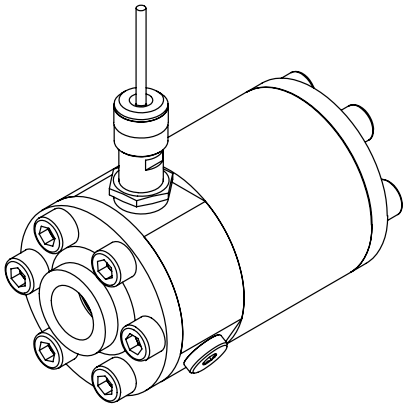
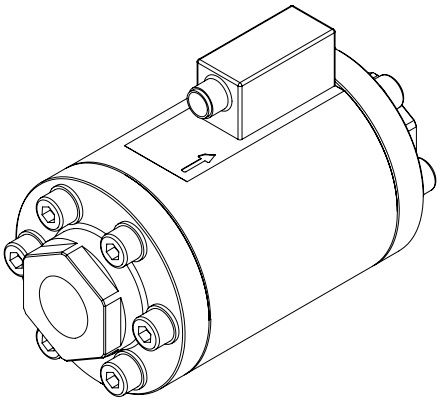
Operating instructions





KRAL flowmeters.

Series OMS

High-viscosity liquids

OIO 31en-GB
Edition 2024-03
Original instructions

Table of contents

1 About this document ... 3
1.1 General information ... 3
1.2 Target groups ... 3
1.3 Symbols ... 3
1.3.1 Danger levels ... 3
1.3.2 Danger signs ... 4
1.3.3 Symbols in this document ... 4
1.4 Associated documents ... 4

2 Safety ... 5
2.1 Proper use ... 5
2.2 Foreseeable misuse ... 5
2.3 Obligations of the operator-owner ... 5
2.4 Safety instructions ... 5
2.4.1 Fundamental safety instructions ... 5

3 Identification ... 6
3.1 Type code ... 6
3.2 Rating plate ... 6

4 Technical data ... 7
4.1 Operating limits ... 7
4.2 Pressure pulsation ... 7
4.3 Maximum values ... 7
4.4 Pick up ... 8
4.5 Pin assignment / Connection diagram ... 8
4.6 Dimensions and weights ... 9
4.6.1 Pipe thread (BSPP thread) ... 9

5 Function description ... 10
5.1 Structure ... 10
5.2 Functional principle ... 10
5.3 Signal generation ... 10
5.4 Recognition of flow direction ... 11
5.5 Temperature compensation (optional) ... 11

6 Transportation, storage ... 11
6.1 Dangers during storage ... 11
6.2 Unpacking and checking the state of delivery ... 11
6.3 Transporting flowmeters ... 11
6.4 Storing the flowmeter ... 11

7 Installation, removal ... 12
7.1 Dangers during installation ... 12
7.2 Dangers during removal ... 12
7.3 Installing the flowmeter ... 12
7.3.1 Protecting the flowmeter against soiling ... 12
7.3.2 Installation types ... 13
7.3.3 Installation recommendation ... 14
7.3.4 Installing the flowmeter ... 15
7.4 Installing the trace heating (optional) ... 15
7.5 Removing the flowmeter ... 16

8 Connection ... 16
8.1 Dangers during connection work ... 16
8.2 Connecting the flowmeter to the pipe system ... 17
8.3 Connecting the pick up ... 17

9 Operation ... 18
9.1 Dangers during operation ... 18
9.2 Commissioning ... 18
9.2.1 Cleaning the pipe system ... 18
9.2.2 Checking the function ... 18
9.2.3 Commissioning the flowmeter ... 18
9.3 Decommissioning ... 19
9.3.1 Switching off the flowmeter ... 19
9.4 Recommissioning ... 19
9.4.1 Recommissioning the flowmeter ... 19

10 Maintenance ... 19
10.1 Required maintenance ... 19
10.2 Recalibration of the flowmeter ... 20

11 Disposal ... 20
11.1 Dangers during disposal ... 20
11.2 Dismantling and disposing of the flowmeter ... 20

12 Troubleshooting ... 22
12.1 Possible faults ... 22
12.2 Troubleshooting ... 22

13 Appendix ... 24
13.1 Tightening torques for screws with metric screw threads with and without wedge lock washers ... 24
13.2 Tightening torques for screw plugs with thread measured in inches and elastomer seal ... 24
13.3 Contents of the Declaration of Conformity ... 25

1 About this document

1.1 General information

These instructions form part of the product and must be kept for future reference. Furthermore please observe the associated documents.

1.2 Target groups

The instructions are intended for the following persons:

- ☐ Persons who work with the product
- ☐ Operator-owners who are responsible for the use of the product

Persons who work with the product must be qualified. The qualification ensures that possible dangers and material damage that are connected to the activity are detected and avoided. These persons are qualified personnel who carry out the work properly due to their training, knowledge and experience and on the basis of the relevant provisions.

Information on the required qualification of the personnel is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

Target group	Activity	Qualification
Transport personnel	Transporting, unloading, setting up	Qualified personnel for transport, mobile crane operators, crane operators, forklift operators
Fitter	Mounting, connection	Qualified personnel for mounting
Electrician	Electrical connection	Qualified personnel for electric installation
Trained personnel	Delegated task	Personnel trained by the operator-owner who know the task delegated to them and the possible dangers arising through improper behaviour.

Tab. 1: Target groups

1.3 Symbols

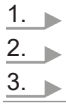
1.3.1 Danger levels

	Signal word	Danger level	Consequences of non-observance
	DANGER	Immediate threat of danger	Serious personal injury, death
	WARNING	Possible threat of danger	Serious personal injury, invalidity
	CAUTION	Potentially dangerous situation	Slight personal injury
	ATTENTION	Potentially dangerous situation	Material damage

1.3.2 Danger signs

	Meaning	Source and possible consequences of non-observance
	Electrical voltage	Electrical voltage causes serious physical injury or death.
	Raised load	Falling objects can result in serious physical injury or death.
	Heavy load	Heavy loads can result in serious back problems.
	Risk of slipping	Discharging pumped liquid and oils on the foundation or tread surfaces can cause falls with serious physical injury or death.
	Flammable substances	Discharging pumped liquid and oils can be easily inflammable and can result in serious burns.
	Hot surface	Hot surfaces can cause burns.

