Insertion Paddle Wheel Flow Meter / Monitor

for Low Viscosity Liquids

measuring • monitoring • analyzing

DOR

- Flow Range:
  5.5 … 180 GPM to 25,000 … 800,000 GPM
- Flow Velocity Range: 1.0...33.0 ft/s
- p_{max}: 1160 PSI
- t_{max}: 300 °F
- Connection: 1½" NPT, 2" NPT Male, R 1½, & R 2 Male for Pipe Sizes: 1½"...100"
- Linearity: ±1.5% with Well Established Flow Profile
- Body Material: Stainless Steel
- Outputs: Pulse, LCD Display, Batching, Totalizing, 4 - 20mA, Switches

Order from:

C A Briggs Company

632 Davisville Road
Willow Grove, PA 19090
Phone: 215-784-9250; Fax: 215-784-0611
E-Mail: Sales@cabriggs.com
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Description

The DOR series insertion paddle wheel flow sensor offers cost effective measurement of the flow of water or water-like liquids in large pipes. The sensor is inserted into the process piping via a suitable tee, thread-o-let or half coupling. Flow through the pipe results in rotation of the paddle wheel which is proportional to the flow velocity and to the flowrate in the pipe. The DOR is much less expensive than full bore flowmeters, especially in larger pipe sizes. Insertion paddle wheel sensors are rugged and boast exceptional tolerance to dirt and solids.

The DOR features an all 316 L stainless steel body. The rotor is made of PVDF or PEEK, with a long-life graphite/PTFE self-lubricating bearing. It has an integral, precision insertion mechanism that allows insertion of the rotor to a precise depth in the pipe for optimal readings. Available signal outputs include NPN open collector frequency, and/or reed contact frequency or millivolt frequency. Optional indicators include battery powered totalizers and loop powered rate meter/totalizers with outputs and batch controllers. The DOR-5 may be installed through a 2" ball valve to allow serviceability with minimal process interruption. With its symmetrical design, the DOR may also be used for bi-directional flow measurement when fitted with the quadrature output option in conjunction with an appropriate discriminator circuit or display.

Applications

- HVAC: Hot and Cold Water, Fire Systems, and Thermal Energy Monitoring
- Municipal: Water Distribution, Water Management and Water Treatment
- Irrigation: Water Management
- Water Treatment: Chlorination, Desalination and Mechanical Filtration Plants, Chemical Injection Systems
- Refineries: Fire and Cooling Systems
- Power Generation: Boiler Feed Water, Steam Condensate, Process Water and Water Balancing
- Chemical: Process & Cooling Tower Water, Chemical and Water Batching
- Others: Cement Manufacturing, Flow Testing, Fire Truck and Hydrant Flow Monitoring, Food Processing, Pulp/Paper, Mining, and Fountains

Technical Details

Velocity Range (Linear):	1.0 ... 33 ft/s
Linearity:	±1.5% w/Well Established Flow Profile
Repeatability:	±1% of f. s. at Factory Conditions and Optimal Straight Runs
Max Pressure:	1160 PSI
Temperature Range:	5 … 212 °F Standard, See Max. Allowable Media Temperature Table for Other Options and Restrictions

Materials

Body:	316L Stainless Steel
Rotor:	PVDF or PEEK (Depending on Model)
Rotor Shaft:	316L Stainless Steel
Bearing:	Graphite/PTFE
Seals:	FKM (Standard): 5 … 300 °F EPR (Ethylene Propylene Rubber): -40 … 260 °F NBR (Nitrile): -40 … 260 °F

Electronics

Max. Frequency:	220 ... 240 Hz (Hall Effect and Voltage Output)
	73 ... 80 Hz (Reed Switch Output)
Supply Voltage:	See Electronics Comparison Table
Electronic Features:	See Electronics Comparison Table
Wiring (Standard):	10 Ft., 5 wire Shielded Cable
Transmission Distance:	3000 ft Maximum, without Integrated Electronics
Cable Entry (Terminal Box):	Standard: M20x1.5 Optional: 1/2" NPT via Adapter
Ingress Protection:	IP 66/67 IP 68 w/Cable Connection
Straight Piping Requirement:	Minimum: 10xd (Upstream), 5xd (Downstream) Optimal: 25xd (Upstream), 10xd (Downstream)
Weight (Approx.):	3.6 lb (DOR-4), 5.5 lb (DOR-5) without Electronics

Electrical Output Specifications

Hall Effect Sensor Output (Fx, Nx, Qx)

The Hall Effect Sensor is a high resolution, solid state 3 wire device providing an unsourced, open collector, NPN transistor output. The term "unsourced" means that no voltage is applied to the output from within the flowmeter. It must be pulled to a 'high' or 'on' state by 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 10 kΩ) 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). The power supply requirement is: 5 - 24 $V_{DC,}$ 20 mA max.

