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

Ring Piston Flow Meter

for low/high Viscous Liquids

measuring • monitoring • analysing

DRT

- Measuring range: 0.2 ... 10 L/min to 12 ... 330 L/min
- Viscosity range: low viscous to high viscous liquids
- Accuracy: ± 0.2 % ... 1 % of reading
- p_{max}: 350 bar; t_{max}: +150 °C
- Connection: G½ ... G2 female, ½" NPT ... 2" NPT female, DIN flanges DN 15 ... DN 50, ANSI flanges ½" ... 2"
- Material: Stainless steel, aluminium
- Output: Pulses, LCD display, 4 ... 20 mA, batching, totalising

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Description

The Kobold model DRT flowmeters utilise the widely accepted oscillating piston design principle with the performance enhanced by the use of modern engineering materials to provide a cost effective and reliable solution for a wide range of industrial flow measurement applications.

This flowmeter utilises the oscillating piston principle, where the passage of liquid causes a piston to oscillate smoothly in a circular motion inside a round measuring chamber. Each piston cycle displaces a known volume of liquid from the inlet port to the outlet port. Small high energy magnets located within the piston activate the integral electronics which in turn generate high resolution pulse outputs suitable for remote flow integration instruments, computers and PLC's.

This simple and robust design offers the advantage of only one moving part with both high resolution NPN Hall Effect open collector and reed switch outputs as standard. As each piston oscillating cycle passes a known volume of liquid, the inherent repeatability of the positive displacement flowmeter makes it particularly suited to batching and dispensing duties.

Positive displacement flowmeters are an inexpensive means to accurately meter high viscosity clean liquids as high as 1 million centipoise however, the appropriate meter must be sized so that the pressure drop across the primary measuring elements (oscillating or oval rotor), does not exceed the maximum capability of either. The oscillating piston meter can withstand 2.8 bar differential pressure making it more suitable to high viscosity liquids, the oval wheel is limited to 1 bar differential due to the pressure imposed on the rotor shafts.

Applications

Common applications range from non-conductive low viscosity solvents through to extremely viscous lubricants, chemicals and food bases. Application flexibility is further enhanced as meter performance is independent of flow profile eliminating the restrictive need for straight pipe runs required with most alternate metering technologies.

The DRT has no stagnate chambers to harbor contaminants. There is no restriction on mounting orientation and the flowmeter may be operated under vacuum flow, pumped flow or gravity flow conditions.

The aluminium model is suitable for metering petroleum products, diesel, fuel oil, lubrication oil, hydraulic oil, kerosene, gasoline, alcohol, solvents, laquers and grease.

Typical applications for stainless steel model include chemical and allied products, pharmaceuticals, petroleum, LPG, deionised water, container filling machines, fuel additives, bitumen, paint, synthetic rubber, latex, detergent and soap, pigments.

The high pressure stainless steel model applications include hydraulics, lube oil, mercaptan, petroleum, deionised water, resins, MEK, ethylene oxide, oil and gas industry, injection of chemical and bonding solution

Technical Details

Materials:

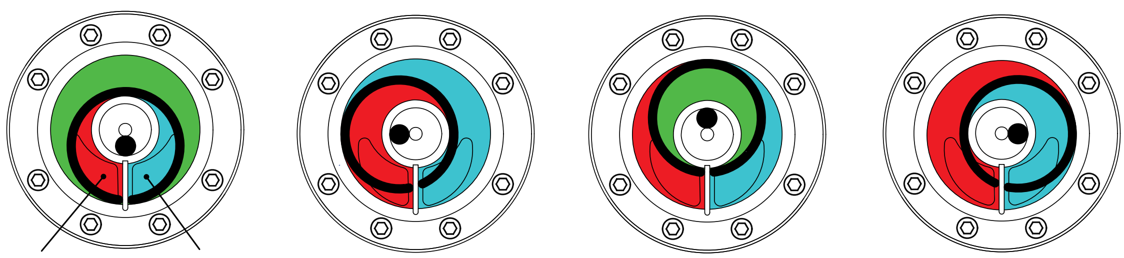
Body:	Stainless steel 1.4404 (316L) or aluminium
Piston:	CFT - Carbon Filled PTFE (standard) or PEEK
Partition Material:	Stainless steel 1.4404 (316L) or ceramic (for abrasive or low lubricity fluids such as water, road marking paints etc.)

