VSE flow measurement

Solutions for Fluid Technology

OPERATING INSTRUCTIONS

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

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IMPORTANT BASIC INFORMATION

Dear customer, dear user,

These installation and operating instructions should provide you with the information you need to properly install and commission the flow meter. Installation, commissioning and testing are to be performed by trained and qualified personnel only. These operating instructions must be read and applied carefully to ensure proper, trouble-free and safe operation of the flow meter. VSE is not liable for any damage incurred resulting from not complying with the instructions in this operating instruction. It is not permitted in any case to open the device.

These operating instructions for flow meters of the series "VS in Standard-Version" from VSE must be stored, so that they can be read by the group of authorized personnel at any time. Chapters may not be taken of these instructions at any time. A missing operating instructions manual or missing pages must be replaced immediately. VSE can supply you with new instructions or you can download the operating instructions from the internet (www.vse-flow.com). The operating instructions must be given to each subsequent user of this product.

Legal information

This document is not managed by an updating service of VSE Volumentechnik GmbH.
Changes to this document may be made without notice.

VSE Volumentechnik GmbH does not provide any implicit guarantees of commercial qualities and suitability for a specific purpose.

If the device has been opened, modified or incorrectly connected to the electrical circuits, the guarantee of VSE Volumentechnik GmbH for safe operation is void. VSE Volumentechnik GmbH is not liable in any way for personal injuries or damage to goods resulting from improper installation or improper operating of the flow meter.

GENERAL FUNCTION DESCRIPTION OF FLOW METER

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

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

GENERAL DESCRIPTION

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

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

FLOW METER SELECTION

The correct selection (version) of type and constructional size is crucial for a trouble-free and safe operation of the flow meters. Owing to the great number of various applications and flow meter versions, the technical specifications in the VSE catalogue material are of a general nature. Performance of the flow meter depends on type, size and meter range and on the liquid that is to be measured. Please consult VSE for an exact description.

DECLARATION OF CONFORMITY

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

All flow meters are tested according to the valid, legally prescribed electromagnetic compatibility directives EN 55011 and EN 61000 and possess the CE-certification. The EC-declaration of conformity is the CE-label attached to all flow meters.

GENERAL CONDITIONS FOR INITIAL START-UP

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

1. The process fluid

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

2. The hydraulic properties of the system

- ➜ Is the **max. operating pressure of the system** lower than the max. permitted operating pressure of the flow meter?
- ➜ Is the **max. fall of pressure 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 protective shielding** correctly connected on both sides on the earth conductor PE?
- ➜ Is there a **potential difference** between the earth conductor connection PE on the flow meter and the earth conductor PE on the evaluation device?
- ➜ Does a correcting lead have to be laid to eliminate the **potential difference** between the flow meter and the evaluation device?
- ➜ Is the flow meter connected firmly to the **earth conductor PE** (e.g. via the pipe lines)?
- ➜ Is the meter of the flow meter constructed to be **insulated** to the earth conductor PE (e.g. connection via hoses)? If this is the case, the meter has to be connected with the earth conductor PE!
- ➜ Is there a **continuous connection** of the cable protective shielding (earth conductor PE) via the housing, of the 4-pin round plug to the housing of the flow meter?
- ➜ Is the cable laid fault-free and the installation secured from input of **interference pulses**?
- ➜ Is the **4-pin round plug** of the connection cable firmly screwed together with the plug of the flow meter?
- ➜ Are the wires on the **evaluation device** correctly and properly connected?
- ➜ Does the entire system correspond to the directives of the electromagnetic compatibility laws (**EMC**)?
- ➜ Have all local valid regulations, **applicable directives**, guidelines and background conditions of the **electromagnetic compatibility laws** been maintained and observed?
- ➜ Systems that can lead to personal injury through malfunction or failure are to be equipped with the **appropriate safety devices**. The functioning of these safety devices is to be checked at regular intervals.

MAXIMUM OPERATING PRESSURE

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

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

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

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

STATEMENT TO EU-DIRECTIVE 97/23/EG, PRESSURIZED DEVICES

VSE flow meters are pressurized devices according to article 1, paragraph 2.1.4. of above mentioned directive. Therefore they are subject to the regulations to this directive.

According to article 3, paragraph 1.4, VSE flow meters have to conform with the technical requirements of the guideline. The fluids to be measured are belonging in most of all cases to the class 2, defined in article 9, paragraph 2.2. VSE flow meters do not reach the limit values as defined in article 3, paragraph 1.1. The technical requirements for VSE flow meters therefore are limited to the parts indicated in article 3, paragraph 3. It means the devices have to be designed and manufactured in conformity with acknowledged engineering, such as practiced in one of the member states. This is herewith confirmed. Beside this, the paragraph declares that these devices must not have a CE-marking according to Directive 97/23/EG. Therefore we do not issue declarations of CE and our products are not labelled acc. to 97/23/EG.

FLOW METER RANGE

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

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

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

ASSEMBLY OF THE FLOW METER

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

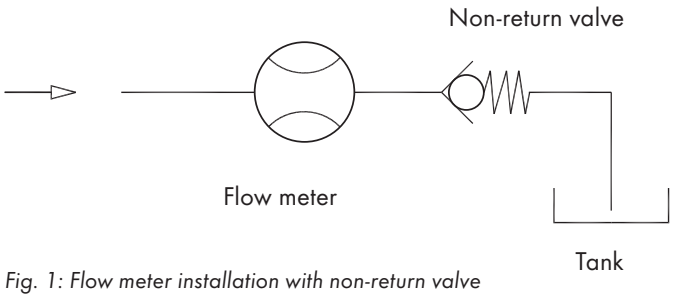


Fig. 1: Flow meter installation with non-return valve

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

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

Block assembly:
The flow meter is directly mounted onto a subplate or manifold, extra components are not needed. The block contains the hydraulic supply and outflow of the flow meter and the fixing bore holes (see flow meter dimension sheet).

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

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

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

Table 1: Torque of fastening screws

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

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

Important:
When mounting the flow meter, you must take great care that the seals are not damaged and correctly placed in the hydraulic connections of the flow meter. Wrongly installed or damaged seals lead to leakage and to an leaky system, which may have dire consequences.
Please make sure that flow meters with EPDM seals do not come into contact with oil and greases on a mineral oil basis. These fluids can decompose the seals.
The yellow plastic plugs in the hydraulic connections of the flow meter protect the meter against dirt and contamination during storage and shipping. Before mounting the flow meter you have to remove these plugs so that in- and outflow is free and open.

CLEANING AND FLUSHING OF PIPE LINES BEFORE INITIAL START-UP

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

Flow meters are measurement pick-up systems made with high-level precision. They have a mechanical meter consisting of two toothed wheels and which is adapted to the housing with narrow slots. Even the tiniest damage to the toothed wheels and bearings can cause a measurement error. So always make sure that no extraneous material gets into the meter and that the fluid flowing through is always free from dirt and contamination.
After the system has been carefully flushed out and no extraneous material is in the pipe line, you can mount the flow meter and commence the initial start-up.

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

FILTERING OF LIQUID

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

Table 2: Pre-switched filters

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

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

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

PREAMPLIFIER

The preamplifier for the standard version is short-circuit-proof, reverse-polarity-proof and processes the signals of the scan sensors. A high level of interference protection is achieved through the push-pull output stages of the preamplifier. You can easily connect evaluation devices with both PNP and NPN inputs to the outputs. The two-channel output of digital signals enables a higher measurement resolution and also a direction recognition of the flow.

