

# WORKING INSTRUCTIONS

## GUARDIAN RANGE

This working instruction leaflet covers the following ranges of switches:-

P1100	Medium Pressure Switch
P1200	Medium Pressure Switch
P1100FD	Flush Diaphragm Pressure Switch
P1300	High Pressure Switch
P1400	High Pressure Switch
P1100 3 & 4"	Low Pressure Switch
V1100	Vacuum Switch
DP1500	Differential Pressure Switch
T1100	Temperature Switch with Thermowell
T1200	Temperature Switch without Thermowell
T1700/T1800	Capillary Temperature Switch
L1100	Horizontal Level Switch
L1200	Vertical Level Switch
L120	Vertical Reed Level Switch
F1100	Flow Switch

### INSTALLATION

#### HEALTH AND SAFETY AT WORK ACT 1974

##### WARNING

Your attention is drawn to the electrical potential that will be present if the terminal cover is removed while the switch is connected to a live supply. The electrical supply must be isolated prior to removal of the terminal housing cover.

Similarly, on pressurised process systems, prior to removal of an instrument it should be isolated from the pressurised medium or the system pressure should be relieved.

**Note: The two 5 countersink screws holding the square retaining plate on the top of the switch, opposite the process entry should not be removed. Disassembly will effect the operation of the switch, and invalidate the warranty.**

**The two M5 pan head screws on the same plate, can be removed and used to attach brackets.**

Precautions must be taken with regard to the possible operating temperatures present when performing adjustment.

The units must be specified, installed and operated by competent personnel, and their use be limited to within the published specifications. (All hazardous area models must be installed in accordance with BS EN 60079-14).

Unauthorised modification, repair or operation outside the specified limits may invalidate the warranty. Servicing should be carried out by qualified personnel only.

On pressure devices, should pulsation or surges be anticipated, then a suitable pressure snubber should be fitted.

### FAILURE HAZARD

The process medium temperature should not be allowed to exceed that stated in the product data and under the "OPERATING TEMPERATURES" section in this document. If process temperatures in excess of those stated are possible, then the switch should be remote mounted via a length of tubing or pipe to ensure dissipation of heat.

### PROCESS CONNECTIONS

#### Pressure & Differential Pressure Switches

Various process entries are available, and the installation will vary dependent upon exact type. It is recommended that PTFE tape is used on tapered fittings and the use of the correct size bonded seal on parallel fittings.

#### Temperature Switches

These are usually provided either with a thermowell having a male screwed connection or a flange to a recognised international standard or with a male screwed fitting allowing the bare sensing probe to come in contact with the process medium.

Suitable pipe sealant or flange gasket should be incorporated when installing to ensure a good leak free fit.

### MATERIALS

The materials of construction are as follows: -

Main Body – Black anodised LM25TF aluminium or ANC4B (316) stainless steel.  
Outer Covers – 316 stainless steel.  
Wetted Parts - 316 stainless steel or Monel 400.  
Pressure Seals: Viton®, Nitrile, EPDM, Kalrez® or PTFE  
Environmental Seals - Nitrile  
Internal Switch Mechanisms – Stainless steel.  
External Fasteners - Stainless steel  
Internal Fasteners & Springs – Zinc plated carbon steel.  
Flow Plates – Tufnol® or Gunmetal.

### OPERATING TEMPERATURES

The operating temperatures restrictions for the **Guardian** series are as follows: -

#### Ambient:

Operational (all models) -40°C to +85°C

#### Ambient ('T' values as certified for hazardous areas).

ATEX IIIG Exia IIC certified.

-50°C to +78°C T6  
-50°C to +93°C T5  
-50°C to +128°C T4

**Storage:** -40°C to +85°C

#### Process:

P1100, P1200, P1100FD, V1100, DP1500, P1300 & P1400

Viton® -20°C to +150°C  
Nitrile -30°C to +100°C

L1100, L1200, L120 & F1100

0 to +100°C

T1100, T1200, T1700 & T1800

Refer to temperature range specification.

**Special versions available.** Please contact Pyropress Engineering Sales department for any assistance.

### MOUNTING INSTRUCTIONS

The **Guardian** series has been designed for easy installation in any situation.

The P1100, P1300, T1700 & T1800 can be mounted from the fixings in the body. The case is counter bored and tapped to allow direct fixing through the body. This can be accomplished using 2 off M6 cap head screws, from the switch conduit side, passing through the case and into a panel or bracket. Alternatively the case is tapped M8 to accept bolts from behind into the rear of the switch body.

