

Bailey & Mackey Ltd



PRESSURE SWITCHES

Keeping pressure
under control

AN ISO 9000 COMPANY

Pressure Switches

Bailey & Mackey have been manufacturing high quality pressure instruments for over 75 years. The product range has been extended over this period and we now manufacture Pressure Switches, Pressure Gauges, Temperature Gauges and Pressure Transducers.

Our products satisfy most pressure and temperature sensing applications in many industrial markets including, **Aerospace, Automotive, Chemical, Marine, Medical, Water, Waste, Fire, Food, Heating and Ventilating, and General Industries.** In fact we have products which cover almost every pressure sensing application.

Expertise in pressure sensing technology enables us to manufacture to the highest standard of quality and reliability.

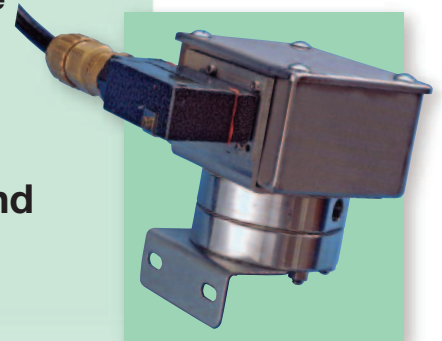
Our quality management system, which is approved by B. S. I. Quality assurance to BS EN 9001, ensures that all products have been correctly assembled and tested prior to despatch to our customers.

Bailey & Mackey aims to lead its chosen sectors of the **Pressure Switch, Pressure Gauge, Temperature Gauge and Pressure Transducer** Industry through excellence in customer service and product quality.

Bailey & Mackey – Pressure control experience and innovation for over 75 years



Cert No. FM 59294



Bailey & Mackey Pressure Switches

measure pressures relative to atmospheric pressure and are divided into three main groups, each group being based on a different measuring principle. The majority of our pressure switches have a SPDT micro-switch fitted, but where double pole switching is required, we can supply a range of pressure switches fitted with a DPDT micro-switch.

Diaphragm Switches

consists of either a corrugated metallic diaphragm or a synthetic rubber diaphragm. Metallic diaphragms are more versatile as the diaphragm can be treated to meet the majority of chemical applications, where as synthetic rubber diaphragms are limited to the compatibility of the synthetic rubber. The maximum pressure that diaphragm switches normally operate is 42 bar but they can be overload protected to 200 bar. Diaphragm pressure switches can also be set to switch in vacuum.

Piston Switches

consists of a piston that has a o'ring seal that is either mounted on the piston or in the body. Piston switches are normally used where the pressure is above that of diaphragm switches. Piston switches should not be used on gasses due to the inherent high friction that an o'ring has especially when pressure is not applied for a period of time. Piston switches are for high-pressure applications of up to 700 bar.

Bourdon Tube Switches

consists of a formed tube with one end fixed and the other end free to deflect under pressure and operate an electrical switch. Bourdon tube switches should be used for high pressure gas applications. Pressure ranges up to 600 bar can be supplied.

Bailey & Mackey Pressure Switches

can be modified to suit almost any requirement. Please contact our sales office for technical assistance.

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This series of pressure switches can be used for all applications where an electrical circuit is required to close or open at a required pressure.

The robustness of this series of pressure switches enables all applications in all industries to be satisfied.

- **Robust & Reliable**
- **Diaphragm Operated <42 bar**
- **Piston Operated >42 bar**
- **Proven Performance**
- **Wetted parts for use with all Fluids**
- **Fully Adjustable**
- **Easily Customised**
- **Enclosure Rating IP65**
- **CE marked for all Directives that apply**
- **LPCB Approved**
- **UL 508 Certified**

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
1381	-1 to +1 bar	0.04 bar
1381	0.2 to 4 bar	0.07 bar
1381	0.5 to 11 bar	0.3 bar
1381	0.7 to 14 bar	0.4 bar
1381	2 to 28 bar	0.6 bar
1381	2 to 42 bar	0.8 bar
1481	5 to 125 mbar	2.5 mbar
1481	15 to 250 mbar	4 mbar
1481	25 to 400 mbar	10 mbar
1581	9 to 100 bar	10 bar*
1581	14 to 200 bar	18 bar*
1581	20 to 400 bar	25 bar*

*Typical for mid-range set point

Maximum Pressure

To ensure long service life select the pressure range as follows:
 Dynamic pressure applications Pmax = 75% of Range
 Static pressure applications Pmax = 100% of Range
 Maximum pressure that can be applied is 125% of pressure range (see option Q page 8 for higher pressures.)

Electrical Ratings

10 amp at 250V 50 Hz Inductive load
 1 amp at 30V dc Inductive load
 For other voltages and currents please consult our technical department.

Setting Accuracy±2%

Temperature Range-10 to +85°C
 (Process fluid must not solidify)

Temperature Coefficient0.05%
 of range per °C from 20°C



Installation

These pressure switches can be mounted directly on the connecting thread. Sealing grooves are machined onto the end face of parallel threads for use with sealing washers. A Mounting Bracket is available if required.

Vacuum Setting

At ambient pressure the switches will be in the operated condition consequently the wiring should be reversed i.e. NO becomes NC.

Connecting Threads

All connecting threads used in industry are available including British, American and metric. Please state the connection thread when ordering.

Flanges & Hygienic Fittings

(see page 5 for alternative connections)

Flanged fittings are available and all types of Hygienic fittings can be supplied assembled directly onto the pressure switch. If flush diaphragms are required please consult our Technical Department

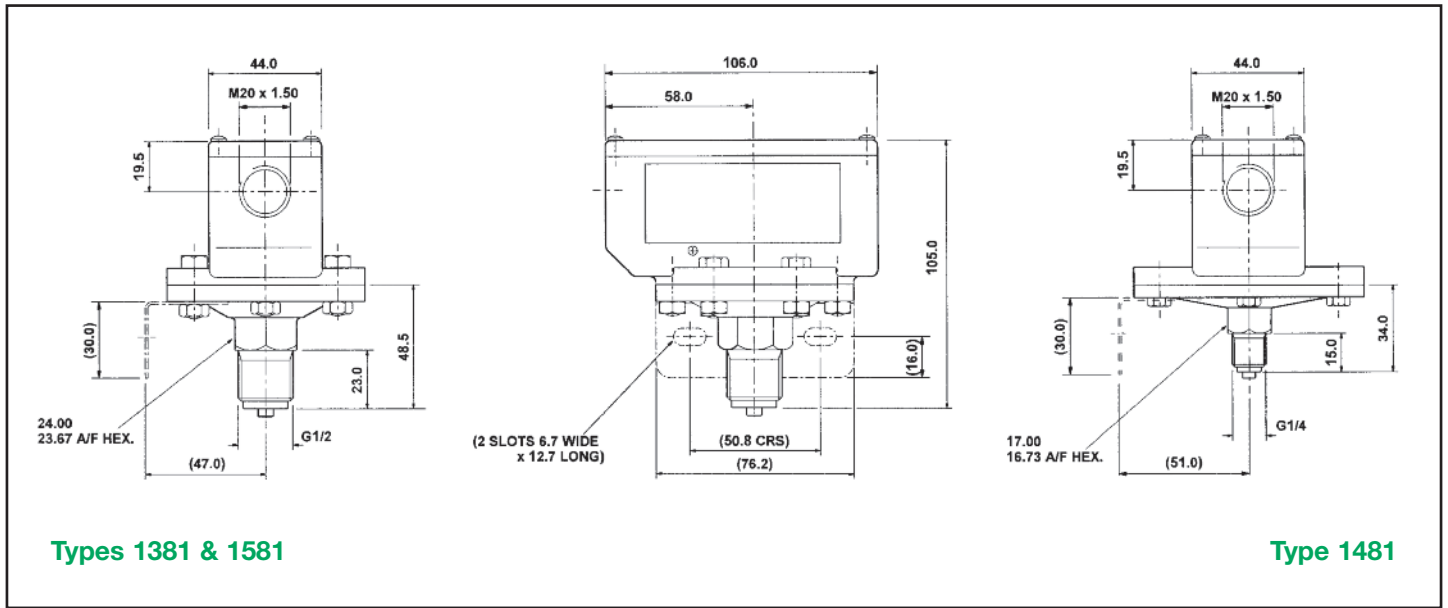
Materials of Construction Types 1381 & 1481

Diaphragm.....Beryllium Copper
 SealGlass filled PTFE <11 bar
 Nitrile rubber >11 bar
 BaseBrass
 HousingAluminium / Zinc diecast
 Cover.....Glass Filled Nylon with Nitrile seal

Material of Construction Type 1581

PistonStainless Steel
 SealNitrile rubber with PTFE
 anti-extrusion rings
 BaseStainless Steel
 HousingAluminium / Zinc diecast
 Cover.....Glass Filled Nylon with Nitrile seal

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Types 1381 & 1581

Type 1481

Alternative Wetted Parts

(see page 9 for abbreviated chemical compatibility chart)

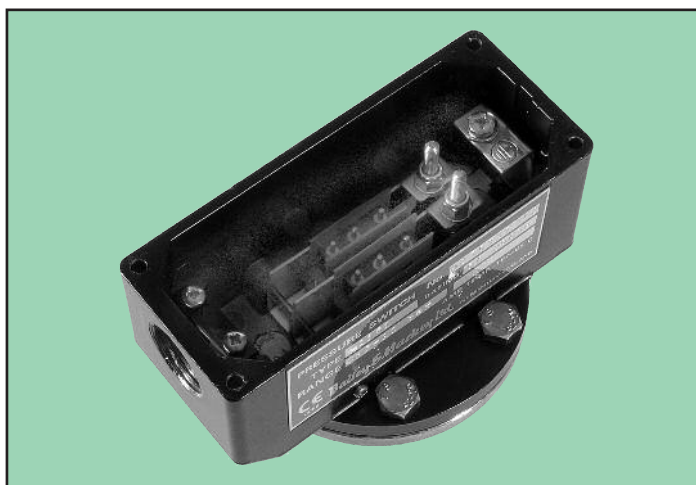
Switches with standard wetted parts above are suitable for applications using air, nitrogen, inert gasses, oils, water & steam.

Alternatives for use with fluids other than these are shown opposite.

Please contact our Technical Department for further information.

MATERIAL	BASE	DIAPHRAGM	PROTECTION DISC
316 Stainless Steel	Yes	No	Yes
17/7 Stainless Steel	No	Yes	No
Carbon Steel	Yes	No	No
UPVC	Yes	No	No
PTFE	Yes	No	Yes
PVDF	Yes	No	No
Silver Plate	No	No	Yes
Pure Silver	No	Yes	Yes
Halar Lined	Yes	No	No
Dykor coated	No	Yes	No
Rubber Lined	Yes	No	No
Chrome Plated	Yes	Yes	No

Variants To Series 1000 Pressure Switches Type 2381, 2481 & 2581 Twin Circuit Pressure Switches



- Two independently operating Micro-switches.
- External Dimensions are the same as the Standard Switches.
- Reset Differentials are approx. twice those given for standard switches.
- Electrical Rating 5 amp at 250V 50Hz
- For Pressure ranges see page 2

Applications

Both micro-switches are SPDT and can be used to give two independent opening or closing contacts at different switch points. The two micro-switches cannot be set to give a switch at the same pressure. A DPDT micro-switch must be used for this function see page 10. These switches can be set to give High/High, Low/Low or High/Low set points.

Type 1391, 1491 & 1591 Single Visual Setting Pressure Switches

Type 2391, 2491 & 2591 Twin Visual Setting Pressure Switches



- Accurate Visual Setting Scale
- One or Two independently operating Micro-switches depending on type
- External adjustment
- Scale calibrated to $\pm 2\%$ of range

Applications

Visual setting pressure switches are particularly suitable for application where frequent alteration of the pressure setting is required.

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
1391 & 2391	1 to 0 bar vacuum	Hysteresis as the standard for single visual setting
1391 & 2391	0 to 1 bar	
1391 & 2391	0.2 to 4 bar	
1391 & 2391	0.5 to 10 bar	
1391 & 2391	2 to 30 bar	Hysteresis approx. twice the standard for twin visual setting.
1391 & 2391	2 to 40 bar	
1491 & 2491	5 to 125 mbar	
1491 & 2491	15 to 250 mbar	
1491 & 2491	25 to 400 mbar	See p2.
1591 & 2591	9 to 100 bar	
1591 & 2591	14 to 200 bar	
1591 & 2591	20 to 400 bar	

Cooling Coil Transmitter

- For temperatures up to 300°C
- For viscous or corrosive fluids

The pressure switch body is isolated from the heat source via a secondary diaphragm and coiled copper tube allowing the heat to be dissipated.