Voltage Pulse Output (Fx)

A self generating 2 wire voltage pulse output with 1.5V voltage spike of approximately 10 microseconds duration is generated with no dependence on rotor speed.

Reed Switch Pulse Output (Rx)

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. When using the reed switch output, the liquid temperature must not change at a rate greater than 18 °F per minute. In general, the reed switch life will exceed 2 billion actuations when switching less than 5V_{DC} at 10mA. The voltage/current limits are: 30 V_{DC} max, 200 mA max.

Quadrature Pulse Output (Qx)

Two Hall-Effect sensors are arranged to give separate outputs out of phase with one another. The Quadrature output is commonly used to provide verification of output signal integrity or to measure bi-directional flow in conjunction with an appropriate discriminator circuit or display. The power supply requirement is: 8 - 24 V_{DC}, 20 mA max.

NPN Inductive Pick-up (Ex)

Inductive pick-up with non-magnetic rotor for applications with high ferrous content liquids. The signal output is 3-wire, NPN transistor. The power supply requirement is: 5 - 24 $V_{DC,}$ 20 mA max.

Electronic Options with LCD Display

Model	..Z1	..Z3	..Z7	..B1
Function	Dual Totalizer	Rate Totalizer	Rate Totalizer	Batch Controller
Power Source				
Battery-powered	yes	yes	yes	no
External (Required for 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
Accumulated Total	yes	yes	yes	yes
Resettable Total	yes	yes	yes	no
Linearization	no	yes	no	no
Rate Display	no	yes	yes	no
Backlighting	no	no	yes	no
Input Type				
Unpowered Sensors	See display user manual			
Powered Sensors	See display user manual			
Outputs				
4-20 mA (750 Ω)	no	yes	no	no
High/Low Flow Output	no	NPN/PNP	no	no
Batch End & Control	no	no	no	NPN/PNP
Pulse Output	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	2 x gland	3 x ½"NPT	3 x M16	3 x ½"NPT
Intrinsic Safe Option	upon req.l	upon req.	no	no
Mounting	Standard: Meter mounted via stem Optional: Wall, pipe or panel mounting			
Ambient Temperature	-4...176 °F (non-condensing)			

* Replaces solid state outputs, consult factory for availability

DOR Series Nominal Flow Measuring Ranges (Sch 40 Steel Pipe, 1...33 ft/s Fluid Velocity)

Line Size (Sch. 40 Steel)	Nominal Measuring Range (GPM)	Line Size (Sch. 40 Steel)	Nominal Measuring Range (GPM)
1-1/2"	6...210	**10"**	245...8,080
2"	10...345	**12"**	360...11,625
2-1/2"	15...490	**14"**	480...15,850
3"	25...760	**16"**	560...18,175
4"	40...1,300	**18"**	700...23,100
6"	90...2,975	**20"**	875...28,550
8"	160...5,170	**24"**	1,250...41,250