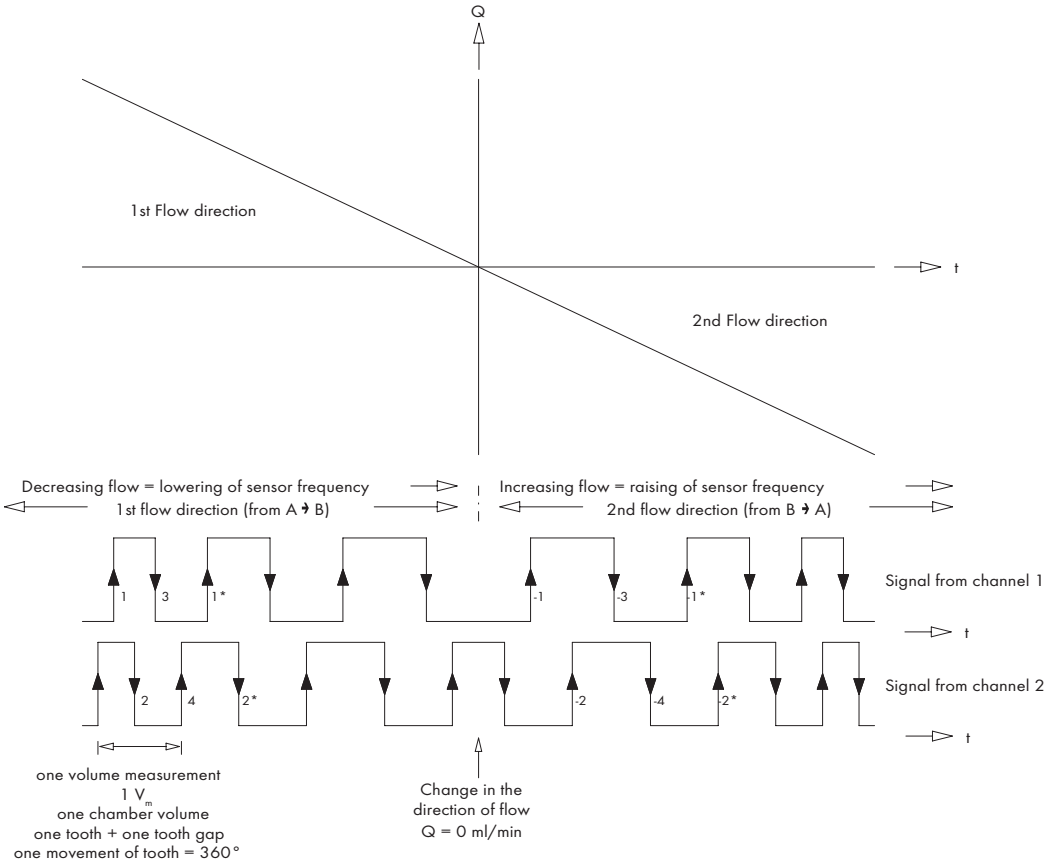


Fig. 2: Signal output of preamplifier

Power supply voltage in voltage range U_b = 10 ... 28 V DC. You can operate the preamplifier with any voltage in this voltage range U_b but make sure that the signal voltage is always adjusted to the power supply voltage and that the output signal has a signal level of $U_{sig} = U_b - 1$ V.
Permitted for the power supply is a steady direct voltage with a maximum residual ripple of ±15%.

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

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

Power supply voltage U_b = 12 V DC I_{0max12} = 25 mA
Power supply voltage U_b = 24 V DC I_{0max24} = 40 mA
Max. current per channel I_{Kmax} = 20 mA

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

Total current reception (at 12 V DC) $I_{0tot.}$ = 65 mA
$I_{0tot.} = I_{0max12} + (2 \times I_{Kmax})$ P_{max} = 0.78 W

Total current reception (at 24 V DC) $I_{0tot.}$ = 80 mA
$I_{0tot.} = I_{0max24} + (2 \times I_{Kmax})$ P_{max} = 1.92 W

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

Important:
Only use well-shielded cables for the connection cable, with a wire cross section of ≥ 4 x 0.25 mm².
Please make sure that the housing of the round plug is metallic, that it has a connection for the shielding and that the potential of the earth conductor PE is connected to the cable shielding and the housing of the preamplifier.

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

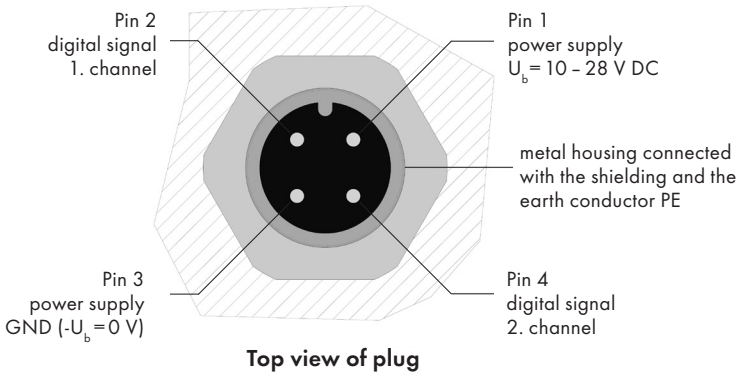


Fig. 3: M12 plug connector installed in the preamplifier housing of the flow meter

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

The maximum cable length between flow meter and the evaluation electronics is approx. 120 m. With extensive cable lengths (as of approx. 40 m) you must take care that the connecting cable is laid in an interference-free environment, that the shielding is connected on both sides of the earth conductor PE and that there is no potential difference between the two earth conductor connections.

MAINTENANCE

Working life is dependent on operating conditions and thus the specific properties of the devices, limited through wear, corrosion, deposits or age.
The operator is responsible for regular control, maintenance and recalibration. Any indication of a malfunction or damage prohibits any further use. On request, we can supply you with a borrowed device for the duration of repair or overhauling.
We advise to a yearly control and recalibration.

SENDING BACK OF REPAIRS AND SAMPLE DEVICES

It is imperative that you enclose an exact description of the complaint, objection or fault, when returning the device so as to ensure a rapid and economic repair of the flow meters and other components. Furthermore, you must include a security sheet, which informs unambiguously, which fluid was run with the flow meter and how dangerous this fluid is. The maintenance of legal regulations as regards work safety, such as workplace regulations, accident prevention regulations, stipulations on environmental protection, waste disposal and the water management law, obliges industrial corporations to protect their employees and other persons and environment against harmful effects, when handling hazardous materials. If further safety precautions are still necessary despite careful emptying and cleaning of the flow meter, information on this is imperative and must be included with the returned despatch.
When returning flow meters to VSE Volumentechnik GmbH, please note that inspection and repair will only be performed if the **safety specifications sheet** of the utilised medium is enclosed and the flow meters completely cleaned and flushed. This protects our employees and simplifies our work.
If this is not followed, the despatch will be returned, chargeable to the recipient.