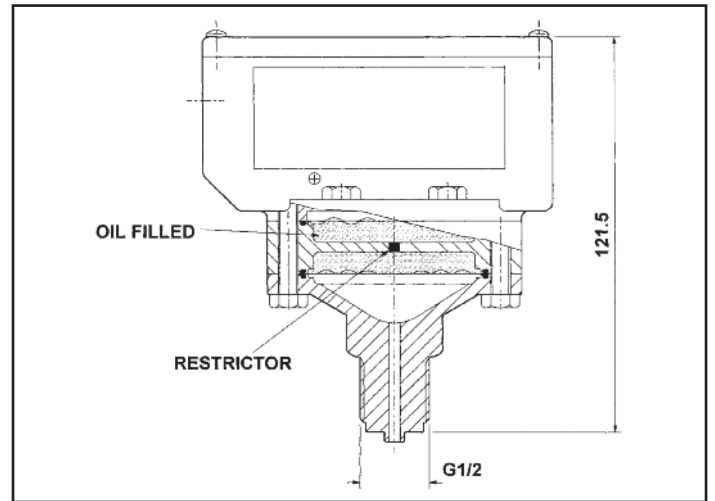
The flange clamping bolts must not be un-tightened as this will break the pressure seal and render the switch in-operative.



Throttled Transmitter

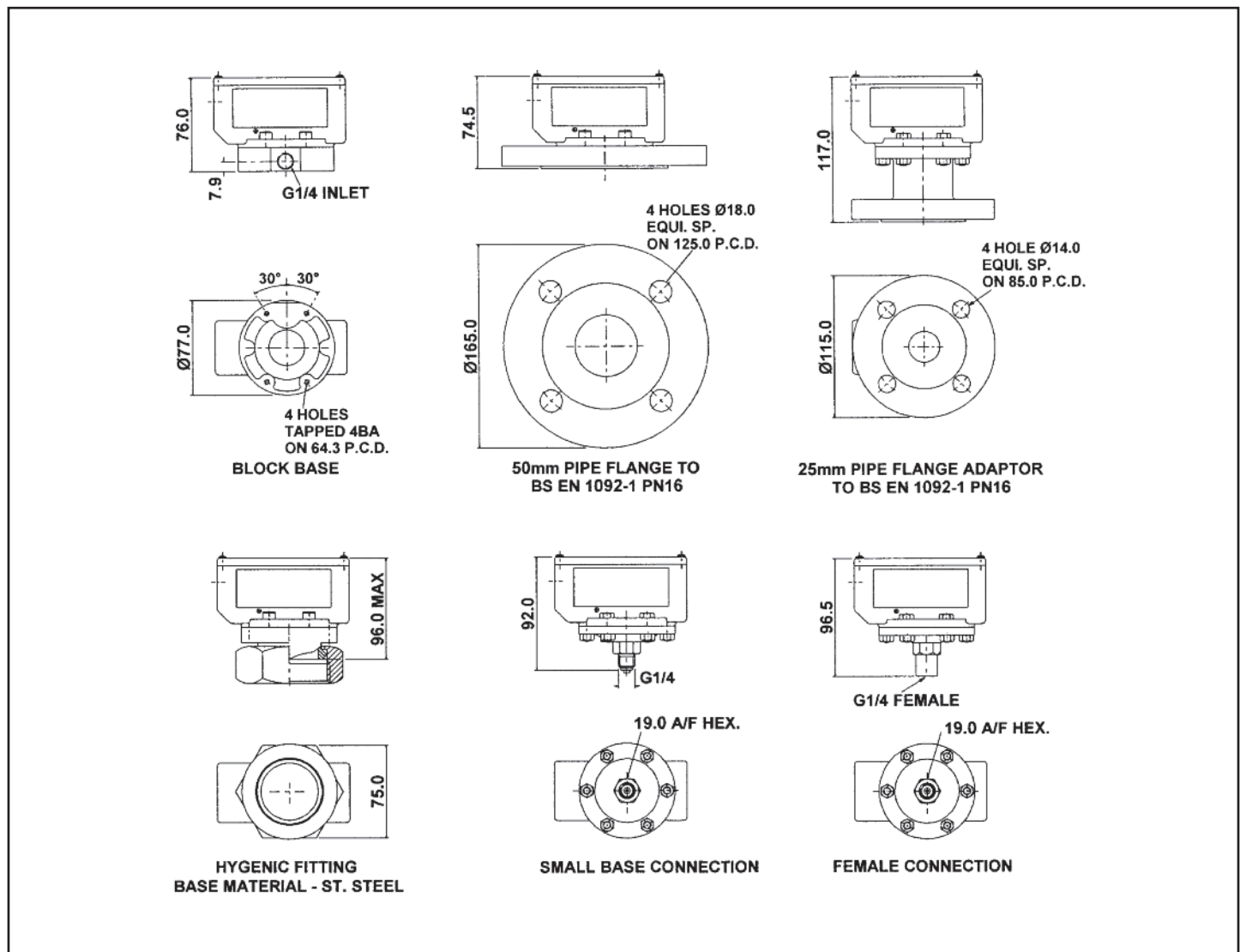
■ Stops pressure pulses giving false switching

In many applications where pressure switches are used it is not possible to provide protection against pulsating pressures by means of a snubber involving small orifices. The Bailey & Mackey solution to this problem is integral hydraulic damping, allowing a mean switch point to be achieved irrespective of the severity of the pressure pulses.



Alternative Base Fittings

Suitable for adding to 1000 Series & 3000 series



- For use in Pneumatic Systems
- For use in Hazardous Areas
- Signal Above Set Point suffix A or
- Signal Below Set Point suffix B
- Automatic or Manual Reset

Applications

Pneumatic Pressure Switches are ideal for use where an electric pressure switch cannot be used.

In Hazardous areas they can provide a more sensitive and cost effective alternative to flameproof or intrinsically safe equipment. The Pneumatic signal can be used to operate pneumatic valves or similar equipment or taken into the safe area and made to operate an electric pressure switch.

This type of pressure switch operates on an air bleed system. Gasses other than air should not be used as the pilot medium. Please see page 24 for pneumatic pressure switches without the air bleed.

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
1361	-1 to 0.07 bar	40 mbar
1361	-1 to +1 bar	40 mbar
1361	0.2 to 4 bar	70 mbar
1361	0.5 to 10 bar	0.3 bar
1361	0.7 to 14 bar	0.4 bar
1361	2 to 28 bar	0.6 bar
1361	2 to 42 bar	0.8 bar
1461	10 to 125 mbar	3 mbar
1461	15 to 250 mbar	6 mbar
1461	25 to 400 mbar	10 mbar
1561	9 to 100 bar	10 bar*
1561	14 to 200 bar	18 bar*
1561	20 to 400 bar	25 bar*

*Typical for mid-range set point

Maximum Pressure

To ensure long service life please select the pressure range as follows:

Dynamic pressure applications $P_{max} = 75\%$ of Range

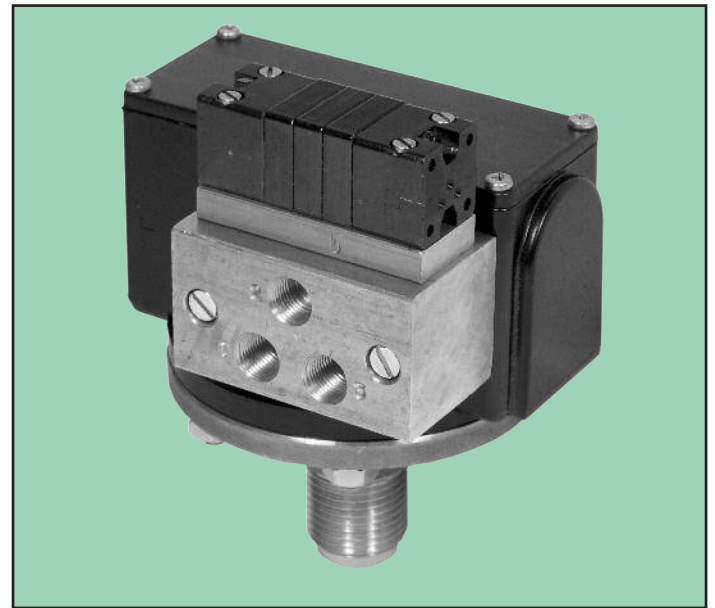
Static pressure applications $P_{max} = 100\%$ of Range

Maximum pressure that can be applied is 125% of pressure range (see option Q page 8 for higher pressures)

Setting Accuracy±5%

Temperature Range-10 to +85°C
(Process fluids must not solidify)

Temperature Coefficient0.05%
of range per °C from 20°C



Signal Air Supply

Compressed air at a supply pressure between 2 and 8 bar is required to operate the switch. Signal output is 200NI / min at 5.5 bar with a 10% pressure drop. The flow of air through the bleed from the back-pressure valve when it is open is less than 3NI / min. A 25µM filter should be fitted in the supply line.

Signal Air Connection

Switches with suffix A

For signal above set point – connect air supply to port marked 1, connect signal line to port marked 2, exhaust on change-over will come from port marked 3.

Switches with suffix B

For signal below set point – connect air supply to port marked 3, connect signal line to port marked 2, exhaust on change-over will come from port marked 1.

Installation

These pressure switches can be mounted directly on the connecting thread. Sealing grooves are machined onto the end face of parallel treads for use with sealing washers.

A Mounting Bracket is available if required.

It is recommended that these switches be installed vertically i.e. with the process connection vertically down.

Vacuum Setting

At ambient pressure the back-pressure valve will be operated, consequently, if the pneumatic signal is required between atmospheric pressure and the vacuum setting suffix A is required, suffix B gives an air signal after the vacuum has been reached.

Connecting Threads

All process connecting threads used in industry are available including British, American and metric. Please state the connection thread when ordering.

To make series 1000 Pressure Switches more suitable for many applications there are several standard options available.

Option D – Degreased for oxygen use

Pressure switches for use on oxygen have to be free from all traces of oil or grease. Diaphragm pressure switches have the diaphragm, pressure chamber and seal specially cleaned and handled during assembly and are marked with the 'Use no oil' symbol.

Option G – Gold plated Micro-switches

Micro-switches with Gold plated contacts are used in low power circuits where the contact resistance of standard silver contacts is to high. For electrical loads below 6V at 0.1A dc.

Option H – Low leak assembly

A modified design of pressure switch is available for use on extinguishers, switchgear, transformers or other sealed pressure systems. Special machining and assembly gives freedom from leaks greater than 10^{-5} Nccs/sec.

Option M – For mining applications

No aluminium parts used.

Option P – With plug & socket

Fitted with 4 – pin plug and socket for SPDT micro-switch version.
Fitted with 7 – pin plug and socket for twin SPDT or DPDT micro-switch versions.

Option Q – Overload Protection

Pressures above the adjustable range shown in the table should not be applied to the switches. Overload will strain the diaphragm, either causing distortion that will alter the set point of the pressure switch or reduce the diaphragm life through fatigue failure. Normally, the pressure range should be chosen to cover the highest pressures likely to develop in the system; Series 1000 switches can be constructed to accept higher pressures than the adjustable range by fully supporting the diaphragm above its normal operating deflection. Maximum temperature is 60°C.

MAXIMUM ADJUSTABLE RANGE	OVERLOAD PRESSURE ALT. 1	OVERLOAD PRESSURE ALT. 2
400 mbar	7 bar	–
1 bar	28 bar	–
2 bar to 42 bar	70 bar	200 bar

Option R & RF – Manual Reset

On some applications, for safety reasons, a manual reset is required e.g. after changing a filter element or for alarm purposes.

R = Manual Reset above the set point

RF = Manual Reset Below the set point.

Option V – Adjustable Hysteresis

This option enables the hysteresis to be increased and can be varied between approximately 5% and 95% of the adjustable pressure range.

Option X

In some applications a higher electrical rating is required this option is fitted with a micro-switch for 15amps at 250V 50Hz.

