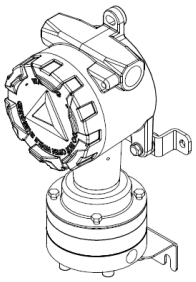
Installation, Operation & Maintenance **Instructions**

Sentry Series
Models D01, D02, D03 (Differential Pressure Switches)



delta-mobrey

SAFETY INSTRUCTIONS

Information ...points out useful tips, recommendations and information for efficient and trouble-free operation.

CAUTION! ...indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.

WARNING! ...indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.

WARNING! ...identifies hazards caused by electric power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.

WARNING! ...indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.

WARNING! ...indicates a potentially dangerous situation in the hazardous area that can result in serious injury or death, if not avoided.

Ex applications ...special instructions for Ex applications.

CONTENTS

Foreword
- Allowed over range
- Ambient Temperature
- Process Temperature
- Tools to be use for checking and adjusting set point

Operating principle
Marking
List of standard to which the product conforms
Special conditions for use
Installation
- Mounting
- Electrical connections
- Wiring
- Earthing connections

Operation
- Adjustments
- Calibration
- Periodical calibration check

Safety Integrity Level (SIL) installation requirements
Commissioning
Inspections and maintenance
- Periodical visual inspection
- Periodical functional verification

Replacement parts
Warranty
Decommissioning
Disposal
Level Alarm on liquid process, dry leg installation
Level Alarm on liquid process, wet leg installation
Model code

Foreword

The unit is manufactured, checked and supplied in accordance with our published specification, and when installed and used in normal or prescribed applications, with the lid in place and within the parameters set for mechanical and electrical performance, will not cause danger or hazard to life or limb.

Warning: Units must be selected and installed by suitably trained and qualified personnel in accordance with appropriate codes of practice so that the possibility of failure resulting in injury or damage caused by misuse or misapplication is avoided.

Warning: before installation **check** that the instrument **characteristics** comply with process and plant requirements

Warning: The users attention is drawn to the fact that, when the unit is 'live' with respect to electrical or pressure supplies, a hazard may exist if the unit is opened or dismantled

Warning: where any special condition of the product has been required as identified by the last 4 digits of the part number, follow the necessary safety instruction for a correct installation.

If the equipment is likely to come into contact with aggressive substances, suitable precautions should be taken that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised. Aggressive substances: e.g. acidic liquids or gases that may attack metals or solvents that may affect non-metallic materials. Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

Allowed over range

Pressure exceeding the adjustable range can be allowed up to the max static pressure stated on nameplate. The voltage and current limits for the microswitch must not be exceeded. (see fig 2 & 3).
Forward pressure will be contained without failure. Refer to Technical Data Sheet and Commissioning for more information.
Transitory electrical over ranges can have a destructive effect on the microswitch.

Ambient Temperature

The surface temperature of the instrument is influenced by the process temperature, electrical working conditions, installation and environmental. Special attention must be taken to avoid exceeding the limits specified on table below (i.e. remote mounting, valves, siphons, diaphragm seals. See Mounting).

Process Temperature

For the instrument model D0* the following table is applicable.

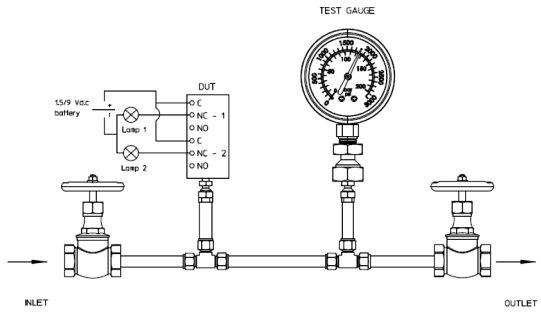
Temperature Class	Ambient temperature range	Max. working temperature at the process connection	Max electrical loads (resistive loads)
T6 or T85	-30°C to +65°C or -60°C to +65°C	65°C	15 A, 250 V a.c. & 5 A, 30V d.c.
T5 or T100	-30°C to +80°C or -60°C to +80°C	80°C	

Tools to be use for checking and adjusting set point

- Allen Key 1.5 mm
- Wrench Key Ch 13
- Screwdriver

The following calibration circuit is to be use to proceed with the calibration of the set point or periodical functional verification.
The test gauge should have a range similar to the instrument under verification with an accuracy consistent with the accuracy required to calibrate the set point.

