	6,5	6,7	9	16	16	25	25
P	M6	M6	M6	M6	M8	M8	M12	M12

4.5.2 Serie 1, Type of connection P, Version S, H; VC ./79, VC 12, VC 16

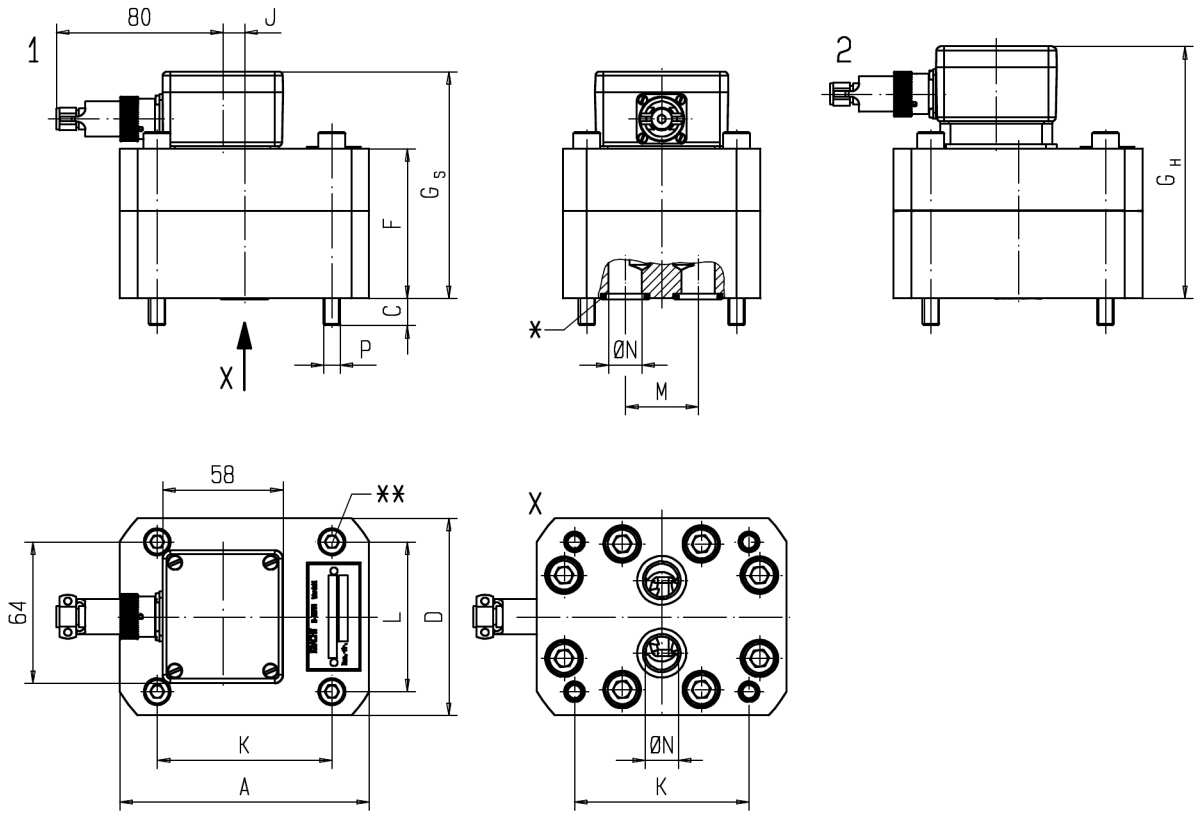


1 = Version S
2 = Version H

* = O-rings
** = Tightening torque M_A
X = Connection side

Nominal size VC	VC 3 /79*	VC 5 /79*	VC 12	VC 16
Series avaliable	1	1	1	1
Weight in kg	16,3	18,9	53,5	57,4
Tightening torque in Nm	120	120	400	400
Dimensions				
C	24,5	22	44	44
D	180	180	249	249
F	99	115	168	184
G_S	150	166	219	235
G_H	163	179	232	248
J	46,5	46,5	77	77
K	46	46	120	120
L	95	95	140	140
M	50	50	70	70
N	25	25	38	38
P	M12	M12	M20	M20

4.5.3 Serie 1, 2, 3, 4, 7; Type of connection P; Version S, H with terminal box

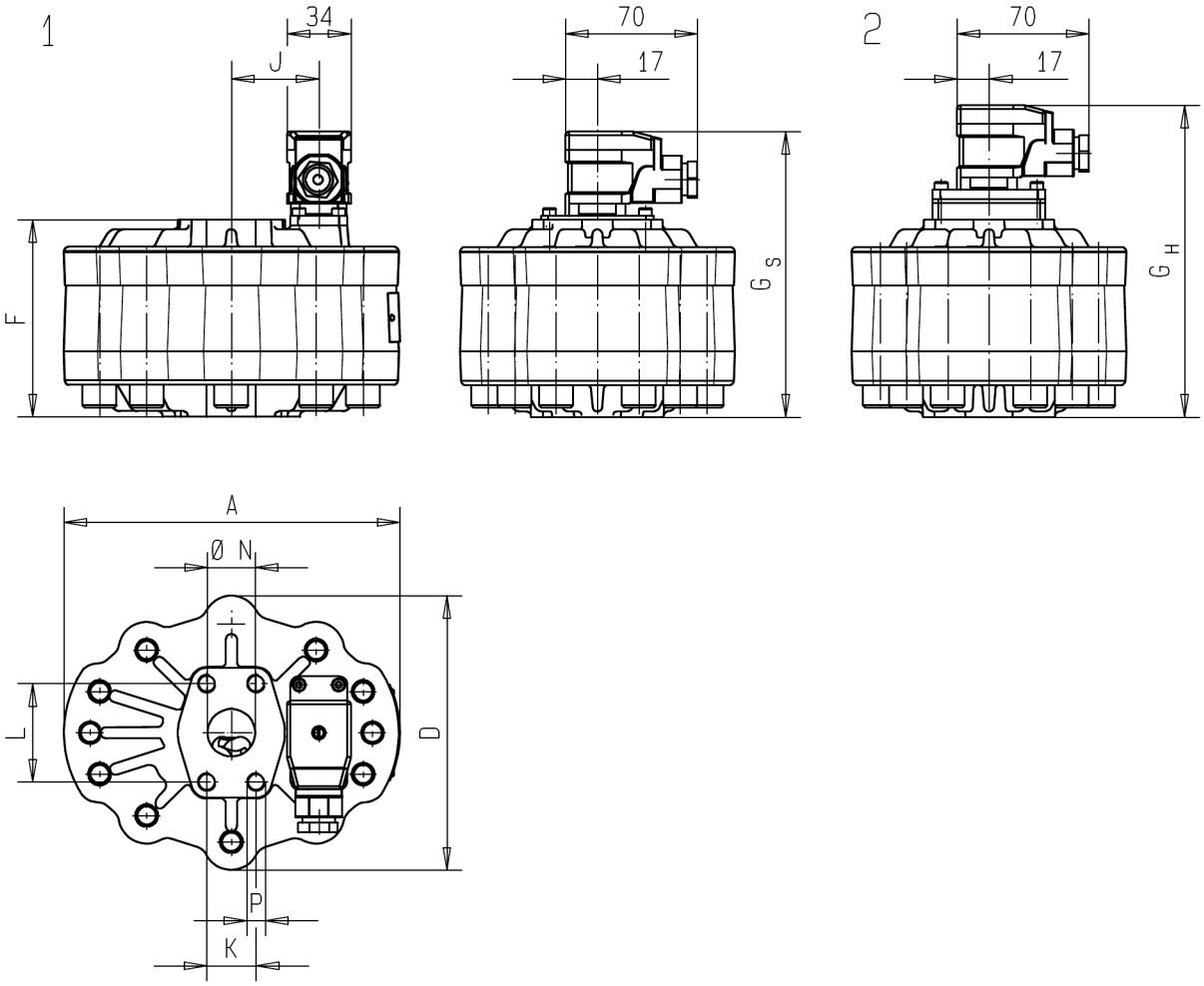


1 = Version S
2 = Version H

* = O-rings
** = Tightening torque M_A
X = Connection side

Nominal size VC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	1, 7	1, 7	1, 7	1, 2, 4 ,7	1, 4	1, 2, 3, 4, 7	1, 4	1, 2, 3, 4, 7
Weight in kg	1,8	2	2,3	2	3,7	5,2	9	13
Tightening torque in Nm	14	14	14	14	35	35	120	120
Dimensions								
A	85	85	85	85	100	120	170	170
C	10	9	10	13	17	13	18	22
D	60	60	60	60	90	95	120	120
F	50	56	55	57	63	72	89	105
G_S	87	93	102	94	100	109	126	142
G_H	99	105	114	106	112	121	138	154
J	-	-	-	-	-	10,5	40,5	40,5
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
M	20	20	20	20	34	35	50	50
N	6,5	6,5	6,7	9	16	16	25	25
P	M6	M6	M6	M6	M8	M8	M12	M12

