PRESSURE / DIFFERENTIAL PRESSURE SWITCHES

SWITZER Pressure or Differential Pressure Switch is a simple electro mechanical device operating on basic principles of Levers and opposing forces. Three essential elements, various combinations of which form the basics for presenting hundreds of variants to suit a variety of industrial applications. They are :

1. sensing element either of bellows or diaphragm (metallic or elastomeric)
2. a stable spring to determine the range setpoint and
3. a snap-acting microswitch available in a wide variety.

Mounting / Connections / Precautions

1. Position gaskets correctly while covers are fixed. Cover mounting screws must be tight.
2. Properly seal the electrical entries and cables with correct cable gland, weatherproof or flameproof as required. If in doubt, consult factory.
3. Process pressure should not exceed stated maximum working pressure.
4. Connected electrical load should not exceed declared maximum electrical capacity BOTH in amperes and volts.
5. **Do not establish pressure connections by rotating the housing. Hold hexagon of the sensor pressure connector with suitable spanner and tighten.**
6. Mount the instrument firmly and rigidly either directly on the pressure piping or on a vibration free wall, panel or pipe stanchion.
7. If outdoor installation is envisaged provide sufficient protection against aggressiveness of air, dust, very low or very high temperature, solar radiation, water penetration etc. This is essential even for weatherproof instruments.
8. If process temperature is higher than the permissible maximum temperature, it can be brought down at the instrument end by employing a longer pressure piping. Ask factory for piping nomogram.
9. A condensate coil or Pig tail should be used invariably for steam service.
10. Ensure that suitable dampener / snubber is used in rapidly fluctuating pressure lines.

OPERATION

***Pressure Switch* : Models 201, 203, 281, 204, 208, 209 and 021 & 023**

Process pressure when applied to the sensing element creates a force which overcomes that of a pre-tensioned spring, and in turn moves a balancing arm to effect a minimal movement required to actuate a microswitch (es).

Refer table below for sensing element type and material.

Instrument Model	**Sensor & Material**	**On-off** Differential
201	**Bellows** Phosphor Bronze / 316L SS / Monel	Fixed
203	**Bellows** Phosphor Bronze / 316L SS / Monel	Adjustable
281 (Dual Setpoint)	**Bellows** Phosphor Bronze / 316L SS / Monel	Fixed
204 (High Static Pressure)	**Metallic Diaphragm** 316 SS / Monel / Hast'l C	Fixed
208	**Metallic Diaphragm** 316 SS / Monel / Hast'l C	Fixed
209 (Food Grade / Hygenic Service)	**Metallic Diaphragm** 316L SS	Fixed
021 (Draft & Compound Ranges)	**Elastomer Diaphragm** Nitrile / EPDM / Viton / Silicone	Fixed
023 (Draft & Compound Ranges)	**Elastomer Diaphragm** Nitrile / EPDM / Viton / Silicone	Adjustable

Differential Pressure Switch : Models 301, 303, 381, 304, 384, 306, 386, 310, 313, GN 310

When pressures from two different sources in a process are connected across the sensing diaphragm, metallic or elastomeric, the pressure difference creates a force which when overcomes that of a pre-tensioned spring, moves a balancing arm to effect the minimal movement required to actuate a microswitch(es).

High and low pressures are applied on either side of the specially contoured diaphragm and this design feature straight away eliminates the errors due to the difference in area, a common problem present in twin element pressure differential switches.

In models 301/ 4, 303, 381/ 4, 306, 386 and GN 310, a unique motion transfer assembly is used, which is sensitive to minute movements of the diaphragm but

immune to the application of very high static pressure except in 310, 313 & GN 310.

In models 310 & 313, the task of transferring the resultant movement of the diaphragm is achieved by employing an additional sealing diaphragm above the low pressure chamber.

Refer table below for sensing element type and material.

Instrument Model	Sensor & Material	On-off Differential
301	**Metallic Diaphragm** 316L SS	Fixed
303	**Metallic Diaphragm** 316L SS	Adjustable
304 (High Static Pressure)	**Diaphragm** 316L SS	Fixed
381 (Dual Setpoint)	**Diaphragm** 316L SS	Fixed
384 (Dual Setpoint, High Static Pressure)	**Diaphragm** 316L SS	Fixed
306 (Economy Version)	**Diaphragm** Nitrile	Fixed
386 (Dual Setpoint, Economy Version)	**Diaphragm** Nitrile	Fixed
310, GN 310 (Low Ranges)	**Diaphragm** Neoprene / EPDM / Silicone	Fixed
313	**Diaphragm** Neoprene / EPDM / Silicone	Adjustable

SETTING OF SWITCHING POINTS

Set-up

A pressure source and a master gauge of accuracy better than 0.5% is required to set the actuating point. In the case of Differential Pressure switches connect the pressure source to the high pressure port and leave the low pressure port vented to atmosphere.

