Operating Instructions

for

Flow Meter

Model: KDF-9/KDG-9

Contents

Manufactured and sold by:

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1 Applications

1.1 KDF-9 / KDG-9

The flow meter can be used for measuring the flow of liquid and gaseous products in pipes.
It shows the current flow in volume or mass per unit time.
Applications:
Measuring the flow of liquid and gaseous products in pipes as well as dosing, superimposing, monitoring, regulating and controlling them.

1.2 KDF-9 / KDG-9 differential pressure regulator

The flow meter can be used for stabilizing a constant flow of liquid and gaseous products in pipes. The flow is kept constant regardless of pressure changes during product inflow for type KDF-9 / KDG-9-...E/F or of a pressure change during product outflow for type KDF-9 / KDG-9-...A/B.
Applications: Constant dosing, level measurement in open and closed vessels, N_2 superposition of combustible media
Caution: The devices should be used with the greatest possible caution to measure potentially hazardous liquids and (especially) gases. Precautionary measures must be taken to protect personnel and equipment from any potential danger or damage due to glass-tube breakage. The plant operator is fully responsible for using the devices. Where possible, we recommend the use of metal devices such as type KDS.

2 Operational mode and system design KDF-9/KDG-9

Float principle:
The product flows through the meter vertically from the bottom to the top. The height of the float in the measuring tube is a measure of the flow quantity. The float is in equilibrium between the buoyant force of the flowing medium and the counteracting force of gravity on the float. The measured value is displayed on the measuring-tube scale with the upper edge or the indicator edge of the float (ball).

2.1 KDF-9 / KDG-9 system design

The meter consists of a conical measuring tube made of glass containing a float that can move vertically. The height of the float in the measuring tube reproduces the calibrated flow quantities on the measuring tube.

2.2 Measuring principle for KDF-9 / KDG-9

Differential pressure regulator
The diaphragm of the controller is in a state of equilibrium when the pressure conditions are the same on both sides. The pressure on the input side is determined by the pressure of the product; the pressure on the output side is determined by the pressure drop of the setting valve of the flow meter.
If either the inlet or outlet pressure changes, the change in pressure is compensated by the built-in diaphragm valve - thus maintaining a constant set flow rate.
Important: The controller can only regulate inlet or outlet pressure fluctuations. Steady pressure conditions must prevail on the other side.

2.3 KDF-9 / KDG-9 system design

The unit consists of a KDF-9/KDG-9 variable-area flow meter, equipped with a diaphragm differential pressure flow controller. The variable-area flow meter consists of a device fitting with an integrated measuring tube made of glass that contains a vertically movable float and the valve for setting the flow rate. The differential pressure flow controller is made of stainless steel and consists of a diaphragm made of Viton or PTFE and a compensating valve made of stainless steel. For gaseous products, two versions are available:
KDF-9/KDG-9-...A/B for a constant inlet pressure and a variable outlet pressure
KDF-9/KDG-9-...E/F for a constant outlet pressure and a variable inlet pressure
For liquids, both versions can be used; however, the **KDF-9/KDG-9-…A/B** version should be preferred.

3 Input

3.1 Measured variable:

Volume flow

3.2 Measuring range:

(lower-range and upper-range values)
Measuring span water 20 °C KDF-9:
Smallest measuring range: 0.02-0.25 l/h water Largest measuring range: 10-100 l/h water
Measuring **span air 20°C, 1,013 bar abs. KDG-9**
Smallest measuring range: 2-20 Nl/h air Largest measuring range: 300-3000 Nl/h air
Measuring /controlling range for E/F/A/B (option diff.pressure regulator)
Span: 10-100%
Smallest measuring/controlling range
0.02-0.25 l/h water 2-20 Nl/h air
Largest measuring/controlling range
10-100 l/h water 300-3000 Nl/h air
Measuring range table
All measuring range values with fully opened valve, * Restricted contact adjustment range / contact only adjustable as minimum contact

