

# Operating instructions

for flow meters of the product series "Ex-Type VHM"



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## 1. IMPORTANT INFORMATION AND LEGAL NOTICES

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

This operating instruction for flow meters of the **“Ex-Type VHM”** series by VSE Volumentchnik GmbH (VSE) contains information required to properly install and commission the flow meter in potentially hazardous areas according to the regulations.

Any installation, commissioning, operation, maintenance and testing may only be carried out by trained and authorized personnel with knowledge of the national regulations relating to explosion protection. 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 electrical connection of the flow meter, the warranty as well as the product liability by VSE will be void.

## 2. GENERAL FUNCTION DESCRIPTION OF FLOW METER FOR EX-HAZARDOUS AREAS

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 one single, two or four pulses, depending on the type of the pick-up system.

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 indicate liquid flow depending on their chamber volume.

The liquid flow quantity within one meter rotation of a tooth division determines 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.

$$V_m (\text{l/Imp}) = 1/\text{K-factor}$$

The "Ex-type VHM" generates a modulated digital current signal which is amplified and converted to a digital voltage signal by an isolating switching amplifier.

## 3. GENERAL DESCRIPTION

Please follow all instructions in this operating manual; only this ensures 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 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 "VHM" 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.

All flow meters are tested according to the valid, legally prescribed electromagnetic compatibility directives.

Since the electromagnetic compatibility of the total measuring system depends as well 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 guaranteed.

"Ex-Type"-flow meters from VSE are authorized for use in explosion hazardous areas and comply with the safety requirements of the ATEX directive 2014/34/EU and the relevant European standards. These flow meters are certified by an accredited body. The certificate can be found in this operation manual. A copy of the declaration of conformity is to be supplied with each "Ex-Type" product that is delivered.

## 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 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 compensating cable 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 **isolating switching amplifier and evaluation unit** correctly 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 **explosion protection and 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 "VHM"  $p_{\max} = 250 \text{ bar} / 3600 \text{ psi}$
- Flow meter "VHM Titan"  $p_{\max} = 10 \text{ bar} / 145 \text{ psi}$

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

VSE flow meters are classified as „piping“ under Article 2, No. 3 of the aforementioned Directive and are therefore subject to this Directive. According to Article 4, paragraph (1c), VSE flow meters must comply with the technical requirements specified in Article 4 of the Directive. Only fluids of Group 2, according to Article 13, paragraph (1b) may be measured with the flow meters. If (hazardous) fluids of Group 1 are to be measured, VSE must be consulted.

The flow meters offered by VSE do not reach the limit values specified in Article 4, paragraph (1c) (ii). The technical requirements for VSE flow

meters are therefore limited to the criteria set out in Article 4, paragraph (3). This means that the devices must be designed and manufactured in accordance with good engineering practice in a Member State, which is hereby confirmed.

The paragraph also specifies that these units must not bear the CE marking referred to in Article 18. Therefore, a CE declaration of conformity is not issued in accordance with Directive 2014/68/EU.

The CE marking of our flow meters refers to Directive 2014/30/EU + Directive 2014/34/EU for our Ex-type flow meters.

## 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  $21 \text{ mm}^2/\text{s}$  at a temperature of  $20^\circ\text{C}$ . For this flow meter range, VSE specifies measurement accuracy of up to 0.5% of the measurement value and a repetition accuracy of 0.5%.

For viscosities from 1 to  $10 \text{ mm}^2/\text{s}$ , a measuring accuracy of up to 1.0% of the measured value and a repeatability of 0.5% is given.

### 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 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.

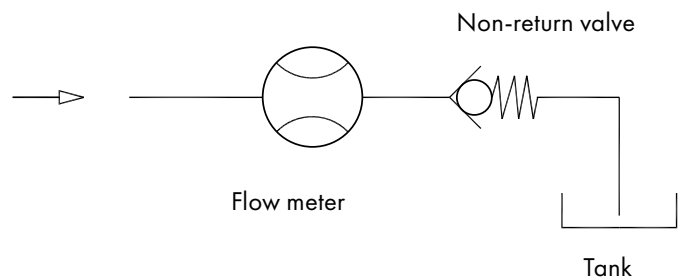


Fig. 1: Flow meter installation with non-return valve

### 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 "VHM" product line can be mounted directly onto a subplate installed in the pipe line. 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 "VHM" 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 subplate with cheese head screws.

Tighten the screws by hand. In special cases, the flow meter can also be mounted directly in the pipe.

**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.**



## 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 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 VHM 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. A blocking flow meter can stop the whole flow.**



## 12. FLOW METER FOR EXPLOSION HAZARDOUS AREAS

The operation of flow meters in areas with a hazard of explosion is subject to very specific legal regulations. For this reason, only flow meters with a registered certification are permitted to be used in explosion hazardous areas.

To protect people from harm and equipment from damage, national and international regulations must be followed when using electrical components and systems in explosion hazardous areas.

Danger of explosion can arise when handling flammable substances. A hazardous situation occurs when these gaseous substances mix with oxygen have reached a dangerous level.

In this case a potential source of ignition like sparks or higher temperatures can lead to an explosion, which can injure people and damage plants or buildings.

All electrical devices which are used in explosion hazardous areas must be approved and marked for the relevant Ex-zone.

The Ex-zone classification depends on the frequency and duration of the explosive atmosphere and must be specified by the operator of the plant.

Ex-Type flow meters from VSE are suitable for intrinsically-safe "ia/IS" circuits and are certified for Zone 0/Division 1 (gas) . They must always be operated with an isolating switching preamplifier.

Intrinsically safe and non-intrinsically safe circuits must always be wired separately. You can find relevant connection diagrams under "Installation of VSE flow meter in hazardous areas".

The Ex-Type VHM is approved for II 1G EX ia IIC T6 Ga .

The permitted ambient and media (fluid) temperatures for the Ex-Type VHM flow meter are classified for the corresponding temperature classes (T4, T5 or T6) and must be observed!

Please see "Maximum ambient and media temperatures".

The system Ex-Type flow meter and isolating switching amplifier is based on in-trinsically safe circuits. The devices are approved by authorised bodies for use in those countries to which the approval applies.

For correct usage in explosion hazardous areas please observe and follow the national regulations and directives strictly. Following please find some guidelines referring to the actual frame-work directive of the European Union (ATEX), of the US (NEC) or of the corresponding country.

The isolating switching amplifier, which is delivered by VSE, is classified as associated apparatus which is equipped with an intrinsically safe and a non-intrinsically safe circuit. It may only be installed in the non-explosion hazardous area in dry clean and well monitored locations.

The Ex-type flow meter is wired to the blue intrinsically safe terminals of the preamplifiers as intrinsically safe equipment.

Please note:

Once that intrinsically safe circuit has been connected to the non-intrinsically safe circuit, it is not permitted to use the device subsequently as intrinsically safe equipment.

The Ex-Type VHM must be operated by isolating switching preamplifier.

The VSE-Cable for the intrinsically safe circuit is also marked with blue color. It must be separated from the non-intrinsically safe circuit.

Please observe the specified clearances between the intrinsically safe connections and the grounded components and connections of other devices.

If the flow meter or an isolating switching preamplifier is opened by a person other than the manufacturer the approval becomes void.

### **Important:**

**The installation and connection of the Ex-Type flow meter and the isolating switching amplifier are only to be performed by trained and qualified personnel with knowledge of the relevant national regulations to explosion protection.**

**The most important data of the Ex-Type flow meter can be found under the corresponding "Safety data" of this manual.**






### 13. INSTALLATION OF VSE FLOW METERS IN EXPLOSION HAZARDOUS AREAS

The following figures show the connection diagrams for Ex-Type VHM flow meters for use in areas subject to an explosion hazard. Please connect each piece of equipment as shown in the diagram. Isolating switching amplifiers also contain non-intrinsically-safe circuits and may not be installed in hazardous areas.

VSE supplies connection cables for EMC-safe operation in which the shield is seated on the union nut of the four-pin circular connector. It is not necessary to connect the shield to a ground connection at the other end of the connection cable, but it is recommended.

You must always make sure that the grounded conductor "PE" is correctly connected with the flow meter and that no voltage differences can arise between the grounded conductor PE connections (flow meter » isolating switching amplifier » electronic signal processor). To accomplish this, always install an extra wire connection (about Ø 4 ... Ø 6 mm<sup>2</sup>) between each of the pieces of equipment (see the PE arrows in the following figures) or connect every single PE connection point in a star configuration to a specific location on the grounded conductor PE. There is a terminal for this on the flow meter. A conductor with a minimum diameter of 4 mm<sup>2</sup> can be connected here.

**Important:**  
**Mounting and installation must always be performed according to the locally applicable regulations and the operator of the plant is responsible for ensuring that these regulations are complied with.**  
**You must make sure that no voltage differences can arise between the pieces of equipment and must install potential equalization!**  
**Please particularly observe the safety instructions in this manual.**



The connection diagram in figure 5 shows the processed signal from the flow meter. With this measuring system you can measure the flow rate and the volume in one direction.

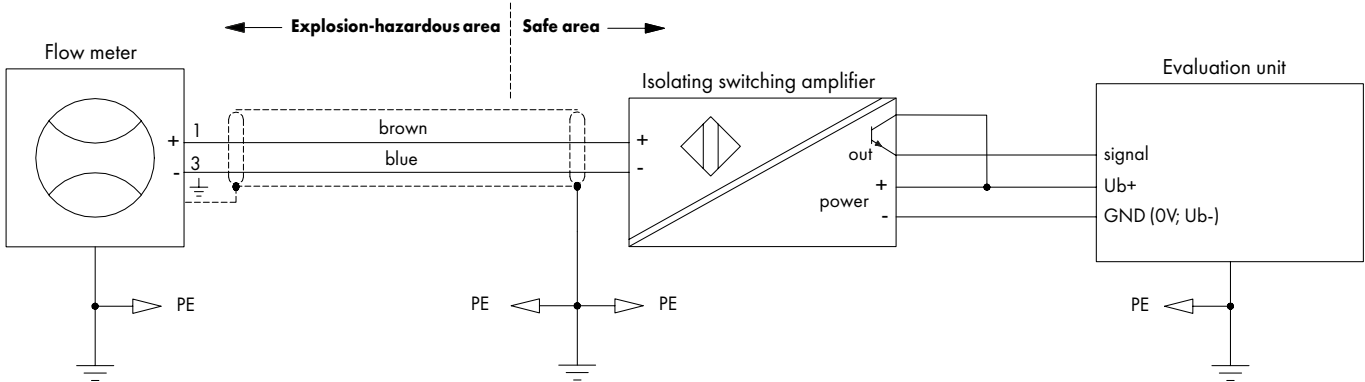


Figure 5: Connection diagram for the Ex-Type VHM measuring system

**Important:**  
**Persons assigned or contracted to install, commission and operate the devices must have relevant qualifications for the job. In particular, they must have knowledge of explosion protection.**



## 14. CONTROL DRAWING

### Hazardous (Classified) Location

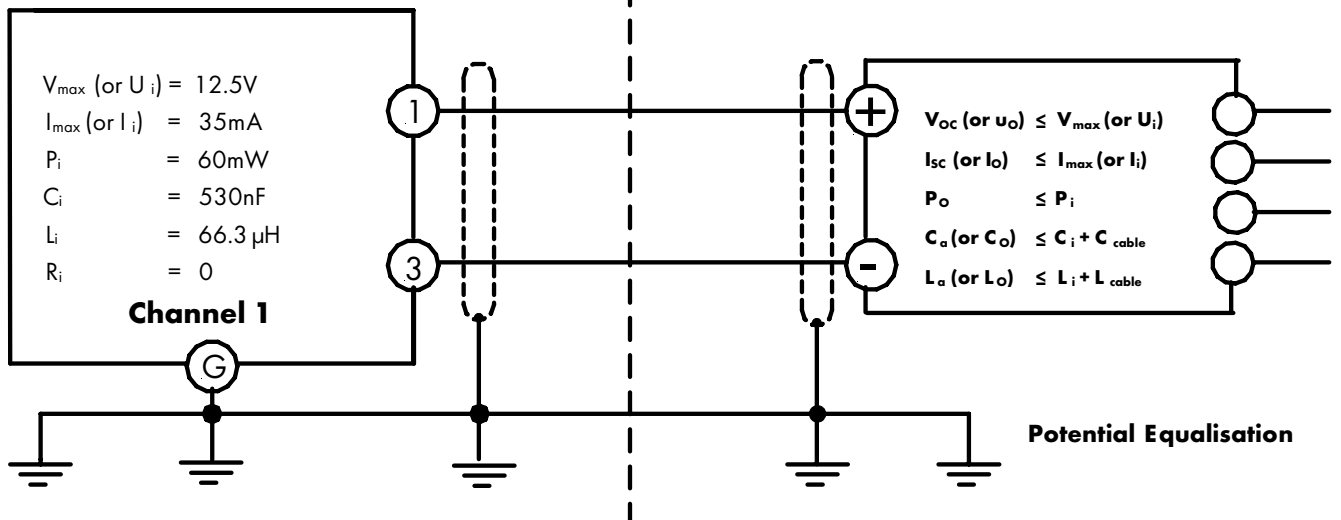
Class I, Division 1, Groups A, B, C & D T4...T6

Note: T4...T6 temperature code based on 50°C (122°F)

**VHM\*-\*\*\*\*\*/\*-V\*L-\*S\*\*/Ex-NAMUR**  
**VHM\*-\*\*\*\*\*/\*-V\*L-\*S\*\*/Ex-M**

### Unclassified Location

**ASSOCIATED APPARATUS  
WITH ENTITY PARAMETERS**



1. The installation must be in accordance with the National Electrical Code, NFPA 70, Articles 504 and 505, and ANSI/ISA-RP12.06.01.

