

Operating instructions

for flow meters of the product line "RS High Temperature Version"



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1. IMPORTANT INFORMATION AND LEGAL NOTICES

Dear customer, dear user,

This operating instruction for flow meters of the **“RS High Temperature Version”** 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. 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-HT 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 magnetic pole wheel and a non-contact signal pick-up system detect the rotation of the measuring element and convert 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.

Explanation of the sensor system RS high-temperature version (HT)

The non-contact pick-up system consists of two AMR bridges (sin/cos), which are located in a sensor unit in a cartridge housing that is specially designed for high temperatures. It detects the movement of the magnetic pole wheel and routes the sin/cos signals to the separated 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 a 1-channel evaluation, a separate directional signal is available.

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
- Resistant to high and low temperatures
- Gentle fluid measurements

A selectable pulse filter can offset and suppresses 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 120 kHz. The pick-up system is suitable for media temperatures of -40°C / -40°F to +200°C / 392°F (short-term peak of 220°C / 428°F).

The preamplifier is connected to the flow meter by a cable with a special plug connector. It is necessary to keep the preamplifier separated from high temperature and / or low temperature applications. The preamplifier electronics are protected against reverse polarity and incorrect connection.

3. GENERAL DESCRIPTION

Please follow all instructions in this instructions to ensure the trouble-free operation of the RS flow meters in high-temperature version. VSE does not assume responsibility or liability for damages resulting from

noncompliance with these instructions. The device may only be opened within the warranty period after consultation and approval by VSE.

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. Certain properties of the devices are 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.

5. DECLARATION OF CONFORMITY

Flow meters of the series "RS high-temperature version" 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.

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 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**?

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 Δp** (at flow meter) below the max. permissible pressure drop?
- Is the **pressure drop Δp** 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 meter and is this equipped with the **appropriate preamplifier**?
- Is the flow meter used in a high- or low-temperature application? Is the preamplifier **spatially separated** from the heated or cooled flow meter?
- Is the **fluidity** of the media **sufficient**? Is it necessary to **heat** the flow meter with a ring heater?
- Is the **separated preamplifier** connected correctly to the pick-up system of the flow meter?
- 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 **connection 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 the flow meter connected firmly to the **earth conductor PE** or is the cable protective shield connected to ground GND?
- Are the connection cable and the connecting cable of the separated preamplifier laid interference-free and is the installation secured from input of **interference pulses**?
- Is the **round plug** of the connection cable firmly screwed together with the plug of the flow meter?
- Are the wires on the **evaluation device** correctly and properly connected?
- Is there a **potential difference** between the earth conductor PE on the flow meter and the earth conductor PE on the evaluation device?
- Does a correcting lead have to be laid to eliminate the **potential difference** between the flow meter and the evaluation device?
- Does the entire system correspond to the directives of the electromagnetic compatibility laws (**EMC**)?
- Have all local valid regulations, **applicable directives**, guidelines and background conditions of the **electromagnetic compatibility laws** been maintained and observed?
- Systems that can lead to personal injury through malfunction or failure are to be equipped with the **appropriate safety devices**. The functioning of these safety devices is to be checked at regular intervals!

7. MAXIMUM OPERATING PRESSURE

Before installing the flow meter, you must check whether the max. operating pressure of the system does not exceed the max. permissible operating pressure of the flow meter. The operating limits regarding pressure and temperature are explicitly specified in chapter 23 „Pressure / Temperature Limits“ and must be observed. Please observe that peak pressures may occur when operating the system.

In addition it is very important to choose the correct sealing material for your particular application.

Please consult VSE for the correct seals.

Important:

It is very important to use the correct sealing material for your particular application. This must be observed especially for application temperatures outside the range of -20°C / -4°F ... 120°C / 248°F. Please always consult VSE for the correct seals.



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.

graph (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 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, para-

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 mm²/s at a temperature of 20°C. For this measuring range, VSE specifies accuracy up to 0.3% of the measured value and a repeatability of 0.05%.

In fluids with low viscosity (< 21 mm²/s), the measurement accuracy degrades while it may improve with fluid with a high viscosity (> 21 mm²/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.

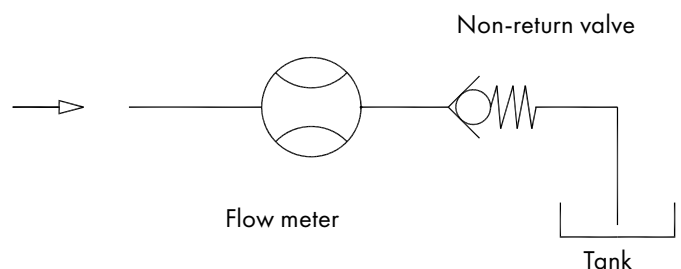


Fig. 1: Flow meter with backpressure

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 separated preamplifier away from any potential heating or cooling 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 screws 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 meter 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.

Important:

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



12. FLUID FILTERING

Heavily contaminated fluids or foreign matter in the fluid can block, da-mage, 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: Pre-switched Filter

Flow meter size	Filter size for ball bearings
RS 25	in preparation
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. FUNCTION OF THE RS-HT-SENSOR ELECTRONICS

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 magnetic pole wheel permanently fixed to the rotors is scanned without contact by a sensor module.