1.3.3 Symbols in this document

	Meaning
	Warning personal injury
	Safety instruction
	Request for action
	Multi-step instructions for actions
⇨	Action result
	Cross-reference

1.4 Associated documents

- ☐ Calibration certificate (optional)
- ☐ Declaration of conformity according to EU Directive 2006/42/EC
- ☐ Manufacturer's declaration according to EU Directive 2014/68/EU
- ☐ Corresponding operating instructions for accessories

2 Safety

2.1 Proper use

- ☐ Flowmeter solely for flow measurement of lubricating liquids that are chemically neutral and that do not contain gas or solid components.
- ☐ Flowmeters require operation with clean liquids. If coarse soiling, solid particles in the liquid or abrasive fine particles occur during operation, the flowmeter must be protected additionally by a correspondingly dimensioned operating filter in the pipe system.
- ☐ Use the flowmeter only within the operating limits specified on the rating plate and in the chapter "Technical data". Deviating operating data can result in damage to the flowmeter. If the operating data does not match the specifications on the rating plate, please contact the manufacturer.
- ☐ Strong changes in the flow rate (for example rapid shutdown, pulsations, etc.) cause marked pressure differences in the flowmeter and can damage the measuring unit. The pressure loss of the flowmeter must not exceed the values shown in the chapter "Technical data".

2.2 Foreseeable misuse

- ☐ Any use that extends beyond the proper use or any other use is misuse.
- ☐ The product is not suitable for pumping liquids outside the operational limits.
- ☐ Any bypassing or deactivation of safety equipment during operation is prohibited.

2.3 Obligations of the operator-owner

The operator-owner is the person who operates the product commercially or permits a third party to use it and who bears the legal responsibility for the product, the protection of the personnel and third parties during its operation.

The product is used in industrial applications. The operator-owner is therefore subject to the statutory obligations concerning occupational health and safety.

In addition to the safety instructions in these instructions, the regulations on safety, accident prevention and environmental protection respectively valid for the range of application of the product are to be observed.

2.4 Safety instructions

2.4.1 Fundamental safety instructions

The following safety instructions must be observed strictly:

- ☐ Read these operating instructions carefully and observe them.
- ☐ Read the operating instructions for the electronic unit and the sensors carefully and observe them.
- ☐ Have work only carried out by qualified personnel / trained personnel.
- ☐ Wear personal protective equipment and work carefully.
- ☐ Pumped liquids can be subject to high pressure and can result in personal injury and damage to property in case of incorrect operation or damaged components.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic.
- ☐ Observe the associated data sheets and safety regulations when handling dangerous materials.
- ☐ Avoid skin contact with system parts carrying liquids at operating temperatures exceeding 60 °C.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations. Neutralize residues.
- ☐ Keep the mounting surfaces, scaffolding, ladders, lifting platforms and tools clean in order to prevent slipping or stumbling.
- ☐ If pressurized or energized components are damaged, shut down the flowmeter immediately. Replace the components or flowmeter.

3 Identification

3.1 Type code

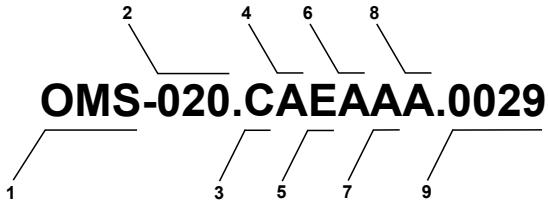


Fig. 1: Type code

1 Series
2 Size
3 Sensor equipment (pick up)
4 Function of the sensor equipment
5 Bearing material
6 Seal material
7 Mechanical connection
8 Electrical connection
9 Version index

Item	Designation	Description	
1	Series	OMS	Stainless steel
2	Size		Corresponds to the diameter of the measuring screw large in [mm]
3	Sensor equipment (pick up)	C	Standard resolution
		L	High resolution
		X	Special design
4	Function of the sensor equipment	A	Without recognition of flow direction
		B	With recognition of flow direction
		C	Without recognition of flow direction, with temperature compensation
		D	With recognition of flow direction, with temperature compensation
		X	Special design
5	Bearing material	E	Hard metal
		X	Special design
6	Seal material	A	FPM (FKM)
		X	Special design
7	Mechanical connection	A	Thread connection BSPP
		X	Special design
8	Electrical connection	A	Loose cable end
		X	Special design
9	Version index		For internal administration

Tab. 2: Type code

3.2 Rating plate

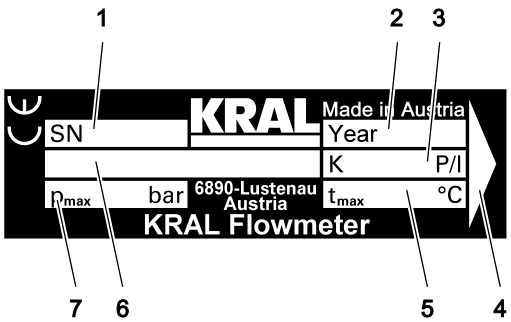


Fig. 2: Rating plate

1 Serial number
2 Construction year
3 K-factor
4 Preferred flow direction
5 Max. temperature
6 Series
7 Max. pressure

4 Technical data

4.1 Operating limits

The values specified on the rating plate apply, as well as the values on the calibration certificate if the optional calibration of the flowmeter was ordered.

The permissible operating limits of individual values influence each other so that every application is checked individually by the manufacturer when selecting the flowmeter.

