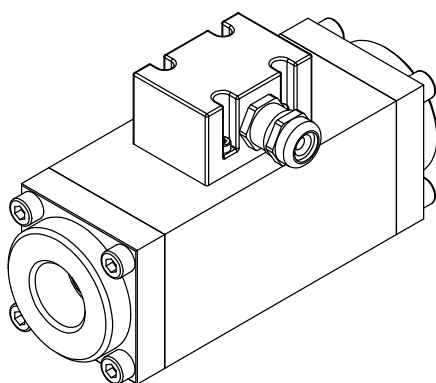
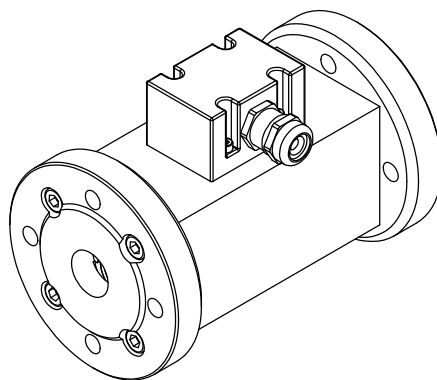
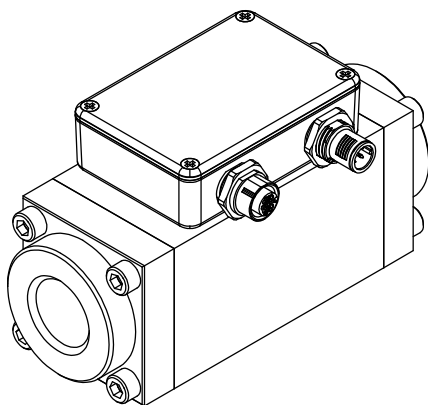




Operating instructions

KRAL



KRAL flowmeters.

OME Compact series

OIO 20en-GB
Edition 2024-04
Original instructions

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1 About this document

1.1 General information

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




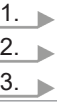


	Signal word	Danger level	Consequences of non-observance
	DANGER	Immediate threat of danger	Serious personal injury, death
	WARNING	Possible threat of danger	Serious personal injury, invalidity
	CAUTION	Potentially dangerous situation	Slight personal injury
	ATTENTION	Potentially dangerous situation	Material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

	Meaning	Source and possible consequences of non-observance
	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
- ☐ Declaration of Conformity according to EU Directive 2006/42/EC
- ☐ Manufacturer's declaration according to EU Directive 2014/68/EU
- ☐ Relevant operating instructions for attachments (e.g. pick up, temperature sensor, electronics)

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 strictly observed:

- ☐ Read and observe these operating instructions carefully.
- ☐ Read the operating instructions for the electronic unit and the sensors carefully and observe them.
- ☐ Work must only be carried out by qualified/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. Neutralise residues.
- ☐ Keep the mounting surfaces, scaffolding, ladders, lifting platforms and tools clean in order to prevent slipping or stumbling.
- ☐ If pressurised or energised components are damaged, shut down the flow meter immediately. Replace the components or flow meter.
- ☐ Housing and flanges of the OME series KRAL flow meter are anodised. When installing the flow meter in a pipeline, electrical interruptions to the earthed pipeline system cannot be ruled out. A possible interruption of the earthing must therefore be taken into account by the operator.

3 Identification

3.1 Type code

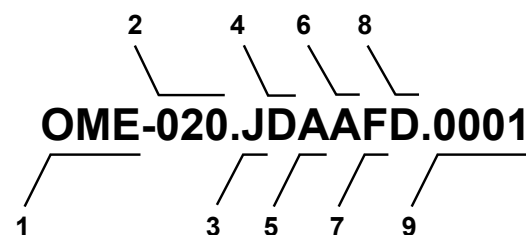


Fig. 1: Type code

- 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	OME Economy
2	Size	Corresponds to the diameter of the measuring screw large in [mm]
3	Sensor equipment (pick up)	J BEG 60-62 (compact sensor)
		X Special design
4	Function of the sensor equipment	D With flow direction recognition, with temperature compensation
		X Special design
5	Bearing material	A Steel
		X Special design
6	Seal material	A FPM (FKM)
		B FFPM (FFKM)
		C Low-temperature FPM
		D EPDM
		X Special design
7	Mechanical connection	A Thread connection BSPP
		B Flange connection DIN
		C Thread connection NPT
		D Flange connection ANSI
		X Special design
8	Electrical connection	C Cable gland compact sensor
		D Fixing kit for display and processing unit
		E Smart Solution version
		X Special design
9	Version index	For internal administration

Tab. 2: Type code

3.2 Rating plate

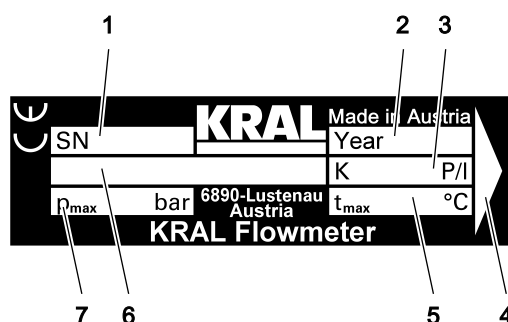


Fig. 2: Rating plate

- 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

4 Technical data

4.1 Operating limits

The values specified on the rating plate and the calibration certificate apply. 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

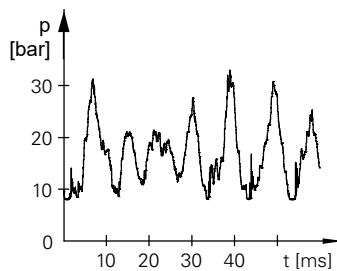


Fig. 3: Pressure pulses

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 compact sensor or Smart Solution electronic unit must be observed.

		Size			
Parameter	Unit	13	20	32	52
Flow rate					
<input type="checkbox"/> Q _{max}	[l/min]	15	45	150	525
<input type="checkbox"/> Q _{rated}	[l/min]	10	30	100	350
<input type="checkbox"/> Q _{min}	[l/min]	0.1	0.3	1.0	3.5
Max. pressure	[bar]	40			
Min. - max. temperature	[°C]	-20 ... +125			
Min.- max. viscosity	[mm²/s]	1 – 1000000			
Measuring chamber volume	[ml/U]	1.65	6.24	25.6	112.8
Speed					
<input type="checkbox"/> n (Q _{max})	[min ⁻¹]	9120	7260	5850	4658
<input type="checkbox"/> n (Q _{rated})	[min ⁻¹]	6060	4830	3900	3105
<input type="checkbox"/> n (Q _{min})	[min ⁻¹]	61	48	39	31
Number of poles K1		2			
K factor K1	[P/l]	1214	321	78	17.73
Millilitres/pulse K1	[ml/P]	0.824	3.12	12.8	56.4
Pulse frequency					
<input type="checkbox"/> f1 (Q _{max})	[Hz]	304	242	195	155
<input type="checkbox"/> f1 (Q _{rated})	[Hz]	202	161	130	104
<input type="checkbox"/> f1 (Q _{min})	[Hz]	2.0	1.6	1.3	1.0

4.4 Substitute operating data

The following table shows standardised values for the flow rate, temperature and viscosity. These values can be used at the same time as maximum values without impairing the service life of the flowmeter. In addition, the operating limits of the corresponding completion, of the sealing material and of the compact sensor or Smart Solution electronic unit must be observed.

Parameter	Unit	Size			
		13	20	32	52
Flow rate					
<input type="checkbox"/> Q_{\max}	[l/min]	10	30	100	350
<input type="checkbox"/> Q_{rated}	[l/min]	10	30	100	350
<input type="checkbox"/> Q_{\min}	[l/min]	0.2	0.6	2.0	7.0
Max. pressure	[bar]	40			
Min. – max. temperature	[°C]	-20 ... +125			
Min. – max. viscosity	[mm²/s]	1 – 50			

Tab. 3: Substitute operating data

4.5 Sound pressure level

The sound pressure level of the flowmeters amounts to less than 70 dB(A).