Switching point should preferably lie in the mid 50% of the adjustable range span.

Markings provided on the range scale are for guidance only. ***To set switching points precisely use a master Pressure Gauge.***

The switching point can be set, either for fall in pressure or rise in pressure by rotating the Range Adjusting screw.

Remove the instrument cover. Unscrew and remove the lock plate, which prevents the movement of the Range screw.

Now proceed with the setting of the switching points as below:

Fixed ON-OFF Differential Models

a) Rotate the range adjustment screw clockwise to increase the switching point. Rotating anti-clockwise will decrease the switching point.

b) After setting, re-fix the locking device back in position to prevent unauthorised adjustment of the setpoint.

c) The center screw and the striker screw are precisely adjusted and factory-set using Loctite. **Alteration** of centre screw height will disturb the contact established between the sensor and the balance beam. **Disturbance** of stricker screw will result in microswitch not acting or set-point shift. Ref. Fig 1.

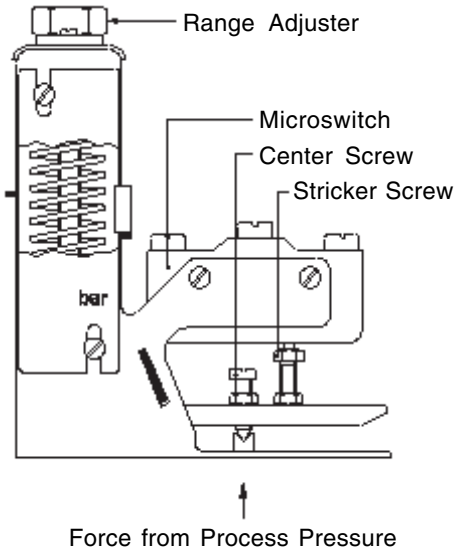

Fig.1 : Fixed On-Off Differential Model

Models 281 & 381/4 provide an independently adjustable high and low setpoint facility. A single sensing element actuates two different balance arms through a floating arm. See Fig.2. Two sets of range springs, range scales, balance arms and micro switches are independently operated.

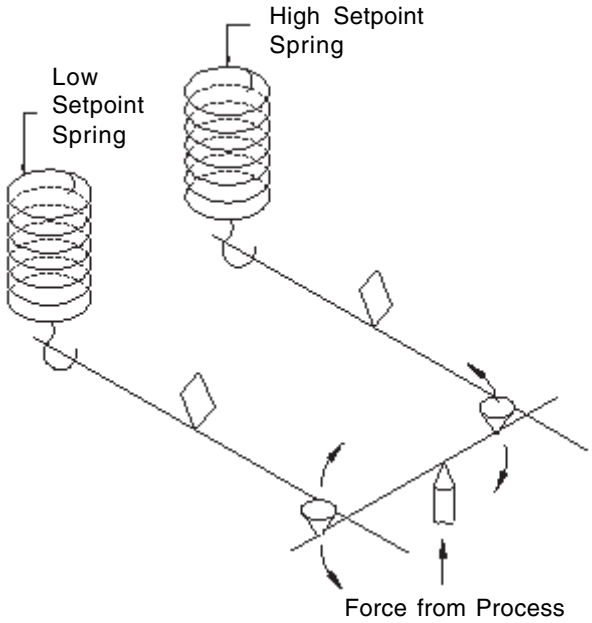

Fig.2 : Operating Principle of Dual Setpoint Version

Both the range springs are clearly marked for high and low functions. First set the low range spring and adjust the desired value for the actuation of the microswitch. The high range spring should then be adjusted similarly to the desired high setpoint. Ensure that the correct microswitch is monitored while settings are done. Refer Fig.3.

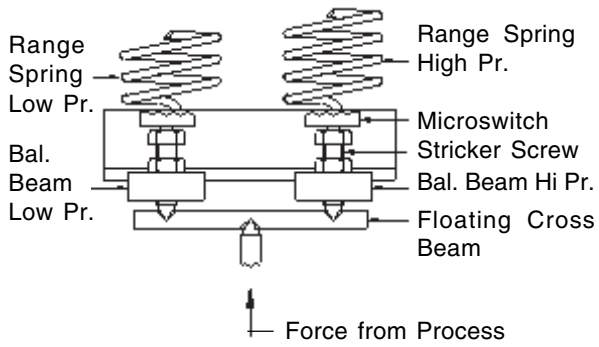

Fig.3 : Side-view of Mechanical Frame S.A. of Dual Setpoint Version

Adjustable ON-OFF Differential Models

On-Off differential value can be adjusted for a wider value from about 10 to 15% of the span to a maximum of 60% as specified against each range. The minimum value will vary with different switch combinations. This facility is achieved by an auxiliary spring brought into action when the switch actuating plate moves up before it operates the microswitch. Adjustment of the tension of the spring decides the pressure difference between the on point and off point. Refer Fig. 4.

