

# DF PADDLE WHEEL FLOW SENSOR



Flow  
Pressure  
Level  
Temperature  
measurement  
monitoring  
control



S4

- $\pm 2.5\%$  of Full Scale Accuracy
- Analog Output
- Easy to Install and Maintain
- Robust and Reliable
- No. Min. Requirements for Straight Inlet and Outlet Pipe
- Low Pressure Drop
- 7 Different Material Combinations Available



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Model:  
DF



### Flow Sensor DF

The main feature of the KOBOLD DF flow sensor is the incorporation of a multipole magnet ring into the paddlewheel. As the paddlewheel rotates, these magnets, hermetically separated from the fluid medium, induce an DC signal in a Hall sensor mounted on the device housing. Since the DC signal frequency is proportional to paddlewheel rotation, an accurate flowrate reading is possible.

The DF sensor, when coupled with the appropriate KOBOLD electronic unit, can offer the user a number of features useful in the measurement and control of fluid flow. These features include an analog output, adjustable switches, batch controller, or totalizer.

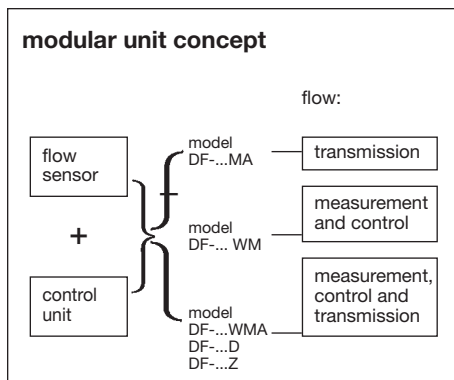
### Specifications

- Accuracy:** ± 2.5% of full scale
- Media:** water and low viscosity liquids
- Orientation:** universal
- Fittings:** 1/8" NPT ... 1 1/2" NPT, flange ANSI 1/2", 1", 1 1/2"
- 7 different material combination:** trogamid, polysulfone, brass, SS, teflon



DF-... with flange

### DF-... with female thread



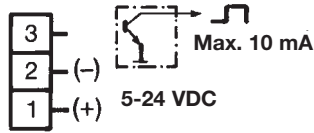
Materials combination	Standard				High Pressure Design	
	I	II / IIB*	III	IV*	VI *	VII *
Connecting type	Female thread	Female thread	Female thread	Female thread flange	Female thread	Female thread flange
Housing	Trogamid	Polysulfone/PP	Brass Nickel-plated	SS	Brass Nickel-plated	SS
Housing lid	Trogamid	Polysulfone/PP	Polysulfone	Polysulfone	Brass Nickel-plated	SS
Connection	Brass Nickel-plated	SS/PP	Brass Nickel-plated	SS	Brass Nickel-plated	SS
Locking pins	Brass	Brass	Brass	-	-	-
O-rings	Buna-N	Viton	Buna-N	Viton	Buna-N	Viton
Paddle wheel	Delrin	Teflon	Delrin	Teflon	Delrin	Teflon
Axle	SS	SS/Ceramic	SS	SS	SS	SS
Axle Bearing	Teflon	Teflon	Teflon	Teflon	Teflon	Teflon
Orifice	Teflon <sup>2</sup>	Teflon <sup>2</sup>	Teflon <sup>2</sup>	Teflon <sup>2</sup>	Teflon <sup>2</sup>	Teflon <sup>2</sup>
Max. operating pressure PSI	145	145/85	230	230	1450	1450 (with flange 580)
Max. operating temperature (°F)	145	180	180	180	180	180

\* Fittings not rotatable <sup>1</sup>for Model DF..01 Titanium <sup>2</sup> for Model DF..01 SS

### 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 (10 mA sinking capability).

### Wiring Diagram



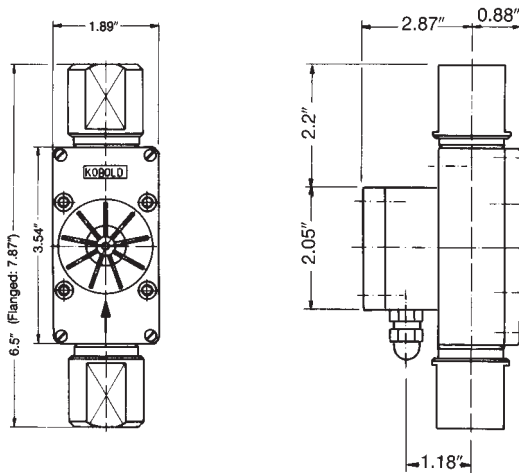
### Specifications

- Power Supply:** + 5 to + 24 VDC
- Open Collector:** + 5 to + 24 VDC, 10 mA max.
- Temperature Range:** -10°F to 180°F (145°F DF-01...)
- Protection:** NEMA 4