Measuring ranges water 20 °C					Measuring ranges air 1,013 bar abs., 20 °C				
Float st. 1.4401 (316L) / glass					Float st. 1.4401 (316L) / glass				
Range N°	Water l/h	ø Float (mm)	ø Valve seat (mm)	Press. loss (mbar)	Range N°	air l/h	ø Float (mm)	ø Valve seat (mm)	Press. loss (mbar)
91	0.02-0.25	glass	2.8	2	88	2-20	glass	2.8	1
92	0.08-0.7	glass	2.8	3	89	4-40	glass	2.8	2
79	0.1-1	1.4401	2.8	2	70	5-50	1.4401	2.8	1
80	0.25-2.5	1.4401	2.8	3	71	10-100	1.4401	2.8	2
81	1.0-10	1.4401	2.8	3	90	12-120	glass	2.8	2
82	1.5-16	1.4401	2.8	5	72	25-250	1.4401	2.8	2
83	2.5-25	1.4401	2.8	5	73	30-350	1.4401	2.8	2
84	4-40	1.4401	2.8	5	74	50-450	1.4401	2.8	3
85	5-65	1.4401	2.8	5	75	60-800	1.4401	2.8	3
86	6-63	1.4401	2.8	6	76	120-1200	1.4401	2.8	3
87	10-100	1.4401	2.8	6	77	200-2000	1.4401	2.8	3
					78	300-3000	1.4401	2.8	3

4 Electrical output (option)

1 inductive limit switch
Mono- or bistable

4.1 Ad-on limit switches Type RC 10/15-14-XX, Manufacturer Pepperl & Fuchs

Monostable	Type	RC 10/15-14-N0
Bistable	Type	RC 10/15-14-N3

4.2 Ad-on limit switches Type N7R**A, Manufacturer ifm electronic

Monostable	Typ	N7R28A (Inside diameter 10mm) N7R30A (Inside diameter 15mm)
Bistable	Typ	N7R29A (Inside diameter 10mm) N7R31A (Inside diameter 15mm)

5 Measuring accuracy

5.1 Reference conditions:

Water 20°C (air 20°C; 1, 013 bar abs)

5.2 Measured error

(Liquid/Gas): ±3% qG=50% acc.. VDE/VDI 3513 page 2
E/F/A/B (option diff.pressure regulator): ± 3, 5 % / ± 5 % FS within 10-100% of the range

5.3 Repeatability

(Liquid/Gas) ± 1.0 % FS,
E/F/A/B (option differential pressure regulator): ± 1, 5 % / ± 2, 5 % FS within 10-100% of the range

5.4 Influence of ambient temperature

none

5.5 Influence of fluid temperature

Deviations in fluid temperature from the temperature observed during calibration can result in a proportional display fault because of the corresponding change in density and viscosity.

6 Conditions of use

The VDI/VDE guidelines must be observed.
The devices can be used for:
- liquid products that are sufficiently free-flowing, are free of solids, do not bond or do not tend to settle.
- gases with linear flow behavior and an adequate inlet pressure.

V/N(option differential pressure regulator)
The minimum differential inlet and outlet pressures must be 350 mbar.

Please refer to the instructions for potentially hazardous products in Section 1.2.

6.1 Mounting / start-up

When starting up the flowmeter, the following points must be observed:

- The variable-area flow meter must be installed perpendicularly (direction of flow from the bottom to the top).
- Take special care to install glass-tube devices free from strain.
- The size of the product line to be connected must be identical to the size of the device connection.
- All instruments are shipped with the valve installed at the inlet. By turning the glass tube resp. the fitting, the valve also can be installed at the outlet.
- **E/F/A/B** (option diff.pressure regulator): When using gases, the version for a constant inlet pressure with "valve at the top" and for a constant counter pressure with "valve at the bottom" should be used. If liquids are involved, the position of the valve does not have any impact on the function of the meter.
- Slowly open the shut-off valve upstream and downstream of the flowmeter.
- When measuring liquids, vent the pipes carefully.
- When measuring gases, increase pressure slowly.
- Void float impact (e.g. caused by solenoid valves), as this is likely to damage the measuring section or float.

6.2 Ambient conditions

6.2.1 Ambient temperature ranges

-20°C to +100°C (with limit switch -20° +70°C) **(risk of breakage due to frost)**

6.2.2 Storage temperature

-20°C to +100°C

6.2.3 Climatic category

Weather-protected and/or unheated locations

6.2.4 Degree of protection

IP65 (EN60529)

6.2.5 Shock resistance/vibration resistance

The meter should be protected from shocks and vibrations, which could cause damage.

6.2.6 Electromagnetic compatibility

Built in limit switch:
acc. NAMUR recommendation NE 21
Product standard: EN 60947-5-2: 2004

6.3 Fluid conditions

6.3.1 Fluid temperature ranges

without limit switch -20°C to + 100°C
with limit switch -20°C to + 70°C **(risk of breakage due to frost)**

6.3.2 Fluid pressure limit

16 bar (at 20 degrees Celsius)
Important:
All pressure values are for non-hazardous liquids and for devices installed free from strain.
For **E/F/A/B,** (option differential pressure regulator) the maximum unilateral pressure resistance of the diaphragm is **7 bar**.

6.3.3 Inlet and outlet sections

Inlet and outlet sections are not required for a linear flow profile of the fluid.