Pressure Conditions

Standard materials for wetted parts are brass pressure chamber and beryllium copper diaphragm. This can be changed to make the wetted parts suitable for most other fluid applications. The diaphragm can be protected against corrosion, by a thin sheet of suitable material and the pressure chamber can be electro-plated or machined from a suitable material either metal or plastic. Examples of suggested materials for use with a range of chemicals are given in the tables below ; these are only suggestions and it is the users responsibility to ensure that the material used is compatible with the chemicals used and the application conditions of concentration and temperature.

Vacuum Conditions

Diaphragm protection under vacuum conditions must be integral with the diaphragm. On vacuum applications or where suction can occur a 17/7 precipitation hardened stainless steel can be used as an alternative to beryllium copper. 17 / 7ph is less corrosion resistant than 316 stainless steel but it can be hardened and tempered to give reasonable spring properties. If this is not sufficiently resistant for the application the beryllium copper diaphragm can be electroplated or coated with a suitable plastic material.

Malleable Iron Base, 316 S.Steel Disc

Acetylene
Alkyl Chlorides
Ammonia (Max 60°C)
Aniline
Calcium Chloride (Max 60°C)
Caustic Soda (Max 60°C)
Chlorides of Na, K, Mg
Hydrocyanic Acid
Pyridine

Silver Plated Base, Fine Silver Disc

Brines
Bromine
Chlorine (wet or dry)
chlorates of Na, K, Ba
Chlorides of Na, K, Mg
Flourine
Mercuric Chloride
Ozone

UPVC Base 1/2" BSP, PTFE Disc

Max Temperature 40°C
Max Pressure 200 lbf/in²
Anhydrous Ammonia
Aluminium Chloride
Caustic Soda
Hydrobromic Acid (50%)
Hydrochloric Acid (36%)
Hydrogen Sulphide
Lead Acetate
Methanol
Oxalic Acid
Phosphoric Acid (50%)
Potassium Salts
Sodium Hypochlorite
Sodium Salts
Sulphuric Acid (70%)
Waste Gases

316 Stainless Base and Disc

Acetic Acid
Ammonium Hydroxide
Carbon Disulphide
Carbon Tetrachloride
Caustic Soda
Caustic Potash
Citric Acid
Formic Acid
Fruit Juices
Food Machinery
Hexamine
Hydrogen Peroxide
Oil-Phosphate Ester Based
Silver Nitrate
Water De-ionised

Type 1371P, 1371PV and 2371P

Being a modified version of our series 1000 pressure switches these pressure switches have been specially developed for heavy duty cyclic applications.

They can be used for compressor control, pump control or other applications where accuracy and long service life are paramount. Variants of this pressure switch type are adjustable set point with fixed hysteresis, adjustable set point with adjustable hysteresis and either Single Pole Double Throw (SPDT) or Double Pole Double Throw (DPDT) micro-switches as well as twin switches for high/low adjustable set points.

- **Robust and Reliable**
- **Long Service Life**
- **Diaphragm Operated**
- **Accurate and Stable**
- **SPDT & DPDT versions**
- **Gold contacts available**
- **Enclosure Rating IP65**
- **CE marked for all Directives that apply**

Pressure Ranges

0.5 to 2.5 bar
1 to 4 bar
1.5 to 6 bar
2.5 to 11 bar
4 to 16 bar
7 to 25 bar
8 to 32 bar

Maximum working pressure.....70 bar

Temperature range-40 to +85 °C
(Process fluids must not solidify)

Electrical connection

Via 4 pin plug & socket on SPDT switches and 7 pin plug & socket on DPDT and twin switches.



Construction Materials

Diaphragm.....Silicon rubber
 ConnectionBrass
 HousingAluminium / Zinc alloy
 Cover.....Glass filled nylon with Nitrile rubber seal.

Type 1371P

Features an adjustable set point and a fixed hysteresis. Both SPDT and DPDT micro-switches can be fitted; when ordering state which is required. Standard micro-switch contacts are silver, gold contacts can be provided for electrical loads below 6 volts at 0.1 amps dc.

Type 1371VP

Features an adjustable set point and an adjustable hysteresis. Both SPDT and DPDT micro-switches can be fitted; when ordering state which is required. Standard micro-switch contacts are silver, gold contacts can be provided for electrical loads below 6 volts at 0.1 amps dc.

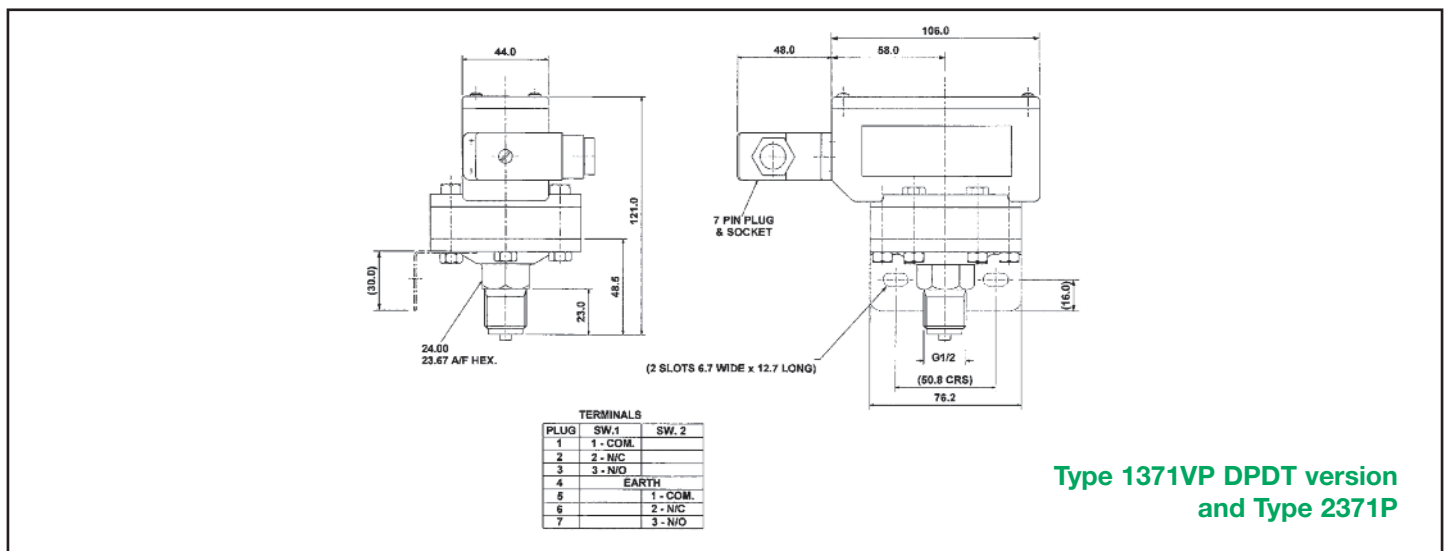
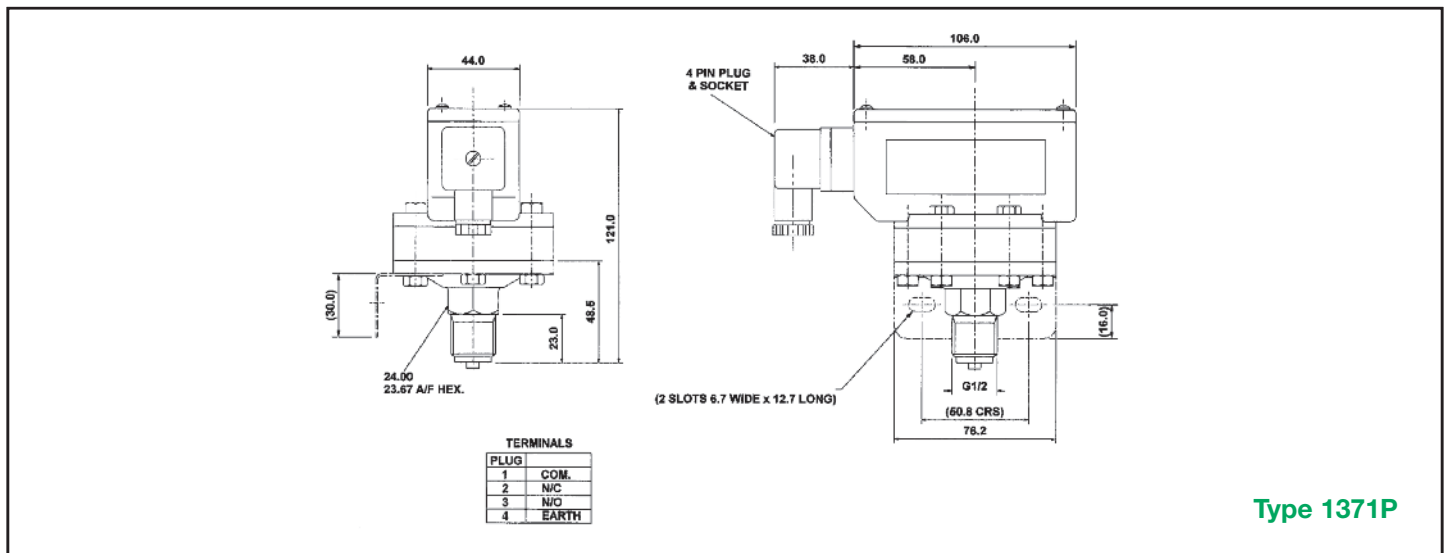
Type 2371P

Features 2 adjustable set points with a fixed hysteresis. Only SPDT micro-switches can be fitted. Standard micro-switch contacts are silver, gold contacts can be provided for electrical loads below 6 volts at 0.1 amps dc.

Electric Ratings

	A.C. AMPS				D.C. AMPS				
Volts	14	30	125	250	8	14	30	125	250
Type 1371P and 1371VP SPDT Switch									
Resistive	15	15	15	15	FOR D.C. LOADS				
Inductive	15	15	15	15	Consult our Technical Department				
Type 1371P and 1371VP DPDT Switch									
Resistive	10	10	10	10	10	10	10	0.5	0.25
Inductive	6	6	6	4	6	6	4	0.05	0.03
Type 2371P SPDT Switch									
Resistive	5	5	5	5	FOR D.C. LOADS				
Inductive	5	5	5	5	Consult our Technical Department				

Dimensions



This series of pressure switches are used to monitor the difference between two pressures. For example, they can be used to monitor filter condition and signal when the filter is becoming blocked. They can also be used as flow monitoring switches if used across orifice plates etc.

- Robust and Reliable
- Diaphragm Operated
- Proven Performance
- Fully Adjustable
- Enclosure Rating IP65
- CE marked for all Directives that apply
- UL 508 Certified

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
1382	0.07 to 1 bar	0.04 bar
1382	0.2 to 4 bar	0.07 bar
1382	0.5 to 11 bar	0.3 bar
1382	2 to 28 bar	0.6 bar
1482	5 to 125 mbar	2.5 mbar
1482	15 to 250 mbar	4 mbar
1482	25 to 400 mbar	10 mbar

Max. Line Pressure

Pressure range >250mbar34 bar

Pressure range <125 mbar 14 bar

Electrical Ratings

10 amp at 250V 50Hz Inductive load

1 amp at 30V dc Inductive load

For other voltages and currents please consult our technical department.

Overload

Dimensions of the diaphragm housing are such that the movement of the diaphragm is stopped when the diaphragm exceeds the range. This ensures that the differential pressure switches will accept the accidental application of 4 times the range without damage except for a possible setting shift of up to 2 % of range. It is possible that these switches can be modified to accept the full line pressure on one side of the diaphragm.



Installation

These pressure switches can be mounted directly on the connecting thread. A Mounting Bracket is available if required.

Vacuum Use

If used to detect the difference between two levels of vacuum a slight modification is needed and vacuum use must be specified when ordering.

At ambient pressure the switches will be in the operated condition consequently the wiring should be reversed i.e. NO becomes NC.

