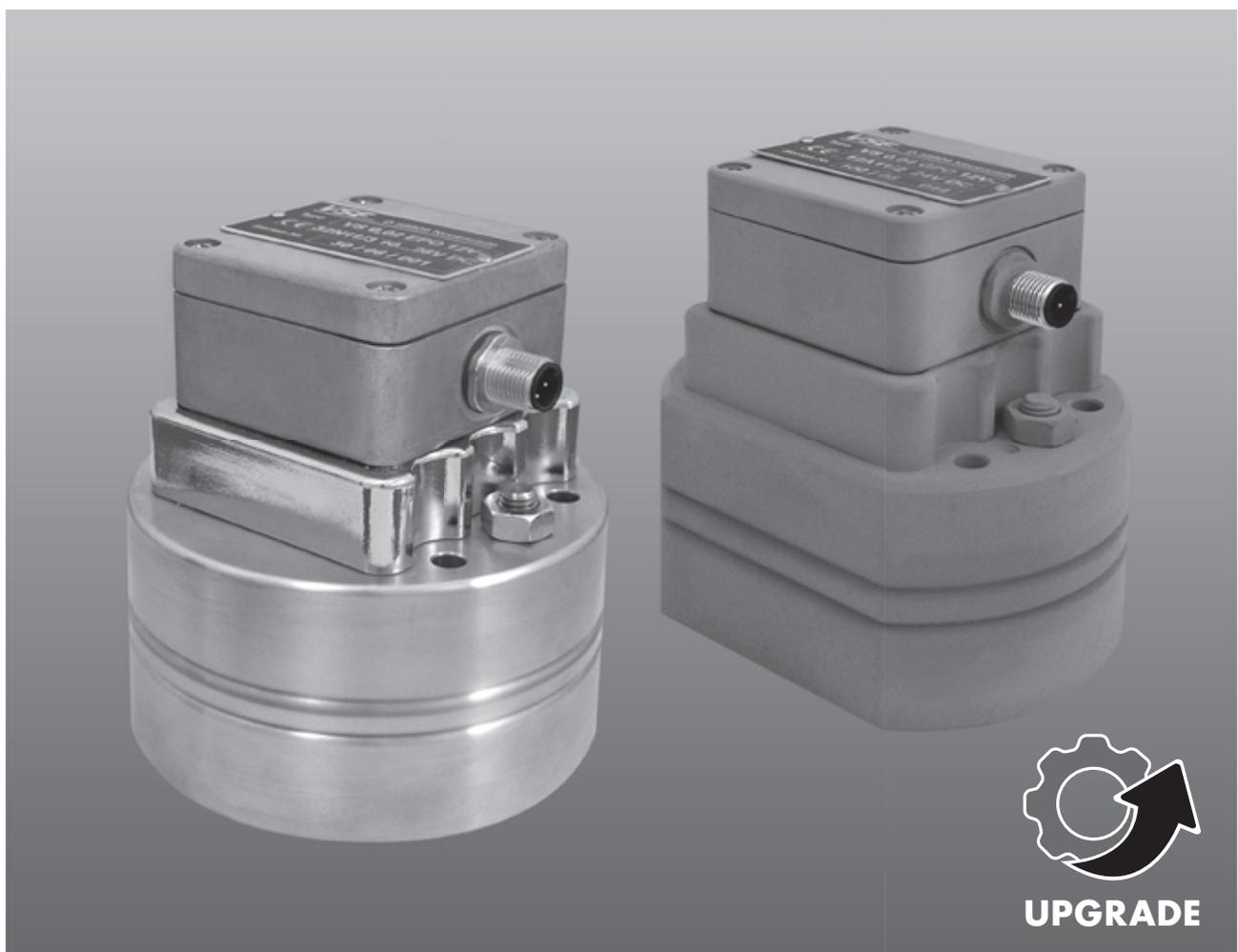


Solutions for Fluid Technology



OPERATING MANUAL

for flow meters of the product line "VSI High Definition Flow Meter"

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Last revised: 02/2022



1. IMPORTANT INFORMATION AND LEGAL NOTICES

Dear customer, dear user,

This operating instruction for volume sensors of the “**VSI High Definition Flow Meter**” series by VSE Volumen-technik 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. 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.

2. 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. In flow meters of high resolution (VSI), each tooth is output as a multiple of digital pulses, depending on interpolation setting.

The gaps within 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 within one meter rotation of a tooth division is divided by the set interpolation factor. This gives the volume measurement per pulse (V_m) and is defined in cm^3/pulse . It identifies the constructional size of a flow meter (e.g. VSI 1/16).

3. GENERAL DISCRPTION

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

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

4. 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..

5. DECLARATION OF CONFORMITY

Flow meters of the "VSI" product line are tested for their electromagnetic compatibility and interference transmission in terms of the law on electromagnetic 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 on cable layout, correct connection of protective shielding 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 assured.

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.

6. 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 medium**?
- 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**?
- Are the fluid and the cleaning agent compatible with the **seals**?

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 Δp** (on flow meter) below the max. permitted fall of pressure?
- Does an excessively **great fall in pressure Δp** 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 shield?
- Is there a **connection** of the cable protective shielding via the round plug to the housing of the flow meter?
- Is the flow meter connected firmly to the **earth conductor PE** or is the cable protective shield connected to ground GND?
- Is the cable laid interference-free and is 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?
- Is there a **potential difference** between the earth conductor 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?
- 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!

7. 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 $p_{\max} = 700 \text{ bar}/10100 \text{ psi}$

Important:

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



8. 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.

9. 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 mm²/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 mm²/s) measurement accuracy deteriorates, while for fluids of higher viscosity (> 21 mm²/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.



10. 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. Take care, when installing the flow meter that liquid always 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, since this clamps the flow meter firmly in the liquid column (the meter supports itself through this on the liquid column) and the pipe line cannot run empty. 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.

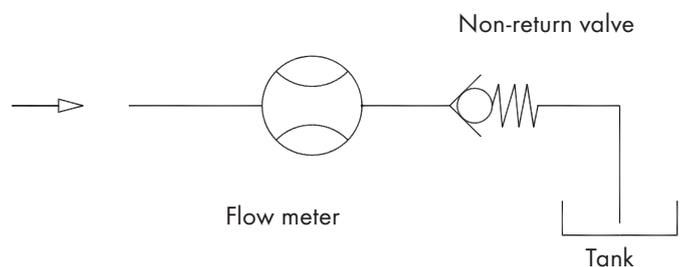


Fig. 1: Flow meter installation with non-return valve

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 “VSI” 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 “VSI” 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 sub-plate 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 pretensed 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 |
|---|--------|
| VSI 0.02; VSI 0.04; VSI 0.1; VSI 0.2 | 15 Nm |
| VSI 0.4; VSI 1; VSI 2 | 35 Nm |
| VSI 4 | 120 Nm |
| VSI 10 | 250 Nm |

Please note the special instructions for mounting sizes VSI 4 and VSI 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 a 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.



11. 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 fluid can effect 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 un-desirable reactions. You can consult the suppliers and manufacturers of the fluid or contact VSE for the corresponding information.

VSE supplies bypass plates for all VSI-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, 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 within the flow meter.



12. FILTERING OF LIQUID

Strongly contaminated fluids 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 to the flow meter. The necessary filtering depends on size, bearing system and model of flow meter.

Table 2: Pre-switched Filter

| Flow meter size | Filter meter size for ball bearings |
|-----------------------|-------------------------------------|
| VSI 0.02 / 0.04 / 0.1 | 10 µm |
| VSI 0.2 / 0.4 | 20 µm |
| VSI 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.



13. FLOW METERS WITH HIGH DEFINITION OF VOLUME MEASUREMENT

The preamplifiers of the standard version for flow meters of the "VS" product line output a pulse per tooth gap volume V_z , which corresponds to the volume measurement V_m ($V_m = V_z/\text{pulse}$). This takes place in two channels, so that you can attain a maximum resolution of $1/4 V_z$ for the evaluation of all flanks. A higher resolution is not possible with these preamplifiers.

But since as high a resolution as possible is necessary for precise and exact flow and volume measurements, the volume measurement V_m must be resolved even more than with conventional preamplifiers. VSE has therefore developed the preamplifier with interpolation, with which a selectable resolution of up to 64 flanks (16 pulses) per period can be attained (see table 3). This means that you can resolve the volume measurement V_m with this preamplifier to a maximum of $1/64 V_m$. For the evaluation, this means that a part volume of $1/64 V_m$ from pulse flank to pulse flank (for quadruple evaluation or flank count) is measured, or a full signal pulse is counted as part volume of $1/16 V_m$ (pulse count) (see fig. 3, interpolation $V_m/16$).

This individually programmed high resolution enables you to set the volume measurement V_m optimally for each provided case of application. Furthermore, new applications can be availed of with the higher resolution potential:

- Measuring, controlling and regulating in the lower flow range
- Measuring controlling and regulating in zero flow
- Measuring, controlling and regulating in both flow directions
- Measuring, controlling, dosing and filling of small volume

Flow meters with interpolation electronics (VSI) output two digital signals with programmable high resolution that are phase-offset 90° (see fig. 3). In addition to the signal emission, a zero signal emission is provided, which emits a zero signal at each fully registered volume measurement V_m (see fig. 2).