Oscillating Piston Principle

Liquid Entering the Measuring Chamber

Liquid in Transition

Liquid Leaving the Measuring Chamber



Inlet Port

Outlet Port

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Seals:	FPM (standard): -15 … +200 °C EPR (Ethylene Propylene Rubber): -20 … +150 °C, for ketones only PTFE encapsulated FPM: -20 … +150 °C NBR: -65 … +100 °C
Cover (for pulse output):	Glass reinforced nylon, st. steel (options NE, QE)
Accuracy (at 3 cP):	±1 % of reading (DRT-xx4) ± 0.5 % of reading (for all other models/sizes) ± 0.2 % of reading (with ZOD-Z3 linearisation)
Viscosity range:	(see graphs on page 5 for higher viscosities with flow de-rating)
Repeatability:	± 0.03%
Temperature range:	-20 … +80 °C for options Z and B and -20 … +120 °C for pulse output for options Z and B with cooling fin and +150 °C only with piston material PEEK and NPN pulse output
Pressure drop:	see flow de-rating graph
Supply voltage:	see electrical output specifications, electronics comparison table and ZOD datasheet
Electronic features:	see electronics comparison table or ZOD datasheet
Electrical output:	see page 4
Output frequency at max. velocity:	67 ... 110 Hz (Hall effect pulse output), 14 ... 33 Hz (Reed switch pulse output)
Wiring (standard):	5 core, screened cable
Transmission distance:	1 000 meters maximum, without integrated electronics
Cable entry:	see order details
Protection Class:	IP 66/67
Straight pipe runs requirement:	none
Mounting:	universal (bi-directional flow)
Maximum Pressure (threaded version):	see table below
Output pulse resolution:	see table below
ATEX-approval (option Z4):	Ex II 2G EEx ia IIB T4 (-20°C ≤ Ta ≤ +60°C)
(options NE, QE):	Ex II 2G Ex d IIB T6 (-20°C ≤ Ta ≤ +70°C) Ex II 2G Ex d IIB T4 (-20°C ≤ Ta ≤ +120°C) Ex I M2 Ex d IMb (st. steel models only)
Approx. shipping weights (threaded meters only):	see table below
Recommended filters:	150 microns (100 mesh) minimum

Electrical Output Specifications

Hall Effect Sensor Pulse Output (N1)

The Hall Effect Sensor is a high resolution solid state 3 wire device providing an un-sourced, open collector, NPN transistor output. The term "un-sourced" means that no voltage is applied to the output from within the flowmeter, it must be pulled to a 'high' or 'on' state by between 5...24V_{DC} supplied from an external source, typically the receiving instrument.

The pulse output between signal and -0V is a voltage square wave with the high level being the DC voltage available at the open collector and the low level being -0V.

The receiving instrument must incorporate a pull up resistor (typically greater than 10K ohms in most instruments) which ties the open collector to the available DC voltage level when the Hall sensor is not energized. When energized the open collector output is pulled to ground through the emitter (-0V).

Power supply: max. 5...24 V_{DC}, max. 20 mA

These pulses are suited to small volume batching applications requiring high levels of repeatability. The square wave pulses are unevenly spaced due to the cyclic motion of the piston, but like the reed switch each pulse is representative of an equal volume.

Max. Pressure (threaded meters)/output pulse resolution/approx. shipping weights (threaded meters)

Size \ Model	Maximum pressure (bar)			Measuring range (pulses/litre)				Weight (kg)	
	DRT-A	DRT-S	DRT-H	(L/min)	Reed Switch	Hall Effect	Quadrature Hall Effect	DRT-S/H	DRT-A
DRT-xx4*	30	100	350	0.2 ... 10	200	400	200	2.3/3.2	1.1
DRT-xx6	60	60	150	2 ... 50	20	100	20	3.1/4.8	1.6
DRT-xx8	30	60	150	4 ... 140	7.3	44	7.3	6.5/8.0	3.3
DRT-xx9	20	30	-	12 ... 330	2.5	20	2.5	10/12.2	4.6

with flanges, max. pressure rating as above or as per flange pressure rating, whichever is lower
*at a time, only one of the three sub ranges 0.2 ... 1.7 LPM, 1.7 ... 7 LPM, 5 ... 10 LPM may be used (diff. K-factors for each range)

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 (simple apparatus) 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 per minute. In general the reed switch life will exceed 2 billion actuations when switching less than 5V_{DC} at10mA.

