M-Zert
Zertifiziertes QM-System
DIN EN ISO 9001
Zertifikat-Nr. 01017

Oval Wheel Flow Meter, High Pressure

for low and high viscous liquids

KOBOLD

measuring • monitoring • analysing

DON-H

- Measuring range: 0.5 … 36 l/h und 1 … 40 l/min
- Viscosity range: up to 1000 cP higher on request
- Accuracy: ±0.2 % …1% of reading
- Material: stainless steel
- p_{max}: 400 bar; t_{max}: 120 °C
- Pulse output, LCD display

S4

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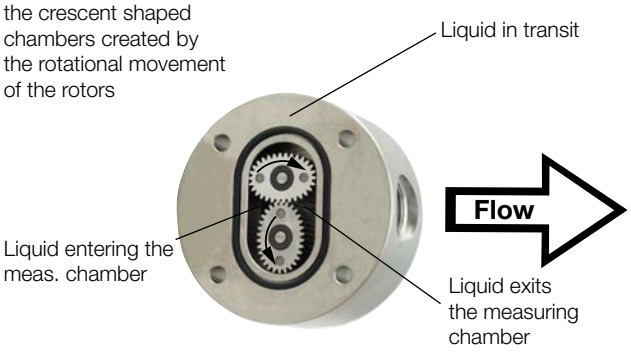
Principle of Operation

Oval wheel flow meters are categorised as positive displacement flow technology. When liquid flows through this type of positive displacement flow meter, 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 process externally via a remote display controller or PLC or via a variety of output/display options available as accessories attached to the flow meters.

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



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.

Areas of Application

For all viscous, non abrasive clean liquids like:

- Petroleum
- Oil
- Chemicals
- Grease
- Fuels
- Ink etc.
- Pastes

Stainless steel flow meters are suited to most products and chemicals and aluminium meters are suitable for fuels, fuel oils & lubricating liquids.

Technical Details

Material

Body:	stainless steel 1.4404
Oval wheels:	stainless steel 1.4404
Bearing:	carbon graphite
Axes:	stainless steel 1.4404
O-rings:	FKM: -20…+150 °C FKM Vi 840: -40…+150 °C NBR: -20…+100 °C FEP-O-seal: -15…+130 °C (FEP-O-seal, FEP encased, with solid core EPDM) Fluoroprene® acc. to EN 1935

Note: *Choose appropriate sealing according to permissible temperature limits of the flow meter.*

Cover for cable connection:	polyamide PA6 GF35 UL94 HB/VO stainless steel 1.4404 (optional)
Material screws:	steel, coated with GEOMET® 321
Magnet encapsulation:	DON-x05, -x10 PEEK DON-x15, -x20 st. st. 1.4404
Accuracy (under reference conditions*):	± 1 % of reading (DON-H05…DON-H15) ± 0.5 % of reading (DON-H20) ± 0.2 % of reading (DON-H20; with optional Z3-electronics based on linearisation function)
Max. pressure	400 bar
Repeatability:	typ. ± 0.03 %
Protection class:	IP 66/67
Medium temp.:	-20 °C ... +80 °C for options Zx and -20 °C ... +120 °C with pulse output and options Zx with cooling fins -40 °C ... +120 °C for DON-2/4 with pulse output and O-rings FKM Vi 840
Ambient temper.:	-20 °C ... +80 °C
Cable entry:	M 20 x 1.5, ½" NPT adapter

ATEX-approval

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

Options 1A/2A/3A/5A:
Intrinsic safety ⟨Ex⟩ II 2G Ex ia IIC T4 Gb (-20°C ≤ Ta ≤ +60°C)

Option HA:
Intrinsic safety ⟨Ex⟩ II 3G Ex ic IIC T4/T3 Gc

* Reference conditions: x05 (calibration oil 10 cSt, 20 °C, 5 bar), x10 ... x20 (calibration oil 4,6 cSt, 25 °C, 1 bar)
Accuracy data is valid for given viscosities and higher.

Recommended Filter

DON-H05 ... DON-H15 < 75 µm micron (200 mesh)
DON-H20 < 150 µm micron (100 mesh)

Pulse Output (H0/HA)

Options H0/HA are equipped with a Reed switch pulse output and a Hall sensor pulse output.

Reed switch pulse output

The reed switch output is a two wire normally open SPST voltage free contact ideal for installations without power or for use in hazardous area locations when Intrinsically Safe (I.S.) philosophy is adopted.

