

## Diaphragm Operated Pressure Difference Switches: **Industrial** **S30 Series**

**S31 / 4**  
**Issue F.1**

- Field set point adjustment against a reference scale.
- SPDT or DPDT switching.
- Terminal block for easy field wiring.
- Hermetically sealed microswitch options.
- Optional gold alloy contacts.
- NACE MR-01-75 compatibility.
- Maximum working pressure up to 250 bar (3500 psi).
- Ranges available up to 10 bar (160 psi).
- Safety vented design as standard.
- Explosionproof NEMA 4, 4X, 7, 9
- Flameproof EEx d IIC - ATEX.

### Performance **characteristics**

#### Enclosure

- IP66 Protection

#### Wetted parts options

- 316 Stainless Steel diaphragm (standard)
- Suitable for NACE MR-01-75.
- Nitrile diaphragm and seal with aluminium or cast iron flanges (limited ranges)

#### Standard Electrical ratings – Refer to Table 6

- 1 Amp with gold contacts
- 5 Amps – general purpose, environmentally sealed & hermetically sealed.

#### Process connection

- Rc ¼ (BSP), ¼ NPT Internal, ½ NPT Internal & ½ NPT External.

#### Unit weight

- Between 4.0kg – 13.1kg (8.8lb – 29.9lb)

#### Accuracy

- Set point repeatability  $\pm 1\%$  of span at 20 °C / 68 °F ambient.



### Product **applications**

The S31/4 is suitable for a wide range of applications in many industry sectors:

- Oil & Gas
- Chemical
- Petrochemical
- Refining
- Power
- OEM

The choice of models available ensures that the S31/4 is suitable for use in:

- Corrosive atmospheres
- Resistant to chemical attack

### How can we **help you?**

Delta Controls' range of reliable pressure and temperature measurement instruments can be customised to meet individual requirements. For technical advice or to discuss your application please contact us on +44 (0)1252 729 140

## Enclosure

### FINISH

All enclosures except Type R, A and U are finished in light grey epoxy resin paint. Special finishes to order.

### INTRINSIC SAFETY

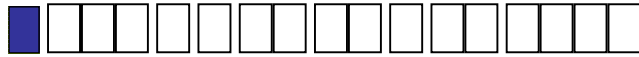
Because of the low voltages and currency of I.S. circuits, we recommend using gold and/or sealed contacts.







**NOTE:** *In the interests of safety and reliability not all enclosures are available with all wetted parts. See Table 4.*

**NOTE: Codes T and U** – to increase gas class see Table 6 NOTE 2.

**NOTE: Codes H, T for 4X**  
Aluminium Enclosure protected by quality epoxy paint system. Performance of enclosure required careful installation and sealing of cable gland connection in situ. Assembly requires to be built for Marine use, See Table 8, Code 02.

TABLE 1



| FLAMEPROOF ENCLOSURES (ZONE 1)   | Code |
|--|------|
| <b>EExd IIC T6(-60 to +65°C) T5 (-60 to+80°C)</b><br>Gravity die-cast enclosure in aluminium-silicon alloy, epoxy painted internally and externally certified to CENELEC EN 50 014 and EN50 018 II2GD.<br>Weatherproof to NEMA type 4, 4X, IP66. See Note.  | H    |
| <b>For Aggressive Atmospheres EExd IIC T6(-60 to +65°C) T5 (-60 to +80°C)</b> Investment cast enclosure in austenitic stainless steel certified to CENELEC EN 50 014 and EN50 018 II2GD.<br>Weatherproof to NEMA type 4X, IP66.                             | R    |
| <b>Aluminium Alloy NEC 500, NEMA 7,9</b><br>Gravity die-cast enclosure in aluminium-silicon alloy.<br>Class 1, Groups C and D, Class II, Groups E, F and G, Div. 1 & 2 Weatherproof to NEMA type 4, 4X, IP66.   | T    |
| <b>For Aggressive Atmospheres NEC 500, NEMA 7,9</b><br>Investment cast enclosure in austenitic stainless steel.<br>Class 1, Groups C and D, Class II, Groups E, F and G, Div.1 & 2. Weatherproof to NEMA type 4X, IP66.                                     | U    |
| WEATHERPROOF ENCLOSURES  |      |
| <b>General Purpose</b><br>The basic enclosure is pressure die-cast in zinc alloy, epoxy painted, with weather protection not less than NEMA type 4, IP66.  | W    |
| <b>For Aggressive Atmospheres</b><br>Investment cast enclosure in austenitic stainless steel with weather protection not less than NEMA type 4X, IP66.   | A    |
| INTRINSIC SAFE ENCLOSURES  |      |
| <b>General Purpose Weatherproof EEx ia IIC T6 (-25 to +60°C) or T5 (-60 to +80°C)</b><br>The basic enclosure is pressure die-cast in zinc alloy, epoxy painted, with weather protection not less than NEMA type 4, IP66.                                  | 5    |
| <b>Weatherproof for Aggressive Atmosphere EEx ia IIC T6 (-25 to +60°C) or T5 (-60 to +80°C)</b><br>Investment cast enclosure in austenitic stainless steel with weather protection not less than NEMA type 4X, IP66.                                      | 4    |

