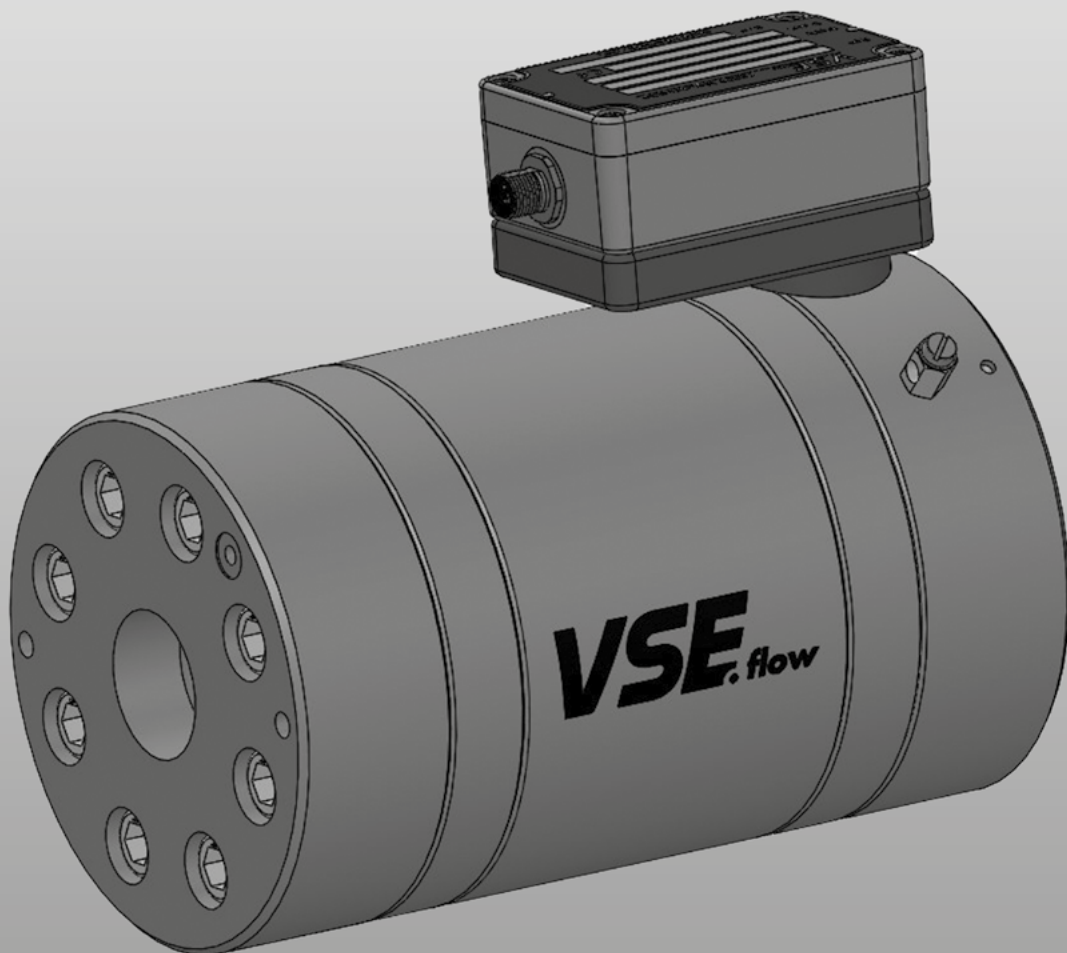


# Operating instructions

for flow meters of the product series "RS"



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## 1. IMPORTANT INFORMATION AND LEGAL NOTICES

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

This operating instruction for flow meters of the “**RS**” series by VSE Volumentchnik GmbH (VSE) contains information required to properly install and commission the flow meter for the intended purpose.

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

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

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

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

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

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

## 2. FUNCTION DESCRIPTION OF THE RS FLOW METERS

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
- Lowest pressure losses
- Short response time due to innovative rotor profile and reduced mass
- Highest functionality due to intelligent sensor technology
- Gentle fluid measurements

## 3. GENERAL DESCRIPTION

Please follow all instructions in this manual to ensure the trouble-free operation of the RS flow meters. VSE does not assume responsibility or liability for damages resulting from noncompliance with these instruc-

## 4. RS 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 general in nature. Certain properties of the devices are

## 5. DECLARATION OF CONFORMITY

Flow meters of the "RS" series have been tested for their electromagnetic compatibility and interference emissions as outlined by the EMC Directive and are in compliance with the applicable statutory EMC Directives.

They cannot be operated independently, are connected by cable to a power source, and provide digital electrical signals for electronic evaluation. All flow meters have a declaration of conformity, which can be requested if necessary.

### Sensor System Explanation

The non-contact pick-up system consists of two magneto-resistive sensors, 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 sensor signals are amplified and digitised in high resolution by the preamplifier electronics. 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.

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 120 kHz. The preamplifier is protected against reverse polarity and incorrect connection. It is designed for media temperatures of -30°C to +120°C and is mounted directly on the RS flow meter.

tions. The device may only be opened within the warranty period after consultation and approval by VSE.

dependent on type, size and measuring 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.

Since the electromagnetic compatibility of the entire measuring system is also dependent on the installation of the cables, the correct connection of the shield, and each individual connected device, all components must comply with the EMC Directive, and the electromagnetic compatibility of the entire system, machine, or system must be ensured as well.

All flow meters have been tested in accordance with the applicable statutory EMC Directives and are CE certified. The EC conformity marking is the CE mark affixed to the type-plate of all flow meters.

## 6. GENERAL OPERATING REQUIREMENTS

Before assembly or putting into operation (commissioning), check and verify the following properties and aspects of the respective circumstances of your system to ensure operation is trouble-free, safe, and reliable.

### 1. The Fluid to be Processed

- Is the flow meter **suitable for the fluid**?
- Is the fluid **viscous** or **abrasive**?
- Is the fluid **dirty** or does it contain **contaminants/pollutants** and **solid particles**?
- Which **grain sizes** do these solids have and could they **block the measuring** element?
- Does the fluid have **fillers** or other **additives**?
- Is it necessary to install an upstream **hydraulic filter**?
- Are **tubes and pipes clean** and free of assembly residues such as chips, weld spatter?
- Is the **tank clean** and is it impossible for impurities or **foreign substances** to reach the pipeline or tubing system from the tank?
- Is a different fluid used frequently and is the system sufficiently flushed and **rinsed** in between?
- Are pipelines/tubes and the entire system completely **deaerated**?
- Which **cleaning agent** is being used?
- Are fluid and cleaning agent compatible with the **seals**?
- Are the **seals suitable** for the fluid to be measured (**compatibilities of seals**)?

### 2. Hydraulic Properties of the System

- Is the **max. operating pressure** of the system less than the max. permissible operating pressure of the flow meter?
- Is the **max. pressure drop  $\Delta p$**  (at flow meter) below the max. permissible pressure drop?
- Is the **pressure drop  $\Delta p$**  not excessive with max. flow (e.g. high viscosity)?
- Does the flow range of the flow meter (dependent on the viscosity) correspond with the **present flow**?
- Please note that the flow range is less with **higher viscosity!**
- Does the temperature range of the flow meter correspond with **the present max. temperature** of the fluid?
- Is the **cross-section** of the pipelines/tubes large enough and are there no overly large pressure drops in the system?
- Is the **hydraulic connection** (inlet/outlet) connected corrected and sealed properly?
- Does the **pump** have enough power to operate the system?
- A blocked flow meter can stop the entire flow. Does the system feature an **overpressure / bypass valve**? This valve must be checked and maintained at regular intervals.

