



Series PFT Paddlewheel Flow Sensor

Specifications - Installation and Operating Instructions



The **Series PFT** is a paddlewheel flow sensor used to monitor liquid flow rates in pipes from 1-1/2 to 40" with one size adjustable sensor. A square wave output signal is generated with frequency proportional to flow velocity.

OPERATING PRINCIPLE

The PFT uses inductive sensing to sense the blades of the impeller as they rotate. Sensor technology does not use magnets allowing low flow rate monitoring and no concerns with magnetic material in the flow.

INSTALLATION

Ensure that the process fluid is compatible with the wetted materials, and do not exceed the maximum device ratings.



Ensure that the system is not pressurized before installing or removing this device or other objects from the system. The device and/or object may become a projectile.

Fitting Position

Bubbles, turbulence, and sediments will cause improper operation. For best operation, mount 30° to 150° off vertical on horizontal runs (See Figure 1). Allow a straight run of at least 10 pipe diameters upstream and 5 pipe diameters downstream to insure optimal flow measurement. See Table 1 for recommendations for other mounting requirements.

Upstream Item	Upstream Diameters Needed
Flange	10
Reducer	15
Valve/Pump	50
90° Elbow	20

Table 1: Fitting Location

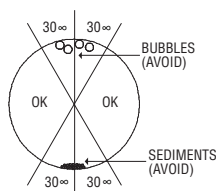
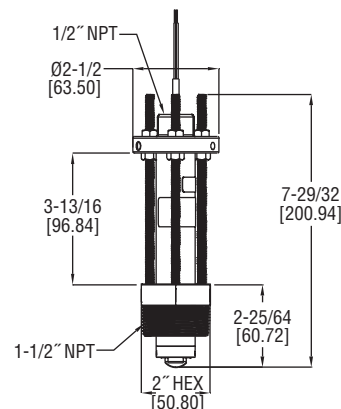


Figure 1: Mounting Orientation

**SPECIFICATIONS**

Service: Water-based fluids.

Range: 1.2 to 25 ft/s (0.37 to 7.62 m/s).

Wetted Materials: Body and fitting: brass or 316 SS; fitting o-ring: FKM standard, silicone or Buna-N optional; impeller: 316 SS; shaft: tungsten carbide standard or 316 SS optional; bearing: PTFE standard, carbon graphite optional.

Linearity: ±1.0% of full range.

Repeatability: ±0.5% of full range.

Temperature Limits: -40 to 212°F (-40 to 100°C).

Pressure Limits: 400 psig (27.6 bar) @ 100°F (37.8°C), 325 psig (22.4 bar) @ 212°F (100°C).

Process Connection: 1-1/2" NPT male standard, 2" NPT male optional.

Output:

Pulse: NPN open collector with square wave output, rated 60 V @ 50 mA maximum. Frequency: 3.2 to 200 Hz. Pulse Width: 2.5 msec ±25%.

4 to 20 mA: 4 mA is 0 ft/s, 20 mA is 25 ft/s.

Power Requirement: 10 to 35 VDC.

Power Consumption: 40 mA (max.).

Electrical Connection: 22 AWG shielded UL type PTLC rated 105°C, 20' (6.1 m) long with cable gland. Can be extended up to 2000' (609 m) with similar cable. Optional UL listed burial rated cable.

Enclosure Rating: NEMA 6P (IP67).

Housing Materials: Brass or 316 SS.

Weight: 3 lb.

Agency Approvals: CE.

Connecting Sensor to Fitting

It is recommended to use a weld-on or saddle female fitting with 1-1/2" or 2" NPT connection depending on sensor model. Use proper pipe sealant on sensor threads. When threading the sensor into the fitting use the wrench flats on the bottom of the housing to prevent damage to the sensor.

The sensor must be aligned with the direction of flow. On the side of the sensor body is a hole for the included alignment rod. Insert the supplied alignment rod into the alignment hole (Do not turn the alignment rod to loosen the screw in the alignment hole). When threading the sensor into the fitting make sure that when the rod is inserted into the hole it is pointing downstream in the direction of flow. Try to line it up as best as can be done. If the sensor is off slightly once threaded into the fitting then the sensor can be rotated in the housing during final installation but adjustment is only $\pm 60^\circ$.