2. The Flow Meter Systems Serie VHM\*-\*\*\*\*\*/\*-V-L-\*S\*\*/Ex-NAMUR and VHM\*-\*\*\*\*\*/\*-V-L-\*S\*\*/Ex-MK is suitable for use in Class I, Division 1 and Zone 0 (AEx ia) applications. If connected to Associated Apparatus the Flow Meter System VHM\*-\*\*\*\*\*/\*-V-L-\*S\*\*/Ex-NAMUR or VHM\*-\*\*\*\*\*/\*-V-L-\*S\*\*/Ex-MK may be used in areas classified as Zones. . If connected to AEx [ib] Associated Apparatus, the flow meter system may only be used in Zone 1 or 2 Hazardous (Classified) Locations.

3. In order to suppress inductive interference, a connecting cable with the shield bearing on the coupling nut of the four-pole circular plug-in connector must be used during the installation of the flow meter. In explosionprone areas the flow meter is connected to the ground potential. The greatest care must be taken to ensure that between each end of the electrical circuit (i.e. between the explosive area and the non-explosive area) potential equalisation exists.

**Drawing No. V 06 6 08 4c**

## 15. PREAMPLIFIERS FOR EX-TYPE VHM SERIES

### General information

The preamplifiers are supplied in different versions depending on the application. There are single and dual pick-ups available. The basic method used to sense and measure is the same for both versions and is based on the carrier frequency principle.

When a dual pickup is used, you simply double or quadruple the number of pulses depending on the setting. All versions must be operated with the isolating switching amplifier.

### The single pick-up

The single pick-up operates with a carrier frequency oscillator that is modulated whenever a tooth passes by. This modulation is evaluated by the subsequent preamplifier electronics and generates a modulated digital current signal that is amplified and digitized by the isolating

switching amplifier. The number of pulses is proportional to the volume delivered. The flow rate can then be evaluated from the frequency of this pulse signal.

### The dual pick-up

The dual pick-up operates with two independent carrier frequency oscillators that are modulated whenever a tooth passes by. The electronics generates a pulse signal for each modulation. The pulses from both pick-up systems are combined in the subsequent preamplifier electronics and output as a double pulse for each tooth. If necessary, you can select pulse quadrupling by changing an internal jumper, please note

that the flow rate range is reduced with this setting. The output signal from the preamplifier is also a current-modulated pulse signal that is amplified and digitized by the isolating switching amplifier. The volume of fluid and the flow rate can be evaluated from the number of pulses and the frequency.

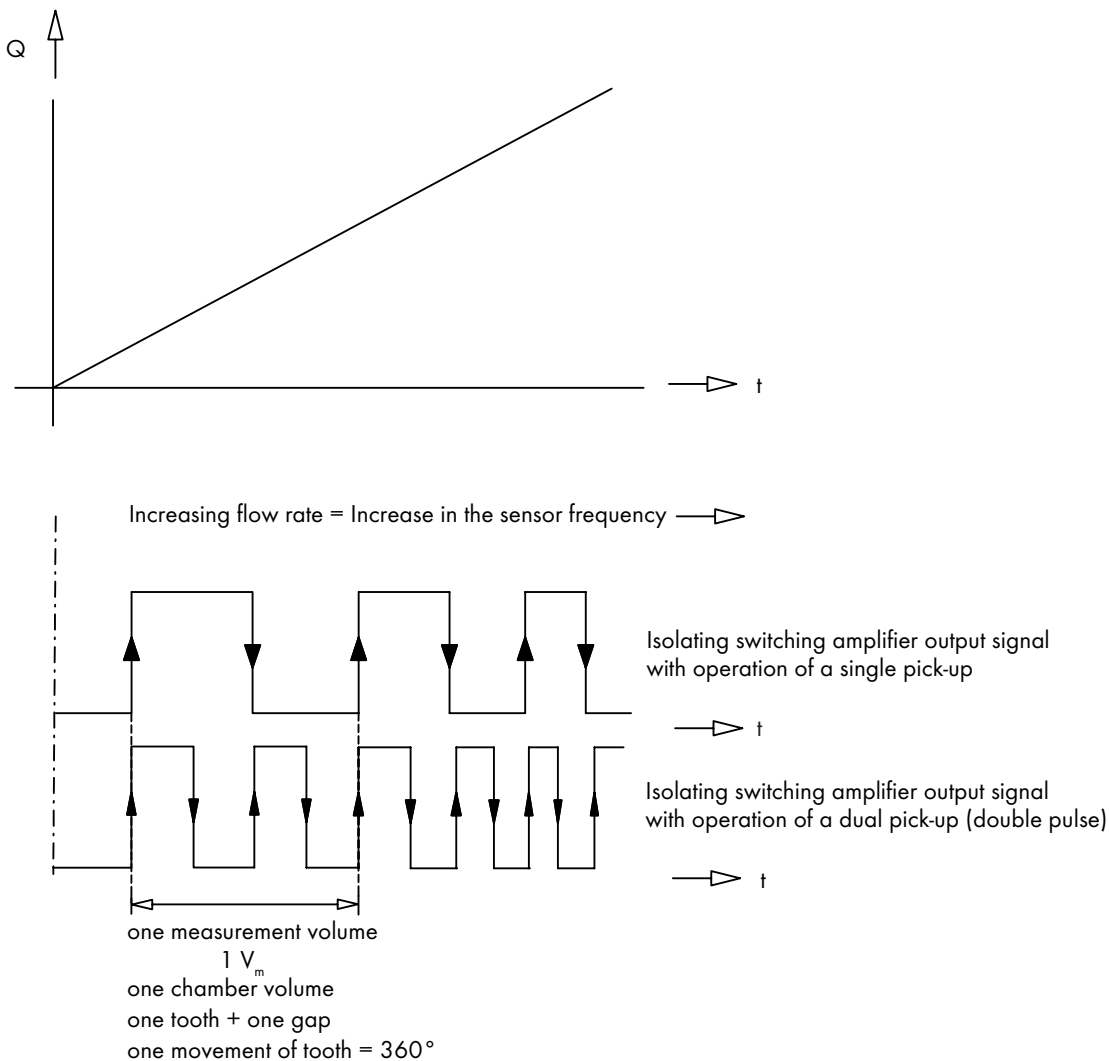


Figure 7: Signal output

## 16. APPLICATION WITH DIRECTION DETECTION

If it is necessary to detect the direction of flow, the VHM-flow meter must be operated with two single pick-ups with different carrier frequencies of type VIL\*-S\*\*/EX-NAMUR and VTL\*-S\*\*/EX-NAMUR. The pick-ups generate two pulse signals with a phase offset of 90°.

Each of the pick-ups is operated with an isolating switching amplifier. Also it is possible to increase the resolution, when you process the rising and falling edges from both channels (1/4 Vm).