If no operating data are provided by the orderer, standardized substitute operating data are used.

4.2 Pressure pulsation

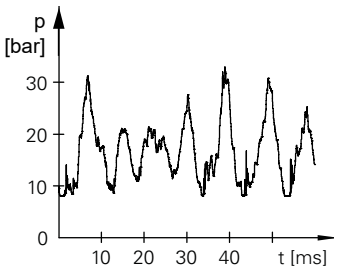


Fig. 3: Pressure pulses

Strong pressure pulsations in the system can reduce the service life of the flowmeter.

4.3 Maximum values

The following table shows the respective maximum values that, however, may not occur simultaneously. In addition, the operating limits of the corresponding completion, of the sealing material and of the pick up must be observed.

	Unit	OMS-020 (high resolution)	OMS-020 (standard resolution)
Flow rate			
Q_{rated}	[l/min]	10	30
Q_{min}	[l/min]	0.04	0.04
Max. pressure	[bar]	400	400
Temperature			
min - max	[°C]	-20 ... +80	-20 ... +150
Viscosity			
min - max	[mm^2/s]	10^2 – 10^6	10^2 – 10^6
K-factor	[P/l]	66000	2400

Tab. 3: Maximum values

4.4 Pick up

For OMS version "standard resolution" with pick up BEG 44, observe the operating instructions for the pick up.

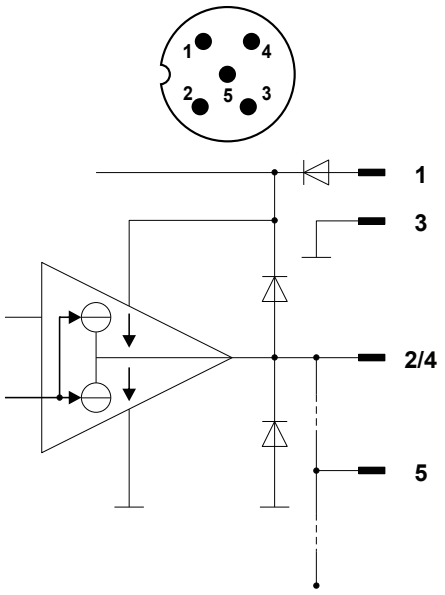
	Unit	OMS-020 (high resolution)
Supply voltage U_B	[VDC]	10 – 29
Closed current	[mA]	< 20
Frequency range	[Hz]	44 – 11000 (with K-factor 66000 P/l)
Electrical connection		M12 socket connector, 5-pole, A-coding
Output		Push-pull, driver stages
Short-circuit proof		Yes
Output current limiting	[mA]	30 (per output)
Output low level	[V]	< 0.5 (@ 1 mA), 1 (@10 mA)
Output high level	[V]	U_{high} > 22.5 (@U_b = 24 V, 1 mA) U_{high} > 22.0 (@U_b = 24 V, 10 mA)
Degree of protection		IP 67

Tab. 4: Pick up (high resolution)

4.5 Pin assignment / Connection diagram

For OMS version "standard resolution" with pick up BEB 44, refer to the operating instructions for the pick up.

OMS “high resolution” version:

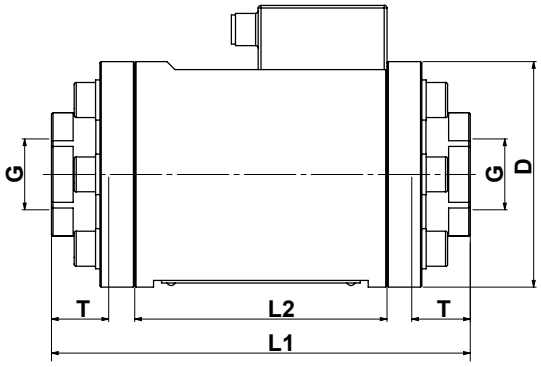


1	$+U_B$
2	f_B (Signal OUT (Push Pull))
3	GND (0 V)
4	f_A (Signal OUT (Push Pull))
5	Not connected

Fig. 4: Pin assignment / connection diagram (OMS "high resolution" version)

4.6 Dimensions and weights

4.6.1 Pipe thread (BSPP thread)



G	Pipe thread
D	Outer diameter
L1	Total length
L2	Length of the flowmeter without connections
T	Max. screw-in depth

Fig. 5: Dimensioned drawing pipe thread (schematic diagram)

	Unit	OMS-020 (high resolution)	OMS-020 (standard resolution)
G	[inch]	3/4	3/4
Pressure stage	[bar]	400	400
D	[mm]	84	84
L1	[mm]	156	150
L2	[mm]	94	108
T	[mm]	21	16
Weight	[kg]	6.0	5.0