4.6 Dimensions and weights

4.6.1 OME with compact sensor (BSPP thread)

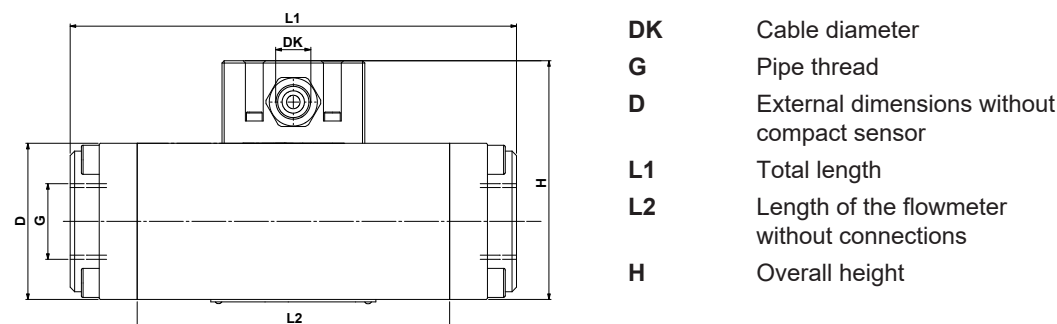


Fig. 4: Scale drawing of OME with compact sensor and pipe thread connection

Parameter	Unit	Size			
		13	20	32	52
DK	[mm]	5 – 13	5 – 13	5 – 13	5 – 13
G	[inch]	1/2	3/4	1	1 1/2
Pressure stage	[bar]	40	40	40	40
D	[mm]	45 x 45	55 x 55	70 x 70	110 x 110
L1	[mm]	110	145	200	310
L2	[mm]	65	95	140	225
H	[mm]	82	92	107	147
Weight	[kg]	0.7	1.2	3.0	9.0

Tab. 4: Dimensions and weights - OME with compact sensor and pipe thread connection

4 Technical data

4.6 Dimensions and weights

4.6.2 OME with Smart Solution electronic unit (BSPP thread)

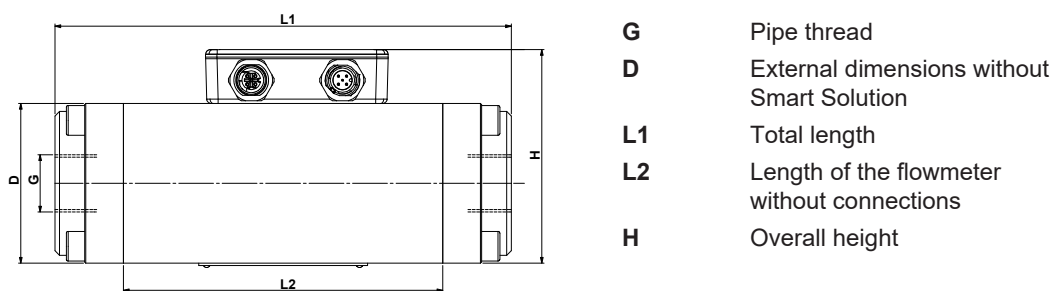


Fig. 5: Scale drawing OME with Smart Solution electronic unit and pipe thread connection

Parameter	Unit	Size			
		13	20	32	52
G	[inch]	1/2	3/4	1	1 1/2
Pressure stage	[bar]	40	40	40	40
D	[mm]	45 x 45	55 x 55	70 x 70	110 x 110
L1	[mm]	110	145	200	310
L2	[mm]	65	95	140	225
H	[mm]	69	79	94	134
Weight	[kg]	0.7	1.2	3.0	9.0

Tab. 5: Dimensions and weights - OME with Smart Solution electronic unit and pipe thread connection

4.6.3 OME with compact sensor (DIN flange)

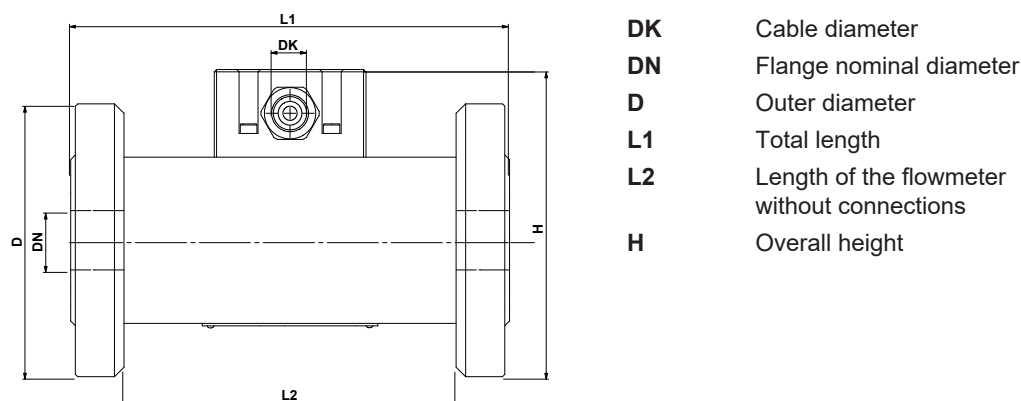
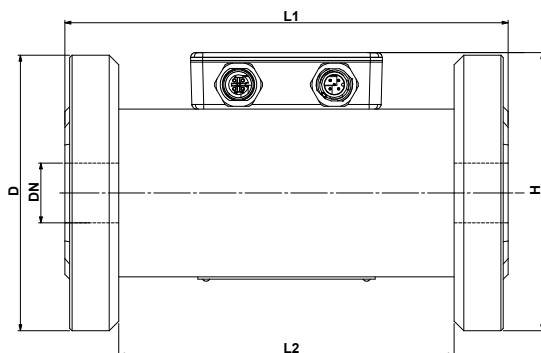


Fig. 6: Scale drawing OME with compact sensor and DIN flange connection

Parameter	Unit	Size			
		13	20	32	52
DK	[mm]	5 – 13	5 – 13	5 – 13	5 – 13
DN		15	20	25	40
Pressure stage	[bar]	40	40	40	40
D	[mm]	95	105	115	150
L1	[mm]	105	135	185	325
L2	[mm]	65	95	140	225
H	[mm]	107.0	117.0	129.5	167.0
Mass	[kg]	1.2	1.7	3.0	11.8

Tab. 6: Dimensions and weights - OME with compact sensor and DIN flange connection

4.6.4 OME with Smart Solution electronic unit (DIN flange)



DN	Flange nominal diameter
D	Outer diameter
L1	Total length
L2	Length of the flowmeter without connections
H	Overall height

Fig. 7: Scale drawing OME with Smart Solution electronic unit and DIN flange connection

Parameter	Unit	Size		
		20	32	52
DN		20	25	40
Pressure stage	[bar]	40	40	40
D	[mm]	105	115	150
L1	[mm]	135	185	325
L2	[mm]	95	140	225
H	[mm]	79	94	134
Mass	[kg]	1.7	3.0	11.8

Tab. 7: Dimensions and weights - OME with Smart Solution electronic unit and DIN flange connection

Note The OME flowmeter with DIN flange is not available in size 13 in the Smart Solution version.

