Instruction Manual

DOZ01

Oval gear flowmeter for low flows

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Operating manual for paddle wheels and oval wheels

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1 Preface

The flowmeters that work on the paddlewheel or oval wheel principle function reliably and are easy to use. Observe the following points to benefit fully from the advantages of this device:
All persons authorized to start up or operate these devices must have read and understood the operating instructions and especially the safety instructions!

2 Safety instructions

2.1 General remarks

Operate the flowmeter only as instructed in the operating manual to guarantee safe operation. Observe also the legal and safety regulations necessary for the specific application case during use. This also applies analogously when using accessories.

2.2 Intended use

Flowmeters that work on the paddlewheel or oval wheel principle act to monitor continuous flows of low-viscosity to viscous fluids (find the viscosity range of the employed flow meter in Section 8 → Technical Data). Employment beyond this is always considered to be contrary to the regulations. The specified K-factors apply to H_2O at 21°C unless stated otherwise. Especially application in which pulsed loading occurs (e.g. pulsed operation) must always be discussed and checked with our technical personnel. Flowmeters that work on the paddlewheel or oval wheel principle must not be used as the only means of preventing dangerous states in machines and plants. Machines and plants must be designed in such a manner that defects cannot lead to hazardous situations for operating personnel.

2.3 Qualified personnel

Flowmeters that work on the paddlewheel or oval wheel principle must be installed only by qualified personnel able to deploy the devices in a professional manner. Qualified personnel are persons acquainted with the assembly, erection, commissioning and operation of these devices and who possess qualifications appropriate to their job function.

2.4 Chemical resistance

Check the resistance of the specified materials against the chemicals you use (find the materials used in the flowmeter in Section 8 → Technical Data).

3 Function description

3.1 Function description of flowmeters working on the paddlewheel principle

The flow of the medium sets the paddlewheel in rotation.
Paddlewheel rotation in flowmeters working on the optic-electronic sensor system is detected by a forked-light barrier.
Flowmeters working with a Hall Effect or inductive detection system determine the rotation of the paddlewheel equipped with magnets from the change of the magnetic field by the Hall-effect sensor or the coil (see Section 8 → Technical Data for the function principle and sensor system of the employed flowmeter type).
The signals created by the rotation of the paddlewheel are transmitted in accordance with the selected output signal and employed electrical connection method (see Section 8 → Technical Data for output signal, functional principle and electrical connection for the employed flowmeter type).

3.2 Function description of flowmeters working on the oval wheel principle

The flow of the medium rotates an intermeshed, oval gearwheel pair, which is offset by 90°. The oval wheels that are equipped with magnets generate a continuously changing magnetic field, which is detected by a Hall sensor. The signals created by the rotation of the oval-wheel pair are transmitted in accordance with the selected output signal and employed electrical connection method (see Section 8 → Technical Data for output signal, functional principle and electrical connection for the employed flowmeter type).

4 Mounting

4.1 Process connection

Compliance with the following requirements is mandatory to avoid damage to the flowmeter and/or the plant:
- A process connector matched to the device must be provided on-site
- Check connector size
- Check screw engagement depth
- Use a suitable sealant (N.B. fluid sealant can damage the flowmeter if it enters the measurement chamber)
- Seal correctly

4.2 Ambient conditions

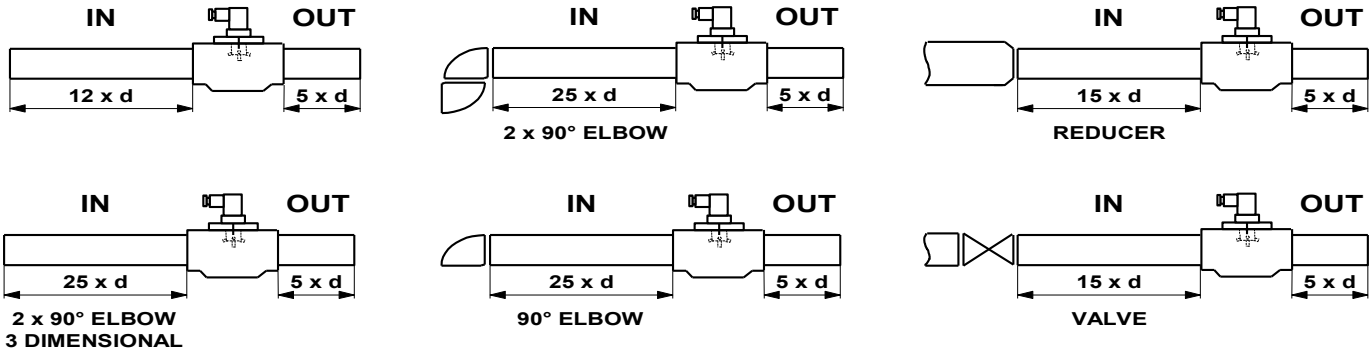
Compliance with the following requirements is mandatory to avoid damage to the flowmeter and/or the plant:
- Do not use the flowmeter as a load-bearing component in pipe structures.
- The medium must not contain solid particles. Magnetic particles gather on the magnets and impair the function.
- Check the compatibility of corrosion protection and anti-freeze agents before use.
- Durability of the specified materials with regard to the chemicals you use must be guaranteed.