Sensor Height

The sensor must be installed so that the impeller shaft is located 10% inside the pipe ID. To install properly the sensor install height, "H" shown in Figure 2, must be figured and used. Table 2 in this instruction manual has "H" dimensions for standard pipe materials and sizes.

If your application pipe is not listed in Table 2 it will need to be calculated with the following procedure:

1. Using a ruler measure the pipe ID and the pipe wall thickness.

Pipe Wall Thickness: _____ Pipe ID: _____

2. Use the following equation to figure "H":

$$H = 5.85 - \text{Pipe Wall Thickness} - (0.10 \times \text{Pipe ID})$$

$$H = \underline{\hspace{2cm}}$$

Once "H" is known from the chart or from the equation adjust the sensor so that "H" is the distance from the bottom of the flange to the top of the pipe. The insertion height of the sensor is adjustable by loosening the top and bottom nuts holding the flange and then moving the sensor by the flange up or down as needed.

Final Sensor Alignment

The sensor must be aligned with the direction of flow. Insert the supplied alignment rod into the hole in the side of the sensor. The hole should be roughly in line based on installing the sensor into the fitting earlier. To make final adjustments loosen the three 3/32" set screws around the flange, the supplied alignment rod can be used with these screws. With the alignment rod in the alignment hole the sensor can now be rotated $\pm 60^\circ$ (Do not turn the alignment rod to loosen the screw in the alignment hole). Once final alignment is made tighten the screws in the flange and tighten the height adjustment nuts.

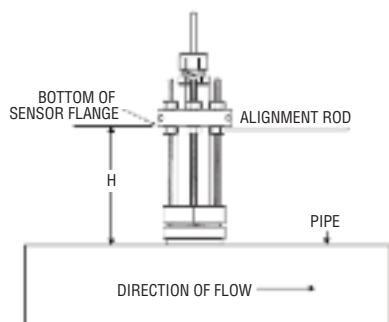


Figure 2: Sensor Install Height

CALIBRATION TABLES

The PFT uses K factors for calibration. See Table 2 in this instruction manual for K factors based on pipe type and size used in the application.

For 4-20 mA output version use the following equation to convert to flow rate.

$$q = (I-4) \times K$$

Nomenclature:

q = Liquid volumetric flow rate

I = Transmitted mA output

K = K - factor. If use GPM/mA then q will be in U.S. GPM. If use LPM/mA then q will be in LPM.

ELECTRICAL CONNECTION

Pulse Output Wiring

The PFT has a NPN open collector output. The output rating is 60V @ 50 mA maximum. Typical wiring to a PLC or counter is shown in Figure 3 and Figure 4. When wiring to a counter, select the Power Supply voltage and Dropping Resistor according to the counter's instructions and make sure the Power Supply is within the 10-35 VDC specification of the PFT.

To insure noise immunity, wire the shield conductor to an earth ground.

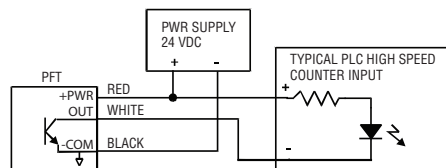


Figure 3

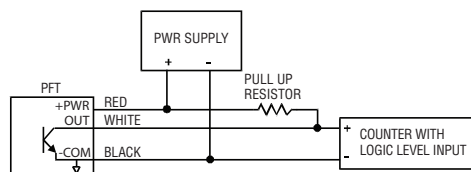


Figure 4

The PFT can also be wired in a two-wire pulse output, 600 μ A / 40 mA configuration with the red and black leads only to replace competitor units. Unit needs 600 μ A of power and produces 40 mA 2.5 ms pulses. Consult factory for details.

4-20 mA Output Wiring

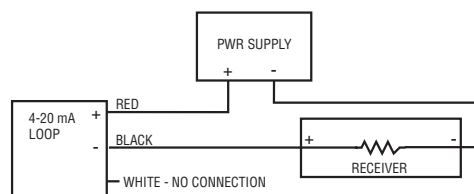


Figure 5

AGENCY APPROVALS AND TEST STANDARDS

CE: CENELEC EN 55011: 2006

CENELEC EN 61326-1: 2006

IEC 61000-4-2: 2008

IEC 61000-4-3: 2006

IEC 61000-4-4: 2004

IEC 61000-4-5: 2005

IEC 61000-4-6: 2006

CENELEC EN 55022: 2006

2004/108/EC EMC DIRECTIVE

Note: For 4-20 mA output models only under the 10 V/M RF field as specified in IEC 61000-4.3, linearity may be as high as $\pm 3.7\%$. Under normal ambient conditions linearity is $\pm 1\%$.