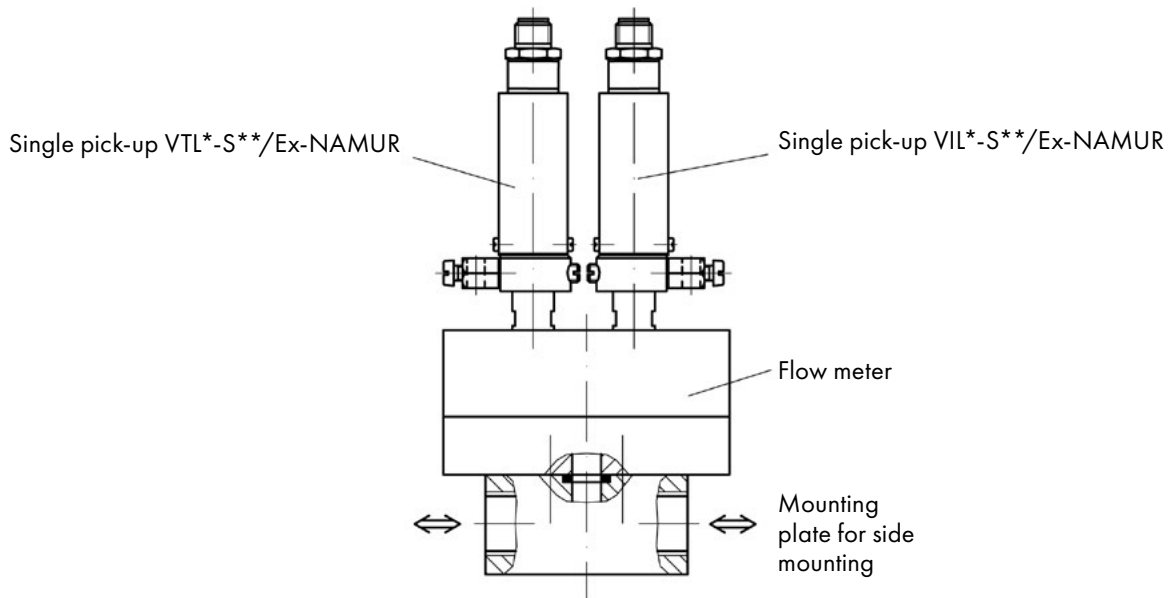


Figure 8: VHM-flow meter with direction detection

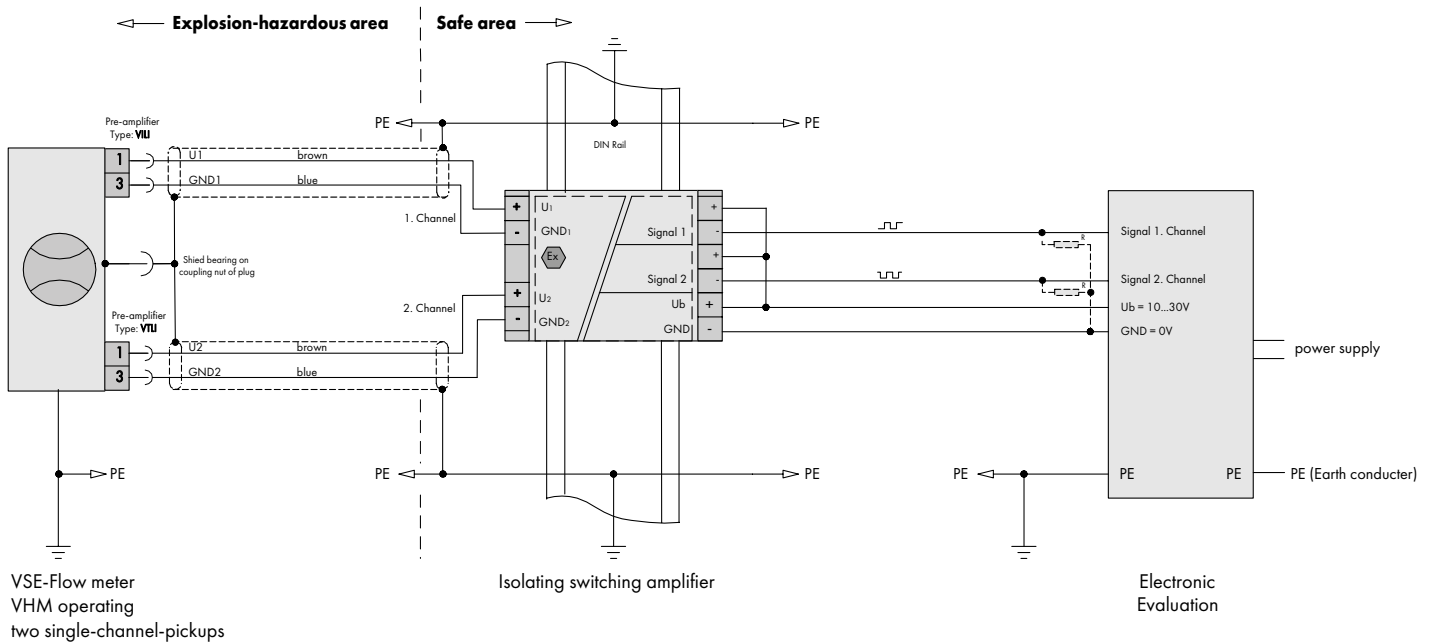


Figure 9: Application with direction detection

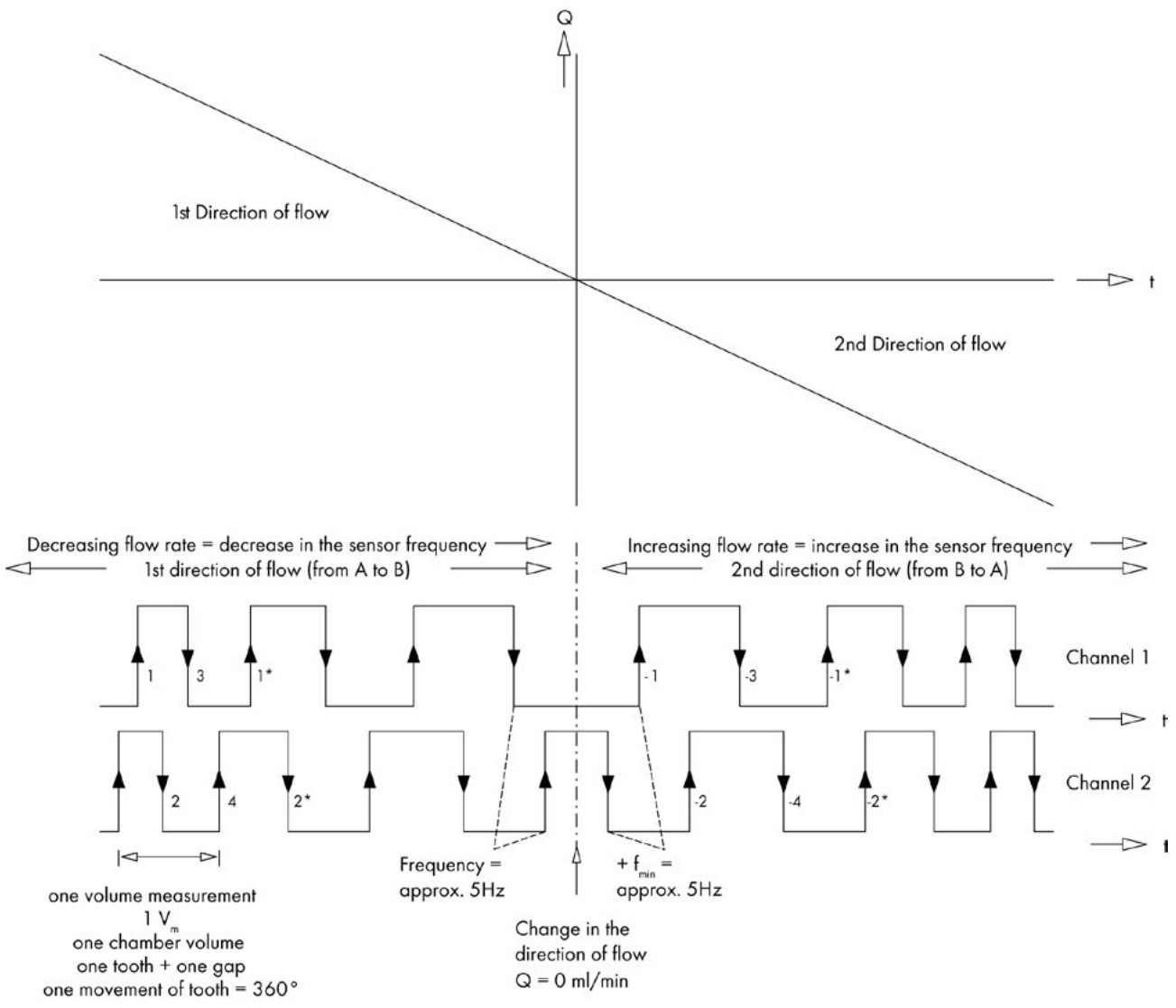


Figure 10: Signal output with two single pick-ups (Ex-type)

## 17. SAFETY INSTRUCTIONS FOR INSTALLATION AND OPERATION IN HAZARDOUS AREAS

1. Only qualified personnel, meaning authorized persons with special explosion protection training, are permitted to install explosion-protected equipment and systems!
2. The qualified personnel must have read and understood the installation regulations and the corresponding type Examination Certificates and Declarations of Conformity!
3. Work may only be done on the devices in a de-energized state!
4. Before you operate the flow meter, you must carefully clean and rinse the entire system so that no foreign particles from the installation can get into the measuring unit of the flow meter.
5. The pipes and the flow meter must always be filled in operation so that no gas bubbles can form!
6. Extremely dirty media or foreign particles in the medium can block, damage or even destroy the measuring unit. In these cases you should always install a sufficiently rated filter ahead of the flow meter so that no foreign particles or substances can get into the measuring unit and damage the flow meter.
7. The permissible ambient and media temperatures in the corresponding temperature class may not be exceeded at any time, when operating the flow meter.
8. You may not change or extend the devices in any way, if the modifications were not expressly permitted by the manufacturer. If changes are made to the preamplifier electronics or the isolating switching amplifier, the explosion protection becomes invalidated.
9. The VSE flow meters are not authorized for use in areas subject to a dust explosion hazard!
10. To suppress inductive interference, you must use a connection cable in which the shield is seated on the union nut of the four-pin circular connector. In Ex-hazardous areas, the flow meter is connected to a ground potential. You must be extremely certain that there is an equalization of potential between each end of the circuit. The potential equalization of the ground conductor PE must be present throughout the entire area.
11. The operator of the plant must maintain the system in proper operating condition, operate the system properly, monitor it constantly, perform the necessary maintenance and any related work immediately, and follow the relevant safety regulations, when doing so.
12. VSE supplies special flow meters from the VHM series, when the flow meter is to be operated in a Ex-hazardous area. These flow meters are authorized for use in Ex-hazardous areas and must always be operated in conjunction with isolating switching amplifiers that guarantee intrinsic safety and are Ex-certified. The intrinsically safe circuits are marked in blue and offer the safety level required for explosion protection!
13. The isolating switching amplifier must guarantee the "ia/IS" level of intrinsic safety of the signal circuit, and their limit values may not exceed the highest permitted input value of the flow meter.
14. When equipment is connected electrically, a "Verification of Intrinsic Safety" must be performed according to the actual regulations and standards. Even if an intrinsically safe circuit is connected just once to a non-intrinsically safe circuit, then the piece of equipment is not authorized for use anymore as a device with intrinsically safe circuits. This applies to the isolating amplifiers as well as the flow meters. The relevant, applicable regulations apply to the installation of intrinsically safe circuits, the mounting of external connectors, the properties and routing of lines and cables. Cables and terminals with intrinsically safe circuits must be labeled accordingly and must be isolated from non-intrinsically safe circuits or be equipped with appropriate isolation according to the actual standards.
15. The sum of the maximum effective capacitance  $C_i$  and inductivity  $L_i$  of the flow meter and the four-pin connection cable may not exceed the maximum values  $C_0 (C_a)$  and  $L_0 (L_a)$  of the corresponding isolating switching amplifier. Pay attention to the manufacturer's specifications for the connection cable and to the lengths of the cables used.
16. It must be especially observed that the radial thickness of the insulation of a conductor have a minimum thickness of 0.2 mm. The diameter of a finely stranded conductor must not be smaller than 0.1 mm. The ends of the conductor have to be protected against fanning out, e.g. by ferrules.  
In addition to this the sheath insulation must be tested in respect of electrostatic charge to ensure a safe use in the intrinsically safe area. The VSE-Ex-cable corresponds to these requirements.
17. It must be especially observed that for the use of devices with two safe power circuits in a cable. Here please observe the corresponding regulations and standards (e.g. EN60079-14; part 12.2.2.7/8). An installation firm and protected against damages is always necessary for this kind of operation.
18. When operating or performing maintenance or repairs on the flow meter, the surface of the flow meter housing must be safely protected from impact or sharp edges, tools or other items!
19. The flow meter parts contain shares of aluminum, magnesium, titan and /or zirconium. The generation of impacts and friction, especially between different metals, must be prevented so that the production of sparks is ruled out!
20. The marking on the typeplate must stay readable.



## 18. MAINTENANCE, SERVICE LIFE AND WARRANTY

Depending on the operating conditions, the service life and specific properties of the flow meter are limited by wear, corrosion, deposits, or ageing. The operator is responsible for regular inspection, maintenance, and recalibration. In case of detected malfunctions or damage, operation must be immediately stopped. On request, we can provide a

replacement flow meter for the duration of the repair. We recommend an annual inspection and recalibration. Under normal operating conditions, the service life is approximately 10,000 hours. The warranty period is 12 months.

## 19. STORAGE, RETURN AND DISPOSAL

### Temporary storage

All VSE flow meters are delivered with sealing plugs and in suitable packaging for all destinations and transport types, ensuring optimal protection. The flow meters should always be stored in their original foam packaging or transport boxes. The flow meters must not be exposed to temperatures below  $-20^{\circ}\text{C}$  or above  $+40^{\circ}\text{C}$  and must be protected from direct sunlight and moisture or its effects. The maximum storage period is 48 months. If the maximum storage time is exceeded, the flow meter must be disassembled by the manufacturer VSE or an authorised service partner. This includes cleaning, replacing the seals, and recalibration.

### Return

1. The flow meter must be properly cleaned before being returned to prevent the risk of poisoning/contamination of humans and the environment from harmful, explosive, or otherwise hazardous media.
2. If media have been measured whose residues can cause corrosion or ignite on contact with oxygen, the flow meter must be additionally neutralised and thoroughly dried with anhydrous, inert gas.
3. The return of the flow meter must always include a fully completed declaration of non-objection (see page 38). All applied safety and decontamination measures must be specified.
4. When returning the flow meter, it must be packed according to applicable logistics standards and sealed with sealing plugs.

### Disposal

VSE actively promotes environmental protection and is certified according to ISO 9001:2015 (Environmental Management). The environmental and human impact should be minimised during production, storage, transport, use and disposal of our products and solutions:

- Collect rinsing liquid as well as residual fluids and dispose them according to statutory provisions and regulations.
- Wear protective clothing and a protective mask/goggle if necessary.

Materials must be properly disposed of as follows:

- Metal
- Plastics
- Electronic components
- etc.

Disposal must comply with the waste-related regulations and requirements of the respective destination country!

## 20. TECHNICAL DATA FOR THE VHM FLOW METER

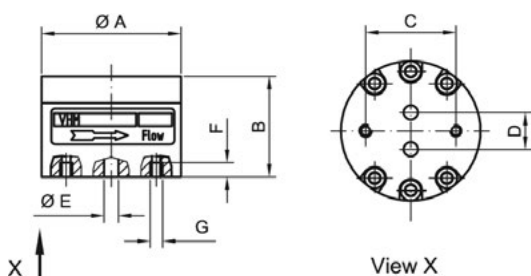
Size	Measurement Range l/min	Measured Volume $V_m$ ml/imp.	Frequency Hz	K-factor imp./liter
VHM 01-2	0.01 ... 1	ca. 0.045	ca. 3.7 ... 370.0	ca. 22,200
VHM 02-1	0.05 ... 2	ca. 0.120	ca. 6.9 ... 278.0	ca. 8,800
VHM 02-2	0.10 ... 4	ca. 0.225	ca. 7.4 ... 296.0	ca. 4,400
VHM 02-3	0.40 ... 8	ca. 0.450	ca. 14.8 ... 296.0	ca. 2,200
VHM 03-2	0.50 ... 20	ca. 1.010	ca. 8.25 ... 330.0	ca. 1,000

The exact data can be found in the calibration report.

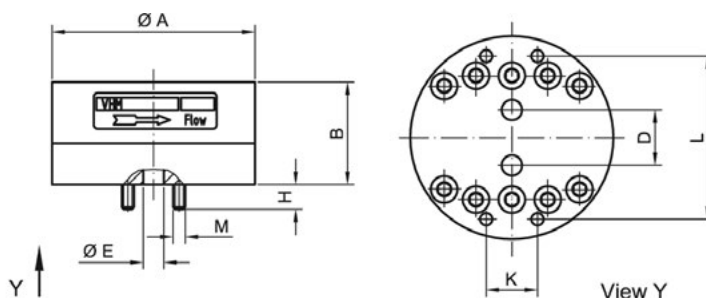
<b>Measurement accuracy</b>	± 0.5 % of the measured value (at viscosities > 10 mm <sup>2</sup> /s) ± 1 % of the measured value (at viscosities 1 – 10 mm <sup>2</sup> /s)
<b>Repeating accuracy</b>	± 0.5 % under the same operating conditions
<b>Materials</b>	Gear housing: stainless steel 1.4404 Gears: stainless steel 1.4462 Gear bearings: tungsten carbide Preamplifier housing: stainless steel 1.4305 or aluminum
<b>Gear bearings</b>	Sleeve bushing, ball bearings (optional)
<b>Seals</b>	FEP with FPM core (standard) or PTFE
<b>Max. operating pressure</b>	250 bar / 3600 psi
<b>Medium temperature (Ex-type)</b>	-20°C ... +70°C (-4°F ... 158°F)
<b>Ambient temperature</b>	-20°C ... +50°C (-4°F ... 122°F)
<b>Viscosity range</b>	1 ... 20,000 mm <sup>2</sup> /s
<b>Installation position</b>	Any
<b>Direction of flow</b>	See the direction of the arrow on the flow meter
<b>Mounting</b>	On the mounting plate with piping connections or as a piping system (custom version).