Order Details (Example: **DOR-42 2 F N8 F6 Z3)**

Model	Rotor/Shaft	Sealing Material	Mechanical Connection	Output/ Electrical Connection	Electronics
DOR-42.. = Pipe Size 1½" ... 36"	**..2..** = PVDF/SS (Max. 212 °F) **..4..** = PEEK/SS (Max. 300 °F)	**..F..** = FKM (Standard) **..E..** = EPR **..N..** = NBR	**DOR-42 Options** **..N8..** = 1½" NPT Male **..N9..** = 2" NPT Male **..R8..** = R 1½ Male **..R9..** = R2 Male	**..F1..** = NPN OC + 1.5V-Pulse + 10' Cable (Standard) **..F2..** = NPN OC + 1.5V-Pulse + 30' Cable **..F3..** = NPN OC + 1.5V-Pulse + 60' Cable **..F4..** = NPN OC + 1.5V-Pulse + 150' Cable **..F5..** = NPN OC + 1.5V-Pulse + Terminal Box on Stem Kit **..F6..** = NPN OC + 1.5V-Pulse + Integral Electronic on Stem Kit	**..00** = Frequency Output Only **Only for Output F6** **..B1** = Batch Controller **..Z1** = Dual Totalizer **..Z3** = Rate/Dual Totalizer **..Z7** = Rate/Dual Totalizer
				..N5*.. = NPN OC + Terminal Box on Stem kit + High Temp. Sensor	
DOR-52.. = Pipe Size 2" ... 100"			**DOR-52 Options** **..N9..** = 2" NPT Male **..R9..** = R2 Male	**..R1..** = Reed Switch + 10' Cable **..R2..** = Reed Switch + 30' Cable **..R3..** = Reed Switch + 60' Cable **..R4..** = Reed Switch + 150' Cable **..R5..** = Reed Switch + Terminal Box on Stem Kit	
				..Q1.. = 2x NPN OC + 10' Cable **..Q2..** = 2x NPN OC + 30' Cable **..Q3..** = 2x NPN OC + 60' Cable **..Q4..** = 2x NPN OC + 150' Cable **..Q5..** = 2x NPN OC + Terminal Box on Stem Kit	
				..E1.. = Non-magnetic Rotor for Ferrous Media, NPN, 10' Cable **..E2..** = Non-magnetic Rotor for Ferrous Media, NPN, 30' Cable **..E3..** = Non-magnetic Rotor for Ferrous Media, NPN, 60' Cable **..E4..** = Non-magnetic Rotor for Ferrous Media, NPN, 150' Cable **..E5..** = Non-magnetic Rotor for Ferrous Media, NPN, Terminal Box on Stem Kit	

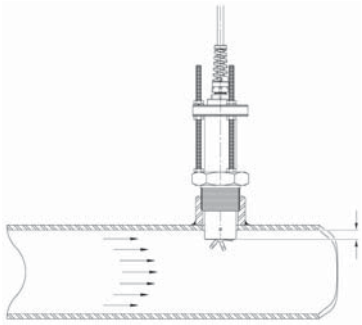
* Only available with PEEK rotor and sealing material: "F"

Process Temperature Limits with Rotor and Output Options*

Rotor	Max. Media Temperature
PVDF	212 °F
PEEK	300 °F
Output Type	
E1 - E4	185 °F
F1 -F4 R1 - R4 Q1 - Q4	212 °F/260°F*
F5, F6, R5	260 °F*
N5	300 °F*

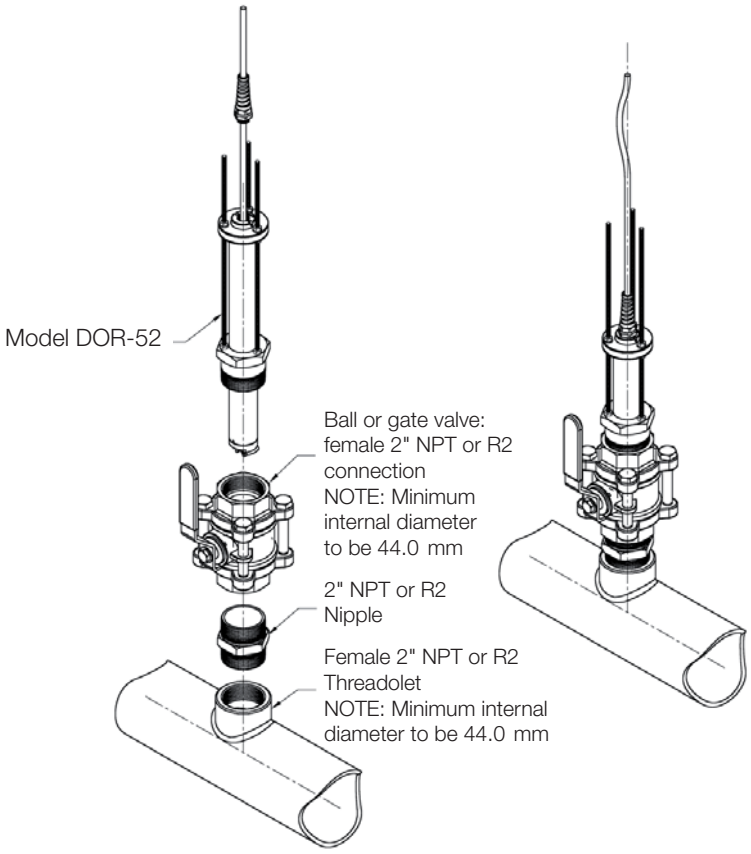
* Must use PEEK rotor for all output options with media temperatures > 212 °F. Additionally, be sure to select an appropriate seal material suitable for both media compatibility and the maximum media temperature.

