

**Solutions for Fluid Technology**



**OPERATING INSTRUCTIONS**

For Flow Meters of the Product Series "VS in Standard Version"

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## IMPORTANT INFORMATION AND LEGAL NOTICES

### **Dear customer, dear user,**

This operating instruction for volume sensors of the **“VS in Standard Version”** series by VSE Volutentechnik GmbH (VSE) contains information required to properly install and commission the flow meter for the intended purpose.

Any installation, commissioning, operation, maintenance and testing may only be carried out by trained and authorized personnel. The operating instructions must be read and followed carefully to ensure a trouble-free, proper and safe operation of the flow meter. In particular, the safety instructions are essential.

These operating instructions must be kept safe and accessible for the authorized personnel at all times. At no time should contents of the operating instructions be removed. A missing manual or missing pages must be replaced immediately if lost. The operating instructions can be requested at any time from VSE or downloaded from our website [www.vse-flow.com](http://www.vse-flow.com). The operating instructions must be passed on to each subsequent user of the flow meter.

This operating instruction is not subject to any modification service by VSE. VSE reserves the right to make technical changes at any time without notice.

VSE makes no warranties, express or implied, with respect to commercial qualities and suitability for a particular purpose.

VSE accepts no liability for damage and malfunctions resulting from operating errors, failure to observe these operating instructions, improper installation, commissioning or maintenance as well as improper use of the flow meter.

The opening of the flow meter is absolutely not permitted. After an unauthorized opening or rebuilding as well as after a single, incorrect connection of the flow circuits of the flow meter, the warranty as well as the product liability by VSE expire.

## GENERAL FUNCTION DESCRIPTION OF FLOW METER

Flow meters made by VSE Volumentechnik GmbH measure the volume flow of liquids according to the toothed wheel principle. A pair of very precisely adjusted toothed wheels in the housing constitutes the meter. A signal pick-up system registers meter rotation free of contact and tooth by tooth. Each tooth is put out as digital pulse.

The gaps in the teeth of the meter wheels form meter chambers in the areas, in which they are completely enclosed by the housing walls; these chambers digitalise liquid flow depending on their chamber volume. The liquid flow quantity within one meter rotation of a tooth division forms the volume measurement per pulse ( $V_m$ ) and is defined in  $\text{cm}^3/\text{pulse}$ . It identifies the constructional size of a flow meter.

## GENERAL DESCRIPTION

Please follow all instructions in this operating manual; only this guarantees a trouble-free operation of the flow meters. VSE is not liable for any damage ensuing from non-following of these instructions.

Opening the devices during the term of guarantee is only authorised after consultation and approval of VSE.

## FLOW METER SELECTION

The correct selection (version) of type and constructional size is crucial for a trouble-free and safe operation of the flow meters. Owing to the great number of various applications and flow meter versions, the technical specifications in the VSE catalogue material are of a general

nature. Performance of the flow meter depends on type, size and meter range and on the liquid that is to be measured. Please consult VSE for an exact description.

## DECLARATION OF CONFORMITY

Flow meters of the "VS" product line are tested for their electromagnetic compatibility and interference transmission in terms of the law on electro-magnetic compatibility and correspond to the legal prescriptions enforced by EMC directives. They may not be operated independently and are to be connected via cable to a power source and supply digital electric signals for electronic evaluation. A declaration of conformity is submitted for all flow meters, which you can request if you require. Since the electromagnetic compatibility of the total measuring system depends as well on cable layout, correct connection of protective shield-

ing and each single connected device, you must ensure that all components correspond to the electromagnetic compatibility directives and that the electromagnetic compatibility of the total system, machine or plant is guaranteed.

All flow meters are tested according to the valid, legally prescribed electromagnetic compatibility directives and possess the CE-certification. The EC-declaration of conformity is the CE-label attached to all flow meters.

## GENERAL CONDITIONS FOR INITIAL START-UP

Before assembly and before initial start-up, you have to note the following properties and aspects of the corresponding characteristics of your system, so that a trouble-free and safe operation is possible.

### 1. The process fluid

- Is the flow meter **suitable for the fluid**?
- Is the fluid **viscous or abrasive**?
- Is the fluid **contaminated** or is there **solid matter in the fluid**?
- Which **granular size** does the solid matter possess and can it **block the meter**?
- Does the fluid have **fillers** or other **additional material**?
- Is it necessary to install a pre-switched **hydraulic filter**?
- Are the **pipe lines clean** and free of assembly residues such as swarf, weld chips?
- Is the **tank clean** and is it ensured that **no extraneous materials** can get into the pipe line system from the tank?
- Is the fluid often changed and is **sufficient flushing performed in this case**?
- Are the pipe lines and the entire system completely **deaerated**?
- What **cleaning agent** is being used?
- Are the fluid and the cleaning agent compatible with the **seals**?
- Are the **seals suitable** for the fluid undergoing measurement (**seal compatibility**)?

## 2. The hydraulic properties of the system

- Is the **max. operating pressure of the system** lower than the max. permitted operating pressure of the flow meter?
- Is the **max. fall of pressure  $\Delta p$**  (on flow meter) below the max. permitted fall of pressure?
- Does an excessively **great fall in pressure  $\Delta p$**  occur on the flow meter at max. flow (e.g. with higher viscosity)?
- Does the flow range of the flow meter (depending on viscosity) correspond to the **provided flow**?
- Note that flow range decreases the **greater the viscosity!**
- Does the temperature range of the flow meter correspond to the **provided max. temperature** of the medium?
- Is the **cross section** of the pipe line large enough and are the falls in pressure in the system not excessive?
- Is the **hydraulic connection** (supply and reverse flow) correctly connected and leak-proof?
- Has the **pump** sufficient power to operate the system?
- A blocking flow meter can stop the whole flow. Is a **pressure control valve / bypass** provided in the system?

## 3. Electronic evaluation and electrical safety

- Have you selected the optimal flow meter and is this equipped with the **appropriate preamplifier**?
- Does the **power supply voltage** of the flow meter correspond to the provided voltage?
- Is the power supply voltage supplied by the mains or evaluation device sufficiently **steady**?
- Does the **output** of the power supply voltage correspond to the required power output?
- Has the electric connection been installed based on the enclosed **connection plan**?
- Is the cable **protected** by a shielding?
- Is there a **connection** of the cable protective shielding via the 4-pin round plug to the housing of the flow meter?
- Is there a **potential difference** between the earth conductor connection PE on the flow meter and the earth conductor PE on the evaluation device?
- Does a correcting lead have to be laid to eliminate the **potential difference** between the flow meter and the evaluation device?
- Is the flow meter connected firmly to the **earth conductor PE** (e.g. via the pipe lines)?
- Is the flow meter mounted to be **insulated** to the earth conductor PE (e.g. connection via hoses)? If this is the case, the earth conductor PE has to be connected to the flow meter!
- Is the cable laid fault-free and the installation secured from input of **interference pulses**?
- Is the **round plug** of the connection cable firmly screwed together with the plug of the flow meter?
- Are the wires on the **evaluation device** correctly and properly connected?
- Does the entire system correspond to the directives of the electromagnetic compatibility laws (**EMC**)?
- Have all local valid regulations, **applicable directives**, guidelines and background conditions of the **electromagnetic compatibility laws** been maintained and observed?
- Systems that can lead to personal injury through malfunction or failure are to be equipped with the **appropriate safety devices**. The functioning of these safety devices is to be checked at regular intervals.

## MAXIMUM OPERATING PRESSURE

Before assembling the flow meter, you have to test that the max. operating pressure of the system does not exceed the max. permitted operating pressure of the flow meter. Meanwhile, observe the top pressures that can occur, when operating the system.

The following operating pressures are permitted depending on flow meter version:

- Flow meter in grey cast iron version  $p_{max} = 315 \text{ bar} / 4500 \text{ psi}$
- Flow meter in stainless steel version  $p_{max} = 450 \text{ bar} / 6500 \text{ psi}$
- Flow meter in special version  $p_{max} = \text{up to } 700 \text{ bar} / 10100 \text{ psi}$

### Important:

**Please consult VSE for all operating pressures > 450 bar / 6500 psi and for special versions.**



## INFORMATION ON EU DIRECTIVE 2014/68/EU ON PRESSURE EQUIPMENT

In terms of Article 2, No. 5 of the directive named above, VSE volume sensors are so-called "pressure-maintaining components" and this directive thereby relates to them.

VSE volume sensors must thereby comply with the technical requirements named in Section 4 of the directive in accordance with Article 4, Paragraph (1d), Piping according to Paragraph (1c).

Typically, the fluids measured fall into Group 2 in accordance with Article 13, Paragraph (1b). The volume sensors sold by VSE do not comply with the limit values defined under Article 4, Paragraph (1a).

The technical requirements on volume sensors from VSE are therefore limited to the criteria defined in Article 4, Paragraph (3). That means that the devices must be designed and manufactured in accordance with the good engineering practices prevailing in the member state. We hereby confirm this. The paragraph also states that these units may not bear the CE label named in Article 18.

A CE declaration of conformity is therefore not issued in accordance with 2014/68/EU.

The CE label of our volume sensors refers to Directive 2014/30/EU.