## 21. DIMENSIONS FOR VHM FLOW METERS

### VHM 01/02



### VHM 03



Type	øA	B	C	D	øE	F	G	K	L	M	H	Weight kg
VHM 01-2	68	29	44	12	4	6	M6					0.750
VHM 02-1	68	29	44	18	6	6	M6					0.740
VHM 02-2	68	34	44	18	6	6	M6					0.860
VHM 02-3	68	43	44	18	6	6	M6					1.075
VHM 03-2	99	50		27	10			25	81	M6	12	2.700

Dimensions in mm

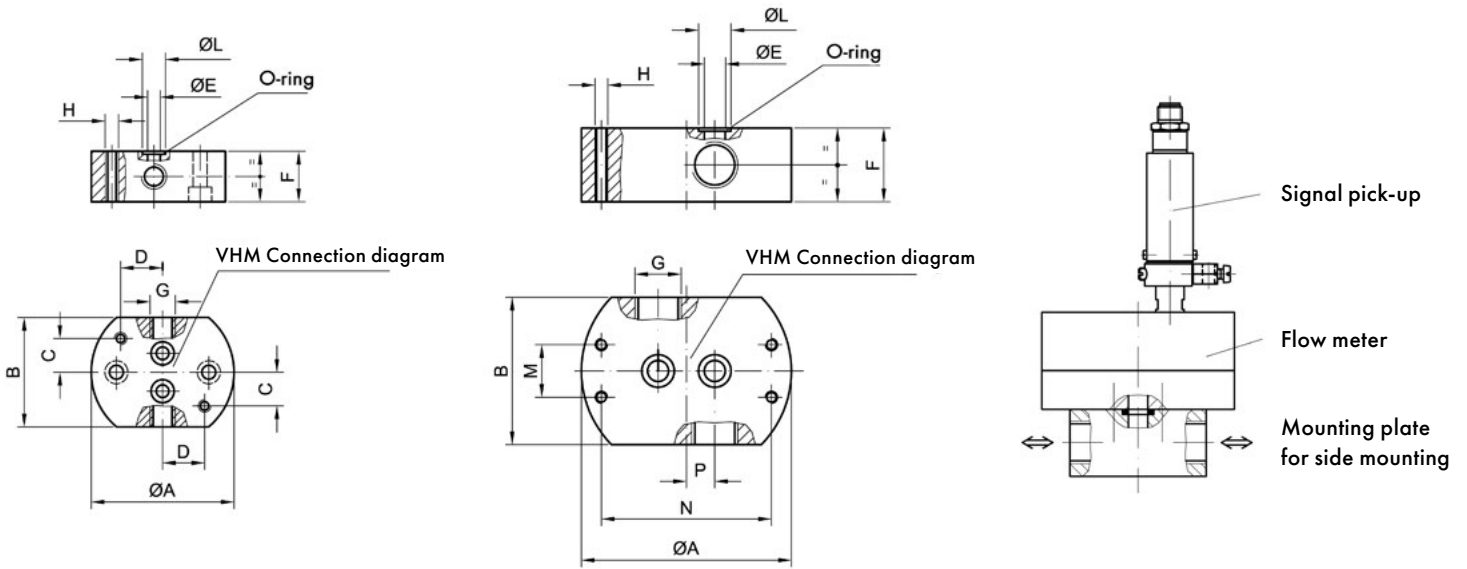


## 22. DIMENSIONS OF THE AHM MOUNTING PLATE

**AHM 01/02** for side mounting

**AHM 03** for side mounting

Position of the cable connections

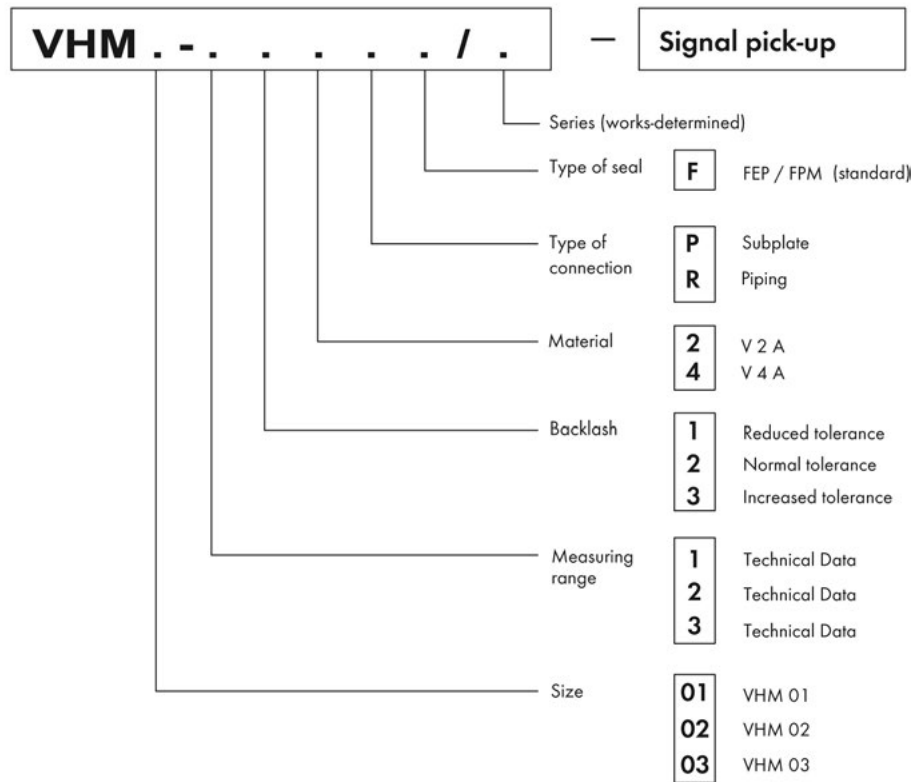


Permissible Size VHM	G	ø A	B	C	D	øE	F	H	øL	M	N	P	O-ring
01-1	G 1/8"	68	52	16	20	4	24	M6	9.4				6.07 x 1.78
	G 1/4"												
02 - 1, 2, 3	G 1/8"	68	52	16	20	6	24	M6	11				7.65 x 1.78
	G 1/4"												
	1/8" NPT												
	1/4" NPT												
03	G 3/8"	100	70			10	35	M6	15.5	25	81	13.5	12.42 x 1.78
	G 1/2"												
	3/8" NPT												
	1/2" NPT												

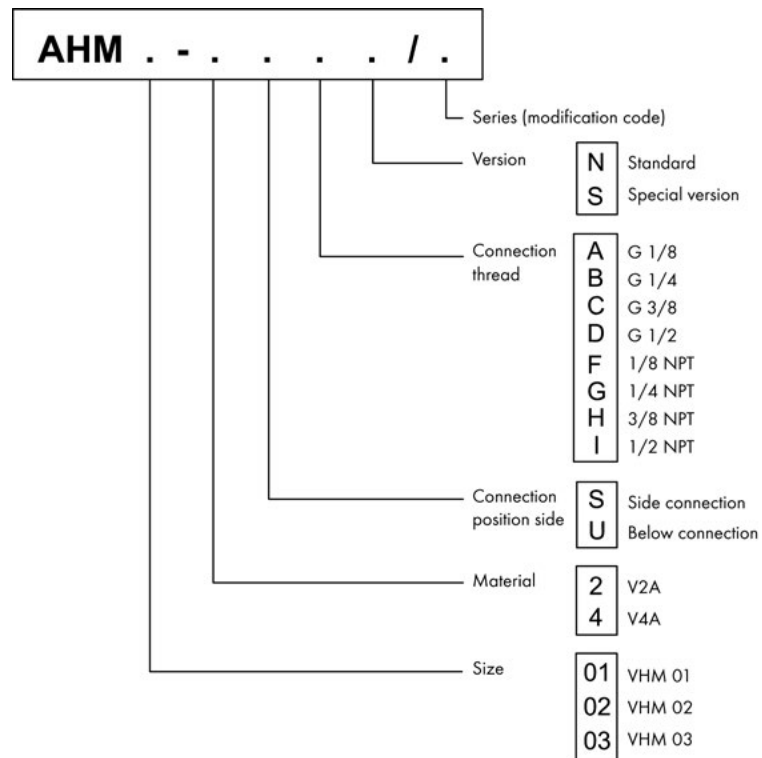
Dimensions in mm

## 23. TYPE CODE FOR VHM, AHM

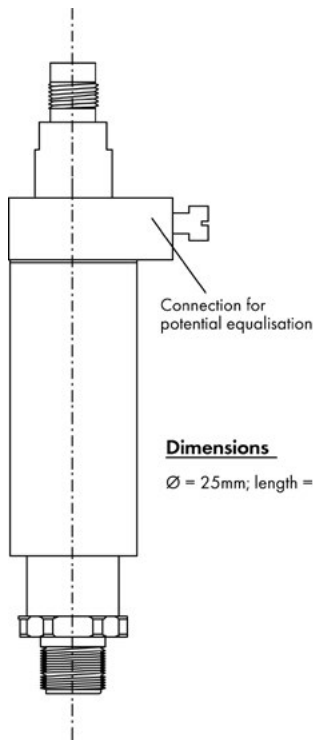
### VHM flow meter



### AHM mounting plate

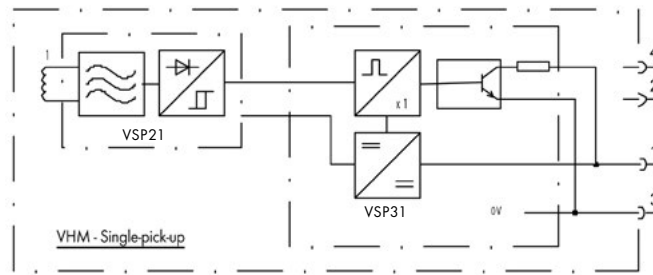


## 24. TECHNICAL DATA FOR SINGLE PICK-UPS VIL\*-S\*\*/EX-NAMUR/MK, VTL\*-S\*\*/EX-NAMUR/MK

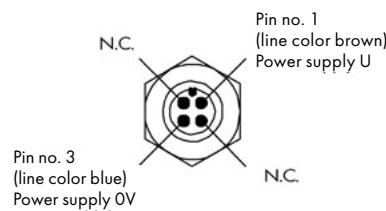


**Dimensions**

Ø = 25mm; length = 119 mm



**Block diagram**




**Pin configuration**

**Type Plates**


**VSE** flow Hönnestrasse 49  
58809 Neuenrade / Germany  
Type: VIL\*-S1\*/Ex-NAMUR  
Serial-No.: \*\*\* Manufacture: \*\*/\*\*  
**IECEX BVS 23.0024X**  
**BVS 23 E 035 X**  
**II 1 G Ex ia IIC T6 Ga**  
U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
T<sub>med.</sub> = -20°C ... 70°C T<sub>amb.</sub> = -20°C ... 50°C

**VSE** flow Hönnestrasse 49  
58809 Neuenrade / Germany  
Type: VIL\*-S1\*/Ex-MK  
Serial-No.: \*\*\* Manufacture: \*\*/\*\*  
**IECEX BVS 23.0024X**  
**BVS 23 E 035 X**  
**II 1 G Ex ia IIC T6 Ga**  
U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
T<sub>med.</sub> = -20°C ... 70°C T<sub>amb.</sub> = -20°C ... 50°C

**VSE** flow Hönnestrasse 49  
58809 Neuenrade / Germany  
Type: VIL\*-S1\*/Ex-NAMUR  
Serial-No.: \*\*\* Manufacture: \*\*/\*\*  
IS Cl 1 Div1 GRPS A, B, C, D T6  
**ENTY Parameters:**  
U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
T<sub>4...T6@T<sub>amb.</sub></sub> = -20°C (-4°F) ... +50°C (122°F)  
T<sub>4...T6@T<sub>Med.</sub></sub> = -20°C (-4°F) ... +70°C (158°F)  
FM23US0010X CTL.DWD.V06 6 08 4c



**VSE** flow Hönnestrasse 49  
58809 Neuenrade / Germany  
Type: VIL\*-S1\*/Ex-MK  
Serial-No.: \*\*\* Manufacture: \*\*/\*\*  
IS Cl 1 Div1 GRPS A, B, C, D T6  
**ENTY Parameters:**  
U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
T<sub>4...T6@T<sub>amb.</sub></sub> = -20°C (-4°F) ... +50°C (122°F)  
T<sub>4...T6@T<sub>Med.</sub></sub> = -20°C (-4°F) ... +70°C (158°F)  
FM23US0010X CTL.DWD.V06 6 08 4c



**Electronic Connection data**

**EC-Type Examination Certificate** IECEX BVS 23.0024X; BVS 23 ATEX E035X; FM23US0010X

**Type Code** VIL\*-S\*\*/Ex-NAMUR/MK;  
VTL\*-S\*\*/Ex-NAMUR/MK

**Certification** **Ex** II 1G Ex ia IIC T6 Ga  
IS Cl 1 Div1 GRPS A, B, C, D T6

**Nominal voltage** 8 ... 10.5 V

**Switching currents** I<sub>Low</sub> < 1.2 mA; I<sub>High</sub> > 2.1 mA (NAMUR)  
I<sub>Low</sub> < 2.7 mA; I<sub>High</sub> > 3.7 mA (MK)