## Models

### S31

Maximum working pressure 1.0 bar (14.5 psi)/110 bar (1600 psi) see Table 5.

### S34

Maximum working pressure 250 bar (3,500 psi).

TABLE 2



|   | Code |
|---|------|
| <b>Fixed Switching Differential.</b><br>SPDT & DPDT options available. See Table 6. | S31  |
| <b>Fixed Switching Differential</b><br>SPDT & DPDT options available. See Table 6.  | S34  |



Applies to all models



## Electrical Entry

Adaptors are available for other popular thread sizes.



For codes 3 & 6 – see approvals and Table 1 Codes T & U



TABLE 3

|   | Code |
|---|------|
| Enclosure W: Clearance for 20mm (3/4 in) outside dia conduit. | 1    |
| Enclosure W: M20 x 1.5 elbow adaptor to suit.                 | 0    |
| Enclosure W: 3/4-NPT INT. elbow adaptor to suit.              | 3    |
| Enclosures H, R & A: M20 x 1.5 ISO thread.                    | 0    |
| Enclosures H, R & A M20 x 1.5 ISO thread, dual entry.         | 5    |
| Enclosures H, R, T & U: 3/4-NPT INT (direct)                  | 3    |
| Enclosures H, R, T & U: 3/4-NPT INT. dual entry               | 6    |

## Material of Wetted Parts

For aluminium flanges (Code D) select only from enclosures codes H, T and W. For Cast Iron flanges (Code E) select only from enclosure codes R, U or A. See Table 1



Applies to all materials



TABLE 4

| Ranges |  | Code |
|--------|--|------|
| BD-EA  | 316 Stainless steel diaphragm. All other wetted parts fully austenitic 300 series stainless steel, PTFE and Nitrile seals. | I    |
|        | For wetted parts required to conform with Sour Gas or Sour Crude, applications as laid down in NACE standard MR-01-75.     | L    |
| BC     | Nitrile diaphragm and seal with aluminium flanges.   | D    |
|        | Nitrile diaphragm and seal with cast iron flanges.   | E    |

## Setting Ranges

When ordering, please state units required. Range and set point will be in units of preference. Unless otherwise stated, units will be in bar/mbar.

$P_{max}$  = maximum working pressure

The instruments will sustain, without loss of performance, a continuous forward over pressure equal to the maximum static pressure and/or full vacuum.

**NOTE:** For pressure difference switches maximum working pressure ( $P_{max}$ ) and maximum static/line pressure mean the same.

