

**Operating Instructions
for
Oval Gear Flow Meter**

Model:

DON-...Lx/Hx/Dx/Gx/Kx/Bx/Zx/M4/1x



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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.

The devices are only to be used, maintained, and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EC-machine guidelines.

as per PED 2014/68/EU

DON-1/3 Aluminum-Version

Model DON-1/3	DN	P _{max} [bar]	diagram 8 group 1 dangerous liquids	diagram 9 group 2 no dangerous liquids
DON- x 04	1/8	64	art. 4, par. 3	art. 4, par. 3
DON- x 05	1/8	64		
DON- x 10	1/4	64		
DON- x 15	3/8	64		
DON- x 20	1/2	64		
DON- x 25	25	64		
DON- x 30	40	40		
DON- x 35	50	40		
DON- x 40	50	16		
DON- x 45	80	16		
DON- x 50	80	16		
DON- x 55	100	16		
DON- x 60	100	16		

DON-2/4/8/9 Stainless steel version

Model DON-2/8	DN	P _{max} [bar]	diagram 8 group 1 dangerous liquids	diagram 9 group 2 no dangerous liquids
DON- x 04	1/8	100	art. 4, par. 3	art. 4, par. 3
DON- x 05	1/8	100	art. 4, par. 3	
DON- x 10	1/4	100	art. 4, par. 3	
DON- x 15	3/8	100	art. 4, par. 3	
DON- x 20	1/2	100	art. 4, par. 3	
DON- x 25	25	100	category II	
DON- x 30	40	50	category II	
DON- x 35	50	50	category II	
DON- x 40	50	16	category II	
DON- x 45	80	16	category II	
DON- x 50	80	16	category II	
DON- x 55	100	16	category II	
DON- x 60	100	16	category II	

DON

DON-1 M4 Aluminum version with mechanical totalizer

Option M4 Model DON-1/3	DN	P _{max} [bar]	diagram 8 group 1 dangerous liquids	diagram 9 group 2 no dangerous liquids
DON- x 04	1/8	-	-	-
DON- x 05	1/8	-	-	-
DON- x 10	1/4	-	-	-
DON- x 15	3/8	-	-	-
DON- x 20	1/2	40	art. 4, par. 3	art. 4, par. 3
DON- x 25	1	40	art. 4, par. 3	
DON- x 30	1 1/2	40	category II	
DON- x 35	2	30	category II	
DON- x 40	2	16	category II	
DON- x 45	3	16	category II	
DON- x 50	3	16	category II	
DON- x 55	4	16	category II	
DON- x 60	4	16	category II	

DON 2/8 Stainless steel with mechanical totalizer

Option M4 Model DON -2/4/8/9	DN	P _{max} [bar]	diagram 8 group 1 dangerous liquids	diagram 9 group 2 no dangerous liquids
DON- x 04	1/8	-	-	-
DON- x 05	1/8	-	-	-
DON- x 10	1/4	-	-	-
DON- x 15	3/8	-	-	-
DON- x 20	1/2	40	art. 4, par. 3	art. 4, par. 3
DON- x 25	1	40	art. 4, par. 3	
DON- x 30	1 1/2	40	category II	
DON- x 35	2	30	category II	
DON- x 40	2	16	category II	
DON- x 45	3	16	category II	
DON- x 50	3	16	category II	
DON- x 55	4	16	category II	
DON- x 60	4	16	category II	

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition. Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:

The standard delivery includes:

- Oval Gear Flow Meter model: DON
- Operating Instructions
- Calibration Certificate

Each DON volume counter has been calibrated to function with mineral oil, which means the remainder of the calibration oil still remains in the device.

The oil used is:

for measurement ranges x04/x05 and x15 for high viscosities: SHELL Morlina 10
for measurement ranges x10 to x60: EXXSOL D120

4. Regulation Use

The oval gear meter is a precise positive displacement flowmeter incorporating a pair of oval geared rotors. These meters are capable of measuring the flow of a broad range of clean liquids.

Stainless Steel flowmeters are suited to most water-based products and chemicals and aluminium meters are suitable for fuels, fuel oils, & lubricating liquids. It is important to ensure that the media to be measured is compatible with the materials used in the instrument. (See section 10 "Technical Data") It is also imperative to comply with the maximum permissible operating parameters specified in the "Technical Data" section.

The flowmeter is available as a measurement transducer with pulse output or with other forms of evaluation electronics. Details of how to operate the electronics are included in a separate instruction manual.

These flowmeters DON can be installed within hazardous areas when ordered with optional Exd approval, or by using the reed switch pulse output in Intrinsically Safe loops or installing Intrinsically Safe certified Instruments.

Any use of the oval gear flow meter model: DON, which exceeds the manufacturer's specification, may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

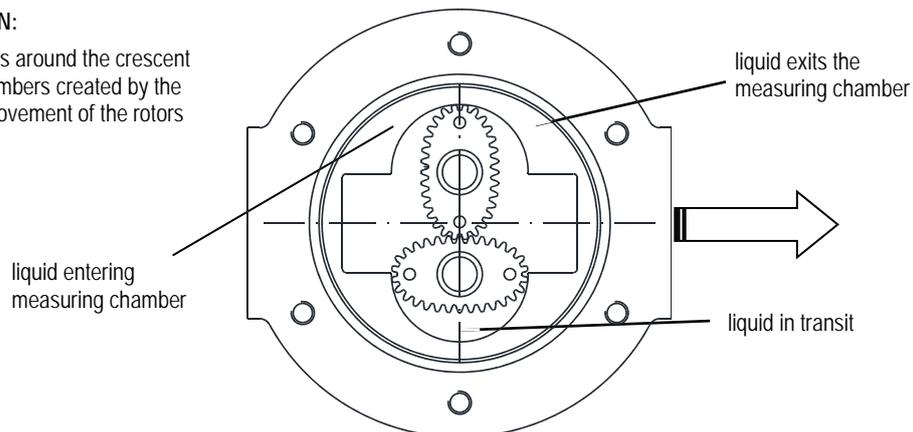
5. Operating Principle

Oval gear flowmeters are categorized as positive displacement flow technology. When liquid flows through this type of positive displacement flowmeter, two oval geared rotors measure a constant volume per rotation within a precisely machined measuring chamber. With each rotation, a constant volume of liquid is measured. The rotation of the oval gears is sensed via magnets embedded within the rotors. These magnets transmit a high-resolution pulse output. The output signal can be processed externally via a remote display controller or PLC or via a variety of output/display options available as accessories attached to the flowmeters.

The positive displacement flow technology allows for precise flow measurement of most clean liquids regardless of the media conductivity. Other liquid properties also have a minimal effect on the performance of this type of meter. Flow profile conditioning is not required as with alternative flow technology options making oval gear installations simple to install in tight spaces and at an economical price.

OPERATION:

Liquid travels around the crescent shaped chambers created by the rotational movement of the rotors



6. Mechanical Connection

6.1 General

Points to verify before meter installation:

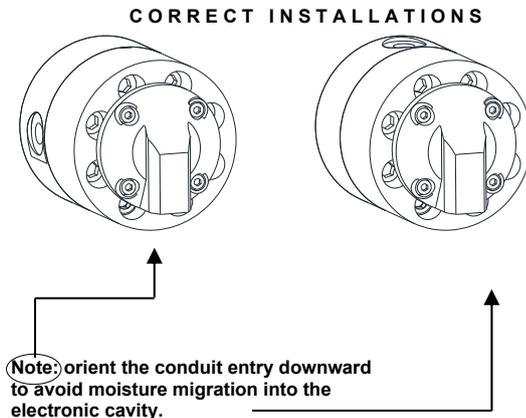
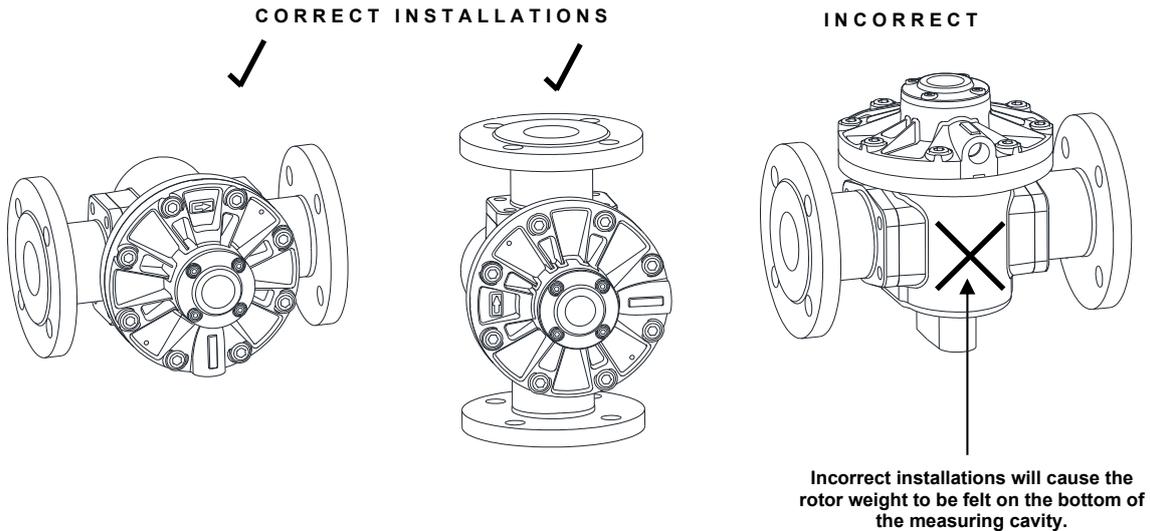
Chemical compatibility of the liquid. Be sure that all wetted parts are identified and confirmed suitable for use with the media being measured. If unsure, please contact a KOBOLD engineer for guidance in obtaining the proper reference materials.

Verify that the operational pressure and temperature limits are within capability of the fully specified meter. Verify that the operational flow rates are within the specified flow range. Viscous liquids may limit the maximum allowable flow based on the viscosity. The max allowable flow rate may need to be limited to ensure the differential pressure across the flowmeter does not exceed 1 Bar, (100 kPa, 15 PSIG).

Be sure that the flowmeter is not subject to any process temperatures and/or pressures that can cause the measured liquid to freeze or flash inside the meter.

6.2 Orientation

When installing the flowmeter, orientation must be considered. The rotor shafts must be in a horizontal plane. To verify that the rotor shafts are in a horizontal plane, electronic cover or optional digital display will be facing in a horizontal direction. For modification in the field, the electronic cover or digital display can be rotated in any 90 degree position. This accommodates access to the electrical entry and allows the electronic display orientation to best suit the installation.



The DON flowmeter accommodates both horizontal and vertical flows. It is recommended that for vertical flow installations that the liquid flow up through the meter (*i.e. bottom to top*). This orientation assists in air or entrained gas removal. The flow meter is bidirectional. To identify the flow direction, in which the flowmeter was calibrated, the flowmeters are marked with arrows. These arrows are placed on the lower side for models DON-x04 .. DON-x15 and on the top side for models DON x20..DON-x60. The flowmeter calibration data refers to this arrow direction. This is also the preferred flow direction.

6.3 Flow Conditioning and Location

It is highly recommended to INSTALL a filter immediately before (prior to) the meter. Filters are available and sold separately.

Recommended Filter (e.g. MFR-DO...):

DON-x04...DON-x15: < 75 µm particle size (200 mesh)

DON-x20...DON-x35: < 150 µm particle size (100 mesh)

DON-x40...DON-x60: < 350 µm particle size (45 mesh)

Flow conditioning: Flow conditioning is not required since the DON flowmeter does not require any straight pipe runs before or after the flowmeter.

Location: The recommended installation would be before of any flow control and/or shut off valves, this installation prevents complete emptying of the meter. This minimizes the risk of leakage and/or air entrapment which could result in damage to the flowmeter or inaccurate initial readings.

A by-pass installation is recommended for process or safety critical meters. Isolation valves enable the meter to be isolated from the system and serviced as needed. System purging is also possible with a by-pass arrangement. Accommodate all meter ratings and locate the meter on the discharge side of the process pump.

For outdoor applications, be sure all electrical entries are sealed properly via the proper glands, mounting, sealing or containment. For humid environments, mount the instrument appropriately as to avoid condensation build up. Generally, these installations have the conduit connection pointing downward as to drain any condensate away from the electronics.

Liquid State: Liquid within the flowmeter must not freeze. If heat tracing is necessary, please be sure to adhere to the temperature limits of the flow meter. Ensure the liquid does not flash, do not exceed the max DP of the flowmeter.

Hydraulic shock: Surge dampeners or pressure relief valves must be installed if hydraulic shock or pressure spikes are present. Highly pulsating flow can also damage the DON flowmeter. Diaphragm pumps and specific application profiles can cause high frequency pulsating flow. Proper pulsating dampers are highly recommended.

7. Electrical Connection

7.1 Connecting Cable

Proper shielded instrument cable is highly recommended. Low capacitance twisted pair 7 x 0.3 mm (0.5 mm²) for use with the DON and any remote receiving instrumentation. Typical cable would be Belden® 9363 or similar. Connect the cable shield to DC common or designated grounding terminal at the receiving instrument. Remember to only connect the end of the cable shielding at the receiving instrument (not the DON) to ensure proper interference protection.

Please be sure not to run the connecting cable within a common conduit or in close proximity to conduit with high inductive loads or power sources. This could result in noise or inducted errors to the output signal or result in damage to the electronic components. Always run the instrument cables in a separate conduit or within a common conduit with other low power cables. Max cable length should be limited to 3280 ft (1000 m).

7.2 Electrical connection for integrated electronics options

The electrical connection of the integrated electronics options always requires the electronics cover to be dismantled. Models from size X05 to X20 incorporate the cable inlet into the electronics cover, while models from the X25 size onwards accommodate the cable inlet in the housing cover.

The connecting cable must be routed through the cable duct and connected in accordance with 7.2.1 to 7.2.3. The connecting terminals are of the plug-in type, and can be taken out of the terminal compartment to facilitate connection.

7.2.1 Hall-effect sensor with active pulse output (H0/HE/HA/B0/BE/BA/G0/GE/GA/K0/KE/KA/HU options)

The H0/HE/HA/B0/BE/BA/G0/GE/GA/K0/KE/KA electronics options combine a hall-effect sensor with an active push-pull output stage. The B0/BE/BA options involve combining bipolar Hall sensors with alternating polarised magnets. This option is particularly suitable for pulsating currents, although the pulse rate is halved compared to the H0/HE/HA option. A three-phase electrical connection is used. The output is actively switched, either to the input terminal voltage +Vs or to GND. The external input terminal voltage is 8 to 30 V_{DC}. No additional external wiring is required (e.g. pull-up resistor). The high signal corresponds approximately to the +Vs input terminal voltage and the low signal approximately to 0 V.

The electrical load can be connected to either the input terminal voltage or GND

Max. output current (power source or sink): 100 mA (short-circuit protected).

DON

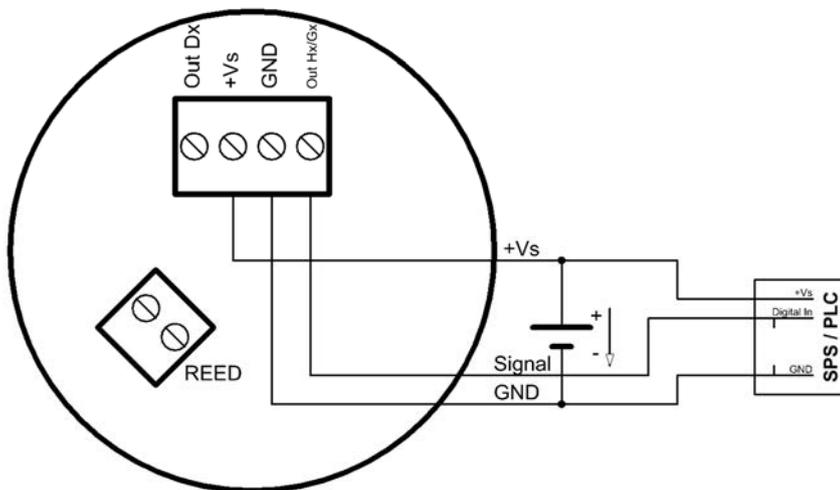
The HU electronics option provides the NPN output with built-in 4.7 kΩ pull-up resistor. The external supply voltage is 5-30 VDC and the max. switching current is 200 mA (short-circuit protected).



Note!

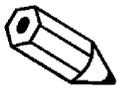
The electronic options H0/HE/HA/HU are available with reed switch output while all other options are equipped without additional reed switch.

Hall sensor output connection for H0/HE/HA/B0/BE/BA/G0/GE/GA/K0/KE/KA



7.2.2 Reed Switch Pulse Output (Option H0/HE/HA)

The DON reed switch output is a SPST potential free N/O 2-wire output. This is a passive output so no power is required.



Note: when using the reed switch output the liquid temperature must not change at a rate greater than 10 °C per minute (50 °F per minute).

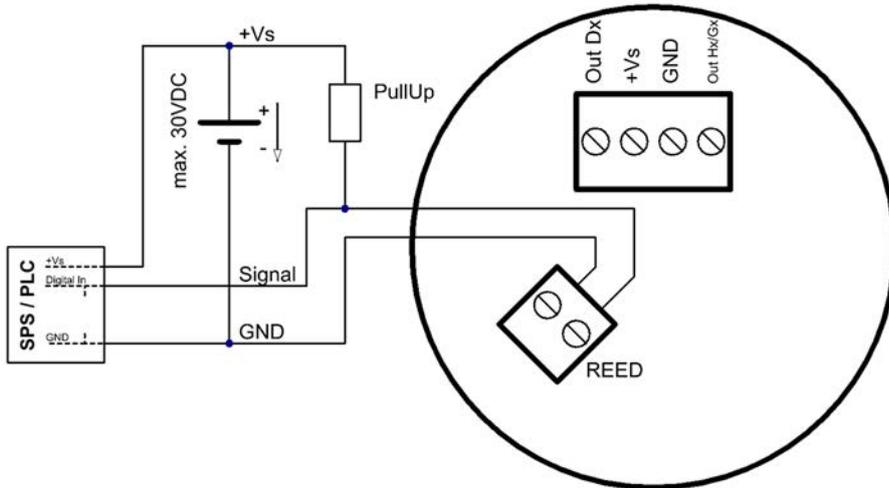
Average electrical endurance of switching contact (MTTF – Mean Time To First Failure):

Max. switching voltage (100 V/10 mA) 5×10^5 switching cycles

Max. current load (20 V/500 mA) 5×10^6 switching cycles

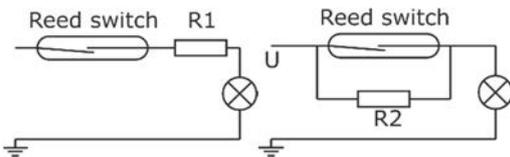
Min. load (<5 V/10 mA) 5×10^8 switching cycles

Switching capacity: Max. 30 V_{DC}, max. 200 mA

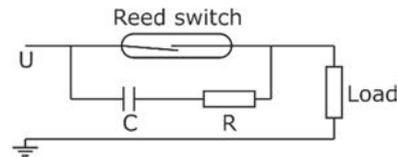


The individually specified maximum electrical values of the reed switch must never be exceeded, even for a moment. Higher switching values may reduce the service life or even destroy the contact.

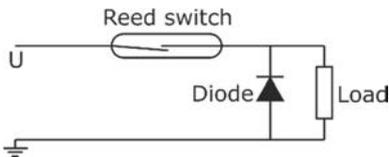
For capacitive and inductive loads (e.g. via long lines), we recommend the following protective circuits:



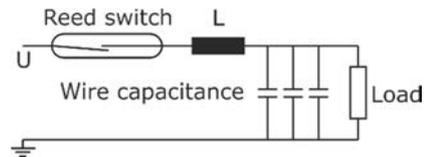
Lamp load with series or parallel resistance to the reed switch.



Protection with a RC suppressor For a.c. current and inductive load.



Protection with a diode for d.c. current and inductive load.



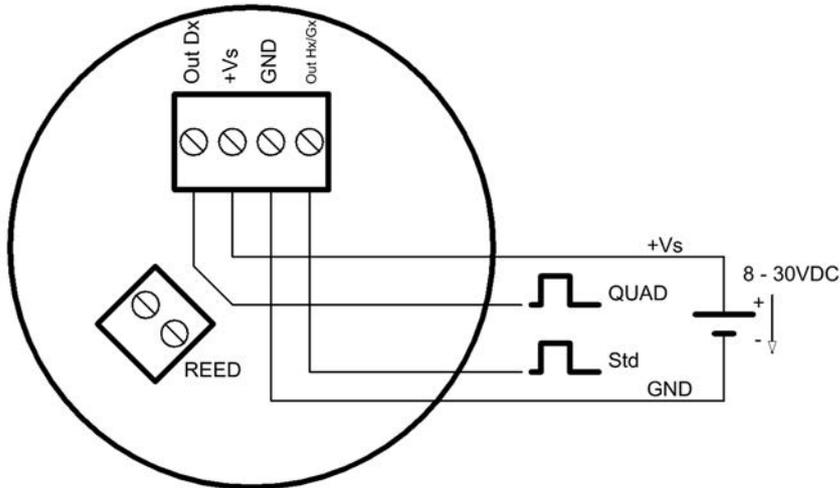
Protection with an inductance or Resistance for capacitive load.

7.2.3 Quadrature Pulse Output (QUAD, Option D0/DE/DA)

For the D0/DE option, the DON devices come with 2 independent hall-sensor elements. The hall-effect sensors are arranged so that they emit separate phase-shifted signals to one another.

The QUAD output is best-suited for verified use with a redundant signal or for counting bidirectional currents (detecting the current direction).

Max. output current per channel (power source or sink): 100 mA (short-circuit protected).



