## F61 Series Standard Flow Switches

## Installation

IMPORTANT: All F61 Series Flow Switches are intended to control equipment under normal operating conditions. Where failure or malfunction of an F61 Flow Switch could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of, or protect against, failure or malfunction of the F61 Flow Switch must be incorporated into and maintained as part of the control system.

Some models of the F61 Series Standard Flow Switches require installation or adjustment of paddles prior to mounting. See Installing the Flow Paddles.

## Parts Included

Standard models of the F61 flow switch include an installed three-piece flow paddle. Some models also include a large flow paddle for large pipe sizes.

Table 1: Replacement Parts

| Kit Number | Description |
| :---: | :---: |
| KIT21A-600 | Stainless Steel Three-piece Paddle <br> (3 in., 2 in., and 1 in. Segments) |
| KIT21A-601 | Stainless Steel 6 in. Paddle |
| PLT52A-600R | Stainless Steel Three-piece Paddle <br> (3 in., 2 in., and 1 in. Segments) and <br> 6 in. Paddle |
| CVR62A-600R | Replacement Cover Assembly for LB, <br> MB, MD, and MG types |

## Installing the Flow Paddles

IMPORTANT: To allow the switch to detect changes in the fluid flow, the flow paddle must not touch the pipe or any restrictions in the pipe.

Adjust flow paddles to the size of the pipe used. If needed, trim the large flow paddle at the arc corresponding to pipe size (see Figure 1 and Figure 2) and install.


Figure 1: Installing the Paddles


Figure 2: Trimming Diagram for Large Flow Paddle

## Dimensions



Figure 3: NEMA 1 Enclosure (F61KB Types) Dimensions, in./mm


Figure 4: NEMA 3 or NEMA 3R Enclosure (F61LB, F61MB, F61MG Types) Dimensions, in./mm

## Mounting



CAUTION: Risk of Equipment Damage. To avoid damaging the switch, do not tighten the switch to the tee by grasping the switch enclosure. Use only the wrench flats provided.

Mount the F61 Series Flow Switch, using the following guidelines:

- Install the switch so that the cover and interior are accessible.
- Mount the switch so that the flow of fluid is in the direction of the arrow on the switch casing.
- Use a pipe union on each side of the flow switch to allow easy removal or replacement.
- Mount the switch so that the pipe does not extend too far into the flow switch casing.
- Use pipe thread sealer on male threads only.
- Do not remove the cover gasket or the wire grommet from the conduit opening.

For 1 in. pipe installation, mount the F61 flow switch in a standard 1 in. $x 1$ in. $x 1$ in. tee. For larger sizes of pipe, use a reducing tee to keep the flow switch close to the pipe and provide adequate paddle length in the flow stream.

Example: Use a 2 in. $\times 2$ in. $\times 1$ in. tee for a 2 in. pipe. If a standard 2 in. $\times 2$ in. $\times 2$ in. tee is used, install a face or hex bushing in the top opening to reduce it to 1 in .

Mount the flow switch so the terminals or wire leads are easily accessible for wiring. Screw the flow switch in position so the flat of the paddle is at a right angle to the flow. The arrow on the side of the case must point in the direction of the flow.

## Location Considerations

Mount the F61 flow switch in a horizontal pipeline or a vertical pipeline with upward fluid flow. Do not use in a vertical pipeline with downward flow. When mounted in a vertical pipe with upward flow, the switch trips at a slightly higher flow than shown in Table 3 through Table 6, due to the effect of gravity on the switch mechanism.

Mount the F61 flow switch in a section of pipe where there is a straight run of at least five pipe diameters on each side of the flow switch from the nearest elbow, valve, or other pipe restriction. See Figure 5.


Figure 5: Required Piping Distance
Do not subject the flow switches to water hammer. Use a suitable water hammer arrester if a fast-closing valve is located downstream of the flow switch. See Figure 6.


Figure 6: Water Hammer Arrester Location Schematic

## Wiring

WARNING: Risk of Electrical Shock. Disconnect power supply before making electrical connections. Failure to follow this precaution may result in electrical shock or death.

CAUTION: Risk of Equipment Damage. Using terminal screws other than those provided will void the warranty and may damage the switch. Use only the terminal screws furnished.

