

## Operation Manual

### Flow Switches

*(Models AP74 and AP74B)*

#### A. General information

The AP74 and AP74B flow switches are used in gas delivery systems to signal an increase in flow above a trip point. The signal is transmitted by a closed or open electrical contact from a reed switch. The signal is typically monitored by a controller, which closes an isolation valve in the gas delivery system when an “excess flow” signal is received. Many models are available with different operating characteristics (pressure ratings, trip points, etc.) and porting configurations.

Refer to the appropriate catalog data sheet for specific product information.

Product Note PN 423 is the application guide for flow switch sizing, installation, and troubleshooting. It is available on the AP Tech website ([www.aptech-online.com](http://www.aptech-online.com)). Click the “Tech Briefs” tab at the top of the page and scroll down to “Product Notes”.

To assist in flow switch selection, an online calculator tool is also found on the website. Access the tool in the lower left corner of the home page by clicking the tab marked “Flow Trip Point Calculator”. Enter gas and pressure conditions and read the calculated trip points adjacent to the flow switch models.

**Note:** Excess flow switches are intended to be used to send an electric signal when gas flow exceeds the device trip point. Excess flow switches do not stop flow the flow of gas. Excess flow switches are not intended to be operated outside of their specific temperature, pressure, and flow specifications. It is the sole responsibility of the user to determine if the wetted materials are compatible with the process gas.

#### B. Installation

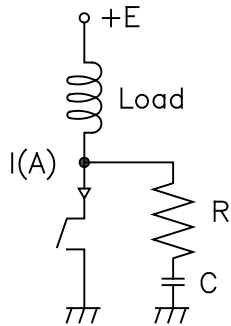
1. Prior to installation, verify that the operating characteristics of the flow switch as described below are appropriate for the system in which it will be installed.
  - a. Verify the materials of construction are compatible with the intended process gas.
  - b. Verify the pressure and temperature ratings are acceptable for the intended application.
  - c. Verify that the trip point of the flow switch is appropriate for the application.
  - d. Verify that the flow switch will be used in gas service only.
2. Inspect the flow switch to determine the flow path through the device and how the flow switch will need to be installed in the system.

- a. The AP74 has a flow arrow on the model number label on the body that indicates the forward flow direction.
  - b. The AP74B has a flow arrow on the model number label on the body of the switch in the bypass line that indicates the forward flow direction. The forward flow direction in the AP74B main line is parallel to the flow in the bypass line.
3. Ensure there are no sensitive electronic devices near the intended installation location. The flow switch contains a strong magnet that could adversely affect these devices. Ensure there are no strong magnets near the AP74 or AP74B. A strong magnet can adversely affect the reed switch operation.
4. Install the flow switch using the appropriate method described below.
  - a. For tube stub connections, weld connectors or other components to the tube stubs per standard industry practice (reference SEMI standard F78).
  - b. For metal face seal connectors, assemble connections per standard practice described by fitting supplier (typically 1/8 turn past fingertight).
5. Connect switch signal wires to appropriate controller as described below (see also section C. Precautions and Applications).
  - a. Use brown and blue wires for normally closed contact installation
  - b. Use black and blue wires for normally open contact installation
6. After installation, verify the following to ensure correct operation.
  - a. Verify the AP74 is installed within 8 degrees of vertical with the inlet on the bottom
  - b. Verify the switch in the AP74B bypass line is installed within 8 degrees of vertical (the AP74B mainline can optionally be horizontal or vertical)
7. After installation, perform a helium leak test of all face seal connections and welds per standard industry practice (reference SEMI standard F1).
8. After installation, perform a nitrogen gas flow test to verify that the switch trips sending a signal to the controller and resets when flow is shut off.

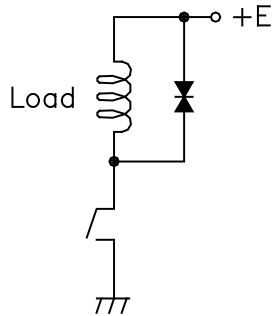
### **C. Precautions and Applications for Wiring Reed Switch**

When a reed switch is to be connected to an inductive load or a load where surge current or a rush current flows, the following contact protection circuits are required.

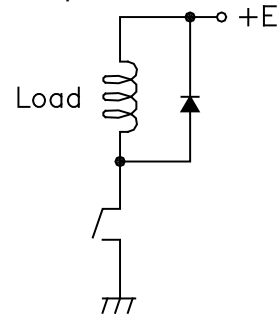
1. Inductive loads – when an electromagnetic relay, electromagnetic solenoid, or electromagnetic counter, which has inductance, is installed as a load in a circuit, the energy stored in the device will cause an inverse voltage when the reed contacts open. The voltage sometimes reaches as high as several hundred volts and becomes a major factor to deteriorate contacts. Many types of protection circuits can prevent this, typical examples are shown in the figures below.