The P1200, P1100FD, P1400 & F1100 are mounted from the process entry.

The P1100 3 & 4", V1100 & DP1500 are mounted via their integral mounting bracket.

The T1100 is mounted from the supplied thermowell.

The T1200 is mounted from the supplied stem head.

The L1100, L1200 & L120 are mounted via their level head assemblies.

All switches (\*except the DP1500 Diaphragm Code 08) can be mounted in any orientation to suit, without effecting accuracy, set point or operation.

\*DP1500 Diaphragm Code 08 should be mounted with switch case beneath the pressure plates.

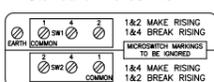
When installing direct mounting pressure switches, particular care should be taken to ensure the internal 1/4" nipple is not loosened during the positioning or tightening procedure. If the unit is likely to be subjected to high shock levels or physical loads then additional supports should be incorporated.

### ELECTRICAL INSTALLATION

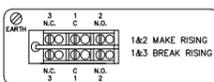
The **Guardian** series incorporates a M20 conduit entry in the switch housing. Access to the terminals is gained by removing the terminal cover, adjacent to the conduit entry. Connection details are provided on the inside of the cover and should be studied to make sure the correct mode of operation is selected. This will vary dependent on whether rising or falling operation is required.

Options of single or dual microswitches are available, refer to diaphragm for details.

#### Standard Microswitch



#### Double Pole Microswitch



The design allows easy access to the screw terminals, which are directly on the rear of the microswitches. These are located behind the terminal cover, which is located, closest to the conduit entry. Terminals are suitable for cables, single or multi strand up to 2.5mm<sup>2</sup> or 4BA crimp eyelets.

The cover should be replaced making sure that the gasket is properly seated.

Options of 1 or 2 SPDT micro switches are available.

**For specific wiring details please refer to product drawings on reverse.**

The **Guardian** range is certified to be installed in a CAT1 (Zone 0) environment, when supplied from an approved Intrinsically Safe Interface that is compatible with the following electrical parameters:

Ui: 28Vdc  
Ii: 93mA  
Pi: 0.65W  
Ci: 0 nF  
Li: 0mH

### SETTING & CALIBRATION

The **Guardian** series are supplied pre calibrated, a scale has been provided for on site adjustment. Basic setting of the set point for all microswitch combinations is carried out from behind the pressure adjustment cover. The factory set range is indicated on the external switch label. Switch point setting is detailed on the rear of the pressure adjustment cover.

#### 1) SINGLE SET POINT

P1100, P1200, P1300, P1400, P1100FD, V1100, DP1500, T1700, T1800 & F1100.

The scale plate is situated at the bottom right hand corner of the mechanism and is read against the centre line of the red 'indicator disc'. Before adjustment is made to the switch, the M4 locking grub screw must first be released; this is situated on the face of the switch housing. Adjustment can then be made by rotating the adjuster screw and red indicator ring assembly, with a suitable 3mm diameter Tommy Bar or Allen Key, until the desired set point is reached. The M4 locking grub screw should then be re-tightened to prevent any possibility of movement of the set point.

T1100 & T1200.

The operating point is read from the middle of the 'V' cutout against the calibration scale plate. Adjustment can then be made by rotating the adjuster screw with a suitable 3mm diameter Tommy Bar or Allen Key. The locking ring should then be re-tightened to prevent any possibility of movement of the set point.

#### 2) DUAL SET POINTS

Where dual set points are specified the microswitches can be set to operate simultaneously or set independently within the limits specified in the sales literature. All switches are fitted with a standard adjuster and depending on the span required between the two operating points, the pressure switch can be fitted with a secondary adjuster, which further increases this span. It should be noted that the calibrated scale only indicates the lowest operating point, which is always set on the first microswitch. Adjustment of the second microswitch can only be made after correctly setting the lowest set point. The procedures detailed below should be followed.

#### Standard Adjuster.

The second set point cannot be set against the internal scale plate and should be adjusted with the assistance of appropriate measurement equipment. Adjustment is made by turning the M4 setting grub screw located on the pivot plate, on the conduit entry side of the main push rod, viewed from the adjustment side. Clockwise rotation reduces the second set point, while counter clockwise rotation increases the setting.

#### Secondary Adjuster.

The second set point can be set against a nominal high/low scale plate. This setting must only be made with the assistance of appropriate measuring equipment to adjust the setting. The locking collar of the adjuster must be unscrewed, and then the

adjusting collar can be adjusted to the new setting. When the correct setting is attained, then the locking collar must be re-tightened.