IMPORTANT: To prevent moisture from entering and condensate from forming inside the NEMA 3R enclosure, do not remove the cover gasket or the wire grommet from the conduit opening.

IMPORTANT: Install all wiring in accordance with the National Electrical Code and local regulations. Make all wiring connections using copper conductors only. Do not exceed the control's electrical rating.

The F61KB and F61LB models have three color-coded terminals. Red is common. See Table 2 and Figure 1 for switch action.

The F61MB and F61MG models have four color-coded wire leads. Red is common, green is ground. See Table 2.

Table 2: Switch Action

| Flow Action | Switch Closure |
| :---: | :---: |
| Increase | Red to Yellow |
| Decrease | Red to Blue |

> Increase in Flow Above Setpoint

Decrease in Flow


Figure 7: Switch Action
Setup and Adjustments

CAUTION: Risk of Equipment Damage. Sealed settings (screws marked with black paint) are not intended to be changed. Adjustment attempts may damage the control or cause loss of calibration, voiding the warranty.

To adjust the setting of the flow switch:

1. Disconnect power supply before making electrical connections.
2. Remove the F61 flow switch cover.
3. Turn the adjusting screw clockwise to raise the flow rate. Turn the adjusting screw counterclockwise to lower the flow rate. See Figure 8.
4. Replace the cover after completing adjustments. Tighten the cover screws to 12 in lbs of torque.

Note: Do not lower the flow rate unless it has been raised from the factory setting.


Figure 8: Flow Rate Adjustment

To verify that the flow rate is set above the factory minimum (see Figure 9):

1. depress the main lever numerous times. If the lever fails to click upon return at any time, the flow rate is set below the factory-set minimum.
2. raise the flow rate to approximately the factory minimum by turning the adjusting screw clockwise until the lever clicks upon return every time.


Figure 9: Minimum Adjustment

## Typical Flow Rates for Standard F61 Flow Switches

Table 3: F61KB, F61LB, and F61MB Models, 1-3 in. Paddles

| GPM (m ${ }^{3} / \mathrm{hr}$ ) Required to Actuate Switch |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pipe Size (in.) |  | 1 | 1-1/4 ${ }^{1}$ | 1-1/2 ${ }^{1}$ | 2 | 2-1/2 ${ }^{2}$ | 3 | $4^{3}$ | $5^{3}$ | $6^{3}$ | $8^{3}$ |
| Minimum Adjustment | Flow Increase ( R to Y Closes) | $\begin{gathered} 4.20 \\ (0.95) \end{gathered}$ | $\begin{gathered} 5.80 \\ (1.32) \end{gathered}$ | $\begin{gathered} 7.50 \\ (1.70) \end{gathered}$ | $\begin{gathered} 13.7 \\ (3.11) \end{gathered}$ | $\begin{gathered} 18.0 \\ (4.09) \end{gathered}$ | $\begin{gathered} 27.5 \\ (6.24) \end{gathered}$ | $\begin{gathered} 65.0 \\ (14.8) \end{gathered}$ | $\begin{gathered} 125 \\ (28.4) \end{gathered}$ | $\begin{gathered} 190 \\ (43.2) \end{gathered}$ | $\begin{gathered} 375 \\ (85.2) \end{gathered}$ |
|  | Flow Decrease (R to B Closes) | $\begin{gathered} 2.50 \\ (0.57) \end{gathered}$ | $\begin{gathered} 3.70 \\ (0.84) \end{gathered}$ | $\begin{gathered} 5.00 \\ (1.14) \end{gathered}$ | $\begin{gathered} 9.50 \\ (2.16) \end{gathered}$ | $\begin{gathered} 12.5 \\ (2.84) \end{gathered}$ | $\begin{gathered} 19.0 \\ (4.32) \end{gathered}$ | $\begin{gathered} 50.0 \\ (11.4) \end{gathered}$ | $\begin{gathered} 101 \\ (22.9) \end{gathered}$ | $\begin{gathered} 158 \\ (35.9) \end{gathered}$ | $\begin{gathered} 320 \\ (72.7) \end{gathered}$ |
| Maximum Adjustment | Flow Increase (R to Y Closes) | $\begin{aligned} & 8.80 \\ & (2.0) \end{aligned}$ | $\begin{gathered} 13.3 \\ (3.02) \end{gathered}$ | $\begin{gathered} 19.2 \\ (4.36) \end{gathered}$ | $\begin{gathered} 29.0 \\ (6.59) \end{gathered}$ | $\begin{gathered} 34.5 \\ (7.84) \end{gathered}$ | $\begin{gathered} 53.0 \\ (12.0) \end{gathered}$ | $\begin{gathered} 128 \\ (29.1) \end{gathered}$ | $\begin{gathered} 245 \\ (55.6) \end{gathered}$ | $\begin{gathered} 375 \\ (85.2) \end{gathered}$ | $\begin{gathered} 760 \\ (173) \end{gathered}$ |
|  | Flow Decrease ( R to B Closes) | $\begin{gathered} 8.50 \\ (1.93) \end{gathered}$ | $\begin{gathered} 12.5 \\ (2.84) \end{gathered}$ | $\begin{gathered} 18.0 \\ (4.09) \end{gathered}$ | $\begin{gathered} 27.0 \\ (6.13) \end{gathered}$ | $\begin{gathered} 32.0 \\ (7.27) \end{gathered}$ | $\begin{gathered} 50.0 \\ (11.4) \end{gathered}$ | $\begin{gathered} 122 \\ (27.7) \end{gathered}$ | $\begin{gathered} 235 \\ (53.4) \end{gathered}$ | $\begin{gathered} 360 \\ (81.8) \end{gathered}$ | $\begin{gathered} 730 \\ (166) \end{gathered}$ |