4 Technical data

4.7 Compact sensor specification

4.7 Compact sensor specification

Specification	Unit	Data
Double pick up		
<input type="checkbox"/> Operating principle		Magneto-resistive
<input type="checkbox"/> Output circuit		Push-pull
<input type="checkbox"/> Short-circuit protection		Yes
<input type="checkbox"/> Reverse polarity protection		Yes
<input type="checkbox"/> Max. output current per signal	[mA]	20
<input type="checkbox"/> Frequency range	[kHz]	0 – 25
<input type="checkbox"/> Supply voltage	[V DC]	10 – 30
<input type="checkbox"/> Max. supply current	[mA]	50
<input type="checkbox"/> Voltage drop	[V]	< 1
<input type="checkbox"/> Electrical phase shift		90° ± 20°
Temperature sensor		
<input type="checkbox"/> Sensor type		Pt100, IEC 751
<input type="checkbox"/> Accuracy class		B
<input type="checkbox"/> Circuit		3-wire
Mechanical specification		
<input type="checkbox"/> Protection class		IP 65
<input type="checkbox"/> Operating temperature	[°C]	-40 ... +125
<input type="checkbox"/> Pressure on front face	[bar]	40
<input type="checkbox"/> Cable diameter	[mm]	5 – 13
<input type="checkbox"/> Core cross-section	[mm]	0.1 – 1.5
<input type="checkbox"/> Compact sensor housing material		Anodised aluminium

4.8 Smart Solution electronic unit specification

For the specification of the Smart Solution electronic unit, see the relevant operating instructions.

5 Function description

5.1 Structure

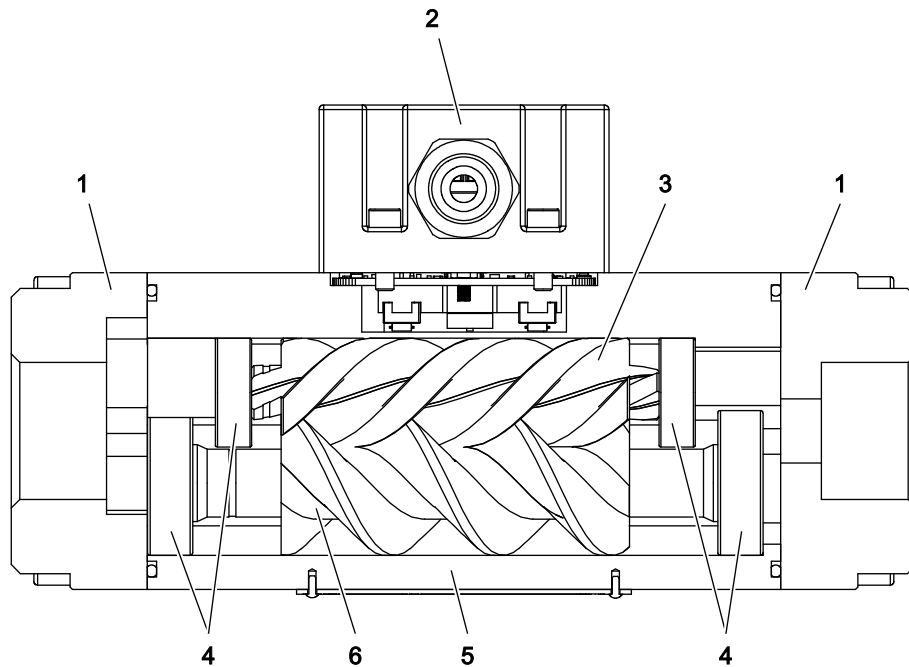


Fig. 8: Flowmeter structure

- | | |
|---|-------------------------|
| 1 Connection | 4 Ball bearing |
| 2 Compact sensor/Smart Solution electronic unit | 5 Measuring housing |
| 3 Small measuring screw | 6 Large measuring screw |

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 Rolling bearings

Thanks to precision rolling bearings the measuring unit operates contact-free and with low friction in the flowmeter housing. Single row deep groove ball bearings are used for OME series flowmeters.

5.4 Signal generation

The measuring pulses are sampled by the pick up directly at the screw and - depending on the size and operating point - result in a certain number of pulses per volume unit of flow. This device-specific characteristic is called the K factor (unit: pulses/litre) and is specified on the rating plate as well as the enclosed calibration certificate.

- ☐ The compact sensor forwards the generated pulses per volume unit unprocessed.
- ☐ With the Smart Solution electronic unit, the generated pulses per volume unit are immediately converted into a reading. For more information, see the relevant operating instructions for the Smart Solution electronic unit.

The installation method of the compact sensor or the Smart Solution electronic unit allows for assembly without contacting the medium to be measured.

The preferred flow direction is specified on the flowmeter rating plate. This preferred direction ensures that the compact sensor or Smart Solution electronic unit delivers positive signal sequences during normal operation.

5.5 Linearization

The calibration certificate of the flowmeter contains a mean K-factor that has been determined for the flow range 10:1 and that can therefore be used across a wide flow range. However, the K-factor shows slightly different values at different flow rates. These are also documented in the enclosed calibration certificate. If highest measuring precision is required, it is therefore advisable, especially at strongly varying flow rates, to take these different values into consideration by means of a "Linearization". The K-factors are therefore stored in a suitable electronic unit by means of several interpolation values of the flow rate. The K-factor relevant for the flow rate being measured is then determined by means of linear interpolation between the two nearest interpolation values.

The viscosity dependence of the K-factors must also be taken into account. These are determined during calibration at a viscosity of approximately 4.2 mm²/s. The influence of the flow rate on the K-factor decreases at higher viscosities so that the mean K-factor can then also be used in a considerably larger flow range without noteworthy errors.

5.6 Compact sensor

The signals from the sensors are converted into square-wave pulses in the robust compact sensor. The flow direction can be determined via the phase-shifted signal and the incremental encoder positions available in an external KRAL electronic unit, and then taken into account when calculating the total values. The compact sensor is also equipped with a temperature sensor. The current density of the medium flowing through can be calculated with the help of a density table stored in the electronics. This allows standardised volume measurement in which the readings 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.

5.7 Smart Solution electronic unit

The Smart Solution electronic unit combines the functions of the compact sensor and an external electronic unit in one compact device. For more information, see the relevant operating instructions for the Smart Solution electronic unit.

6 Transportation, storage

6.1 Dangers during transportation



The following safety instructions must be observed:

- ☐ Have all work only carried out by authorized transport personnel.
- ☐ Use intact and correctly dimensioned hoisting equipment.
- ☐ Ensure that the means of transport is in a flawless state.
- ☐ Ensure that the centre of gravity of the load is taken into consideration.
- ☐ Do not stand under raised loads.

6.2 Dangers during storage



The following safety instructions must be observed:

- ☐ Observe the storage conditions.

6.3 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. ➤ Store the supplied sensors for the installation.
4. ➤ Dispose of packaging material in accordance with the locally applicable regulations.

6.4 Transporting flowmeters



WARNING

Risk of injury and damage to equipment through falling and toppling parts.

- ▶ Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ▶ Select the lift points for the hoisting equipment in accordance with the centre of gravity and the weight distribution.
- ▶ Use at least two load ropes.
- ▶ Do not stand under raised loads.

ATTENTION

Damage to equipment through improper transportation.

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

Requirement:

- ✓ Sufficiently dimensioned hoisting equipment
- ✓ The used hoisting equipment corresponding to the local rules and regulations for the prevention of accidents

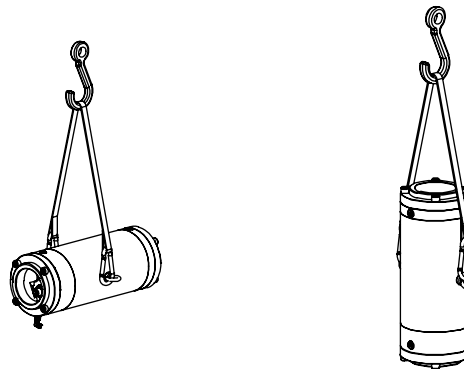


Fig. 9: Fastening of hoisting equipment - principle diagram

1. ▶ Fasten hoisting equipment on the flowmeter.
2. ▶ Transport the flowmeter to the installation location or temporary storage site.

6.5 Storing the flowmeter

As a result of the calibration, the internal components of the flowmeter are wetted with calibration liquid that has a preservative effect. In addition, a special anticorrosive agent is sprayed onto the interior of the flowmeter before being dispatched. The connections of the flowmeter are fitted with protective covers. The preservation applied at the factory will protect the flowmeter for up to six weeks, if it is stored in a dry and clean location. The manufacturer optionally offers a long-term preservation for storage times of up to 60 months. The flowmeter is additionally packed in hermetically sealing anti-corrosion paper.