### 3. Electronic Evaluation and Electrical Safety

- Have you selected the optimal flow sensor and is this equipped with the **appropriate preamplifier**?
- Does the **supply voltage** of the flow meter match the available power supply?
- Is the supply voltage to the power supply adapter or the evaluating device sufficiently **filtered**?
- Does the **output** of the supply voltage correspond with the required output?
- Is the electrical connection established based on the enclosed **wiring plan**?
- Is the cable protected by a shield?
- Is a **connection** of the cable shielding installed via the housing of the round pin plug to the flow meter?
- Is there a **potential difference** between the PE on the flow meter and the PE at the evaluating device?
- Is a compensation line to eliminate the **potential difference** needed between the flow meter and the evaluating device?
- Is the flow meter permanently attached to the **protective earth conductor (PE)** (e.g. via the pipelines)?
- Is the flow meter **insulated** to the protective earth conductor (PE) (e.g. connection via pipes/tubes)? If this applies, the protective earth conductor (PE) must be connected to the flow meter!
- Is the cable installed free of interference and is it impossible to couple **interfering impulses**?
- Is the **round pin plug** of the connection cable firmly attached to the plug of the flow meter?
- Are the wires at the **evaluating** device connected correctly?
- Does the entire system meet the legal rules and regulations concerning electromagnetic compatibility (**EMC**)?
- Is compliance with all local rule and regulations, **applicable rules**, guidelines and basic conditions of the **EMC** ensured?
- Systems where a malfunction or failure may lead to personal injuries must be equipped with **suitable safety mechanisms**. The function of these safety mechanisms must be checked at regular intervals.

## 7. MAXIMUM OPERATING PRESSURE

Before installing the flow meter, you must check whether the max. operating pressure of the system does not exceed the max. permissible

operating pressure of 450 bar of the flow meter. Make sure to keep in mind that peak pressures may occur when operating the system.

**Important:**

**Please contact VSE with all operating pressures > 450 bar and in case of special models.**



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

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

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

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

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

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

## 9. FLOW RATE MEASURING RANGE

The **flow rate** measuring range specified in the data sheet ( $Q_{\min}$  –  $Q_{\max}$ ) of the flow meter refers to the test fluid ‚hydraulic oil‘ with a viscosity of 21 mm<sup>2</sup>/s at a temperature of 20°C. For this measuring range, VSE specifies accuracy up to 0.5% of the measured value and a repeatability of 0.05%.

In fluids with low viscosity (< 21 mm<sup>2</sup>/s), the measurement accuracy degrades while it may improve with fluid with a high viscosity (> 21 mm<sup>2</sup>/s). Note also that the flow measuring range is limited at higher viscosity (see „RS flow meter technical data“).

**Important:**

**Verify that the specified maximum permissible operating pressure of the flow meter can never be exceeded in any operating mode of the system. Also pay attention to the flow measuring range, which is dependent on the viscosity of the fluid to be measured.**



## 10. MOUNTING THE FLOW METER

The flow meter should be mounted in an easily accessible location so that disassembly to clean the measuring elements is easy. Since flow meters operate in any installation position and flow direction, you can mount it anywhere in your system. When installing the flow meter, make sure that liquid remains in the flow meter even at standstill of the system and that the flow meter can never run dry. The outlet of the flow meter should always have a certain backpressure since this fixes the measuring element of the flow meter in the liquid column and the pipeline cannot empty itself (the measuring element uses to support itself on the liquid column). In critical cases, or if the pipeline can run empty in standstill or standby mode, it is always advisable to install an additional non-return check valve in the outlet line.

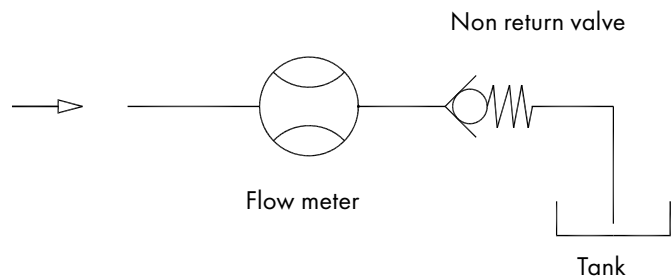


Fig. 1: Flow meter with backpressure

### Important:

**Make sure that the flow meter measuring elements are always completely filled both in inlet and outlet and that the outlet has a little backpressure. This prevents the measuring elements from being damaged by a sudden and steep increase of flow and at the same time improves measurement accuracy.**



Flow meters of the "RS" series can be installed in the pipeline. Always select large cross-sections (if possible) for the hydraulic inlet and outlet or the entire pipeline system. This reduces the pressure drop and the flow rate throughout the system.

### Installation Notes

#### Installation Position

Any, note arrow indicating preferred direction if necessary (calibration arrow). Mount the device in such a way that the preamplifier is turned away from any potential heat source.

Straight pipe sections are **not** required in inlet/outlet.

#### Connecting Units

If the connecting units (mounting flanges) are to be installed on-site, compliance with the specified torque is required.

#### Pipe Thread

Please comply with the screw-in depths and sealing systems. Teflon tape or liquid sealants such as adhesives are not permitted!

#### Fastening

The devices must be installed stress-free into the pipeline. This is accomplished with fastening threads located at the face sides in the connecting units. For stress-free assembly, the compressive strength may be limited!

Table 1: Starting torque of the connection units

RS Flow Meter Size	Torque
RS 40	35 Nm
RS 100	70 Nm
RS 400	120 Nm
RS 800	280 Nm
RS 2500	280 Nm

## 11. CLEANING AND FLUSHING OF PIPELINE BEFORE INITIAL START-UP

Before initial start-up of the flow meter, you must flush and clean the whole system to prevent contaminants from reaching the measuring elements during the assembly and installation. Foreign matter or contaminants may block the flow meter or severely damage it so that the flow meter readings are no longer valid and the device must be returned for repairs. After completion of the installation or piping, you must first flush the entire pipeline system and carefully clean and flush the tank. This requires that the flow sensor is removed from the fluid circuit to flush out all foreign matter or contaminants (e.g. chips, metal parts) without problems. Use a rinsing fluid that is compatible with the subsequent used fluid and will not cause adverse reactions. Such information can

be obtained from the supplier or manufacturer of the fluid or from VSE. Flow meters are sensors manufactured with a high degree of precision. They have mechanical measuring elements consisting of two rotors fitted into the housing with narrow gaps. Even the smallest damage to the rotors causes a measuring error. Always make sure that foreign matter or contaminants cannot reach the measuring elements and that the fluid flowing through the flow meter is always free of pollutants and particles. Once the system is thoroughly flushed and no extraneous material is in the piping system, you can mount the flow meter into the fluid circuit and start the actual initial startup process.

## 12. FLUID FILTERING

Heavily contaminated fluids or foreign matter in the fluid can block, damage, and even destroy the flow meter. In these cases, always install a sufficiently large filter in front of the flow meter so that foreign particles

and solids are prevented from entering the measuring elements, thus preventing damage to the flow meter. The required filtering depends on the size, bearing, and design of the flow meter.