1. Values for 2 in. paddle trimmed to fit pipe.
2. Values for 3 in. paddle trimmed to fit pipe.
3. Values calculated for factory-installed set of 1, 2, and 3 in . paddles.

Table 4: F61KB, F61LB, and F61MB Models, 6 in. Paddles*

| GPM (m3/hr) Required to Actuate Switch |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pipe Size (in.) |  |  |  |  |  |  | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{8}$ |
| Minimum | Flow Increase (R to Y Closes) | $37.0(8.40)$ | $57.0(12.9)$ | $74.0(16.8)$ | $205(46.6)$ |  |  |  |  |  |
| Adjustment | Flow Decrease (R to B Closes) | $27.0(6.13)$ | $41.0(9.31)$ | $54.0(12.3)$ | $170(38.6)$ |  |  |  |  |  |
| Maximum | Flow Increase (R to Y Closes) | $81.0(18.4)$ | $118(26.8)$ | $144(32.7)$ | $415(94.3)$ |  |  |  |  |  |
| Adjustment | Flow Decrease (R to B Closes) | $76.0(17.3)$ | $111(25.2)$ | $135(30.7)$ | $400(90.8)$ |  |  |  |  |  |

[^0]Table 5: F61MG Models, 1-3 in. Paddles

| GPM ( $\mathrm{m}^{3} / \mathrm{hr}$ ) Required to Actuate Switch |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pipe Size (in.) |  | 1 | 1-1/4 ${ }^{1}$ | 1-1/2 ${ }^{1}$ | 2 | 2-1/2 ${ }^{2}$ | 3 | $4^{3}$ | $5^{3}$ | $6^{3}$ | $8^{3}$ |
| Minimum Adjustment | Flow Increase ( R to Y Closes) | $\begin{gathered} 3.80 \\ (0.86) \end{gathered}$ | $\begin{gathered} 5.30 \\ (1.20) \end{gathered}$ | $\begin{gathered} 6.90 \\ (1.57) \end{gathered}$ | $\begin{gathered} 12.7 \\ (2.88) \end{gathered}$ | $\begin{gathered} 16.7 \\ (3.79) \end{gathered}$ | $\begin{gathered} 24.3 \\ (5.52) \end{gathered}$ | $\begin{gathered} 61.0 \\ (13.8) \end{gathered}$ | $\begin{gathered} 118 \\ (26.8) \end{gathered}$ | $\begin{gathered} 183 \\ (41.6) \end{gathered}$ | $\begin{gathered} 362 \\ (82.2) \end{gathered}$ |
|  | Flow Decrease ( R to B Closes) | $\begin{gathered} 2.50 \\ (0.57) \end{gathered}$ | $\begin{gathered} 3.70 \\ (0.84) \end{gathered}$ | $\begin{gathered} 5.00 \\ (1.14) \end{gathered}$ | $\begin{gathered} 9.50 \\ (2.16) \end{gathered}$ | $\begin{gathered} 12.5 \\ (2.84) \end{gathered}$ | $\begin{gathered} 19.0 \\ (4.32) \end{gathered}$ | $\begin{gathered} 50.0 \\ (11.4) \end{gathered}$ | $\begin{gathered} 101 \\ (22.9) \end{gathered}$ | $\begin{gathered} 158 \\ (35.9) \end{gathered}$ | $\begin{gathered} 320 \\ (72.7) \end{gathered}$ |