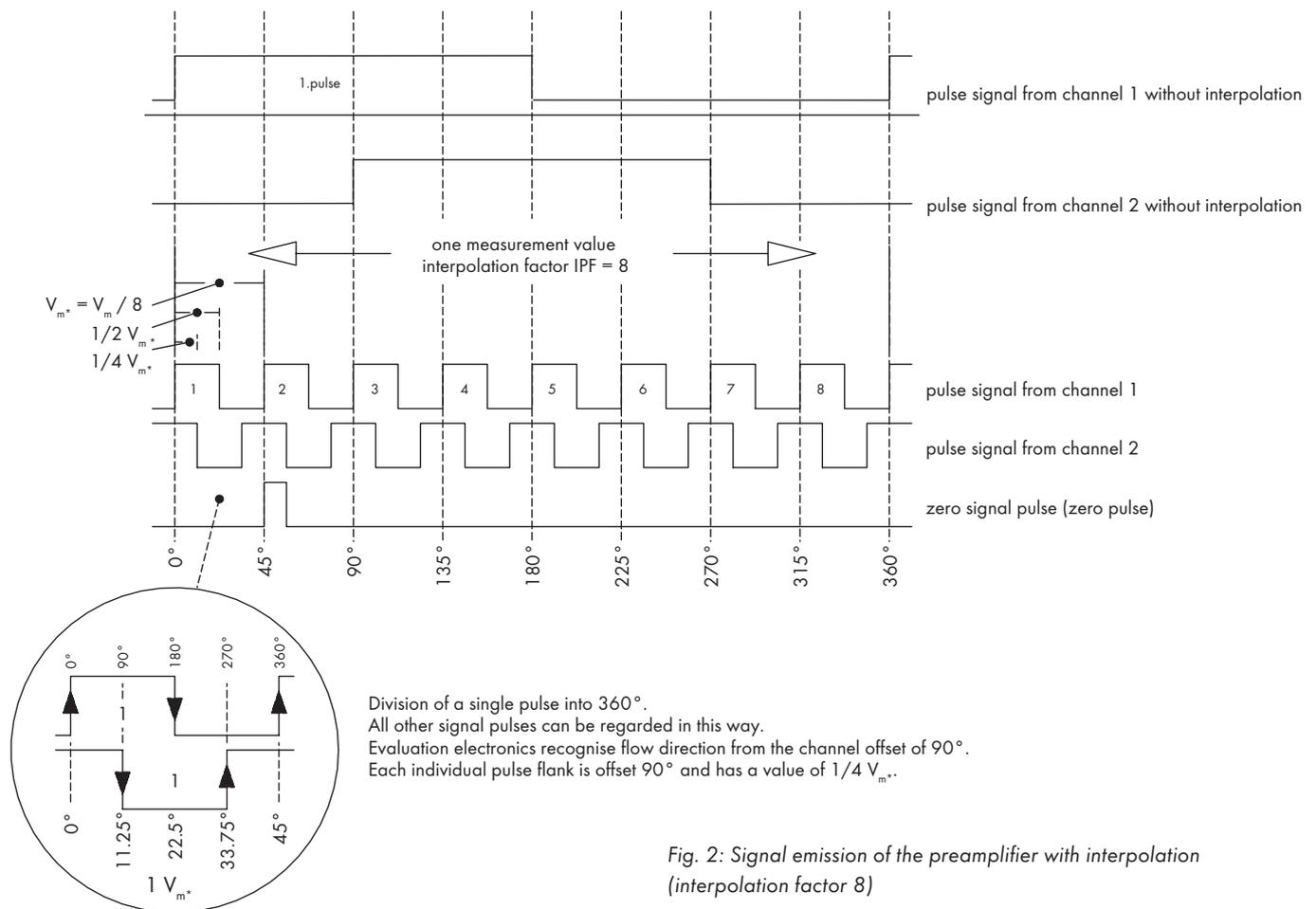


Fig. 2: Signal emission of the preamplifier with interpolation (interpolation factor 8)

Fig. 2 shows the resolution of the volume measurement V_m with an interpolation factor of 8. This resolves each volume measurement into eight individual part volumes. A pulse on the signal output of channel 1 or channel 2 thus has a value of $V_{m^*} = V_m / 8 = 1/8 V_m$ per pulse. In double evaluation (flank evaluation of one channel) this results in a value of $1/2 V_{m^*} = V_m / 16 = 1/16 V_m$ and for quadruple evaluation (flank evaluation of both channels) the result is a value of $1/4 V_{m^*} = V_m / 32 = 1/32 V_m$ per flank.

Evaluation electronics can recognise flow direction from signals offset 90° . Hence you can program a resolution of 4 to 64 angular steps per volume measurement V_m (see fig. 3). The frequency multiplication "f*" lies between 1 and 16 (see table 3).

Table 3: Interpolation factor and resolution

| Interpolation factor | Pulse/ V_m | Max. resolution (evaluation of signal flanks) | Resolution V_m^* (volume measurement V_m^*) [ml] | Max. resolution (angle degrees) | Frequency f_{max}^* |
|----------------------|--------------|---|---|---------------------------------|-----------------------|
| 1 | 1 | 4 (quadrupling) | $V_m / 4$ | 90° | $f_{max} \times 1$ |
| 2 | 2 | 8 | $V_m / 8$ | 45° | $f_{max} \times 2$ |
| 3 | 3 | 12 | $V_m / 12$ | 30° | $f_{max} \times 3$ |
| 4 | 4 | 16 | $V_m / 16$ | 22.5° | $f_{max} \times 4$ |
| 5 | 5 | 20 | $V_m / 20$ | 18° | $f_{max} \times 5$ |
| 8 | 8 | 32 | $V_m / 32$ | 11.25° | $f_{max} \times 8$ |
| 10 | 10 | 40 | $V_m / 40$ | 9° | $f_{max} \times 10$ |
| 12 | 12 | 48 | $V_m / 48$ | 7.5° | $f_{max} \times 12$ |
| 16 | 16 | 64 | $V_m / 64$ | 5.625° | $f_{max} \times 16$ |
| 24 | 24 | 96 | $V_m / 96$ | 3.75° | $f_{max} \times 24$ |
| 32 | 32 | 128 | $V_m / 128$ | 2.8125° | $f_{max} \times 32$ |

Only the marked lines are illustrated in the diagram of fig. 3

Column 1: Programmable interpolation factor IPF (programmed in the factory).

Column 2: Pulses per volume measurement V_m .

Column 3: Maximum resolution of the signal flanks. The signal flanks of channels 1 and 2 are evaluated.

Column 4: Volume measurement V_m^* resulting from the maximum resolution of the signal flanks.

Column 5: Maximum resolution in angle degrees at resolution of signal flanks.

Column 6: Maximum frequency f_{max}^* at maximum flow Q_{max} and programmed interpolation factor IPF

In practice, the maximum flow Q_{max} of the flow meter is seldom run, so that a lower frequency can be calculated. The maximum frequency is then calculated according to the following formula:

$$f_{max}^{\circ} = \frac{(Q_{max}^{\circ}) \cdot IPF}{V_m} \quad \text{Formula 1}$$

f_{max}° Maximum frequency of the flow meter signals

Q_{max}° Maximum flow attained in the case of application described here

IPF Programmed interpolation factor

V_m Volume measurement of the flow meter

Example: Flow meter VSI 1/10... max. flow the system can be run on at a maximum

$$Q_{max}^{\circ} = 40 \text{ l/min} = 666.667 \text{ ml/sec}; IPF = 10; V_m = 1 \text{ ml/pulse}; f_{max}^{\circ} = 6666.67 \text{ Hz} = 6.66667 \text{ kHz}$$

At max. flow $Q_{max}^{\circ} = 40 \text{ l/min}$, the flow meter VSI 1/10... outputs a frequency of $f_{max}^{\circ} = 6666.67 \text{ Hz}$.