The current direction of the media is defined as follows:

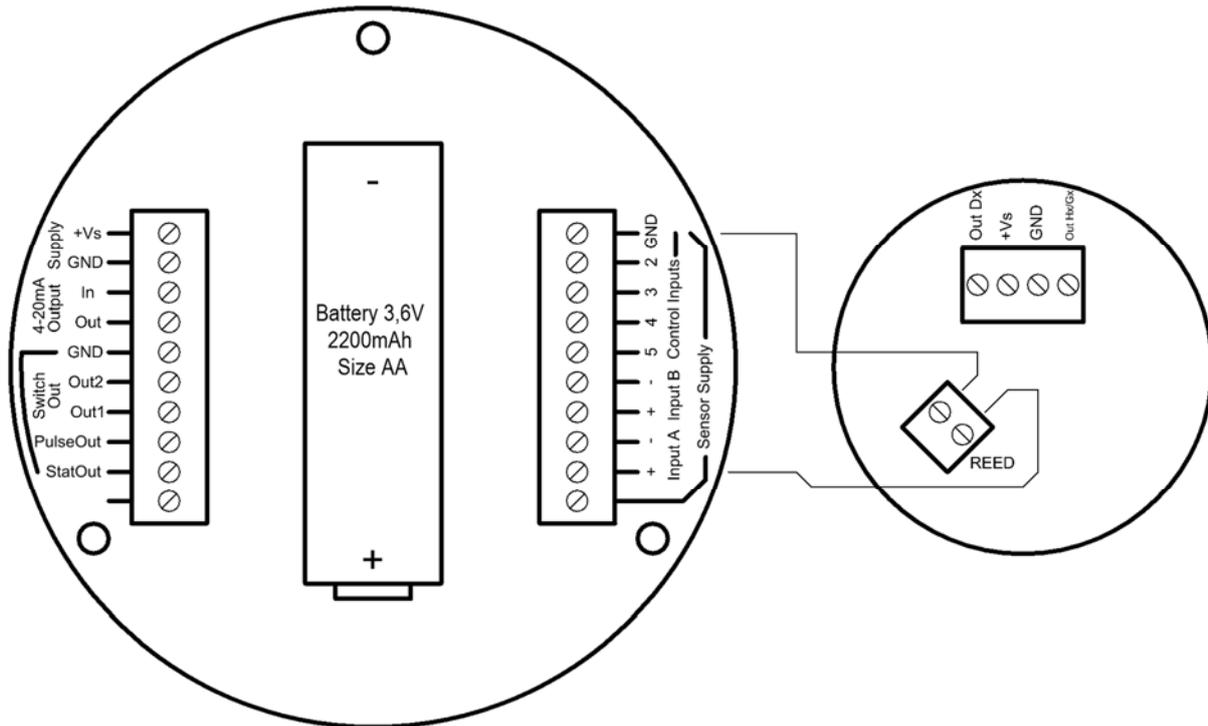
- Hx signal leading over Dx signal: Current flowing in the direction of the marked arrow (positive)
- Hx signal lagging behind Dx signal: Current flowing against the direction of the marked arrow (negative)

7.3 Internal wiring with electronic options –1x/Zx

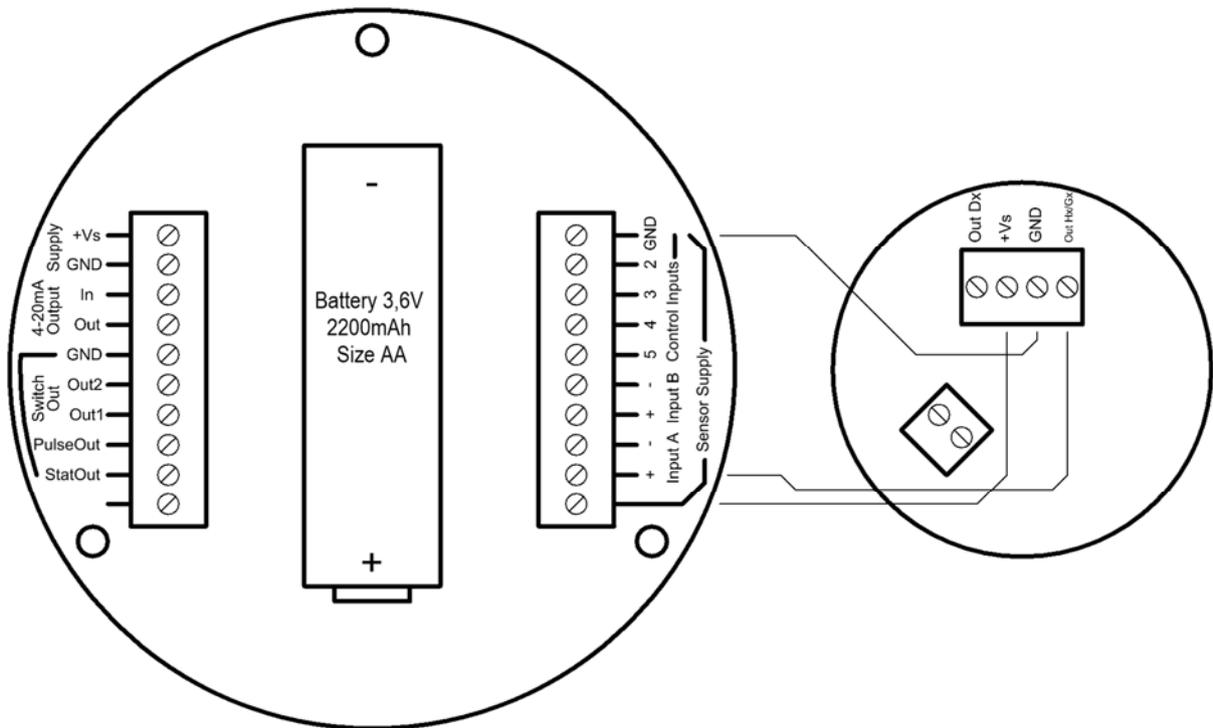
The 1x/Zx electronic options are pre-configured ex works in connection with the sensor boards. Reconfiguration is available on request.

7.3.1 For Z1/Z3/1A/3A electronic options (reed switch and Hall sensor)

a) Wiring diagram with reed switch (ex works standard)



b) Wiring diagram with Hall sensor (recommended in connection with external supply)



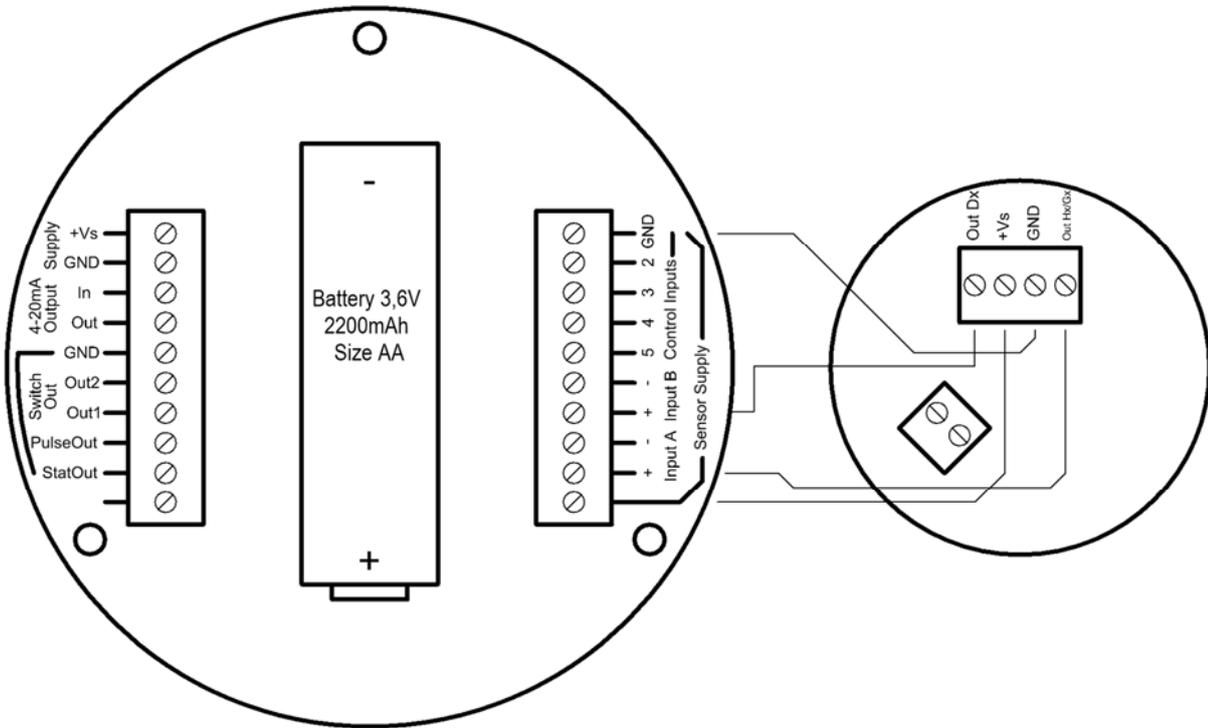
7.3.2 For Z6/Z7 electronics options (bipolar Hall sensor)

The circuitry corresponds to 7.3.1 b.)

7.3.3 For 1A...5A electronics options

Refer operating instructions supplement ZOK-Ex wiring options 1A...5A

7.3.4 For Z2/Z8/Z9 electronics options (2 Hall sensors for direction detection)



7.3.5 Analog output 4-20 mA, 2-line (L0/LE option)

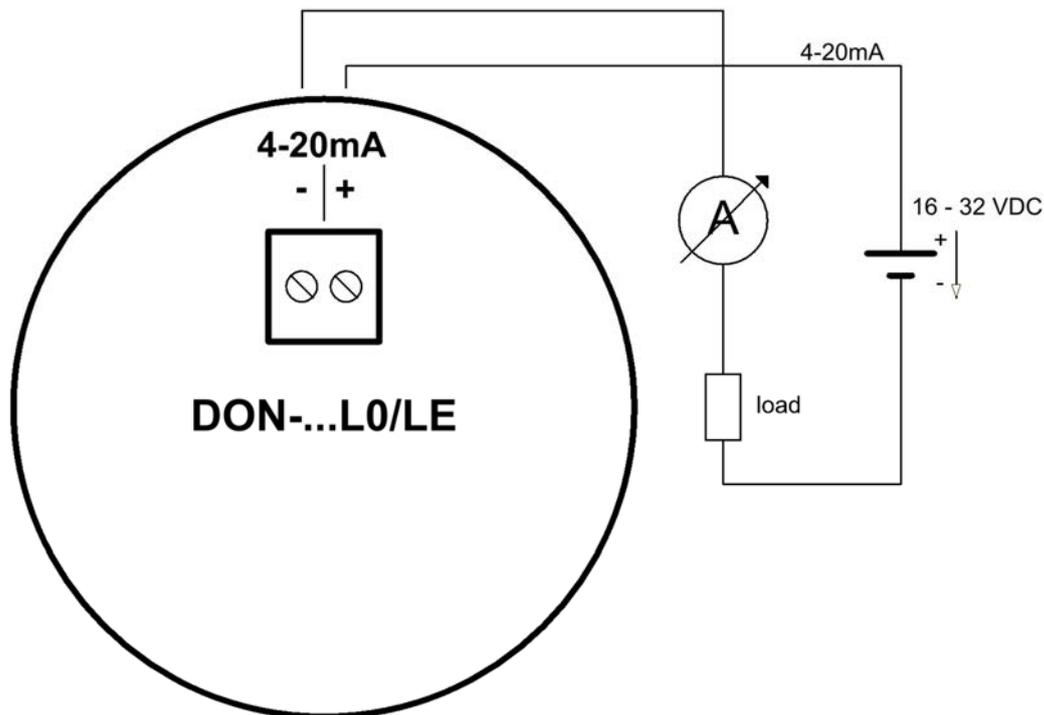
The L0 and LE (explosion hazard) options include a loop-powered 4-20 mA output. The loop is powered by an external voltage source 16 – 32 V_{DC}. The maximum working resistance of loads connected in series (PLC-analogue input / electronic displays) depends on the supply voltage level, namely:

Max. working resistance (ohms) = $(+V_s - 9 \text{ V}_{DC}) / 0.02 \text{ A}$ [ohms]

Example: $+V_s = 32 \text{ V}_{DC} \Rightarrow$ max. working resistance = 1150 ohms

$+V_s = 16 \text{ V}_{DC} \Rightarrow$ max. working resistance = 350 ohms

The load can be coupled at any point of the current loop, provided the polarity is correct.



All DON devices with L0/LE options are factory-calibrated to the respective measurement range end value. This setting should only be modified by the manufacturer.

7.3.6 Calibration Factor (scale or K Factor)

The DON flowmeter is delivered with a factory calibration certificate. Within this certificate, a calibration factor is provided. The calibration factor is a specific representation of pulses per unit volume. (i.e. pulses per liter) for that specific meter.

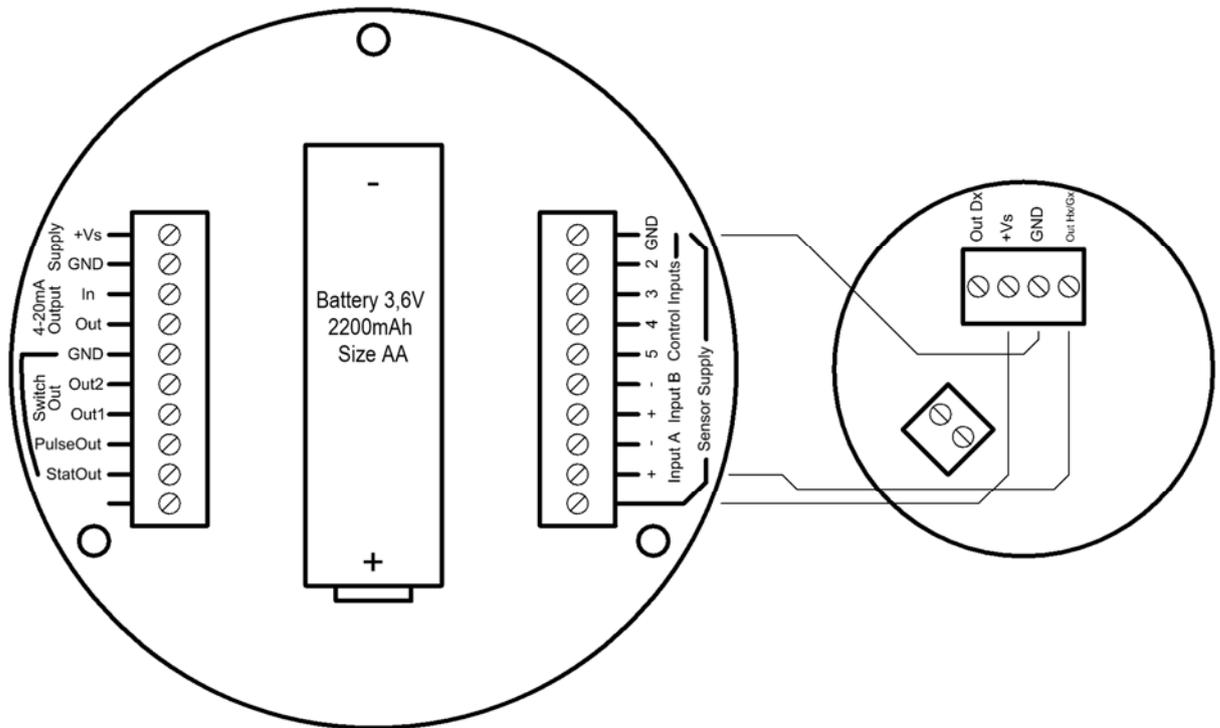
Measurement devices with attached electronics are factory pre-configured to the corresponding calibration factor. Depending on the model, the calibration protocol is based on either the flow rate display or the analog output.

Please reference the appropriate digital display manual for programming details.

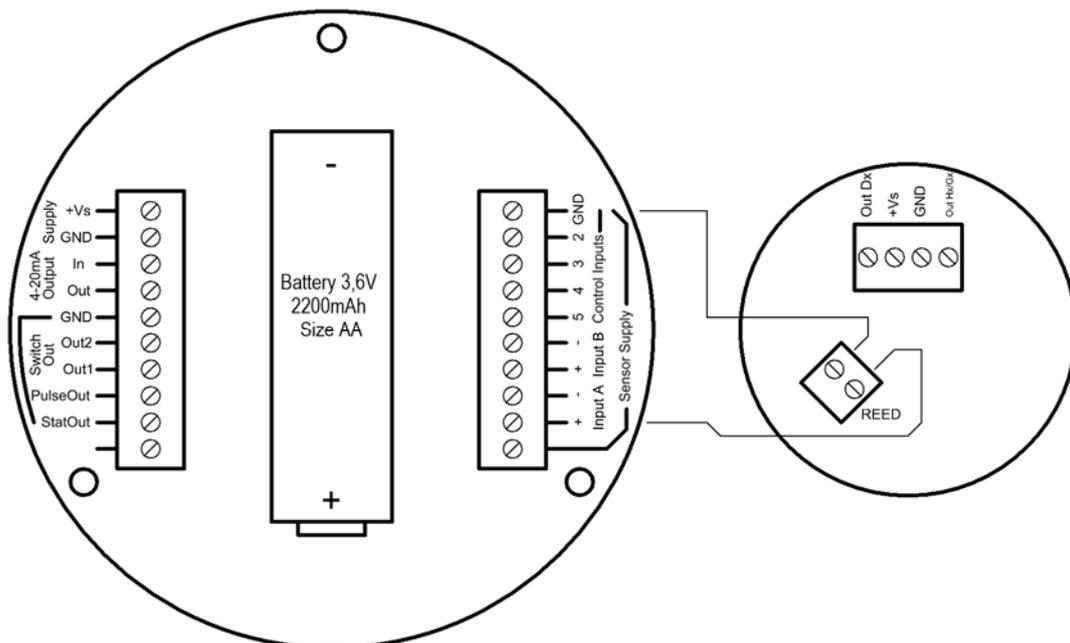
7.4 External wiring with electronic unit ZOK-Zx

7.4.1 Wiring with ZOK-ZxK

a) Circuit with Hall sensor (not for battery operation)

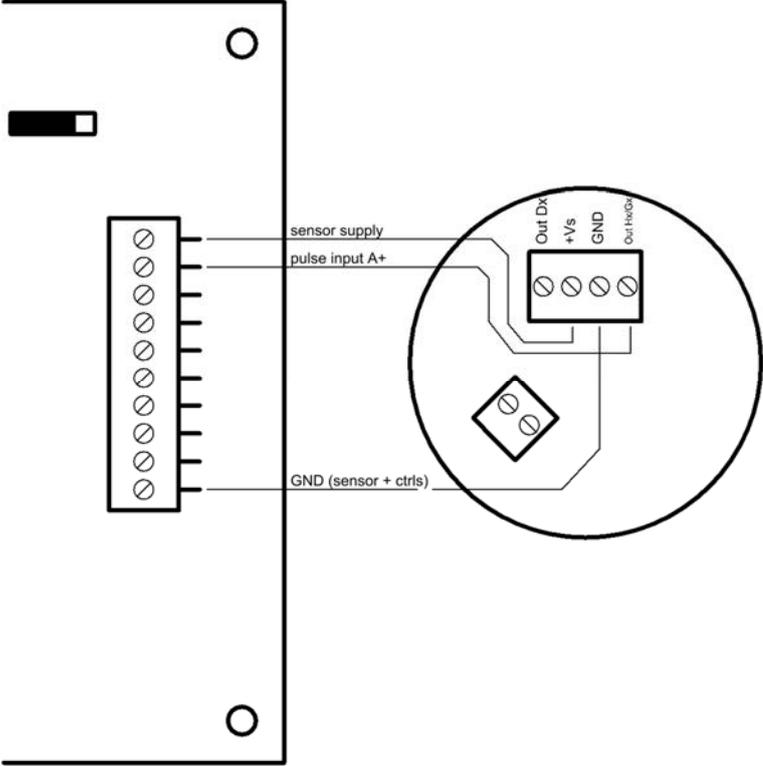


b) Circuit with Reed switch (only for battery or 4-20mA loop operation, shielded connection cable is recommended, shield on GND)

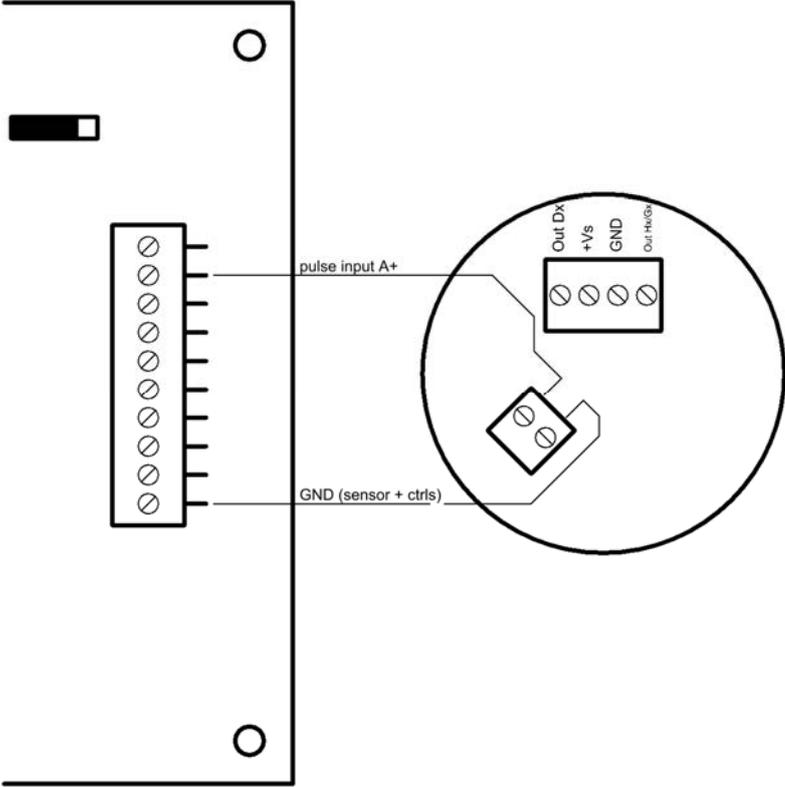


7.4.2 Wiring with ZOK-ZxP

a) Circuit with Hall sensor



b) Circuit with Reed switch (shielded connection cable is recommended, shield on GND)

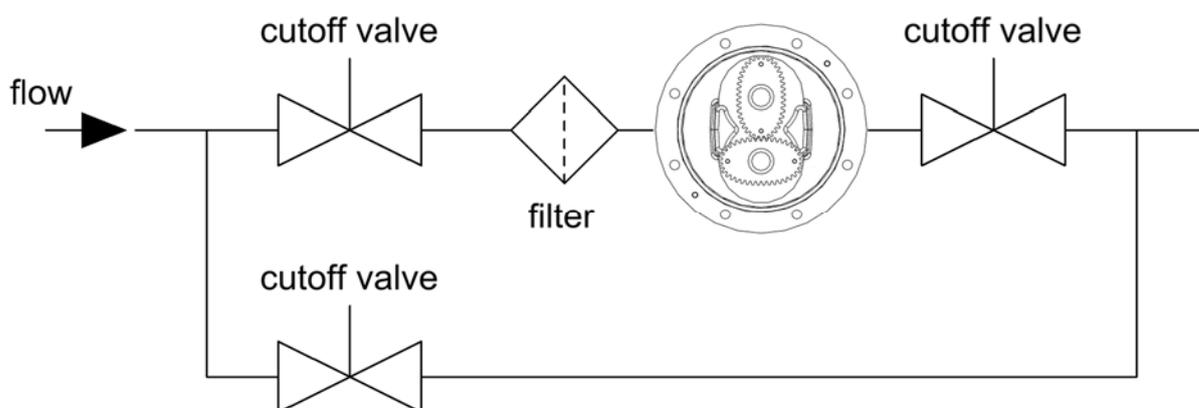


8. Commissioning

The piping **MUST** be flushed of debris before installation. Debris such as slag from welding, grinding dust, rust, pipe tape or sealing compound are common within new piping installations and will damage the flowmeter if not flushed or filtered from the process piping before installation and operation.