Materials of Construction Types 1382 & 1482

Diaphragm.....Beryllium Copper

All Seals.....Nitrile rubber

ConnectionBrass

HousingAluminium / Zinc diecast

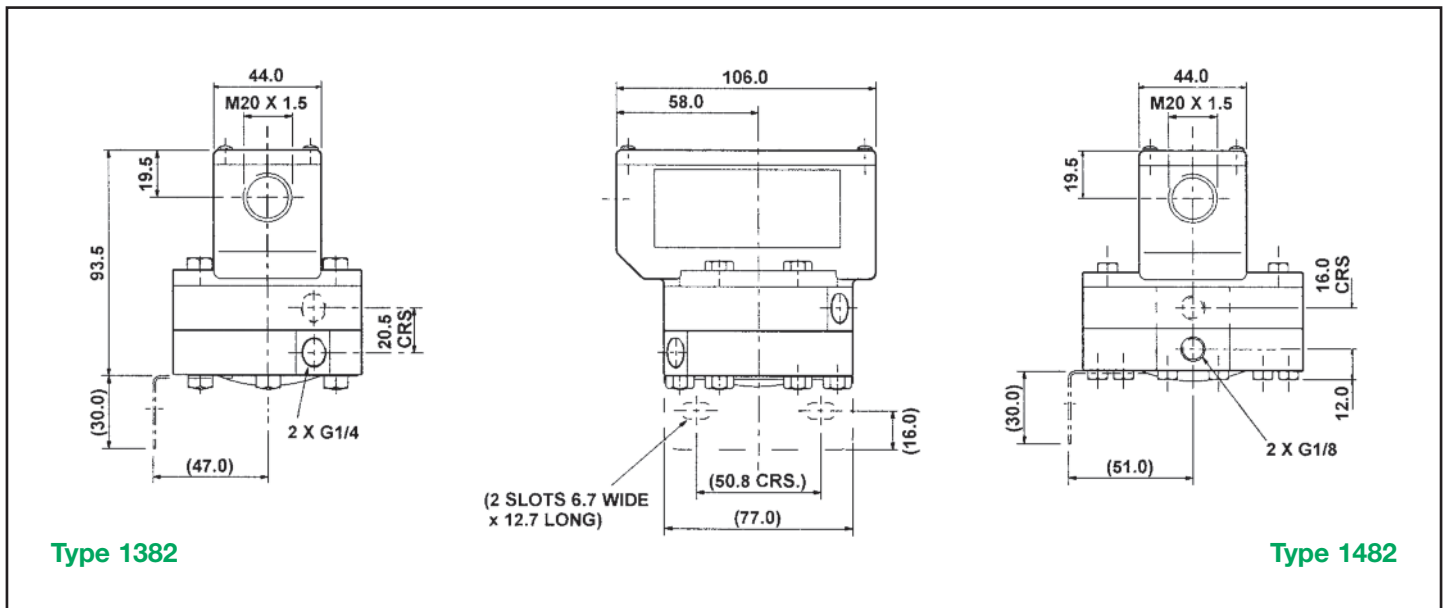
CoverGlass Filled Nylon with Nitrile seal

Alternative Wetted Parts

Connections316 Stainless Steel

Diaphragm.....17 / 7 ph Stainless Steel

SealsViton rubber



Type 1382

Type 1482

Options Available

To make Series 1000 Differential Pressure Switches more suitable for many applications there are several standard options available. A suffix letter that follows the Type Number designates these options.

Option D – Degreased for oxygen use

Pressure switches for use on oxygen have to be free from all traces of oil or grease. Diaphragm pressure switches have the diaphragm, pressure chamber and seal specially cleaned and handled during assembly and are marked with the 'Use no oil' symbol.

Option G – Gold plated micro-switches

Micro-switches with Gold plated contacts are used in low power circuits where the contact resistance of standard silver contacts is too high. For electrical loads below 6V at 1.0A dc.

Option P – With plug & socket

Fitted with 4 –pin plug and socket for SPDT micro-switch version.
Fitted with 7 –pin plug and socket for twin SPDT & DPDT micro-switch versions.

Option R & RF – Manual Reset

On some applications, for safety reasons, a manual reset is required e.g. after changing a filter element or for alarm purposes.

R = Manual Reset above the set point

RF = Manual Reset below the set point

Option V- Adjustable Hysteresis

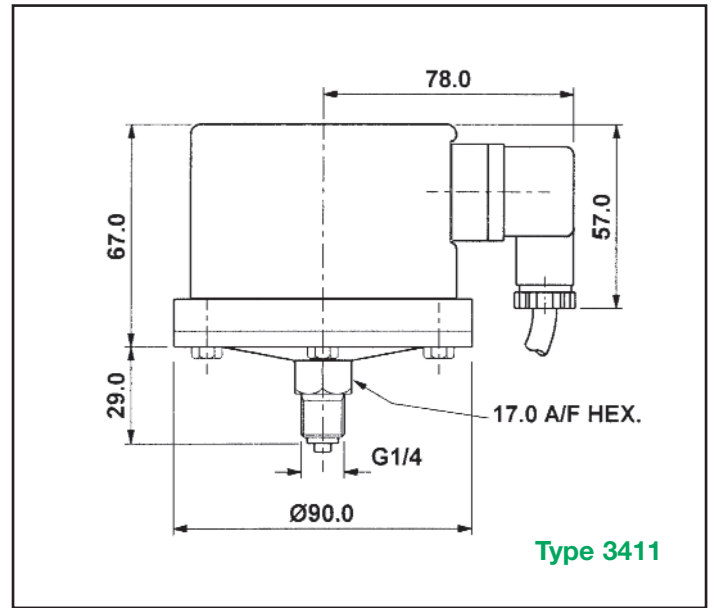
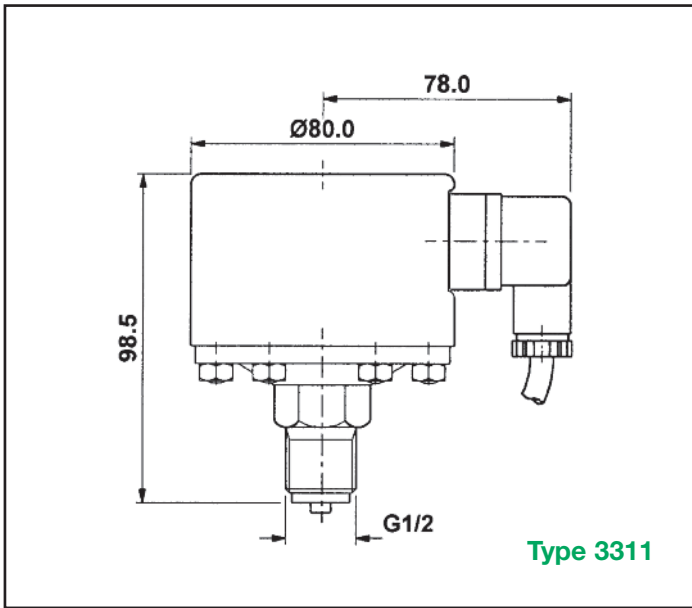
This option enables the hysteresis to be increased and can be varied between approximately 5% and 95% of the adjustable pressure range.

Option X

In some applications a higher electrical rating is required this option is fitted with a micro-switch for 15 amps at 250V 50Hz.

Other Options

Visual Setting Scale	Type 1392 & 1492
Twin Circuit	Type 2382 & 2482
Twin Circuit with Visual Setting Scale	Type 2392 & 2492



Alternative Wetted Parts

(see page 9 for abbreviated chemical compatibility chart)

Switches with standard wetted parts above are suitable for applications using air, nitrogen, inert gasses, oils, water and steam.

Alternative wetted parts for use with fluids other than these are shown opposite.

Please contact our technical Department for further information.

TYPE	MATERIAL	BASE	DIAPHRAGM	PROTECTION DISC
3311	316 Stainless	Yes	No	Yes
3311	Carbon Steel	Yes	No	No
3311 & 3411	UPVC	Yes	No	No
3311 & 3411	PTFE	Yes	No	Yes
3311 & 3411	PVDF	Yes	No	No
3311	Halar Lined	Yes	No	No
3311	Rubber Lined	Yes	No	No
3311 & 3411	Chrome Plated	Yes	Yes	No
3311 & 3411	17/7 Stainless Steel	No	Yes	No
3311 & 3411	Silver Plate	Yes	Yes	No
3311	Pure Silver	No	No	Yes
3311 & 3411	PVDF (Dykor) coated	No	Yes	No

To make Series 3000 Pressure Switches more suitable for many applications there are several standard options available.

Option D – Degreased for oxygen use

Pressure switches for use on oxygen have to be free from all traces of oil or grease. Diaphragm pressure switches have the diaphragm, pressure chamber and seal specially cleaned and handled during assembly and are marked with the 'Use no oil' symbol.

Option G – Gold plate Micro-switches

Micro-switches with Gold plated contacts are used in low power circuits where the contact resistance of standard silver contact is too high. For electrical loads below 6V at 0.1A dc.

Option H – Low leak assembly

A modified design of pressure switch is available for use on extinguishers, switchgear, transformers or sealed pressure systems. Special machining and assembly gives freedom from leaks greater than 10^{-5} Nccs / sec.

Option M – For Mining Applications

No aluminium parts used

Option Q – overload Protection

Pressures above the adjustable range shown in the table should not be applied to the switches. Overload will strain the diaphragm, either causing distortion that will alter the set point of the pressure switch or reduce the diaphragm life through fatigue failure.

Normally, the pressure range should be chosen to cover the highest pressures likely to develop in the system; Series 3000 switches can be constructed to accept higher pressures than the adjustable range by fully supporting the diaphragm above its normal operating deflection.

Maximum temperature 60°C

MAXIMUM ADJUSTABLE RANGE	OVERLOAD PRESSURE ALT. 1	OVERLOAD PRESSURE ALT. 2
40 mbar	1 bar	-
20 to 400 bar	7 bar	-
1 bar	28 bar	200 bar
2 to 40 bar	70 bar	200 bar

Series 3000

Differential Pressure Switches

This series of pressure switches are used to monitor the difference between two pressures. For example, they can be used to monitor filter condition and signal when the filter is becoming blocked. They can also be used as flow monitoring switches if used across orifice plates etc.

- Robust and Reliable
- Diaphragm Operated
- Proven Performance
- Fully adjustable
- Enclosure Rating IP65
- CE marked for all Directives that apply

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
3312	0.07 to +1 bar	0.04 bar
3312	0.2 to 3 bar	Adjustable
3312	0.6 to 8 bar	Adjustable
3312	1 to 20 bar	Adjustable
3412	10 to 160 mbar	Adjustable
3412	20 to 400 mbar	Adjustable

Available hysteresis range from 5% to 90% of range typical.

Max. Line Pressure

Pressure range > 250 mbar 34 bar
 Pressure range < 250 mbar 14 bar

Electrical Ratings

10 amp at 250V 50Hz Inductive load
 1 amp at 30V dc Inductive load
 For other voltages and currents please consult our technical department.

Overload

Dimensions of the diaphragm housing are such that movement is stopped when the diaphragm exceeds the range. This ensures that the differential pressure switches will accept the accidental application of 4 times the range without damage except for a possible setting shift of up to 2% of the Range. It is possible that these switches can be modified to accept the full line pressure on one side of the diaphragm.

Temperature Range-10 to +85°C
 (Process fluid must not be allowed to solidify)

Temperature Coefficient0.05%
 of range per °C from 20 °C



Installation

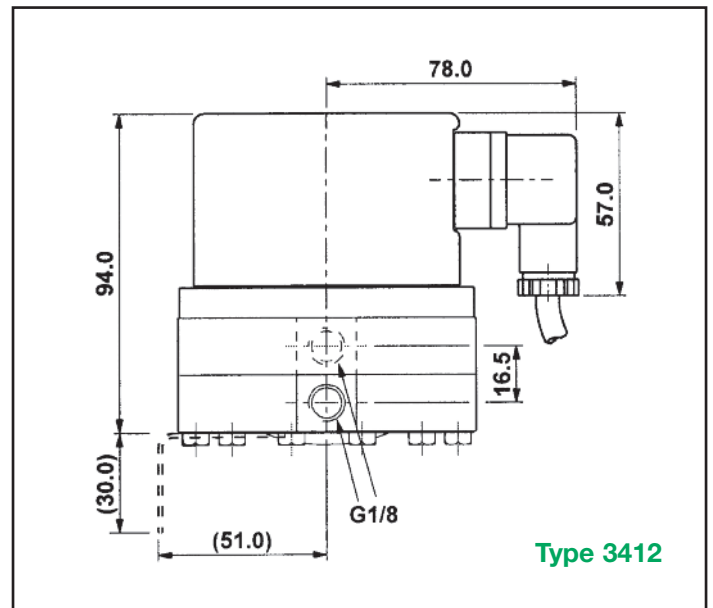
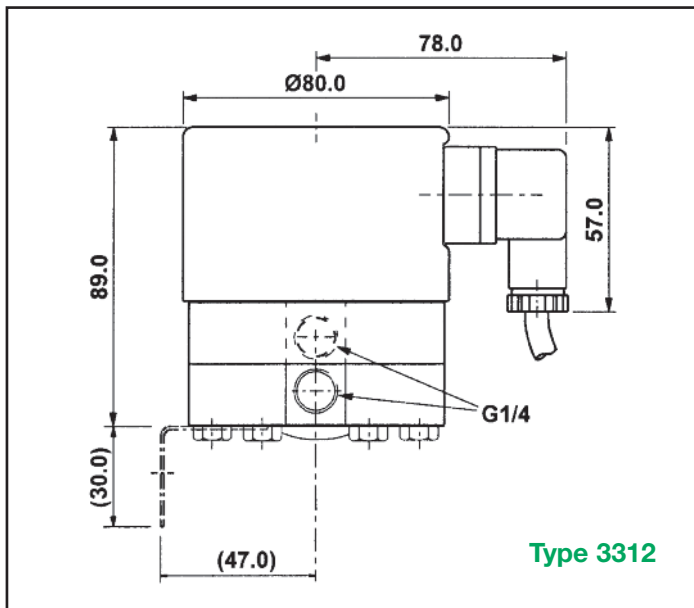
These pressure switches can be mounted directly on the connecting thread. A Mounting Bracket is available if required.