The non-contact pick-up system is specially designed for the high-temperature range. It consists of two AMR bridges (sin/cos), which are located in a sensor unit in cartridge design. It detects every movement of the sensing gear and routes the sin/cos signals to the separated pre-amplifier 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 phase-shifted by 90° are bidirectional and can be utilised by any evaluating device as well as computers and PLC controls.

The flow is proportional to the edges/pulse count and the flow rate is proportional to the frequency. The adjustable interpolator can be used to adjust the resolution explicitly to the downstream connected evaluating unit 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.

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

The preamplifier unit is connected to the high-temperature resistance pick-up system of the flow meter by a teflon cable with a push-pull-connector. This conception enables the operation in a wide temperature range of -40°C / -40°F to +200°C / 392°F (short-term peak of 220°C / 428°F). The standard cable with a length of 3.0m allows to place the preamplifier away from the heating or cooling source. For example the measurement system can be used in climatic chambers or near combustion chambers.

The separated preamplifier is protected against reverse polarity and incorrect connection.

The fluid volume passed through by one gear division of the sensing wheel within the measuring element is divided by the set interpolation factor. This forms the measurement volume per pulse (V_m) with the defined unit [cm³/pulse]. The frequency of the output signals can be calculated as follows:

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

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

Table 3, Formula 2, and the subsequent diagrams can be used to determine the corresponding resolution or the corresponding IPF for the respective application.

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 – HT			
Interpolation factor (IPF)	Measurement volume V_m [cm ³ /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	0,3219	3107	11761
2	0,161	6213	23519
3	0,1073	9320	35280
4	0,0805	12426	47038
5	0,0644	15533	58799
8	0,0402	24852	94075
10	0,0322	31066	117598
12	0,0268	37279	141116
16	0,0201	49705	188154
25	0,0129	77664	293990
32	0,0101	99410	376308
50	0,0064	155328	587981
64	0,005	198820	752616
100	0,0032	310655	1175957
128	0,0025	397639	1505228

RS 100 – HT			
Interpolation factor (IPF)	Measurement volume V_m [cm ³ /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	0,5866	1705	6454
2	0,2933	3409	12904
3	0,1955	5114	19359
4	0,5866	6819	25813
5	0,1173	8524	32267
8	0,0733	13638	51625
10	0,0587	17047	64530
12	0,0489	20457	77438
16	0,0367	27276	103251
25	0,0235	42618	161327
32	0,0183	54552	206502
50	0,0117	85237	322657
64	0,0092	109103	413000
100	0,0059	170474	645314
128	0,0046	218207	826004

RS 400 – HT			
Interpolation factor (IPF)	Measurement volume V_m [cm ³ /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	3,2587	307	1162
2	1,6294	614	2324
3	1,0862	921	3486
4	0,8147	1227	4645
5	0,6517	1534	5807
8	0,4073	2455	9293
10	0,3259	3069	11617
12	0,2716	3682	13938
16	0,2037	4910	18586
25	0,1303	7672	29042
32	0,1018	9820	37173
50	0,0652	15344	58083
64	0,0509	19640	74346
100	0,0326	30687	116163
128	0,0255	39279	148687

RS 800 – HT			
Interpolation factor (IPF)	Measurement volume V_m [cm ³ /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	10,3846	96	363
2	5,1923	193	731
3	3,4615	289	1094
4	2,5962	385	1457
5	2,0769	481	1821
8	1,2981	770	2915
10	1,0385	963	3645
12	0,8654	1156	4376
16	0,649	1541	5833
25	0,4154	2407	9111
32	0,3245	3081	11663
50	0,2077	4815	18227
64	0,1623	6163	23329
100	0,1038	9630	36454
128	0,0811	12326	46659

RS 2500 – HT

Interpolation factor (IPF)	Measurement volume V_m [cm ³ /Imp]	K-Factor [Imp/l]	K-Factor [Imp/gal.]
1	38,4231	26	98
2	19,2116	52	197
3	12,8077	78	295
4	9,6058	104	394
5	7,6846	130	492
8	4,8029	208	787
10	3,8423	260	984
12	3,2019	312	1181
16	2,4014	416	1575
25	1,5369	651	2464
32	1,2007	833	3153
50	0,7685	1301	4925
64	0,6004	1666	6306
100	0,3842	2603	9853
128	0,3002	3331	12609

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 - HT

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:
$$IPF \approx \frac{f_{\max} \times V_{mIPF1} \times 60}{Q_{\max} \times 1000} = \frac{20.000 \frac{1}{s} \times 3,259}{140} \times \frac{60 s}{1000 ml} = 27,9 \approx 25$$

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.

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

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.

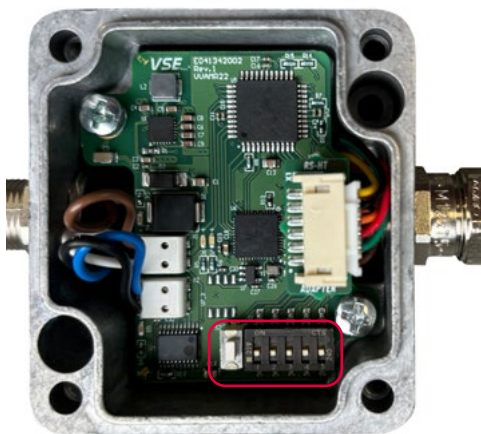


Fig. 2: Preamplifier electronics

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

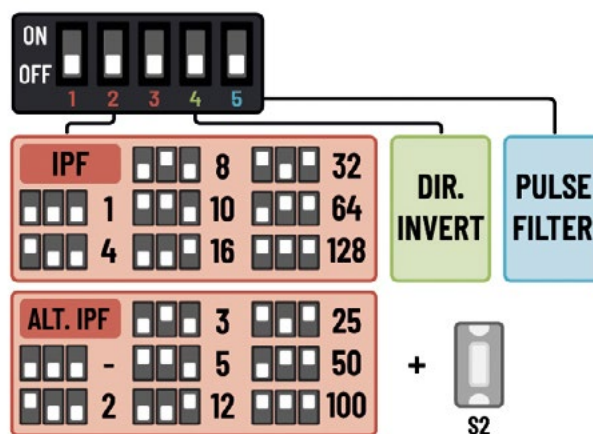


Fig. 3: Settings

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.