Typical DOR Installation

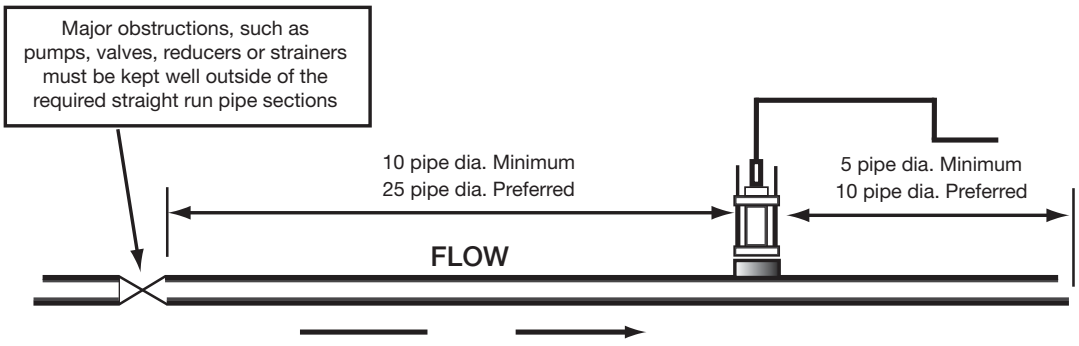


Insertion Depth = 1/8 of Pipe Inner Diameter

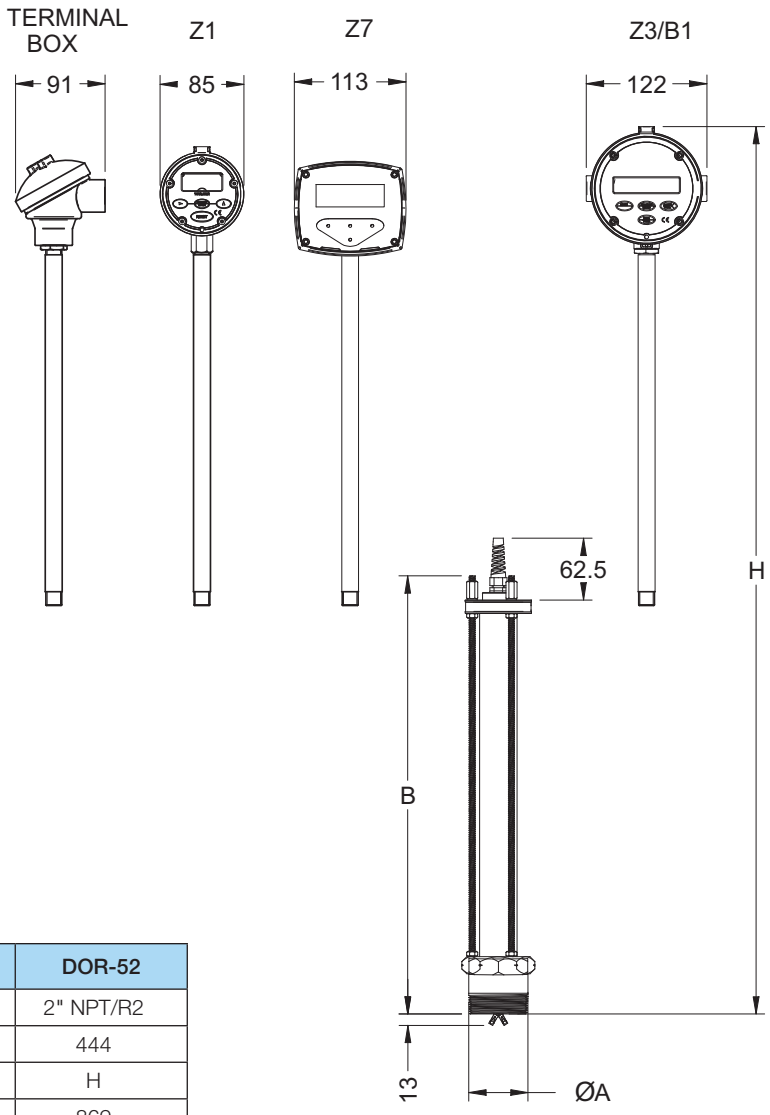
Through-Valve Installation for DOR-52 series



DOR Upstream/Downstream Straight Piping Requirements



Dimensions (mm)



	DOR-42	DOR-52
ØA	1-½" or 2" NPT/R2	2" NPT/R2
B	198	444
Configuration	H	H
Terminal Box	385	869
Z1	394	880
Z3/B1	415	900
Z7	380	865

All dimensions in mm, ±2 mm