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

# Turbine Wheel Flowmeter / Monitor

for low viscous liquids

measuring • monitoring • analysing

## DOT

- Measuring range:
  0.11 - 1.1 $m^3/h$ … 270 - 2 700 $m^3/h$ water (higher on request)
- Viscosity range: low viscous
- Linearity: ±0.5 % of reading
- $p_{max}$: 250 bar; $t_{max}$: 120 °C
- Connection:
  G ½ … G 2 male, ½" NPT … 2" NPT male, DIN flanges DN 15 … DN 300 (larger on request), ANSI flanges ½"... 12" (larger on request)
- Material: stainless steel, carbon steel
- Output:
  pulse output, LC display, 4…20 mA, batching, totalising

S4

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1/08 - 2017

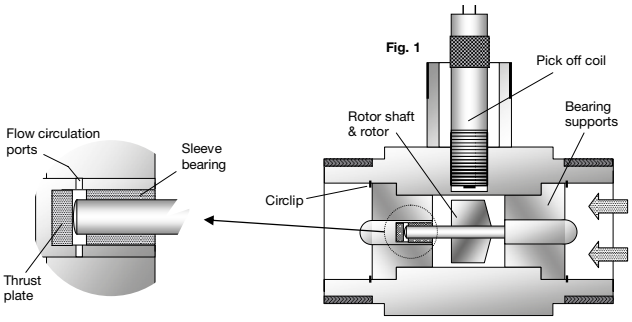
## Description

The turbine flowmeter model DOT consists of a helically shaped turbine rotor supported in two tungsten carbide bearings, the rotor being solid ferritic stainless steel of a grade compatible with the metered liquid, all contained within a housing of non-magnetic stainless steel.

A pick off coil having a permanent magnet core is mounted in the housing adjacent to the rotor blade tips such that a magnetic circuit is set up via the rotor blades (Fig.1).

Rotation of the rotor varies the reluctance of this magnetic circuit and the flux changes induce a small voltage in the coil, the frequency of which is directly proportional to the rotor speed and therefore proportional to the volumetric flow rate.

The effects of increasing viscosity reduce the linear flow range and shifts the k-factor. Further, the effect of viscosity depends on the frequency (RPM of rotors). Therefore, smaller the meter, higher is the effect of viscosity on the linearity curve.




## Design

The DOT is a highly accurate, reliable and robust turbine meter used to measure the flow of clean low viscosity liquids.

Stainless steel construction with tungsten carbide bearings provides long life with a wide range of aggressive and non-lubricating liquids in petrochemical and general industrial applications.

The basic meter is available with a pre-amplified square wave output.These meters have MS (military style) plug/socket for the pulse output connection.

Alternatively the meter is supplied fitted with integral instruments. These may include e.g. dual totaliser, rate counter Z3/ZE/ZB or dosing unit.

The electronics are identical to the series ZOK and ZOE. ATEX certification is not available. For further information please see the operation manual of ZOK and ZOE.

## Applications

- Chemical and allied products
- Pharmaceuticals
- Deionised water
- Fuel additives
- Petrochemicals
- Plastics and hydraulics
- Water conditioning
- Other low viscous fluids

## Technical Details

| | |
|---|---|
| Sizes: | 15 mm ... 300 mm (½" ... 12" ANSI, DN 15 ... DN 300), bigger on request (see model no. designation for information on available sizes) |
| Linearity at 1cP: | ± 0.5 % of reading, (± 0.2% when utilising the linearisation feature of electronic type Z3) |
| Repeatability: | ± 0.02 ... 0.05 % under steady flow conditions |
| Max. pressure: | threaded connections: 250 bar<br>flange connections: corresponding to flange specifications |
| Medium temperature: | -20 ... +120 °C<br>(ambient temperature max. +80 °C) |
| Pressure drop: | approximately 0.28 bar at maximum flow (SG = 1.0, Vis. = 1 mm²/s) |
| Supply voltage: | see electronics |
| Electronic features: | see comparison table |
| Flanges: | according to DIN 2501 or ASME B16.5 (optional) |