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### Dimensions



### Order Numbers

Range water	Stand. conn.	Dia. of Orifice	Press. drop max.	DF Flow Sensor Material Combination							Range Size
				I	II	II B	III	IV	VI	VII	
GPM	NPT	inches	PSI	DF-01..	DF-02..	DF-00..	DF-03..	DF-04..	DF-06..	DF-07..	
0.02- 0.14	1/8"	0.04	10.2								..01
0.05- 0.30	1/4"	0.08	4.2								..02
0.05- 0.60	1/2"	0.08	10.4								..03
0.1 - 0.7	3/4"	0.11	9.6								..04
0.2 - 2.5	1"	0.19	12.1								..05
0.4 - 5	1 1/4"	0.32	2.9								..06
0.5 - 6	1 1/2"	0.32	4.4								..07
0.5 -12	2"	0.49	4.4								..08
1 -25	2 1/2"	0.59	15.9								..09
1.5 -36	3"	0.73	13.5								..10

### Options (add suffix to order number)

Special conn. NPT Suffix "-B"	For flange connection (only material combination IV and VII) Suffix "FL"
1/4"	Inductive pickup with NUMUR output (material comb. I, II, IIB) Suffix "IS" on request
3/8"	
1/2"	
3/4"	
1"	
1 1/2"	
2"	

Note to place an order

1. Select the sensor order no.
2. Select the required suffix

For example: DF-0109B

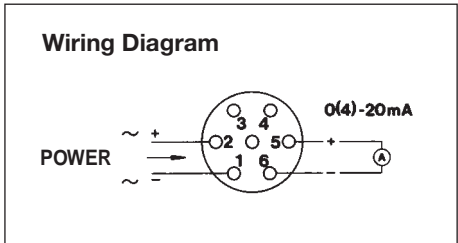
All Sensors will be delivered with calibration certificate

Subject to change without prior notice.



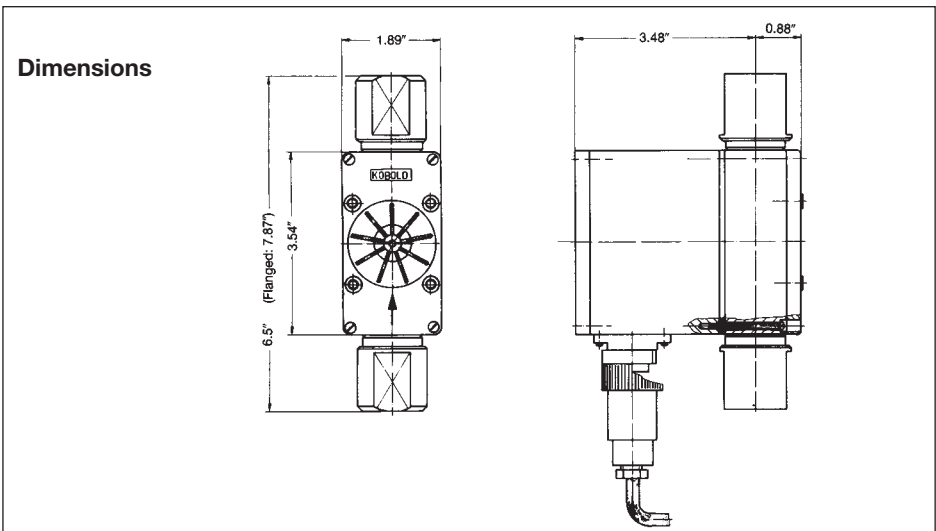
**Electronic DF- ... MA Specifications**

**Power consumption:** 1.5 W max.  
**Power supply:** 24 VDC  
 24, 110 VAC, 230 VAC + 15%/-10%  
**Analog Output:** 0-20 mA, 4-20 mA, 0-5 VDC  
 or 0-10 VDC  
**Load:** 0-500 Ω  
**Temperature range:** -10 to 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 (-)