4.5.4 Serie 1; Type of connection R, Version S, H; VC 5 .../165

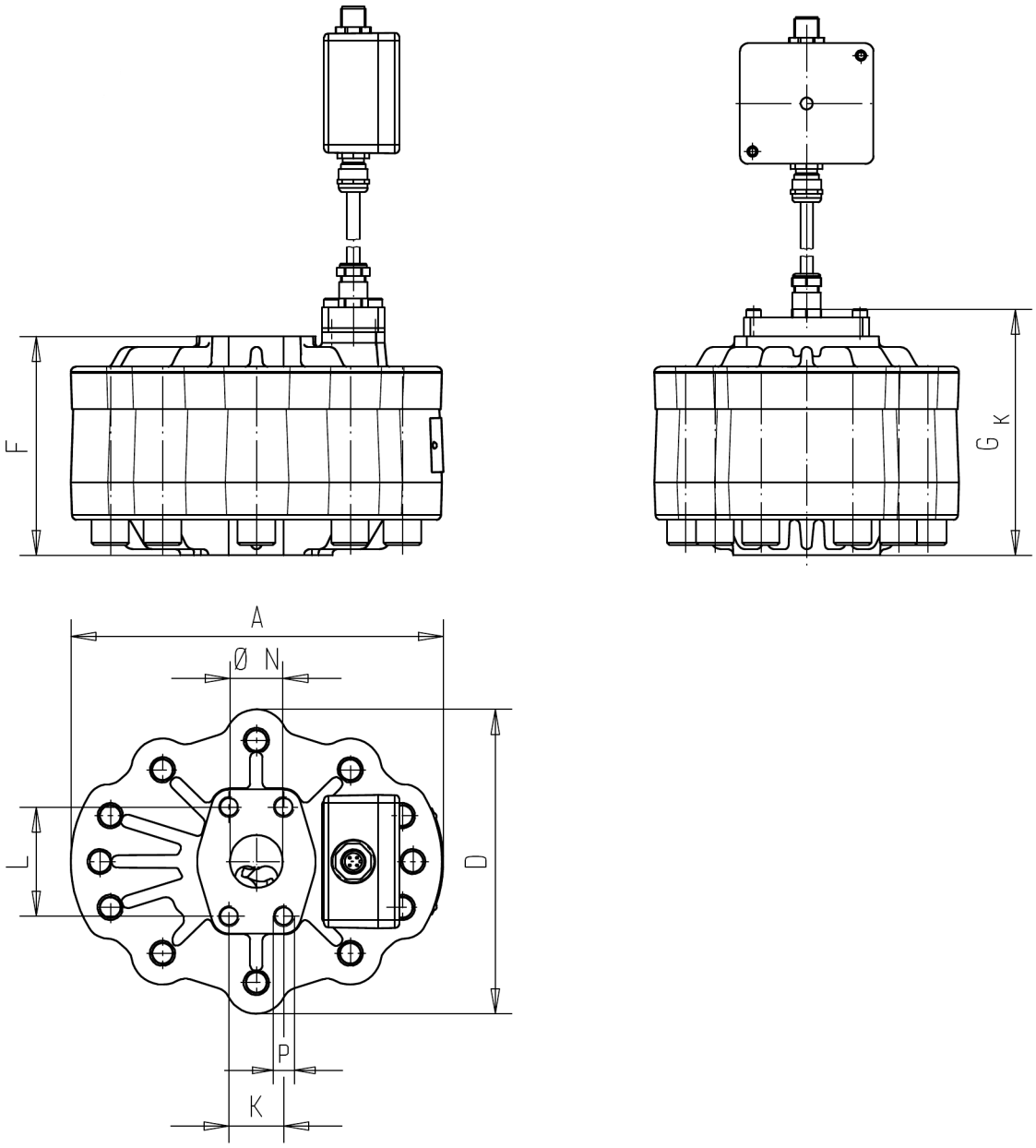


1 = Version S

2 = Version H

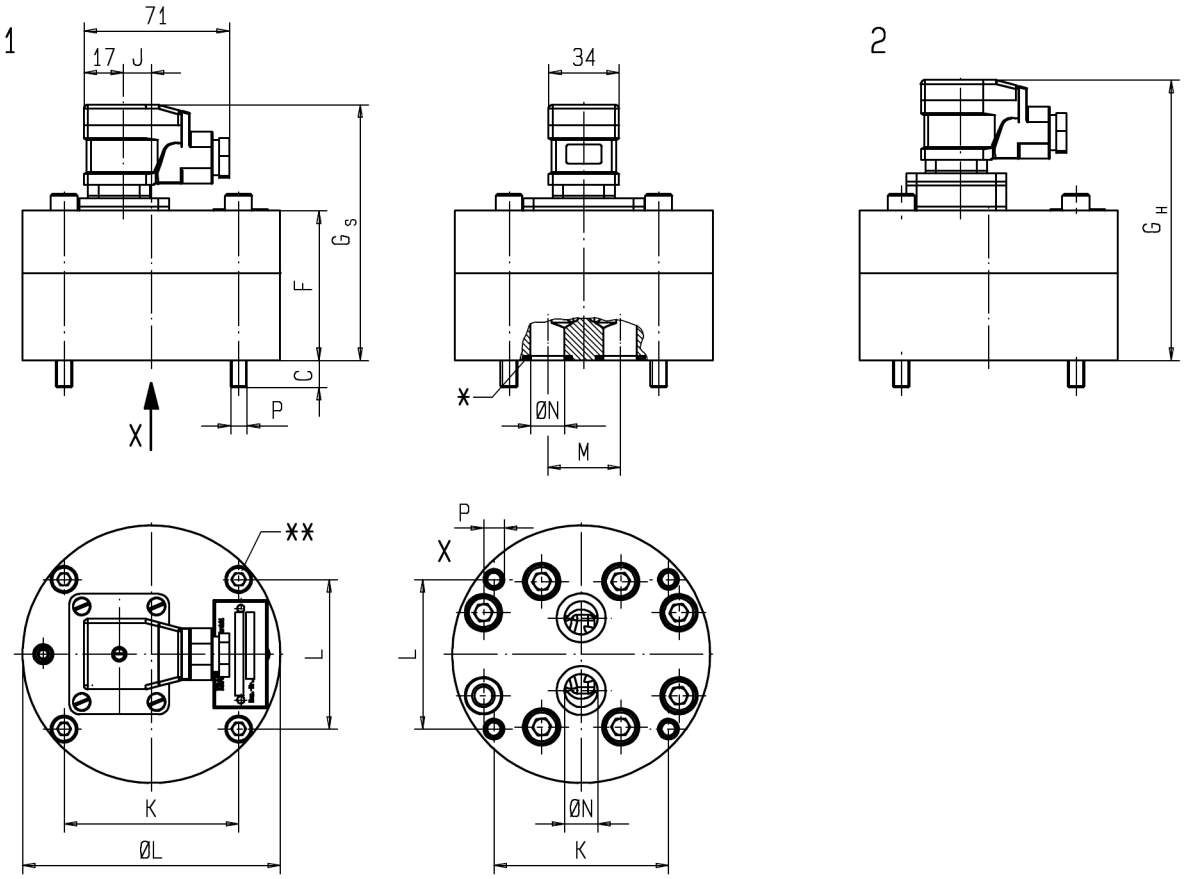
Product name	VC 5 .1 RS /165	VC 5 .1 RH /165
Series avaliable	1	1
Weight in kg	11	11
Dimensions		
A	178,6	178,6
D	146	146
F	105	105
G_S	152	-
G_H	-	166
J	46,5	46,5
K	26,2	26,2
L	52,4	52,4
N	25,4	25,4
P	M10 / t=17	M10 / t=17

4.5.5 Serie 1; Type of connection R; Version K, VC 5 .../165



Product name	VC 5 .1 RK /165
Series avaliable	1
Weight in kg	11
Dimensions	
A	178,6
D	146
F	105
G_K	118
K	26,2
L	52,4
N	25,4
P	M10 / t=17