Note: *When using the reed switch output the liquid temperature must not change at a rate greater than 10 °C/min.*

Average switching life of reed contact (MTTF):
max. Load (30 V / 10 mA) 5×10^5 switching cycles
min. Load (<5 V / 10 mA) 5×10^8 switching cycles

Switching capacity: max. 30 V_{DC}, max. 20 mA

Hall sensor pulse output

In the electronics options H0/HA, a Hall Effect sensor is combined with an active push-pull output. The electrical connection is provided in 3-wire version. The output is actively switched either to +Vs or to ground. The external supply voltage is 8 ... 30 V_{DC}. No additional external circuit is required (e.g pull up resistor). The high signal is approximately equal to the supply voltage +Vs and the low signal is approximately 0 V. The electrical load may optionally be connected to the supply voltage or to GND.

Maximum output current (current source or sink): 100 mA (short circuit protected).

1/09 - 2023

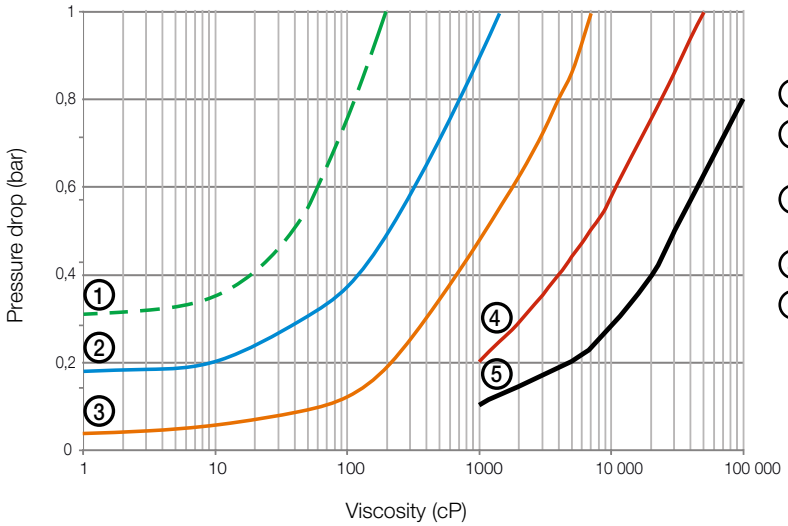
Electronic with LCD Display

Model	..Z1	..Z2	..Z3	..Z5	..1A	..2A	..3A	..5A
Function	dual totaliser	dosing unit	rate/ counter	rate/ counter	dual totaliser	dosing unit	rate/ counter	rate/ counter
Power supply								
Battery-powered (outputs inactive)	yes	no	yes	yes	optional[2)]	no	optional[2)]	yes
External	5 - 24 V_{DC}	12 - 24 V_{DC}	5 - 24 V_{DC}	5 - 24 V_{DC}	5 - 24 V_{DC}	5 - 24 V_{DC}	5 - 24 V_{DC}	5 - 24 V_{DC}
LCD display								
Selectable units	yes	yes	yes	yes	yes	yes	yes	yes
Decimal point	yes	yes	yes	yes	yes	yes	yes	yes
Accumulative total	yes	yes	yes	yes	yes	yes	yes	yes
Resettable total	yes	yes	yes	yes	yes	yes	yes	yes
Linearisation	yes	no	yes	yes	yes	no	yes	yes
Rate display	yes	yes	yes	yes	yes	yes	yes	yes
Backlighting	yes	yes	yes	yes	no	no	no	no
Input								
Sensors	Hall sensor/ reed switch							
Outputs								
4-20 mA	no	no	yes	yes	no	no	yes	yes
Flow rate alarm min./max.	no	no	NPN/PNP/PP	NPN/PNP/PP	no	no	no	with solid-state relay board
Batch end & control	no	yes	no	no	no	yes	no	no
Pulse outputs	no	no	PP	PP	no	no	no	with solid-state relay board
2 x SPDT relays[1)]	no	yes	no	yes	no	with solid-state relay board	no	
Installation								
IP 65	yes	yes	yes	yes	yes	yes	yes	yes
Cable entries	M20x1.5/ ½" NPT							
Medium temperature (Option: max. +150 °C)	-20...+80 °C							
Ambient temperature	-20 ... +80 °C				-20 ... +60 °C			
Housing material	PA6 GF35 UL94 HB/VO/PC UL94 V-2							
ATEX approval	no				yes			