Tab. 5: Dimensions and weights - pipe thread connection

5 Function description

5.1 Structure

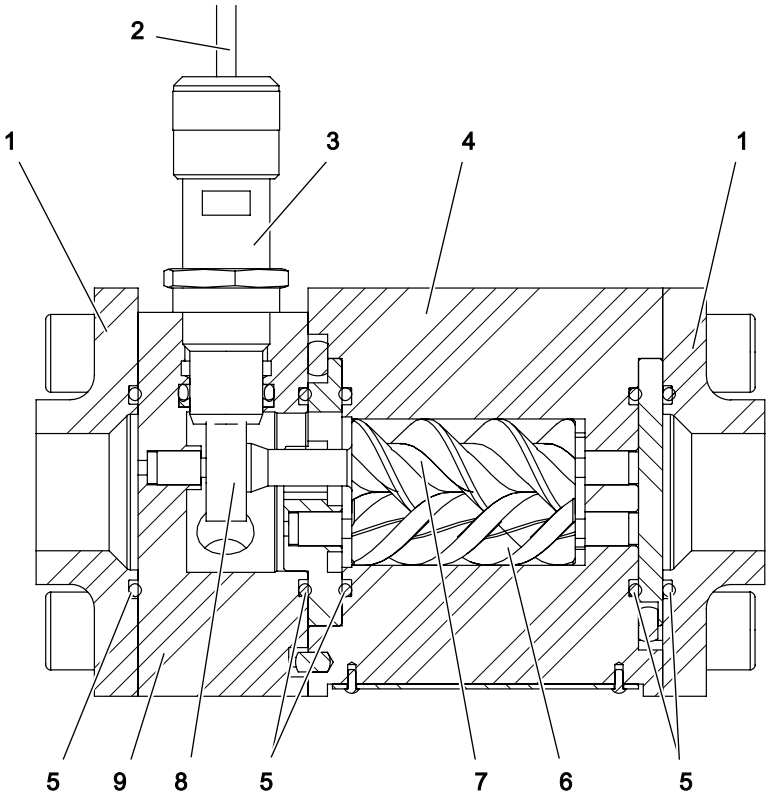


Fig. 6: Flowmeter design (OMS "standard resolution" version)

1	Mechanical connection	**6**	Small measuring screw
2	Electrical connection	**7**	Large measuring screw
3	Pick up	**8**	Pole wheel
4	Measuring housing	**9**	Intermediate flange
5	O-ring		

5.2 Functional principle

Flowmeters belong to the group of rotating displacement meters as screw meters. The pumped liquid makes the measuring unit rotate. The displacement effect results from the continuous filling, axial displacement and discharge of the volumes that are formed by the measuring housing and measuring unit. The measured pumped liquid flows around and lubricates all the rotating parts. Thanks to the displacement principle, the flowmeter does not require inlet sections and smoothing sections at the feed line and outlet.

Depending on the customer requirements, the flowmeters can be equipped with suitable end connections for connection to various flanges.

5.3 Signal generation

A pole wheel **8** whose pole is sampled by a pick up **3** is affixed at the end of the large measuring screw **7**. This pick up generates a specific number of pulses per flow volume unit - depending on the size and working point. This device-specific characteristic is called the K factor (unit: Pulse/litre) and is specified on the rating plate as well as the optional calibration certificate.

The preferred flow direction is specified on the rating plate and on the measuring housing **4** of the flowmeter. When this flow direction is observed, the pick up is located on the low-pressure end (outlet) in the case of blocking.

5.4 Recognition of flow direction

In the case of systems with pressure pulsation a reversal of the flow direction can occur briefly.

- ☐ **OMS "high resolution" version**
  The flowmeter is equipped with a two-channel pick for flow direction detection. The flow direction can be determined by means of the additional phase-shifted signal and then taken into account for the calculation of the total values.
- ☐ **OMS "standard resolution" version**
  Flow direction detection is possible when using two pick ups.

5.5 Temperature compensation (optional)

Flowmeters of the series OMS can additionally be equipped with a temperature sensor. The current density of the flowing liquid can be calculated from the measured values of the temperature sensor by using a density table stored in an external evaluation electronic unit. This allows standardised volume measurement in which the displayed values are converted to a reference temperature that can be selected freely. This ensures that measuring errors caused by changes in the density due to temperature variations are avoided.

6 Transportation, storage

6.1 Dangers during storage

The following safety instructions must be observed:

- ☐ Observe the storage conditions.

6.2 Unpacking and checking the state of delivery

1. ▶ Upon delivery unpack the flowmeter and check it for damage during transportation.
2. ▶ Report damage during transportation immediately to the manufacturer.
3. ▶ Dispose of packaging material in accordance with the locally applicable regulations.

6.3 Transporting flowmeters

ATTENTION

Damage to equipment through improper transportation.

► Protect the flowmeter against damage, heat, sunlight, dust and moisture.

▶ Transport the flowmeter in the original packaging.

6.4 Storing the flowmeter

The connections of the flowmeter are fitted with protective covers before being dispatched.

ATTENTION

Damage to equipment and corrosion if stored improperly and during longer standstills.

► Protect the flowmeter against damage, heat, sunlight, dust and moisture.

► Observe measures for storage.

▶ Store cool and dry and protect against sunlight.

7 Installation, removal

7.1 Dangers during installation

The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Do not take apart the flowmeter.

7.2 Dangers during removal

The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the collection tank for emitted liquids is sufficiently large.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

7.3 Installing the flowmeter

7.3.1 Protecting the flowmeter against soiling

Note Soiling in the pipe system impairs the service life of the flowmeter. In order to protect the flowmeter against soiling the manufacturer generally recommends the installation of an operating filter.

Personnel qualification:	☐ Fitter
Personal protective equipment:	☐ Work clothing ☐ Protective gloves ☐ Safety boots

ATTENTION

Damage to device through solid particles in the pipe system.

- ► During welding work attach protective covers in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the flowmeter.
- ► Ensure that an operating filter is installed when the pipe system is flushed and cleaned using the flowmeter.

1. ▶ Install the operating filter in front of the flowmeter, mesh width ↳ Commissioning, Page 18.
2. ▶ After the connecting work clean the pipe system thoroughly ↳ Commissioning, Page 18.

7.3.2 Installation types

Flowmeters can be operated in different installation positions.

Both flow directions are possible. The preferred flow direction is indicated on the rating plate by means of an arrow Identification, Page 6.

