



DIFFERENTIAL PRESSURE SWITCHES

301 / 303 / 304
381 / 384

- GOOD REPEATABILITY ● HIGH STATIC PRESSURE ●
- TAMPERPROOF SET POINT ADJUSTER WITH LOCKING DEVICE ●
- WEATHERPROOF OR FLAMEPROOF HOUSING ●
- OVERTRAVEL STOP ● RUGGED DESIGN ●



STYLE 301 IN GK FLAMEPROOF ENCLOSURE



STYLE 301 IN GM WEATHERPROOF ENCLOSURE

Series 300 Pressure Difference Switches are designed and made to the latest standards to comply with current international philosophy of process instrumentation. The series is compact, easy to install and features high sensitivity over the entire adjustable range together with very high static

pressure capability. The sensing element is mounted external to the switch mechanisms which are of stainless steel for arduous atmospheres and high humidity. Enclosures, sensing element and switching modes can be combined to offer the variety needed to suit the different applications.

GENERAL SPECIFICATIONS

| | | | |
|--------------------------|---|-------------------------------|--|
| Enclosure | | Switching differential | Fixed or Wide band adjustable, refer tables 'A' & 'B'. |
| GM | Aluminium pressure die cast weatherproof to IP:66 | Max. Working Pressure | 110 bar for 301, 303 & 381 250 bar for 304 & 384 |
| GA | 304 / 316 SS, investment cast, weather-proof to IP:66 | Ambient Temperature | (-)25°C to (+)60°C |
| GK | Aluminium die cast, weatherproof to IP:66 & flameproof to Gr.IIA, IIB or IIC (Note 1) | Max. Process Temp. | 70°C. For higher temperatures use longer impulse lines. (Note 15) Ask for piping nomogram #441184-4 |
| Ranges | Several standard ranges between 3 mbar to 15 bar | Connection Process | ¼" NPTF. Adaptors for other sizes optional |
| Sensor | 316L SS Diaphragm | Electrical | ¾" ET (F) std. ½" NPTF optional. Dual entry on request. |
| Wetted parts | 304 SS or 316 SS | Mounting | Back panel/wall/Field. Vertical position only |
| Repeatability | ±1% FSR (Note 4) | Conformity | Generally to BS 6134:1991 |
| Scale Accuracy | ±5% FSR (Note 6) | | |
| Switching Element | Instrument quality SPCO(SPDT) microswitch (Notes 10 & 11) | | |

ORDERING MATRIX

ENCLOSURE

- Aluminium pressure die cast weatherproof to IP:66 with Nitrile gasket. **GM**
- 304 / 316 SS investment cast weatherproof to IP:66 with overall size as style GM fit for offshore. **GA**
- Aluminium die cast flameproof cum weatherproof. CIMFR approved to Gr.IIA, IIB & IIC of IS:2148:2004 for flameproofness and IP:66 for weatherproofness. **GK**

MODEL

- This is the basic differential pressure switch having close, fixed non-adjustable switching differential actuated by a stainless steel diaphragm. **301**
- Same as 301 but with auxiliary mechanism permitting switching differential adjustment over a wide band. **303**
- Same as 301 but suitable for higher static pressure upto 250 bar. **304**
- A variant of series 301, employs twin levers each operating a SPCO microswitch actuated by a single sensor through a unique linkage there by providing two independent adjustable set points, each with its own setting scale, spring and switch. Minimum separation between setpoints must be more than sum of on-off differentials or 10% of FSR whichever is higher. **381**

MATERIALS OF WETTED PARTS

- 316L SS diaphragm with 304 SS pressure chambers **04**
- 316L SS diaphragm with 316 SS pressure chambers **02**
- 316L SS diaphragm with 316SS wetted parts and Viton 'O' ring to NACE MR-01-75 **0N**
- Nitrile diaphragm with 304SS pressure chambers for applications with pressure reversal **B4**
- Nitrile diaphragm with 316 SS pressure chambers for applications with pressure reversal. **B2**

RANGE CODE : Refer Table-1

SWITCH CODE AND RATING : Refer Table-2

ELECTRICAL ENTRY : Refer Table-3

DIAPHRAGM CHEMICAL SEALS

Diaphragm chemical seals can be provided as optional extra either direct mounted or remote with capillary and threaded/flanged connection, duly evacuated and filled with suitable filling liquid. This device permits the use of differential pressure switches for viscous / aggressive fluids and permits higher process temperatures. Switching lag will be present, when pressure changes rapidly.