TABLE 5

| Model        | $P_{max}$    |                | Range                 |            |                           | Code       |
|--------------|--------------|----------------|-----------------------|------------|---------------------------|------------|
|              | bar          | psi            | mbar / bar            | Code       | in H <sub>2</sub> O / psi |            |
| S31          | 1.0          | 14.5           | <b>-12.5 to +12.5</b> | BC*        | <b>-5.0 to +5.0</b>       | BU*        |
| S31<br>(S34) | 110<br>(250) | 1600<br>(3500) | <b>6 to 40</b>        | BD<br>(0D) | <b>2.5 to 16</b>          | BY<br>(0Y) |
| S31<br>(S34) | 110<br>(250) | 1600<br>(3500) | <b>25 to 160</b>      | CB<br>(0B) | <b>10 to 64</b>           | CS<br>(IS) |
| S31<br>(S34) | 110<br>(250) | 1600<br>(3500) | <b>100 to 600</b>     | CE<br>(0E) | 1.5 to 8.5                | CK<br>(0K) |
| S31<br>S34   | 110<br>250   | 1600<br>3500   | 0.4 to 2.5            | DC         | 6 to 40                   | DP         |
| S31<br>S34   | 110<br>250   | 1600<br>3500   | 0.6 to 4              | DD         | 10 to 60                  | DT         |
| S31<br>S34   | 110<br>250   | 1600<br>3500   | 1.6 to 10             | EA         | 25 to 160                 | EH         |

\* Forward overpressure is limited to 500 mbar



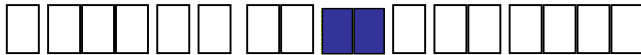
Applies to all ranges above

Maximum static/line pressure applied in the reverse direction (i.e., to low pressure connection with high pressure connection open to atmosphere) will be contained without failure. The diaphragm on ranges BD to EA (BY to EH) will however have been distorted, leading to a degradation of performance and a shortening of the service life.

For applications where regular reversals of pressure are inevitable, a special engineering facility is available, see Table 9.


## Switching Options

TABLE 6



| Model S31 / 4   |   |  |       |           |           |       |                |                |      |
|---|---|--|-------|-----------|-----------|-------|----------------|----------------|------|
| UL/CSA Rating<br>(RESISTIVE)<br>§SEE NOTE   | IEC 947-5-1/EN 60947-5-1 Rating                 |  |       |           |           |       |                | Contact        | Code |
|   | Designation &<br>Utilization<br>Category        | Rated operational current $I_e$<br>(A) at rated operational<br>voltage $U_e$ | $U_i$ | $U_{imp}$ | VA Rating |       |                |                |      |
|   |   |  |       |           | Make      | Break |                |                |      |
| 5 Amps @ 110/250V AC<br>Light Duty for AC only  | AC14 D300                                       | 0.6/0.3A @ 120/240V AC   | 250V  | 0.8kV     | 432       | 72    | SPDT<br>DPDT   | 00<br>01       |      |
|   | DC13 R300                                       | 0.22/0.1A @ 125/250V DC  |       |           | 28        | 28    |                |                |      |
| 5 Amps @ 110/250V AC &<br>2 Amps @ 30V DC<br>General purpose precision                          | AC14 D300                                       | 0.6/0.3A @ 120/240V AC   | 250V  | 0.8kV     | 432       | 72    | SPDT<br>DPDT   | 02<br>03       |      |
|   | DC13 R300                                       | 0.22/0.1A @ 125/250V DC  |       |           | 28        | 28    |                |                |      |
| 1 Amp @ 125V AC &<br>§100mA @ 30V DC gold alloy<br>contacts for low voltage<br>switching        | 1 A @ 125 VAC RESISTIVE (IEC 1058-1/EN 61058-1) |  |       |           |           |       | SPDT<br>DPDT   | 04<br>05       |      |
| § 5 Amps @ 110/250V AC &<br>5 Amps @ 30V DC<br>Environmentally sealed.                          | AC14 D300                                       | 0.6/0.3A @ 120/240V AC   | 250V  | 0.5kV     | 432       | 72    | SPDT*<br>DPDT* | 08<br>09       |      |
|   | DC13 R300                                       | 0.22/0.1A @ 125/250V DC  |       |           | 28        | 28    |                |                |      |
| § 1 Amp @ 30V AC &<br>30V DC Environmentally<br>sealed with gold contacts                       | AC14 E150                                       | 0.3A @ 120V AC   | 125V  | 0.5kV     | 216       | 36    | SPDT*<br>DPDT* | 0G<br>0H       |      |
| 5 Amps @ 250V AC and<br>2 Amps @ 30V DC<br>Hermetically sealed. Gold<br>plated silver contacts. | AC14 D300                                       | 0.6/0.3A @ 120/240V AC   | 250V  | 0.5kV     | 432       | 72    | SPDT<br>DPDT   | H2<br>H3†, H6‡ |      |
|   | DC13 R300                                       | 0.22/0.1A @ 125/250V DC  |       |           | 28        | 28    |                |                |      |


