



Oval Wheel Flowmeter, High Pressure

for low and high viscous liquids



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: $\pm 0.2\%$... 1% of reading
- Material: stainless steel
- p_{\max} : 400 bar; t_{\max} : 120°C
- Pulse output, LCD display



S4

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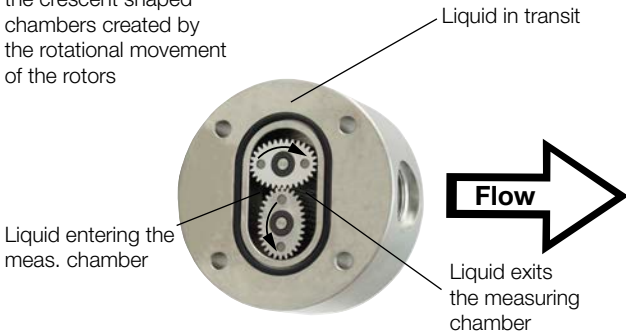
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Principle of Operation

Oval wheel flowmeters are categorised 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 process externally via a remote display controller or PLC or via a variety of output/display options available as accessories attached to the flowmeters.

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 flowmeters 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
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 flowmeter.

- 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
- Ambient temper.: -20°C ... +80°C
- Cable entry: M20x 1.5, ½" NPT adapter

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)

Option HA:

Intrinsic safety 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 x 10⁵ switching cycles
min. Load (<5 V / 10 mA) 5 x 10⁸ 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).



Electronic with LCD Display

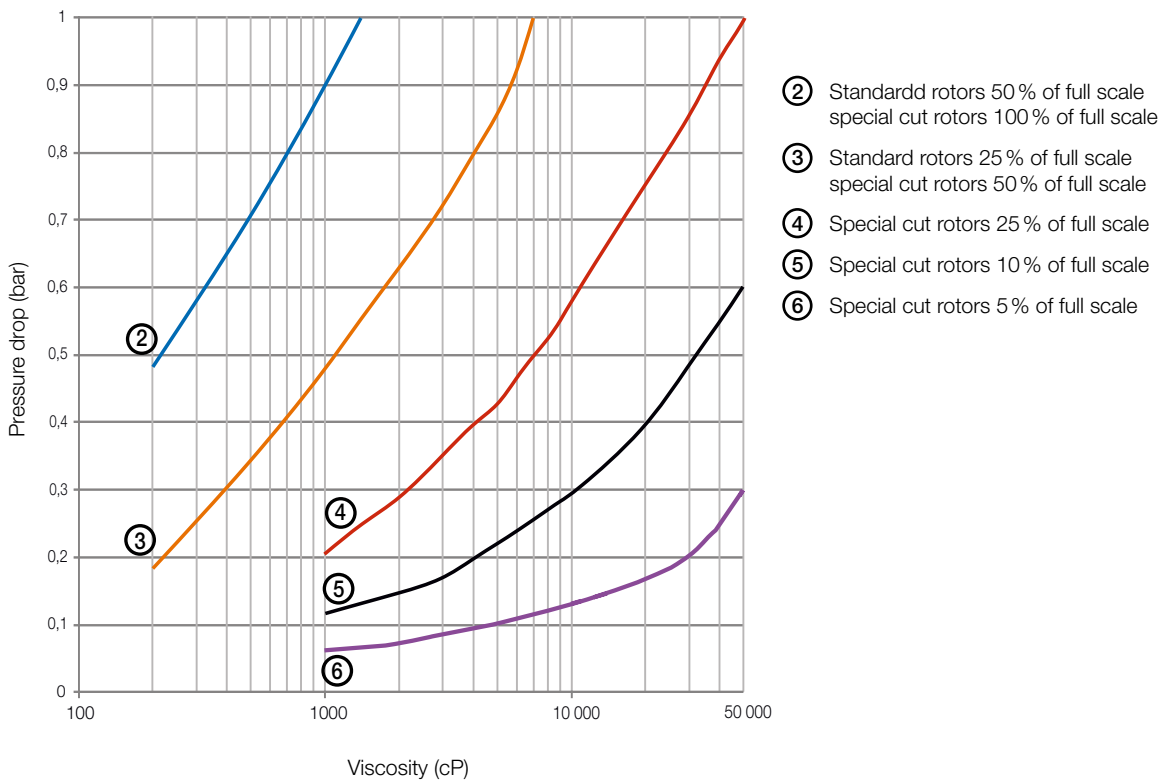
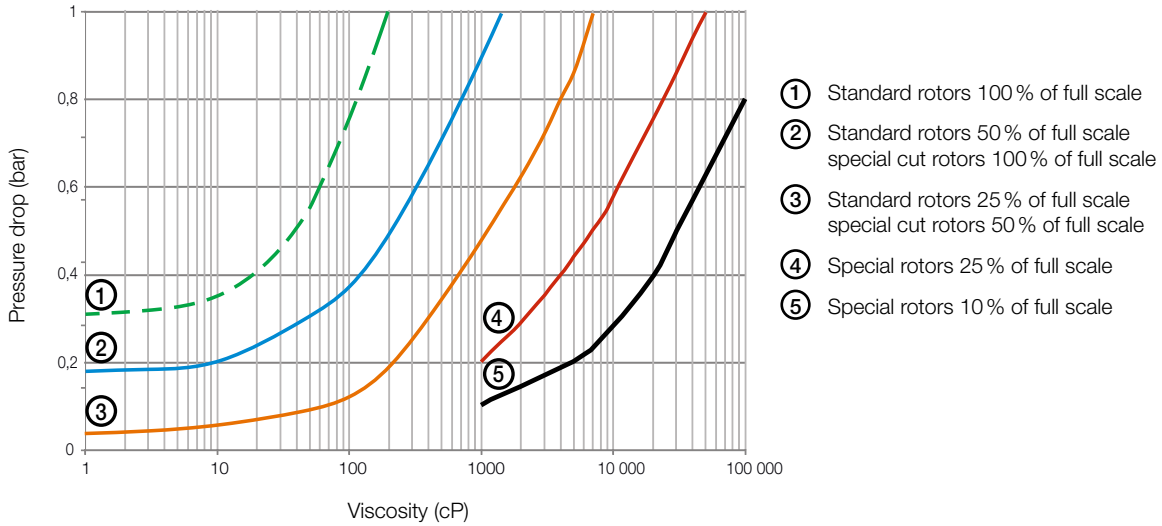
Model	..Z1	..Z2	..Z3	..Z5	..1A	..2A	..3A	..5A
Function	dual totaliser	dosing unit	rate/ counter	rate/ counter	dual totaliser	dosing unit	rate/ counter	rate/ counter
Power supply								
Battery-powered (outputs inactive)	yes	no	yes	yes	optional ²⁾	no	optional ²⁾	yes
External	5 - 24 V _{DC}	12 - 24 V _{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 tempera- ture (Option: max. +120 °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



