

Paddle Wheel Flow Sensors for Low Viscosity Liquids



measuring
•
monitoring
•
analyzing

DF



- Body Material Options: Brass, Stainless, or Polysulfone
- Easy to Install, No Straight Runs Required
- Robust and Reliable
- 6 Different Material Combinations Available
- Electronic Options: Frequency, Analog, Relay, Totalizer, and/or Batch Controllers with Digital Displays



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Description

The main feature of the DF flow sensors is the incorporation of a multipole magnet ring embedded into the paddlewheel. As the paddle wheel rotates, the magnets, hermetically separated from the liquid media, induce a DC signal into a Hall-Effect sensor mounted on the device housing. Since the DC signal frequency is proportional to paddlewheel rotation, an accurate flow rate reading is possible.

The DF sensors, when coupled with the appropriate KOBOLD electronics unit, can offer the user a number of features useful in the measurement and control of low viscosity liquid flow. These features include a frequency output, analog output, adjustable switches, digital displays with integrated batch controllers, or totalizers.

Specifications

- Accuracy:** ± 2.5% of full scale
- Media:** Water and low viscosity liquids
- Orientation:** Universal
- Fittings:** 1/8" NPT ... 1-1/2" NPT



Material Combination

| Material Combination | Standard | | | | High Pressure Design | |
|---------------------------------|----------------------|---------------------|----------------------|--------------------|----------------------|--------------------|
| | I B | II | III | IV | VI ¹⁾ | VII ¹⁾ |
| Order Code | P | B | D | E | G ¹⁾ | H ¹⁾ |
| Connecting type | Female thread | Female thread | Female thread | Female thread | Female thread | Female thread |
| Housing | Polysulfone | Polysulfone | Brass, Nickel-plated | 316L SS | Brass, Nickel-plated | 316L SS |
| Housing lid | Polysulfone | Polysulfone | Polysulfone | Polysulfone | Brass, Nickel-plated | 316L SS |
| Connection | Brass, Nickel-plated | 316-Ti SS | Brass, Nickel-plated | 316-Ti SS | Brass, Nickel-plated | 316-Ti SS |
| Locking pins | Brass ³⁾ | Brass ³⁾ | Brass ³⁾ | - | - | - |
| O-rings | NBR | FKM | NBR | FKM | NBR | FKM |
| Paddle wheel | POM | PTFE | POM | PTFE | POM | PTFE |
| Axle | 316L SS | 316L SS | 316L SS | 316L SS | 316L SS | 316L SS |
| Axle bushing | PTFE | PTFE | PTFE | PTFE | PTFE | PTFE |
| Orifice | PTFE ²⁾ | PTFE ²⁾ | PTFE ²⁾ | PTFE ²⁾ | PTFE ²⁾ | PTFE ²⁾ |
| Max. operating pressure [PSI] | 145 | 145 | 230 | 230 | 1450 | 1450 |
| Max. operating temperature [°F] | 180 | 180 | 180 | 180 | 180 | 180 |

¹⁾ Fittings are not rotatable ²⁾ For Model DF..01 Stainless Steel Orifice ³⁾ Non-wetted



Description

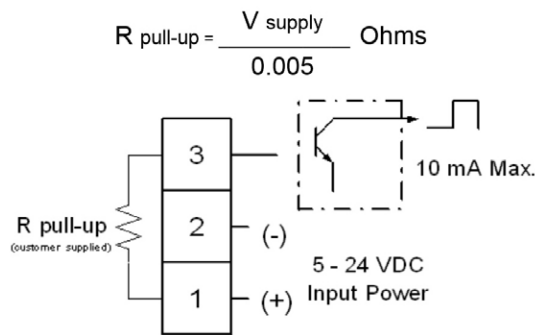
The KOBOLD DF Flow Sensor is used in applications where flow measurement is desired and flow rate data is to be transmitted as a pulse rate output. The DF Flow Sensor contains a flow transducer which transmits a pulse signal. The output signal is linearly proportional to the flow and is transmitted by a bipolar transistor operating in an open collector configuration (max. 10 mA sinking capability). A user-supplied, pull-up resistor is required to produce a signal output.