† 2 Single pole, double throw, simultaneous falling under pressure  
‡ 2 Single pole, double throw, simultaneous rising under pressure.


 00, 01, 02, 03, 04 & 05 microswitches

**NOTE 1 :** Enclosure Codes T and U.  
Microswitch Codes 02 and 03  
UL/CSA rating as follows:-  
110/250V AC 5A 250V/125V DC 0.25/0.5A

Enclosure Codes H and R  
Microswitch Codes 02 and 03  
UL/CSA rating as follows:-  
110/250V AC 5A 250V/125/30V DC 0.25/0.5/2A

**NOTE 2 :** Using codes H2, H3, H6 increases the Gas Class to:  
Class 1, Groups A, B, C and D, Div 2, for Enclosures T and U.

 H2, H3 † & H6‡ microswitches

 00, 01, 02, 03, 04, 05, H2, H3† & H6‡ microswitches

UL recognised component for use in Hazardous areas  
Class 1, Div 2, Groups A, B, C, D. Class II Groups F  
and G. When used in enclosure T and U

CSA accepted component for use in hazardous  
areas Class 1, Div 2, Groups A, B, C, D.  
When used in enclosures T and U.

The electrical rating is dependent on the microswitch fitted to the instrument. The electrical ratings defined by each approval that the microswitch complies with and is shown on the product nameplate, ie UL/CSA, or IEC. It should be noted that the instrument must be used within the electrical rating specified from the approval you require. This table lists the actual IEC ratings against the Designation & Utilization Category marked on the nameplates. In the absence of any verification by UL/CSA the microswitch § manufacturer's rating is stated in **italics and bold**. **If in doubt seek guidance from the factory.**

**NOTE:** For low energy circuits e.g. 30V and up to 100mA, we recommend using gold alloy contact switches.  
 $U_i$  = rated insulation voltage       $U_{imp}$  = rated impulse withstand voltage across contacts.

## Process Connection

TABLE 7



**NOTE:** Range code BC (BU) can only be supplied with integral Rc1/4 or 1/4 NPT process connections. For other thread sizes specify adaptors.

**NOTE:** Range code BC/BU for CSA or UL can only be supplied with process connections Code A or F.



For Code A, F, H, J



|                                      | Code |
|--------------------------------------|------|
| Rc 1/4 (1/4 BSP tr INT) to (ISO 7/1) | A    |
| 1/4 – 18NPT INT                      | F    |
| 1/2 – 14NPT INT                      | H    |
| 1/2 – 14NPT EXT                      | J    |

## Options & Treatments

TABLE 8



Combinations available, apply for details.

|  | Code              |
|--|-------------------|
| Tropicalisation High humidity environment  | 01*               |
| Marine and Offshore Saline atmosphere or salt spray  | 02*               |
| Ammonia Process (wetted) parts and construction suitable for atmospheric ammonia.                            | 03                |
| Oxygen Service 2: Process (wetted) parts are cleaned for oxygen.   | 04*               |
| Oxygen Service3: Process and non-process parts are cleaned for use with oxygen.                              | 05*               |
| Stainless Steel Pipe Mounting Bracket Permits local 2" pipe work to be utilised for mounting the instrument. | 10                |
| Tagging - Variety of tagging methods are available   | APPLY FOR DETAILS |
| Applies when – no option is required and selection is made from special engineering.                         | 00                |