Before commissioning, the line should be filled slowly and carefully with the media.

A by-pass system is common for frequent system flushing or frequent meter removal. If a by-pass system is not practical or possible, removal of the gears before flushing is necessary (refer to section 9.1 “Disassembly of Pulse meter”).



For proper operation the flowmeter must be purged of air. During long periods of inactivity or after a flushing, air may be in the piping. Elimination of the air may be achieved by operating the meter at a low flow rate until all the air is eliminated. Damage may occur to the flowmeter if it is run above the maximum rated flow rate or if the maximum differential pressure of 15 psi (1 bar, 100 kPa) is exceeded.

After mechanical and electrical installation according to the guidelines set forth within this user manual, the DON flowmeter is ready for operation.



Warning!

Risk of damage by blocking of measuring mechanism. A missing count signal may indicate a blocked measuring mechanism. The resulting increase in pressure before the device can lead to further damage to the unit and / or the plant. Remove the unit or shut down the plant immediately, if an unplanned absence of the counter signal takes place. Eliminate the cause of the malfunction.

9. Maintenance

Flowmeter maintenance precautions:

- Remove/disconnect power to the flowmeter.
- Ensure that flow supply to the meter is turned off and the system is not under pressure.
- Completely drain the flowmeter
- Confirm that any signal output(s) will not affect the system when de-energized or removed from the circuit.

Oval gear positive displacement flowmeters are mechanical by nature. A periodic maintenance/inspection schedule is suggested for an extended service life. Follow the guidelines within this user manual for the maximum flowmeter performance.

The maintenance/inspection schedule should be determined based off of application factors such as media type (abrasiveness, lubricity, and/or chemical compatibility), flow rate, and operating/maximum temperature and pressure.

9.1 Disassembly of DON with Pulse meter

Concerning options Hx, Dx, Gx, Bx, Kx and Rx

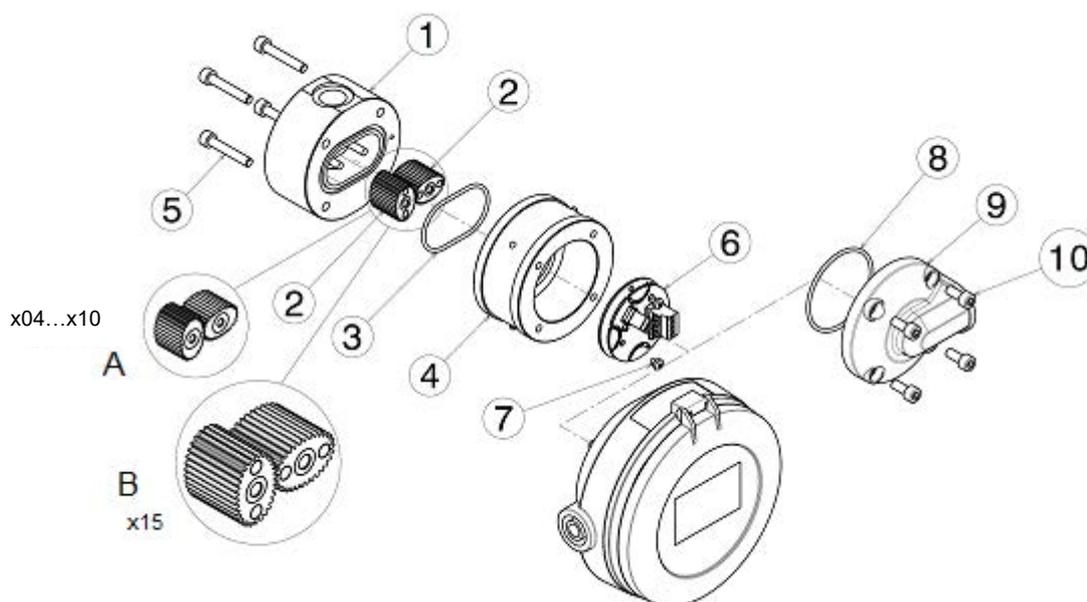
9.1.1 Pulse output board removal (refer exploded view diagram)

To remove the pulse output board, remove the 4 electronic cover screws (10), and remove the electronic cover (9). The pulse output board (6) can now be accessed and removed via the removal of the electronic board screws (7).

9.1.2 Oval gear removal for DON-x04...DON-x15 (refer exploded view diagram)

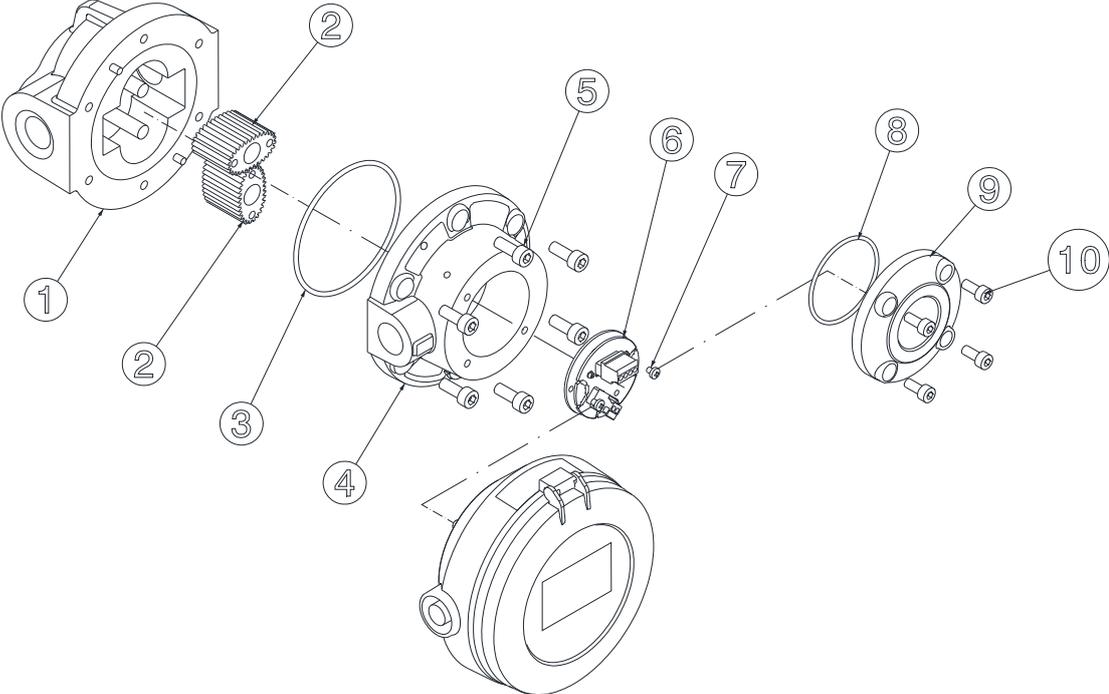
For access to the oval wheel, remove the 4 lower meter body screws (5). With care, remove the upper meter body assembly (4) being careful not to damage or misplace the O-ring (3) or changing the positioning of the oval wheels (2) and/or damaging them.

For DON models DON-x04, -x10, when disassembling, please notice the dimples located on the meter bodies (1 & 4) face just outside the o-ring groove. These markings must be matched during assembly. Only one oval wheel is equipped with a magnet in these small flow meters. The oval gear without magnet must be mounted on axis that is closest to the dimple. For these oval wheels, the sides without boring hole for the magnet must face upwards, see detail A. For all other devices (DON-x15 and larger) both gears are equipped with magnets and can be mounted in any position.



9.1.3 Removal of oval gears for DON-x20 (refer exploded view)

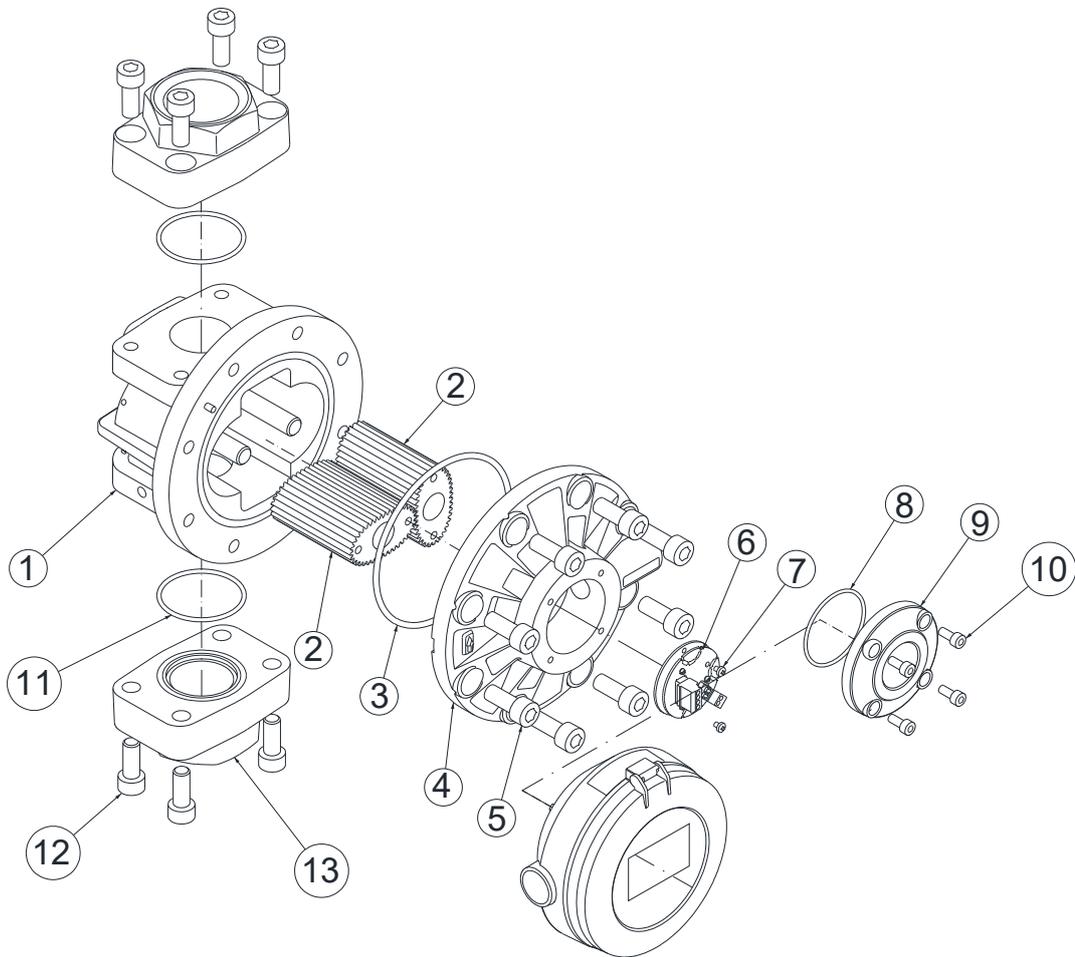
For access to the oval gears, remove the 6 upper meter body screws (5). With care, remove the upper meter body assembly (4) being careful not to damage or misplace the O-ring (3). You can then remove the oval gears (2).



Optional

9.1.4 Removal of oval gears for DON-x25...DON-x40 (refer exploded view)

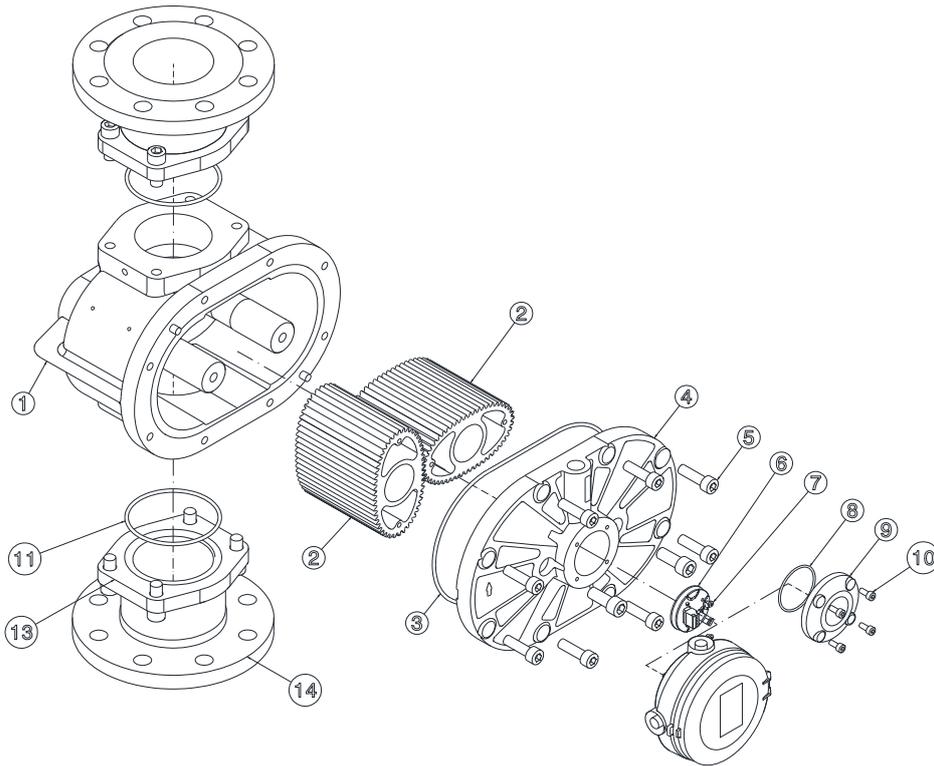
For access to the oval gears, remove the 8 upper meter body screws (5). With care, remove the upper meter body assembly (4) being careful not to damage or misplace the O-ring (3). You can then remove the oval gears (2).



Optional

9.1.5 Removal of oval gears for DON-x45...DON-x60 (refer exploded view)

For access to the oval gears, remove the 8 upper body screws (5). With care, remove the upper body assembly (4) being careful not to damage or misplace the O-ring (3). You can then remove the oval gears (2).



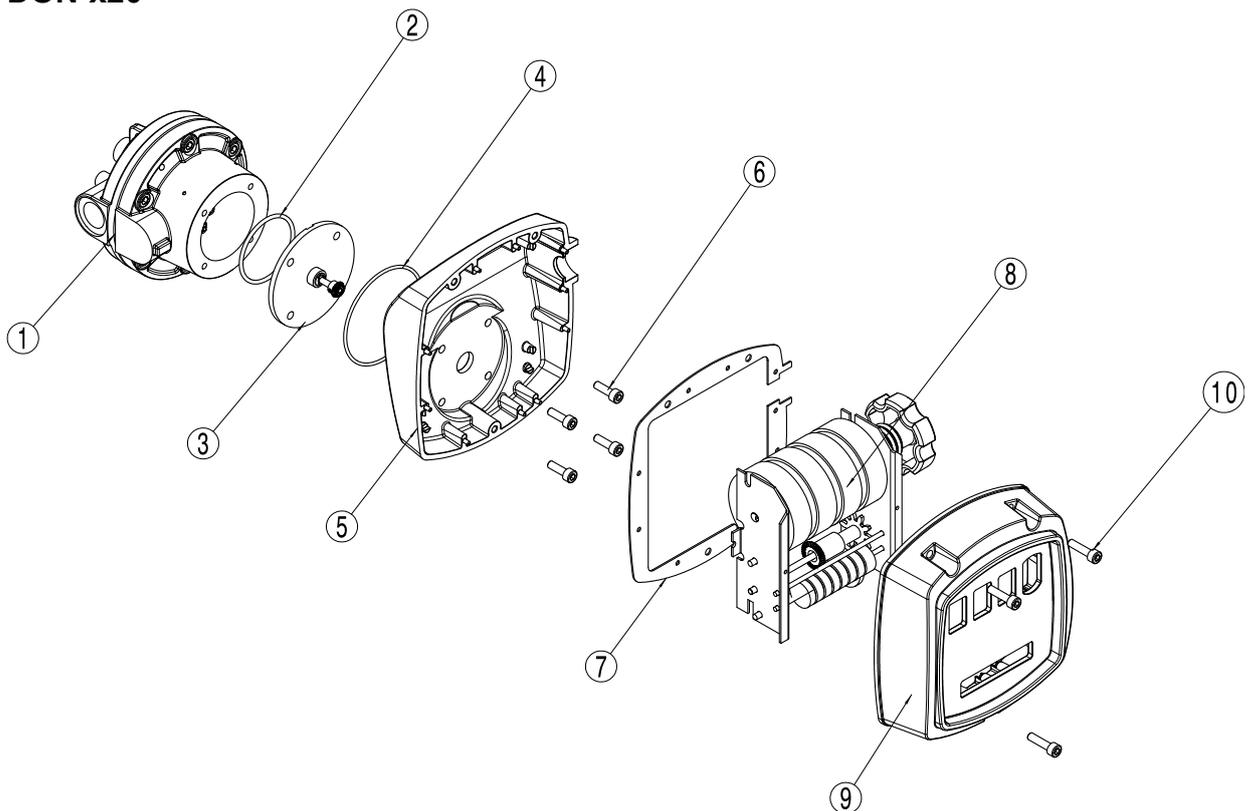
Optional

9.1.6 Structure of the DON-M4 mechanical counting mechanism

- Loosen three screws (10)
- Remove cover (9)
- Lift out counting mechanism (8)
- Remove seal (7)
- Loosen 4 screws (6)
- Remove lower housing section (5)
- Remove seal (4), washer (3) and seal (2).

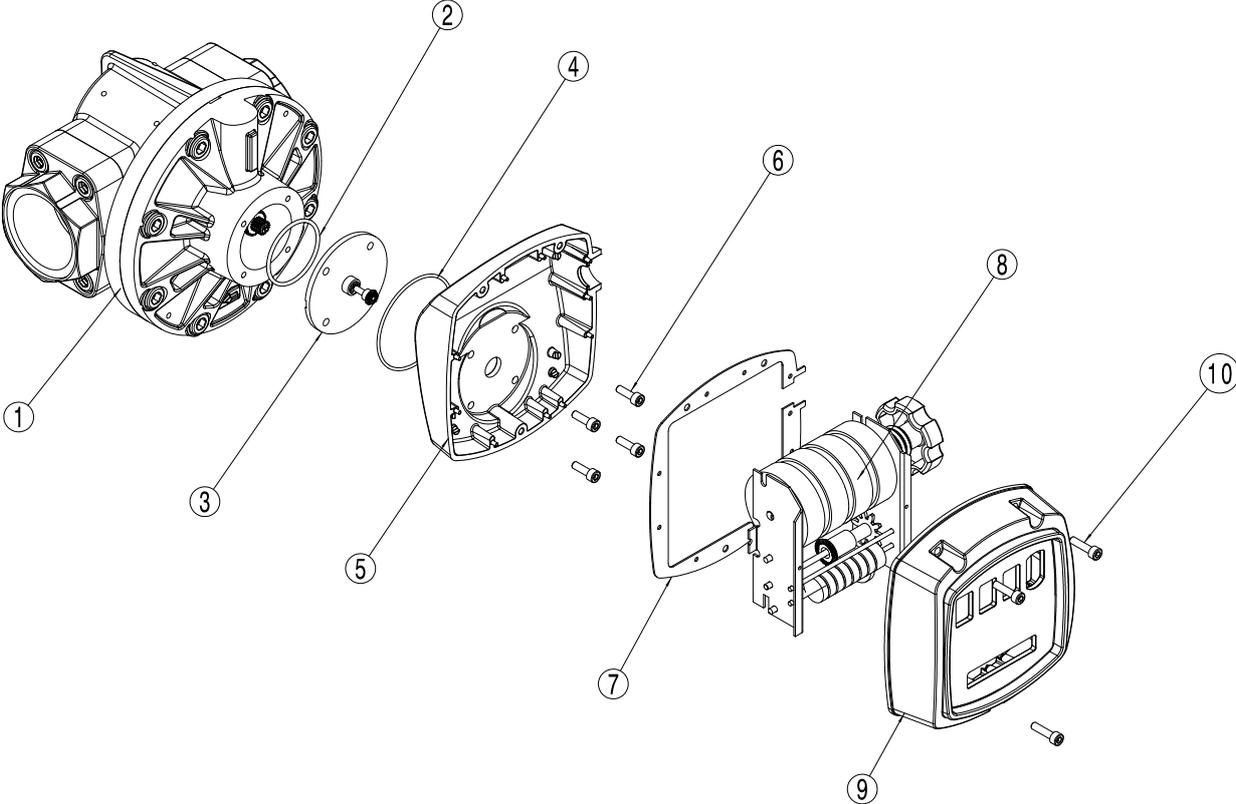
When assembling, it is important to ensure the oval gear of (3) is correctly positioned relative to the counting mechanism (8). When mounting the counter mechanism, it is preferable to keep the DON in a horizontal position. This allows the counter mechanism (8) to be mounted distortion-free from above on the cone gear wheel (3).