4.5.6 Serie 5, 6, 8; Type of connection P; Version S, H

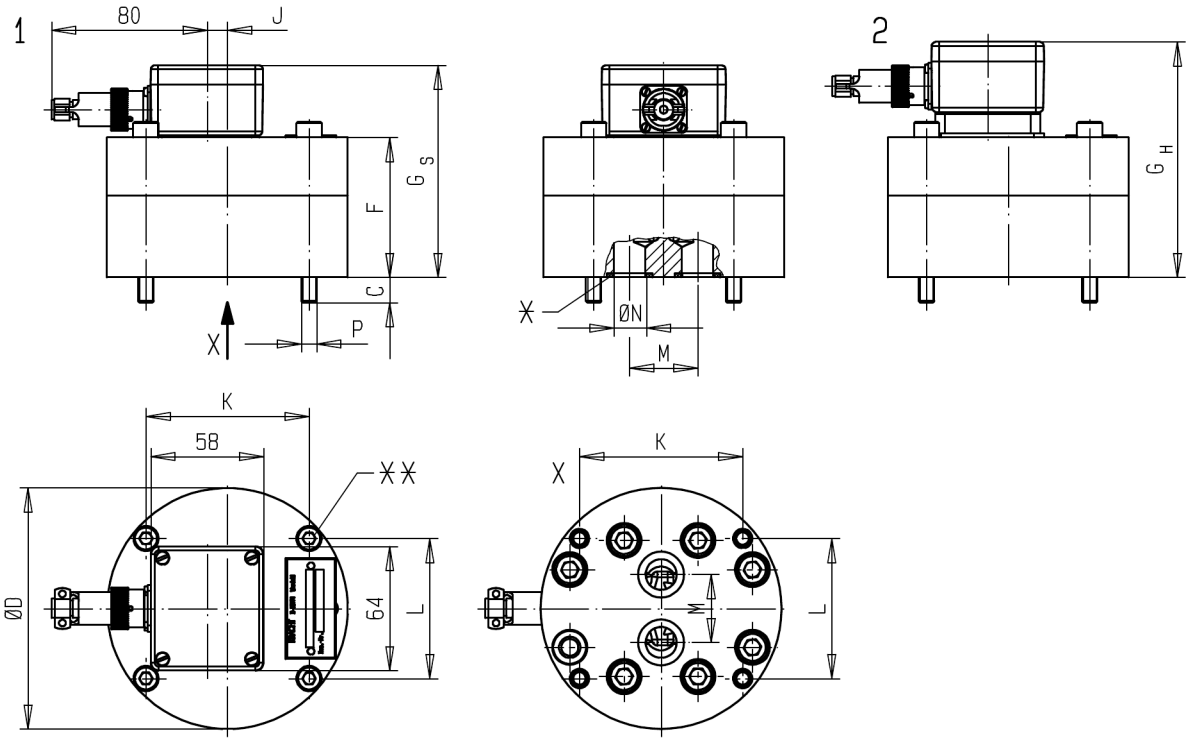


1 = Version S
2 = Version H

* = O-rings
** = Tightening torque M_A
X = Connection side

Nominal sizeVC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	5, 6, 8	6, 8	6, 8	5, 6, 8	5	5, 6, 8	5, 6	5, 6
Weight in kg	3	3	3	3,1	4,8	7	15,9	18,7
Tightening torque in Nm	14	14	14	14	35	35	120	120
C	15	9	10	13	17	13	21	25
D	94	94	94	94	118	124	170	170
F	55	56	65	57	63	72	89	105
G_S	106	107	116	108	114	123	140	156
G_H	119	120	129	121	127	136	153	169
J	-	-	-	-	-	15,5	46,5	46,5
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
M	20	20	20	20	34	35	50	50
N	6,5	6,7	6,7	9	16	16	25	25
P	M6	M6	M6	M6	M8	M8	M12	M12

4.5.7 Serie 5, 6, 8; Type of connection P; Version S, H with terminal box

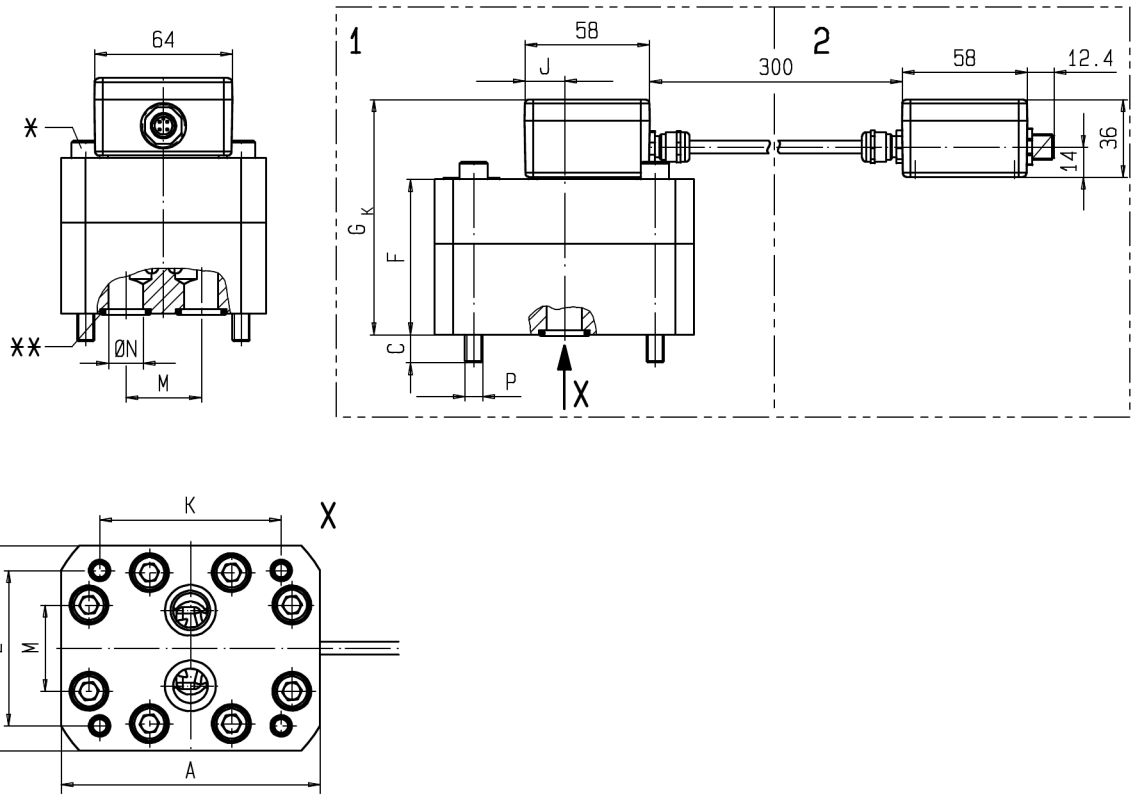


1 = Version S
2 = Version H

* = O-rings
** = Tightening torque M_A
X = Connection side

Nominal size VC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	5, 6, 8	6, 8	6, 8	5, 6, 8	5	5, 6, 8	5, 6	5, 6
Weight in kg	3	3	3	3,1	4,8	7	15,9	18,7
Tightening torque in Nm	14	14	14	14	35	35	120	120
C	15	9	10	13	17	13	21	25
D	94	94	94	94	118	124	170	170
F	55	56	65	57	63	72	89	105
G_S	106	107	116	108	114	123	140	156
G_H	119	120	129	121	127	136	153	169
J	-	-	-	-	-	15,5	46,5	46,5
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
M	20	20	20	20	34	35	50	50
N	6,5	6,7	6,7	9	16	16	25	25
P	M6	M6	M6	M6	M8	M8	M12	M12

4.5.8 Serie 1; Type of connection P; Version K

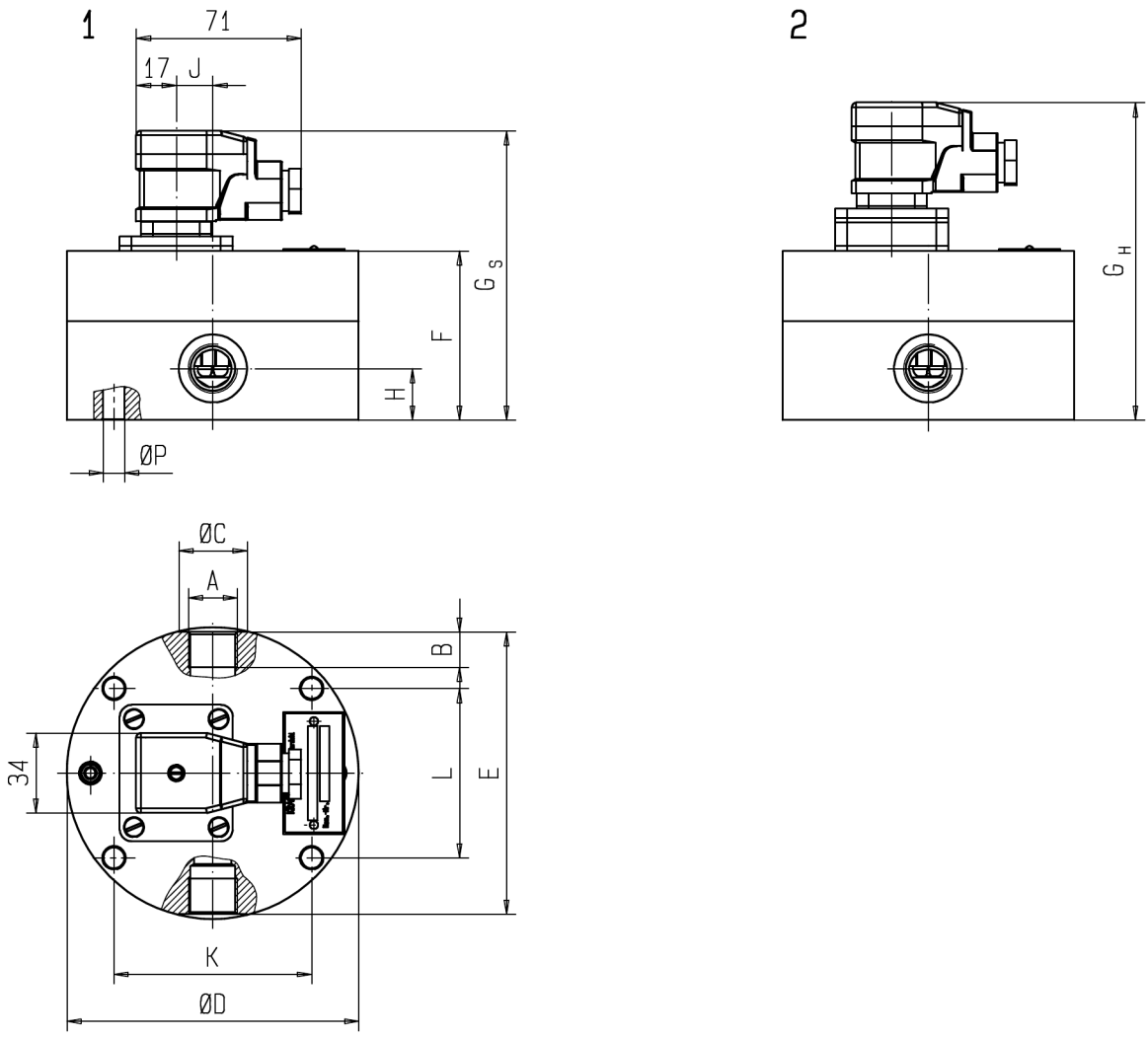


1 = Extrem temperature area
2 = Normal temperature area

* = Tightening torque M_A
** = O-rings
X = Connection side

Nominal size VC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	1	1	1	1	1	1	1	1
Weight in kg	1,8	2	2,3	2	3,7	5,2	9	13
Tightening torque in Nm	14	14	14	14	35	35	120	120
Dimensions								
A	85	85	85	85	100	120	170	170
C	10	9	10	13	17	13	18	22
D	60	60	60	60	90	95	120	120
F	50	56	65	57	63	72	89	105
G_K	87	93	102	94	100	109	126	142
J	-	-	-	-	-	18,5	11	11
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
M	20	20	20	20	34	35	50	50
N	6,5	6,5	6,7	9	16	16	25	25
P	M6	M6	M6	M6	M8	M8	M12	M12