While ordering it is important to specify ambient and process temperatures, setpoint, maximum process pressure, relative elevation between connection and switch head, nature of process medium and whether reactive to common filling liquids should the diaphragm seal leak into the process.

Table-1 : RANGE CODE & AVAILABILITY

| RANGE CODE | RANGE | 301 / 304 | 303 | 381 / 384 |
|------------|----------------|-----------|-----|-----------|
| C6D | 3 to 25 mbar | ✓ | ✗ | ✓ |
| E1D | 5 to 120 mbar | ✓ | ✓ | ✓ |
| E8D | 50 to 350 mbar | ✓ | ✓ | ✓ |
| G5B | 0.1 to 1.5 bar | ✓ | ✓ | ✓ |
| J0B | 0.2 to 4 bar | ✓ | ✗ | ✓ |
| B7K | 0.7 to 7 bar | ✓ | ✗ | ✓ |
| P8B | 1.5 to 15 bar | ✓ | ✗ | ✗ |

Table-2 : SWITCH CODE, RATING & AVAILABILITY

| SWITCH CODE (SPCO) | AC RATING | DC RATING IN AMPS | | | | | | AVAILABILITY OF SPCO IN MODELS | AVAILABILITY OF DPCO IN MODELS |
|--------------------|----------------|-------------------|------|------|-----------|------|------|--------------------------------|--------------------------------|
| | | RESISTIVE | | | INDUCTIVE | | | | |
| | | 220V | 110V | 24V | 220V | 110V | 24V | | |
| D | 15A 250 / 125V | 0.2 | 0.4 | 2.0 | 0.02 | 0.03 | 1.0 | 301, 304, 381 & 384 | 301 & 304 |
| 3 | 15A 250 / 125V | N.R. | N.R. | N.R. | N.R. | N.R. | N.R. | 301, 304, 381 & 384 | 301 & 304 |
| w | 15A 250 / 125V | 0.3 | 0.5 | 6.0 | 0.05 | 0.1 | 4.0 | 303 | 303 |
| 4 | 1A 125V | N.A. | 0.5 | 0.5 | N.A. | 0.25 | 0.25 | 301, 304, 381 & 384 | 301 & 304 |
| 5 | 5A 250 / 125V | 0.2 | 0.4 | 4.0 | 0.2 | 0.4 | 3.0 | 301 & 304 | 301 & 304 |
| 6 | 0.1A 125V | N.R. | N.R. | 0.1 | N.R. | N.R. | N.A. | 301, 304, 381 & 384 | 301 & 304 |
| 7 | N.R. | N.R. | N.R. | 1.0 | N.R. | N.R. | 0.5 | 301 & 304 | 301 & 304 |
| 8 | 5A 250 / 125V | N.A. | N.A. | 5.0 | N.A. | N.A. | 3.0 | 301 & 304 | 301 & 304 |
| J | 5A 250V | N.A. | N.A. | 5.0 | N.A. | N.A. | 3.0 | 301 & 304 | 301 & 304 |
| K | 1A 125V | N.A. | N.A. | 1.0 | N.A. | N.A. | 0.5 | 301 & 304 | 301 & 304 |
| E | 15A 250 / 125V | 0.30 | 0.75 | 15.0 | 0.2 | 0.4 | 10.0 | 301 & 304 | --- |
| F | 15A 250 / 125V | 0.30 | 0.75 | 15.0 | 0.2 | 0.4 | 10.0 | 301 & 304 | --- |
| S | 5A 250 / 125V | 0.25 | 0.5 | 3.0 | 0.1 | 0.2 | 2.0 | 301 & 304 | 301 & 304 |

Codes 3, D & W - For General purpose usages.
 Code 4 - With Gold alloy contact.
 Code 5 - For General purpose with good DC rating.
 Code 6 - With Gold alloy contact (Low Rating)
 Code 7 - Environmentally sealed switch with Gold plated contact.
 Code 8 - Environmentally sealed switch with Silver alloy contact.
 Code J - Hermetically sealed, inert gas filled with Silver alloy contact.
 Code K - Hermetically sealed, inert gas filled with Gold plated contact.
 Codes E & F - Manual reset switch. Auto change over on rising and falling pressure respectively. Resetting is Manual.
 Code S - IP:67 sealed microswitch with silver Nickel contact.