**Signal frequency** 5 Hz – ca. 1000 Hz (\*)

**Max. input voltage** U<sub>i</sub> ≤ 12.5 V

**Max. input current** I<sub>i</sub> ≤ 35 mA

**Max. power consumption** P<sub>i</sub> ≤ 60 mW

**Internal inductance** L<sub>i</sub> ≤ 66.3 µH

**Internal capacitance** C<sub>i</sub> ≤ 530 nF

**Additional equipment** isolated switching amplifier

(\*) Depends on the size of the flow meter

**Housing data**

**Dimensions** Ø = 25 mm; l = 119 mm

**Protection class** IP 64

**Material** Stainless steel 1.4305

**Weight** 115 g

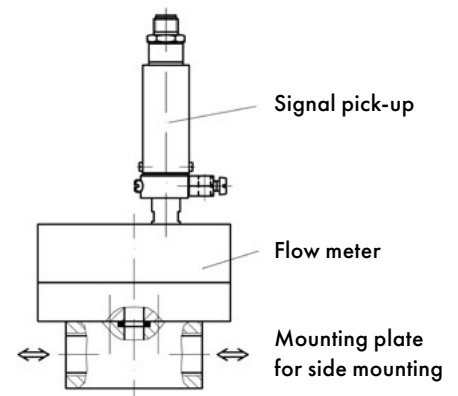
**Max. surface temperature** T<sub>4</sub> ... T<sub>6</sub> = 80°C (176°F)

**Ambient temperature** -20°C ... 50°C (-4°F ... 122°F)

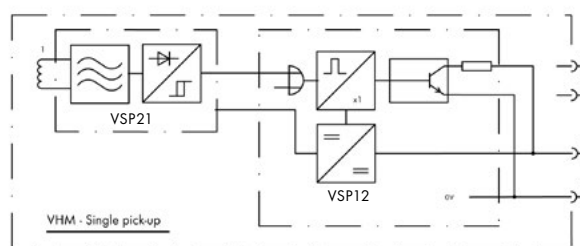
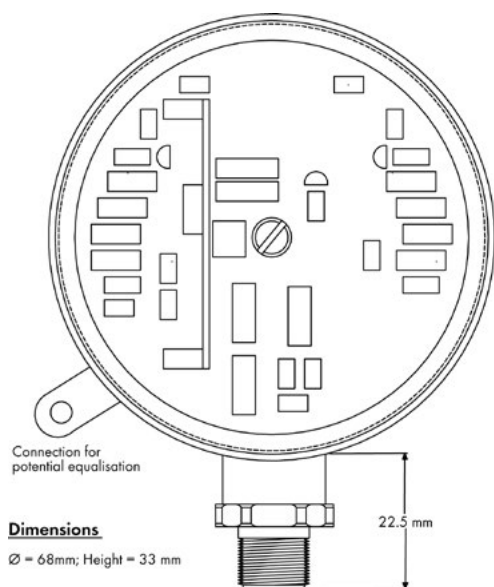
**Seals** FPM

**Coil encapsulating** 2K-Epoxy

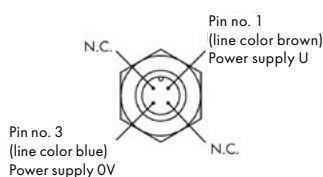
**Connector** VSE Standard Connector M12



## 25. TECHNICAL DATA FOR SINGLE PICK-UPS VEL\*-\*S\*\*/EX-NAMUR/MK



**Block diagram**

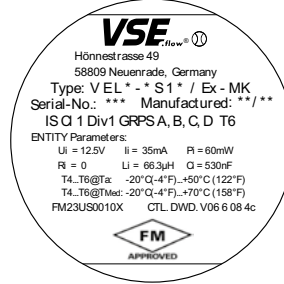
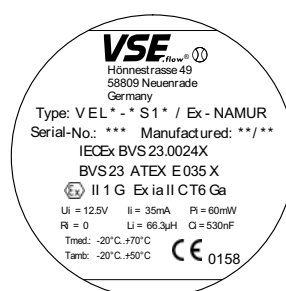


**Pin configuration**

### Electronic connection data

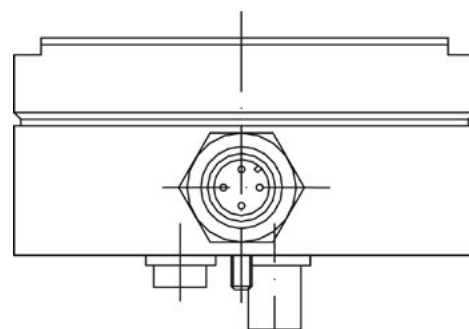
<b>EC-Type Examination Certificate</b>	IECEX BVS 23.0024X; BVS 23 ATEX E035X; FM23US0010X
<b>Type Code</b>	VEL*-*S**/Ex-NAMUR/MK
<b>Certification</b>	II 1G Ex ia IIC T6 Ga; IS Cl 1 Div1 GRPS A, B, C, D T6
<b>Nominal voltage</b>	8 ... 10.5 V
<b>Switching currents</b>	$I_{Low} < 1.2 \text{ mA}; I_{High} > 2.1 \text{ mA}$ (NAMUR); $I_{Low} < 2.7 \text{ mA}; I_{High} > 3.7 \text{ mA}$ (MK)
<b>Signal frequency</b>	5 Hz – 800 Hz
<b>Max. input voltage</b>	$U_i \leq 12.5 \text{ V}$
<b>Max. input current</b>	$I_i \leq 35 \text{ mA}$
<b>Max. power consumption</b>	$P_i \leq 60 \text{ mW}$
<b>Internal inductance</b>	$L_i \leq 66.3 \mu\text{H}$
<b>Internal capacitance</b>	$C_i \leq 530 \text{ nF}$
<b>Additional equipment</b>	isolating switching amplifier

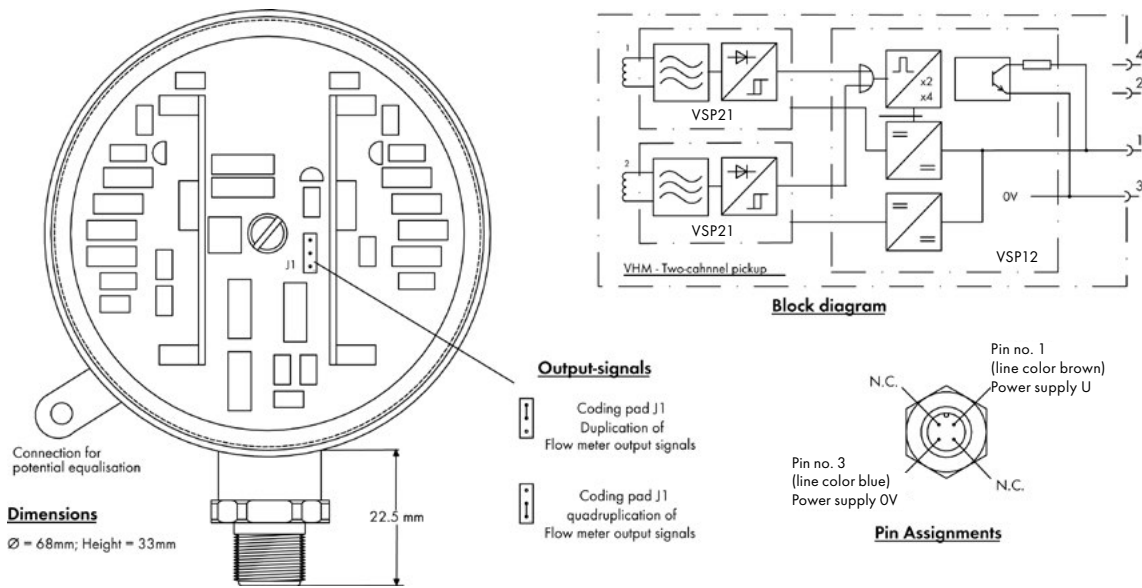
### Type Plates



### Housing Data

<b>Dimensions</b>	Ø = 68 mm; h = 33 mm
<b>Protection class</b>	IP 64
<b>Material</b>	Anodized blue aluminum Stainless steel 1.4305 (coil)
<b>Weight</b>	165 g
<b>Max. surface temperature</b>	T4 ... T6 = 80°C (176°F)
<b>Ambient temperature</b>	-20°C ... 50°C (-4°F ... 122°F)
<b>Seals</b>	FPM
<b>Coil encapsulating</b>	2K-Epoxy
<b>Connector</b>	VSE Standard Connector M12





**Electronic connection data**

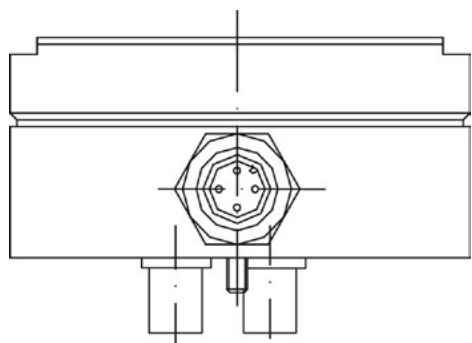
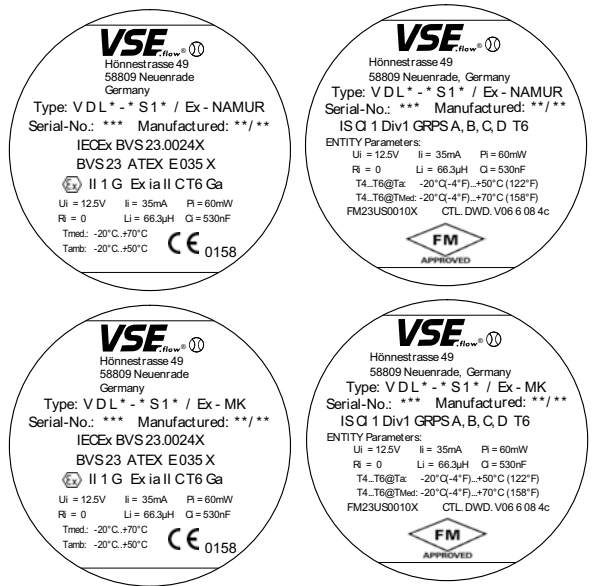
<b>EC-Type Examination Certificate</b>	IECEX BVS 23.0024X; BVS 23 ATEX E035; FM23US0010X
<b>Type Code</b>	VDL*-S**/Ex-NAMUR/MK
<b>Certification</b>	Ex II 1G Ex ia IIC T6 Ga; IS CI 1 Div1 GRPS A, B, C, D T6
<b>Nominal voltage</b>	8 ... 10.5 V
<b>Switching currents</b>	$I_{Low} < 1.2\text{ mA}$ ; $I_{High} > 2.1\text{ mA}$ (NAMUR); $I_{Low} < 2.7\text{ mA}$ ; $I_{High} > 3.7\text{ mA}$ (MK)
<b>Signal frequency</b>	5 Hz – 800 Hz (Pulse doubling) 10 Hz – 500 Hz (Pulse quadrupling) (*)
<b>Max. input voltage</b>	$U_i \leq 12.5\text{ V}$
<b>Max. input current</b>	$I_i \leq 35\text{ mA}$
<b>Max. power consumption</b>	$P_i \leq 60\text{ mW}$
<b>Internal inductance</b>	$L_i \leq 66.3\mu\text{H}$
<b>Internal capacitance</b>	$C_i \leq 530\text{ nF}$
<b>Additional equipment</b>	isolating switching amplifier

(\*) Note that the restricted flow rate measurement range due to the quadrupling of the pulse

**Housing data**

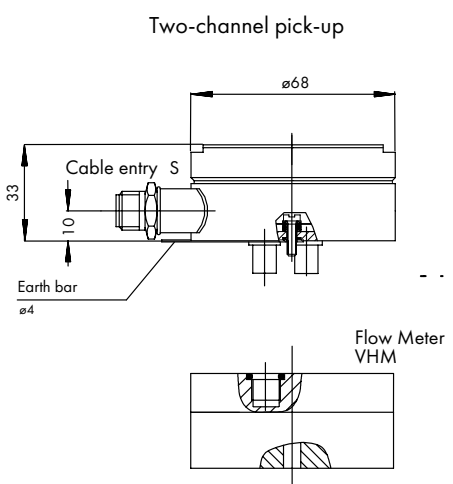
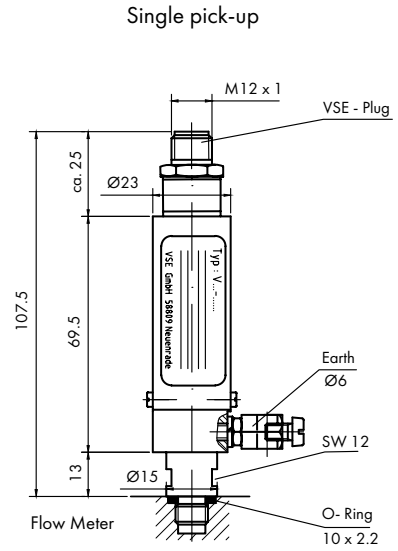
<b>Dimensions</b>	$\varnothing = 68\text{ mm}$ ; h = 33 mm
<b>Protection class</b>	IP 64
<b>Material</b>	Anodized blue aluminum Stainless steel 1.4305 (coil)
<b>Weight</b>	165 g
<b>Max. surface temperature</b>	T4 ... T6 = 80°C (176°F)
<b>Ambient temperature</b>	-20°C ... 50°C (-4°F ... 122°F)
<b>Seals</b>	FPM
<b>Coil encapsulating</b>	2K-Epoxy
<b>Connector</b>	VSE Standard Connector M12