4.5.9 Serie 5, 6, 8; Type of connection R

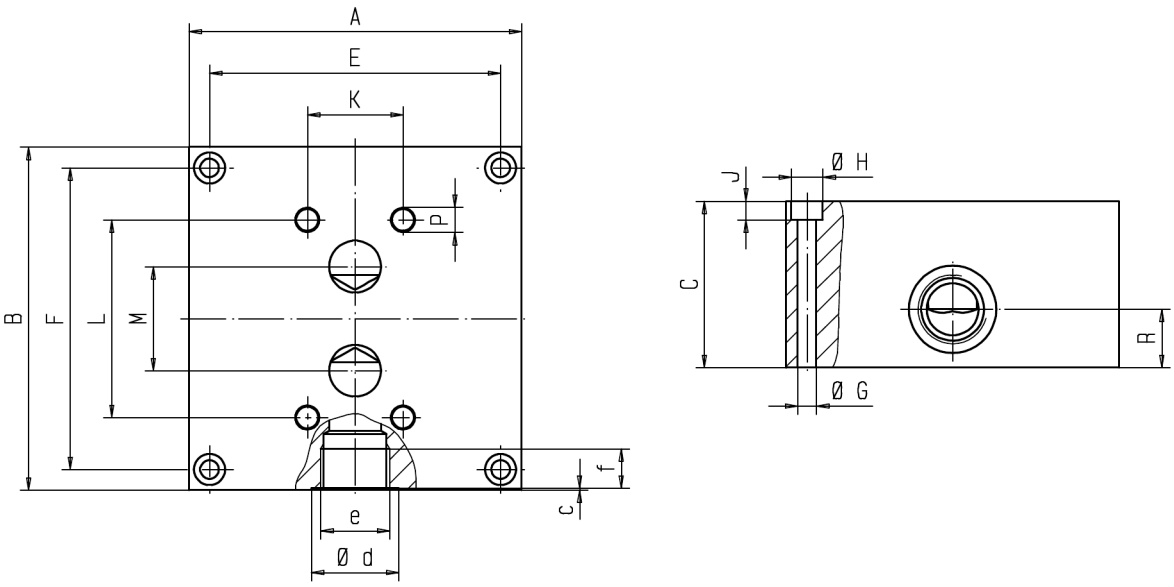


1 = Version S

2 = Version H

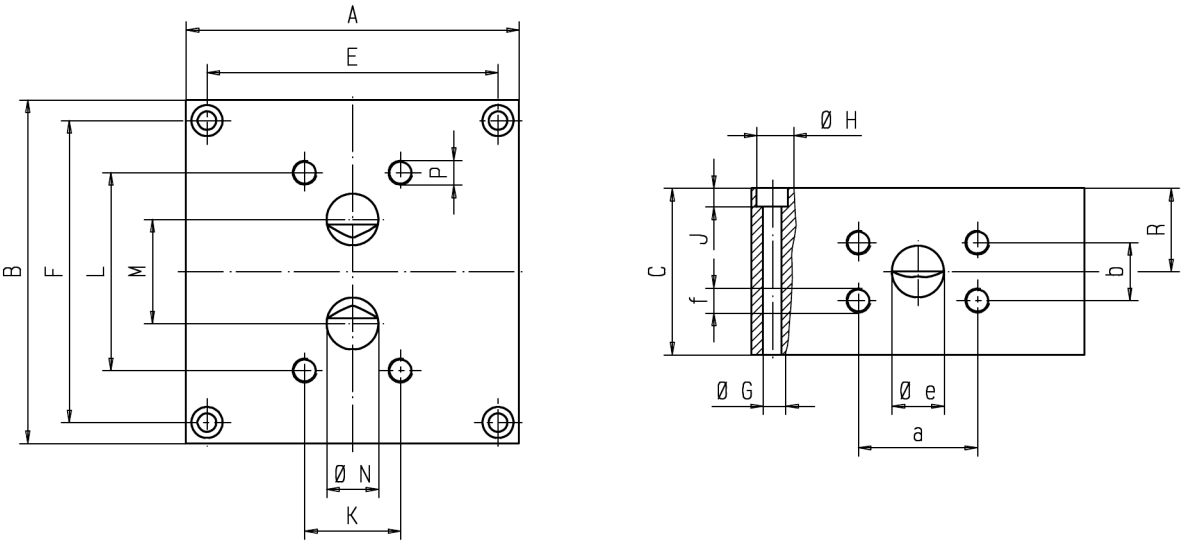
Nominal size VC	0,025	0,04	0,1	0,2	0,4	1	3	5
Series avaliable	5, 6, 8	6, 8	6, 8	5, 6, 8	5	5, 6, 8	5, 6	5, 6
Weight in kg	3	3	3	3,1	4,8	7	15,9	18,7
Dimensions								
A	G ⅛	G ¼	G ⅜	G ⅜	G ½	G ½	G 1	G 1
B	9	13	13	13	15	15	19	19
C	17	21	25	25	29	29	42	42
D	94	94	94	94	118	124	170	170
E	90	90	90	90	112	120	162	162
F	55	56	65	57	63	72	89	105
G_S	106	107	116	108	114	123	140	156
G_H	119	120	129	121	127	136	153	169
H	15	15	20	16	17,5	22	30	30
J	-	-	-	-	-	15,5	46,5	46,5
K	70	70	70	70	80	84	46	46
L	40	40	40	40	38	72	95	95
P	6,7	6,7	6,7	6,7	M8	9	13	13

