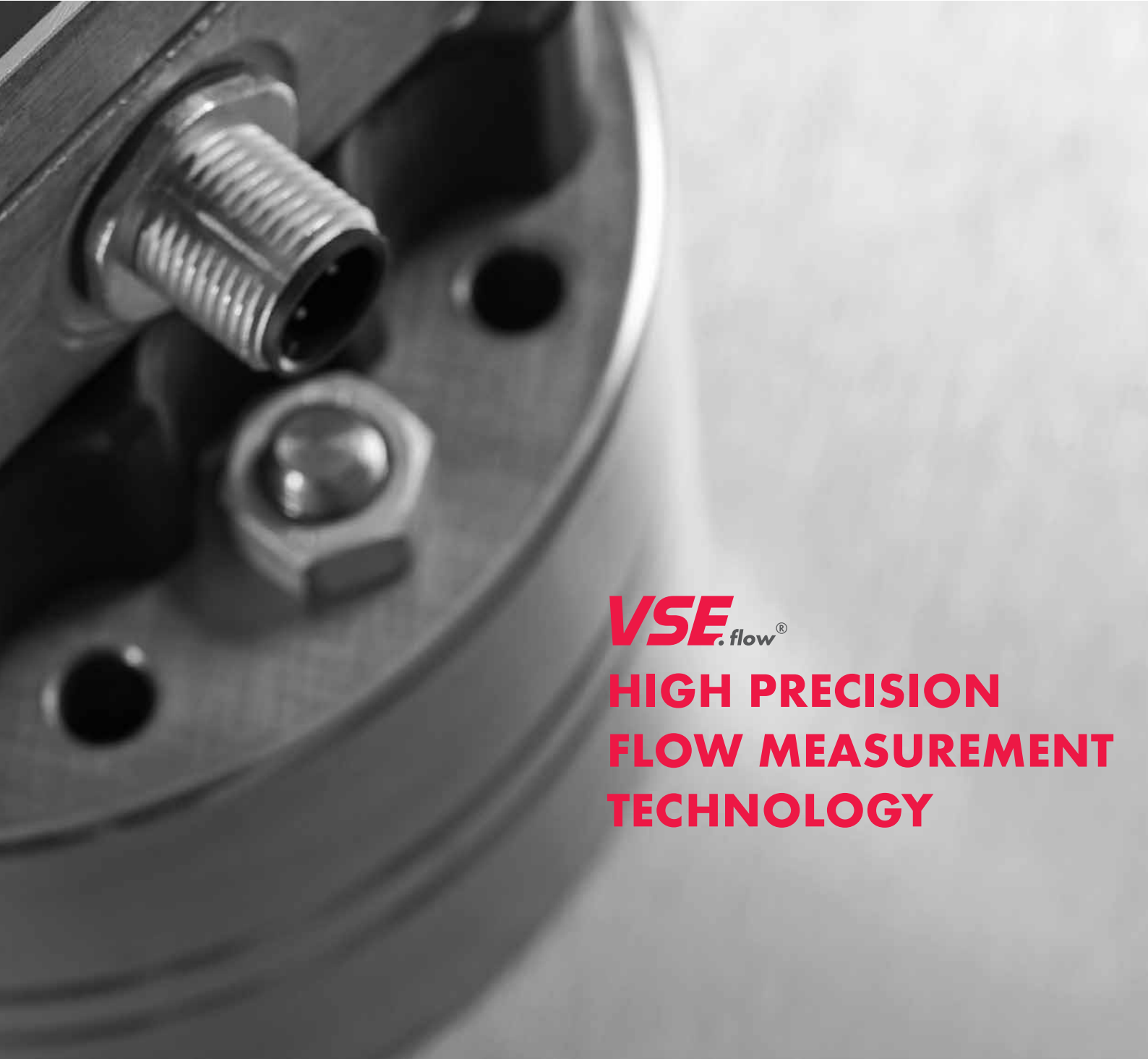




Solutions for Fluid Technology

A close-up, black and white photograph of a VSE flow meter component. The image shows a threaded metal fitting with a hexagonal base, mounted on a circular metal plate with several holes. The background is a blurred, light-colored surface.

VSE.flow[®]

**HIGH PRECISION
FLOW MEASUREMENT
TECHNOLOGY**

VSE HIGH PRECISION FLOW MEASUREMENT TECHNOLOGY

E FLUID TECHNOLOGY – YOUR COMPETENT VSE PARTNER

E Fluid Technology (Shanghai) Co., Ltd. is a subsidiary of the German e.holding company group. We supply and distribute flow meters, instrumentation, specialist pumps, and magnetic couplings of the German quality brands VSE, DST and Beinlich on the Chinese market.

VSE HIGH PRECISION FLOW MEASUREMENT TECHNOLOGY

VSE is a leading international manufacturer of flow measurement technology. VSE develops and produces flow meters for virtually all pumpable media and the corresponding evaluation devices. Whether for water or highly viscous adhesive media with filler material, the VSE in-house development and design department produces technically sophisticated flow meters.

SOLUTIONS IN COOPERATION WITH THE CUSTOMER

Most of the VSE output is tailored to customer requirements, thereby putting handcraft back into industry. VSE can utilise modular systems that are adjusted in line with the technical specifications for each individual order and needs of the customer. Our clients benefit from our technical know-how and from a close cooperation throughout all stages of planning and production. We support your projects optimally through our comprehensive application and material knowledge. We have a suitable solution for almost every requirement.

FLOW METERS FOR VARIOUS APPLICATIONS

VSE flow meters are used primarily where it is critical to have an accurate measurement possible. VSE flow measurement technology is used worldwide in high-tech processing plants in the plastics, polyurethane, chemical, pharmaceutical, paint and varnish, hydraulic and automobile industries, as well as in 2-component technology.

QUALITY PRODUCTS AND EXCELLENT SERVICE

E Fluid Technology, based in Shanghai and Guangzhou, is your local partner for VSE standard flow meters as well as customer-specific innovations. We provide distribution, application expertise, quality service and technical support. We work closely with the customers from the initial inquiry stage onwards and can provide innovative solutions for demanding applications.

We have a wealth of experience in helping you choose effective solutions for your application along with excellent technical knowledge and support. We also offer a competitive calibration and repair service with our own test stand. Our friendly team is always on hand to deal with your inquiry.

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HELICAL SCREW FLOW METER **RS**

4



HELICAL SCREW FLOW METER **RS**

GEAR FLOW METER **VS**

24



GEAR FLOW METER **VS**

GEAR FLOW METER **VHM**

52



GEAR FLOW METER **VHM**

GEAR FLOW METER **VSE EF ECOFLOW**

68



GEAR FLOW METER **VSE EF ECOFLOW**

TURBINE FLOW METER **VTR**

78



TURBINE FLOW METER **VTR**





HELICAL SCREW FLOW METER RS

RS FLOW METER

RS flow meters measure the flow rate based on the screw pump principle. A pair of rotors fitted precisely into the housing constitutes the measuring element. An integrated gear and non-contact signal pick-up system detects the rotations of the measuring element and converts them to digital pulses.

Together with the housing walls, the rotor edges form closed measuring chambers in which the fluid is transported from the inlet to the outlet side.

The fluid volume put through within one main rotor rotation is the rotation volume, which is divided by the sensing gear and digitised, processed and output in the sensor module.

ADVANTAGES

High degree of precision that is mostly independent of viscosity

Pulsation-free measurement with minimal shear

Lowest pressure losses

Short response time due to innovative rotor profile and reduced mass

Highest functionality due to intelligent sensor technology

FLOW METER SELECTION

For the trouble-free, safe and reliable operation of the flow meters, selecting the correct type and size is critical. Because of the wide variety of applications and flow meter designs, the technical data in the VSE catalogue are of a general nature.

Certain properties of the devices depend on type, size, and measurement range as well as the liquid to be measured. Please contact VSE or one of our sales and service representatives for detailed information about the appropriate flow meter for your particular application.

SENSOR SYSTEM EXPLANATION

The non-contact pick-up system consists of two GMR-bridges (sin/cos), which are located in a sensor unit in cartridge design. It detects the movement of the sensing gear and routes the sin/cos-signals to the preamplifier electronics.

The preamplifier electronics digitise and amplify the sensor signals and multiply them by a high-resolution interpolator using adjustable settings. The square wave signals are bidirectional and can be utilised by any evaluating instrument as well as computers and PLC-controls.

The resolution is selectable in steps from factor 1 to 128.

In case of an 1-channel evaluation, a separate directional signal is available.

An adjustable pulse filter can offset and suppress negative flows (e.g. generated by vibrations) while still in the device.

The frequency of the output signals is proportional to the flow (volume flow) and depends on the respective flow meter size. The frequency range is from 0 to 100 kHz. The preamplifier is protected against reverse polarity and incorrect connection. It is suitable for fluid temperatures of -30°C to +120°C (-22°F to +248°F) (with HT sensor for a range of -40°C...+210°C (-40°F...+410°F)) and is mounted directly on the RS flow meter.

TECHNICAL DATA OVERVIEW

Size	Measurement range (Q_{max}) l/min.	RV ccm/ rev	VE ccm/Imp.	K-Factor* Imp./l min.	K-Factor* Imp./l max.	P max. bar	Filtering my
RS 40	0.04 – 40 (50)	8.37	0.31	3,226	413,000	450	100
RS 100	0.50 – 100 (120)	15.7	0.5815	1,720	220,000	450	250
RS 400	1.00 – 400 (525)	56.6	3.138	318	40,800	450	250
RS 800	4.00 – 800 (1,000)	180.0	10	100	12,800	450	500
RS 2500	10.00 – 2,500 (3,000)	666.0	37	27	3,459	40	500

*adjustable

FREQUENCY RANGE

0 ... 100 kHz, adjustable

REPEATABILITY ACCURACY

± 0.05 % with same operating conditions

MEASUREMENT ACCURACY

up to 0.5% (1 %)** of measured value with viscosity
of > 21 cSt.

**RS 2500

MATERIALS

GRAY CAST IRON MODEL

EN-GJS-400-15 (EN 1563)/16 Mn Cr 5
or 1.4112 (depending on size)

INSTALLATION POSITION

Any, using selectable connection units, also customer
specific

STAINLESS STEEL MODEL

Stainless steel 1.4305/1.4112, additional available
upon request

SUPPLY VOLTAGE

10 ... 28 VDC

BEARING

Fluid-dependent as anti-friction bearing or SSIC/
wolfram carbide friction bearing

CURRENT CONSUMPTION

65 mA at 24 VDC unloaded

SEAL

FPM (standard) PTFE, NBR, EPDM upon request

DELAY

≤ 8 µs

FLUID TEMPERATURE

-30°C ... +120°C (standard)
-40°C ... +210°C (HT design)

PROTECTION CLASS

IP 65

EXPLOSION PROTECTION

Protection type: intrinsically safe, available soon

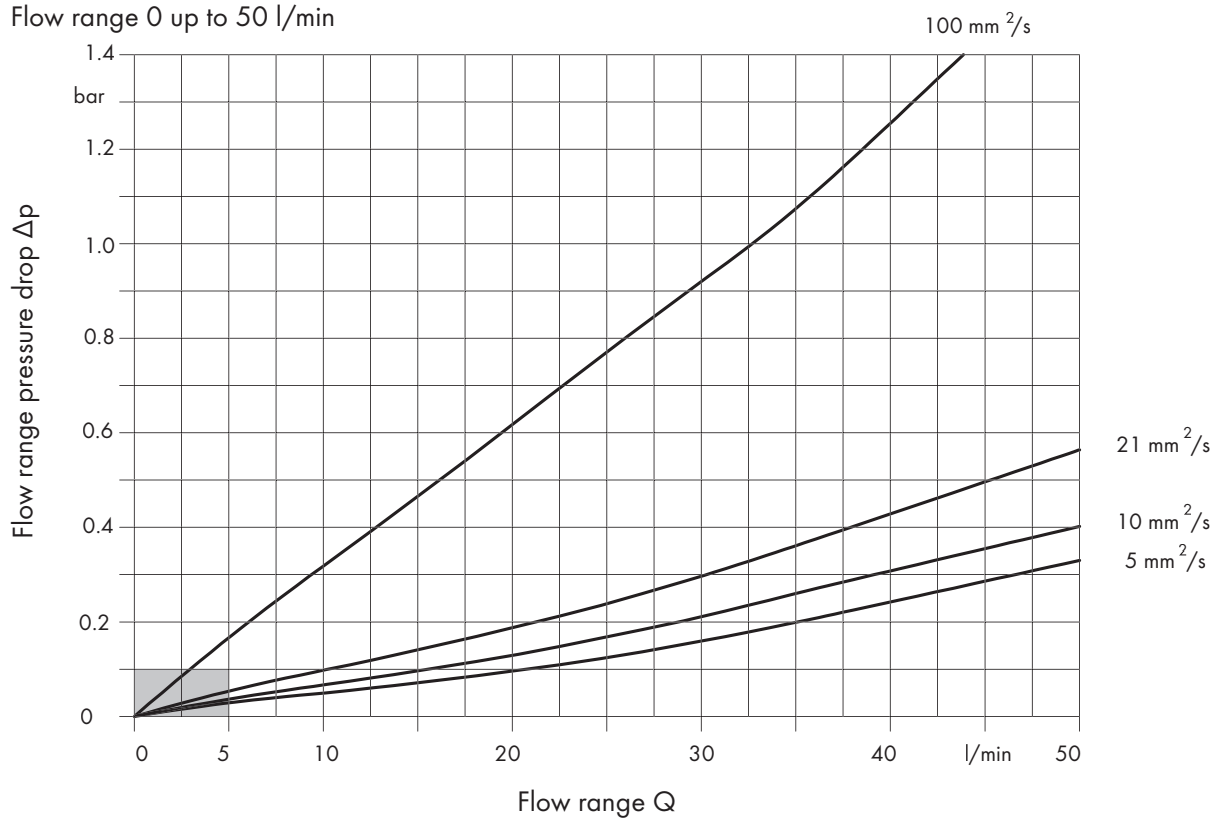
VISCOSITY RANGE

1 ... 1,000,000 cSt.