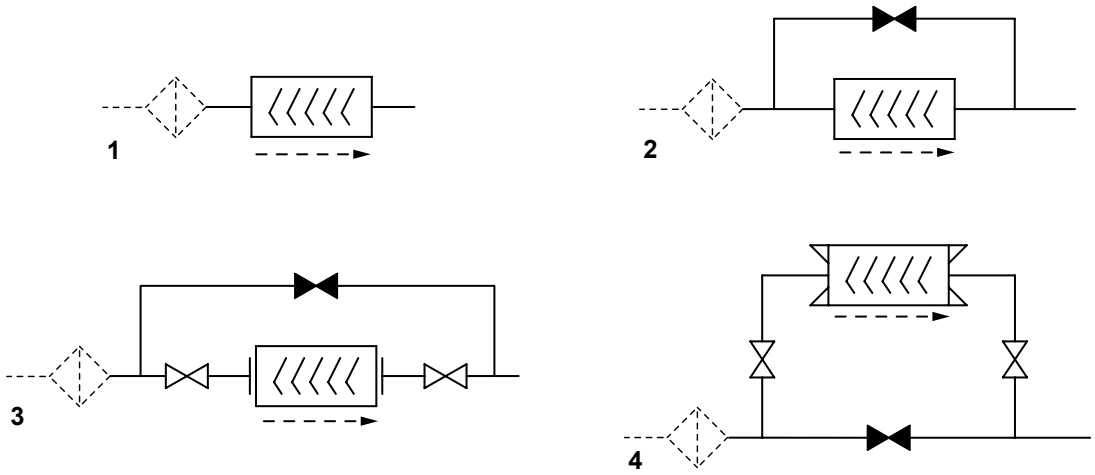


Fig. 7: Installation types

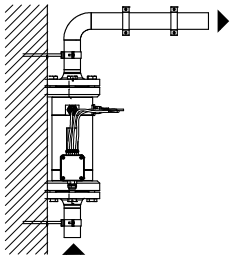
The arrow with dashed line identifies the preferred flow direction when an operating filter is used.

	Installation type	Properties
1	☐ Without bypass ☐ With or without operating filter	☐ Small space requirements ☐ Flowmeter can only be disassembled by interrupting operation
2	☐ Manual bypass ☐ With or without operating filter	☐ Manual opening of the bypass ☐ Flowmeter can only be disassembled by interrupting operation
3	☐ Bypass with 3 shut-off valves for flange connection ☐ With or without operating filter	☐ Flowmeter can be disassembled without interrupting operation
4	☐ Bypass with 3 shut-off valves for pipe thread connection ☐ With or without operating filter	☐ Flowmeter can be disassembled without interrupting operation ☐ Minimal higher pressure loss

Tab. 6: Installation types

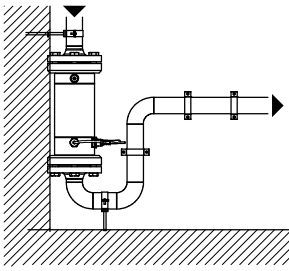
7.3.3 Installation recommendation

In order to avoid measuring errors observe the following recommendations of the manufacturer when installing the flowmeter in the pipe system.

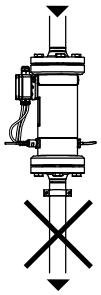


Preferred installation variant:
- Install the flowmeter vertically.
- Route the flow from the bottom upwards.

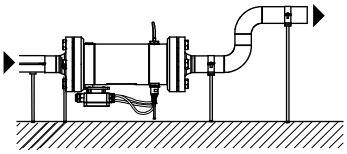
Recommendations for alternative installation variants



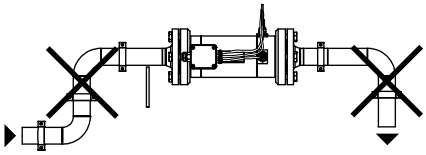
Alternative installation variant:
- Install the flowmeter vertically.
- Route the flow from the top downwards.
- Route the piping at the outlet upwards.



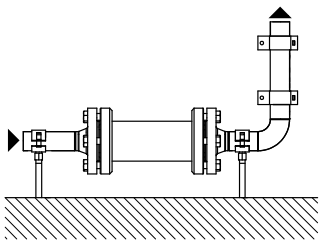
Source for measuring error:
- Lack of counter-pressure at the outlet through downward routing of the piping.



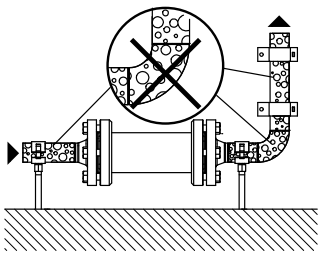
Alternative installation variant:
- Install the flowmeter horizontally.
- Route the piping at the outlet upwards.



Source for measuring error:
- Formation of an air pocket through the installation of the flowmeter at the highest point of the piping.



Recommendation:
- Carefully vent the pipe system during commissioning.



Source for measuring error:
- Gas inclusions in the pipe system

7.3.4 Installing the flowmeter

Personnel qualification:	☐ Fitter
Personal protective equipment:	☐ Work clothing ☐ Protective gloves ☐ Safety boots

ATTENTION

Measuring error through air pocket in the flowmeter.

► During installation ensure that the flowmeter is not installed at the highest point in the pipe system.

ATTENTION

Measuring error through a lack of counter-pressure.

► During the installation ensure that the piping at the outlet of the flowmeter runs upwards or that the pipe diameter is reduced through a reducer so that the liquid generates a counter-pressure.

→► During the installation of the flowmeter observe the recommendations for the installation variants and avoid error sources.

7.4 Installing the trace heating (optional)

The flowmeter can optionally be equipped with a trace heating system provided by the customer. The manufacturer recommends a heating system at high-viscosity liquids that do not flow sufficiently if not heated.

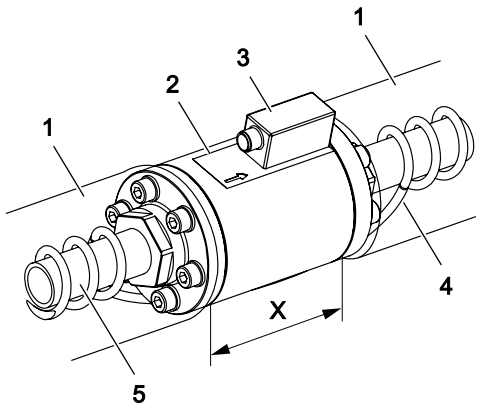
Note Before installing trace heating provided by the customer, contact the manufacturer.