4.5.10 Connection plates with thread connection on the side

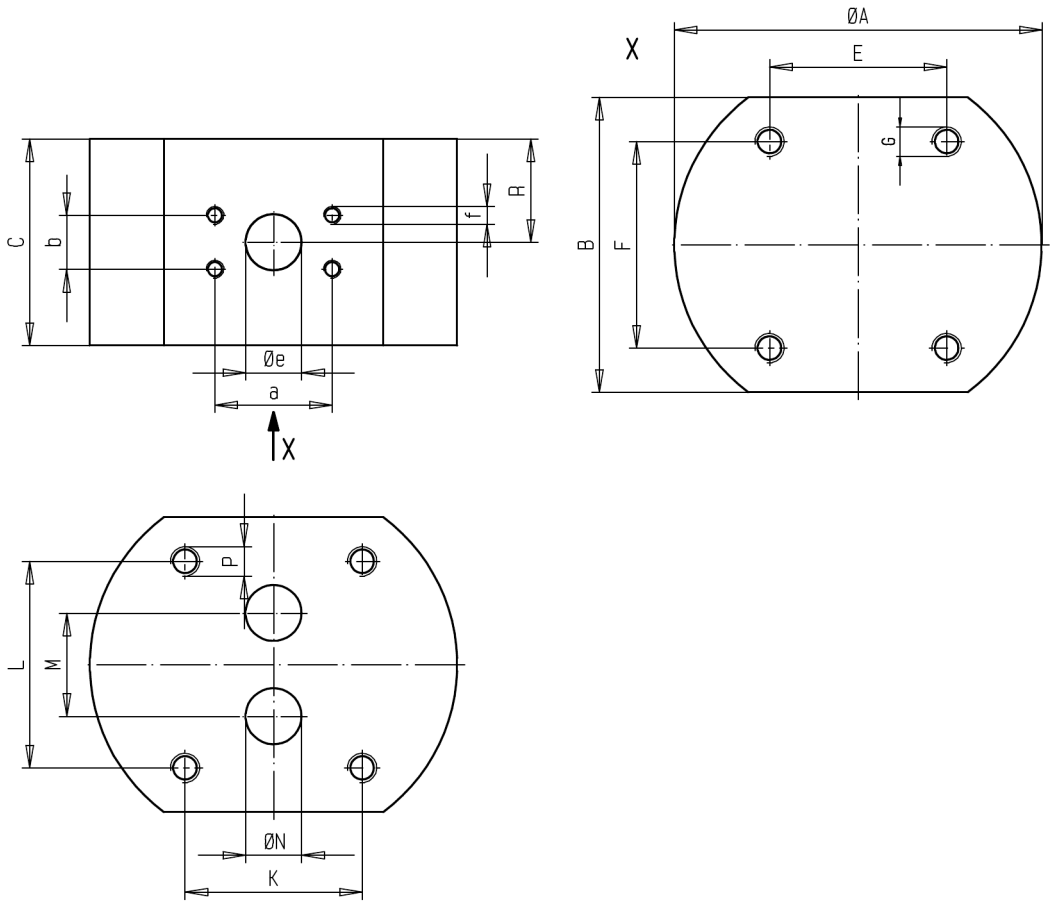


Order code	MVC 0,2 R3 B05* Cast iron	MVC 0,2 R3 B11* Stainless steel	MVC 0,4 R1 C09 Cast iron	MVC 1 R2 C05 Cast iron	MVC 5 R2 E05** Cast irons	MVC 10 R2 G05* Cast iron
Weight in kg	1,8	1,8	2,7	2,9	14	28
Dimensions						
A	85	85	100	100	160	200
B	90	90	110	120	165	215
C	35	35	37	37	80	100
E	65	65	86	80	140	176
F	76	76	96	106	145	191
G	7	7	7	7	9	11
H	11	11	11	11	15	18
J	7	7	7	7	9	11
K	70	70	80	84	46	64
L	40	40	38	72	95	125
M	20	20	34	35	50	70
N	6,5	6,5	16	12	25	38
P	M6 / t=14	M6 / t=14	M8 / t=18	M8 / t=18	M12 / t=24	M16 / t=25
R	17	17	18,5	17,5	28	35
c	0,7	0,7	0,7	0,7	1	1
d	25	25	29	29	42	58
e	G ⅜	G ⅜	G ½	G ½	G 1	G 1 ½
f	13	13	15	15	19	23
* = also suitable for VC 0,04 and VC 0,025			** = also suitable for VC 3			

4.5.11 Connection plates with SAE flange connection on the side

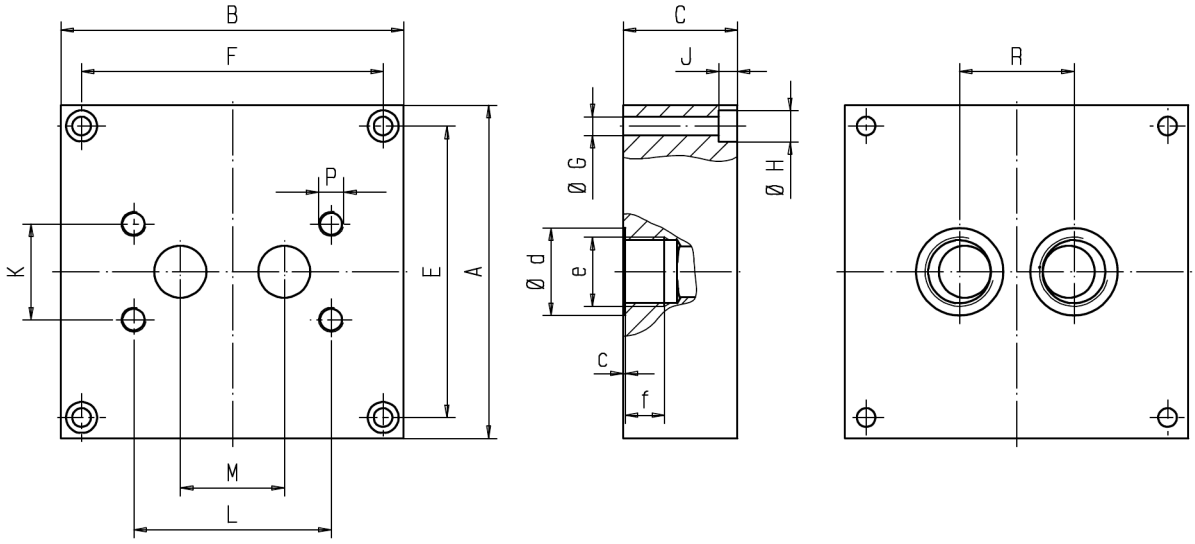


Order code	MVC 5 V2 E0,5* Cast iron	MVC 10 V2 G05 Cast iron
Weight in kg	14	29
Dimensions		
A	160	200
B	165	215
C	80	100
E	140	176
F	145	191
G	9	11
H	15	18
J	9	11
K	46	64
L	95	125
M	50	70
N	25	38
P	M12 / t=24	M16 / t=25
R	40	40
a	57,2	79,4
b	27,8	36,5
e	25	32
f	M12 / t=24	M16 / t=25
* = also suitable for VC 3		


ØA
X
E
G
B
F
C
b
f
R
Øe
a
X
P
L
M
ØN
K

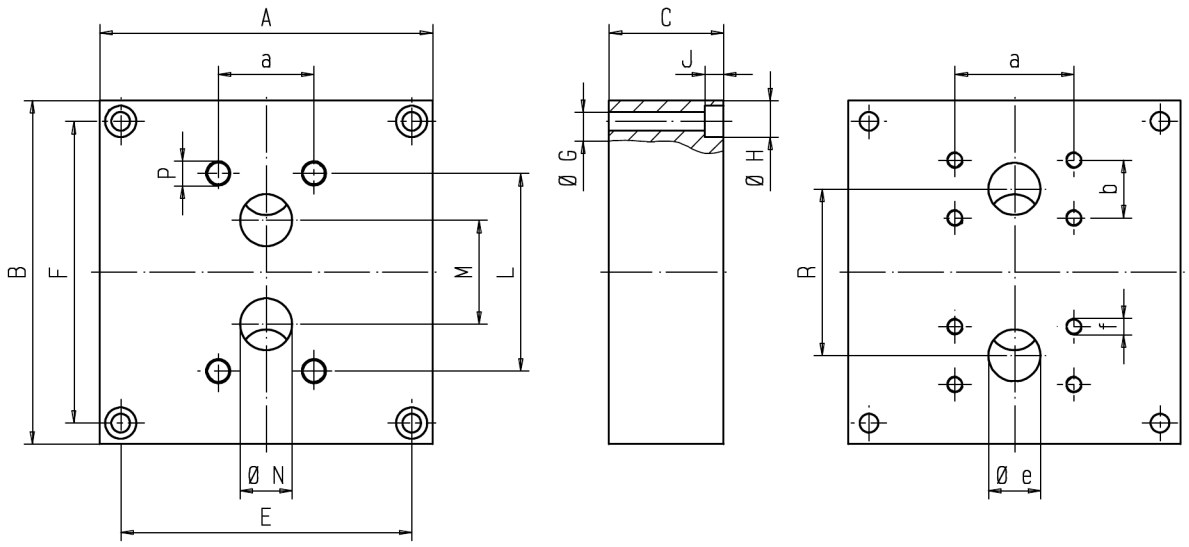
Order code	MVC 5 V1 E09* Cast iron	MVC 12 V1 G09** Cast iron
Weight in kg	14,2	41,2
Dimensions		
A	160	249
B	165	200
C	90	140
E	110	120
R	110	140
G	M8 / t=15	M20 / t=20
K	46	120
L	95	140
M	50	70
N	25	38
P	M12 / t=24	M20 / t=45
R	50	70
a	57,2	79,4
b	27,8	36,5
e	25	38
f	M12 / t=24	M16/ t=25
* = suitable for VC 3 /79 and VC 5 /79 (high-pressure variant) ** = also suitable for VC 16		

4.5.12 Connection plates with thread connection on the rear



Order code	MVC 0,2 R3 B04* Cast iron	MVC 0,4 R1 C08 Cast iron	MVC 1 R2 C04 Cast iron	MVC 5 R2 E04** Cast iron	MVC 10 R2 G04 Cast iron
Weight in kg	1,6	2,5	2,7	9,6	15
Dimensions					
A	85	100	100	160	200
B	90	110	120	165	215
C	35	37	37	55	55
E	65	86	80	140	176
F	76	96	106	145	191
G	7	7	7	9	11
H	-	11	-	15	18
J	-	7	-	9	11
K	70	80	84	46	64
L	40	38	72	95	125
M	20	34	35	50	70
N	6,5	16	12	25	38
P	M6 / t=14	M8 / t=18	M8 / t=18	M12 / t=24	M16 / t=25
R	28	46	50	55	72
c	0,7	0,7	0,7	1	1
d	25	29	29	42	58
e	G ⅜	G ½	G ½	G 1	G 1 ½
f	13	15	15	19	22
* = also suitable for VC 0,04 and VC 0,025			** = also suitable for VC 3		

4.5.13 Connection plates with SAE flange connection on the rear



Order code	MVC 5 V2 E0,4* Cast iron	MVC 10 V2 G04 Cast iron
Weight in kg	9,5	16
Dimensions		
A	160	200
B	165	215
C	55	55
E	140	176
F	145	191
G	9	11
H	15	18
J	9	11
K	46	64
L	95	125
M	50	70
N	25	38
P	M12 / t=24	M16 / t=25
R	80	100
a	57,2	79,4
b	27,8	36,5
e	25	32
f	M12 / t=24	M16 / t=25
* = also suitable for VC 3		

5 Transport and storage

5.1 Transport damage

Inspect the device for shipping damage as soon as the delivery has been received.

If shipping damage is discovered, inform the shipping company.

