Oval Wheel Flow Meter, High Pressure

for low and high viscous liquids

measuring • monitoring • analysing

DON-H / DON-S

- 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
- U-PACE electronics: temperature measuring, IO-Link

Model: POD (optional electronics)

S4

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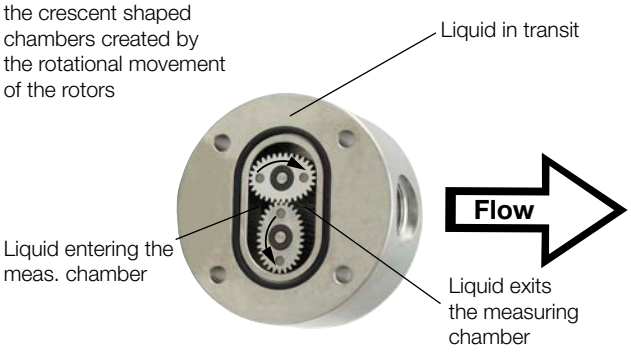
Principle of Operation

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.

CSA certification of U-PACE electronics for Ordinary Locations (Ordloc).

International IECEE Certification acc. to CB-Scheme with U-PACE

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-x05…DON-x15) ± 0.5 % of reading (DON-x20) ± 0.2 % of reading (DON-x20; with optional Z3-electronics based on linearisation function)
Max. pressure	400 bar 200 bar for CSA and IECEE variant
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 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:
Ⓔx II 2G Ex h IIC T4/T3 Gb

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

Intrinsic safety	Ⓔx II 2G Ex ia IIC T4 Gb (-20°C ≤ Ta ≤ +60°C)
Option HA: Intrinsic safety	Ⓔx II 3G Ex ic IIC T4/T3 Gc
Option HE: Flameproof enclosure	Ⓔx II 2G Ex db IIC T4/T6 Gb Ⓔx I M2 Ex db I Mb Only St.St. Enclosure

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Technical Details (continued)

IECEx-approval

Option HE:
Flameproof enclosure: Ex db IIC
Ex db I Mb

* 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-x05 ... DON-x15 < 75 µm micron (200 mesh)

DON-x20 < 150 µm micron (100 mesh)

Pulse Output (H0/HA/HE)

Options H0/HA/HE 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/HE, 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).

U-PACE electronics (...CT)

The universal U-PACE electronics (Universal Precision and Control Electronics, order code CT) features two outputs arbitrarily configurable by the customer.

In addition, the U-PACE electronics offers various diagnostic functions and the following features:

- Flow- and temperature measurement
- Monitoring, dosing and transmitter function
- Dosing function with external control input
- Coloured, multi-parameter configurable TFT-display, rotatable in 90° steps
- Intuitive setup menu via 4 optical touch keys
- 2 configurable outputs (pulse-/frequency-/alarm- and analogue output)
- Grand and resettable totaliser
- IO link function

Materials

Housing:	st. st. 1.4404
Display screen:	PC
Housing screw cap:	PA6

Electrical Details U-PACE

Supply voltage:	19 - 30 V_{DC}, internal power consumption max. 200 mA
Display:	TFT display, 128 x 128 pixels, 1.4" display orientation in 90° steps adjustable
Display repetition rate:	0.5 ... 10 s, adjustable
Pulse output	Push-Pull, freely scalable, configurable for partial and accumulated totaliser
Frequency output	Push-Pull, freely scalable, 2 kHz @ overflow f_{min} @ FS = 50 Hz f_{max} @ FS = 1000 Hz
Alarm output:	NPN, PNP, Push-Pull, configurable max. 30 V_{DC}, max. 200 mA short-circuit proof
Analogue output:	active, 3 wire, 0(4)-20 mA, max. load 500 Ω or 0(2)-10 V_{DC}, (R_i = 500 Ω) (factory calibrated with R_L = 1 MΩ)
Control input:	active signal U_{high} max. 30 V_{DC} 0 <Low <10 V_{DC} 15 V_{DC} <High <Vs
Dosing function:	Dosing output OUT2: Push-Pull, High active Control input OUT1: START/STOP 0.5 s <t_{high} <4 s RESET t_{high} >5 s
Response time electrical outputs:	Size X05 to X20 and X45 to X60: < 1.5 s Size X25 to X40: < 0.5 s

