

# 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 (Standard)  
(Higher Viscosities with Special Cut Rotors)
- 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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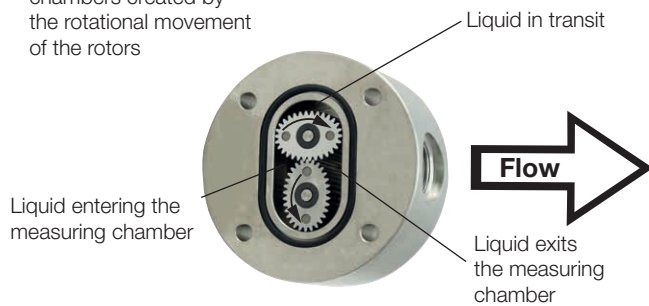
## Oval Gear Flowmeter for High Pressures Model DON-H

### 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 an economical price.

### Areas of Application

Suitable for viscous, non abrasive, clean liquids like:

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

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

### Technical Details

<b>Body:</b>	316L Stainless Steel
<b>Gears:</b>	316L Stainless Steel
<b>Bearing:</b>	Carbon Graphite
<b>Axles:</b>	316L Stainless Steel
<b>O-Rings*:</b>	
<b>FKM:</b>	-4...300 °F
<b>NBR:</b>	-4...212 °F
<b>FEP-O-Seal:</b>	5...266 °F (FEP Encased, with Solid EPDM Core)
<b>Fluoroprene®:</b>	Acc. to Regulation EN 1935
<b>Cover for Cable Connection</b>	
<b>Standard:</b>	Polyamide PA6 GF35 UL94 HB/VO
<b>Optional:</b>	316L Stainless Steel
<b>Screw Material:</b>	Steel, Coated with GEOMET® 321
<b>Magnet Encapsulation</b>	
<b>DON-H05... DON-H10:</b>	PEEK
<b>DON-H15... DON-H20:</b>	316L Stainless Steel

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

### Accuracy\*\*

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

<b>Max. Pressure:</b>	5800 PSIG
<b>Repeatability:</b>	typ. ± 0.03 %
<b>Protection Class:</b>	IP 66/67
<b>Media Temperature</b>	
<b>Option ..Zx:</b>	-4...176 °F
<b>Pulse Output and</b>	
<b>Option ..Zx w/ Cooling Fins:</b>	-4...250 °F
<b>Ambient Temperature:</b>	-4...176 °F
<b>Cable Entry:</b>	M20x 1.5, 1/2" NPT Adapter

### ATEX-Approval

**Mechanical Explosion Protection:** II 2G Ex h IIC T4/T3 Gb

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

**Intrinsically Safe** II 2G Ex ia IIC T4 Gb  
(-20 °C ≤ Ta ≤ +60 °C)

**Options HA:**

**Intrinsically Safe** II 3G Ex ic IIC T4/T3 Gc

### 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 18 °F/min.

Average switching life of reed contact (MTTF):

Max. Load (30 V / 10 mA) 5 x 10<sup>5</sup> switching cycles

Min. Load (<5 V / 10 mA) 5 x 10<sup>8</sup> switching cycles

Switching Capacity: Max. 30 V<sub>DC</sub>, 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<sub>DC</sub>. 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).

\*\* Reference Conditions: x05 (Calibration Oil, 10 cSt, 68 °F, 73 PSIG)  
x10...x20 (Calibration Oil, 4.6 cSt, 77 °F, 14.5 PSIG)  
Accuracy data is valid for given viscosities and higher