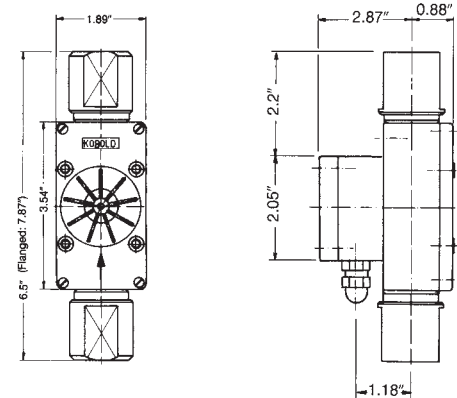
Specifications

Power Supply: 5 to 24 V_{DC}
Signal Output: NPN - Open Collector
 10 mA max.
Temperature Range: -4...176 °F
 (140 °F for DF-01..)
Protection: IP 65
Accuracy: ± 2.5% of F.S.

Wiring Diagram



Dimensions



Order Details (Example: DF-0402B)

| Range (Water) (GPM) | Standard Connection (NPT) | Diameter of Orifice (Inch) | Pressure Drop Max. (PSI) | DF Flow Sensor Material Combination | | | | | | Options (Add Suffix to Order Number) | |
|---------------------|---------------------------|----------------------------|--------------------------|-------------------------------------|---------|---------|---------|---------|---------|--------------------------------------|--------------------------|
| | | | | I B | II | III | IV | VI | VII | Suffix "...B" Special Conn. (NPT) | Suffix "...HNP" |
| 0.02...0.14 | 1/8" | 0.04 | 10.2 | DF-0901 | DF-0201 | DF-0301 | DF-0401 | DF-0601 | DF-0701 | 1/4" | 5 point Calibration Cert |
| 0.05...0.30 | 1/4" | 0.08 | 4.2 | DF-0902 | DF-0202 | DF-0302 | DF-0402 | DF-0602 | DF-0702 | 3/8" | |
| 0.05...0.60 | 1/4" | 0.08 | 10.4 | DF-0903 | DF-0203 | DF-0303 | DF-0403 | DF-0603 | DF-0703 | 3/8" | |
| 0.1...0.7 | 1/4" | 0.11 | 9.6 | DF-0904 | DF-0204 | DF-0304 | DF-0404 | DF-0604 | DF-0704 | 3/8" | |
| 0.2...2.5 | 3/8" | 0.19 | 6.0 | DF-0905 | DF-0205 | DF-0305 | DF-0405 | DF-0605 | DF-0705 | 1/2" | |
| 0.4...5 | 1/2" | 0.32 | 2.9 | DF-0906 | DF-0206 | DF-0306 | DF-0406 | DF-0606 | DF-0706 | 3/4" | |
| 0.5...6 | 3/4" | 0.32 | 4.4 | DF-0907 | DF-0207 | DF-0307 | DF-0407 | DF-0607 | DF-0707 | 1" | |
| 0.5...12 | 3/4" | 0.49 | 4.4 | DF-0908 | DF-0208 | DF-0308 | DF-0408 | DF-0608 | DF-0708 | 1" | |
| 1...25 | 1-1/4" | 0.59 | 15.9 | DF-0909 | DF-0209 | DF-0309 | DF-0409 | DF-0609 | DF-0709 | 1-1/2" | |
| 1.5...36 | 1-1/4" | 0.73 | 20.0 | DF-0910 | DF-0210 | DF-0310 | DF-0410 | DF-0610 | DF-0710 | 1-1/2" | |

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



Paddle Wheel Flow Sensors DF-MA - Analog Transmitter

Special Features

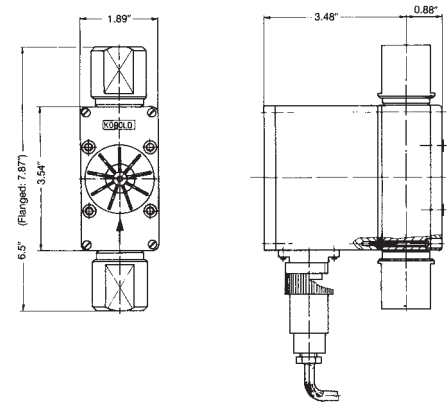
- For Transmission of Measured Flow
- Output: 0(4)–20 mA, 0–10 V_{DC}, 0–5 V_{DC}