Fig. 1 - Calibration Circuit



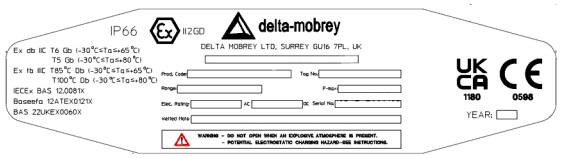
Operating principles

Pressure Switch models D0* are diaphragm operated switches.
This diaphragm generates a force proportional to the applied pressure and is balanced by a user adjustable control spring.
When the force exceeds that created by the control spring, the diaphragm moves causing a push rod to actuate a snap-acting micros-witch.

Marking

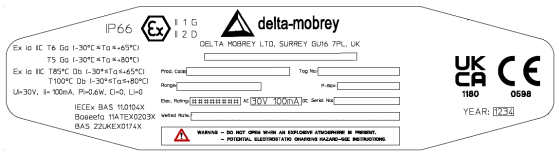
Flameproof models carry the following label markings:

Fig. 2 - Flameproof nemeplate



Intrinsic Safety Model carry the following label markings:

Fig. 3 - Intrinsic Safety nemeplate



Input limitations for intrinsic safety:
Ui = 30V, Ii = 100mA, Pi = 0.6W

List of standard to which the product is conform

This product complies with the following standards:		
IECEx	**ATEX**	**UKEx**
IEC 60079-0: Ed.7	EN IEC 60079-0:2018	BS EN IEC 60079-0:2018
IEC 60079-1: Ed 7	EN 60079-1:2014	BS EN 60079-1:2014
IEC 60079-31: Ed.2	IEC 60079-31:2014	BS EN 60079-31:2014
IEC 60079-11: Ed 6	EN 60079-11:2012	BS EN 60079-11:2012

Special conditions of use

Warning: The Sentry Differential Pressure switch must not be installed in a location where moving dust flow can generate an electrostatic charge on the equipment.

Warning: Instruments with aluminium enclosure. The instrument must be protected against accidental damage and impacts of the housing.

Warning: if the equipment is likely to come into contact with aggressive substances, e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected thus ensuring that the type of protection is not compromised .

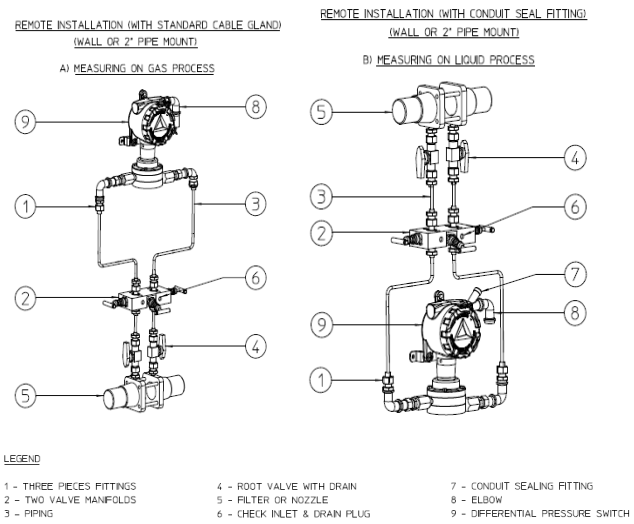
Warning: The flamepaths are not to be repaired.

Installation

Mounting

The instruments are designed to be mounted vertically with the process connection underneath. However, mounting up to 45° from the vertical in any plane is acceptable, although a small calibration shift may occur.
They can be mounted either to a wall or panel using the mounting holes provided. Select the mounting point so as to avoid excessive shock, vibration or temperature fluctuation.
If sudden changes of pressure (pulsations) are likely then we recommend that snubber are fitted between the process line and instrument.
Instruments should be mounted to avoid excessive heat transfer from the process lines or adjacent plant. With applications on process fluid that could crystallize/solidify, we suggest the use of adequate chemical seals and capillary.
The length of the line between the process taps and the instrument, should be of identical length.
Use a spanner to support the process connection when fitting the instrument.
The following figures show the minimal installation tips.

Fig. 4 - Remote installation



Caution: Check the connection thread size and specification on the unit to avoid mismatching with the process connection adaptor. See digit 11 of product code.
The maximum allowed torque is 50 Nm as stated on the label fitted to the instrument.