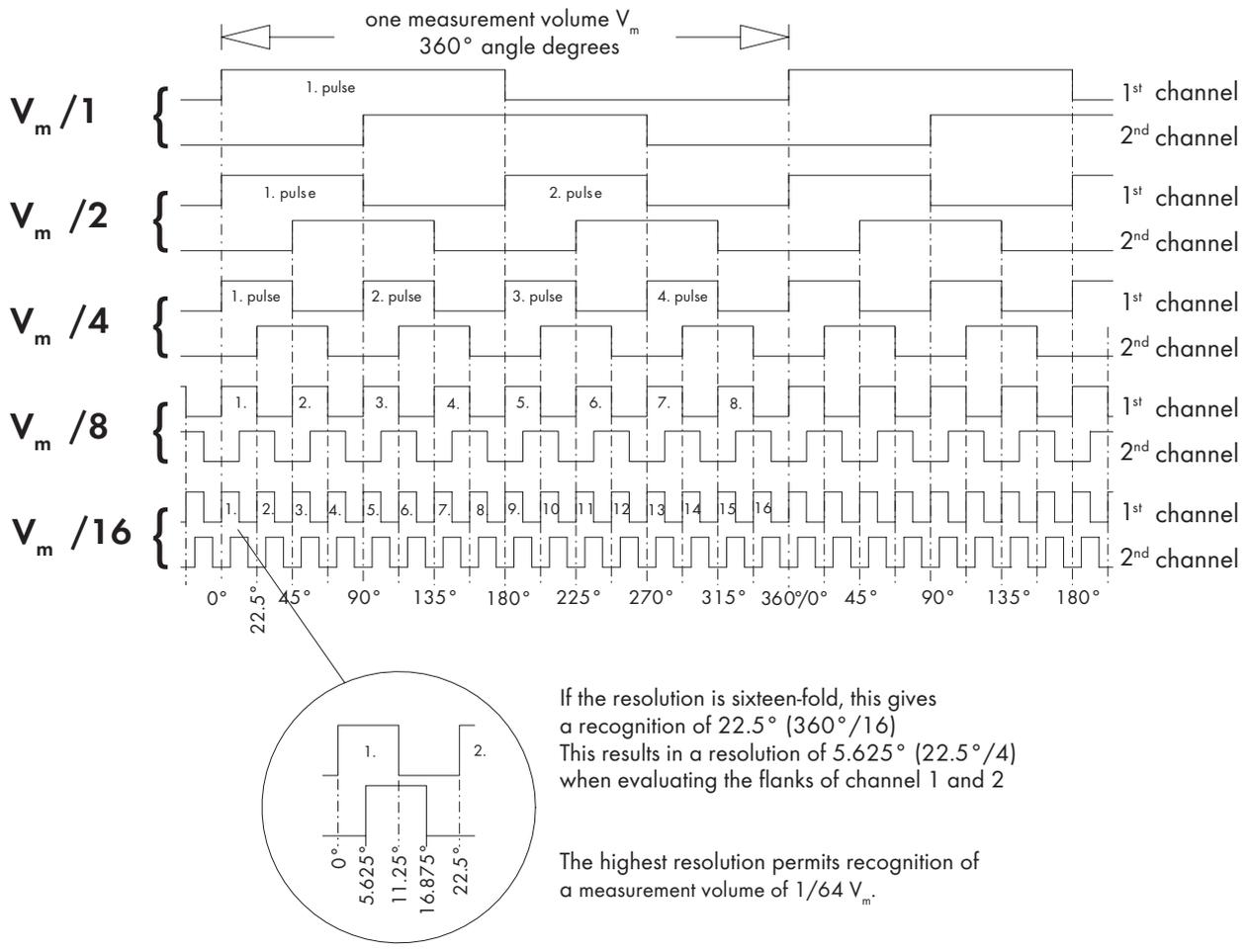


Fig. 3: Interpolation of the volume measurement V_m

At initial start-up of the system, you have to program the volume measurement V_m^* or the correct K-factor (see table 4, column 4) in your evaluation electronics as parameter value (e.g. multiplier). The evaluation electronics then multiply every pulse the flow meter outputs by the volume measurement V_m^* and thus calculates the flow and the volume. For flow meters with high resolution, the parameter value volume measurement V_m^* is dependent on volume measurement V_m (see

table 4, column 2) and on the programmed interpolation factor IPF (see table 4, column 3). Please consult this first of all for the volume measurement V_m^* or the K-factor and program this value as parameter into your evaluation electronics.

The maximum flow rates with the corresponding frequencies are listed in columns 4 and 8 of table 4.

Important:
Test the connected evaluation electronic system as to whether it can process the maximum frequency f_{max}^* of the flow meter. Check the data from the following table for the relevant flow meter, or calculate the maximum frequency data f_{max}^* with formula 1.

!

Table 4: Volume measurement and max. frequency at high resolution

| Flow meter | Vol. measurement V_m | Interpol. IPF* | Vol. measurement V_m^* (ml/pulse) | K-factor* (Imp/l) | Q_{max} | f_{max} | f_{max}^* (Hz) |
|-------------|------------------------|----------------|-------------------------------------|-------------------|---|------------|------------------|
| VSI 0.02... | 0.02 ml/Imp | 1 | 0.02 | 50,000 | 2 l/min (= 2,000 ml/min = 33.33 ml/s) | 1,666.7 Hz | 1,666.7 |
| | | 2 | 0.01 | 100,000 | | | 3,333.3 |
| | | 3 | 0.0067 | 150,000 | | | 5,000.0 |
| | | 4 | 0.005 | 200,000 | | | 6,666.7 |
| | | 5 | 0.004 | 250,000 | | | 8,333.3 |
| | | 8 | 0.0025 | 400,000 | | | 13,333.3 |
| | | 10 | 0.002 | 500,000 | | | 16,666.7 |
| | | 12 | 0.00167 | 600,000 | | | 20,000.0 |
| | | 16 | 0.00125 | 800,000 | | | 26,666.7 |
| | | 24 | 0.00083 | 1,200,000 | | | 40,000.0 |
| VSI 0.04... | 0.04 ml/Imp | 1 | 0.04 | 25,000 | 4 l/min (= 6,000 ml/min = 66.67 ml/s) | 1,666.7 Hz | 1,666.7 |
| | | 2 | 0.02 | 50,000 | | | 3,333.3 |
| | | 3 | 0.0133 | 75,000 | | | 5,000.0 |
| | | 4 | 0.01 | 100,000 | | | 6,666.7 |
| | | 5 | 0.008 | 125,000 | | | 8,333.3 |
| | | 8 | 0.005 | 200,000 | | | 13,333.3 |
| | | 10 | 0.004 | 250,000 | | | 16,666.7 |
| | | 12 | 0.0033 | 300,000 | | | 20,000.0 |
| | | 16 | 0.0025 | 400,000 | | | 26,666.7 |
| | | 24 | 0.00167 | 600,000 | | | 40,000.0 |
| VSI 0.1... | 0.1 ml/Imp | 1 | 0.1 | 10,000 | 10 l/min (= 10,000 ml/min = 33.33 ml/s) | 1,666.7 Hz | 1,666.7 |
| | | 2 | 0.05 | 20,000 | | | 3,333.3 |
| | | 3 | 0.033 | 30,000 | | | 5,000.0 |
| | | 4 | 0.025 | 40,000 | | | 6,666.7 |
| | | 5 | 0.02 | 50,000 | | | 8,333.3 |
| | | 8 | 0.0125 | 80,000 | | | 13,333.3 |
| | | 10 | 0.01 | 100,000 | | | 16,666.7 |
| | | 12 | 0.0083 | 120,000 | | | 20,000.0 |
| | | 16 | 0.00625 | 160,000 | | | 26,666.7 |
| | | 24 | 0.004167 | 240,000 | | | 40,000.0 |
| VSI 0.2... | 0.2 ml/Imp | 1 | 0.2 | 5,000 | 18 l/min (= 18,000 ml/min = 300 ml/s) | 1,500 Hz | 1,500.0 |
| | | 2 | 0.1 | 10,000 | | | 3,000.0 |
| | | 3 | 0.067 | 15,000 | | | 4,500.0 |
| | | 4 | 0.05 | 20,000 | | | 6,000.0 |
| | | 5 | 0.04 | 25,000 | | | 7,500.0 |
| | | 8 | 0.025 | 40,000 | | | 12,000.0 |
| | | 10 | 0.02 | 50,000 | | | 15,000.0 |
| | | 12 | 0.0167 | 60,000 | | | 18,000.0 |
| | | 16 | 0.0125 | 80,000 | | | 24,000.0 |
| | | 24 | 0.0083 | 120,000 | | | 36,000.0 |
| VSI 0.4... | 0.4 ml/Imp | 1 | 0.4 | 2,500 | 40 l/min (= 40,000 ml/min = 666.7 ml/s) | 1,666.7 Hz | 1,666.7 |
| | | 2 | 0.2 | 5,000 | | | 3,333.3 |
| | | 3 | 0.133 | 7,500 | | | 5,000.0 |
| | | 4 | 0.1 | 10,000 | | | 6,666.7 |
| | | 5 | 0.08 | 12,500 | | | 8,333.3 |
| | | 8 | 0.05 | 20,000 | | | 13,333.3 |
| | | 10 | 0.04 | 25,000 | | | 16,666.7 |
| | | 12 | 0.033 | 30,000 | | | 20,000.0 |
| | | 16 | 0.025 | 40,000 | | | 26,666.7 |
| | | 24 | 0.0167 | 60,000 | | | 40,000.0 |
| | | 32 | 0.0125 | 80,000 | 53,333.3 | | |

Table 4: Volume measurement and max. frequency at high resolution

| Flow meter | Vol. measurement V_m | Interpol. IPF* | Vol. measurement V_m^* (ml/pulse) | K-factor* (Imp/l) | Q_{max} | f_{max} | f_{max}^* (Hz) |
|------------|------------------------|----------------|-------------------------------------|-------------------|---|------------|------------------|
| VSI 1... | 1 ml/Imp | 1 | 1.0 | 1,000 | 80 l/min (= 80,000 ml/min = 1,333.3 ml/s) | 1,333.3 Hz | 1,333.3 |
| | | 2 | 0.5 | 2,000 | | | 2,666.7 |
| | | 3 | 0.33 | 3,000 | | | 4,000.0 |
| | | 4 | 0.25 | 4,000 | | | 5,333.3 |
| | | 5 | 0.2 | 5,000 | | | 6,666.7 |
| | | 8 | 0.125 | 8,000 | | | 10,666.7 |
| | | 10 | 0.1 | 10,000 | | | 13,333.3 |
| | | 12 | 0.083 | 12,000 | | | 16,000.0 |
| | | 16 | 0.0625 | 16,000 | | | 21,333.3 |
| | | 24 | 0.04167 | 24,000 | | | 32,000.0 |
| VSI 2... | 2 ml/Imp | 1 | 2.0 | 500 | 120 l/min (= 120,000 ml/min = 2,000 ml/s) | 1,000 Hz | 1,000.0 |
| | | 2 | 1.0 | 1,000 | | | 2,000.0 |
| | | 3 | 0.67 | 1,500 | | | 3,000.0 |
| | | 4 | 0.5 | 2,000 | | | 4,000.0 |
| | | 5 | 0.4 | 2,500 | | | 5,000.0 |
| | | 8 | 0.25 | 4,000 | | | 8,000.0 |
| | | 10 | 0.2 | 5,000 | | | 10,000.0 |
| | | 12 | 0.167 | 6,000 | | | 12,000.0 |
| | | 16 | 0.125 | 8,000 | | | 16,000.0 |
| | | 24 | 0.0833 | 12,000 | | | 24,000.0 |
| VSI 4... | 4 ml/Imp | 1 | 4.0 | 250 | 250 l/min (= 250,000 ml/min = 4,166.7 ml/s) | 1,041.7 Hz | 1,041.7 |
| | | 2 | 2.0 | 500 | | | 2,083.3 |
| | | 3 | 1.33 | 750 | | | 3,125.0 |
| | | 4 | 1.0 | 1,000 | | | 4,166.7 |
| | | 5 | 0.8 | 1,250 | | | 5,208.3 |
| | | 8 | 0.5 | 2,000 | | | 8,333.3 |
| | | 10 | 0.4 | 2,500 | | | 10,416.7 |
| | | 12 | 0.33 | 3,000 | | | 12,500.0 |
| | | 16 | 0.25 | 4,000 | | | 16,666.7 |
| | | 24 | 0.167 | 6,000 | | | 25,000.0 |
| VSI 10... | 3,33 ml/Imp | 1 | 3.33 | 300 | 525 l/min (= 525,000 ml/min = 8,750 ml/s) | 2,625 Hz | 2,625.0 |
| | | 2 | 1.67 | 600 | | | 5,250.0 |
| | | 3 | 1.11 | 900 | | | 7,875.0 |
| | | 4 | 0.83 | 1,200 | | | 10,500.0 |
| | | 5 | 0.66 | 1,500 | | | 13,125.0 |
| | | 8 | 0.4167 | 2,400 | | | 21,000.0 |
| | | 10 | 0.33 | 3,000 | | | 26,250.0 |
| | | 12 | 0.278 | 3,600 | | | 31,500.0 |
| | | 16 | 0.20833 | 4,800 | | | 42,000.0 |
| | | 24 | 0.1389 | 7,200 | | | 63,000.0 |
| | | 32 | 0.104167 | 9,600 | 84,000.0 | | |