**Table 2: Upstream filters**

Flow meter size	Filter size for ball bearing
RS 40	100 µm
RS 100	250 µm
RS 400	250 µm
RS 800	500 µm
RS 2500	500 µm

*The filter size for flow meters with slide bearings, in special designs, or with specially adapted measuring element tolerances can be obtained from VSE GmbH upon request.*

### Important:

**A blocked flow meter is capable of stopping the entire flow.  
An overpressure / bypass valve must be installed in the system side.**



## 13. SENSOR ELECTRONICS FUNCTION

The liquid to be measured flows through the rotor chambers in axial direction, resulting in an even rotation of the screw spindles.

This is done especially gentle and with very low resistance for the fluid to be measured as well as pulsation-free and almost free of leaks due to the specially designed fluidic profile geometry.

A sensing wheel permanently affixed to the rotors is scanned without contact with a sensor module. The pick-up system detects every movement of the sensing gear and routes the sin/cos signals to the preamplifier electronics. The preamplifier electronics amplify the signals and digitise them in high resolution. The square wave signals phase-shifted by 90° are bidirectional and can be utilised by any evaluating device as well as computers and PLC controls.

The pulse-quantity is proportional to the edges/pulse-number and the flow rate is proportional to the pulse-frequency. The pulse resolution can be preset and explicitly adapted to the downstream evaluation electronics for obtaining highly precise measuring results of the entire system. This applies to the following application cases, for example:

- Measuring, controlling, and regulating high viscosity fluids
- Measuring, controlling, and regulating in lower flow ranges
- Measuring, controlling, and regulating when passing through zero
- Measuring, controlling, and regulating in both flow directions
- Measuring, controlling, metering, and filling of small volumes

The resolution is selectable in steps from factor 1 to 128. The frequency range is from 0 to 120 kHz.

The preamplifier is protected against reverse polarity and incorrect connection. It is designed for fluid temperatures of -30°C up to +120°C and is mounted directly on the RS flow meter.

The measuring volume is calculated by the liquid volume flowed through by one tooth pitch of the measuring wheel divided by the resolution factor or interpolation factor IPF. It is defined by the unit [cm<sup>3</sup>/imp]. The frequency of the output signals can be calculated as follows:

**Formula 1: Calculation of the output frequency with Q in l/min**

$$f = \frac{Q}{V_m} \times \frac{1000}{60}$$

The sensor electronics can generate a maximum pulse output frequency of 120 kHz. The maximum IPF can be determined using the above formula. Alternatively, the following tables can also be used for the determination.

Adjustable interpolation factors IPF:

1, 2, 3, 4, 5, 8, 10, 12, 16, 25, 32, 50, 64, 100, 128



Table 3: Measurement volumes and K-factors

RS 40			
Interpolation factor (IPF)	Measurement volume $V_m$ [cm <sup>3</sup> /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	0.31	3226	12212
2	0.155	6452	24424
3	0.1033	9678	36636
4	0.0775	12904	48848
5	0.062	16130	61060
8	0.0388	25808	97696
10	0.031	32260	122120
12	0.0258	38712	146544
16	0.0194	51616	195392
25	0.0124	80650	305300
32	0.0097	103232	390784
50	0.0062	161300	610600
64	0.0048	206464	781568
100	0.0031	322600	1221200
128	0.0024	412928	1563136

RS 100			
Interpolation factor (IPF)	Measurement volume $V_m$ [cm <sup>3</sup> /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	0.5649	1770	6700
2	0.2825	3540	13400
3	0.1883	5310	20100
4	0.1412	7080	26800
5	0.113	8850	33500
8	0.0706	14160	53600
10	0.0565	17700	67000
12	0.0471	21240	80400
16	0.0353	28320	107200
25	0.0226	44250	167500
32	0.0177	56640	214400
50	0.0113	88500	335000
64	0.0088	113280	428800
100	0.0056	177000	670000
128	0.0044	226560	857600

RS 400			
Interpolation factor (IPF)	Measurement volume $V_m$ [cm <sup>3</sup> /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	3.138	319	1206
2	1.569	638	2412
3	1.046	957	3618
4	0.7845	1276	4824
5	0.6276	1595	6030
8	0.3923	2552	9648
10	0.3138	3190	12060
12	0.2615	3828	14472
16	0.19613	5104	19296
25	0.12552	7975	30150
32	0.09806	10208	38592
50	0.06276	15950	60300
64	0.04903	20416	77184
100	0.03138	31900	120600
128	0.02452	40832	154368

RS 800			
Interpolation factor (IPF)	Measurement volume $V_m$ [cm <sup>3</sup> /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	10.000	100	379
2	5.0000	200	758
3	3.3333	300	1137
4	2.5000	400	1516
5	2.0000	500	1895
8	1.2500	800	3032
10	1.0000	1000	3790
12	0.8333	1200	4548
16	0.6250	1600	6064
25	0.4000	2500	9475
32	0.3125	3200	12128
50	0.2000	5000	18950
64	0.1563	6400	24256
100	0.1000	10000	37900
128	0.0781	12800	48512

## RS 2500

Interpolation factor (IPF)	Measurement volume $V_m$ [cm <sup>3</sup> /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	37.000	37	102
2	18.5000	54	204
3	12.3333	81	306
4	9.2500	108	408
5	7.4000	135	510
8	4.6250	216	816
10	3.7000	270	1020
12	3.0833	324	1224
16	2.3125	432	1632
25	1.4800	675	2550
32	1.1563	864	3264
50	0.7400	1350	5100
64	0.5781	1728	6528
100	0.3700	2700	10200
128	0.2891	3456	13056

## Formula 2: Calculating the max. IPF

$$IPF \approx \frac{f_{max} \times V_{mIPF1} \times 60}{Q_{max} \times 1000}$$

The set IPF may not be larger than the calculated IPF!

IPF	Interpolation factor
$f_{max}$	Max. processable input frequency
$V_{mIPF1}$	Measurement volume with IPF = 1 (volume of a gear structure of the sensing wheel)
$Q_{max}$	Max. operating flow in l/min

## Example

Flow meter: RS 400

Max processable input frequency of the downstream evaluating unit: 20 kHz

Max. operating flow: 140 l/min

Path 1: The diagram yields an IPF of 25

Path 2:

$$IPF \approx \frac{f_{max} \times V_{mIPF1} \times 60}{Q_{max} \times 1000} = \frac{20,000 \frac{1}{s} \times 3.138 \text{ ml}}{140} \times \frac{60 \text{ s}}{1000 \text{ ml}} = 26.9 \approx 25$$

### 14. SETTINGS OF THE PREAMPLIFIER

The settings are made with the DIP switches located in the lower right corner of the preamplifier housing (see Figure 2). With these the corresponding interpolation factor IPF (bit 1 to 3) can be selected, the direction inversion (bit 4) and the activation/deactivation of the pulse filter (bit 5). A description of the settings is shown in figure 3. The settings can be modified at any time during operation.

alternative IPF from Figure 3 must be set via the three DIP switches. Alternatively, the DIP switches can also be set to the corresponding positions and then you can switch between the "normal" IPF and the "alternative" IPF with a "double click" on the S2 button. An enabled or set alternative IPF, is indicated by the green LED flashing at 3-second intervals.

For activating the alternative IPFs, the DIP switches 1 to 3 must be set to „OFF“. Then, with the button S2 constantly pressed, the corresponding



Fig. 2: Preamplifier electronics

The standard description is also located in the lid of the preamplifier housing so that the settings can be changed directly on site.