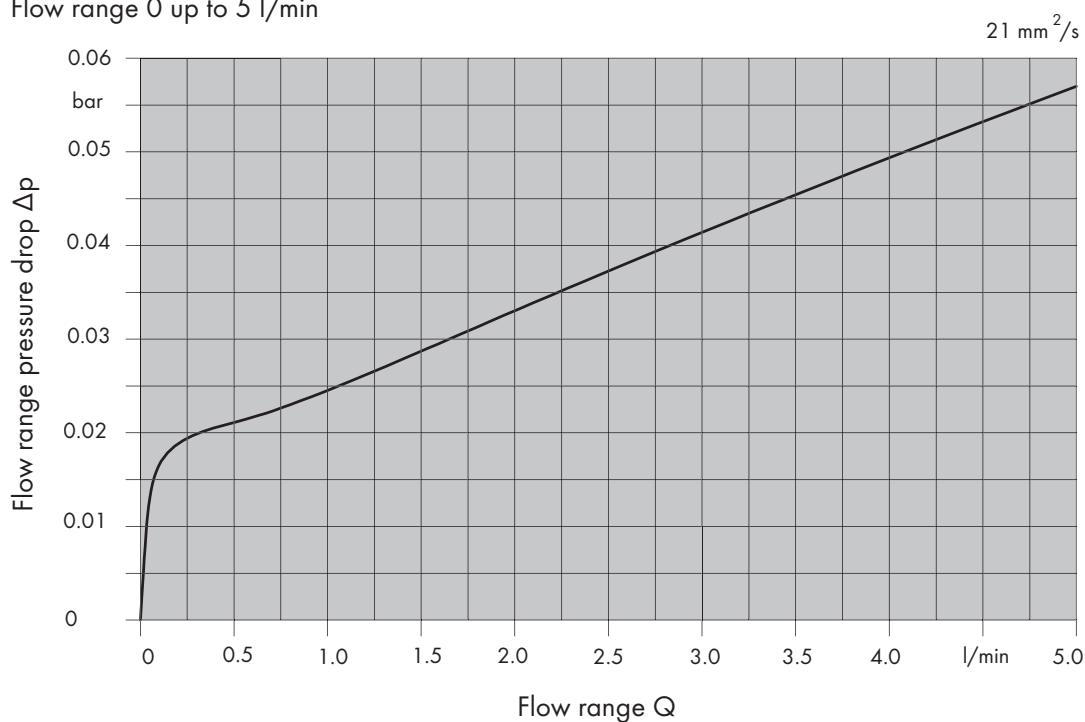
FLOW RANGES

SIZE 40

Flow range 0 up to 50 l/min

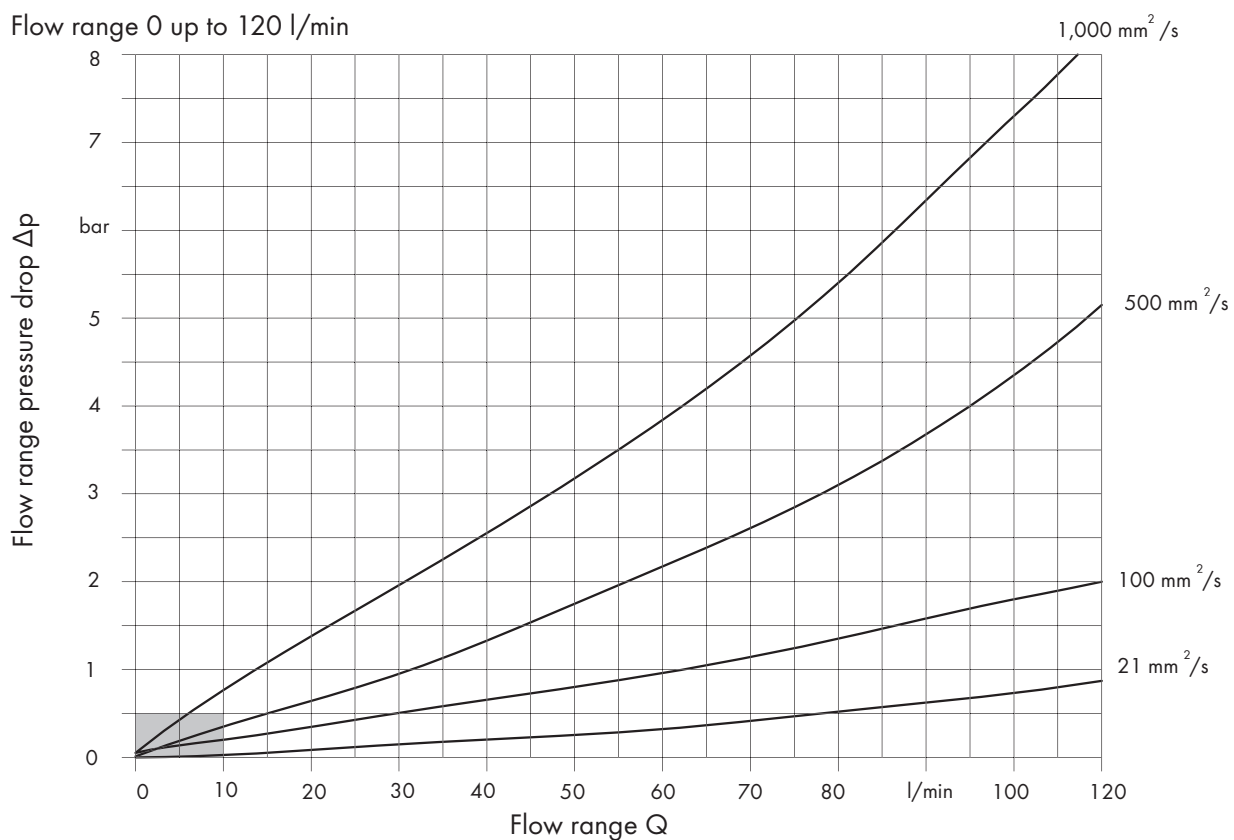


Flow range 0 up to 5 l/min

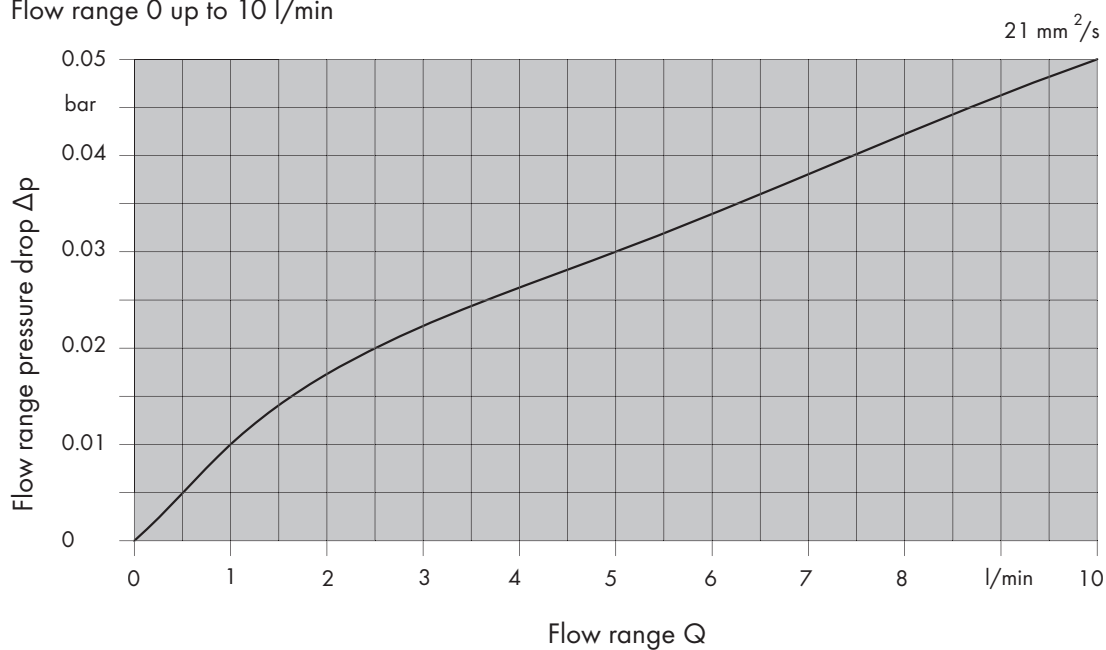


SIZE 100

Flow range 0 up to 120 l/min



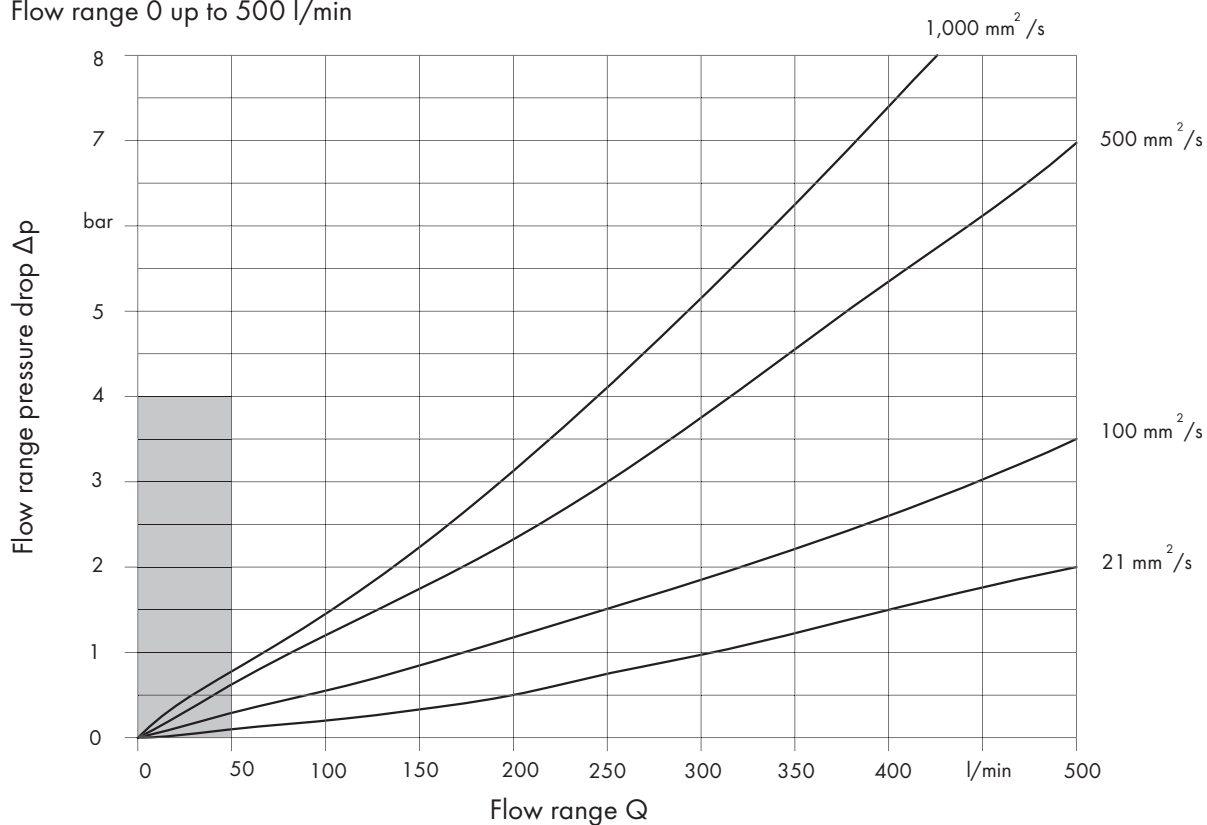
Flow range 0 up to 10 l/min



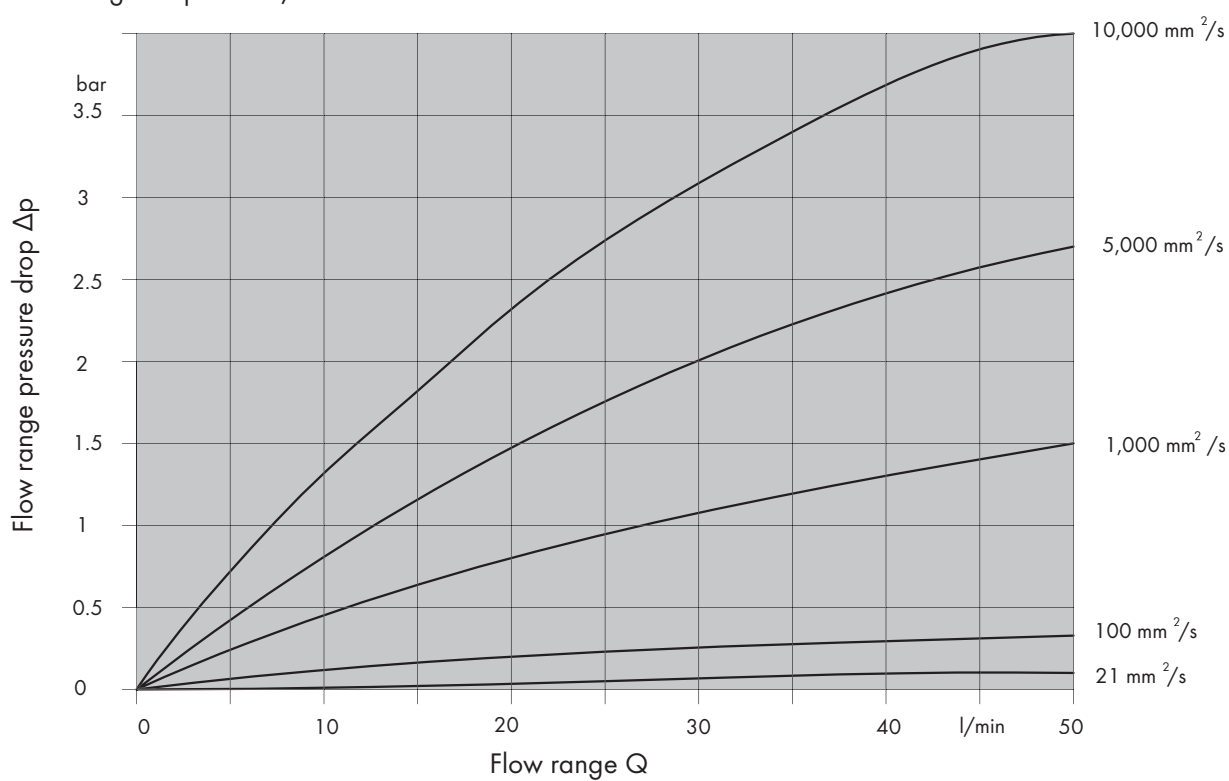
FLOW RANGES

SIZE 400

Flow range 0 up to 500 l/min

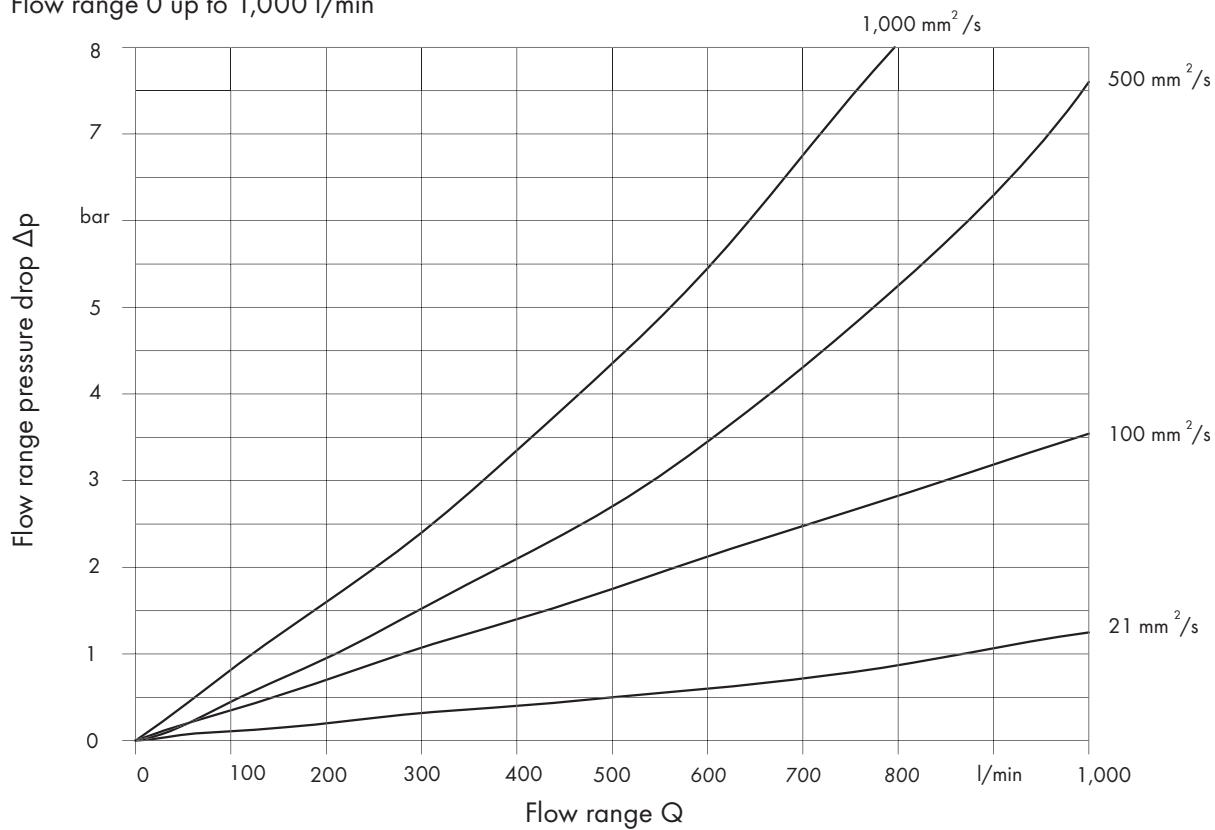


Flow range 0 up to 50 l/min



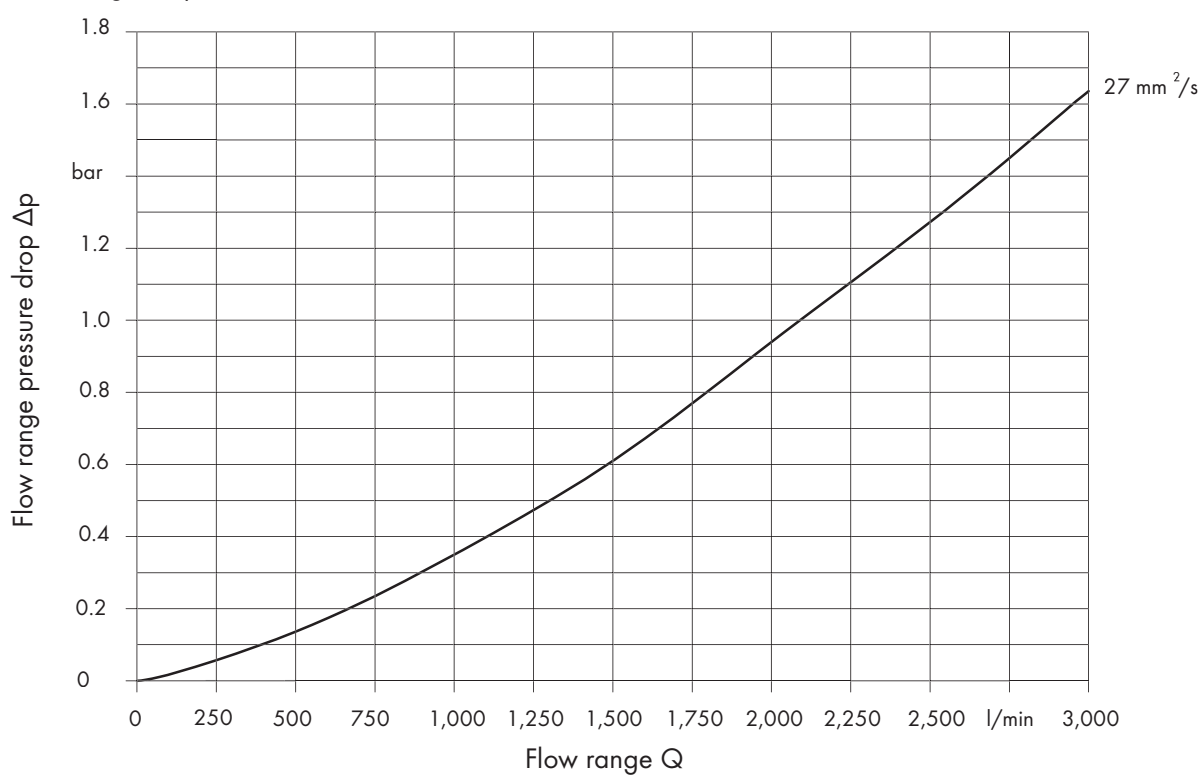
SIZE 800

Flow range 0 up to 1,000 l/min



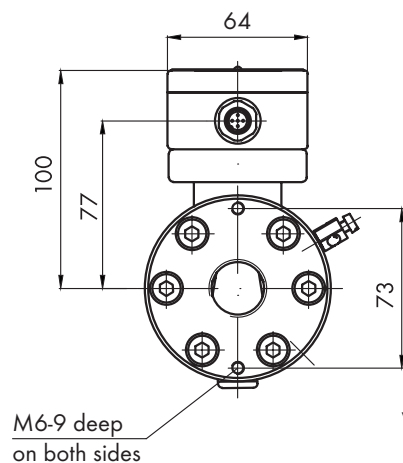
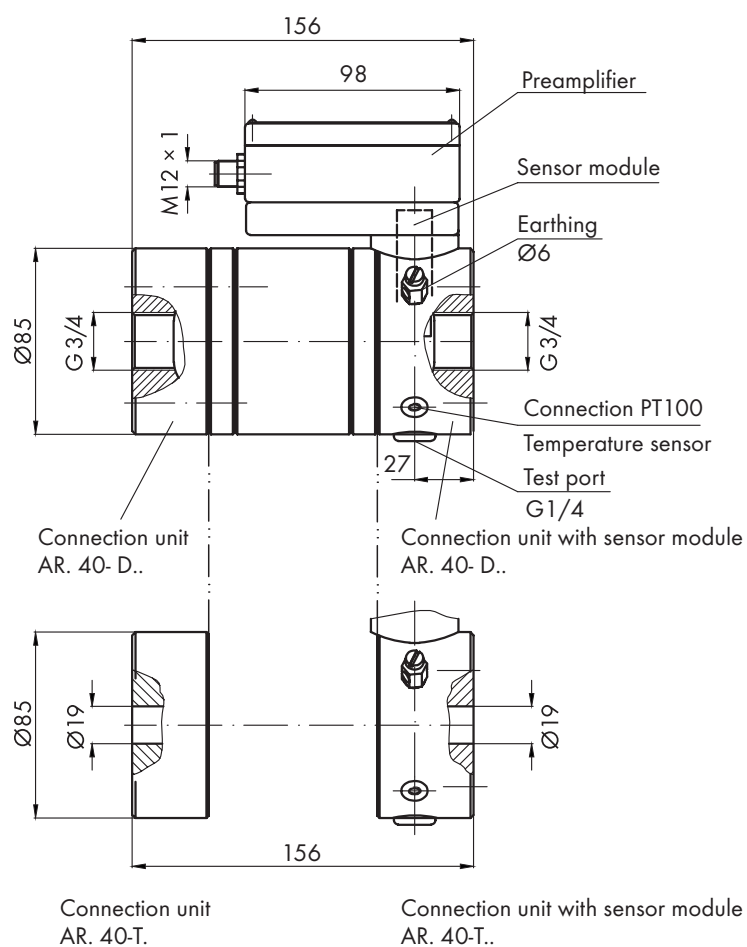
SIZE 2500

Flow range 0 up to 3,000 l/min



DIMENSIONS

RS 40



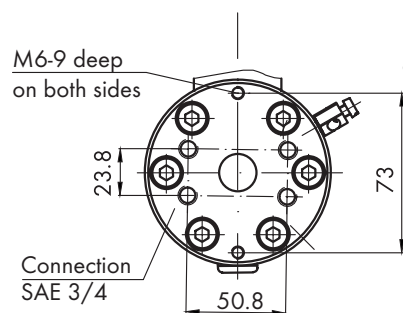
Weight:

Design "G"

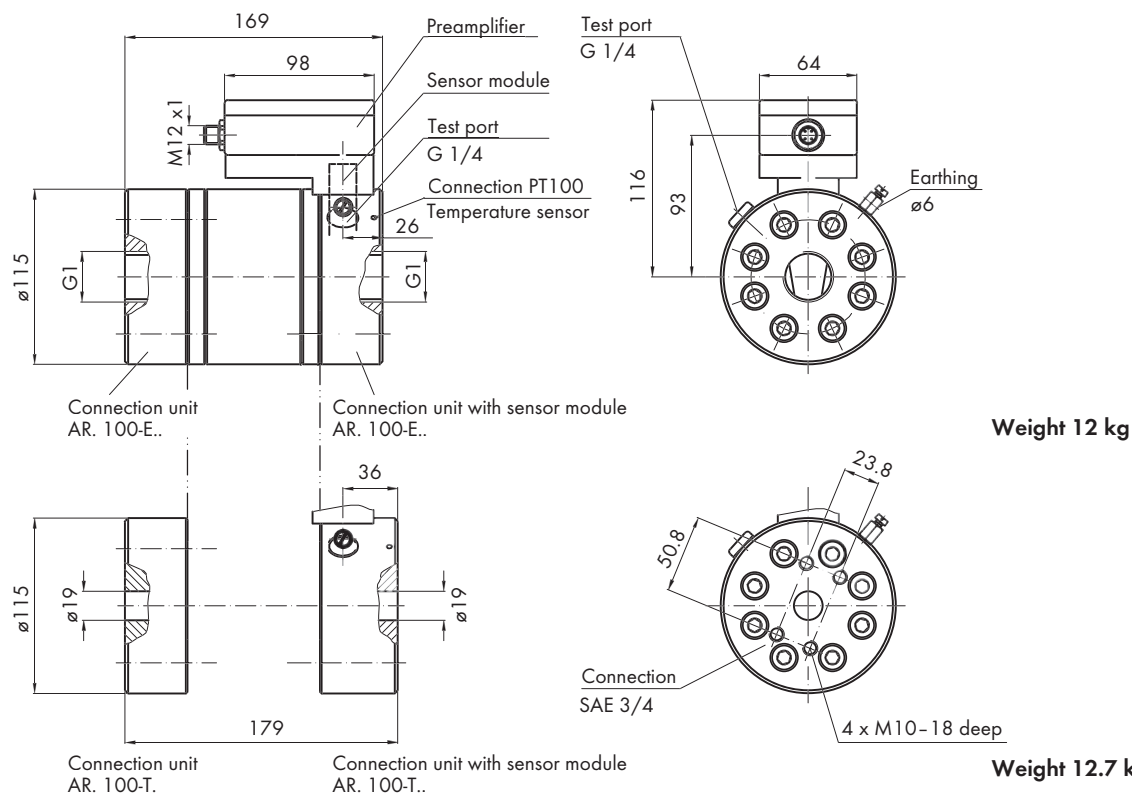
6.0 kg

Design "E + X"

