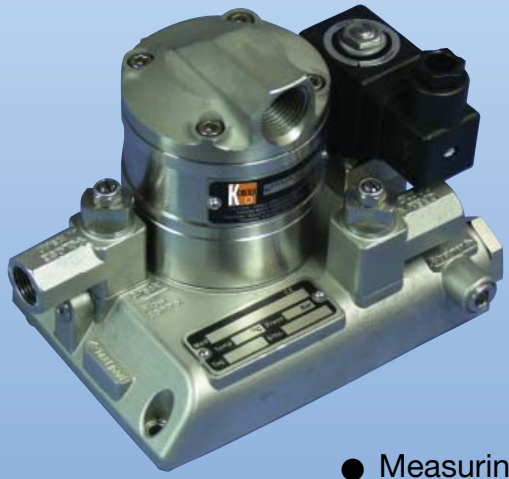
Zertifiziertes QM-System
DIN EN ISO 9001
Zertifikat-Nr. 01017

# Oval Gear Manifold Block

for Additive Injection

measuring • monitoring • analysing

## DOP



- Measuring range:
  0.01 ... 0.6 L/min ... 0.25 ... 9.16 L/min
- Viscosity range:
  low to medium viscous fluids
- Accuracy: ±0.5 % of reading (at 3 cP)
- $p_{max}$: 20 bar; $t_{max}$: 100 °C
- Connection:
  ⅜" NPT elbows, 3 x 90° orientation positions
- Material: Stainless steel, FPM, PTFE, NBR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## Overview

The DOP block is a compact all stainless steel manifold assembly complete with isolating, flow regulating & check valves, a fine mesh strainer, solenoid valve & a precision oval gear flowmeter. Inlet & outlet elbows can be arranged in three orientations providing installation flexibility. All assemblies shown are modular to the manifold & may be quickly changed in-situ.

## Principle of operation

The DOP flowmeter is a manifold mounted, stainless steel Oval Gear Positive Displacement Flowmeter with inlet & outlet ports in meter base with fluid flow through injection block manifold. Meters have stainless steel body, rotors and Carbon Ceramic bearings, with O-Ring choice according to customer specifications.

## Applications

DOP accurately injects small amounts of modifying additives & performance enhancing agents into fuels & base product. Additives include lead replacements, dyes and markers, lubricants, colourings, denaturants, detergents, odorizing, anti-freeze, anti-corrosion, anti-static, anti-detonating, anti-icing, anti-foaming, emulsifiers and performance enhancing agents.

## Technical details

### Materials

| | |
|---|---|
| Meter/valves/strainer: | stainless steel 1.4401 (SS316) |
| O-ring: | FPM (standard)<br>EPR (Ethylene Propylene Rubber) for ketones only<br>PTFE/ FFKM (for aggressive chemicals)<br>NBR |
| Cover: | glass reinforced nylon,<br>stainless steel (ATEX option Exd) |

### Wetted Parts

| | |
|---|---|
| Manifold block: | stainless steel 1.4305 (SS303) |
| Inlet and Outlet flow valves, strainer and hex plugs: | stainless steel 1.4401 (SS316) |
| Solenoid valve base: | stainless steel 1.4401 (SS316) |
| O-ring (see ordering table): | FPM (standard)<br>EPR (Ethylene Propylene Rubber) for Ketones only<br>PTFE/FFKM (for aggressive chemicals)<br>NBR |
| Solenoid valve seat: | FFKM (Kalrez) |
| Flowmeter body/ gear wheels/shafts: | stainless steel 1.4401 (SS316) |
| Bearing: | ceramic |
| Flow range: | 0.01 ... 0.6 L/min ... 0.25 ... 9.16 L/min |
| Connection: | ⅜" NPT elbows,<br>3 x 90° orientation positions |
| Accuracy: | ± 0.5% of reading (at 3 cP) |
| Repeatability: | typically ± 0.25% |
| Viscosity range: | low to medium viscosity fluids<br>(It will vary according to fluid type, flow rate and orifice size) |
| Solenoid valve: | Direct acting |
| Solenoid coil: | 8 W (110 $V_{AC}$/ 220 - 230 $V_{AC}$) or 9 W (24 $V_{DC}$) coil (see ordering information for supply voltage) |
| Operating temperature: | -20 ... +100 °C (standard),<br>-20 ... +65 °C (Exd approval model) |
| Protection class: | IP 65 (standard),<br>IP 67 (Exd approval model) |
| Mounting position: | Base vertical |
| Flow direction: | in arrow direction. Inlet Port is marked on DOP block manifold, and Outlet Port has Flow arrow marked on manifold. |

