

Liquid Flow Switches

The flow of liquids in pipelines plays an important role in industry and commerce. Under most circumstances it is essential to know whether or not there is a flow in a pipeline, and to act upon that knowledge. That is the reason for, and the function of, McDonnell & Miller Flow Switches.

A complete line of Liquid Flow Switches has been developed for a wide range of applications and literally hundreds of uses, including:

- Air Conditioning
- Hot Water Space Heating Systems
- Hot Water Supply Systems
- Pump Systems
- Water Cooled Equipment
- Blending or Additive Systems
- Liquid Transfer Systems
- Fire Sprinkler Systems
- Water Treatment Systems
- Swimming Pool Chlorination
- Industrial Laser Coolant System

Flow Switches	NEMA Enclosure
All Models	Type 1—General purpose indoor
FS1W, FS6W FS7-4W, FS8W	Type 4X—Watertight, Dust tight and Corrosion resistant
FS7-4E	Type 7—Hazardous Location (Class 1—Group C or D) Type 9—Hazardous Location (Class 2—Group E, F or G)

Models FS74E, FS74SE Flow Switches are Underwriters Laboratories Inc. Listed for use in these hazardous locations:

Class I, Division I, Group C – Atmospheres containing ethylether vapors, ethylene or cyclopropane.

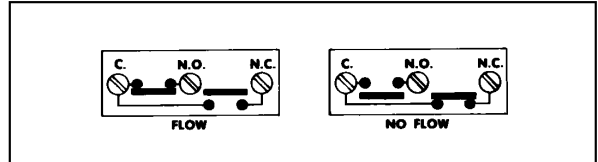
Class I, Division I, Group D – Atmospheres containing gasoline, petroleum, naphtha, benzene, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors or natural gas.

Class II, Division I, Group E – Atmospheres containing dust of aluminum, magnesium or their commercial alloys.

Class II, Division I, Group F – Atmospheres containing carbon black, coal or coke dust.

Class II, Division I, Group G – Atmospheres containing flour, starch or grain dusts.

Note: For other listings contact the factory.

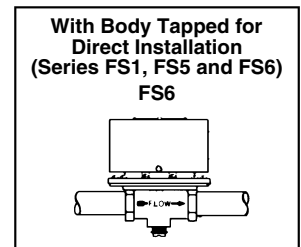
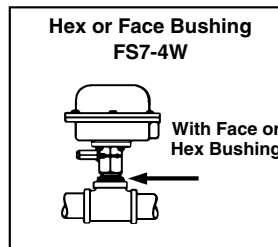
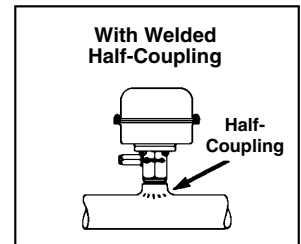
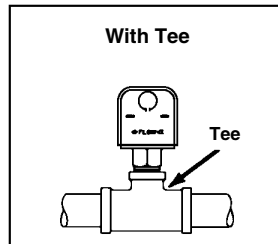


In the tables of flow rates included in this catalog the word “Flow” means that switch will close one circuit and open the other, when flow rate is increased to the rate shown.

The words “No-Flow” mean the switch will reverse position—open first circuit and close the second—when flow rate is decreased to the rate shown.

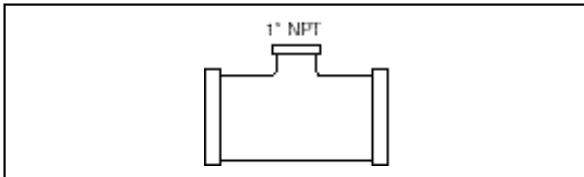
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Mounting Methods

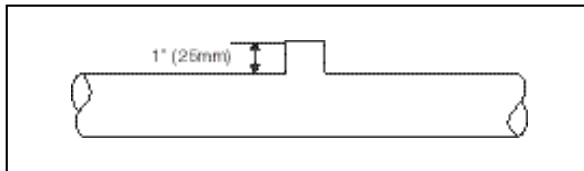


Flow Switch Installation

For best operation, the paddle type flow switches should be installed in a horizontal pipe in the upright position. They should be installed in a threaded pipe tee on 2" or smaller pipe or a welded half coupling when installing on larger welded pipe.



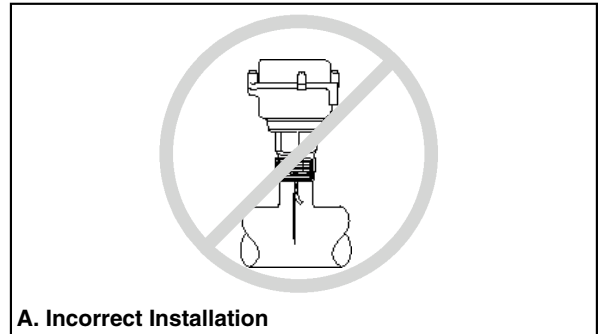
OR



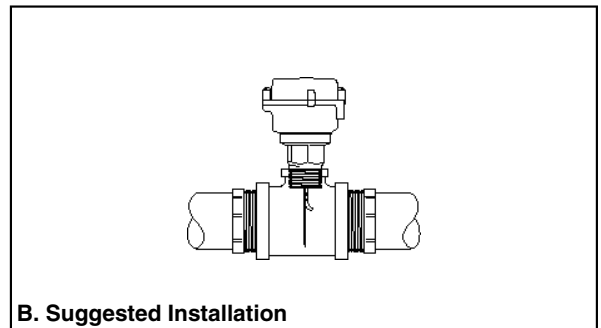
Installation in copper pipe requires special attention. The use of thread to sweat adapters to install the flow switch can cause the paddle arm to be out of the flow of water. It is critical that the paddle and paddle arm be in the run of the pipe for proper operation.

We have found that a paddle type flow switch may not work properly when installed using a thread to sweat adapter. The width of the paddle needs to be reduced in order to fit through the adapter. The additional height locates the paddle arm and a portion of the paddle above the flow of the water (**A**). This changes the fulcrum point of the mechanism and can result in the paddle hitting the wall of the adapter before it proves. Because the flow switch does not work when first installed, the adjustment screw is turned one way or the other to get it to trip. The combination of trimmed paddle, paddle arm out of flow and attempted adjustment will keep the flow switch from operating properly.

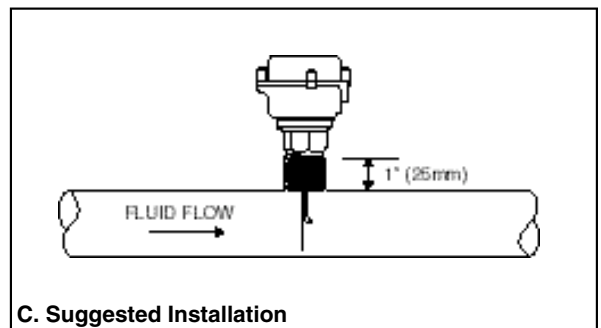
If the flow switch is installed in 2" or smaller copper pipe, the use of a threaded reducing tee and thread to sweat adapters on the main run tee connections would be best (**B**). Larger pipe may require cutting down the 1" thread to sweat adapter to just below the threads and brazing this piece to a hole in the larger pipe (**C**). The intention is to maintain the 1" or less distance from the wall of the pipe to the top of the thread adapter. Keeping this distance to less than 1" ensures the paddle arm and paddles are in the flow of water.



A. Incorrect Installation



B. Suggested Installation



C. Suggested Installation



How To Select Liquid Flow Switches

1. What function will the flow switch perform?

McDonnell & Miller Flow Switches are equipped with either one or two SPDT switches except for Model FS7-4A (Pneumatic). They can make or break an electrical circuit when flow starts or when flow stops, and can be used to:

- Actuate a signal when flow stops
- Start a motor with flow
- Shut off an alarm when flow is adequate
- Stop a motor with no flow

2. Size of pipe

McDonnell & Miller Flow Switches may be used on pipe sizes 1/2" - 36" NPT.

3. How much flow is present?

The flow rate at which the flow switch is to respond should be determined next. McDonnell & Miller Flow Switches are actuated (make or break) with an increase in flow. The term "Flow" represents the actual movement (velocity) of liquid within a pipe sufficient to actuate the switch. The term "No-Flow" represents a decrease in velocity, or total flow stoppage, which will permit the switch to return to its original position.

IMPORTANT: In operation, the switch must be actuated by "Flow" before it can be reversed again by "No-Flow". All McDonnell & Miller Flow Switches can easily be adjusted in the field to require a higher actuating "Flow" or "No-Flow".

4. Maximum liquid pressure in pipe

The maximum pipeline pressure should be considered when selecting a particular model. Different flow switch models can accommodate a range of pipeline pressures up to 1000 psi (70kg/cm²).

5. Maximum temperature

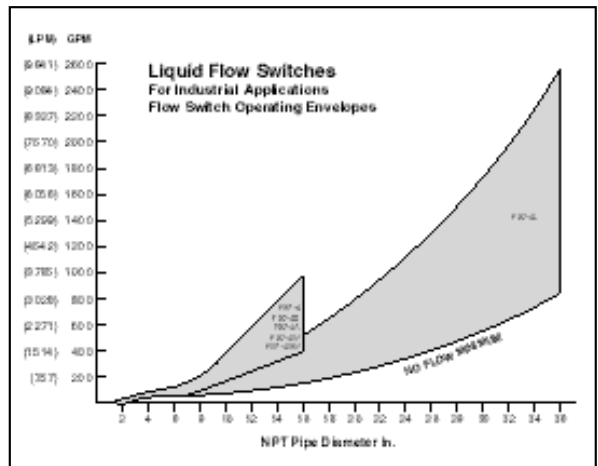
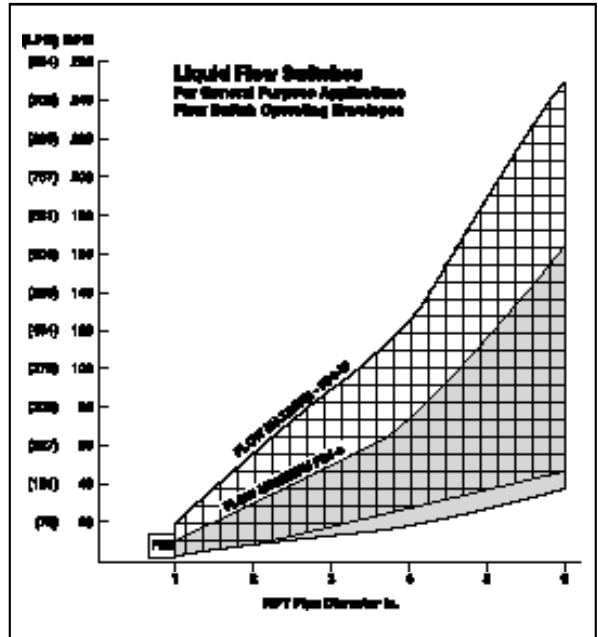
Determine the liquid and ambient atmospheric temperature when selecting the flow switch model. Various McDonnell & Miller Flow Switches can be used at ambient temperatures from 32°F (0°C) and liquid temperatures up to 300°F (149°C). If ambient temperatures are lower than 32°F (0°C) use the FS7-4W.