For DPCO, change switch code '3' to '33', '4' to '44', etc., while ordering

N.A. - Not Available N.R. - Not Recommended

Table 3 : ELECTRICAL ENTRY

| Size * | Single Entry | | Dual Entry | |
|-------------------|--------------|-----|------------|-----|
| | GM/GA | GK | GM/GA | GK |
| 3/4" ETF | A | --- | M | --- |
| 1/2" NPTF | B | B | N | N |
| 3/4" NPTF | C | --- | O | --- |
| M20 x 1.5 ** | D | D | P | P |
| M15 x 1.5 | E | --- | Q | --- |
| Through Connector | | | | |
| 3 pin plug | 2 | --- | --- | --- |
| 7 pin plug | 3 | --- | --- | --- |
| 9 pin plug | 4 | --- | --- | --- |

* Cable gland available on request.
 ** Cable Entry is optional. Available on request.

NOTES

- Gr.IIA & IIB of IS:2148 is equivalent to NEC CL.1, Gr.C & D. Gr.IIC of IS:2148 is equivalent to NEC CL.1, DIV.1, Gr.A & B.
- Style GM/GA is weatherproof only if all entries and joint faces are properly sealed. Style GK is weatherproof only if cover 'O' ring is retained in position and flameproof only if proper FLP cable gland is used. It is recommended to procure cable glands along with GK instruments to avoid neglect of it during installation.
- Intrinsic Safety (Exi) — Differential Pressure switches are classified as simple apparatus as they neither generate nor store energy. Hence differential pressure switches in weatherproof (GM / GA) enclosures also may be used in intrinsically safe systems without certification provided the power source is certified IS. Because of the low voltages and currents it is recommended to use gold contact and / or sealed contacts.
- Accuracy & Repeatability are not different for all blind differential pressure switches. A shift of $\pm 2\%$ may be observed in setpoint when pressure falls from full static pressure. Settings will also shift with varying temperature.
- The instrument is calibrated in the mounting position depicted in the drawing. Mounting in any other direction will cause a minor range shift, especially in low and compound ranges. Ranges above 1 bar will not experience this shift.
- A Differential Pressure switch is a switching device and not a measuring instrument — even though it has a scale with $\pm 5\%$ FSR accuracy to assist setting. For this reason, Test Certificates will not contain individual ON-OFF switching values at different scale readings. Maximum differential obtained alone will be declared, besides other specifications.
- Select working range of the instrument such that the set value lies in the mid 35% of the range i.e., between 35% and 70% of range span.
- For switching differential values please refer respective **Differential** table. Switching differentials furnished are nominal values under test conditions at mid-scale and will vary with range settings and operating conditions.
- On and off settings should not exceed the upper or lower range value.
- DPCO action is achieved by two SPCO switches synchronised to practical limits i.e., $\pm 2\%$ of FSR. Deadband for DPCO contacts are higher than that of SPCO as force required to actuate the contacts are more. Please refer respective differential table.
- Contact life of microswitches are 5×10^5 switching cycles for nominal load. To quench DC sparks, use diode in parallel with inductance, ensuring polarity. A 'R-C' network is also recommended with 'R' value in Ohms equal to coil resistance and 'C' value in micro Farads equal to holding current in Amps.
- Model 301 can be supplied with Nitrile diaphragm for applications where pressure reversal is envisaged.
- All differential pressure switches are calibrated by applying pressure to HI port, venting LO port to atmosphere. Inspection will also be limited to such a practice.
- Ambient temperature range: All models are suitable for operating within a range of ambient temperature from (-25°C) to $(+60^\circ\text{C})$ provided the process does not freeze within this range. Below 0°C , precautions should be taken in humid atmospheres to prevent frost formation inside the instrument from jamming the mechanism. Occasional excursions beyond this range are possible but accuracy might be impaired. The microswitch is the limiting factor which should never exceed the limits (-50°C) to $(+80^\circ\text{C})$.
- Fluid Temperature: A Differential Pressure switch when connected to the process is not subjected to through flow and therefore is not fully exposed to the fluid temperature. Use of adequate length of impulse piping will greatly reduce excessive heating of the sensing element. For example connection of 7.5 cm of 12 mm dia impulse piping will reduce water temperature of 100°C to 65°C at an ambient temperature of 50°C . Ask factory for piping nomogram #441184-4 for different temperatures.
- Ensure that impulse pipework applies no stress on sensing element housing and use spanners to hold pressure port/housing when connections are made.
- Custom built instruments are available for special service requirements under Special Engineering Category.
- For less rigorous applications models 306/386 with Nitrile diaphragm & Aluminium wetted parts are available at lesser cost.
- Complementary instrumentation for pressure is available in 200 series.
- Accuracy figures are exclusive of test equipment tolerance on the claimed values.**
- All performance data are guaranteed to $\pm 5\%$.**