ATEX- approval (option 'E')

| | |
|---|---|
| Flowmeter: | ⟨Ex⟩ II 2 G Exd II B T6/T4 |
| Solenoid coil: | ⟨Ex⟩ II 2 GD Exd mb IIC T4 |



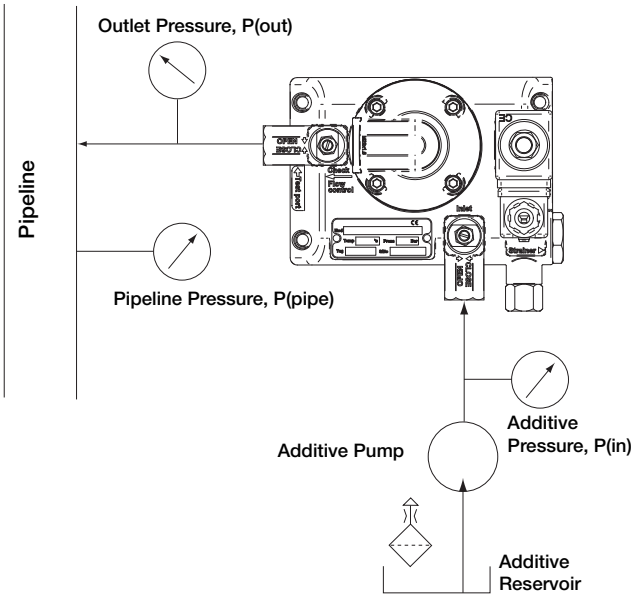


1/08-2011

## Max. Pressure
## DOP Block Pressure ratings

| Orifice Size | Coil Type | Max. Static Pressure* | Max. Operating Pressure** | Max. Differential Pressure*** |
|---|---|---|---|---|
| 3 mm | AC | 30 bar | 20 bar | 7 bar |
| 3 mm | DC | 30 bar | 7 bar | 7 bar |
| 5 mm | AC | 30 bar | 20 bar | 8.5 bar |
| 5 mm | DC | 30 bar | 7 bar | 3.5 bar |