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Temperature measurement

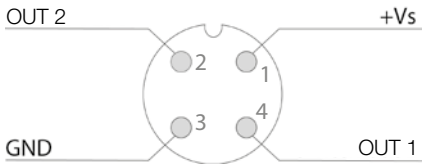
Meas. range:	-20 ... +80 °C
Accuracy:	±1.0 °C (depending on ambient temperature)

Configuration of outputs

Output 1 (OUT1, PIN 4)	Output 2 (OUT2, PIN 2)
Analogue output 4-20 mA	Analogue output 4-20 mA
Analogue output 0-20 mA	Analogue output 0-20 mA
Analogue output 2-10 V	Analogue output 2-10 V
Analogue output 0-10 V	Analogue output 0-10 V
Switching output NPN/PNP/PP	Switching output NPN/PNP/PP
Pulse output PP	Pulse output PP
Frequency output PP	Frequency output PP
Communication mode KofiCom	
Communication mode IO-Link	
Control input	
Control input dosing function	Dosing output

IO-Link specification

Manufacturer ID:	1105 (decimal), 0 x 0451 (hex)
Manufacturer name:	Kobold Messring GmbH
IO-Link specification:	V1.1
Bitrate:	COM3
Minimal cycle time:	1,1 ms
SIO-Mode:	yes (OUT1 in configuration IO-Link)
Block parameterisation:	yes
Operational readiness:	10 s
Max. cable length:	20 m



When operated under the CSA Label, the equipments shall be supplied with an external power supply which fulfils the requirements of Cl. 6.3.1, 6.3.2, 9.4 of IEC/CSA/UL 61010-1 and fulfils the requirements of the national authorities.

For example, by the use of a Class 2 Limited Power Source (LPS)

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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

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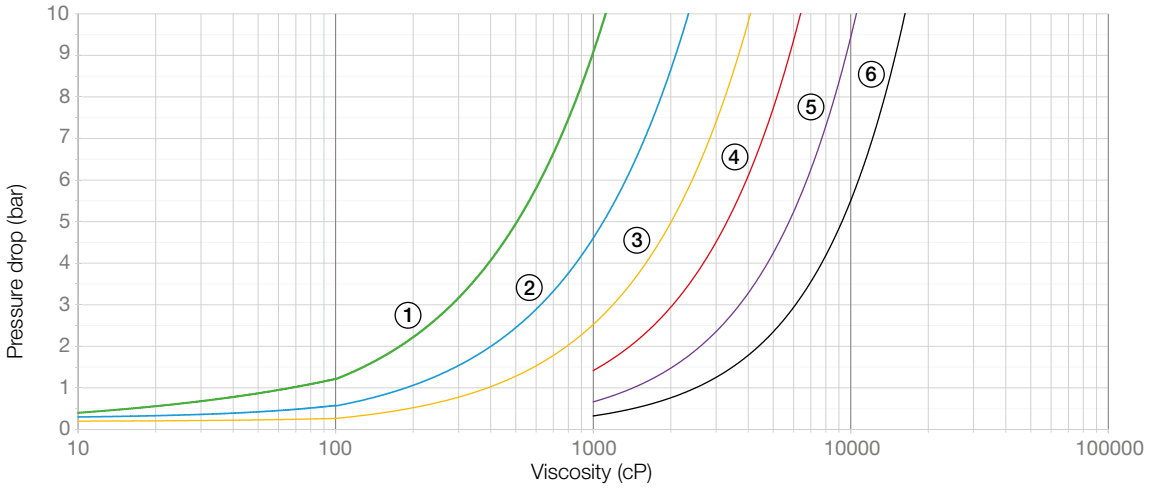
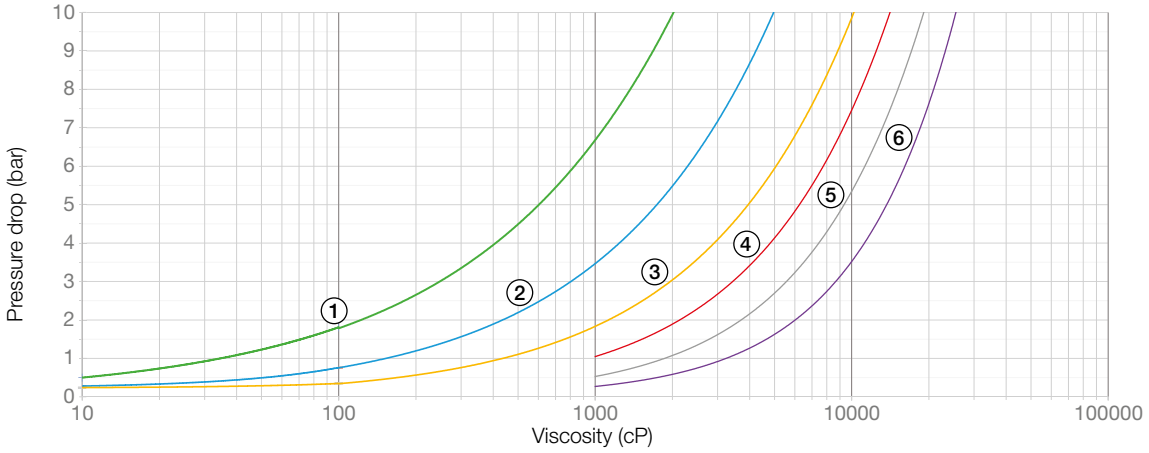
DON Pressure Drop Curves versus Viscosity