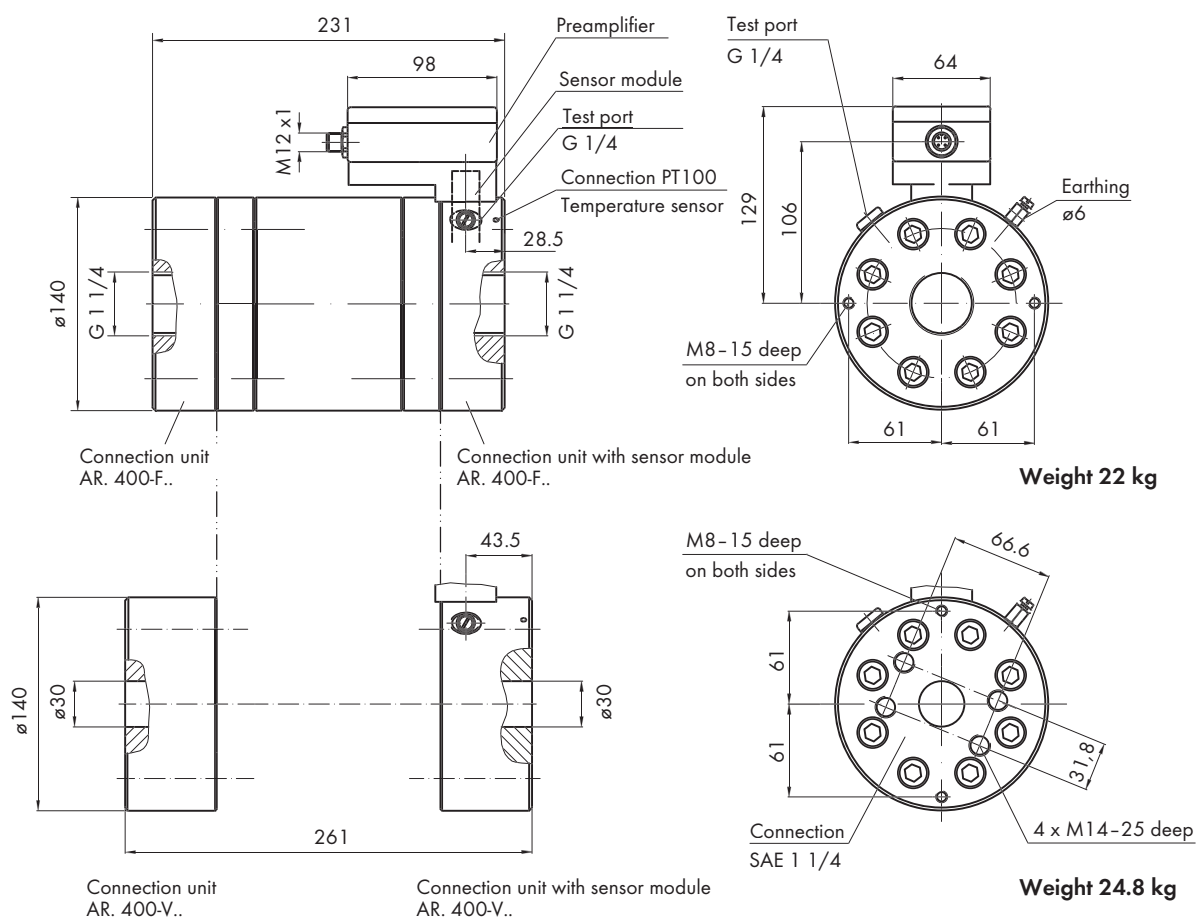
6.5 kg



RS 100

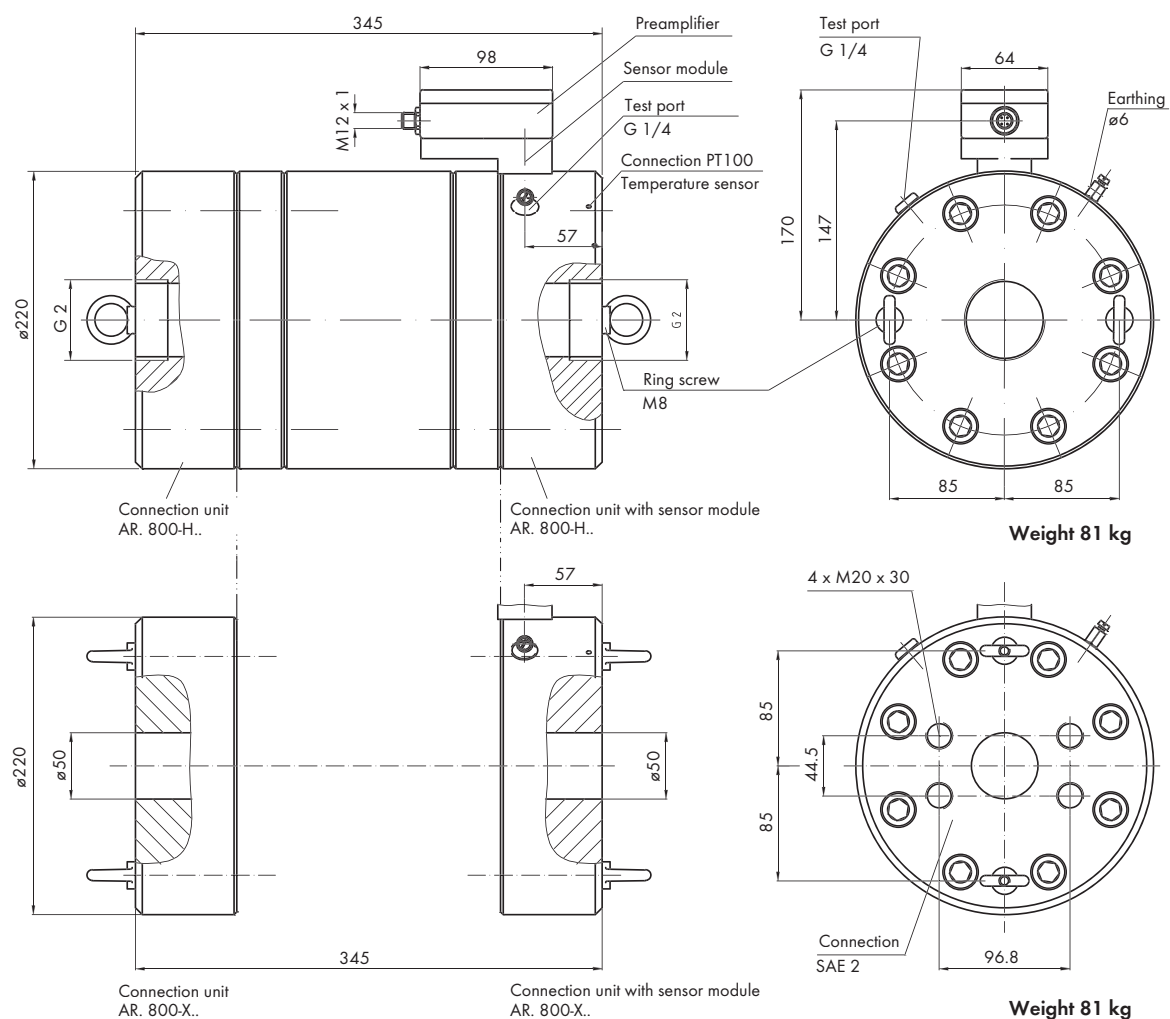


RS 400

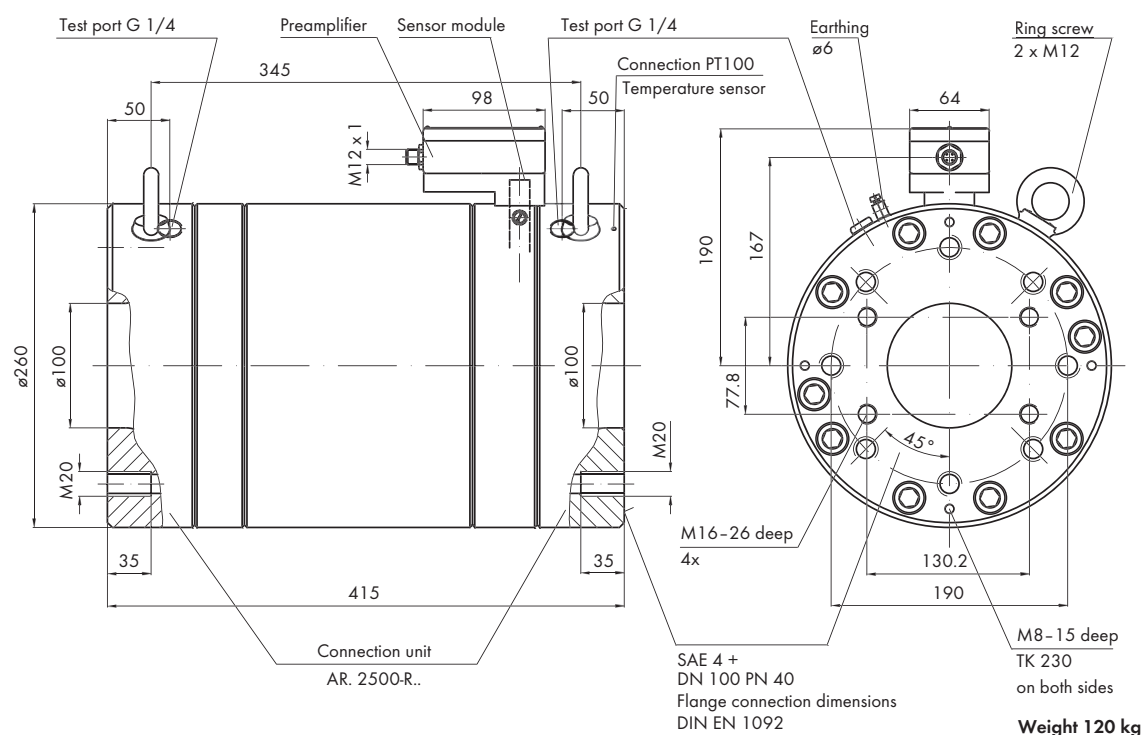


DIMENSIONS

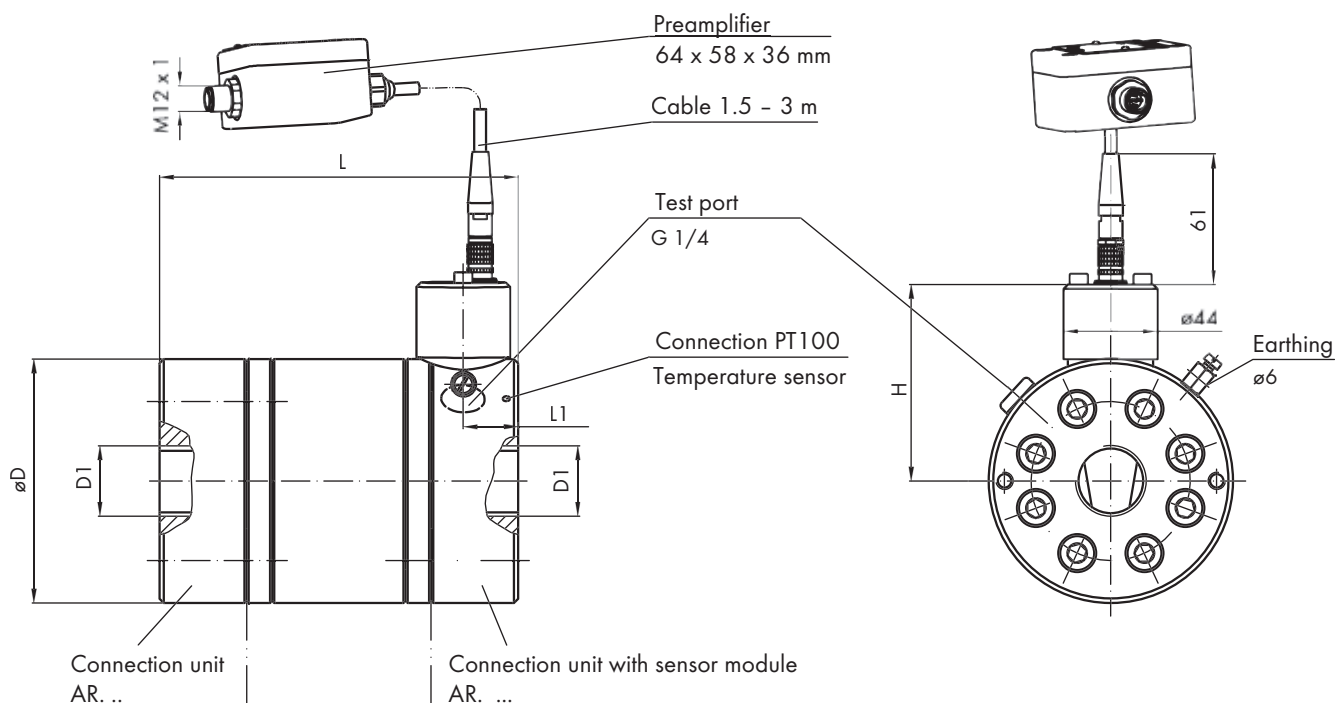
RS 800



RS 2500

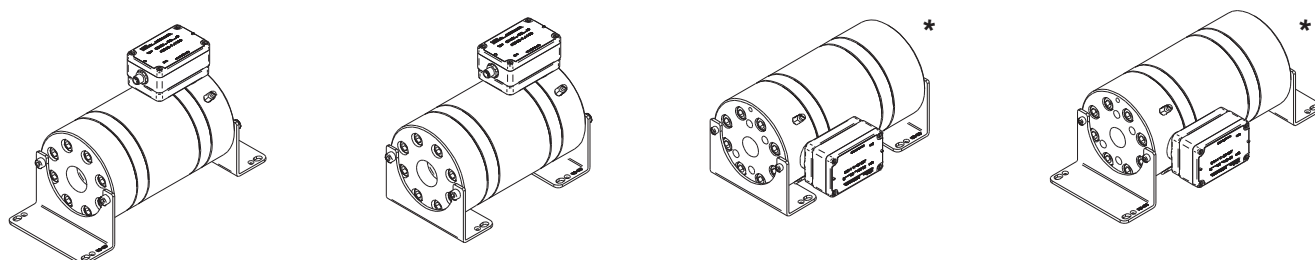
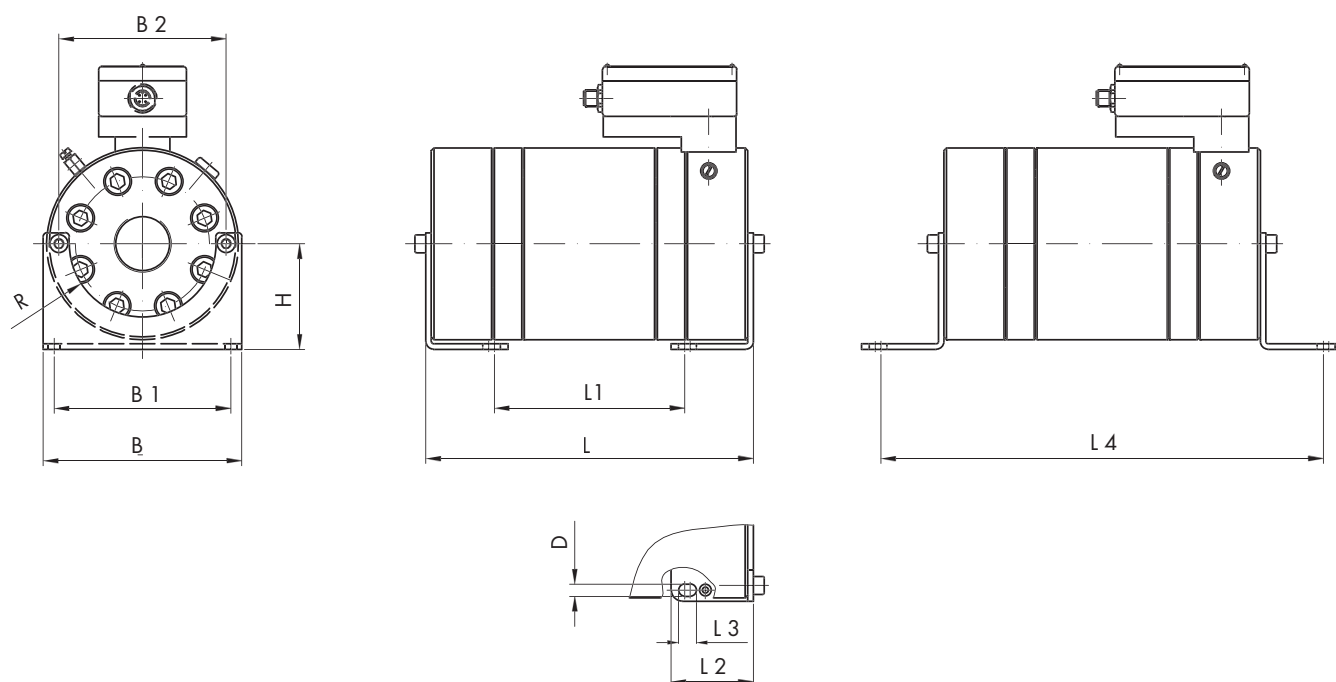


RS High temperature



Size	Ø D	D 1	L	L 1	H
RS 40	85	G 3/4 SAE 3/4	156	27	78.5
RS 100	115	G 1	169	26	93.5
		SAE 3/4	179	36	
RS 400	140	G 1 1/4	231	28.5	106
		SAE 1 1/4	261	43.5	
RS 800	220	G 2	345	57	147
		SAE 2			
RS 2500	260	SAE 4 + DN100 PN40	415	84	167.5

BRACKET CONNECTIONS RS



* Alternative bracket connections not available for all connection sizes

Size	Connection	B	B 1	B 2	R	H	L	L 1	L 2	L 3	L 4	D
RS 40	G 3/4 SAE 3/4	85	73	73	30.5	49	164	107-113	35	9.5	207-213	6.5
RS 100	G 1	120	104	100	41	64	177	97-105	50	13	241-249	9
	SAE 3/4						187	107-115			251-259	
RS 400	G 1 1/4	145	129	122	53.5	77	239	139-147	60	13	323-331	9
	SAE 1 1/4						269	169-177			353-361	
RS 800	G 2	225	209	180	76	117	353	193-201	90	13	497-505	9
	SAE 2											
RS 2500	SAE 4 + DN100 PN40	265	240	230	100	142	425	235-245	110	16	595-605	11

SENSOR MODULE

SENSOR ELECTRONICS DESCRIPTION

A special sensor system detects any movement of the pair of rotors or of the liquid column. For this purpose, a precision gear connected to a shaft of the rotor pair is scanned by a special magnetoresistive sensor. The scanning sensor includes two GMR-bridges (sin/cos) and is housed in a removable stainless steel cartridge case together with a signal conditioning and amplifier unit. The downstream electronics unit features a high-resolution sin/cos-interpolator, which is adjustable with ten different resolution factors. Furthermore, a programmable signal filter is available as well, which can offset unwanted negative pulse sequences up to an adjustable degree. In addition, a signal for a separate direction detection, e.g. in case of a 1-channel evaluation, is provided by the electronics. Optionally, this output can be used for the detection of excess flows and temperatures.

FEATURES

- Adjustable interpolation factors IPF:
1, 2, 5, 10, 25, 32, 50, 64, 100, 128
- Adjustable pulse filtering: up to 22 % of the rotation volume
- Adjustable preferential direction for filtering processes
- Generating frequencies up to 100,000 Hz
- Output of a separate directional signal or error signal (selectable)
- Automatic offset adjustment of the GMR-sensor-bridge (sinus, cosine)
- Detection of stalled sensor or sensor faults/magnet wheel damages
- Flow overload detection with logging
- Excess temperature detection with logging
- Detection of exceeding the max. permissible highest frequency (> 100,000 Hz)
- Readable error code LEDs

POWER SUPPLY

Supply voltage

$U = 10 \dots 28 \text{ VDC}$; reverse pole protection

Current consumption

$I_0 = 65 \text{ mA}$ (at 24 VDC); unloaded

Delay

$t_v = 8 \mu\text{s}$ max. (between scanning and measured value)

SIGNAL OUTPUTS

Output signal shape

Quadrature signals
(A, B with 90° phase shift)

Directional output

Positive high (24 V); negative low (0.8 – 1 V)

Error output

Active high (24 V); inactive low (0.8 – 1 V)

Max. output frequency

100 kHz

Signal voltage output

(channel 1, channel 2, direc/err)
 $V_{ss} = 9 \dots 27 \text{ VDC}$

Signal output current

(channel 1, channel 2)
 $I_{OUT} = 300 \text{ mA}$ max. at 24 VDC

Output final stages

Push-pull-final stages, current-limited, short-circuit proof, internal cable adjustment, small saturation voltage, thermal shutdown with hysteresis, high-impedance outputs in case of error

SENSOR MODULE

PULSE FILTERING PRINCIPLE

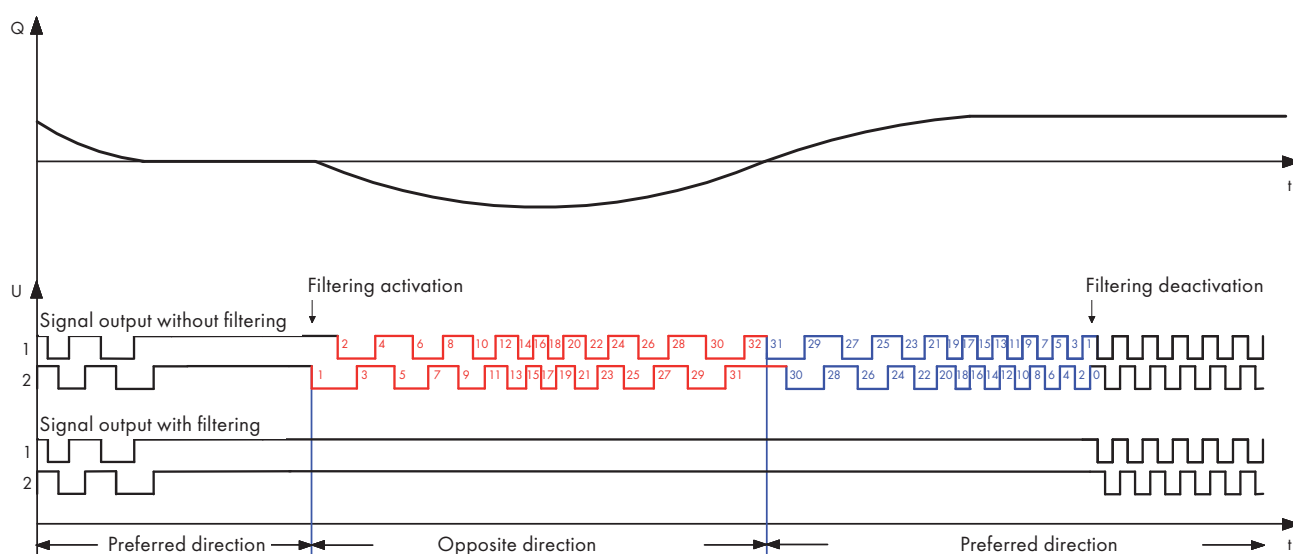
Oscillations in fluid systems manifest themselves through constant forward and backward movements of the liquid column, which is also detected by the rotor sensors and converted into proportional electronic pulses or edge sequences. These generated pulses can be incorrectly interpreted by the downstream evaluating unit or controller, which can be very distracting for the respective operating process.

The signal filtering function of the internal electronics continuously offsets these generated edges during the rapid forward and backward movements of the rotor measuring element. The signals at the channel outputs are also suppressed until the internal offset is equalized or the initial position of the rotor measuring element has been reached again.

The user is able to set the degree of filtering in the form of partial volumes using rotary coding switches.

SUPPRESSED VOLUME WITH PULSE FILTERING ACTIVATION [ml]

Filter position	RS 40X	RS 100X	RS 400X	RS 800X	RS 2500X
0	0	0	0	0	0
1	0.0775	0.145375	0.7845	2.5	9.25
2	0.155	0.29075	1.569	5.0	18.50
3	0.2325	0.436125	2.3535	7.5	27.75
4	0.31	0.5815	3.138	10.0	37.00
5	0.3875	0.726875	3.9225	12.5	46.25
6	0.465	0.87225	4.707	15.0	55.50
7	0.5425	1.017625	5.4915	17.5	64.75
8	0.62	1.163	6.276	20.0	74.00
9	0.6975	1.308375	7.0605	22.5	83.25
10	0.775	1.45375	7.845	25.0	92.50
11	0.8525	1.599125	8.6295	27.5	101.75
12	0.93	1.7445	9.414	30.0	111.00
13	1.0075	1.889875	10.1985	32.5	120.25
14	1.085	2.03525	10.983	35.0	129.50
15	1.1625	2.180625	11.7675	37.5	138.75



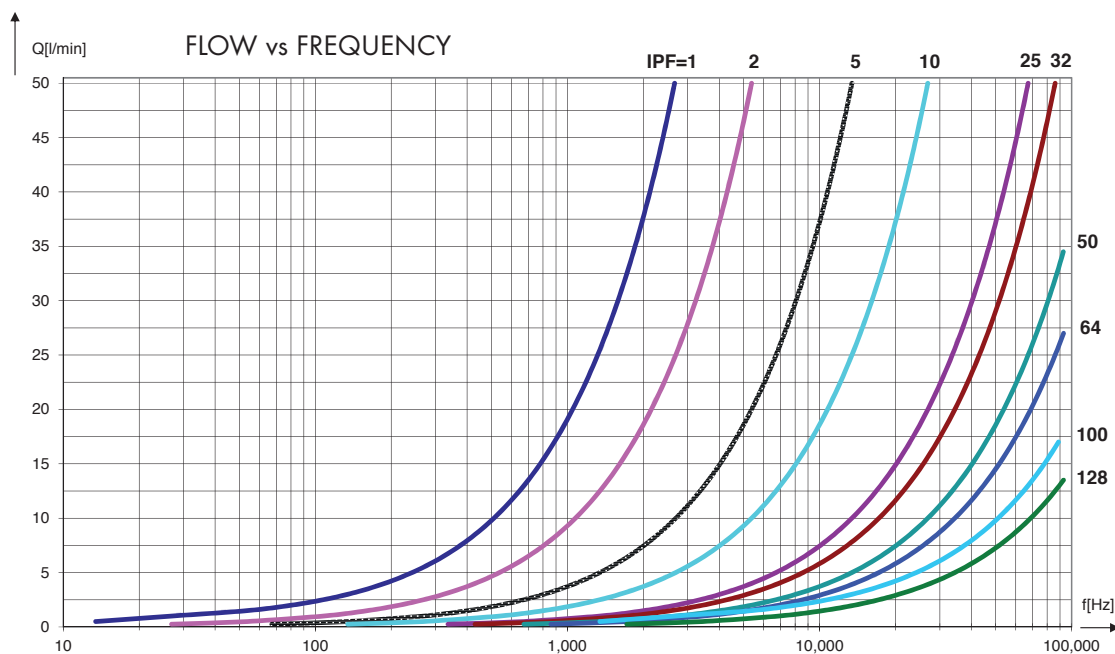
Pulse filtering chart

TECHNICAL DATA

RS 40

Max. permissible flow 40 l/min

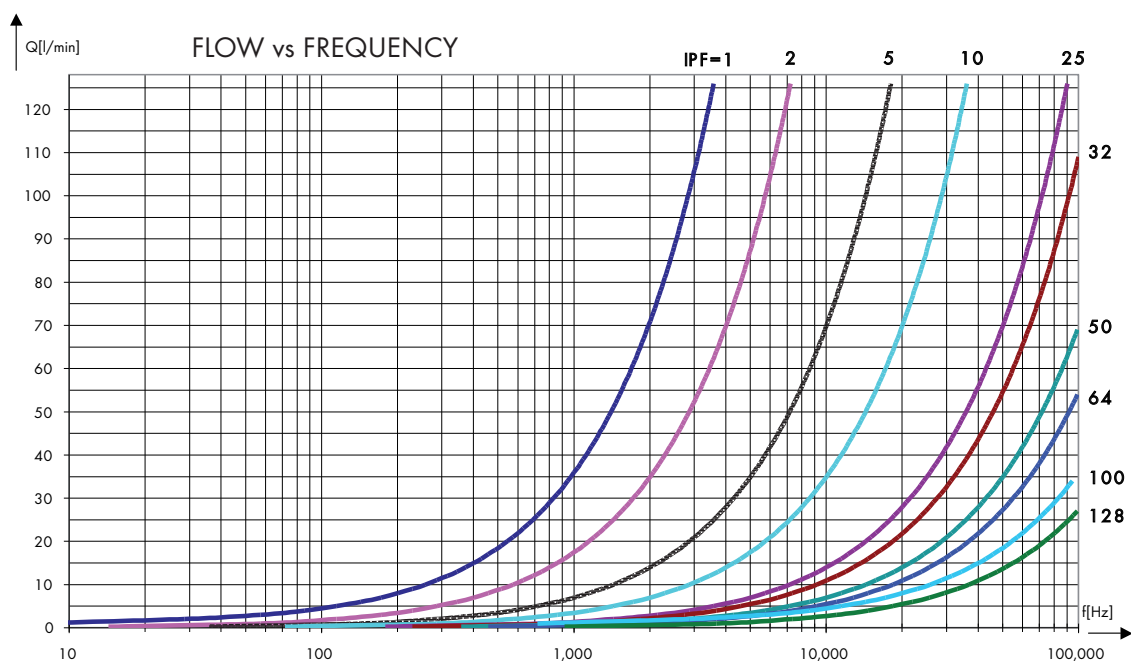
Min. permissible flow 0.04 l/min



RS 100

Max. permissible flow 100 l/min

Min. permissible flow 0.25 l/min

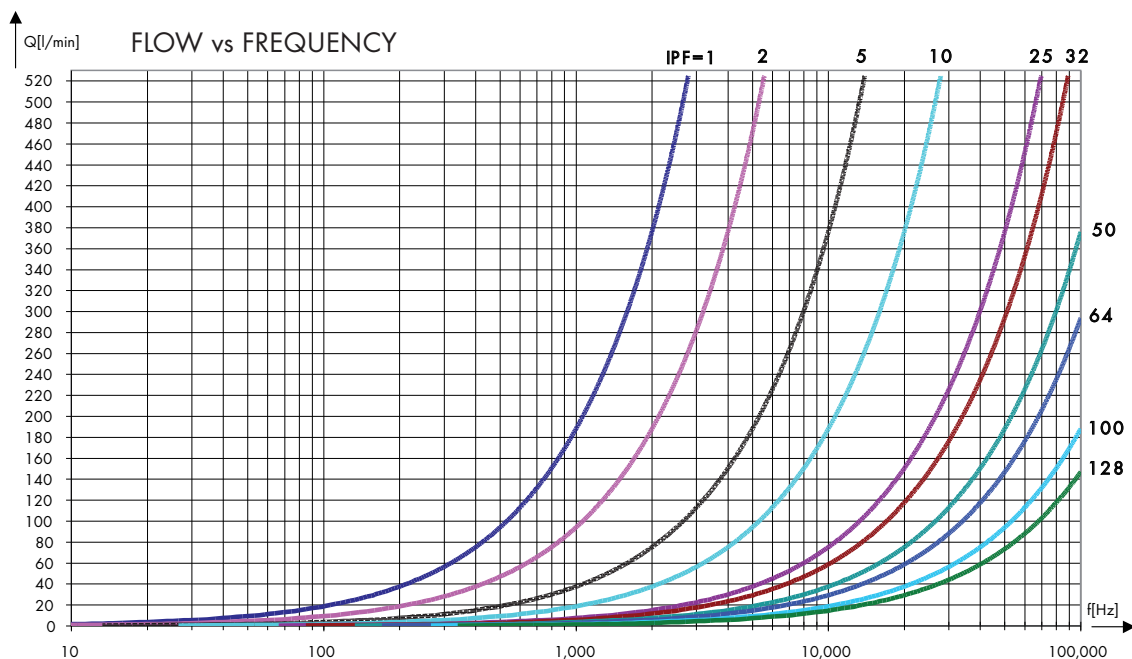


TECHNICAL DATA

RS 400

Max. permissible flow 400 l/min

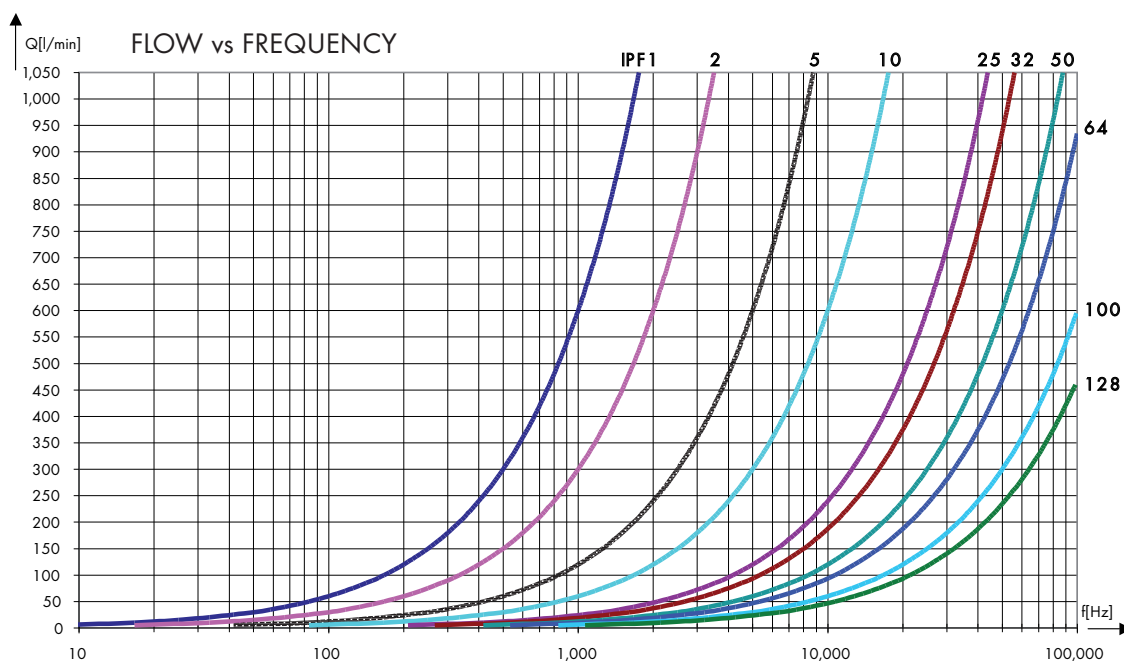
Min. permissible flow 0.5 l/min



RS 800

Max. permissible flow 800 l/min

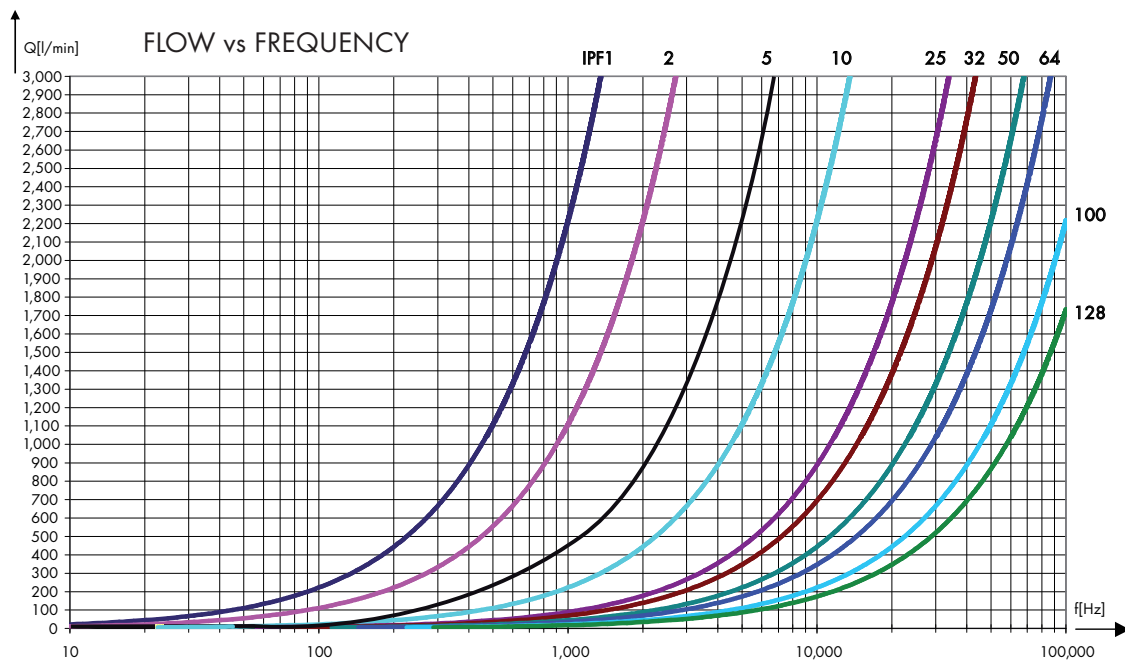
Min. permissible flow 5 l/min



RS 2500

Max. permissible flow 2,500 l/min

Min. permissible flow 10 l/min



TYPE CODE

Example

RS 800 / 50 G R 0 1 2 V - HT / X													Flow meter																		
Size		Interpolation		Material	Connection type	Factory provided	Bearing	Backlash	Sealing type	Design	Construction range	X	Modification figure Factory provided																		
														HT	High temperature design																
																V P T E B S	FPM (Viton) Standard NBR (Perbunan) PTFE EPDM EPDM - 41B8 Silicone														
																		2	Standard												
																				1 4 6 7	Ball bearing Ball bearing - Low temperature Hard metal sleeve bearing Angular contact ball bearing										
																						0	Standard								
																								R	Pipeline connection						
																										G E X	EN-GJS-400-15 (DIN EN 1563)) Stainless steel 1.4305 (V2A) Stainless steel 1.4571 (V4A)				
																												1 2 5 10 25 32 50 64 100 128	Selectable interpolation factor		
																														RS 40 RS 100 RS 400 RS 800 RS 2500	

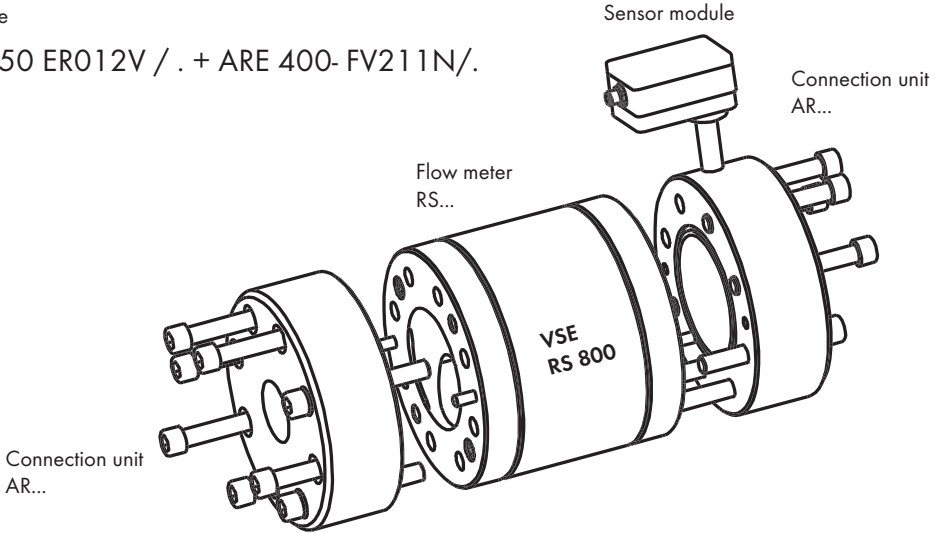
Example

Connection unit

AR	G	800	-	G	V	2	0	0	N	/	X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

Order example

RS 400 / 50 ER012V / . + ARE 400- FV211N/.