V_m = physical volume measurement (size) of the flow meter (volume per tooth and per tooth gap)

Q_{max} = max. flow (test conditions)

f_{max} = max. frequency at Q_{max}

IPF* = programmable interpolation factor

* = all characters marked with * refer to IPF*

V_m^* = interpolated volume measurement

f_{max}^* = max. interpolated frequency at Q_{max}

$$f_{max} = Q_{max} / V_m$$

$$V_m^* = V_m / IPF^* ; K\text{-factor}^* = 1 / V_m^*$$

$$f_{max}^* = Q_{max} / V_m^*$$

Example of flow meter "VSI 0.1/10 ..."

| | | |
|-----------|--|-----------------------------------|
| 1. Column | Flow meter, version VSI and size 0.1 | VSI 0.1... |
| 2. Column | Physical volume measurement V_m (corresponds to the volume measurement V_m at interpolation factor $IPF^* = 1$) | $V_m = 0.1 \text{ ml/Imp}$ |
| 3. Column | Interpolation factor $IPF^* =$ hardware programmed | $IPF^* = 10$ |
| 4. Column | Volume measurement V_m^* | $V_m^* = 0.01 \text{ ml/Imp}$ |
| 5. Column | K-factor*; reciprocal value of volume measurement V_m^* | K-factor* = 100,000 Imp/l |
| 6. Column | Maximum flow Q_{max} of the flow meter | $Q_{max} = 10 \text{ l/min}$ |
| 7. Column | Maximum frequency f_{max} at interpolation factor $IPF = 1$ (see column 2) (corresponds to the volume measurement V_m at interpolation factor $IPF = 1$) | $f_{max} = 1,666.7 \text{ Hz}$ |
| 8. Column | Maximum frequency f_{max}^* at programmed interpolation factor (see column 3) | $f_{max}^* = 16,666.7 \text{ Hz}$ |

14. PROGRAMMING OF THE PREAMPLIFIER

All functions of the electronics can be set easily and quickly. A rotary coding switch (S4), a push button (S1) and two switches (S2, S3) are located on the electronics board. The interpolation factor is set by the rotary coding switch.

In order for activating the flow meter you only need to set the desired interpolation factor with the rotary coding switch (S4), according to table 5. For this turn the rotary coding switch with a small screwdriver to the corresponding direction. The chosen factor is switched directly and is available at the output.

The IPF-setting can be modified at any time during operation.

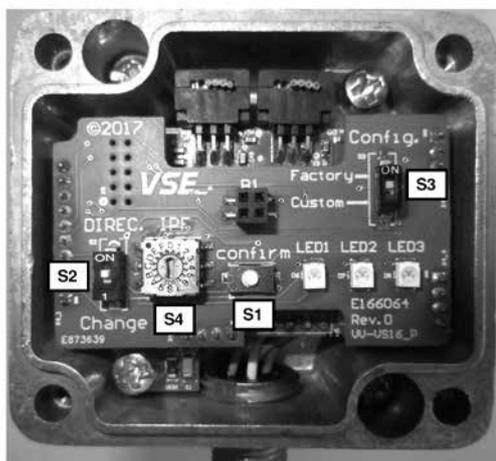


Fig. 4: Preamplifier peripheral board

With an already mounted flow meter it is possible to reserve the direction of the dual channel signals easily by switching (S2). Additionally the polarity of the separate direction signal on pin 5 is changed.

Table 5: Interpolation factors

| Switch position S4 | Interpolation factor |
|--------------------|----------------------|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |
| 4 | 5 |
| 5 | 8 |
| 6 | 10 |
| 7 | 12 |
| 8 | 16 |
| 9 | 24 |
| A | 32 |
| B-F | no function |

Important:

Take ESD preventive measures to prevent electrostatic discharge while working on the preamplifier electronics.



15. INDICATING LEDs

The LEDs of the electronics give information about the corresponding state. This includes certain operating and error conditions (see table 6 and 7).

The different states of the three LEDs indicate the corresponding condition.

These are either operating, warning or alarm messages. Operating messages signal the current setting (see. table 6). Warning and alarm-messages give exact information about overload, component faults of the system and factors which might negatively influence the measurement (see. table 7).

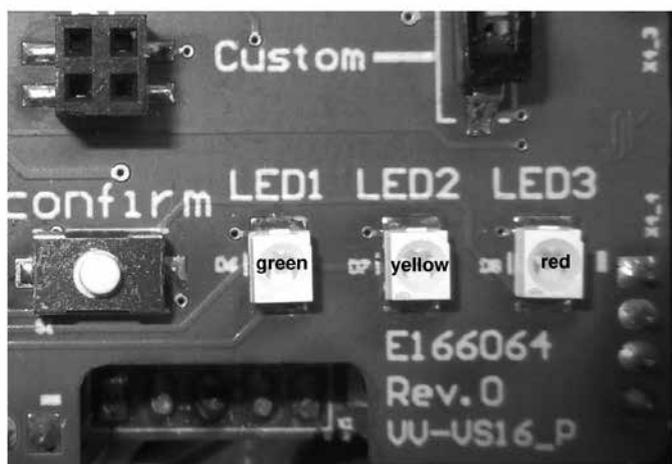


Fig. 5: Indicating LEDs of the peripheral board

Table 6: Operating messages

| Mode | LED yellow | LED green | LED red |
|------------------|------------|-----------|---------|
| Normal operation | off | on | off |
| No IPF selected | off | flash | off |

The electronics of the VSI- flow meters is able to detect three events, which may lead to measurement errors. Error are signaled by the red LED. Lighting up of this LED indicates events with negative effects on the measurement.

Table 7: Warning- and alarm messages

| Warning | LED yellow | LED green | LED red | Warning message description |
|--|------------|-----------|---------|---|
| 1 Configuration necessary | on | on | on | The preamplifier electronics has been replaced. A configuration has to be made before operating. There is no signal output. |
| Alarm | LED yellow | LED green | LED red | Alarm message description |
| 2 GMR-pickup fault or interpolator error | on / off | on / off | on | Recognition of pickup breaking off or mechanical damage. The signal output may be incorrect. |
| 3 Flow overload | on / off | on / off | on | The maximum permitted flow range has been exceeded. |
| 4 Electronics error | flash | flash | flash | Defect component in the interpolator circuit. Error uncorrectable. There is no signal output. |

16. TECHNICAL SPECIFICATIONS OF PREAMPLIFIER

| | |
|---------------------|---|
| Pickup sensor | 2 x GMR-sensor (sine and cosine signals) |
| Configuration | automatically via peripheral board |
| Resolution | programmable 1, 2, 3, 4, 5, 8, 10, 12, 16, 24, 32 |
| Frequency | up to 100kHz |
| Signal outputs | Channel A, channel B, direction signal „DIREC“ (high positiv; low negativ) |
| Channel A and B | Two signal outputs for emitting the digital flow sensor signals; between channel A and channel B there is a channel offset of 90° |
| Flow direction | Recognition of flow direction from channel offset of the signals from channel A to channel B or from the separate direction signal on pin 5, direction can be changed by the preamplifier electronics |
| Outputs | 3 current limiting and short-circuit-proof push-pull output stages (channel A, channel B, DIREC); driver current approx. 200 mA at 24 V power supply; small saturation voltage up to 30 mA load current; short switching times; reverse voltage protection by integrated free-run diodes against V_b and GND; temperature protection switching with hysteresis; outputs are of high impedance in case of error; ESD protected |
| Error messages | Electronics error (e.g. defective interpolator); sensor error (e.g. sensor break-off); configuration necessary; overload (flow peaks) |
| Operating voltage | $V_b = 10 \dots 28$ VDC |
| Current consumption | $I_{\text{oper}} = \text{approx. } 65 \text{ mA}$; total current consumption depending on loading of outputs |

17. PLUG ASSIGNMENT OF PREAMPLIFIER

Fig. 6 shows the plug assignment of the preamplifier.