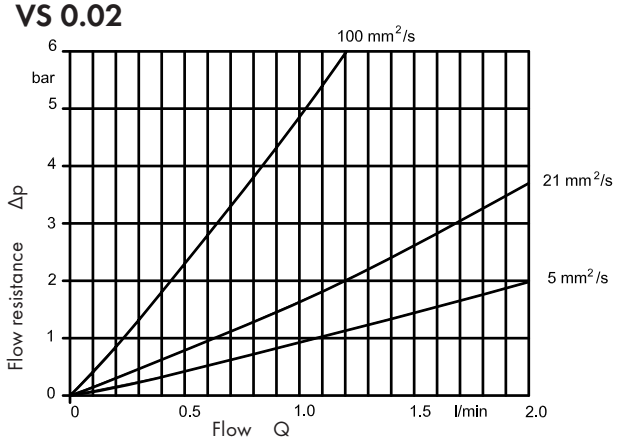
TECHNICAL SPECIFICATIONS VS 0.02 – VS 4

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

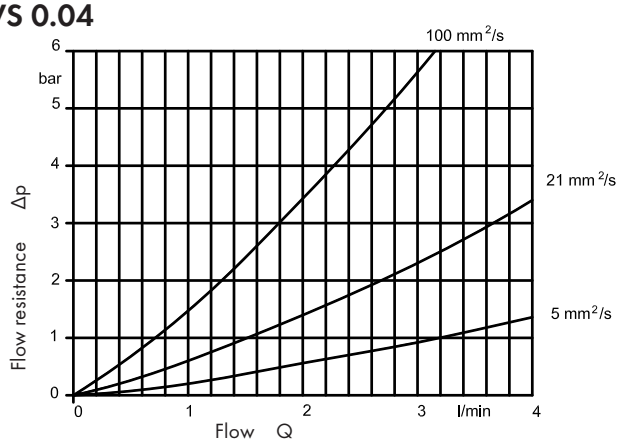
Measurement accuracy	: up to 0.3% of measurement value (with viscosity > 20 mm^2/s)
Repetition accuracy	: ± 0.05% under the same operating conditions
Material	: Cast iron EN-GJS-400-15 (EN 1563) or Stainless steel 1.4305
Meter bearing	: Ball bearings or steel plain bearings (medium-dependent)
Seals	: FPM (standard), NBR, PTFE or EPDM
Max. operating pressure	: Cast iron EN-GJS-400-15 (EN 1563) 315 bar/4500 psi Stainless steel 1.4305 450 bar/6500 psi
Medium temperature	: –40 ... + 120°C (–40°F ... 248°F)
Ambient temperature	: –20 ... + 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 version	: 10 to 28 volts/DC
Pulse output	: 2 x push-pull output stages reverse-polarity-proof, short-circuit-proof low signal: 0 = GND; high signal: 1 = U_b -1 I_{max} = 80 mA (at 24 V) P_{max} = 1.92 W (at 24 V)
Channel offset	: 90° ± 30° max.
Pulse-width repetition rate	: 1/1 ± 15° max.
Preamplifier housing	: Aluminium
Protection type	: IP 65

FLOW RESPONSE CURVES VS 0.02 – VS 4

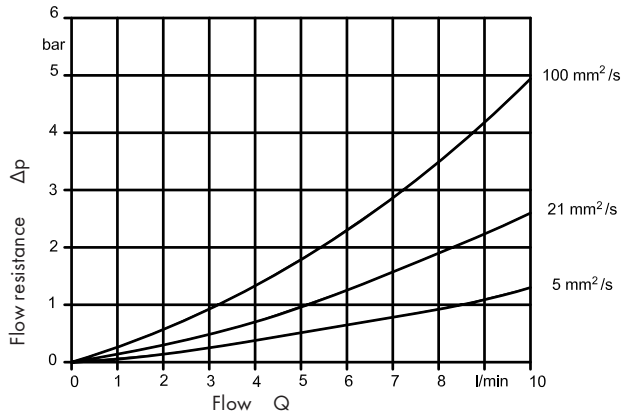
VS 0.02



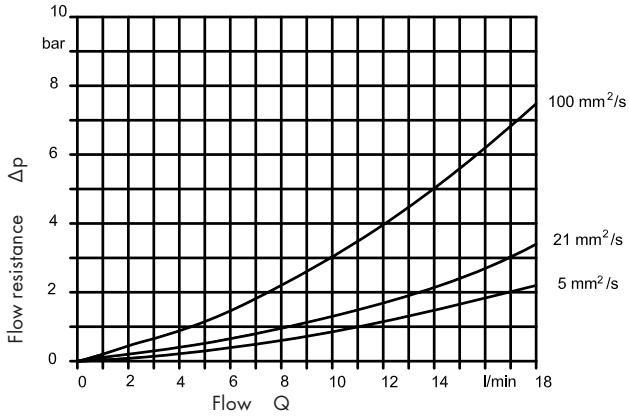
VS 0.04



VS 0.1



VS 0.2



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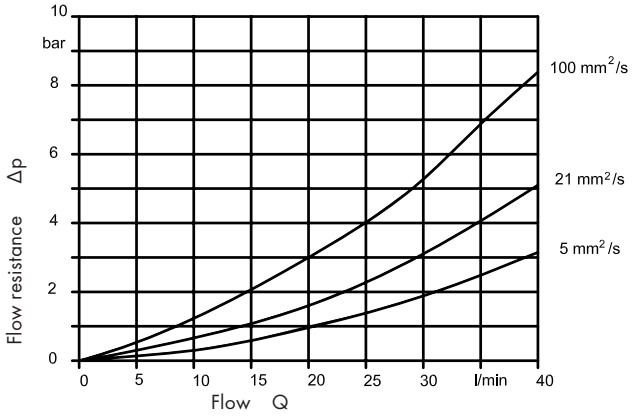
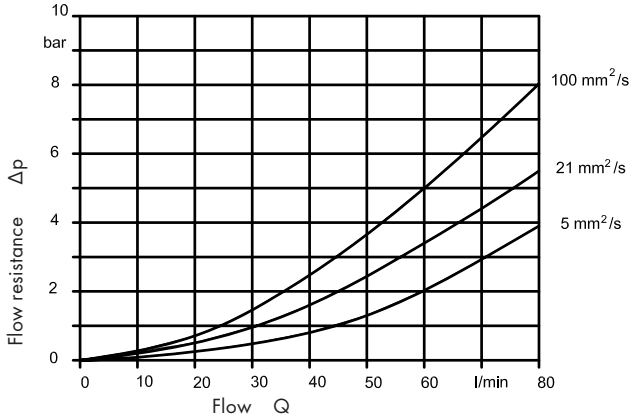
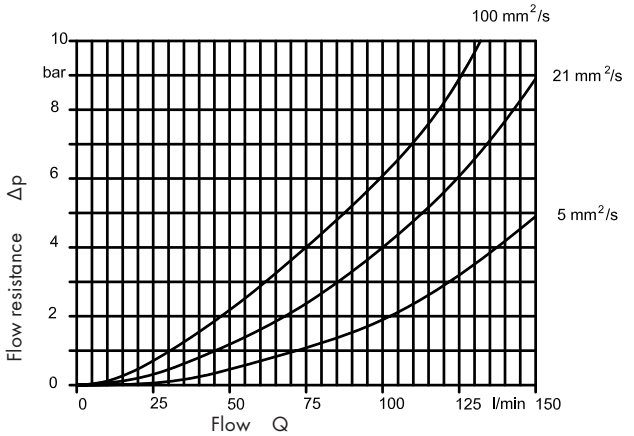