Specifications

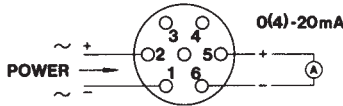
| | |
|---------------------------|--|
| Power Consumption: | 3.5 W max. |
| Power Supply: | 24 V _{DC} , 24 V _{AC} , 110 V _{AC} , 230 V _{AC} + 15% / -10% |
| Analog Output: | 0–20 mA, 4–20 mA, 0–5 V _{DC} or 0–10 V _{DC} |
| Max Load: | 500 Ω |
| Temperature Range: | -10...180 °F (145 °F for DF-71..) |
| Cable Connections: | (5 ft PVC-cable standard, Plug connection optional) No. 1 Power (-) No. 2 Power (+) No. 5 Analog Output (+) No. 6 Analog Output (-) |



Dimensions



Wiring Diagram



Order Details (Example: DF-7202BP04S1)

| Range (Water) (GPM) | Standard Connection (NPT) | Diameter of Orifice (Inch) | Pressure Drop Max. (PSI) | DF-MA Material Combination | | | | | | Options (Add Suffix to Order Number) | | |
|---------------------|---------------------------|----------------------------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|--------------------------------------|--|-----------------------|
| | | | | I B | II | III | IV | VI | VII | Suffix "..B.." Special Conn. (NPT) | Suffix "..L.." Special Range GPH (Water) | Suffix "..P.." |
| 0.02...0.14 | 1/8" | 0.04 | 10.2 | DF-7901.. | DF-7201.. | DF-7301.. | DF-7401.. | DF-7601.. | DF-7701.. | 1/4" | 1...7 | Power Conn. with Plug |
| 0.05...0.30 | 1/4" | 0.08 | 4.2 | DF-7902.. | DF-7202.. | DF-7302.. | DF-7402.. | DF-7602.. | DF-7702.. | 3/8" | 3...25 | |
| 0.05...0.60 | 1/4" | 0.08 | 10.4 | DF-7903.. | DF-7203.. | DF-7303.. | DF-7403.. | DF-7603.. | DF-7703.. | 3/8" | 3...36 | |
| 0.1...0.7 | 1/4" | 0.11 | 9.6 | DF-7904.. | DF-7204.. | DF-7304.. | DF-7404.. | DF-7604.. | DF-7704.. | 3/8" | 6...42 | |
| 0.2...2.5 | 3/8" | 0.19 | 6.0 | DF-7905.. | DF-7205.. | DF-7305.. | DF-7405.. | DF-7605.. | DF-7705.. | 1/2" | 12...150 | |
| 0.4...5 | 1/2" | 0.32 | 2.9 | DF-7906.. | DF-7206.. | DF-7306.. | DF-7406.. | DF-7606.. | DF-7706.. | 3/4" | - | |
| 0.5...6 | 3/4" | 0.32 | 4.4 | DF-7907.. | DF-7207.. | DF-7307.. | DF-7407.. | DF-7607.. | DF-7707.. | 1" | - | |
| 0.5...12 | 3/4" | 0.49 | 4.4 | DF-7908.. | DF-7208.. | DF-7308.. | DF-7408.. | DF-7608.. | DF-7708.. | 1" | - | |
| 1...25 | 1-1/4" | 0.59 | 15.9 | DF-7909.. | DF-7209.. | DF-7309.. | DF-7409.. | DF-7609.. | DF-7709.. | 1-1/2" | - | |
| 1.5...36 | 1-1/4" | 0.73 | 20.0 | DF-7910.. | DF-7210.. | DF-7310.. | DF-7410.. | DF-7610.. | DF-7710.. | 1-1/2" | - | |

| Power Supply Options | |
|----------------------|----------------------------|
| Description | Add Suffix to Model Number |
| Power Supply 24 VDC | ..P01.. |
| Power Supply 24 VAC | ..P02.. |
| Power Supply 110 VAC | ..P03.. |
| Power Supply 230 VAC | ..P04.. |

| Output Options | |
|----------------------|----------------------------|
| Description | Add Suffix to Model Number |
| 0–20 mA Output | ..S1 |
| 4–20 mA Output | ..S2 |
| 0–10 V _{DC} | ..S3 |
| 0–5 V _{DC} | ..S4 |