Contact protection by capacitor and resistor (connection at the load terminal is allowed).

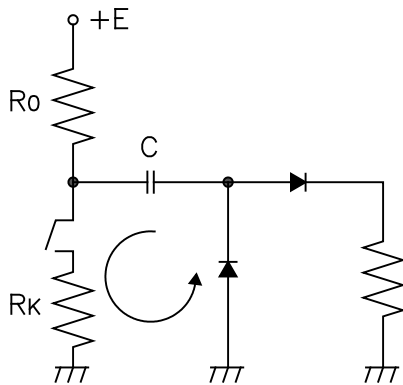


Contact protection by varistor. When the contact is open for a long time, the varistor should be connected at the load terminal.

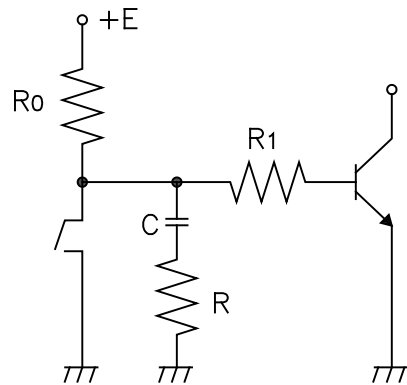


Contact protection by diode. Breakdown voltage of diode should be larger than E volt. Forward current of diode should be almost equal to 5 E divided by the coil resistance.

2. Capacitive loads – when a capacitor is provided in series or in parallel with the reed switch contacts in a closed circuit, the inrush current, which flows at the time of charge and discharge of the capacitance, will cause deterioration of the reed contacts. The two figures shown below are typical examples of the protection circuits used to prevent inrush current.

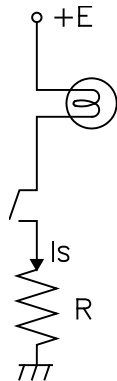


Current limiting resistor ( $R_K$ ) is installed to protect contact.



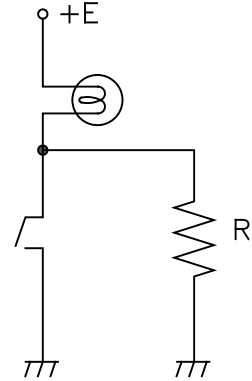
Resistor (R) is installed to protect contact. R should be between 50 and 500 Ohm.

3. Lamp loads – when a lamp load is used with the reed switch, the inrush current can cause deterioration of the reed contacts. The follow two figures show examples of protection circuits.



Current limiting resistor (R) is installed to protect contact. R should be determined to satisfy:

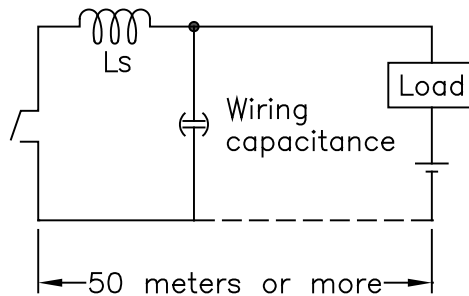
$$I_s < 0.2A$$



Parallel resistor (R) is installed to preheat lamp filament and increase the resistance. R should be:

$$R < \text{Filament resistance} / 3$$

4. Wiring capacitance – when wiring a load and reed switch over a long distance, electrostatic capacitance arising from the cable can influence the reed switch contact and an inductor  $L_s$  should be installed. The inductance ( $L_s$ ) value depends on the load current, but should be in the range of 0.5 to 5 mH. The figure below shows a typical protection circuit.



## D. Operation

The AP74 or AP74B flow switch does not require any specific action by the system operator for correct operation once installed.

When system flow exceeds the trip point, a magnet inside the device will move upward causing the reed switch normally open contacts to close and normally closed contacts to open. When flow drops slightly below the trip point, the magnet will move downward and the reed switch contacts will revert to the previous position.

**Note:** Initial pressurization of system lines can cause a flow surge that exceed the system maximum design flow rate and trips the flow switch. If this occurs, first check the system for leaks or open vent valves and, if no problems are found, reset the controller and reinitiate system pressurization.

*Please contact the factory or your local representative to answer questions or for further information.*