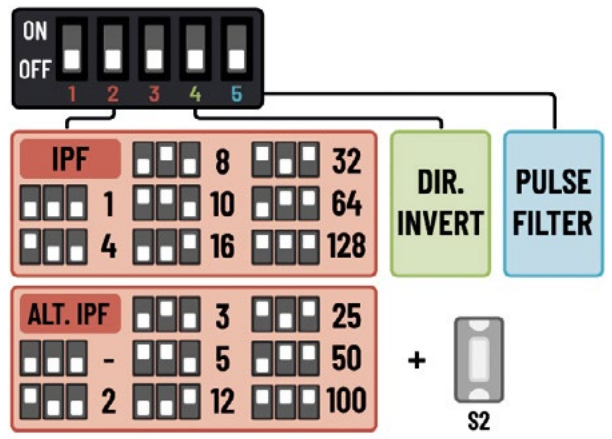


Fig. 3: Settings

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



## 15. PULSE FILTERING

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. Depending on the application, oscillations or vibrations can occur during the flow rest phases or discontinuous flows. The pulses generated during the oscillation phase 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 move-

ments of the rotor measuring unit. The signals at the channel outputs are also suppressed at the same time until the internal offset is equalized or the initial position of the rotor measuring unit has been reached again (see Fig. 4).

The user has the possibility of activating or deactivating the pulse filtering via the switch (Bit5). The filter memory comprises a rotational movement over 8 teeth of the sensing wheel. If this movement of 8 teeth is exceeded, the pulses are output in the corresponding direction, which is then automatically stored as the preferred direction.

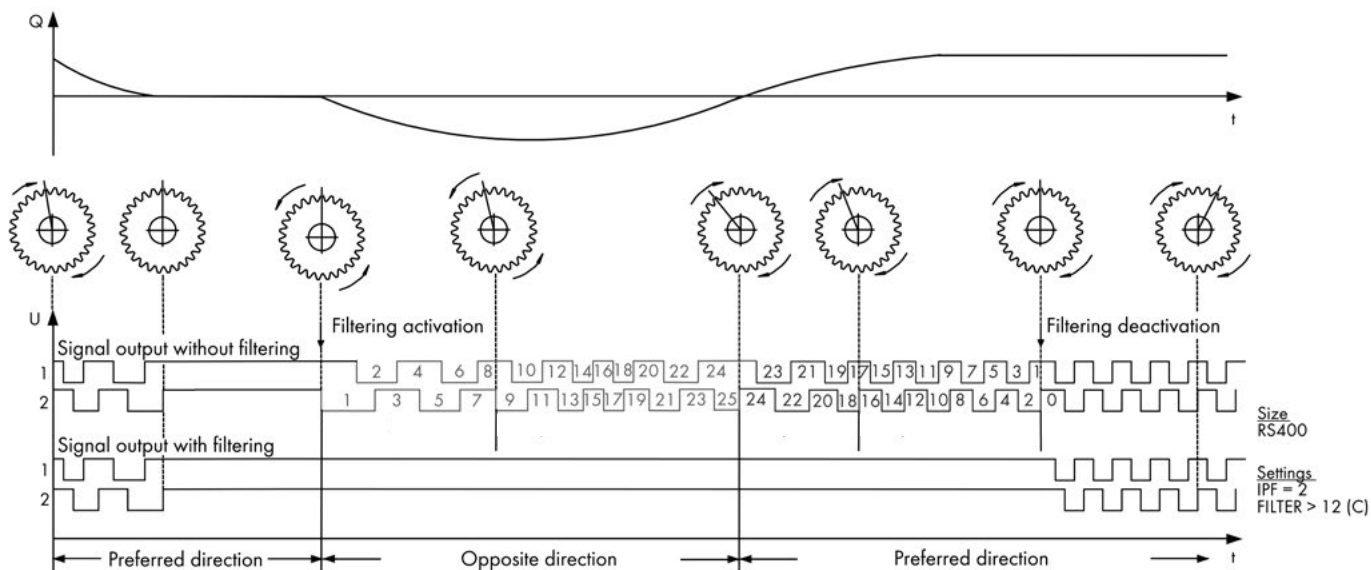


Fig. 4: Pulse filtering principle

Table 4: Suppressed volume with pulse filtering activation [ml]

Filter activation	RS 40X	RS 100X	RS 400X	RS 800X	RS 2500X
-	3.03	5.815	31.38	100	370

## 16. INDICATING LEDs

The LEDs provide information about the corresponding status of the outputs (high / low) and indicate operating and error conditions.

The two orange LEDs near to the wire connections indicate the states of the outputs, which can be used to check the activity flow / standstill. The green LED signals the general ON/OFF operating status and the red LED signals an error (see Figure 5).

Operating status				Operation ON / Output active
				Operation ON / alternative IPF active / Output active
				Signal error, Sensor error

Fig. 5: Indicating LEDs of the preamplifier board

## 17. PREAMPLIFIER TECHNICAL DATA

<b>Scanning sensor</b>	Magneto-resistive double measuring bridge
<b>Resolution</b>	programmable via DIP Switch 1, 2, 3, 4, 5, 8, 10, 12, 16, 25, 32, 50, 64, 100, 128
<b>Adjustable pulse filtering</b>	8 tooth units
<b>Frequency</b>	up to 120 kHz
<b>Output signals</b>	channel A, channel B
<b>Channel A and B</b>	two signal outputs for outputting the digital flow sensor signals, a channel offset of 90° between channel A and channel B; Low signal level: 0.7 ... 1 V High signal level: $U_b - 1$ V
<b>Flow direction</b>	Detection of flow direction from the channel offset of the signals from channel A to channel B
<b>Outputs</b>	2 current-limited and short-circuit-proof output stages (channel A, channel B); driver current approx. 300 mA at supply of 24 V
<b>Error messages</b>	Electronics fault, sensor errors, configuration necessary
<b>Operating voltage</b>	$V_b = 10 \dots 28$ VDC
<b>Current consumption</b>	$I_{\text{load}} = \text{approx. } 65 \text{ mA}$ , at 24 VDC unloaded

## 18. PLUG ASSIGNMENT OF PREAMPLIFIER

Fig. 6 shows the plug assignment of the preamplifier.

The pin assignment of the connector pins is compatible with all VS(I) preamplifier versions. The common 4- or 5-wired connection cables can still be used to connect the volume sensor.

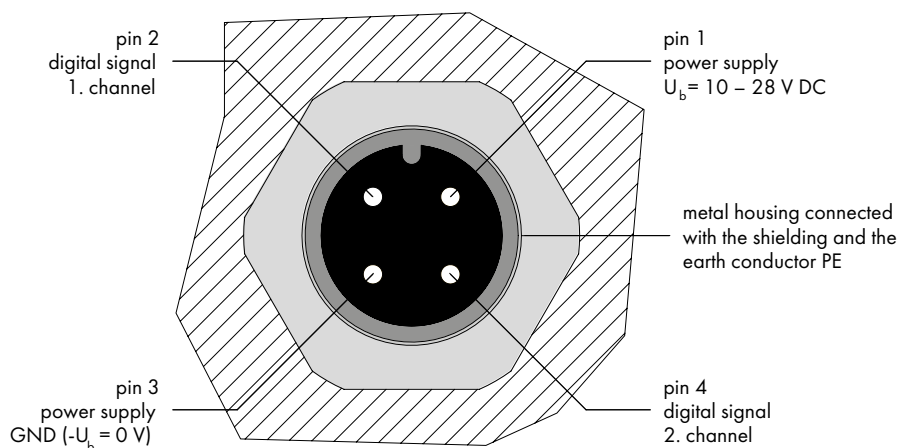
Please note that the shielding of the cable on the connector side is connected to the metal housing of the connector.