**Type Plates**



27. TYPE CODES – SIGNAL PICK-UPS

**V . . . - . . 1 . / . - NAMUR / MK**



**Version**

- N** Standard
- Ex** Intrinsically safe

**Series**

**Cable entry**

- S** Plug connector with VSE standard connector

**Size**

- 1** Flow meter VHM 01
- 2** Flow meter VHM 02
- 3** Flow meter VHM 03

**Sensor grounding**

- I** Not grounded to 0V

**Connection**

- I** 4 conductor connection (Standard)
- L** 2 conductor connection (Intrinsically safe)

**Signal pick-up**

- D** Two-channel pick-up (impulses x 2 / impulses x 4)
- E** Two-channel pick-up (impulses x 1)
- T** Single-channel pick-up with modified carrier frequency
- I** Single-channel pick-up with normal carrier frequency

\* With the VDB series... (fiber-optic output), the signal can only be doubled (pulse x 2)

## 28. TECHNICAL DATA FOR THE VHM TITAN

Size	Measurement range l/min	Measured Volume $V_m$ ml/imp.	Frequency Hz	K-factor imp./liter
VHM 01-1_T1	0.01 ... 1	approx. 0.04	approx. 5 ... 417	approx. 24,000
VHM 02-2_T1	0.05 ... 2	approx. 0.11	approx. 7.6 ... 303	approx. 8,800

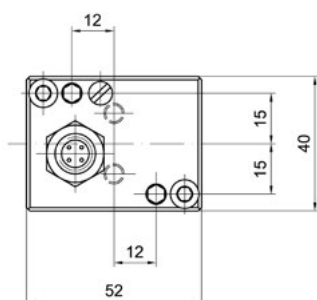
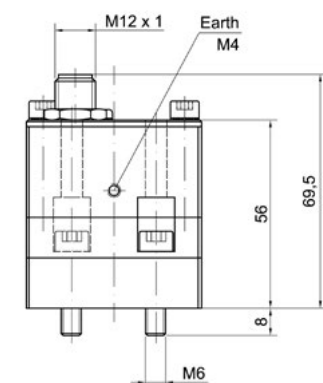
The exact data can be found in the calibration report.

<b>Measurement accuracy</b>	± 0.5 % of the measured value (at viscosities > 10mm <sup>2</sup> /s) ± 1 % of the measured value (at viscosities 1 – 10mm <sup>2</sup> /s)
<b>Repeating accuracy</b>	± 0.5 % under the same operating conditions
<b>Materials</b>	Gear housing: Titanium Gears: Stainless steel 1.4462 Gear bearings: tungsten carbide Preampfier housing: Aluminum (Al Mg Si 1) EN AW-6082
<b>Gear bearings</b>	Sleeve bushing
<b>Max. operating pressure</b>	10 bar / 145 psi
<b>Medium temperature (Ex-type)</b>	-20 ... + 70°C (-4°F ... 158°F)
<b>Ambient temperature</b>	-20 ... + 50°C (-4°F ... 122°F)
<b>Viscosity range</b>	1 ... 20,000 mm <sup>2</sup> /s
<b>Installation position</b>	Any
<b>Direction of flow</b>	See the direction of the arrow on the flow meter
<b>Installation</b>	Block mounting
<b>Protection class</b>	IP 64

## 29. DIMENSIONS FOR VHM TITAN

### Flow meter with preamplifier

VHM 01-22TS1/1. + V.L. - 01S00/.



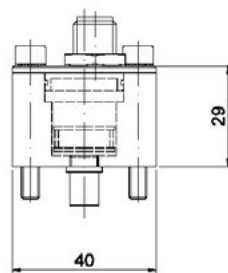
### Preamplifier

VR11 – 01S00 / N Standard

VR11 – 01S00 / Ex intrinsically safe

VW11 – 01S00 / N Standard

VW11 – 01S00 / Ex intrinsically safe

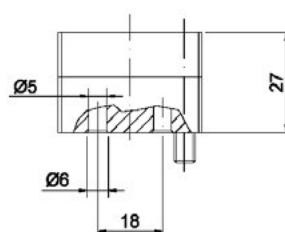


### Flow meter

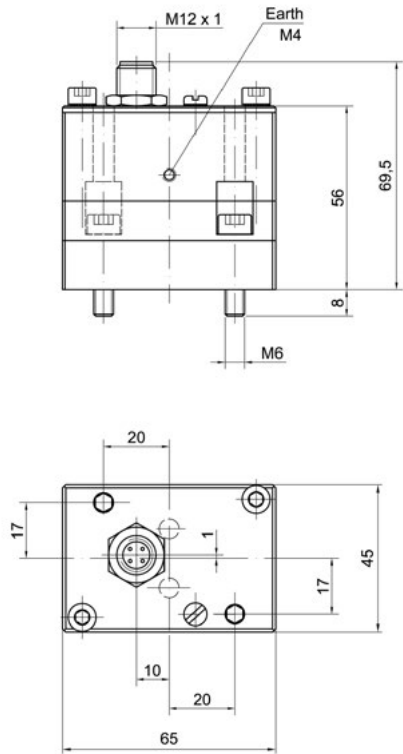
VHM – 01-22TS1/1 N Standard

S Special shaft

D D-Shaft

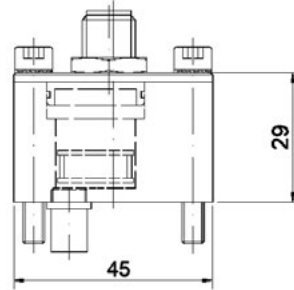


**Flow meter with preamplifier**  
**VHM 02-12TS13/1. + V.L. - 02S00/.**

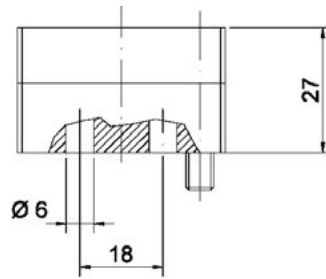


**Preamplifier**  
**VRII – 02S00 / N** Standard  
**VRLI – 02S00 / Ex** intrinsically safe

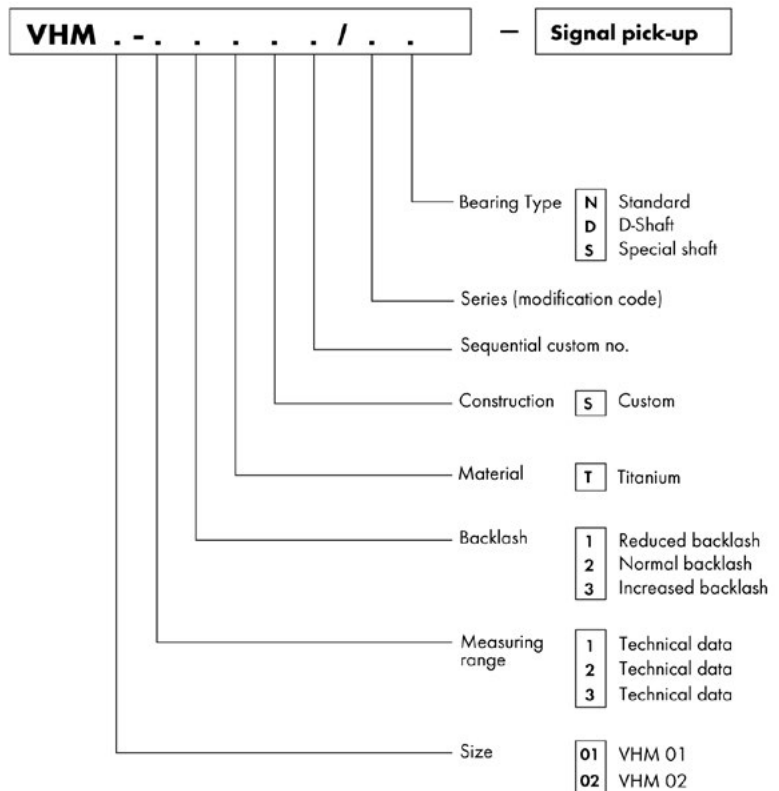
**VWII – 02S00 / N** Standard  
**VWLI – 02S00 / Ex** intrinsically safe



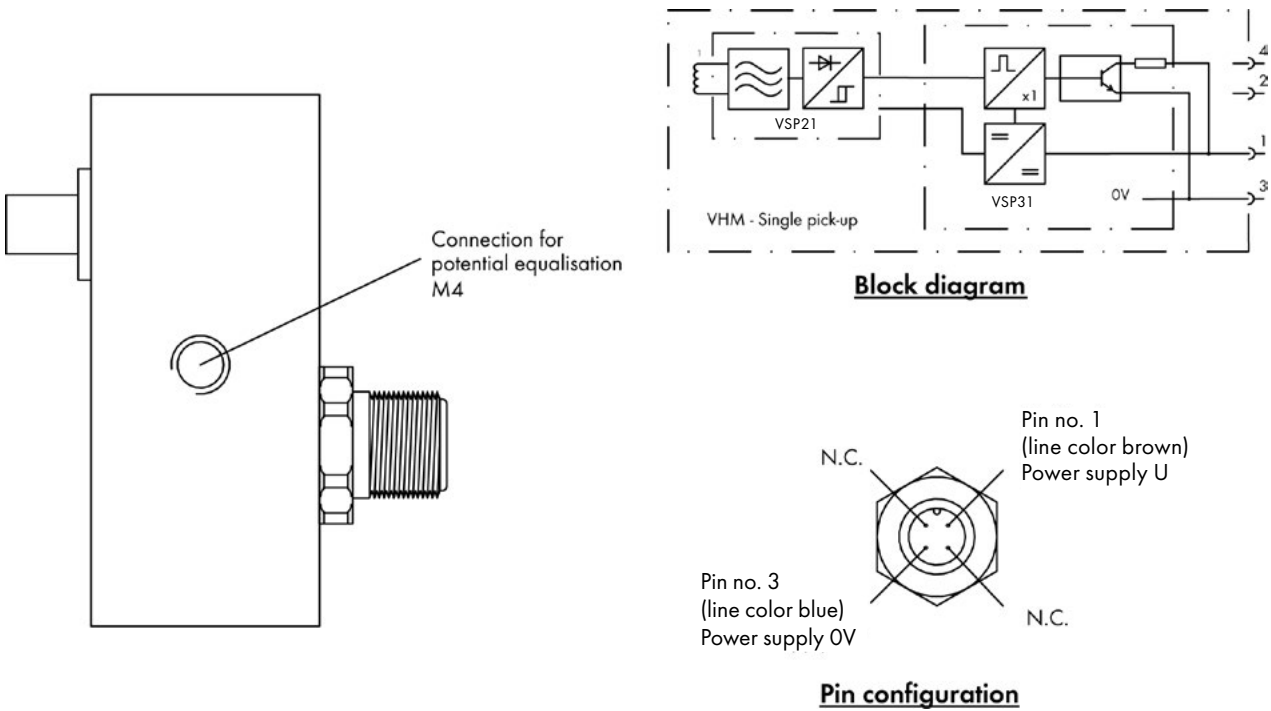
**Flow meter**  
**VHM – 02-12TS13/1 N** Standard  
**S** Special shaft  
**D** D-Shaft



**30. TYPE CODE VHM TITAN**  
**Flow Meter VHM Titan**








**Electronic connection data**

<b>EC-Type Examination Certificate</b>	IECEX BVS 23.0024X; BVS 23 ATEX E035X; FM23US0010X
<b>Type Code</b>	VRL*-*S**/Ex-NAMUR/MK
<b>Certification</b>	Ex II 1G Ex ia IIC T6 Ga IS Cl 1 Div1 GRPS A, B, C, D T6
<b>Nominal voltage</b>	8 ... 10.5 V
<b>Switching currents</b>	$I_{Low} < 1.2 \text{ mA}; I_{High} > 2.1 \text{ mA}$ (NAMUR) $I_{Low} < 2.7 \text{ mA}; I_{High} > 3.7 \text{ mA}$ (MK)
<b>Signal frequency</b>	6 Hz – 800 Hz
<b>Max. input voltage</b>	$U_i \leq 12.5 \text{ V}$
<b>Max. input current</b>	$I_i \leq 35 \text{ mA}$
<b>Max. power consumption</b>	$P_i \leq 60 \text{ mW}$
<b>Internal inductance</b>	$L_i \leq 66.3 \mu\text{H}$
<b>Internal capacitance</b>	$C \leq 530 \text{ nF}$
<b>Additional equipment</b>	isolating switching amplifier

### Housing data


Dimensions	See the section "Dimensions for VHM Titan"
Protection class	IP 64
Material	(Al Mg Si 1) EN AW-6082
Weight	125 g
Max. surface temperature	T4 ... T6 = 80°C (176°F)
Ambient temperature	-20°C ... 50°C (-4°F ... 122°F)
Seals	FPM
Coil encapsulating	2K-Epoxy
Connector	VSE Standard Connector M12


### Type plates

**VSE**<sub>flow</sub>   
 Hönnestrasse 49  
 58809 Neuenrade  
 Germany  
 Type: VRL\*- \*S 1\*/ Ex- NAMUR  
 Serial-Nr.: \*\*\*  
 Manufactured: \*\*/ \*\*