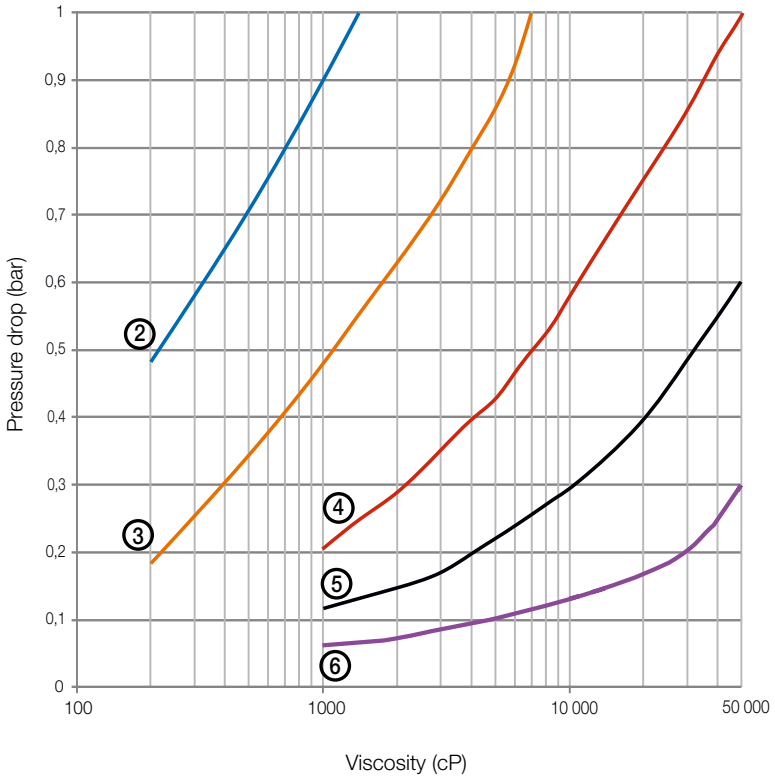
[1)] Replaces solid state outputs, for details see data sheet ZOK

[2)] See data sheet ZOK

DON Pressure Drop Curves versus Viscosity



1. Standard rotors 100 % of full scale
2. Standard rotors 50 % of full scale
   special cut rotors 100 % of full scale
3. Standard rotors 25 % of full scale
   special cut rotors 50 % of full scale
4. Special rotors 25 % of full scale
5. Special rotors 10 % of full scale



2. Standardd rotors 50 % of full scale
   special cut rotors 100 % of full scale
3. Standard rotors 25 % of full scale
   special cut rotors 50 % of full scale
4. Special cut rotors 25 % of full scale
5. Special cut rotors 10 % of full scale
6. Special cut rotors 5 % of full scale

Pressure drop limit versus flowrate

The curves above represent the pressure drop for standard cut oval rotors. Special cut rotors option «Y» 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**.

1/09 - 2023

Maximum Flowrate Multiplier (for higher viscosities)

Viscosities (cP)	Standard rotor	Special cut rotor
≤ 1 000	1	1
≤ 2 000	0.5	1
≤ 4 000	0.42	0.84
≤ 6 000	0.33	0.66
≤ 8 000	0.25	0.5
≤ 30 000	0.15	0.3
≤ 60 000	0.12	0.25
≤ 150 000	0.1	0.2
≤ 250 000	0.05	0.1
≤ 1 000 000	0.025	0.05

Special cut rotors for higher viscosities

For viscosity >1000 cP, special cut rotors option «DON-Sxx» should be used to reduce pressure drop. This applies to DON-S15 and larger sizes. For higher viscosities, the flow meter max. flowrate is de-rated according to the attached chart. At viscosities <1000 cP these special rotors are less accurate.

Example: DON-S20 measuring oil at 8000 cP,
max. flow 40 l/min x 0.5 = 20 l/min new maximum flow rate.

Output Pulse Resolution

Model	Measuring range [l/min]	Pulse/litre	
		Reedswitch	Hall sensor
DON-H05	0.5 - 36 l/h	2670	2670
DON-H10	2 - 100 l/h	1054	1054
DON-H15	15 - 550 l/h	355	710
DON-H20	1 - 40	82	163

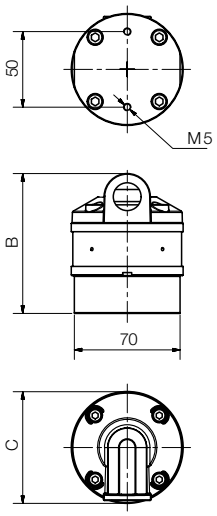
The values in above mentioned table are only approximate guidelines. The actual value for pulse rate can deviate from the values in this table and is mentioned in calibration certificate delivered with the flow meter.