6.3.4 Physical state:

Liquid or gaseous

6.3.5 Pressure for gas measurement

The measured values only apply to the calibrated fluid data stated on the scale. Any change or deviation in pressure will cause a display fault.

6.3.6 Pressure loss

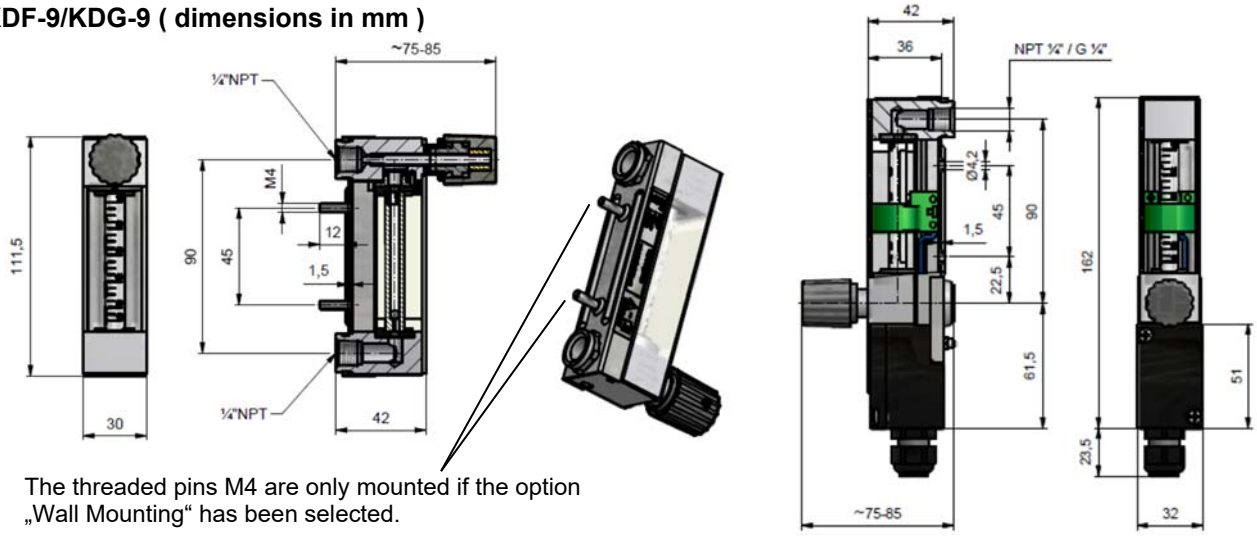
Depends on the measuring range. (see measuring range tables in Section 3.2)

7 Design details

7.1 Design/dimensions

The meter consists of a conical measuring tube made of borosilicate glass with a vertically movable float made of stainless steel or glass. The measuring tube is installed in the device fitting and does have a horizontal connection on the rear.
The standard version of the device is equipped with an adjusting valve at the outlet

KDF-9/KDG-9 (dimensions in mm)



The threaded pins M4 are only mounted if the option „Wall Mounting“ has been selected.

7.2 Design / dimensions / operating details E/F/A/B (option differential pressure regulator)

Differential pressure regulators are used to achieve constant flow values at variable inlet and outlet pressures.

➔ Differential pressure regulators are not pressure reduction valves

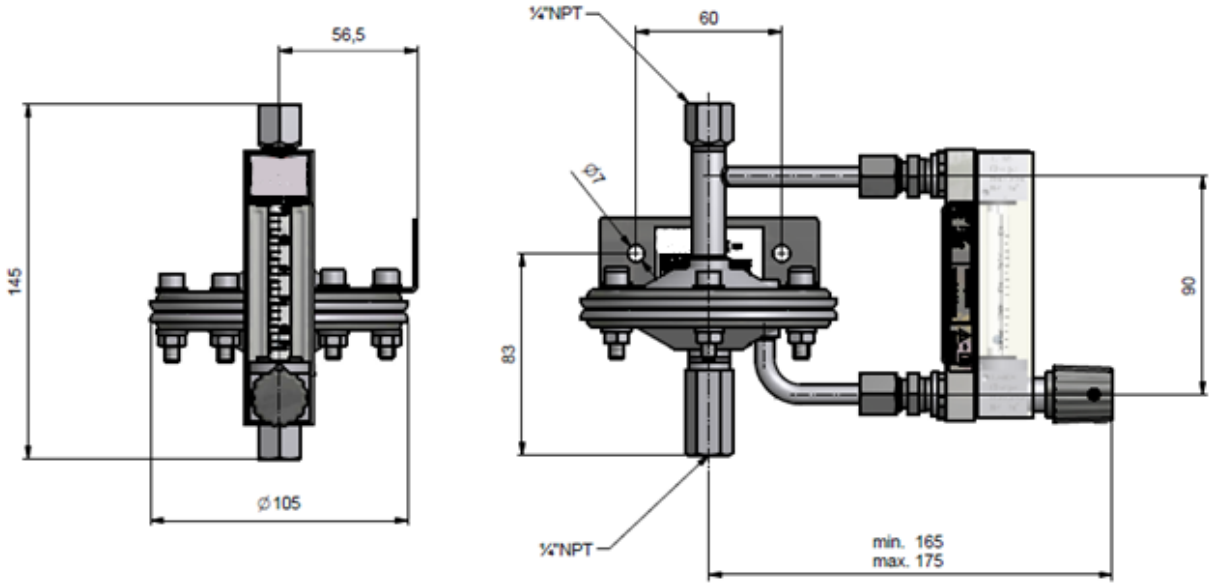
The measuring device consists of variable area flowmeter with control valve and mounted differential pressure regulator.
The flow amount will be adjusted via the integrated adjusting valve.