## FLOW METER RANGE

The flow meter range specified in the flow meter data sheet ( $Q_{\min}$  -  $Q_{\max}$ ) refers to the testing fluid "hydraulic oil" with a viscosity of 21 mm<sup>2</sup>/s at a temperature of 20°C. For this flow meter range, VSE specifies measurement accuracy of up to 0.3% of the measurement value and a repetition accuracy of 0.05%.

For fluids of lower viscosity (< 21 mm<sup>2</sup>/s) measurement accuracy deteriorates, while for fluids of higher viscosity (> 21 mm<sup>2</sup>/s) it can improve. Also note, however, that the flow meter range is restricted in case of higher viscosity (see "Technical specifications").

### Important:

**Make sure that the specified maximum permitted operating pressure of the flow meter cannot be exceeded, whatever the operating mode of the system. Note the flow meter range that is dependent on the viscosity of the fluid to be measured.**



## ASSEMBLY OF THE FLOW METER

The flow meter should be mounted on an easily accessible location, so that dismantling for cleaning the meter presents no problem. Since flow meters can work in any installation position and flow direction, you can mount it on any location of your system that you wish. Take care when installing the flow meter that always liquid remains in the flow meter even at system standstill and that it can never run empty. The outflow of the flow meter should therefore always show a certain back pressure. In critical cases or when the pipe line is at standstill or standby and can run empty, we recommend installing an extra non-return valve in the outflow line.

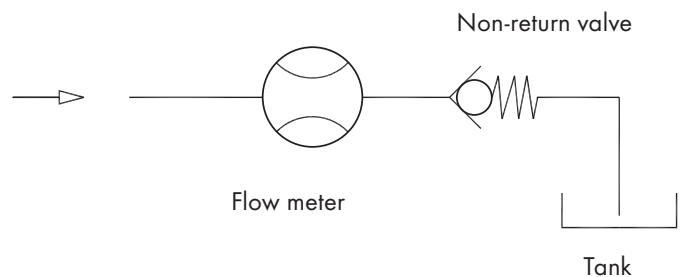


Fig. 1: Flow meter installation with non-return valve

### Important:

**Make sure that the flow meter is always completely filled both in inflow and outflow and that the outflow has a little back pressure. This prevents the meter being damaged by a sudden and steep increase of flow and at the same time improves measurement accuracy.**



Flow meters of the "VS" product line can be mounted directly onto a block or into the pipe line using four screws. Always select large cross sections for the hydraulic supply and return flow respectively for the entire pipe line system (if possible). This lowers the fall in pressure and the flow rate in the total system.

VSE supplies subplates for all flow meters of the "VS" product line; they have various pipe threads and side or rearside connection. Depending on the provided conditions, the installed pipe line, the pipe cross section or pipe thread, the operator can choose the suitable subplate and incorporate this into the system or machine without additional reductions.

The flow meter is screwed onto the block or subplate with four DIN 912 cheese head screws. The screws are to be evenly pre-tensed crosswise with the following torques.

When changing the fastening screws you must take great care that the screws are of property class 10.9 and 12.9.

Table 1: Torque of fastening screws

Flow meter, size (cast iron and 1.4305)	Torque
VS 0.02; VS 0.04; VS 0.1; VS 0.2	15 Nm
VS 0.4; VS 1; VS 2	35 Nm
VS 4	120 Nm
VS 10	250 Nm

Please note the special instructions for mounting sizes VS 4 and VS 10 (see appendix)

**Important:**

**When mounting the flow meter, you must take great care that the seals are not damaged and correctly placed in the hydraulic connections of the flow meter. Wrongly installed or damaged seals lead to leakage and to an leaky system, which may have dire consequences.**

**Please make sure that flow meters with EPDM seals do not come into contact with oil and greases on a mineral oil basis. These fluids can decompose the seals.**

**The yellow plastic plugs in the hydraulic connections of the flow meter protect the meter against dirt and contamination during storage and shipping. Before mounting the flow meter you have to remove these plugs so that in- and outflow is free and open.**



## CLEANING AND FLUSHING OF PIPE LINES BEFORE INITIAL START-UP

Before initial start-up of the flow meter, you must flush and clean the whole system. Contaminated fluids can affect the correct function of the flow meter or seriously damage the meter.

After preparing and connecting up the system pipes, you must first carefully flush and clean the whole pipe line system and the tank. To do this, you have to mount a diversion plate onto the block or subplate instead of the flow meter, so that the fluid can flow through the diversion plate and all extraneous material (e.g. swarf, metal chips, etc.) can be flushed out without obstruction. Use a fluid as cleansing agent, which is compatible with the fluid being used later and which does not cause undesirable reactions. You can consult the suppliers and manufacturers of the fluid or contact VSE for the corresponding information. VSE supplies bypass-plates the corresponding for all VS flow meter sizes.

Flow meters are measurement pick-up systems made with high-level precision. They have a mechanical meter consisting of two toothed wheels and which is adapted to the housing with narrow slots. Even the tiniest damage to the toothed wheels and bearings can cause a measurement error. So always make sure that no extraneous material gets into the meter and that the fluid flowing through is always free from dirt and contamination.

After the system has been carefully flushed out and no extraneous material is in the pipe line, you can mount the flow meter and commence the initial start-up.

**Important:**

**Please flush out the pipe lines and the tank thoroughly, to prevent contamination with the flow meter.**



## FILTERING OF LIQUID

Strongly contaminated fluid or extraneous material in the fluid can block, damage or even destroy the flow meter. Always install a sufficiently large filter for these cases in front of the flow meter to prevent damage. The necessary filtering depends on size, bearing system and version of flow meter.

**Table 2: Pre-switched filters**

Flow meter size	Filter size for ball bearings
VS 0.02 / 0.04 / 0.1	10 µm
VS 0.2 / 0.4	20 µm
VS 1 / 2 / 4 / 10	50 µm

*For information on filter size for flow meters with plain bearings, in special version, or with specially adjusted meter tolerances, please consult VSE Volumentchnik GmbH.*

**Important:**

**A blocking flow meter can stop the whole flow. You have to provide a control valve / bypass for the system.**



## PREAMPLIFIER

The preamplifier for the standard version is short-circuit-proof, reverse-polarity-proof and processes the signals of the scan sensors. A high level of interference protection is achieved through the push-pull output stages of the preamplifier. You can easily connect evaluation devices

with both PNP and NPN inputs to the outputs. The two-channel output of digital signals enables a higher measurement resolution and also a direction recognition of the flow.

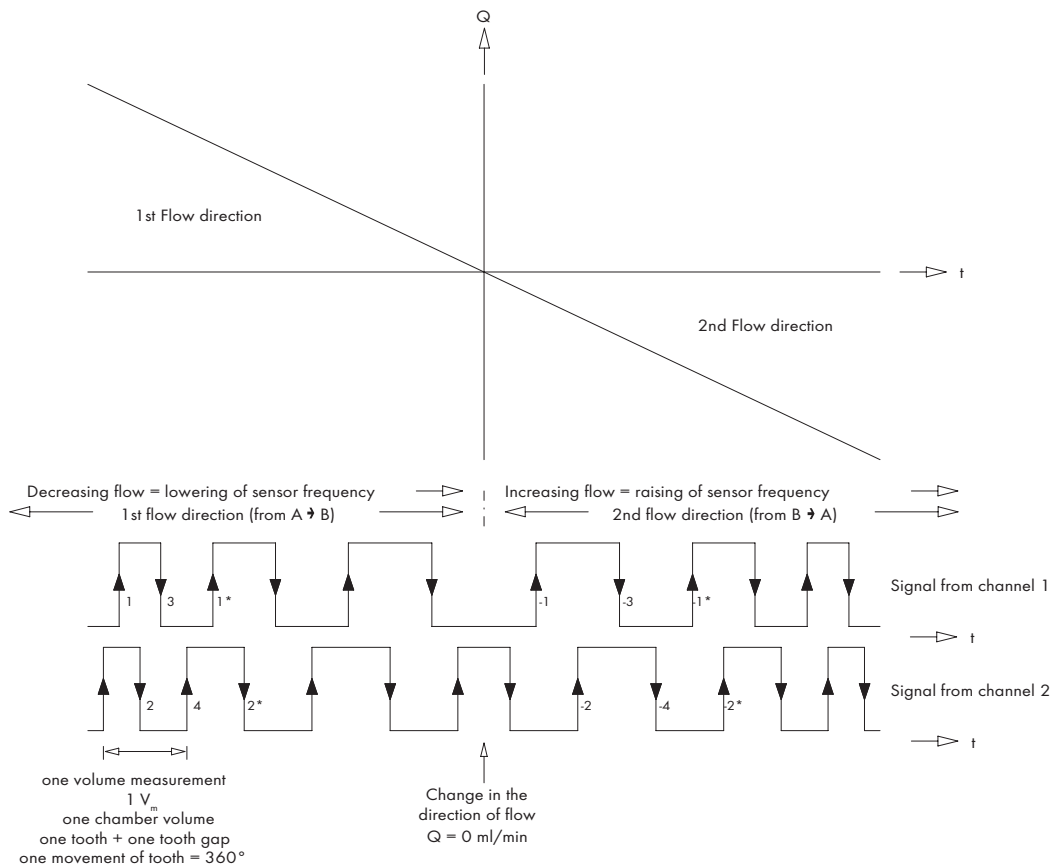


Fig. 2: Signal output of preamplifier

The power supply voltage range is  $U_b = 10 \dots 28 \text{ V DC}$ . You can operate the preamplifier with any voltage in this voltage range  $U_b$  but make sure that the signal voltage is always adjusted to the power supply

voltage. Permitted for the power supply is a steady direct voltage with a maximum residual ripple of  $\pm 15\%$ .

