

Oval Gear Flowmeter for High Pressures

for Low and High Viscosity Liquids



measuring
•
monitoring
•
analyzing

DON-H



- Measuring Range:
0.13...9.5 GPH to 0.26...10.6 GPM
- Viscosity Range: up to 1000 cP
(Higher on Request)
- Accuracy: $\pm 0.2\% \dots 1\%$ of Reading
- Material: Stainless Steel
- p_{\max} : 5800 PSI
- t_{\max} : 250 °F
- Pulse Output, LCD Display



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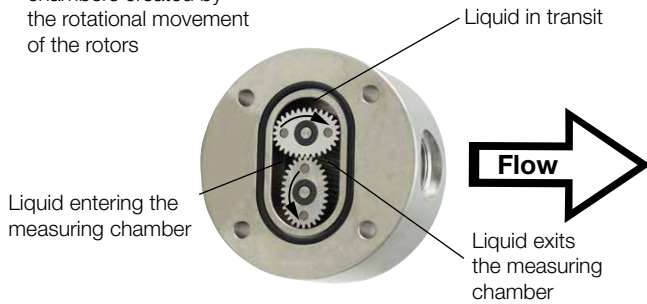
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Description

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.

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's 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 a economical price.

Areas of Application

Suitable for viscous, non abrasive, clean liquids like:

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

In addition to lubricating media, stainless steel flowmeters are suitable for most products and chemicals.

Technical Details

Body:

DON-H05... DON-H15	316L Stainless Steel
DON-H20	316L/301* Stainless Steel

Gears: 316L Stainless Steel

Bearing: Carbon Graphite

Axles: 316L Stainless Steel

O-Rings:

FKM:	-4...300 °F
NBR:	-4...212 °F
FEP-O-Seal:	5...266 °F (FEP Encased, with Solid EPDM Core)

Note: Choose appropriate seal according to permissible temperature limits of the flowmeter.

* Closest AISI Equivalent to 1.3955 Stainless Steel

Electrical Cover (for Cable Connection)

Standard:	Polyamide PA6 GF35 UL94 HB/VO
Optional:	316L Stainless Steel
Cable Entry:	M20 x 1.5 or 1/2" NPT Adapter
Screw Material:	Steel, Coated with GEOMET® 321

Accuracy**

DON-H05...DON-H15:	± 1 % of Reading
DON-H20:	± 0.5 % of Reading, ± 0.2 % of Reading with Optional Z3-Electronics based on Linearization Function)

Max. Pressure:	5800 PSIG
Repeatability:	typ. ± 0.03 %
Protection Class:	IP 66/67
Media Temperature -	
Option ..Zx:	-4...176 °F
Pulse Output/ ..Zx with Cooling Fins:	-4...250 °F
Ambient Temperature:	-4...176 °F
Cable Entry:	M20x1.5, 1/2" NPT Adapter
ATEX-Approval (Options E1/E3/E4/E5):	Ⓔ II 2G Ex ia IIC T4 Gb (-20 °C ≤ Ta ≤ +60 °C)

**Reference conditions: x05...x20 (mineral oil 10 cSt, 68 °F, 75 PSIG); Accuracy data is valid for given viscosities and higher.

Recommended Filter

DON-x05 ... DON-x15:	< 75 µm micron (200 mesh)
DON-x20:	< 150 µm micron (100 mesh)

Reed Switch Pulse Output (..R0)

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 18 °F/min.

Average switching life of reed contact (MTTF):
 Max. Load (100 V/10 mA) 5 x 10⁵ switching cycles
 Min. Load (<5 V/10 mA) 5 x 10⁸ switching cycles
 Power Supply: max. 30 V_{DC}, max. 200 mA

Hall Sensor Pulse Output (..H0)

In the electronics options H0, 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).

In addition to a Hall sensor, this option is equipped with a Reed switch which works the same as Option R0.