**DF-...MA Special Features**

- For transmission of measured flow
- Output 0(4)-20 mA



**Order Numbers**

Range water GPM	Stand. conn. NPT	Dia. of Orifice inches	Press. drop max. PSI	DF Flow Sensor Material Combination							Range Size
				I DF-71..	II DF-72..	II B DF-70..	III DF-73..	IV DF-74..	VI DF-76..	VII DF-77..	
0.02- 0.14	1/8"	0.04	10.2								..01
0.05- 0.30	1/8"	0.08	4.2								..02
0.05- 0.60	1/4"	0.08	10.4								..03
0.1 - 0.7	1/4"	0.11	9.6								..04
0.2 - 2.5	3/8"	0.19	12.1								..05
0.4 - 5	1/2"	0.32	2.9								..06
0.5 - 6	3/4"	0.32	4.4								..07
0.5 -12	3/4"	0.49	4.4								..08
1 -25	1 1/4"	0.59	15.9								..09
1.5 -36	1 1/4"	0.73	13.5								..10

**Options (add suffix to order number)**

Special conn. NPT Suffix "-B"	Special Range GPH water Suffix "-L"	
1/4"	1 - 7	
3/8"	3 - 25	
3/8"	3 - 36	
3/8"	6 - 42	
1/2"	12-150	
3/4"	For flange conn. (only material comb. IV & VII)	
1"		Suffix "FL" on request
1 1/2"		

- S 1	0-20 mA Output
- S 2	4-20 mA Output
- S 3	0-10 VDC
- S 4	0-5 VDC

Suffix "P"	Plug connector with Plug
- P 01	Power Supply 24 VDC
- P 02	Power Supply 24 VAC
- P 03	Power Supply 110 VAC
- P 04	Power Supply 230 VAC
-	Calibration Test Certificate

**DF-K Special Features**

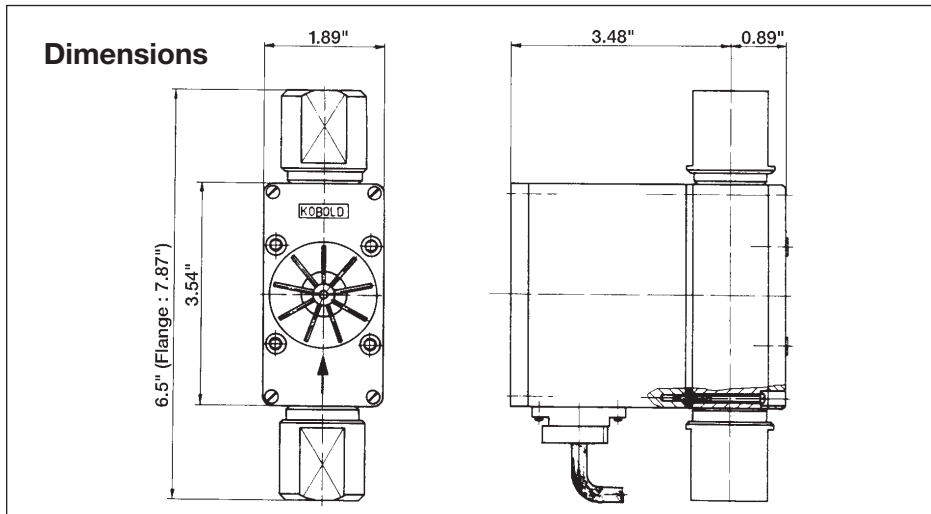
- Compact Design
- Digital Flow Rate Indication
- Analog Transmission of Flow Rate
- Two limit switches for Flow Control

**Physical Description**

**Display:** 3-Digit, 7-Segment LED with fixed decimal place  
**Temperature Range:** -10 °F to 180 °F  
**DF4100:** -10 °F to 145 °F  
**Protection:** NEMA 4  
**Wiring:** 5 foot pigtail

**Electrical Specifications**

**Power Supply**  
**Voltage:** 24 VDC, +15%/-10%  
**Consumption:** 5 Watts  
**Analog Output**  
**Current:** 0-20 mA, 4-20 mA  
 Load: 0-500 ohm  
**Voltage:** 0-10 VDC, 0-5 VDC  
 Load: > 500 kohm  
**Relays:** 2 SPDT: 1 Minimum  
 1 Maximum  
**Rating:** 2 Amps @ 24 Volts  
**Hysteresis:** 2.5% of full scale  
**Set Points:** Front Panel Adjustable