The max.one side pressure resistance of the regulator membrane is 7 bar. If the operating pressure exceeds 7 bar, the control valve must not be fully closed as this leads into overstressing the membrane.

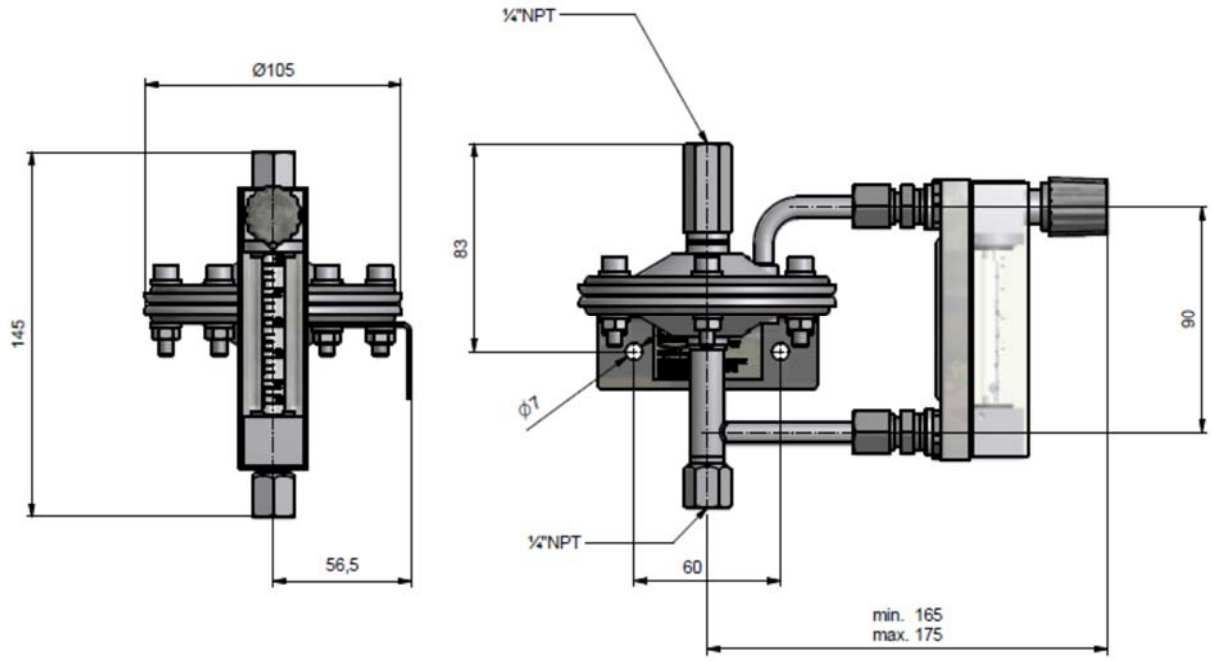
IMPORTANT OPERATION DETAILS

- ➔ The installation of any valve before the inlet and outlet of the instrument shall be avoided
- ➔ Initial operation / start up of the process only with opened control valve
- ➔ When operating any gas the inlet pressure shall be increased slowly to avoid strong pressure peaks
- ➔ Any operation of the instrument trough any solenoid valve shall be avoided, this will prevent the float will be thrown upwards heavily.
- ➔ For the operation of the regulator minimum inlet pressure are required.
  Regulator with constant outlet pressure: 350 mbar
  Regulator with constant inlet pressure: 350 mbar