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.**



Maximum 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

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 flowmeter.

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 flowmeter 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.

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

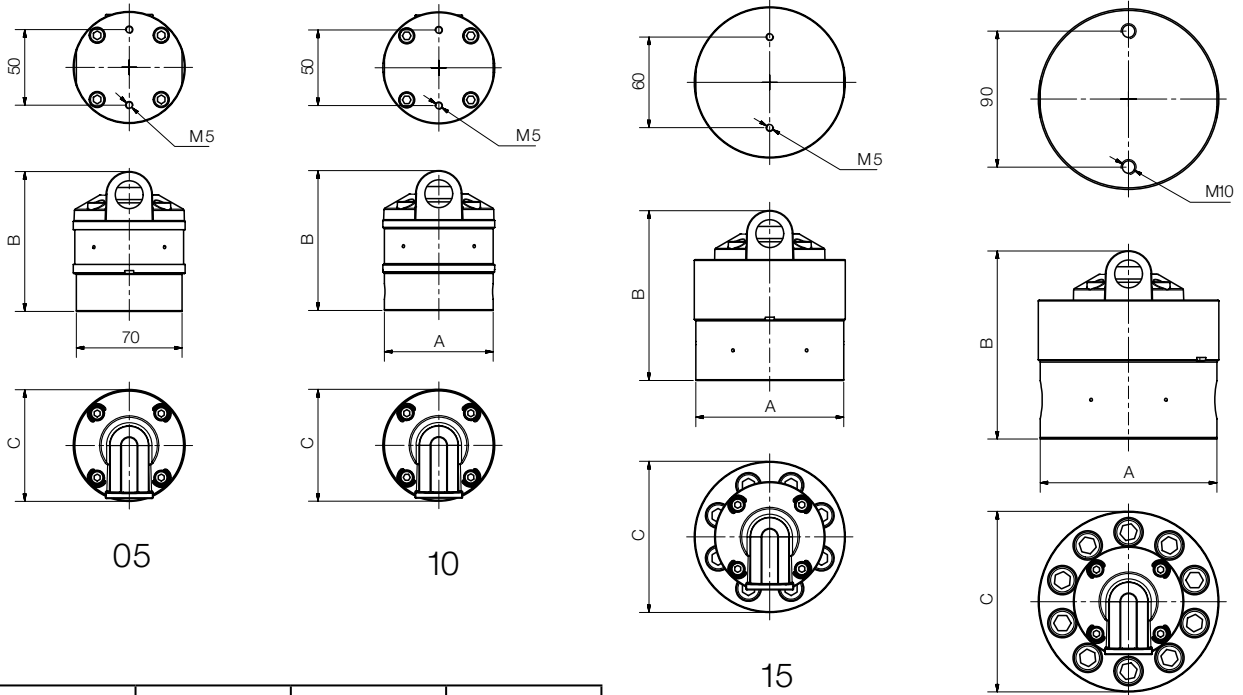
Measuring range [l/min]	Housing material ²⁾ Stainless steel	Connection	O-ring material	Electronics	Cable entry	Option
0.5 - 36 l/h	DON-H05H	R1 = G 1/8 N1 = 1/8" NPT	1 = FKM 3 = FEP-O-ring 4 = NBR 5 = Fluoroprene® 9 = Special materials (not for ATEX)	H0 = Hall sensor (Push-Pull)/ Reed switch, pulse output 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 1A⁴⁾ = E1 + HA (ATEX Exi) 2A⁴⁾ = E2 + HA (ATEX Exi) 3A⁴⁾ = E3 + HA (ATEX Exi) 5A⁴⁾ = E5 + HA (ATEX Exi)	M = M20 N = 1/2" NPT S³⁾ = M20 with cooling fin T³⁾ = 1/2" 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 1/4 N2 = 1/4" NPT				
15 - 550 l/h	DON-H15H ¹⁾	R2 = G 1/4 N2 = 1/4" NPT				
1 - 40	DON-H20H ¹⁾	R4 = G 1/2 N4 = 1/2" NPT				

¹⁾ Replace Hxx with Sxx for special rotor for higher viscosities > 1000 cP 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



Oval Wheel Flowmeter, High Pressure Model DON-H

Dimensions [mm]



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