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Order Numbers											
Range Water	Standard Fitting	Dia. of Orifice	Max. Pressure Drop PSI	DF Flow Sensor with Model K Electronics Material Combinations							
				I	II	IIB	III	IV	VI	VII	
0.02- 0.14	1/8"	0.04	10.2	DF-4101	DF-4201	DF-4001	DF-4301	DF-4401	DF-4601	DF-4701	
0.05- 0.30	1/4"	0.08	4.2	DF-4102	DF-4202	DF-4002	DF-4302	DF-4402	DF-4602	DF-4702	
0.05- 0.60	1/4"	0.08	10.4	DF-4103	DF-4203	DF-4003	DF-4303	DF-4403	DF-4603	DF-4703	
0.1 - 0.7	1/4"	0.11	9.6	DF-4104	DF-4204	DF-4004	DF-4304	DF-4404	DF-4604	DF-4704	
0.2 - 2.5	3/8"	0.19	12.1	DF-4105	DF-4205	DF-4005	DF-4305	DF-4405	DF-4605	DF-4705	
0.4 - 5	1/2"	0.32	2.9	DF-4106	DF-4206	DF-4006	DF-4306	DF-4406	DF-4606	DF-4706	
0.5 - 6	3/4"	0.32	4.4	DF-4107	DF-4207	DF-4007	DF-4307	DF-4407	DF-4607	DF-4707	
0.5 -12	3/4"	0.49	4.4	DF-4108	DF-4208	DF-4008	DF-4308	DF-4408	DF-4608	DF-4708	
1 -25	1 1/4"	0.59	15.9	DF-4109	DF-4209	DF-4009	DF-4309	DF-4409	DF-4609	DF-4709	
1.5 -36	1 1/4"	0.73	13.5	DF-4110	DF-4210	DF-4010	DF-4310	DF-4410	DF-4610	DF-4710	

Options	
Add Suffix to Model#	
Larger Fittings Suffix »-B«	GPH Scale Suffix »-L«
1/4"	1 - 7
3/8"	3 -25
3/8"	3 - 36
3/8"	6 - 42
1/2"	12 - 150
3/4"	Flanges for Material IV and VII on request
1"	
1 1/2"	
1 1/2"	Suffix »-FL«

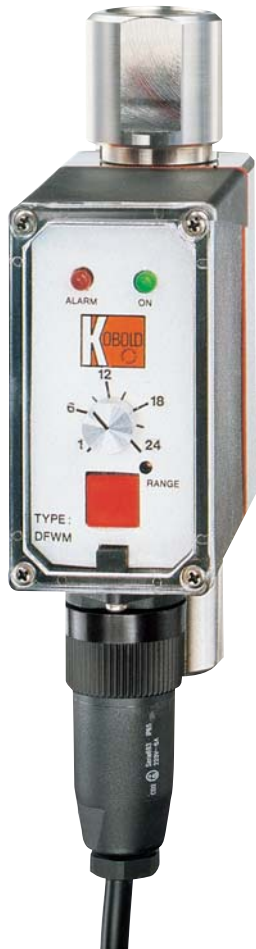
Output Options	
Description	Add Suffix to Model#
0-20 mA Current Output	-S1
4-20 mA Current Output	-S2
0-10 VDC Voltage Output	-S3
0-5 VDC	-S4

**To Place an Order:**

1. Select the desired sensor wetted parts material combination.
2. Select the required sensor range.
3. The order number for your selection is found at the intersection of the »Range« row and »Material Combination« column.
4. Add the required fitting or scale option suffix found in the »Options« table on the right.
5. Add the required analog output suffix found in the lower left »Output Options« table.

**For Example:**

DF-4205-B-S3 for 2.5 GPM polysulfone sensor with 1/2" NPT fittings & 0-10 VDC output.



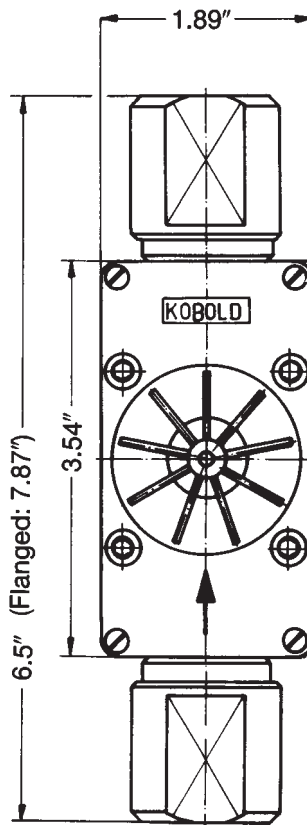
**DF-...WM Special Features**

- Adjustable limit contact for flow control
- Push-button alarm override switch and potentiometer with scale for indirect flow measurements