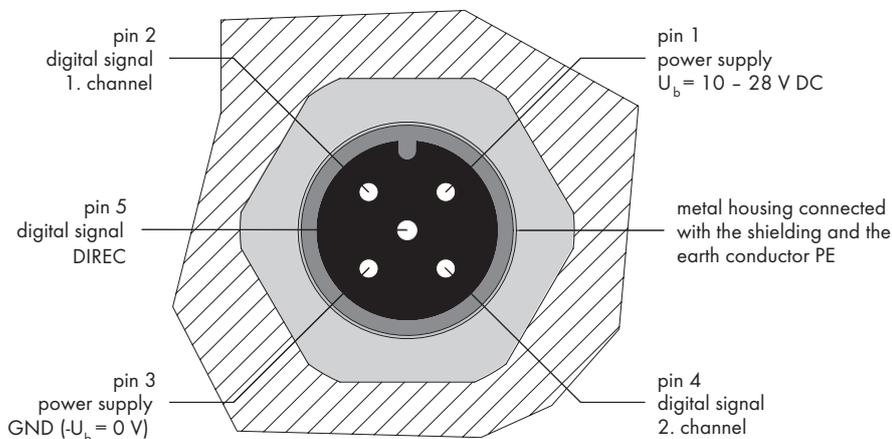
As you can see, this plug has five pins, the outer four assigned exactly as the ones in standard preamplifiers. In addition to the power supply and signal output of channel 1 and 2, there is a fifth pin, which emits the zero signal.

As a rule, only the four outer pins are needed to evaluate the flow meter signals; pin assignment is therefore the same as standard preamplifiers. For this reason you can use a normal 4 or 5-wired connection cable for the connection of the flow meter. But please make sure that the shielding of the cable is laid on the plug side onto the metal housing of the plug. 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.

In order to prevent interference either the shield should be connected to ground GND or to a protective earth conductor (PE). Alternatively the flow meter must be connected electrically to earth (PE). This is generally ensured with the grounded pipelines. This is normally secured by the earthed pipe lines.

If there are potential differences between the preamplifier housing and the earth conductor PE of the evaluating electronics, you have to lay a correcting earth.



Top view of plug

Fig. 6: Flange plug installed in the preamplifier housing of the flow meter

Important:

Only use well-shielded cables for the connection cable, with a wire cross section of ≥ 4 or 5×0.25 mm². Please make sure that the housing of the round plug is metallic and that it has a connection to the shielding.

**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).



18. MAINTENANCE, SERVICE LIFE AND WARRANTY

Depending on the operating conditions, the service life and therefore the specific properties of the units are limited by wear, corrosion, deposits or ageing. The operator is responsible for regular inspection, maintenance and recalibration. Any observation of a malfunction or damage prohibits further use. On request, we can provide you with a

loan unit for the duration of the overhaul. We recommend an annual check and recalibration. Under normal operating conditions, the service life is 10,000 hours.

The warranty period is 12 months.

19. STORAGE, RETURN AND DISPOSAL

Temporary storage

All VSE flow meters are supplied with sealing plugs and in suitable packaging for all destinations and modes of transport to ensure optimum protection. The flow meters should always be stored in their original foam packaging or transport box.

The units must not be exposed to temperatures below -20°C or above +60°C and must be protected from moisture and its effects.

Return

1. The flow meter must be properly cleaned by the customer before being returned to prevent the risk of poisoning/contamination by harmful, explosive and other high-risk pumped media for humans and the environment.
2. If media have been conveyed whose residues with atmospheric humidity lead to corrosion damage or ignite on contact with oxygen, the flow meter must be additionally neutralised and thoroughly cleaned with anhydrous, inert gas to dry.
3. The return of the flow meter must always be accompanied by a fully completed declaration of no objection (see section 31, page 26). All applied safety and decontamination measures must be indicated.
4. When returning the flow meter, it must be packed in accordance with the applicable logistics standards and sealed with sealing plugs.

Disposal

VSE actively promotes environmental awareness and has an operational management system that meets the requirements of ISO 9001:2015. The impact on the environment and people should be minimised during the production, storage, transport, use and disposal of our products and solutions.

- Collect rinsing liquid as well as residual liquid and dispose of it in accordance with the statutory provisions and regulations.
- Wear protective clothing and protective mask/+ goggles if necessary.

Materials must be disposed of properly as follows:

- Metal
- Plastics
- Electronic components
- etc.

When disposing of the materials, ensure that the waste-relevant rules and regulations of the respective country of destination are observed!

20. TECHNICAL SPECIFICATIONS VSI 0.02 / IPF – VSI 4 / IPF

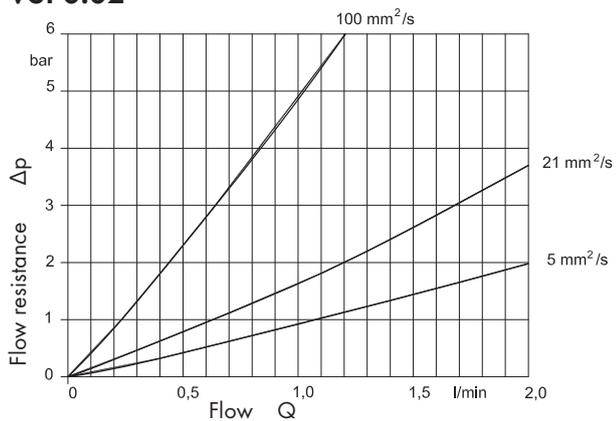
| Size | Measuring range l/min | Frequency Hz | Pulse value cm ³ /pulse | K-factor Imp/liter |
|----------|--------------------------|--------------------------------|---------------------------------------|-----------------------|
| VSI 0.02 | 0.002 ... 2 | 1.667 * IPF ... 1,666.67 * IPF | 0.02 / IPF | 50,000 * IPF |
| VSI 0.04 | 0.004 ... 4 | 1.667 * IPF ... 1,666.67 * IPF | 0.04 / IPF | 25,000 * IPF |
| VSI 0.1 | 0.01 ... 10 | 1.667 * IPF ... 1,666.67 * IPF | 0.1 / IPF | 10,000 * IPF |
| VSI 0.2 | 0.02 ... 18 | 1.667 * IPF ... 1,500.00 * IPF | 0.2 / IPF | 5,000 * IPF |
| VSI 0.4 | 0.03 ... 40 | 1.250 * IPF ... 1,666.67 * IPF | 0.4 / IPF | 2,500 * IPF |
| VSI 1 | 0.05 ... 80 | 0.833 * IPF ... 1,333.33 * IPF | 1 / IPF | 1,000 * IPF |
| VSI 2 | 0.1 ... 120 | 0.833 * IPF ... 1,000.00 * IPF | 2 / IPF | 500 * IPF |
| VSI 4 | 1.0 ... 250 | 4.167 * IPF ... 1,041.67 * IPF | 4 / IPF | 250 * IPF |

Adjustable interpolation factors IPF: 1; 2; 3; 4; 5; 8; 10; 12; 16; 24; 32

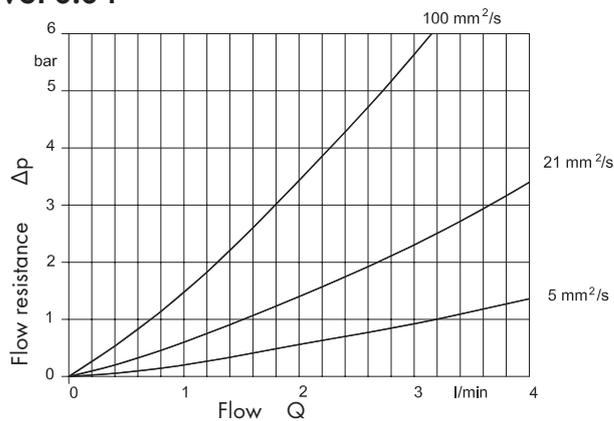
| | | |
|------------------------------------|---|---|
| Measurement accuracy | up to 0.3 % of measurement value (with viscosity > 20 mm ² /s) | |
| Repetition accuracy | ± 0.05 % under the same operating conditions | |
| Material | Cast iron EN-GJS-400-15 (EN 1563) or Stainless steel 1.4305 | |
| Meter bearing | Ball bearings or steel plain bearings (medium-dependent) | |
| Seals | FPM (standard), NBR, PTFE or EPDM | |
| Max. operating pressure | Cast iron EN-GJS-400-15 (EN 1563) Stainless steel 1.4305 | 315 bar / 4500psi 450 bar / 6500 psi |
| Medium temperature | -40°C ... + 120°C (-40°F ... 248°F) | |
| Ambient temperature | -20°C ... + 50°C (-4°F ... 122°F) | |
| Viscosity range | 1 ... 100,000 mm ² /s | |
| Installation position | any | |
| Flow direction | any | |
| Running noise | max. 72 db(A) | |
| Power supply voltage | 10 up to 28 volts/DC | |
| Pulse output | 3 current limiting and short-circuit-proof output stages low signal: 0 = GND; high signal: 1 = U _b -1 | |
| Channel offset | 90° ± 5° max. | |
| Pulse-width repetition rate | 1/1 ± 5% max. | |
| Preamplifier housing | Aluminium | |
| Protection type | IP 65 | |