Electrical connections

One or two electrical entries are provided, into which cable glands can be assembled. The thread type and size is marked on the enclosure, just below the connection.

Warning: fittings/adaptors/plugs used for the electrical connection of the flameproof instruments shall be certified according the IEC or EN standards and shall guarantee instrument degree of protection (IP66)

Warning: cable entries not used must be plugged and sealed with plugs so as to prevent rainwater or other from entering the instrument enclosure. **In case of flameproof instruments these plugs, if not correctly installed and sealed to prevent their removal, do NOT guarantee the mode of protection Ex d.**
Furthermore, in order to guarantee the degree of protection IP66 and the non-loosening of plugs, it is recommended to seal the threads of connection with the same anaerobic sealant used for the glands. For instance, a sealant like Loctite ® 542 can be applied on the thread of plugs, before screw

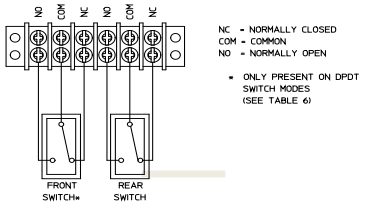
Wiring

Disconnect all supply circuits before wiring
Wire in accordance with local and national codes.
Use cables no larger than 2.5 mm^2 (14 AWG)

Warning: Do not exceed electrical ratings stated in literature and on nameplates.

Warning: If the ambient temperature exceeds 60 ° C it is recommended to use cables suitable for operating temperatures not less than 105 °C.
The three switch terminals are clearly marked “NORMALLY CLOSED”, “NORMALLY OPEN” and “COMMON” as per fig.5

Fig. 5 - Electrical Connections



Insert bare wires fully into the terminal block and tighten securely. Keep wiring tails to a minimum and check that wires do not interfere with the operating mechanism.
The instrument may be equipped with a micro switch single or double pole, double throw or two independent switches.

Warning: in case of Intrinsically Safe Instruments: All the electrical connection must form part of the same intrinsically safe circuit. The relevant entry parameters are written on the nameplate .and are:
Ui = 30 V d.c.; Ii = 100 mA; Pi = 0.60 W;
Ci = 0 mF; Li = 0 mH

Before closing the lid:
- Ensure wire is clear of all moving parts.
- Ensure that wires do not touch the lid as it is closed.

Close the lid, being careful not to trap any wires in doing so. Securely tighten the M3 lid locking screw set provided using a 1.5mm hex key.

Earthing connections

Warning: The instrument is supplied with two protective grounding connection, one inside and one outside the enclosure. The two connection provide effective connection of a conductor with a cross-sectional area of at least 4 mm^2.

Warning: In order to protect the instrument against extreme environmental conditions, a coating thicker than 0,2 mm should be applied. The grounding connection has to be adequately realized to prevent an electrostatic charge on the instrument surface. **CLEAN ONLY with a damp cloth.**

Operation Adjustments

Pressure Switches are supplied adjusted at midscale falling unless otherwise specified.
If the instrument has been ordered with specific calibration values the adhesive label shows the set point values.
It is good rule to check the calibration values marked on the relevant adhesive label, prior to installation.

Calibration

Please follow the below suggested steps to calibrate the set point of the instrument:
Connect the instrument to the pneumatic tools in the normal installation position (see Fig.1) using the high pressure port, leaving the low pressure port to atmosphere.
In case of very low differential pressure switch the pneumatic circuit must have a volume of almost 5l to avoid the influence of the displacement volume of the sensing element to the measured pressure. Slacken the lid lock screw and unscrew the lid. Connect the warning lamp according the desired function to the terminals.

Caution: Do not attempt to set the switch outside the scale limits.

Though the unit may be set anywhere within its range, for optimum performance, it is good practice to have a set point value between 25% and 75% of span.