Vacuum Use

If used to detect the difference between two levels of vacuum a slight modification is needed and vacuum use must be specified when ordering. At ambient pressure the switches will be in the operated condition consequently the wiring should be reversed i.e. NO becomes NC.

Materials of Construction Types 3312 & 3412

Diaphragm17 / 7ph Stainless Steel
 SealsNitrile rubber
 Connection316 Stainless Steel
 Housing316 Stainless Steel



Options Available

To make Series 3000 Differential Pressure Switches more suitable for many applications there are several standard options available. A suffix letter that follows the Type Number designates these options.

Option D – Degreased for oxygen use

Pressure switches for use on oxygen have to be free from all traces of oil or grease. Diaphragm pressure switches have the diaphragm, pressure chamber and seal specially cleaned and handled during assembly and are marked with the 'Use no oil' symbol.

Option G – Gold plate Micro-switches

Micro-switches with Gold plated contacts are used in low power circuits where the contact resistance of standard silver contact is too high. For electrical loads below 6V at 0.1A dc.

Option V – Adjustable Hysteresis

This option enables the hysteresis to be increased and can be varied between approximately 5 % and 95 % of the adjustable pressure range.

Option X

In some applications a higher electrical rating is required this option is fitted with a micro-switch for 15 amps at 250V 50Hz

This series of pressure switches are intended for use in hazardous areas where an intrinsically safe circuit cannot be used. They can be used to monitor or control pressures within a fluid system by either closing or opening an electrical circuit. The pressure switches consist of a housing containing the pressure sensing mechanism with an external micro-switch contained within an ATEX housing.

- Robust and reliable
- Diaphragm operated < 40 bar
- Piston operated > 40 bar
- Wetted parts for use with all fluids
- Fully adjustable set point
- Enclosure rating IP67
- ATEX Approved to:- CE Ex II2 G (EEx.d.e. IIC. T6)

Pressure Ranges

TYPE NO.	PRESSURE RANGE	HYSTERESIS TYPICAL
5381	0.25 to 1 bar vacuum	0.25 bar
5381	0.25 to 1 bar	0.25 bar
5381	1 to 4 bar	0.35 bar
5381	2 to 10 bar	0.8 bar
5381	3 to 14 bar	0.8 bar
5381	6 to 28 bar	2.5 bar
5381	10 to 40 bar	3.0 bar
5581	20 to 100 bar	19 bar*
5581	40 to 200 bar	40 bar*
5581	100 to 400 bar	95 bar*

*Typical for mid-range set point.

Maximum Pressure

To ensure long service life select the pressure range as follows: Dynamic pressure applications Pmax = 75% of range. Static pressure applications Pmax = 100% of range. Maximum pressure that can be applied is 125% of pressure range.

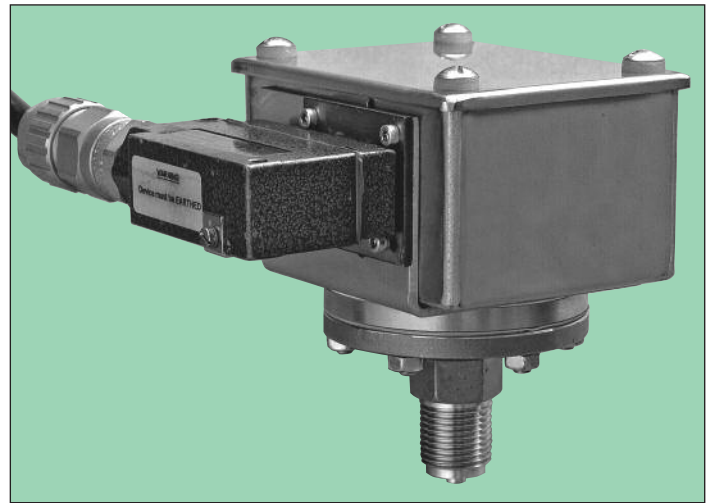
Electrical Rating

5 amp at 250V 50 Hz. For other voltages and currents please consult our technical department.

Setting Accuracy ± 5%

Temperature Range -10 to +85°C
(Process fluid must not be allowed to solidify)

Temperature Coefficient 0.05%
of range per °C from 20°C



Installation

These pressure switches can be mounted directly on the connecting thread. Sealing grooves are machined onto the end face of parallel threads for use with sealing washers. A mounting bracket is available if required.

Vacuum Setting

At ambient pressure the switches will be in the operated condition consequently the wiring should be reversed i.e. Normally Open becomes Normally Closed.

Connecting Threads

All connecting threads used in industry are available including British, American and Metric. Please state the connecting thread when ordering.

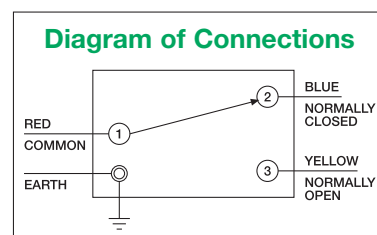
Flanges and Hygienic Fittings

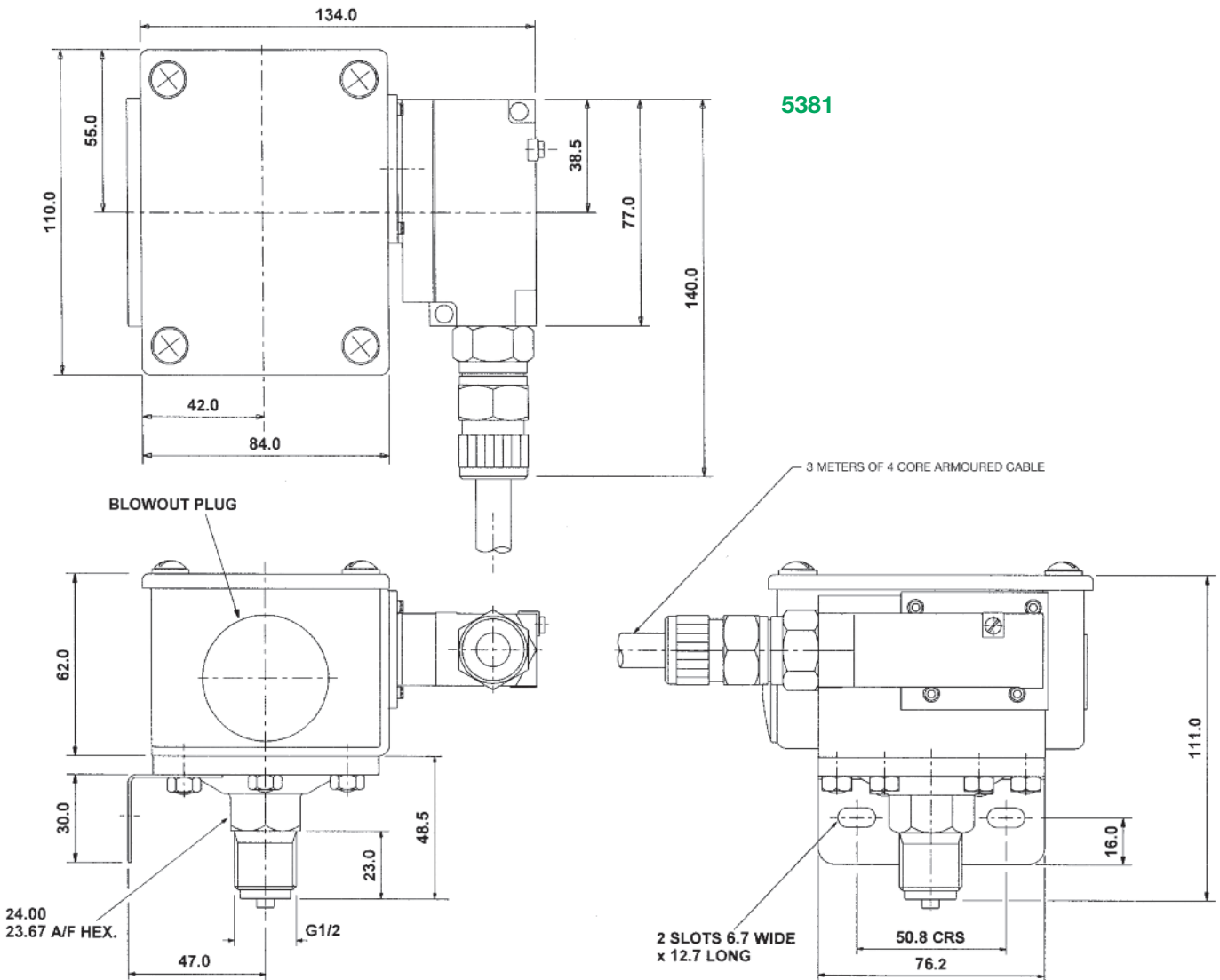
Flanged fittings are available and all types of hygienic fittings can be supplied assembled directly onto the pressure switch. If flush diagrams are required please consult our technical department.

Materials of Construction

Connection	316 Stainless Steel
Diaphragm Type 5381.....	17/7 PH Stainless Steel
	Optional 316 protection disc
Piston Type 5581	316 Stainless Steel
Seals	Glass filled PTFE < 14 bar
	Nitrile Rubber > 14 bar
Housing.....	Polyester Powder Coated
	Stainless Steel

Other wetted parts available for fluids not compatible with those stated above. Please see page 9.





Series 5000 ATEX Differential Pressure Switches

This series of pressure switches are intended for use in hazardous areas where an intrinsically safe circuit cannot be used. Differential pressure switches are used where the difference between two pressures needs to be monitored or controlled. The pressure switches consist of a housing containing the pressure sensing mechanism with an external micro-switch contained within an ATEX housing.

- Robust and reliable
- Spring diaphragm operated
- Max. line pressure 34 bar
- Fitted with mounting bracket
- Fully adjustable
- Enclosure rating IP67
- ATEX Approved to:- CE Ex II2 G (EEx.d.e. IIC. T6)

Pressure Ranges

TYPE NO.	PRESSURE RANGE	HYSTERESIS TYPICAL
5382	0.25 to 1 bar	0.25 bar
5382	0.6 to 4 bar	0.6 bar
5382	1.2 to 10 bar	1.2 bar
5382	3.5 to 25 bar	3.5 bar

Maximum Pressure

To ensure long service life select the pressure range as follows: Dynamic pressure applications $P_{max} = 75\%$ of range. Static pressure applications $P_{max} = 100\%$ of range.

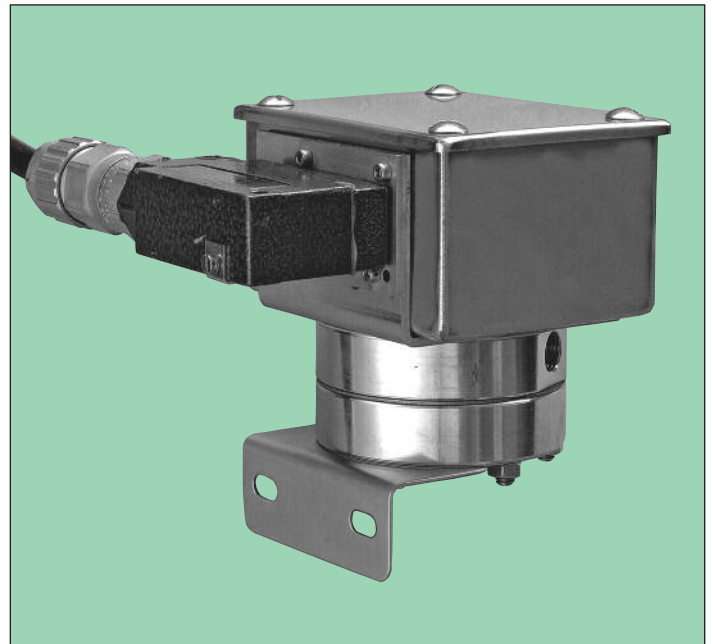
Electrical Rating

5 amp at 250V 50 Hz. For other voltages and currents please consult our technical department.