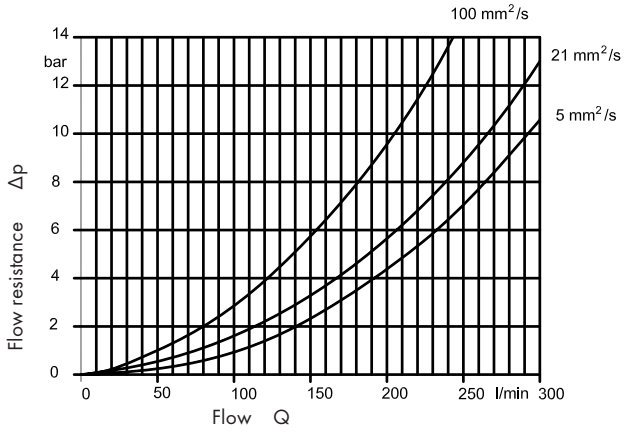
VS 1



VS 2

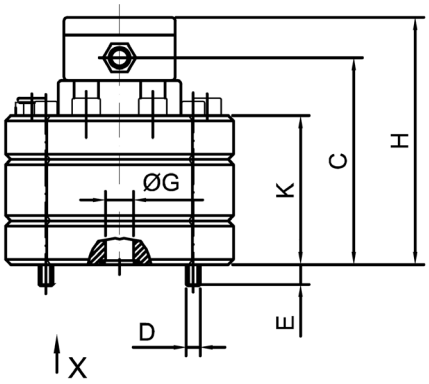


VS 4



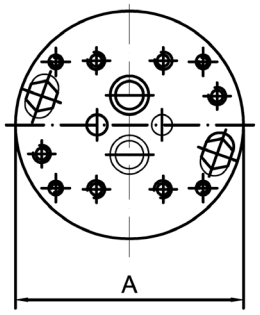
DIMENSIONS VS 0.02 – VS 4

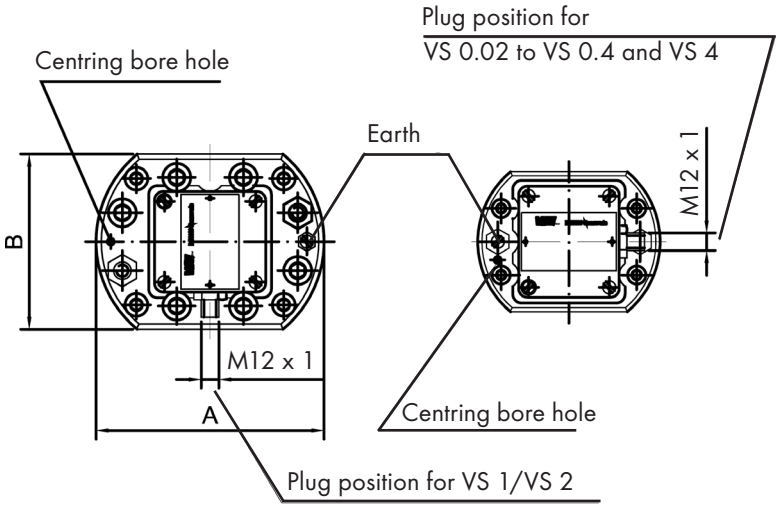
Cast iron version



Stainless steel version
Connection diagram
Housing without milled edge

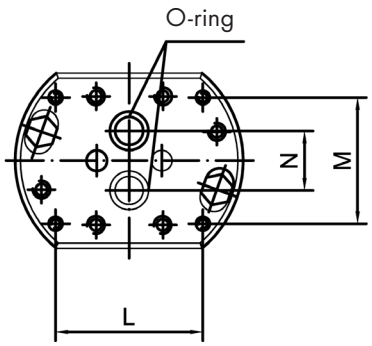
View X





Cast iron version
Connection diagram

View X

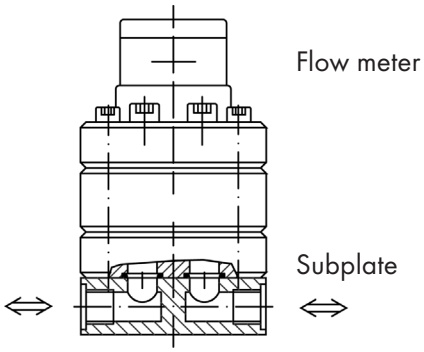


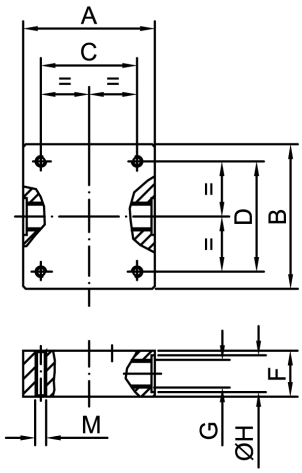
size VS	A	B	C	D	E	øG	H	K	L	M	N	O-ring	Weight GCI kg	 SS kg
0.02	100	80	91	M6	12.0	9	114	58	70	40	20	11 x 2	2.8	3.4
0.04	100	80	92	M6	11.5	9	115	59	70	40	20	11 x 2	2.8	3.4
0.1	100	80	94	M6	9	9	117	61	70	40	20	11 x 2	2.8	3.4
0.2	100	80	94	M6	9.5	9	117	61	70	40	20	11 x 2	3.0	3.7
0.4	115	90	96.5	M8	11.5	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	145	M12	20	30	168	110	46	95	45	36.17 x 2.62	14.7	18.4

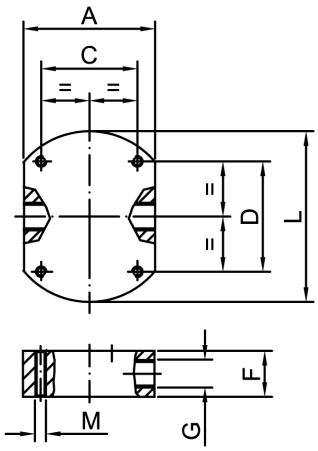
Dimensions in mm

DIMENSIONS, SUBPLATES AP. 02 - 4

Connection position, side



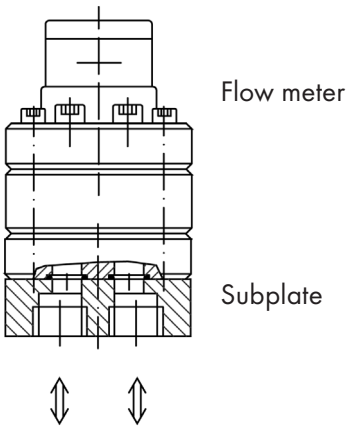


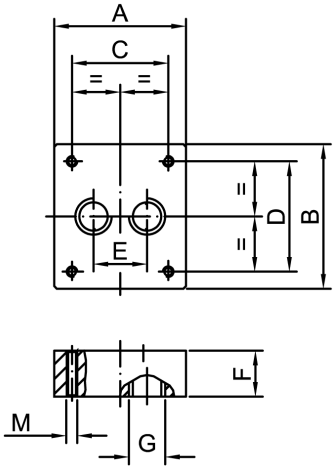


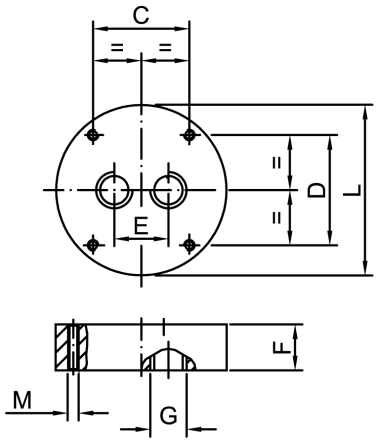
Size VS	Connection thread G	F	øH	A	B	C	D	E	L	Thread / depth M	Weight kg
0.02 **0.04** **0.1** **0.2**	G 1/4"	35	20	80	90	40	70	26	100	M6/12	1.8
	G 3/8"		23					30			
	G 1/2"		28					38			
0.4	G 1/2"	35	28	90	100	38	80	46	115	M8/15	2.7
	G 3/4"	40	33					52			
1 **2**	G 1/2"	35	28	100	110	72	84	46	130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