Personnel qualification:	☐ Fitter
Personal protective equipment:	☐ Work clothing ☐ Protective gloves ☐ Safety boots

ATTENTION

Defective components through the maximum temperature being exceeded.

► Do not heat the pick ups, socket connectors and connecting cables above the maximum permissible temperature Technical data, Page 7.



1	Thermal insulation
2	Flowmeter
3	Pick up
4	Heating line
5	Piping
X	Area necessarily without thermal insulation

Fig. 8: Flowmeter with trace heating

→► Wind the heating line **4** around the piping **5**. Ensure that the pick up **3**, junction box and associated cables are not thermally insulated. The area **X** must remain free of thermal insulation.

7.5 Removing the flowmeter

Personnel qualification:	☐ Fitter ☐ Electrician
Personal protective equipment:	☐ Work clothing ☐ Face protection ☐ Protective gloves ☐ Safety boots
Aids:	☐ Collection tank

⚠ DANGER

Risk of death resulting from electric shock.

- ► Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ► Observe the operating instructions of the electrical components.

⚠ DANGER

Risk of death through emitted pumped liquid.

Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- ► Wear personal protective equipment during all the work. Ensure face protection.
- ► Before beginning work, let the flowmeter cool down to the ambient temperature.
- ► Ensure that the flowmeter is depressurized.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

Requirement:

✓ System switched off
✓ Disconnect the system from the power supply and secure it against being switched back on
✓ Flowmeter cooled down to the ambient temperature

1. ▶ Drain the pipe system or divert the pumped liquid via bypass.
2. ▶ Remove the flowmeter.
3. ▶ Attach protective covers in front of connecting flanges.
4. ▶ For storage of the flowmeter Transportation, storage, Page 11.

8 Connection

8.1 Dangers during connection work

The following safety instructions must be observed strictly:
☐ Have all the work on the flowmeter and pipe system only carried out by authorized qualified personnel.
☐ Ensure that solid particles cannot get into the flowmeter and pipe system.
☐ Ensure that mechanical connections are mounted free of stress.
☐ Observe the tightening torques.
☐ Have all the work on the electrical equipment only carried out by electricians.
☐ Before beginning work on the flowmeter ensure that the electrical power supply is deenergized and is secured against being switched back on.
☐ If the insulation of the electrical cables or wires is damaged, disconnect the power supply immediately.
☐ The connecting line of the pick up/temperature sensor connection is to be shielded and laid separately from the supply lines.

8.2 Connecting the flowmeter to the pipe system

Personnel qualification:	☐ Fitter
Personal protective equipment:	☐ Work clothing ☐ Protective gloves ☐ Protective helmet ☐ Safety boots
Aids:	☐ Hoisting equipment

ATTENTION

Damage to device through mechanical stress.

- ► Ensure that the flowmeter is mounted free of mechanical stresses in the pipe system.
- ► Observe the tightening torques.

ATTENTION

Damage to device through solid particles in the pipe system.

- ► During welding work attach protective covers in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the flowmeter.
- ► Ensure that an operating filter is installed when the pipe system is flushed and cleaned using the flowmeter.

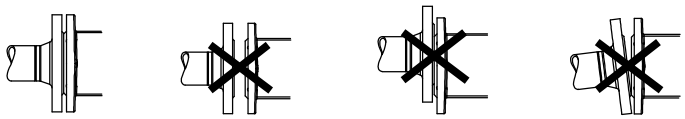
ATTENTION

Damage to device when the pipe threading is screwed in too far.

- ► Observe the thread length of the flowmeter.
- ► Use a standard cutting ring screw connection.

Note The screw-in length of the piping may not exceed the threaded length of the flowmeter, since the flow cross-section is narrowed and internal components can be damaged.

1. ▶ Remove the protective covers and store them.
2. ▶ Place the piping in position and support the weight of the piping.
3. ▶ Install the flowmeter stress-free into the pipe system. In the process take the preferred flow direction into account and ensure that the connections of the pick up remain accessible.



4. ▶ Check the linear offset, lateral offset and angular offset and correct if necessary. If the screws tighten easily, this is a sure sign that the installation is stress-free.
5. ▶ Tighten the connecting screws crosswise with torque ↳ Appendix, Page 24.

8.3 Connecting the pick up

OMS “high resolution” version

The flowmeter is equipped with a two-channel pick up.

1. ▶ Connect the pick up with a 5-pin socket connector. Take the pin assignment into account ↳ Technical data, Page 7.
2. ▶ Tighten the fastening screw at socket connector only hand-tight.
3. ▶ Earth the flowmeter carefully.

OMS “standard resolution” version

For OMS version "standard resolution" with pick up BEG 44, observe the operating instructions for the pick up.

9 Operation

9.1 Dangers during operation

The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ Ensure that the flowmeter is only operated within the operating limits.
- ☐ Ensure that during cooling down or heating up the flowmeter is only subjected to slow temperature changes.
- ☐ Ensure that existing safety equipment is not bypassed or activated during operation.

9.2 Commissioning

9.2.1 Cleaning the pipe system

Note Soiling in the pipe system impairs the service life of the flowmeter. In order to protect the flowmeter against soiling the manufacturer generally recommends the installation of an operating filter.

ATTENTION

Damage to device through usage of an incorrect flushing liquid.

► Under no circumstances may water or superheated steam be used to flush the pipe system.

—► Flushing via bypass:
Close the shut-off devices before and after the flowmeter.

- or -

—► Flushing via flowmeter:
Install the operating filter before the flowmeter. In this case select the mesh width of the operating filter in accordance with the pumped liquid.

9.2.2 Checking the function

1. —► Check the flow direction of the flowmeter.
2. —► Check the installation of the pick up and optional temperature sensor.
3. —► Check for leaks at the pipe thread/connecting flange.
4. —► Check the electrical installation.
5. —► Check the power supply.