DON-x20

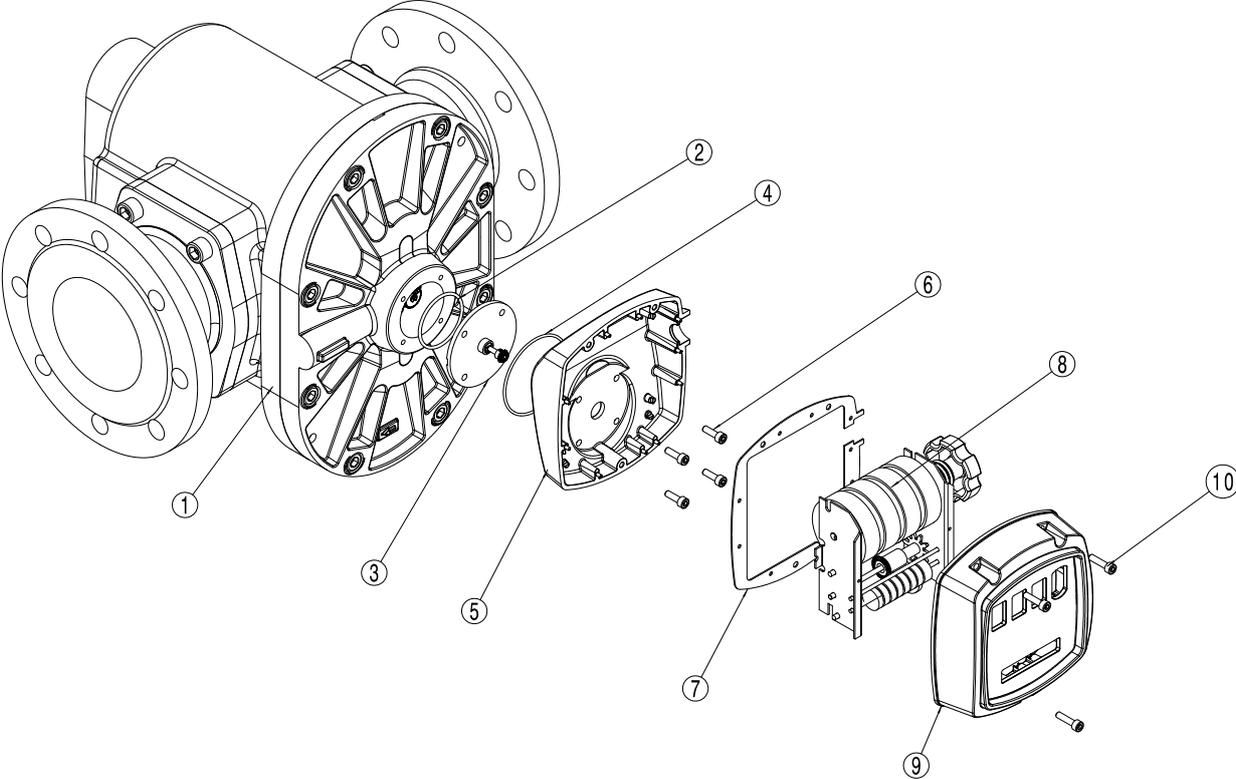


DON

DON-x25 to x40



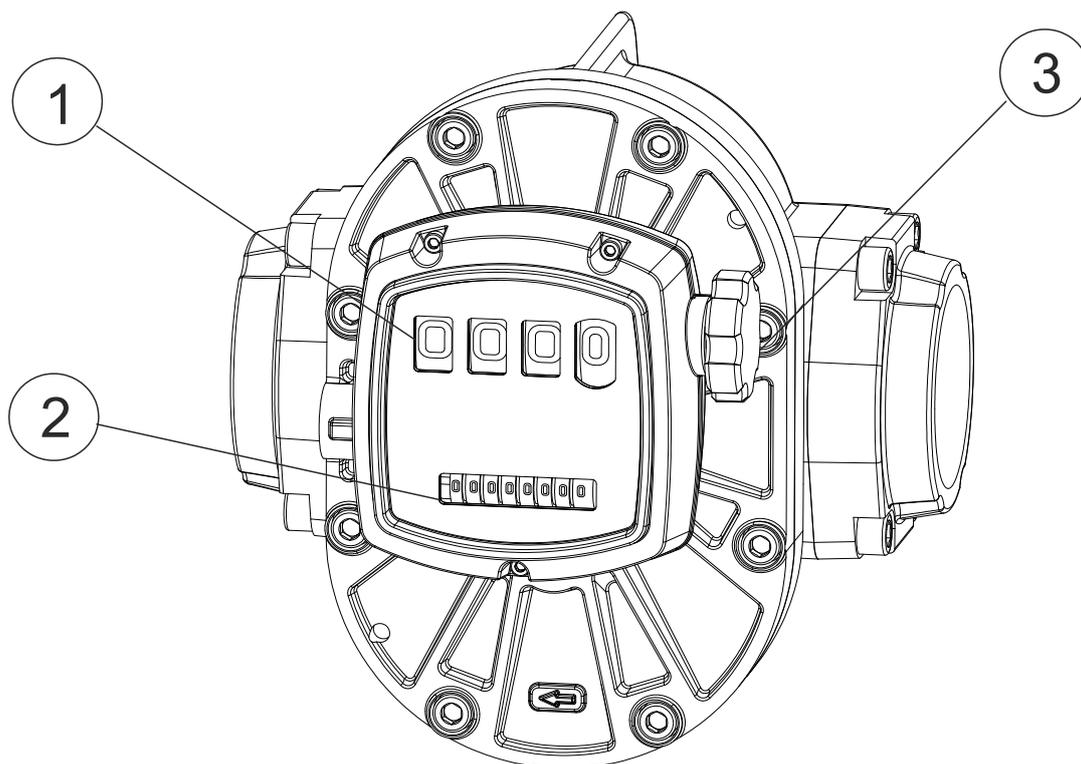
DON-x45 to x60



9.1.7 Adjusting the DON-M4 mechanical counter mechanism

The M4 mechanical counter display comprises a 4-digit mechanical totalizer (1) and an 8-digit sum display (2). Depending on the order option, the display is calibrated in either litres or gallons.

The totalizer display can be reset to zero by turning the function dial (3) in an anti-clockwise direction.



9.2 Demounting of the electronics mounted on a DON with option Zx or 1x

To access the device battery, terminal connections and pulse output board, the electronic cover with display must first be removed in case of flowmeters with built-in electronics. To do this, loosen the 4 screws of the display cover and carefully remove it without pulling out or damaging the connecting cable. During this procedure, be careful not to lose or damage the O ring. The terminal connection, device battery and pulse output board are now freely accessible. To remove the electronics, the screws used to connect the electronics housing to the oval gearbox housing should be loosened.

9.3 Spare Parts

Please consult your closest KOBOLD-Office
Internet: www.koboldusa.com

9.4 Inspection (refer Exploded View)

Inspection points will be the following:

O-rings – Inspect for physical or chemical damage or deformation.

Rotors – Inspect for physical damage due to unfiltered media or damage due to chemical attack. Also observe also the magnets, if exposed, for chemical attack.

Measuring Cavity – Inspect for physical damage (scoring) due to improperly filtered media or long-term wear and tear.

Axle Shafts – Inspect for physical damage and ensure that the shafts are not loose and do not rotate.

9.5 Re-assembly of DON

Before re-assembly, please be sure to thoroughly clean all parts.

Care must be taken when reinstalling the rotors such that the magnets should face the pulse output board.

9.5.1 Re-assembly of DON-x04...DON-x15

The small flow meters (DON-x04 to -x10) have dimples on both housing parts (1 and 4). These markings must be matched during assembly. Only one oval gear is equipped with magnets in these small flow meters. The oval gear without magnet must be mounted on the axis that is closest to the dimple. For all other devices (DON-x15 and larger) both gears are equipped with magnets and can be mounted in any position.

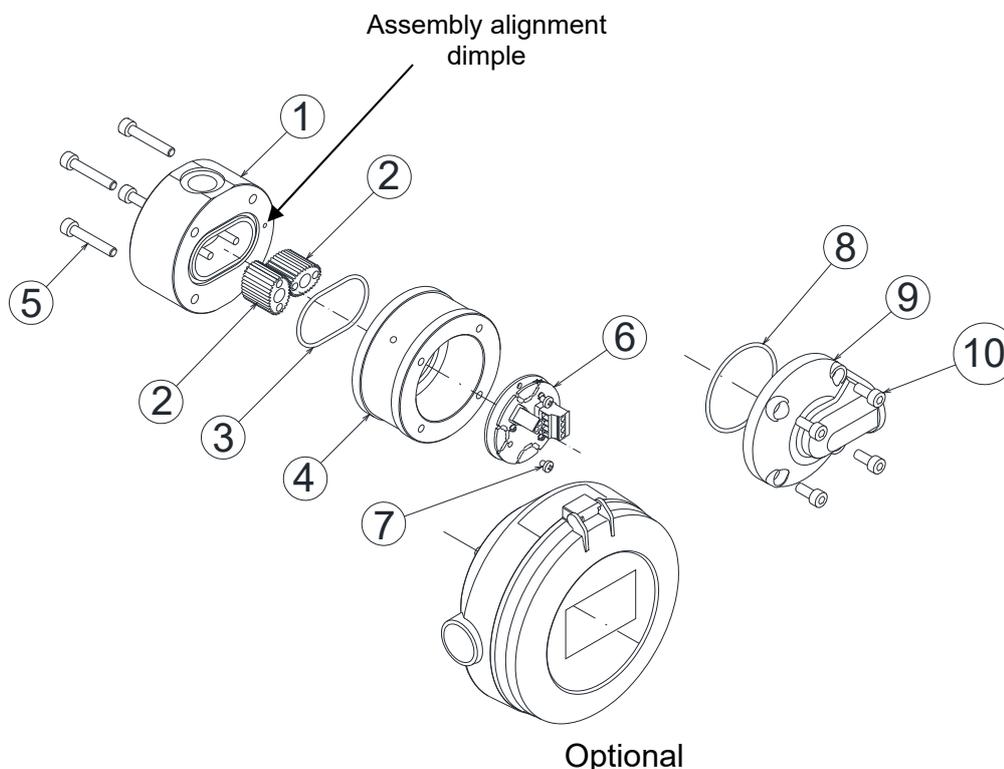
Both gears are properly mounted when they are at 90 ° to each other. They should be easy to move.

Check for correct seating, wear of bearing shafts and bearings by slowly turning the gears by hand.

Then insert the O-ring (3) into the groove of the measuring housing (1) and assemble both parts (1 and 4). For the smaller devices (DON-x04 to DON-x10), make sure the markers are in line.

The hexagon socket screws (5) are inserted and alternately tightened crosswise opposite to each other. Afterwards, the screws should be tightened with a torque according to table chapter 9.5.2 in the same order. By following this procedure, the flow casings are evenly mounted.

Then, if necessary, mount the pulse output board, the cover with the cable gland or the attached electronics. Make sure the O-ring (8) is seated correctly.



9.5.2 Re-assembly of DON-x20...DON-x40

Both oval gears are placed on the axle shafts with the magnets oriented towards the upper meter body (4). Verify that the axle shafts are not loose. Both oval gears are equipped with embedded magnets, allowing them to each be mounted on either axle.

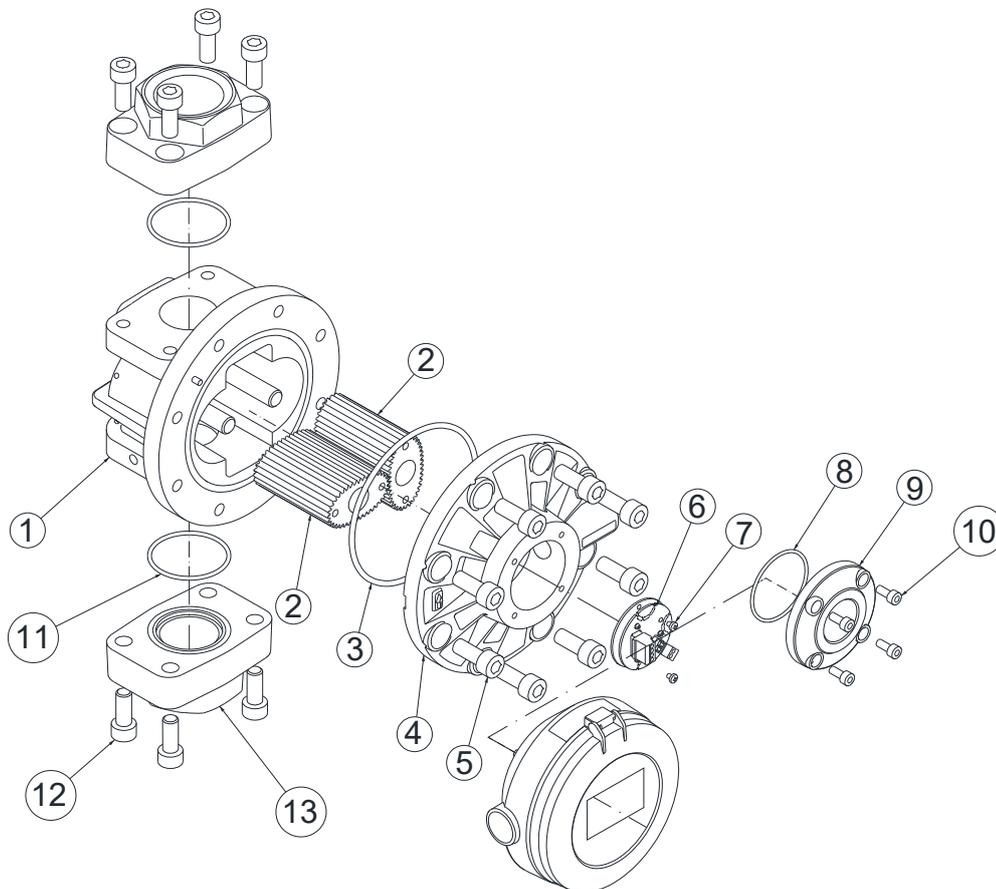
Install the rotors exactly perpendicular from each other (90° in orientation). They will only work if installed precisely. Manually test full rotation after installation as the rotors will not completely rotate freely unless installed precisely 90° from each other.

Proper placement of the O-ring within the groove is necessary for leak free operation. After placement, items (1 & 4) will then require assembly.

Tighten the upper meter body to the lower meter body (1 & 4) with the screws (5) in an alternating pattern (1, 3, 2, 4). Tighten to each to a torque according to table chapter 9.5.2. The alternating tightening procedure is preferred for proper and even assembly.

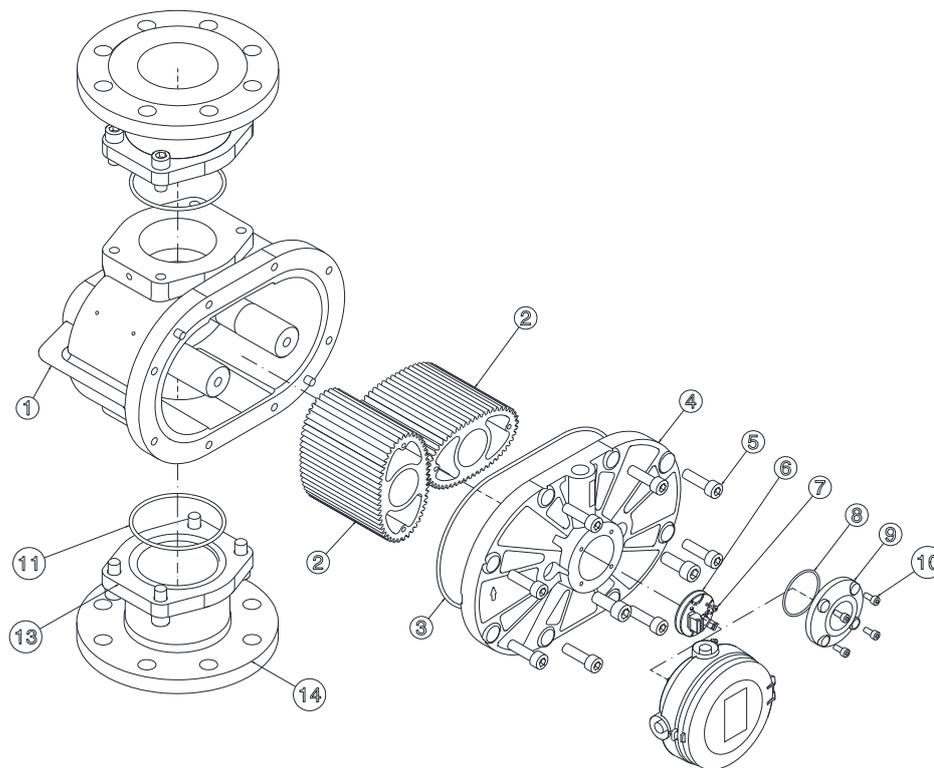
Install the pulse detector board, the o-ring into the provided groove, and then install either the electronic cover (9) or optional electronic assembly.

Exploded view of DON-x25...DON-x40



Optional

Exploded view of DON-x45...DON-x60



Optional

Table tightening torque

Model	Housing screws		Connections and axes	
	Thread	Torque [Nm]	Thread	Torque [Nm]
x04...x15	M5	6	-	-
x20...x25	M6	10	M8	16
x20...x25*	M6	20	M8	16
x30...x40	M10	32	M10	32
x45...x60	M10	32	M12	56

* Steel screws with Geomet coating for high pressure version

10. Technical Data

Material:

DON-1/3

Body: aluminium
Oval wheels: PPS GF 30/PTFE/PEEK
Axes: stainless steel 1.4404

DON-2/4

Body: stainless steel 1.4404 DON-x04...DON-x15
stainless steel 1.4404/1.3955
DON-x20...DON-x60
Oval wheels: stainless steel 1.4404 DON-x04...DON-x40
stainless steel 1.3955 DON-x45...DON-x60
Bearing: carbon graphite
Axes: stainless steel 1.4404

DON-8/9

Body: stainless steel 1.4404 DON-x04...DON-x15
stainless steel 1.4404/1.3955 DON-x20...DON-x60
Oval wheels: PPS GF 30/PTFE, PEEK
Axes: stainless steel 1.4404

O-Rings:

media temperature
FKM: -20..+150 °C
NBR: -20..+100 °C
FEP-O-seal/FKM: -15...+130 °C
(FEP-O-seal, FEP encased, with solid core
EPDM/FKM, only for DON-x04...x40)
Fluoropene® acc. VO (EG) Nr. 1935/2004

Cover for cable
connection:

polyamide PA6 GF35 UL94 HB/VO DON-1
stainless steel 1.4404 DON-2 and DON-8

Magnet
encapsulation:

DON-x04...DON-x10 PEEK
DON-x15...DON-x60 st.st. 1.4404

Accuracy (under
reference conditions*):

± 3 % of reading 0.5-3.6 l/h (DON-x04)
± 1 % of reading 3.6-36 l/h (DON-x04)
± 1 % of reading (DON-x05..DON-x15);
± 0.5 % of reading (DON-x20..DON-x60)
± 0.2 % v. MW (DON-x20..DON-x60);
with optional Z3/3A-electronics based on
linearization function
PPS Rotors: ± 1 % of reading (DON-x20...DON-x60)
± 0.5 % of reading (DON-x20...DON-x60;
(DON-x20...DON-x60; with optional Z3/3A-
electronics based on linearisation function)
± 1 % of reading (option M)
(better accuracy for higher viscosities on request)

SS-rotors:

PPS Rotors:

Additional max. inaccuracy for analog outputs: $\pm 0.15\%$ ME
 Repeatability: typ. $\pm 0.03\%$
 Protection class: IP 66/67 (IP65 for M4)
 Media temperature: -20...+80 °C for options -Lx, Zx, M4, DON-1/3/8/9 and -20 °C...+120 °C for pulse output and DON-2/4 with cooling fins (+150 °C with option T0) for models with PPS/PEEK-rotors, max. temp. is limited to +80 °C
 Ambient temperature: -20...+80 °C, option M4 0 °C...+60 °C
 Cable entry: M20x1.5, 1/2" NPT

ATEX approval

Mechanical explosion protection:  II 2G Ex h IIC T4/T3 Gb

Options 1A/2A/3A/5A:

Intrinsic safety  II 2G Ex ia IIC T4 Gb (-20 °C ≤ Ta ≤ +60 °C)

Options HE, DE, BE, KE, GE, LE:

Flameproof enclosure  II 2G Ex db IIC T4/T6 Gb

 II M2 Ex db I Mb

Options HA, DA, BA, KA, GA:

Intrinsic safety  II 3G Ex ic IIC T4/T3 Gc

IECEx-Zulassung

Options HE, DE, BE, KE, GE, LE:

Flameproof enclosure Ex db IIC
 Ex db I Mb

* Reference conditions: x10...x60 (calibration oil 4.6 cSt, 25 °C, 1 bar).
 X04/x05 and x15 for high viscosities (calibration oil 10 cSt, 20 °C, 5 bar)
 Accuracy data is valid for given viscosities and higher.