7.2.1 Dimension drawing KDF-9/KDG-9-…E/F with conn. ¼“ NPT (F) as regulator c/w constant outlet pressure



7.2.2 Dimension drawing KDF-9/KDG-9-...-A/B with conn. ¼“ NPT (F) as regulator c/w constant inlet pressure



7.3 Weights:

KDF-9/KDG-9: 0.4 kg, KDF-9/KDG-9…E/F/A/B: 0.8 kg

7.4 Materials:

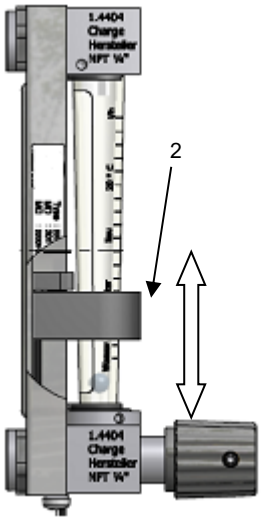
Fitting, connections, setting valve: 1.4404 (316L)
Float 1.4401 / glass
Seals measuring tube:viton, FFKM (option)
Valve: PTFE, Hoses: PVC
E/A (option differential pressure regulator)
Controller/control pipes: 1.4301

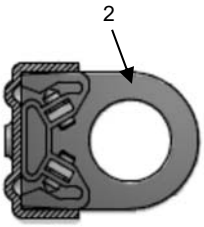
7.5 Process connection:

NPT¼“ (F)
Special connections: Ermeto, Swagelok, G ¼“, Hose connector 8 mm
Important: Other connections are available as special versions

8 Electrical connection for limit switch (option)

with cable end length of 2 m

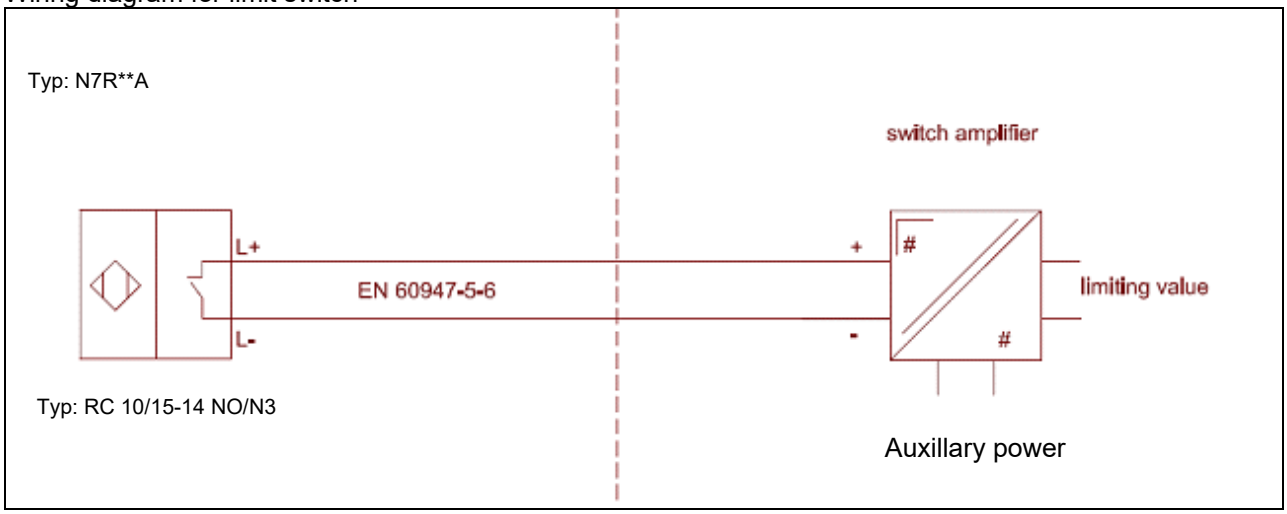




The limit switch (ring form) can be adjusted alongside of the measuring tube. It is fixed via two screws (1) at the back wall of the instrument.
Adjusting of the contact:
-unlock the fixing screws (1)
-move contact (2) to bottom or top
-lock fixing screws (1)

ATTENTION: (limited switching range)
Measuring ranges 78, 78 and all ranges with glass float cannot be equipped with contact. For the measuring tubes N° 77 and 86 the contact cannot be moved to the max. flow range.

Wiring diagram for limit switch



9 Indicator unit

Direct indication via the position of the float in the measuring tube

10 CE marking

The measuring system meets the statutory requirements of the following EU directives: Electromagnetic Compatibility (EMC) Directive 2014/30/EU.
With respect to the Pressure Equipment Directive 2014/68/EU, the devices fall within the scope of application of Article 4, Section 3, and need no CE mark in accordance with this directive.
Kobold Messring confirms compliance with the directives by attaching the CE mark.