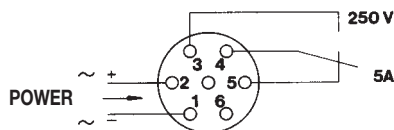
**Specifications**

**Power consumption:** 1.5 W max.  
**Power supply:** 24 VDC  
 24, 110 VAC, 230 VAC + 15%/-10%  
**Switching rating:** 250 V max./5A  
**Resistance =** < 100 Ω  
**Temperature range:** -10 to 180°F  
 (145°F for DF 81..)  
**Cable connections:** (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**



**Electronic DF-...WM**

**Order Numbers**

Range water GPM	Stand. conn. NPT	Dia. of Orifice inches	Press. drop max. PSI	DF Flow Sensor Material Combination							Range Size
				I DF-81..	II DF-82..	II B DF-80..	III DF-83..	IV DF-84..	VI DF-86..	VII DF-87..	
0.02- 0.14	1/8"	0.04	10.2								..01
0.05- 0.30	1/4"	0.08	4.2								..02
0.05- 0.60	1/4"	0.08	10.4								..03
0.1 - 0.7	1/4"	0.11	9.6								..04
0.2 - 2.5	3/8"	0.19	12.1								..05
0.4 - 5	1/2"	0.32	2.9								..06
0.5 - 6	3/4"	0.32	4.4								..07
0.5 -12	3/4"	0.49	4.4								..08
1 -25	1 1/4"	0.59	15.9								..09
1.5 -36	1 1/4"	0.73	13.5								..10

**Options  
(add suffix to order number)**

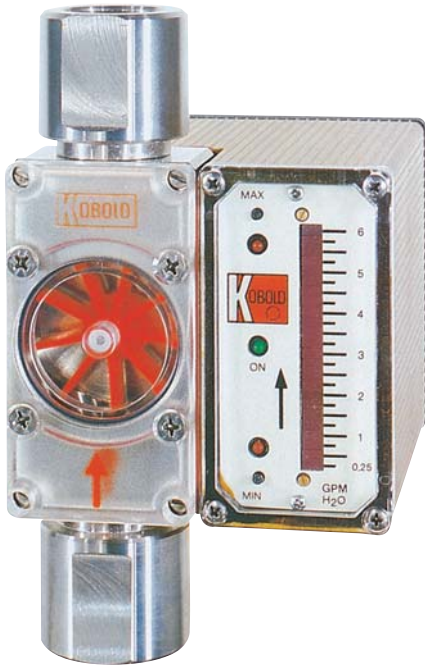
Special conn. NPT Suffix "-B"	Special range GPH water Suffix "-L"
1/4"	1 - 7
3/8"	2 -25
3/8"	3 -40
3/8"	2.5-60
1/2"	For flange connection
3/4"	(only material comb. IV & VII)
1"	<b>Suffix "FL"</b>
1 1/2"	<b>on request</b>
1 1/2"	

Note: To place an order

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

For example: DF-8109 BP01

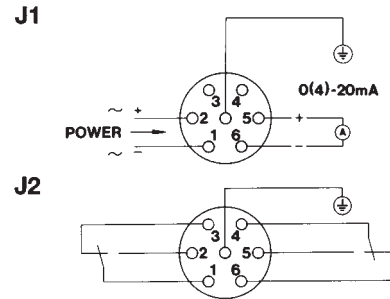
Suffix "P"	Plug connection with Plug
- P 01	Power Supply 24 VAC
- P 02	Power Supply 24 VAC
- P 03	Power Supply 110 VAC
- P 04	Power Supply 230 VAC



**DF-...WMA Special Features**

- For continuous measurement and control of flow
- 2 limit value relays
- Output 0(4)-20 mA
- Integrated LED bar indicator