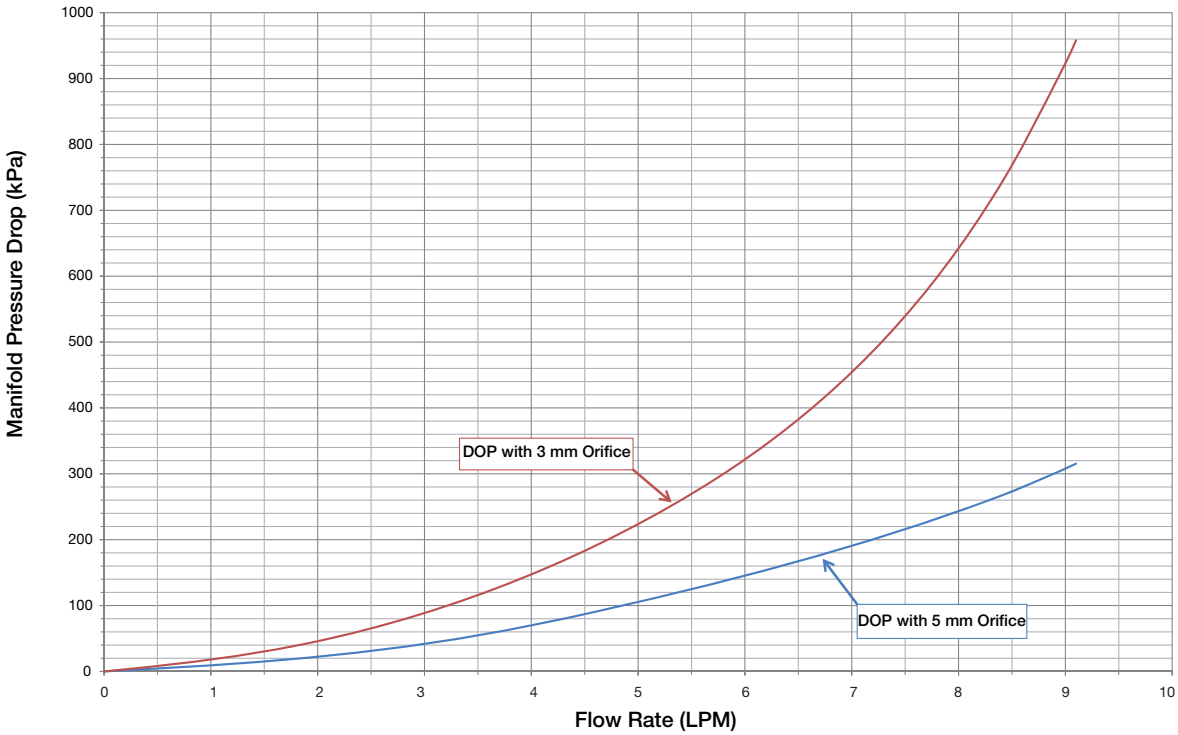
* Maximum additive pressure (absolute) to avoid component failure
** Maximum additive pressure (absolute) for solenoid valve operation
*** Maximum difference between additive pressure and pipeline pressure




### Notes for Pressure Calculations:

1) When Solenoid Valve is Closed: *P(out) = P(pipe)*
2) When Solenoid Valve is Open: *P(out) = P(in) - P(drop)*
   *P(drop) is the 'Manifold Pressure Drop' (see pressure drop chart). 'Manifold Pressure Drop' is dependent on flow rate, orifice size, and fluid viscosity.
3) When Calculating Maximum Differential Pressure: *ΔP = P(in) - P(pipe)*

**Pressure Drop versus Flow rate at 3cP** (DOP pressure drop curves based on diesel calibration fluid)



## Pulse Output

### Hall Effect sensor pulse output

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 5~24 $V_{DC}$ supplied from an external source, typically the receiving instrument.

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

The receiving instrument must incorporate a pull up resistor (typically greater than 10 kΩ 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 (-0 V).

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

### Quadrature Hall Effect pulse output

Two Hall Effect sensors arranged to give separate outputs out of phase with one another.