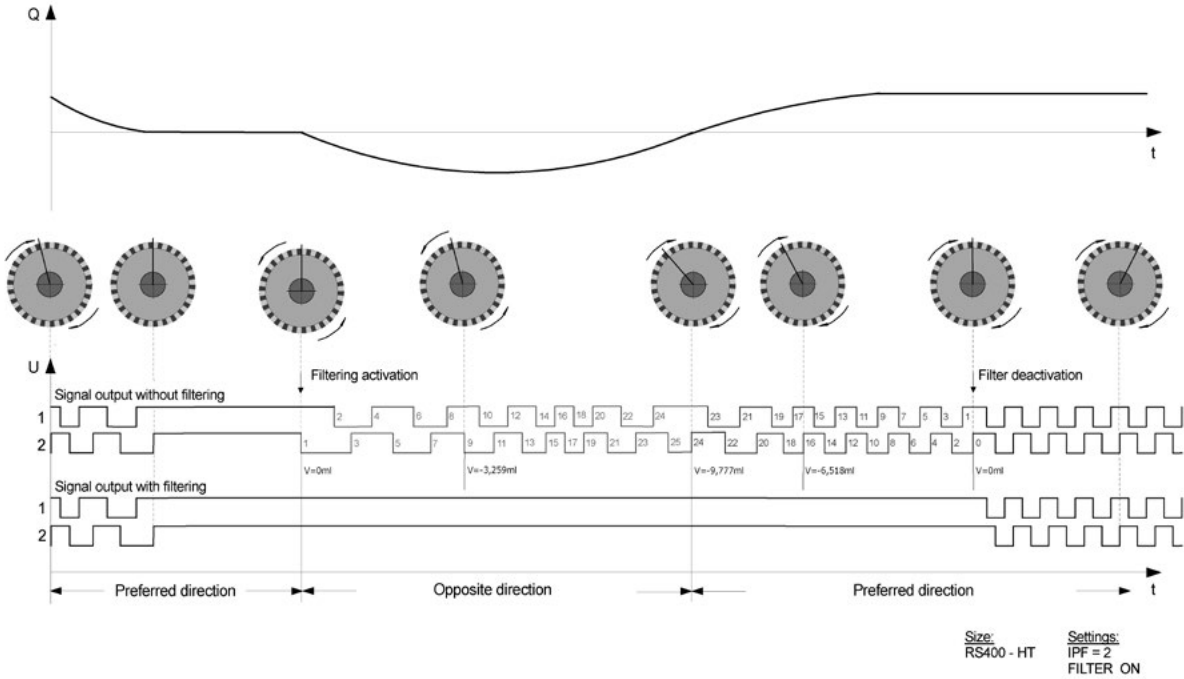


Fig. 4: Pulse filtering principle

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

Filter activation	RS 40X	RS 100X	RS 400X	RS 800X	RS 2500X
-	3.22	5.87	32.26	103.8	384.2

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

Scanning sensor	2 x AMR-sensor in a bridge circuit (sine and cosine signals) / pole wheel (26 pole pairs)
Resolution	programmable via DIP Switch 1, 2, 3, 4, 5, 8, 10, 12, 16, 25, 32, 50, 64, 100, 128
Configuration	automatically via peripheral board
Adjustable pulse filtering	8 tooth units
Frequency	up to 120 kHz
Output signals	channel A, channel B
Channel A and 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: $V_b - 1$ V
Flow direction	Detection of flow direction from the channel offset of the signals from channel A to channel B
Outputs	2 current-limited and short-circuit-proof output stages (channel A, channel B); driver current approx. 300 mA at supply of 24 V
Error messages	Electronics fault, sensor errors, configuration necessary
Operating voltage	$V_b = 10 \dots 28$ VDC
Current consumption	$I_{\text{no load}} = \text{approx. } 65 \text{ mA}$, 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 RS-HT preamplifier versions. The common 4 or 5-wired connection cables can still be used to connect the volume sensor.