ATTENTION

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

- ▶ Protect the flowmeter against damage, heat, sunlight, dust and moisture.
- ▶ Protect against corrosion during longer standstill.
- ▶ Observe measures for storing and preservation.

1. ▶ Store cool and dry and protect against sunlight.
2. ▶ Observe the information on preservation.

7 Preservation

7.1 Preservation table

7 Preservation

7.1 Preservation table

Preservation has to be carried out additionally under the following conditions:

Type of delivery	Condition
Standard delivery	<input type="checkbox"/> Storage time exceeding six weeks <input type="checkbox"/> Unfavourable storage conditions such as high humidity, salty air, etc.
Delivery with long-term preservation	<input type="checkbox"/> Opened or damaged packaging

Tab. 8: Conditions for additional preservation

Note After a longer storage time the manufacturer recommends that you have the flowmeter recalibrated
➔ Maintenance, Page 24.

7.2 Preserving the inner surfaces

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Preservative (acid-free and resin-free oil)

- Close a connection of the flowmeter with a blind flange.
- Position the flowmeter vertically.
- Fill non-corrosive and resin-free oil into the pressure connection up to approx. 1 cm under the flange at the top while turning the measuring unit slowly, so that the measuring unit is also wetted.
- Close the upper connection with a blind flange.
- After about six months storage check the filling level of the oil and if necessary top up.

7.3 Preserving the outer surfaces

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Castrol Rustilo DWX 33 or other preservative offering comparable protection

- Paint or spray the preservative onto all plain and unpainted parts.
- At intervals of about six months check the preservation and if necessary repeat.

7.4 Removing the preservation

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvent <input type="checkbox"/> Collection tank



CAUTION

Risk of injury through discharging preservative.

- Wear personal protective equipment during all the work.
- Collect any discharging preservative safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

1. ➤ Remove one of the blind flanges.
2. ➤ Drain the flowmeter, collecting the preservative oil in a suitable vessel.
3. ➤ Remove the second blind flange.
4. ➤ Either remove the residual oil with solvent or flush the flowmeter with pumped liquid.

8 Installation, removal

8.1 Dangers during installation



The following safety instructions must be strictly observed:

- ☐ Have all work carried out by authorised qualified personnel only.
- ☐ Do not take the flowmeter apart.
- ☐ When installing a trace heating system, keep the compact sensor or Smart Solution electronic unit and associated cables free of thermal insulation ➤ Accessories, Page 36.

8.2 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.

8.3 Installing the flowmeter

8.3.1 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> 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 22.
2. ➤ After the connecting work clean the pipe system thoroughly ➤ Commissioning, Page 22.

8.3.2 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 7.

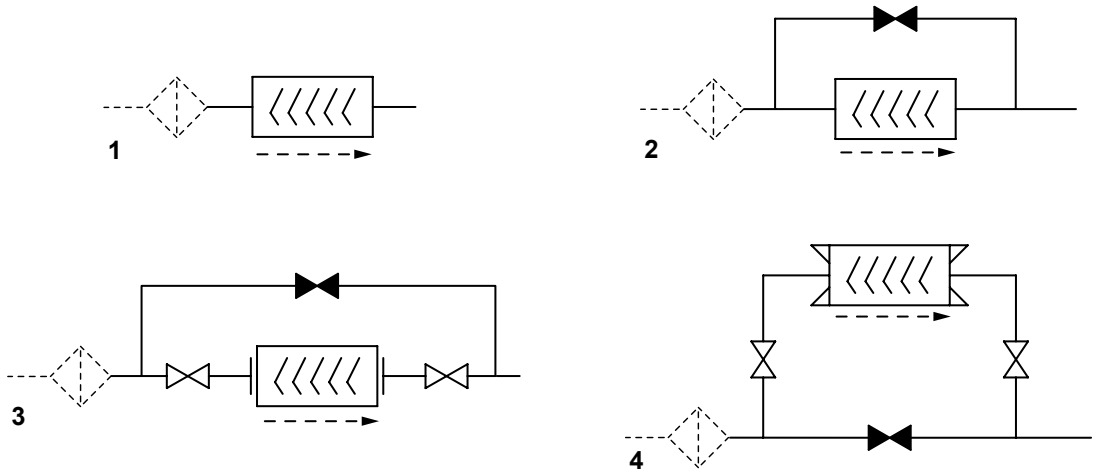


Fig. 10: Installation types

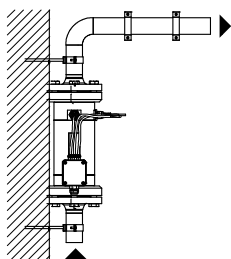
The arrow with dashed line identifies the preferred flow direction when an operating filter is used.

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

Tab. 9: Installation types

8.3.3 Installation recommendation

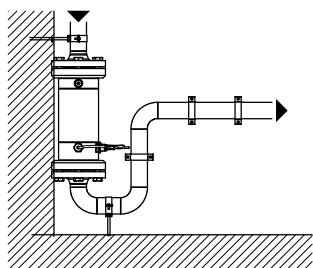
In order to avoid measuring errors observe the following recommendations of the manufacturer when installing the flowmeter in the pipe system.



Preferred installation variant:

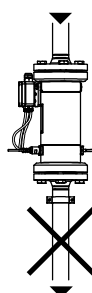
- Install the flowmeter vertically.
- Route the flow from the bottom upwards.

Recommendations for alternative installation variants



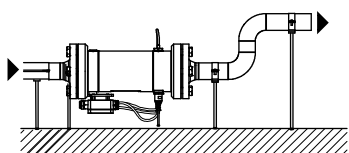
Alternative installation variant:

- Install the flowmeter vertically.
- Route the flow from the top downwards.
- Route the piping at the outlet upwards.



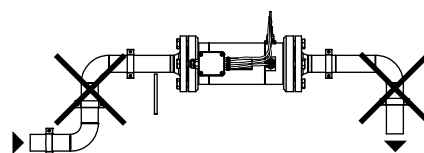
Source for measuring error:

- Lack of counter-pressure at the outlet through downward routing of the piping.



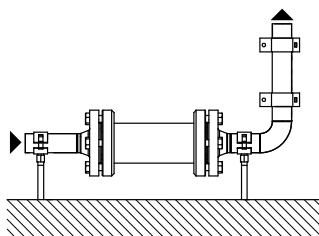
Alternative installation variant:

- Install the flowmeter horizontally.
- Route the piping at the outlet upwards.



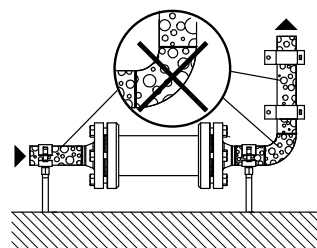
Source for measuring error:

- 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

8 Installation, removal

8.4 Removing the flowmeter

8.3.4 Installing the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> 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.

8.4 Removing the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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 14 and ↪ Preservation, Page 16.

9 Connection

9.1 Dangers during connection work



The following safety instructions must be strictly observed:

- ☐ All work on the flow meter and pipe system must only be carried out authorised qualified personnel.
- ☐ Ensure that solid particles cannot enter the flow meter and pipe system.
- ☐ Ensure that mechanical connections have been carried out without tension.
- ☐ Observe the tightening torques.
- ☐ Have all the work on the electrical equipment only carried out by electricians.
- ☐ Before beginning work on the flow meter ensure that the electrical power supply is de-energised and is secured against being switched back on.
- ☐ If the insulation of the electrical cables or wires is damaged, disconnect the power supply immediately.
- ☐ Ensure that the supply voltage is correct.
- ☐ The connection cable for the compact sensor or the Smart Solution electronic unit must be shielded and laid separately from the supply lines.
- ☐ Observe the instructions for connecting the compact sensor or the Smart Solution electronic unit ↪ Servicing, Page 25.
- ☐ Housing and flanges of the OME series KRAL flow meter are anodised. When installing the flow meter in a pipeline, electrical interruptions to the earthed pipeline system cannot be ruled out. A possible interruption of the earthing must therefore be taken into account by the operator.