**Wiring Diagram**

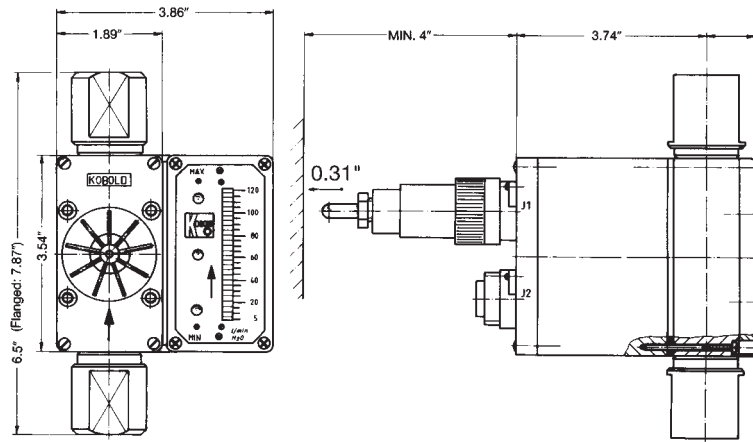


**Electronic DF-...WMA**

**Specifications**

**Power Consumption:** 3.6 W max.  
**Power Supply:** 24 VDC, 24, 110, 230 VAC + 15%/-10%  
**Switch Rating:** 250 V max./5A  
**Resistance:** <200 MΩ  
**Analog Output:** 0(4)-20 mA  
**Load:** 0-300 Ω  
**Temperature Range:** 10 to 180°F (145°F for DF 91..)  
**Electric Connection:** Two plug connectors incl.  
**Electric Protection:** NEMA 4

**Dimensions**



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**Order Numbers**

Range water	Stand. conn.	Dia. of Orifice	Press. drop max.	DF Flow Sensor Material Combination							Range Size
				I	II	II B	III	IV	VI	VII	
GPM	NPT	inches	PSI	DF-91..	DF-92..	DF-90..	DF-93..	DF-94..	DF-96..	DF-97..	
0.02- 0.14	1/8"	0.04	10.2								.01
0.05- 0.30	1/4"	0.08	4.2								.02
0.05- 0.60	1/4"	0.08	10.4								.03
0.1 - 0.7	1/4"	0.11	9.6								.04
0.2 - 2.5	3/8"	0.19	12.1								.05
0.4 - 5	1/2"	0.32	2.9								.06
0.5 - 6	3/4"	0.32	4.4								.07
0.5 -12	3/4"	0.49	4.4								.08
1 -25	1 1/4"	0.59	15.9								.09
1.5 -36	1 1/4"	0.73	13.5								.10

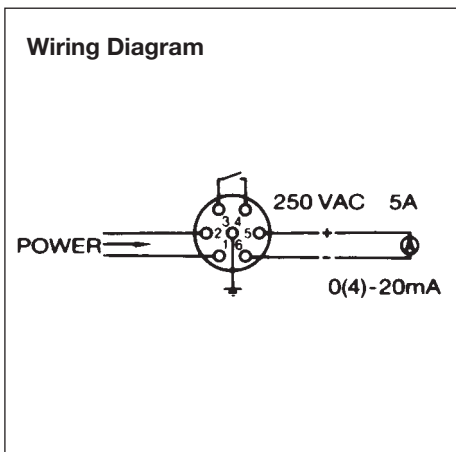
**Options (add suffix to order number)**

Special conn. NPT Suffix "-B"	Special Range GPH water Suffix "-L"
1/4"	1 - 7
3/8"	3 - 25
3/8"	3 - 36
3/8"	2.5- 60
1/2"	
3/4"	For flange conn. (only material comb. IV & VII) Suffix "FL" on request
1"	
1"	
1 1/2"	
1 1/2"	

\* not with 1 1/2" connection    \*\* not available

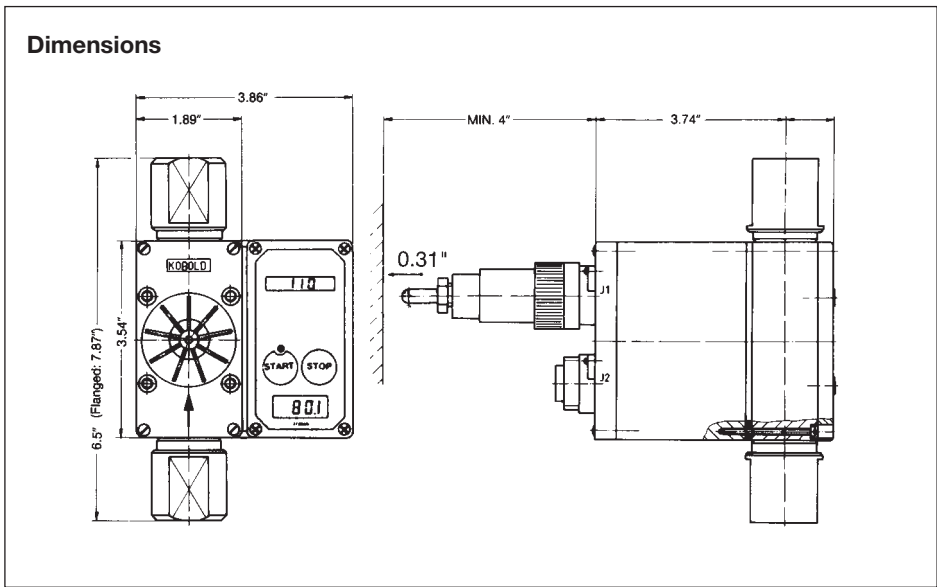
- S 1	0-20 mA Output
- S 2	4-20 mA Output