If proper operation of the device is impaired by the damage, the device must be replaced or repaired. In that case, contact the manufacturer.

5.2 Transport

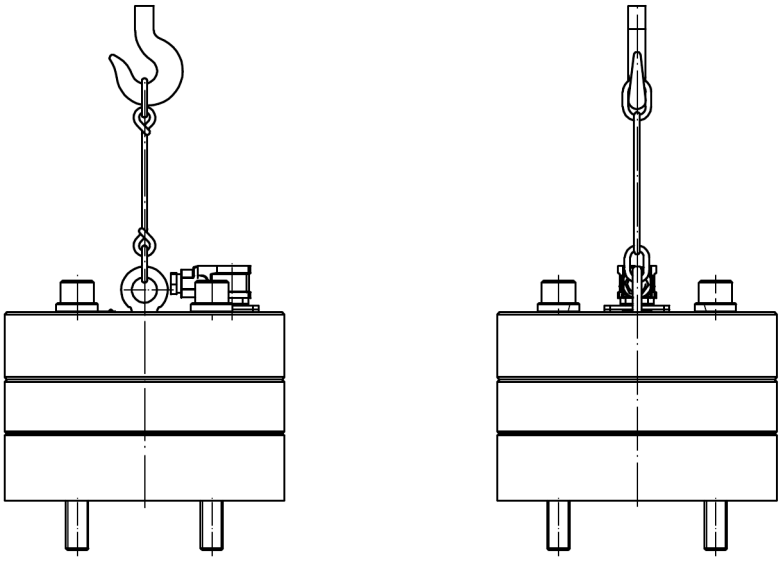
WARNING

Danger due to falling and or loads falling over!
Due to the size and weight of the unit, accidents can occur resulting in severe injuries or death during transport and shipping.

- Compliance with applicable industrial safety requirements is mandatory.
- Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
- Attach lifting trackle only to suitable points (see table 5.1).
- Attach the lifting tackle in such a manner that it cannot slip.
- Secure the device so that toppling over and falling down is impossible.
- Always avoid jerks, impacts and strong vibrations during transportation.
- Never walk under suspended loads, never work under suspended loads.
- To prevent damage to the device, be extremely cautious when shipping or transporting.
- Wear suitable protective clothing.

☞ **Handling aid**
When transporting gear type flow meters VC 12 and VC 16, the eyebolts can be scerwed into the cover as a handling aid.
For more severe connection plates existing threaded holes can also be used for eyebolts.

Tab. 5.1: Example for safe transport of gear type flow meters VC 12 and VC 16



5.3 Corrosion protection

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil protects the interior parts for about 6 months.

Clean bare outer metal parts have also been protected by anti-corrosive oil or protective metal paint for a period of 6 months against corrosion.

The device must not be exposed in the influence of the weather and major fluctuations in temperature during transport and storage and must be stored in a dry place.

If the device is stored over a longer period, it must be treated on the inside and outside with a suitable corrosion protecting oil. In addition, it must be protected from humidity by a humidity-absorbing agent.

If high air humidity or aggressive atmosphere is to be expected during transport, suitable corrosion prevention measures must be carried out.

NOTICE

Corrosion damage on units with EPDM seals

The functionality of units with EPDM seals is not tested. There is no preservation of the interior parts. If the unit is not put into operation immediately, corrosion damage can occur.

- Protect the unit by using suitable corrosion-preventing measures.

NOTICE

Chemical impact on the device and the sealing materials

Incompatibility between the preservation agents and the materials and elastomers used in the device can lead to damage of the device and the seals being used.

- Check to make sure the preservation agent is compatible with the materials and elastomers used in the device.
- Check to make sure the preservation agent is compatible with the media to be pumped.

6 Installation

6.1 General points

DANGER

Danger due to pressure loaded lines.

When working on pressure loaded lines, uncontrolled or squirting fluids can lead to accidents and severe injuries or even result in death.

- Always depressurize all lines during all work on the unit and before disassembly.

NOTICE

Danger of property damage due to insufficiently qualified personnel

Improper work can lead to damages and malfunctions in the device and in the plant.

- Permit only expert and technically qualified personnel to work on the device.

NOTICE

Danger of property damage due to a lack of cleanliness

During installation, foreign bodies can get into the interior of the device or the plant due to a lack of cleanliness and cause malfunctions there.

- Pay attention to cleanliness during all work.

6.2 Mechnical installation

DANGER

Danger due to breakage or squirting fluids!

If the device is blocked it acts like a closed gate. The pressure level that occure in this case can result in damage to the device and to up or downstream plant elements. Breakage can lead to parts flying around uncontrolled or to fluids squirting out which can lead to accidents and severe injuries or even result in death.

- A pressure relief valve or other kind of over-pressure safeguard must be installed before the device.The pressure relief device must be dimensioned so that entire delivery volume can be conducted through with the lowest possible pressure or pressureless.
- Do **not** put the device into operation without a pressure relief device.

DANGER

Danger due to breakage or squirting fluids!
Using unsuitable connections and lines can lead to breakage. Parts flying around uncontrolled or squirting fluids can lead to accidents with severe injuries or even lead to death.

- Use only connections and lines approved for the expected pressure range.
- Comply with each manufacturer's regulations.

CAUTION

Danger due to hot surfaces!
When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- At medium temperatures above 60 °C, take measures against unintended contact.
- Wear safety gloves.

NOTICE

Danger of property damage due to incorrect installation
Incorrect installation can cause malfunctions or damage the device and/or the system.

- During transport and installation, the device must always be held by the housing and never by the plug.
- The device must be installed in such a way that it is not exposed to any impermissible vibrations.
- Hot parts must not be installed since any escaping fluid could ignite.
- It must be guaranteed that all lines and connections are tight and no leakages can occur
- During operation start-up, the device must be checked for leaks under operating conditions.

The device was tested in the factory before delivery and can be used immediately following installation and connection of the electrical cables.

The space required for the device is specified in the chapter 4 “Technical data”.

The built-in measuring device should also be safely accessible for visual inspection at any time during operation.

Depending on the type of connection the device is connected to the system via a connection plate or connections within the housing.

- Before installation, the device must be checked for transport damage and soiling.

- Any preserving agents must be removed before installation using benzine or solvent.
- Clean the pipework of dirt, scale, sand, swarf, etc. prior to installation. Welded pipes in particularly must be pickled or flushed. Cotton waste must not be used for cleaning.

6.2.1 Plate connection

- Attach the connection plate to the planned position in the plant.

NOTICE

Danger of property damage due to a lack of cleanliness
A lack of cleanliness can lead to damages and malfunctions in the device and in the plant.

- Make sure that the seal fit properly.
- The contact surface must be free of dirt, residual paint etc..

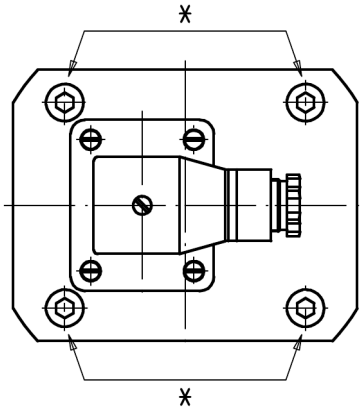
- Set the housing onto the connection plate in such a way that the attachment bore holes are aligned.
- Screw the housing to the connection plate.

NOTICE

Danger of malfunction due to distortion
Any distortion of the unit can be uneven or with the wrong torque tightened screws may lead to malfunction.

- Tighten the fastening screws VC / connection plate crossway.
- Observe the given torques. For torques, see the section "Dimensions and weights" in the chapter 4 “Technical data”.

- After the system has been put into operation, check all connections for air-tightness.



* Attachment screws

6.2.2 Installation on external connection plates or valve blocks

The values for evenness and roughness given below must be observed for installation.

Nominal size*		0,025 ... 1	3 ... 16
Evenness	µm	0,01	0,02
Roughness height R_t	µm	10	10
** See type key and type description on the device: VC ...*			

The device must be installed analogue to the section 6.2.1 “Plate connection” descibed above.

6.2.3 Pipe connection

- During installation, make sure that no sealant gets into the pipeline. Sealing agents such as hemp and putty are not permitted since they can lead to soiling and thus to functional problems.
- Connect the pipelines to the inlet and outlet points on the measuring device. Always heed the respective manufacturer's instructions.

NOTICE

Danger of property damage due to distortion

The load on the device due to impermissible external loads can lead to malfunctions or to breakage of the flange or housing.

- Pipelines must be fitted absolutely tension-free to the device connections.
- Pipelines must be designed in such a way that no tension e.g. caused by changes in lenght due to fluctuations in temperature can be transferred to the device.

- After the system has been put into operation, check all connections for air-tightness.

6.3 Assembly with further components and devices

NOTICE

Danger of property damage if installation is not correct

Incorrect assembly with components or devices from other manufacturers can lead to breakdowns.

- Comply with each manufacturer's operating instructions when assembling with additional components or devices.

6.4 Electrical connection

DANGER

Danger due to electric voltage!

Danger of death due to electric shock.

- Follow the special safety regulations during all work on electrical installations.
- Only allow electricians to work on electrical systems.