MAINTENANCE & REPAIR

Inspect and clean wetted parts at regular intervals. Disassembly or modifications made by the user will void the warranty and could impair the continued safety of the product. If repair is required obtain a Return Goods Authorization (RGA) number and send the unit, freight prepaid, to the address below. Please include a detailed description of the problem and conditions under which the problem was encountered.

Dwyer Instruments, Inc.
Attn: Repair Department
102 Indiana Hwy 212
Michigan City, IN 46360

PARTS

P-PFT-KITA: Contains impeller, PTFE bearings, cage bearing set screws, tungsten carbide shaft

P-PFT-KITB: Contains impeller, PTFE bearings, cage bearing set screws, 316SS shaft

Table 2: "H" Dimension and K Factor

Sch 40 Plastic Pipe Per ASTM-D-1785

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.537	56.55	14.941	9.691	36.68
2	5.482	38.16	10.082	16.05	60.76
2.5	5.391	28.37	7.495	24.57	93.01
3	5.317	18.09	4.779	35.38	133.9
3.5	5.258	13.25	3.501	47.38	179.4
4	5.199	10.07	2.661	61.12	231.5
5	5.075	6.13	1.620	96.25	364.4
6	4.950	4.07	1.075	139.1	526.6
8	4.715	2.20	0.581	241.3	913.4
10	4.465	1.32	0.349	380.6	1441
12	4.231	0.89	0.235	540.6	2046

Sch 80 Plastic Pipe Per ASTM-D-1785

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.490	63.36	16.740	8.330	31.53
2	5.428	43.23	11.421	13.99	52.96
2.5	5.328	32.31	8.536	20.04	75.86
3	5.246	20.53	5.424	31.37	118.8
3.5	5.180	14.97	3.955	42.30	160.1
4	5.114	11.33	2.993	54.81	207.5
5	4.975	6.85	1.810	86.89	328.9
6	4.821	4.60	1.215	120.7	457.0
8	4.564	2.45	0.647	218.8	828.3
10	4.272	1.47	0.388	344.5	1304
12	3.993	1.00	0.264	487.7	1846

Sch 5S Stainless Steel Pipe Per ANSI B36.19

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.608	47.36	12.513	11.98	45.35
2	5.560	31.98	8.449	19.27	72.95
2.5	5.496	23.03	6.085	29.00	109.8
3	5.434	14.90	3.937	42.38	160.4
3.5	5.384	11.03	2.914	56.21	212.8
4	5.334	8.45	2.232	71.83	271.9
5	5.206	5.33	1.408	109.2	413.4
6	5.100	3.56	0.941	157.0	594.3
8	4.900	1.94	0.513	270.3	1023
10	4.668	1.18	0.312	420.1	1590
12	4.450	0.80	0.211	591.6	2239
14	4.325	0.65	0.172	716.5	2712
16	4.118	0.48	0.127	939.0	3555
18	3.918	0.37	0.098	1194	4520
20	3.700	0.30	0.079	1473	5576
22	3.500	0.24	0.063	1788	6768
24	3.276	0.20	0.053	2123	8036

Sch 10S Stainless Steel Pipe Per ANSI B36.19

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.573	51.64	13.643	10.82	40.96
2	5.525	34.55	9.128	17.82	67.46
2.5	5.467	24.38	6.441	26.55	100.50
3	5.404	15.63	4.129	40.64	153.84
3.5	5.354	11.51	3.041	54.06	204.6
4	5.304	8.77	2.317	69.39	262.7
5	5.187	5.44	1.437	107.3	406.2
6	5.080	3.62	0.956	154.5	584.8
8	4.869	1.98	0.523	265.3	1004
10	4.643	1.19	0.314	415.2	1572
12	4.431	0.81	0.214	587.0	2222
14	4.300	0.66	0.174	709.8	2687
16	4.100	0.48	0.127	933.5	3534
18	3.900	0.37	0.098	1188	4497
20	3.676	0.30	0.079	1464	5542
22	3.476	0.24	0.063	1778	6731
24	3.250	0.20	0.053	2112	7995