DON x05 ... x15



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. Standard rotors 12.5 % of full scale
   Special cut rotors 25 % of full scale
5. Standard rotors 5 % of full scale
   Special cut rotors 10 % of full scale
6. Standard rotors 2.5 % of full scale
   Special cut rotors 5 % of full scale

DON x20



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4. Standard rotors 12.5 % of full scale
   Special cut rotors 25 % of full scale
5. Standard rotors 5 % of full scale
   Special cut rotors 10 % of full scale
6. Standard rotors 2.5 % of full scale
   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 of DON-S... series have alternate tooth relieve which effectively reduces the pressure drop by approx. 50%.

Please note: Pressure surges are not permitted when starting up the system. Pressure surges >3 bar can lead to blocking of the gears, especially with sizes x05 ... x15.

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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

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-x05	0.5 - 36 l/h	2670	2670
DON-x10	2 - 100 l/h	1054	1054
DON-x15	15 - 550 l/h	355	710
DON-x20	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.

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Order Details DON-H (Example: **DON-H10H R1 1 H0 M 0**)

Measuring range	Housing material: 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) **HE** = H0 + ATEX (Exd) **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 **P**[8] = electr. connection M12x1	**0** = without **N** = without battery **Y** = special option (specify in clear text; not for ATEX)
0.13 - 9.5 GPH	**DON-H05G**					
2 - 100 l/h	**DON-H10H**	**R2** = G ¼ **N2** = ¼" NPT				
0.5 - 27 GPH	**DON-H10G**					
15 - 550 l/h	**DON-H15H**	**R2** = G ¼ **N2** = ¼" NPT				
4 - 145 GPH	**DON-H15G**					
1 - 40 l/min	**DON-H20H**	**R4** = G ½ **N4** = ½" NPT		**CT**[7] = U-PACE, TFT display, 2 outputs (current/voltage/pulse/ frequency/alarm output/IO link configurable), M12x1 plug, with cCSAus and IECEE CB Scheme Approval Max. pressure 200 bar	**0** = without	
0.26 - 10.6 GPM	**DON-H20G**					

[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 [7] l/min-package (nameplate (l/min or ml/min, °C, bar)), calibrated range and temperature °C; GPM-package (nameplate (GPM or GPH, °F, PSI)), calibrated range and temperature °F [8] Only possible with electronics "H0"

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Order Details DON-S for special rotors for higher viscosities > 1000 cP (Example: **DON-S15H R2 1 H0 M 0**)

Measuring range	Housing material: Stainless steel	Connection	O-ring material	Electronics	Cable entry	Option
15 - 550 l/h	**DON-S15H**	**R2** = G ¼ **N2** = ¼" 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) **HE** = H0 + ATEX (Exd) **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 **P**[8] = electr. connection M12x1	**0** = without **N** = without battery **Y** = special option (specify in clear text; not for ATEX)
4 - 145 GPH	**DON-S15G**					
1 - 40 l/min	**DON-S20H**	**R4** = G ½ **N4** = ½" NPT		**CT**[7] = U-PACE, TFT display, 2 outputs (current/voltage/pulse/ frequency/alarm output/IO link configurable), M12x1 plug, with cCSAus and IECEE CB Scheme Approval Max. pressure 200 bar	**0** = without	
0.26 - 10.6 GPM	**DON-S20G**					