## Materials

| | |
|---|---|
| Housing: | stainless steel 1.4401 (316 SS) |
| Flanges: | stainless steel 1.4401 (316 SS) or carbon steel A106 |
| Rotor: | SS 430 (up to DOT-xx15),<br>SS ANC 21 (Duplex stainless steel, for bigger sizes) |
| Bearing support: | stainless steel 1.4401 (316 SS) |
| Bearings: | tungsten carbide (shaft, bush, thrust plate) |



1/08 - 2017

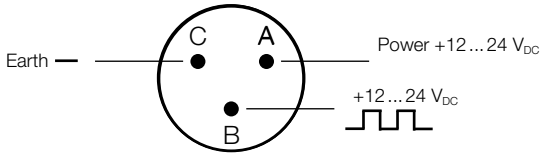
### Output

| | |
|---|---|
| Preamplifier: | Inductive sensor in option »F4S« is a turbine wheel sensor with integrated preamplifier. Specially designed for turbine flowmeters, the sensor provides amplified output on 3 wire. |
| Transmission distance: | max. 500 m |
| Housing: | stainless steel |
| Connector: | MS acc. to MIL-DTL-5015 including mating plug with 3 x soldering pins |
| Power supply: | 12 - 24 $V_{DC}$ |
| Pulse output: | NPN, max. 25 mA |
| Others: | see relevant electronics datasheets ZOK/ZOE |
| Protection: | IP 55 (with option »F4S«)<br>IP 66/67 (with integrated electronic ZOK/ZOE) |

### Recommended filters

| | |
|---|---|
| Sizes up to DN 50: | 0.3 mm (300 microns or 60 mesh) |
| Sizes from DN 80: | 0.5 mm (500 microns or 100 mesh) |

### Wire diagram




### Electronic with LCD Display

| Model | ..Z1 | ..Z2 | ..Z3 | ..ZE | ..ZB |
|---|---|---|---|---|---|
| Function | dual totaliser | dosing unit | rate / counter | | |
| **Power supply** | | | | | |
| Battery-powered (outputs inactive) | yes | no | yes | | |
| External (also for backlighting) | 5 - 28 $V_{DC}$ | 12 - 28 $V_{DC}$ | 5 - 28 $V_{DC}$ | 9 - 28 $V_{DC}$ | - |
| **LCD display** | | | | | |
| Selectable units | yes | yes | yes | yes | yes |
| Decimal point | yes | yes | yes | yes | yes |
| Accumulative total | yes | yes | yes | yes | yes |
| Resettable total | yes | yes | yes | yes | yes |
| Linearisation | yes | no | yes | yes | yes |
| Rate display | yes | yes | yes | yes | yes |
| Backlighting | yes | yes | yes | yes | no |
| **Outputs** | | | | | |
| 4-20 mA | no | no | yes | no | no |
| Flow rate alarm min./max. | no | no | NPN/PNP/PP | no | no |
| Batch end & control | no | yes | no | no | no |
| Pulse outputs | no | no | PP | PP | no |
| 2 x SPDT relays[1)] | no | yes | option | no | no |