9.2 Connecting the flowmeter to the pipe system

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Protective helmet <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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.

10 Operation

9.3 Connecting the flow meter electrically

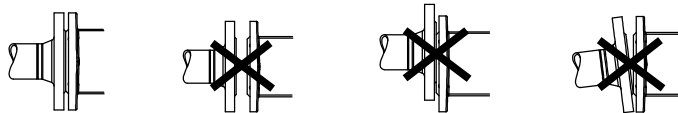
ATTENTION

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 37.

9.3 Connecting the flow meter electrically

- When electrically connecting the compact sensor or Smart Solution electronic unit, observe the relevant operating instructions and ↪ Servicing, Page 25.

10 Operation

10.1 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.

10.2 Commissioning

10.2.1 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.

Note Through the calibration, the internal components of the flowmeter are wetted with calibration liquid. If required, use an appropriate solvent to flush the flowmeter.

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 in front of the flowmeter, while observing the mesh width of the operating filter, see the following table.

The operating filter mesh width is based on the size of the flowmeter.

Parameter	Unit	Size			
		13	20	32	52
Max. mesh width	[mm]	0.10	0.10	0.25	0.25

Tab. 10: Operating filter mesh width

10.2.2 Checking the function

1. ▶ Check the flow direction of the flowmeter.
2. ▶ Check for leaks at the pipe thread/connecting flange.
3. ▶ Check the electrical installation.
4. ▶ Check the power supply.

10.2.3 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 17
- ✓ Flow meter connected to the pipeline network without tension
- ✓ Pipe system is free of impurities
- ✓ Pipe system vented
- ✓ Shut-off devices in the feed line and outlet opened

—▶ Switch on the measuring system.

- ⇒ Flow meter measures when the compact sensor or Smart Solution electronic unit generates a signal.

10.3 Decommissioning

10.3.1 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.

10.4 Recommissioning

10.4.1 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.

11 Maintenance

11.1 Required maintenance

Flowmeters are fundamentally maintenance-free. Under observance of the operating limits ↗ Technical data, Page 8, 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 heavy fuel oil with catalyst residues, plastic components 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.

11.2 Maintaining flowmeters

The following table lists signs of progressive wear of individual elements of the flowmeter:

Finding	Cause	Elimination
Increased running noises	Incipient damage to bearing	—► Replace the bearing.
Leakage	Damage to sealing	—► Replace the seals or dry sleeve.
Measured values not realistic	🔗 Troubleshooting, Page 32	—► 🔗 Troubleshooting, Page 32

Tab. 11: Check table for required maintenance

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots



WARNING

Risk of injury through emitted pumped liquid.

Pumped liquids can be hot, poisonous, combustible and caustic.

- Wear personal protective clothing during all the work. Ensure face protection.
- Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

1. ► Check the flowmeter visually and acoustically every four weeks.
2. ► Check for signs of wear as listed in the table above and eliminate the cause.

11.3 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.

The manufacturer provides the factory calibration as standard. If higher requirements are placed on the flowmeter, accredited calibration in accordance with EN/ISO/IEC 17025 is also possible.

12 Servicing

12.1 Dangers during servicing



The following safety instructions must be observed strictly:

- ☐ Have all work only carried out by authorized qualified personnel.
- ☐ To ensure the measuring precision, the measuring unit may only be replaced by the manufacturer.
- ☐ Before beginning work, let the flowmeter cool down slowly to the ambient temperature. Avoid rapid temperature changes.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic.
- ☐ Observe the tightening torques 🔗 Appendix, Page 37.
- ☐ Observe the operating instructions and data sheets of the sensors.

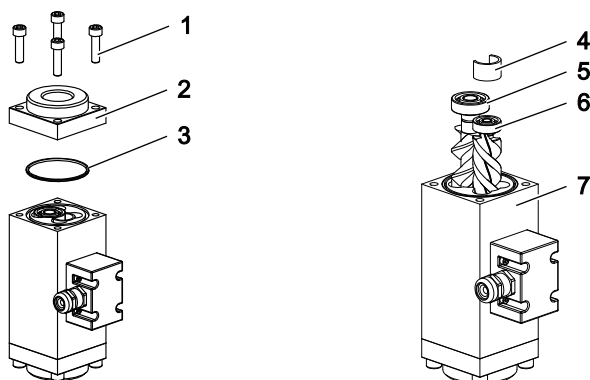
12.2 Flowmeter

12.2.1 Removing seals and ball bearings

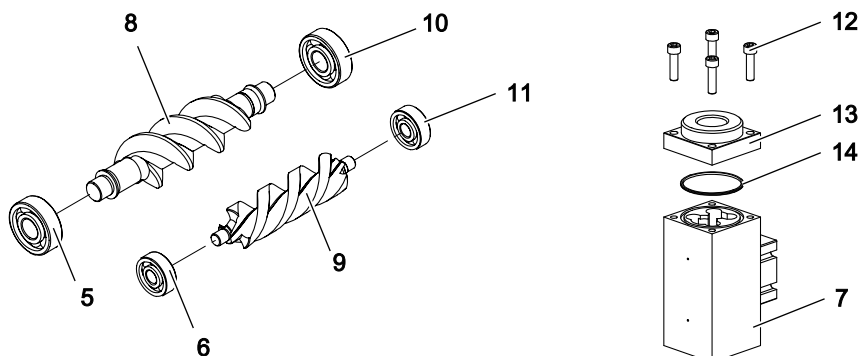
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Extractor

Requirement:

✓ Flowmeter removed from system



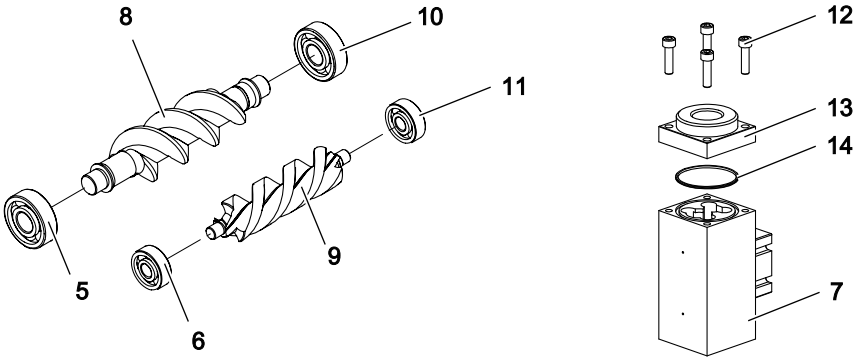
1. ➤ On the outlet side remove the socket screws **1**, take off the end cover **2** and O-ring **3**.
2. ➤ Remove the screw set with ball bearings and spacer sleeve **4** from the measuring housing **7**. Note the assembly for later re-assembly. Remove the spacer sleeve.



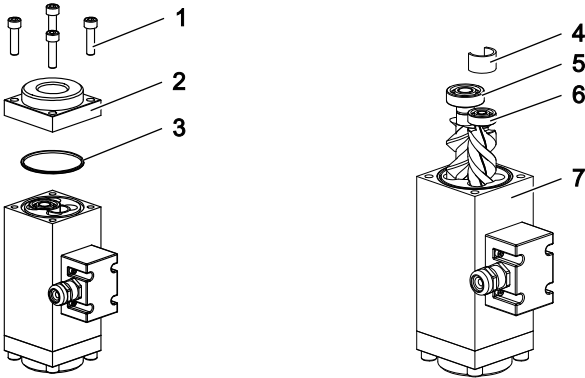
3. ➤ Pull the ball bearings **5**, **6**, **10** and **11** off the measuring screws **8**, **9**. Use an extractor to do this.
4. ➤ Remove the socket screws **12**, take off the end cover **13** and O-ring **14**.
5. ➤ Clean all the parts using a suitable detergent.