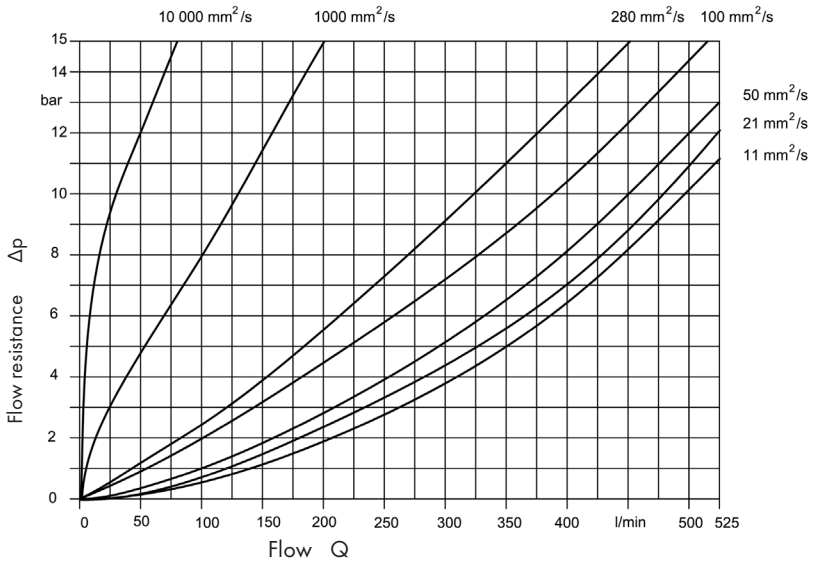


TECHNICAL SPECIFICATIONS VS 10

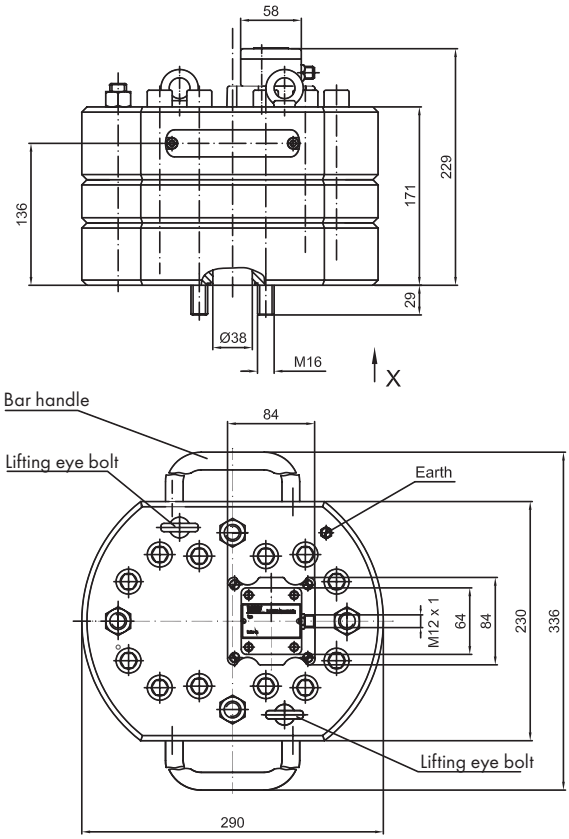
Size	Measuring range l/min	Frequency Hz	Pulse value cm^3/pulse	K-factor pulse/litre
VS 10	1.5 ... 525	7.50 ... 2625.00	3.333	300

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-600-3 (EN 1563)
Meter bearing	: Ball bearings or steel plain bearings (medium-dependent)
Weight	: 70 kg without subplate
Seals	: FPM (standard), NBR, PTFE or EPDM
Max. operating pressure	: 420 bar / 6000 psi
Medium temperature	: -40 ... 120°C (-40°F ... 248°F)
Ambient temperature	: -20 ... + 50°C (-4°F ... 122°F)
Viscosity range	: 5 ... 100 000 mm^2/s
Installation position	: any
Flow direction	: any
Running noise	: db(A)
Power supply version	: 10 to 28 volts/DC
Frequency range	: 0 ... 2625 Hz
Pulse output	: 2 x push-pull output stages reverse-polarity-proof, short-circuit-proof low signal: 0 = GND; high signal: 1 = U_b -1 I_{max} = 80 mA (at 24 V) P_{max} = 1.92 W (at 24 V)
Channel offset	: 90° ± 30° max.
Pulse-width repetition rate	: 1/1 ± 15° max.
Preamplifier housing	: Aluminium
Protection type	: IP 65

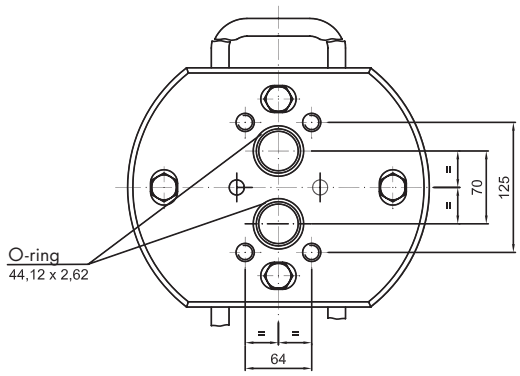
FLOW RESPONSE CURVES VS 10



DIMENSIONS VS 10



View X



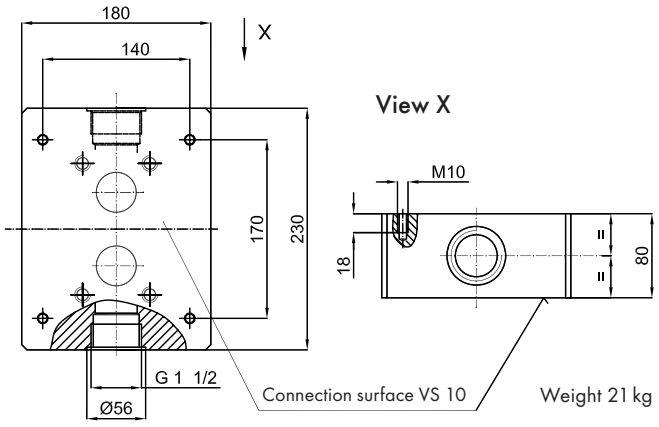
Connection diagram

Weight 70 kg

Dimensions in mm

DIMENSIONS, SUBPLATE APG 10.