Connection C-NO terminal

- The circuit is opened at the normal operating pressure, the switch closes the circuit as the pressure increases when the desired value is reached.
- The circuit is closed at the normal operating pressure, the switch opens the circuit as the pressure decreases when the desired value is reached

Connection C-NC terminal

- The circuit is closed at the normal operating pressure, the switch opens the circuit as the pressure increase when the desired value is reached.
- The circuit is open at the normal operating pressure, the switch closes the circuit as the pressure decrease when the desired value is reached

Pressurize the circuit and slowly increase the pressure up to the set point.
Slacken the set point lock screw.
Using a suitable spanner (Ch13), rotate the range adjuster clockwise to increase the set point and counter-clockwise to decrease the set point up to the relative lamp turn ON (or OFF).
Go to the normal operating pressure and increase (or decrease) the pressure up the relative lump turn ON (or OFF). Read the pressure on the test gauge. Adjust the range adjuster if necessary and recheck using the lump up to the set point is reached with the required accuracy.
Tighten the set point lock screw.
Close the instrument lid and tighten lid lock screw.
Write the set point on the adhesive label

Caution: The striker screw and lock nut are factory set and should not be adjusted. Should these parts be accidentally loosened, please contact Delta Mobrey for assistance.

Periodical calibration check.

Connect the instrument to the pneumatic tools in the normal installation position (see Fig.1).
Slacken the lid lock screw and unscrew the lid.
Connect the warning lamp according the desired function.

Set point calibrated with increasing pressure

From atmospheric pressure pressurize the circuit and increase slowly the pressure up to the set point (the warning lamp switches ON).
Record the pressure reading on the test gauge..
Return to atmospheric pressure.
Repeat the above operation twice.

Set point calibrated with decreasing pressure

From atmospheric pressure pressurize the circuit up to upper range value.
Decrease slowly the pressure up to the set point (the warning lamp switches ON).
Record the pressure reading on the test gauge.
Return to upper range pressure value.
Repeat the above operation twice.

Evaluation of set point value and repeatability

With all the above values detected, calculate:

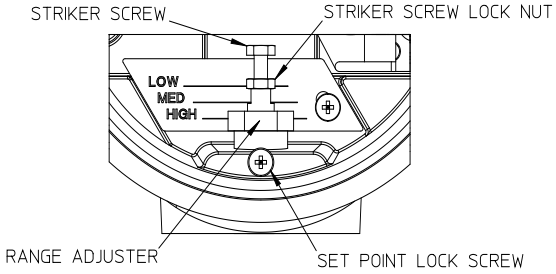
- Average set point value
- Repeatability as the max difference of the detected set point.

If the average set point is different from the expected, the instrument must be recalibrated.
If the repeatability is higher than the value of the Technical Data Sheet replace the instrument with a new one and contact the factory.

End of verification

Remove the instrument from the pneumatic tool and disconnect the warning lamp
Close the instrument lid and tighten lid lock screw

Fig. 6 - Set point adjusting



Safety Integrity Level (SIL) instrument and installation requirements

Refer to Functional Safety Manual Sentry Series

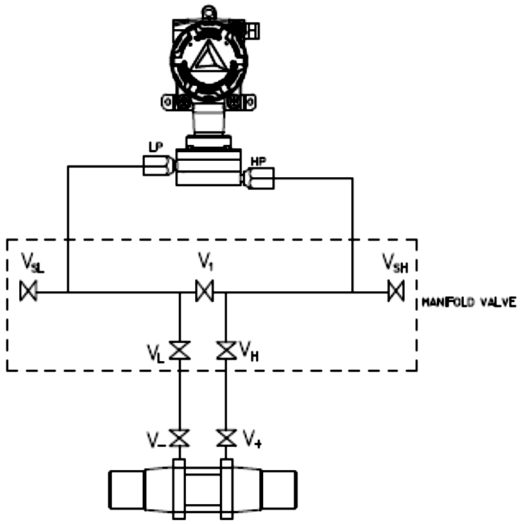
Commissioning

With reference to the following figure the valve V_+, V_-, V_H, V_L V_{SH}, V_{SL} and V_1 are closed.
Open by pass valve(V_1), open V_H.and slowly open V_+. Vent the instrument opening slowly V_{SH} and V_{SL}.

Warning: the process fluid can be hot or corrosive.

Close by pass valve(V_1), open V_L.and slowly open V_-.
The instrument is ready to work.

Fig. 7 - Commisioning



Inspections and maintenance

The instrument is maintenance-free but is a good practices to conduct periodic inspections (visual and functional).
Inspections should be carried out at list once a year depending upon the operating, environmental conditions and customer plan.

Caution: It is recommended that instruments used to provide an alarm, a shutdown or are safety related are operated periodically to ensure they are functioning correctly.
If further maintenance is required seek advice from Delta Mobrey before attempting repair or replacement of parts.