Electrical data for standard configuration 24 V	
Number of measuring channels	2
Operating voltage	U_B = 24 V DC ± 20%, protected against reverse polarity
Impulse amplitude	$U_A \geq 0{,}8\ U_B$
Impulse shape with symmetrical output signal	Rectangular, pulse-duty factor/ channel 1:1 ± 15%
Impuls offset between the two channels	90° ± 30°
Power requirement	$P_{b\ max}$ = 0,9 W
Power output / channel	$P_{a\ max}$ = 0,3 W, short-circuit resistant
Normal protective range	IP 65 (DIN 40050)
Signal output	PNP

Pre-condition: A 24 V (DC) supply cable (± 20%) must be planned for power supply to the pre-amplifier.

NOTICE

Damage by overvoltage

Devices that are designed for an operation voltage of 12 V DC (polarity protected) shall not be operated at a voltage of 24 V DC. The excessively high voltage can cause damage and malfunction of the device. This applies to devices with the special numbers 74, 75, 90, 110, 137, 138, 151 und 167.

- Operate the equipment only with the correct voltage (12 V DC or 24 V DC).
- If you are not sure which version is present, please consult the manufacturer.

6.4.1 Standard plug version

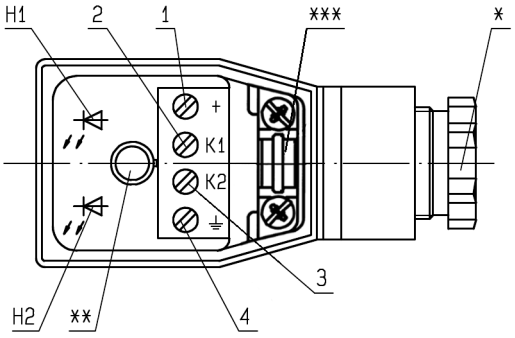
- The electrical connections have to be carried out according to the assignment diagram shown below.

Comfortable work

- To make wake more convenient, the plug may be pulled off the housing cover for cable connection.

The assignment of the terminals for channel 1 and channel 2 influences the direction of rotation of the measuring device indicated and thus the sign with which the measured volume flow is indicated in the evaluation device.

Assignment standard plug



H1: Status display channel 1
H2: Status display channel 2
* Cable screw connection
** Attachment screw cover
*** Strain relief

1: 24 Volt (broen)
2: Channel 1 (green)
3: Channel 2 (yellow)
4: 0 Volt (white)

NOTICE

Danger of malfunction due to incorrect installation

Loose cable or connections may cause malfunction of the device..

- After installation, the fastening screws *(slightly)* an the cable screw connection have to be tightened.

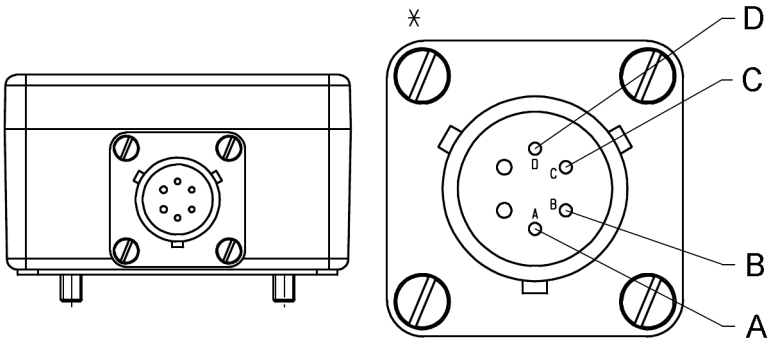
6.4.2 Terminal box version

The plug-type contact on the terminal box is equipped by the manufacturer according to the assignment diagrams shown below.

The mating plugs provided must be connected accordingly by the customer.

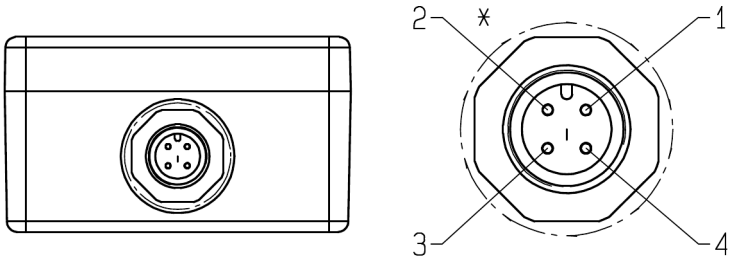
The assignment of the terminals for channel 1 and channel 2 influences the direction of rotation indicated and thus the sign with wich the measured volume flow is indicated in the evaluation device.

Pin assignment terminal box version with Cannon plug



A: 24 Volt
B: Channel 1
C: Channel 2
D: 0 Volt
* = Detailed view of plug

Pin assignment terminal box version with round plug-type connection M12x1



1: 24 Volt
2: Channel 1
3: 0 Volt
4: Channel 2
* = Detailed view of plug

7 Operation start-up

7.1 Preparation

NOTICE

Danger of proerty damage due to incorrect commisioning

Improper commissioning can lead to damages and malfunctions in the device and in the plant.

- All work on the device may only be carried out by trained and professionally qualified personnel.
- Comply with the permissible operating data such as rotational speed, pressure temperature, permissible media, etc. (see chapter 4 “Technical data”).
- Pay attention to cleanliness during all work.
- The medium must guarantee a minimum lubrication.
- Before starting the system make sure that a sufficient quantity of the operating fluid is extant to avoid dry running.
- Before starting the plant, the device must be filled with operating fluid to prevent damage during dry operation.
- It must be guaranteed that all lines and connections are tight and no leakages can occur

WARNING

Danger due to hazardous fluid!

Danger of death upon contact with hazardous fluids and when inhaling vapours from these liquids.

- Comply with the safety data sheets and regulations on handling the hazardous liquids!
- Collect and dispose leaks of hazardous materials so that no hazards arise for people or the environment.
- Comply with national and international rules at the place of installation.
- Wear suitable protective clothing.

CAUTION

Danger due to hot surfaces!

When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- At medium temperatures above 60 °C, take measures against unintended contact.
- Wear safety gloves.

- Check the permissible operating data against the operating states to be expected.
- Check all fastening screws on the device.
- Fill the device with operating fluid.

7.2 Further operation start-up

The device was tested in the factory before delivery. It can be put into operation immediately, as soon as the mechanical and electrical connections hace been set up. During operation, the two LEDs in the device plug light up as long as there is a continual flow of fluids through the measuring device.

Zündgefahr durch heiße Oberflächen
If the device is operated under impermissible operating conditions there is a hazard of ignition from the hot surfaces on the device.

1. Check the surface temperature that occurs during normal operation. If it lies more than 20 K over the media input temperature check the operating conditions. If applicable consult the manufacturer. The points to check on the device are the bearing points and the housing.

NOTICE

Danger of propery damage due to blocked measuring plant
A lack of counter signal may indicate a blockage mechanism. The resulting increase in pressure before the device can lead to further damage of the device and / or the system.

- The system must be switched off **immediately** if the counter signal fails unexpectedly.
- Remove the cause of the disorder.

7.3 Permissible limits for operation

The device may only be operated within the given limit values (see section 1.3 “Intended use” and chapter 4 “Technical data”)

NOTICE

Danger of device damage due to overload
A too high flow resistance Δp can cause mechanical damage on the device.

- The maximum pressure loos in the device may **not** exceed **16 bar**.

8 Removal

8.1 General points

NOTICE

Danger of property damage due to insufficiently qualified personnel

Improper work can lead to damages and malfunctions in the device and in the plant.

- Permit only expert and technically qualified personnel to work on the device.

NOTICE

Danger of property damage due to a lack of cleanliness

A lack of cleanliness can lead to damages and malfunctions in the device and in the plant.

- Pay attention to cleanliness during all work.
- Close all openings with protective caps to prevent dirt from penetrating into the system.

8.2 Removal of the gear type flow meter

WARNING

Danger due to hazardous fluid!

Danger of death upon contact with hazardous fluids and when inhaling vapours from these liquids.

- Comply with the safety data sheets and regulations on handling the hazardous liquids!
- Collect and dispose leaks of hazardous materials so that no hazards arise for people or the environment.
- Comply with national and international rules at the place of installation.
- Wear suitable protective clothing.

WARNING

Hazard caused by fluid squirting out!

During all work on the unit, squirting fluids can lead to accidents and severe injuries r even result in death.

- Depressurize all connection lines during all work and before removal the unit.

DANGER

Danger due to electric voltage!

Danger of death due to electric shock.

- Follow the special safety regulations during all work on electrical installations.
- Only allow electricians to work on electrical systems.

CAUTION

Danger due to hot surfaces!

When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- When the medium temperature is over 48 °C, let the device cool off.
- Wear safety gloves.

It must be guaranteed that the connection pipes have been made pressureless and the electrical connection is voltage-free.

- Loosen the attachment screw on the plug.
- Pull the plug off the housing.
- *Plate connection:* Remove the screws used to attach the device to the plate.
- *Pipe connection:* Loosen the pipe connections from the housing or take the housing off the fixture.

NOTICE

Danger of malfunction due to curing liquids

Curing liquids can engage the device mechanically and make it unusable.

- Immediately clean the pump or store it in such a way that curing is definitely prevented in cases where the pump was operated with curing liquids.

9 Maintenance

9.1 General points

NOTICE

Danger of property damage due to insufficiently qualified personnel
Improper work can lead to damages and malfunctions in the device and in the plant.

- Permit only expert and technically qualified personnel to work on the device.