Setting Accuracy $\pm 5\%$

Temperature Range -10 to $+85^{\circ}\text{C}$
(Process fluid must not be allowed to solidify)

Temperature Coefficient 0.05%
of range per $^{\circ}\text{C}$ from 20°C



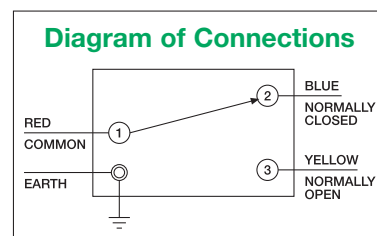
Connecting Threads

All connecting threads used in industry are available including British, American and Metric. Please state the connecting thread when ordering.

Materials of Construction

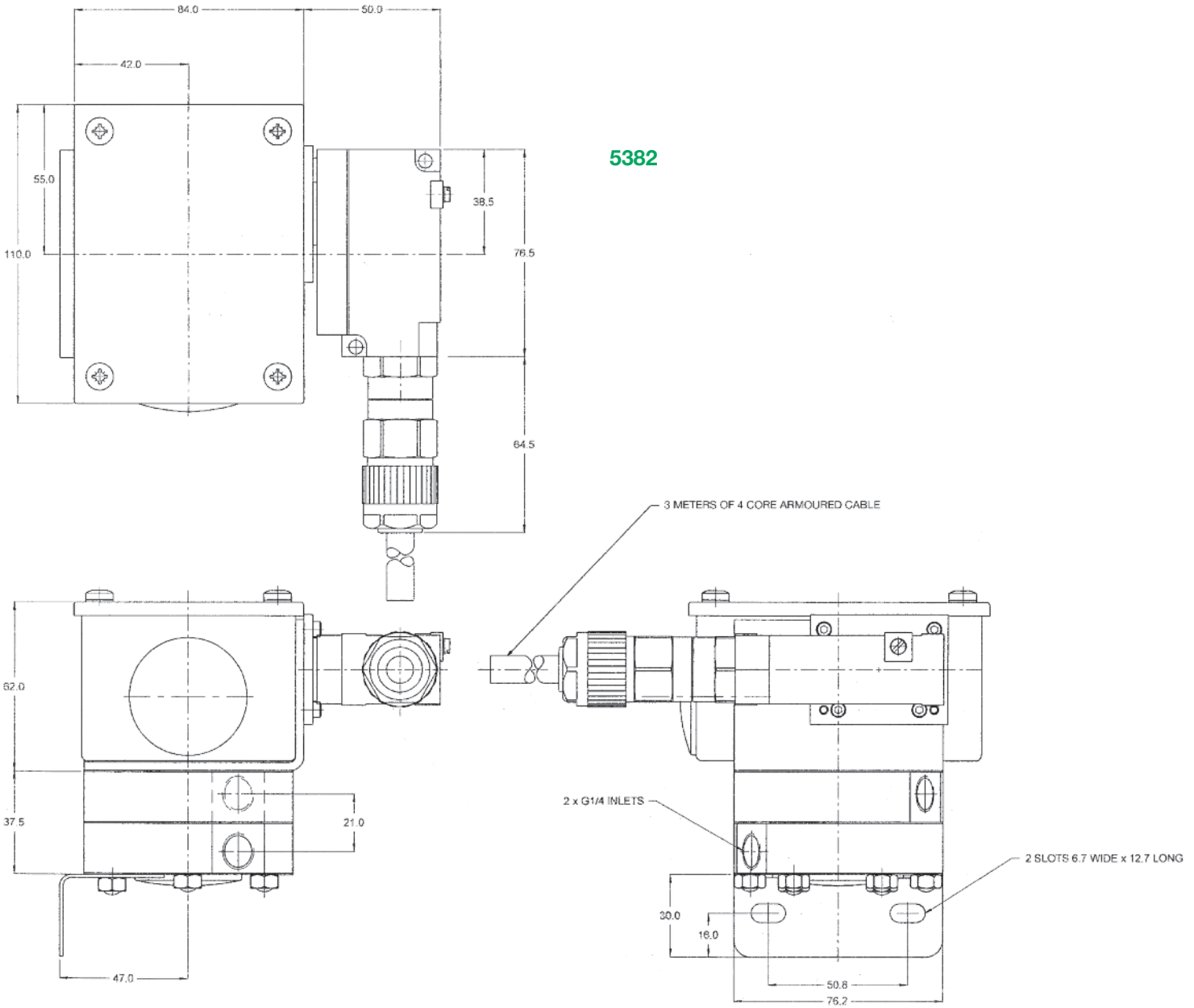
Connections 316 Stainless Steel
Diaphragm 17/7 PH Stainless Steel
Seals Nitrile Rubber
Housing Polyester Powder Coated
Stainless Steel

Other wetted parts available for fluids not compatible with those stated above. Please contact our Technical Department for further information.



ATEX Differential Pressure Switches Series 5000

5382



Type 12

Pressure Switches

Applications

Type 12 pressure switches are suitable for alarm or safety cut out applications on air water, oil and other low viscosity fluids that are compatible with EPDM rubber and brass.

- Very small and compact
- Factory set or field adjustable
- Spring diaphragm operated
- Rated 5 amp at 250V 50Hz
- Burst pressure 100 bar
- CE marked

Adjustable pressure ranges

PRESSURE RANGE	HYSTERESIS TYPICAL
0.5 to 3 bar	0.5 bar
0.7 to 5 bar	0.7 bar
1 to 8 bar	0.9 bar
2 to 10 bar	1.5 bar
3 to 22 bar	3 bar
5 to 35 bar	4 bar
9 to 60 bar	5 bar

Maximum working pressure

To ensure long service life select the Pressure Range as follows:
 Dynamic Pressure Applications Pmax = 75% of Range.
 Static Pressure Applications Pmax = 100% of Range.

Electrical Data

Switching is effected by means of a micro-switch rated at 5 amp 250V 50Hz. The use on dc circuits or with micro-processor controls should be discussed with our technical department.

Type 12 pressure switches are supplied with 0.5 metre of 4 core cable connected as follows;

- CommonBrown
- Normally OpenBlack
- Normally ClosedGrey
- EarthGreen / Yellow

Temperature

Type 12 pressure switches are suitable for use in ambient temperature of -10 to +80°C. The process fluid must not solidify within these limits.

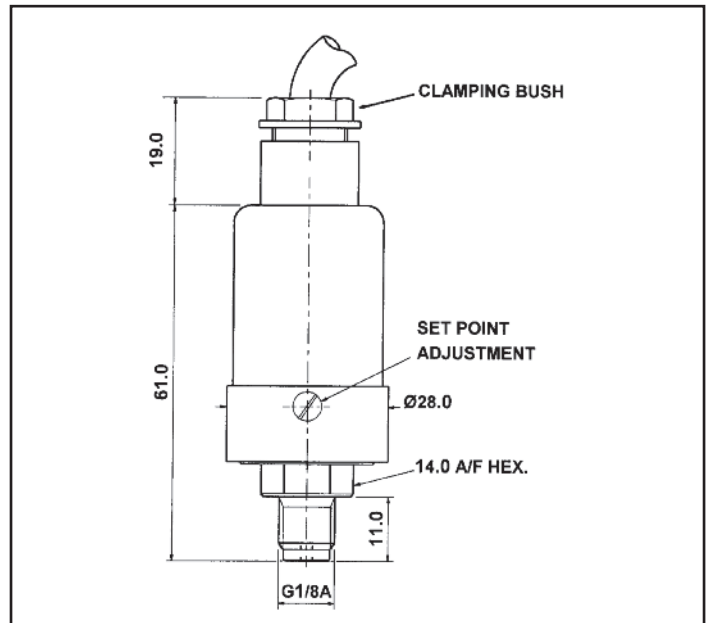


Materials of Construction

- ConnectionBrass
- BodyDelrin
- Seal.....EPDM rubber
- DiaphragmBeryllium Copper

Corrosive Applications

The connection can either be stainless steel or UPVC.
 The diaphragm can be protected from corrosion by fitting a thin disc of PTFE (Switches fitted with a protection disc should not be subject to vacuum)
 Seals can be PTFE, Viton or Nitrile rubber.



Type 14 and 14HP pressure switches are used for monitoring system pressure in all non-corrosive gasses and non-corrosive liquids except those with high viscosity.

- Miniature Pressure Switches
- Diaphragm Operated
- For Water, Air Oil etc.
- Factory Set or Field Adjustable
- Rated 5A at 250V 50Hz
- CE marked for all Directives that apply

Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL
141	35 to 125 mbar	0.02 mbar
14	-1 to -0.15 bar	0.07 bar
14	0.15 to 1 bar	0.08 bar
14	0.4 to 4 bar	0.3 bar
14	1 to 11 bar	0.9 bar
14	2 to 25 bar	1.25 bar
14HP	25 to 200 bar	4 bar

Maximum Pressure

To ensure long service life select the pressure range as follows:
 Dynamic pressure applications $P_{max} = 75\%$ of Range
 Static pressure applications $P_{max} = 100\%$ of Range
 Maximum pressure that can be applied is 125 % of pressure range.

Vacuum Use

These switches will not be damaged by the application of vacuum; but a requirement for the switch on vacuum should be specified when ordering as a minor modification is required. On a pressure switch set to operate on vacuum the micro-switch will be in the operated condition at atmospheric pressure so the wiring should be reversed i.e. NO becomes NC.

Electrical Ratings

5 amp at 250V 50Hz
 For other voltages and currents please consult our technical department.

Electrical Connection

Wires can be soldered onto the micro-switch's terminals. Crimp / solder push-on tags are available if required.
 Type 14 pressure switches can be supplied with flying leads if required.

Setting Accuracy±6%

Temperature Limits-10 to +60°C
 (Process fluid must not solidify)



Materials of Construction Type 14

Pressure Connection...Brass
 BodyPolyethelene
 Diaphragm.....Beryllium Copper
 SealNitrile rubber

Materials of Construction Type 14HP

This switch is a modified type 14 for use with high pressure applications.
 Pressure Connection..Brass
 BodyPolyethelene
 ElementPhosphor Bronze Bourdon Tube

Corrosive Applications

The connection can be either stainless steel or UPVC (max. 16 bar).
 The diaphragm can be protected from corrosion by fitting a thin disc of PTFE (switches fitted with a protection disc should not be subject to vacuum) Seals can be PTFE, Viton or EPDM.

Options available

Suffix G -

Has gold contacts in the micro-switch.