| Maximum Adjustment | Flow Increase ( R to Y Closes) | $\begin{gathered} 8.70 \\ (1.98) \end{gathered}$ | $\begin{gathered} 13.1 \\ (2.98) \end{gathered}$ | $\begin{gathered} 18.8 \\ (4.27) \end{gathered}$ | $\begin{gathered} 28.9 \\ (6.56) \end{gathered}$ | $\begin{gathered} 33.7 \\ (7.65) \end{gathered}$ | $\begin{gathered} 52.1 \\ (11.8) \end{gathered}$ | $\begin{gathered} 126 \\ (28.6) \end{gathered}$ | $\begin{gathered} 243 \\ (55.2) \end{gathered}$ | $\begin{gathered} 372 \\ (84.5) \end{gathered}$ | $\begin{gathered} 753 \\ (171) \end{gathered}$ |
|  | Flow Decrease ( R to B Closes) | $\begin{gathered} 8.50 \\ (1.93) \end{gathered}$ | $\begin{gathered} 12.5 \\ (2.84) \end{gathered}$ | $\begin{gathered} 18.0 \\ (4.09) \end{gathered}$ | $\begin{gathered} 27.0 \\ (6.13) \end{gathered}$ | $\begin{gathered} 32.0 \\ (7.27) \end{gathered}$ | $\begin{gathered} 50.0 \\ (11.4) \end{gathered}$ | $\begin{gathered} 122 \\ (27.7) \end{gathered}$ | $\begin{gathered} 235 \\ (53.4) \end{gathered}$ | $\begin{gathered} 360 \\ (81.8) \end{gathered}$ | $\begin{gathered} 730 \\ (166) \end{gathered}$ |

1. Values for 2 in. paddle trimmed to fit pipe.
2. Values for 3 in. paddle trimmed to fit pipe.
3. Values calculated for factory-installed set of 1, 2, and 3 in . paddles.

Table 6: F61MG Models, 6 in. Paddles*

| GPM (m $\mathbf{3} / \mathbf{h r}$ ) Required to Actuate Switch |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Pipe Size (in.) | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{8}$ |  |
| Minimum | Flow Increase (R to Y Closes) | $35.0(7.95)$ | $53.0(12.0)$ | $69.0(15.7)$ | $197(44.7)$ |  |
| Adjustment | Flow Decrease (R to B Closes) | $27.0(6.13)$ | $41.0(9.31)$ | $54.0(12.3)$ | $170(38.6)$ |  |
| Maximum | Flow Increase (R to Y Closes) | $80.0(18.2)$ | $116(26.3)$ | $142(32.2)$ | $412(93.6)$ |  |
| Adjustment | Flow Decrease (R to B Closes) | $76.0(17.3)$ | $111(25.2)$ | $135(30.7)$ | $400(90.8)$ |  |

* Where paddle size is larger than pipe size, values are for 6 in. paddle trimmed to fit pipe.


## Checkout

IMPORTANT: Ensure installation, wiring, and control settings are according to the application requirements. Refer to the controlled system's manufacturer specifications for the proper settings when adjusting these controls.

Apply power to the control and controlled equipment. Cycle the controlled system at least three times at normal operating conditions.

The circuit between the red and the yellow leads (terminals) closes when sufficient fluid flows through the pipe to trip the F61 flow switch.

## Troubleshooting

Use the information in Table 7 to troubleshoot the flow switch.

