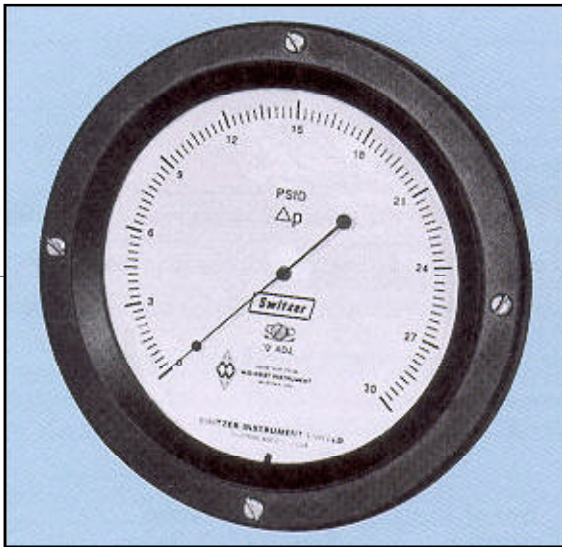


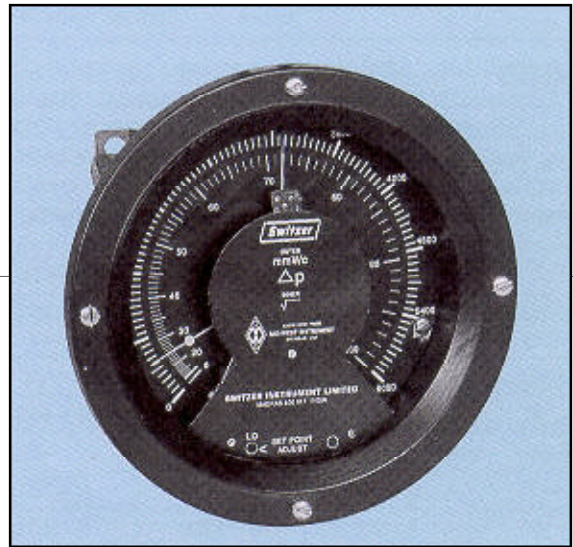


DIFFERENTIAL PRESSURE INDICATORS — SWITCHES

- MID-WEST, USA DESIGN ● BOURDON SENSOR ● HIGH OVER PRESSURE ●
- 270 DEG. POINTER TRAVEL ● ONE OR TWO VISIBLE SET POINTERS ●
- POWER SUPPLY OPTIONS ● OPTIONAL DEAD BAND ADJUSTMENT ●



STYLE 109



STYLE 109 WITH LLC

Switzer style 109 Differential Pressure Indicator is powered by a test gauge quality Bourdon tube assembly. It is encapsulated in a high pressure chamber fitted with a pressure connection to the inside of the Bourdon tube and a second connection to the pressure chamber. The Bourdon assembly indicates the difference in pressure applied inside and outside the Bourdon tube.

The volume displacement of the Bourdon tube is near to zero (0.02 cc); so the speed of response of the indicator to change in differential is instantaneous even on low volume pressure system. The low volume displacement is an important advantage for differential pressure leak detection.

The output shaft of the Bourdon sensor is magnetically coupled through the solid wall of the pressure chamber to a sensitive jewelled pointer shaft in the dial housing outside the pressure chamber. The solid separation wall eliminates the requirement of a separate blow-out disc in the gauge case.

The Differential Pressure Indicator can be provided with alarm switching facility through an electronic “**Locked Logic Alarm Control**” Switching (LLC). This is an all solid-state switching facility available with one or two set points.

The “Locked Logic” concept provides a control system which has a two step latch-lock control action, for a positive locked control above and below the set point. The control action is fully protected against electrical disturbances.

This System Offers

- Freedom from friction, no contacts no springs; no sliding and wearing wipers; no burn-out; no chatter.
- Freedom from moving parts; all solid state; no shift; no misalignment; no interaction with Gauge movement.
- Freedom from auxiliary mechanisms.
- Adequately rated relay contacts.

FEATURES

- 270° Pointer travel.
- Field adjustable electronic switching — one or two setpoints.
- Centre zero on request.
- No liquid filled sensor thus eliminating complicated temperature compensation, failure due to leaks and loss of liquid.
- Over pressure protection by a two-way over-range relief valve — Not available in chemical seal instruments.
- Buna-N seal standard Viton seals optional.
- Panel or 2" pipe mounting.