R0/RE electronics options: max. switching voltage: 30 V_{DC}
(Reed switch pulse output) max. switching current: 200 mA
max. switching capacity: 10 W
Service life: > 2*10⁶ switching cycles
(at 5 V_{DC} and 10 mA)

H0/HE/HA/B0/BE/BA electronics options:

(Hall sensor + reed switch pulse output)

Hall pulse output: Supply voltage: 8 to 30 V_{DC}
Supply current: max. 5 mA (without load)
active push-pull, max. 100 mA,
short-circuit-proof
HIGH level: min. +V_s – 1.3 V
LOW level: max. 1.3 V

Reed pulse output: max. switching voltage: 20 VDC
max. switching current: 20 mA
max. switching capacity: 10 W
Service life: > 2 * 10⁶ switching cycles (at 5 VDC and 10 mA)

HU electronics option:

(Hall sensor + reed switch pulse output) Supply voltage: 5 to 30 V_{DC}
Hall pulse output: NPN output,
int. pullup 4.7 kΩ
max. switching current: 200 mA
Reed pulse output: as H0/HE/HA

G0/GEGA and K0/KE/KA electronics options:

(Pulse output hall sensor High resolution) Supply voltage: 8 to 30 V_{DC}
Supply current: max. 8 mA (without load)
Hall pulse output: like H0/HE/HA

D0/DE/DA electronics options:

(2x Pulse output hall sensor) Supply voltage: 8 to 30 V_{DC}
Supply current: around 8 mA
Hall pulse output: like H0/HE/HA
Current direction: positive: Hx leading over QUAD
negative: QUAD leading over Hx

L0/LE electronics options: Supply voltage: 16 to 32 V_{DC}
(Current output 4-20mA) Analog output: 4 20 mA, 2-wire
Max. working resistance: 750 ohms (at 24 V_{DC})

Z1/Z2/Z3 electronics options (common properties):

Supply voltage:	8 to 32 V _{DC}
Battery operation (only Z1/Z3)	
Battery:	3.6 V/2200 mA AA size
Display:	LCD, graphic 128x64 Backlighting adjustable
Operation:	4 buttons
Housing:	plastic, PA6, GF-reinforced
Cable inlet:	3x M20x1.5, prepared
Electrical connection:	plug-in terminals

Z1 electronics option:
(Dual counter)

Signal inputs:	2x, configurable
Daily/overall counter:	1x per input
Signal outputs:	none

Z2 electronics option:
(Batching device)

Signal inputs:	1x, configurable
Batching function:	2-stage
Signal outputs:	relay output

Z3 electronics option:
(Flow controller)

Signal inputs:	2x, configurable
Signal outputs:	current output 4-20 mA 2-wire / 3-wire pulse output, scalable status output
Max. working resistance of current output:	750 ohms (at 24V _{DC})

M4 mechanical counter:

4-digit quantity indication
in litres or gallons
8-digit sum display

Electronic options 1A...5A:

see operating instructions supplement ZOK-Ex

Maximum Pressure (threaded version)

Model	Maximum pressure (bar)			
	DON-1/3	DON-2/4/8/9	DON-1.. (option – M4)	DON-2/8 (option – M4)
DON-x04	64	100	-	-
DON-x05			-	-
DON-x06			-	-
DON-x10			-	-
DON-x15			-	-
DON-x20			40	50
DON-x25				
DON-x30				
DON-x35	40	50	30	30
DON-x40	16	16	16	16
DON-x45				
DON-x50				
DON-x55				
DON-x60				

with flanges, maximum pressure rating is above or as per flange rating, whichever is lower

Max. Flowrate Multiplier (for higher viscosities)

Viscosities (cP)	Standard rotor	Special cut rotor
≤ 1000	1	1
≤ 2000	0,5	1
≤ 4000	0,42	0,84
≤ 6000	0,33	0,66
≤ 8000	0,25	0,5
≤ 30000	0,15	0,3
≤ 60000	0,12	0,25
≤ 150000	0,1	0,2
≤ 250000	0,05	0,1
≤ 1000000	0,025	0,05

Special cut rotors for higher viscosities

For viscosity > 1000 cP, special cut rotors of DON-3/4/9 should be used to reduce pressure drop. This applies to DON-x15 and larger sizes. For higher viscosities, the flowmeter max. flowrate is de-rated according to the attached chart.

At viscosities <1000cP, these special rotors are less accurate.

Example: DON-x25 measuring oil at 8000 cP, max. flow 150 LPM x 0.5 = 75 LPM new maximum flow rate.

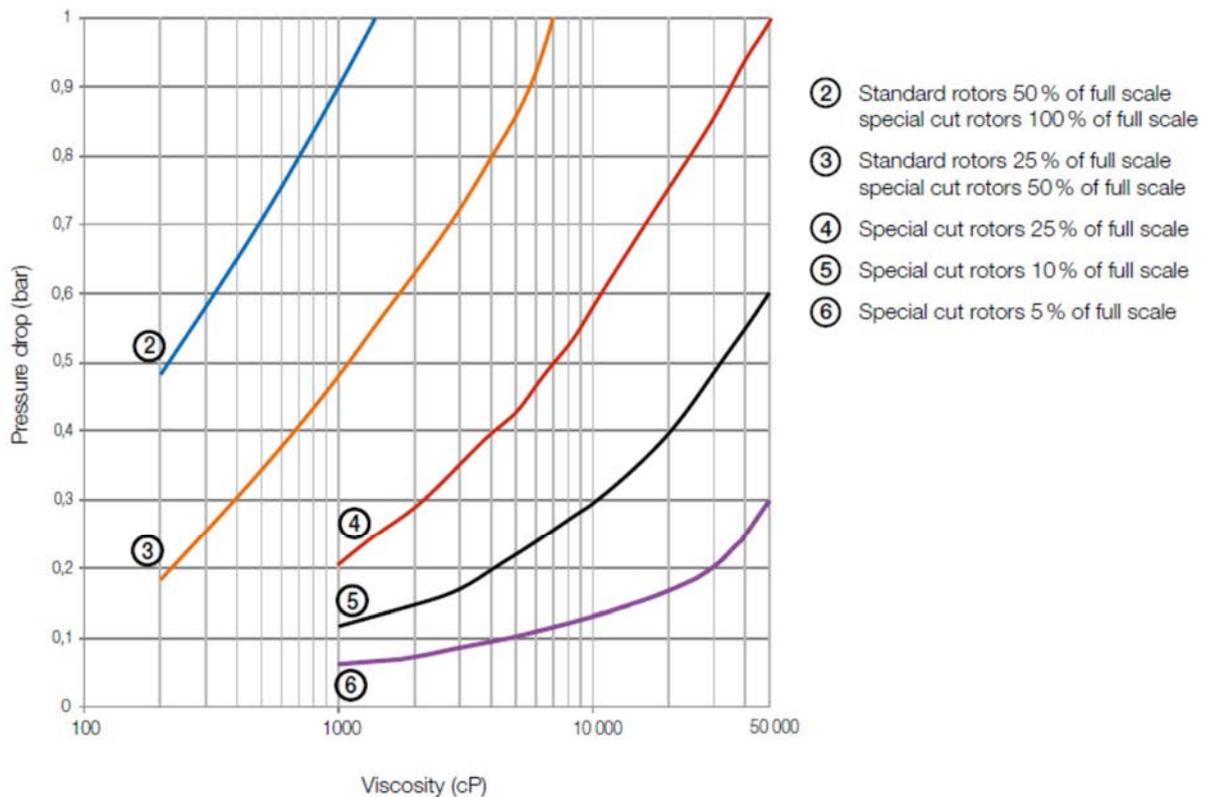
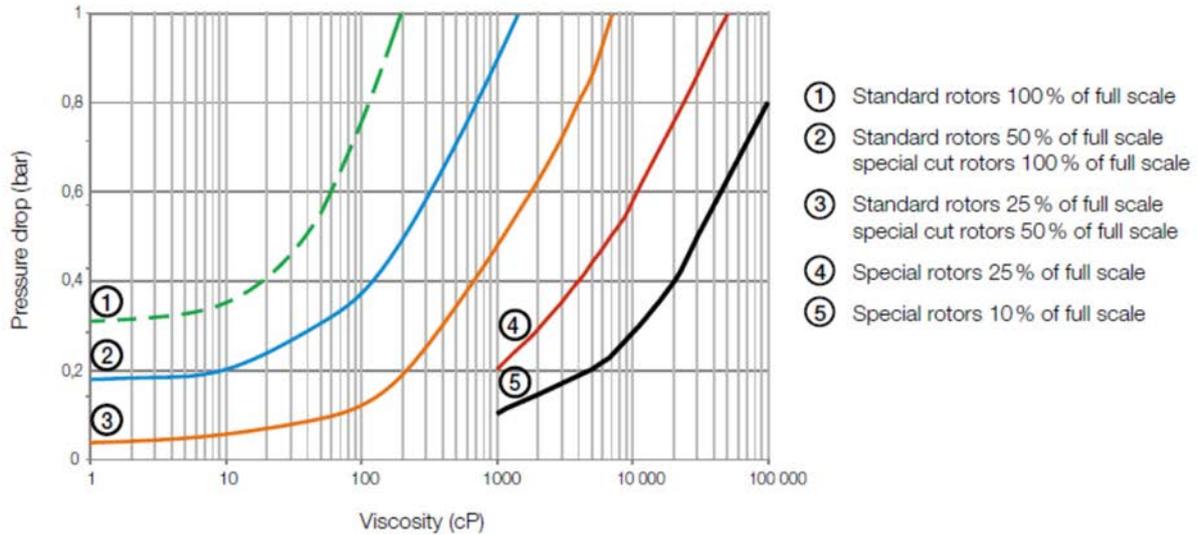
Output Pulse Resolution

Model	Measuring range [l/min]	Pulse / liter					
		Reed switch Hx	Hall sensor Hx	Hall sensor Bx	Quadr. hall sensor Dx	Hall sensor high resolution Gx	Hall sensor high resolution Kx
DON-x04	0.5 - 36 L/h	2670	2670	-	2670	11320	5340
DON-x05	0.5 - 36 L/h	2670	2670	-	2670	11320	5340
DON-x10	2 - 100 L/h	1062	1062	-	1062	4248	2124
DON-x15	15 – 550 L/h	351	702	351	702	-	1404
DON-x20	1-40	82	163	82	163	-	-
DON-x25	10 - 150	26	104	26	52	-	-
DON-x30	15 - 250	13.5	55	13.5	27	-	-
DON-x35	30 - 450	6.4	25.5	6.4	13.5	-	-
DON-x40	50 - 580	4.9	19.6	4.9	9.8	-	-
DON-x45	35 - 750	2.57	10.3	2.57	5.15	-	-
DON-x50	50 - 1000	1.5	5.9	1.5	3	-	-
DON-x55	75 - 1500	1.05	4.2	1.05	2.1	-	-
DON-x60	150 - 2500	0.56	2.3	0.56	1.15	-	-

The values in above mentioned table are only approximate guidelines. The actual value for pulse rate can deviate from the values in this table and is mentioned in calibration certificate delivered with the flowmeter.

11. Pressure drop curves

DON Pressure Drop Curves versus Viscosity



Pressure drop limit versus flowrate

The curves above represent the pressure drop for standard cut oval rotors. Special cut rotors of DON-3/4/9 have alternate tooth relieve which effectively reduces the pressure drop by 50%. When sizing a meter, be sure your selection falls below the 1 bar maximum allowable pressure drop line on the graph.

12. Order codes

Note: See KOBOLD USA Datasheet for USA Order Codes

Example: DON-105H R1 1 L0 M 0

Measuring range [l/min]	Housing material ⁴⁾			Connection	O-Ring Material	Electronics	Cable entry	Option			
	Aluminium with PPS Rotor	Stainless steel	St. st. with PPS rotor								
0.5 – 36 l/h	DON-104H	DON-204H	DON-804H	R1 = G 1/8 N1 = 1/8" NPT	1 = FKM 3 ¹⁴⁾ = FEP-O-ring 4 = NBR 5 ¹³⁾ = Fluoroprene [®] 9 = special materials (not for ATEX)	H0 = Pulse output Hall sensor (Push/Pull)/reed switch HU = Pulse output Hall sensor (NPN)/Reed switch, supply 5-30 V _{DC} B0 ³⁾ = Pulse output Hall sensor (Push/Pull) for pulsating flow T0 ⁸⁾ = Pulse output Hall sensor (Push-Pull), +150 °C, K0 ⁹⁾ = Pulse output Hall sensor (Push/Pull) high resolution (x2) G0 ²⁾ = Pulse output Hall sensor (Push-Pull) high resolution (x4) D0 = 2 phased outputs Hall sensor (Push-Pull) L0 = F/I transmitter output 4...20 mA „loop powered“ analogue output Z1 = LCD dual totalizer, with battery supply outputs deactivated (ZOK-Z1) Z2 = LCD dosing unit Z3 = LCD totalizer, rate, outputs: 4-20 mA, alarm, pulse (ZOK-Z3) (impulses not for battery supply) Z5 = as Z3, but with 2 relays/SPDT relays Z6 = Z1 + B0 Z7 = Z3 + B0 Z8 = Z1 + D0 Z9 = Z3 + D0 ZE = LCD counter flow (ZOE with external supply/with battery) ZB ¹¹⁾ = LCD counter/flow (ZOE without external supply/with battery) HE = H0 + ATEX (Exd) BE ³⁾ = B0 + ATEX (Exd) KE ⁹⁾ = K0 + ATEX (Exd) GE ²⁾ = G0 + ATEX (Exd) DE = D0 + ATEX (Exd) LE = L0 + ATEX (Exd) HA = H0 + ATEX (Exi) BA ³⁾ = B0 + ATEX (Exi) KA ⁹⁾ = K0 + ATEX (Exi) GA ²⁾ = G0 + ATEX (Exi) DA = D0 + ATEX (Exi) 1A ¹¹⁾ = ZOK-E1 + HA (ATEX Exi) 2A ¹¹⁾ = ZOK-E2 + HA (ATEX Exi) 3A ¹¹⁾ = ZOK-E3 + HA (ATEX Exi) 5A ¹¹⁾ = ZOK-E5 + HA (ATEX Exi)	M = M20 N = 1/2" NPT S ⁷⁾ = M20 + cooling fin T ⁷⁾ = 1/2" NPT + cooling fin	0 = without N = without battery Y = special option, (specify in clear text, not for ATEX, e.g. check valve)			
0.5 – 36 l/h	DON-105H	DON-205H	DON-805H	R1 = G 1/8 N1 = 1/8" NPT							
2 – 100 l/h	DON-110H	DON-210H	DON-810H	R2 = G 1/4 N2 = 1/4" NPT							
15 – 550 l/h	DON-115H	DON-215H	DON-815H	R3 = G 3/8 N3 = 3/8" NPT							
1 – 40	DON-120H	DON-220H	DON-820H	R4 = G 1/2 N4 = 1/2" NPT H4 ⁵⁾ = G 1/2 (100 bar) P4 ⁹⁾ = 1/2" NPT (100 bar)							
10 – 150	DON-125H	DON-225H	DON-825H	R6 = G 1 N6 = 1" NPT F6 = DIN flange PN 16/40 (DN 25) A6 = ANSI flange 150 lbs (1") B6 = ANSI flange 300 lbs (1") H6 ⁵⁾ = G 1 (100 bar) P6 ⁹⁾ = 1" NPT (100 bar)							
15 – 250	DON-130H	DON-230H	DON-830H	R8 = G 1 1/2 N8 = 1 1/2" NPT F8 = DIN flange PN16/40 (DN40) A8 = ANSI flange 150 lbs (1 1/2") B8 = ANSI flange 300 lbs (1 1/2")							
30 – 450	DON-135H	DON-235H	DON-835H	R9 = G 2 N9 = 2" NPT F9 = DIN flange PN16 (DN50) C9 ⁹⁾ = DIN flange, PN 40 (DN50) A9 = ANSI flange 150 lbs (2") B9 ¹⁾ = ANSI flange 300 lbs (2")							
50 – 580	DON-140H	DON-240H	DON-840H								
35 – 750	DON-145H	DON-245H	DON-845H	RB = G3 NB = 3" NPT FB = DIN flange PN 16 (DN80) AB = ANSI flange 150 lbs (3")							
50 – 1000	DON-150H	DON-250H	DON-850H								
75 – 1500	DON-155H	DON-255H	DON-855H	RC = G4 NC = 4" NPT FC = DIN flange PN16 (DN100) AC = ANSI flange 150 lbs (4")							
150 – 2500 ¹⁰⁾	DON-160H	DON-260H	DON-860H						M4 ⁶⁾ = mech. totaliser 4-digit	0 = without	

¹⁾ only for DON-x35 ²⁾ only for DON-x04, -x05 and -x10 ³⁾ Not for DON-x04, -x05 and -x10 ⁴⁾ Replace 'H' with 'G' to order GPH (GPM)
⁵⁾ With steel screws, only for DON-2... and DON-8... ⁶⁾ Only for DON-x20...DON-x60. Please specify the flow direction in clear text while ordering (possible flow directions "bottom to top" or "left to right" or "right to left". Standard flow direction is from bottom to top. ⁷⁾ Only for electronic options -Z/-xA, not for DON-1... and DON-8...⁸⁾ Only for DON-2 ⁹⁾ Only for DON-x04, -x05, -x10, -x15 without Reed switch ¹⁰⁾ Calibrated up to 2200 l/h. Higher flow rate calibration on request
¹¹⁾ Without backlighting ¹²⁾ From DON-x20 PPS ¹³⁾ Only for DON-x04...x20, this version is not calibrated with oil (no calibration certificate).
 Use k-factor values from the data sheet ¹⁴⁾ Only for DON-x04...x40

Example: DON-320H R4 1 L0 M 0

Measuring range	Housing material ⁴⁾			Connection	O-Ring Material	Electronics	Cable entry	Option
	Aluminium with PPS/ PEEK ¹²⁾ rotor for high viscosities	Stainless steel with rotor for high viscosities	St. st. with PPS/ PEEK ¹²⁾ rotor for high viscosities					
0.5 – 36 l/h	-	-	-	R1 = G 1/8 N1 = 1/8" NPT	1 = FKM 3 ¹⁴⁾ = FEP-O-ring 4 = NBR 5 ¹³⁾ = Fluoroprene [®] 9 = special materials (not for ATEX)	H0 = Pulse output Hall sensor (Push/Pull)/ reed switch HU = Pulse output Hall sensor (NPN)/Reed switch, supply 5-30 V _{oc} B0 ³⁾ = Pulse output Hall sensor (Push/Pull) for pulsating flow T0 ⁹⁾ = Pulse output Hall sensor (Push-Pull), +150 °C, K0 ⁹⁾ = Pulse output Hall sensor (Push/Pull) high resolution (x2) G0 ²⁾ = Pulse output Hall sensor (Push-Pull) high resolution (x4) D0 = 2 phased outputs Hall sensor (Push-Pull) L0 = F/I transmitter output 4...20 mA „loop powered“ analogue output Z1 = LCD dual totalizer, with battery supply outputs deactivated (ZOK-Z1) Z2 = LCD dosing unit Z3 = LCD totalizer, rate, outputs: 4-20 mA, alarm, pulse (ZOK-Z3) (impulses not for battery supply) Z5 = as Z3, but with 2 relays/SPDT relays Z6 = Z1 + B0 Z7 = Z3 + B0 Z8 = Z1 + D0 Z9 = Z3 + D0 ZE = LCD counter flow (ZOE with external supply/with battery) ZB ¹¹⁾ = LCD counter/flow (ZOE without external supply/with battery) HE = H0 + ATEX (Exd) BE ³⁾ = B0 + ATEX (Exd) KE ⁹⁾ = K0 + ATEX (Exd) GE ²⁾ = G0 + ATEX (Exd) DE = D0 + ATEX (Exd) LE = L0 + ATEX (Exd) HA = H0 + ATEX (Exi) BA ³⁾ = B0 + ATEX (Exi) KA ⁹⁾ = K0 + ATEX (Exi) GA ²⁾ = G0 + ATEX (Exi) DA = D0 + ATEX (Exi) 1A ¹¹⁾ = ZOK-E1 + HA (ATEX Exi) 2A ¹¹⁾ = ZOK-E2 + HA (ATEX Exi) 3A ¹¹⁾ = ZOK-E3 + HA (ATEX Exi) 5A ¹¹⁾ = ZOK-E5 + HA (ATEX Exi) M4 ⁶⁾ = mech. totaliser 4-digit	M = M20 N = 1/2" NPT S ⁷⁾ = M20 + cooling fin T ⁷⁾ = 1/2" NPT + cooling fin	0 = without battery Y = special option, (specify in clear text, not for ATEX, e.g. check valve)
0.5 – 36 l/h	-	-	R1 = G 1/8 N1 = 1/8" NPT					
2 – 100 l/h	-	-	R2 = G 1/4 N2 = 1/4" NPT					
15 – 550 l/h	DON-315H	DON-415H	DON-915H	R3 = G 3/8 N3 = 3/8" NPT				
1 – 40	DON-320H	DON-420H	DON-920H	R4 = G 1/2 N4 = 1/2" NPT H4 ⁵⁾ = G 1/2 (100 bar) P4 ⁵⁾ = 1/2" NPT (100 bar)				
10 – 150	DON-325H	DON-425H	DON-925H	R6 = G 1 N6 = 1" NPT F6 = DIN flange PN 16/40 (DN 25) A6 = ANSI flange 150 lbs (1") B6 = ANSI flange 300 lbs (1") H6 ⁵⁾ = G 1 (100 bar) P6 ⁵⁾ = 1" NPT (100 bar)				
15 – 250	DON-330H	DON-430H	DON-930H	R8 = G 1 1/2 N8 = 1 1/2" NPT F8 = DIN flange PN16/40 (DN40) A8 = ANSI flange 150 lbs (1 1/2") B8 = ANSI flange 300 lbs (1 1/2")				
30 – 450	DON-335H	DON-435H	DON-935H	R9 = G 2 N9 = 2" NPT F9 = DIN flange PN16 (DN50) C9 ⁸⁾ = DIN flange, PN 40 (DN50) A9 = ANSI flange 150 lbs (2") B9 ¹⁾ = ANSI flange 300 lbs (2")				
50 – 580	DON-340H	DON-440H	DON-940H					
35 – 750	DON-345H	DON-445H	DON-945H	RB = G3 NB = 3" NPT FB = DIN flange PN 16 (DN80)				
50 – 1000	DON-350H	DON-450H	DON-950H	AB = ANSI flange 150 lbs (3")				
75 – 1500	DON-355H	DON-455H	DON-955H	RC = G4 NC = 4" NPT FC = DIN flange PN16 (DN100) AC = ANSI flange 150 lbs (4")				
150 – 2500 ¹⁰⁾	DON-360H	DON-460H	DON-960H					

¹⁾ only for DON-x35

²⁾ only for DON-x04, -x05 and -x10

³⁾ Not for DON-x04, -x05 and -x10

⁴⁾ Replace 'H' with 'G' to order GPH (GPM)

⁵⁾ With steel screws, only for DON-2... and DON-8... ⁶⁾ Only for DON-x20...DON-x60. Please specify the flow direction in clear text while ordering (possible flow directions "bottom to top" or "left to right" or "right to left". Standard flow direction is from bottom to top. ⁷⁾ Only for electronic options -Zx/-xA, not for DON-1...and DON-8...