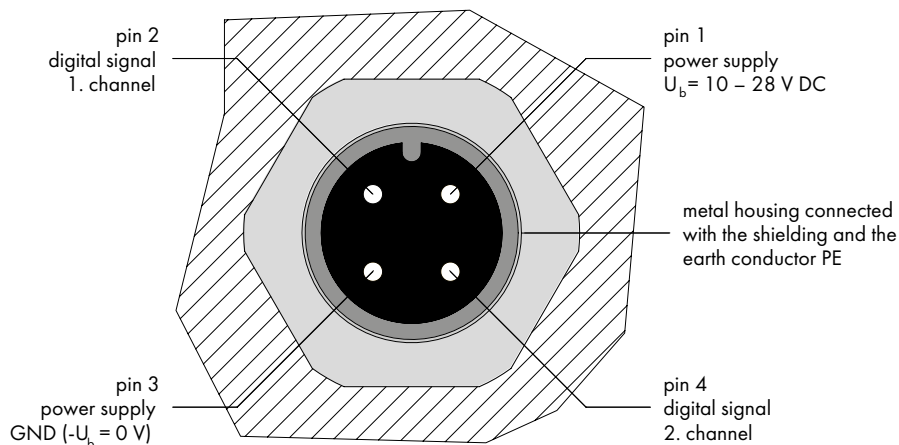
Please note that the shielding of the cable on the connector side is connected to the metal housing of the connector.

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 eva-

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

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

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



Top view of plug

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

Important:

Only use well-shielded cables for the connection cable, with a wire cross section of ≥ 4 or $5 \times 0.25 \text{ mm}^2$. 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 additional inductors such as contactors, relays, valves, etc. are connected to the power supply of the flow meter. These components are potential sources of interference which produce high interference pulses during the switching, and may disrupt the function of the flow meter even though it complies with the EMC directives (especially if the inductors are not provided with adequate protective circuits).



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°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 23). 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-HT FLOW METER TECHNICAL DATA

Overall size	Measuring range l/min	RV cm ³ /Imp.	VE cm ³ /Imp.	K-Factor Imp./l (min)	K-Factor Imp./l (max)	p max. cm ³ /pulse	Filtriering µm
RS 40 – HT	0.04 – 40 (50)	8.37	0.322	3,107	397,600	see chap. 23	100
RS 100 – HT	0.50 – 100 (120)	15.7	0.587	1,705	218,200	see chap. 23	250
RS 400 – HT	1.00 – 400 (525)	56.5	3.26	307	39,200	see chap. 23	250
RS 800 – HT	4.00 – 800 (1,000)	180.0	10.39	96	12,300	see chap. 23	500
RS 2500 – HT	10.00 – 2,500 (3,000)	666.0	38.42	26	3,330	40 bar	500

Frequency range 0 ... 120 kHz, adjustable

Measuring accuracy ± 0.5 % (1%)* of measured value at viscosity of 21 cSt / 21 mm²/s

Repeatability ± 0.05 % with same operating conditions

Materials:

– **Gray cast iron version** EN-GJS-400-15 (EN 1563)/16 Mn Cr 5 or 1.4112

– **Stainless steel version** Stainless steel 1.4305/1.4112, additional available upon request

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

Seals FPM (standard) upon request PTFE, NBR, EPDM, EPDM-41B8, silicone, FVMQ

Fluid temperature - 40°C / - 40°F ... + 200°C / 392°F (short-time +220°C / 428°F)

Ambient temperature separated preamplifier - 20°C / -20°F ... + 85°C / 185°F

Viscosity range 1 ... 1,000,000 mm²/s

Installation position Any using selectable connection units, also customer specific

Supply voltage 10 ... 28 VDC

Current consumption 65 mA at 24VDC unloaded

Delay time ≤ 8µs

Cable length to pick-up system 3m (standard)

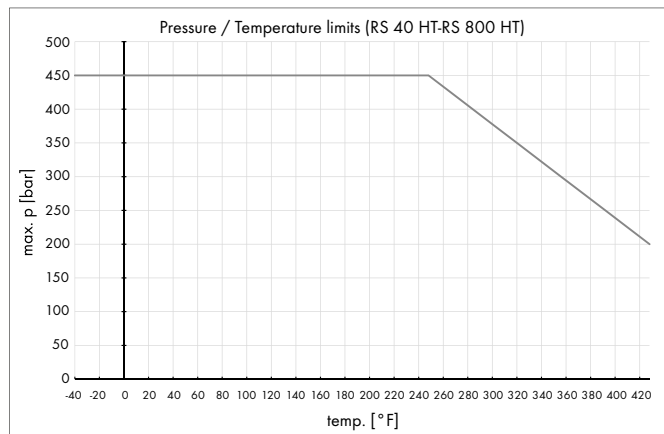
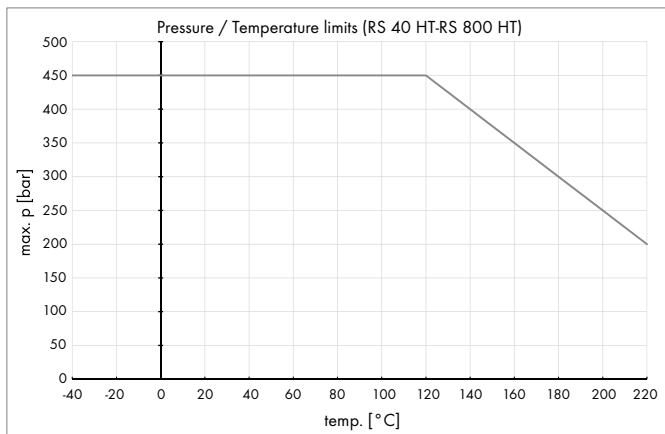
Protection type IP 65

* RS2500

22. PRESSURE/TEMPERATURE LIMITS AND MAX. RATES OF TEMPERATURE CHANGE

Important:

The following diagram explicitly shows the operating limits regarding pressure and temperature, which must be observed. Please note that the maximum operating pressure of the RS2500 is generally specified as 40 bars and must not be exceeded. The sealing material must be correctly chosen for the particular application. This must be observed especially for application temperatures outside the range of -20°C / -4°F ... 120°C / 248°F. Please always consult VSE for the correct seals.