### Important:

**Please make sure that no extra inductive elements are connected in the power supply of the flow meter, such as contactors, relays, valves etc. These components are potential sources of interference, which generate high interference pulses when switched and can interfere with the functioning of the flow meter, although this complies with the electromagnetic compatibility directives (especially if the inductive elements are not provided with an adequate protective circuit).**



The no-load current reception of the preamplifier depends on each power supply voltage.

Power supply voltage $U_b = 12 \text{ V DC}$	$I_{0\text{max}12} = 25 \text{ mA}$
Power supply voltage $U_b = 24 \text{ V DC}$	$I_{0\text{max}24} = 40 \text{ mA}$
Max. current per channel	$I_{K\text{max}} = 20 \text{ mA}$

The electric connection of the flow meter is performed via the 4-pin round plug located on the preamplifier housing. The connection cable plug is plugged into the plug connection of the flow meter and screwed together.

(the current  $I_K$  is dependent on the input impedance of the evaluation electronics)

Total current reception (at 12 V DC)	$I_{0\text{tot.}} = 65 \text{ mA}$
$I_{0\text{tot.}} = I_{0\text{max}12} + (2 \times I_{K\text{max}})$	$P_{\text{max}} = 0.78 \text{ W}$

Total current reception (at 24 V DC)	$I_{0\text{tot.}} = 80 \text{ mA}$
$I_{0\text{tot.}} = I_{0\text{max}24} + (2 \times I_{K\text{max}})$	$P_{\text{max}} = 1.92 \text{ W}$



**Important:**

**Only use well-shielded cables for the connection cable, with a wire cross section of  $\geq 4 \times 0.25 \text{ mm}^2$ . Please make sure that the housing of the round plug is metallic, that it has a connection for the shielding and that the potential of the earth conductor PE is connected to the housing.**



The shielding of the connection cable could be placed on both sides. The earth conductor PE is then connected via the shielding from the evaluation electronics to the preamplifier housing and the meter. The cable shielding should always be laid continuously as far as the flow meter and not interrupted in cross connectors or branch sockets. Lay the connection cable as directly as possible from the evaluating device to the flow meter, since interruptions are always a potential source of error.

The flow meter must be connected electrically with the earth conductor PE. This is normally secured by the earthed pipe lines.

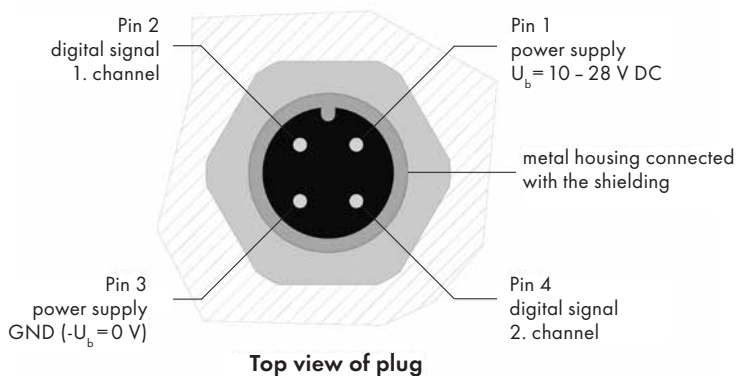


Fig. 3: M12 plug connector installed in the preamplifier housing of the flow meter

**Important:**

**If there are potential differences between the preamplifier housing and the earth conductor PE of the evaluating electronics, you have to lay a potential equalisation (see connection diagram).**



The maximum cable length between flow meter and the evaluation electronics is approx. 120 m. With extensive cable lengths (as of approx. 40 m) you must take care that the connecting cable is laid in an in-

terference-free environment, that the shielding is preferably connected on both sides of the earth conductor PE and that there is no potential difference between the two earth conductor connections.

## MAINTENANCE

**Working life is dependent on operating conditions and thus the specific properties of the devices, limited through wear, corrosion, deposits or age.**

**The operator is responsible for regular control, maintenance and recalibration. Any indication of a malfunction or damage prohibits any further use. On request, we can supply you with a borrowed device for the duration of repair or overhauling.**

**We advise to a yearly control and recalibration.**



## SENDING BACK OF REPAIRS AND SAMPLE DEVICES

It is imperative that you enclose an exact description of the complaint, objection or fault, when returning the device so as to ensure a rapid and economic repair of the flow meters and other components. Furthermore, you must include a security sheet, which informs unambiguously, which fluid was run with the flow meter and how dangerous this fluid is. The maintenance of legal regulations as regards work safety, such as workplace regulations, accident prevention regulations, stipulations on environmental protection, waste disposal and the water management law, obliges industrial corporations to protect their employees and other persons and environment against harmful effects, when handling

hazardous materials. If further safety precautions are still necessary despite careful emptying and cleaning of the flow meter, information on this is imperative and must be included with the returned despatch. When returning flow meters to VSE Volumentchnik GmbH, please note that inspection and repair will only be performed if the **safety specifications sheet** of the utilised medium is enclosed and the flow meters completely cleaned and flushed. This protects our employees and simplifies our work.

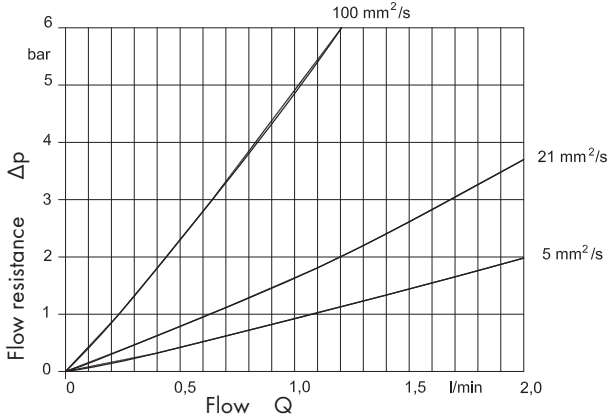
**If this is not followed, the despatch will be returned, chargeable to the recipient.**

## TECHNICAL SPECIFICATIONS VS 0.02 – VS 4

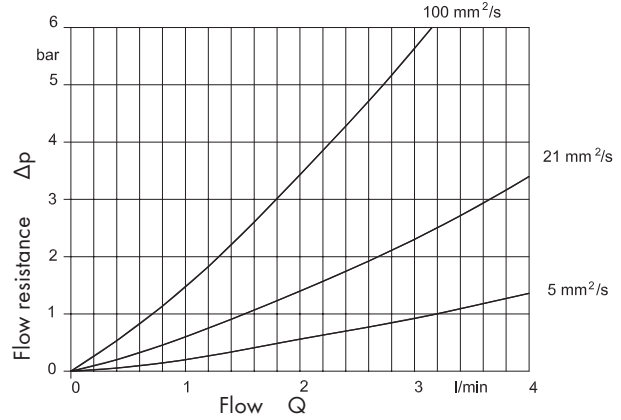
Size	Measuring range l/min	Frequency Hz	Pulse value cm <sup>3</sup> /pulse	K-factor pulse/litre
VS 0.02	0.002 ... 2	1.667 ... 1666.67	0.02	50 000
VS 0.04	0.004 ... 4	1.667 ... 1666.67	0.04	25 000
VS 0.1	0.01 ... 10	1.667 ... 1666.67	0.1	10 000
VS 0.2	0.02 ... 18	1.667 ... 1500.00	0.2	5 000
VS 0.4	0.03 ... 40	1.250 ... 1666.67	0.4	2 500
VS 1	0.05 ... 80	0.833 ... 1333.33	1	1 000
VS 2	0.1 ... 120	0.833 ... 1000.00	2	500
VS 4	1.0 ... 250	4,167 ... 1041.67	4	250

<b>Measurement accuracy</b>	up to 0.3% of measurement value (with viscosity > 20 mm <sup>2</sup> /s)
<b>Repetition accuracy</b>	± 0.05% under the same operating conditions
<b>Material</b>	Cast iron EN-GJS-400-15 (EN 1563) or Stainless steel 1.4305
<b>Meter bearing</b>	Ball bearings or steel plain bearings (medium-dependent)
<b>Seals</b>	FPM (standard), NBR, PTFE or EPDM
<b>Max. operating pressure</b>	Cast iron EN-GJS-400-15 (EN 1563) 315 bar/4500 psi Stainless steel 1.4305 450 bar/6500 psi
<b>Medium temperature</b>	-40 ... + 120°C (-40°F ... 248°F)
<b>Ambient temperature</b>	-20 ... + 50°C (-4°F ... 122°F)
<b>Viscosity range</b>	1 ... 100 000 mm <sup>2</sup> /s
<b>Installation position</b>	any
<b>Flow direction</b>	any
<b>Running noise</b>	max. 72 db(A)
<b>Power supply version</b>	10 to 28 volts/DC
<b>Pulse output</b>	2 x push-pull output stages reverse-polarity-proof, short-circuit-proof low signal: 0 = GND; high signal: 1 = U <sub>b</sub> -1 I <sub>max</sub> = 80 mA (at 24 V) P <sub>max</sub> = 1.92 W (at 24 V)
<b>Channel offset</b>	90° ± 30° max.
<b>Pulse-width repetition rate</b>	1/1 ± 15° max.
<b>Preamplifier housing</b>	Aluminium
<b>Protection type</b>	IP 65