Power supply: max. 30 V_{DC}, 200 mA.

Quadrature Hall Effect Pulse Output (Q2)

Two Hall Effect sensors arranged to give separate outputs out of phase with one another. The quadrature output is typically suited to ensure output signal integrity or to measure bi-directional flow.

Power supply: max. 8-24 V_{DC}, max. 20 mA.

Viscosity Effects on DRT Pulse Output (K-factor)

Each DRT flowmeter is calibrated at the factory using Diesel as the test media. When metering higher viscosity liquids the meter K-factor will be a more positive number than that of Diesel at 2.55 cSt viscosity. To calculate the approximate relative K-factor for other liquid viscosities apply the approximate K-factor multiplier from the graph below as per the following example:

K-factor when used with liquid 1cp = 101.255

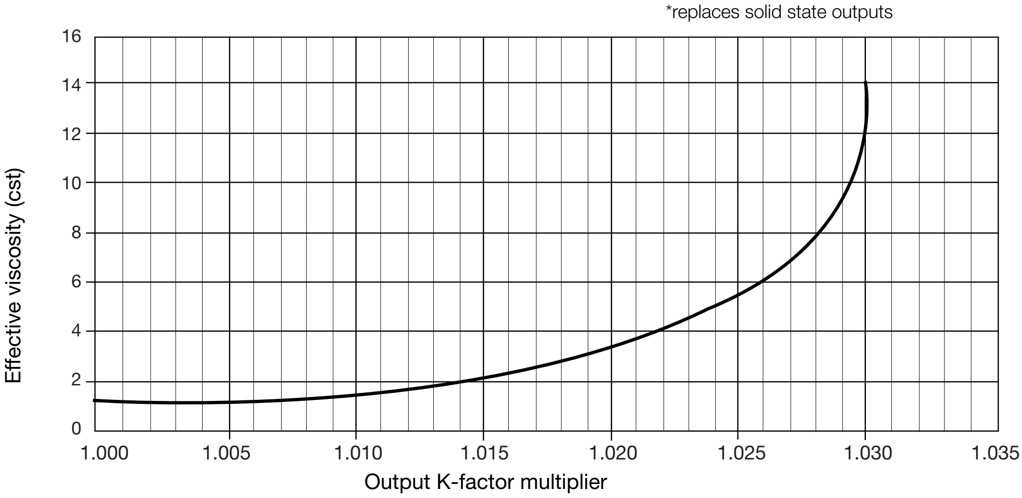
K-factor when used with liquid 12 cSt = 104 .293 (101.255 x 1.030).

This is a generic Output "K" factor multiplier chart as based on water at 1 cSt, for reference only. Always use the Calibration Certificate "K" factor as the default setting unless otherwise specified. The factory "K" factor is suitable for most applications without any need for correction.

Electronic with LCD display

Model	--Z1	..Z3	..Z5	..B1
Function	dual totalizer	rate totalizer	rate totalizer	batch controller
Power source				
battery-powered	yes	yes	yes	no
external (drives output, backlighting)	8 - 24 V_{DC}	8 - 24 V_{DC}	8 - 24 V_{DC}	12 - 24 V_{DC}
LCD display				
-line 1 / no. of digits	7.5 mm/5	9 mm/8	17 mm/6	9 mm/8
-line 2 / no. of digits	3.6 mm/8	–	7 mm/8	–
selectable units	yes	yes	yes	yes
decimal point	yes	yes	yes	yes
subscripts displayed	yes	yes	yes	yes
accumulative total	yes	yes	yes	yes
resettable total	yes	yes	yes	no
linearisation	no	yes	no	no
rate display	no	yes	yes	no
backlighting	no	no	yes	no
Input type				
un-powered sensors	see ZOD datasheet			
powered sensors	see ZOD datasheet			
Outputs				
4-20 mA (750 Ω)	no	yes	no	no
high/low flow alarm	no	NPN/PNP	NPN	no
batch end & control	no	no	no	NPN/PNP
pulse outputs	NPN/PNP	NPN/PNP	NPN	NPN/PNP
2 x SPDT relays	no	optional*	no	optional*
Installation				
IP 66/67	yes	yes	yes	yes
cable entries	1 x gland (meter mount) 2 x glands (remote)	3 x M 20	3 x M 16	3 x M 20
intrinsic safe (option)	no	yes	no	no
mounting	meter mount, wall, pipe or panel mounting			
temperature range	-20 ... +80 °C (Option: -20 ... +120 °C)			