4.3 Installation

Comply with the following requirements to avoid incorrect function of the flowmeter or falsification of the measurement results.
- External magnetic fields influence the flowmeter. Ensure sufficient distance from magnetic

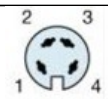
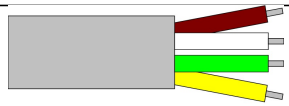
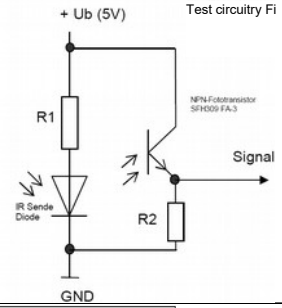
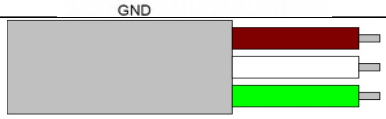
fields (e.g. electric motors).

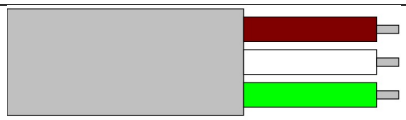
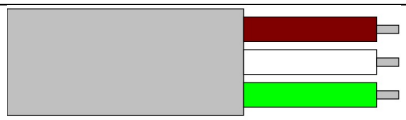
- Ferro-magnetic tubes, process connectors or supports influence the magnetic field of the flowmeter. Keep a minimum clearance of 100 mm from such materials (e.g. steel).
- Ensure ventilation of the device.
- Cross-section changes, branches or bends in the piping influence the measurement accuracy. Use the following stabilizing sections (extract from DIN 1952) (d = nominal internal pipe diameter)



4.4 Electrical connection and output signal

The scanning system, output signal and output type provided in your flowmeter can be found in Section 8 → Technical Data (items: scanning system, output signal and electrical connection).

<table>
<tr><th>Scan system</th><th>Output signal</th><th>Output type</th><th colspan="3">Electrical connection and typical circuit diagram</th></tr>
<tr><td rowspan="2">Inductive</td><td rowspan="2">Sinusoidal</td><td rowspan="2">Inductive</td><td colspan="2"> 
Flat plug (6.3 mm)
Pin1: Arbitrary Pin2: Arbitrary</td><td>connectorElectrical</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Opto-electronic</td><td rowspan="2">Sinusoidal</td><td rowspan="2">NPN-photo-transistor</td><td> 
Round plug (Type MAS4)
Pin1: IR-transistor emitter (receiver)
Pin2: IR-transistor collector (receiver)
Pin3: IR-diode Cathode (transmitter)
Pin4: IR-diode Anode (transmitter)</td><td> 
LiYY 4x0.25mm²
Brown: IR-transistor emitter (receiver)
White: IR-transistor collector (receiver)
Green: IR-diode Cathode (transmitter)
Yellow: IR-diode Anode (transmitter)</td><td>Electrical connector</td></tr>
<tr><td colspan="2">  </td><td>Circuit diagram</td></tr>
<tr><td rowspan="2">Opto-electronic</td><td rowspan="2">Rectangle</td><td rowspan="2">NPN</td><td colspan="2"> 
LiYY 3x0.14mm²
Brown: Ground (GND) White: +5,0…24.0V_{DC} (V_{in})
Green: Signal (OUT)</td><td>connectorElectrical</td></tr>
<tr><td colspan="2"></td><td>Circuit diagram</td></tr>
</table>