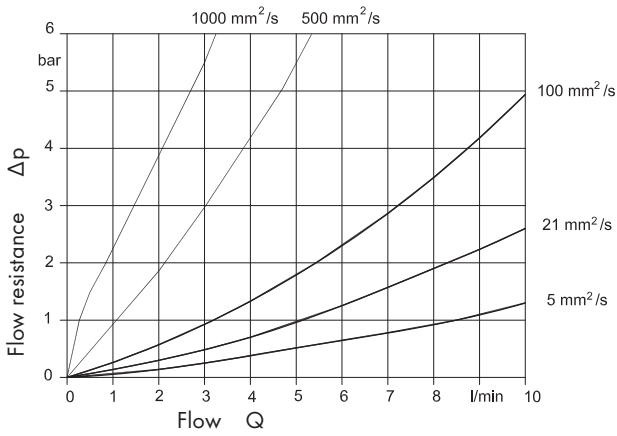
**VS 0.02**



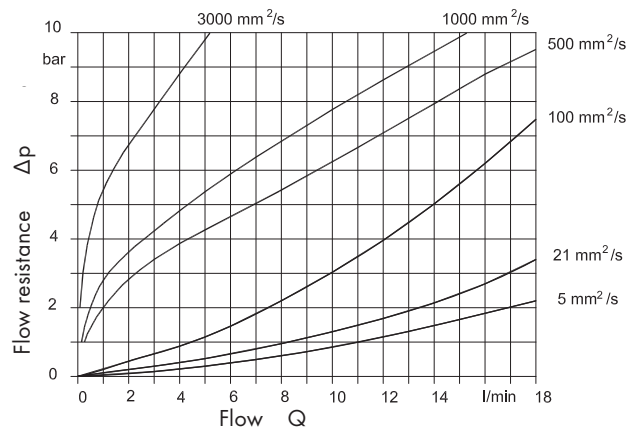
**VS 0.04**



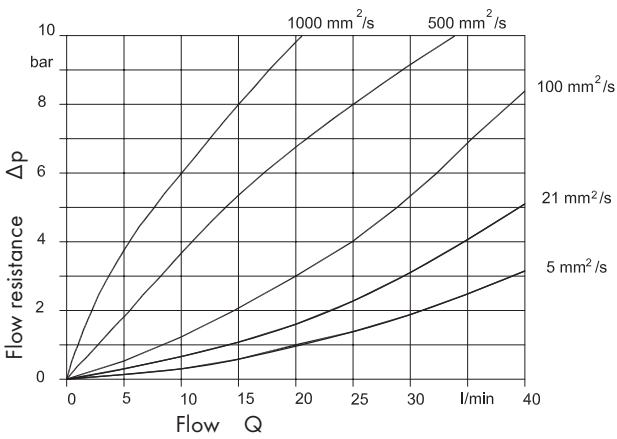
**VS 0.1**



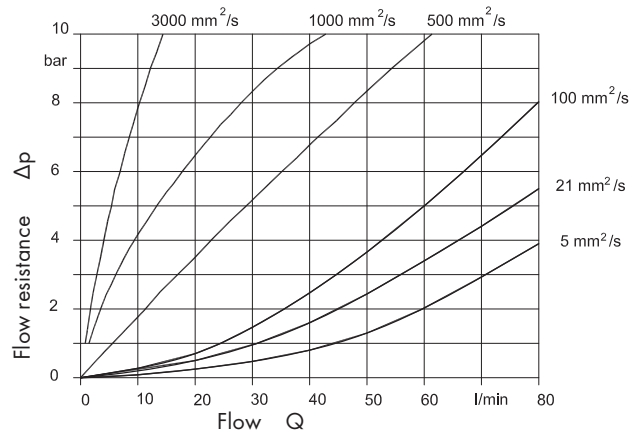
**VS 0.2**



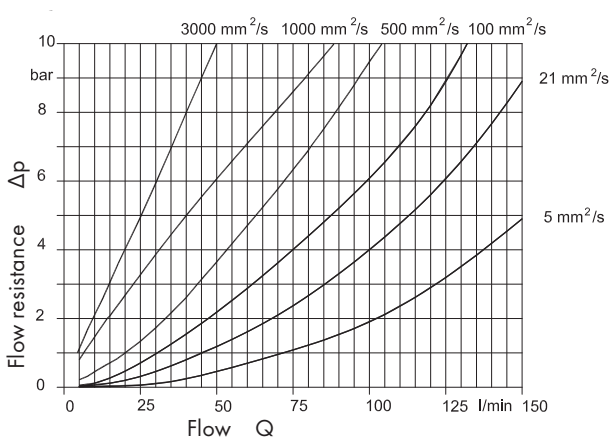
**VS 0.4**



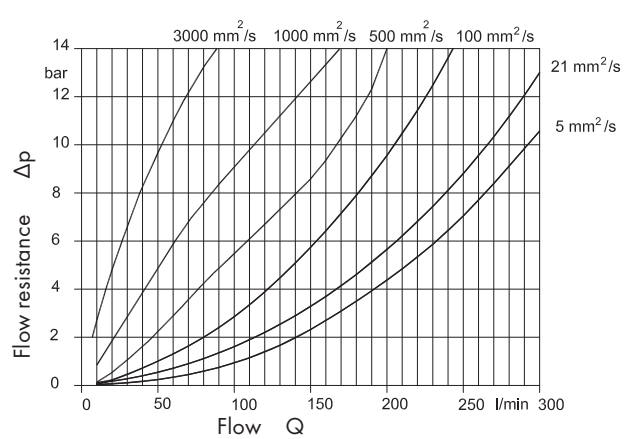
**VS 1**



**VS 2**

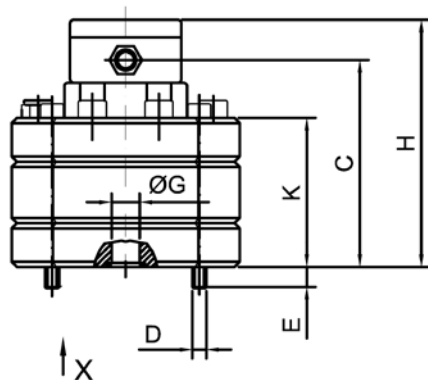


**VS 4**



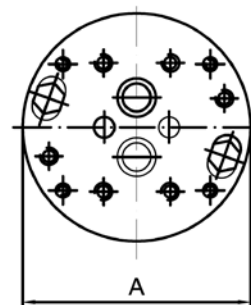
## DIMENSIONS VS 0.02 – VS 4

Cast iron version

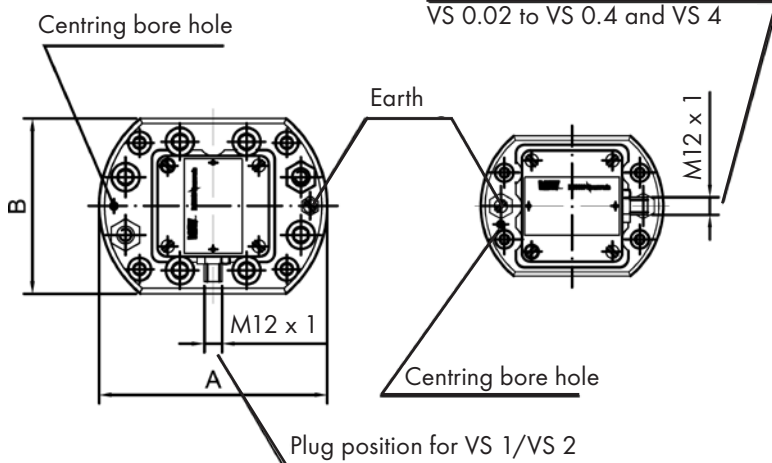


Stainless steel version  
Connection diagram  
Housing without milled edge

View X

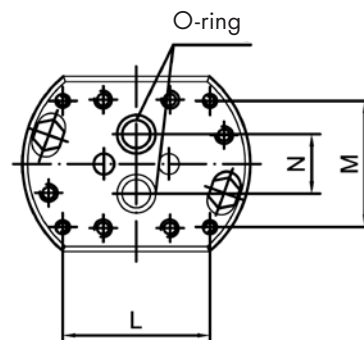


Plug position for  
VS 0.02 to VS 0.4 and VS 4



Cast iron version  
Connection diagram

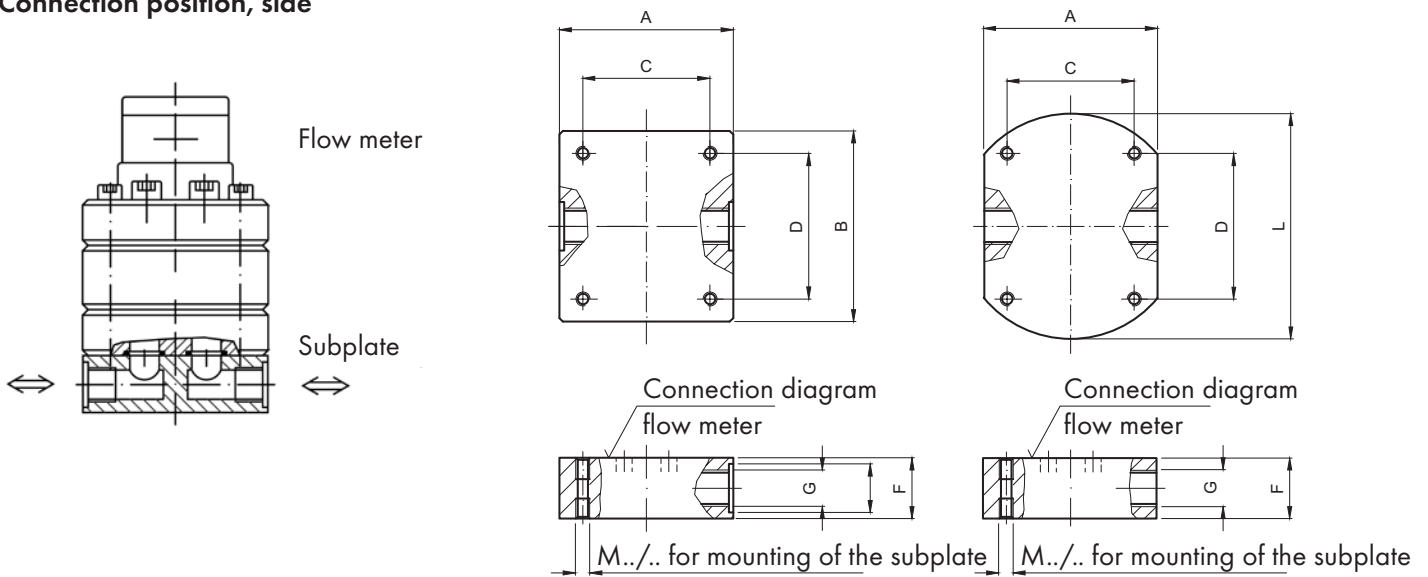
View X



size	A	B	C	D	E	øG	H	K	L	M	N	O-ring	Weight		
													GCI kg	SS kg	
<b>VS</b>															
0.02	100	80	91	M6	12.0	9	114	58	70	40	20	11 x 2	2.8	3.4	
0.04	100	80	92	M6	11.5	9	115	59	70	40	20	11 x 2	2.8	3.4	