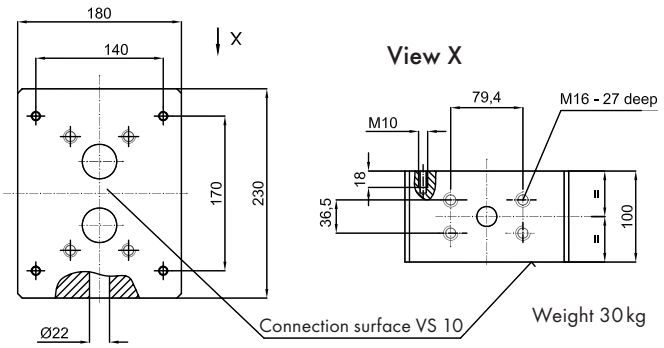
APG 10 SG0N / 1



View X

Weight 21 kg

APG 10 SW0N / 1



View X

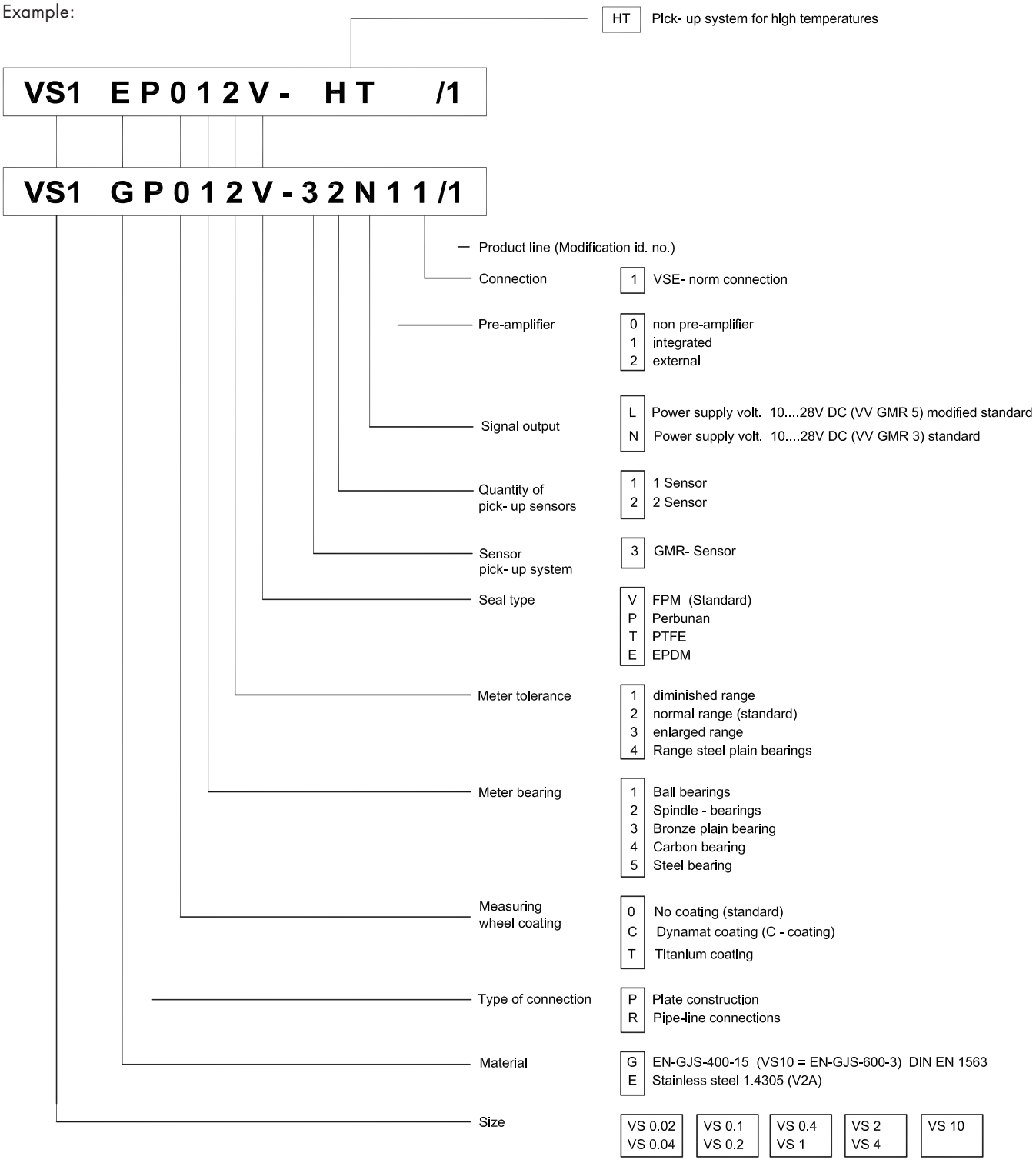
Weight 30 kg

Dimensions in mm

TYPE KEY

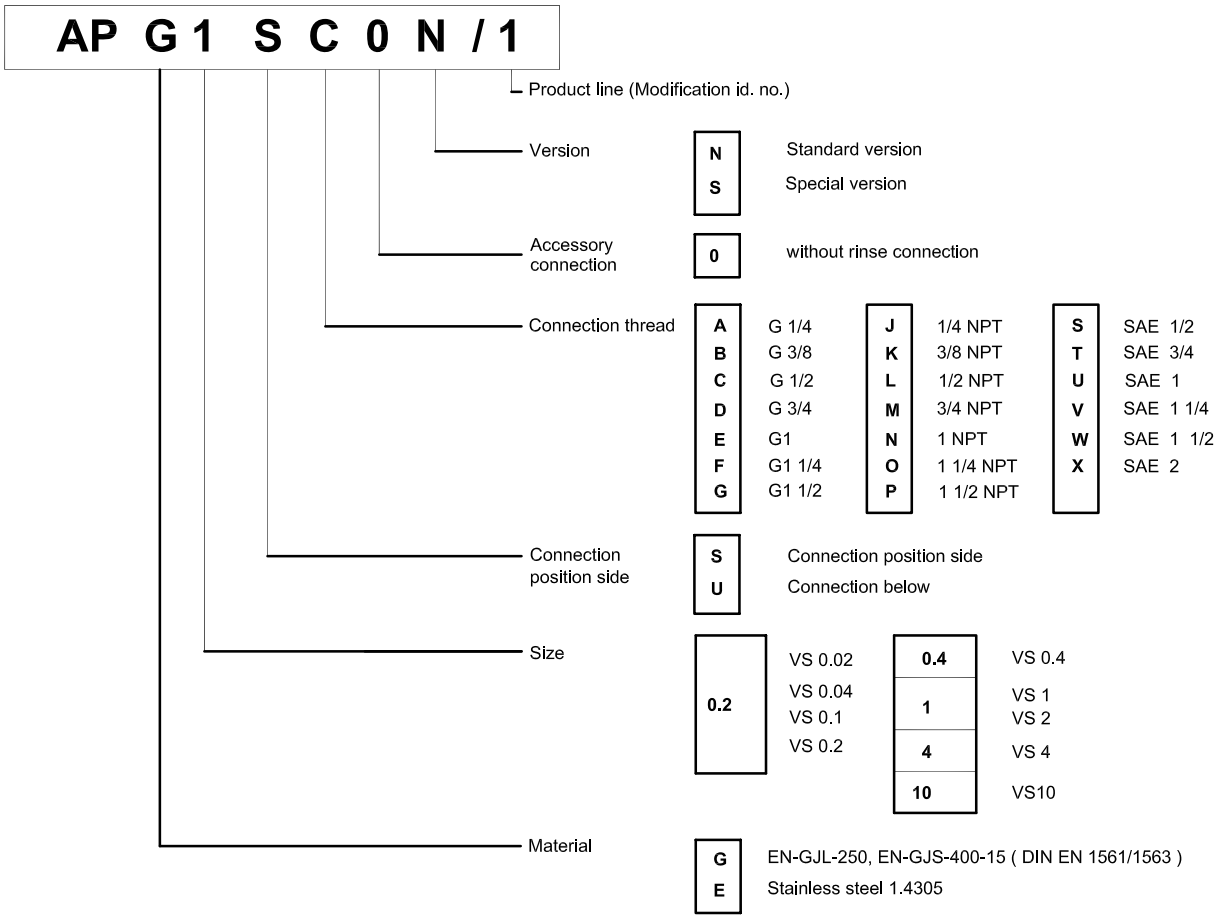
Flow meters VS

Example:

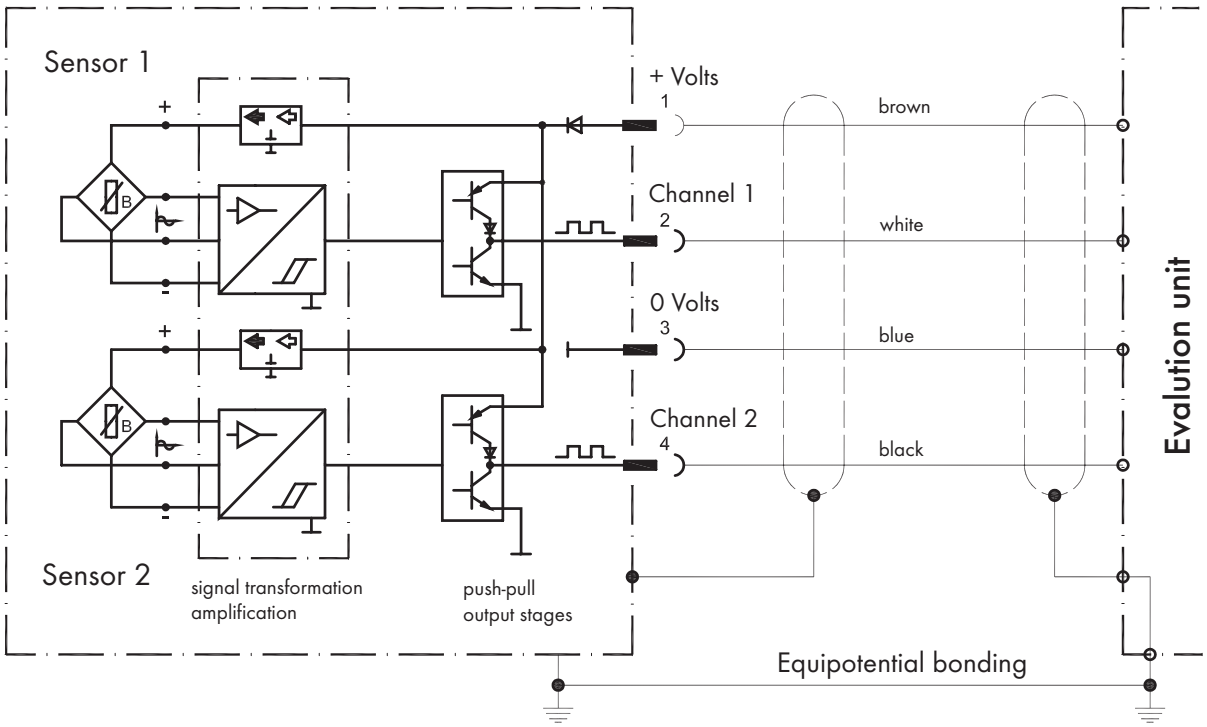


Subplates AP ...