IS CI 1 Div1 GRPS A, B, C, D T6  
 ENTITY Parameters:  
 U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
 R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
 T4...T6@Ta: -20°C (-4°F)...+50°C (122°F)  
 T4...T6@TMed: -20°C (-4°F)...+70°C (158°F)  
 FM23US0010X  
 CTL. DWD. V06 6 08 4 c

**VSE**<sub>flow</sub>   
 Hönnestrasse 49  
 58809 Neuenrade  
 Germany  
 Type: VRL\*- \*S 1\*/ Ex- NAMUR  
 Serial-Nr.: \*\*\*  
 Manufactured: \*\*/ \*\*

IECEX BVS 23.002 X  
 BVS 23 ATEX E035 X  
  
 U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
 R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF   
 Tmed: -20°C..+70°C  
 Tamb: -20°C..+50°C

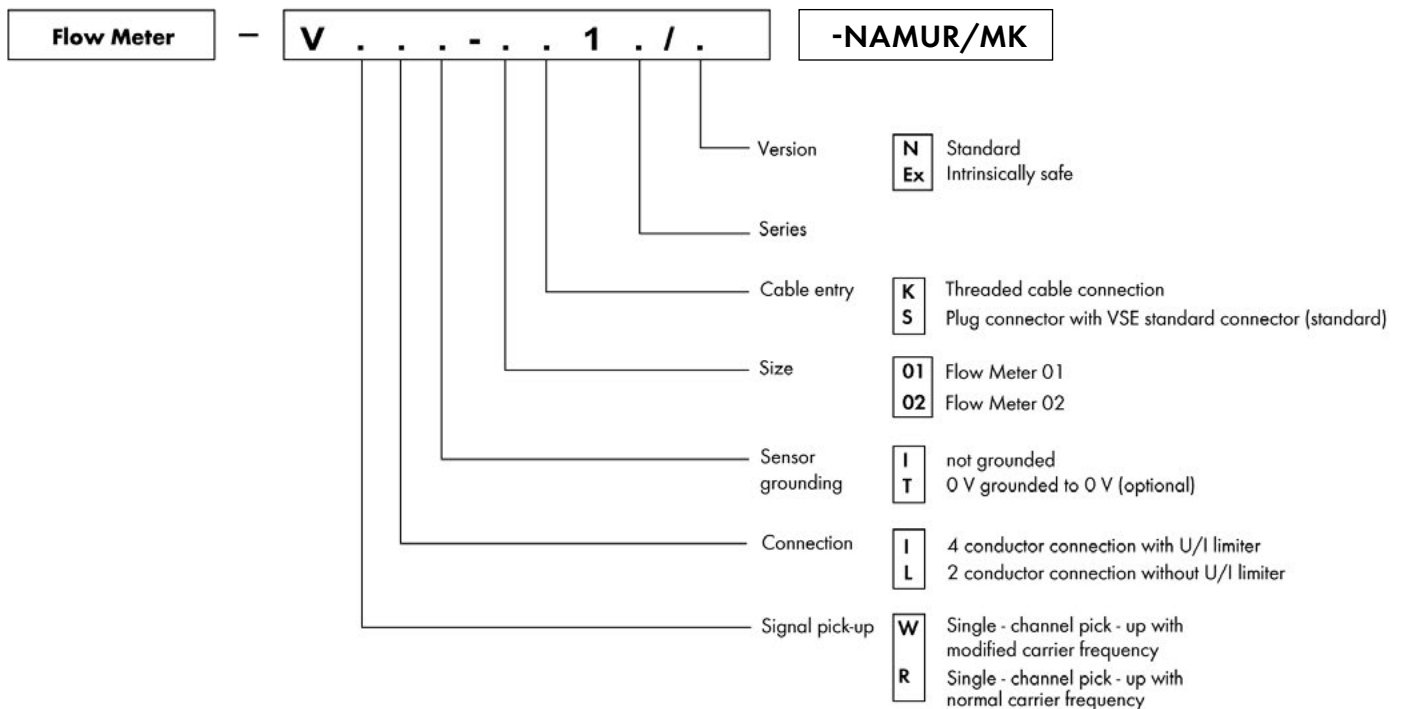
**VSE**<sub>flow</sub>   
 Hönnestrasse 49  
 58809 Neuenrade  
 Germany  
 Type: VRL\*- \*S 1\*/ Ex- MK  
 Serial-Nr.: \*\*\*  
 Manufactured: \*\*/ \*\*

IS CI 1 Div1 GRPS A, B, C, D T6  
 ENTITY Parameters:  
 U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
 R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF  
 T4...T6@Ta: -20°C (-4°F)...+50°C (122°F)  
 T4...T6@TMed: -20°C (-4°F)...+70°C (158°F)  
 FM23US0010  
 CTL. DWD. V06 6 08 4 c

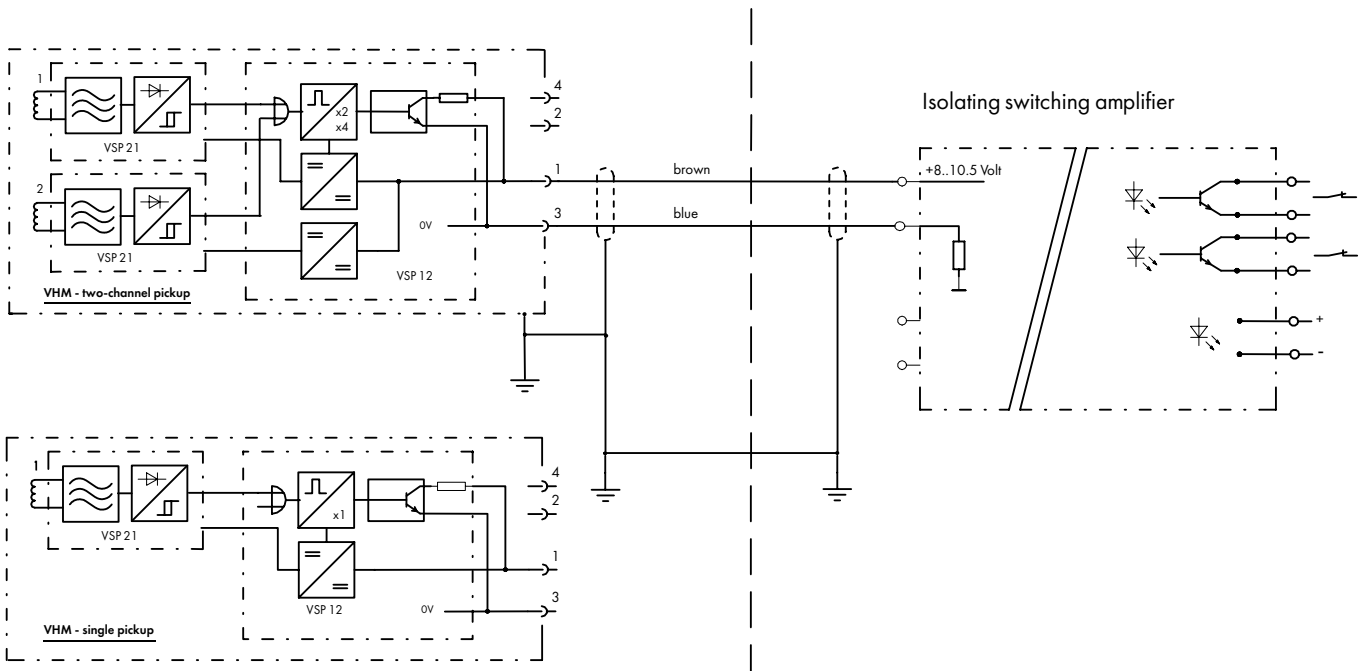
**VSE**<sub>flow</sub>   
 Hönnestrasse 49  
 58809 Neuenrade  
 Germany  
 Type: VRL\*- \*S 1\*/ Ex- MK  
 Serial-Nr.: \*\*\*  
 Manufactured: \*\*/ \*\*

IECEX BVS 23.002 X  
 BVS 23 ATEX E035 X  
  
 U<sub>i</sub> = 12.5V I<sub>i</sub> = 35mA P<sub>i</sub> = 60mW  
 R<sub>i</sub> = 0 L<sub>i</sub> = 66.3µH C<sub>i</sub> = 530nF   
 Tmed: -20°C..+70°C  
 Tamb: -20°C..+50°C

### 32. TYPE CODE – SIGNAL PICK-UP FOR VHM TITAN



### 33. WIRING DIAGRAM WITH ISOLATING SWITCHING AMPLIFIER



### 34. MEDIA AND AMBIENT TEMPERATURES

Temperature class: T4 ... T6  
 Media temperature: -20°C (-4°F) ... max. permissible 70°C (158°F)  
 Ambient temperature: -20°C (-4°F) ... max. permissible 50°C (122°F)

### 35. FLOW METER LABELS AND CERTIFICATIONS

Name and address of the manufacturer: **VSE Volumenteknik GmbH**  
**Hönnestraße 49**  
**58809 Neuenrade / Germany**

CE marking: **CE** 0158

Type designation: **V\*L\*-\*S\*\*/Ex-NAMUR; V\*L\*-\*S\*\*/Ex-MK**

Marking: **Ex** II 1G Ex ia IIC T6 Gq; IS CL1 Div 1 GRPS A,B,C,D T6

Certificates: **IECEx BVS 23.0024X; BVS 23 ATEX E035X; FM23US0010X**

## 36. SUMMARY OF THE SAFETY-RELATED TECHNICAL DATA

### PICK-UP-SYSTEMS

TYPE: V\*L\*-S\*\*/EX-NAMUR, V\*L\*-S\*\*/EX-MK

IECEX BVS 23.0024X; BVS 23 ATEX E035X; FM23US0010X



II 1G Ex ia IIC T6 Ga



IS CL1; Div 1; GRPS A,B,C,D; T4...T6

U<sub>i</sub> = 12.5 V

I<sub>i</sub> = 35mA

P<sub>i</sub> = 60mW

L<sub>i</sub> = 66.3μH

C<sub>i</sub> = 530nF

<b>Temperature class</b>	T4 ... T6
<b>Max. media temperature</b>	-20°C (-4°F) ≥ T <sub>Med</sub> ≥ 70°C (158°F)
<b>Max. ambient temperature</b>	-20°C (-4°F) ≥ T <sub>amb</sub> ≥ 50°C (122°F)

### VSE Connection Cable, blue RAL 5015

PUR, shielded 2 x 0.34 mm<sup>2</sup>

R = 0.053 Ω/m

L = 0.76 μH/m (x)

CA-A = 60 pF/m (x)

CA-S = 120 pF/m (x)

[(x) = Measured at 1000 Hz ]

## Translation

1 **EU-Type Examination Certificate**2 **Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014**3 EU-Type Examination Certificate Number: **BVS 23 ATEX E 035 X** Issue: **00**4 Equipment: **Flowmeter type**  
**VHM\*\*-\*S\*\*/Ex-NAMUR,**  
**VHM\*\*-\*S\*\*/Ex-MK**5 Manufacturer: **VSE Volumentchnik GmbH**6 Address: **Hönnestrasse 49, 58809 Neuenrade, Germany**

7 This product and any acceptable variations thereto are specified in the appendix to this certificate and the documents referred to therein.

8 DEKRA Testing and Certification GmbH, Notified Body number 0158, in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.  
The examination and test results are recorded in the confidential Report No. BVS PP 23.2067 EU.

9 Compliance with the Essential Health and Safety Requirements has been assured by compliance with:


**EN IEC 60079-0:2018** **General requirements**  
**IEC 60079-11:2023** **Intrinsic Safety "i"**

Where additional criteria beyond those given here have been used, they are listed at item 18 in the Schedule.

10 If the sign "X" is placed after the certificate number, it indicates that the product is subject to the "Specific Conditions of Use" listed under item 17 of this certificate.

11 This EU-Type Examination Certificate relates only to the technical design of the specified product in accordance with the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

12 The marking of the product shall include the following:

 **II 1G Ex ia IIC T6 Ga**DEKRA Testing and Certification GmbH  
Bochum, 2023-09-26

Signed: Oliver Brumm

Managing Director

## 13 Appendix

## 14 EU-Type Examination Certificate

**BVS 23 ATEX E 035 X issue 00**

## 15 Product description

### 15.1 Subject and type

Flowmeter type VHM\*\*-\*c\*\*/\*-VaL\*-\*S\*\*/Ex-b

The flowmeter is designed in the following variants:

a = Variants of inductive pickup electronic, carrier frequency and material

E: Dual pickup (pulse signal x 1); preamplifier housing = aluminium; flowmeter = stainless steel

D: Dual pickup (pulse signal x 2 / pulse signal x 4); preamplifier housing = aluminium; flowmeter = stainless steel

I: Single pickup with standard carrier frequency; preamplifier housing = stainless steel; flowmeter = stainless steel

T: Single pickup with modified carrier frequency; preamplifier housing = stainless steel; flowmeter = stainless steel

R: Single pickup with standard carrier frequency; preamplifier housing = aluminium; flowmeter = titanium

b = Variants of switching range

NAMUR: For NAMUR switching range  $I_{Low} < 1.2 \text{ mA}$ ;  $I_{High} \geq 2.1 \text{ mA}$

MK: For special isolating switch amplifier  $I_{Low} < 2.7 \text{ mA}$ ;  $I_{High} \geq 3.7 \text{ mA}$

c = Material of the mechanical part of the flowmeter

T: Titanium

2 or 4: Stainless steel

Instead of asterisks, variant-specific letters and numbers are used in the type of designation to identify the volumetric sensor, but these have no influence on explosion protection.