VSE^{flow}

D-58809 Neuenrade

Type: VS 0,02 EPO 12T 32Q11/3

S.-Nr.: 090/09/093

Bj: 09/09

BVS 05 ATEX E 071 X



II 1G Ex ia IIC T6..T4

U_i = 18.5 V
R_i = 0

I_i = 24 mA
L_i = 0

P_i = 100 mW
C_i = 0,27 µF

CE 0158



GEAR FLOW METER VS

VS POSITIVE DISPLACEMENT FLOW METERS

VS FLOW METER

VS positive displacement flow meters are volume rate measuring sensors based on the meshing gear principle and are designed for use with liquids. Two precisely matched gear wheels are enclosed in a very accurately machined housing. Gear rotation is sensed by a non-contacting signal pick-up system. Each tooth produces one impulse.

The space between the gear teeth, when fully enclosed on both sides by the housing, constitutes measuring chambers. Fluid flow causes the gears to rotate and the incoming flow is separated into discrete volumes within these chambers i. e. the volume of liquid passing through the unit will cause rotation of the gears by exactly one tooth pitch.

This volume is known as the Volume/Impulse (V_m) and is stated in cc/Imp. It is used to define the size of a flow meter.

EXPLANATIONS FOR PREAMPLIFIER OF SIGNAL PICK-UP SYSTEM

The non-contact pick-up sensors consist of two differential magneto resistors, which are circumferentially offset from one another by 1/4 of a tooth pitch. The signals of both pick-up sensors are digitised with two signal amplifiers and amplified via followed short circuit proof push-pull output stages.

The square wave output signals are bidirectional and may be simply processed by any external electronics, plc control or computer. The processing of the 90° phase angle between signals enables recognition of flow direction and impulse rate conversion with a factor of 1, 2 and 4.

The signal frequency is proportional to the momentary flow rate (volume rate) dependent on the particular flow meter size. The frequency range extends from 0 – 2000 Hz. The preamplifier is protected against reverse polarity and incorrect connection. For medium temperatures between -40°C and 120°C (-22°F and 248°F) the unit is mounted directly on the flow meter cover.

SENSOR SYSTEMS FOR EXTENDED TEMPERATURE RANGE

For liquid temperatures from -40°C up to 210°C a special pick up system is available.

VSI HIGH DEFINITION PREAMPLIFIER

The VSI High Definition Preamplifier supplies digital signals with a higher resolution of the measured value. The high definition preamplifier is available in two versions.

The first version has a selectable resolution between 4 and 64 angle steps which enables an increase of the K-factor by 16 or 64 with a flank evaluation. The other version offers more performance. A very big advantage is the compatibility. With this version, preamplifiers of the standard VS and the VSI series are interchangeable. The customer can therefore easily replace or upgrade a preamplifier himself. In addition, this preamplifier electronics offers an selectable resolution between 4 and 128 angular steps, which allows a maximum increase of the K-factor by 32 or 128 with a flank evaluation.

EX-TYPES

Intrinsically safe models, with approval code  II 1G Ex ia IIC T4-T6, are supplied for applications in potentially explosion-hazardous areas. VSE delivers these types with isolation switch amplifier models MK 13 P Ex 0/24 VDC/K15.

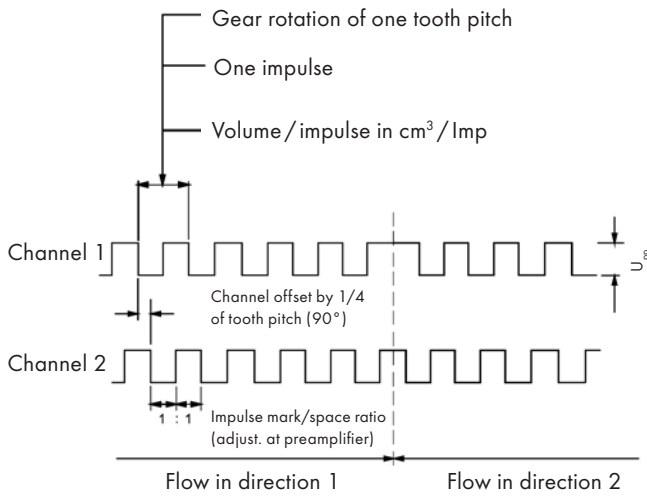
VS FLOW METER SELECTION

For trouble-free and safe operation of the flow meters the correct selection of type and size is decisive. Due to the great number of different applications and flow meter versions, the technical data in the VSE catalogues are of general character.

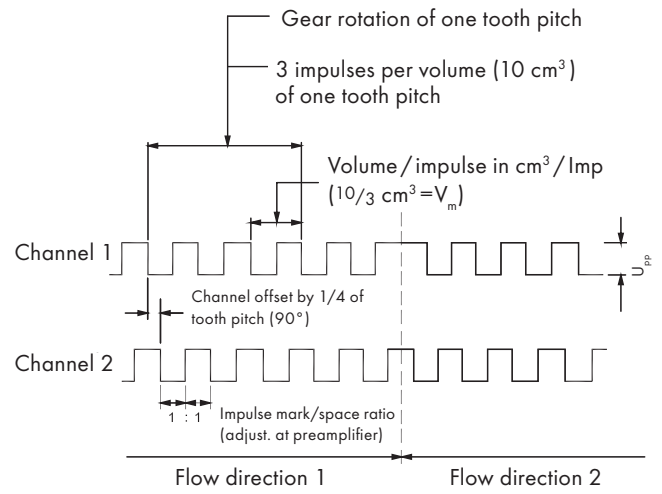
Certain characteristics of the devices depend on type, size and measuring range as well as on the medium to be measured. For exact flow meter selection please contact VSE.

OUTPUT SIGNALS OF PREAMPLIFIER

FLOW METER VS 0.02... VS 4



FLOW METER VS 10



VOLTAGE RANGES

Supply voltages: $U_v = 10 \dots 28 \text{ V DC}$

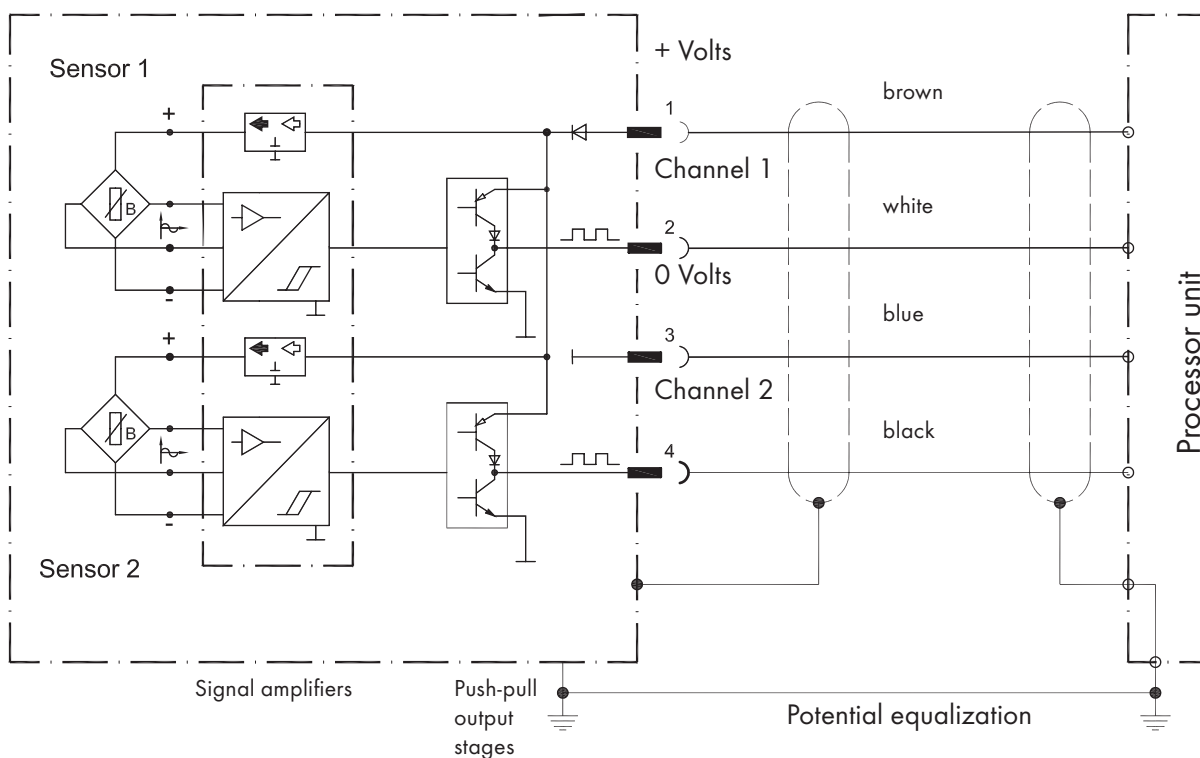
Impulse voltages: $U_{pp} = U_v - 1 \text{ V}$

VOLTAGE RANGES

Supply voltages: $U_v = 10 \dots 28 \text{ V DC}$

Impulse voltages: $U_{pp} = U_v - 1 \text{ V}$

BLOCK DIAGRAM



RANGES OF APPLICATIONS

APPLICATIONS

All liquids that can be pumped and have known lubrication properties can be measured, for example: paraffin, kerosene, benzine, diesel, Skydrol, mineral oils, hydraulic oils including fire resistant fluids, inks, dyes and paints, greases, polyurethane, polyol and isocyanates, Araldite, glues, pastes and creams, resins, waxes and many others.

RANGES OF APPLICATIONS IN THE AUTOMOTIVE INDUSTRY

Braking system test stands

Fuel consumption measurement

Polyurethane foams for steering wheels, fascia, seats etc.

Paint spraying systems

Steering systems

Batching and filling of motor oils, brake fluids, anti-freeze, corrosion preventatives, waxes etc.

Adhesive coatings for windscreens, headlights, engine housings etc.

HYDRAULICS

Volume and flow rate measurement

Leakage and rupture monitoring

Cylinder speed and position measurement

Positioning and step control

Measurement, control and regulation of flow rates and volumes

Test stands for pumps, motors, valves, proportionals and servo-valves

Synchronised multi-cylinder monitoring

Filling and additive blending

DYES AND PAINTS

Paint spraying systems

Batching and filling

Volume, flow rate and consumption

Monitoring of mixing ratios

PLASTICS TECHNOLOGY

Mixing, moulding and batching systems for single and multicomponent fluid plastics

Consumption measurement of e.g.:

Epoxy adhesives and potting compounds (resins and hardeners) for transformers, coils, relays, condensers, armatures, initiators, auto-electronics

Measuring, control and regulation of single components and mixing ratios

Silicon potting compounds

Polyurethane foams (polyol and isocyanate) for steering wheels, seals, shoes, soles, surf boards, furniture, computer casings, isolation etc.

Hot adhesive

CHEMICAL INDUSTRY

Flow rate and volume measurement in process plants and plant systems

Dosing and filling of chemical products such as liquid plastics, adhesives, resins, hardeners, potting compounds, solvents, fuels, foams, plasticisers, dyes and paints, oils and synthetic products etc., application in laboratories and manufacturing plants (in normal and explosion-hazardous areas)

Control and regulation of single components, mixing ratios and consumption of various components

Leakage measurement and leakage monitoring on plants

Measurement, indication and logging of data for product quality assurance

Special designs on request

TECHNICAL DATA OVERVIEW

Size	Flow range*		K-factor	
	l / min	GPM	Imp./l	Imp. / Gal.
VS 0.02	0.002 ... 2	0.0005 ... 0.53	50,000	189,272.00
VS 0.04	0.004 ... 4	0.0011 ... 1.06	25,000	94,636.00
VS 0.1	0.01 ... 10	0.0026 ... 2.64	10,000	37,854.40
VS 0.2	0.02 ... 18	0.0053 ... 4.76	5,000	18,927.20
VS 0.4	0.03 ... 40	0.0079 ... 10.57	2,500	9,463.60
VS 1	0.05 ... 80	0.0132 ... 21.13	1,000	3,785.44
VS 2	0.1 ... 120	0.0264 ... 31.70	500	1,892.72
VS 4	1 ... 250	0.2642 ... 66.00	250	946.36
VS 10	1.5 ... 525	0.39 ... 138.00	300	1,135.63
	*at 21 cSt	*at 21 cSt		

CALCULATION FACTOR

1 litre = 0.26417 U.S. Gallon

1 U.S. Gallon = 3.78544 litre

1 bar = 14.503684 psi

1 psi = 0.068948 bar

$^{\circ}\text{C} = \frac{5}{9} \times (^{\circ}\text{F} - 32)$ psi = pound-weight per square inch

$^{\circ}\text{F} = \frac{9}{5} \times ^{\circ}\text{C} + 32$ GPM = U.S. Gallon per minute

Accuracy	up to 0.3 % of measured value at viscosity > 20 cSt (< 20 cSt reduced accuracy)		
Repeatability	± 0.05 % under same operating conditions		
Materials	Body EN-GJS-400-15 (EN 1563) Stainless Steel 1.4305	Bearings Ball / Plain / Plain (Copper-free) depend on liquid	Seals FPM (standard) NBR, PTFE, EPDM
Max. operating pressures	Cast iron 315 bar/4,568 psi	Stainless steel 450 bar / 6,526 psi	
Medium temperature	Standard Ex-design High temperature	-40 ≤ ... 120° C -20 ≤ ... 100° C (T4) -40 ≤ ... 210° C	
Viscosity ranges	1...100,000 cSt		
Mounting positions	Unrestricted, on subplate with side or bottom connections		
Filtering for ball bearing type	VS 0.02/0.04/0.1 10 µm VS 0.2/0.4 20 µm VS 1/2 50 µm VS 4 50 µm	Exceptions Flow meters with special clearance on request.	
Noise level	Max. 72 dB(A)		
Preamplifier	10 to 28 Volt (DC)		

VS 10 FLOW METER

TECHNICAL DATA

Size	Flow range l/min	GPM	K-Factor Imp./l	Imp. / Gal.
VS 10	1.5 ... 525	0.3963 ... 138.69	300	1,135.63

Accuracy	up to 0.3 % of measured value at viscosity > 20 cSt (< 20 cSt reduced accuracy)		
Repeatability	± 0.05 % under same operating conditions		
Materials	Body EN-GJS-600-3 EN 1563	Bearings Ball / Plain gearings depend on liquid	Seals FPM (Standard) NBR, PTFE, EPDM
Max. operating pressure	400 bar/6,000 psi		
Medium temperature	Standard Ex-design High temperature	-40 ≤ ... 120° C -20 ≤ ... 100° C (T4) not available	
Viscosity range	1 ... 100,000 cSt		
Mounting positions	Unrestricted, on subplate with side or bottom connections		
Filtering	50 µm		
Preamplifier	Short circuit proof and reverse polarity proof 10 ... 28 V DC/45 mA, additional current on signal output max. 20 mA		

THE VSI HIGH DEFINITION PREAMPLIFIER

For precise and exact flow and volume measurements, it is necessary to increase the resolution as high as possible by resolving the measurement V_m , even more than with conventional preamplifiers.

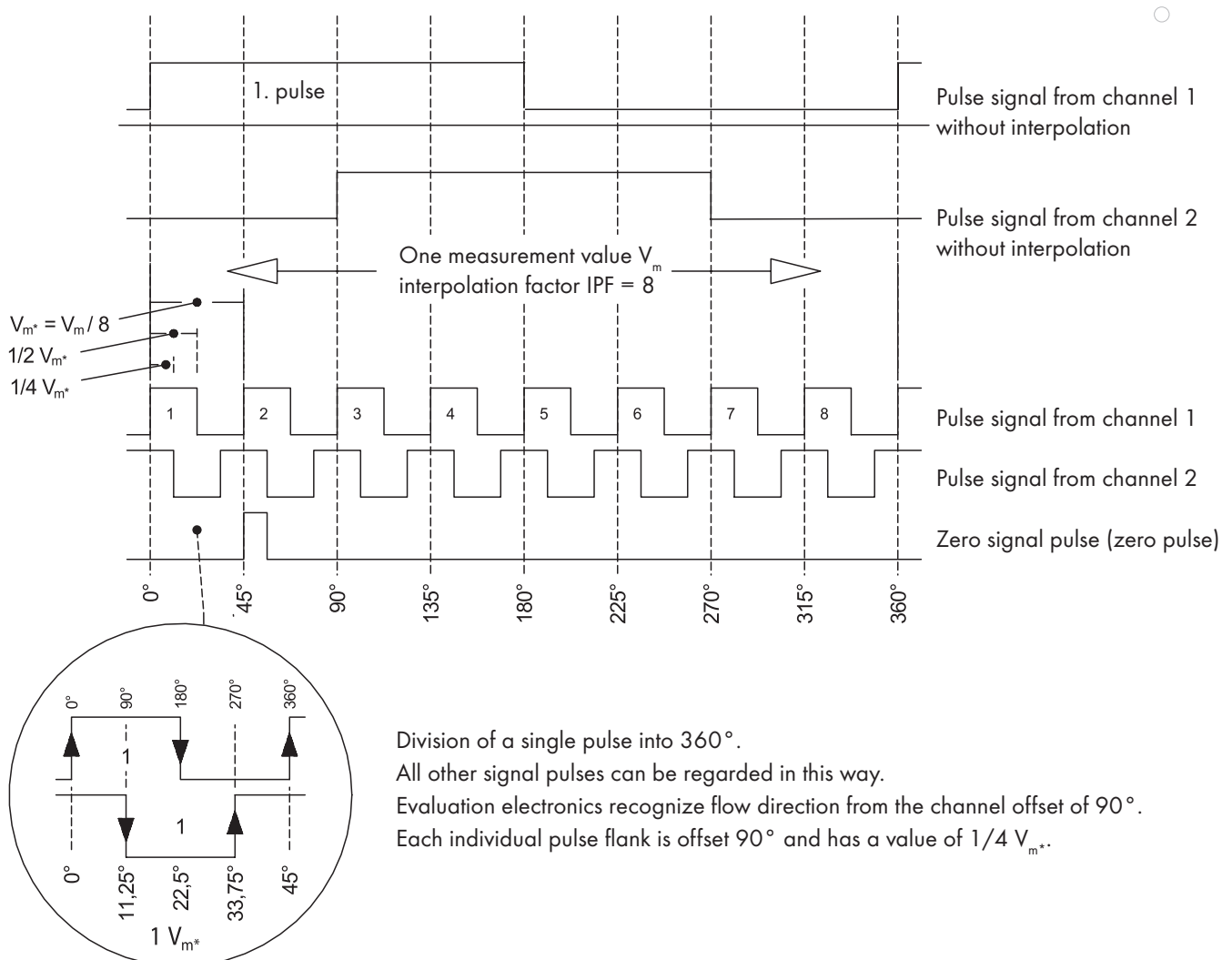
With the VSI-preamplifier versions a selectable resolution of up to 128 flanks (32 pulses) per period can be attained (see table below).

This means that you can resolve the volume measurement V_m with this preamplifier to a maximum of $1/128 V_m$.

For the evaluation, this means that a part volume of $1/128 V_m$ from pulse flank to pulse flank (for quadruple evaluation or flank count) is measured, or a full signal pulse is counted as part volume of $1/32 V_m$ (pulse count).

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

- Measuring, controlling and regulating in lower flow ranges
- Measuring, controlling and regulating in zero flow
- Measuring, controlling and regulating in both flow directions
- Measuring, controlling, dosing and filling of small volumes



TECHNICAL DATA OF VSI PREAMPLIFIER

Pickup sensor	2 x MR sensor (sine and cosine signals)
Number of sensors	Two pick up sensors for generating the sine and cosine signal
Adjustment	Offset adjustment by two potentiometers
Resolution	Programmable in a range of 1 – 64 flanks per volume measurement V_m
Frequency	Frequency multiplication: programmable in a range of 1 – 16 times the frequency of the pick-up sensors
Output signals	Channel A, channel B, zero channel Z
Channel A and B	Two signal outputs for emitting the digital flow sensor signals; between channel A and channel B there is a channel offset of 90°
Flow direction	Recognition of flow direction from channel offset of the signals from channel A to channel B
Zero signal Z	Zero signal, marks the flow of one volume measurement V_m
Outputs	3 current limiting and short-circuit-proof push-pull output stages (channel A, channel B, zero signal Z); driver current approx. 300 mA at 24 V power supply; small saturation voltage up to 30 mA load current; short switching times; reverse voltage protection by integrated free-run diodes against V_b and GND; temperature protection switching with hysteresis; outputs are of high impedance in case of error; ESD protected
Operating voltage	$V_b = 10 \dots 28$ VDC
Current consumption	$I_{no\ load} =$ approx. 40 mA; total current consumption depending on loading of outputs

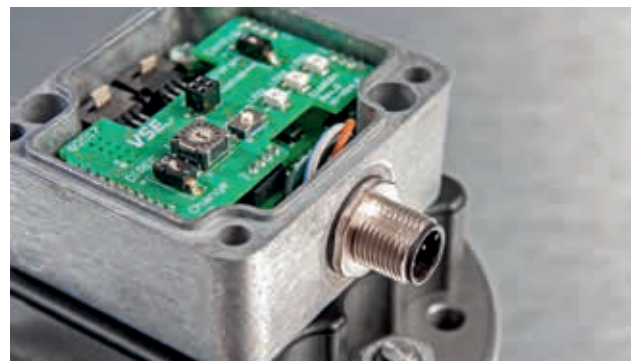


TECHNICAL DATA OF VSI PREAMPLIFIER – UPGRADE (HIGH PERFORMANCE)

Pickup sensor	2 x MR-sensor (sine and cosine signals)
Configuration	automatically via peripheral board
Resolution	programmable 1, 2, 3, 4, 5, 8, 10, 12, 16, 24, 32
Frequency	up to 100kHz
Output signals	Channel A, channel B, direction signal „DIREC“ (high positiv; low negativ)
Channel A and B	Two signal outputs for emitting the digital flow sensor signals; between channel A and channel B there is a channel offset of 90°
Flow direction	Recognition of flow direction from channel offset of the signals from channel A to channel B or from the separate direction signal on pin 5, direction can be changed by the preamplifier electronics
Outputs	3 current limiting and short-circuit-proof push-pull output stages (channel A, channel B, DIREC); driver current approx. 200 mA at 24 V power supply; small saturation voltage up to 30 mA load current; short switching times; reverse voltage protection by integrated free-run diodes against V_b and GND; temperature protection switching with hysteresis; outputs are of high impedance in case of error; ESD protected
Error messages	Electronics error (e.g. defective interpolator); sensor error(e.g. sensor break-off); configuration necessary; overload (flow peaks)
Operating voltage	$V_b = 10 \dots 28$ VDC
Current consumption	$I_{no\ load} =$ approx. 65 mA; total current consumption depending on loading of outputs

ADVANTAGES

Easy replaceable, Upgrade for standard VS, higher resolution, more stability under harsh conditions



INTERPOLATION FACTOR AND RESOLUTION

Interpolation factor	Imp/V _m	Max. resolution (evaluation of signal flanks)	Resolution V _m * (volume measurement V _m *) [ml]	Max. resolution (angle degrees)	Frequency f _{max} *
1	1	4 (quadrupling)	V _m / 4	90°	f _{max} x 1
2	2	8	V _m / 8	45°	f _{max} x 2
3	3	12	V _m / 12	30°	f _{max} x 3
4	4	16	V _m / 16	22.5°	f _{max} x 4
5	5	20	V _m / 20	18°	f _{max} x 5
8	8	32	V _m / 32	11.25°	f _{max} x 8
10	10	40	V _m / 40	9°	f _{max} x 10
12	12	48	V _m / 48	7.5°	f _{max} x 12
16	16	64	V _m / 64	5.625°	f _{max} x 16
24*	24	96	V _m / 96	3.75°	f _{max} x 24
32*	32	128	V _m / 128	2.8125°	f _{max} x 32

*Only VSI upgrade version

Column 1: Programmable interpolation factor IPF (programming is done in the factory)

Column 2: Pulses per volume measurement V_m

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

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

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

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

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

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

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

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

IPF Programmed interpolation factor

V_m Volume measurement of the flow meter

Example Flow meter VSI 1/10... max. flow rate of the system at maximum capacity

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

At max. flow f_{max}* = 40 l/min, the flow meter VSI 1/10... outputs a frequency of

$$f_{\max} = 6666.67 \text{ Hz.}$$

VSI+ A FURTHER DEVELOPMENT OF THE VSI SERIES

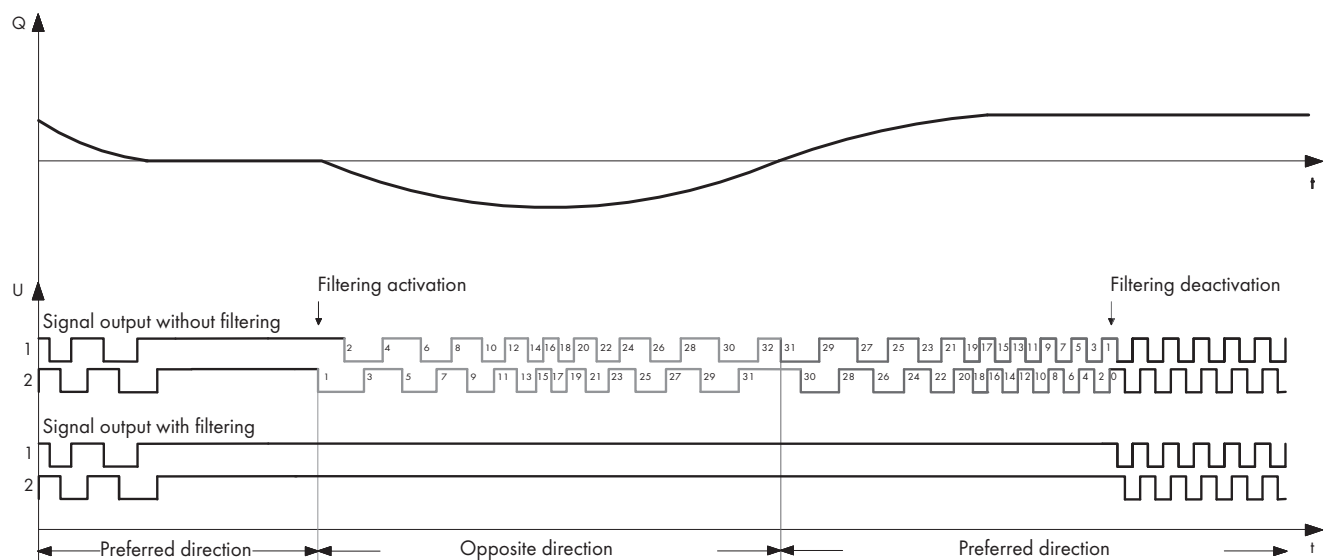
Even more resolution, higher signal quality and more functions. The core components of the VSI+ transducer system are two magnetoresistive sensors, each embedded in a sturdy, compact plastics injected moulded part. Compared to the current system, these sensors are installed outside the flow through measurement chamber, so there is no longer any direct contact with the fluid. In combination with high performance pream-

plifier electronics, higher resolutions (IPF factors) are possible and frequency interferences independent of the flow are eliminated. A constant signal processing ensures the quality of the output impulses, even under difficult conditions like high temperatures or high load changes. A switchable impulse filter for a suppression of interfering pulsations in the fluid system and a direction switching have additionally been integrated.