Periodical visual inspection

Isolate the unit from process and power.

Warning: The flameproof or intrinsically safe instruments installed in explosive atmospheres where there is combustible dust, must be periodically cleaned externally in order to remove any accumulation of dust.
Verify the integrity of the electrical unit using IEC 60079-17 as guide.
Verify if the device for natural ventilation is in place and is free from obstructions such as fungi, molds and insects.
Verify the leakage of the process externally.
Slacken the lid lock screw and unscrew the lid

Warning: flameproof instrument. Before removing the lid or the cable gland check that no explosive atmosphere is present and that the instrument is de-energized.

- Check all terminals for tightness.
- Check that cable tails are not fouled or chafed.
- Check for internal condensation.
- Check that the gasket is seated properly in the lid recess and is not worn.
- Check that the vent area does not become blocked or obstructed and vent plug has not degraded.

Periodical functional verification

The verification consists in check the set point.
This verification is done, usually, removing the instrument from the plant and perform the verification on a test room (see calibration check paragraph).

Warning: Flameproof instrument. Before removing the lid or the cable gland check that the electrical supply is not energized and that no explosive atmosphere is present.
If the verification is done on site the preferred procedure is the verification of the entire loop without remove the lid or the cable gland.

Warning: The flameproof instruments may be checked on site only if apparatus suitable for explosive atmospheres are used.

Warning: Verify that loop is in a safe configuration before acting on the valves and instrument. Do not dispose the process fluid into environment if this causes pollution or personal injury.

Replacement parts

Only the microswitch and terminals can be replaced. Use factory authorised parts only.

IMPORTANT NOTE: operations involving replacement of essential components must be carried out at our workshop, especially for instruments with flameproof certificate; this is to guarantee the user the total and correct restoration of the product original characteristics.

Warning: The flamepaths (cable entry & cover threads, range adjuster) are not to be repaired.

Warranty

See Standard Conditions of Sale.

Decommissioning

Warning: Verify that the loop is in a safe configuration before acting on the valves and instrument. Power off the instrument.

Warning: verify, in case of flameproof instrument, the absence of explosive atmosphere.

Do not dispose the process fluid into the environment if this cause pollution or personal injury.

Warning: In the case of flame proof instruments, it is recommended to follow at least the standard IEC 60079-17 and for the withdrawal from service of electrical apparatus.

Following the figure on Commissioning, isolate the instrument from the process closing the valve V_+ and V_-.

- Open V_1 slowly and depressurize the line pressure acting on the valves V_{SH} and V_{SL}.

Warning: the process fluid can be hot or corrosive

- Close the valve V_H and V_L.
- Slacken the lid lock screw and unscrew the lid.
- Disconnect all the live terminals and insulate the cables.
- Disconnect the grounding.
- Remove the cable gland.
- Dismount the instrument from the process connection.

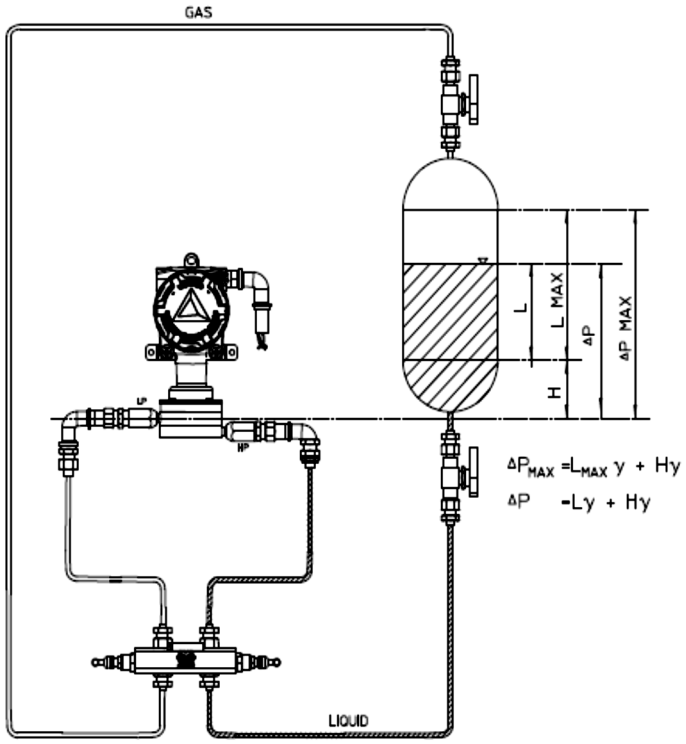
Warning: the process fluid can be hot or corrosive.