6. Type of liquid

McDonnell & Miller Flow Switch models have wetted parts of brass, monel or stainless steel. Depending on the particular model they may be used with water, certain light viscous fluids, some oils, various caustic solutions and other fluids.

7. Atmosphere surrounding flow switch

It should be determined if the location will be subject to high humidity, weather conditions or explosive atmospheres. Standard, water tight and hazardous duty flow switch models are available.



NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

8. Incompressible fluids

Fluid flow within a pipe contains both laminar and turbulent flow. The desired placement of any flow switch is in the more predictable laminar flow regions. Turbulent flow is unpredictable, can cause false indications of flow speed and can cause damage to the flow sensing device. An obstruction of flow such as an elbow, fitting or inlet generates a turbulent wave or wake. For that reason placement is recommend at least 5 pipe diameters downstream for liquid flow switches.

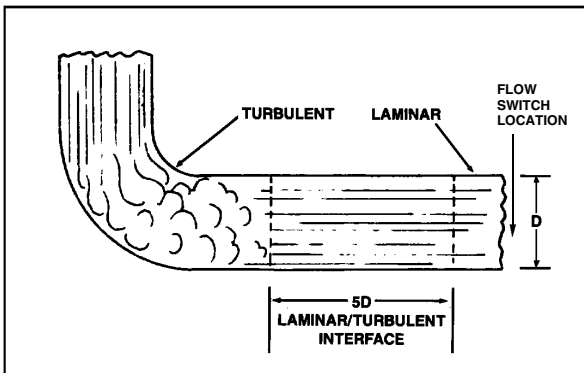
In any flow problem, the flow rate in either feet per second (fps) or gallons per minute (gpm) must be established. For your convenience, we have provided the formulas for determining flow in your application. Use the table (below right) to quickly determine the inside area of standard pipes. For nonstandard pipe schedules, determine the inside area by finding the inside diameter and applying the formula to the right.

Position of the Flow Switch

Installing the flow switch in a horizontal run of pipe is recommended. However because of space limitations, the only available installation may be in a vertical section of pipe. The Series FS4-3, FS8-W and FS5 may be used in this situation as they will generally operate satisfactorily when installed in a vertical pipe with either upward or downward flow (upward flow is preferable) **PROVIDED THERE IS NO UNUSUAL AMOUNT OF DIRT OR SEDIMENT IN THE WATER.**

Flow rates required to actuate the Series FS4-3, FS8W and FS5 are not available for vertical pipe installation. A "factory adjusted" flow switch normally does not require any field adjustment for upward or downward flow. But to make sure, it is advisable to hold flow switch in position to be installed and check for "no flow" switch operation by hand operation of the paddle.

The Series FS7-4, FS6, and FS1 must be mounted on upperside of horizontal pipe. These units will not operate properly on a vertical pipe.



Formulas

$$\text{Area} = D^2 / 4$$

$$D = \text{Inside Diameter} = 3.14$$

Formula for large pipe, higher velocities

$$1. \text{ Velocity in ft. per sec. (FPS)} = \frac{\text{GPM} \times 0.321}{\text{Pipe Area in sq. in.}}$$

Example: With a flow of 1200 GPM through an 8" pipe, determine velocity.

$$\text{Velocity} = \frac{1200 \times 0.321}{50.0} \text{ or } 7.7 \text{ ft. per sec.}$$

$$2. \text{ GPM} = \frac{\text{Velocity in ft. per sec.} \times \text{Pipe Area sq. in.}}{0.321}$$

Example: With a flow of 6.5 ft. per sec. through a 10" pipe, determine GPM.

$$\text{GPM} = \frac{6.5 \times 78.9}{0.321} \text{ or } 1600 \text{ GPM}$$

3. LPM = Liters per Minute

$$\text{Velocity in meters per sec. (MPS)} = \frac{\text{LPM} \times .163}{\text{Pipe Area in cm}^2}$$

$$\text{LPM} = \frac{\text{Velocity in meters per sec.} \times \text{Pipe Area in cm}^2}{.163}$$

$$\text{GPM} = \text{LPM} \times .264 \quad \text{LPM} = \frac{\text{GPM}}{.264}$$

Nominal Standard Pipe Size in.	Pipe Schedule No.	Inside Area Sq. in. (cm ²) "A"
1/2	40	.304 (1.96)
3/4	40	.533 (3.44)
1	40	.864 (5.57)
1 1/4	40	1.496 (9.65)
1 1/2	40	2.036 (13.14)
2	40	3.36 (21.68)
2 1/2	40	4.79 (30.90)
3	40	7.39 (47.68)
3 1/2	40	9.89 (63.81)
4	40	12.73 (82.13)
5	40	20.01 (129)
6	40	28.89 (186)
8	40	50.0 (322)
10	40	78.9 (509)
12	30	113.1 (730)
14	30	137.9 (890)
16	30	182.6 (1181)

Liquid Flow Switch Specification Chart

General Purpose Applications															
Model Number	Use on NPT Pipe Sizes in.	Connection		Wetted Parts						Maximum Pressure		Fluid Temperature °F (°C)		Minimum Ambient Temp. °F (°C)	Switch Enclosure
		NPT	BSPT	Brass	Stainless Steel	Monel	Bare N	Viton	Solder	psi	kg/cm ²	Min.	Max.		
FS4-3 ²	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3D ^{1,2}	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3J ²	1-6		•	•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3RP ²	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3S ²	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS5-3/4	3/4	•		•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-1	1	•		•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-D-3/4 ¹	3/4	•		•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-D-1 ¹	1	•		•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-J-1	1		•	•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-DJ-3/4 ¹	3/4		•	•				3		150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-S-1	1	•		•			•			150	10.5	32 (0)	225 (107)	32 (0)	General Purpose
FS5-DS-1 ¹	1	•		•			•			150	10.5	32 (0)	225 (107)	32 (0)	General Purpose
FS8-W	1-6	•		•	•	•			•	160	11.3	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS8-WJ	1-6		•	•	•	•			•	160	11.3	32 (0)	225 (107)	32 (0)	NEMA 4-X
High Sensitivity Applications															
FS6-3/4	3/4	•		•					•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-1	1	•		•					•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-J-3/4	3/4		•	•					•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-J-1	1		•	•					•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-W-3/4	3/4	•		•					•	100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-W-1	1	•		•					•	100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-WJ-3/4	3/4		•	•					•	100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-WJ-1	1		•	•					•	100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS1	1/2	•		•	•				•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS1-J	1/2		•	•	•				•	100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS1-W	1/2	•		•	•				•	100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X

1 "D" Denotes 2 SPDT Switches
 2 With reinforced Stainless Steel paddle
 3 Ethylene-Propylene Elastomer
 4 Brazed

NEMA 4X flow switches are water tight, dust tight and corrosion resistant
 NEMA7, 9 flow switches are rated for hazardous duty

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Liquid Flow Switch Specification Chart (continued)

Industrial/Heavy Duty Applications															
Model Number	Use on NPT Pipe Sizes	Connection		Wetted Parts					Maximum Pressure		Fluid Temperature °F (°C)		Minimum Ambient Temp. °F (°C)	Switch Enclosure	
				in.	NPT	BSPT	Brass	Stainless Steel			Bronze	Teflon			Solder
	FS7-4	1 1/4 - 16	•							•			•	•	
FS7-4A	1 1/4 - 16	•		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4D ¹	1 1/4 - 16	•		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4E	1 1/4 - 16	•		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4EJ	1 1/4 - 16		•	•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4EL	8 - 32	•		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4ELJ	8 - 32		•	•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4J	1 1/4 - 16		•	•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DJ ¹	1 1/4 - 16		•	•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4L	8 - 32	•		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4LJ	8 - 32		•	•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4S	1 1/4 - 16	•			•			•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DS ¹	1 1/4 - 16	•			•			•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SE	1 1/4 - 16	•			•			•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SEJ	1 1/4 - 16		•		•			•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SJ	1 1/4 - 16		•		•			•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SDJ	1 1/4 - 16		•		•			•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SW	1 1/4 - 16	•			•			•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4SWJ	1 1/4 - 16		•		•			•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4W	1 1/4 - 16	•		•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WJ	1 1/4 - 16		•	•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WL	8 - 32	•		•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WLJ	8 - 32		•	•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X

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Flow Velocities

Gallons Per Minute (GPM)

Velocity FPS	Pipe Size (NPT)											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
	GPM											
.2	.19	.33	.54	.94	1.27	2.1	3.0	4.8	6.2	7.9	12.5	18
.4	.38	.66	1.08	1.88	2.54	4.2	6.0	9.6	12.4	15.8	25.0	36
.6	.57	.99	1.62	2.92	3.81	6.2	8.9	13.4	18.6	23.7	37.5	54
.8	.76	1.32	2.16	3.76	5.08	8.3	11.9	19.2	24.8	31.6	50.0	72
1.0	.95	1.66	2.70	4.70	6.30	10.5	14.9	23.0	30.8	39.7	65.4	90
1.5	1.42	2.50	4.05	7.10	9.48	15.8	22.4	34.5	46.2	59.6	98.1	135
2.0	1.89	3.32	5.40	9.40	12.6	21.0	29.8	46.0	61.6	79.4	131	180
2.5	2.37	4.16	6.75	11.8	15.8	26.3	37.3	57.5	77.0	99.3	164	225
3.0	2.84	4.94	8.10	14.1	19.0	31.5	44.7	69.0	92.4	119	196	270
3.5	3.31	5.82	9.45	16.5	22.1	36.8	52.2	80.5	108	139	229	315
4.0	3.78	6.65	10.8	18.8	25.3	42.0	59.6	92.0	123	159	262	360
4.5	4.26	7.48	12.2	21.2	28.4	47.3	67.1	104	139	179	294	405
5.0	4.74	8.32	13.5	23.5	31.6	52.5	74.5	115	154	199	327	450
6.0	5.68	9.99	16.2	28.2	37.9	63.0	89.4	138	185	238	392	540
7.0	6.62	11.61	18.9	32.9	44.2	73.5	104	161	216	278	458	630
8.0	7.56	13.32	21.6	37.6	50.5	84.0	119	184	246	318	523	720
9.0	8.52	15.02	24.3	42.3	56.8	94.5	134	207	277	357	589	810
10.0	9.48	16.62	27.0	47.0	63.0	105	149	230	308	397	654	900

Liters Per Minute (LPM)