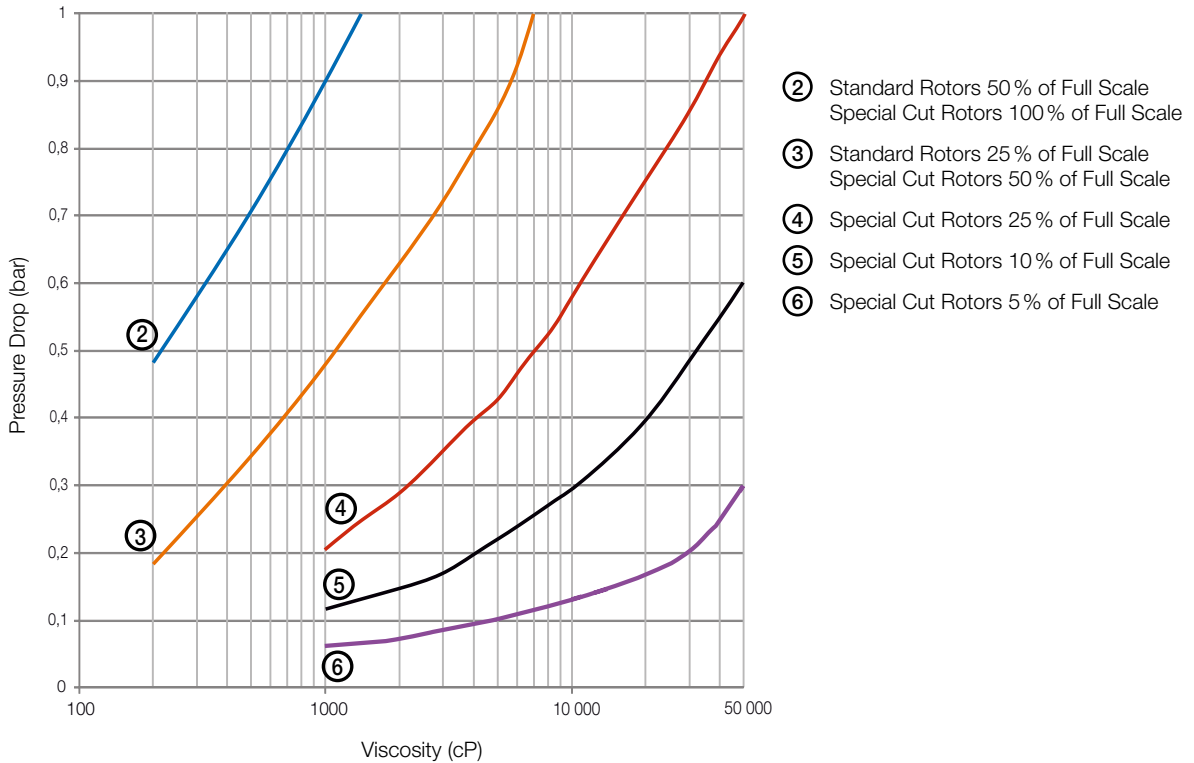
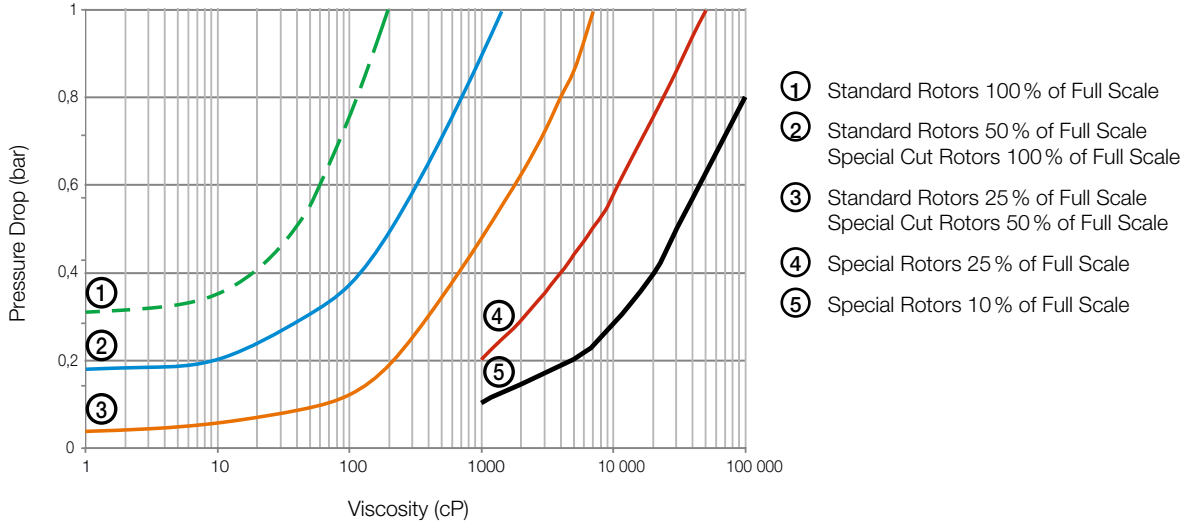
Electronic with LCD Display