11 Available accessories

1 inductive limit switch ; mono-stable or bi-stable
Special connections

12 Order information

Please include the following information in your order: Product data,(specific weight, temperature, pressure, viscosity) material design, connection size, measuring range, desired accessories, required approvals and material certificates.

13 Standards and directives

Measuring range rated and converted to other products according to VDE/VDI guidelines 3513
Directive 2014/68/EU (Pressure Equipment Directive)
For the electrical sensor
EN 60079-0 General regulations
EN 60079-11 instrinsically safeness
Guideline 2014/30/EU (EMC guidleine)
NAMUR recommendation NE 21
EN 60529 – Degrees of protection through housing (IP code)
EN 61010-1 – Safety requirements for electrical measuring, control and laboratory devices

14 Safety instructions

14.1 Intended use

The KDF-9/KDG-9 variable-area flow meter may be used only for flow measurements of fluid and gaseous media. The manufacturer shall not be liable for damage that may result from improper or unintended use.
When dealing with an aggressive medium, clarify the material durability of all wetted parts.

14.2 Installation, start-up and operating personnel

Only trained specialists authorized by the system operator may carry out the installation, electrical installations, start-up, maintenance and operation. They must read and understand the operating manual and follow its instructions.
Basically, follow the conditions and provisions applicable in your country.

15 Packaging, storage and shipment

Carefully unpack the device to avoid damaging it. With the help of the delivery note enclosed in the packaging, check whether all technically relevant data coincide with your requirements.
Storage and installation must be done in a clean and dry room so that contamination – especially of the interior of the fitting – is avoided. Follow the limit values for ambient temperature.
When transporting the device to a remote mounting location, we recommend that you reuse the factory-issued packaging and the transport protection.

16 Maintenance

If you use the meter in the intended manner special maintenance is not necessary. However, the variable area flow meter should be checked in the context of the routine maintenance of the facility and the pipelines. You have to eighth especially for dirt, corrosion denudation, mechanical wear as well damage at the glass cone. We recommend checking the meter once a year.
In the recurrent pressure test of the system, the maximum allowed pressure test PT (see name plate) must not be exceeded.

Attention
If cleaning of the float or of the measuring cone is necessary due to contamination, please note following items:

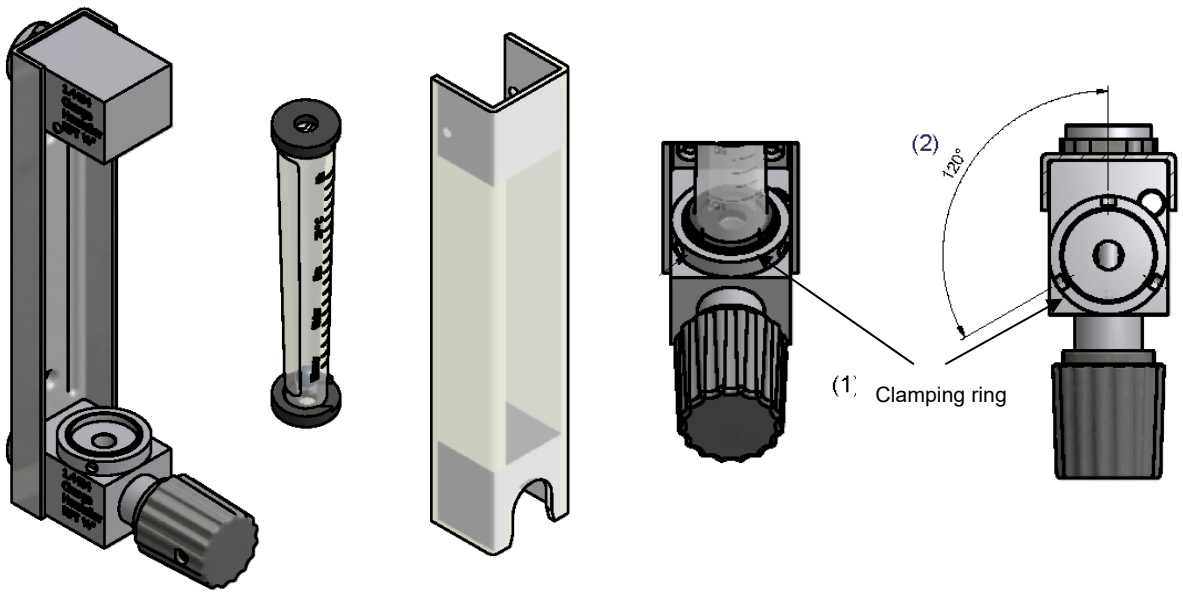
- Before removing a device, make sure that the pipe line is empty (no product residues) depressurized and cooled.
- For devices that are used to measure corrosive or hazardous media, appropriate security precautions have to be taken regarding any remaining liquid in the measuring unit
- Avoid electrostatic charging of surfaces when cleaning non-conductive surfaces (e.g. protective hood)
- Having dismantled the device, dirt on the inside of glass measuring cones can be gently cleaned with a brush and appropriate media.
- When assembling and reinstalling the system always new gaskets have to be used.