**Electronic with LCD Display**

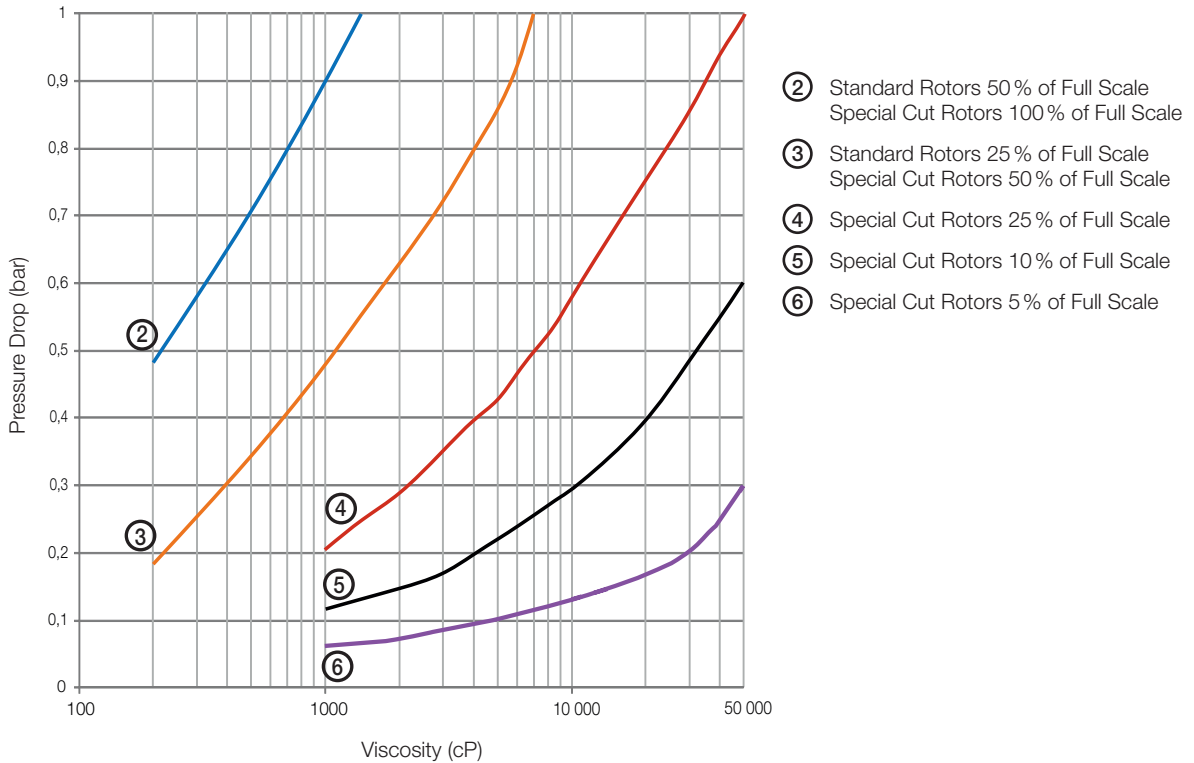
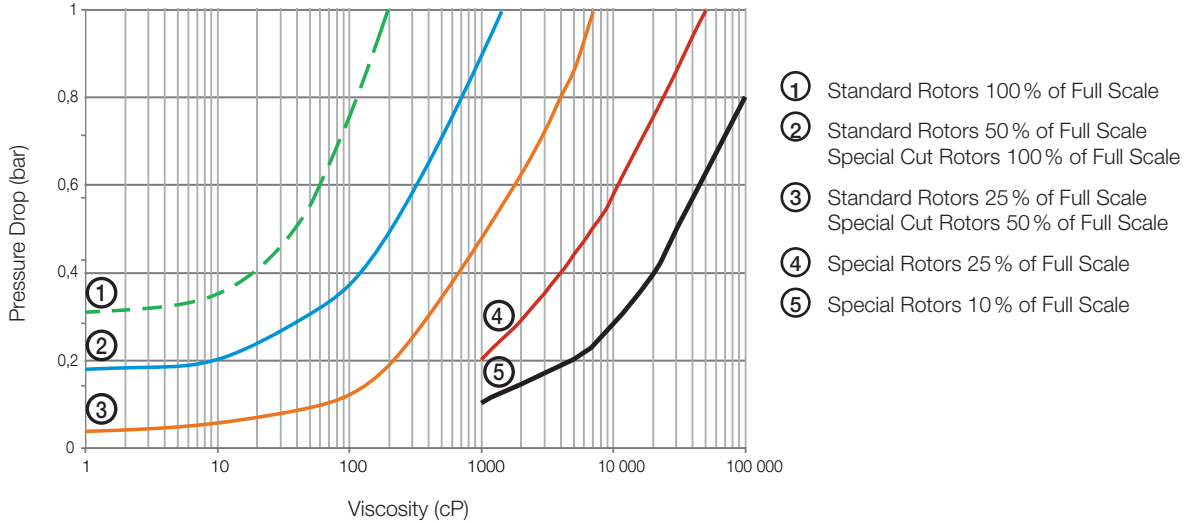
Model	..Z1	..Z2	..Z3	Z5	..1A	..2A	..3A	..5A
Function	Dual Totalizer	Batching Unit	Rate/Totalizer	Rate/Totalizer	Dual Totalizer	Batching Unit	Rate/Totalizer	Rate/Totalizer
<b>Power Supply</b>								
Battery-Powered (Outputs Inactive)	yes	no	yes	yes	optional <sup>2)</sup>	no	optional <sup>2)</sup>	yes
External	5 - 24 V <sub>DC</sub>	12 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>	5 - 24 V <sub>DC</sub>
<b>LCD Display</b>								
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	yes	no	yes	yes
Rate Display	yes	yes	yes	yes	yes	yes	yes	yes
Backlighting	yes	yes	yes	yes	no	no	no	no
<b>Input</b>								
Sensors	Hall Sensor / Reed Switch							
<b>Outputs</b>								
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 Output	no	no	Push-Pull	Push-Pull	no	no	no	with Solid State Relay Board
2 x SPDT Relays <sup>1)</sup>	no	yes	no	yes	no	with Solid State Relay Board	no	
<b>Installation</b>								
IP 65	yes	yes	yes	yes	yes	yes	yes	yes
Cable Entries	M20x1.5 or ½" NPT							
Media Temperature Range (Cooling Fin Option: Max. 250 °F)	-4...176 °F							
Ambient Temperature Range	-4... 176 °F				-4 ... 140 °F			
Housing Material	PA6 GF35 UL94 HB/VO/PC UL94 V-2							
ATEX Approval	no				yes			