Order Details (Example: **DON-H10H R1 1 R0 M 0**)

Measuring range [l/min]	Housing material[2] Stainless steel	Connection	O-ring material	Electronics	Cable entry	Option
0.5 - 36 l/h	**DON-H05H**	**R1** = G ⅛ **N1** = ⅛" NPT	**1** = FKM **3** = FEP-O-ring **4** = NBR **5**[5] = Fluoro-prene® **8**[6] = FKM Vi 840 **9** = Special materials (not for ATEX)	**H0** = Hall sensor (Push-Pull)/ Reed switch, pulse output **HA** = H0 + ATEX (Exi) **Z1** = dual LCD totaliser **Z2** = dosing unit LCD **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOK-Z3) (impulses not for battery supply) **Z5** = as Z3, but with 2 relays/SPDT relays **1A**[4] = E1 + HA (ATEX Exi) **2A**[4] = E2 + HA (ATEX Exi) **3A**[4] = E3 + HA (ATEX Exi) **5A**[4] = E5 + HA (ATEX Exi)	**M** = M20 **N** = ½" NPT **S**[3] = M20 with cooling fin **T**[3] = ½" NPT with cooling fin	**0** = without **N** = without battery **Y** = special option (specify in clear text; not for ATEX)
2 - 100 l/h	**DON-H10H**	**R2** = G ¼ **N2** = ¼" NPT				
15 - 550 l/h	**DON-H15H**[1]	**R2** = G ¼ **N2** = ¼" NPT				
1 - 40	**DON-H20H**[1]	**R4** = G ½ **N4** = ½" NPT				

[1] Replace Hxx with Sxx for special rotor for higher viscosities > 1000 cP, not for measuring range code 05 / 10 [2] Replace 'H' with 'G' to order GPH (GPM) (e.g. 15 G instead of 15 H) [3] Only for electronic options -Zx [4] E1 / E2 / E3 / E5 = Z1 / Z2 / Z3 / Z5 in ATEX version (Exi), without backlighting [5] This version is not calibrated (no calibration certificate) [6] not for ATEX ,only for Pulse Output

Dimensions [mm]



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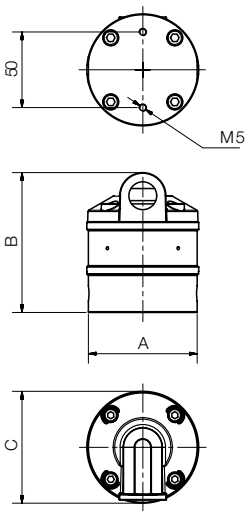

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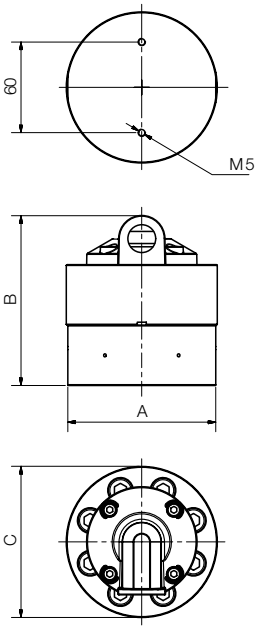

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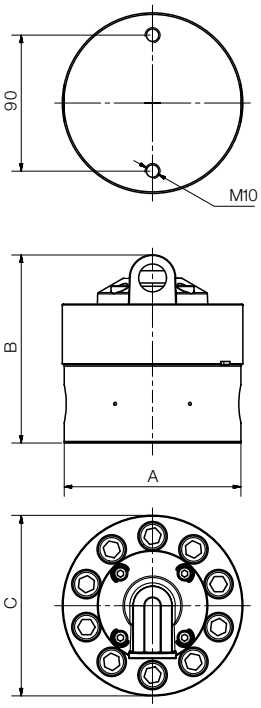

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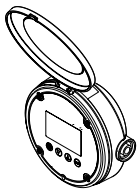
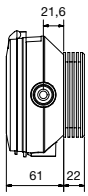
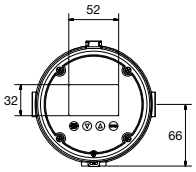
Model	A	B	C
DON-H05	70	96	74
DON-H10	72	96	74
DON-H15	98	116	100
DON-H20	117	128	120

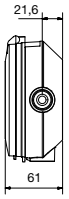
Electronic with LCD display / Zx / Ex

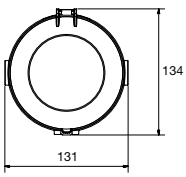




with optional cooling fins







1/09 - 2023