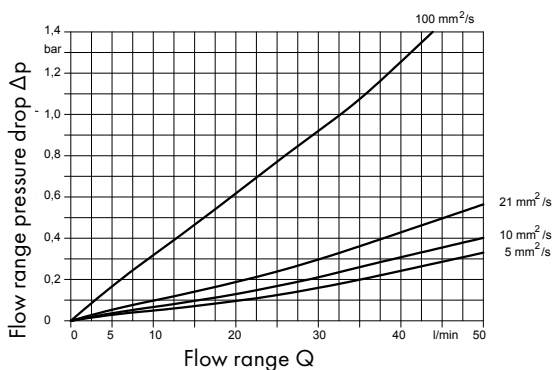


A maximum rate of temperature change must not exceed 6 K/min.

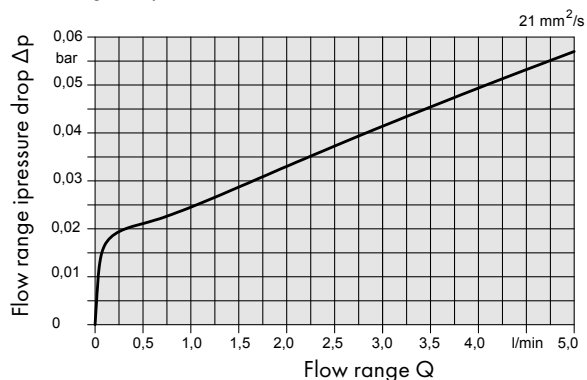
23. RS-HT FLOW METER FLOW CHARACTERISTICS