#### 3) SINGLE SET POINT WITH ADJUSTABLE DEADBAND

When the adjustable dead band mechanism is fitted the pressure switch has the ability to have the switching dead band adjusted to a specific setting. This is achieved by increasing the rising set point of the switch, whilst keeping the falling reset point constant. To set a fixed dead band the adjustable dead band must first be set to zero. The falling reset point can now be set using the main adjuster screw against the calibrated scale as detailed under single set point adjustment. Once this has been achieved then the adjustable dead band mechanism can be increased until the required rising set point is set. The locking collar can then be tightened to the adjuster collar, preventing set point drift due to vibration etc. The rising set point should be adjusted with reference to an external calibrated instrument.

**Note: Minor adjustments to the falling set point may be required after the switching differential has been set, particularly if a large differential is required.**

All the above calibrations and settings can be performed by Pyropress before delivery.

### ATEX CERTIFICATION

The **Guardian** range of switches comply with the following standards:

Intrinsically Safe.  
EN60079-0:2006, EN60079-11:2007, EN60079-26:2004.

The equipment is designed to satisfy the requirements of Clause 1.2.7 of the Essential Health and Safety Requirements ANNEX II of directive 2014/34/EU.

#### Conditions of certification apply-

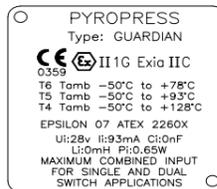
#### Exia CAT1 Applications.

**ATEX certification for CAT1 environments to the Non-electrical standard BS EN 13463-1:2001. Clause 8.2 states that:**

**Equipment manufactured from aluminium of greater than 10% by mass, are only suitable for CAT1 environments if, 'the ignition assessment shows that there is no risk from incendive friction, impact or abrasion sparks' reference to BS EN 1127-1:1998 Clause 6.4.4.**

**This product has been certified with an 'X' suffix, indicating it is the responsibility of the end user to carry out an assessment of the equipment and installation to establish that "no hazards due to mechanically generated sparks have been identified". This assessment to be performed by a qualified person, legally responsible for the site/company safety.**

#### INTRINSICALLY SAFE LABEL



### PRESSURE EQUIPMENT DIRECTIVE

#### Pressure Equipment Directive (PED)

It is a requirement that all items of pressure equipment and assemblies with a maximum allowable pressure of over 0.5 bar be assessed under the PED. Installers should be aware and address the following sections of the PED.

**These switches are classified as pressure accessories and are manufactured to Sound Engineering Practice (SEP) Art.3 (3). The CE mark is for compliance to the ATEX Directive or Low Voltage Directive.**

#### Handling

Notice is drawn to the installation warnings with respect to: Closures and openings, access to the process entry when pressurised, and surface temperature.

#### Operation

In the case of fluids, which may become unstable and/or over-pressure (including surge), and/or over-temperature it is the installer's responsibility to ensure the device is operated within the published specifications and instructions.

#### Misuse

Notice is drawn to the installation warnings with respect to: Operation outside the specified limits in terms of over pressure or temperature.

#### Degradation of materials, Erosion

Notice is drawn to the requirements of routine maintenance and the expected working life of elastomeric materials.

#### Corrosion/Chemical attack

It is the installer's responsibility to ensure the selection of construction materials from the published specification is compatible with the operating medium.

#### Mounting, Piping

Provide adequate support, constraint, anchoring, alignment and pre-tensioning to prevent free movement and over-stressing of connections and flanges.

Consider condensation within piping and the means of drainage.

Consider potential damage from turbulence and vortices and make allowances for wear if appropriate. Consider fatigue due to vibration.

Keep appropriate records for maintenance, inspection and repair.

#### Toxic, Flammable fluids

For group 1 gas and fluids (explosive or toxic nature) provide means to isolate and assess size for significant risk, protect as necessary. Clearly mark discharge points indicating fluid contents.

#### Mechanical damage

Consider potential damage from objects such as vehicles, falling bodies or adjacent machinery and house or protect as necessary.

#### Fire

Consider potential damage in the event of external fire and house or protect as necessary.

#### Supply Fault

Consider the consequence of a power supply fault, failure or overload and protect as necessary.

### ROUTINE MAINTENANCE

Routine inspection of the installation should take place at regular intervals. It is recommended that the switch is checked and operated every 6 months. Electrical connections and covers should be checked periodically to tightness.