Velocity MPS	Pipe Size (NPT)											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
	LPM											
.06	.72	1.25	2.04	3.56	4.81	7.95	11.4	18.2	23.5	29.9	47.3	68.1
.12	1.44	2.5	4.09	7.12	9.61	15.9	22.7	36.3	46.9	60	94.6	136.2
.18	2.16	3.75	6.13	11.1	14.4	23.5	33.7	50.7	70.4	89.7	141.6	204.4
.24	2.88	5	8.18	14.2	19.2	31.4	45	72	93.9	119.6	189.2	272.5
.30	3.6	6.3	10.2	17.8	23.9	39.7	56.4	87	116.6	150.3	247.5	340.7
.46	5.4	9.5	15.3	26.9	35.9	59.8	84.8	130.6	174.9	225.6	371.3	511
.61	7.2	12.6	20.5	35.4	47.6	79.5	112.8	174.1	233.2	300.5	495.8	681.3
.76	9	15.8	25.6	44.7	59.8	99.6	141.2	217.6	291.5	375.9	620.8	851.6
.91	10.8	18.7	30.7	53.4	71.9	119.2	169.2	261.2	349.7	450.4	741.9	1021.9
1.07	12.6	22	35.8	62.5	83.7	139.3	197.6	304.7	408.8	526.1	866.8	1192.3
1.22	14.3	25.2	40.9	71.2	95.8	159	225.6	348.2	465.6	601.8	991.7	1362.6
1.37	16.1	28.3	46.2	81.2	107.5	179	254	393.6	526.2	677.5	1112.8	1532.9
1.52	17.9	31.5	51.1	89	119.6	198.7	282	435.3	582.9	752.2	1237.7	1703.3
1.83	21.5	37.8	61.3	106.7	143.5	238.5	338.4	522.3	700.2	900.8	1483.7	2043.9
2.13	25.1	43.9	71.5	124.5	167.3	278.2	393.6	609.4	817.6	1052.2	1733.5	2384.6
2.44	28.6	50.4	81.8	144.3	191.1	317.9	450.4	696.4	931.1	1203.6	1979.6	2725.2
2.74	32.3	56.9	92	160.1	215	357.7	507.2	783.5	1048.5	1351.3	2229.4	3065.3
3.05	35.9	62.9	102.2	177.9	238.5	397.4	564	870.6	1165.8	1502.7	2475.4	3406.5



Pressure Drop

PSI

Pipe Size NPT (in.)	Series	Flow Rate (GPM)															
		.2	.5	1.0	2.0	4.0	8.0	10.0	15.0	20.0	25.0	30.0	50.0	75.0	100.0	150.0	200.0
1/2	FS1	.26	.32	.47	.72	2.74	9.74	14.4									
3/4 & 1	FS6	.01	.02	.03	.04	.36	1.44	2.16	4.86	7.94	12.3	18	50				
3/4	FS5 3/4"				1.75	2.25	2.80	3.10	8.05	6.3							
1	FS5 1"				1.75	2.25	2.80	3.10									
1	FS4-3					.15	.32	.54	1.26	2.20							
1	FS8-W				.01	.05	.20	.33	.74	1.30							
1 1/4	FS7-4					.03	.08	.17	.39	.72							
2	FS7-4						.02	.02	.04	.09	.13	.19	.51	.90			
3	FS4-3									.01	.01	.02	.05	.10	.18	.40	.79
3	FS8-W									.01	.01	.02	.06	.10	.13	.17	.19
4	FS7-4											.01	.02	.03	.05	.06	
6	FS7-4												.01	.01	.02	.02	

kPa

Pipe Size NPT (in.)	Series	Flow Rate (LPM)															
		.76	1.89	3.79	7.57	15.1	30.3	37.9	56.8	75.7	94.6	113.6	189.3	283.9	378.5	567.8	757
1/2	FS1	1.79	2.21	3.24	4.96	18.89	67.15	99.28									
3/4 & 1	FS6	0.07	0.14	0.21	0.28	2.48	9.93	14.89	33.51	54.74	84.81	124.11	344.74				
3/4	FS5 3/4"				12.07	15.51	19.31	21.37	55.50	43.44							
1	FS5 1"				12.07	15.51	19.31	21.37									
1	FS4-3					1.03	2.21	3.72	8.69	15.17							
1	FS8-W				0.07	0.34	1.38	2.28	5.10	8.96							
1 1/4	FS7-4					0.21	0.55	1.17	2.69	4.96							
2	FS7-4						0.14	0.14	0.28	0.62	0.90	1.31	3.52	6.21			
3	FS4-3									0.07	0.07	0.14	0.34	0.69	1.24	2.76	5.45
3	FS8-W									0.07	0.07	0.14	0.41	0.69	0.90	1.17	1.31
4	FS7-4											0.07	0.14	0.21	0.34	0.41	
6	FS7-4												0.07	0.07	0.14	0.14	

Flow Switches

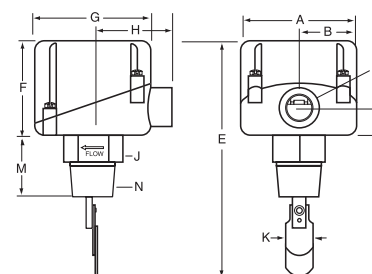
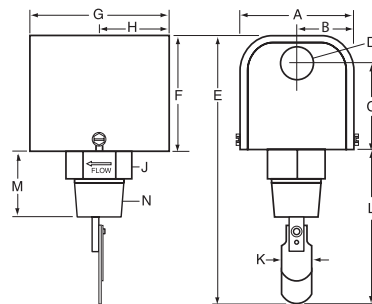
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

Series FS250

General Purpose Liquid Flow Switches

- Universal design serves the widest variety of applications
- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- Replacement for common flow switches from Johnson/Penn, Potter/Taco, Watts, Hydrolevel and other manufacturers
- 1" NPTM Pipe Connection
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- EPDM O-ring sealed
- Four stainless steel paddles included - 1", 2", 3" & 6" (25, 50, 80, & 150mm)
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 250°F (121°C)
- Maximum pressure 160 psi (11.2 kg/cm²)
- **Models:**
 FS251 - NEMA1 enclosure
 FS254 - NEMA4 enclosure



Dimensions, in. (mm)

	A	B	C	D	E	F	G
FS251	3 (76)	1-1/2 (38)	2-7/32 (56)	7/8 (22)	8-7/16 (211)	2-15/16 (75)	3-3/8 (86)
FS254	3-1/4 (83)	1-5/8 (41)	3/4 (19)	1/2 NPTF	8-3/8 (213)	2-3/4 (70)	3-7/8 (98)

	H	J	K	L	M	N	O Turn-in Radius (not shown)
FS251	1-11/16 (43)	1-1/2 (38)	1-1/8 (29)	3-7/16 (87)	2-1/16 (52)	1" NTPM	2-5/16 (59)
FS254	2-1/4 (57)	1-1/2 (38)	1-1/8 (29)	3-7/16 (87)	1-7/8 (48)	1" NTPM	2-5/16 (59)

Flow Switches – Liquid

Series FS250 (continued) General Purpose Liquid Flow Switches

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1	Factory or			27 (102)
	Minimum	5.8 (22)	5.1 (19)	
	Maximum	12.6 (48)	11.9 (45)	
1¼	Factory or			47 (178)
	Minimum	6.7 (25)	6.0 (23)	
	Maximum	19.1 (72)	18.0 (68)	
1½	Factory or			63 (242)
	Minimum	8.4 (32)	7.0 (26)	
	Maximum	25.3 (96)	24.1 (91)	
2	Factory or			105 (397)
	Minimum	12.9 (49)	11.2 (42)	
	Maximum	31.5 (119)	30.2 (114)	
2½	Factory or			149 (564)
	Minimum	17.9 (68)	14.5 (55)	
	Maximum	43.2 (164)	40.0 (151)	
3	Factory or			230 (871)
	Minimum	26.2 (99)	20.2 (76)	
	Maximum	54.9 (208)	49.8 (188)	
4	Factory or			397 (1503)
	Minimum	42.0 (159)	33.7 (128)	
	Maximum	75.6 (286)	68.0 (257)	
5	Factory or			654 (2475)
	Minimum	54.6 (207)	46.7 (177)	
	Maximum	109.4 (414)	98.4 (372)	
6	Factory or			900 (3407)
	Minimum	67.7 (256)	60.2 (228)	
	Maximum	131.1 (496)	123.5 (467)	

Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS251	120611	General purpose flow switch-- NEMA1	1.9 (0.9)
FS254	120610	General purpose flow switch-- NEMA4	1.9 (0.9)

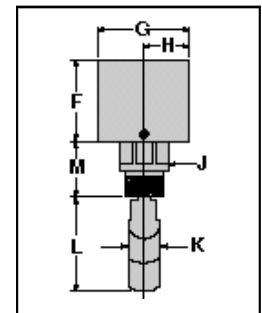
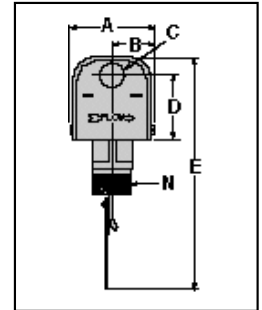
Flow Switches – Liquid

Series FS4-3 (for specified models)

General Purpose Liquid Flow Switches



- Universal design serves the widest variety of applications
- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- Replacement for common flow switches from Johnson/Penn, Potter/Taco, Watts, Hydrolevel and other manufacturers
- 1" NPT
- Two electrical knock-outs allows connection from either end
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- Hardened stainless steel bearings minimize friction
- Sealed Monel bellows
- Four stainless steel paddles included - 1", 2", 3" & 6" (25, 50, 80, & 150mm)
- Optional features
 - Time delay (5 or 20 seconds)
 - Two SPDT switches to make or break two separate circuits
 - Materials of construction suitable for corrosive liquids
 - Fire sprinkler service - Model FS4-3F only for 1", 1 1/4", & 1 1/2" NPT piping only (see chart) next page (p. 89)
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum pressure 160 psi (11.3 kg/cm²)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
3 (76)	1 1/2 (38)	7/8 (22)	2 7/32 (56)	8 7/16 (211)	2 15/16 (75)	3 3/8 (86)
H	J	K	L	M	N	
1 11/16 (43)	1 7/16 (37)	1 1/8 (29)	3 7/16 (87)	2 1/16 (52)	1 NPT	

Flow Switches – Liquid

Series FS4-3 (continued) General Purpose Liquid Flow Switches

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1	Factory or Minimum	6 (22.7)	3.6 (13.6)	27 (102.2)
	Maximum	10.2 (38.6)	9.2 (34.8)	
1¼	Factory or Minimum	9.8 (37.1)	5.6 (21.2)	47 (177.9)
	Maximum	16.8 (63.6)	15 (56.8)	
1½	Factory or Minimum	12.7 (48.1)	7 (26.5)	63 (238.5)
	Maximum	23 (87.1)	19.5 (73.8)	
2	Factory or Minimum	18.8 (71.2)	9.4 (35.6)	105 (397.4)
	Maximum	32.8 (124.1)	24 (90.8)	
2½	Factory or Minimum	24.3 (92)	11.6 (43.9)	149 (564)
	Maximum	42.4 (160.5)	37.5 (141.9)	
3	Factory or Minimum	30 (113.6)	12 (45.4)	230 (870.6)
	Maximum	52.1 (197.2)	46.1 (174.5)	
4	Factory or Minimum	39.7 (150.3)	19.8 (74.9)	397 (1502.7)
	Maximum	73.5 (278.2)	64.2 (242)	
5	Factory or Minimum	58.7 (222.2)	29.3 (110.9)	654 (2415.4)
	Maximum	115 (435.3)	92 (348.2)	
6	Factory or Minimum	79.2 (300)	39.6 (150)	900 (3406.5)
	Maximum	166 (628.3)	123 (465.6)	

Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3	114400	General purpose flow switch	1.9 (0.9)
FS4-3J	114610	FS4-3 w/BSPT connections	1.9 (0.9)
FS4-3-RPT	114639	FS4-3 w/test button	1.9 (0.9)
FS4-3Z	114410	FS4-3 w/ANSI terminal connections	1.9 (0.86)
FS4-3A	114450	FS4-3 w/tamper-proof cover screws	2.0 (0.9)
FS4-3D	114550	FS4-3 w/2 SPDT switches	2.3 (1.0)
FS4-3S	114641	FS4-3 w/SS body, monel bellows	1.9 (0.9)
FS4-3SJ	176216	FS4-3 w/BSPT connections	1.9 (0.9)
FS4-3DS	114642	FS4-3S w/2 SPDT switches	3.3 (1.5)
FS4-3-5R	114405	FS4-3 w/5 second DOB	2.3 (1.0)
FS4-3-20	114425	FS4-3 w/20 second DOM	2.3 (1.0)
FS4-3J-E	114611	FS4-3J-CE conformance rated	1.9 (0.9)
FS4-3D-E	114552	FS4-3D-CE conformance rated	1.9 (0.9)
FS4-3S-E	114646	FS4-3S-CE conformance rated	1.9 (0.9)

See page 132 for CE Conformance information

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3F	114625	FS4-3 for fire sprinkler service	1.9 (0.9)
FS4-3FCAN	114626	FS4-3 for fire sprinkler service (Canada)	2.3 (1.0)
FS4-3F-20	114635	FS4-3F w/20 second DOM	2.3 (1.0)
FS4-3DF	114555	FS4-3F w/2 SPDT switches	2.3 (1.0)
FS4-3DF-20	114640	FS4-3F w/20 second DOM, 2 SPDT switches	3.3 (1.50)

For Model FS4-3F & FS4-3DF

NPT Pipe Size In.	Paddle to use Length	TEE Size
1"	1 ^{11/32} " as furnished (only)	1" x 1" x 1" NPT Tee
1¼"	Trim 1½" pipe size paddle with template	1¼" x 1¼" x 1" NPT Tee (Paddle must be bowed for insertion into 1¼" tee)
1½"	2 ^{1/16} " as furnished (only)	1½" x 1½" x 1" NPT Tee (Paddle must be bowed for insertion into 1½" tee)

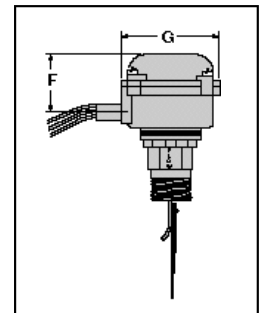
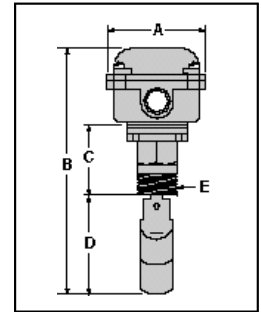
NOTE: ONLY LISTED PIPE SIZES MEET UL REQUIREMENTS FOR FIRE SPRINKLER SYSTEMS.

Flow Switches – Liquid

Series FS8-W (for specified models)

General Purpose Liquid Flow Switches

- For general purpose applications with environmental exposure, or those requiring a water-tight, dust tight, or a NEMA 4X rated flow switch
- 1" NPT
- Sealed Monel bellows
- Single pole, double throw snap switch
- Four stainless steel paddles included - 1", 2", 3" and 6" (25, 50, 80 and 150mm)
- Sensitivity adjusting screw makes flow adjustment easy
- Optional features
 - BSPT threads
 - Gold plated contacts
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 160 psi (11.3 kg/cm²)
- Replacement for NEMA 4X-style flow switches from Potter/Taco, Watts, Penn and other manufacturers



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	50 or 60 cycles

Dimensions, in. (mm)

A	B	C	D	E	F	G
3¼ (83)	8¾ (213)	2 ⁵ / ₁₆ (59)	3 ⁷ / ₁₆ (87)	NPT	1	3¼ (83)

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation				Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	Velocity fps (mps)	No Flow gpm (lpm)	Velocity fps (mps)	
1	Factory or Minimum	4.9 (18.5)	1.82 (.55)	3.4 (12.9)	1.25 (.38)	27 (102.2)
	Maximum	17.6 (66.6)	6.53 (2.00)	15 (56.8)	5.56 (1.69)	
1¼	Factory or Minimum	7.5 (28.4)	1.60 (.49)	5.3 (20.1)	1.14 (.35)	47 (177.9)
	Maximum	29 (110)	6.23 (1.9)	24.6 (93.1)	5.28 (1.61)	
1½	Factory or Minimum	9.4 (35.6)	1.48 (.45)	6.7 (25.4)	1.05 (.32)	63 (238.5)
	Maximum	37.8 (143)	5.95 (1.81)	32.2 (122)	5.07 (1.54)	
2	Factory or Minimum	13.7 (51.8)	1.31 (.4)	9.4 (35.6)	.9 (.27)	105 (397.4)
	Maximum	56.4 (214)	5.39 (1.64)	47.4 (179)	4.53 (1.38)	
2½	Factory or Minimum	17.9 (67.8)	1.20 (.36)	12.1 (45.8)	.81 (.25)	149 (564)
	Maximum	71.3 (270)	4.78 (1.46)	59.2 (224)	3.97 (1.21)	
3	Factory or Minimum	24.2 (91.6)	1.05 (.32)	16.4 (62.1)	.71 (.22)	230 (870.6)
	Maximum	89 (337)	3.87 (1.18)	72.5 (274)	3.15 (.96)	
4	Factory or Minimum	35.3 (134)	.89 (.27)	27 (102)	.68 (.21)	397 (1502.7)
	Maximum	118 (446)	2.89 (.91)	105 (397)	2.64 (.8)	
5	Factory or Minimum	48.6 (184)	.78 (.24)	37.4 (142)	.6 (.18)	654 (2475.4)
	Maximum	178 (674)	2.86 (.87)	160 (606)	2.57 (.78)	
6	Factory or Minimum	60.3 (228)	.67 (.20)	46.8 (177)	.52 (.16)	900 (3406.5)
	Maximum	245 (927)	2.72 (.83)	225 (852)	2.5 (.76)	

Values are ± 10%

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS8-W	120601	General purpose flow switch w/NEMA 4X enclosure	2.0 (0.9)
FS8-WJ	120602	FS8-W w/BSPT connections	2.0 (0.9)
FS8-WG	120603	FS8-W w/gold plated switch contacts	2.0 (0.9)
FS8-WG-SL	120604	FS8-W w/gold plated switch contacts, sealed leads	2.0 (0.9)
FS8-WZ	120605	FS8-W w/ANSI terminal connections	2.0 (0.9)
FS8-WJA	120751	FS8-WJ w/adjusting indicator	2.3 (1.0)
FS8-WJA-E	120752	FS8-WJA- CE conformance rated	2.3 (1.0)

See page 132 for CE Conformance information

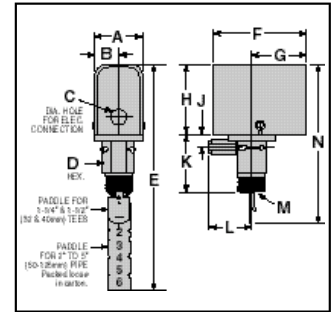
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

Series FS7-4 (for specified models)

Industrial Liquid Flow Switches

- Universal design serves the widest variety of large pipe applications, including heating and hydronic systems, air conditioning, refrigeration and process work
- 1 1/4" NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm - Model FS7-4L
 - Two SPDT switches to make or break two separate circuits
 - Stainless steel body and paddles
 - BSPT threads
 - Fire sprinkler service - Model FS7-4F- for 1 1/4" thru 2 1/2" NPT piping only (see chart p.93)
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models
- Pneumatic control - FS7-4A - option available w/ 1/8" NPT airline connection; max. 50 psi air supply (non-electrical)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
2 7/8 (73)	1 1/16 (37)	7/8 (22)	1 3/4 (45)	13 9/16 (345)	5 13/16 (148)	3 3/8 (86)
H	J	K	L	M	N	
4 1/8 (105)	1 5/16 (24)	3 7/16 (87)	2 5/8 (67)	1 1/4 NPT	9 1/2 (241)	



Flow Rates

Model	Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
			Flow gpm (lpm)	No Flow gpm (lpm)	
FS7-4	1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
		Maximum	7.7 (29.1)	5.9 (22.3)	
	1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
		Maximum	10 (37.9)	7 (26.5)	
	2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
		Maximum	15.8 (59.8)	11 (41.6)	
	2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
		Maximum	23.7 (89.7)	17 (64.3)	
	3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
		Maximum	35.5(134.4)	29.2(110.5)	
	4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
		Maximum	61.4(232.4)	37.7(142.7)	
	5	Factory or Minimum	44.4(168.1)	31 (117.3)	654 (2475.4)
		Maximum	84 (317.9)	51 (193)	
	6	Factory or Minimum	56.3(213.1)	48.7(184.3)	900 (3406.5)
		Maximum	114.8(434.5)	71 (270.6)	
8	Factory or Minimum	104(393.6)	89 (336.9)	1,500 (5677.5)	
	Maximum	210(794.9)	131(495.8)		
10	Factory or Minimum	184(696.4)	157(594.2)	2,500 (9462.5)	
	Maximum	369 (1397)	231(874.3)		
12	Factory or Minimum	289 (1094)	247(934.9)	3,500 (13,247.5)	
	Maximum	582 (2203)	363 (1374)		
14	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)	
	Maximum	753 (2850)	495 (1874)		
16	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)	
	Maximum	998 (3777)	656 (2483)		
FS7-4L	20	Factory or Minimum	520 (1968)	260 (984)	8,000 (30,280)
		Maximum	780 (2952)	693 (2623)	
	24	Factory or Minimum	752 (2846)	376 (1423)	12,000 (45,420)
		Maximum	1128(4269)	1002(3793)	
	30	Factory or Minimum	1177(4455)	589 (2229)	20,200 (76,457)
		Maximum	1766(6684)	1570(5950)	
	36	Factory or Minimum	1723(6522)	861 (3259)	28,270 (107,002)
		Maximum	2584(9870)	2297(8694)	

Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4	119700	Industrial flow switch	5.5 (2.5)
FS7-4D	119750	FS7-4 w/2 SPDT switches	5.5 (2.5)
FS7-4S	120160	FS7-4 w/SS body	5.0 (2.3)
FS7-4DS	119760	FS7-4S w/2 SPDT switches	5.0 (2.3)
FS7-4J	120060	FS7-4 w/ BSPT connections	5.5 (2.5)
FS7-4SJ	120171	FS7-4J w/SS body	5.0 (2.3)
FS7-4SDJ	120174	FS7-4SJ w/2 SPDT switches	5.0 (2.3)
FS7-4L	119900	FS7-4 w/extended paddle and paddle arm	5.5 (2.5)
FS7-4LJ	119980	FS7-4L w/ BSPT connections	5.7 (2.6)
FS7-4J-E	120061	FS7-4J - CE conformance rated	5.5 (2.5)
FS7-4SJ-E	120172	FS7-4SJ- CE conformance rated	5.0 (2.3)

See page 132 for CE Conformance information

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4F	119800	FS7-4 for fire sprinkler service	5.5 (2.5)
FS7-4F CAN	119801	FS7-4 for fire sprinkler service (Canada)	5.5 (2.5)
FS7-4DF	119825	FS7-4F w/2 SPDT switches	5.7 (2.6)

For Model FS7-4F Only

NPT Pipe Size In.	Paddle to use Length	TEE Size NPT
1¼	1 ¹⁹ / ₁₆ " as furnished (only)	1 ¼" x 1 ¼" x 1 ¼" Tee
1½	Trim 2" pipe size paddle with template	1 ½" x 1 ½" x 1 ¼" NPT Tee
2	2 ⁹ / ₁₆ " as furnished (only)	2" x 2" x 1 ¼" Tee
2½	3" as furnished (only)	2 ½" x 2 ½" x 1 ¼" Tee (Paddle must be bowed to insert into 1 ¼" NPT opening)

NOTE: ONLY LISTED PIPE SIZES MEET UL REQUIREMENTS FOR FIRE SPRINKLER SYSTEMS.