12.2.2 Installing seals and ball bearings

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Torque wrench



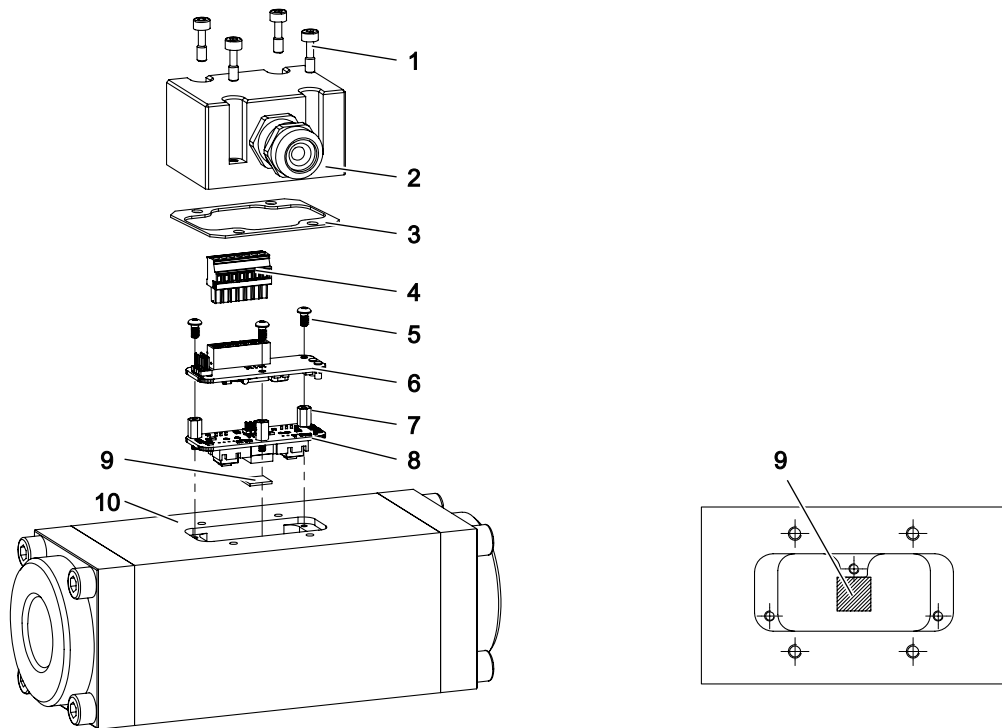
1. ➤ Insert the O-ring 14 into the measuring housing 7. Position the end cover 13, tighten the socket screws 12 with torque.
2. ➤ Press ball bearings 5, 6, 10 and 11 onto measuring screws 8, 9.
Note: Press on via inner ring only!



3. ➤ Slide the screw set into the measuring housing. Pay attention to the assembly and insert the spacer sleeve 4 flush into the bore of the small measuring screw 9.
4. ➤ Insert the O-ring 3 into the measuring housing and place the end cover 2. Tighten the socket screws 1 with torque,

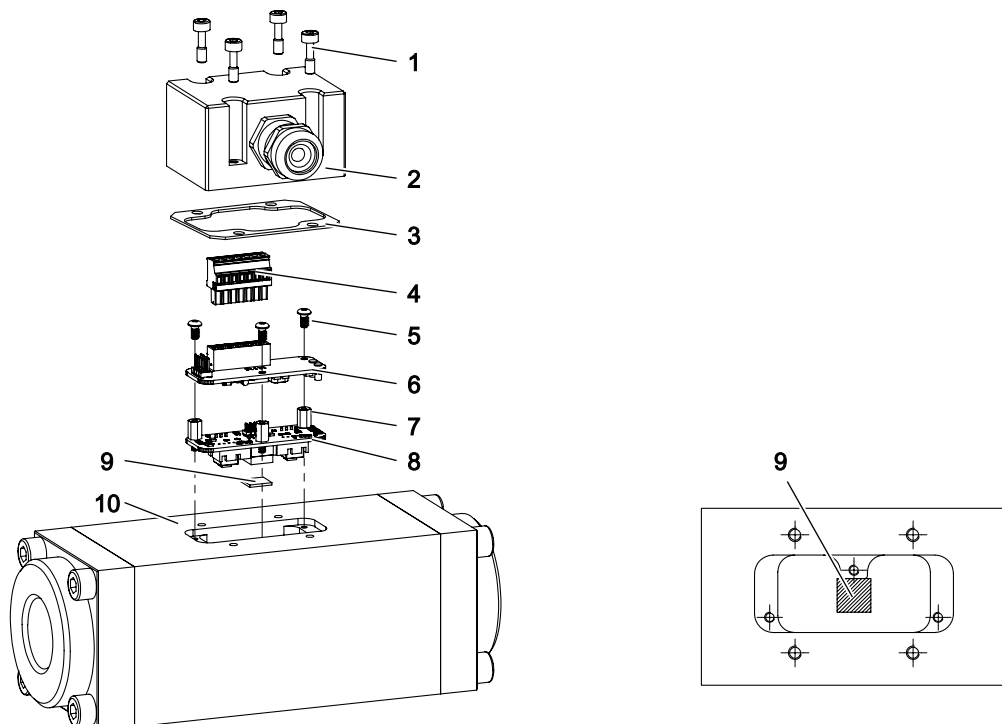
12.3 Compact sensor

12.3.1 Removing the sensor insert



1. ➤ Loosen the cable gland from the cover of the compact sensor 2.
2. ➤ Loosen the cylinder screws 1, remove the cover of the compact sensor and the flat gasket 3.
3. ➤ Pull the PCB connector 4 off the upper board 6.
4. ➤ Loosen the screws 5 and remove the upper board.
5. ➤ Loosen the hexagonal spacer 7 and remove the lower board 8 from the sensor bore.
6. ➤ Remove the heat conducting foil 9 from the sensor bore in the measuring housing 10.

12.3.2 Installing the sensor insert



1. ➤ Clean the sensor bore in the measuring housing **10**.
2. ➤ Remove the protective foil from new heat conducting foil **9** and stick the heat conducting foil at the bottom of the sensor bore,
3. ➤ Insert the lower board **8** into the sensor bore and screw it tight with hexagonal spacers **7**.
4. ➤ Fit the upper board **6** and fix it with screws **5**.
5. ➤ Plug the PCB connector **4** onto the upper board. See compact sensor assignment table.
6. ➤ Insert the flat gasket **3** into the cover of the compact sensor **2**.
7. ➤ Put on the cover of the compact sensor and fix it with cylinder screws **1**.
8. ➤ Fasten the cable gland to the cover of the compact sensor.