The cable shielding should always be laid continuously as far as the flow meter and not interrupted in cross connectors or branch sockets. Lay the connection cable as directly as possible from the eval-

uating device to the flow meter, since interruptions are always a potential source of error.

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

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



**Top view of plug**

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

**Important:**

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

**Important:**

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



## 19. MAINTENANCE, SERVICE LIFE AND WARRANTY

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

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

**Safety note:**

**Seals are not covered by the warranty, as they are parts that are subject to wear and tear. Over the course of time, the nature of plastics such as elastomer seals can change, in respect of flexibility, strength and toughness. Operating conditions have a decisive effect on the durability and lifespan of seals. Therefore, they should be checked, and if necessary, replaced, at regular intervals.**



## 20. STORAGE, RETURN AND DISPOSAL

**Temporary storage**

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

**Return**

1. The flow meter must be properly cleaned before being returned to prevent the risk of poisoning/contamination of humans and the environment from harmful, explosive, or otherwise hazardous media.
2. If media have been measured whose residues can cause corrosion or ignite on contact with oxygen, the flow meter must be additionally neutralised and thoroughly dried with anhydrous, inert gas.
3. The return of the flow meter must always include a fully completed declaration of non-objection (see page 22). All applied safety and decontamination measures must be specified.
4. When returning the flow meter, it must be packed according to applicable logistics standards and sealed with sealing plugs.

**Disposal**

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

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

Materials must be properly disposed of as follows:

- Metal
- Plastics
- Electronic components
- etc.

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

## 21. RS FLOW METER TECHNICAL DATA

Overall size	Measuring 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 $\mu\text{m}$
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)	56.5	3.138	318	40,800	450	250
RS 800	4.00 – 800 (1000)	180.0	10	100	12,800	450	500
RS 2500	10.00 – 2500 (3000)	666.0	37	27	3,459	40	500

<b>Frequency range</b>	0 ... 120 kHz, adjustable
<b>Measuring accuracy</b>	$\pm 0.5\%$ , $1\%^*$ of measured value at viscosity of 21 cSt
<b>Repeatability</b>	$\pm 0.05\%$ with same operating conditions

### Materials

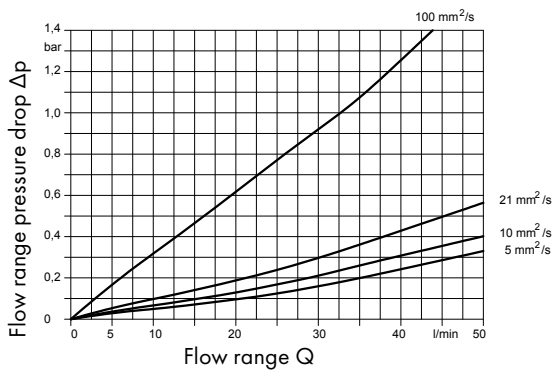
<b>Gray cast iron version</b>	EN-GJS – 400 – 15 (EN 1563) / 16 Mn Cr 5 or 1,4112
<b>Stainless steel version</b>	Stainless steel 1.4305/1.4112, additional available upon request
<b>Bearing</b>	Fluid-dependent as anti-friction bearing or SSIC/wolfram carbide friction bearing
<b>Seals</b>	FPM (standard) PTFE, NBR, EPDM upon request, EPDM-41B8
<b>Fluid temperature</b>	-30°C ... +120°C
<b>Viscosity range</b>	1 ... 1,000,000 mm <sup>2</sup> /s
<b>Installation position</b>	Any using selectable connection units, also customer specific
<b>Supply voltage</b>	10 ... 28 VDC
<b>Current consumption</b>	65 mA at 24 VDC unloaded
<b>Delay time</b>	$\leq 8 \mu\text{s}$
<b>Protection type</b>	IP 65

\*RS 2500, RS 800

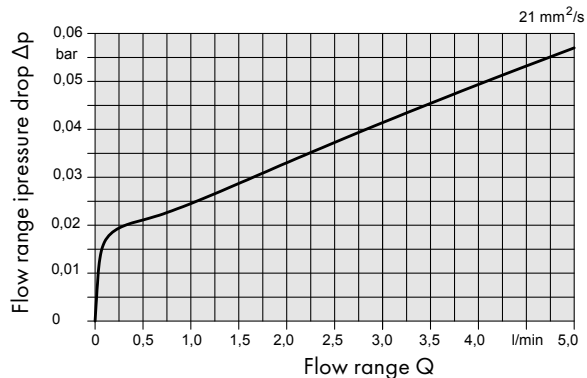
## 22. RS FLOW METER FLOW CHARACTERISTICS