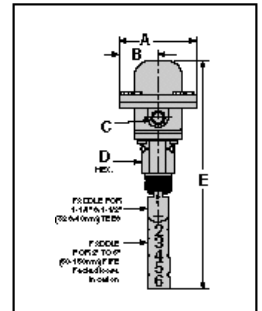
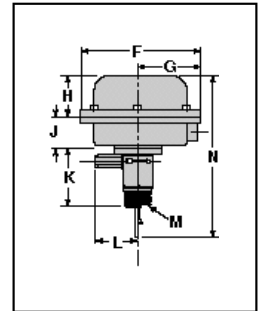
Flow Switches – Liquid

Series FS7-4E (for specified models)

Industrial Liquid Flow Switches



- For hazardous environment applications requiring a **NEMA 7 (Class I, Group C or D) or NEMA 9 Class II, Group E, F, or G** rated flow switch
- 1¼" NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm
 - Stainless steel body and paddles
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D	E	F	G
4 ⁵ / ₈ (117)	2 ⁵ / ₁₆ (59)	½	1 ³ / ₄ (45)	13 ³ / ₄ (350)	7 ¹ / ₄ (184)	3 ²⁵ / ₃₂ (96)
H	J	K	L	M NPT	N	
2 ⁷ / ₁₆ (62)	1 ¹⁵ / ₁₆ (50)	3 ⁷ / ₁₆ (87)	2 ⁵ / ₈ (67)	1 ¹ / ₄	9 ¹¹ / ₁₆ (246.6)	

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
	Maximum	7.7 (29.1)	5.9 (22.3)	
1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
	Maximum	10 (37.9)	7 (26.5)	
2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
	Maximum	15.8 (59.8)	11 (41.6)	
2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
	Maximum	23.7 (89.7)	17 (64.3)	
3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
	Maximum	35.5 (134.4)	29.2 (110.5)	
4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
	Maximum	61.4 (232.4)	37.7 (142.7)	
5	Factory or Minimum	44.4 (168.1)	31 (117.3)	654 (2475.4)
	Maximum	84 (317.9)	51 (193)	
6	Factory or Minimum	56.3 (213.1)	48.7 (184.3)	900 (3406.5)
	Maximum	114.8 (434.5)	71 (270.6)	
8*	Factory or Minimum	104 (393.6)	89 (336.9)	1,500 (5677.5)
	Maximum	210 (794.9)	131 (495.8)	
10*	Factory or Minimum	184 (696.4)	157 (594.2)	2,500 (9462.5)
	Maximum	369 (1397)	231 (874.3)	
12*	Factory or Minimum	289 (1094)	247 (934.9)	3,500 (13,247.5)
	Maximum	582 (2203)	363 (1374)	
14*	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)
	Maximum	753 (2850)	495 (1874)	
16*	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)
	Maximum	998 (3777)	656 (2483)	

Values are ± 10%

* Equipped with a 6" paddle

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4E	120100	FS7-4 w/NEMA 7 & 9 enclosure	12.3 (5.6)
FS7-4EJ	120135	FS7-4E w/BSPT connections	12.7 (5.8)
FS7-4EL	120150	FS7-4E w/extended paddle & paddle arm	12.3 (5.6)
FS7-4ELJ	120158	FS7-4EL w/BSPT connections	12.7 (5.8)
FS7-4SE	120175	FS7-4S w/NEMA 7 & 9 enclosure	11.7 (5.3)
FS7-4SEJ	120186	FS7-4SE w/BSPT connections	12.0 (5.4)
FS7-4EJ-E	120136	FS7-4EJ - CE conformance rated	12.7 (5.8)

See page 132 for CE Conformance information

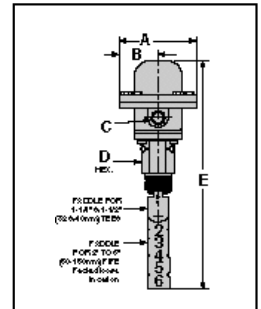
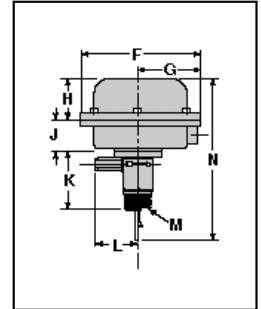
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

Series FS7-4W (for specified models)

Industrial Liquid Flow Switches

- For applications requiring a water-tight, dust-tight or a **NEMA 4X** rated flow switch
- 1 1/4" NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm
 - Stainless steel body and paddles
 - BSPT threads
- Minimum temperature (fluid or ambient) -65°F (-54°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D	E	F	G
4 5/8 (117)	2 5/16 (59)	1/2	1 3/4 (45)	13 3/4 (350)	7 1/4 (184)	3 25/32 (96)
H	J	K	L	M NPT	N	
2 7/16 (62)	1 5/16 (50)	3 7/16 (87)	2 5/8 (67)	1 1/4	9 11/16 (246.6)	

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
	Maximum	7.7 (29.1)	5.9 (22.3)	
1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
	Maximum	10 (37.9)	7 (26.5)	
2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
	Maximum	15.8 (59.8)	11 (41.6)	
2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
	Maximum	23.7 (89.7)	17 (64.3)	
3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
	Maximum	35.5 (134.4)	29.2 (110.5)	
4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
	Maximum	61.4 (232.4)	37.7 (142.7)	
5	Factory or Minimum	44.4 (168.1)	31 (117.3)	654 (2475.4)
	Maximum	84 (317.9)	51 (193)	
6	Factory or Minimum	56.3 (213.1)	48.7 (184.3)	900 (3406.5)
	Maximum	114.8 (434.5)	71 (270.6)	
8*	Factory or Minimum	104 (393.6)	89 (336.9)	1,500 (5677.5)
	Maximum	210 (794.9)	131 (495.8)	
10*	Factory or Minimum	184 (696.4)	157 (594.2)	2,500 (9462.5)
	Maximum	369 (1397)	231 (874.3)	
12*	Factory or Minimum	289 (1094)	247 (934.9)	3,500 (13,247.5)
	Maximum	582 (2203)	363 (1374)	
14*	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)
	Maximum	753 (2850)	495 (1874)	
16*	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)
	Maximum	998 (3777)	656 (2483)	

Values are ± 10%

* Equipped with a 6" paddle

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4W	120201	FS7-4 w/NEMA 4X enclosure	12.3 (5.6)
FS7-4SW	120191	FS7-4W w/SS body	11.7 (5.3)
FS7-4WJ	120261	FS7-4W w/BSPT connections	12.3 (5.6)
FS7-4SWJ	120197	FS7-4SW w/BSPT connections	11.7 (5.3)
FS7-4WL	120301	FS7-4W w/extended paddle & paddle arm	12.7 (5.8)
FS7-4WLJ	120361	FS7-4WL w/BSPT connections	12.7 (5.8)
FS7-4WJ-E	120262	FS7-4WJ - CE conformance rated	12.7 (5.8)

See page 132 for CE Conformance information

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

“K” Factors – adjusting paddle length

If the flow rate in the pipe exceeds the maximum adjustment on the Flow Switch a change can be made in the paddle length. Modifying the paddle length is a simple procedure that will adapt this equipment to a broader range of applications. Use the following formula as a guide when changing paddle lengths

$$\text{Paddle Length} = \frac{K}{\text{Flow Rate (GPM)}}$$

FS4-3 Example A

Calculate paddle length to provide switch action when flow in a 3 inch pipe increases to 100 GPM (366 LPM)

Use Maximum Adjustment Flow

$$L = \frac{162.5}{100} = 1.625 \text{ in. (41.27mm)}$$

FS7-4 Example B

Calculate paddle length to provide switch action when flow in a 3 inch pipe increases to 100 GPM (366 LPM)

Use Maximum Adjustment Flow

$$L = \frac{92.94}{100} = .93 \text{ in. (23.62mm)}$$

FS7-4 Example C

Calculate paddle length to provide switch action when flow in a 12 inch pipe decreases to 1200 GPM (4392 LPM)

Use Maximum Adjustment No-Flow

$$L = \frac{2439.8}{1200} = 2.033 \text{ in. (51.63mm)}$$

FS8W Example D

Calculate paddle length to provide switch action when flow in a 4 inch pipe increases to 200 GPM (732 LPM)

Use Maximum Adjustment Flow

$$L = \frac{442}{200} = 2.21 \text{ in. (56.13mm)}$$

FS4-3 “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	69.2	50.3
2½	102.2	81.0
3	162.5	143.5
4	276.0	241.0
5	550.0	440.0
6	977.0	728.0

FS7-4 “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	34.63	30.43
2½	54.00	47.46
3	92.94	81.69
3½	133.67	117.49
4	183.35	161.15
5	322.61	283.55
6	510.70	448.87
7	705.05	619.67
8	1014.47	891.62
9	1302.47	1144.79
10	1791.70	1574.74
12	2776.04	2439.88
14	3729.02	3255.02
16	4869.81	4250.81
18	6164.08	5380.57
20	7661.11	6687.31
30	18202.0	15888.0

FS8-W “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	118.5	99.5
2½	168.9	141.8
3	278.0	227.0
4	442.0	391.0
5	847.0	762.0
6	1440.0	1325.0

Flow Switches – Liquid

Series FS5

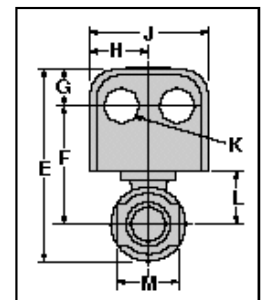
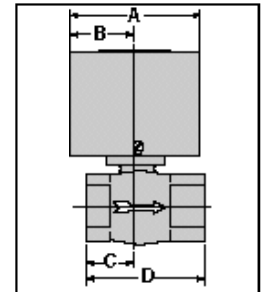


(for specified models)