21. FLOW RESPONSE CURVES 0,02 – VSI 4

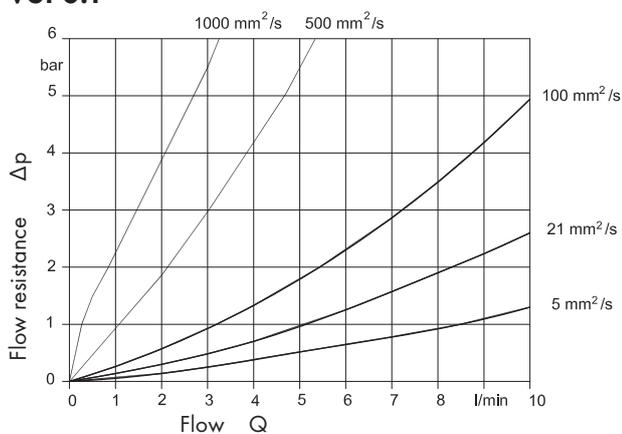
VSI 0.02



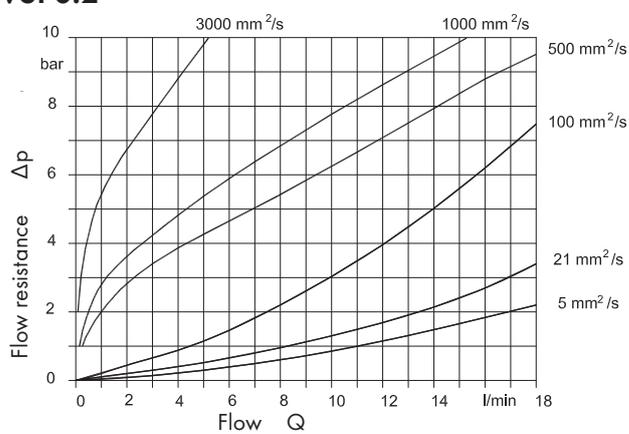
VSI 0.04



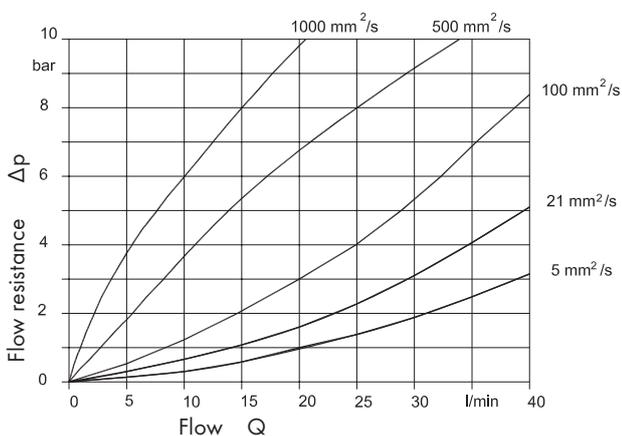
VSI 0.1



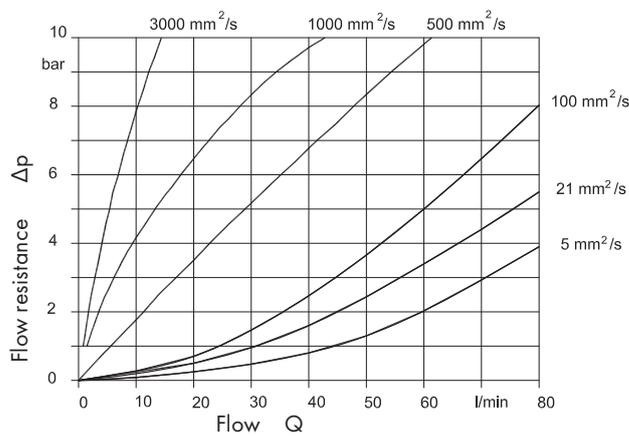
VSI 0.2



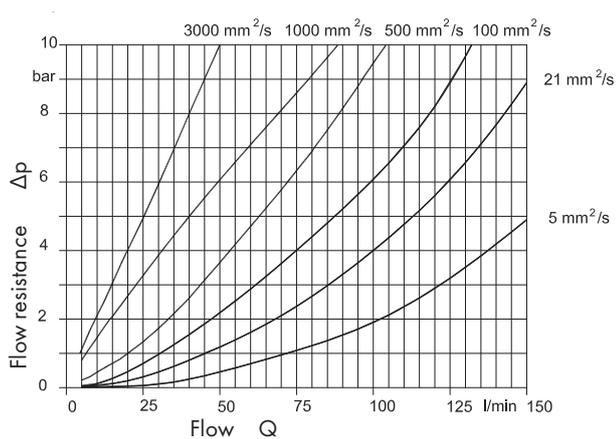
VSI 0.4



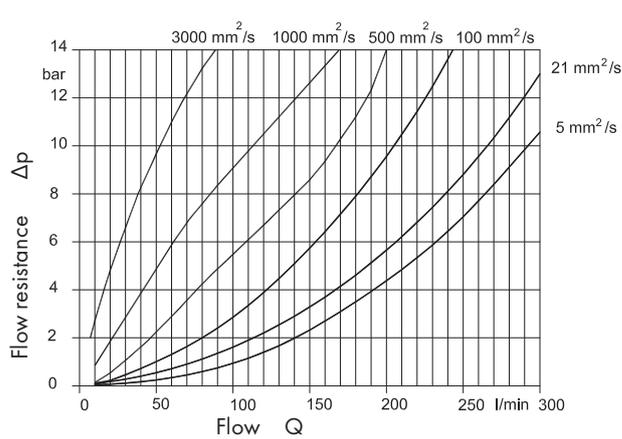
VSI 1



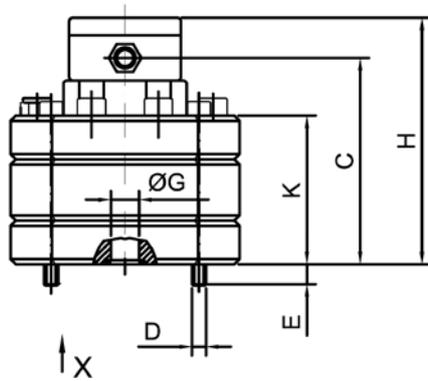
VSI 2



VSI 4

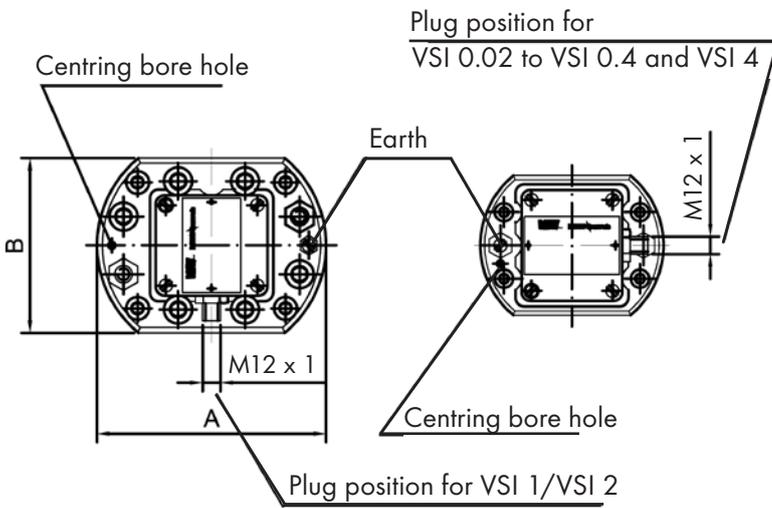
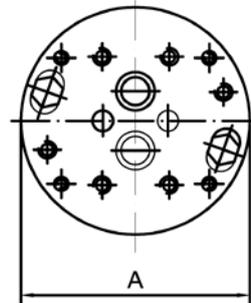


Cast iron version



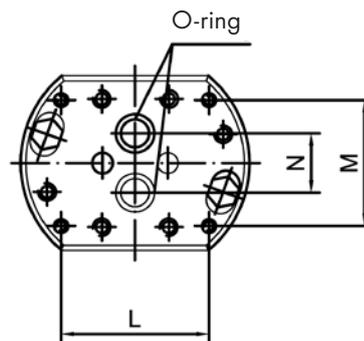
Stainless steel version
Connection diagram
Housing without milled edge

View X



Cast iron version
Connection diagram

View X

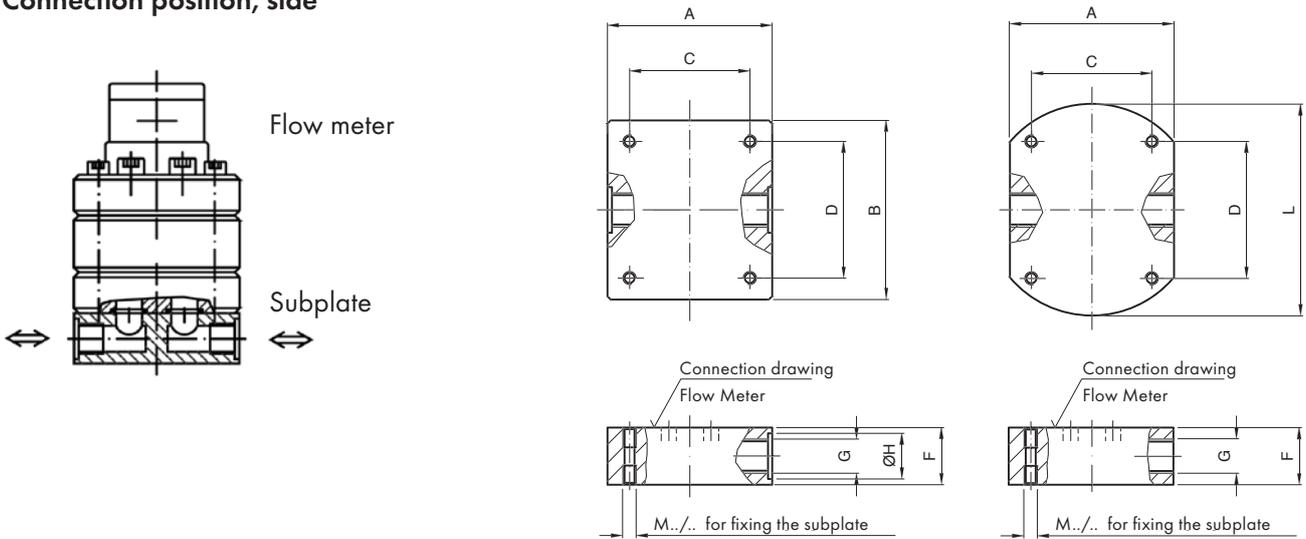


| Size | A | B | C | D | E | ø G | H | K | L | M | N | O-ring | GCI kg | SS kg |
|-------------|-----|-----|------|-----|------|-----|-----|------|----|----|----|--------------|-----------|----------|
| VSI | | | | | | | | | | | | | | |
| 0.02 | 100 | 80 | 91 | M6 | 12.0 | 9 | 114 | 58 | 70 | 40 | 20 | 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