⁸⁾ Only for DON-2 ⁹⁾ Only for DON-x04, -x05, -x10, -x15 without Reed switch ¹⁰⁾ Calibrated up to 2200 l/h. Higher flow rate calibration on request

¹¹⁾ Without backlighting

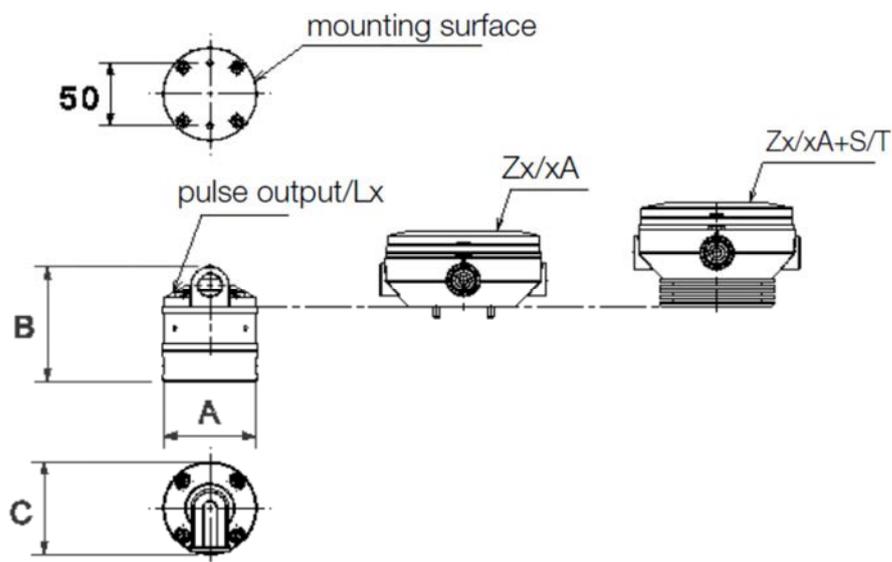
¹²⁾ From DON-x20 PPS

¹³⁾ Only for DON-x04...x20, this version is not calibrated with oil (no calibration certificate).

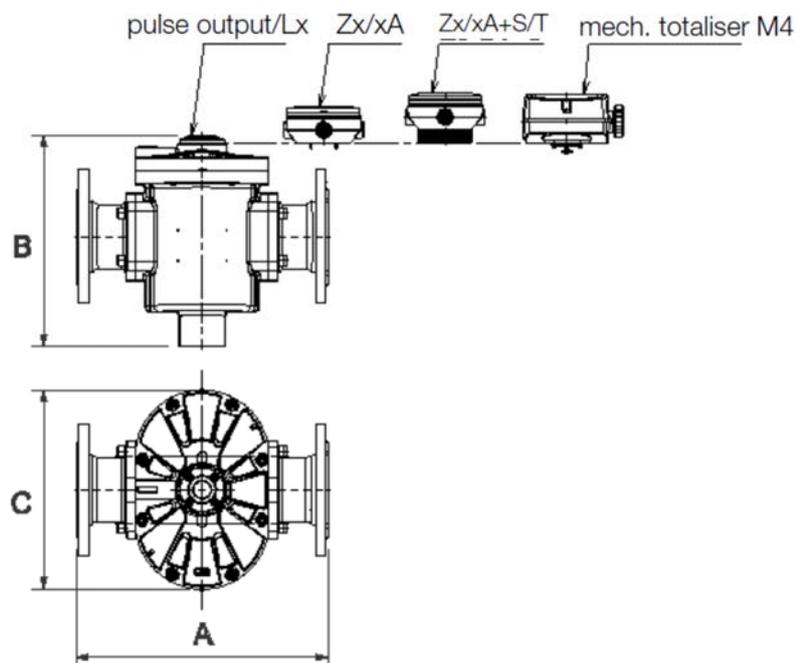
Use k-factor values from the data sheet ¹⁴⁾ Only for DON-x04...x40

13. Dimensions

DON-1/-2/-3/-8/-9
DON-x04...DON-x15

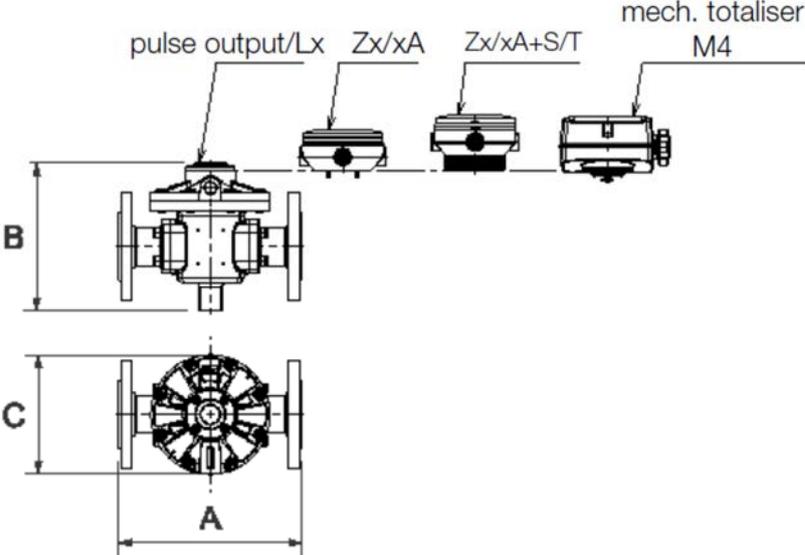


DON-x45...DON-x60

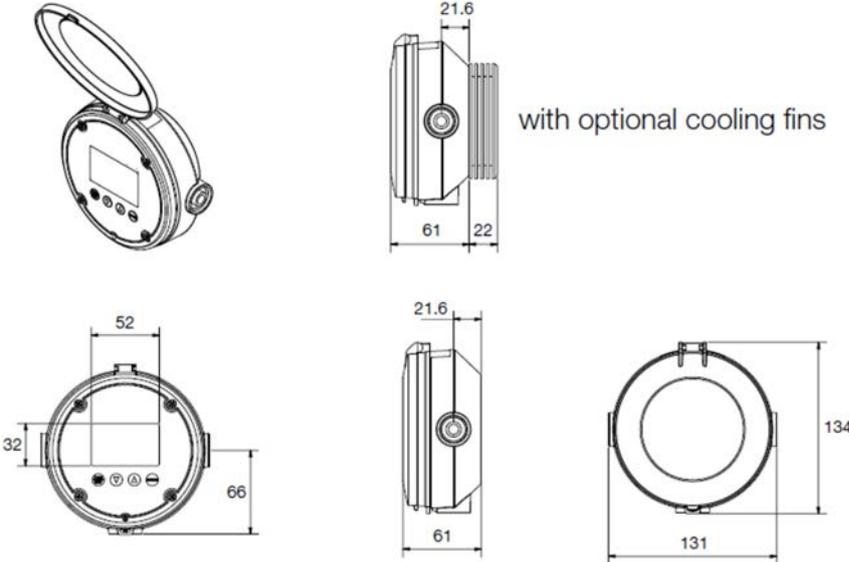


DON

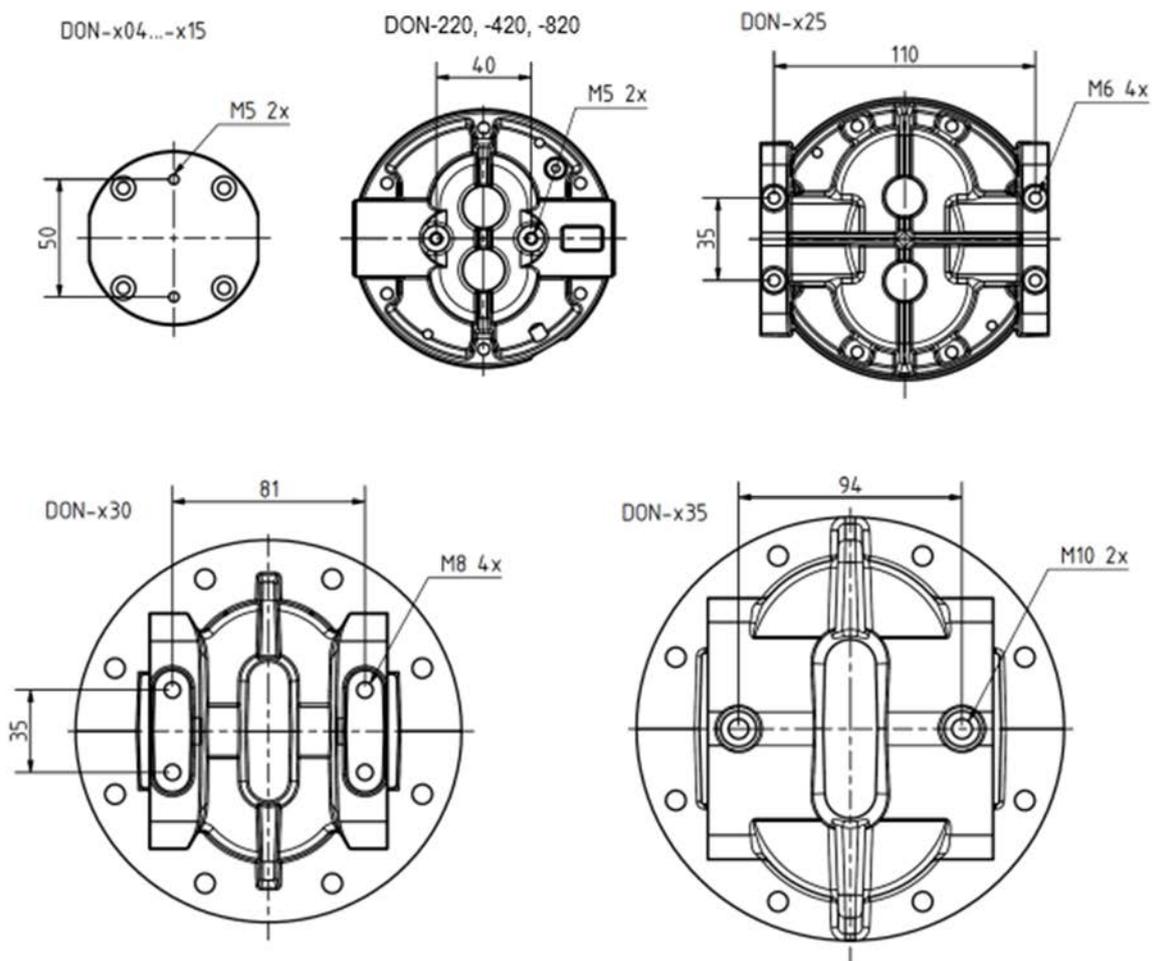
DON-x20...DON-x40



Electronic with LCD display /Zx/xA



Mounting threads for wall mounting



Dimensions DON-1/-2/-3/-4/-8/-9...(±2 mm)

Model	A [mm]		B [mm]			C [mm]		
	Thread connection	Flange connection	Pulse output/Lx	Zx/Ex	Mechanical totaliser M4	Pulse output/Lx	Zx/Ex	Mechanical totaliser M4
DON-x04	68	-	92	131	-	72	134	-
DON-x05	68	-	92	131	-	72	134	-
DON-x10	68	-	92	131	-	72	134	-
DON-x15	68	-	99	138	-	72	134	-
DON-x20	110	-	105 (101)	134 (130)	182 (178)	112	134	165
DON-x25	176	237	136	165	194	120	134	170
DON-x30	188	252	166	195	223	163	163	200
DON-x35	212	277	172	201	244	180	180	200
DON-x40	212	277	246	275	299	180	180	200
DON-x45	266	354	232	261	284	238	238	239
DON-x50	294	382	229	258	302	290	290	290
DON-x55	294	388	274	303	347	290	290	290
DON-x60	320	414	351	380	424	331	331	331

Note: Dimensions for DON-2/-4/-8/-9... are specified in () only when they are different from DON-1/-3...

14. Troubleshooting

Oval gear flowmeters have two clearly distinct portions: one of which is mechanical, wetted areas with the oval gears surrounded by a housing, and the other is the electrical area, which includes the pulse output board.

Details of some key troubleshooting steps will now be provided. Please also refer to the instructions on troubleshooting errors contained on the following page.

Step 1 - Check application, installation and set-up.

Carefully read the section on mechanical installation to ensure full knowledge of all relevant installation and application factors which may affect the operation of the counter. These include pulsation, trapped air or selecting the wrong counter, including incorrect flow rate, temperature or pressure, or material incompatibility. Refer to the section on electrical installation to ensure correct cabling.

Step 2 - Check for blockages.

For new and modified systems in particular, the most frequent cause of error or sub-optimal counter operation is internal system or counter blockages due to foreign particles, such as beads of condensate, sealing tape residues or mixtures of deposits, rust, etc.

Step 3 - Guarantee flow rate.

Flow stopping or a flow rate declining below the usual limit may be attributable to a blocked screen, flowmeter rotors which are stuck or damaged, a defective pump, closed valves or an insufficient liquid level in the storage tank.

Step 4 - The oval gears in the counter must revolve.

This rotation is audible: try holding a screwdriver blade against the counter housing and push the handle right against your earlobe. Test the counter as required with flow switched on and off, to ensure you are familiar with the audible sound of rotation.

Step 5 - Ensure that pulses are generated when liquids flow.

Here, a multimeter is often not fast enough to capture the pulse sequence of the reed switch or the Hall Effect sensor. However, an oscilloscope will allow you to observe the output pulse sequence. When testing the reed switch pulse, a pull-up resistor must be installed between the single connection of the reed switch and the supply voltage, while the other connection must be connected to the reference potential of the measurement device (oscilloscope) (see electrical installation).

Step 6 - Confirm device operation.

If a mounted electronic component is connected to the DON, check the functions by simulating a pulse input. A reed switch pulse input can be simulated by a swift and pulse-driven short-circuiting of the input terminals.

Problem	Possible cause	Solution
Counter values too high	1. Disruption of the output signal	1. Ground shielding of the signal cable
		2. Re-lay the cable away from sources of high current
	2. Air or gas pockets	1. Eliminate the source of the air or gas pocket
		2. Install an upstream air separator
	3. Pulsating flow from the piston pump	1. Increase back-pressure to the pump
2. Install a quick-response one-way check valve		
3. Install a pulsation damper between the pump and the counter		
Counter values are too low	1. Damaged or worn rotors	1. Check, repair, clear or replace rotors
		2. Damaged or worn measurement chamber
	3. Disruption of the output signal	1. Check measurement chamber for damage - repair as required
		2. Check concentricity of the rotor shafts in the chamber
		3. Check all electrical connections and wires for the presence of current.
No output from counter	1. Soiled rotors	1. Check whether the rounded teeth at the base of the chamber are visible
		2. Check for any obstructing foreign particles
		3. Clear, repair or replace rotors
	2. Counter incorrectly mounted	1. See instructions for re-mounting the counter, focusing on the positioning of rotors and magnets above all
	3. No output from the output board	1. Check screw terminal connections and soldering joints
2. Ensure the presence of DC voltage at +Vs and 0V/GND and that the analytical electronics connected include a pull-up resistor when using the reed switch		
No flow signals indicated on the analytical device	1. Defective analytical electronics	3. Replace output plate
		1. Check settings and parameter data in the set-up menu
		2. Check screw terminal connections and the presence of electrical current
		3. Repair/replace analytical electronics

15. Use in Ex areas

15.1 General information

The flow meter is intended for commercial systems and may only be used in accordance with the information in the technical documentation from Kobold and the information on the nameplate. It is operated exclusively together with certified products via an intrinsically safe circuit. They correspond to the applicable standards and regulations. The installation regulations (e.g. EN 60079-14) for systems in potentially explosive areas must be considered.

15.1.1 General safety information

The flow meter corresponds to the state of the art and is operationally safe. The flow meter can bear a residual risk if it is used and operated improperly by untrained personnel. Every person who is entrusted with the installation, commissioning, maintenance or repair of the flow meter must have read and understood the assembly instructions and in particular the safety instructions.

- a) When selecting a product and using it as intended, follow the general rules of technology.
- b) All connected electrical and mechanical equipment must be suitable for the respective application.
- c) Observe the information in these operating instructions as well as the conditions of use and permissible data that appear on the imprints / nameplates of the respective products.
- d) It must be ensured that only the product types of protection that correspond to the zones are installed!
- e) The product is only approved for appropriate and intended use in a normal industrial atmosphere. Immersion in liquids is not permitted.
- f) It must be ensured that no falling objects can hit the product. If there is a risk of impact sparks, external housing parts made of light metal must be installed in a protected manner.
- g) The operator must ensure lightning protection for the entire system in accordance with local regulations.
- h) It is the responsibility of the installer to ensure that the flow meter functions properly in connection with the individual evaluation devices and that it is approved for the intended purpose.
- i) A safe to operate and non-critical media is elementary for this type of protection and must be strictly adhered to!

15.1.2 Intended use

- a) To ensure safe operation, the products may only be used in accordance with the information in the assembly instructions. When using the device, the legal and safety regulations required for the respective application must also be considered. This also applies analogously to the use of accessories.

- b) If the instructions given here are not followed or if the product is handled improperly, our liability is void. In addition, the warranty on products and spare parts does not apply.
- c) The products are not safety elements in the sense of their intended use.
- d) Only original parts from the manufacturer may be used.
- e) Flammable media within the flow meter must not be heated in Zone 1 above 80% of their ignition temperature without taking special measures
- f) Charging of the media is not permitted; measures by the operator are necessary.

15.1.3 Temperature classes and media temperatures

z	Material seal	Marking	Cat. 2 (Zone 1)	TC	Cat. 3 (Zone 2)	TC
1	FKM	e = 1	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
2			-20 °C .. 100 °C	T3	-20 °C .. 110 °C	T3
3	FEP / EPDM 92	e = 3	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
4			-20 °C .. 110 °C	T3	-20 °C .. 120 °C	T3
5	NBR	e = 4	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
6			-20 °C .. 100 °C	T3	-20 °C .. 110 °C	T3
7	Fluoroprene	e = 5	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
8			-20 °C .. 130 °C	T3	-20 °C .. 130 °C	T3

15.1.4 Maximum operating pressure

Model	Maximum pressure	
	DON-1 ***** DON-3 *****	DON-2 ***** DON-4 ***** DON-8 ***** DON-9 *****
DON-* 04 ***** DON-* 05 ***** DON-* 10 ***** DON-* 15 ***** DON-* 20 ***** DON-* 25 *****	64 bar	100 bar
DON-* 30 ***** DON-* 35 *****	40 bar	50 bar
DON-* 40 ***** DON-* 45 ***** DON-* 50 ***** DON-* 55 ***** DON-* 60 *****	16 bar	16 bar

15.1.5 Servicing, maintenance

Definition of terms according to IEC 60079-17:

Maintenance and repair: A combination of all activities carried out in order to keep an object in a condition or to bring it back into a condition that meets the requirements of the relevant specification and ensures the execution of the required functions.

Inspection: An activity that involves the careful examination of an object with the aim of making a reliable statement about the condition of this object, without dismantling or, if necessary, with partial dismantling, supplemented by measures e.g. measurements is carried out.

Visual inspection: A visual inspection is an inspection in which visible defects are found (e.g. missing screws) without the use of devices or tools.

Close-up inspection: An inspection that, in addition to the aspects of the visual inspection, identifies defects such as loose screws that can only be removed through the use of access devices (e.g. if necessary stairs) and tools. For close-up tests, a housing usually does not need to be opened or the equipment needs to be de-energized.

Detailed inspection: An inspection in which, in addition to the aspects of close-up inspection, defects such as loose connections, which can only be identified by opening housings and / or, if necessary, using tools and testing equipment, are treated.

Maintenance measures may only be carried out by qualified persons.

Only accessories that meet all the requirements of the European directives and national legislation may be used in potentially explosive areas.

Maintenance measures including dismantling the flow meter may only be carried out in a non-explosive atmosphere.

Components may only be replaced with original spare parts that are also approved for use in Ex areas. Repairs only by the manufacturer or specialist workshop.

The products must be regularly serviced and cleaned in the Ex area. The intervals are determined by the operator in accordance with the environmental stresses on site.

	Activity	Visual inspection per month	Close-up inspection every 6 months	Detailed inspection every 12 months
1	Visual inspection of the flow meter for damage and remove dust deposits	•		
2	Check for integrity and function			•
3	Examination of the entire system	In the operator's area of responsibility		

Tightening torques of the screws used

Thread	Quality	Material	Tightening torques
M5	80	A4	6 Nm
M6	80	A4	10 Nm
M6	12.9	Steel	20 Nm
M10	70	A2	40 Nm

15.1.6 Troubleshooting

No changes may be made to products that are operated in connection with potentially explosive areas. Repairs to the product may only be carried out by specially trained and authorized specialists.

15.1.7 Disposal

The packaging and used parts must be disposed of in accordance with the regulations of the country in which the product is installed.

15.2 ATEX version Exi (electronics options xA and 1A to 5A)

While evaluating the product, following Norms were considered:

- a) EN IEC 60079-0: 2018 Ed. 7 Hazardous areas - Part 0: Equipment - General requirements
- b) IEC 60079-11: 2011 Ed. 6 + Corr. 2012 / EN 60079-11: 2012 Hazardous areas - Part 11: Equipment protection by intrinsic safety "i"
- c) EN ISO 80079-36 2016 Explosive atmospheres - Part 36: Non-electrical devices for use in explosive atmospheres - Basics and requirements.
- d) EN ISO 80079-37 2016 Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety "c", control of ignition source "b", liquid immersion "k"

15.2.1 General information on explosion protection

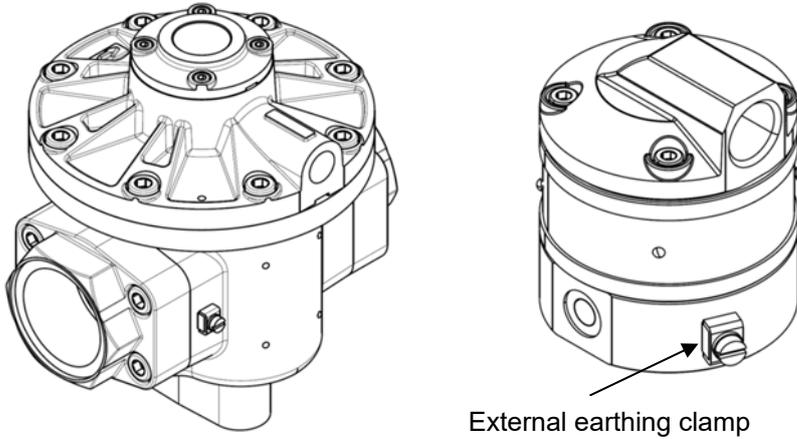
The electrical connection is made via a plug in a separate inductively coupled electronics compartment - exclusively in intrinsically safe systems. The electronics option HA is combined with the electronics models ZOK-E * M (compact version) or ZOK-E * K (remote electronics) in accordance with LOM 16 ATEX 2062 to form the electronics options 1A, 2A, 3A and 5A.