General Purpose Liquid Flow Switches

- For general purpose applications requiring low flow rate sensitivity
- In-line configuration eliminates need for a pipe tee
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Materials of construction
 - Brass, carbon & EPDM elastomer (for water); Models FS5 & FS5-D
 - Stainless steel, carbon & Buna N (for water or water and petroleum base compounds) Models FS5-S & FS5-DS
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature
 - 225°F (107°C) – Stainless Steel models
 - 250°F (121°C) – Brass
- Maximum operating pressure 150 psi (10.5 kg/cm²)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D
3 ⁷ / ₁₆ (87)	1 ¹ / ₁₆ (40)	1 ⁵ / ₁₆ (33)	3 ³ / ₁₆ (56)
E	F	G	H
5 ¹ / ₁₆ (129)	3 ¹ / ₄ (83)	7 ⁷ / ₈ (22)	1 ¹⁹ / ₃₂ (40.5)
J	K	L	M
3 ³ / ₁₆ (81)	7 ⁷ / ₈ (22)	1 ¹ / ₈ (35)	1 ¹¹ / ₁₆ (43)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS5-3/4	114760	General purpose flow switch 3/4" NPT	2.5 (1.1)
FS5-D-3/4	114763	FS5-3/4 w/2 SPDT switches	2.5 (1.1)
FS5-J-3/4	114765	FS5-3/4 w/BSPT connections	2.5 (1.1)
FS5-1	114780	General purpose flow switch 1" NPT	2.5 (1.1)
FS5-D-1	114783	FS5-1 w/2 SPDT switches	2.5 (1.1)
FS5-J-1	114785	FS5-1 w/BSPT connections	2.5 (1.1)
FS5-S-1	114795	FS5-1 w/SS body	2.3 (1.0)
FS5-DS-1	114793	FS5-1 w/SS body, 2 SPDT switches	2.5 (1.1)
FS5-J-3/4-E	114766	FS5-J-3/4 - CE conformance rated	2.5 (1.1)
FS5-J-1-E	114787	FS5-J-1 - CE conformance rated	2.5 (1.1)

See page 132 for CE Conformance information

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
3/4 or 1	Factory or			
	Minimum	1.5 (5.7)	1.1 (4.2)	16.62 (62.9)
	Maximum	15 (56.8)	10 (37.9)	27 (102.2)

Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

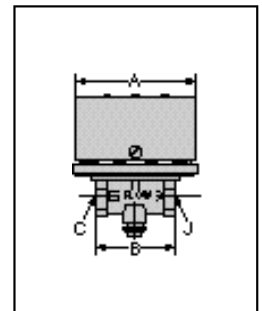
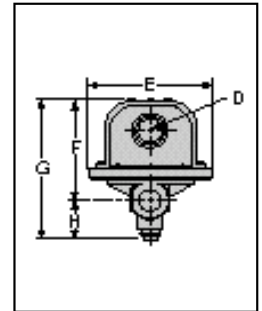
Series FS1 High Sensitivity Liquid Flow Switches



(for specified models)



- For general purpose applications where high sensitivity is required and moderate or low flow rates are encountered such as air conditioning, heating and hydronic systems, water, fuel oil, some viscous liquids and oils in process work
- In-line configuration eliminates need for a pipe tee
- High flow capacity
- ½" NPT
- Single pole, double throw snap switch
- Switch compartment is completely sealed to protect it from the liquid
- Sensitivity adjusting screw makes flow adjustment easy
- Optional features
 - BSPT threads
 - Gold plated contacts
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 100 psi (7 kg/cm²)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

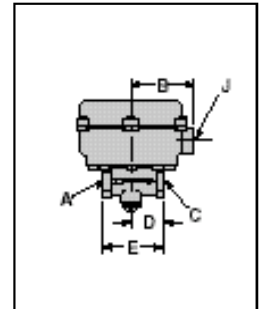
A	B	C	D	E	F	G	H	J
3¼ (95)	2⅝ (67)	½ NPT	7⁄8 (22)	3¹³⁄₁₆ (97)	3⁹⁄₁₆ (81)	4⁷⁄₁₆ (113)	1¼ (32)	½ NPT

Flow Switches – Liquid

Model FS1-W High Sensitivity Liquid Flow Switches

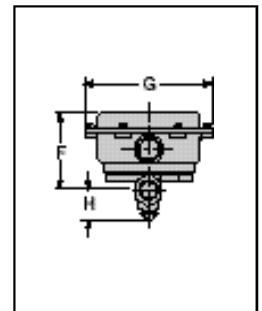


- For applications requiring a water-tight, dust-tight, or a NEMA 4X rated flow switch



Dimensions, in. (mm)

A NPT	B	C NPT	D	E
1/2	2 5/8 (67)	1/2	1 3/8 (35)	2 5/8 (67)
F	G	H	J NPT	
3 7/16 (87)	5 1/2 (140)	1 1/4 (32)	1/2 (15)	



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS1	113200	High sensitivity flow switch - 1/2" NPT body	3.0 (1.4)
FS1-G	113250	FS1 w/gold plated contacts	3.0 (1.4)
FS1-J	113550	FS1 w/BSPT connections	3.3 (1.5)
FS1-L	113560	FS1 set @ 1.7gpm	3.0 (1.4)
FS1-W	113601	FS1 w/NEMA 4X enclosure	3.5 (1.6)
FS1-J-E	113551	FS1-J CE conformance rated	3.3 (1.5)
FS1-W-E	113602	FS1-W CE conformance rated	3.0 (1.4)

See page 132 for CE Conformance information

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Rates

Settings	Mode of Operation		Max. Flow Rate gpm (lpm)
	Flow gpm (lpm)	No Flow gpm (lpm)	
Factory or Minimum	0.41 (1.55)	0.24 (.91)	25 (95)
Maximum	1.81 (6.85)	1.28 (4.84)	

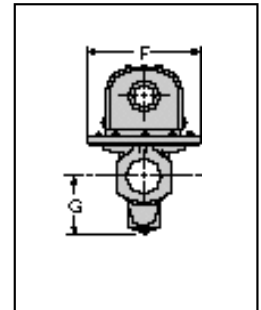
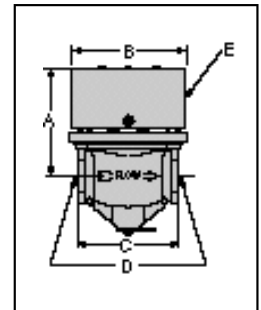
Values are ± 10%

Flow Switches – Liquid

Series FS6 (for specified models)

High Sensitivity Liquid Flow Switches

- For heavy duty applications where high sensitivity is required, such as water treatment systems, cooling systems for electronic circuits, compressors, booster pumps, and bearings, and other applications that need instant switching
- In-line configuration eliminates need for a pipe tee
- Very high flow capacity
- Actuates at extremely low flow rate
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Single pole, double throw snap switch
- Switch compartment is completely sealed to protect it from the liquid
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 100 psi (7 kg/cm²)



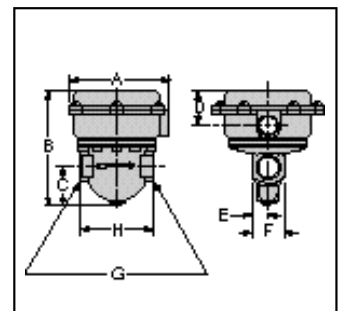
Dimensions, in. (mm)

A	B	C	D NPT	E	F	G
3 1/2 (89)	3 23/32 (94.4)	3 3/8 (86)	3/4 or 1	7/8 (22)	3 3/4 (95)	2 (51)

Model FS6-W

High Sensitivity Liquid Flow Switches

- For applications requiring a water-tight, dust-tight, or a NEMA 4X rated flow switch



Dimensions, in. (mm)

A	B	C	D	E	F	G NPT	H
5 (127)	5 3/4 (146)	2 (51)	1 5/8 (41)	2 9/32 (23)	1 13/16 (46)	3/4 or 1	3 3/8 (86)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm)
		Flow gpm (lpm)	No Flow gpm (lpm)	
¾ or 1	Factory or			70 (265)
	Minimum	.12 (.45)	.06 (.23)	
	Maximum	2.5 (9.46)	1.5 (5.68)	

Values are ± 10%

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS6-¾	115400	High sensitivity flow switch ¾" NPT body	4.5 (2)
FS6-J-¾	115550	FS6-¾ w/BSPT pipe threads	4.5 (2)
FS6-1	115600	High sensitivity flow switch 1" NPT body	4.5 (2)
FS6-J-1	115650	FS6-1 w/BSPT pipe threads	4.5 (2)
FS6-W-¾	115651	FS6-¾ w/NEMA 4X enclosure	4.5 (2)
FS6-WJ-¾	115653	FS6-W-¾ w/BSPT connections	4.5 (2)
FS6-W-1	115652	FS6-1 w/NEMA 4X enclosure	4.5 (2)
FS6-WJ-1	115654	FS6-W-1 w/BSPT connections	4.5 (2)
FS6-J-¾-E	115551	FS6-J-¾ - CE conformance rated	4.5 (2)
FS6-J-1-E	115655	FS6-J-1 - CE conformance rated	4.5 (2)
FS6-WJ-¾-E	115656	FS6-WJ-¾ - CE conformance rated	4.5 (2)
FS6-WJ-1-E	115657	FS6-WJ-1 CE conformance rated	4.5 (2)

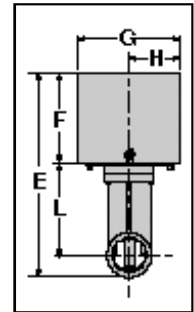
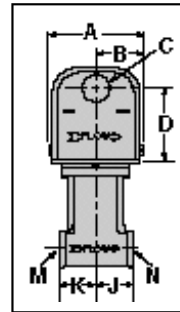
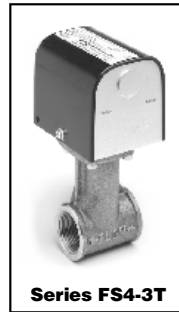
See page 132 for CE Conformance information

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

Series FS4-3T (for specified models) General Purpose Liquid Flow Switches

- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- In-line configuration eliminates need for a pipe tee
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Paddles available for low, medium or high flow
- Two electrical knock-outs allows connection from either end
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- Hardened stainless steel bearings minimize friction
- Sealed Monel bellows
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum pressure 160 psi (11.3 kg/cm²)



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3T1-3/4	114800	3/4" NPT body - high flow rate	3 (1.4)
FS4-3T2-3/4	114900	3/4" NPT body - medium flow rate	3 (1.4)
FS4-3T3-3/4	115000	3/4" NPT body - low flow rate	3 (1.4)
FS4-3T1-1	115100	1" NPT body - high flow rate	3 (1.4)
FS4-3T2-1	115200	1" NPT body - medium flow rate	3 (1.4)
FS4-3T3-1	115300	1" NPT body - low flow rate	3 (1.4)
FS4-3T3-3/4-E	115001	FS4-3T3-3/4 -CE conformance rated	3 (1.4)
FS4-3T3-1-E	115301	FS4-3T3-1 -CE conformance rated	3 (1.4)

See pages 132 for CE conformance information

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
3 (76)	1 1/2 (38)	7/8 (22)	2 7/32 (56)	6 7/8 (175)	2 15/16 (75)	3 3/8 (86)
H	J	K	L	M	N	
1 11/16 (43)	1 1/16 (33)	1 1/8 (29)	3 1/16 (78)	3/4 or 1 NPT	3/4 or 1 NPT	