Note: To place an order

1. Select the sensor order no.
2. Select the desired option suffixes
3. Specify the required power supply suffix
4. Specify the required output option suffix



Special Features

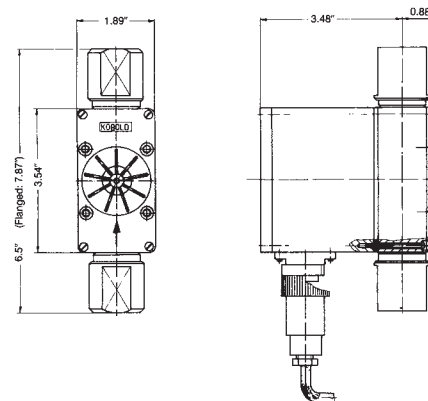
- Adjustable Limit Contact for Flow Control
- Push-Button Alarm Override Switch and Potentiometer with Scale for Indirect Flow Measurements

Specifications

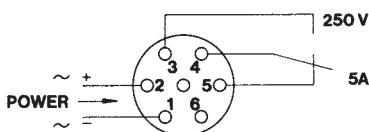
Power Consumption: 3.5 W max.
Power Supply: 24 V_{DC}, 24 V_{AC}, 110 V_{AC}, 230 V_{AC} + 15% / -10%
Contact Rating: 250 V max./5A
Contact Resistance: = < 100 Ω
Temperature Range: -10...180 °F (145 °F for DF-81..)
Cable Connection: (5 ft PVC-cable standard, Plug connection optional)
 No. 1 Power Supply (-)
 No. 2 Power Supply (+)
 No. 3 Relay Contacts
 No. 4 Relay Contacts
 No. 5 Relay Contacts



Dimensions



Wiring Diagram



Order Details (Example: DF-8308BP03)

| Range (Water) (GPM) | Standard Connection (NPT) | Diameter of Orifice (Inch) | Pressure-Drop Max. (PSI) | DF-WM Material Combination | | | | | | Options (Add Suffix to Order Number) | | |
|---------------------|---------------------------|----------------------------|--------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|--------------------------------------|---|-----------------------|
| | | | | I B | II | III | IV | VI | VII | Suffix "...B.." Special Conn. (NPT) | Suffix "...L.." Special Range GPH (Water) | Suffix "...P.." |
| 0.02...0.14 | 1/8" | 0.04 | 10.2 | DF-8901.. | DF-8201.. | DF-8301.. | DF-8401.. | DF-8601.. | DF-8701.. | 1/4" | 1...7 | Power Conn. with Plug |
| 0.05...0.30 | 1/4" | 0.08 | 4.2 | DF-8902.. | DF-8202.. | DF-8302.. | DF-8402.. | DF-8602.. | DF-8702.. | 3/8" | 3...25 | |
| 0.05...0.60 | 1/4" | 0.08 | 10.4 | DF-8903.. | DF-8203.. | DF-8303.. | DF-8403.. | DF-8603.. | DF-8703.. | 3/8" | 3...36 | |
| 0.1...0.7 | 1/4" | 0.11 | 9.6 | DF-8904.. | DF-8204.. | DF-8304.. | DF-8404.. | DF-8604.. | DF-8704.. | 3/8" | 6...42 | |
| 0.2...2.5 | 3/8" | 0.19 | 6.0 | DF-8905.. | DF-8205.. | DF-8305.. | DF-8405.. | DF-8605.. | DF-8705.. | 1/2" | 12...150 | |
| 0.4...5 | 1/2" | 0.32 | 2.9 | DF-8906.. | DF-8206.. | DF-8306.. | DF-8406.. | DF-8606.. | DF-8706.. | 3/4" | - | |
| 0.5...6 | 3/4" | 0.32 | 4.4 | DF-8907.. | DF-8207.. | DF-8307.. | DF-8407.. | DF-8607.. | DF-8707.. | 1" | - | |
| 0.5...12 | 3/4" | 0.49 | 4.4 | DF-8908.. | DF-8208.. | DF-8308.. | DF-8408.. | DF-8608.. | DF-8708.. | 1" | - | |
| 1...25 | 1-1/4" | 0.59 | 15.9 | DF-8909.. | DF-8209.. | DF-8309.. | DF-8409.. | DF-8609.. | DF-8709.. | 1-1/2" | - | |
| 1.5...36 | 1-1/4" | 0.73 | 20.0 | DF-8910.. | DF-8210.. | DF-8310.. | DF-8410.. | DF-8610.. | DF-8710.. | 1-1/2" | - | |