Sch 40S Stainless Steel Pipe Per ANSI B36.19

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.544	55.45	14.650	9.91	37.51
2	5.489	37.47	9.900	16.34	61.85
2.5	5.400	27.82	7.350	23.31	88.24
3	5.327	17.77	4.695	35.99	136.2
3.5	5.269	13.04	3.445	48.14	188.2
4	5.210	9.92	2.621	61.98	234.6
5	5.087	6.05	1.598	97.40	368.7
6	4.964	4.02	1.062	140.7	532.6
8	4.730	2.18	0.576	243.6	922.1
10	4.483	1.30	0.343	383.9	1453
12	4.250	0.88	0.232	621.6	2353
14	4.100	0.71	0.188	658.6	2493
16	3.850	0.53	0.140	860.4	3257
18	3.600	0.41	0.108	1089	4122
20	3.375	0.32	0.085	1353	5122
24	2.900	0.22	0.058	1957	7408

Sch 80S Stainless Steel Pipe Per ANSI B36.19

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/ma	K-FACTOR LPM/ma
1.5	5.500	61.86	16.343	4.626	17.50
2	5.438	42.19	11.147	14.38	54.43
2.5	5.342	31.41	8.299	20.64	78.13
3	5.260	20.00	5.284	32.16	121.7
3.5	5.196	14.61	3.860	43.27	163.8
4	5.130	11.08	2.927	55.97	211.9
5	4.994	6.71	1.773	88.58	335.3
6	4.842	4.51	1.192	126.9	480.4
8	4.588	2.41	0.637	222.3	841.5
10	4.300	1.45	0.383	349.6	1323
12	4.025	0.98	0.259	494.7	1973
14	3.850	0.79	0.209	597.5	2262
16	3.575	0.59	0.156	783.2	2965
18	3.300	0.45	0.119	994.1	3763
20	3.025	0.36	0.095	1230	4656
22	2.750	0.29	0.077	1492	5648
24	2.575	0.24	0.063	1778	6731

Sch 40 Wrought Steel Pipe Per ANSI B36.10

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/mA	K-FACTOR LPM/mA
1.5	5.544	55.45	14.650	9.91	37.51
2	5.489	37.47	9.900	16.34	61.85
2.5	5.400	27.82	7.350	23.31	88.24
3	5.327	17.77	4.695	35.99	136.2
3.5	5.269	13.04	3.445	48.14	188.2
4	5.210	9.92	2.621	61.98	234.6
5	5.087	6.05	1.598	97.40	368.7
6	4.964	4.02	1.062	140.7	532.6
8	4.730	2.18	0.576	243.6	922.1
10	4.483	1.30	0.343	383.9	1453
12	4.250	0.88	0.232	621.6	2353
14	4.100	0.71	0.188	658.6	2493
16	3.850	0.53	0.140	860.4	3257
18	3.600	0.41	0.108	1089	4122
20	3.375	0.32	0.085	1353	5122
24	2.900	0.22	0.058	1957	7408

Sch 80 Wrought Steel Pipe Per ANSI B36.10

Pipe Size	Height "H"	Pulse Output		Current Output	
		K-FACTOR PULSES/ U.S. Gallon	K-FACTOR PULSES/LITER	K-FACTOR GPM/mA	K-FACTOR LPM/mA
1.5	5.500	61.86	16.343	4.626	17.50
2	5.438	42.19	11.147	14.38	54.43
2.5	5.342	31.41	8.299	20.64	78.13
3	5.260	20.00	5.284	32.16	121.7
3.5	5.196	14.61	3.860	43.27	163.8
4	5.130	11.08	2.927	55.97	211.9
5	4.994	6.71	1.773	88.58	335.3
6	4.842	4.51	1.192	126.9	480.4
8	4.588	2.41	0.637	222.3	841.5
10	4.300	1.45	0.383	349.6	1323
12	4.025	0.98	0.259	494.7	1973
14	3.850	0.79	0.209	597.5	2262
16	3.575	0.59	0.156	783.2	2965
18	3.300	0.45	0.119	994.1	3763
20	3.025	0.36	0.095	1230	4656
22	2.750	0.29	0.077	1492	5648
24	2.575	0.24	0.063	1778	6731