Flow Rates

Pipe Model Number	Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
			Flow gpm (lpm)	No Flow gpm (lpm)	
FS4-3T1-3/4	3/4	Factory or Minimum	4.4 (16.7)	2.6 (9.8)	16.62 (62.9)
		Maximum	10.5(39.7)	9.8(37.1)	
FS4-3T2-3/4	3/4	Factory or Minimum	3.7 (14)	2.2 (8.3)	
		Maximum	8.9 (33.7)	8.3(31.4)	
FS4-3T3-3/4	3/4	Factory or Minimum	2 (7.6)	1.2 (4.5)	
		Maximum	4.5 (17)	4.1(15.5)	
FS4-3T1-1	1	Factory or Minimum	5 (18.9)	3.2(12.1)	27 (102.2)
		Maximum	11.5(43.5)	11(41.6)	
FS4-3T2-1	1	Factory or Minimum	4.8 (18.1)	2.9 (11)	
		Maximum	10.1(38.2)	9.4(35.6)	
FS4-3T3-1	1	Factory or Minimum	2 (7.6)	1.2 (4.5)	
		Maximum	4.5 (17)	4.1(15.5)	

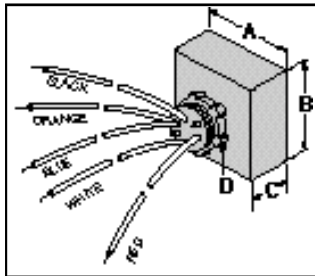
Values are ± 10%

Flow Switches – Time Delay Relays

Series T5R Time Delay Relay



- For Series FS1, FS4-3, FS6, FS7-4 and FS8-W liquid flow switches and Series AF2 and AF3 air flow switches, to add time delay function
- Provides **5 second delay on break** (opening) circuit
- Permits intermittent switching of controlled equipment
- Eliminates false signals and rapid cycling from turbulence or fluctuations
- Direct mounting on Series FS4-3, AF2 and AF3
- Remote mounting on main control panel or conduit box with Series FS1, FS6, FS7-4 and FS8-W
- 120 VAC
- 1/2" NPT lock nut
- 10" (254mm) lead wires
- Solid state
- Completely encapsulated
- Minimum current 20ma
- Optional feature—24 Volt



Electrical Ratings

Model Number	Switch Rating	
	Input Voltage	Maximum Amperes
T5R	120 VAC	1
T5R-24V	24 VAC	1

Dimensions, in. (mm)

A	B	C	D
1 5/8 (41)	1 3/4 (45)	3/4 (19)	NPT 1/2

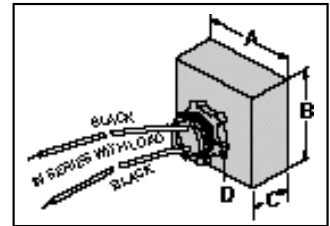
Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
T5R-120V	112000	Time delay relay	.3 (.1)
T5R-24V	112005	T5R w/24 volt	.3 (.1)

Series T20 Time Delay Relay



- For Series FS1, FS4-3, FS6, FS7-4 and FS8-W liquid flow switches and Series AF2 and AF3 air flow switches, to add time delay function
- Provides **20 second delay on make** (closing) circuit
- Permits intermittent switching of controlled equipment
- Eliminates false signals and rapid cycling from turbulence or fluctuations
- Direct mounting on Series FS4-3, AF2 and AF3
- Remote mounting on main control panel or conduit box with Series FS1, FS6, FS7-4 and FS8-W
- 120 VAC
- 1/2" NPT lock nut
- 10" (254mm) lead wires
- Solid state
- No polarity
- Completely encapsulated
- Optional features
 - 24 Volt AC
 - 24 Volt DC
- Minimum current 20 ma



Electrical Ratings

Model Number	Switch Rating	
	Input Voltage	Maximum Amperes
T20	120 VAC	1 AC
T20-24V	24 VAC	1 AC
T20-24VDC	24 VDC	1 DC

Note: 20 milliamperes minimum

Dimensions, in. (mm)

A	B	C	D
1 5/8 (41)	1 3/4 (45)	3/4 (19)	NPT 1/2

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
T20-120V	112050	Time delay relay	.3 (.1)
T20-24V	112055	T20 w/24 volt AC	.3 (.1)
T20-24VDC	112060	T20 w/24 volt DC	.3 (.1)

Air Flow Switches

McDonnell & Miller Air Flow Switches sense air flow or no air flow by responding only to velocity of air movement. They provide a positive and economical way to detect change or loss of air flow velocity caused by closed damper or fan inlet, a loose fan wheel, a slipped or broken fanbelt, a dirty or clogged filter, or an overload on a fan motor switch.

The Series AF1 flow switches are designed for medium and higher velocity systems. Models AF2 and AF3 are for systems with lower air flow velocities.

Air flow switches can be used for a variety of applications such as, but not limited to:

- Clean Room Filter Systems
- Duct Type Heating
- Exhaust Ventilating
- Air Supply System
- Air Treatment Systems

Flow Switches	NEMA Enclosure
All Models	Type 1—General purpose indoor
AFE1	Type 7—Hazardous Location (Class 1—Group C or D) Type 9—Hazardous Location (Class 2—Group E,F or G)

Model AFE1 Flow Switches are Underwriters Laboratories Inc. Listed for use in these hazardous locations:

Class I, Division I, Group C – Atmospheres containing ethylether vapors, ethylene or cyclopropane.

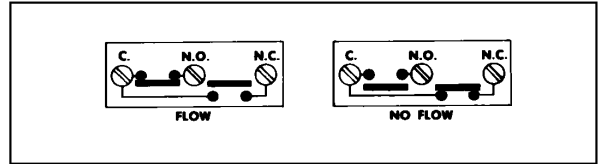
Class I, Division I, Group D – Atmospheres containing gasoline, petroleum. naphtha, benzene, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors or natural gas.

Class II, Division I, Group E – Atmospheres containing dust of aluminum, magnesium or their commercial alloys.

Class II, Division I, Group F – Atmospheres containing carbon black, coal or coke dust.

Class II, Division I, Group G – Atmospheres containing flour, starch or grain dusts.

Note: For other listings contact the factory.



In the tables of flow rates included in this catalog, the word “Flow” means that switch will close one circuit and open the other, when flow rate is increased to the rate shown.

The words “No-Flow” mean the switch will reverse position—open first circuit and close the second—when flow rate is decreased to the rate shown.

Air Flow

Cubic Feet Per Minute (CFM) Duct Area x FPM

$$\text{FPM} = \frac{\text{CFM}}{\text{Duct Area}}$$

One Square Foot = (12" x 12" = 144 sq. In.)

How To Select Air Flow Switches

1. What function will the flow switch perform?

McDonnell & Miller Air Flow Switches are equipped with single pole double throw switches; consequently, they can be used to make or break an electrical circuit either when flow starts or when flow stops. For example, the Flow Switch can be used to:

- Actuate a signal when flow stops
- Start a motor with flow
- Shut off an alarm when flow is adequate
- Stop a motor with no flow

2. How much flow is present?

The air flow velocity at which the Air Flow Switch is to respond should be determined first. McDonnell & Miller Air Flow Switches are actuated (make or break) with an increase in velocity and will reverse switch position (break or make) with a decrease in velocity. The term "Flow" represents the actual movement of air (velocity) within a duct sufficient to actuate the switch. The term "No Flow" represents a decrease in velocity or a total air flow stoppage, which will permit the switch to return back to the original position.

IMPORTANT: In operation the switch must be actuated by "Flow" before it can be reversed again by "No-Flow". All McDonnell Flow Switches can easily be adjusted to require a higher actuating "Flow" or "No-Flow".

3. Size of duct

McDonnell & Miller Air Flow Switches are designed for installation in ducts six inches (150mm) and larger.

4. Maximum temperature

Air temperature inside and outside of the duct should be considered. Different McDonnell & Miller Air Flow Switches can be used at temperatures from 32°F (0°C) up to 300°F (149°C).

5. Maximum Velocities

The Series AF1 is designed for medium and higher velocity applications up to 2500 fpm (12.7mps). The Models AF2, AF3, and AF3-D are designed for lower air flow velocities with a maximum of 2000 fpm (10.2mps).

6. Type of air

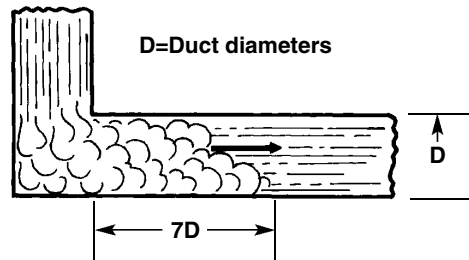
Depending on the model, McDonnell & Miller Air Flow Switches have brass, steel, aluminum, stainless steel, Viton and Teflon® parts exposed to the inside of the duct. In addition to use with normal air, they may be used in applications where certain chemical fumes or other air-borne elements are present.

7. Installation

It is recommended that all models be located in a horizontal duct, 10 duct diameters downstream from fan or 7 duct diameters downstream from an elbow, junction or other cause of turbulence.

Often the actual flow rates in the duct appreciably exceed the flow rate required to actuate the switch. If the flow switch must be located closer than 10 duct diameters from a fan, it is recommended that the flow switch be installed on the suction side of the fan.

For air flow applications, the air flow switch should be mounted 7 duct diameters downstream of a flow obstruction like an elbow; 10 duct diameters downstream of a blower.



Air Flow Switch Specifications – Horizontal Mounting

Model Number	Operating Velocity Range for Horizontal Installation fpm (mpm)	Maximum Allowable Operating Velocity fpm (mpm)	Vane Material	Seal Material	Seal Strength	Enclosure	Switch	Maximum Air Temperature °F (°C)
AF1	480 - 2230 (146 - 680)	2500 (762)	Brass, Steel	Chrome Teflon®	Low	General Purpose Indoor	SPDT	300 (149)
AF1-S	480 - 2230 (146 - 680)	2500 (762)	Stainless Steel 18-8,302 & 316	Viton	Medium	General Purpose Indoor	SPDT	300 (149)
AFE-1	350-1900 (107 - 579)	2000 (610)	Brass, Stainless Steel Aluminum	Magnetic Insulation	High	Hazardous Duty Class I & II	SPDT	275 (135)
AF2	380-1250 (116 - 381)	2000 (610)	Brass, Steel, Aluminum	Chrome Teflon®	Low	General Purpose Indoor	SPDT	300 (149)
AF3	235-1445 (72 - 440)	2000 (610)	Brass, Steel, Aluminum	Chrome Teflon®	Low	General Purpose Indoor	SPDT	275 (135)
AF3-D	295-1445 (90 - 440)	2000 (610)	Brass, Steel, Aluminum	Chrome Teflon®	Low	General Purpose Indoor	DPDT	275 (135)