| Plug Connector with Plug Options | |
|----------------------------------|----------------------------|
| Description | Add Suffix to Model Number |
| Power Supply 24 VDC | ..P01 |
| Power Supply 24 VAC | ..P02 |
| Power Supply 110 VAC | ..P03 |
| Power Supply 230 VAC | ..P04 |

Note: To place an order

1. Select the sensor order no.
2. Select the desired option suffixes
3. Specify the required power supply suffix



Paddle Wheel Flow Sensors DF-KL - Digital Flowmeter

Special Features

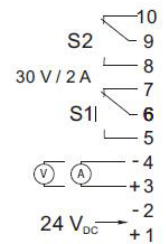
- Digital Display: Continuous Rate with Bargraph
- Output: 2 SPDT Relays Fully Programmable
- Output: 4-20 mA or 0-10 V_{DC}

Specifications

| | |
|---------------------------|---|
| Display: | 3-digit, 7-segment LED with fixed decimal place and bar graph indicator |
| Temperature Range: | -10...180 °F (145 °F for DF-...A..) |
| Protection: | NEMA 4 |
| Wiring: | 5 foot cable, 10-wire (standard) Extended cable (optional) |



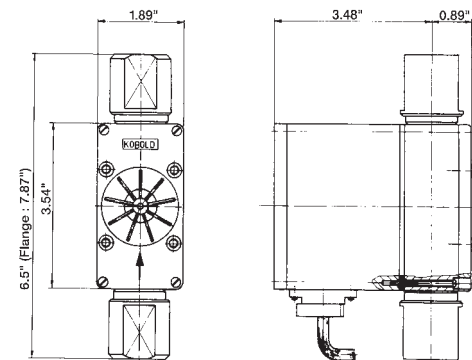
Electrical Connection



Electrical Specifications

| | |
|------------------------|--|
| Power Supply | |
| Voltage: | 24 V _{DC} , ±20% |
| Consumption: | Approx. 100 mA analog output |
| Current Output: | 4-20 mA Load: 500 ohm max |
| Voltage Output: | 0-10 V _{DC} Load: > 100 kohm |
| Relays: | 2 SPDT: 1 Minimum 1 Maximum |
| Contact Rating: | 2 amps at 30 Volts max |
| Hysteresis: | 2.5% of full scale |
| Set Points: | Front panel adjustable |

Dimensions



Order Details (Example: DF-U1BN06KLK34)

| Flow Rate (GPM) | Model | Material Combination | Fitting Type*/Size | Electronic | Analog Output | | |
|-----------------|---------|--|--|---|---------------|--|--------------|
| 0.02...0.14 | DF-U1.. | ..B.. = Polysulfone/ Stainless Steel | ..N06.. = 1/8" NPT ..N08.. = 1/4" NPT | ..KLK3.. = Digital flowrate display, switching, and analog output, 24 V _{DC} with 1.5 m cable connection | ..4 = 4-20 mA | | |
| 0.05...0.30 | DF-U2.. | | ..N08.. = 1/4" NPT ..N10.. = 3/8" NPT | | | | |
| 0.05...0.60 | DF-U3.. | ..D.. = Brass | ..N10.. = 3/8" NPT ..N15.. = 1/2" NPT | | | | |
| 0.1...0.7 | DF-U4.. | | ..N15.. = 1/2" NPT ..N20.. = 3/4" NPT | | | | |
| 0.2...2.5 | DF-U5.. | ..E.. = Stainless Steel | ..N20.. = 3/4" NPT ..N25.. = 1" NPT | | | ..KLL3.. = Digital flowrate display, switching, and analog output, 24 V _{DC} cable connection (please clearly specify cable length) | ..1 = 0-10 V |
| 0.4...5.0 | DF-U6.. | ..G.. = Brass (1450 PSI) ..H.. = Stainless Steel (1450 PSI) | ..N25.. = 1" NPT | | | | |
| 0.5...6.0 | DF-U7.. | ..P.. = Polysulfone/Brass | ..N32.. = 1-1/4" NPT ..N40.. = 1-1/2" NPT | | | | |
| 0.5...12.0 | DF-U8.. | | | | | | |
| 1.0...25.0 | DF-U9.. | | | | | | |
| 1.5...36.0 | DF-UA.. | | | | | | |