0.1	100	80	94	M6	9	9	117	61	70	40	20	11 x 2	2.8	3.4	
0.2	100	80	94	M6	9.5	9	117	61	70	40	20	11 x 2	3.0	3.7	
0.4	115	90	96.5	M8	11.5	16	120	63.5	80	38	34	17.96 x 2.62	4.0	5.0	
1	130	100	101	M8	12.5	16	124	68	84	72	34	17.96 x 2.62	5.3	6.8	
2	130	100	118	M8	15	16	141	85	84	72	34	17.96 x 2.62	6.7	8.4	
4	180	140	143	M12	20	30	166	110	46	95	45	36.17 x 2.62	14.7	18.4	

Dimensions in mm

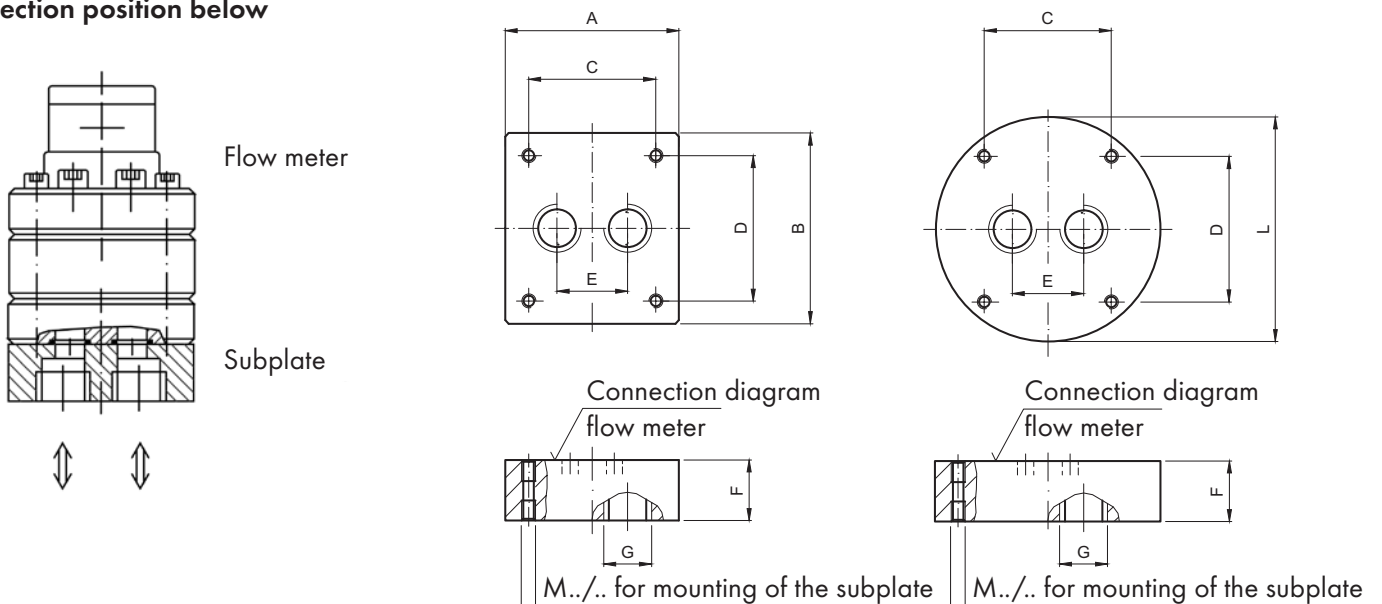
**Connection position, side**



Size	Connection thread	F	øH	A	B	C	D	E	L	Thread/depth	Weight
<b>VS</b>	<b>G</b>									<b>M</b>	<b>kg</b>
0.02	G 1/4"	35	20	80	90	40	70	26	100	M6/12	1.8
0.04	G 3/8"		23					30			
0.1	G 1/2"		28					38			
0.2											
0.4	G 1/2"	35	28	90	100	38	80	46	115	M8/15	2.7
	G 3/4"	40	33					52			
1	G 1/2"	35	28	100	110	72	84	46	130	M8/15	3.6
2	G 3/4"	40	33					52			
	G 1"	55	41					55			
4	G 1 1/4"	70	51	120	130	100	110	60	M8/15	7.4	
	*G 1 1/2"	70	56	140			120	72			
	G 1 1/2"	80					110	180		12.0	

only for AP. 4 U...