23. DIMENSIONS SUPPLATES AP.0.2 – 4

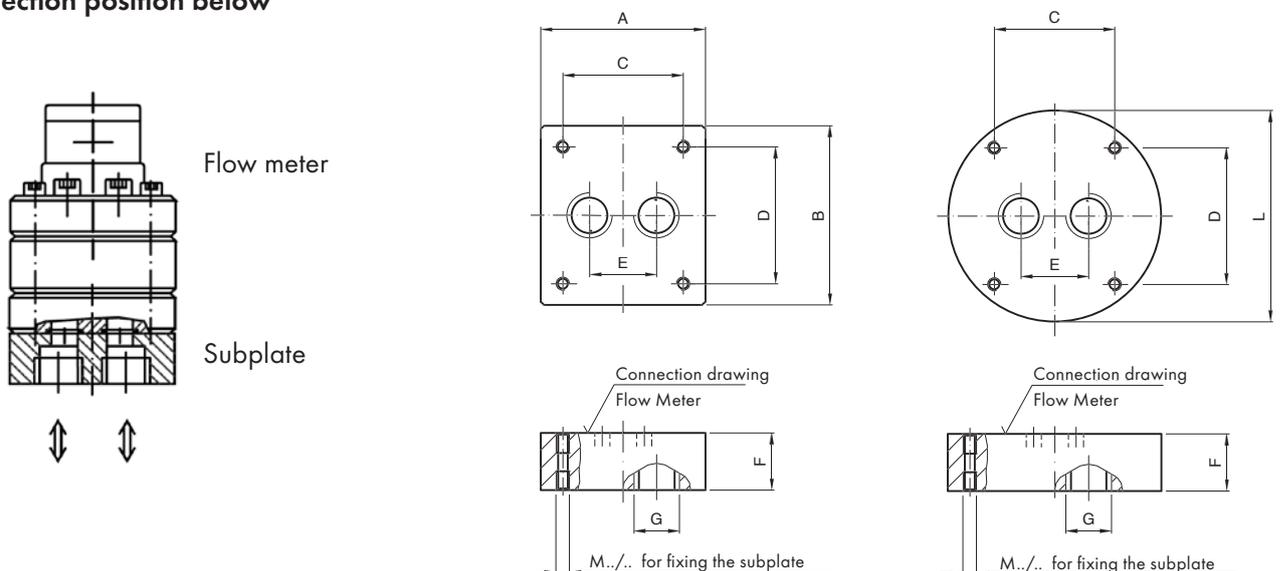
Connection position, side



| Size | Connection thread | F | øH | A | B | C | D | E | L | Thread / depth | Weight |
|------|-------------------|----|----|-----|-----|-----|------|-----|-------|----------------|--------|
| VSI | G | | | | | | | | | M | kg |
| 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 | | | | | 120 | | | 72 |
| | G 1 1/2" | 80 | | 140 | 110 | 180 | 12.0 | | | | |

only for AP . 4 U...

Connection position below



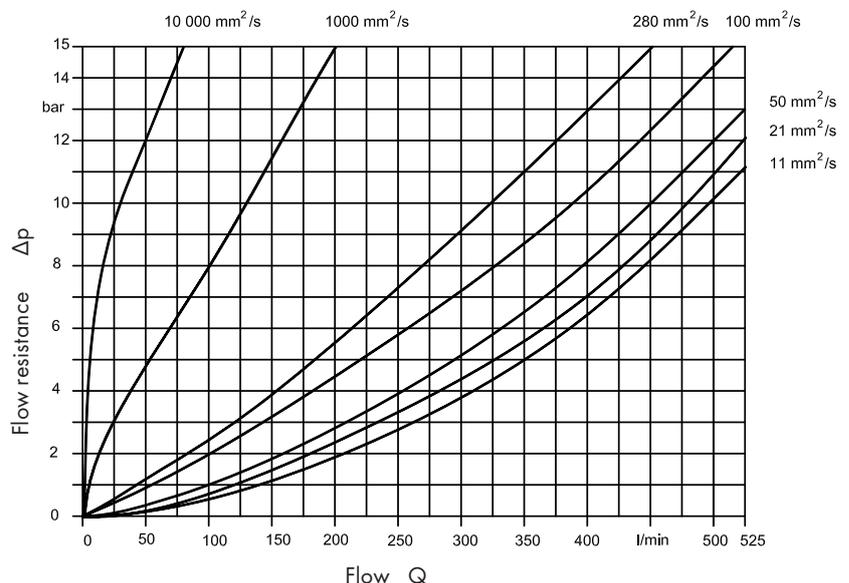
24. TECHNICAL SPECIFICATIONS VSI 10 / IPF

| Size | Measuring range l/min | Frequency Hz | Pulse value cm ³ /pulse | K-factor Imp/liter |
|--------|--------------------------|-------------------------------|---------------------------------------|-----------------------|
| VSI 10 | 1.5 ... 525 | 7.50 * IPF ... 2,625.00 * IPF | 3.333 / IPF | 300 * IPF |

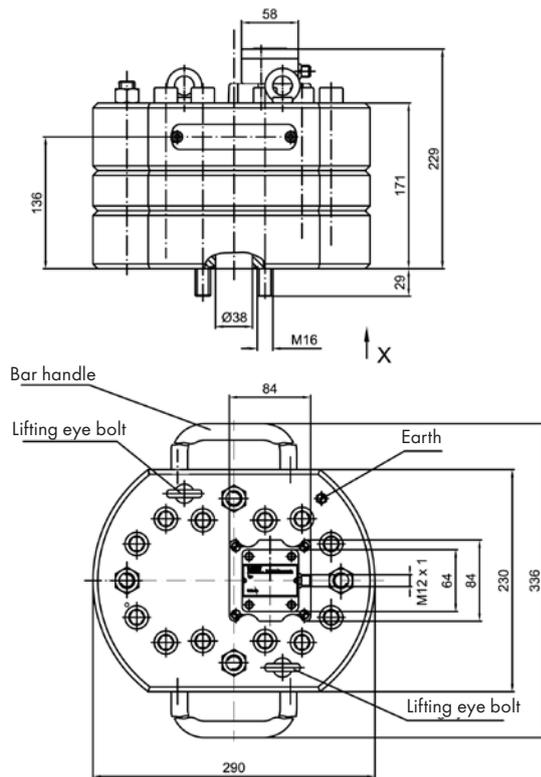
Adjustable interpolation factors IPF: 1; 2; 3; 4; 5; 8; 10; 12; 16

| | |
|-----------------------------|--|
| Measurement accuracy | up to 0..5% of measurement value (with viscosity > 20 mm ² /s) |
| Repetition accuracy | ± 0.05% under the same operating conditions |
| Material | Cast iron EN-GJS-600-3 (EN1563) |
| Meter bearing | Ball bearings or steel plain bearings (medium-dependent) |
| Weight | 70 kg without subplate |
| Seals | FPM (standard), NBR, PTFE oder EPDM |
| Max. operating pressure | 420 bar/6000 psi |
| Medium temperature | -40°C ... + 120°C (-40°F ... 248°F) |
| Ambient temperature | -20°C ... + 50°C (-4°F ... 122°F) |
| Viscosity range | 5 ... 100,000 mm ² /s |
| Installation position | any |
| Flow direction | any |
| Running noise | < 80 db(A) |
| Power supply voltage | 10 up to 28 volts/DC |
| Pulse output | 3 current limiting and short-circuit-proof output stages low signal: 0 = GND; high signal: 1 = U _b -1; low signal: 0 = GND |
| Channel offset | 90° ± 5° max. |
| Pulse-width repetition rate | 1/1 ± 5% max. |
| Preamplifier housing | Aluminium |
| Protection type | IP 65 |

