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The selection of mechanical switches for valve monitoring applications

A mechanical micro switch relies on contact from a switch cam for operation, there are moving contacts within the switch and ingress protection is provided by the switchbox enclosure. Here are some important definitions that should help when selecting mechanical micro switches.

Single Pole (S.P): Ascribed to switches capable of controlling one circuit.

Double Pole (D.P): Ascribed to switches capable of controlling two circuits.

Single Throw (S.T): A switch which provides an ON-OFF or OFF-ON function but does not changeover from one conductor to another.

Double Throw (D.T): A switch which opens one pair of contacts and closes another pair when it is actuated. One contact is common to both pairs in three terminal micro switches.

Changeover (C.O): See "Double Throw". Can be abbreviated C.O. in place of D.T.

Normally open /closed (N.O/N.C): The relationship of the fixed and moving contacts when the switch is in free position.

S.P.D.T switches: Single pole double throw - 3 wires required.

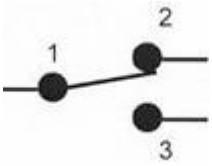

Diagram shows layout of S.P.D.T Switch.
1 = Common.
2 = Normally Closed Contact.
3 = Normally Open contact.

S.P.S.T switches: Single pole single throw - 2 wires required.

(An S.P.S.T switch can be obtained by only wiring two connections of an S.P.D.T switch, typically the common and normally open contacts).

D.P.D.T switches: Double pole double throw (see above definitions) - 6 wires required.
Each pair of contacts within a D.P.D.T switch is mechanically linked such that two electrically independent circuits may be switched simultaneously. Alternatively two S.P.D.T switches can act as a single D.P.D.T switch by mechanically linking a pair of switch cams.

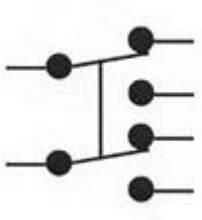

Diagram shows layout of a D.P.D.T. switch.
Essentially two S.P.D.T switches operated at the same time.

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Wireless solutions
Linear or rotary adaptation

K Controls can also supply your positioner requirements

D.P.S.T switches: Double pole single throw (see above definitions). 4 wires required. This is achieved by only wiring two connections of each independent circuit.

Gold plated contacts: Used primarily in applications where switched voltage and current levels are low, e.g. 1mA at 12 volts, and the corrosion of silver contact switches would create high resistance contact faults (i.e. a switch appears to be open when closed). Gold contact micro switches are usually specified on intrinsically safe circuits or on applications where a switch may remain unused for a long time especially in a corrosive atmosphere.

Switch ratings: These define a switch's ability to make or break at a given current and voltage. Heating and arcing eventually limit a switch's ability to function. If it is not switching then the mechanism is purely I^2R (I = current, R=resistance) heating due to contact resistance and there won't be any arcing with closed contacts. When the switch is operated, arcing takes place. In addition to the heat, the contacts get pitted (they actually melt locally) and there can be a build up of carbon (from burning of particles in the atmosphere). This increases the contact resistance and eventually, if there is too much heat, the switch will fail. Keeping the voltage and current within the specification will ensure a long switch life. It is also important to ensure the application uses the over travel of the switch plunger because this adds to the contact pressure, reducing the contact resistance and hence the heat generated in the contacts. (K Controls cam design ensures there is adequate switch plunger over travel).

AC versus DC switch ratings: Micro switches are derated for DC operation. The reason for this is that the rate of heat dissipation is directly related to the wattage (volts x current) and type of the load being switched. A DC voltage is constant whereas an AC voltage passes through 0 volts twice every 20 milli-seconds. For a given voltage the average power switched is considerably less on AC systems than on DC and therefore there will be less arcing. For this reason a switch will handle more AC than DC current.

Inductive versus resistive loads: Most applications in valve monitoring involve switching resistive loads (e.g. PLC input cards). Occasionally an inductive load will be switched e.g. a solenoid coil. With inductive loads higher voltages than the nominal are induced during switching which increase the wattage and thus the heating effect. Therefore any given switch has an inductive rating that is lower than its resistive rating. As mentioned above, with DC supplies an arc is generated between the contacts during switching which adds to the heating effect. However with DC operation on a resistive load, the switch is operating at a constant current and voltage and therefore there is "constant arcing". With an inductive load, the back emf generated increases the voltage across the contacts at switch-off which produces even more arcing. This is the reason why DC inductive ratings are so low.

Pneumatic mechanical micro switches : Although not often used K Controls products are available with one or two pneumatic switches. Each is of a "two port with vent" design and has a rating of 3 to 8 bar. The conduit entry is replaced with a manifold in which there are three 6mm O/D push-in fittings. Where two switches are fitted, the manifold provides a common inlet and two outlets. Where one switch is fitted the third port is blanked.

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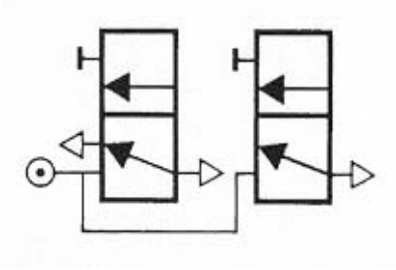

Diagram shows the layout of two, two port with vent pneumatic switches with a common inlet.

Similar documents covering reed and inductive proximity switches are available on request.