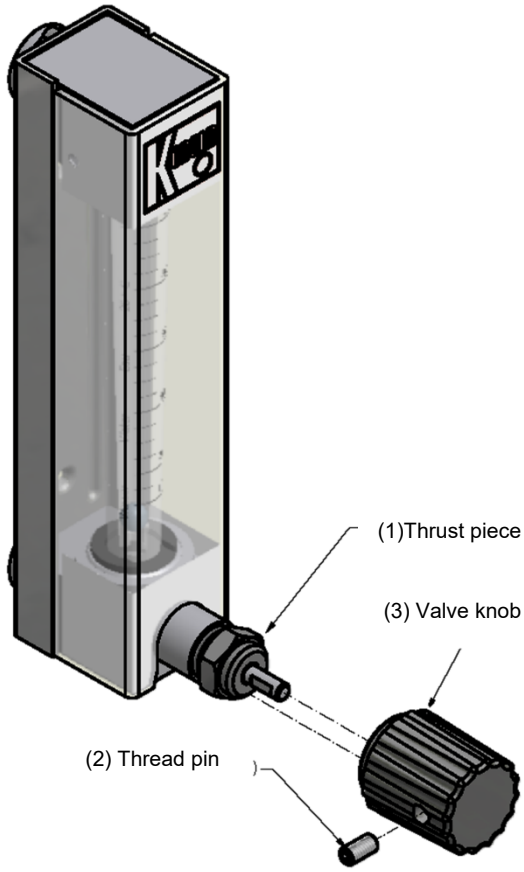
Replacing the measuring cone
Removal:

- Close valve in front and behind the unit
- Close needle valve of the device
- Shift protective cover upwards and remove to the front.
- By turning the adjusting ring at the unit base counterclockwise the measuring glass can be loosened and removed.

Installation:

- Installation has to be carried out in reverse order
- The measuring glass is fixed by clamping the adjusting ring on the unit base hand tightened
- With a 3 mm pin the clamping ring is fixed by **4, max. 5 120° turns** clockwise.
- The torque should be max 2.8 to 3 Nm.
- Caution! To avoid breaking of the glass flow tube it has to be installed centrally between the seals.
- Before re-commissioning the tightness of the measuring device has to be checked by suitable means.





Attention
The shaft packing of the valve must be readjusted during the life cycle. This requires tightening of the thrust piece (1)
Loosen thread pin (2) M4x8 with hexagon 2mm and remove valve knob (3).
Tighten thrust piece (1) SW14 with a torque of 3, 8 Nm - 4, 0 Nm

Caution
Valves that have not been operated for a long time may require a higher operating torque.

17 Returning devices for repair and service

Note:
In accordance with the applicable German waste disposal legislation, the owner/client is responsible for the disposal of special waste and hazardous materials. Consequently, all devices sent to us for repair must be free of any hazardous materials. This also applies to possible hollow spaces and fissures in the devices.
If repair is necessary, confirm the above-mentioned requirement in writing (please use the form in the Appendix).
If hazardous materials remain in or on the device after it has been returned, Kobold Messring is authorized to remove them at the client's expense without further inquiry.

18 Decontamination certificate for device cleaning

Company: ..... City: .....

Department: ..... Name: .....

Tel: …….....

This variable-area flowmeter

Type KDF-9/KDG-9-…….....

was operated using the measured medium.....

Since this measured medium is dangerous in water*/poisonous*/corrosive*/flammable*,

we have:

- checked that all hollow spaces of the device are free of these materials*
- neutralized and flushed all hollow spaces of the device*

*cross out what is not applicable.

We hereby confirm that in resending the device no danger to persons or the environment is posed by the residual measured substance.

Date: ..... Name: ……. Signature: .....