\* Not available on range BC/BU

## Special Engineering

TABLE 9



Refer to engineering



| FEATURE  | Code |
|--|------|
| Please consult Delta sales engineering for special requirements. | TBA  |

## Performance Data

TABLE 10

### Bar Units (SI)

#### FIXED SWITCHING DIFFERENTIAL

Due to manufacturing tolerances, the figures quoted in these tables are for guidance only. Should the differential be critical for specific applications, our engineers should be consulted prior to ordering.

| Code | Range<br>mbar / bar | $P_{max}$<br>Bar | Model      | Microswitch – Option Switching Differential Mbar |     |     |     |     |     |       |       |     |       |
|------|---------------------|------------------|------------|--|-----|-----|-----|-----|-----|-------|-------|-----|-------|
|      |                     |                  |            | 00   | 01  | 02  | 03  | 04  | 05  | 08/0G | 09/0H | H2  | H3/H6 |
| BC   | 12.5 to 12.5        | 1                | S31        | 0.6  | 1   | 2   | 2.5 | 1   | 1.5 | 1.8   | 2.4   | 2.4 | 2.4   |
| BD   | 6 to 40             | 110<br>250       | S31<br>S34 | 1.3  | 2   | 4   | 6   | 2   | 3   | 8     | 11    | 10  | 10    |
| CB   | 25 to 160           | 110<br>250       | S31<br>S34 | 2.6  | 4   | 9   | 12  | 4   | 6   | 16    | 21    | 18  | 21    |
| CE   | 100 to 600          | 110<br>250       | S31<br>S34 | 3.3  | 5   | 12  | 15  | 6   | 9   | 20    | 27    | 30  | 32    |
| DC   | 0.4 to 2.5          | 110<br>250       | S31<br>S34 | 50   | 75  | 120 | 160 | 70  | 100 | 300   | 400   | 200 | 270   |
| DD   | 0.6 to 4            | 110<br>250       | S31<br>S34 | 60   | 90  | 210 | 270 | 90  | 140 | 360   | 480   | 350 | 480   |
| EA   | 1.6 to 10           | 110<br>250       | S31<br>S34 | 120  | 180 | 420 | 540 | 180 | 250 | 720   | 960   | 800 | 1200  |

### PSI Units

| Code | Range<br>ins H <sub>2</sub> O / psi | $P_{max}$<br>Psi | Model      | Microswitch – Option Switching Differential Ins H <sub>2</sub> O / Psi |      |      |      |      |      |       |       |      |       |
|------|-------------------------------------|------------------|------------|--|------|------|------|------|------|-------|-------|------|-------|
|      |                                     |                  |            | 00   | 01   | 02   | 03   | 04   | 05   | 08/0G | 09/0H | H2   | H3/H6 |
| BU   | -5.0 to +5.0                        | 14.5             | S31        | 0.2  | 0.4  | 0.8  | 1.0  | 0.4  | 0.6  | 0.7   | 0.9   | 0.9  | 0.9   |
| BY   | 2.5 to 16                           | 1600<br>3500     | S31<br>S34 | 0.5  | 0.9  | 1.6  | 2.3  | 0.8  | 1.2  | 3.1   | 4.3   | 3.9  | 3.9   |
| CS   | 10 to 64                            | 1600<br>3500     | S31<br>S34 | 1.0  | 1.6  | 3.5  | 4.7  | 1.6  | 2.3  | 6.2   | 8.2   | 7.2  | 8.2   |
| CK   | 1.5 to 8.5                          | 1600<br>3500     | S31<br>S34 | 0.05   | 0.07 | 0.17 | 0.21 | 0.08 | 0.13 | 0.29  | 0.39  | 0.43 | 0.46  |
| DP   | 6 to 40                             | 1600<br>3500     | S31<br>S34 | 0.72   | 1.1  | 1.7  | 2.3  | 1.0  | 1.4  | 4.3   | 5.8   | 2.9  | 3.9   |
| DT   | 10 to 60                            | 1600<br>3500     | S31<br>S34 | 0.87   | 1.3  | 3.0  | 3.9  | 1.3  | 2.0  | 5.2   | 7.0   | 5.1  | 7.0   |
| EH   | 25 to 160                           | 1600<br>3500     | S31<br>S34 | 1.7  | 2.6  | 6.1  | 7.8  | 2.6  | 3.6  | 10.4  | 13.9  | 11.6 | 17.4  |

## Technical Specifications

### ACCURACY

Set point repeatability  $\pm 1\%$  of span at 20°C ambient.