Example:

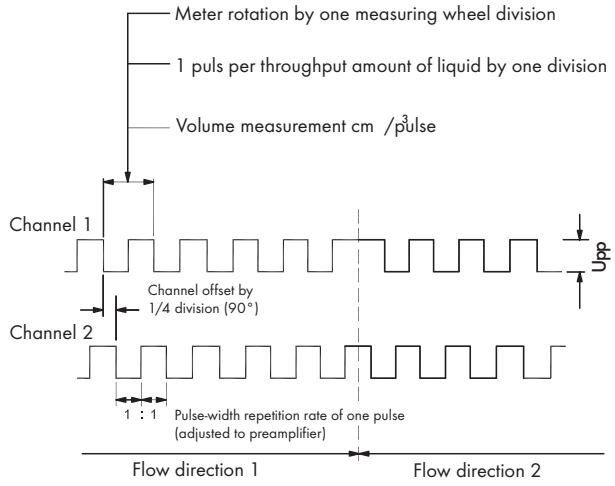


PREAMPLIFIER-BLOCK WIRING DIAGRAM

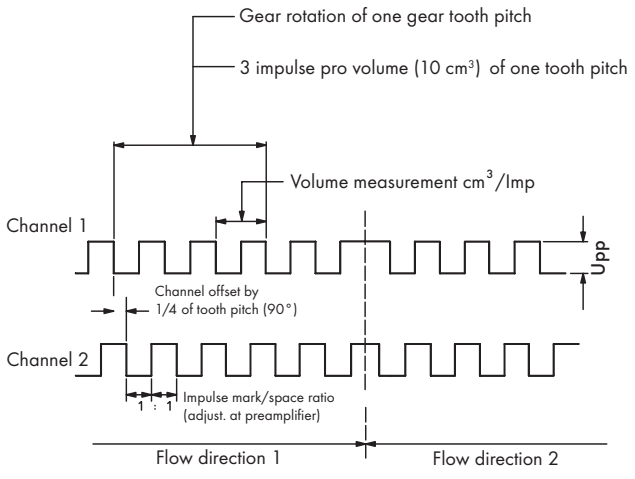


OUTPUT SIGNALS ON PREAMPLIFIER

Flow meter VS 0.02 ... VS 4



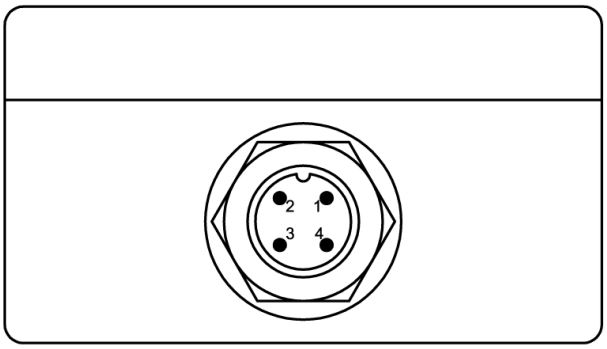
Flow meter VS 10

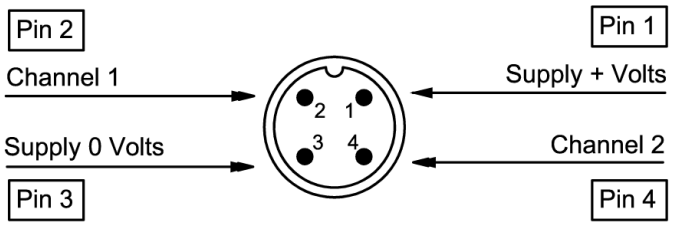


Voltage ranges

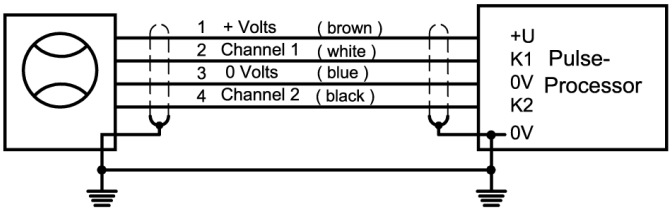
Power supply voltage: U_V = 10 ... 28 V DC
Signal voltage: $U_{ss} = U_V - 1$ V

PLUG ASSIGNMENT





CONNECTION DIAGRAM

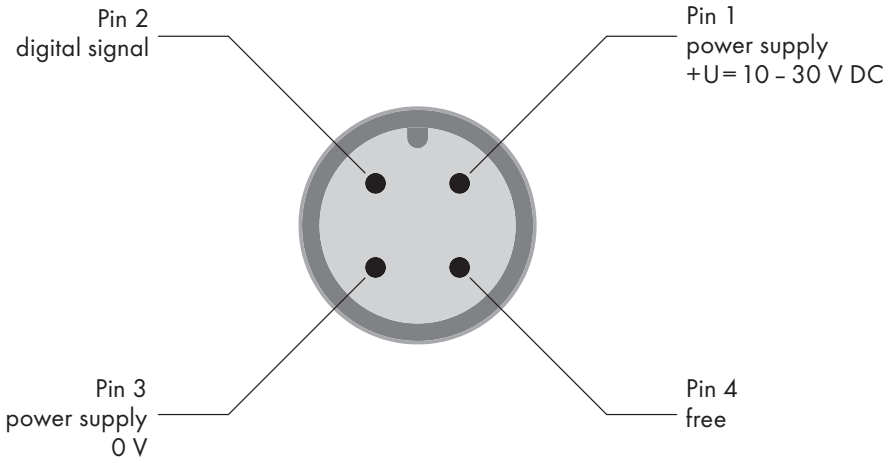


Modification of flow direction indication
(+ to - / - to +) by interchanging
channels
(channel 1 _ channel 2)

PICK-UP SYSTEM FOR HIGH TEMPERATURES HT

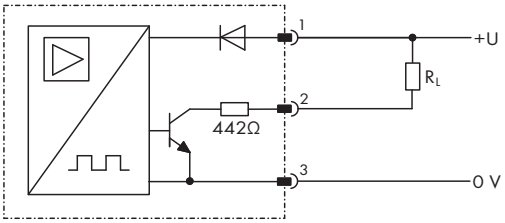
For medium temperatures >120°C, the high temperature (HT) versions by VSE have to be deployed. Flow meters of stainless steel are used exclusively in this case.
The sensor or pick-up system consists of a sensor unit, which is screwed into the cover of the flow meter and a downstream amplifier. The amplifier is connected with the flow meter via a temperature-stable cable and has to be installed outside the high temperature zone. The ambient temperature should be no more than 50°C in this area.
The digital signals are emitted as PNP- or NPN-signals, depending on amplifier version.
With extensive cable lengths, we recommend using shielded cables and a pull-down (PNP signal) or pull-up impedance (NPN signal).