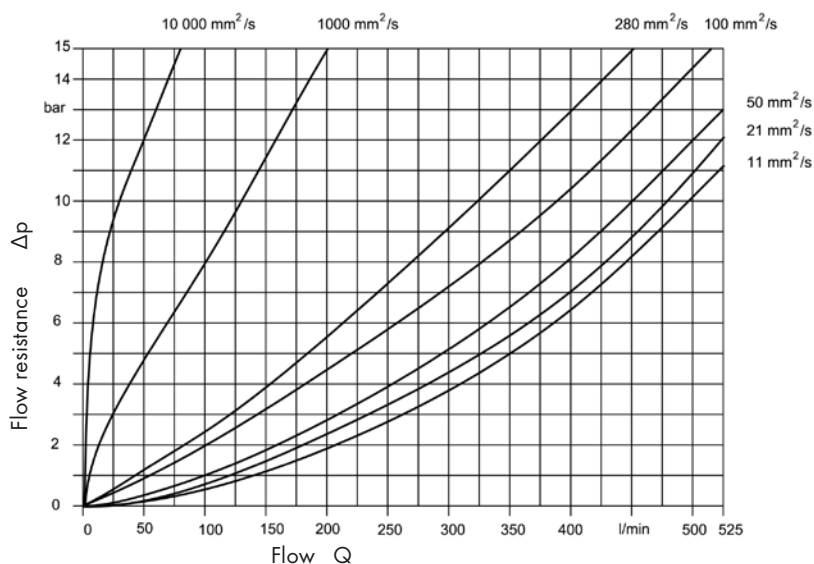
**Connection position below**

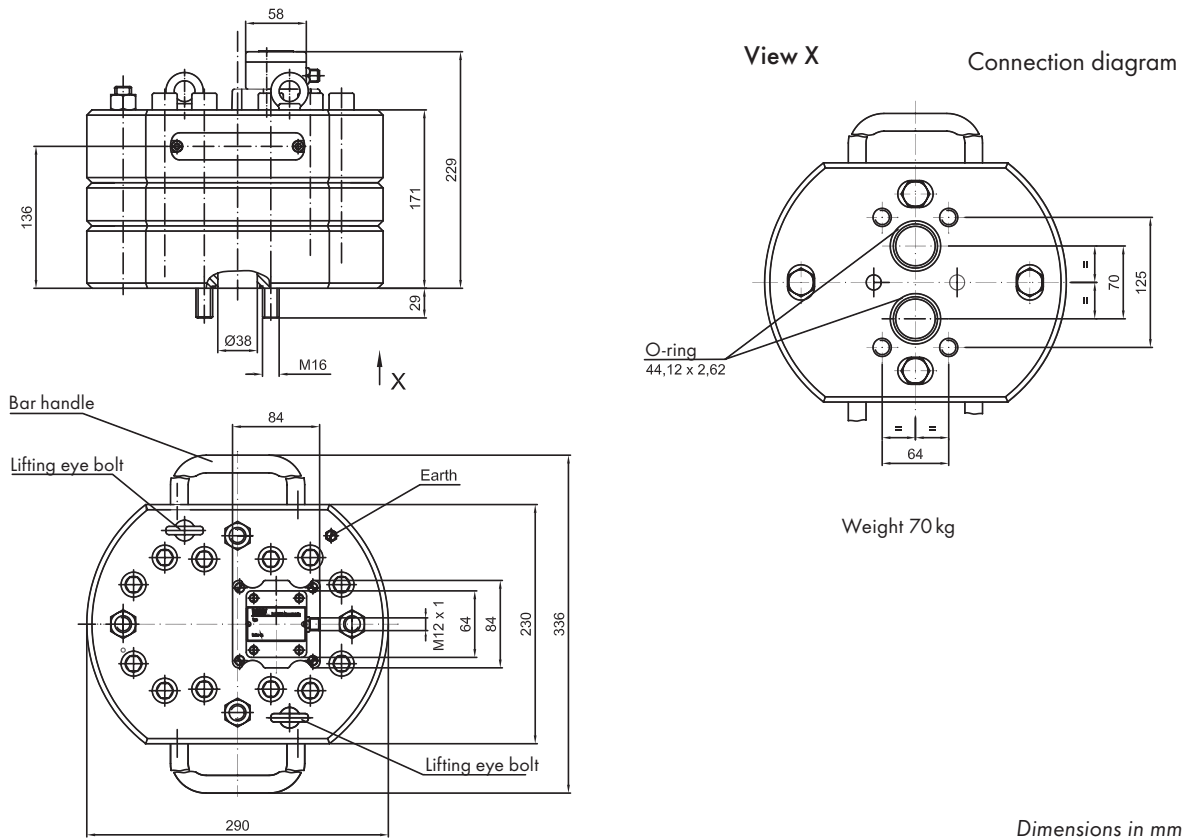


## TECHNICAL SPECIFICATIONS VS 10

Size	Measuring range l/min	Frequency Hz	Pulse value cm <sup>3</sup> /pulse	K-factor pulse/litre
VS 10	1.5 ... 525	7.50 ... 2625.00	3.333	300
<b>Measurement accuracy</b>	up to 0.3% of measurement value (with viscosity > 20 mm <sup>2</sup> /s)			
<b>Repetition accuracy</b>	± 0.05% under the same operating conditions			
<b>Material</b>	Cast iron EN-GJS-600-3 (EN 1563)			
<b>Meter bearing</b>	Ball bearings or steel plain bearings (medium-dependent)			
<b>Weight</b>	70 kg without subplate			
<b>Seals</b>	FPM (standard), NBR, PTFE or EPDM			
<b>Max. operating pressure</b>	420 bar/6000 psi			
<b>Medium temperature</b>	-40 ... 120°C (-40°F ... 248°F)			
<b>Ambient temperature</b>	-20 ... + 50°C (-4°F ... 122°F)			
<b>Viscosity range</b>	5 ... 100 000 mm <sup>2</sup> /s			
<b>Installation position</b>	any			
<b>Flow direction</b>	any			
<b>Running noise</b>	> 80 db(A)			
<b>Power supply version</b>	10 to 28 volts/DC			
<b>Frequency range</b>	0 ... 2625 Hz			
<b>Pulse output</b>	2 x push-pull output stages reverse-polarity-proof, short-circuit-proof low signal: 0 = GND; high signal: 1 = U <sub>b</sub> -1 I <sub>max</sub> = 80 mA (at 24 V) P <sub>max</sub> = 1.92 W (at 24 V)			
<b>Channel offset</b>	90° ± 30° max.			
<b>Pulse-width repetition rate</b>	1/1 ± 15° max.			
<b>Preamplifier housing</b>	Aluminium			
<b>Protection type</b>	IP 65			

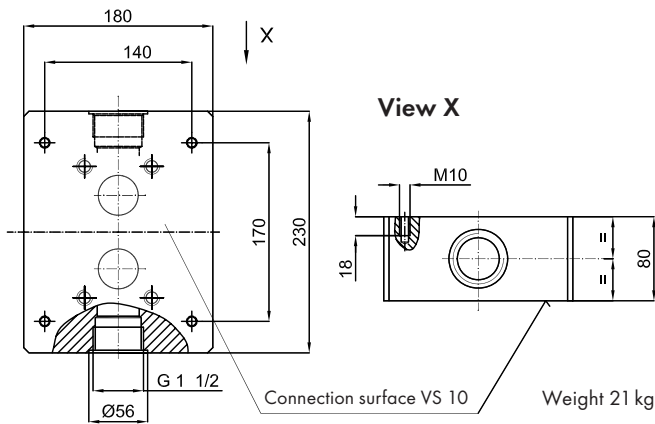
## FLOW RESPONSE CURVES VS 10



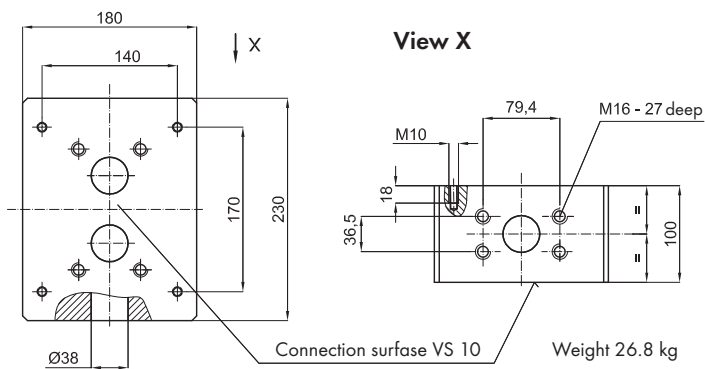


**DIMENSIONS, SUBPLATE APG 10.**

APG 10 SG0N / 1



APG 10 SW0N / 1



Dimensions in mm

**TYPE KEY**

**Flow meters VS**

Example:

	<b>H</b>	<b>T</b>	Pick-up system for high temperature ranges (...210 °C) signal output PNP or NPN			
<b>-</b>	<b>H</b>	<b>T</b>			<b>/</b>	<b>X</b>

<b>VS 1</b>	<b>G</b>	<b>P</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>V</b>	<b>-</b>	<b>3</b>	<b>2</b>	<b>N</b>	<b>1</b>	<b>1</b>	<b>/</b>	<b>X</b>		
Size	Material	Type of connection	Gear coating	Instruments bearing	Instrument tolerance	Type of seal	Pick-up system	Quantity of pick-up	Signal output	Pre-amplifier	Connection	Series		No. factory preset		
															<b>1</b>	VSE 4 pole plug connection (Standard design)
															<b>0</b>	Non pre-amplifier
															<b>1</b>	Integrated
															<b>2</b>	External
															<b>N</b>	Supply voltage 10 ... 28 V DC (Standard)
															<b>Q</b>	Supply voltage 5 ... 10 V DC (Ex-design)
															<b>1</b>	1 pick-up
															<b>2</b>	2 pick-up
															<b>3</b>	GMR- Sensor
															<b>V</b>	FPM (Viton) Standard
															<b>P</b>	NBR (Perbunan)
															<b>T</b>	PTFE
															<b>E</b>	EPDM
															<b>B</b>	EPDM-41B8
<b>S</b>	Silicone															
<b>1</b>	Reduced tolerance															
<b>2</b>	Normal tolerance (Standard)															
<b>3</b>	Increased tolerance															
<b>4</b>	Tolerance steel plain bearing															
<b>1</b>	Ball bearing															
<b>2</b>	Spindle bearing															
<b>3</b>	Bronze plain bearing															
<b>4</b>	Carbon plain bearing															
<b>5</b>	Steel plain bearing															
<b>O</b>	No coating (Standard)															
<b>C</b>	Dynamat coating (C-surface coating)															
<b>T</b>	Titanium coating															
<b>P</b>	Plate construction															
<b>R</b>	Pipeline connections															
<b>G</b>	EN-GJS-400-15 (VS10 = EN-GJS-600-3) DIN EN 1563															
<b>F</b>	Stainless steel 1.4305 (V2A)															
<b>H</b>	EN-GJS-600-3 (High pressure) DIN EN 1563															
<b>VS 0.02</b>																
<b>VS 0.04</b>																
<b>VS 0.1</b>																
<b>VS 0.2</b>																
<b>VS 0.4</b>																
<b>VS 1</b>																
<b>VS 2</b>																
<b>VS 4</b>																
<b>VS 10</b>																