Stamp

19 Model Code

Liquids Order Details (Example: **KDF-9291 NV 0 00 0**)

Measuring range water [l/h]	Valve seat [mm]	Pressure drop [mbar]	Order no. stainless steel	Connection	Gasket option	Wall-installation	Contact option	Miscellaneous options
0,02-0,25	**2,8**	**2**	**KDF-9291...**[1]	**N** = ¼“ NPT **R** = G ¼[4] **W** = hose connector angular, 90°, for 8 mm hose **S** = hose connector, straight, for 8 mm hose **Y** = Special	**V** = FPM **T** = FFKM	**0** = without **W** = with	**00** = without contactt **with 2 m cable** **M3** = 1 contact monostable **N3** = 1 contact bistable **with junction box** **A3** = 1 contact monostable **B3** = 1 contact bistable	**0** = without **E** = differential pres. contr. with constant outlet pressure, valve at input ¼“ NPT, FPM **A** = differential pres. contr. with constant inlet pressure, valve at output ¼“ NPT, FPM **F** = as ‚E‘ however with FFKM instead of FPM **B** = as ‚A‘ however with FFKM instead FPM **Y** = e.g. without valve, Please specify in writing
0,08-0,7	**2,8**	**3**	**KDF-9292...**[1]					
0,1-1,0	**2,8**	**2**	**KDF-9279...**					
0,25-2,5	**2,8**	**3**	**KDF-9280...**					
0,6-6,3	**2,8**	**3**	**KDF-9281...**					
1,0-10	**2,8**	**5**	**KDF-9282...**					
1,5-16	**2,8**	**5**	**KDF-9283...**					
2,5-25	**2,8**	**5**	**KDF-9284...**					
4,0-40	**2,8**	**5**	**KDF-9285...**					
6,0-63	**2,8**	**6**	**KDF-9286...**[2]					
10-100	**2,8**	**6**	**KDF-9287...**[1]					
Special range	**on request**	**on request**	**KDF-92YY...**					

Gases Order Details (Example: **KDG-9288 NV 0 00 0**)

Measuring range air [Nl/h]	Valve seat [mm]	Pressure drop [mbar]	Order no. stainless steel	Connection	Gasket option	Wall installation	Contact option	Miscellaneous options
2.0-20	**2.8**	**1**	**KDG-9288...**[1]	**N** = ¼“ NPT **R** = G ¼[4] **W** = hose connector angular, 90°, for 8 mm hose **S** = hose connector, straight, for 8 mm hose **Y** = Special	**V** = FPM **T** = FFKM	**0** = without **W** = with	**00** = without contactt **with 2 m cable** **M3** = 1 contact monostable **N3** = 1 contact bistable **with junction box** **A3** = 1 contact monostable **B3** = 1 contact bistable	**0** = without **E** = differential pres. contr. with constant outlet pressure, valve at input ¼“ NPT, FPM **A** = differential pres. contr. with constant inlet pressure, valve at output ¼“ NPT, FPM **F** = as ‚E‘ however with FFKM instead of FPM **B** = as ‚A‘ however with FFKM instead FPM **Y** = e.g. without valve, Please specify in writing
4.0-40	**2.8**	**2**	**KDG-9289...**[1]					
5.5-50	**2.8**	**1**	**KDG-9270...**					
10-100	**2.8**	**2**	**KDG-9271...**					
12-120	**2.8**	**2**	**KDG-9290...**[1]					
25-250	**2.8**	**2**	**KDG-9272...**					
30-350	**2.8**	**2**	**KDG-9273...**					
50-450	**2.8**	**3**	**KDG-9274...**					
60-800	**2.8**	**3**	**KDG-9275...**					
120-1200	**2.8**	**3**	**KDG-9276...**					
200-2000	**2.8**	**3**	**KDG-9277...**[2]					
300-3000	**2.8**	**3**	**KDG-9278...**[1]					
Special range	**on request**	**on request**	**KDG-92YY...**					

[1] not available with contact
[2] only available for contacts with limited switching range
[3] at 1013 bar abs. and 20 °C
[4] not with differential pressure controller

20 EU Declaration of conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Flow Meter **Model: KDF-9/KDG-9-...** with limit switches Type **RC 10/15-14-XX** or Type **N7R**A**

to which this declaration relates is in conformity with the standards noted below:

EN 61000-6-2:2011 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

EN 61000-6-3:2012 Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

EN 55011:2011 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

EN 61326-1:2011 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

EN 50581:2012 Technische Dokumentation zur Bewertung von Elektro- und Elektronikgeräten im Hinblick auf die Beschränkung gefährlicher Stoffe

Also the following EU guidelines are fulfilled:

2014/30/EU **EMC Directive**
2011/65/EU **RoHS** (category 9)

Hofheim, 01 November 2018

H. Peters
General Manager

M. Wenzel
Proxy Holder