<table>
<tr><td rowspan="5">Hall-effect</td><td rowspan="5">Rectangle</td><td rowspan="5">NPN</td><td colspan="2"> 
Cube plug (EN 175301-803A)</td><td colspan="2"> 
LiYY 3x0.14mm²</td><td rowspan="2">Electrical connector</td></tr>
<tr><td>Pin1:</td><td>+4.5…24.0V_{DC} (V_{in})</td><td>Brown:</td><td>Ground (GND)</td></tr>
<tr><td>Pin2:</td><td>Signal (OUT)</td><td>White:</td><td>+4.5…24.0V_{DC} (V_{in})</td></tr>
<tr><td>Pin3:</td><td>Ground (GND)</td><td>Green:</td><td>Signal (OUT)</td></tr>
<tr><td colspan="4"></td><td>Circuit diagram</td></tr>
<tr><td rowspan="5">Hall-effect</td><td rowspan="5">Rectangle</td><td rowspan="5">Comple-mentary final stage (Push / pull)</td><td colspan="2"> 
Cube plug (EN 175301-803A)</td><td colspan="2"> 
LiYY 3x0.14mm²</td><td rowspan="2">Electrical connector</td></tr>
<tr><td>Pin1:</td><td>+4.5…24.0V_{DC} (V_{in})</td><td>Brown:</td><td>Ground (GND)</td></tr>
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<tr><td colspan="4"></td><td>Circuit diagram</td></tr>
</table>

5 Determination of the K-factor

You can find the K-factor (specified in pulses/liter) for the employed flowmeter based on H_2O at 21°C and continuous flow under Section 8 → Pulse curve. If a medium other than H_2O and/or other temperatures or dis continuous flow is used, then it is necessary to determine the individual K-factor. A renewed determination of the K-factor is recommended after approx. 200 operating hours, especially for flow meters based on the oval-wheel principle. Determine the K-factor as follows:

1 Ensure that the flow meter is connected properly.
2 Ensure that sufficient medium is present.
3 Ensure that the system is free of air.
4 Place a sufficiently large, empty measuring beaker under the outlet (recommended measuring period of the K-factor > 60 seconds).
5 Start the measuring process and count the pulses (e.g. using a pulse counter).
6 Stop the measuring process and divide the number of pulses counted by the volume (converted to liters) of the drained medium:

$$\text{K-factor} = \frac{\text{counted\_pulses}}{\text{measured\_quantity\_}[\text{liters}]}$$

7 Repeat this process at least three times.
8 Calculate the average value from the results obtained under Point 6 (do not use runaway values).

6 Maintenance and care

The flowmeters require little maintenance due to the small number of moving parts. A regular function check and maintenance increases the service life and functional safety not only of the device, but also of the whole plant.
The maintenance intervals depend on:
Contamination of the medium
Ambient conditions (e.g. vibration)

At least the following points must be inspected during maintenance:
Check the signal outputs and the free movement of the paddlewheel
→ Free movement of the paddlewheel and the output of the output signal can be tested by changing the flow and observing the signal (signal change is directly proportion to the flow).
- Leakages in the device

It is the responsibility of the operator to define suitable maintenance intervals depending on the application.
Remarks:
- Flushing with clean medium provides sufficient cleaning in most cases.
  Commercially available cleaning agents can be used in stubborn cases (e.g. lime deposits) insofar as these materials do not attack the materials in the device.

Attention!!! The guarantee becomes void if the device is opened.

7.1 No signal output

1. No flow
   → Check that medium is flowing
2. Flowless than measurement range
   → Use flowmeter with different measuring range
3. Incorrectly installed or connected
   → Install according to Section 4
4. Paddlewheel or oval wheel pair blocked (dirt)
   → Clean flowmeter according to Section 6
5. Electronics defective
   → Remove the cause of the defect (e.g. short-circuit, overload)
   → Exchange flowmeter
6. Device defective
   → Send flowmeter to manufacturer for repair or calibration

7.1 Measured quantity does not agree with the actual flow

1. Wrong K-factor
   → Determination of the K-factor according to Point 5
2. Paddlewheel or oval wheel pair contaminated
   → Clean flowmeter according to Section 6
3. Device defective
   → Send flowmeter to manufacturer for repair or calibration