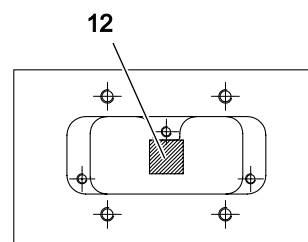
Terminal strip	Designation	Terminal strip	Designation
1	0 V	5	Com. t
2	10 – 30 V	6	Com. t
3	Sig. 1 Q	7	Sig. t
4	Sig. 2 Q		

Tab. 12: Compact sensor assignment table

12.3.3 Check the function of the compact sensor

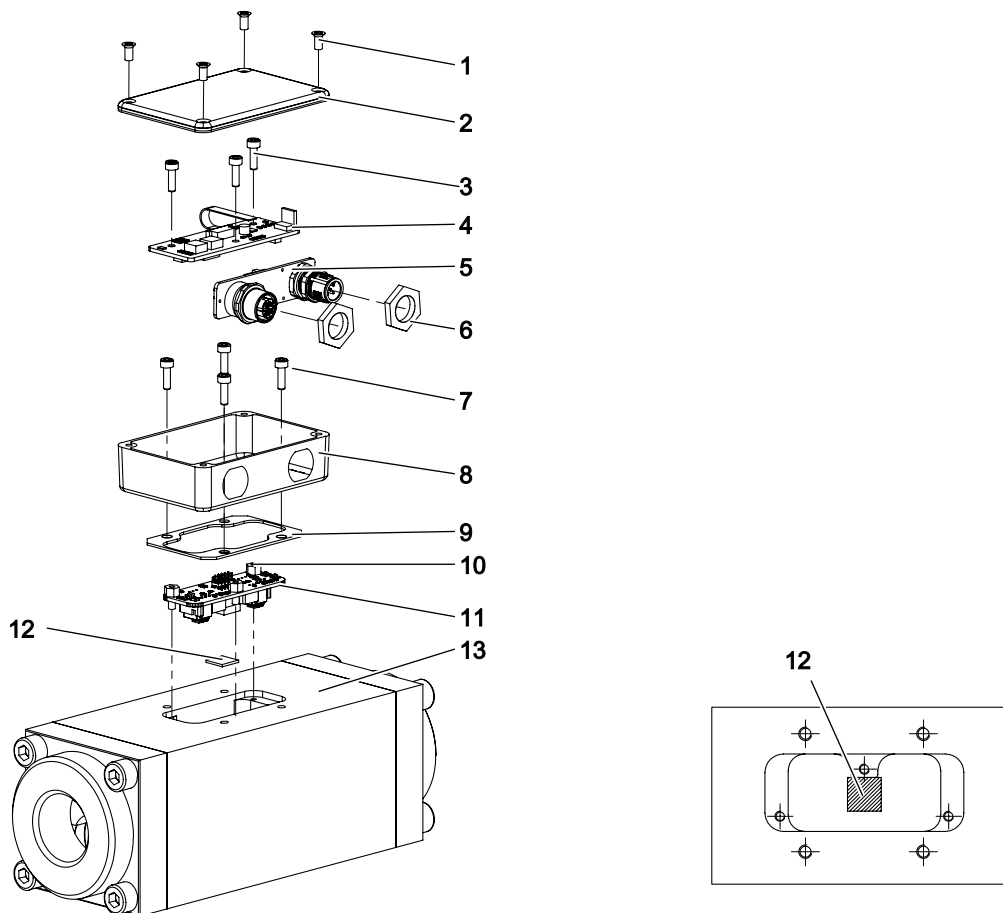
1. ➤ Pick up:
Simulate low flow and measure signal voltages between terminal strips 1 and 3, as well as between 1 and 4.
The signal voltages should alternate between approx. 1 and 21 V DC.
The green LED for the power supply should light up continuously, the yellow LED for the signal should flash as follows: 1 pulse lit, 3 pulses interval, etc.
2. ➤ Temperature sensor:
Remove connections at terminal strip 5, 6 and 7 and measure the following resistances at the three-wire Pt100.
The resistance between terminal strips 5 and 6 should be less than 1 Ω at 20 °C.
The resistance between terminal strips 6 and 7 should be approx. 108 Ω at 20 °C.

12.4.1 Removing the Smart Solution electronics unit



1. ➤ Loosen the Phillips screws **1** and remove the cover **2** of the Smart Solution electronics unit.
2. ➤ Loosen the plug connection between the upper board **4** and the cable connection **5**.
3. ➤ Undo the socket screws **3** and remove the upper board.
4. ➤ Undo the hexagon nuts **6** on the cable connection and remove the cable connection from the housing **8**.
5. ➤ Loosen socket screws **7** and remove the housing.
6. ➤ Remove sensor insert **11**, see Removing the sensor insert.

12.4.2 Installing the Smart Solution electronics unit



1. ➤ Install the sensor insert **11**, see Installing the sensor insert.
2. ➤ Place the housing **8** on the flat gasket **9** and screw it tight with socket screws **7**.
3. ➤ Guide the cable connection **5** through the holes in the housing and tighten with hexagon nuts **6** with a torque of 2 Nm.
4. ➤ Insert the upper board **4** into the housing and screw it tight with socket screws **3**.
5. ➤ Make the plug-in connection between the upper circuit board and the cable connection.
6. ➤ Place the cover **2** on the housing and fasten with Phillips screws **1**.

12.4.3 Testing the Smart Solution electronics unit

- For functional testing of the Smart Solution electronic unit, see the relevant operating instructions.

13 Disposal

13.1 Dangers during disposal

13 Disposal

13.1 Dangers during disposal



The following safety instructions must be observed strictly:

- ☐ Neutralize residues.

13.2 Dismantling and disposing of the flowmeter

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvents or industrial cleaners suitable for the pumped liquid <input type="checkbox"/> 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.

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.

14 Troubleshooting

14.1 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

14.2 Troubleshooting

Fault identification							Cause	Remedy
1	–	–	–	–	–	–	Seal preload too low	<ul style="list-style-type: none"> ➔ Preload the screws.
1	–	–	–	–	–	–	Seal damaged	<ul style="list-style-type: none"> ➔ Replace the seal. ➔ Check the chemical resistance of the seal.
–	2	3	–	5	–	–	Foreign particles in the liquid and/or flowmeter	<ul style="list-style-type: none"> ➔ Dismantle the flowmeter and clean it. ➔ Use the commissioning filter.
–	–	3	–	5	–	–	Compact sensor faulty	<ul style="list-style-type: none"> ➔ Test the compact sensor. ➔ Replace compact sensor.
–	–	3	–	5	6	–	Compact sensor incorrectly connected	<ul style="list-style-type: none"> ➔ Check the connection of the compact sensor. ➔ Check the power supply of the compact sensor.
–	–	3	–	5	6	–	Smart Solution electronics unit faulty	<ul style="list-style-type: none"> ➔ Test the Smart Solution electronics unit, observing the operating instructions of the Smart Solution electronics unit. ➔ Replace Smart Solution electronics unit.
–	2	3	–	–	–	–	Inlet pressure too low	<ul style="list-style-type: none"> ➔ Increase the inlet pressure.
–	–	–	4	–	–	–	Viscosity of the liquid too high	<ul style="list-style-type: none"> ➔ Increase the temperature. Observe the temperature range in the process.
–	–	3	–	–	–	–	Flow rate too low	<ul style="list-style-type: none"> ➔ Increase the flow rate. -or- Use a flowmeter with a suitable size. -or- Use linearisation. Note the operating instructions of the electronic equipment.
–	–	–	4	–	–	–	Flow rate too high	<ul style="list-style-type: none"> ➔ Reduce the flow rate. -or- Use a flowmeter with a suitable size.
–	–	–	–	5	–	–	Airlocks	<ul style="list-style-type: none"> ➔ Deaerate the system and check for leaks.
–	–	–	–	5	–	–	Outgassing	<ul style="list-style-type: none"> ➔ Increase the system pressure. ➔ Reduce the temperature.
–	–	–	–	5	6	–	Pulsations too high	<ul style="list-style-type: none"> ➔ Use another feed pump. ➔ Carry out changes to the system. ➔ Use OMG series.
–	–	–	–	5	–	–	Back pressure too low	<ul style="list-style-type: none"> ➔ Increase the back pressure.