Permitted use

The intrinsically safe flow meter can be used as follows:

- In Zone 2 (Gas-Ex, Category 3G, EPL Gc) in explosion groups IIA, IIB and IIC.
- The requirements for simple electrical equipment in intrinsically safe circuits in Zone 1 according to EN 60079-11 are met for various versions.
- The qualification with regard to the surface temperature is T4 / T3; for all gases, vapours and fog with an ignition temperature $\geq 135^{\circ}\text{C}$ / $\geq 200^{\circ}\text{C}$, the products are not an ignition source.
- The permissible ambient temperature range is from $-20^{\circ}\text{C} \leq T_a \leq 80^{\circ}\text{C}$.

In accordance with the installation regulations, housing must be grounded using the earthing clamps. The maximum connection cross-section is 4 mm².



15.2.2 Electrical parameters of the electronic options HA/BA/GA/KA/DA when used in Zone 1/2

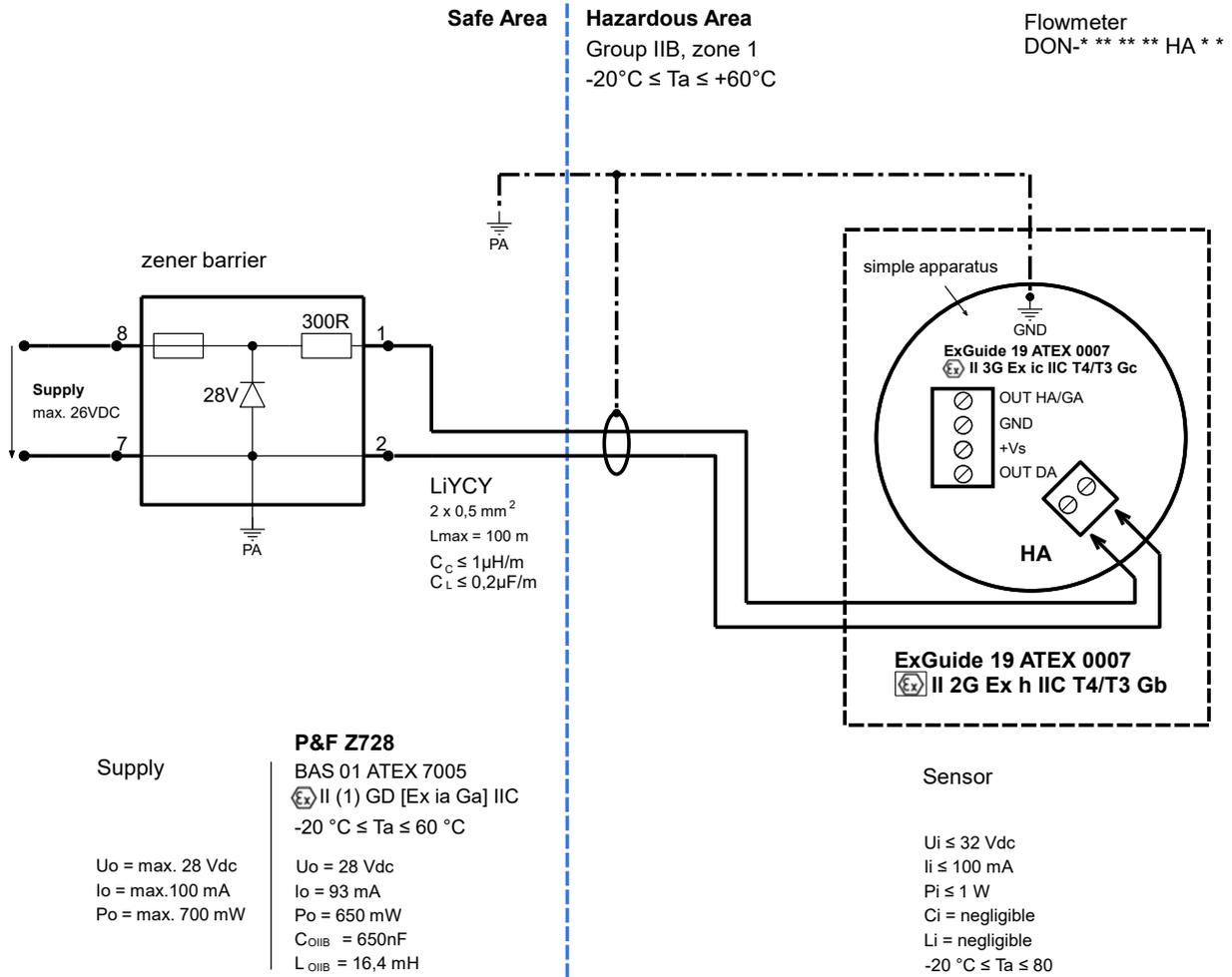
Electrical data:

- Rated voltage up to 32 volts DC
- Rated current up to 100 mA
- $I_i \leq 100 \text{ mA} \cdot P_i \leq 1 \text{ W}$ @ max. 80 ° C ambient temperature

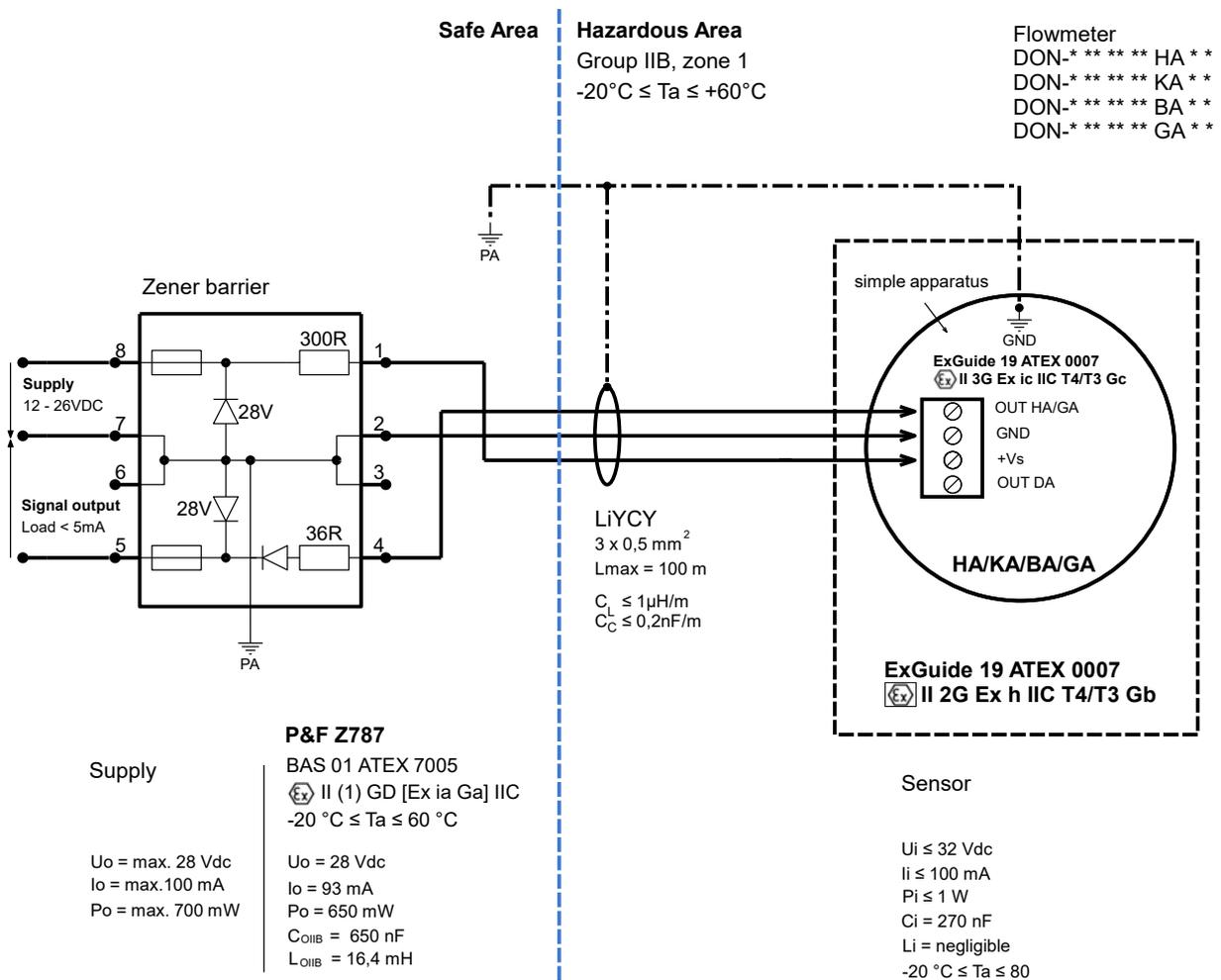
Electronics option	Use in zone	U_i	I_i	C_i
Hall sensor HA/BA/GA/KA/DA	1	$U_{iIB} \leq 32 \text{ VDC}$	$\leq 100 \text{ mA}$	270 nF
	2			
Reed switch HA	1			10 nF
	2			

15.2.3 Wiring examples for electronics options HA/KA/BA/GA with Zener barriers

Control Drawing for DON-***HA Oval Gear Flowmeter with pulse output (Reedswitch, usage with zener barrier) for Group IIB zone 1



Control Drawing for DON-HA/KA/BA/GA Oval Gear Flowmeter with pulse output (Hallsensor, usage with zener barrier) for group IIB zone 1



15.2.4 Electronics options 1A to 5A when used in Zone 1/2

With the electronics options 1A to 5A, the electronics option HA in connection with a flow meter / doser / controller of the type ZOK-E * K * F3 or ZOK-E * M * F3 ** according to LOM 16 ATEX 2062 X is a simple electrical equipment used and supplied electrically by this equipment only.

Interconnection examples for options 1A to 5A can be found in the instruction manual supplement "z2gbm_zok-ex_supplement".

15.2.5 Commissioning, installation

Depending on the IP degree of protection, the time for cleaning the equipment (dust deposits) must be specified. Other important facts:

- a) The product may only be put into operation in Zone 2 (Cat. 3G, EPL Gc) or in Zone 1 (Cat. 2G, EPL Gb) in intrinsically safe circuits by specialists with a qualification similar to a qualified person in accordance with TRBS 1203.
- b) The requirements for simple electrical equipment, which apply to the potentially explosive area of zone 1 according to EN 60079-11, are met.
- c) The products may only be used in a normal industrial atmosphere. If aggressive substances are present in the air, the manufacturer should always be consulted. The products must be appropriately protected in adverse environmental conditions.
- d) The operation of the product is only permitted in the completely assembled and undamaged housing. In the event of possible damage, the operator may have to consider the spread of zones. In addition, operation is not permitted if the housing is damaged.
- e) The environmental conditions specified in the operating instructions must be strictly followed. Appropriate protection against adverse environmental conditions needs to be realised.
- f) The flow meter may only be operated when it is completely filled. Exceptions according to the operator's risk assessment are only permitted for start-up and shutdown.
- g) Thermal radiation from third-party products / components must be taken into account.
- h) The flow meter must be protected against inadmissible ingress of liquids and / or contamination.
- i) Stuck parts (e.g. due to frost or corrosion) must not be loosened with force in the presence of an explosive atmosphere. Icing must therefore be avoided.
- j) The flow meter may only be exposed to low vibrations, see also IEC 34-14.
- k) A direct electrostatic discharge of high energy onto the equipment is not permitted (usually cannot be generated by human contact). To ensure that electrostatic charges are discharged, the national requirements must be taken into account.
- l) In particular, isolated established capacities must be prevented.
- m) All construction parts must be connected to one another in metal, central connection for equipotential bonding.
- n) Equalizing currents must not be routed through the metallic structures.
- o) The intrinsically safe connection must be made using approved / tested evaluation devices that may have to be equipped with suitable Zener barriers or switching amplifiers.
- p) Only Zener barriers or switching amplifiers whose output circuits are approved / tested for use in an explosive atmosphere may be used. In Europe, use in Zone 1 requires an EC type-examination certificate for the equipment in question, which is issued by a body designated for explosion protection.
- q) The voltage of the supply devices must be less than or equal to the voltage U_i of the flow meter.
- r) The total current I_o of the supply devices must be less than or equal to the current I_i of the flow meter.

- s) The ignition limit curves from EN 60079-11 must be taken into account in Zone 2 without a safety factor and must be observed during installation. The safety factor 1.5 is to be used in zone 1. A control drawing (system description) to be created by the installer / operator is required for the installation of the intrinsically safe circuit.
- t) Equipotential bonding must be established along the intrinsically safe circuit. The certificates, including the special conditions specified therein, must be taken into account.
- u) Within the potentially explosive area, assembly may only be carried out in accordance with the locally applicable installation regulations. The following conditions must be observed (incomplete):
 - a) Installation and maintenance may only be carried out in an explosion-free atmosphere and in compliance with the regulations applicable in the operator's country.
 - b) Additional precautions must be taken if the presence of hydrogen sulfide, ethylene oxide and / or carbon monoxide is to be expected: These substances have a very low ignition energy!
 - c) If these substances are present and if a substance of explosion group IIC is present and an explosive atmosphere is likely to be present, only non-sparking tools may be used!
 - d) The flow meters must not be used in systems with cathodic corrosion protection; in borderline cases, consult the manufacturer.
 - e) Particular care must be taken to ensure that no stray currents (e.g. generated by motors that are operated on frequency converters, welding systems and / or cathodic corrosion protection systems) are fed through the flow meter.

15.2.6 Identification of the flow meter (nameplate)

Basic device label DON- (example)



Device label for Ex version intrinsically safe, options HA / GA / DA / KA / BA (example)



15.3 ATEX Exd version (electronic options BE/HE/DE/GE/KE/LE)

15.3.1 General information

Products which were ordered with the optional encapsulated pressure-proof connector housing (Exd) are marked with an ATEX label (see figure). The label includes details relating to explosion group and temperature class. Before installing and operating the device, the label should be checked to ensure it contains all the required details.

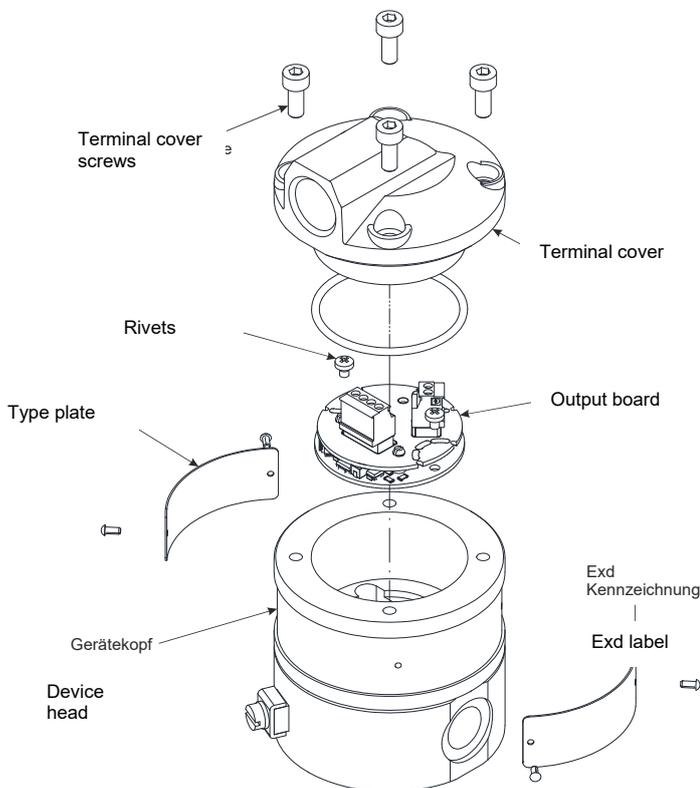
The relevant explosion groups and temperature classes are as follows:

Ex I: Devices for use in mining with mine gas accumulation. Mine gas refers to the methane gas naturally generated from coal and coal seams in the coal mining industry. **Only stainless steel devices** are suitable for use in explosion group I (in accordance with IEC 60079-0, section 8.1.1). Aluminium devices are not permitted for explosion group I. If the flowmeter includes the label for group I, the surface temperature of the process fluid must not exceed 150 °C.

Ex IIC T4/T6: Devices for use in areas with potentially explosive atmospheres outside the mining field, but with mine gas accumulation. Either aluminium or stainless steel devices may be used in explosion group II. For T4 temperature class applications, the surface temperature of the process fluid must not exceed 120 °C, and for T6 temperature class applications, the surface temperature of the process fluid must not exceed 70 °C.

Operating instructions:

The Exd device must be removed from the explosive zone before the terminal cover can be opened.

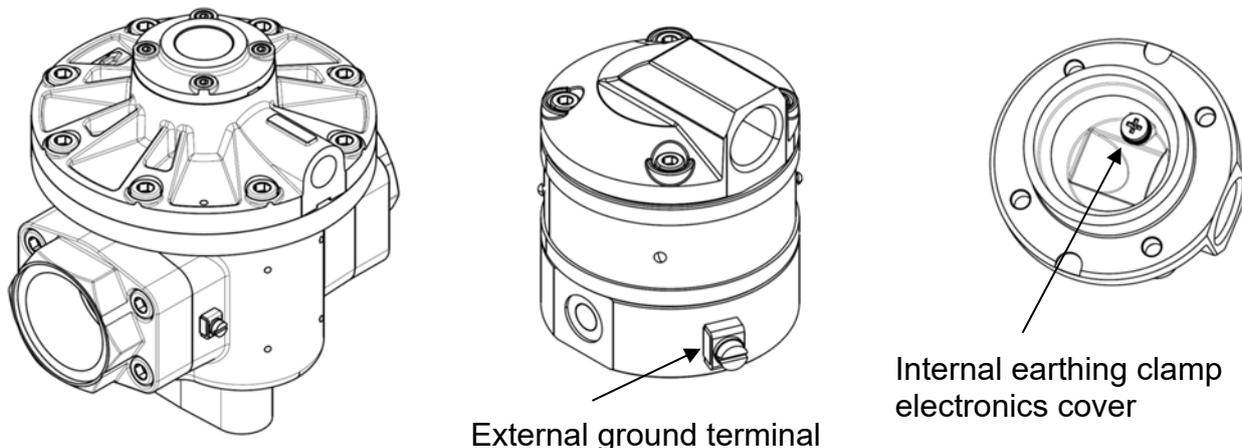


The maximum permissible annular gap between the terminal cover and the measuring device must not exceed 0.15 mm. If the annular gap exceeds 0.15 mm due to corrosion or wear and tear, the worn out parts must be replaced.

The product does not meet the requirements of the Exd protection class unless the terminal cover is completely snapped into place and screwed down. No other screw sizes or lengths may be used than the ones of the original screws.

15.3.2 Electrical connection

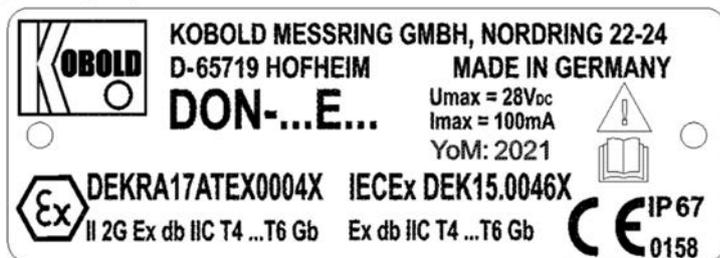
In accordance with the installation regulations, both the housing and the electronics cover must be grounded using the attached grounding clamps. The maximum connection cross-section is 4 mm².



The installer must ensure that the maximum supply voltage of 28 Vdc and the maximum current of 100 mA are not exceeded. This must be ensured by means of suitable external safety elements.

15.3.3 Identification of the flow meter (nameplate)

Device label for explosion-proof version, group 2 options HE / GE / DE / KE / BE (example)



Device label for explosion-proof version, group 1/2 options HE / GE / DE / KE / BE (example)



16. EU Declaration of Conformance

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

Oval Gear Flow Meter Model: DON-...

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

2014/68/EU PED

- Category II Diagram 8, pipes, group 1 dangerous fluids
- Module D, marking CE0575
- Notified body: DNV GL
- Certificate No. PEDD000000R

2011/65/EU RoHS
2015/863/EU Delegated Directive (RoHS III)

All devices with electronic are in conformance with:

2014/30/EU EMC Directive
2014/34/EU ATEX Directive
Notified body BVS 0158 (DEKRA EXAM, Bochum)

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 1: General requirements

EN 60079-0: 2018
Explosive atmospheres - Part 0: Equipment – General requirements

EN 60079-11: 2012
Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"

DIN EN 80079-37:2016
Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

EN 60079-1:2014
Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures 'd'

Also complies with the following European and national standards and technical regulations:

- Technical rules for hazardous substances (TRGS) 727: 2016, avoidance of ignition hazards due to electrostatic charges

Hofheim, 29 July 2021



H. Volz
General Manager



M. Wenzel
Proxy Holder

17. Statement of Conformity



- (1) **Konformitätsaussage** *Statement of Conformity*
- (2) **- Richtlinie 2014/34/EU -** *- Directive 2014/34/EU -*
Geräte zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen *Equipment Intended for Use in Potentially Explosive Atmospheres*
- (3) Nummer: **ExGuide 19 ATEX 0007X**
Document-ID:
- (4) Geräte: **Ovalzahnrad-Durchflussmesser / Oval Gear Flow Meter**
Equipment: **Type DON-*******
- (5) Hersteller: **KOBOLD Messring GmbH**
Manufacturer:
- (6) Anschrift: **Nordring 22-24, DE 65719 Hofheim**
Address:
- (7) Die Bauart dieses Produktes, sowie die verschiedenen zulässigen Ausführungen, sind in der Anlage zu dieser Konformitätsaussage festgelegt. *This product and any acceptable variation thereto is specified in the enclosure to this Statement of Conformity.*
- (8) ExGuide Technology - Günter Kämper VDI bescheinigt, dass dieses Produkt die grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption von Produkten der Kategorie 2 zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie erfüllt. Das ISO 9001 - System des Unternehmens ExGuide Technology - Günter Kämper VDI wird von der GZQ unter der Registrierung Q7180217 überwacht. Die Ergebnisse der sicherheitlichen Betrachtung sind im vertraulichen Dokument D068190802 hinterlegt. *ExGuide Technology – Gunter Kamper VDI certifies that this product has been found to comply with the Essential Safety and Health Requirements relating to the design and construction of product of Category 2 intended for use in potentially explosive atmospheres given in Annex II of the Directive. The ISO 9001 system of ExGuide Technology – Gunter Kamper VDI is supervised by GZQ under the registration number Q7180217. The examination and test results are recorded in the confidential report number D068190802.*

Seite / page 1 von / of 5 zu / to ExGuide19 ATEX 0007X
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- (9) Die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen wird durch Übereinstimmung mit den folgenden Normen bestätigt:
- EN IEC 60079-0:2018
 - EN 60079-11:2012
 - EN ISO 80079-36 2016
 - EN ISO 80079-37 2016
 - TRBS 727:2016
- (10) Falls das Zeichen "X" hinter der Nummer (3) steht, wird in der Anlage zur dieser Konformitätsaussage auf besondere Bedingungen für die sichere Anwendung des Produktes hingewiesen.
- (11) Diese Konformitätsaussage bezieht sich nur auf die Konzeption und den Bau des festgelegten Produktes. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen.
- (12) Die Kennzeichnung des Produktes soll die folgenden Angaben enthalten:

Compliance with the Essential Safety and Health Requirements has been assured by compliance with the following standards:

If the sign "X" is placed after the Document-ID (3), it indicates that the product is subject to special conditions for safe use specified in the enclosure of this Statement of Conformity.