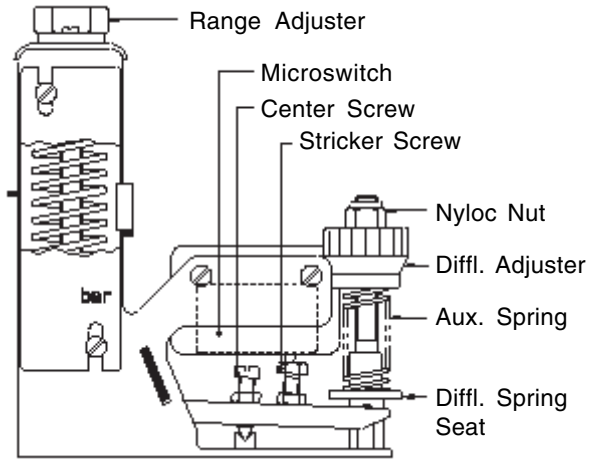

Fig.4 : Wideband Adj. Differential Mechanism

a) In adjustable differential model set the lower switching point first. Release the aux. spring to be free by lifting up the nyloc nut and the diffl. Adjuster. Using the range adjuster set the lower switching point. Then load the aux. spring by turning in the Diffl. Adjuster to set the upper switching point.

b) Adjusting the differential adjuster will shift only the upper switching point i.e. the switching pressure difference (on-off differential) alone changes. A clockwise rotation will increase upper switching point and anti-clockwise rotation will decrease it.

c) The upper switching point should not exceed the maximum range value.

d) After setting the differential, tighten the Nyloc nut to lock the differential adjuster to prevent loosening during operation.

Precaution

The switch actuating screw on the balancing arm is critically adjusted. **Disturbance** of this would result in not achieving the desired result while ON-OFF differential adjustments are made. If accidentally disturbed, to reset the microswitch for correct operation adjust the height of the striker screw such that the balancing arm is not in contact with the auxiliary spring seat at the time of switch de-actuation. Refer Fig.5. This alone will ensure unloaded condition of the auxiliary spring during de-actuation. For actuation of the microswitch, the balance beam has to lift the aux. spring seat which is pre-loaded with the desired value of wide band On-Point. Refer Fig.6.

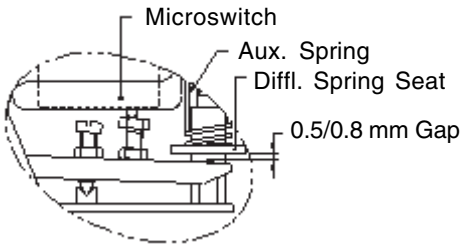

Fig.5 : Switch at 'OFF' Position – Aux Spring load not acting

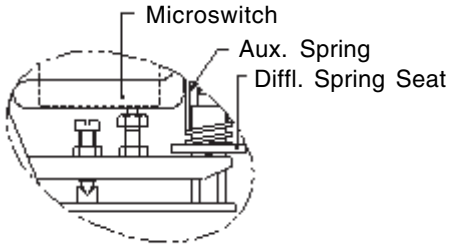

Fig.6 : Switch at 'ON' Position – Aux Spring load acting

Notes

1) In the instruments with 2 SPDT switches for DPDT action, the synchronization of actuation is achieved within practical limits. The switches are synchronized as per customer preference either on falling or on rising pressure. If no preference is indicated, synchronization is done on fall in pressure at factory.

2) Do not exceed the rated maximum working pressure. Over pressure beyond the specified value will permanently damage the sensing element leading to replacement.

MAINTENANCE

Instruments are so designed with rugged components that they seldom require maintenance. Occasional cleaning of the moving parts, checking of the microswitch(s) and ensuring firm electrical contacts at the terminals will provide a long trouble-free performance.

In the case of diaphragm operated instruments, **do not attempt** dismantling the sensing diaphragm as it would permanently disturb the factory settings. Special jigs are needed for reassembly and hence replacement is not recommended at the user end. However, cleaning of the diaphragm chamber can be performed by flushing with a cleaning fluid, which is compatible with the diaphragm and its housing material.