* For G fitting type, substitute R for N



Special Features

- Digital Display: Rate, Total, and Grand Total
- Output: 2 SPDT Relays Fully Programmable
- Output: 4-20 mA or 0-10 V_{DC}

Specifications

Display: 2x 8-digit, 7-segment LED with fixed decimal place

Temperature Range: -10...180 °F (145 °F for DF-..A..)

Protection: NEMA 4

Wiring: 5 foot cable, 10-wire (standard)
Extended cable (optional)



Electrical Connection

| Wire Number | Function |
|-------------|-----------------------|
| 1 | + 24 VDC |
| 2 | GND |
| 3 | Analog output |
| 4 | GND |
| 5 | do not connect |
| 6 | Reset part quantities |
| 7 | Relay S1 |
| 8 | Relay S1 |
| 9 | Relay S2 |
| 10 | Relay S2 |

Specifications

Power Consumption: 2.4 W max.

Power Supply: 24 V_{DC}, ±20%

Contact Rating: 250 V, 5A max

Contact Resistance: <100 mΩ

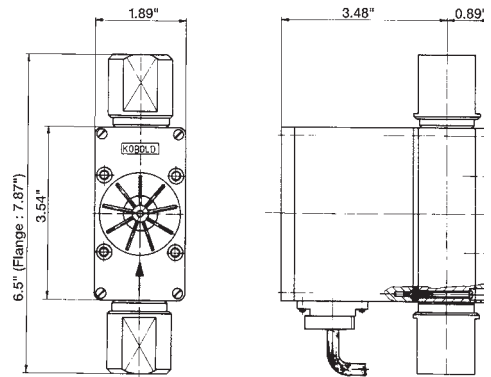
Analog Output: 4-20 mA

Max Load: 500 Ω, 4-20 mA, or >100 kΩ 0-10 V_{DC}

Temperature Range: 0...180 °F (145 °F for DF-..A..)

Protection: NEMA 4

Dimensions



Order Details (Example: **DF-U1BN06ZLK34**)

| Flow Rate (GPM) | Model | Material Combination | Fitting Type*/Size | Electronic | Analog Output | | |
|-----------------|---------|---|--|---|---------------|--|--------------|
| 0.02...0.14 | DF-U1.. | ..B.. = Polysulfone/ Stainless Steel | ..N06.. = 1/8" NPT ..N08.. = 1/4" NPT | ..ZLK3.. = Electronic ratemeter/totalizer, 24 V _{DC} , 1.5 m cable connection | ..4 = 4-20 mA | | |
| 0.05...0.30 | DF-U2.. | | ..N08.. = 1/4" NPT ..N10.. = 3/8" NPT | | | | |
| 0.05...0.60 | DF-U3.. | ..D.. = Brass | ..N10.. = 3/8" NPT ..N15.. = 1/2" NPT | | | | |
| 0.1...0.7 | DF-U4.. | ..E.. = Stainless Steel | ..N15.. = 1/2" NPT ..N20.. = 3/4" NPT | | | | |
| 0.2...2.5 | DF-U5.. | ..G.. = Brass (1450 PSI) | ..N20.. = 3/4" NPT ..N25.. = 1" NPT | | | | |
| 0.4...5.0 | DF-U6.. | ..H.. = Stainless Steel (1450 PSI) | ..N32.. = 1-1/4" NPT ..N40.. = 1-1/2" NPT | | | | |
| 0.5...6.0 | DF-U7.. | ..P.. = Polysulfone/Brass | | | | ..ZLL3.. = Electronic ratemeter/totalizer, 24 V _{DC} , cable connection (please clearly specify cable length) | ..1 = 0-10 V |
| 0.5...12.0 | DF-U8.. | | | | | | |
| 1.0...25.0 | DF-U9.. | | | | | | |
| 1.5...36.0 | DF-UA.. | | | | | | |