## Repairs and Replacement

Do not make field repairs, except for replacement of the cover and paddles. For a replacement flow switch, paddle kit or cover, contact the nearest Johnson Controls/PENN ${ }^{\text {TM }}$ distributor. For more information, contact Refrigeration Application Engineering at (800) 275-5676.

Table 7: Troubleshooting

| Symptom/Problem | Solution |
| :---: | :---: |
| Water (condensate) is within the enclosure. | Use a model with a NEMA 3R enclosure. If using a model with <br> a NEMA 3R enclosure, inspect the grommet in the conduit <br> fitting. Replace grommet if defective. |
| Fluid from the tank is leaking into enclosure due to <br> bellows failure. | Replace flow switch. |
| Switch does not activate due to debris caught within <br> the switch mechanism. | Clear any debris within the switch mechanism. Test the <br> operation of switch several times for proper operation. |
| Control switch action is reversed. | Ensure connections follow wiring diagrams. |
| Control does not switch. | Check connections. |
| Switch fails to return to the no flow position. | Switch is set lower than the factory setting. Increase the setting. <br> On vertical pipes, ensure that direction of flow is up. The arrow <br> on switch must point in direction of flow (up). |
| Control does not switch on flow increase. | Check for cracked/broken paddle. Replace if necessary. |

## Electrical Ratings

Table 8: Electrical Ratings for F61KB, F61LB, and F61MB Models

| Electrical Ratings | 120 VAC | 208 VAC | 240 VAC | 277 VAC |
| :---: | :---: | :---: | :---: | :---: |
| Horsepower | 1 | 1 | 1 | - |
| Full Load Amperes | 16.0 | 8.8 | 8.0 | - |
| Locked Rotor Amperes | 96.0 | 52.8 | 48.0 | - |
| Non-inductive Amperes | 16.0 | 16.0 | 16.0 | 16.0 |
| Pilot Duty | 125 VA at $24 / 277$ VAC |  |  |  |

Table 9: Electrical Ratings for F61MG Models

| Electrical Ratings | 120 VAC |
| :---: | :---: |
| Full Load Amperes | 1 |
| Locked Rotor Amperes | 6 |
| Non-inductive Amperes | 2 |
| Pilot Duty | 125 VA at 24/277 VAC |

## Technical Specifications

| Product | F61 Series Standard Flow Switches |
| :---: | :---: |
| Maximum Fluid Pressure | 150 psig ( 1034 kPa ) |
| Minimum Fluid Temperature | $32^{\circ} \mathrm{F}\left(0^{\circ} \mathrm{C}\right)(\mathrm{F} 61 \mathrm{~KB}, \mathrm{~F} 61 \mathrm{LB})$ |
|  | $-20^{\circ} \mathrm{F}\left(-29^{\circ} \mathrm{C}\right)$ (F61MB, F61MG) |
| Maximum Fluid Temperature | $250^{\circ} \mathrm{F}\left(121^{\circ} \mathrm{C}\right)$ |
| Switch | Single Pole Double Throw |
|  | Screw Type Terminals (F61KB, F61LB) |
| Wiring Connections | Four Color-coded No. 14 AWG Solid Conductor Wire Leads, 7 in. ( 178 mm ) Long (F61MB, F61MG) |
| Pipe Connector | 1 in. 11-1/2 NPT Threads |
| Conduit Connection | One 7/8 in. (22 mm) Hole for 1/2 in. Conduit with 1-1/8 in. (29 mm) Knockout Ring for 3/4 in. Conduit (F61KB) |
|  | Female Hub for $1 / 2 \mathrm{in}$. Conduit, 1/2-14 NPSM Threads (F61LB, F61MB, F61MG) |
| UL Listed | E5368, CCN NMFT |
| Agency  <br> Listings CSA <br> Certified | LR948, Class 3211 06, Class 4813 02, Class 122201 (F61KB) |
|  | (F61LB - Not CSA Certified) |
|  | LR948, Class 321106 (F61MB, F61MG) |
| Shipping Weight | $2.8 \mathrm{lb}(1.3 \mathrm{~kg})$ |

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Refer to the F61 Series Flow Switches Product/Technical Bulletin (LIT-125225) for necessary information on operating and performance specifications of this product.

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[^0]:    * Where paddle size is larger than pipe size, values are for 6 in. paddle trimmed to fit pipe.