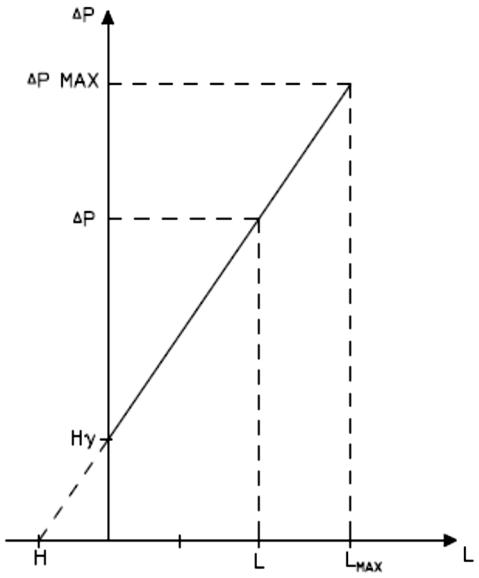
- Plug the process pipe.
- Reassembly the lid.
- Remove the mounting screws to the wall/ panel.

Disposal

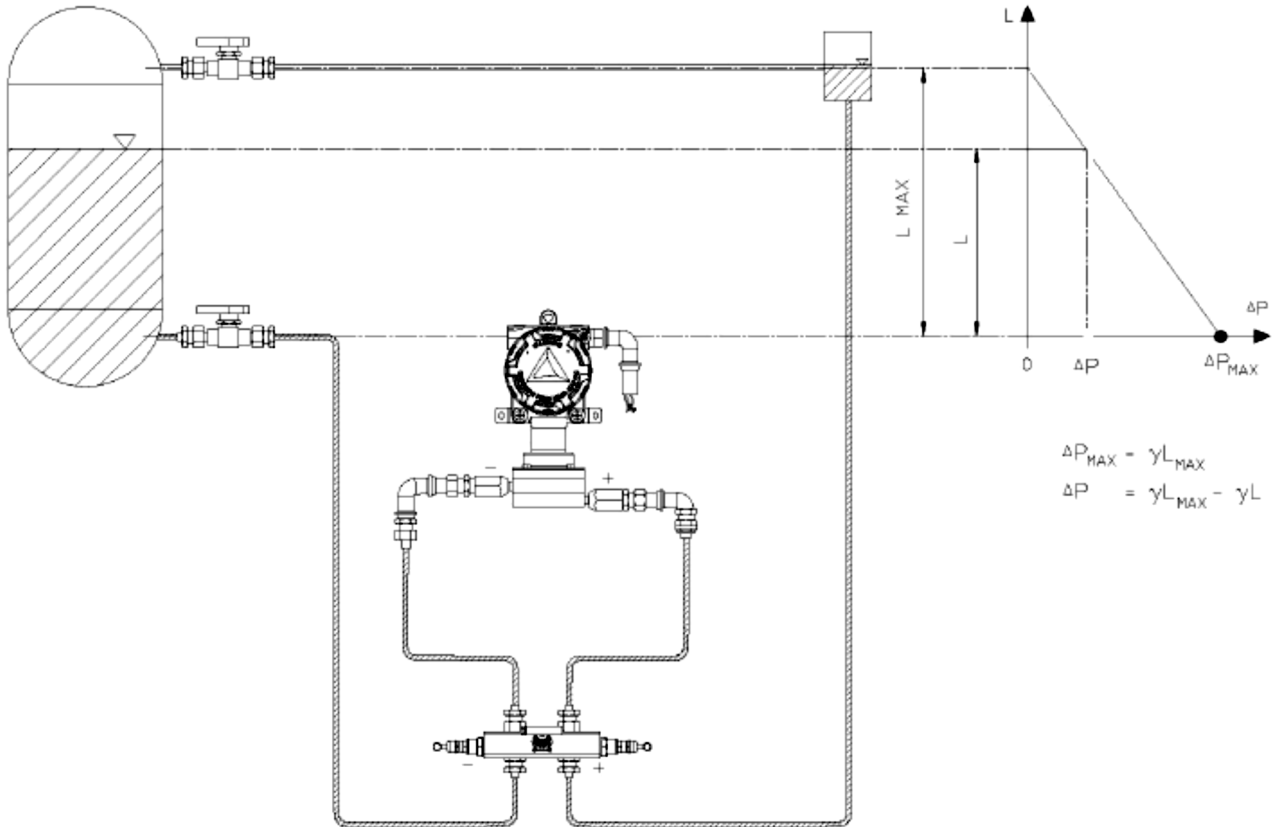
The instrument is mainly made of aluminium and stainless steel. Remove the microswitch and clean the wetted parts before scrap the instrument