SWITCHING DIFFERENTIAL DATA

TABLE : A — GM / GA Enclosures

| Range Code | Range | On-off Differential in mbar | | | | | | |
|------------|----------------|-----------------------------|-----|------|-------|-------|-------------|------------|
| | | Fixed | | | | | | Adjustable |
| | | Models 301 / 304 | | | | | Model 381/4 | Model 303 |
| | | D/3/6 | 4 | 5 | 7/8/S | J / K | D/3/4/6 | W |
| C6D | 3 to 25 mbar | 6 | 6 | 6 | 12 | 10 | 7.5 | --- |
| E1D | 5 to 120 mbar | 5 | 6 | 10 | 20 | 12 | 20 | 45 to 70 |
| E8D | 50 to 350 mbar | 12 | 15 | 20 | 40 | 30 | 40 | 70 to 200 |
| G5B | 0.1 to 1.5 bar | 60 | 60 | 85 | 125 | 120 | 250 | 300 to 900 |
| J0B | 0.2 to 4 bar | 175 | 200 | 350 | 450 | 500 | 400 | --- |
| B7K | 0.7 to 7 bar | 300 | 350 | 500 | --- | --- | 600 | --- |
| P8B | 1.5 to 15 bar | 800 | 800 | 1350 | --- | --- | --- | --- |

On-off differential values for DPCO switching, DPCO (2 x SPCO)

- For style GM/GA enclosures apply a multiplication factor of **1.3** to values in **Table-A**.
- For style GK enclosure apply a multiplication factor of **1.2** to values in **Table-B**.
- In case of adjustable on-off differential models the **multiplication factor** is to be applied **only to the lower limit** of the differential values. Upper limit values remain unchanged.
- For range codes B7K & P8B in models 301, 304 DPCO switching is possible using switch codes 3, D & 4 only.
- For B7K & P8B ranges switch codes 7, 8, J, K, S, 77, 88, JJ, SS & KK are not possible.
- Special Engineering** : In model 301 following higher DP ranges are offered with 316L SS bellows.
 - B1K range 10 to 40 bar, maximum out of balance pressure 50 bar.
 - B2K range 10 to 60 bar, maximum out of balance pressure 80 bar.
- For instruments with chemical seal**, switching differentials will be higher. Apply a Multiplication factor of 1.3 for SPCO and 1.5 for DPCO to values given in table for GM housings and apply a multiplication factor of 1.2 for SPCO and 1.5 for DPCO to values of table for GK housings.
Chemical seals are not available in ranges C6D, E1D & E8D.

TABLE : B — GK Enclosure

| Range Code | Range | On-off Differential in mbar | | | | | | |
|------------|----------------|-----------------------------|------|------|-------|-------|-------------|------------|
| | | Fixed | | | | | | Adjustable |
| | | Models 301 / 304 | | | | | Model 381/4 | Model 303 |
| | | D/3/6 | 4 | 5 | 7/8/S | J / K | D/3/4/6 | W |
| C6D | 3 to 25 mbar | 10 | 10 | 10 | 20 | 17 | 12 | --- |
| E1D | 5 to 120 mbar | 8 | 10 | 16 | 34 | 20 | 30 | 50 to 70 |
| E8D | 50 to 350 mbar | 20 | 25 | 40 | 70 | 50 | 55 | 90 to 200 |
| G5B | 0.1 to 1.5 bar | 100 | 100 | 140 | 210 | 200 | 350 | 425 to 900 |
| J0B | 0.2 to 4 bar | 300 | 340 | 520 | 765 | 900 | 600 | --- |
| B7K | 0.7 to 7 bar | 500 | 600 | 750 | --- | --- | 1000 | --- |
| P8B | 1.5 to 15 bar | 1350 | 1350 | 1750 | --- | --- | --- | --- |

OPTIONS / ACCESSORIES

- Diaphragm Chemical Seal.
- Damping coil for minimising process pulsations — increases instrument's life many times.
- Blow out protection for weatherproof and flameproof enclosures.
- Snubbers
- Brass / SS double compression cable glands to suit cable OD of 1/2", 15 mm & 17 mm.
- Degreasing for Oxygen service & special parts for Ammonia service.
- Provision of line fault monitoring.