[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 [7] l/min-package (nameplate (l/min or ml/min, °C, bar)), calibrated range and temperature °C; GPM-package (nameplate (GPM or GPH, °F, PSI)), calibrated range and temperature °F [8] Only possible with electronics "H0"

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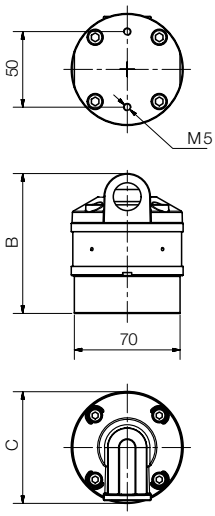
Dimensions [mm]



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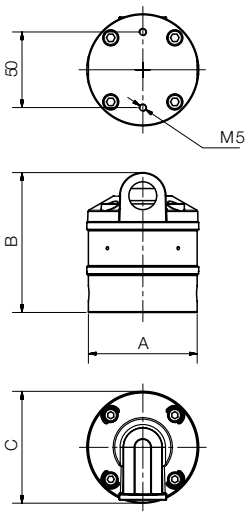

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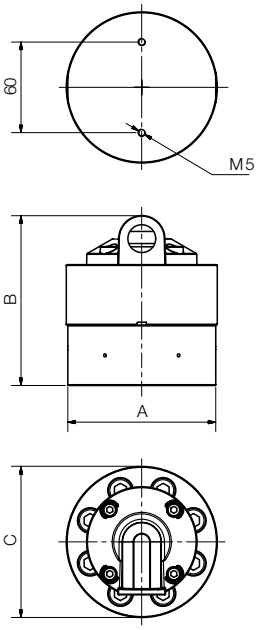

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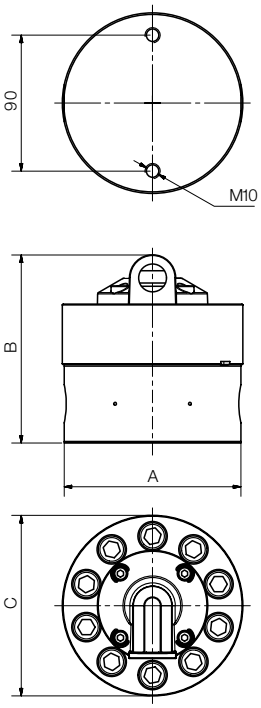

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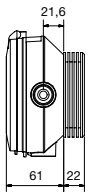
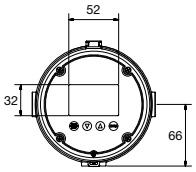
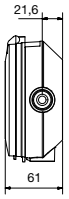
Model	A	B	C
DON-x05	70	96	74
DON-x10	72	96	74
DON-x15	98	116	100
DON-x20	117	128	120

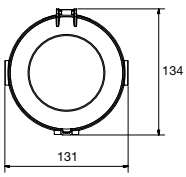
Electronic with LCD display/Zx/Ex



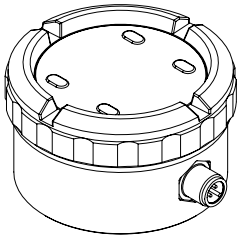
with optional cooling fins

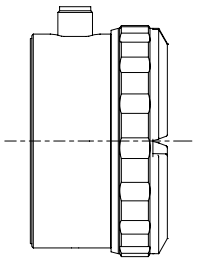


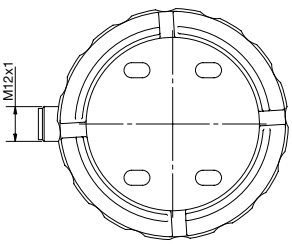


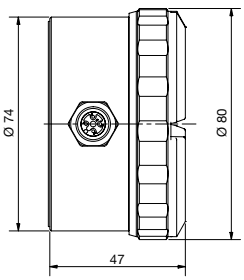


U-PACE electronics (option DON-CT)









No responsibility taken for errors;
subject to change without prior notice.

1/10 - 2026