### AMBIENT TEMPERATURE RANGE

For continuous use below  $-25^{\circ}\text{C}$  ( $-13^{\circ}\text{F}$ ) we recommend using only enclosures H, R, T, U and A with special gaskets and limited switching.

### MAXIMUM PROCESS TEMPERATURE

Subject to appropriate installation practice, the component parts withstand up to  $+60^{\circ}\text{C}$  ( $+140^{\circ}\text{F}$ ).

### ELECTRICAL CONNECTIONS

#### Terminal Block

Cable entry is to a non-pinching terminal block made of a non-hygrosopic thermosetting plastic, suitable for cables up to  $2.5\text{mm}^2/14\text{AWG}$ .

#### Earthing/Grounding

An earthing facility is provided inside all weatherproof enclosures, adjacent to the entry. External earthing is standard on flameproof versions.

### Dielectric Strength

The electrical assembly is capable of withstanding  $\ast 2\text{kV}$  between live parts and earth/ground and 500V between open contacts.

$\ast 1.2\text{kV}$  for micro switch Codes H2, H3 and H6. Refer to Table 6.

### Electrical Entry

Standard options are listed in Table 3. Other threads can be accommodated by adaptors. Dual entry available, see Table 3. **OPTIONAL EXTRAS**

### Chemical Seals

Chemical seals of our own or proprietary manufacture can be fitted when required.

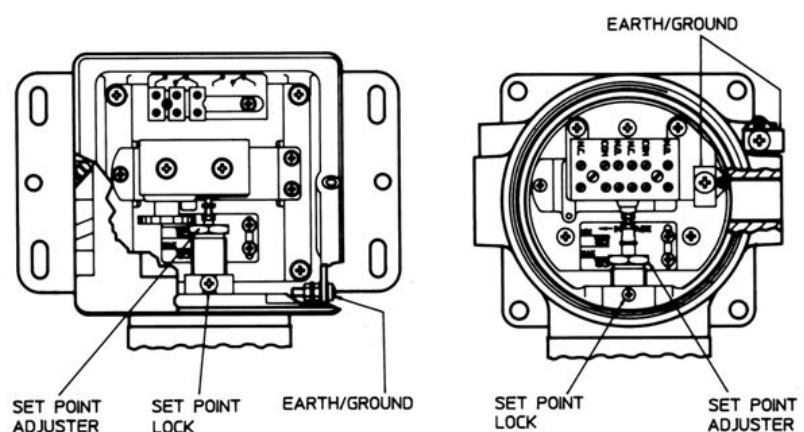
| UNIT WEIGHTS (Approx) |               |               |              |               |               |
|-----------------------|---------------|---------------|--------------|---------------|---------------|
|                       | MODEL S31     |               |              | MODEL S34     |               |
| Range Codes           | BC            | BD/CB/CE      | DC/DD/EA     | BD/CB/CE      | DC/DD/EA      |
| 'H, T' Enclosures     | 4.0kg/8.8lb   | 6.3kg/13.9lb  | 4.2kg/9.3lb  | 8.6kg/19.0lb  | 6.5kg/14.2lb  |
| 'R, U' Enclosures     | 11.5kg/25.4lb | 10.8kg/23.8lb | 8.7kg/19.2lb | 13.1kg/29.9lb | 11.0kg/24.1lb |
| 'W' Enclosure         | 4.0kg/8.8lb   | 6.3kg/13.9lb  | 4.2kg/9.3lb  | 8.6kg/19.0lb  | 6.5kg/14.3lb  |
| 'A' Enclosure         | 8.3kg/18.3lb  | 7.6kg/16.7lb  | 5.5kg/12.1lb | 9.9kg/21.8lb  | 7.8kg/17.2lb  |