*replaces solid state outputs



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

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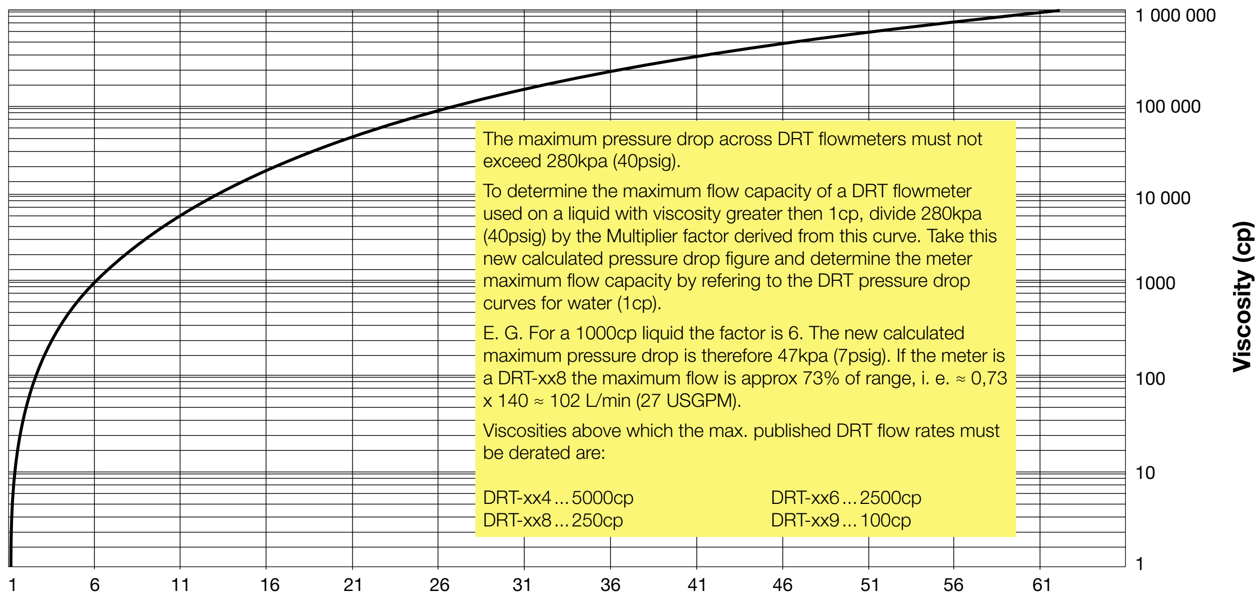
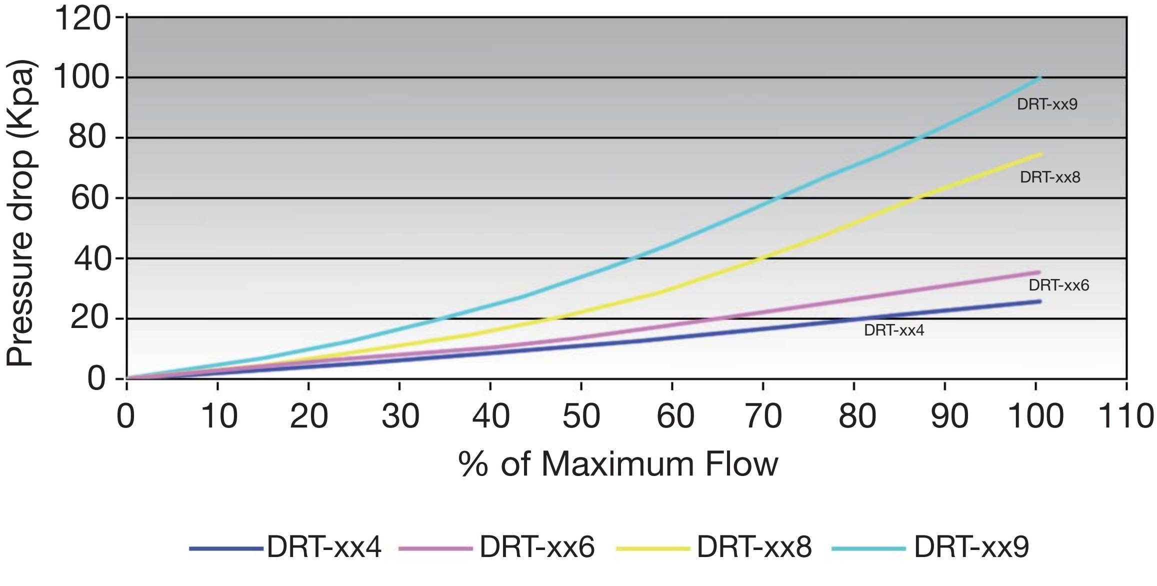
Viscosity Multiplier Factor Curve for DRT Flowmeter Maximum Flow Capacity