### Size 40

Flow range 0 up to 50 l/min

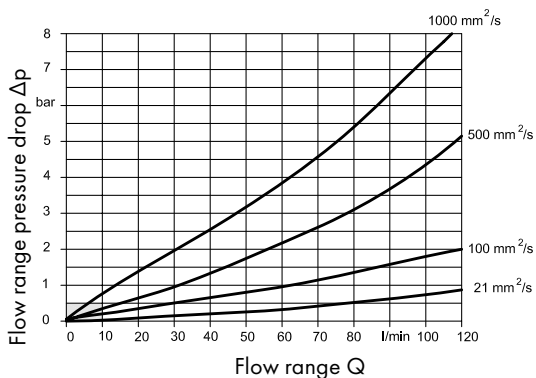


Flow range 0 up to 5 l/min

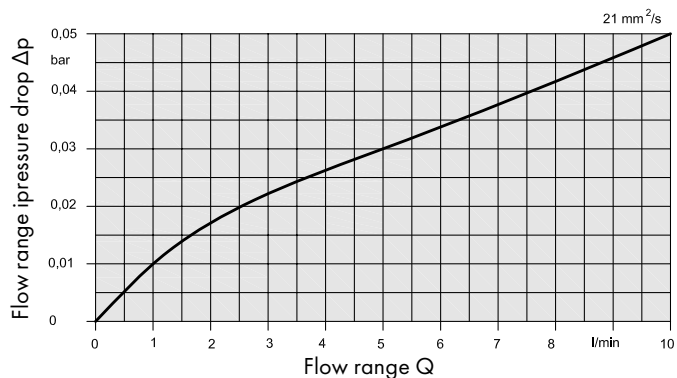


### Size 100

Flow range 0 up to 120 l/min

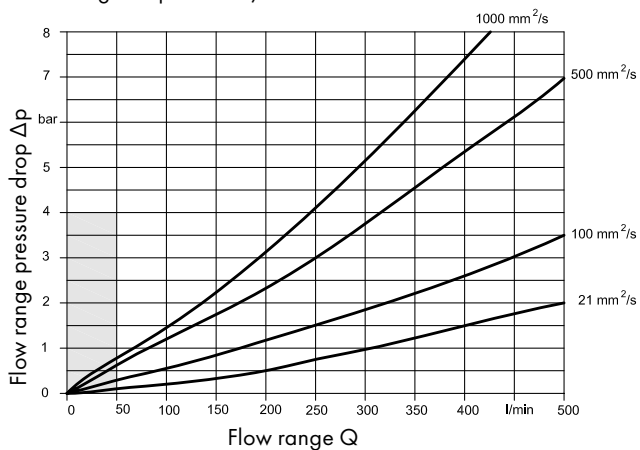


Flow range 0 up to 10 l/min

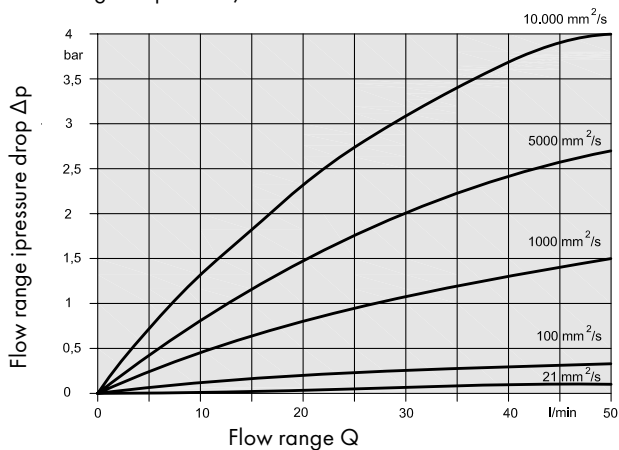


### Size 400

Flow range 0 up to 500 l/min



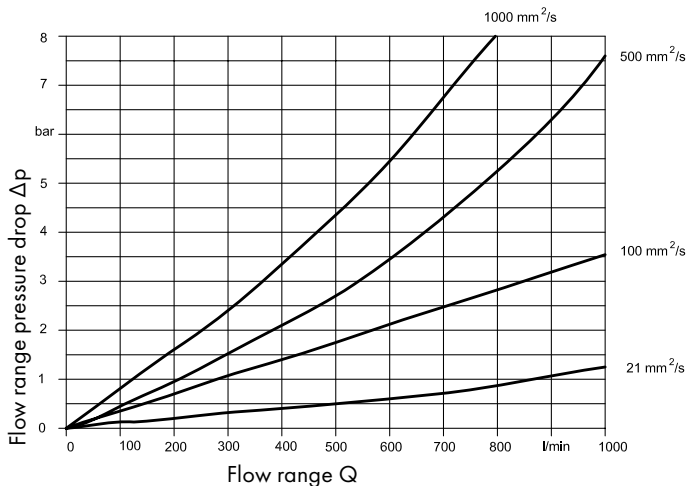
Flow range 0 up to 50 l/min





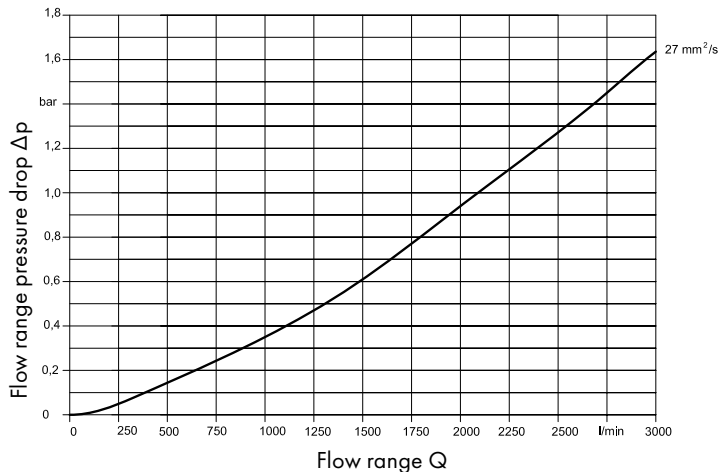
### Size 800

Flow range 0 up to 1,000 l/min



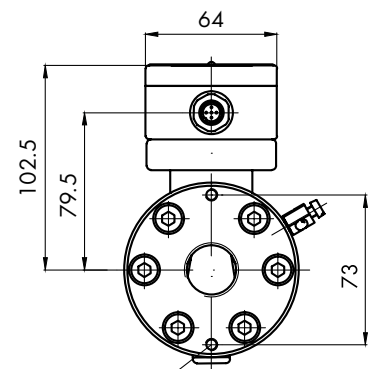
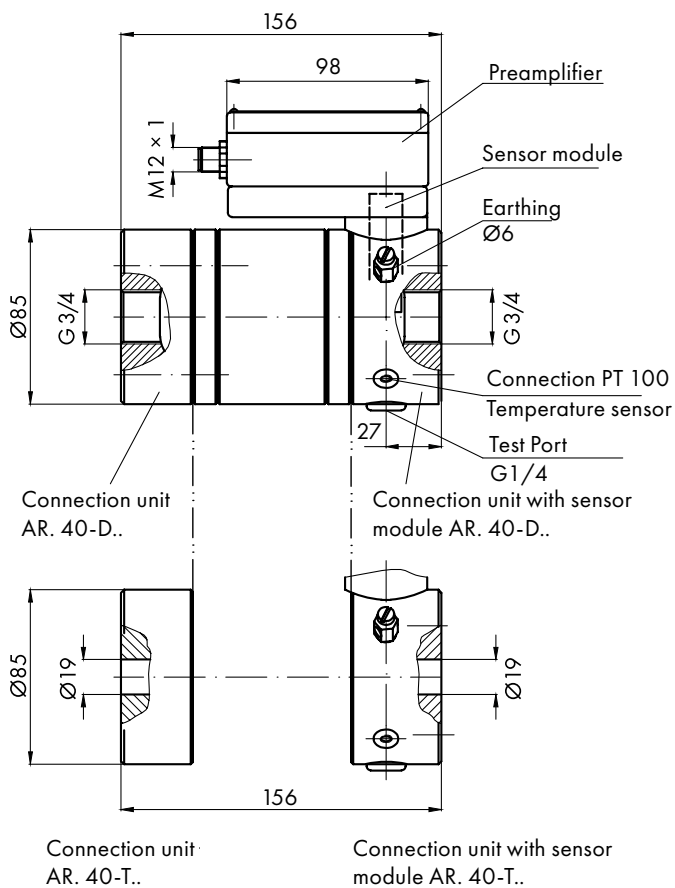
### Size 2500

Flow range 0 up to 3,000 l/min



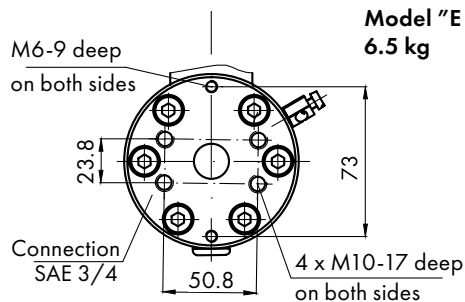
## 23. RS FLOW METER DIMENSIONS

### RS 40



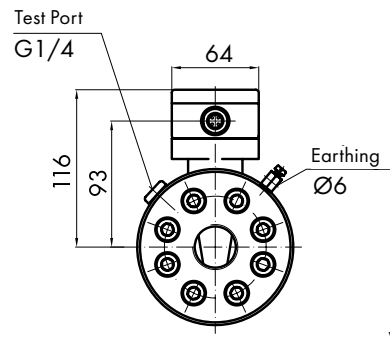
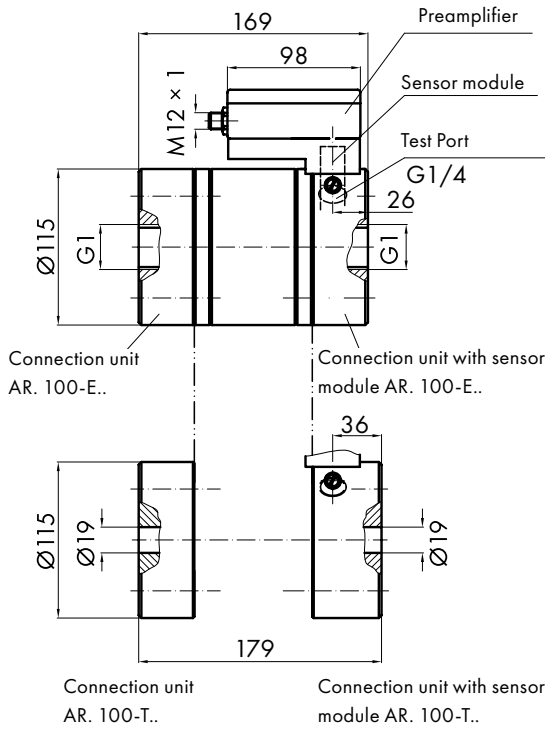
Weight