GENERAL SPECIFICATIONS

Gauge Case	Die Cast Aluminium or 304 SS, weather-proof to IP:66.	Max. Process Temp	100°C for Buna-N seal. 230°C for Viton Seal.
Dial Size	150 mm dia with 300 mm effective scale length. Black letters on white background for indicator. Black dial for indicator plus LLC Switch.	Zero Adjustment	For higher temperature use adequate length of impulse piping. Ask for piping nomogram #441184-4. Through dial adjustment after removing front bezel.
Scale	Linear, Square Root or Both	Sensing Element	316 Ti SS Bourdon
Window Material	Toughened float safety glass	Body Material	316 SS Std.
Ranges	Refer Tables 'A', 'B' & 'C'	Movement	304 SS
Accuracy	Refer Table 'D'	Process Connection	1/4" NPTF / 1/2" NPTF Back
Max. Working Pressure	900 / 1500 / 3000 / 6000 PSIG.	Vent / Drain Plug	Optional
Over Range Protection	Built-in bi-directional relief valve.	Mounting	Flush Panel or 2" Pipe
		Alarm / Switching (optional)	Refer Locked Logic Control (LLC)

RANGES

PSI	Kg/Cm ²	PSI	Kg/Cm ²
0 – 15	0 – 1.0	0 – 300	0 – 20.0
0 – 20	0 – 1.6	---	0 – 25.0
0 – 30	0 – 2.0	0 – 400	---
---	0 – 2.5	0 – 500	---
0 – 50	0 – 3.5	0 – 600	0 – 40.0
0 – 60	0 – 4.0	0 – 800	---
---	0 – 6.0	0 – 1000	0 – 70.0
0 – 100	0 – 7.0	0 – 1500	0–100.0
---	0 – 10.0	---	0–160.0
0 – 160	---	---	0–250.0
0 – 200	---	---	0–350.0
---	0 – 16.0		

PSI	0–35	0–85	0–150	0–230	0–360	0–2275	0–3555	0–4975
Kg/Cm ²	0–11	0–14	0–28	0–35	0–55			

Kg/Cm ²	± 0.5	± 1.0	± 2.0	± 3.5	± 5.0	± 8.0	± 12.5

1.	± 1 % FSR	For all Ranges except those at 2 & 3 below
2.	± 1.5 % FSR	Bi-directional (Centre zero) ranges
3.	± 3 % FSR	Gauges with Chemical Seal / Liquid filled dials
Note : Accuracy includes linearity and Hysteresis		

Type of Connection	Maximum Static Pressure Permissible	Max. Diff. Pressure
Flanged #150 / 300 / 600 ANSI RF (standard) Size 1½" and 2"	Limited to flange rating at relevant temperature and applied simultaneously on HP & LP *	125% of Range
Screwed Connection 1/2" NPT (standard)	(a) 1500 PSI standard (b) >1500 < 6000 PSI Special engineering	125% of Range
* Increased pressure rating could be achieved by usage of trapped 'O' Ring on the flange and the customer resorting to flat faced flange at their end.		
Caution : Since over pressure relief valve does not exist for chemical seal models, care should be taken that maximum static pressure on one port alone should not exceed 125% of range at any time. Sensor will collapse if this condition is violated even once and the guarantee will be void.		

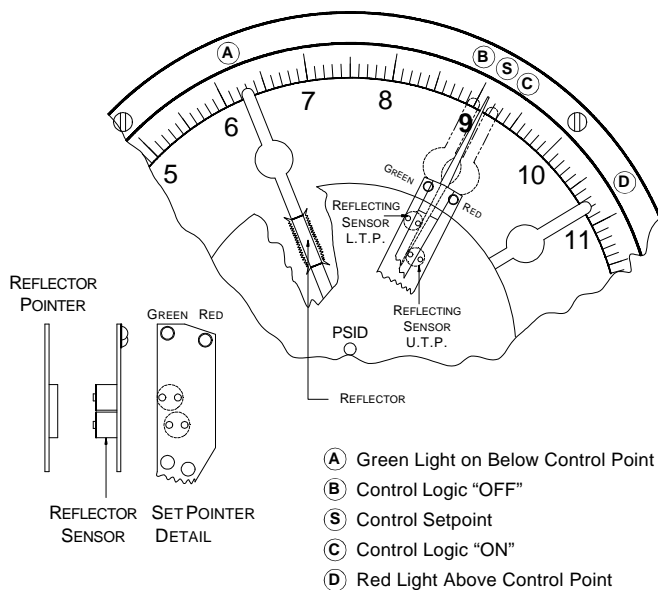
ALARM SWITCHING — LOCKED LOGIC CONTROL (LLC)