Suffix P -

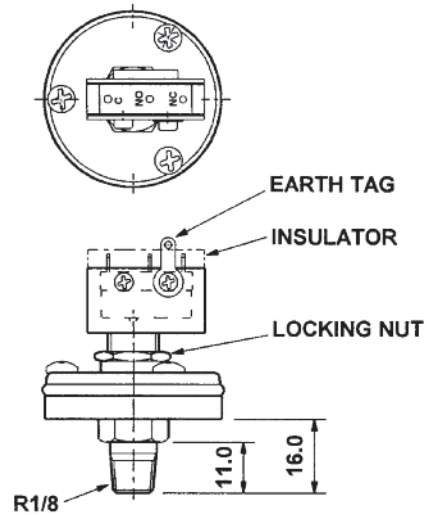
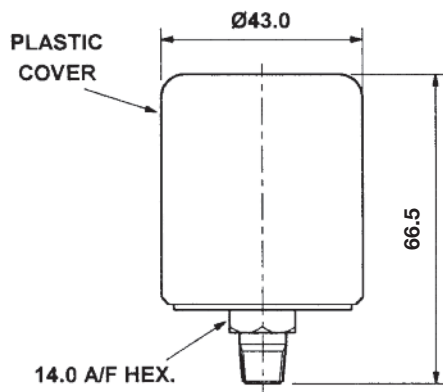
Has four-pin plug & socket fitted

Suffix Q -

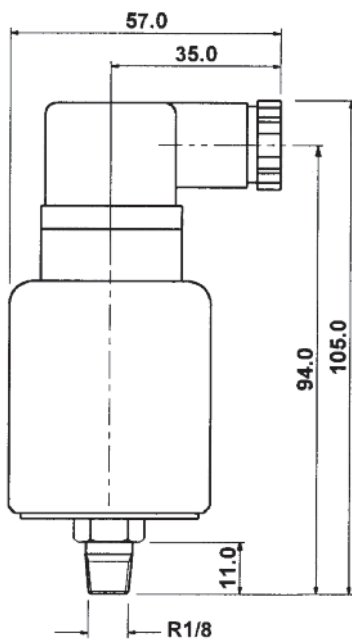
is overload protected to 85 bar (not ranges below 4 bar)

Dimensions

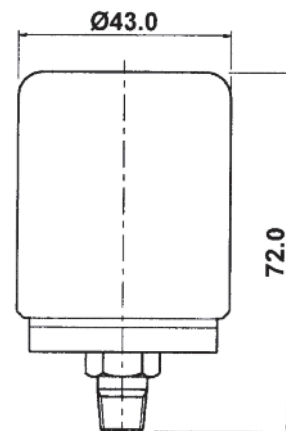
Type 14 & 14HP



Type 14P
& 14HP



Type 14Q



This range of pressure switches are very small and compact and can be used where space is at a premium. They can be used with any fluid compatible with the wetted parts.

- Sub-miniature Pressure Switches
- High Overload Capabilities
- Pressure up to 700 bar
- Rated 5 amp at 250V 50Hz
- External Adjustment
- Diaphragm & Piston Operated

Diaphragm Operated Adjustable Pressure Ratings

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL	MAX.
4XP-VX8	-1 to 0 bar	25 mbar	28 bar
4XP-CX2	0 to 1.5 bar	38 mbar	28 bar
4XP-CX8	1 to 7 bar	250 mbar	28 bar
4XP-BX8	1.5 to 15 bar	400 mbar	28 bar

Materials of Construction

Pressure Connection..Brass
 BodyNylon
 Diaphragm.....Nitrile Rubber

Piston Operated – Dynamic Piston Seal Adjustable Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL	MAX.
4XP-IX2	2.5 to 7 bar	1 bar	120 bar
4XP-IX8	3 to 30 bar	2 bar	120 bar

Materials of Construction

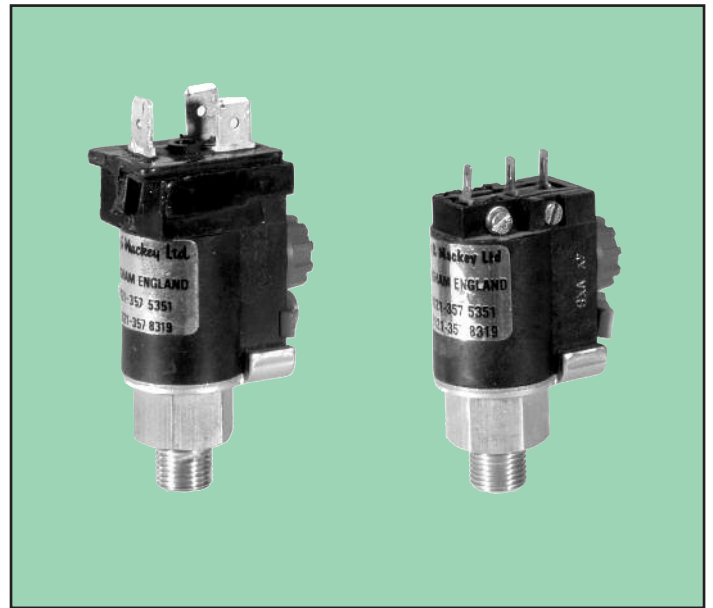
Pressure Connection..Brass
 BodyNylon
 Piston SealPTFE

Piston Operated – Static Piston Seal Pressure Ranges

TYPE No.	PRESSURE RANGE	HYSTERESIS TYPICAL	MAX.
4XP-HX8	40 to 100 bar	10 bar	500 bar
4XP-GX8	70 to 200 bar	15 bar	500 bar
4XP-FX8	100 to 400 bar	20 bar	500 bar

Materials of Construction

Pressure Connection..Brass
 BodyNylon
 PistonSteel Chrome Plated
 SealNitrile Rubber

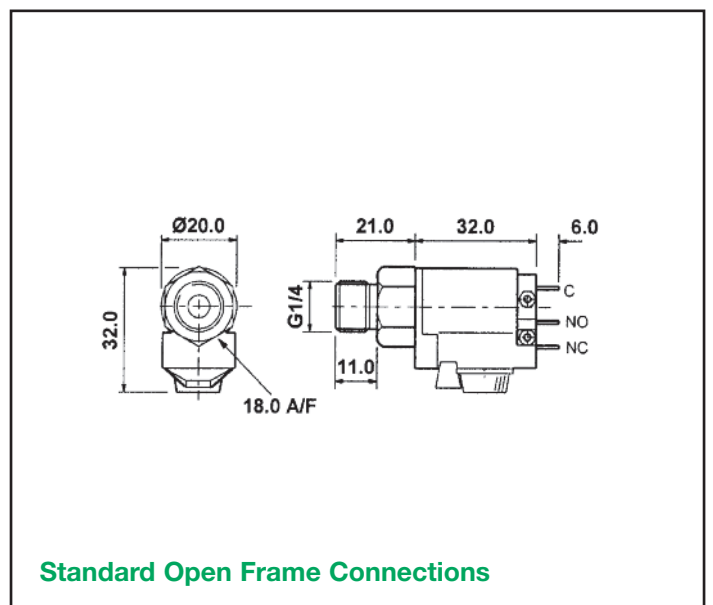


Electric Rating

Electric loading is up to 5A at 250V 50Hz. Current rating on AC and DC circuits are given in the table below.

Use on DC circuits or with electronic control equipment should be discussed with our technical sales department. Microswitches with gold plated contacts are now available for low energy applications.

	VOLTS AC		VOLTS DC					
	125	250	15	30	50	75	125	250
Resistive	5.0	5.0	10.0	5.0	1.0	0.75	0.5	0.25
Inductive	5.0	5.0	10.0	3.0	1.0	0.25	0.06	0.03



Standard Open Frame Connections

Type 807 Pressure Switch Type 815 Pressure Switch

Applications

Type 807 pressure switches are suitable for alarm or safety cut out applications on air, water, oil and other low viscosity fluids that are compatible with nitrile rubber and brass.

Type 815 pressure switches are suitable for sequence initiation in hydraulic systems as well as alarm and safety cut out applications on water, oil and other low viscosity liquids that are compatible with nitrile rubber, stainless steel and brass; piston operated pressure switches are not suitable for use with high pressure gasses.

- Compact Design
- Robust & reliable
- Manifold Mounting Option
- Plug & Socket connection
- High Test Pressure
- Rated 5A at 250V 50Hz
- IP65 Enclosure
- Fully adjustable

Pressure Ranges

Type 807

0.5 to 4 bar
2 to 8 bar
5 to 16 bar

Maximum working pressure60 bar

Type 815

8 to 60 bar
10 to 100 bar
20 to 250 bar
40 to 400 bar

Maximum working pressure.....600 bar

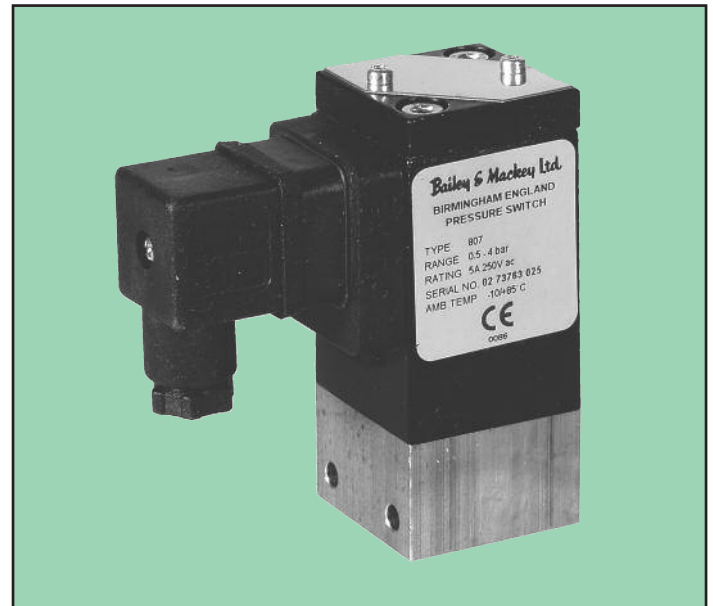
Temperature Range-10 to +80°C
(Process fluids must not solidify)

Installation

The pressure switch can be mounted directly on to G1/4" (1/4" BSPP female) connecting thread or by removing the base can be sub base mounted.

Pressure Pulsations

Types 807 and 815 pressure switches have a throttle screw fitted. This reduces the effect of pressure shocks or pressure pulses on the switch. It is recommended that when these switches are mounted on a sub base a throttle screw is fitted in the mounting arrangement.



Materials of Construction Type 807

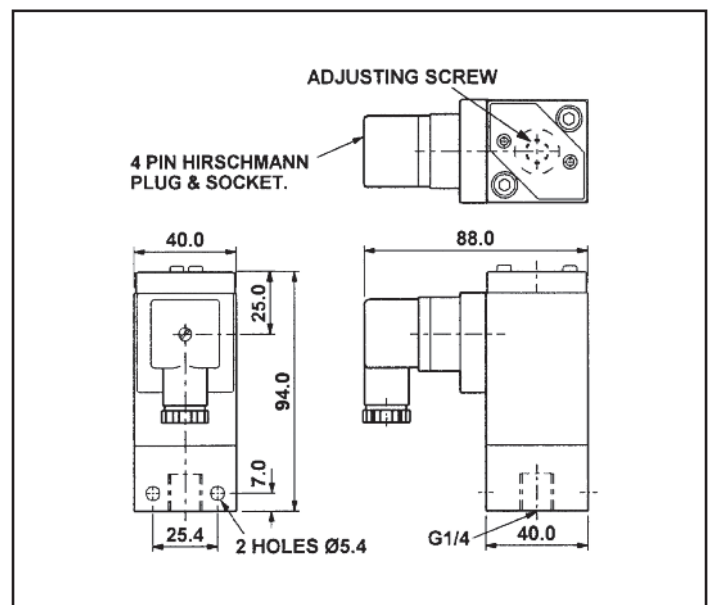
Diaphragm and SealsNitrile rubber
Housing and sub baseBrass

Type 815

PistonStainless Steel
Piston housing.....Stainless Steel
Sub baseBrass
Piston seal.....Nitrile rubber
Anti extrusion ringPTFE

Common to both types

BodyAluminium
Coil Spring.....Spring steel
Micro-switch housingNylon



This type of switch has been specifically designed to meet high pressure gas applications for monitoring pressures over 42 bar, where the pressure to be monitored is higher than a diaphragm switch can accommodate. Based on the bourdon tube principle there are no seals to give high friction and consequently can be used in gas applications.

- Accurate and stable
- Long service life
- Bourdon tube operated
- SPDT micro-switch
- Gold contacts available
- CE marked for all Directives that apply

Pressure Ranges

10 to 100 bar
10 to 200 bar
20 to 400 bar
30 to 600 bar

Temperature limits.....-10 to + 85°C

Electrical Connection via a 4 pin plug & socket.