Plug assignment HT

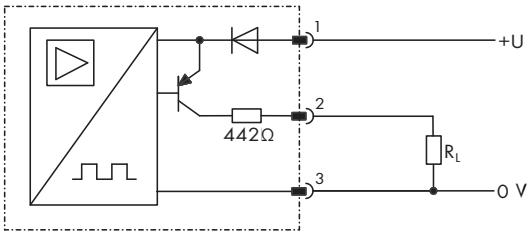


Top view of plug

Connection diagrams HT



Pulse output NPN-version



Pulse output PNP-version

Technical specifications HT

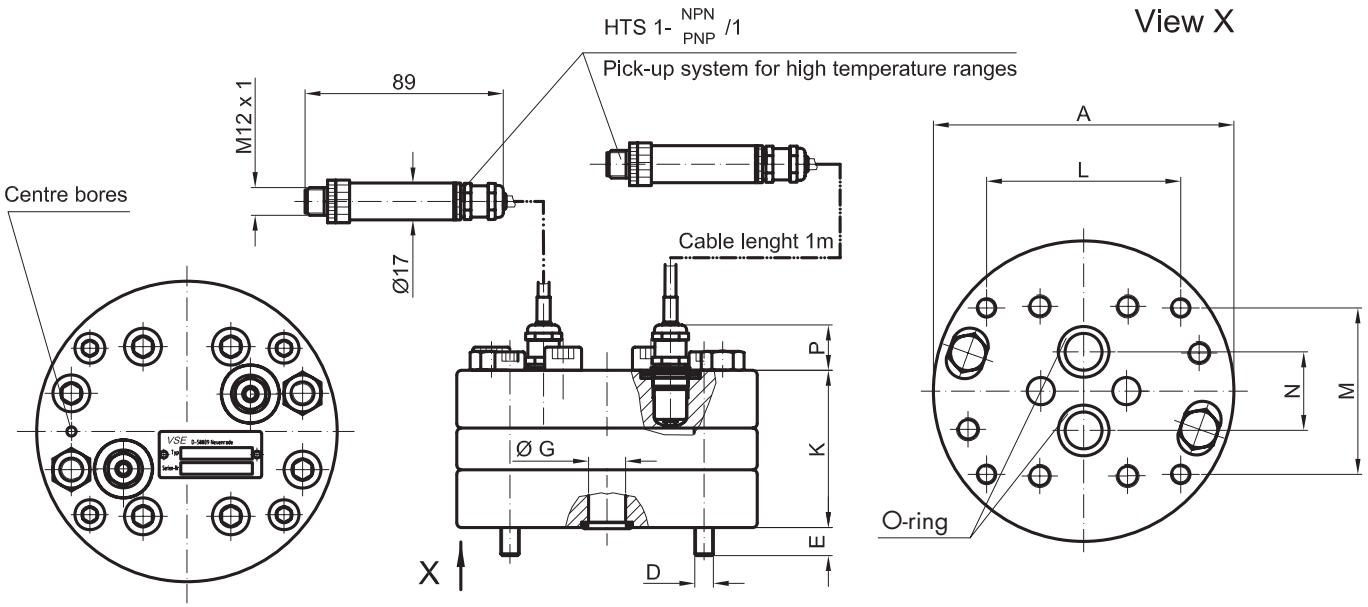
Sensor Unit

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

Amplifier pick-up system for high temperature range HTS 1

Supply voltage	U_b = 10 ... 30 V DC+/- 10%	
Current consumption	I_b = ca. 18 mA (idle motion, without lead)	
Signal output PNP	High Sign.: $U_S = U_b$-1 V; I_S = 25 mA max	
Signal output NPN	Low Sign.: U_S = 0 V; I_S = 25 mA max	
Electrical connection	4 pin round plug M12	
Max. ambient temperature	-20°C ... 50°C	
Protection – class	IP 64	
Pull–Down resistor Rc	4.7 ... 10 KΩ	PNP-Version
Pull–Up resistor Rc	4.7 ... 10 KΩ	NPN-Version

Dimensions flow meter HT



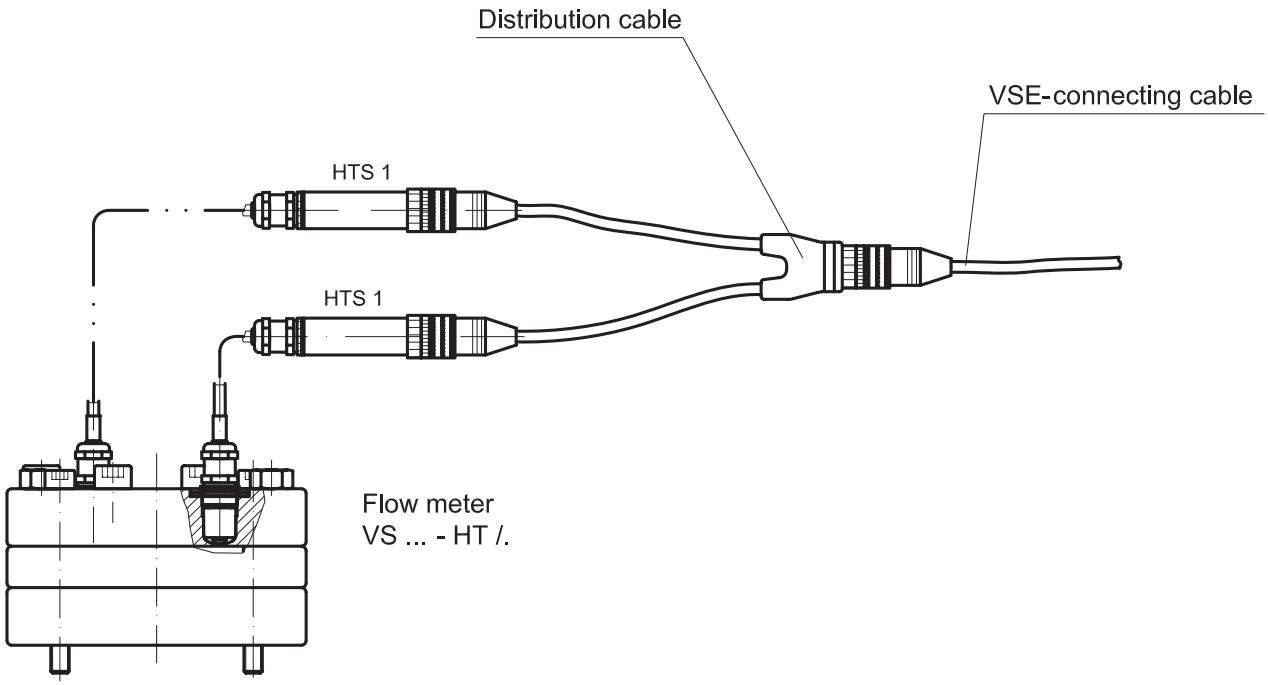
size	A	D	E	øG	K	L	M	N	P	O-ring	Weight
VS 0.04*	100	M6	11.5	ø 9	59	70	40	20	22	11 x 2	3.3
VS 0.1	100	M6	9	ø 9	61	70	40	20	22	11 x 2	3.3
VS 0.2	100	M6	9.5	ø 9	61	70	40	20	22	11 x 2	3.6
VS 0.4	115	M8	11.5	ø 16	63.5	80	38	34	22	18 x 2.62	4.9
VS 1	130	M8	12.5	ø 16	68	84	72	34	22	18 x 2.62	6.7
VS 2	130	M8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

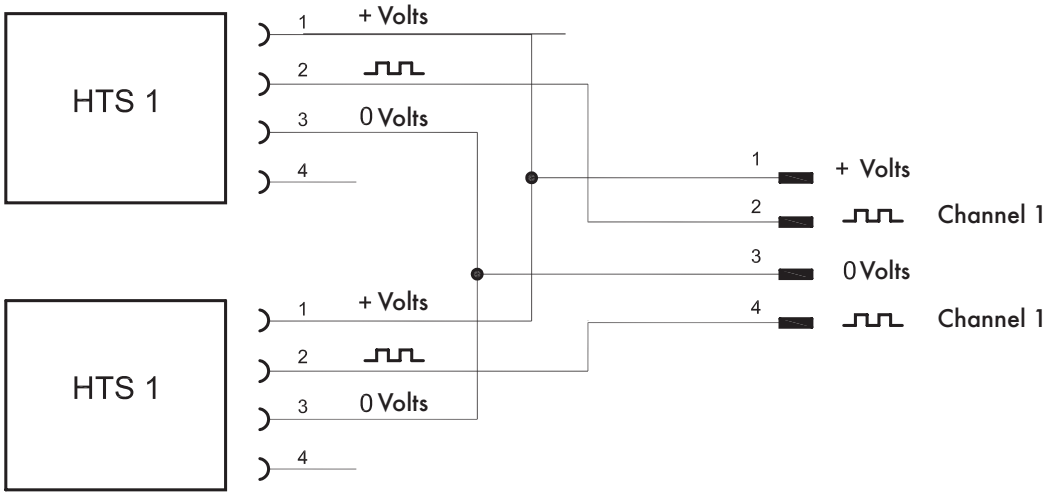
**only available as single-channel version*

Accessories HT

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

Connection diagram 2-channel HT-pick-up system





Notes

Notes

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