[1)] Replaces solid state outputs, for details see data sheet ZOK

**Order Details threaded version** (Example: **DOT-13 15H G5 Z3M B**)

| Housing/ connection material | Range | Mechanical connection* | Electronics/ cable entry/plug | Flow direction |
|---|---|---|---|---|
| **DOT-13** = (st. steel/ st. steel) | **05H** = 0.11 - 1.1 m³/h | **G4** = ½" male | **F4S** = only pulse output preamplified/ MS (military style) connector for max. 120 °C<br>**Z1M** = electronic ZOK-Z1/M20 x 1.5<br>**Z2M** = electronic ZOK-Z2/M20 x 1.5<br>**Z3M** = electronic ZOK-Z3/M20 x 1.5<br>**ZEM** = electronic ZOE with external supply/with battery/ M20 x 1.5<br>**ZBM** = electronic ZOE without external supply/M20 x 1.5<br>**Z1N** = electronic ZOK-Z1/½" NPT<br>**Z2N** = electronic ZOK-Z2/½" NPT<br>**Z3N** = electronic ZOK-Z3/½" NPT<br>**ZEN** = electronic ZOE with external supply/½" NPT<br>**ZBN** = electronic ZOE without external supply/with battery/½" NPT | **0** = all directions (only pulse output)<br>**B** = from bottom to top, indication right<br>**M** = from bottom to top, indication left<br>**L** = from left to right, indication on top<br>**R** = from right to left, indication on top |
| | **10H** = 0.22 - 2.2 m³/h<br>**15H** = 0.4 - 4.0 m³/h<br>**20H** = 0.8 - 8 m³/h | **G5** = ¾" male | | |
| | **25H** = 1.6 - 16 m³/h | **G6** = 1" male | | |
| | **30H** = 3.4 - 34 m³/h | **G8** = 1 ½" male | | |
| | **35H** = 6.8 - 68 m³/h | **G9** = 2" male | | |
| | **XXH** = special option | **XX** = special option | **XX** = special option | |

* Replace DOT-xxxxGx… into DOT-xxxxNx… for NPT connection

**Order Details flanged version** (Example: **DOT-13 50H FE Z3M B**)

| Housing/ connection material | Range | Mechanical connection* | Electronics/ cable entry/plug | Flow direction |
|---|---|---|---|---|
| **DOT-12** = (st. steel/ carbon steel)<br>**DOT-13** = (st. steel/ st. steel) | **05H** = 0.11-1.1 m³/h | **F4** = DN 15, PN 16 | **F4S** = only pulse output preamplified/MS (military style) connector for max. 120 °C<br>**Z1M** = electronic ZOK-Z1/M20 x 1.5<br>**Z2M** = electronic ZOK-Z2/M20 x 1.5<br>**Z3M** = electronic ZOK-Z1/M20 x 1.5<br>**ZEM** = electronic ZOE with external supply/M20 x 1.5<br>**ZBM** = electronic ZOE without external supply/with battery/ M20 x 1.5<br>**Z1N** = electronic ZOK-Z1/½" NPT<br>**Z2N** = electronic ZOK-Z2/½" NPT<br>**Z3N** = electronic ZOK-Z3/½" NPT<br>**ZEN** = electronic ZOE with external supply/½" NPT<br>**ZBN** = electronic ZOE without external supply/with battery/½" NPT | **0** = all directions (only pulse output)<br>**B** = from bottom to top, indication right<br>**M** = from bottom to top, indication left<br>**L** = from left to right, indication on top<br>**R** = from right to left, indication on top |
| | **10H** = 0.22 - 2.2 m³/h<br>**15H** = 0.4 - 4.0 m³/h<br>**20H** = 0.8 - 8 m³/h | **F5** = DN 20, PN 16 | | |
| | **25H** = 1.6 - 16 m³/h | **F6** = DN 25, PN 16 | | |
| | **30H** = 3.4 - 34 m³/h | **F8** = DN 40, PN 16 | | |
| | **35H** = 6.8 - 68 m³/h | **F9** = DN 50, PN 16 | | |
| | **40H** = 13.5 - 135 m³/h | **FB** = DN 80, PN 16 | | |
| | **45H** = 27 - 270 m³/h | **FC** = DN 100, PN 16 | | |
| | **50H** = 55 - 550 m³/h | **FE** = DN 150, PN 16 | | |
| | **XXH** = special option | **XX** = special option | **XX** = special option | |

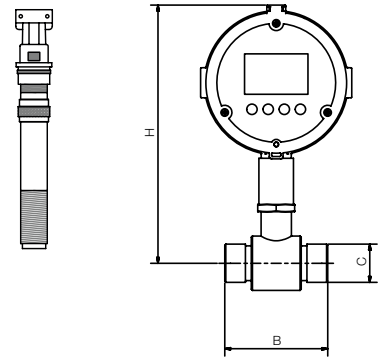
* Change DOT-xxxxFx… into DOT-xxxxHx… for PN25
Change DOT-xxxxFx… into DOT-xxxxAx… for ANSI 150 RF connection or into DOT-xxxxBx… for ANSI 300 RF