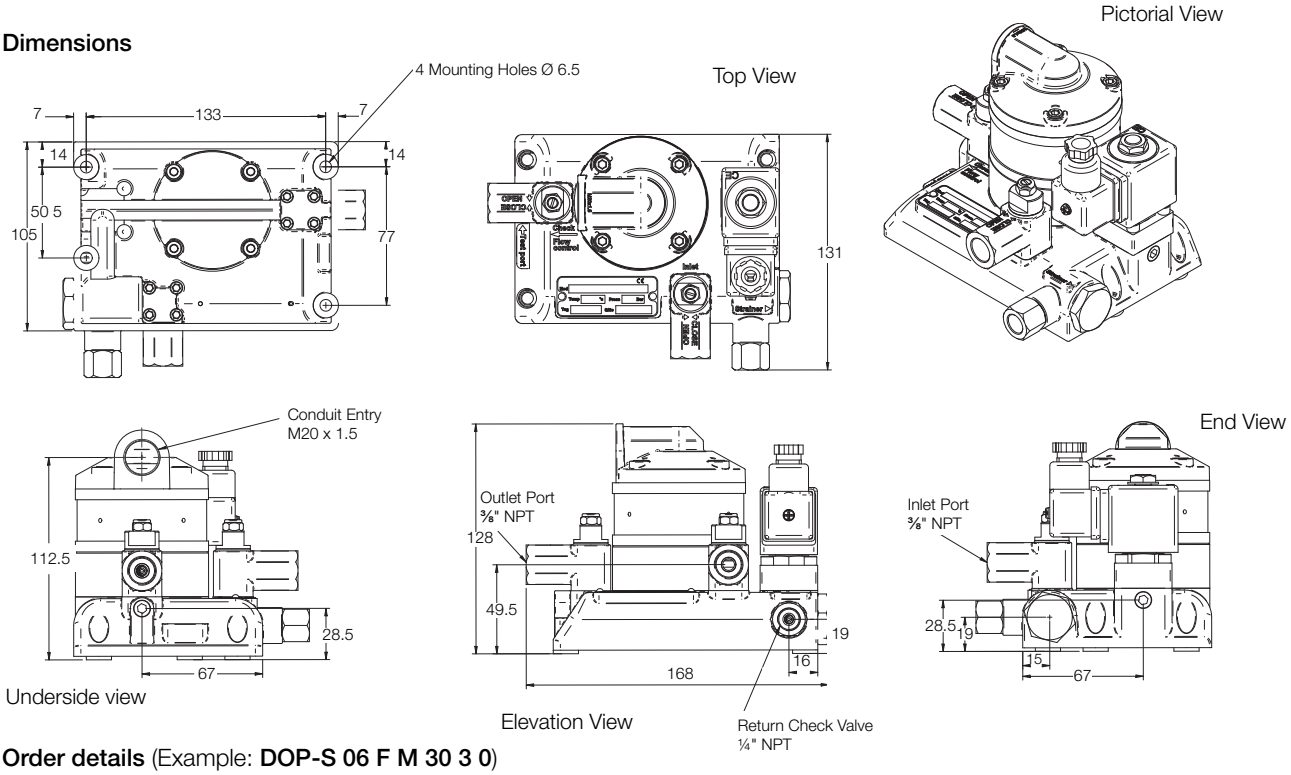
The quadrature output is typically suited to custody transfer applications where signal integrity verification is required.

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

### Output pulse resolution

| Measuring range [L/min] | Pulses/litre Hall Effect |
|---|---|
| **05** = 0.01 ... 0.6 | 2800 |
| **06** = 0.01 ... 0.6 | 11200 |
| **10** = 0.03 ... 1.66 | 1050 |
| **11** = 0.03 ... 1.66 | 4200 |
| **20** = 0.25 ... 9.16 | 355 |

### Dimensions




### Order details (Example: **DOP-S 06 F M 30 3 0**)

| Model | Measuring range [L/min] | Seal | Certification | Cable entry [meter] | Solenoid valve supply | Solenoid valve orifice | Integral options |
|---|---|---|---|---|---|---|---|
| **DOP-S...** | **05** = 0.01 ... 0.6 | **F** = FPM (standard) | **0** = without | **M** = M20x1.5 | **30** = 24 $V_{DC}$ | **3** = Ø 3 mm | **0** = freqency output NPN power supply: 5-24 $V_{DC}$ |
| | **06** = 0.01 ... 0.6 | **N** = NBR | **E** = ATEX (Exd) approval for flowmeter and solenoid valve | **N** = ½" NPT | **10** = 110 ... 115 $V_{AC}$ | **5** = Ø 5 mm | **Q** = 2 x NPN OC 90° phased output power supply: 8-24 $V_{DC}$ |
| | **10** = 0.03 ... 1.66 | **P** = PTFE/FFKM | | | **00** = 220 ... 230 $V_{AC}$ | | |
| | **11** = 0.03 ... 1.66 | **E** = EPR | | | | | |
| | **20** = 0.25 ... 9.16 | | | | | | |





1/08-2011