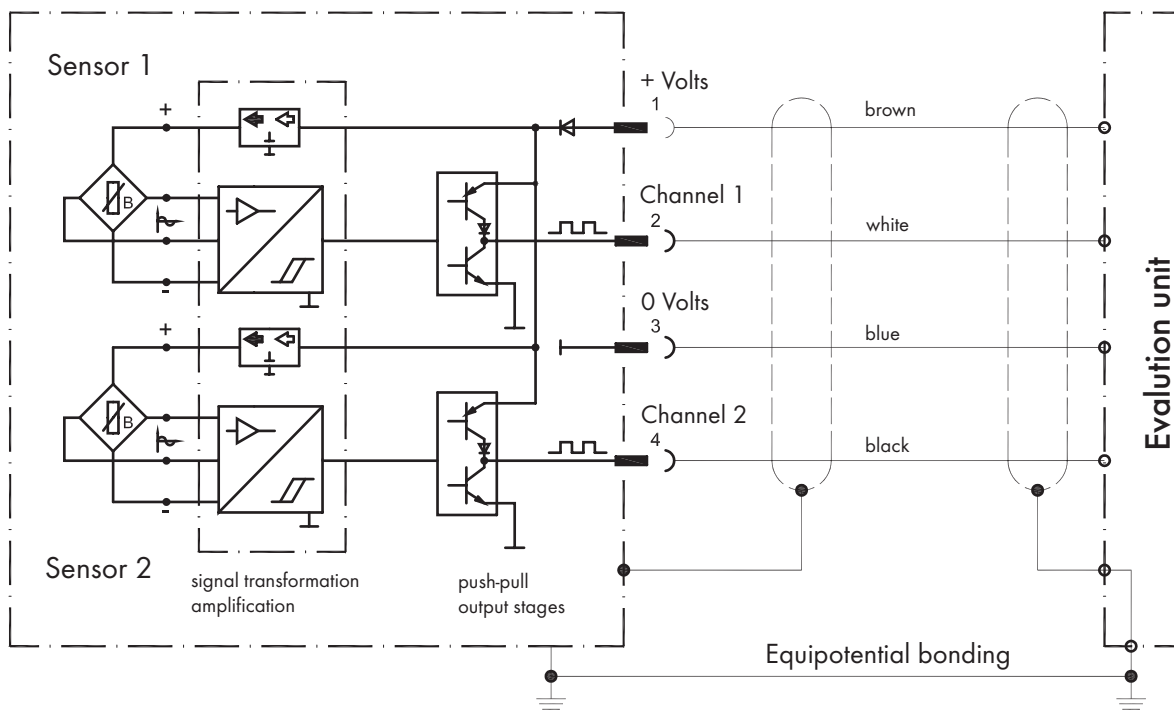


## Subplates AP...

Example:

A	P	G	1	-	S	C	0	N	/	X			
		Material	Size								Product line		
							Connection thread	Accessory connection	Version		Modification Id. No.		
								N	Standard version				
								S	Special version				
							0	Without rinse connection					
							A	G 1/4					
							B	G 3/8					
							C	G 1/2					
							D	G 3/4					
							E	G 1					
							F	G 1 1/4					
							G	G 1 1/2					
							J	1/4 NPT					
							K	3/8 NPT					
							L	1/2 NPT					
							M	3/4 NPT					
							N	1 NPT					
							O	1 1/4 NPT					
							P	1 1/2 NPT					
							S	SAE 1/2					
							T	SAE 3/4					
							U	SAE 1					
							V	SAE 1 1/4					
							W	SAE 1 1/2					
							X	SAE 2					
							S	Side connection					
							U	Bottom connection					
			0,2	VS 0,02 to VS 0,2 / VSI 0,02 to VSI 0,2									
			0,4	VS 0,4 / VSI 0,4									
			1	VS 1 / VS 2 / VSI 1 / VSI 2									
			4	VS 4 / VSI 4									
			10	VS 10 / VSI 10									
Subplate	G	EN-GJL-250, EN-GJS-400-15 DIN EN 1561/ 1563											
	E	Stainless steel 1.4305											
	H	EN-GJS-600-3 DIN EN 1563 (high pressure)											

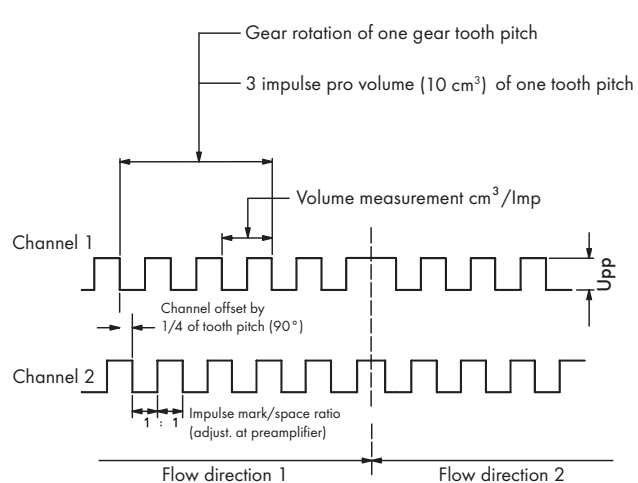
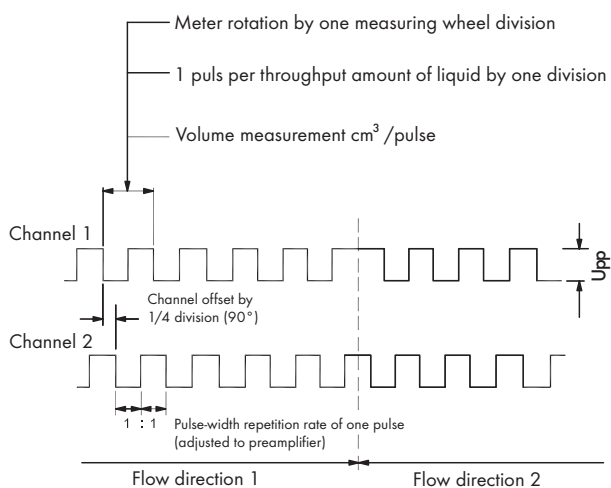
# PREAMPLIFIER-BLOCK WIRING DIAGRAM



## OUTPUT SIGNALS ON PREAMPLIFIER

Flow meter VS 0.02 ... VS 4

Flow meter VS 10

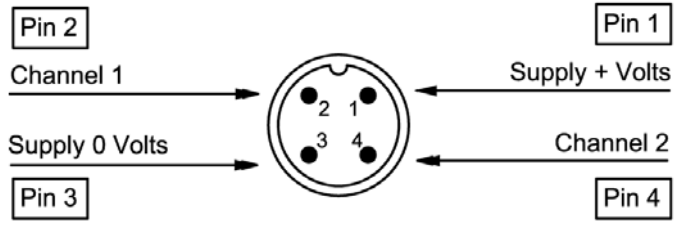
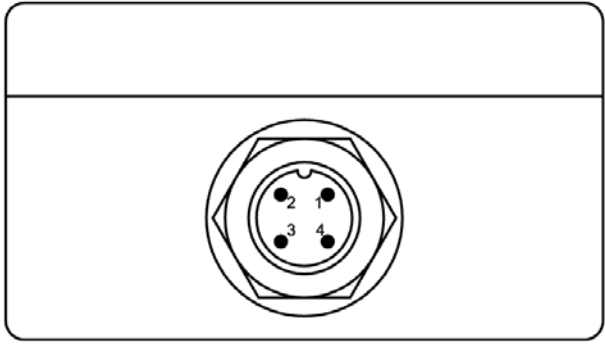


### Voltage ranges

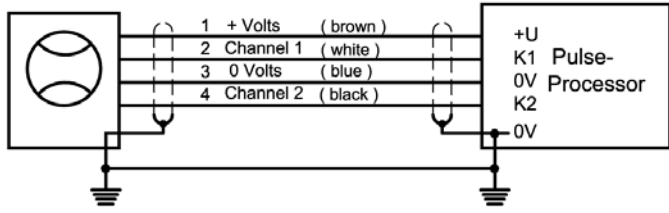
Power supply voltage:  $U_V = 10 \dots 28 \text{ V DC}$

Signal voltage:  $U_{ss} = U_V - 1 \text{ V}$

**PLUG ASSIGNMENT**



**CONNECTION DIAGRAM**



Modification of flow direction indication (+ to - / - to +) by interchanging channels (channel 1, channel 2)

**PICK-UP SYSTEM FOR HIGH TEMPERATURES HT**

For medium temperatures >120°C, the high temperature (HT) versions by VSE have to be deployed. Flow meters of stainless steel are used exclusively in this case.

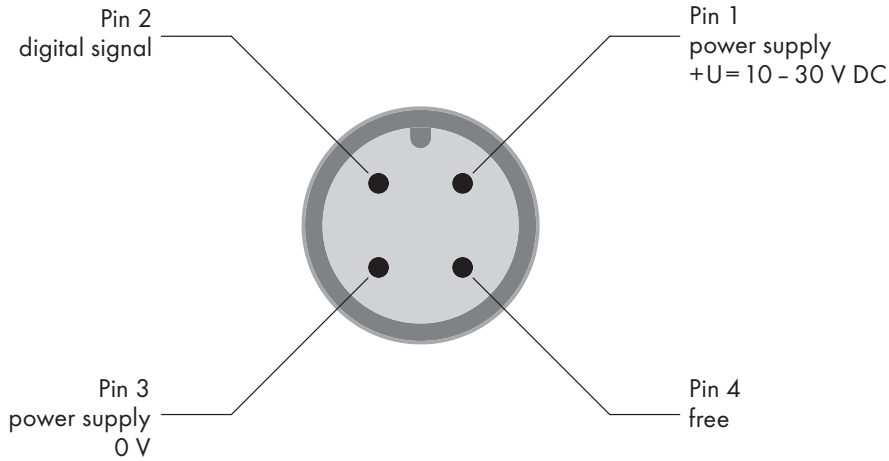
The sensor or pick-up system consists of a sensor unit, which is screwed into the cover of the flow meter and a downstream amplifier. The amplifier is connected with the flow meter via a temperature-stable cable

and has to be installed outside the high temperature zone. The ambient temperature should be no more than 50°C in this area.