## Operation / Installation

### Mounting position / Location / Installation.

Vertical as shown, taking care to avoid sitting in locations that transmit excessive shock or vibration. For further advice contact our engineers

### TYPICAL INTERNAL ARRANGEMENT



## Approvals

### INTRINSIC SAFETY

Because of the low voltages and currents of intrinsically safe circuits, we recommend using gold contacts. Refer to Table 6.

### CENELEC/ATEX II 2 G D

Certified to CENELEC EN50 014 and EN50 018.

For use in Zone 1 hazardous areas EEx d IIC T6 (-60° to +65°C)  
T5 (-60° to +85°C)



Enclosure Codes H and R and all models (see Table 1)

Certificate number BASEEFA 01ATEX2113X

### UNDERWRITER LABORATORIES INC.

Snap switches for use in Hazardous Locations.

Class 1, Groups A, B, C, D Class II, Groups E, F, G Division 1 and 2  
E136771



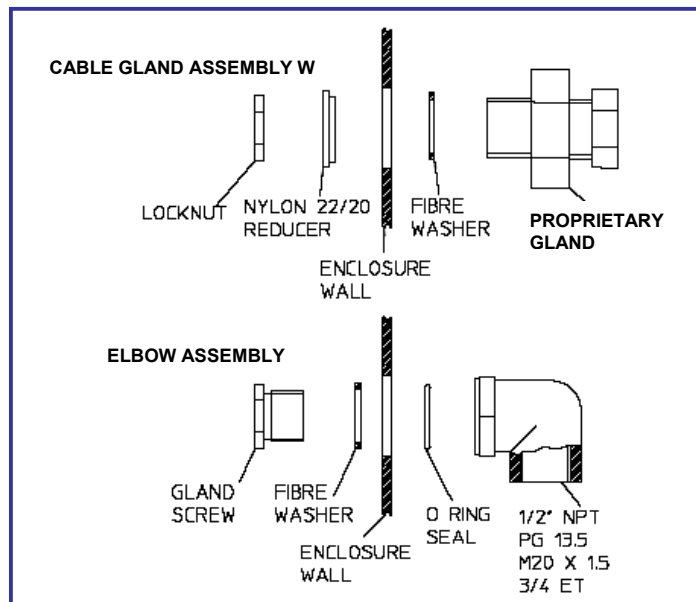
### CANADIAN STANDARDS ASSOCIATION

Snap switches for use in Hazardous Locations.