25. FLOW RESPONSE CURVES VSI 10

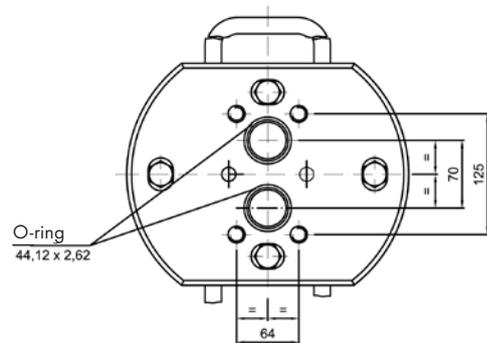


26. DIMENSIONS VSI 10



View X

Connection diagram

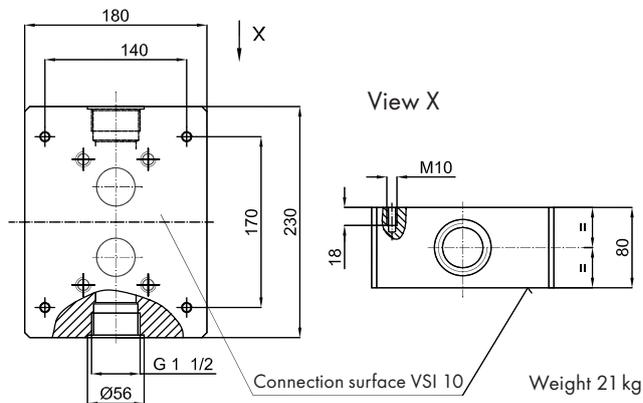


Weight 70 kg

Dimensions in mm

27. DIMENSIONS, SUBPLATE APG 10

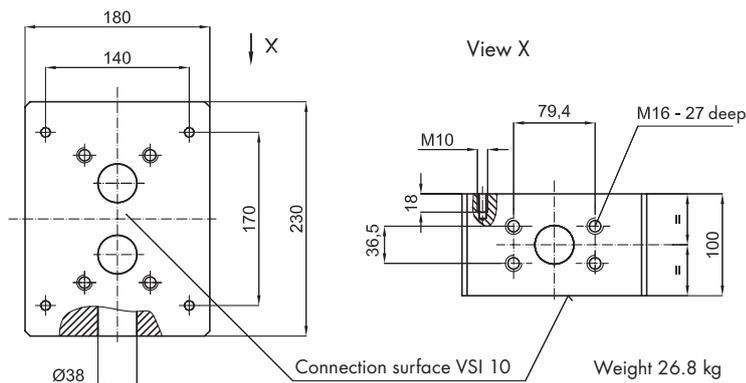
APG 10 SG0N / 1



View X

Weight 21 kg

APG 10 SW0N / 1



View X

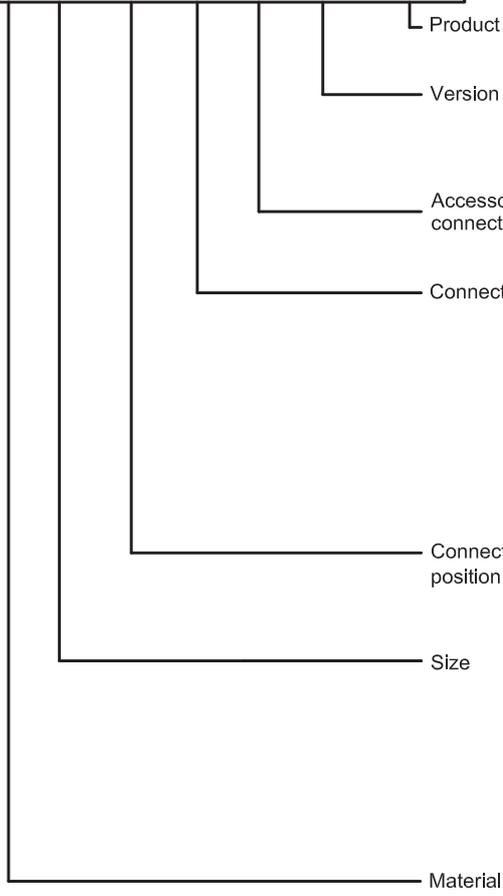
Weight 26.8 kg

Dimensions in mm

Subplates AP ...

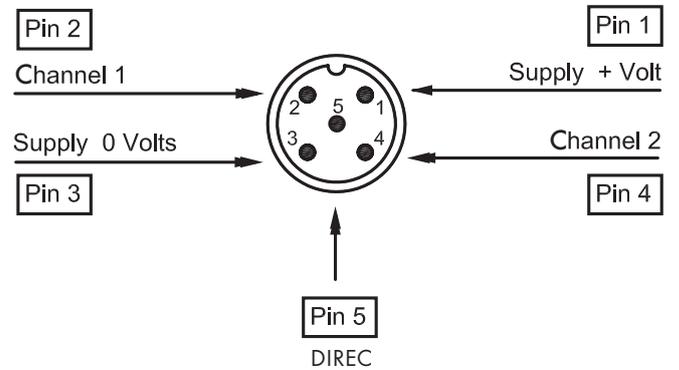
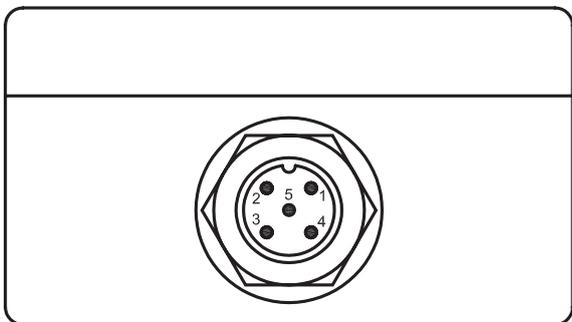
Example

AP G 1 S C 0 N / 1

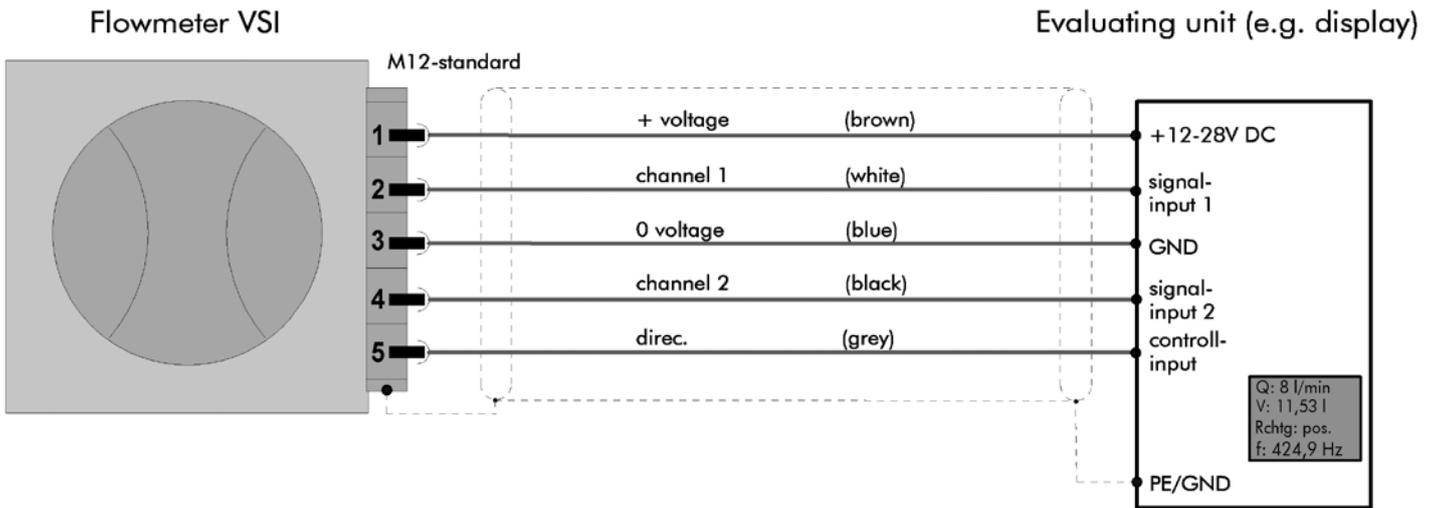


| | | | | | |
|------------|--|------------|----------------|----------|-----------|
| N | Standard version | | | | |
| S | Special version | | | | |
| 0 | without rinse connection | | | | |
| A | G 1/4 | J | 1/4 NPT | S | SAE 1/2 |
| B | G 3/8 | K | 3/8 NPT | T | SAE 3/4 |
| C | G 1/2 | L | 1/2 NPT | U | SAE 1 |
| D | G 3/4 | M | 3/4 NPT | V | SAE 1 1/4 |
| E | G1 | N | 1 NPT | W | SAE 1 1/2 |
| F | G1 1/4 | O | 1 1/4 NPT | X | SAE 2 |
| G | G1 1/2 | P | 1 1/2 NPT | | |
| S | Connection position side | | | | |
| U | Connection below | | | | |
| 0.2 | VSI 0,02 VSI 0,04 VSI 0,1 VSI 0,2 | 0.4 | VSI 0,4 | | |
| | | 1 | VSI 1 VSI 2 | | |
| | | 4 | VSI 4 | | |
| | | 10 | VSI10 | | |
| G | EN-GJL-250, EN-GJS-400-15 (DIN EN 1561/1563) | | | | |
| E | Stainless steel 1.4305 | | | | |

29. PLUG ASSIGNMENT



30. CONNECTION DIAGRAM



31. CERTIFICATE OF NON-OBJECTION



SAFETY DECLARATION FOR RETURN DELIVERIES (CERTIFICATE OF NON-OBJECTION)

Last revised: 10/2021

Please reply to info@vse-flow.com

Flow meters, for which this certificate of conformity has not been completed and signed, cannot be inspected or repaired for safety reasons and will be returned unchecked at your expense.

| | |
|-------------------|--|
| Article number | |
| Quantity | |
| Reason for return | |

The flow meter was used in health/environmentally hazardous media. No Yes

The flow meter is free from residuals. No Yes

Special safety measures or treatment is necessary or expected. No Yes

The flow meter was last used with the following media:

If yes, which

| | <input type="radio"/> No | <input type="radio"/> Yes * | |
|-----------------------------|--------------------------|-----------------------------|--|
| Solvents | <input type="radio"/> | <input type="radio"/> | |
| Toxic liquids | <input type="radio"/> | <input type="radio"/> | |
| Biologically active liquids | <input type="radio"/> | <input type="radio"/> | |
| Radioactive liquids | <input type="radio"/> | <input type="radio"/> | |
| Corrosive liquids | <input type="radio"/> | <input type="radio"/> | |
| Alkali | <input type="radio"/> | <input type="radio"/> | |
| Explosive liquids | <input type="radio"/> | <input type="radio"/> | |
| Other media | <input type="radio"/> | <input type="radio"/> | |

* Please add the safety data sheet for the medium in the appendix.



SAFETY DECLARATION FOR RETURN DELIVERIES (CERTIFICATE OF NON-OBJECTION)

Please reply to info@vse-flow.com

The undersigned assures that the above information is correct and complete and the shipping is carried out according to legal regulations. The undersigned is liable for all damages which arise as a result of the non-marked decontamination of the returned flow meter.

VSE expressly points out that repairs and verification work is carried out by trusting the correctness of the completion of this safety declaration (certificate of non-objection). Should physical injuries, death or even damage to property occur, claims for damages will be asserted.

| | |
|------------------------------|--|
| Company | |
| Street / Building no. | |
| Postcode / Town | |
| Phone | |
| Fax | |
| Email | |

Contact
(in capitals)

Date

Signature
(company stamp)

Enclosed

VSE.flow®

VSE Volumentchnik GmbH
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58809 Neuenrade / Germany

Phone +49 (0) 23 94 / 6 16-30

Fax +49 (0) 23 94 / 6 16-33

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