- P 01	Power Supply 21 VAC
- P 02	Power Supply 24 VAC
- P 03	Power Supply 110 VAC
- P 04	Power Supply 230 VAC
-	Calibration Test Certificate



### Specifications

- Power Consumption:** 5 W Max.
- Power Supply:** 24 VDC, 24, 110, 230 VAC + 15%/-10%
- Switch Rating:** 250 V, 5A
- Resistance:** <100 mΩ
- Analog Output:** 0(4)-20 mA
- Load:** 0-500 Ω
- Temperature Range:** 0°F to 180°F (145°F for DF 61..)
- Protection:** NEMA 4



### DF...Z Special Features

- 30-Digit LED Rate of Flow Indicator
- 6-Digit LED Resettable Counter
- 0(4)-20 mA Analog Output
- Relay Output

Order Numbers											
Range water	Stand. conn.	Dia. of Orifice	Press. drop max.	DF Flow Sensor Material Combination							Range Size
				I DF-61..	II DF-62..	II B DF-60..	III DF-63..	IV DF-64..	VI DF-66..	VII DF-67..	
GPM	NPT	inches	PSI								
0.02- 0.14	1/8"	0.04	10.2								..01
0.05- 0.60	1/4"	0.08	10.4								..03
0.2 - 2.5	3/8"	0.19	12.1								..05
0.5 - 6	3/4"	0.32	4.4								..07
1.5 -36	1 1/4"	0.73	13.5								..10

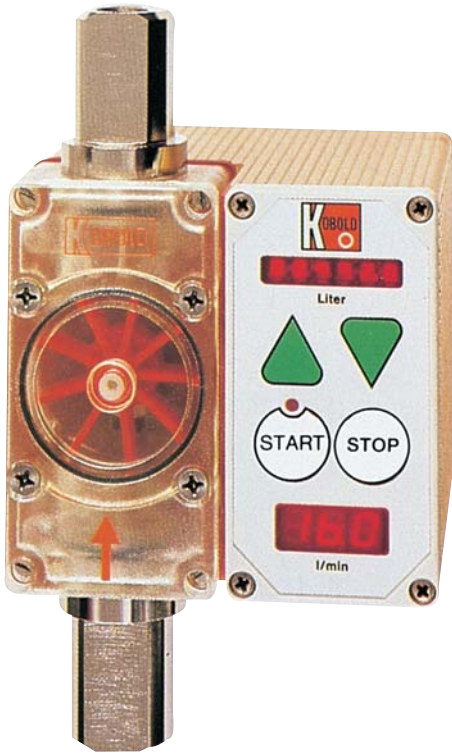
Options (add suffix to order number)	
Special conn. NPT Suffix "-B"	
1/4"	For flange connection (only material comb. IV & VII) Suffix "FL" on request
3/8"	
1/2"	
1"	
1 1/2"	on request

- S 1	0-20 mA Output
- S 2	4-20 mA Output

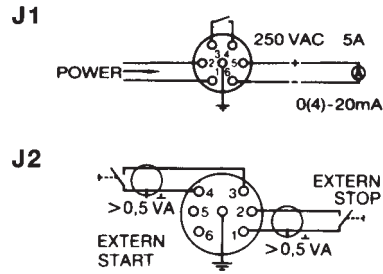
- P 13	Power Supply 110 VAC
- P 14	Power Supply 230 VAC

- 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 analog output suffix.