Size 40

Flow range 0 up to 50 l/min

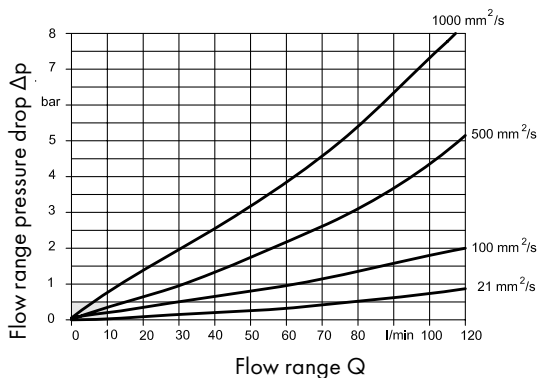


Flow range 0 up to 5 l/min

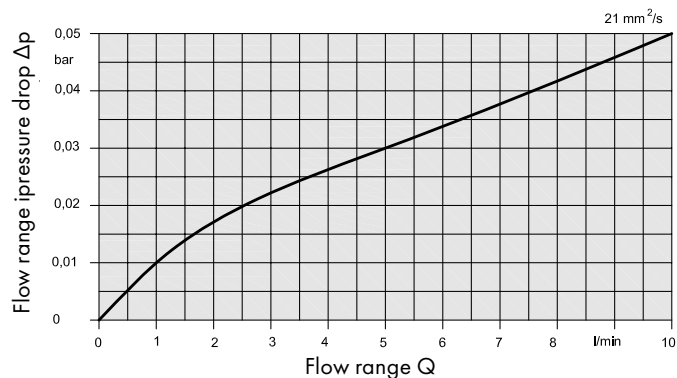


Size 100

Flow range 0 up to 120 l/min

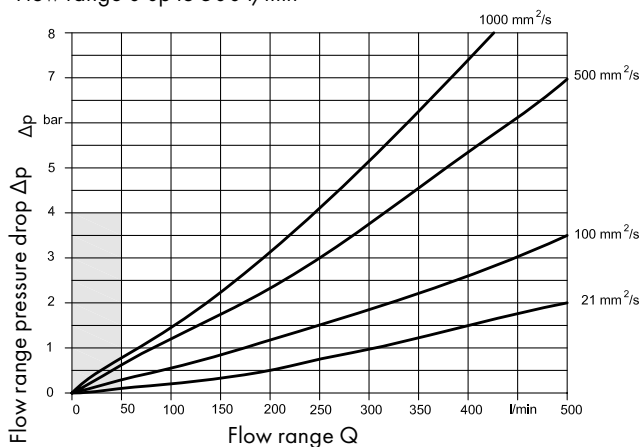


Flow range 0 up to 10 l/min

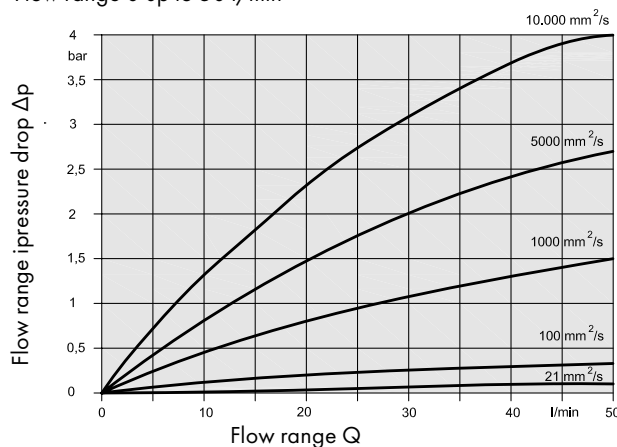


Size 400

Flow range 0 up to 500 l/min

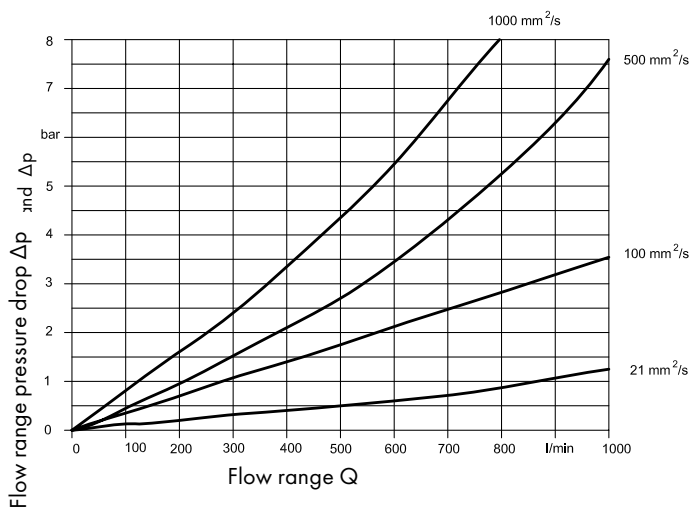


Flow range 0 up to 50 l/min



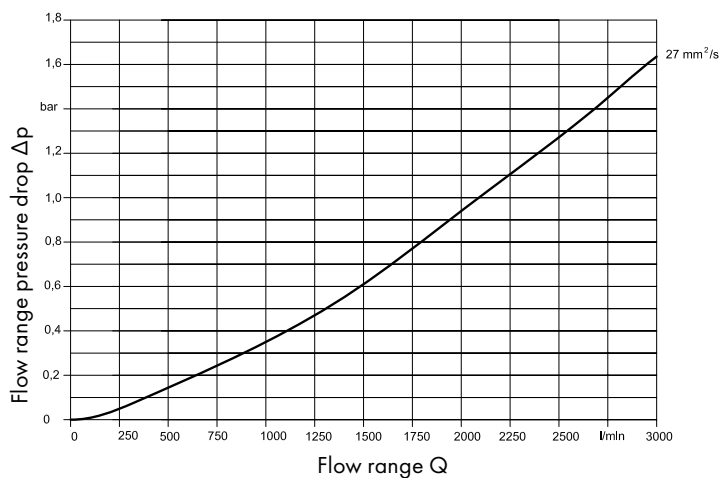
Size 800

Flow range 0 up to 1,000 l/min



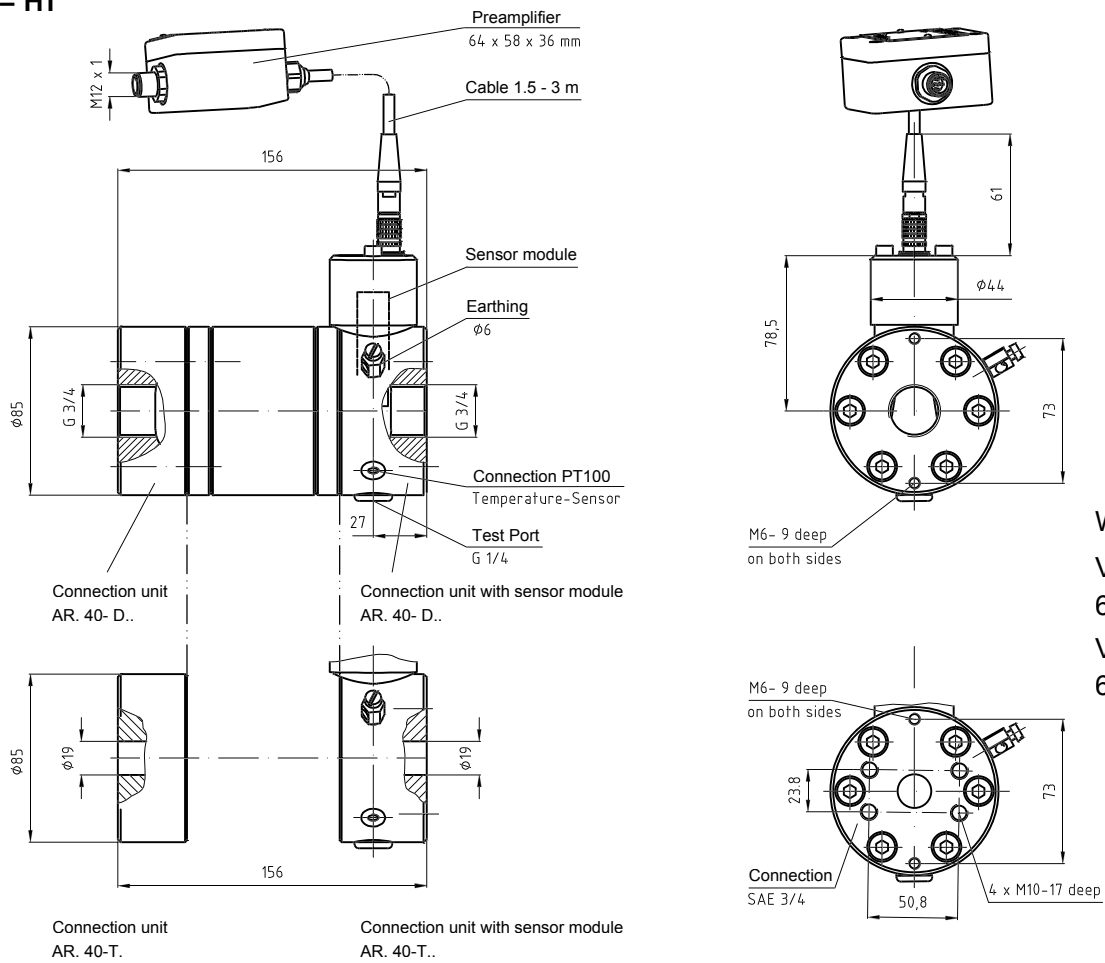
Size 2500

Flow range 0 up to 3,000 l/min



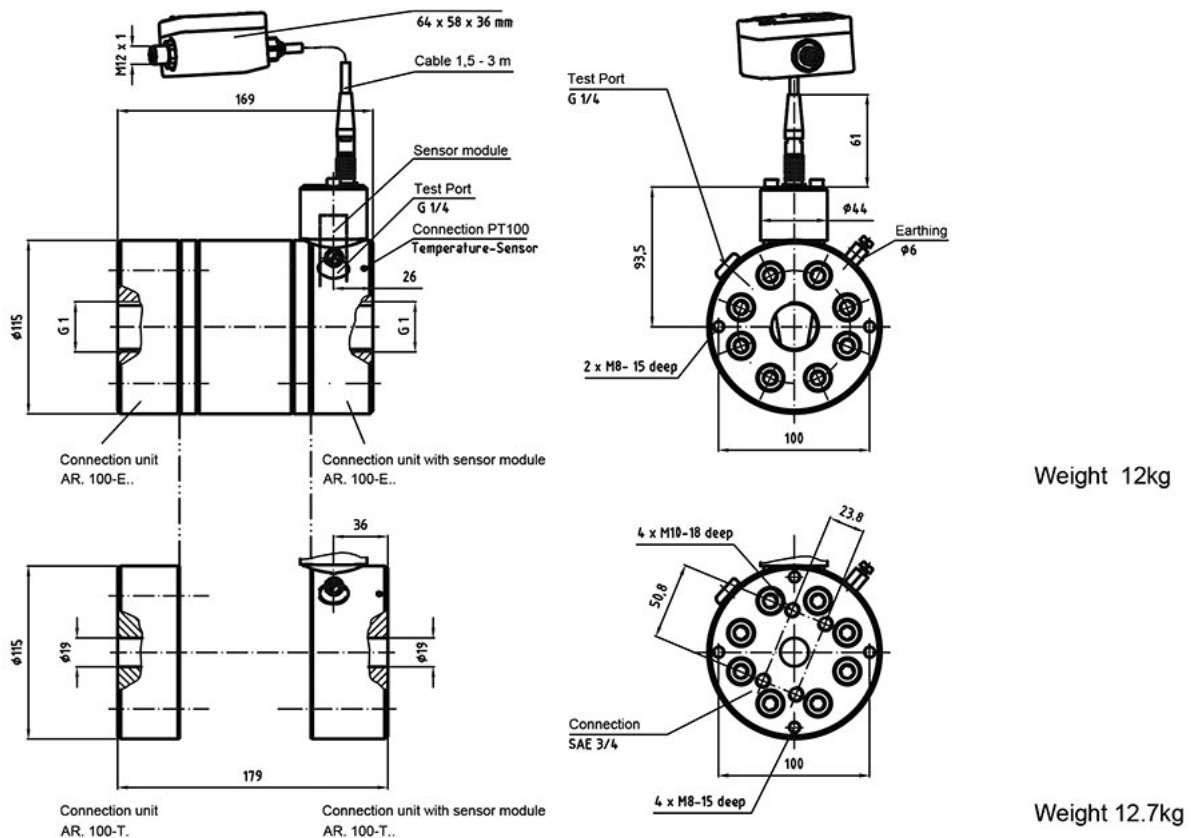