Model	..Z1	..Z2	..Z3	..E1	..E2	..E3	..E4	..E5
Function	Dual Totalizer	Batching Unit	Rate/Totalizer	Dual Totalizer	Batching Unit	Rate/Totalizer	Rate/Totalizer	Rate/Totalizer
Power Supply								
Battery-Powered (Outputs Inactive)	yes	no	yes	optional ²⁾	no	optional ²⁾	yes	yes
External (also for Backlighting)	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
Linearization	yes	no	yes	yes	no	yes	yes	yes
Rate Display	yes	yes	yes	yes	yes	yes	yes	yes
Backlighting	yes	yes	yes	no	no	no	no	no
Input								
Un-powered Sensors	Reed Switch							
Powered Sensors	Hall Sensor			Certified Intrinsically Safe Sensors				
Outputs								
4-20 mA	no	no	yes	no	no	yes	yes (HART [®])	no
Flow Rate Alarm Min./Max.	no	no	NPN/PNP/PP	no	no	no	no	with optocoupler
Batch End & Control	no	yes	no	no	yes	no	no	no
Pulse Output	no	no	Push-Pull	no	no	no	no	with optocoupler
2 x SPDT Relays ¹⁾	no	yes	option	no	with optocoupler	no	no	
Installation								
IP 65	yes	yes	yes	yes	yes	yes	yes	yes
Cable Entries	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT	M20x1.5 or 1/2" NPT
Media Temperature Range (Cooling Fin Option: max. 250 °F)	-4...176 °F							
Ambient Temperature Range	-4... 176 °F			32... 140 °F				
Housing Material	PA6 GF35 UL94 HB/VO/PC UL94 V-2							
ATEX Approval	no	no	no	yes				

¹⁾ Replaces solid state outputs, consult factory ²⁾ See ZOK Datasheet



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 relief which effectively reduces the pressure drop by 50%. When sizing a meter, be sure your selection falls below the 1 bar (14.5 PSI) maximum allowable pressure drop line on the graph.



Maximum Flowrate Multiplier (for Higher Viscosities)

Viscosity (cPs)	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 viscosities > 1000 cP, special cut rotors (option: "Y") are normally required to keep the maximum pressure drop from exceeding acceptable levels. This option applies to DON-H15 and larger sizes. For higher viscosities, the flowmeter max. flowrate is derated according to the table above.

Example:

DON-H20 measuring viscous oil at 8000 cP:
max. flow of 40 GPM x 0.5 = 20.0 GPM new max. flow rate.

Nominal Output Pulse Resolution

Model	Measuring Range	Pulse per Gallon	
		Reed Switch ..Rx	Hall Sensor ..Hx
DON-H05..	0.13...9.5 GPH	10,107	10,107
DON-H06..	0.5...9.5 GPH	10,107	10,107
DON-H10..	0.5...27 GPH	3,990	3,990
DON-H15..	4...145 GPH	1,344	2,688
DON-H20..	0.26...10.6 GPM	310	617

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.

Order Details (Example: DON-H10G N1 1 R0 M 0)

Measuring Range	Stainless Steel Housing ²⁾	Connection	O-Ring Material	Electronics	Cable Entry	Option
0.13...9.5 GPH	DON-H05G ¹⁾N1.. = 1/8" NPT ..R1.. = G 1/8	..1.. = FKM ..3.. = FEP-O-Seal	..R0.. = Reed Switch Pulse Output ..H0.. = Hall Sensor (Push-Pull)/ Reed Switch, Pulse Output ..Z1.. = Dual LCD Totalizer ..Z2.. = Batching Unit LCD ..Z3.. = LCD Totalizer, Rate, Outputs: 4-20 mA, Alarm, Pulse (ZOK-Z3) (Impulses not for Battery Supply) ..E1 ⁵⁾ .. = Z1 + ATEX (Exi) ..E2 ¹⁾⁵⁾ .. = Z2 + ATEX (Exi) ..E3 ⁵⁾ .. = Z3 + ATEX (Exi) without Switching or Pulse Outputs ..E4 ¹⁾⁵⁾ .. = E3 + HART® ..E5 ⁵⁾ .. = E3 + Pulse or Switching Outputs without 4-20 mA	..M = M20 ..N = 1/2" NPT ..S ³⁾ = M20 with Cooling Fin ..T ³⁾ = 1/2" NPT with Cooling Fin	..0 = without ..Y ⁴⁾ = Special Cut Rotors for Higher Viscosities ..Y = Special Option (Specify in Clear Text)
0.5...9.5 GPH	DON-H06G ¹⁾N1... = 1/8" NPT ..R1.. = G 1/8				
0.5...27 GPH	DON-H10G..	..N2... = 1/4" NPT ..R2.. = G 1/4				
4...145 GPH	DON-H15G..	..N2.. = 1/4" NPT ..R2.. = G 1/4	..4.. = NBR ⁶⁾			
0.26...10.6 GPM	DON-H20G..	..N4.. = 1/2" NPT ..R4.. = G 1/2				