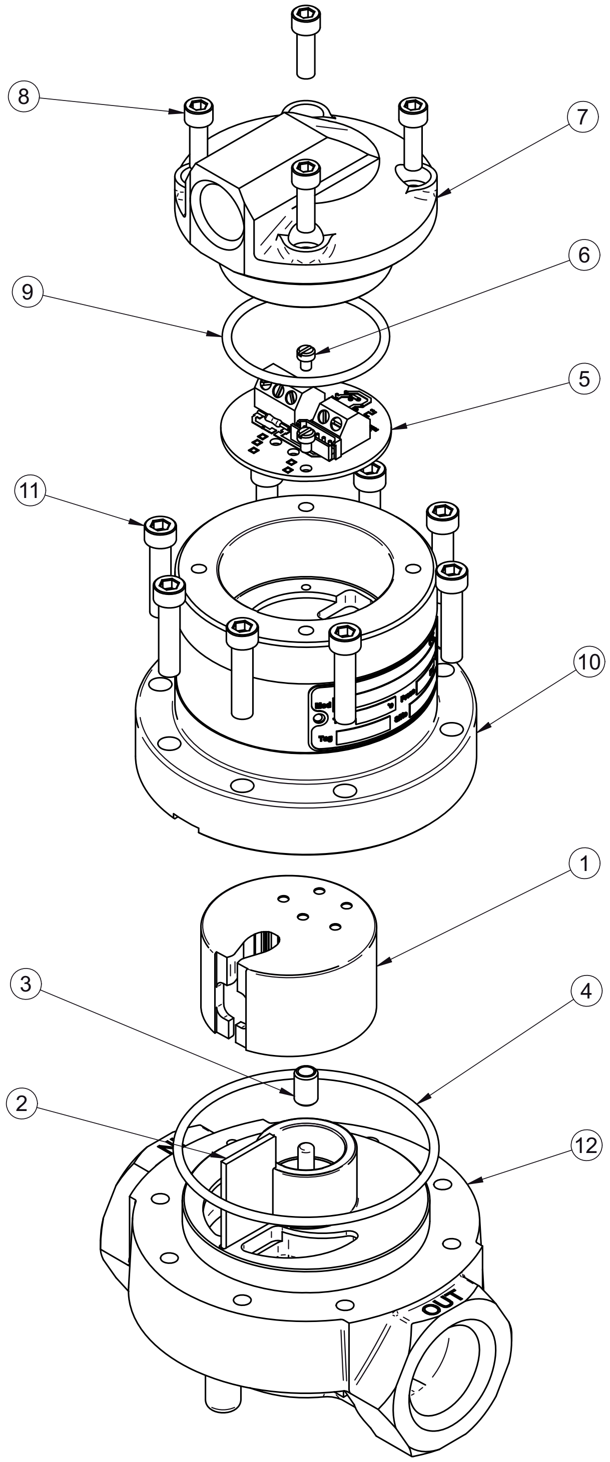
Multiplier factor (ref. DRT pressure drop curve for water)

To determine the pressure loss of a liquid with a viscosity greater than 1cP, use the above graph to derive the multiplier factor to apply to the DRT pressure drop curves for water at 1cP.