The digital signals are emitted as PNP- or NPN-signals, depending on amplifier version.

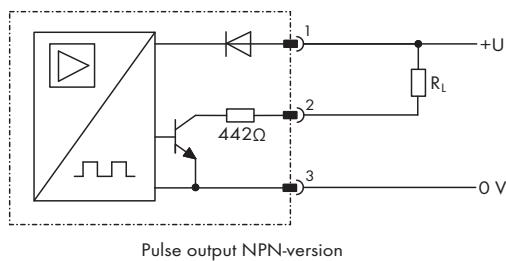
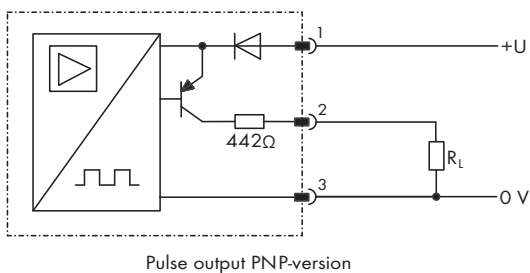
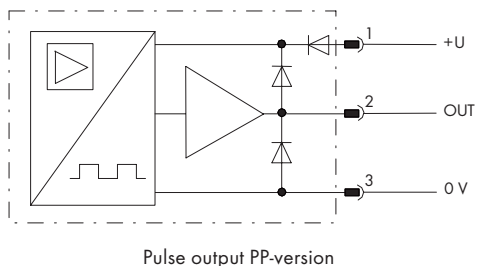
With extensive cable lengths, we recommend using shielded cables and a pull-down (PNP signal) or pull-up impedance (NPN signal).

**Plug assignment HT**



**Top view of plug**

Connection diagrams HT



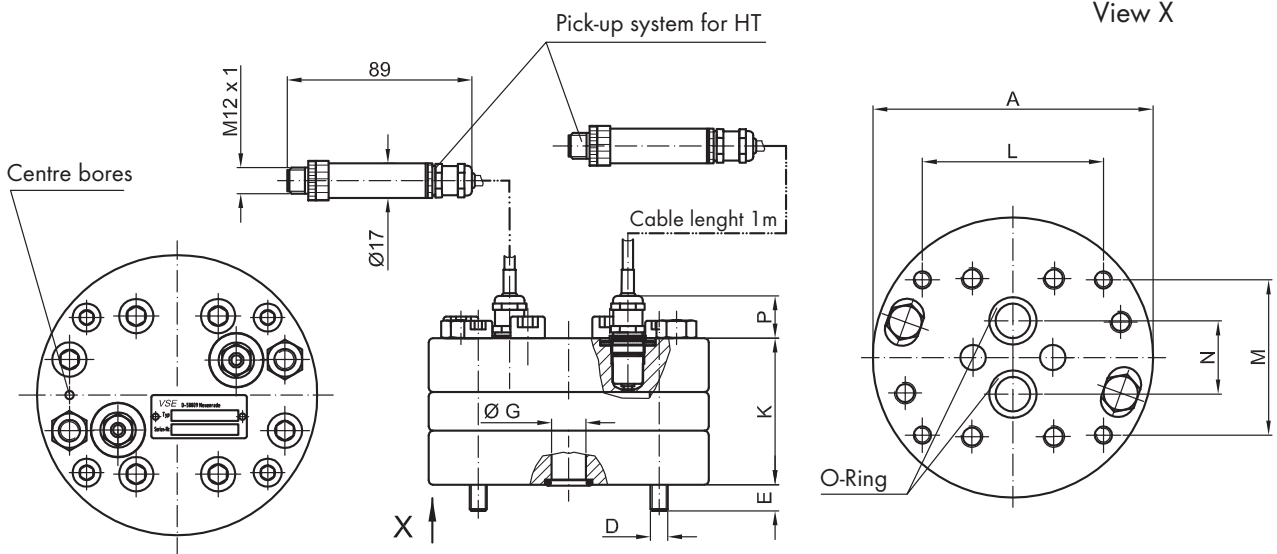
Technical specifications HT

Sensor Unit

Medium temperature	-40°C ... 210°C
Number of pick-ups	1 or 2 pick ups
Pick-up	magneto-resistive
Electrical connection	cable gland
Seals	FPM or EPDM

Amplifier pick-up system for high temperature range HTS

Supply voltage	$U_b = 10 \dots 30 \text{ V}$ DC +/- 10%
Current consumption	$I_b = \text{ca. } 18 \text{ mA}$ (idle motion, without lead)
Signal output PP (Push-Pull)	High Sign.: $U_s = U_b - 1,5 \text{ V}$ ; Low Sign.: $U_s = 0 \text{ V}$ ; $I_s = 100 \text{ mA max}$
Signal output PNP	High Sign.: $U_s = U_b - 1 \text{ V}$ ; $I_s = 25 \text{ mA max}$
Signal output NPN	Low Sign.: $U_s = 0 \text{ V}$ ; $I_s = 25 \text{ mA max}$
Electrical connection	4 pin round plug M12
Max. ambient temperature	-20°C ... 50°C
Protection - class	IP 64

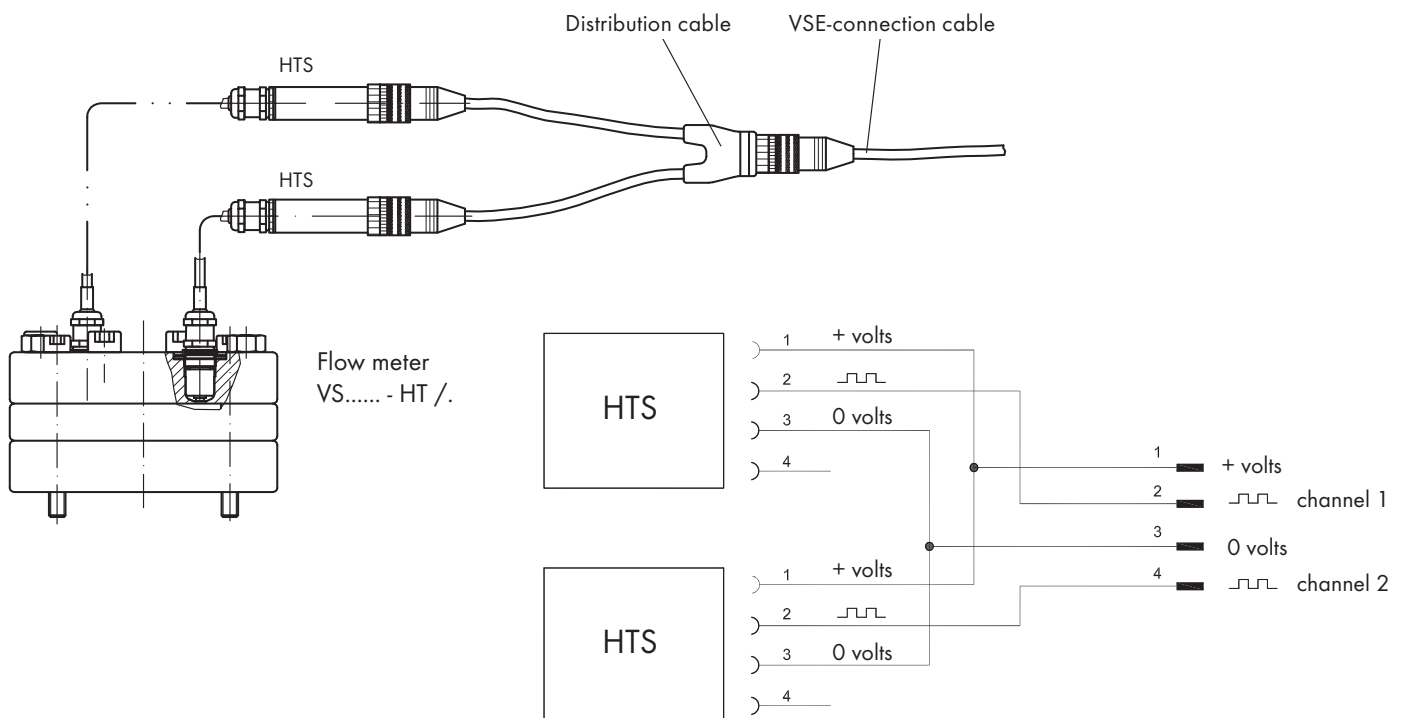


size	A	D	E	ØG	K	L	M	N	P	O-ring	Weight
VS 0.04*	100	M6	11.5	Ø 9	59	70	40	20	22	11 x 2	3.3
VS 0.1	100	M6	9	Ø 9	61	70	40	20	22	11 x 2	3.3
VS 0.2	100	M6	9.5	Ø 9	61	70	40	20	22	11 x 2	3.6
VS 0.4	115	M8	11.5	Ø 16	63.5	80	38	34	22	18 x 2.62	4.9
VS 1	130	M8	12.5	Ø 16	68	84	72	34	22	18 x 2.62	6.7
VS 2	130	M8	15	Ø 16	85	84	72	34	22	18 x 2.62	8.3
VS 4	180	M12	20	Ø 30	110	46	95	45	12	36.17 x 2.62	18.3

\*only available as single-channel version

Accessories HT

Distribution cable for connection of two HT-pick-ups on a VSE-connecting cable.







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