14 Troubleshooting

14.2 Troubleshooting

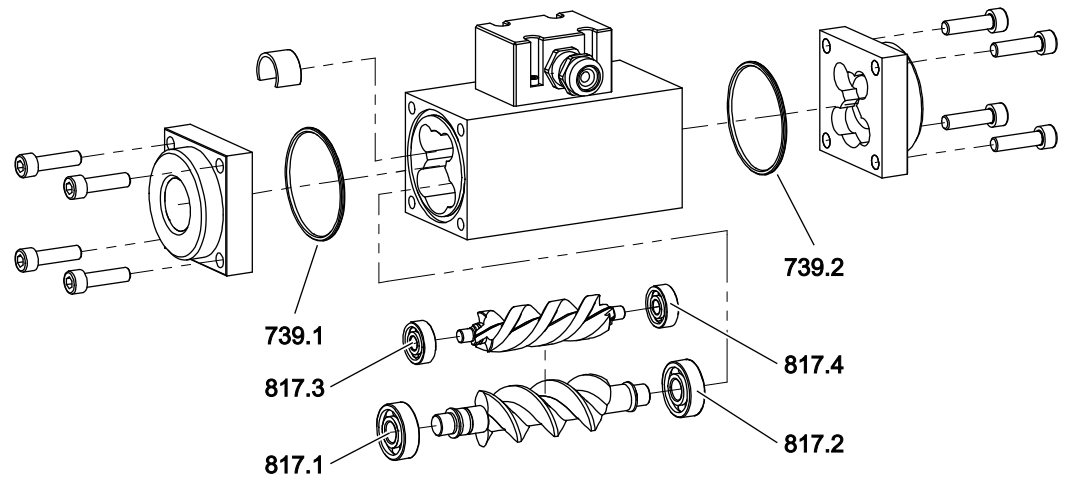
Fault identification							Cause	Remedy
-	-	-	-	5	6	-	Flow rate fluctuations too high	<div> <div></div> <div> Ensure a continuous flow rate by taking suitable measures (using a different pump, valve, damper, etc.). -or- Smooth out the display. Note the operating instructions of the electronic equipment. </div> </div>
-	-	3	-	5	-	-	Insufficient filling amount	<div> <div></div> <div> Use a flowmeter with a suitable size. Use OMG series. </div> </div>
-	-	-	-	5	-	-	Significant deviations in operating data	<div> <div></div> <div> Use a flowmeter from a suitable series. Adapt the operating data to the flowmeter. </div> </div>
-	2	3	4	5	-	-	Measuring unit and bearing wear	<div> <div></div> <div> Replace the measuring unit. Replace the bearings. Filter out the abrasive materials. </div> </div>
-	-	-	4	5	-	-	Sluggishness through deposits	<div> <div></div> <div> Disassemble the flowmeter and clean it carefully. </div> </div>
-	2	3	-	-	-	-	Flow impaired at the system end	<div> <div></div> <div> 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. </div> </div>
-	2	3	-	-	-	-	Flowmeter switched to bypass	<div> <div></div> <div> Switch the flowmeter to through-flow. </div> </div>

Tab. 13: Fault table

15 Spare parts

15.1 Seal and ball bearing kit OME 13 - 52

Note The repair kit contains only the numbered parts and is only supplied complete.



Qty.	Item No.	Part	Qty.	Item No.	Part
1	739.1	O-ring	1	739.2	O-ring

Tab. 14: Seal kit OME 13 - 52

Qty.	Item No.	Part	Qty.	Item No.	Part
1	817.1	Deep-groove ball bearing	1	817.3	Deep-groove ball bearing
1	817.2	Deep-groove ball bearing	1	817.4	Deep-groove ball bearing

Tab. 15: Ball bearing kit OME 13 - 52

15.2 Sensor insert for compact sensor

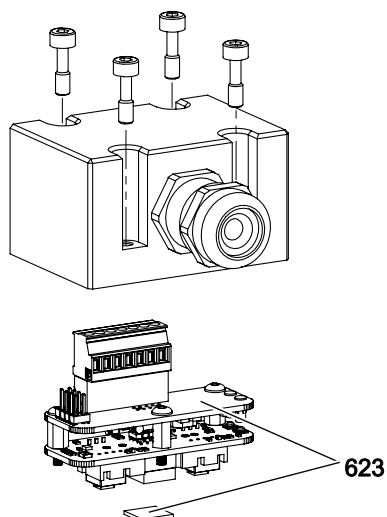


Fig. 11: Sensor insert

Qty.	Item no.	Part
1	623	Sensor insert (including heat conducting foil)

15.3 Smart Solution electronic unit

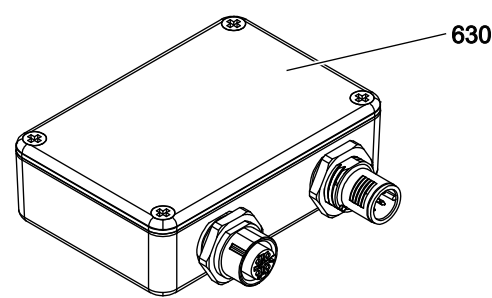


Fig. 12: Smart Solution electronic unit

Qty.	Item no.	Part
1	630	Smart Solution electronic unit

16 Accessories

16.1 Trace heating

The installation of a factory-fitted heating system is not intended. Optionally, KRAL OME series flow-meters can be equipped with a trace heating system provided by the customer. The manufacturer recommends heating systems for high-viscosity liquids that do not flow sufficiently if not heated, since this can lead to bearing damage and destruction of the unit.

Contact the manufacturer before installing trace heating provided by the customer.

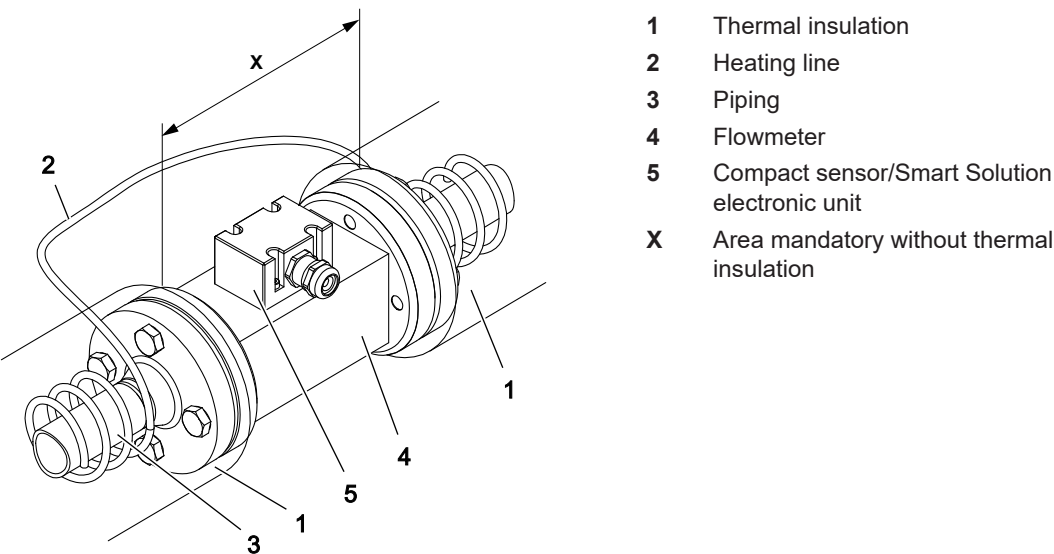


Fig. 13: Flowmeter with trace heating (principle diagram)

ATTENTION

- Faulty compact sensor or Smart Solution electronic unit or wiring due to exceeding the maximum temperature.**
- ▶ Do not heat the compact sensor or Smart Solution electronic unit and associated cables above the temperature specified in the relevant operating instructions.
 - ▶ For values see specification, ↗ Technical data, Page 8
- ▶ Make sure that the compact sensor or Smart Solution electronic unit **5** and associated cables are not heat-insulated, i.e. area **X** must remain free of heat insulation.

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

17 Appendix

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

Tightening torque [Nm]							
Screws with head contact surface					Countersunk screws		
Thread					Stainless steel screws A2 and A4		8.8
	5.6	8.8	10.9	8.8+ Alu*	Property class 70	Property class 80	
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. 16: 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.

17.2 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. 17: Tightening torques with thread measured in inches

17.3 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
2014/34/EU	Directive on Use in Potentially Explosive Areas (ATEX)	Only for machinery in ATEX version

Tab. 18: Directives observed



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