ADJUSTABLE INTERPOLATION FACTORS IPF

Interpolation factor	Imp/V _m	Max. resolution (evaluation of signal flanks)	Resolution V _m ⁺ (volume measurement V _m ⁺) [ml]	Max. resolution (angle degrees)	Frequency f _{max} ⁺
1	1	4	V _m / 4	90°	f _{max} x 1
4	4	16	V _m / 16	22.5°	f _{max} x 4
8	8	32	V _m / 32	11.25°	f _{max} x 8
10	10	40	V _m / 40	9°	f _{max} x 10
16	16	64	V _m / 64	5.625°	f _{max} x 16
32	32	128	V _m / 128	2.8125°	f _{max} x 32
64	64	256	V _m / 256	1.40625°	f _{max} x 64
128	128	512	V _m / 512	70.703125°	f _{max} x 128

SWITCHABLE PULSE FILTERING



FEATURES

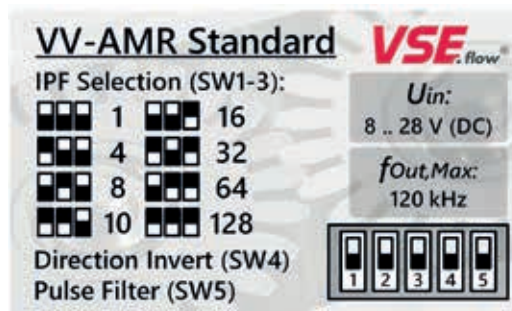
Switchable direction change
 Generating frequencies up to 120,000 Hz
 Easily interchangeable (automatic electronics configuration)
 Signal LEDs

TECHNICAL DATA OF VSI+ PREAMPLIFIER

Pickup sensor	2 x AMR-sensor (sine and cosine signals)
Configuration	automatically via peripheral board
Resolution	selectable 1, 4, 8, 10, 16, 32, 64, 128
Frequency	up to 120kHz
Signal outputs	Channel A, Channel B
Channel A and B	Two signal outputs for emitting the digital flow sensor signals; between channel A and channel B there is a channel offset of 90°
Flow direction	Recognition of flow direction from channel offset of the signals from channel A to channel B. On request also available with separate direction signal, direction can be changed by a switch of the preamplifier electronics
Outputs	2 current limiting and short-circuit-proof push-pull output stages (channel A, channel B); driver current approx. 200 mA at 24 V power supply; small saturation voltage up to 30 mA load current; short switching times; reverse voltage protection by integrated free-run diodes against V_b and GND; temperature protection switching with hysteresis; outputs are of high impedance in case of error; ESD protected
Error messages	Electronics error (e.g. defective interpolator); sensor error (e.g. sensor break-off); configuration necessary
Operating voltage	$V_b = 8 \dots 28 \text{ VDC}$
Current consumption	$I_{no\ load} = \text{approx. } 40 \text{ mA (@24V DC)}$; total current consumption depending on loading of outputs



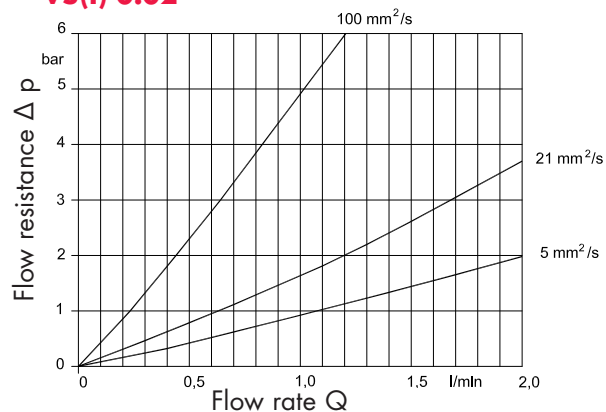
Preamplifier electronics



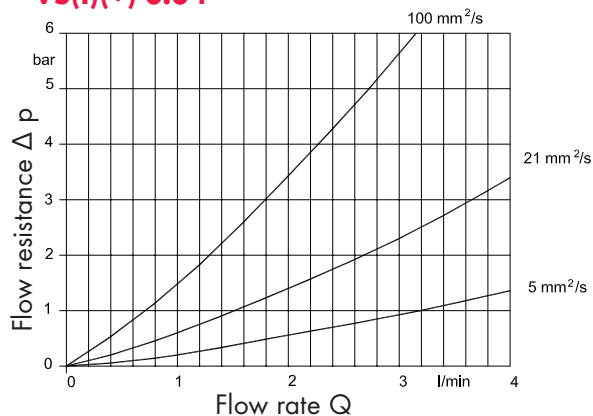
Settings

FLOW RESPONSE CURVES

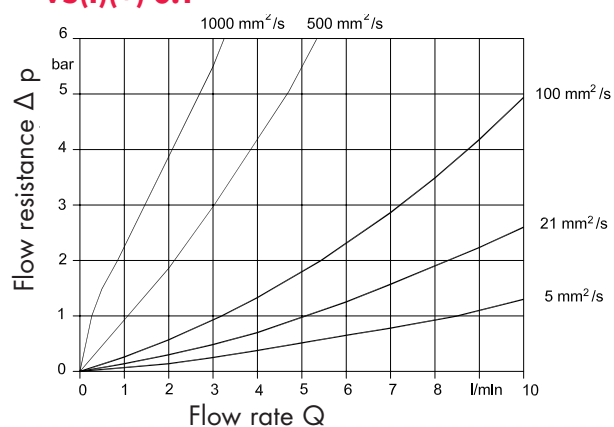
VS(I) 0.02



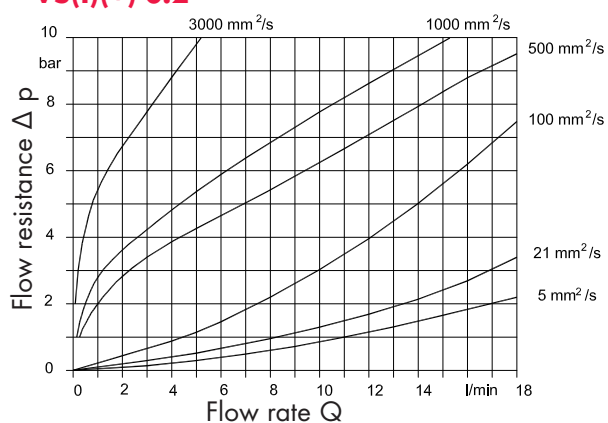
VS(I)(+) 0.04



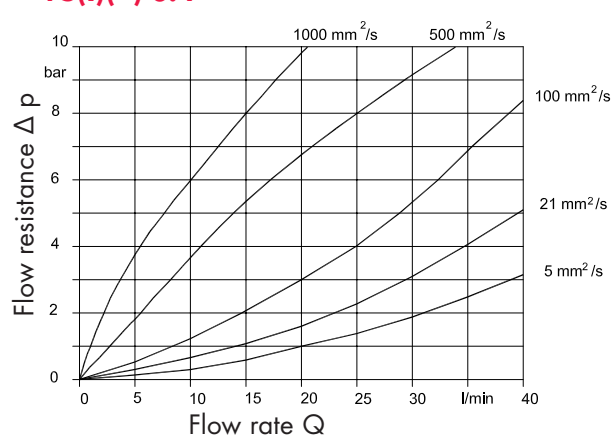
VS(I)(+) 0.1



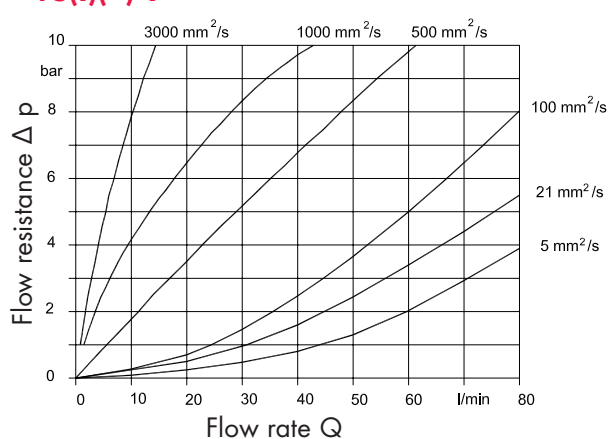
VS(I)(+) 0.2



VS(I)(+) 0.4

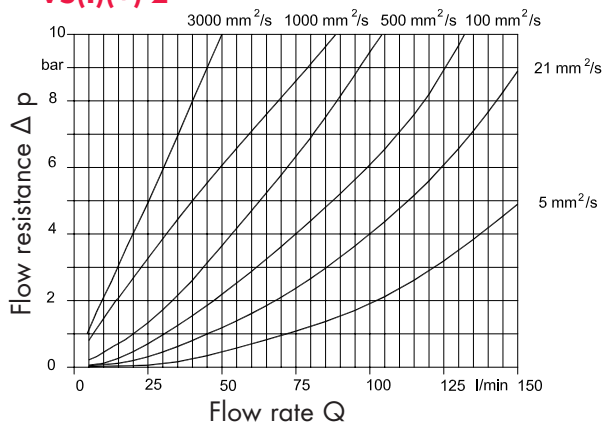


VS(I)(+) 1

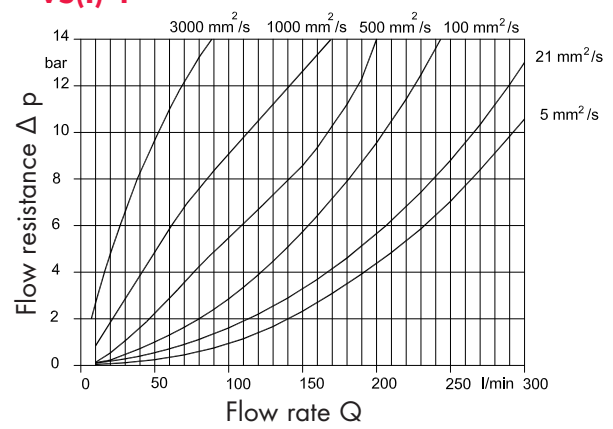


FLOW RESPONSE CURVES

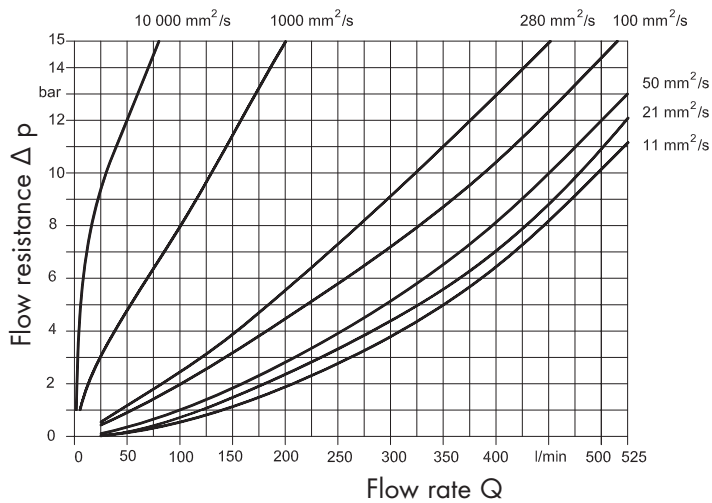
VS(I)(+) 2



VS(I) 4



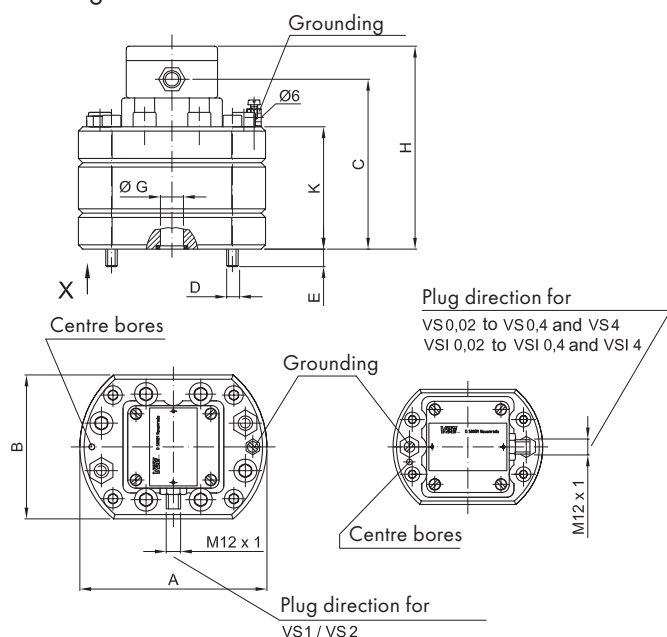
VS(I) 10



VS(I)(+) FLOW METER DIMENSIONS VS(I) 0.02 ... VS(I) 4

CAST IRON VERSION

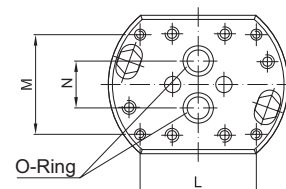
Housing curve mill cutted



CAST IRON VERSION

CONNECTION DRAWING

View X

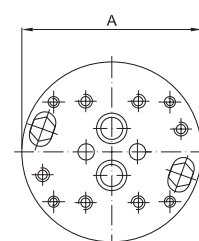


STAINLESS STEEL VERSION

CONNECTION DRAWING

Housing not mill cutted

View X



Size VS/VS1	A	B	C	D	E	ø G	H	K	L	M	N	O-Ring	Weight	
													GG* kg	E** kg
0.02	100	80	91	M 6	12	ø 9	114	58	70	40	20	11 x 2	2.8	3.4
0.04	100	80	91.5	M 6	11.5	ø 9	114.5	58.5	70	40	20	11 x 2	2.8	3.4
0.1	100	80	94	M 6	9	ø 9	117	61	70	40	20	11 x 2	2.8	3.4
0.2	100	80	93.5	M 6	9.5	ø 9	116.5	60.5	70	40	20	11 x 2	3.0	3.7
0.4	115	90	96.5	M 8	11.5	ø 16	119.5	63.5	80	38	34	17.96 x 2.62	4.0	5.0
1	130	100	101	M 8	12	ø 16	124	68	84	72	34	17.96 x 2.62	5.3	6.8
2	130	100	118	M 8	15	ø 16	141	85	84	72	34	17.96 x 2.62	6.7	8.4
4	180	140	143	M 12	20	ø 30	166	110	46	95	45	36.17 x 2.62	14.7	18.4

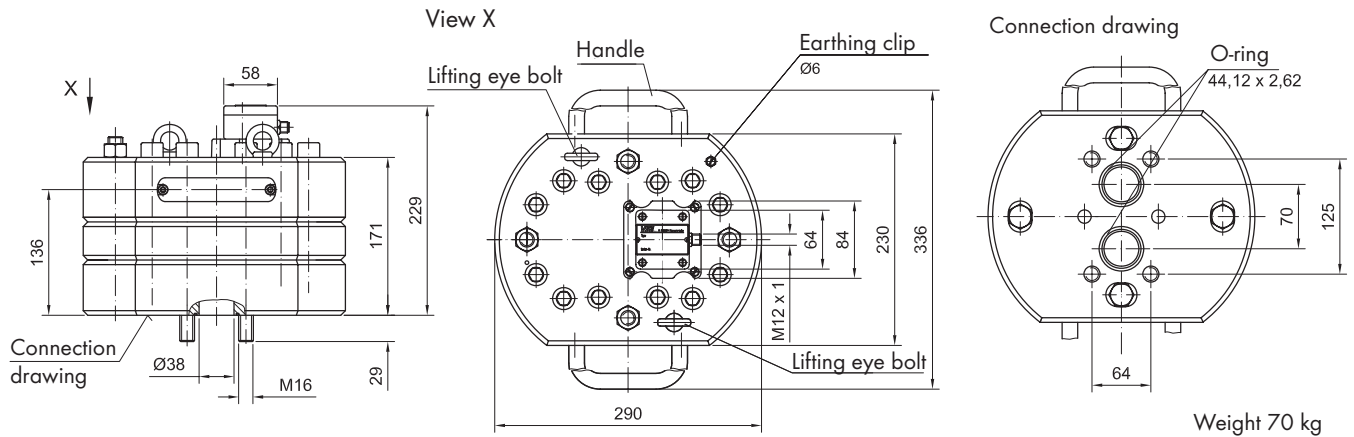
Size VSI+	A	B	C	D	E	ø G	H	K	L	M	N	O-Ring	Weight	
													GG* kg	E* kg
0.04	100	80	83	M 6	11.5	ø 9	106.5	58.5	70	40	20	11 x 2	2.8	3.4
0.1	100	80	85	M 6	9	ø 9	108.5	61	70	40	20	11 x 2	2.8	3.4
0.2	100	80	85	M 6	9.5	ø 9	108.5	60.5	70	40	20	11 x 2	3.0	3.7
0.4	115	90	87.5	M 8	11.5	ø 16	111.5	63.5	80	38	34	17.96 x 2.62	4.0	5.0
1	130	100	92	M 8	12	ø 16	115.5	68	84	72	34	17.96 x 2.62	5.3	6.8
2	130	100	109	M 8	15	ø 16	132.5	85	84	72	34	17.96 x 2.62	6.7	8.4

* GG = Cast Iron EN-GJS-400-15 (EN 1563)

** E = Stainless Steel 1.4305

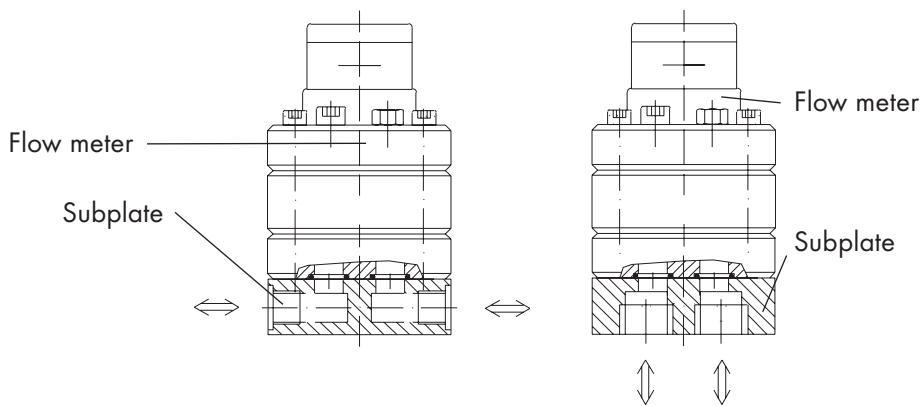
Dimensions are specified in mm

DIMENSIONS VS(I) 10



SIDE PORTS

BOTTOM PORTS



AP SUBPLATE DIMENSIONS

Side ports

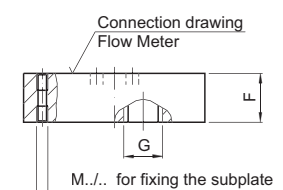
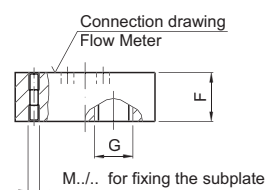
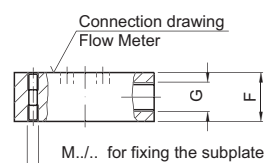
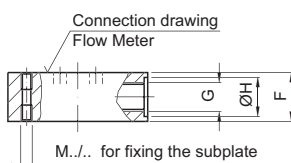
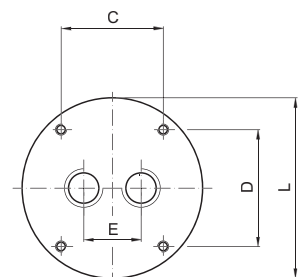
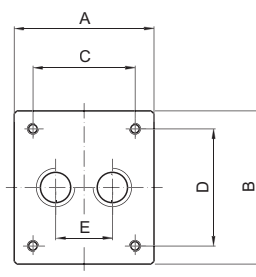
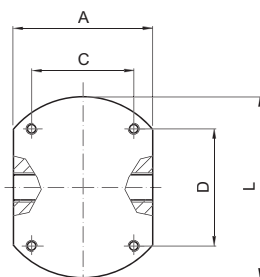
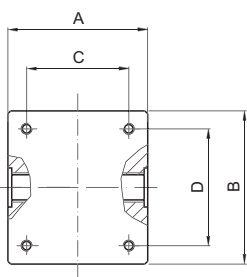
Bottom ports*

Cast iron / APG.S.../.

Stainless steel / APE.S.../.

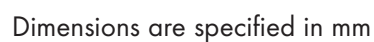
Cast iron / APG.U.../.

Stainless steel / APE.U.../.



* Both bottom ports (G) for size APG 4 U and APE 4 U have a displacement of 90° to the shown drawings.

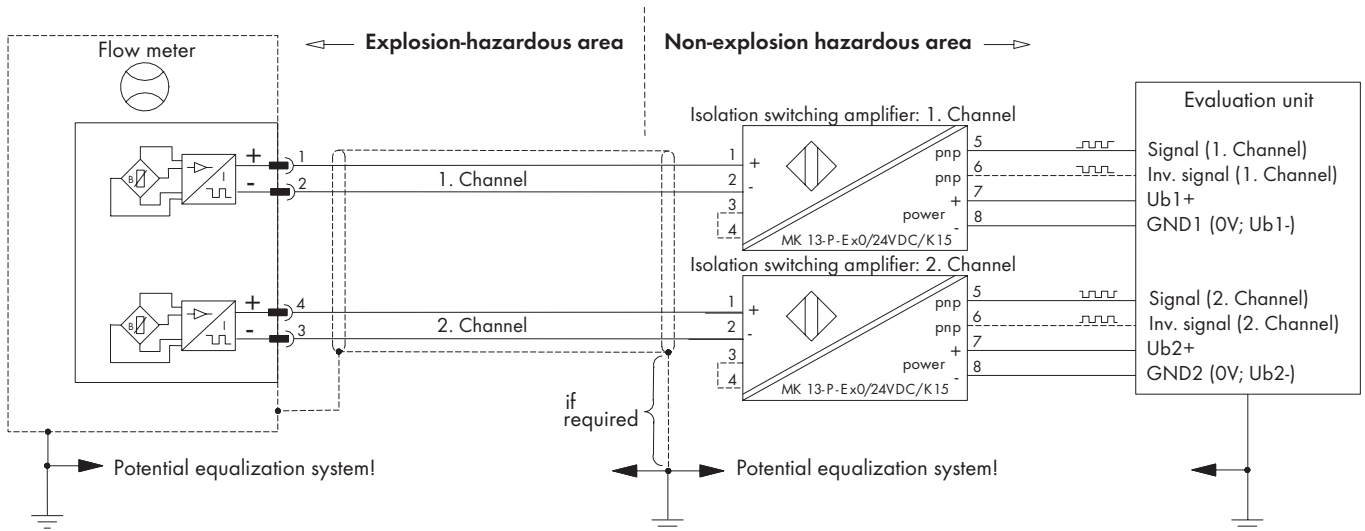
GEAR FLOW METER VS



Size							Depth	Weight
VS / VSI	AP	A	B	C	D	L ②	M	kg
0.02 / 0.04 0.1 / 0.2	AP.02	80	90	40	70	100	M6/12	1.8
0.4	AP.04	90	100	38	80	115	M8/15	2.7
1 / 2	AP.1	100	110	72	84	130	M8/15	3.6
4	APG4	120	130	100	110	–	M8/15	7.4
	APG4 UG	140	120	120	100	–	M8/15	7.4
	APE.4	140	–	100	110	180	M8/15	12

Special designs on request

VSE FLOW METERS IN EX-DESIGN /THE BARRIER AMPLIFIER



VSE FLOW METERS IN EX-DESIGN

The VSE flow meters of the VS series in Ex-design are approved for applications in potentially explosion-hazardous areas and are always operated in conjunction with barrier amplifiers. They have blue markings and offer the necessary Ex-protection security. The type plate shows the necessary description according to DIN EN 60079, the type key and the safety-related and electric data. VSE can supply the flow meters with the barrier amplifiers type MK 13-P-Ex 0/24 VDC/K15.