SPECIFICATIONS

Type	Electronic—Refer "Locked Logic Control" (LLC) for detailed order code.	Switch Deadband	2% FSR (Fixed) — Standard Adj. differential — 10 to 90% FSR. Refer option 'C'
No. of LLC Switches	One for Hi/Lo setting (with one SPDT contact or two SPDT contacts for DPDT action) Two for Hi and Lo setting (Only one SPDT contact for each set point)	Contact Rating	SPDT relay — 6A 230V AC / 115V AC or 6A 28V DC resistive Hermetically sealed SPDT relay 1A 230V AC / 115V AC
Setting Accuracy	±1% FSR (same as the gauge on which the switch is installed)	Power Supply	230V AC — Standard 115V AC or 10 to 24V DC — Optional
Set Point Adjustment	To be done after removing the bezel	Electrical Connection	1M flexible 18 SWG flying lead std. Weatherproof terminal junction box either integral or remote optional.
Switch Setting Range	From 10% to 95% FSR.	Ambient Temperature	(–) 40 to (+) 70°C
Hi-Lo Gap	10% FSR		

PRINCIPLE OF OPERATION

The "Locked Logic" design utilises two reflective optical sensors per set pointer to detect a reflective target on the gauge indicating pointer as it passes a desired setpoint. Two sensors per set pointer provide hysteresis for oscillation prevention. The sensors are positioned so that



upon increasing differential pressure, the right sensor determines the "Upper Trigger Point" (U.T.P.) and upon decreasing differential pressure (assuming Δp above U.T.P.), the left sensor determines the "Lower

Trigger Point" (L.T.P.). The algebraic difference between the U.T.P. and L.T.P. determines the set pointer hysteresis (fixed nominally at 2%).

Figure illustrates the two sensors on the control set pointer, the mirrored target on the indicating pointer, and the logic sequence, as the gauge indicating pointer moves across the control setpoint. For this example, "on" is defined as the output relay energised and "off" as the output relay de-energised.

With the gauge pointer below the setpoint 'S', (i.e. position A) the output is "off". The output will remain "off" until differential pressure increases and the gauge pointer passes position 'S', which is determined by the U.T.P. sensor. As the gauge pointer moves further upscale (i.e. position 'D'), the output will remain "on". For the reverse direction, the output will remain "on" until the gauge pointer passes position "B", which is determined by the L.T.P. sensor.

The "Locked Logic" design is also available with two set pointers configured for adjustable deadband functionality LLC option 'C'. For this option, the left set pointer determines the L.T.P. and the right set pointer determines the U.T.P. The deadband can be adjusted from 10 to 95% of the range span, with both set pointers controlling one SPDT relay or two SPDT relays (for DPDT action). LED indications for this option are on the left set pointer only. Green shall indicate when the output is "off" and red shall indicate when the output is "on".

This type of control facility is readily applied in the following applications:

- | | | | |
|----|---------------|---|---|
| a) | Level Control | — | Pump Start-Stop |
| b) | Filter DP | — | Filter Back wash (cleaning) |
| c) | Flow DP | — | By-pass flow control for boiler feed water (recirculation system) |

NOTES

1. Special ranges can be supplied without extended delivery at Extra Price. Refer Table 'C'.
2. Calibration is as per ANSI / ASME B40.1 Clause 6.2.3.
3. **Accuracy figures are exclusive of test equipment tolerance on the claimed values.**
4. **All performance data guaranteed $\pm 5\%$.**
5. Instrument with switching needs power supply. Customer's scope.

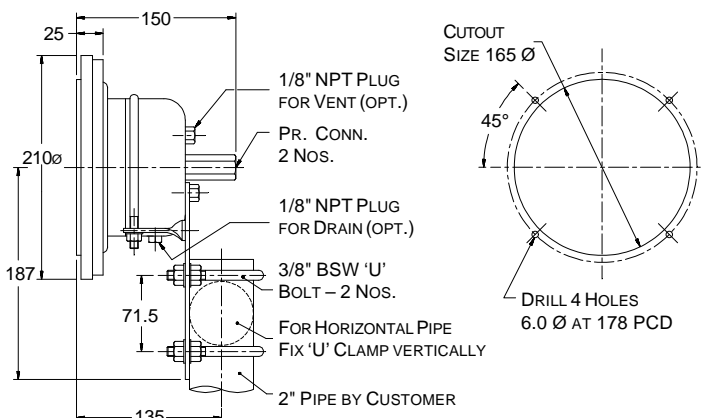
Caution

1. Use of snubber is a must if pressure fluctuations are rapid.
2. Use 3-way / 5-way manifold to avoid damage / shift in calibration.
3. Do not use these gauges for measuring pressure difference between two incompatible fluids, since the built-in over pressure valve relieves pressure from Hi to Lo pressure chambers and vice versa.