It is recommended that the 'O' rings and diaphragms (on pressure and flow switches) be renewed every 3-5 years, and micro switch assemblies every 5-10 years dependant upon equipment usage.

Goretex filters fitted to the 3" and 4" low pressure housings should be checked periodically for potential damage.

### FAULT DIAGNOSIS

If the **Guardian** series fails to operate, the following should be checked: -

The installation of the switch.

Electrical terminals are secure and tight.

The micro switch function is correct.

The mechanical function of the pushrod.

Investigate for signs of process leakage.

Investigate for signs of diaphragm failure (on pressure & flow switches).

### SPARES & REPLACEMENT PARTS

**Qualified personnel, in accordance with current health and safety requirements should, only carry out maintenance and overhaul of any type.**

There are two diaphragm (Bellofram® / 'O' ring) kits available, either in Viton® or Nitrile.

Procedures for replacement of spare parts are as follows: -

Note: After replacement of spare parts it is advised to connect the switch to a suitable test device & check For:-

(i) Leakage via a pressure test to the switches max working pressure.

(ii) The change over state of the microswitch contacts & necessary re-adjust the main adjuster to obtain the original set point using a calibrated test gauge.

#### P1100 & P1200, P1100 3 & 4" Diaphragm Kit.

'O' rings are fitted to 21mm and 15mm diameter only, the 30mm diameter, 3" & 4" builds have no 'O' ring fitted.

Slacken M4 locking screw, back off main adjuster until push rod operating shoulder is reached.

Remove M5 retaining screws securing the process entry & remove, replace diaphragm and sealing 'O' ring (if fitted). Replace process entry taking care to re-tighten the M5 retaining screws evenly to an approximate torque of 6 N.m. (4.4lb.ft).

After resetting re-tighten the locking grub screw.

#### P1300 & P1400 Piston.

Slacken M4 locking screw, back off main adjuster until push rod operating shoulder is reached.

Unscrew the Piston assembly from the switch head.

Remove the adaptor / dowty seal from the piston assembly.

Withdraw the piston; remove the locknut using a suitable pin spanner (Pyropress Part No. 16913).

Remove the piston guide & piston support & outer 'O' ring from the housing. Remove the 'O' rings & backing rings (note order in which they are fitted) from the lock nut & piston support, after applying a suitable grease (Molyslip®) fit the replacement 'O' rings & backing rings to the lock nut & piston support in correct order.

Fit the outer 'O' ring to the lock nut, locate the piston guide onto the outer 'O' ring / lock nut ensuring the centre hole chamfer is facing upwards, locate the piston support onto the guide, apply a suitable grease (Molyslip®) to the piston & refit to the assembly

Refit the assembly into the housing. Tighten securely. Replace the sealing band. Apply a suitable locking compound (Loctite® 243) to the threads of the housing, after ensuring the internal diaphragm is in place refit the piston assembly to the switch head & tighten down. Apply a suitable locking compound (PermaBond® 131) to the adaptor threads, replace the dowty seal & screw into the piston assembly, Tighten securely.

After resetting re-tighten the locking grub screw

**A complete pre-assembled and leak tested replacement piston housing assembly is available, refer to Pyropress sales department for information.**

**F1100 Flow – metal flange material.** Procedure for replacement of spare parts is supplied with the relevant part kits.

**D1500 Diaphragm & Bellofram® Kit.** To replace Diaphragm & belloframs of the 1" build slacken M4 locking screw, back off main adjuster until push rod operating shoulder is reached, remove the 4 off M5 screws retaining the pressure housing. Once the pressure housing has been removed from the switch remove the spacer nut & washer(s) from the M4 cap head screw. Undo the M4 Cap head screw/nut & remove thus allowing the assembly to split in two. This will allow access to the diaphragm and two Belloframs® (& 'O' rings) which are held in place by circlips. It is recommended that a suitable grease (Molyslip®) be applied to the Belloframs® prior to re-assembly. Assembly is the reverse of the above. Retighten the 4 off M5 retaining screws to a torque setting of 6 N.m (4.4lb.ft). After resetting re-tighten the locking grub screw

**For 2", 3" & 8" builds please contact Sales dept for spare part replacement procedure.**

**P1100 Flush Mounted Diaphragm & Vacuum / Pressure.**

**V1100, V1100-70 & V1100-140 Vacuum**

**T1100, T1200 & T1700 Temperature.**

**L1100, L1200 & L120 Level.**

**F1100 Flow – Tufnol® flange material.**

**Due to the complexity of these assemblies, it is recommended that these products be returned to Pyropress for overhaul.**

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