For example: DF-6103BP01S2



**Wiring Diagram**

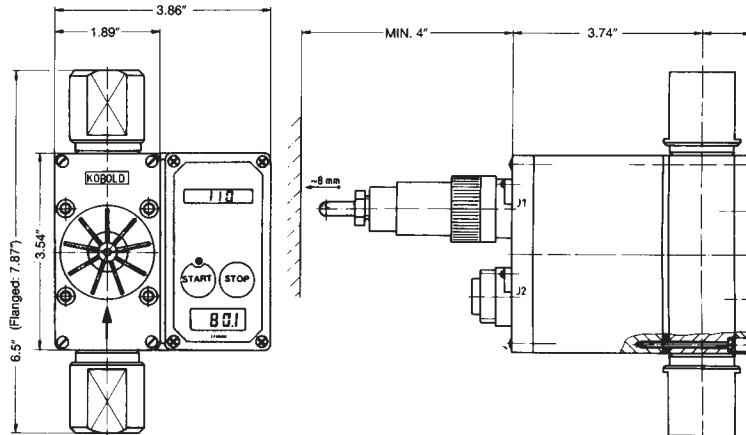


(J2) only for Model DF-D with remote operation

**Specifications**

- Power Consumption:** 5 W Maximum
- Power Supply:** 24 VDC, 24, 110, 230 VAC + 15%/-10%
- Switch Rating:** 250 V, 5A
- Resistance:** <100 m Ω
- Analog Output:** 0(4)-20 mA
- Load:** 0-500 Ω
- Temperature range:** 0°F to 180°F (145°F for DF 51..)
- Protection:** NEMA 4

**Dimensions**



**DF-...D Special Features**

- Batch Controller Relay
- 3-Digit LED Rate of Flow Indicator
- 6-Digit LED Batch Counter
- 0(4)-20 mA Analog Output
- Optional remote Start/Stop

**Order Numbers**

Range water	Stand. conn.	Dia. of Orifice	Press. drop max. PSI	DF Flow Sensor Material Combination							Range Size	
				I DF-51..	II DF-52..	II B DF-50..	III DF-53..	IV DF-54..	VI DF-56..	VII DF-57..		
0.02- 0.14	1/8"	0.04	10.2									.01
0.05- 0.60	1/4"	0.08	10.4									.03
0.2 - 2.5	3/8"	0.19	12.1									.05
0.5 - 6	3/4"	0.32	4.4									.07
1.5 -36	1 1/4"	0.73	13.5									.10

**Options (add suffix to order number)**

Special conn. NPT Suffix "-B"	
1/4"	For flange connection (only material comb. IV & VII) Suffix "FL" on request
3/8"	
1/2"	
1"	
1 1/2"	on request

- S 1	0-20 mA Output
- S 2	4-20 mA Output

Suffix "R"	Remote Start/Stop
- P 13	Power Supply 110 VAC
- P 14	Power Supply 230 VAC

Note: To place an order:

1. Select the sensor order no.
2. Select the desired option suffixes.
3. Specify the required power supply: 110 suffix
4. Specify the required analog output suffix

For example: DF-5107BP01S2

Subject to change without prior notice.

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### DF-Z Series Totalizer Functions and Error Codes



**Starts totalizing**

If the >START< key is pressed after a fault, the current totalizer reading is displayed and totalizing continues from the displayed value. The red LED is lit during totalizing.



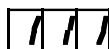
Resets the counter to >>000000<<<. Optionally, the >RESET< key can be disabled at the factory; the totalizer cannot be reset to ZERO after that.

**Fault signals**

Faults are indicated by a **flashing flowrate** display.

**Power Failure**

The output relay drops out upon power failure. Totalizing is interrupted and the last value displayed in the counter is saved.



When power has been restored totalizing can be continued by pressing the >START<key; it can be reset by pressing the >RESET< key and then restarted.

**Overrange**

Should the measuring range be exceeded by more than 20%, serious measuring errors can occur. The output relay drops out.



The last value displayed in the counter is stored.

When the flow rate has been reduced, totalizing can be continued by pressing the >START< key; the totalizer can be reset by pressing the >RESET< key and restarted.

### DF-D Series Batch Controller Functions and Error Codes



**Starts the batching sequence**

The output relay closes, until the pre-selected quantity has been batched. The red LED is lit during batching.

If the >START< key is pressed after a fault, the quantity already batched is displayed and batching continues from the displayed value.



**Stops the batching sequence**

The output relay opens. The display shows the quantity already batched.

Continue batch with >START< or reset to the initial batch amount with the >SET<keys.



**Adjusting the batch quantity**

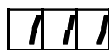
Press to adjust the batch amount.

**Fault signals**

Faults are indicated by a **flashing flowrate** display.

**Power Failure**

The output relay drops out upon power failure. Batch is interrupted and the quantity already batched is stored. When power has



been restored, batching can be continued by pressing the >START<key.

**Overrange**

Should the measuring range be exceeded by more than 20%, serious measuring errors can occur. The output relay drops out.



The quantity already batched is stored.

When the flow rate has been reduced, batching can be continued by pressing the >START< key.