Flow Velocities

Model Number

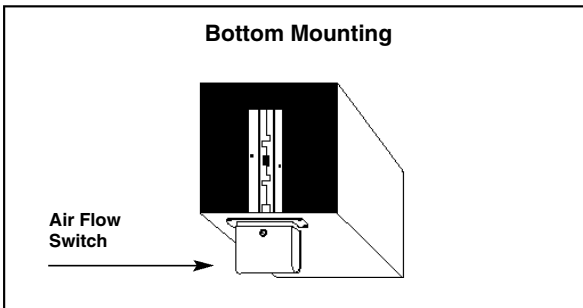
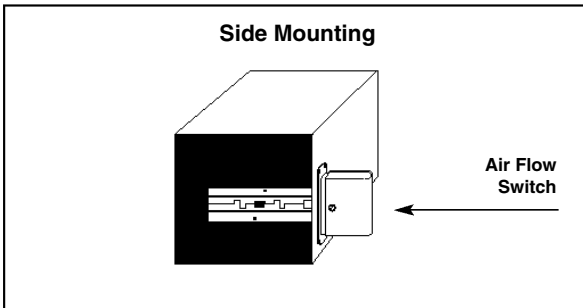
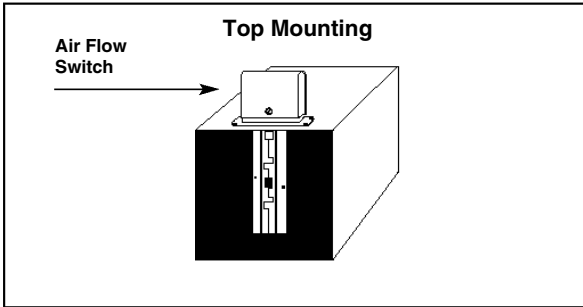


FPM 0 250 500 750 1000 1250 1500 1750 2000 2250 2500
(MPM) (0) (76) (152) (229) (305) (381) (457) (533) (610) (686) (762)

Operating Velocity Range Maximum Allowable Operating Velocity Range

How to Select Air Flow Switches (continued)

Mounting Methods – Horizontal Ducts



Installing the air flow switch in a horizontal duct is recommended. However, if the velocity of air flow exceeds the flow rates shown in the Vertical Duct Chart to the right, the air flow switch may be installed in a vertical duct with **upward** air flow.

Vertical Duct (Upward Flow)

Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF1 Standard 7 1/4" (184mm)	Factory or Minimum	910 (277)	785 (239)
	Maximum	1610 (491)	1460 (445)
AF1 Trimmed 2" (51mm) 5 1/4" (133)	Factory or Minimum	1235 (376)	1050 (320)
	Maximum	2560 (780)	2410 (735)
AF3	Factory or Minimum	450 (137)	430 (131)
	Maximum	1470 (448)	1395 (425)
AF3-D	Factory or Minimum	560 (171)	540 (165)
	Maximum	1470 (448)	1030 (314)

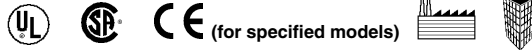
Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
 Values are ± 10%
 Consult factory for downward flow

Density of Air as a Function of Temperature

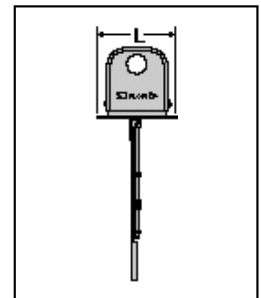
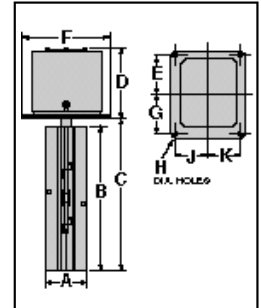
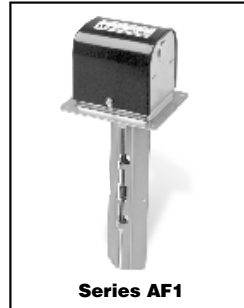
Based on Standard Air			
Temperature		Density	
°F	°C	lbs./ft ³	kg/m ³
-40	-40	.094	1.515
-4	-20	.087	1.395
32	0	.080	1.293
50	10	.078	1.248
68	20	.075	1.205
86	30	.072	1.165
104	40	.070	1.128
140	60	.066	1.060
176	80	.062	1.000
212	100	.059	.946
392	200	.046	.746

Flow Switches – Air

Series AF1 Air Flow Switches



- For general purpose applications with medium and high velocity requirements
- Paddle fits 8" (203mm) minimum duct size, or 6" (152mm) if trimmed
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Two electrical knock-outs allow connection from either end
- Can be equipped with a time delay relay
- Optional features
 - Stainless steel
 - Anti-corrosion treatment
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 300°F (149°C)



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF1	122800	Air flow switch	2.0 (.9)
AF1-S	123000	AF1 w/SS paddle	2.0 (.9)
AF1-J	122920	AF1 w/corrosion coating	2.5 (1.1)
AF1-J-E	122921	AF1-J-CE conformance rated	2.5 (1.1)

See pages 132 for CE conformance information

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F
2 $\frac{1}{8}$ (54)	7 $\frac{5}{16}$ (186)	7 $\frac{23}{32}$ (196)	3 $\frac{7}{16}$ (16)	1 $\frac{29}{32}$ (48.4)	4 $\frac{3}{8}$ (111)

G	H	J	K	L
1 $\frac{29}{32}$ (48.4)	$\frac{9}{32}$ (4.2)	1 $\frac{19}{32}$ (40.5)	1 $\frac{19}{32}$ (40.5)	3 $\frac{13}{16}$ (48.4)

Flow Rates – feet per minute (meters per minute)

Horizontal Duct (Recommended Installation)

Paddle Length	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Standard 7 $\frac{1}{4}$ " (184mm)	Factory or Minimum	480 (146)	185 (56)
	Maximum	1385 (422)	1160 (354)
Trimmed 2" (51mm) 5 $\frac{1}{4}$ " (133mm)	Factory or Minimum	700 (213)	220 (67)
	Maximum	2230 (680)	1820 (555)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are \pm 10%

Vertical Duct (Upward Flow)

Paddle Length	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Standard 7 $\frac{1}{4}$ " (184mm)	Factory or Minimum	910 (277)	785 (239)
	Maximum	1610 (491)	1460 (445)
Trimmed 2" (51mm) 5 $\frac{1}{4}$ " (133mm)	Factory or Minimum	1235 (376)	1050 (320)
	Maximum	2560 (780)	2410 (735)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are \pm 10%

Flow Switches – Air

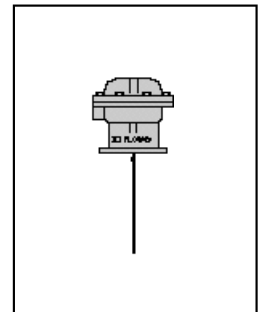
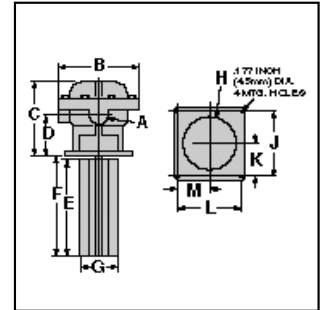
Series AFE-1 Air Flow Switches



(for specified models)



- For industrial hazardous environment applications requiring a **NEMA 7 (Class I, Division I, Group C and D) or NEMA 9 (Class II, Division I, Group E, F, and G)** rated flow switch for medium velocity
- 1/2" NPT conduit connection
- Paddle fits 8" (203mm) minimum duct size
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Maximum ambient temperature 120°F (49°C)
- Maximum duct temperature 275°F (135°C)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AFE-1	123010	Air flow switch w/NEMA 7 & 9 enclosure	6 (2.7)
AFE-1-E	123011	AFE-1-CE conformance rated	6 (2.7)

See page 132 for CE Conformance information

Flow Rates – feet per minute (meters per minute)

Horizontal Duct (Recommended Installation)

Mounting/Duct	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Top (Recommended)	Factory or Minimum	300 (91)	100 (30)
	Maximum	1900 (579)	500 (152)
Side	Factory or Minimum	350 (107)	100 (30)
	Maximum	1950 (594)	900 (274)

 Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
 Values are ± 10%

Dimensions, in. (mm)

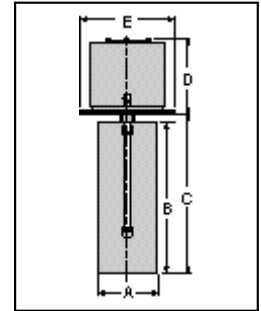
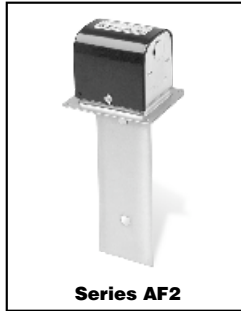
A NPT	B	C	D	E	F
1/2	5 3/4 (146)	5 13/32 (137.3)	2 29/32 (74)	7 1/8 (181)	7 1/2 (191)
G	H	J	K	L	M
2 3/4 (70)	3 5/8 (92)	4 3/8 (111)	2 3/16 (56)	4 3/8 (111)	2 13/16 (56)

Flow Switches – Air

Series AF2 Air Flow Switches



- For low velocity applications
- Paddle fits 8" (203mm) minimum duct size
- Two electrical knock-outs allow connection from either end
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Can be equipped with a time delay relay
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 300°F (149°C)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E
2 ³ / ₄ (70)	7 ¹ / ₄ (184)	7 ² / ₃₂ (194)	3 ⁷ / ₁₆ (87)	4 ³ / ₈ (111)

Flow Rates – feet per minute (meters per minute) using standard paddle

Horizontal Duct

Settings	Mode of Operation	
	Flow fpm (mpm)	No Flow fpm (mpm)
Factory or Minimum	380 (115)	210 (63)
Maximum	1250 (380)	1000 (304)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF2	123200	Air flow switch - low velocity	2.0 (.9)

Flow Switches – Air

Series AF3 Air Flow Switches



(for specified models)



- For general purpose low velocity applications where the most economical flow switch is desired
- Paddle fits 8" (203mm) minimum duct size
- Two electrical knock-outs allow connection from either end
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Can be equipped with a time delay relay
- Optional feature
 - Two SPDT snap switches
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 275°F (135°C)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

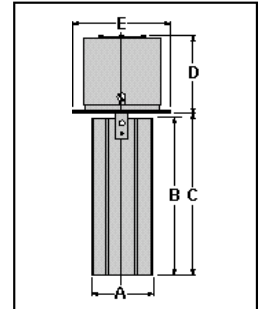
Dimensions, in. (mm)

A	B	C	D	E
2 ³ / ₄ (70)	7 ¹ / ₈ (181)	7 ¹¹ / ₃₂ (186.5)	3 ⁷ / ₁₆ (87)	4 ⁵ / ₈ (111)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF3	123400	Air flow switch - medium velocity	1.7 (.8)
AF3-D	123450	AF3 w/2 SPDT switches	2.0 (.9)
AF3-E	123401	AF3 - CE conformance rated	1.7 (.8)

See page 132 for CE Conformance information



Flow Rates – feet per minute (meters per minute) using standard paddle

Horizontal Duct (Recommended Installation)

Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF3	Factory or Minimum	235 (72)	175 (53)
	Maximum	1445 (440)	1365 (416)
AF3-D	Factory or Minimum	295 (90)	220 (67)
	Maximum	1445 (440)	1000 (305)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Vertical Duct (Upward Flow)

Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF3	Factory or Minimum	450 (137)	430 (131)
	Maximum	1470 (448)	1395 (425)
AF3-D	Factory or Minimum	560 (171)	540 (165)
	Maximum	1470 (448)	1030 (314)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%