This Statement of Conformity relates only to the design and construction of the specified product. If applicable, further requirements of this Directive apply to the manufacturing and supply of this product.

The marking of the product shall include the following:

II 3G Ex ic IIC T4/T3 Gc
II 2G Ex h IIC T4/T3 Gb

$-20\text{ °C} \leq T_a \leq 80\text{ °C}$

ExGuide Technology - Günter Kämper VDI
Ing.-Büro für Explosionsschutz
Birkenstraße 10
DE 44579 Castrop-Rauxel

Telefon: +49 2305 357130
Telefax: +49 2305 357137

E-Mail: info@exguide.org
URL: www.exguide.org

Castrop-Rauxel, den 12. Februar 2020

KAS8190802 DON 19 ATEX 0007X.odt



Anlagen / Enclosure

Diese Konformitätsaussage ist ohne Unterschrift ungültig! Im Original sind Teile in roter Schrift dargestellt (Zeile 1, 3, 14 und Logo).

This statement of conformity is not valid without signature! In the original, parts are printed in red (line 1, 3, 14 and logo).

Seite / page 2 von / of 5 zu / to ExGuide 19 ATEX 0007X

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- | | |
|--|--|
| (13) Anlage zur | <i>Enclosure to</i> |
| (14) | <i>Statement of Conformity</i> |
| Konformitätsaussage | |
| ExGuide 19 ATEX 0007X | |
| (15) Beschreibung des Produktes | <i>Description of product</i> |
| (15a) Der Ovalzahnrad-Durchflussmesser ist ein Messgerät nach dem Verdrängerprinzip zur kontinuierlichen Durchflussmessung und -zählung von reinen Partikel-freien Flüssigkeiten. | <i>The oval gear flow meter is a measuring instrument based on the displacement principle and used for continuous flow measurement and counting of pure particle-free liquids.</i> |
| Er besteht aus einem mechanischen Teil zur Wandlung des Durchflusses in eine Drehbewegung und einer elektronischen Einrichtung zur Erfassung der Drehzahlimpulse. | <i>It consists of a mechanical part for converting the flow into a rotary motion and an electronic device for recording the speed pulses.</i> |
| Die Drehbewegung wird induktiv in einen Elektronikraum übertragen, der elektrische Anschluss erfolgt über einen Stecker – nur für eigensichere Anlagen. | <i>The rotary motion is inductively transmitted to an electronics compartment, the electrical connection is made via a plug – only to be used in intrinsically safe systems.</i> |
| Die Geräte nach (15e) und (15f) können mit einem Durchflusszähler / -Dosierer / -Controller des Typs ZOK-E*K*F3 oder ZOK-E*M*F3** gem. LOM 16 ATEX 2062 X kombiniert werden. | <i>The devices according to (15e) and (15f) can be combined with a flow meter / controller type ZOK-E*K*F3 or ZOK-E*M*F3** according to LOM 16 ATEX 2062 X.</i> |
| (15b) Das Produkt kann folgendermaßen, je nach Kennzeichnung, eingesetzt werden: | <i>The product can be used as follows – in accordance with the marking:</i> |
| a) In der Zone 2 (Gas-Ex, Kategorie 3G, EPL Gc) in den Explosionsgruppen IIA, IIB und IIC. | <i>a) In Zone 2 (Gas, Category 3G, EPL Gc) in the explosion groups IIA, IIB and IIC.</i> |
| b) In der Zone 1 (Gas-Ex, Kategorie 2G, EPL Gb) in den Explosionsgruppen IIA, IIB und IIC. | <i>b) In Zone 1 (Gas, Category 2G, EPL Gb) in the explosion groups IIA, IIB and IIC.</i> |
| Die Qualifizierung hinsichtlich der Oberflächentemperatur ist T4/T3; für alle Gase, Dämpfe und Nebel mit einer Zündtemperatur > 135 °C / > 200 °C sind die Produkte keine Zündquelle. | <i>The qualification with regard to the surface temperature is T4/T3; for all gases, vapours and mists with an ignition temperature > 135 °C / > 200 °C the product is not an ignition source.</i> |
| Die Anforderungen an einfache elektrische Betriebsmittel in eigensicheren Stromkreisen in der Zone 1 nach EN 60079-11 werden erfüllt. | <i>The requirements for simple apparatus according to IEC 60079-11, applicable to the hazardous area of Zone 1, are met.</i> |
| (15c) Elektrische Daten für lineare Kennlinie:
Nennspannung bis 32 VDC
Nennstrom bis 100 mA
$I_i \leq 100 \text{ mA}, P_i \leq 1 \text{ W}@80 \text{ °C}$
Erwärmung am Außengehäuse < 10 K | <i>Electrical data for linear characteristic:
Rated voltage up to
Rated current up to
Warming at the outer enclosure</i> |
| (15d) Typ DON-a bb c dd e LA g h terminal block J1
$U_{MA} \leq 19.5 \text{ VDC}$ $L_i = 83 \mu\text{H}$ $C_i = 3.4 \mu\text{F}$
Diese Ausführung darf nicht als einfaches elektrisches Betriebsmittel in der Zone 1 eingesetzt werden! <i>This type is not for use as simple apparatus in Zone 1</i> | |
| (15e) Typ DON-a bb c dd e ff g h ff = HA, BA, DA, GA terminal block J2 and J3
$U_{MC} \leq 28 \text{ VDC}$ $U_{MB} \leq 32 \text{ VDC}$ $L_i = \text{negligible}$ $C_i = 270 \text{ nF}$
Zone 1: $U_{MC} \leq 18.5 \text{ VDC}$ $U_{MB} \leq 32 \text{ VDC}$ $L_i = \text{negligible}$ $C_i = 270 \text{ nF}$ | |
| (15f) Typ DON-a bb c dd e RA g h terminal block J1
$U_{MC} \leq 28 \text{ VDC}$ $U_{MB} \leq 32 \text{ VDC}$ $L_i = \text{negligible}$ $C_i = \text{negligible}$ | |
| (15g) Die für das jeweilige Gerät relevante Temperaturklasse kann der Betriebsanleitung entnommen werden und ist auf dem Typenschild gekennzeichnet: | <i>The relevant marking of the temperature classification of each piece of equipment is stated in the operator's manual and is marked on the label:</i> |

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- (15h) • Umgebungstemperaturbereich / *Ambient temperature range* $-20\text{ °C} \leq T_a \leq 80\text{ °C}$
 • Mediumtemperatur / *medium temperature* $-20\text{ °C} .. 100\text{ °C}$ → Temperaturklasse / *temperature class* T4
 • Mediumtemperatur / *medium temperature* $-20\text{ °C} .. 130\text{ °C}$ → Temperaturklasse / *temperature class* T3
- (15i) Typenschlüssel *Type code*
 Der detaillierte Typenschlüssel ist der Betriebsanleitung zu entnehmen *The detailed type code can be found in the instructions operating manual (IOM)*
- (15j) DON-* * * * *
 DON-a bb c dd e ff g h
 DON-
- | | | |
|----|--|--|
| a | Material | <i>Material</i> |
| bb | Messbereich | <i>Measuring range</i> |
| c | Anzeigeeinheit | <i>Display unit</i> |
| dd | Anschluss ("x" Δ unterschiedliche Größen) | <i>Connection ("x" represents different sizes)</i> |
| e | O-Ring Werkstoff | <i>Seal material</i> |
| ff | Elektronik (Ex ic) | <i>Electronics / indication (Ex ic)</i> |
| g | Kabeleinführung | <i>Cable entry</i> |
| h | Optionen (nicht ex-relevant) | <i>Options (not ex-relevant)</i> |
- Mindestkennzeichnung *Minimum identification of the electrical system:*
 Hersteller mit Anschrift *Name and address of manufacturer*
 Typ: DON-* * * * *
 (Seriennummer) C€ (Baujahr) *(serial number) C€ (year of construction)*
 TFR: 19 ATEX 0007X
 Ex II 3G Ex ic IIC T4/T3 Gc
 Ex II 2G Ex h IIC T4/T3 Gb
 $-20\text{ °C} \leq T_a \leq 80\text{ °C}$
 (Ergänzungen sind zulässig.) *(Additional hints are allowed.)*
- (15l) Die Prüfungsunterlagen sind im internen Dokument *Test reports are stored in the internal document*
 D068190802 hinterlegt. Gemeinsam mit dem Hersteller ist *D068190802. In cooperation with the manufacturer*
 ein vertraulicher Prüfbericht PB68190802 erarbeitet worden. *a confidential test report PB68190802 was compiled.*
 Die vertrauliche Nachweisdokumentation mit der TFR 19 *The confidential proof documentation with TFR 19*
 ATEX 0007X lag zur Bewertung vor und ist bei der benannten *ATEX 0007X has been submitted to inspection and*
 Stelle 0158 BVS (DEKRA Testing and Certification, Bochum) hinterlegt. *is deposited at the notified body 0158 BVS (DEKRA Testing and Certification, Bochum).*
- (15m) Sicherheitstechnische Hinweise *Safety relevant notes*
 Die Hinweise in der vom Hersteller jedem Produkt beizufügenden Betriebsanleitung (Einbauvorschrift, Montageanweisung) sind unbedingt einzuhalten. *The notes in the operator's manual, enclosed to each order of the manufacturer (installation rules and instructions on assembly), have to be followed strictly.*
- | | |
|---|--|
| a) Zur Sicherstellung des Explosionsschutzes müssen elektrische Betriebsmittel und zusätzlich angebaute (mechanische) Produkte den Anforderungen der vor Ort geltenden Zonen entsprechen und sind vom Errichter der Maschine gesondert zu prüfen. | a) <i>In order to ensure the explosion protection required, any electrical and additional mechanical product has to meet the requirements of the locally applicable zones and has to be checked separately by the company installing the unit.</i> |
| b) An den Stromkreisen dürfen nur Produkte angeschlossen werden, die für den Betrieb in der infrage kommenden Zone geeignet sind und für die die entsprechenden Dokumente vorliegen. | b) <i>Only products suitable for operation in the relevant zone, and for which the relevant documents are available, may be connected to the circuits.</i> |
| c) Der Durchflussmesser ist so zu montieren, dass mögliche elektrostatische Ladungen abfließen können. | c) <i>The flow meter has to be mounted in such a manner that any possible electrostatic charges may be discharged.</i> |
| d) Eine direkte elektrostatische Entladung hoher Energie auf | d) <i>Any direct electrostatic discharge of high energy</i> |

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- das Betriebsmittel ist nicht zulässig (kann üblicherweise durch eine menschliche Berührung nicht erzeugt werden).
- e) Ausgleichsströme dürfen nicht über die metallischen Konstruktionen geführt werden.
 - f) Der Durchflussmesser sollte gegen mechanische Schlagwirkung geschützt eingebaut werden.
 - g) Im Verlauf des eigensicheren Stromkreises ist ein Potenzialausgleich zu errichten – wenn der Durchflussmesser über einen geerdeten Stromkreis versorgt wird.
 - h) Festsitzende Teile, z.B. durch Frost oder Korrosion, dürfen bei vorhandener explosionsfähiger Atmosphäre nicht mit Gewalt gelöst werden.
 - i) Die Zündgrenzkurven aus der EN 60079-11 sind in der Zone 2 ohne Sicherheitsfaktor zu berücksichtigen und bei der Installation zu beachten.
 - j) In der Zone 1 ist der Sicherheitsfaktor 1,5 anzuwenden.
 - k) In jedem Fall hat der Betreiber dazu eine Control Drawing (Nachweis der Eigensicherheit) anzufertigen.
 - l) Eisbildung am Produkt sollte vermieden werden.
- (17) Besondere Bedingungen
- (17a) Die Geräte nach (15e) und (15f) werden in der Zusammenschaltung mit einem Durchflusszähler / -Dosierer / -Controller des Typs ZOK-E*K*F3 oder ZOK-E*M*F3** gem. LOM 16 ATEX 2062 X als einfache elektrische Betriebsmittel genutzt und einzig durch dieses Betriebsmittel elektrisch versorgt.
- (17b) Kennzeichnung der Medientemperatur
- on the product is not permitted (and can usually not be caused by a human touch).*
- e) Equalizing currents must not be conducted using the metallic parts of the construction.*
- f) The installation of the flow meter has to protect them against mechanical impact.*
- g) Equipotential bonding must be installed along of the intrinsically safe circuit – if power to the flow meter is supplied via an earthed circuit.*
- h) Parts being stuck (e.g. by frost or corrosion) may not be removed by force in the presence of explosive atmosphere.*
- i) In Zone 2 the ignition curves of EN 60079-11 have to be observed without a safety factor and to be taken into account for the installation.*
- j) The safety factor 1.5 shall be applied in zone 1*
- k) In each case the operator has to create a control drawing (proof of intrinsic safety).*
- l) Ice formation on the device must be avoided.*
- Special conditions for safe use*
- The devices according to (15e) and (15f) are connected to a flow meter / dosing unit / controller of type ZOK-E*K*F3 or ZOK-E*M*F3** according to LOM 16 ATEX 2062 X as simple apparatus and are supplied electrically only by this equipment.*
- Marking of media temperature*

Anhang / Annex

Temperaturklassen und Mediumtemperaturen / Temperature classes and medium temperature

z	Material seal	Marking	Cat. 2 (Zone 1)	TC	Cat. 3 (Zone 2)	TC
1	FKM	e = 1	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
2			-20 °C .. 100 °C	T3	-20 °C .. 110 °C	T3
3	FEP / EPDM 92	e = 3	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
4			-20 °C .. 110 °C	T3	-20 °C .. 120 °C	T3
5	NBR	e = 4	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
6			-20 °C .. 100 °C	T3	-20 °C .. 110 °C	T3
7	Fluoroprene	e = 5	-20 °C .. 80 °C	T4	-20 °C .. 90 °C	T4
8			-20 °C .. 130 °C	T3	-20 °C .. 130 °C	T3

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18. Exd Certificate



CERTIFICATE

(1) EU-Type Examination

(2) **Equipment or protective systems intended for use in potentially explosive atmospheres - Directive 2014/34/EU**

(3) EU-Type Examination Certificate Number: **DEKRA 17ATEX0004 X** Issue Number: **0**

(4) Product: **Oval Gear Flowmeter Type DON-.....E..**

(5) Manufacturer: **Kobold Messring GmbH**

(6) Address: **Nordring 22-24, 65719 Hofheim, Germany**

(7) This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) DEKRA Certification B.V., Notified Body number 0344 in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential test report number NL/DEK/ExTR17.0002/00.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0 : 2012 + A11 : 2013 EN 60079-1 : 2014

(10) If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.

(11) This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

(12) The marking of the product shall include the following:



**II 2 G Ex db IIC T4/T6 Gb
I M 2 Ex db I Mb**

Date of certification: 21 April 2017

DEKRA Certification B.V.

T. Pijpker
Certification Manager

Page 1/3



° Integral publication of this certificate and adjoining reports is allowed. This Certificate may only be reproduced in its entirety and without any change.

DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 88 96 83000 F +31 88 96 83100 www.dekra-certification.com Registered Arnhem 09085396



(13) **SCHEDULE**

(14) **to EU-Type Examination Certificate DEKRA 17ATEX0004 X** Issue No. 0

(15) **Description**

The oval gear flowmeter type DON-....E.. are positive displacement flowmeters where the passage of liquid causes two oval gears to rotate within a measuring chamber and with each rotation a fixed volume of liquid passes through the meter. Magnets embedded within the gears initiate a pulse train output. The pulse output can be wired directly to process control and monitoring equipment or can be used as an input to instruments supplied with or fitted directly onto the meter. The flowmeters can be made from aluminium or stainless steel for group II and are only stainless steel for group I.

The -RE option (reed switch) has no additional parts and is suitable to be used as "simple apparatus" in Ex i applications.

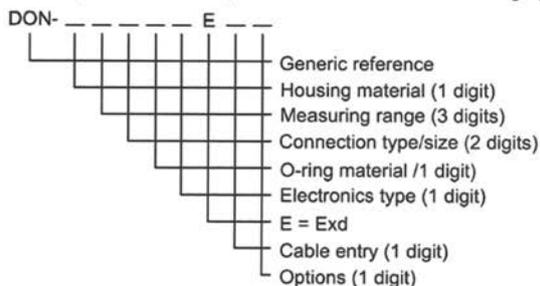
Ambient temperature range:
 -20 °C to +70 °C for Ex db IIC T6 Gb,
 -20 °C to +120 °C for Ex db IIC T4 Gb,
 -20 °C to +150 °C for Ex db I Mb.

The minimum ambient temperature is -15 °C for the option IP67.

Electrical data

Umax : 28 Vdc, Imax : 100 mA

The oval gear flowmeter type DON-....E.. has the following options:



Housing material:	1	Aluminium
	2/8	Stainless Steel
Electronic types:	LE	4-20mA "loop powered" analogue output
	RE	Reed switch pulse output
	HE	Hall sensor and reed switch pulse output
	BE	Hall sensor (bipolar) pulse output
	GE	Hall sensor (high resolution X4) pulse output
	DE	Quad hall sensor pulse output
	KE	Hall sensor (high resolution X2) pulse output
Cable entry options:	M	M20
	N	½" NPT



(13) **SCHEDULE**

(14) **to EU-Type Examination Certificate DEKRA 17ATEX0004 X** Issue No. 0

Installation instructions

The instructions provided with the product shall be followed in detail to assure safe operation.

(16) **Report Number**

No. NL/DEK/ExTR17.0002/00.

(17) **Specific condition of use**

Contact the manufacturer for information on the dimensions of the flameproof joints.

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at item (9).

(19) **Test documentation**

As listed in Report No. NL/DEK/ExTR17.0002/00.

(20) **Certificate history**

Issue 0 - project no. 218403500 initial certificate

19. IECEx Certificate

	IECEX Certificate of Conformity		
INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification Scheme for Explosive Atmospheres <small>for rules and details of the IECEx Scheme visit www.iecex.com</small>			
Certificate No.:	IECEX DEK 15.0046X	Issue No: 0	Certificate history: Issue No. 0 (2017-04-21)
Status:	Current	Page 1 of 4	
Date of Issue:	2017-04-21		
Applicant:	KOBOLD Messring GmbH Nordring 22-24 65719 Hofheim/Ts. Germany		
Equipment:	Oval Gear Flowmeters, types DON-.....E..		
Optional accessory:			
Type of Protection:	Ex db IIC, Ex db I Mb		
Marking:	Ex db IIC T4/T6 Gb, Ex db I Mb		
Approved for issue on behalf of the IECEx Certification Body:	T. Pijpker		
Position:	Certification Manager		
Signature: (for printed version)			
Date:	2017-04-21		
<p>1. This certificate and schedule may only be reproduced in full. 2. This certificate is not transferable and remains the property of the issuing body. 3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.</p>			
Certificate issued by:	DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem The Netherlands		
			



IECEX Certificate of Conformity

Certificate No: IECEX DEK 15.0046X Issue No: 0
Date of Issue: 2017-04-21 Page 2 of 4
Manufacturer: **KOBOLD Messring GmbH**
Nordring 22-24
65719 Hofheim/Ts.
Germany

Additional Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:

The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

[NL/DEK/ExTR17.0002/00](#)

Quality Assessment Report:

[DE/BVS/QAR09.0001/08](#)



IECEX Certificate of Conformity

Certificate No: IECEx DEK 15.0046X

Issue No: 0

Date of Issue: 2017-04-21

Page 3 of 4

Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

The oval gear flowmeter Type DON-...E.. are positive displacement flowmeters where the passage of liquid causes two oval gears to rotate within a measuring chamber and with each rotation a fixed volume of liquid passes through the meter. Magnets embedded within the gears initiate a pulse train output. The pulse output can be wired directly to process control and monitoring equipment or can be used as an input to instruments supplied with or fitted directly onto the meter.

The flowmeters can be made from aluminium or stainless steel for Group II and are only stainless steel for Group I.

The -RE option (reed switch) has no additional parts and is suitable to be used as "simple apparatus" in Ex i applications.

Ambient temperature range:

-20 °C to +70 °C for Ex db IIC T6 Gb,

-20 °C to +120 °C for Ex db IIC T4 Gb,

-20 °C to +150 °C for Ex db I Mb,

The minimum ambient temperature is -15°C for the option IP67.

Electrical data: $U_{max} = 28 \text{ Vdc}$, $I_{max} = 100 \text{ mA}$.

SPECIFIC CONDITIONS OF USE: YES as shown below:

Contact the manufacturer for information on the dimensions of the flameproof joints



IECEX Certificate of Conformity

Certificate No: IECEX DEK 15.0046X

Issue No: 0

Date of Issue: 2017-04-21

Page 4 of 4

Additional Information:

See 218403500-Annex

Annex:

[218403500-Annex .pdf](#)

20. State of safeness

	State of safeness KOBOLD Messring GmbH, D-65719 Hofheim	FO41903E Rev. 02/15
<u>Explanation for our customers:</u> In case of returning please take into account the following details and enclose this state of safeness		
Address of the customer: Contact person: E-Mail-Address: KOBOLD-Product: KOBOLD- Order No.: _____		
<u>To be completed by customer</u>		
<ul style="list-style-type: none">• Description of defect: kind of medium: trade name: _____ supplier: _____		
<ul style="list-style-type: none">• Operation conditions: temperature: _____ °C pressure: _____ bar flow rate: _____		
<ul style="list-style-type: none">• Statement of safeness We hereby certify that there are no noxious substances whatsoever (including detergents) in the instruments returned and that there is no hazard to employees handling the instruments.		
_____ Stamp, date, signature		