THE BARRIER AMPLIFIER

MK 13-P-EX 0/24 VDC/K15

The barrier amplifier MK 13-P-Ex 0/24 VDC/K15 enables an isolated transmission of binary

switching status. It has an intrinsically safe control circuit and is certified according to II(1) GD [Ex ia] II C.

There is a galvanic separation from the control circuit to the output circuit and to the power supply. For the transmission of two channels, two barrier amplifiers of this version are necessary. The control circuit can be monitored concerning wire breaking and short circuit (the monitoring can be switched off via a wire jumper).

An error in the control circuit stops the signal output. One pulse-switching short circuit proof transistor output (PNP-output) provides the digital signal of the connected channel.

Flow meter	VSE connection cable, blue	Barrier amplifier						
Type VS****-32 Q1*/*	Shielded; 4 x 0.34 mm ²	Type MK 13-P-Ex 0/24 VDC/K15						
BVS 05 ATEX E 071 X	PUR	PTB 06ATEX 2025						
 II 1G Ex ia II C T4-T6		 II (1) GD [Ex ia] II C						
U _i = 18.5 V	R = 0.053 Ω/m	U _o = 9,9 V						
I _i = 24 mA	L = 0.85 µH/m (x)	I _o = 22 mA						
P _i = 100 mW	C _{A-A} = 55 pF/m (x)	P _o = 54 mW						
R _i = 0	C _{A-S} = 105 pF/m (x)							
L _i = 0	[(x) = Measured at 1000 Hz]							
C _i = 0.27 µF		IIC				IIB		
		Lo/mH	1	5	10	2	10	20
		Co/µF	1.1	0.75	0.65	5	3.5	3

Temperature class	T4	T5	T6
Ambient temperature	- 20°C ≤ T _{amb} ≤ 95°C	- 20°C ≤ T _{amb} ≤ 70°C	- 20°C ≤ T _{amb} ≤ 55°C
Liquid temperature	- 20°C ≤ T _{Med} ≤ 100°C	- 20°C ≤ T _{Med} ≤ 75°C	- 20°C ≤ T _{Med} ≤ 60°C

PICK-UP SYSTEM FOR HIGH TEMPERATURE RANGES

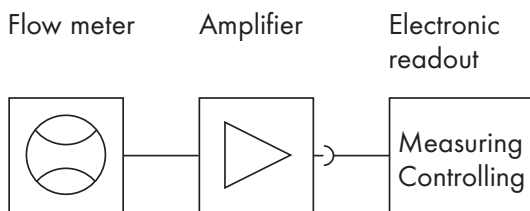


OPTION FOR STAINLESS STEEL FLOW METERS VS 0.04 ... VS 4

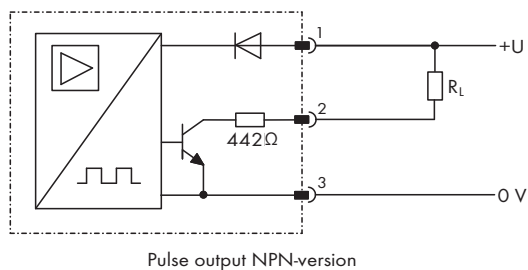
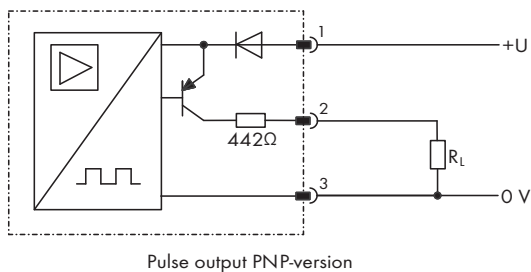
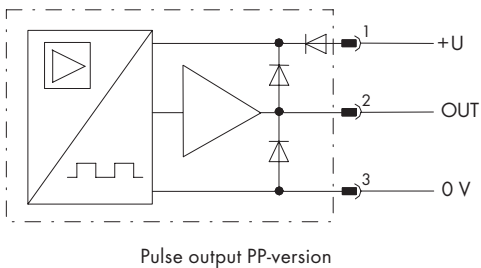
The pick-up system consists of one or two sensor units, which are screwed into the cover of the VS flow meter and of a downstream switched amplifier. This amplifier is connected with the flow meter by means of a temperature resistant cable and has to be installed outside the high temperature area, where the ambient temperature should not exceed 50°C.

The following pictures show the respective connection of the electronic readout.

For long cable lengths and high input impedance of the readout, it is recommended to use shielded cables.



CONNECTION DIAGRAMS



TECHNICAL DATA / FLOW METER DIMENSIONS

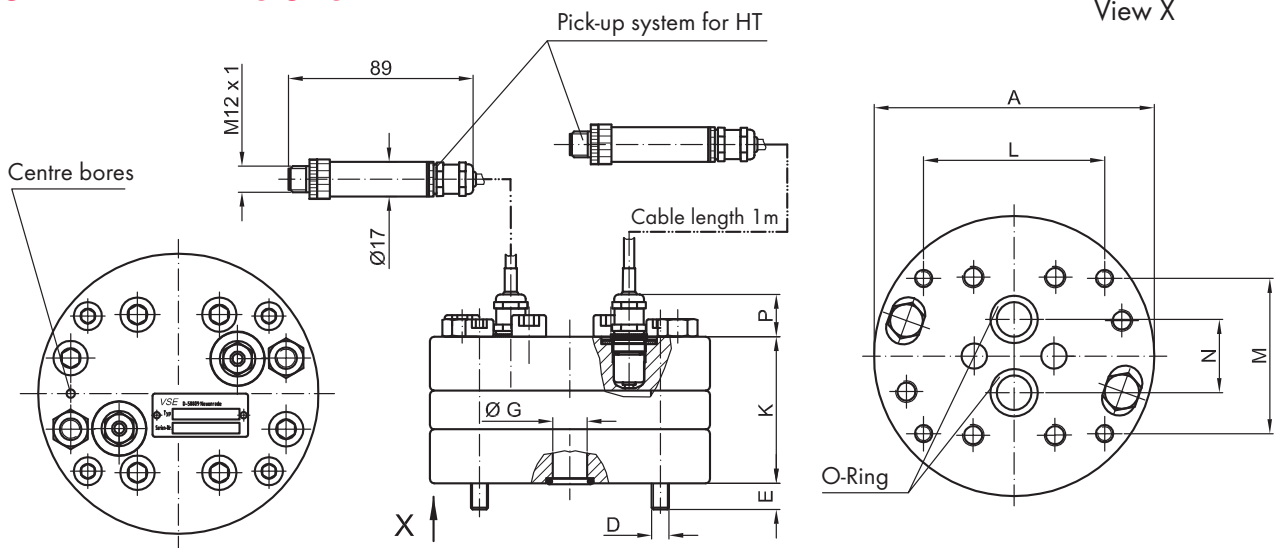
TECHNICAL DATA: SENSOR UNIT

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

TECHNICAL DATA: AMPLIFIER

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

FLOW METER DIMENSIONS



Size	A	D	E	Ø G	K	L	M	N	P	O-Ring	Weight kg
VS 0.04*	100	M 6	11.5	Ø 9	58.5	70	40	20	22	11 x 2	3.5
VS 0.1	100	M 6	9	Ø 9	61	70	40	20	22	11 x 2	3.3
VS 0.2	100	M 6	9.5	Ø 9	60.5	70	40	20	22	11 x 2	3.6
VS 0.4	115	M 8	11.5	Ø 16	63.5	80	38	34	22	17.96 x 2.62	4.9
VS 1	130	M 8	12	Ø 16	68	84	72	34	22	17.96 x 2.62	6.7
VS 2	130	M 8	15	Ø 16	85	84	72	34	22	17.96 x 2.62	8.3
VS 4	180	M 12	20	Ø 30	110	46	95	45	12	36.17 x 2.62	18.3

* Attention: 0.04 with one (1) channel only

TYPE KEY FLOW METERS VS

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

GEAR FLOW METER VS

GEAR FLOW METER VS

EXAMPLE

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

TYPE KEY FLOW METERS VSI

VSI 1	/	4		G	P	O	1	2	V	-	3	2	W	1	5	/	X	...																																																																
Size		Interpolation	Material	Type of connection	Measuring wheel coating	Instrument bearing	Instrument tolerance	Seal type	Sensor pick-up system	Quantity of pick-up sensors	Signal output	Pre-amplifier	Connection	Product line	Power supply voltage	Modification id. No.	Power supply volt.																																																																	
																		Factory preset to the application	Factory preset to the application	V	FPM (Viton) standard	1	Reduced tolerance	1	3 Imp. pro V_z	$V_m = 10/3$ pro Imp.																																																								
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ELECTRONIC EVALUATION UNITS

FLOW RATE MEASURING INSTRUMENT MF1 FOR 2-CHANNEL FLOW SENSOR



Flow direction indication with switching output (0 V/5 V)

2 optocoupler limit value outputs, limit values are individually programmable

Analogue output with flow rate direction dependent voltage-/current-polarity is available

0 ... (±) 10 V

0 ... (±) 20 mA

4 ... 20 mA

A power supply for flow sensor is integrated
24 Volt DC/50 mA

UNIVERSAL MEASURING INSTRUMENT VFM 320 FOR DYNAMIC PROCESS MEASUREMENTS AND CLOSED LOOP CONTROLS



Flow rate, volume and ratio measurements as well as measurement and control of volume-shots or mass-shots in 2-component mixing systems

Signal processing of 2 flow sensors with 2-channel signal outputs

2 independent dynamic analogue outputs with 16 Bit digital-analogue converter D/A-converter:

<3 ms (0 Hz → 2 kHz → 0 Hz)

The flow rate and volume values are direction dependent

(0 V ← Flow in direction 2 5 V → Flow in direction 1 10 V)

or direction independent

(10 V ← Flow in direction 2 0 V → Flow in direction 1 10 V)

Real time output of analogue and digital measurement values

PC-Interface 1 x RS 232, 2 x RS 485

Special designs on request

FLOW RATE MEASURING INSTRUMENT A341-28



The evaluation electronics A341-28 simultaneously records two independent flows via flow meters and is suitable for incremental rotary transducers, proximity switches, etc.

Two individually scalable pulse inputs for 1, 2 or 4 tracks (A, /A, B, /B), suitable for input frequencies of 0.01 Hz to 1 MHz per channel

Single measurement, sum or differential measurement, ratio or percentage deviation, etc.

Linearisation function for each flow measurement

5 independent parameter sets presettable

14-bit analogue output; 0/4 ... 20 mA, 0 ... 10 V and ± 10 V; < 1 ms reaction time

4 limit value settings with very fast responding transistor switch outputs

Programmable via an RS232 interface

2x encoder supply 24 VDC/120 mA

Standard housing 96 x 48 mm and protection class IP65

DISPLAY A350-28



The A350-28 is a multifunctional device for flow and volume measurement.

Universal inputs (HTL/RS422) for encoders / VSE flow meters

186 x 64 pixel graphic display with touch function

Bright, high-contrast display with result-based colour options

Emulation of a 7-segment display with symbols and units

Intuitive and easy parameterisation using plain text and touchscreen or via a RS232 interface

Auxiliary voltage output 5/24 VDC for encoder supply

Input frequency up to 1 MHz

Linearisation with 24 support points

16 bit analog output 0/4 ... 20 mA, 0 ... 10 V and ± 10 V; 20 ms reaction time

Numerous functions such as scaling, filters, startup bridging

Standard installation housing with 96 x 48 mm and protection class IP65

ELECTRONIC EVALUATION UNITS

SIGNAL CONVERTER FU210



GEAR FLOW METER VS

Operating modes as frequency converter
or pulse counter

Conversion time only < 1msec

16 Bit resolution (accuracy 0.1%)

Selectable analogue output: ± 10 V, 0/4...20mA

Programmable linearisation with 24 points

6 control inputs and 6 control outputs

Power supply 18 ... 30 VDC

Easy parameterisation by user interface

EASYLOADER or OS 6.0 via USB or RS232

INSTRUMENTS FOR IMPULSE CONDITIONING

FREQUENCY-/ANALOGUE CONVERTER DIGFU 1



Converter output signal for operation with 1-channel flow sensor

0 ... 10 V

0 ... 20 mA

4 ... 20 mA

Converter output signal with flow direction polarity for operation with 2-channel flow sensor

0 ... ± 10 V

0 ... ± 20 mA

Evaluation of flow direction via digital output signal possible if a 2-channel flow sensor is connected

Proportional to flow frequency a digital output frequency signal with multiplier factor is adjustable

SIGNAL CONVERTER PGW-1 FOR 2- OR 1- CHANNEL FLOW SENSORS TO CONVERT FLOW SENSOR OUTPUT SIGNALS INTO OTHER VOLTAGE LEVELS



For example: for chart recorder with impulse input, forward-/reversecounter, computer, PC- and PLC controls

Available output voltages:

TTL 5 V, 8 V, 12 V, CMOS 15 V

Power supply/current consumption:

10 ... 30 V DC, 20 mA without flow sensor

Inverted and non-inverted output signal for both channels integrated among other things for connection on differential count inputs to achieve a distortion-free signal transmission over long cable distances

BARRIER AMPLIFIER MK-13



Economical interfaces with galvanic isolation between intrinsically safe and non-intrinsically safe circuits

Must be installed in the safe area

Are used to limit the electrical power into an intrinsically safe circuit in such a way that neither sparks nor thermal effects (hot surfaces) can cause an ignition

Connection diagram and exact type no. see page 42.





VSE
D - 58809 Neuenrade
Type: VRLI-1S10/Ex
Serial-Nr.: 001
Baujahr: 03/09

GEAR FLOW METER VHM

GEAR FLOW METER VHM SERIES

We have developed a high precision flow meter for a wide variety of liquids, especially liquids with high abrasiveness and poor lubricity.

Applications include: chemical, petrochemical, pharmaceutical and cosmetic industry, two-component mixers, paints, aviation.

VHM flow meters are dead space optimised for use in the paint industry and for paint spraying systems (easy flushing).

They are positive displacement units based on the meshing gear principle. Each tooth generates an impulse by recognition of the gear rotation by a non-contact detection system according to the carrier frequency principle.

VHM flow meters are available with single, double or quadruple resolution, signal-output with NPN- or PNP-switching mode.

Signal pick-ups with -certification (Ex ia IIC T4 ... T6) and signal pick-ups with a fibre optic output are applicable for hazardous locations.

TECHNICAL DATA

Size	Flow range		K-factor Imp./l	
	l/min	GPM	Imp./l	Imp./Gal.
VHM 01-2	0.01 ... 1 l/min	0.003 ... 0.264	approx. 22,000	approx. 87,000
VHM 02-1	0.05 ... 2 l/min	0.013 ... 0.528	approx. 8,800	approx. 33,311.872
VHM 02-2	0.10 ... 4 l/min	0.026 ... 1.056	approx. 4,400	approx. 16,655.936
VHM 02-3	0.40 ... 8 l/min	0.106 ... 2.113	approx. 2,200	approx. 8,327.968
VHM 03-2	0.50 ... 20 l/min	0.132 ... 5.283	approx. 1,000	approx. 3,785.44

Materials	
Body	Stainless steel 1.4404 (316)
Gears	Stainless steel 1.4462 (316)
Bearings	Tungsten carbide
Seals	FEP-FKM (standard) NBR (upon request) PTFE (upon request)
K-factor	See calibration certificate for precise data

Special designs and materials are available on request.

Accuracy	up to 0.5% up to 1%	Viscosity > 10 mm ² /s Viscosity 1 - 10 mm ² /s
Repeatability	+/- 0.5‰	Under same operating conditions
Max. operating pressure	250 bar	3625 psi
Medium temperature	-20 ... +120 °C	-4 ... +248 °F
Viscosity range	1 - 20.000 mm ² /s	
Mounting positions	Freely selectable	

The installation into the pipe line can be made by means of a mounting plate or manifold.

APPLICATIONS

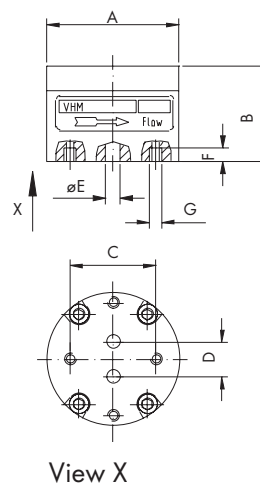
Chemical industry	→	Continuous dosing
Pharmaceutical industry	→	Mixing, batching
Cosmetic industry	→	Dosing, batching
Dyes and paints	→	Flow control, consumption monitoring
2-Component mixers	→	Monitoring, regulation of mixing ratio

DIMENSIONS

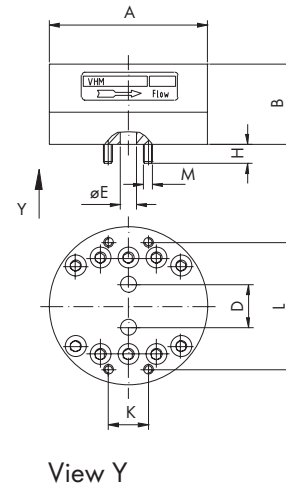
FLOW METER DIMENSIONS

Size	Ø A	B	C	D	Ø E	F	G	K	L	M	H	Weight (kg)
VHM 01-2	68	29	44	18	5	6	M6					0.760
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

VHM 01 / 02



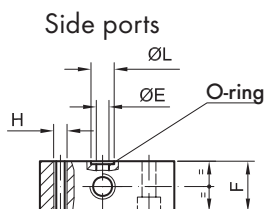
VHM 03



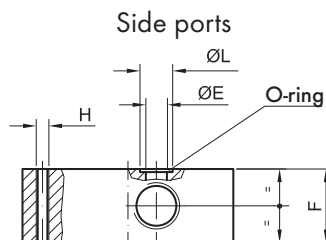
SUBPLATES DIMENSIONS

Type	A	B	C	D	E	F	G	H	L	M	N	P	O-ring
AHM 01-... AN/.	Ø 68	52	16	20	Ø 6	24	G 1/8	M6	Ø 11				7.65 x 1.78
AHM 02-... BN/.	Ø 68	52	16	20	Ø 6	24	G 1/4	M6	Ø 11				7.65 x 1.78
AHM 03-... CN/.	Ø 98	70			Ø 10	35	G 3/8	M6	Ø 15.5	25	81	13.5	12.42 x 1.78
AHM 03-... DN/.	Ø 98	70			Ø 10	35	G 1/2	M6	Ø 15.5	25	81	13.5	12.42 x 1.78

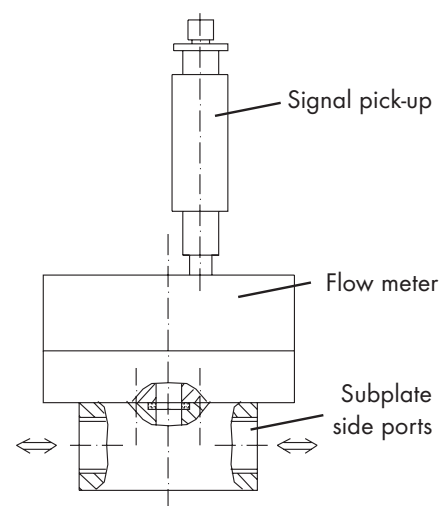
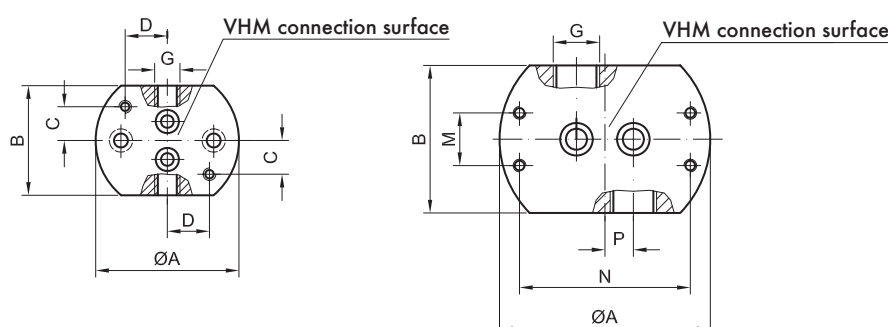
AHM 01 - .S... AHM 02 - .S...



AHM 03 - .S...



SIDE PORT CONNECTION



TYPE CODES

Flow meter VHM	Size	Factory preset	☐
	Type of seal	O-ring with FPM - core FEP-FPM	= [F]
	Type of connection	Subplate Piping	= [P] = [R]
	Housing material: stainless steel	V 2 A V 4 A	= [2] = [4]
	Backlash (factory preset)	Reduced tolerance Normal tolerance Increased tolerance	= [1] = [2] = [3]
	Measuring range	0.01-1 l/min 0.05-2 l/min 0.1-4 l/min 0.4-8 l/min 0.5-20 l/min	[2] [1] [2] [3] [2]
	Size flow meter VHM	[01] [02] [03]	
	Combination VHM/AHM		VHM / .
	Subplate AHM Size	[02] [03]	AHM / .
	Subplates AHM	Housing material: Stainless steel	V 2 A V 4 A
Connection orientation		Side connection Bottom connection	= [S] = [U]
Type of connection (other types on request)		G 1/8 = [A] G 1/4 = [B] G 3/8 = [C] G 1/2 = [D]	
Design		Standard Special	= [N] = [S]
Series		Factory preset	= ☐

Type key

Signal pick-up

GENERAL PRINCIPLE OF FUNCTIONING

The two gear wheels of the instrument are set into motion by the volume flow passing through the flow meter. Each tooth of the gear wheel is scanned by a single or double signal pick-up, which is screwed to the flow meter.

When the gear wheel rotates, this signal pick-up generates an electrical output impulse, when a tooth of the wheel passes the scanning range.

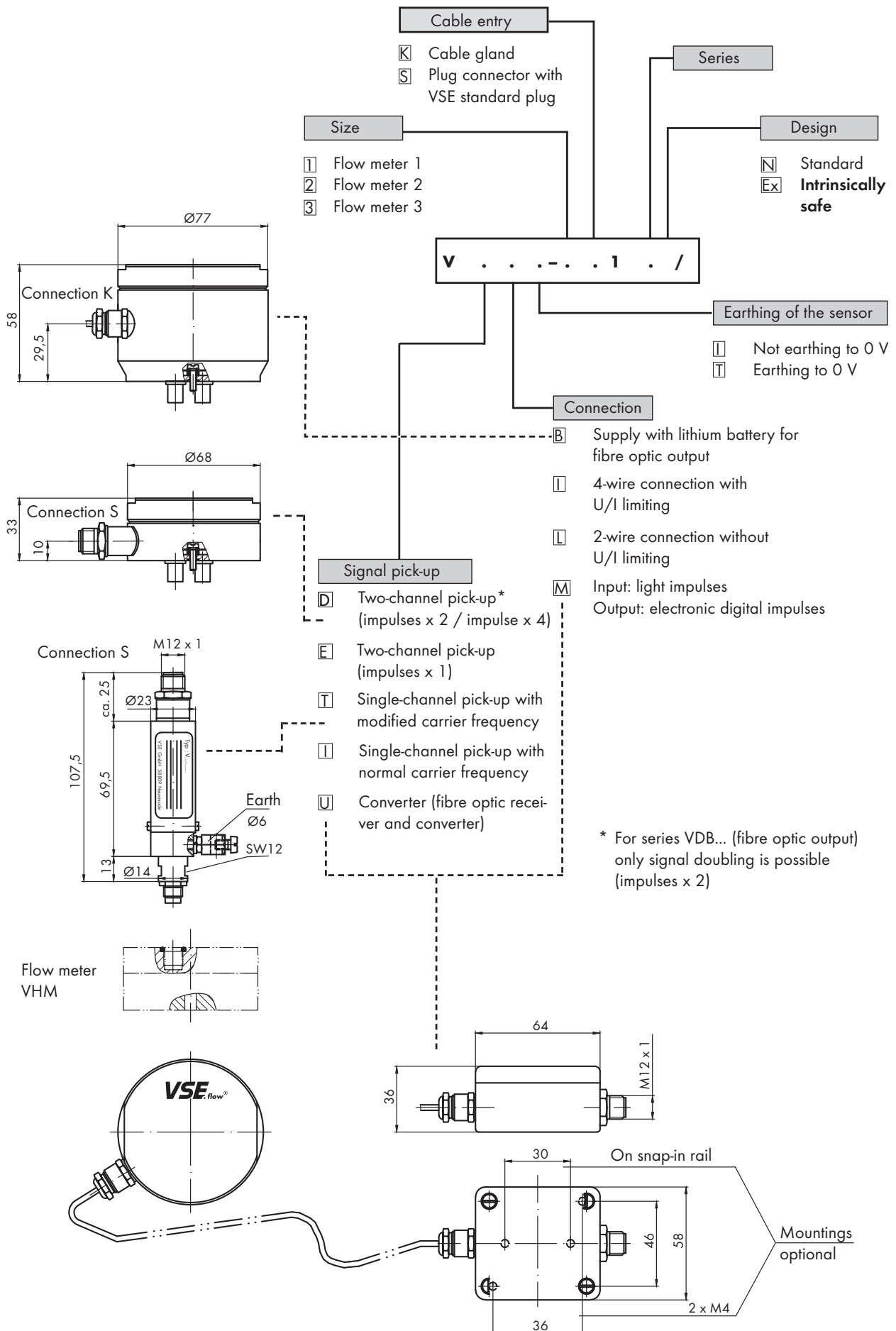
Each conveyed tooth gap volume corresponds to one electrical output impulse for a single signal pick-up, or 2 or 4 electrical output impulses for a double signal pick-up, depending on the jumper coding. This volume

is enclosed between the tooth gaps of the wheel and the body and is conveyed to the outlet side by the rotation of the gear wheel. The volume conveyed out of a tooth gap is designated as the measuring volume V_m , which determines the significance of the impulses depending on the size of the flow meter.