### 15.2 Description

The flowmeter is an intrinsically safe equipment which measures the volume of liquids.

The electronic parts of the flow meter are mounted either into a titanium enclosure (type VHM\*\*-\*c\*\*/\*-VRL\*-\*S\*\*/Ex-b) or into stainless steel enclosure (all other types). The mechanical part of the flowmeter is made of titanium or stainless steel.

For the electrical connection a M12-connector is used.

### 15.3 Parameters

#### 15.3.1 Electrical Parameters

Rated voltage

$U_n$  8...10 V

Current consumption levels

For variant Ex-NAMUR:

$I_{Low} \leq 1.2 \text{ mA}$ ;  $I_{High} \geq 2.1 \text{ mA}$

For variant Ex-MK:

$I_{Low} \leq 2.7 \text{ mA}$ ;  $I_{High} \geq 3.7 \text{ mA}$

#### 15.3.2 Intrinsically safe electrical parameters for all types

Maximum input voltage

$U_i$  DC 12.5 V

Maximum input current

$I_i$  35 mA

Maximum input power

$P_i$  60 mW

Maximum internal capacitance

$C_i$  530 nF

Maximum internal inductance

$L_i$  66.3  $\mu\text{H}$





# IECEX Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION  
IEC Certification System for Explosive Atmospheres  
for rules and details of the IECEx Scheme visit [www.iecex.com](http://www.iecex.com)

Certificate No.:	<b>IECEX BVS 23.0024X</b>	Page 1 of 4	<u>Certificate history:</u>
Status:	<b>Current</b>	Issue No: 0	
Date of Issue:	2023-09-28		
Applicant:	<b>VSE Volumentchnik GmbH</b> Hönnestrasse 49 58809 Neuenrade Germany		
Equipment:	<b>Flowmeter types VHM**.*****/*-V*L*.*S**/Ex-NAMUR and VHM**.*****/*-V*L*.*S**/Ex-MK</b>		
Optional accessory:			
Type of Protection:	<b>Intrinsic Safety "I"</b>		
Marking:	Ex ia IIC T6 Ga		

Approved for issue on behalf of the IECEx  
Certification Body:

**Deniz Pezzutto**

Position:

**Certification Manager**

Signature:  
(for printed version)

2023-09-28

Date:  
(for printed version)

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting [www.iecex.com](http://www.iecex.com) or use of this QR Code.



Certificate issued by:

**DEKRA Testing and Certification GmbH**  
Certification Body  
Dinnendahlstrasse 9  
44809 Bochum  
Germany







# IECEX Certificate of Conformity

Certificate No.: **IECEX BVS 23.0024X**

Page 2 of 4

Date of issue: **2023-09-28**

Issue No: 0

Manufacturer: **VSE Volumentechnik GmbH**  
Hönnestrasse 49  
58809 Neuenrade  
Germany

Manufacturing locations: **VSE Volumentechnik GmbH**  
Hönnestrasse 49  
58809 Neuenrade  
Germany

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEX Quality system requirements. This certificate is granted subject to the conditions as set out in IECEX Scheme Rules, IECEX 02 and Operational Documents as amended

#### STANDARDS :

The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2017 Explosive atmospheres - Part 0: Equipment - General requirements  
Edition:7.0

IEC 60079-11:2023 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "I"  
Edition:7.0

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

#### TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

##### Test Report:

DE/BVS/ExTR23.0030/00

##### Quality Assessment Report:

DE/BVS/QAR23.0004/00



## IECEx Certificate of Conformity

Certificate No.: **IECEx BVS 23.0024X**

Page 3 of 4

Date of issue: **2023-09-28**

Issue No: 0

### EQUIPMENT:

Equipment and systems covered by this Certificate are as follows:

#### Subject and type

Flow meter type VHM\*\*-\*c\*\*/\*-VaL\*-\*S\*\*/Ex-b

The flow meter is designed in the following variants:

a = Variants of inductive pickup electronic, carrier frequency and material

E: Dual pickup (pulse signal x 1); preamplifier housing = aluminium; flowmeter = stainless steel

D: Dual pickup (pulse signal x 2 / pulse signal x 4); preamplifier housing = aluminium;  
flowmeter = stainless steel

I: Single pickup with standard carrier frequency; preamplifier housing = stainless steel;  
flowmeter = stainless steel

T: Single pickup with modified carrier frequency; preamplifier housing = stainless steel;  
flowmeter = stainless steel

R: Single pickup with standard carrier frequency; preamplifier housing = aluminium; flowmeter = titanium

b = Variants of switching range

NAMUR: For NAMUR switching range  $I_{Low} < 1.2 \text{ mA}$ ;  $I_{High} > 2.1 \text{ mA}$

MK: For special isolating switch amplifier  $I_{Low} < 2.7 \text{ mA}$ ;  $I_{High} > 3.7 \text{ mA}$

c = material of the mechanical part of the flowmeter

T: Titanium

2 or 4: stainless steel

Instead of asterisks, variant-specific letters and numbers are used in the type of designation to identify the volumetric sensor, but these have no influence on explosion protection.

#### Description

The flowmeter is an intrinsically safe equipment which measures the volume of liquids.

The electronic parts of the flow meter are mounted either into a titanium enclosure (type VHM\*\*.\*c\*\*/\*-VRL\*-\*S\*\*/Ex-b) or into stainless steel enclosure (all other types).

The mechanical part of the flowmeter is made of titanium or stainless steel.

For the electrical connection a M12-connector is used.

#### SPECIFIC CONDITIONS OF USE: YES as shown below:

The unit must be installed in such a way that impact and friction sparks are excluded.



# IECEX Certificate of Conformity

Certificate No.: **IECEX BVS 23.0024X**

Page 4 of 4

Date of issue: **2023-09-28**

Issue No: 0

## Equipment (continued):

### Parameters

#### 1 Electrical Parameters

Rated voltage  $U_n$  8...10 V

#### Current consumption levels

For variant Ex-NAMUR:  $I_{Low} \leq 1.2 \text{ mA}; I_{High} \geq 2.1 \text{ mA}$

For variant Ex-MK:  $I_{Low} \leq 2.7 \text{ mA}; I_{High} \geq 3.7 \text{ mA}$

#### 2 Intrinsically safe electrical parameters for all types

Maximum input voltage  $U_i$  DC 12.5 V

Maximum input current  $I_i$  35 mA

Maximum input power  $P_i$  60 mW

Maximum internal capacitance  $C_i$  530 nF

Maximum internal inductance  $L_i$  66.3  $\mu$ H

#### 3 Thermal parameters

Ambient temperature range  $T_a$  -20 °C... 50 °C

Fluid temperature range  $T_{med}$  -20 °C... 70 °C

# CERTIFICATE OF CONFORMITY



## 1. HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS

2. **Certificate No:** **FM23US0010X**
3. **Equipment:** **Type VHM../Ex\* Series Flow Sensors**  
(Type Reference and Name)
4. **Name of Listing Company:** **VSE Volumentechnik GmbH**
5. **Address of Listing Company:** **Honnestrasse 49, Neuenrade D-58809, Germany**
6. The examination and test results are recorded in confidential report number:

3026923 dated 18<sup>th</sup> September 2007

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

FM 3600:2022, FM 3610:2021, FM 3810:2021, ANSI/UL 60079-0:2020, ANSI/UL 60079-11:2018, ANSI/UL 61010-1:2019

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

## 10. Equipment Ratings:

Intrinsically Safe for use in Class I, Division 1, Groups ABCD, T6...T4, in accordance with Control Drawing V06 6 08 4c

## 11. The marking of the equipment shall include:

IS Class I, Division 1, Groups ABCD, T6...T4; Entity;  
T6...T4, Ta = -20°C to +50°C, T<sub>med</sub> = -20°C to +70°C (med: liquid medium)

## Certificate issued by:

J.E. Marquedant  
VP, Manager - Electrical Systems

2 November 2023

Date

To verify the availability of the Approved product, please refer to [www.approvalguide.com](http://www.approvalguide.com)

### **THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE**

FM Approvals LLC, 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA  
T: +1 (1) 781 762 4300 F: +1 (1) 781 762 9375 E-mail: [information@fmapprovals.com](mailto:information@fmapprovals.com) [www.fmapprovals.com](http://www.fmapprovals.com)

F 347 (Apr 21)



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**SCHEDULE**

US Certificate Of Conformity No: FM23US0010X

**12. Description of Equipment:**

**General** – The VHM flow meter series are used to measure the volume flow of liquids. The Type VHM../Ex\* generates a modulated digital current signal which is digitalized and amplified by an isolation switching amplifier.  
**Construction** - The housing, dependent on model, consists of the following:

Model Type	Description
VDL	Volume Sensor = 303 Stainless Steel (1.4305), preamplifier housing = aluminum, coil housing = Stainless Steel
VEL	Volume Sensor = 303 Stainless Steel (1.4305), preamplifier housing = aluminum, coil housing = Stainless Steel
VIL	Volume Sensor = 303 Stainless Steel (1.4305), preamplifier housing = Stainless Steel
VTL	Volume Sensor = 303 Stainless Steel (1.4305), preamplifier housing = Stainless Steel
VRL	Volume Sensor = Titanium, preamplifier housing = Aluminum; Coil housing = Stainless Steel

**Ratings** - The Type VHM../Ex\* Flow Sensors are rated for use in an ambient temperature range of -20°C to +50°C and for a liquid medium temperature range of -20°C to +70°C.

See Annex for Entity Parameters

**13. Specific Conditions of Use:**

The flow sensor has to be mounted in such a way that sparks by operational friction or impact are not possible.

**14. Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

**15. Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

**16. Certificate History**

Details of the supplements to this certificate are described below:

Date	Description
18 September 2007	Original Issue.

To verify the availability of the Approved product, please refer to [www.approvalguide.com](http://www.approvalguide.com)

**THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE**

FM Approvals LLC, 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA  
 T: +1 (1) 781 762 4300 F: +1 (1) 781 762 9375 E-mail: [information@fmapprovals.com](mailto:information@fmapprovals.com) [www.fmapprovals.com](http://www.fmapprovals.com)

F 347 (Apr 21)



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### 38. DECLARATION OF NON-OBJECTION

# Declaration of non-objection (Decontamination declaration for return deliveries)

Last Revision: 03/2025

In order to ensure occupational health and safety and to protect our employees from harmful effects when handling hazardous substances, this decontamination declaration must be fully completed and enclosed with all VSE flow meters which are returned.

The declaration is binding and may only be completed and signed by authorised personnel. It must be visibly attached on the outside of the return packaging and sent in advance by email, including all safety data sheets. VSE and its sales partners will only conduct an inspection and failure analysis of the returned VSE flow meters if a fully completed and signed declaration is provided. Otherwise, we explicitly reserve the right to reject the shipment.

It is mandatory to obtain written approval before returning any VSE flow meters.

Approval was granted on  by (contact person)











Type

Serial number  Quantity

Reason for return

1. The VSE flow meter was last used with the following operating medium:   
(Safety data sheet must be enclosed.)

Application-related contamination and effects:

 irritant	<input type="radio"/>	 harmful to health	<input type="radio"/>	 radioactive substances <sup>1</sup>	<input type="radio"/>
 toxic	<input type="radio"/>	 corrosive	<input type="radio"/>	 biologically hazardous substances <sup>1</sup>	<input type="radio"/>
 hazardous to the environment	<input type="radio"/>	 flammable	<input type="radio"/>		
 oxidising	<input type="radio"/>	 explosive	<input type="radio"/>		

<sup>1</sup> The return of VSE flow meters that have been contaminated by radioactive or biologically hazardous substances is expressly excluded.

2.  The VSE flow meter has been carefully emptied, decontaminated and thoroughly cleaned both inside and outside, removing all residues.

The following cleaning agents were used:   
(Safety data sheets must be enclosed).

## Declaration of non-objection (Decontamination declaration for return deliveries)

---

3.  No special safety measures or treatments are necessary.
- Special safety measures or treatments concerning employee protection, environmental protection, and/or disposal are required due to residual contamination, residual liquids, residual substances, solids, and/or used cleaning agents. (Safety data sheets must be enclosed.)

If yes, which:

4.  Are there any other safety aspects to consider?

If yes, which:

We confirm that the information provided in this declaration is true and complete and that the shipment is carried out in accordance with legal regulations. We are aware that we are liable to VSE and its sales partners for any damages caused by incomplete and incorrect information. We commit to indemnify VSE and its sales partners against any claims for damages by third parties arising from incomplete or incorrect information, irrespective of the legal basis on which such claims may arise.

**Company**

**Street/No.**

**Postal code/City**

**Phone**

**Email**

**Contact person**

(In capitals)

**Date**

**Signature**

(Company stamp)

**Enclosures**



---

**VSE**.flow®

VSE Volumentchnik GmbH  
Hönnestraße 49  
58809 Neuenrade / Germany  
Phone +49 (0) 23 94 / 6 16-30  
info@vse-flow.com  
vse-flow.com



A company of  
**e.holding**  
FLUID TECHNOLOGY GROUP