¹⁾ In preparation

²⁾ Replace 'G' with 'H' to order LPH (LPM) (e.g. 15 H instead of 15 G)

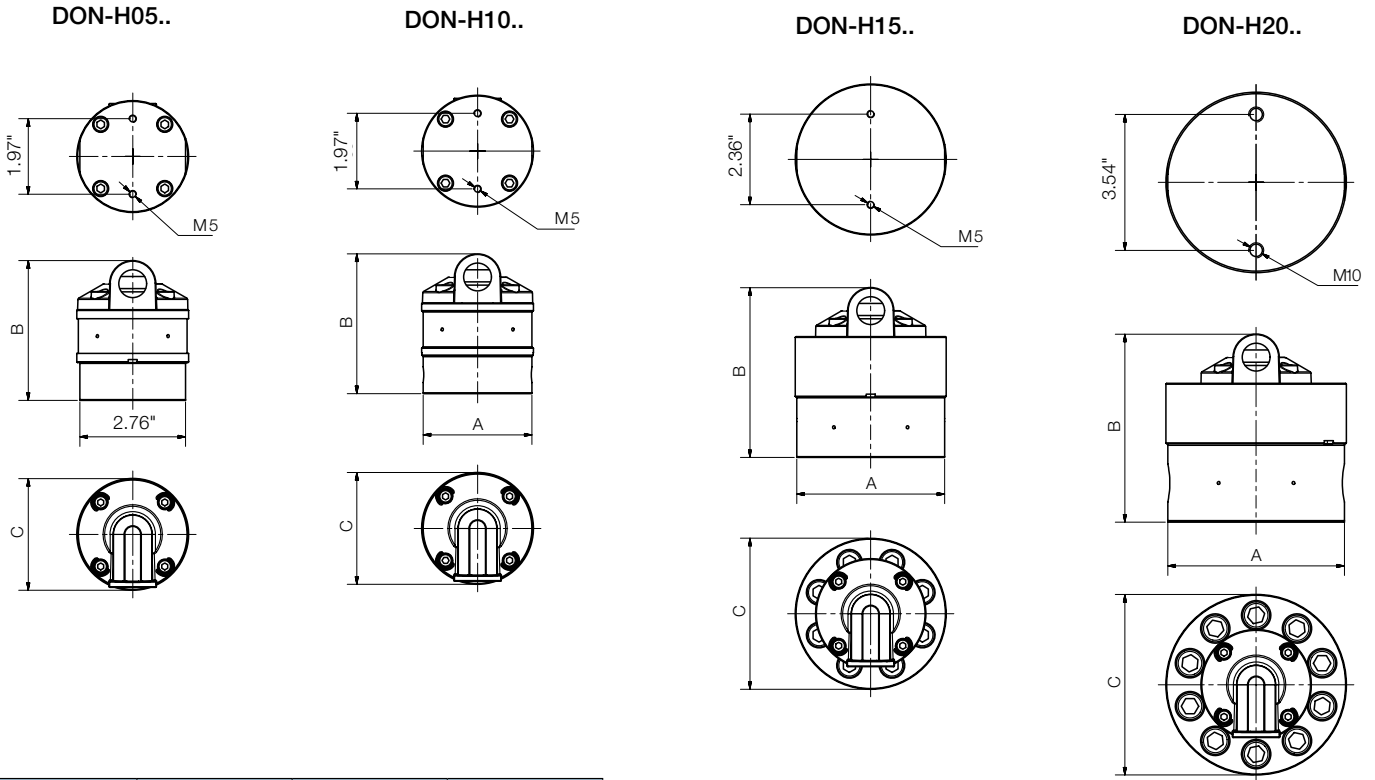
³⁾ Only for electronic options ..Zx

⁴⁾ Not for DON-H05... DON-H10

⁵⁾ Without Backlighting

⁶⁾ Max. Temperature of 212 °F

Dimensions



Model	A	B	C
DON-H05..	2.76"	3.78"	2.91"
DON-H10..	2.83"	3.78"	2.91"
DON-H15..	3.86"	4.57"	3.94"
DON-H20..	4.61"	5.04"	4.72"

Electronic with LCD Display: ..Zx/ ..Ex