<sup>1)</sup> Replaces solid state outputs, for details see ZOK Datasheet

<sup>2)</sup> 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

**Nominal Output Pulse Resolution**

Model	Measuring Range	Pulse per Gallon	
		Reed Switch	Hall Sensor
DON-H05..	0.13...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.

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

Example:

DON-H20 measuring viscous oil at 8000 cP:

max. flow of 40 GPM x 0.5 = 20.0 GPM new max. flow rate.

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

Measuring Range	Stainless Steel Housing <sup>2)</sup>	Connection	O-Ring Material	Electronics	Cable Entry	Option
0.13...9.5 GPH	DON-H05G..	..N1.. = 1/8" NPT ..R1.. = G 1/8	..1.. = FKM ..3.. = FEP-O-Ring	..H0.. = Hall Sensor (Push-Pull)/ Reed Switch, Pulse Output ..HA.. = H0 + ATEX (Exi) ..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) ..Z5.. = Z3 + 2 SPDT Relays	..M = M20 ..N = 1/2" NPT ..S <sup>3)</sup> = M20 with Cooling Fin	..0 = without ..N = Without Battery ..Y = Special Option (Specify in Clear Text, not for ATEX)
0.5...27 GPH	DON-H10G..	..N2.. = 1/4" NPT ..R2.. = G 1/4				
4...145 GPH	DON-H15G <sup>1)</sup> ..	..N2.. = 1/4" NPT ..R2.. = G 1/4	..4.. = NBR	..1A <sup>4)</sup> .. = E1 + HA ATEX (Exi) ..2A <sup>4)</sup> .. = E2 + HA ATEX (Exi) ..3A <sup>4)</sup> .. = E3 + HA ATEX (Exi) ..5A <sup>4)</sup> .. = E5 + HA ATEX (Exi)	..T <sup>3)</sup> = 1/2" NPT with Cooling Fin	
0.26...10.6 GPM	DON-H20G <sup>1)</sup> ..	..N4.. = 1/2" NPT ..R4.. = G 1/2	..5.. = Fluoroprene <sup>®</sup> ..9.. = Special Materials (not for ATEX)			