Pressure drop at 1 cP



Spare parts of a meter with pulse output:



Spare parts:

1. Piston
2. Partition
3. Manifold bearing
4. Manifold O-ring
5. Pulse output board
6. Output board screw
7. Terminal cover
8. Terminal cover screw
9. Terminal cover O-ring
10. Body
11. Body screw
12. Manifold (refer factory for flanged or other non-threaded manifolds)

Order Details Thread Connection (Example: **DRT-S G9 2 S F 3 M N1**)

Range [L/min]	Model/ Housing Material	Connection	Piston Material	Partition Material	O-Ring Material	Temperature Limits	Cable Entry	Electronics
0.2 ... 10	**DRT-A** = aluminium **DRT-S** = st. steel **DRT-H**[1] = st. steel, high pressure	**G4** = G ½ **N4** = ½" NPT	**2** = PEEK **3** = CFT - Carbon Filled PTFE (stdd.)	**S** = st. steel (standard) **C** = Ceramic (for abrasive or low lubricity fluids)	**F** = FPM (standard) **N** = NBR (max. 100 °C) **P** = PTFE encapsulated FPM **N** = EPR	**1** = -20 ... +60 °C **2**[2] = +60 ... +120 °C (for electronics N1, Q2) +60 ... +80 °C (for electronics Z1...Z5, B1) **3**[2] = +120 ... +150 °C (only possible with piston material PEEK and NPN pulse output) **5**[2)3)] = +80 ... +120 °C (for electronics Z1...Z5, B1)	**M** = M20x1.5 **N** = ½" NPT	**R0**[4] = Reed switch pulse output **N1** = Hall sensor (NPN)/ reed switch pulse output **NE** = Hall sensor (NPN)/ reed switch pulse output + ATEX (Exd) **Q2** = Quad Hall sensor 2 phased outputs (NPN) **QE** = Quad Hall sensor 2 phased outputs (NPN) + ATEX (Exd) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX (Exi) **Z5** = dual LCD totaliser/ rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1)
2 ... 50		**G6** = G 1 **N6** = 1" NPT						
4 ... 140		**G8** = G 1 ½ N8 = 1 ½" NPT						
12 ... 330		**G9** = G 2 **N9** = 2" NPT						

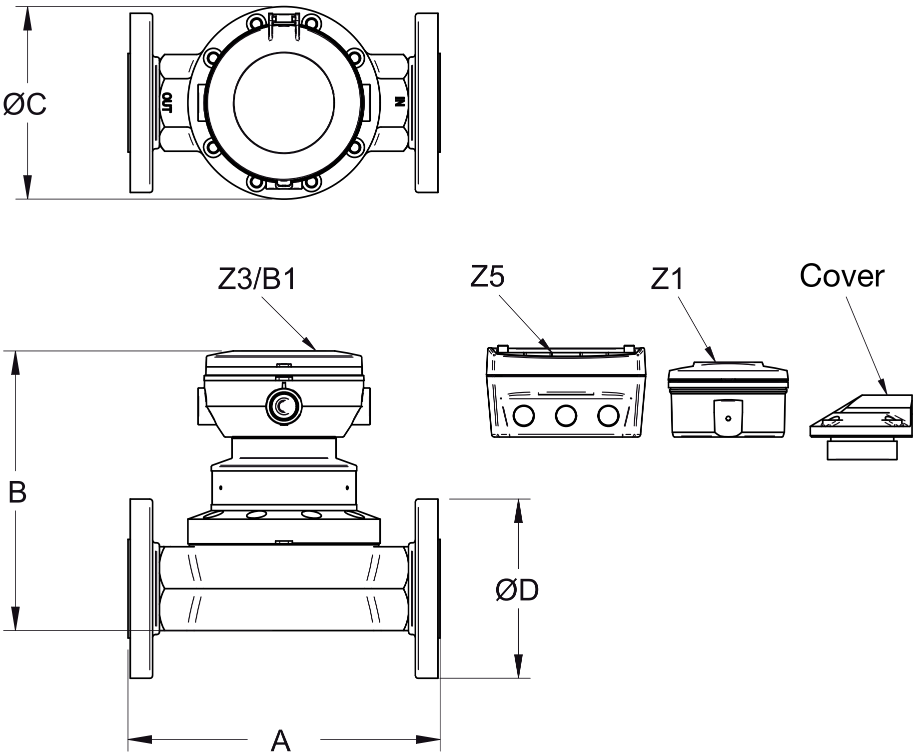
[1] not for DRT-Hx9...; [2)3)] max. temperature limited to +100 °C when choosing NBR as O-ring material ; [3] cooling fin fitted to integral instruments
[4] should be chosen when using DRT in instrinsically safe circuits as "simple apparatus".