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

The frequency of the output impulse signal is processed in the associated electronic circuit and is proportional to the speed of rotation of the gear wheel and to the flow velocity. The flow quantity corresponds to the conveyed volume, which is measured by constant electronic counting of the output impulses.

TYPE CODES – SIGNAL PICK-UP



SELECTION CRITERIA – SIGNAL PICK-UPS

	Single pick-ups series VI .../VT ...	Double pick-ups series VD .../VE ...
General applications	Flow velocity measurement and volume measurement	Flow velocity measurement and volume measurement with high signal resolution
Measured volume signal resolution per conveyed tooth gap volume	1 impulse/measured volume	a) 2 impulses/measured volume or 4 impulses/measured volume optionally coded by jumpers in the pick-up b) 1 impulse/measured volume in modified series VE ...
Galvanic isolation between the supply voltage and the signal output	NPN- or PNP-switching optocoupler output	NPN- or PNP-switching optocoupler output
When 2 single pick-ups are used in one flow meter body, the following possibilities arise	a) A high signal resolution and detection of the flow direction are possible with additional electronics b) Or it is possible to implement a redundant system for increased safety in conjunction with the separate operation of both pick-ups. c) Separate power supply of the single pick-ups from galvanically isolated power supply units is possible.	
EX-Design	With intrinsic safety only in conjunction with VSE barrier amplifier Ex-designation Ex ia IIC T4 ... T6	With intrinsic safety only in conjunction with VSE barrier amplifier Ex-designation Ex ia IIC T4 ... T6

VHM SINGLE PICK-UPS AND DOUBLE PICK-UPS IN STANDARD DESIGN

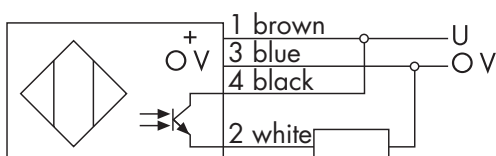
The single pick-up operates with a carrier frequency oscillator, which is modulated when a tooth passes. This modulation is detected by the amplifier and is used to generate one digital impulse per measured volume.

The double pick-up operates with two independent carrier frequency oscillators, which are modulated when a tooth passes. This modulation is detected by the amplifier and is used to generate 2 or 4 digital impulses per measured volume, which can be selected by the coding of the internal jumpers.

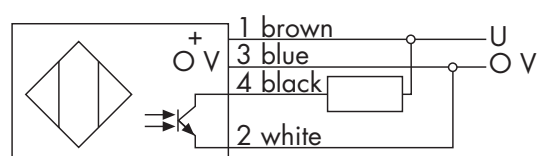
Single and double pick-ups are equipped with an optocoupler transistor output, which has a galvanic isolation between supply voltage and pick-up.

This transistor output can be connected with the supply voltage of the pick-up as shown in the below connection diagrams or can be operated with a separate power supply. Depending on the polarity of the power supply to the transistor, either a PNP- or a NPN-switched output signal is generated.

OUTPUT SIGNAL PNP-SWITCHED



OUTPUT SIGNAL NPN-SWITCHED



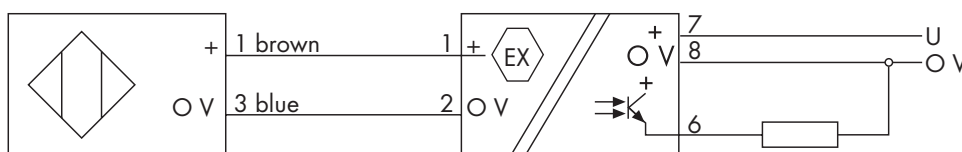
SINGLE PICK-UPS AND DOUBLE PICK-UPS IN EX-DESIGN

The single pick-up operates with a carrier frequency oscillator, which is modulated when a tooth passes. The double pick-up operates with two independent carrier frequency oscillators, which are modulated when a tooth passes.

This modulation is detected by the amplifier and is used to generate a pulsing current signal in the supply current. The connected barrier amplifier detects the signal and generates a digital PNP signal for further processing. The output impulses per measured volume correspond to those of the two standard designs.

Single pick-ups and double pick-ups in Ex-design are designed for intrinsic safety and may only be used in conjunction with the VSE barrier amplifier MK 13-P-Ex 0/24 V DC/K15.

The flow meter with the single pick-up or double pick-up is located in the hazardous area. The barrier amplifier is installed outside the hazardous area in an electrical cabinet or terminal box (snap-in mounted on an installation rail DIN 50022).



DOUBLE PICK-UP WITH FIBRE OPTIC OUTPUT TYPE VDB...

Applications under extremely difficult conditions	Applications	Measured volume signal resolution per conveyed tooth gap volume	Battery operation with energy saving circuit
a) Environments with heavy electromagnetic interference b) High voltage areas c) Rooms with explosion hazards, e.g. spray painting equipment with electrostatic charge	In flow velocity measurement and volume measurement with high signal resolution	2 impulses / measurement volume	2 years of operation without battery change

DOUBLE PICK-UP WITH FIBRE OPTIC OUTPUT TYPE VDB...

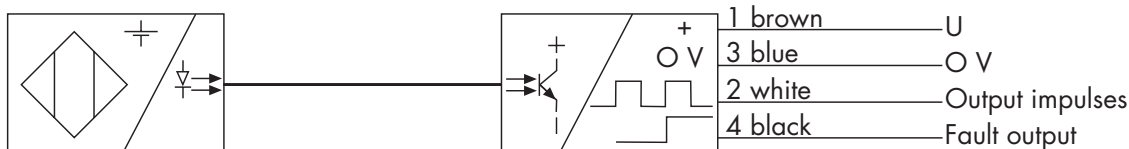
The double pick-up converts electrical impulses into light impulses and transmits these through a plastic optical fibre to the receiver, which is installed away from the extreme conditions. This converts the light impulses of the signal pick-up back into electrical impulses and outputs them to electronic evaluation devices for further processing. The output signal of the fibre optic receiver has a resolution of 2 impulses per measured volume with a pulse duty factor of 1:1.

The signal frequency of the output impulses is proportional to the speed of rotation of the gear wheel and to the flow velocity and must be processed by the connected electronic readout according to the values of the impulses.

The output impulses of the fibre optic receiver can be either a PNP- or a NPN-switched signal. The coding of the signals is easily possible and is performed on 2 separately programmable jumper bars in the receiver.

DOUBLE PICK-UP with lithium battery

FIBRE OPTIC RECEIVER



SIGNAL PICK-UPS FOR VHM FLOW METERS

Technical data part 1	Single pick-ups in standard design Deviations from Ex-design	Double pick-ups in standard design Deviations from Ex-design
Signal pick-ups per flow meter	1 or 2	2 (1 active carrier frequency oscillator in Series VE* ...)
Detection of direction of flow meter	Yes, by 2 signal pick-ups with a phase offset ¹ of 90° mounted on one flow meter body	No
Body data		
Dimensions	Ø = 25 mm; length = 115 mm	Ø = 68 mm; length = 33 mm; overall length with sensor = 43 mm
Protection type	IP 54	IP 54
Material	Stainless steel	Anodised aluminium, coil holder in stainless steel
Weight	100 g	165 g
Medium temperature	-20 ... +120°C / -4 ... +248°F Ex-Design: -20 ... +80°C / -4 ... +176°F	-20 ... +120°C / -4 ... +248°F Ex-Design: -20 ... +80°C / -4 ... +176°F
Ambient temperature	-20 ... +60°C / -4 ... +140°F Ex-Design: -20 ... +50°C / -4 ... +122°F	-20 ... +60°C / -4 ... +140°F Ex-Design: -20 ... +50°C / -4 ... +122°F
Ex-approval	According to Conformity certificate BUS 05 ATEX E 121X	According to Conformity certificate BUS 05 ATEX E 121X
Ex-designation	 II 1G Ex ia IIC T4...T6	 II 1G Ex ia IIC T4...T6
Ex-ignition suppression type in conjunction with specified VSE amplifier	Intrinsically safe MK 13-P-Ex 0/24 V DC/K15	Intrinsically safe MK 13-P-Ex 0/24 V DC/K15
Supply voltage U _{DC}	10-30 V DC, see data sheet page 12	110-30 V DC, see data sheet page 12

VSE barrier amplifier			
Installation site		Outside the Ex-area in an electrical cabinet or terminal box. Mounted on installation rail DIN 50 022	Outside the Ex-area in an electrical cabinet or terminal box. Mounted on installation rail DIN 50 022
Electrical connection		Intrinsically safe control line according to design specifications VDE 0165	Intrinsically safe control line according to design specifications VDE 0165
Supply Voltage U_{DC}	Standard	7–30 V	7–30 V
	Ex-Design	5–9 V (by specified VSE barrier amplifier)	5–9 V (by specified VSE barrier amplifier)
Supply current I_{DC}	Standard	3 mA max.	3 mA max.
	Ex-Design	< 2.7 mA > 3.7 mA (modulated current signal)	< 2.7 mA > 3.7 mA (modulated current signal)
Connection general	Standard	4-wire plug connection	4-wire plug connection
	Ex-Design	2-wire plug connection	2-wire plug connection
Plug with screened cable	Standard	4-pole standard plug, plug length = 25 mm, yellow cable	4-pole standard plug, plug length = 25 mm, yellow cable
	Ex-Design	dto., blue cable	dto., blue cable
Number of signal outputs		1 or 2 (when 2 single pick-ups are used in one flow meter body)	1 or 2 (the 2 signal pick-ups are evaluated by the internal amplifier and are connected to 1 output) 1 impulse in series VE...
Signal resolution per conveyed tooth gap volume (measurement volume V_m)		1 impulse or 2 impulses by 2 single signal pick-ups with a phase offset ¹ of 90° and different carrier frequencies in one flow meter body	Optional 2 impulses (signal doubling) or 4 impulses (signal quadrupling) codable with internal jumpers 1 impulse in series VE...

1 Explanation of series VT ...

If detection of the direction of flow and high signal resolution with additional external circuitry is necessary, 2 single pick-ups are used in one flow meter body,

which are arranged with a mechanical offset of 90° with regard to the tooth flank sequence

SIGNAL PICK-UPS FOR VHM FLOW METERS

Technical data part 2		Single pick-ups in standard design Deviations from Ex-design	Double pick-ups in standard design Deviations from Ex-design
Signal output voltage U_{DC}	Standard	7–30 V (depending on the supply voltage and loading of the optocoupler)	7–30 V (depending on the supply voltage and loading of the optocoupler)
	Ex-Design	To VSE barrier amplifier: 7.5–27.5 V; depending on the supply voltage	To VSE barrier amplifier: 7.5–27.5 V; depending on the supply voltage
Output current I_{DC}	Standard	10 mA max. (for supply voltage > 16 V DC)	10 mA max. (for supply voltage > 16 V DC)
	Ex-Design	VSE barrier amplifier: output circuit < 100 mA	VSE barrier amplifier: output circuit < 100 mA
Signal switching frequency f		3 Hz–1.0 kHz	3 Hz–1.0 kHz
Signal output circuit	Standard	Optocoupler transistor with series resistance $R = 1.2 \text{ K } \Omega$ galvanic isolation from the supply voltage potential	Optocoupler transistor with series resistance $R = 1.2 \text{ K } \Omega$ galvanic isolation from the supply voltage potential
	Ex-Design	VSE barrier amplifier: output short-circuit resistant – see data sheet. Connection to the barrier amplifier supply voltage potential.	VSE barrier amplifier: output short-circuit resistant – see data sheet. Connection to the barrier amplifier supply voltage potential.
Signal switching polarity	Standard	Optional NPN or PNP selectable by external connections	Optional NPN or PNP selectable by external connections
	Ex-Design	PNP output signal via VSE barrier amplifier, i.e. connection to the barrier amplifier supply voltage potential	PNP output signal via VSE barrier amplifier, i.e. connection to the barrier amplifier supply voltage potential
Signal pulse duty factor (p.d.f.)		p.d.f. = 1:1	Coding for signal doubling p.d.f. = 1:1 Coding for signal quadrupling: p.d.f. = dependent on the flow speed (impulse frequency) by which the impulse remains constant. (Series VE* ..., p.d.f. = 1:1)

* Explanation for series VE...

If a single pick-up (1 impulse per conveyed tooth gap volume) cannot be used in an application because of the length of its body (115 mm), **a modified double pick-up** of series VE... **(body length 43 mm)** can

be used, which operates with only one active carrier frequency oscillator and delivers the signals as a single pick-up.

VHM type list single and double pick-ups			Single pick-ups with not earthed 0 V-potential		Double pick-ups with not earthed 0 V-potential	
Preferred types			Single channel pick-ups with normal carrier frequency	Singel channel pick-ups with modified carrier frequency	Double channel pick-ups with (impulses ^{x2} /impulses ^{x4})	Double channel pick-ups modified (impulses ^{x1})
Available VS- connecting ¹	Standard	Size	4-wire connection with U/I-limiting	4-wire connection with U/I-limiting	4-wire connection with U/I-limiting	4-wire connection with U/I-limiting
	Ex-Design		2-wire connection with U/I-limiting	2-wire connection with U/I-limiting	2-wire connection with U/I-limiting	2-wire connection with U/I-limiting
Plug with yellow cable ² 5/10/15/20 m	Standard	01	VIII-1S10/N	VTII-1S10/N	VDII-1S10/N	VEII-1S10/N
		02	VIII-2S10/N*	VTII-2S10/N*	VDII-1S10/N*	VEII-2S10/N
		03	VIII-2S10/N	VTII-2S10/N	VDII-3S10/N	VEII-3S10/N
Plug with blue cable ² 5/10/15/20 m	Ex-Design	01	VIII-1 S10/Ex	VTII-1S10/Ex	VDII-3S10/N	VEII-1S10/Ex
		02	VIII-2S10/Ex*	VTII-2S10/Ex*	VDII-2S10/Ex*	VEII-2S10/Ex
		03	VIII-2S10/Ex	VTII-2S10/Ex	VDII-3S10/Ex	VEII-3S10/Ex

¹ The connecting cables are open at one end, but can be delivered with a second plug on request.

² Other cable lengths are available on request.

* **Stock types, other types on request.**

SIGNAL PICK-UPS WITH OPTICAL FIBRE TECHNOLOGY FOR VHM FLOW METERS

Technical data part 3	Double pick-ups with fibre optic output VDB ...	Fibre optic receiver VUM ...
Signal pick-ups per flow meter body	2	Volume impulse / fault signal Signal voltage U_{DC} : 9–30 V (depending on the supply voltage and loading of the signal output circuit)
Detection of the flow direction	No	Signal current I_{DC} : 10 mA max. (for supply voltages > 16 V DC)
Body data		
Dimensions	Ø = 78 mm; height = 62 mm; overall height with sensor 72 mm	Overall length with optical fibre and plug connector = 98 mm; L = 64 mm; B = 58 mm; H = 37 mm Mounting construction: 2 screws M4 or installation rail snap-in mounting DIN 50022
Protection type	IP 54	IP 54
Material	Anodised aluminium; coil holder in stainless steel	Aluminium
Weight	438 g	218 g
Medium temperature	–20 ... +60°C / –4 ... +140°F	
Ambient temperature	–20 ... +50°C / –4 ... +122°F	–25 ... +60°C / –13 ... +140°F
Ex-approval	According to Conformity certificate BUS 12 ATEX E 058X	LED indicators: LED green: ready LED red: transmission error
Ex-designation	Ex II 16 Ex ia op is IIC T4 6a	Volume impulse / fault signal Signal switching polarity: PNP or NPN programmable by 2 coding jumpers
Associated fibre optic receiver	VUMI-O...	Volume impulse pulse duty factor (PP) PP = 1:1
Installation site of the fibre optic receiver	Outside the Ex-area (or high voltage area) wall-mounted or in an electrical cabinet with screw or installation rail mounting DIN 50022 depending on the type.	
Electrical supply	By internal, sealed lithium battery (use only original parts)	Unregulated power supply with smoothing capacitor
Supply voltage U_{DC}	Battery 3.6 V / 16.5 Ah with integrated series resistor for Ex-applications	9–30 V
Operating time	2 years (integrated energy saving in stand-by mode)	Supply current I_{DC} 8 mA

Technical data part 4	Double pick-ups with fibre optic output VDB ...	Fibre optic receiver vum ...
Optical fibre	Silicone-free plastic optical fibre cable with double sheathing	Optical fibre signal input Signal detection: by fibre optic input transistor
Stress relief	Aramide fibres	Signal type: Digital optical signals from double pick-up (flow meter signals; monitor signal in stand-by; battery status signals)
Outer sheath	Polyurethane red	
Outer dimensions	3.5 mm +/- 0.2	
Bending radius	> 10 mm short-term; > 50 mm permanent	
Optical fibre connector	Cable gland PG 7, length = 20 mm	
Standard cable lengths	5 / 10 / 15 / 20 m	
Number of signal outputs	1, includes information on the flow meter output impulses and status signals	2 volume impulses (flow meter) fault signals
Signal resolution per conveyed tooth gap volume (measured volume V_m)	2 impulses (signal doubling)	2 impulses (signal doubling)
Switching frequency f	3 Hz - 1.0 kHz	3 Hz - 1.0 kHz
Volume impulses/ fault signals - signal output circuit	Fibre optic output diode: Digital optical signals to the fibre optic receiver (volume sensor signals; monitor signals in stand-by; battery status signals)	One transistor each with series resistor $R = 1.2 \text{ k}\Omega$

VHM – TYPE LIST OPTICAL FIBRE TECHNOLOGY

VHM	Size	Double pick-up with fibre optic output
Standard	01	VDBI-1K10/N
	02	VDBI-2K10/N
	03	VDBI-3K10/N*
Ex-Design	01	VDBI-1K10/EX
	02	VDBI-2K10/EX
	03	VDBI-3K10/EX*
* Size 03 on request		

Accessories for double pick-up

VDBI-battery = sealed lithium battery for all double signal pick-ups

LWL cable = plastic optical fibre cable

LWL cable	5 m	LWL cable	20 m*
LWL cable	10 m	* other length of optical fibre cable on request	
LWL cable	15 m		

Fibre optic receiver with plug connections

Body design	Screw mounting	VUMI-0S00/N
	Installation rail snap-in mounting	VUMI-0S01/N

PERFORMANCE CHARACTERISTICS OF THE FAULT SIGNAL OUTPUT

If a low battery state is signalled, the green LED "Ready" extinguishes and the fault signal output becomes active, operation of the system remains possible for a certain time.

The green LED "Ready" is switched on and the fault signal output is reset automatically when a new battery has been installed in the signal pick-up body.

The fault signal output also becomes active on the following transmission errors of the optical fibre, by which the red LED "transmission error" also lights:

- A. Interruption of the optical fibre
- B. Incorrect connection
- C. Weak optical signal

FLOW METER SELECTION

The correct choice (interpretation) of the type and size of flow meter is essential for a trouble-free and safe operation. Due to the large number of different applications and flow meter models, the technical data in the VSE catalogues are of a general nature. Certain characteristics of the devices depend on type, size and measuring range as well as the liquid to be measured. Please consult VSE for an exact choice of flow meter.

Special designs are available on request

BARRIER AMPLIFIER "MK 13-P-EX 0/24 V DC/K15" FOR VHM FLOW METERS

VSE provides the barrier amplifier type "MK 13-P-Ex 0/24 V DC/K15" for the application of VHM flow meters in areas with explosion hazards. This operates in conjunction with the pick-up systems of VHM flow meters.

The barrier amplifier has an intrinsically safe control circuit and is equipped with galvanic isolation between the control and output circuits to the supply. It contains a pulse-switching, short-circuit resistant transistor output and is connected with screw terminals. The amplifier is installed in a plastic housing and is fitted with a snap-in mounting for attachment to an installation rail.

The barrier amplifier must be installed outside the Ex-area in an electrical cabinet or terminal box. The intrinsically safe control lines must be laid and marked according to the design specifications of VDE 0165.

VIL-.../EX; VTL-.../EX

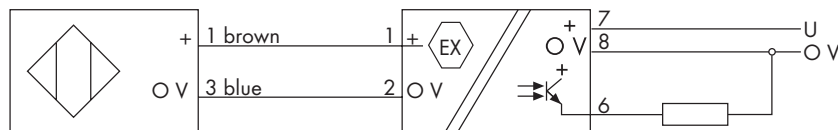
Single pick-up with plug connection

VDL-.../EX; VEL-.../EX

Double pick-up with plug connection

FLOW METER VHM...

BARRIER AMPLIFIER



EXTERNAL INDUCTORS / CAPACITANCE

[EEx ia] IIB

2/10/20 mH 5/3.5/3 μ F

[EEx ia] IIC

1/5/10 mH 1.1/0.75/0.65 μ F

TECHNICAL DATA OF THE BARRIER AMPLIFIER MK 13-P-EX 0/24 V DC/K15

Galvanic isolation of the control and output circuits

Ex-approval according to conformity certificate PTB06 ATEX 2025

Control circuits intrinsically safe: II (1) GD [Ex ia] IIC

Input circuit		Output circuit		Operating values	
Sensor voltage	8.2 V	Signal output	Transistor output PNP-switched	Supply voltage	10–30 V DC
Sensor current	< 2.7 mA > 3.7 mA (modulated current signal)	Voltage drop	< 2.5 V	Current consumption short-circuit resistant	< 20 mA < 31 mA
Switching threshold	Low = < 2.7 mA High = > 3.7 mA	Switching current	< 100 mA Short-circuit resistant		
Hysteresis	> 0.2 mA	Switching frequency	< 3 kHz		

Body	
Dimensions	Length 89 mm, width 18 mm, height 71 mm
Material	Polycarbonate / ABS
Inflammability class	V-O according to UL 94
Mounting	Installation rail (DIN 50022) or G-rail (DIN 50035)
Temperature range	–25 ... +70 °C / –13 ... +158 °F
Protection range	(DIN 40050) IP 20
Weight	70 g

LED indicators	
Ready	Green LED
Switching status	Yellow LED





GEAR FLOW METER VSE EF ECOFLOW

ALUMINIUM FLOW METER VSE EF ECOFLOW SERIES

Based on the same meshing gear principle as the VSE series VSI and VHM, the VSE EF ecoflow sensor measures viscous media, however as in-line-device.

An integrated, magnetoresistive pick-up with PNP or NPN-switching output produces one impulse per tooth with a value of:

Volume / Impulse	Size
0.04 cm ³	EF 0.04
0.1 cm ³	EF 0.1
0.4 cm ³	EF 0.4
2 cm ³	EF 2
4 cm ³	EF 4

Optional:

LCD flow display with analogue output and two limit values, mounted on the flow meter.

The impulse frequency is proportional to the revolutions of the gear wheels, which are driven by the volume stream.

The impulse processing is made by means of VSE-made or any other electronic readout. The VSE EF ecoflow is a economical alternative to the VSI series for applications that require lower accuracy, temperature and pressure.