Level Alarm on liquid process, dry leg installation

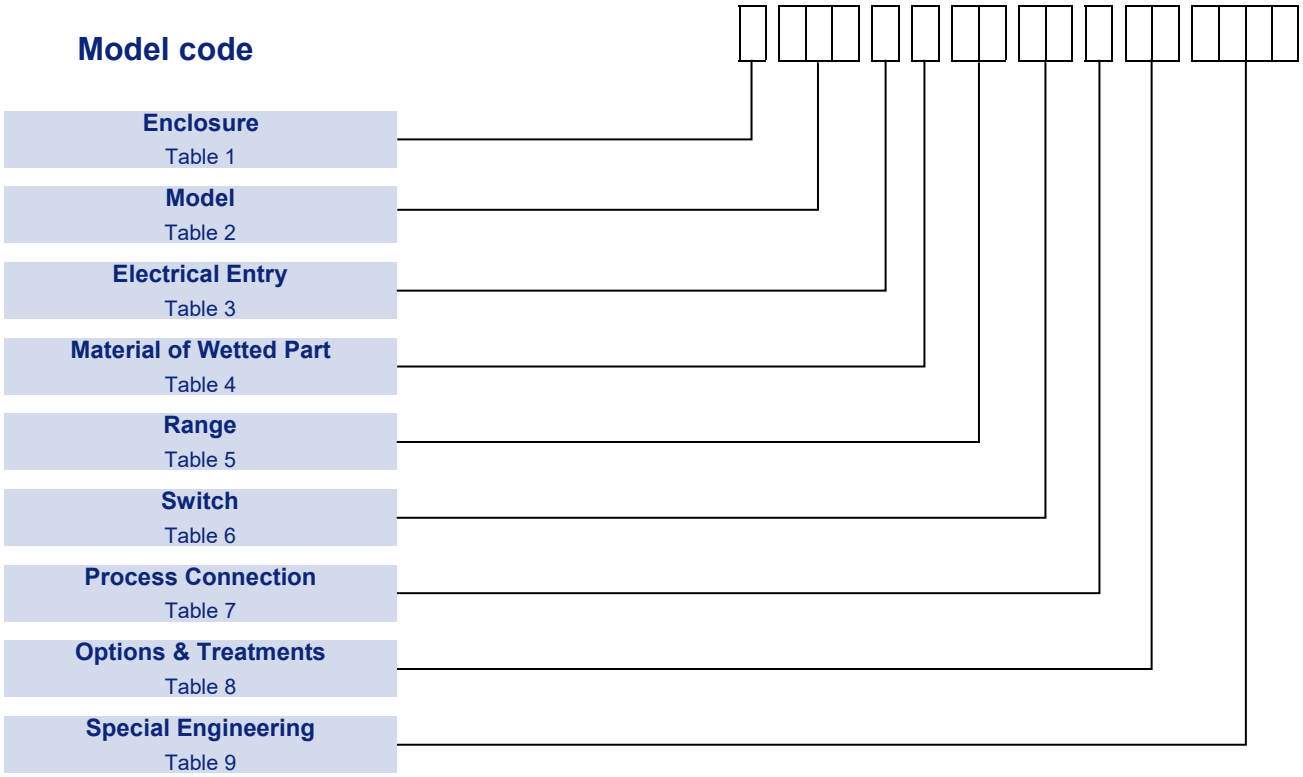




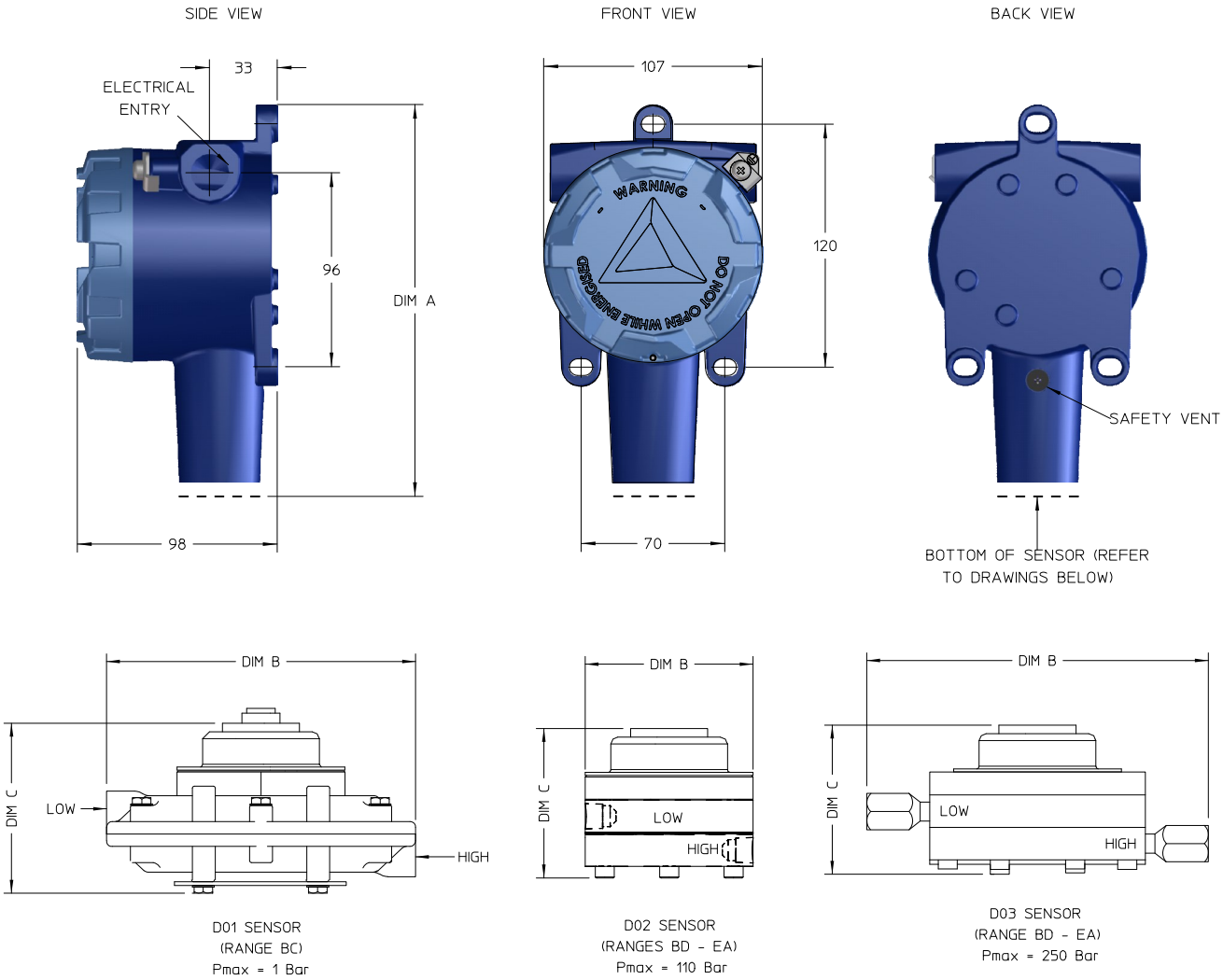
Level Alarm on liquid process, wet leg installation



Model code



DIMENSIONS



Model (weights may vary according to the range)	Weight (Kg)	Weight (lb)
WD01* / HD01* / 5D01*	3.2	7
WD02* / HD02* / 5D02*	3.2	7
WD03* / HD03* / 5D03*	3.2	7
AD01* / RD01* / 4D01*	27.8	61.2
AD02* / RD02* / 4D02*	27.8	61.2
AD03* / RD03* / 4D03*	27.8	61.2

Model	Range	DIM A	DIM B	DIM C
D01	BC	258	162	89
D02	BD - CE	246	114	77
	DC - EA	246	88	77
D03	0D - 0E	271	192	102
	DC - EA	271	166	102