9.2.3 Commissioning the flowmeter

ATTENTION

Increased wear and/or blockade through solid particles or abrasive fine particles in the liquid.

► Protect the flowmeter through correspondingly dimensioned operating filters in the pipe system.

ATTENTION

Measuring error when the pressure drops below the minimum pressure outlet at the outlet.

► Ensure that sufficient counter-pressure exists at the outlet by routing the piping upwards.

ATTENTION

Measuring error through gas inclusion in the pipe system.

► Before commissioning, make sure that the flowmeter is filled.

► Vent the pipe system.

Requirement:
✓ The ambient conditions correspond to the operating data
✓ Flowmeter installed correctly in the pipe system ↳ Installation, removal, Page 12
✓ Flowmeter connection to the pipe system is stress-free
✓ Pipe system is free of impurities
✓ Pipe system vented
✓ Shut-off devices in the feed line and outlet opened

—► Switch on the measuring system.
⇨ The flowmeter measures when the pick up generates a signal.

9.3 Decommissioning

9.3.1 Switching off the flowmeter

ATTENTION

Damage to the measuring unit.

In the case of strong changes to the flow rate (for example, rapid shutdown, pulsations, etc.) there is a danger of excessive pressure differences.

► Ensure that the pressure loss of the flowmeter does not exceed the values specified on the rating plate or the substitute operating data.

—► Ensure that the pressure loss of the flowmeter does not exceed the values specified on the rating plate or the standardised substitute operating data.
⇨ When the flow through the flowmeter is stopped, the generation of the signal stops automatically. No further measures are required to switch off.

9.4 Recommissioning

9.4.1 Recommissioning the flowmeter

ATTENTION

Damage to device through hard, gummy or crystallized pumped liquid in the flowmeter.

► Before recommissioning, ensure that there is no hard, gummy or crystallized pumped liquid in the flowmeter.

Requirement:
✓ The ambient conditions correspond to the operating data
✓ Flowmeter connection to the pipe system is stress-free
✓ Pipe system is free of solid particles
✓ Pipe system vented
✓ Shut-off devices in the feed line and outlet opened

—► Switch on the system.
⇨ The flowmeter is ready to operate.

10 Maintenance

10.1 Required maintenance

Flowmeters are fundamentally maintenance-free. Under observance of the operating limits ↳ Technical data, Page 7, no significant change in the characteristics could be established, even after years of use in many cases. Stresses lying clearly above the rated flow rate can, however, result in excessive wear. In the case of liquids with higher abrasiveness (for example media with fillers, etc.) strongly accelerated wear can occur in the flowmeter.

Note In cases of doubt the manufacturer recommends already carrying out the first inspection after twelve weeks operation time.

10.2 Recalibration of the flowmeter

In order to maintain the high measuring precision of the flowmeter, the manufacturer recommends carrying out the first recalibration after about one year of operation. The results reveal any wear starting on the measuring unit. The interval at which recalibrations are actually required depends strongly on the operating conditions of the flowmeter.

Calibration of the flowmeter is offered as an option.

11 Disposal

11.1 Dangers during disposal

The following safety instructions must be observed strictly:
☐ Neutralize residues.

11.2 Dismantling and disposing of the flowmeter

Personnel qualification:	☐ Fitter ☐ Work clothing ☐ Face protection ☐ Protective gloves ☐ Safety boots ☐ Solvents or industrial cleaners suitable for the pumped liquid ☐ Collection tank

⚠ WARNING

Danger of poisoning and environmental damage through residues.

- ► Wear personal protective clothing during all the work. Ensure face protection.
- ► Before disposal collect any pumped liquid still present safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ► Before disposing neutralize the residues.

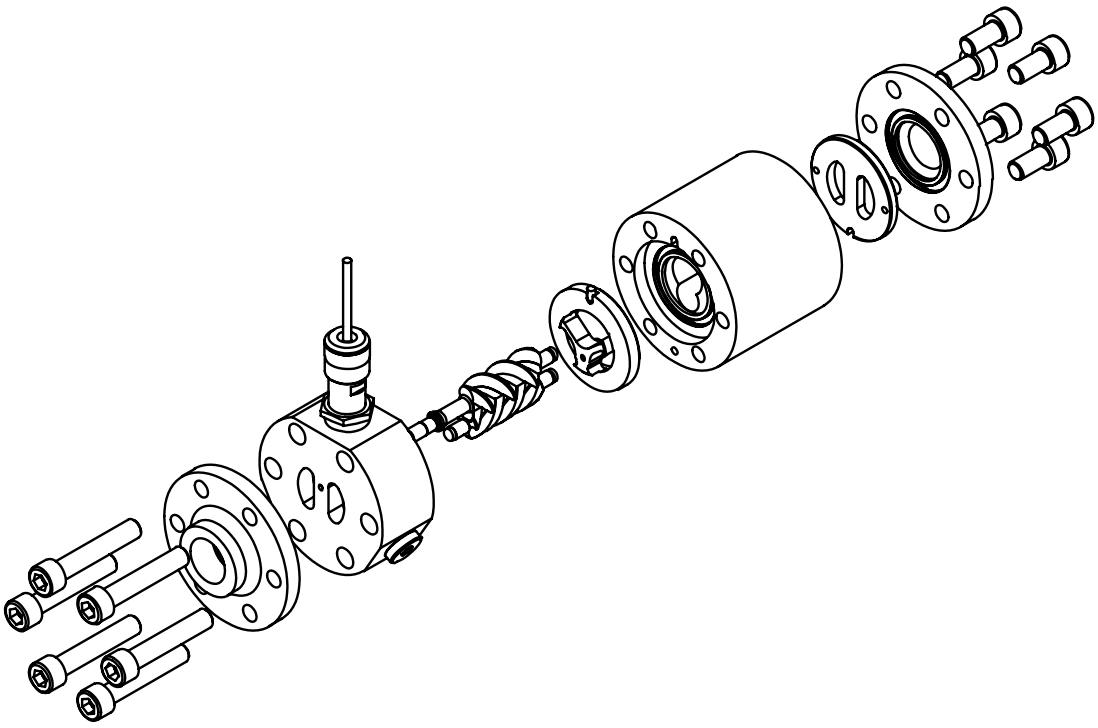


Fig. 9: Exploded view [OMS “standard resolution” version]