1/08 - 2017

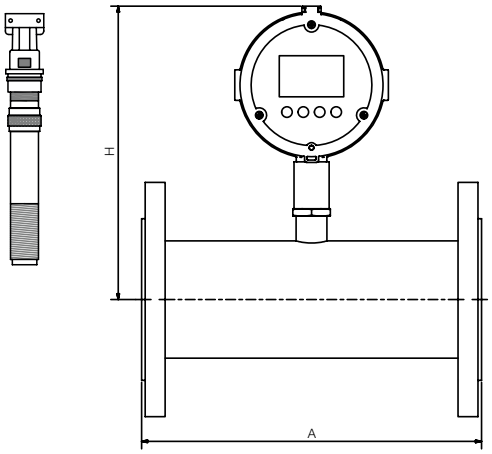
## **Dimensions** [±2 mm]

### Threaded



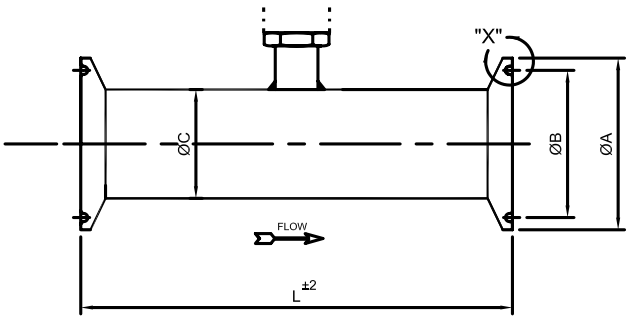

| Flow [m³/h] | C (Thread) | B | H (with pulse output) | H (with ZOK/ZOE electronics) |
|---|---|---|---|---|
| 0.11-1.1 | ½" | 64 | 150 | 222 |
| 0.22-2.2 | ¾" | 65 | 152 | 222 |
| 0.4-4 | ¾" | 65 | 152 | 222 |
| 0.8-8 | ¾" | 83 | 154 | 223 |
| 1.6-16 | 1" | 89 | 158 | 226 |
| 3.4-34 | 1½" | 114 | 164 | 233 |
| 6.8-68 | 2" | 133 | 169 | 237 |

### Flanged




| Flow [m³/h] | A | H (with pulse output) | H (with ZOK/ZOE electronics) |
|---|---|---|---|
| 0.11-1.1 | 127 | 150 | 219 |
| 0.22-2.2 | 127 | 152 | 219 |
| 0.4-4 | 127 | 152 | 219 |
| 0.8-8 | 140 | 154 | 222 |
| 1.6-16 | 152 | 158 | 228 |
| 3.4-34 | 178 | 164 | 231 |
| 6.8-68 | 197 | 169 | 237 |
| 13.5-135 | 254 | 178 | 249 |
| 27-270 | 356 | 197 | 268 |
| 55-550 | 368 | 222 | 298 |

### Clamp ferrule (Tri-Clamp®) (according to DIN 32676)




| Model | ±0.1 ØA | ±0.1 ØB | ±0.025 ØC | ±0.1 F | ±2 L |
|---|---|---|---|---|---|
| **DOT-1305** | 50.5 | 43.5 | 31.7 | 2.85 | 127 |
| **DOT-1310** | 50.5 | 43.5 | 31.7 | 2.85 | 127 |
| **DOT-1315** | 50.5 | 43.5 | 31.7 | 2.85 | 127 |
| **DOT-1320** | 50.5 | 43.5 | 35.0 | 2.85 | 140 |
| **DOT-1325** | 50.5 | 43.5 | 38.1 | 2.85 | 152 |
| **DOT-1330** | 50.5 | 43.5 | 57.2 | 2.85 | 178 |
| **DOT-1335** | 64.0 | 56.3 | 69.5 | 2.85 | 197 |

### Detail »X«