* For G fitting type, substitute R for N



Paddle Wheel Flow Sensors DF-DL - Flowmeter with Batch Controller

Special Features: DF-...DL

- Digital Display: Rate, Totalizing, and Batching
- Subtracting and Adding Totalizer
- Output: 2 SPDT Relays Fully Programmable
1 Batching Relay and 1 Limit Relay
- Output: 0(4)-20 mA or 0-10 V_{DC}

Specifications

| | |
|---------------------------|---|
| Display: | 2x 8-digit, 7-segment LED with fixed decimal place |
| Temperature Range: | -10...180 °F (145 °F for DF-..A..) |
| Protection: | NEMA 4 |
| Wiring: | 5 foot cable, 10-wire (standard) Extended cable (optional) |



Wiring Diagram

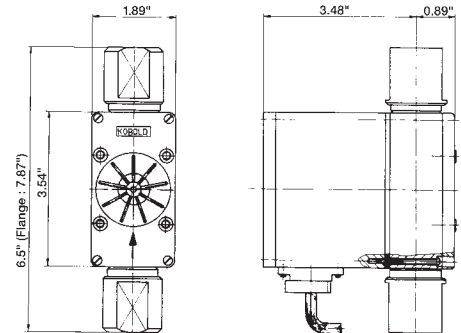
| Wire Number | Function |
|-------------|---------------|
| 1 | + 24 VDC |
| 2 | GND |
| 3 | Analog output |
| 4 | GND |
| 5 | Control 1* |
| 6 | Control 2* |
| 7 | Relay S1 |
| 8 | Relay S1 |
| 9 | Relay S2 |
| 10 | Relay S2 |

* Control 1 <-> GND: Start-batching
Control 2 <-> GND: Stop-batching
Control 1 <-> Control 2 <-> GND: Reset-batching

Specifications

| | |
|----------------------------|--|
| Power Consumption: | 2.4 W max. |
| Power Supply: | 24 V _{DC} , ±20% |
| Contact Rating: | 250 V, 5A |
| Contact Resistance: | <100 mΩ |
| Analog Output: | 0(4)-20 mA |
| Max Load: | 500 Ω, 4-20 mA, or >100 kΩ 0-10 V _{DC} |
| Temperature Range: | 0...180 °F (145 °F for DF-..A..) |
| Protection: | NEMA 4 |

Dimensions



Order Details (Example: DF-U5DN15DLK34)

| Flow Rate (GPM) | Model | Material Combination | Fitting Type*/Size | Electronic | Analog Output |
|-----------------|---------|---|--|---|-----------------------------------|
| 0.02...0.14 | DF-U1.. | ..B.. = Polysulfone/ Stainless Steel | ..N06.. = 1/8" NPT ..N08.. = 1/4" NPT | ..DLK3.. = Batching electronic, 24 V _{DC} 1.5 m cable connection ..DLL3.. = Batching electronic, 24 V _{DC} cable connection (please clearly specify cable length) | ..4 = 4-20 mA ..1 = 0-10 V |
| 0.05...0.30 | DF-U2.. | | ..N08.. = 1/4" NPT ..N10.. = 3/8" NPT | | |
| 0.05...0.60 | DF-U3.. | ..D.. = Brass | | | |
| 0.1...0.7 | DF-U4.. | ..E.. = Stainless Steel | | | |
| 0.2...2.5 | DF-U5.. | ..G.. = Brass (1450 PSI) | ..N10.. = 3/8" NPT ..N15.. = 1/2" NPT | | |
| 0.4...5.0 | DF-U6.. | ..H.. = Stainless Steel (1450 PSI) | ..N15.. = 1/2" NPT ..N20.. = 3/4" NPT | | |
| 0.5...6.0 | DF-U7.. | ..P.. = Polysulfone/Brass | ..N20.. = 3/4" NPT ..N25.. = 1" NPT | | |
| 0.5...12.0 | DF-U8.. | | ..N32.. = 1-1/4" NPT | | |
| 1.0...25.0 | DF-U9.. | | ..N40.. = 1-1/2" NPT | | |
| 1.5...36.0 | DF-UA.. | | | | |

* For G fitting type, substitute R for N