Requirement:

✓ Flowmeter cooled down to the ambient temperature and disconnected from the pipe system
✓ Flowmeter drained completely
✓ Flowmeter placed at a location suitable for dismantling

1. ▶ Dismantle the flowmeter and disassemble it into its individual parts.
2. ▶ Clean residues of the pumped liquid from the individual parts.
3. ▶ Separate sealing elements made of elastomer from the flowmeter and dispose of them separately.
4. ▶ Recycle iron parts.

12 Troubleshooting

12.1 Possible faults

Faults can have different causes. The following tables list the symptoms of a fault, the possible causes and measures for troubleshooting.

In the event of a fault please contact the manufacturer at services@kral.at.

ID	Fault
1	Flowmeter leaks
2	No flow rate
3	Flowmeter does not generate a pulse
4	Pressure loss too high
5	Readings unrealistic
6	Negative flow

12.2 Troubleshooting

Fault identification							Cause / Remedy
1	–	–	–	–	–	–	Seal damaged
							→ Check the chemical resistance of the seal.
–	2	3	–	5	–	–	Foreign particles in the liquid and/or flowmeter
							→ Use the commissioning filter.
–	–	3	–	5	6	–	Pick up not connected correctly
							→ Check the power supply for the pick up.
–	–	3	–	5	–	–	Pick up defective
							→ Check the function of the pick up. Note the pick up operating instructions.
–	2	3	–	–	–	–	Inlet pressure too low
							→ Increase the inlet pressure.
–	–	–	4	–	–	–	Viscosity of the liquid too high
							→ Increase the temperature. Observe the temperature range in the process.
–	–	3	–	–	–	–	Flow rate too low
							→ Increase the flow rate.
–	–	–	4	–	–	–	Flow rate too high
							→ Reduce the flow rate.
–	–	–	–	5	–	–	Airlocks
							→ Deaerate the system and check for leaks.
–	–	–	–	5	–	–	Outgassing
							→ Increase the system pressure.
							→ Reduce the temperature.
–	–	–	–	5	6	–	Pulsations too high
							→ Use another feed pump.
							→ Carry out changes to the system.
–	–	–	–	5	–	–	Back pressure too low
							→ Increase the back pressure.
–	–	–	–	5	6	–	Flow rate fluctuations too high
							→ Ensure a continuous flow rate by taking suitable measures (using a different pump, valve, damper, etc.).
–	–	–	–	5	–	–	Significant deviations in operating data
							→ Adapt the operating data to the flowmeter.
–	2	3	4	5	–	–	Measuring unit and bearing wear
							→ Filter out the abrasive materials.

Fault identification							Cause	Remedy
–	2	3	–	–	–	–	Flow impaired at the system end	
								→ Check whether the fluid flows in the system (pump in operation, slide valve opened, etc.).
								→ Check whether shut-off devices before and after the flowmeter are opened.
–	2	3	–	–	–	–	Flowmeter switched to bypass	
								→ Switch the flowmeter to through-flow.

Tab. 7: Fault table

13 Appendix

13.1 Tightening torques for screws with metric screw threads with and without wedge lock washers

Tightening torque [Nm]							
Screws with head contact surface							Countersunk screws
					Stainless steel screws A2 and A4		
Thread	5.6	8.8	10.9	8.8+ Alu*	Property class 70	Property class 80	8.8
M 3	0.6	1.5	–	1.2	1.1	1.3	1.0
M 4	1.4	3.0	4.1	2.3	2.0	2.3	2.0
M 5	2.7	6.0	8.0	4.8	3.9	4.7	5.0
M 6	4.7	10.3	14.0	7.6	6.9	8.0	9.0
M 8	11.3	25.0	34.0	18.4	17.0	22.0	14.0
M 10	23.0	47.0	68.0	36.8	33.0	43.0	36.0
M 12	39.0	84.0	117	64.0	56.0	75.0	60.0
M 14	62.0	133	186	101	89.0	–	90.0
M 16	96.0	204	285	155	136	180	100
M 18	133	284	390	224	191	–	–
M 20	187	399	558	313	267	370	135
M 24	322	687	960	540	460	605	360

Tab. 8: Tightening torques metric screw thread

*When screwing into aluminium, the tightening torque reduces by 20 % when the screw-in depth is less than double the thread diameter.

13.2 Tightening torques for screw plugs with thread measured in inches and elastomer seal

Tightening torque [Nm]	
Thread	Galvanized + stainless steel
G 1/8"	13.0
G 1/4"	30.0
G 3/8"	60.0
G 1/2"	80.0
G 3/4"	120
G 1"	200
G 1 1/4"	400
G 1 1/2"	450

Tab. 9: Tightening torques with thread measured in inches

13.3 Contents of the Declaration of Conformity

The products described in these instructions are machinery in the sense of the Directive 2006/42/EC. The original of the EC Declaration of Conformity is enclosed with the machinery at delivery.

The machinery fulfils all the relevant provisions of the following directives:

Number	Name	Remark
2006/42/EC	Machinery Directive	–
2014/68/EU	Pressure Equipment Directive	–
2014/30/EU	Directive on Electromagnetic Compatibility	Only for machinery with electrical components
2014/35/EU	Low Voltage Directive	Only for machinery with electrical components

Tab. 10: Directives observed

KRAL

KRAL GmbH, 6890 Lustenau, Austria, Tel.: +43/5577/86644-0, E-Mail: kral@kral.at | www.kral.at