Order Details Flange Connection (Example: **DRT-A F6 3S F 2 M Z 1**)

Range [L/min]	Model/ Housing Material	Connection	Piston Material	Partition Material	O-Ring Material	Temperature Limits	Cable Entry	Electronics
0.2 ... 10	**DRT-A** = aluminium **DRT-S** = st. steel	**F4** = DN 15/PN16 **A4** = ½" ANSI - 150RF **B4** = ½" ANSI - 300RF	**2** = PEEK **3** = CFT - Carbon Filled PTFE (stdd.)	**S** = st. steel (stdd.) **C** = Ceramic (for abrasive or low lubricity fluids)	**F** = FPM (standard) **N** = NBR (max. 100 °C) **P** = PTFE encapsulated FPM **N** = EPR	**1** = -20 ... +60 °C **2**[1] = +60 ... +120 °C (for electronics N1, Q2) +60 ... +80 °C (for electronics Z1...Z5, B1) **3**[1] = +120 ... +150 °C (only possible with piston material PEEK and NPN pulse output) **5**[1)2)] = +80 ... +120 °C (for electronics Z1...Z5, B1)	**M** = M20x1.5 **N** = ½" NPT	**R0**[3] = Reed switch pulse output **N1** = Hall sensor (NPN)/ reed switch pulse output **NE** = Hall sensor (NPN)/ reed switch pulse ouput + ATEX (Exd) **Q2** = Quad Hall sensor 2 phased outputs (NPN) **QE** = Quad Hall sensor 2 phased outputs (NPN + ATEX (Exd) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX (Exi) **Z5** = dual LCD-totaliser/ rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1)
2 ... 50		**F6** = DN 25/PN16 **A6** = 1" ANSI - 150RF **B6** = 1" ANSI - 300RF						
4 ... 140		**F8** = DN 40/PN16 **A8** = 1 ½" ANSI - 150RF **B8** = 1 ½" ANSI - 300RF						
12 ... 330		**F9** = DN 50/PN16 **A9** = 2" ANSI - 150RF **B9** = 2" ANSI - 300RF						

[1)2)] max. temperature limited to +100 °C when choosing NBR as O-ring material; [2] cooling fin fitted to integral instruments; [3] should be chosen when using DRT in instrinsically safe circuits as "simple apparatus".

Dimensions



Model	A [mm]					D [mm]					C [mm]	B [mm]			
	Flange			Thread		Flange			Thread			Integral Electronics			
	DIN PN16	ANSI 150	ANSI 300	G	NPT	DIN PN16	ANSI 150	ANSI 300	G	NPT		Cover	Z1	Z3/B1	Z5
DRT-xx4	140	132	145	100	100	95	89	95	-	-	75	111	134	143	147
DRT-xx6	165	152	170	117	117	115	108	124	-	-	98	147	170	179	183
DRT-xx8	235	224	239	175	175	150	127	156	-	-	140	169	192	201	205
DRT-xx9	258	253	268	202	202	165	152	165	-	-	166	204	225	234	238