NOTICE

Danger of damages and malfunctions due to a lack of maintenance
If the device is not regularly maintained, damage that is not discovered or not repaired can lead to malfunctions and to the failure of the device.

- Maintain the device regularly.
- Check the device initially right after commissioning.
- Adapt the extent and time between maintenance intervals to the demands posed by the location.
- During visual inspections, look purposefully for possible damages.
- The device must not be used if visible damages are found.
- Document the type and extent of the maintenance work. That allows the fastest possible detection of a change in operating performance.

When designed to the conditions of use and fitted correctly, the devices are able to be used for long and problem-free operation. They only require a little maintenance. This is absolutely essential for problem-free operation, however. Experience shows that a high percentage of the problems and damage that occur can be traced back to dirt and lack of maintenance.

The device is basically maintenance-free. If, however, fluids are pumped that can lead to deposits in the measuring device, the device may need cleaning.

Otherwise the device can be cleaned within the context of normal system cleaning. A change in measuring accuracy can be an indication of wear. We recommend checking this regularly.

The extent and time intervals for inspections and maintenance are generally specified by the operator in a respective plan.

Barriers and instructions

- All removed barrieres and warning signs must be put back to their original position on completing maintenance and/or repair.

Checking the operating data

- Regular checking of all operating data such as pressure, temperature, current consumption, degree of filter soiling etc. contributes to early problem detection.

NOTICE

Danger of property damage due to a lack of cleanliness

A lack of cleanliness can lead to damages and malfunctions in the device and in the plant.

- Pay attention to cleanliness during all work.
- Close all openings with protective caps to prevent dirt from penetrating into the system.

DANGER

Danger due to pressure loaded lines.

When working on pressure loaded lines, uncontrolled or squirting fluids can lead to accidents and severe injuries or even result in death.

- Always depressurize all lines during all work on the unit and before disassembly.

DANGER

Danger due to breakage or squirting fluids!

Using damaged connections and lines can cause parts to fly around uncontrolled or fluids to squirt out, which can lead to accidents and severe injuries or even result in death.

- Immediately replace damaged connections, pipes and hose lines.

WARNING

Danger due to hazardous fluid!

Danger of death upon contact with hazardous fluids and when inhaling vapours from these liquids.

- Comply with the safety data sheets and regulations on handling the hazardous liquids!
- Collect and dispose leaks of hazardous materials so that no hazards arise for people or the environment.
- Comply with national and international rules at the place of installation.
- Wear suitable protective clothing.

DANGER

Danger due to electric voltage!
Danger of death due to electric shock.

- Follow the special safety regulations during all work on electrical installations.
- Only allow electricians to work on electrical systems.

CAUTION

Danger due to hot surfaces!
When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- When the medium temperature is over 48 °C, let the device cool off.
- Wear safety gloves.

9.2 Unusual noise

Some damage is indicated by unusual noises. If there is a change in the decive's operating noise, a thorough examination of the cause must always take place.

9.3 Static seals

The static seals on the device's separation joints and the connection lines must be periodically checked for leakproofness.

If there are any visible leaks, immediately stop plant operation.

If the leaks cannot be stopped by simply retightening the connection, replace all affected seals.

9.4 Screw joints

All the screw joints must be checked at regular intervals to make sure they are tight fit. Loose screw joints must be tightened and, if necessary, secured against loosening by e.g. Loctite (medium stregth).

9.5 Desposits in the measuring device

Devices of the series 1, 2, 6, 7 and 8: Never open these devices yourself since they can only be reassembled properly for use by specialists.

Devices of the series 3, 4 and 5: These can be opened and cleaned, taking appropriate care.

The cleaning procedure is described in the chapter 10 “Cleaning”.

10 Cleaning

Devices of the series 1, 2, 6, 7 and 8: Never open these devices yourself since they can only be reassembled properly for use by specialists.

Devices of the series 3, 4 and 5: These can be opened and cleaned, taking appropriate care.

WARNING

Hazard caused by fluid squirting out!
During all work on the unit, squirting fluids can lead to accidents and severe injuries r even result in death.

- Depressurize all connection lines during all work and before removal the unit.

WARNING

Danger due to hazardous fluid!
Danger of death upon contact with hazardous fluids and when inhaling vapours from these liquids.

- Comply with the safety data sheets and regulations on handling the hazardous liquids!
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- Only allow electricians to work on electrical systems.

CAUTION

Danger due to hot surfaces!
When operating the device with hot media, there is a danger of being burned and scaled when touching the hot surfaces.

- When the medium temperature is over 48 °C, let the device cool off.
- Wear safety gloves.

It must be guaranteed that the connection pipes have been made pressureless and the electrical connection is voltage-free.

- Remove the device (see chapter 8 “Removal”).

- Empty the measuring device.
- Loosen the attachment screws that are holding the two halves of the housing together.

  The hexagonal socked screws (4 or 8 pcs.) are accessible from underneath the housing.

NOTICE

Danger of damage to the unit

An improper operating can result in damage or malfunktion to the device.

- When removing the upper part of the gear type flow meter, do **not** use a screwdriver or similar tool as a lever in the joint.
- Do **not** use pliers to remove the gearwheel from the housing.

- Clean the inside of the housing, the gearwheels and the bearing using a suitable cleaning agent.

If any mechanical damage is found inside the housing or on the gearwheels, the whole device must be returned to the manufacturer for repair.

- Inside both gearwheels with bearing into the bottom part of the housing.
- Insert the O-ring in the housing groove.
- Set the upper part of the housing onto the bottom part (insert alignment pins first).
- Tighten all the screws that are holding the housing together crossways with the tightening torque shown below.

NOTICE

Danger of property damage due to a lack of cleanliness

A lack of cleanliness can lead to damages and malfunctions in the device and in the plant.

- All parts have to be free of dirt for installation.
- Take care that no contaminats get inside the device during installation.

Tab. 10.1: Housing connection tightening torque, serie 3, 4 and 5

Nominal size*	**0,025**	**0,04**	**0,1**	**0,2**	**0,4**	**1**	**3**	**5**	**12**	**16**
Tightening torque M_A	40				65		145		290	
** See type key and type description on the device: VC ...*										

- Install the device in the plant again (see chapter 6 “Installation”).

11 Repairs

11.1 General points

The term repairs covers:

- **Troubleshooting**, in other words establishing damage, determining and localising the reason of the damage.
- **Elimination of damage**, in other words eliminating the primary causes and replacing or repairing faulty components.

11.2 Troubleshooting

Leaks are the most frequent problem. If these occure on the pipelines, they can be eliminated by straightforward tightening of the screw joints.

If the device itself is leaking, the respective seals have to be replaced.

11.3 Elimination of damage

Repair damage onsite, predominantly by replacing the defective device. The device itself is generally repaired by the manufacturer.

If corresponding expertise and sufficient equipment is available, the consumer or OEM can also make the repairs. For support, **spare part lists** and **sectional drawings** are available. They can be requested from the manufacturer.

NOTICE

Danger of property damage due to incorrect work and use of nonoriginal spare parts

Improper work can lead to damages and malfunctions in the device and in the plant. That also applies to the use of non-original spare parts.

- Permit only expert and technically qualified personnel to work on the device.
- Use only original spare parts.

11.4 Return

If the device has to be repaired or checked over the manufacturer's permises, ist must be packed suitably for transport. In addition, a safety data sheet for the medium used must be enclosed with the device. In case of well-known mineral oils, at least the exact type description is required.

If harding or agglutinative media are involved, the device must be cleaned befor it is returned.

Cleaning is also necessary of the device has been operated with hazardous fluids.

Any openings must be closed.

11.5 Disposal

Disposal of the packaging and used parts must be disposed according to the regualtions valid in the country where the device is installed.

11.6 Detecting and eliminating problems

If the device does not function properly, the electrical components should be checked first. The measuring device must remain in operation for this.

DANGER

Danger due to electric voltage!

Danger of death due to electric shock.

- Follow the special safety regulations during all work on electrical installations.
- Only allow electricians to work on electrical systems.

If there is no analytical evaluation software available, the following troubleshooting table is to be used for problem analysis.

Fault	Potential causes	Remedy
Both LEDs on the disconnection amplifier are lit, but incorrect values are displayed.	The connection between volume counter and evaluation device is faulty.	Check the connection and replace the cables or plugs if necessary.
One LED does not light up during operation.	The wiring between sensor and board or individual solder spots an the board is damaged.	Send the measuring device back to the manufacturer for repair.
	The respective sensor is faulty.	
Both LEDs do not light up during operation.	Power failure	Check supply cable and fuses.
	Since it is improbable that both sensors fail at the same time, it must be assumed that the measuring unit has stopped.	**Put the device out of operation immediately!** Send devices of the series 1, 2, 6, 7 and 8 to the manufacturer for repair. Devices of the series 3, 4 and 5 can be dismantled and cleaned.
Leaks, media escaping	O-ring in the housing not airtight.	Send devices of the series 1, 2, 6, 7 and 8 to the manufacturer for repair and consult manufacturer. With devices of the series 3, 4 and 5, check seal compatibility, consult the manufacturer if necessary and fit new set of seals (purchase from the manufacturer).
	O-ring between gear type flow meter and connection plate not airtight.	Check seal compatibility, install new O-rings.
Decrease in measuring accuracy	Wear	Check the measuring device or send it back to the manufacturer for repair.