TECHNICAL DATA

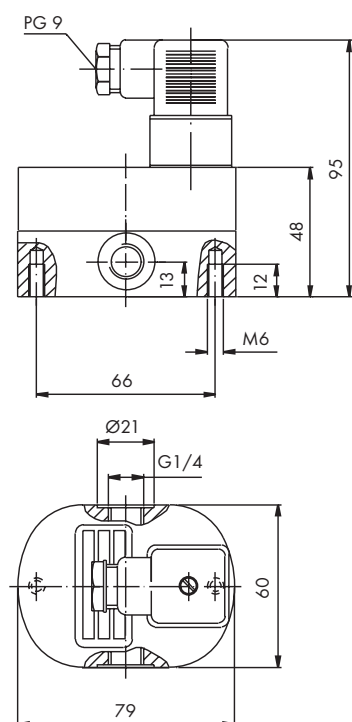
	EF 0.04	EF 0.1	EF 0.4	EF 2	EF 4
Flow range l/min	0.05 ... 4	0.1 ... 10	0.2 ... 30	0.5 ... 70	3.0 ... 150
Flow volume cm ³ /pulse	0.04	0.1	0.4	2.0	4.0
Frequency (Hz)	20.8 ... 1,666.7	16.7 ... 1,666.7	8.3 ... 1,250.0	4.2 ... 583.3	12.5 ... 625.0
K-Factor (pulse/l)	appr. 25,000	appr. 10,000	appr. 2,500	appr. 500	appr. 250
Accuracy at 21 mm ² /s	2 %	2 %	2 %	2 %	3 %
Viscosity range mm ² /s	2 ... 2,000	2 ... 2,000	2 ... 5,000	2 ... 7,000	2 ... 10,000
Max. operating pressure	200 bar (2900 psi)				
Medium temperatur	0°C ... +80°C (32°F ... 176°F)				
Mounting position	unrestricted				
Filtering	20 µm	20 µm	50 µm	50 µm	100 µm
Side pipe connection	G 1/4"	G 3/8"	G 1/2"	G 3/4"	G 1"
Weight	0.62 kg	0.70 kg	1.5 kg	1.7 kg	5.24 kg

MATERIALS

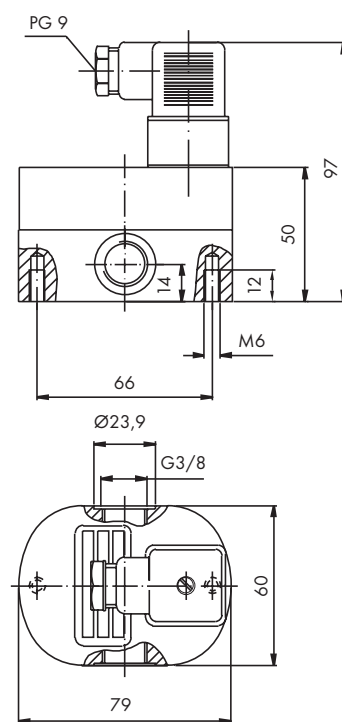
Body	Aluminium
Gear wheels	Stainless steel 1.4122, (DIN EN 1563)
Bearing	Stainless steel ball bearing, DU sleeve bearing, ball bearing or bronze sleeve bearing
Seals	FPM (standard), NBR, PTFE or EPDM (optional)

DIMENSIONS OF FLOW METERS

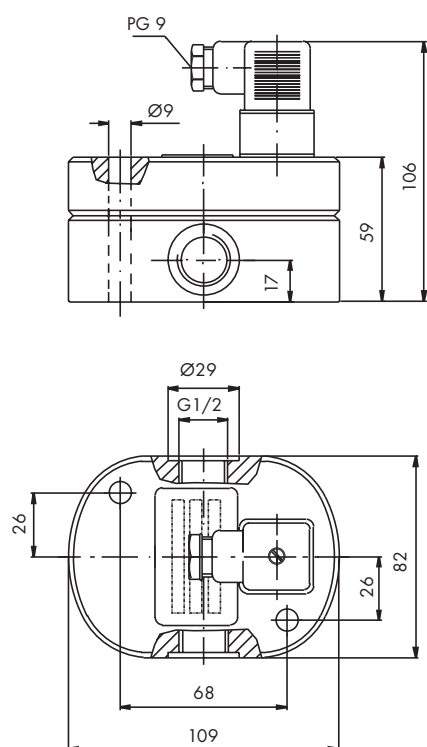
EF 0.04



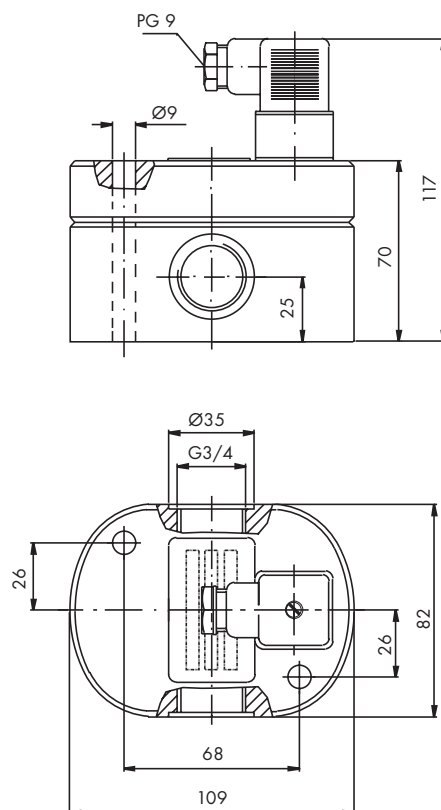
EF 0.1



EF 0.4

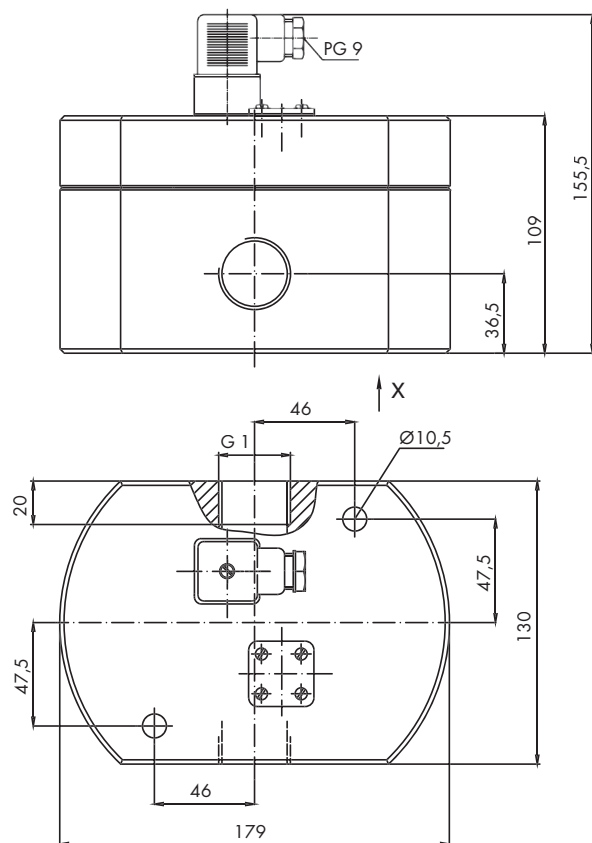


EF 2

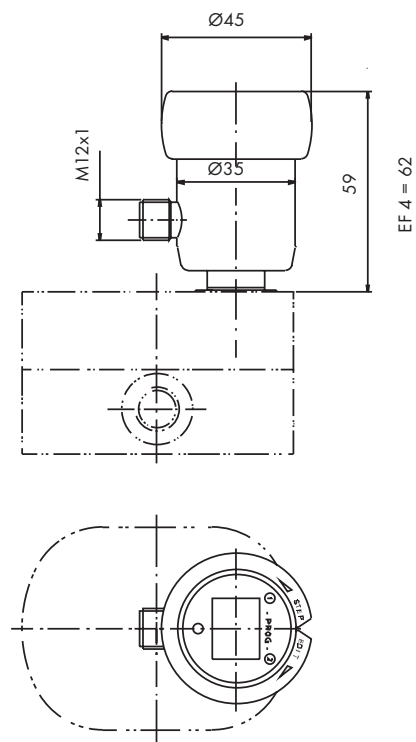


DIMENSIONS OF FLOW METERS

EF 4

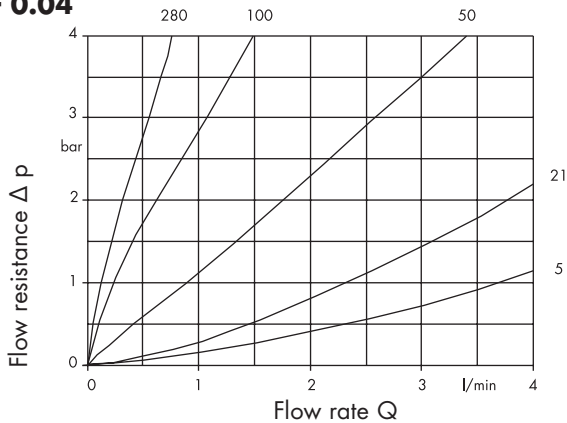


LCD FLOW DISPLAY

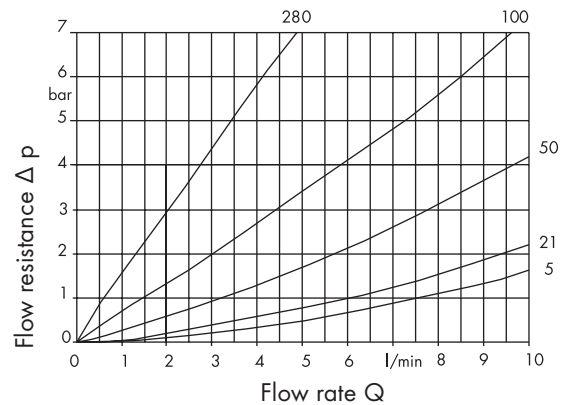


FLOW RESPONSE CURVES

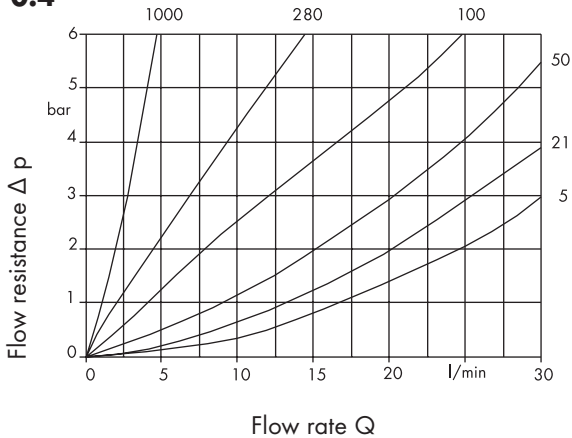
EF 0.04



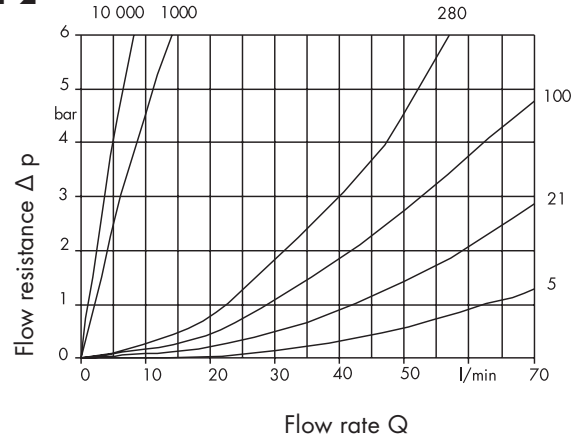
EF 0.1



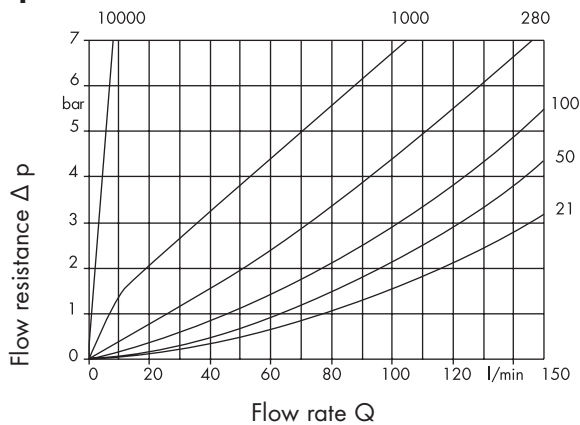
EF 0.4



EF 2



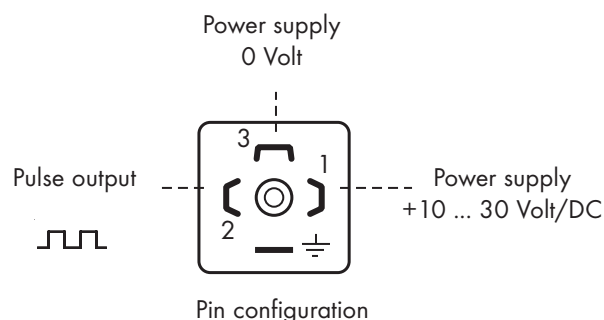
EF 4



Viscosity: mm^2/s

For trouble-free and safe operation of the flow meters, a correct selection of type and size is decisive. Due to the great number of different applications and flow meter versions, the technical data in the VSE catalogues are of general character. Certain characteristics of the devices depend on type, size and measuring range as well as on the medium to be measured. For an exact flow meter selection please contact VSE.

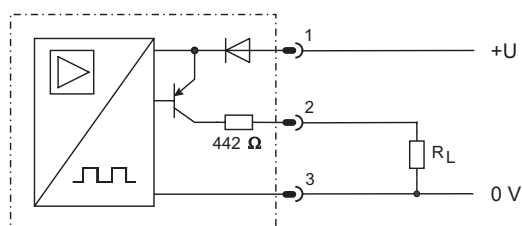
STANDARD: VSE EF ECOFLOW FLOW METER, WITH PULSE OUTPUT



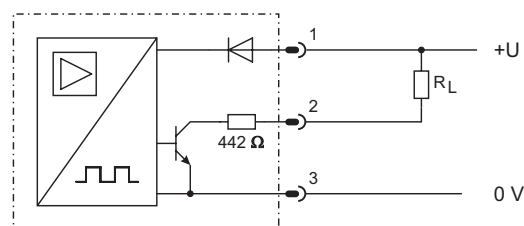
DESCRIPTION

The rotation of the flow meter gear wheels is sensed by a non-contact magnetoresistive pickup, amplified and emitted as pulses. The passing of each individual gear tooth produces a pulse corresponding to a precise positively displaced measured volume. The pulse output can be produced as PNP or NPN signals. The frequency is proportional to the momentary flow.

CONNECTION DIAGRAM



Pulse output - PNP version

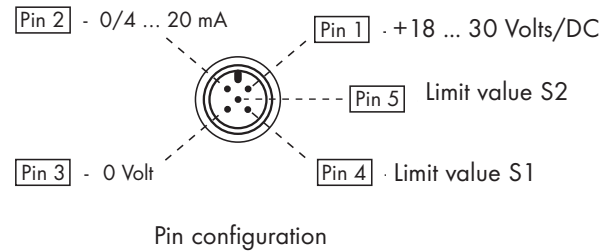


Pulse output - NPN version

Power supply	10 ... 30 Volts/DC
Power consumption	18 mA (no load)
Pulse output	PNP or NPN switching, 20 mA max. Short-circuit-proof (internal protective resistor 442 Ω) Square wave signal, 0 ... 1667 Hz, depending upon flow meter size
Temperature range	0 °C ... +80 °C (32 °F ... 176 °F)
Electrical connection	Square connector according to DIN EN 175301-803-A Cable gland Pg9, Cable diameter 6 - 8 mm, Wire gauge max. 1.5 mm ²
Protection class	IP 65 (with mounted connection plug)

OPTION: LCD FLOW DISPLAY FOR VSE EF ECOFLOW

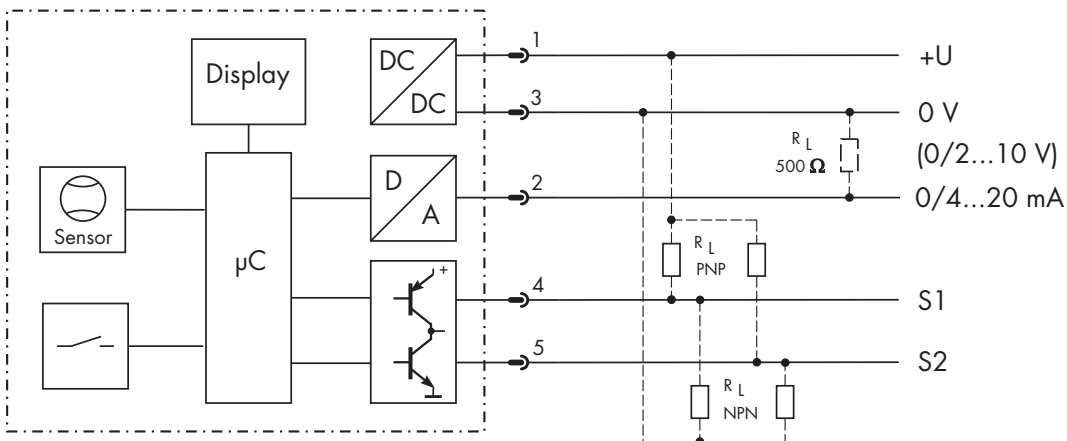
WITH ANALOGUE OUTPUT AND TWO LIMIT VALUES



DESCRIPTION

The programmable flow display evaluates the pulses from the magnetoresistive pickup and shows the chosen units on a backlit LCD-display. Alarm and condition reports are signalled in the display by a red LED with additional text. The measured values are transmitted by means of an analogue output, 0 or 4 up to 20 mA, and 0 or 2 up to 10 Volt by means of a resistor (500 Ohm). The limit values are signalled through two transistor switching outputs.

CONNECTION DIAGRAM



Graphic display	LCD display, 4-digit with backlit; shows value, dimension and dialogue-message; red, flashing LED indicator
Analogue output	0 or 4 ... 20 mA; 12 bit A/D converter (0 or 2 ... 10 Volt, with external 500 Ω resistor)
Switch points	S1 and S2; Transistor output 30 V/100 mA max. Push-pull output, PNP or NPN selectable with external connection Short-circuit proof and reverse-polarity proof Hysteresis adjustable in value and direction
Power supply	18 ... 30 Volt DC/<1 Watt
Temperature range	0°C ... +70°C (32°F ... 158°F)
Electrical connection	Round connector M12 x 1, 5-pole
Protection class	IP 62
Material	Stainless steel 1.4305; mineral glass screen POM-programming ring; FPM-seals
Accessory	PUR-connection, cable 5-pole shielded, 5 or 10 m long alternative: VSE standard plug, 5-pole

Customer specific designs on request

TYPE CODE

EF-./.			
Size	0.05 ... 4 l/min.	= 0.04	= Series (factory preset) 1
	0.1 ... 10 l/min.	= 0.1	
	0.2 ... 30 l/min.	= 0.4	
	0.5 ... 70 l/min.	= 2	
	3.0 ... 150 l/min.	= 4	
Material	Aluminium (standard)	= A	
Connection type	Subplate ①	= P	
	Piping	= R	
Version	Standard	= 0	
	With sight glass ①	= 2	
Gear bearings ✱ ②	Ball bearing	= 1	
	Bronze sleeve bearing	= 3	
	DU sleeve bearing	= 6	
Gear tolerance ②	Reduced tolerance	= 1	
	Normal tolerance	= 2	
	Increased tolerance	= 3	
	Tolerance sleeve bearing	= 4	
Seal type ②	FPM (≥ FKM) Standard	= V	
	NBR	= P	
	PTFE	= T	
	EPDM	= E	
Short term explanation to type of seals			
FPM (≥ FKM)		= Fluorine carbon rubber O-ring	
NBR		= Acrylnitrile butadiene rubber O-ring	
PTFE		= Polytetrafluorethylene rubber O-ring	
EPDM		= Ethylen propylene diene rubber O-ring	
✱ Other type no. = special design			
① Special design upon request			
② Factory preset to the application			





TURBINE FLOW METER VTR

FLOW METERS SERIES VTR

Turbine flow meters are precise and reliable measuring instruments, designed for a wide range of applications. Even under difficult application conditions in the oil, petrochemical and chemical industries as well as in other industrial sectors, the sensors of the VTR series can be installed. The range of nominal widths spans from 10 mm to 500 mm for the flange version as well as from 10 mm to 50 mm for the version with threaded connection. All VTR flow meters are individually calibrated. A wide range of electronic evaluation and display devices is available.

- **Large choice of nominal widths between DN 10 and DN 500**
- **Designed completely in stainless steel**
- **Wide temperature and pressure range**
- **Large measurement range from 110 l/h to 4,500 m³/h**

FUNCTIONING PRINCIPLE

The basic system of the VTR Series consists of a rotor, the housing and a measurement pick-up. The flow of the fluid sets the rotor in motion. If the magnetic field lines of the pick-up system are intersected by the rotor blades, the movement of the rotor is detected. Due to the specific internal diameter, the revolution of the turbine is directly proportional to the flow. The turbine revolution is detected by an external sensor. The output signal is a flow-proportional frequency (pulse sequence). The further processing of the signal can be carried out by a separate evaluation and display device.

SPECIFICATIONS

Response time	< 50 ms for sensors up to DN 40 – longer response times for larger nominal diameters and therefore larger rotor mass
Filter requirements	For safe operation of the flow meter, we suggest filtration requirements in order to avoid damages due to contamination. We would be pleased to provide you with details.
Cable connections	A 4- or 2-connection shielded cable with PUR insulation is recommended. Cross-section: 0.5 mm ²
Frequency	3 up to 1,000 Hz
Electrical connection	VSE standard plug
Mechanical connections	Flange appropriate ANSI or DIN; other specifications on request Threading: up to DN 50, connections with NPT or pipe threads (BSP)
Maximum pressure	Threaded connections: maximum 250 bar; Flange connections: according to flange specifications
Linearity	+/- 0.5 %
Repeatability	+/- 0.05 %
Pressure drop	280 mbar at 100 % of the measurement range (density 1, viscosity 1 cSt)
Temperature range	- 40°C to + 120°C (- 40°F to + 248°F)

All values are valid for viscosities up to 5 cSt. Higher viscosities on request.



DN 10-50

Outer thread G 3/8 - G 2
or NPT 3/8" - NPT 2"



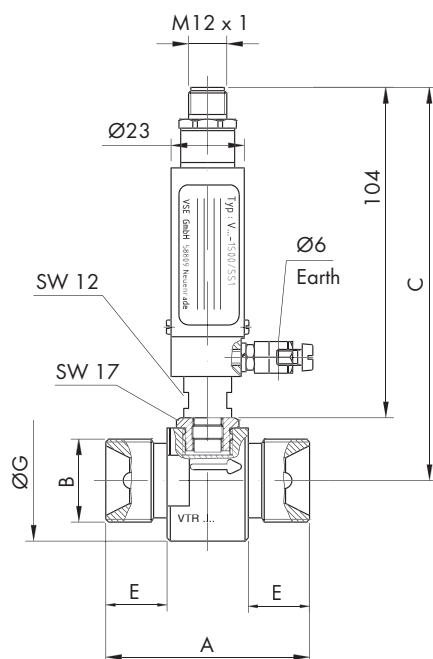
DN 10-500

Flange design according to DIN,
British Standard or ASA 150 RF

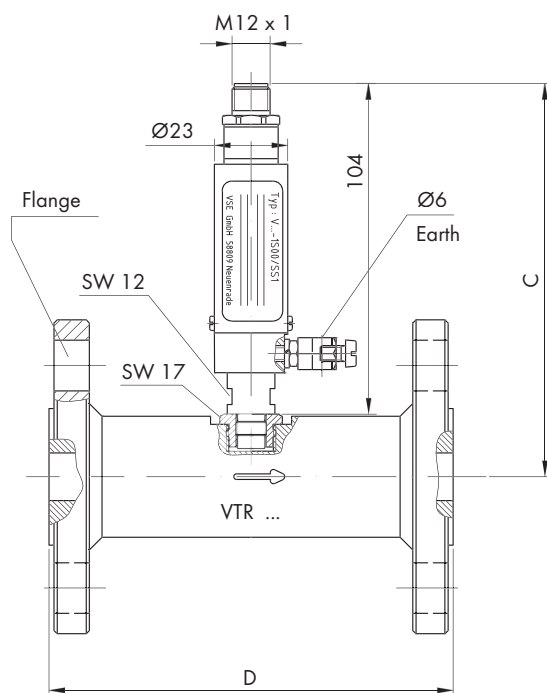
MATERIALS

Housing:	Stainless steel 1.4301, optional 1.4401
Flange:	Steel 1.0432, optional stainless steel 1.4301 or 1.4401
Rotor:	Up to VTR 1020: stainless steel 1.4016, VTR 1025 and higher: stainless steel with 1.75 % to 2.25 % molybdenum
Bearings:	Tungsten-Carbide
Ball bearing:	Stainless steel

DIMENSIONS



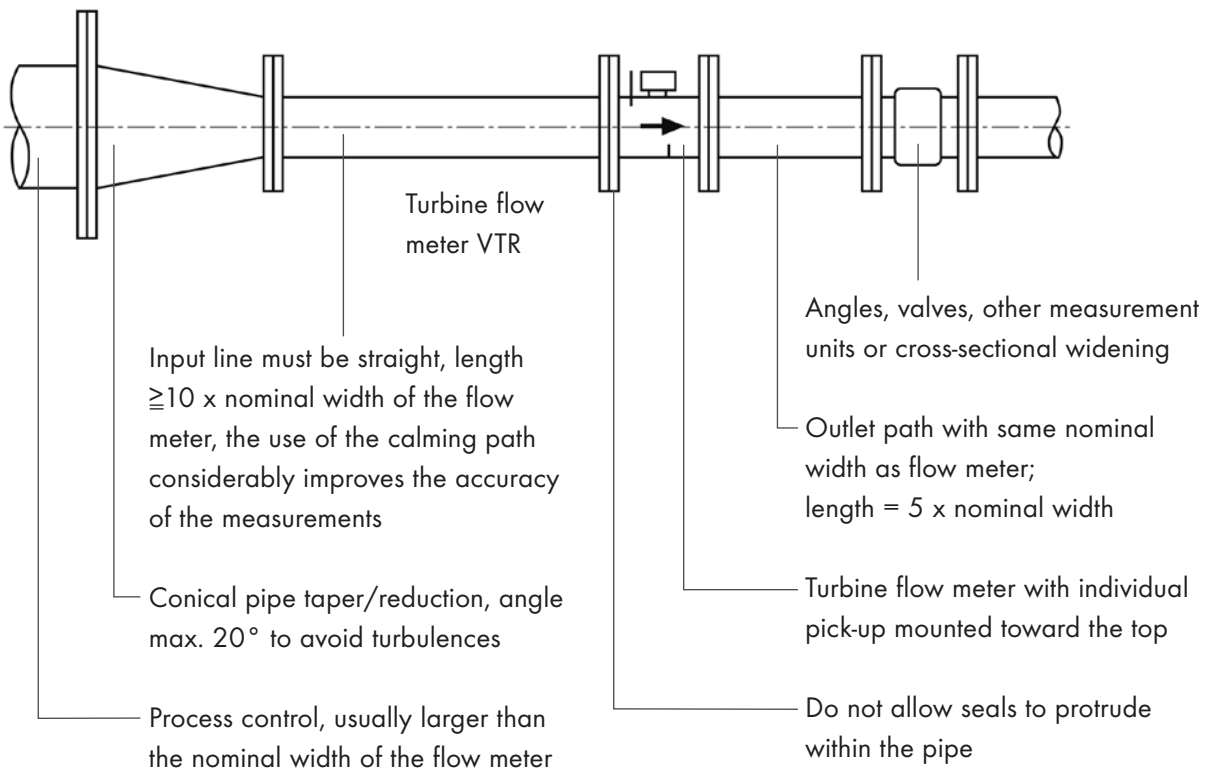
Dimensions
are specified
in mm



A	E	B	ØG	SW	C	TYPE	DN	D	m³/h	l/min.	Imp./l
62	19	G 1/2	33	30	121	VTR 1010	10	-	0.11 - 1.1	1.8 - 18	3000
64	19	G 3/4	38	35	123	VTR 1015-S	15	127	0.22 - 2.2	3.6 - 36	1700
64	19	G 3/4	38	35	123	VTR 1015	15	127	0.4 - 4	6.7 - 67	1100
83	22	G 3/4	41	38	125	VTR 1020	20	140	0.8 - 8	13 - 130	400
89	23	G 1	47	44	128	VTR 1025	25	152	1.6 - 16	27 - 270	190
115	28	G 1 1/2	60	52.5	134	VTR 1040	40	178	3.4 - 34	57 - 570	60
133	29.5	G 2	70	-	139	VTR 1050	50	197	6.8 - 68	113 - 1130	24

Further sizes and versions are available on request. Each turbine flow meter is individually calibrated. This individual pulse count/l (K-Factor) is indicated on the type plate.

INSTALLATION OF THE VTR FLOW METER





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