Model "G"  
6.0 kg

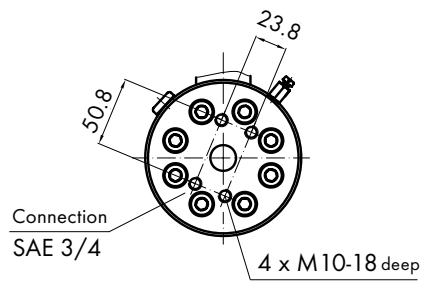


Model "E + X"  
6.5 kg

### RS 100

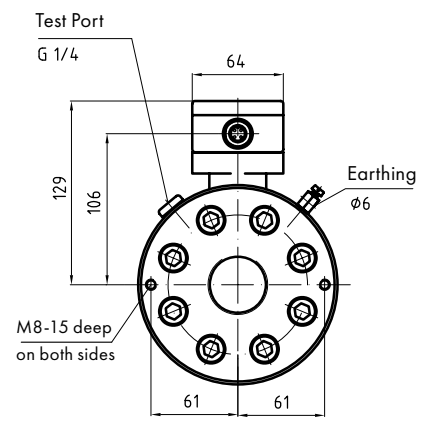
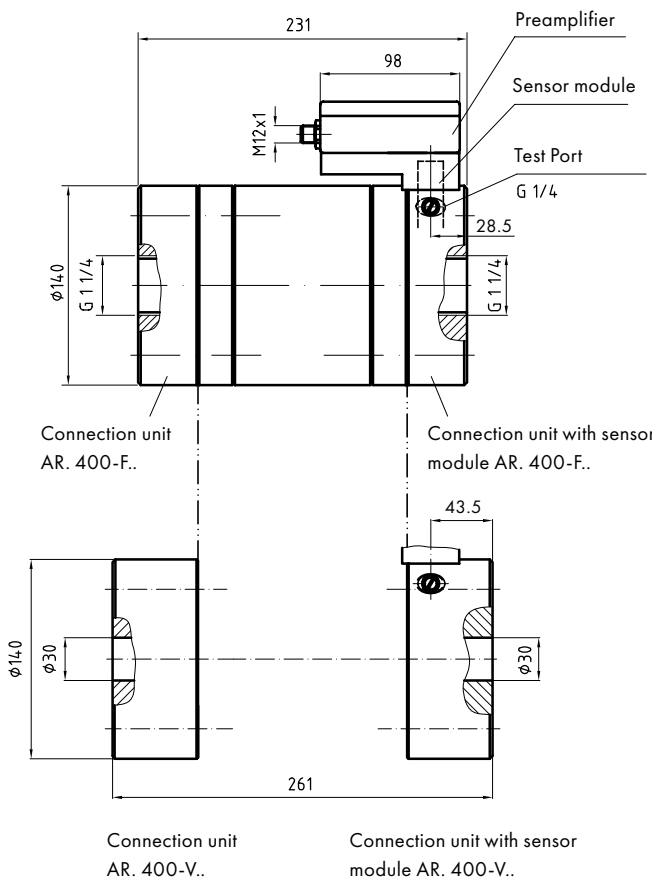