24. RS-HT FLOW METER DIMENSIONS

RS 40 – HT



Weight:
 Version "G" 6.0kg
 Version "E + X" 6.5kg

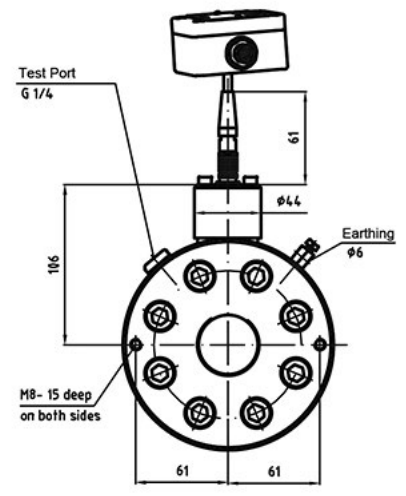
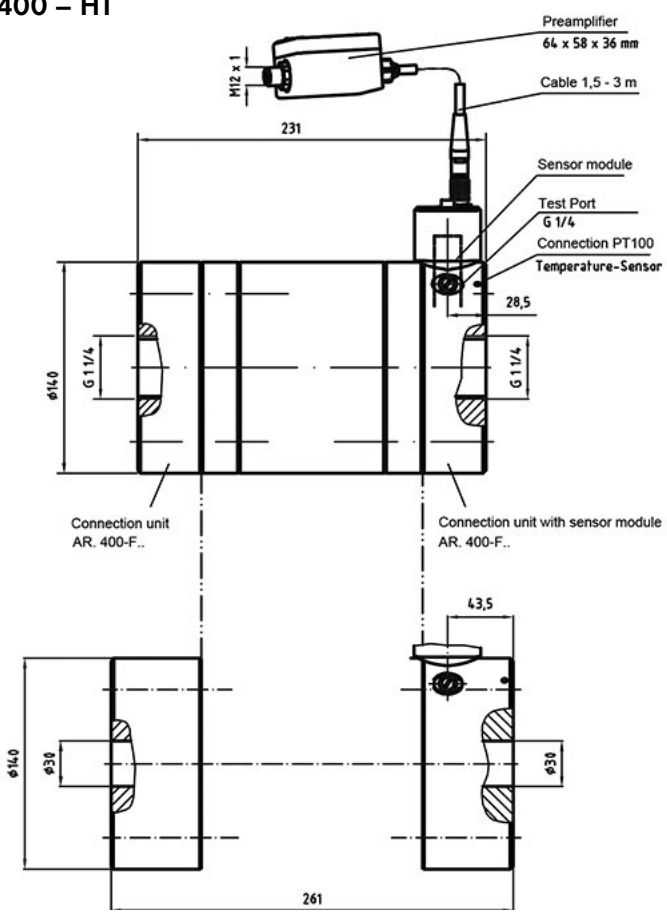
RS 100 – HT



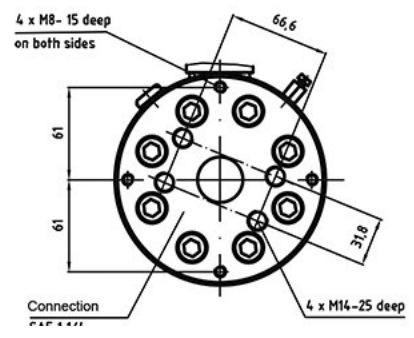
Weight 12kg

Weight 12.7kg

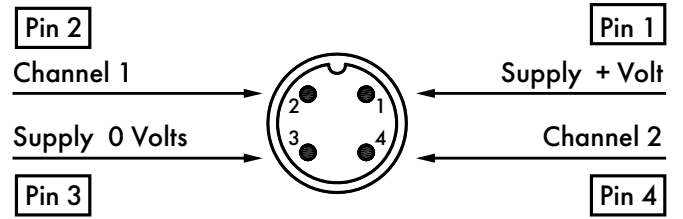
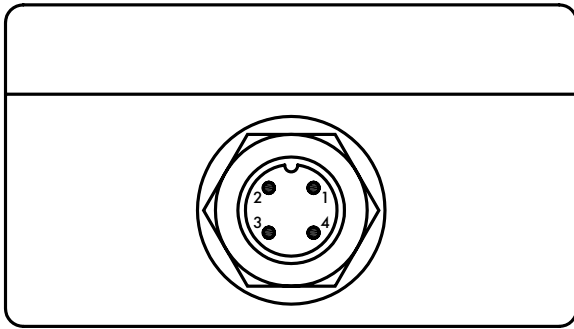
RS 400 – HT



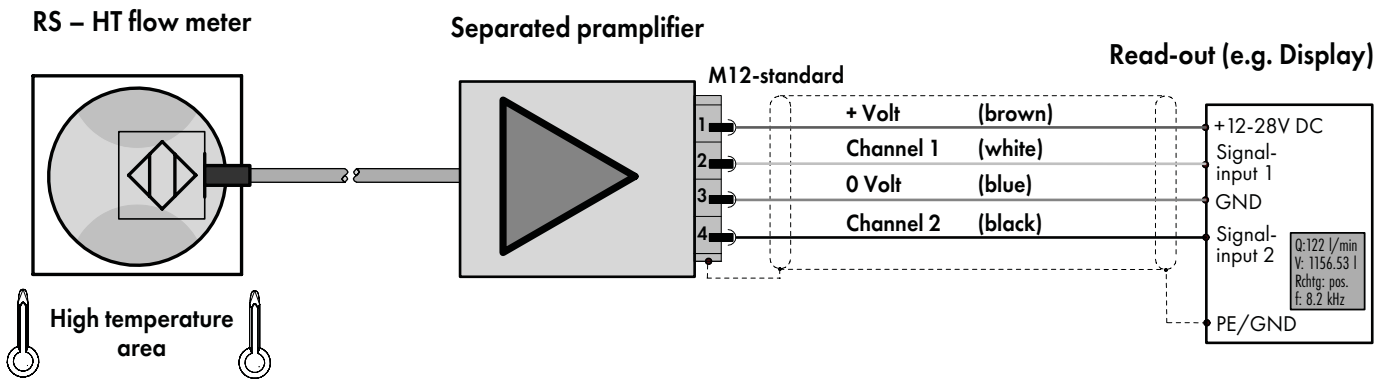
Weight 22kg



26. PLUG ASSIGNMENT



27. CONNECTION DIAGRAM



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

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

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

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

Declaration of non-objection

(Decontamination declaration for return deliveries)

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

If yes, which:

- 4. Are there any other safety aspects to consider?

If yes, which:

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

Company	<input type="text"/>
Street/No.	<input type="text"/>
Postal code/City	<input type="text"/>
Phone	<input type="text"/>
Email	<input type="text"/>

Contact person

(In capitals)

Date

Signature

(Company stamp)

Enclosures

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