<sup>1)</sup> Replace Hxx with Sxx for special rotors for viscosities > 1000 cP

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

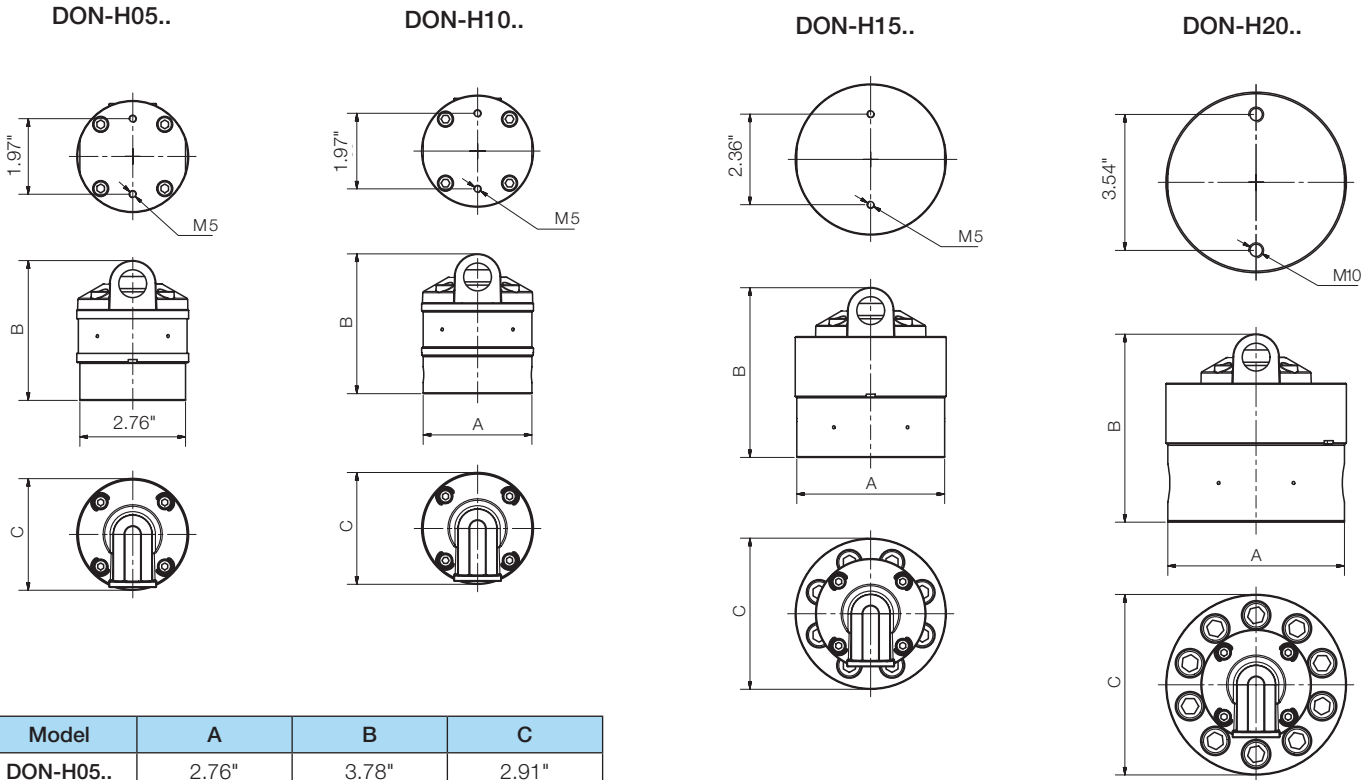
<sup>3)</sup> Only for electronic options ..Zx

<sup>4)</sup> E1/E2/E3/E5 = Z1/Z2/Z3/Z5 in ATEX version (Exi), without backlighting



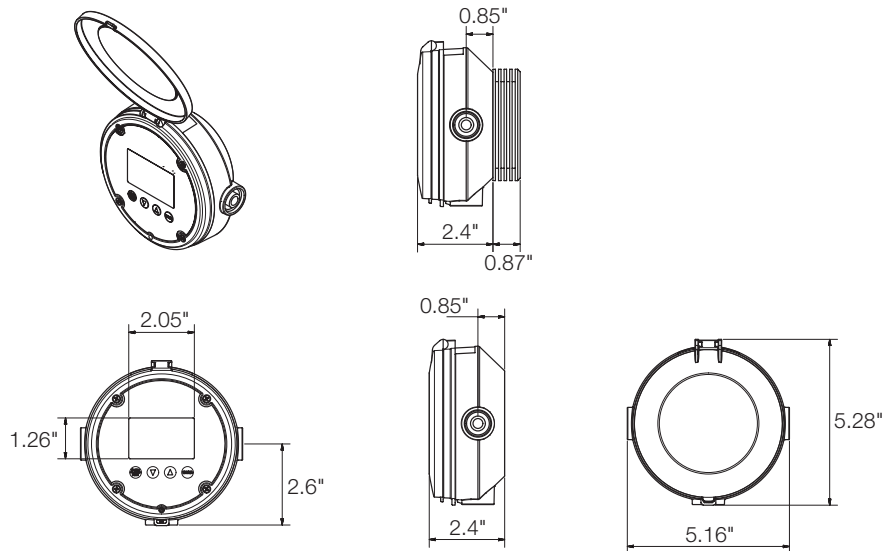
Oval Gear Flowmeter for High Pressures Model DON-H

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



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