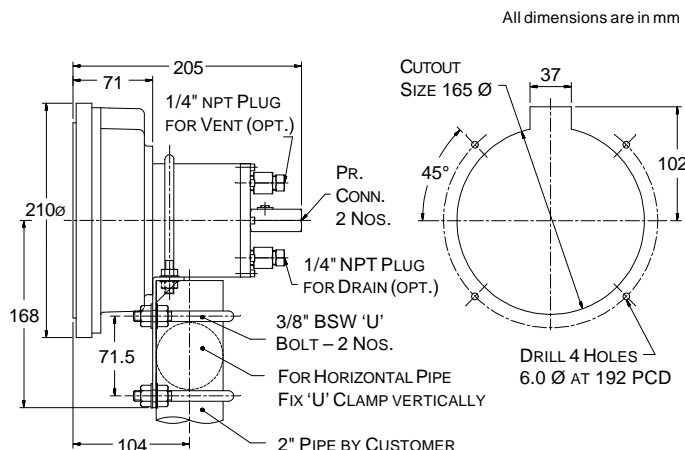
Model 106D is available for use with two incompatible fluids.

MOUNTING DIMENSION

Ranges 1500, 3000 & 6000 PSIG



Range 900 PSIG



Note : Dimensions of gauges with SS Case or alarm switching (LLC) options are different. Ask factory for applicable drawing.

ORDERING MATRIX

109 T E 0 0 0 A 1 L A 1 1

109 Style 109 – 316 Ti SS Bourdon and 316 SS Body & internals

RATING

- T** 900 PSIG (for ranges upto 40 bar)
- U** 1500 PSIG
- V** 3000 PSIG
- W** 6000 PSIG

ACCURACY

- E** 1% FSR , uni-directional
- F** 1.5% FSR, bi-directional (centre zero) ranges
- G** 3% FSR , Liquid filled dial gauge / chemical seal

SEALS

- 1** Buna-N seal
- 2** Viton seal
- 3** Others (consult factory)

PROCESS CONNECTION

- 0** 1/4" NPTF
- 6** 1/2" NPTF
- 9** Others – on request

ACCESSORIES AND OPTIONS *

- 0** None – Standard with Studs for Panel Mounting
 - F** Pipe Mounting with U Bolt & Nuts
 - L** Liquid filled Dial Accuracy $\pm 3\%$ FSR (Not possible with switching option)
 - S** 304 SS Case – Not available in LLC version
 - T** Degreasing for Oxygen service
 - M** Diaphragm Seals – Available for positive ranges (Accuracy $\pm 3\%$ FSR)
 - V** Vent Plug
 - D** Drain Plug
 - X** Others – (consult factory)
- * **If more than one accessory / option is required specify, F, L . . . etc.**

ALARM / SWITCHING (LLC – Locked Logic Control)

- 0** None
- A** One control switch for one setpoint with fixed deadband
- B** Two control switches for two setpoints with fixed deadband
- C** One control switch for one setpoint with adjustable deadband

To suit your application, Select 5-digit code for alarm / switching option. (Your order for switching must include this Code)

ELECTRICAL CONNECTION

- 1** 1M flying lead — Standard
- 2** Integral weatherproof terminal housing
- 3** Remote weatherproof terminal housing

POWER SUPPLY

- 1** 230V AC — Standard
- 2** 110V AC
- 3** 10 to 24V DC

CONTROL FORM OPTIONS

For LLC Switching Option 'A' or 'C'

- LA** Low alarm. Relay Energises on Low alarm
- LB** Low alarm. Relay De-energises on Low alarm
- HA** High alarm. Relay Energises on High alarm
- HB** High alarm. Relay De-energises on High alarm

For LLC Switching Option 'B'

- LHA** Low & High alarms. Relays Energises on Low & High alarm
- LHB** Low & High alarms. Relays De-energise on Low & High alarm
- HHA** High & Very High alarms. Relays Energise on High & Very High alarm
- HHB** High & Very High alarms. Relays De-energise on High & Very High alarm
- LLA** Low & Very Low alarms. Relays Energise on Low & Very Low alarm
- LLB** Low & Very Low alarms. Relays De-energise on Low & Very Low alarm

CONTROL RELAY OPTIONS

- 1** One SPDT relay for LLC switch option **A** or **C** or two independent SPDT relays for LLC switch option **B**
- 2** Two SPDT relays for DPDT action for LLC option **A** or **C** (*DPDT relay not available for LLC option B*)
- 3** One SPDT hermetically sealed relay for LLC option **A** or two independent SPDT hermetically sealed relays for LLC option **B**

Notes :

- Switching is not available for the following option.
- Gauges with Liquid filled dials
- Gauges with SS Case
- Gauges with Chemical Seal

Prior notification of changes in specification is impracticable due to continuous development.

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