DOZ01

Oval Gear Flowmeter for Low Flow Rates

- **viscosity independent**
- **compact design, inlet pipe not necessary**
- **materials: PP, ECTFE or stainless steel**
- **output signals: pulses, 4...20 mA or 2 limit relays**
- **measuring ranges: 8...40 l/h, 14...80 l/h**
- **P_{max}: 20 bar, T_{max}: 80 °C**

Description:

The DOZ01 oval gear flowmeter measures the volume flow of liquid media of water up to a maximum viscosity of 200 cSt, regardless of the actual viscosity of the medium.
In a measuring chamber, two toothed oval gears are rotated by the flowing medium. This rotation is detected by a Hall sensor and output as a pulse. The output frequency of these pulses is directly proportional to the flow rate. Alternatively, the pulse output can be converted into an analogue output signal 4...20 mA or into 2 limit contacts by a downstream electronic circuit. The oval gear flowmeters can be supplied in various material combinations such as PP, ECTFE or stainless steel with oval gears made of PEEK.
A wide variety of axes and seals allow the DOZ01 to be adapted to a wide variety of media. Two measuring ranges (8...40 l/h and 14...80 l/h) are available.

Typical applications:

The DOZ01 oval gear flowmeters are used wherever the flow rate of liquids with different viscosities must be measured reliably and cost-effectively, e.g.:

– in central lubrication systems
– for transformer oils
– for aggressive liquids in the chemical industry

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Models:

DOZ01.P.: standard version housing made of PP, oval gear made of PEEK, axle made of zircon oxide (optional ceramic), gasket FKM (optional EPDM or FFKM)

DOZ01.E.: version for aggressive media, housing made of ECTFE, oval gears made of PEEK, axle made of zircon oxide (optional ceramic), gasket FKM (optional EPDM or FFKM)

DOZ01.V.: stainless steel version for higher operating pressures bis 20 bar, housing made of st. steel 1.4401, oval gears made of PEEK, axle made of zircon oxide (optional ceramic), gasket FKM (optional EPDM or FFKM)

Measuring Ranges:

Measuring range [l/h]	Con-nection (G or NPT female)	Start-up at [l/h]	Width [mm]	Height without plug [mm]	Depth [mm]	pulses / l approx.*)
8…40	1/4"	2	54	45	45	6000
14…80	1/4"	5	54	45	45	3400

*) The number of pulses per liter can vary by approx. ca. ± 3 % due to production reasons. Each instrument is individually calibrated before delivery and marked with the exact number of pulses per liter.

Output Signals:

DOZ01…P: pulse output
square-wave pulses

DOZ01…A: analogue output
4…20 mA, 2-wire

DOZ01…S: switching output
2 limit relays (0,1 A at 24 VDC)
programmable and pulse output

Electrical connection:

	DOZ01.P.	DOZ01.A.	DOZ01.S.
Power supply	Pin 1	-	white
Signal	Pin 2	-	green
Ground	Pin 3	-	brown
Relay 1	-	-	yellow
Relay 1	-	-	grey
Relay 2	-	-	pink
Relay 2	-	-	blue
4…20 mA signal +	-	Pin 1	-
4…20 mA signal -	-	Pin 2	-

Options:

- gaskets made of EPDM or FFKM
- axle made of ceramic

Order Code:

Order number:	DOZ01.	P.	V.	1.	P.	0.	0

Oval gear flowmeter for low flows

Models:
P = housing PP / oval gears PEEK
E = housing ECTFE / oval gears PEEK
V = housing st. steel / oval gears PEEK

Gasket:
V = FKM (standard)
E = EPDM
K = FFKM

Measuring range:
1 = 8...40 l/h
2 = 14...80 l/h

Output signal:
P = pulse output
A = analogue output 4...20 mA
S = 2 limit relays and pulse output

Process connection:
0 = G 1/4
N = 1/4“ NPT

Options:
0 = without
1 = axle made of ceramic
9 = please specify in plain text

Technical Data:

Max. pressure:

PP:	10 bar
ECTFE:	10 bar
st. steel:	20 bar

Medium temperature: 0…80 °C

Accuracy:

5…200 cSt:	± 2,5 % of full scale
< 5 cSt:	± 4 %

Process connection: G 1/4 female, optional NPT

Mounting position: any

Power supply:

pulse output:	4,5…24 VDC
analogue output:	15…24 VDC
limit relay:	15…24 VDC

Electrical connection:

pulse- and analogue output:	cube connector acc. to EN 175301-803A
limit relays:	plug connection with mating plug and 1 m cable

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