Class 1, Groups A, B, C, D Class II, Groups E, F, G Division 1 and 2  
LR94185

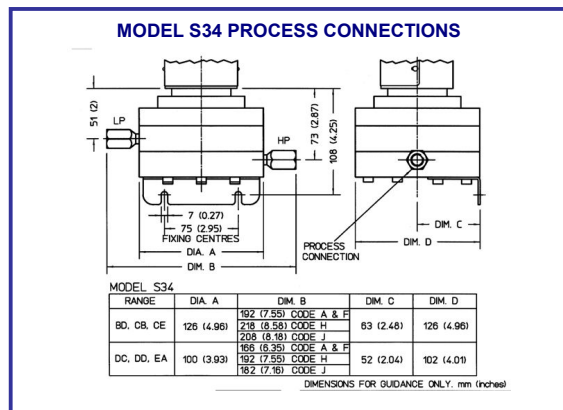
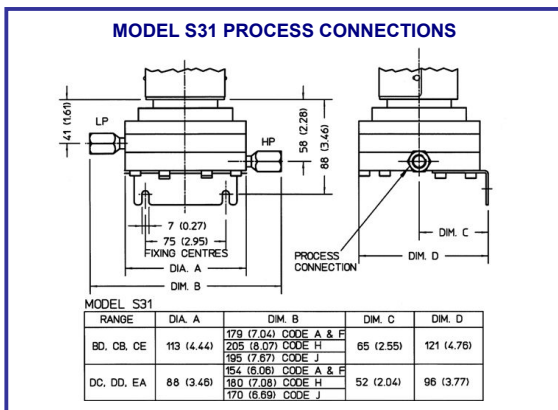
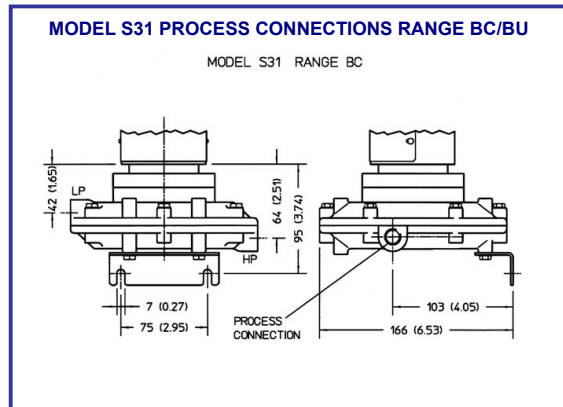
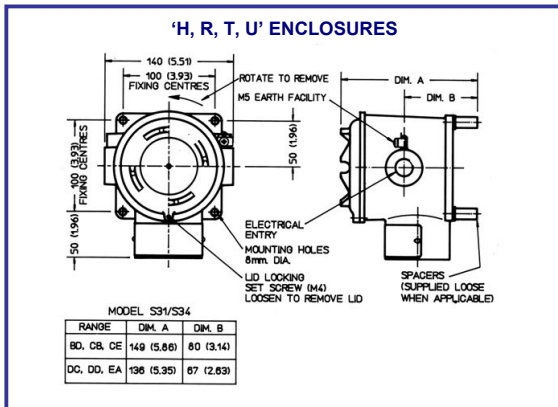
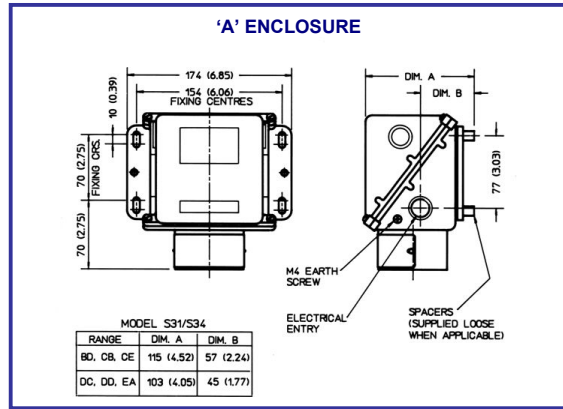
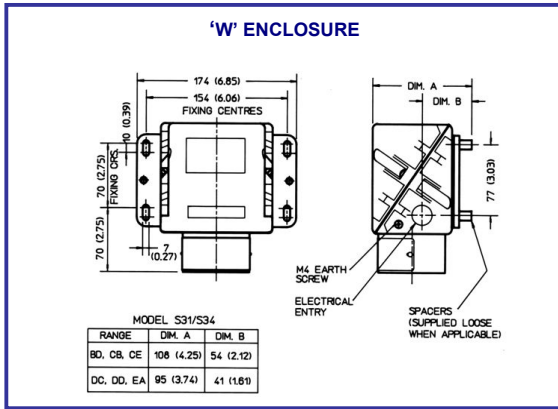


## Dimensions



# Dimensions

All dimensions mm (inches)



In the interest of development and improvement Delta Controls Ltd, reserves the right to amend, without notice, details contained in this publication. No legal liability will be accepted by Delta Controls Ltd for any errors, omissions or amendments.



Delta Controls Limited

Riverside Business Park, Dogflud Way, Farnham, Surrey GU9 7SS, UK.

T+44 (0)1252 729 140 F+44 (0)1252 729 168 E [sales@delta-controls.com](mailto:sales@delta-controls.com) W [www.delta-controls.com](http://www.delta-controls.com)



FM06720