Weight 12 kg

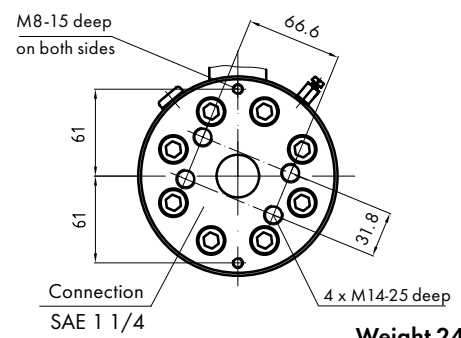


Weight 12.7 kg

### RS 400

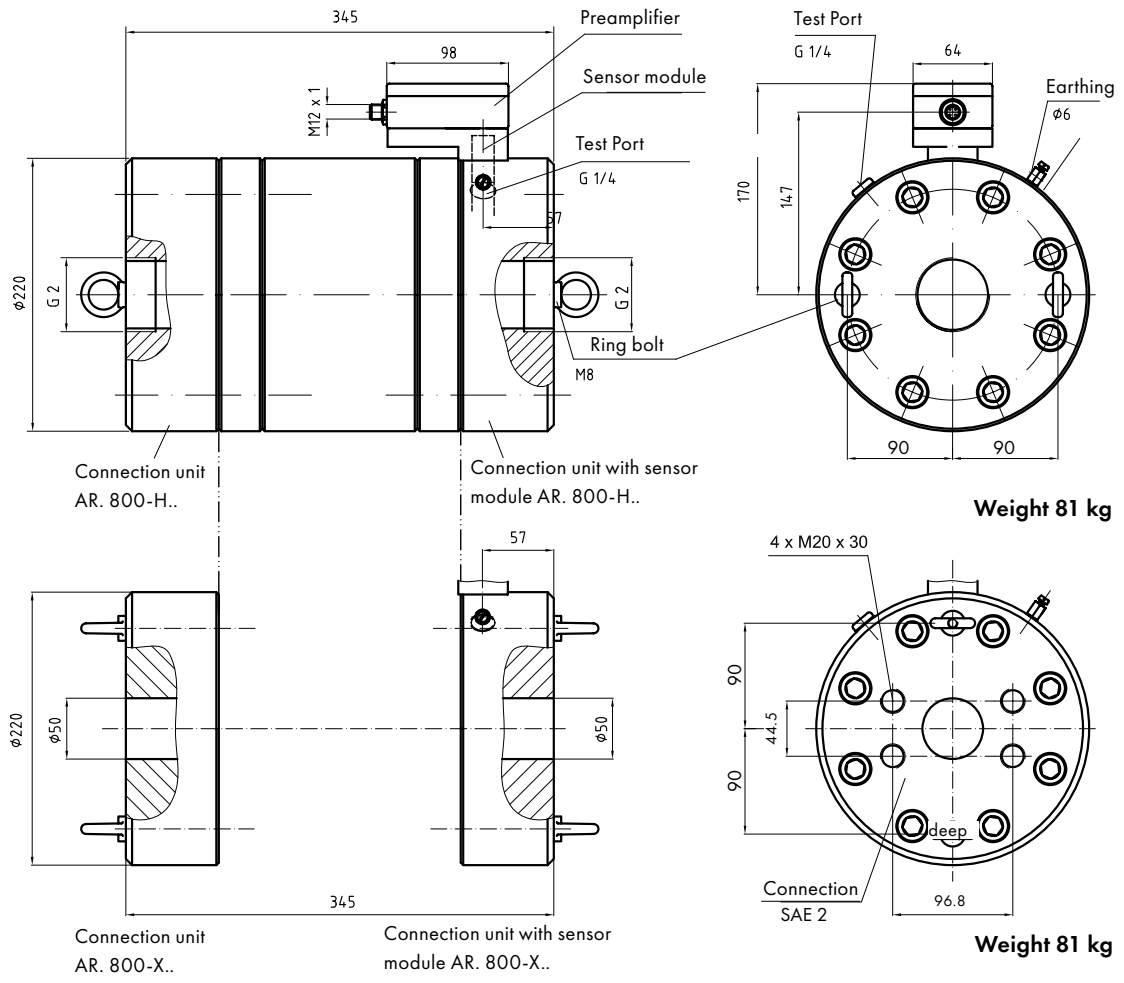


Weight 22 kg

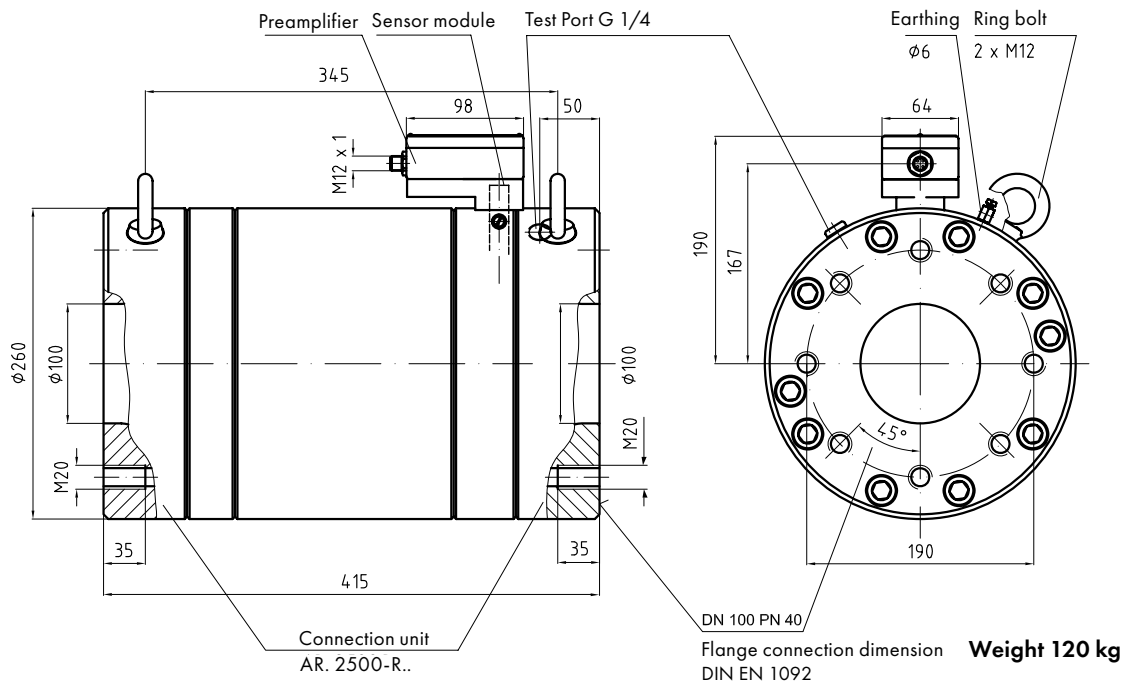


Weight 24.8 kg

### RS 800

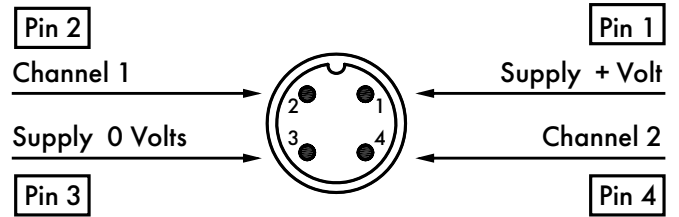
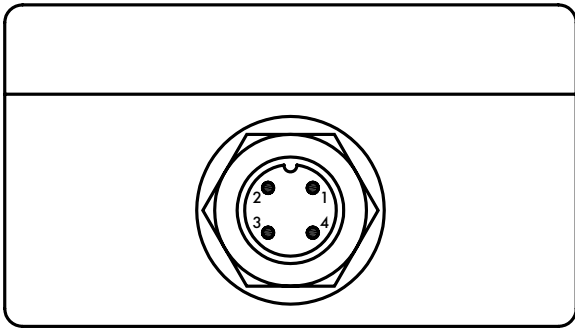


### RS 2500

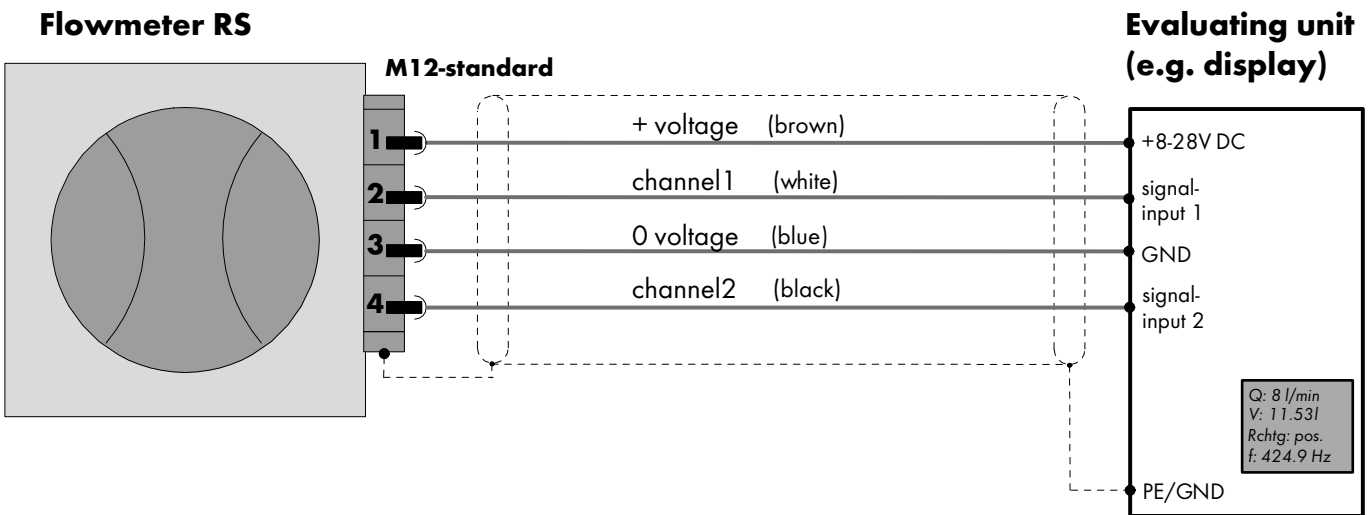




### 25. PLUG ASSIGNMENT



### 26. CONNECTION DIAGRAM



## 27. DECLARATION OF NON-OBJECTION

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

Last Revision: 03/2025

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

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

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

Approval was granted on  by (contact person)











Type

Serial number  Quantity

Reason for return

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

Application-related contamination and effects:

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

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

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

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

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

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

If yes, which:

4.  Are there any other safety aspects to consider?

If yes, which:

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

**Company**

**Street/No.**

**Postal code/City**

**Phone**

**Email**

**Contact person**

(In capitals)

**Date**

**Signature**

(Company stamp)

**Enclosures**



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