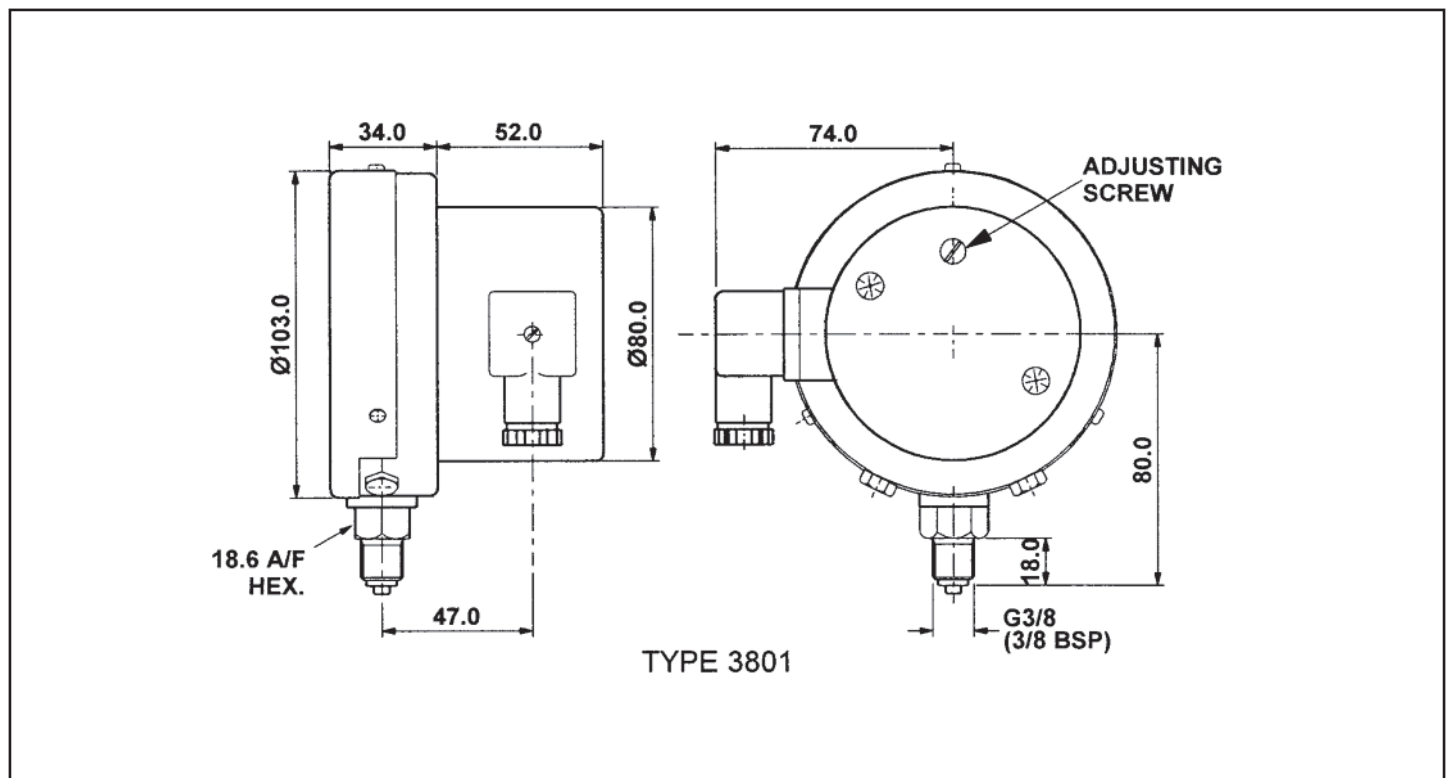


Materials of Construction

Case Black Enamelled Steel
 Internals.... Coiled Steel Tube
 Connection .. Brass

Electrical Rating

10 amp at 250V 50Hz Inductive Load
 1 amp at 30V dc Inductive Load



Pressure Gauge with Switch Function

Type 73E has a bottom connection and Type 82E has a centre back connection.

These gauges allow for the indication of pressure with an electrical switch point that can be factory pre-set for either a normally open or normally closed function.

These gauges can be used for the control of pumps, to indicate the contents and signal a loss in maintained pressure systems.

- 63mm Diameter
- Bottom Connection Type 73E
- Back Connection Type 82E
- Accuracy $\pm 2.5\%$ FSD
- Direct Mounting
- Max. Pressure 400 bar
- SPDT Microswitch

Electrical Rating

3A at 250V 50Hz. For dc ratings please contact our technical department.

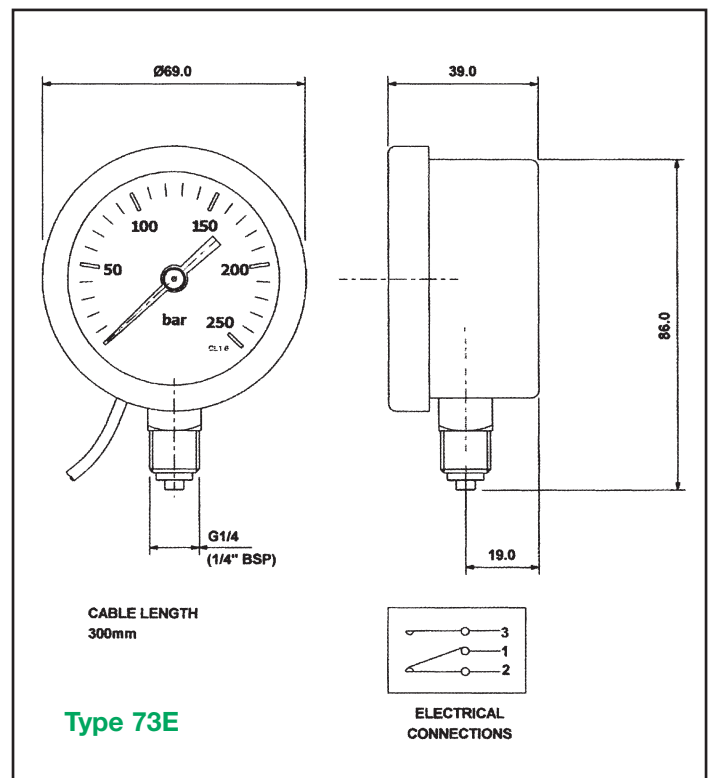
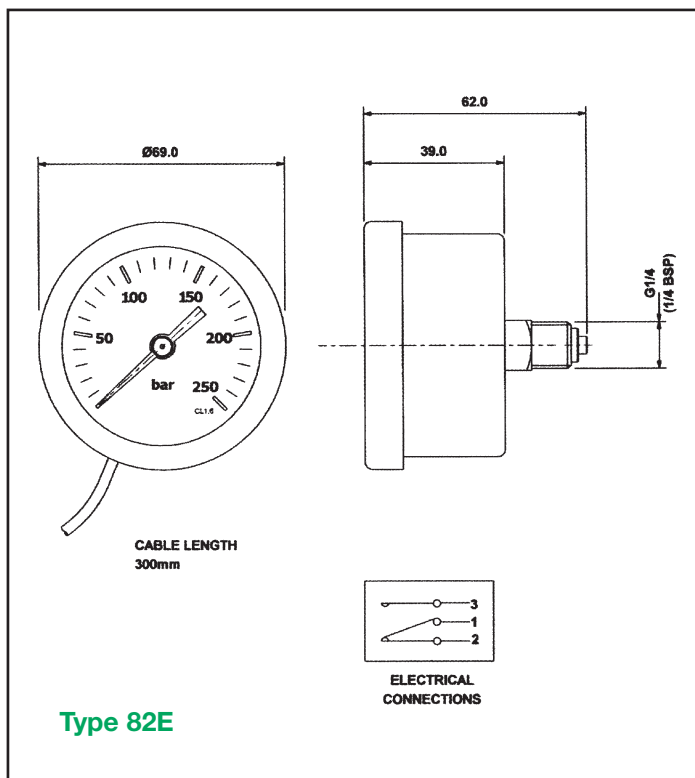
Process Connection

1/4" BSP Parallel male; 1/4" BSP Taper male or 1/4" NPT male



Construction Materials

Case & BezelStainless Steel
 WindowClear Plastic
 Bourdon TubePhosphor Bronze
 ConnectionBrass



Pressure Switches

Installation and use of Pressure Switches

A Pressure Switch correctly installed and to the correct specification gives a switch point at a specific set pressure. This electrical circuit can be used to stop or start a machine, operate an alarm or regulate the pressure in a process. Pressure Switches are invaluable in the efficient and safe operation of plant and machinery.

- a) Before fitting the pressure switch to a pressure source ensure that the maximum pressure of the pressure switch is higher than that of the pressure to be applied.
- b) Before fitting the pressure switch to a pressure source check that the wetted parts are compatible with the fluid being used, and that the pressure connection correctly matches that of the pipework.
- c) Do not use piston type pressure switches on gasses
- d) Do not use standard pressure switches on Oxygen or Acetylene unless approved by our Technical Department.
- e) When fitting the pressure switch to the pipe work use correct sealing methods. Do not use the switch housing to tighten the switch to the pipework, use correct spanners on the base hexagon.
- f) Differential pressure switches should not be used with more than the range applied to one side, unless approved by our Technical Department. Line pressure must not exceed the line pressure stated on the pressure switch label. The higher of the two pressures must be connected to the port marked high and the lower of the two pressures must be connected to the port marked low.
- g) Ensure that the electrical supply is isolated before removing cover. All covers are marked with warning flash.
- h) Ensure before connecting the terminals of the pressure switch to the circuit that the electrical switch is of the correct rating. The rating is stated on the pressure switch label.
- i) Ensure that the terminals are connected correctly and the pressure switch body is correctly earthed.
- j) Ensure that the pressure switch set point is correct before use.
- k) Ambient and process temperature acting on the pressure switch should be within -10°C to $+80^{\circ}\text{C}$ and protected from higher fluid temperatures by means of a siphon tube filled with condensate before use. The fluid in the pressure chamber should not be allowed to freeze or crystallise as this will lead to rupture of the sensing element.

If in doubt concerning the application of any pressure switch contact our Technical Department who will only be too pleased to give you advice.

Pressure Conversion Factors

Multiply units in left hand column by factor to obtain units at top i.e. $\text{bar} \times 14.504 = \text{lb./in}^2$

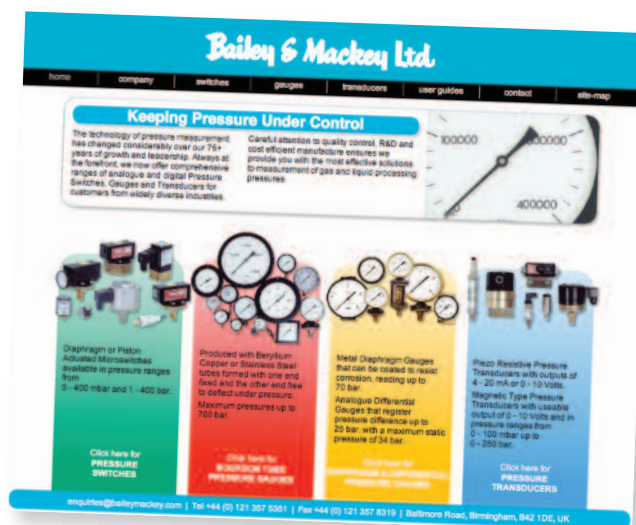
	bar	lb./in ²	kg/cm ²	atm (std)	MH ₂ O	inH ₂ O	mmHg	inHg	N/M ²	Pa
bar	1	14.504	1.0197	0.9869	10.197	401.46	750.06	29.53	100000	100000
lb./in ²	0.0689	1	0.0703	0.068	0.7031	27.68	51.715	2.036	6894.8	6894.8
kg/cm ²	0.9807	14.223	1	0.9678	10	393.7	735.56	28.959	98066	98066
atm (std)	1.0133	14.696	1.0332	1	10.332	406.78	760	29.921	101325	101325
MH ₂ O	0.0981	1.4223	0.1	0.0968	1	39.37	73.556	2.8959	9806.6	9806.6
inH ₂ O	0.0025	0.0361	0.0025	0.0025	0.0254	1	1.8683	0.0736	249.09	249.09
mmHg	0.0013	0.0193	0.0014	0.0013	0.0136	0.5352	1	0.0394	133.32	133.32
inHg	0.0339	0.4912	0.0345	0.0334	0.3453	13.595	25.4	1	3386.4	3386.4
N/M ²	0.00001	0.00015	0.00001	0.00001	0.0001	0.004	0.0075	0.0003	1	1
Pa	0.00001	0.00015	0.00001	0.00001	0.0001	0.004	0.0075	0.0003	1	1



Call our office on +44 (0)121 357 5351 to request literature covering our other product ranges



Or visit our website for further information
www.baileymackey.com



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**DIAPHRAGM & DIFFERENTIAL
PRESSURE GAUGES**



**BOURDON TUBE
PRESSURE GAUGES**



PRESSURE TRANSDUCERS

Keeping pressure under control

Bailey & Mackey Ltd

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