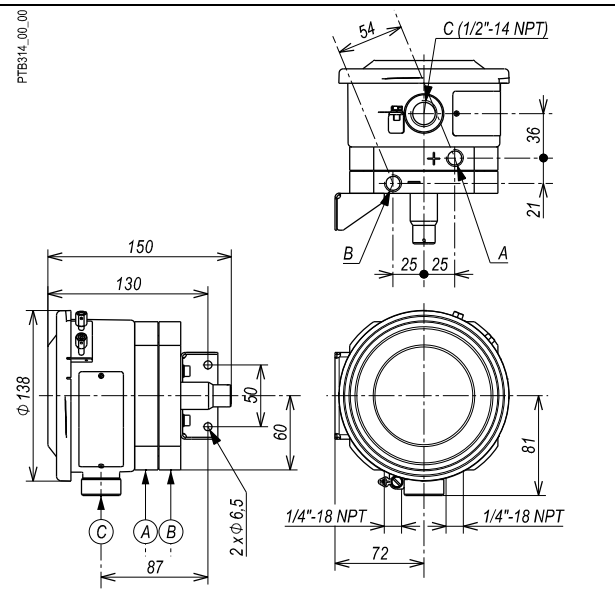
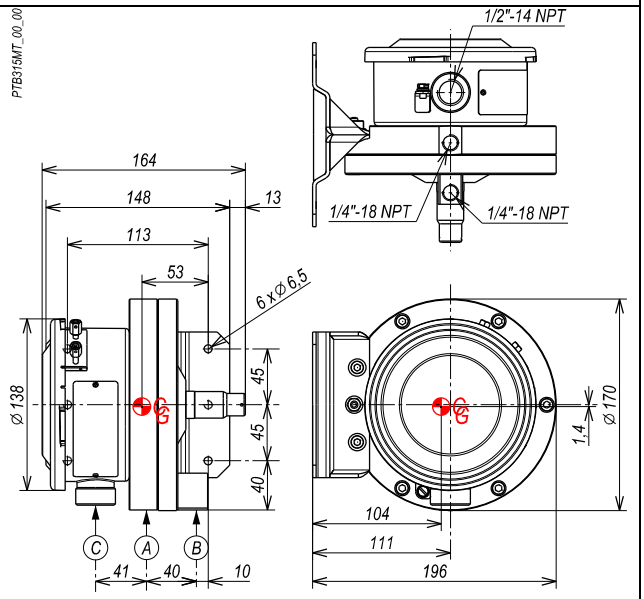
INSTRUCTION MANUAL

NI-210WE
Rev. 4 04/20

DIFFERENTIAL PRESSURE SWITCHES FOR CONTROL ON DRY AND CLEAN GAS SERIES DW03 & DW05

WEATHERPROOF AND INTRINSICALLY SAFE: SERIE DW03	WEATHERPROOF AND INTRINSICALLY SAFE: SERIE DW05
	
A High pressure connection **C Cable entry** **B Low pressure connection** Weight 2,2 kg (dimensions in mm)	**A High pressure connection** **C Cable entry** **B Low pressure connection** Weight 8,2 kg (dimensions in mm)
For surface mounting use two screws M6.	For surface mounting use six screws M6.

NOTE: dimensions and weights are not binding unless released on certified drawings.

CAUTION

- Before installing, using or carrying out maintenance on the instrument it is necessary to **read** and **understand** the indications given in the attached Instruction Manual.
- The instrument must only be installed and maintained by **qualified personnel**
- **INSTALLATION IS TO BE CARRIED OUT ONLY AFTER CHECKING THAT INSTRUMENT CHARACTERISTICS ARE CONSISTENT WITH PROCESS AND PLANT REQUIREMENTS.**
- The functional **features** of the instrument and its degree of protection are shown on the identification plate fixed to the case.

CONTENTS:

RELATED DOCUMENT
To authenticated document with certificate
N° IECEx PRE 16.0074X

1 GENERAL NOTES

1.1 FOREWORD

This instrument is suitable for use on air or clean gas free from vapours that may condensate inside its measuring chambers.

The wrong choice of a series or a model, as well as the incorrect installation, lead to malfunction and reduce instrument life. Failure to follow the indications given in this manual can cause damage to the instrument, the environment and persons.

1.2 ALLOWED OVERRANGE

Pressures exceeding the working range can be **occasionally** tolerated provided they remain within the limits stated in the instrument features (vacuum or proof pressure). **Continuous** pressures exceeding the working range can be applied to the instrument, provided they are clearly stated in the instrument features. The current and voltage values stated in the technical specifications and ratings must **not** be exceeded. Transitory overranges can have a destructive effect on the switch.

1.3 MECHANICAL VIBRATIONS

Can generally lead to the wearing of some parts of the instrument or cause spurious action. It is therefore recommended that the instrument be installed in a place where there are no vibrations. In cases where this is impossible it is advisable to take measures to lessen the effects (elastic supports, installation with the pin of the microswitch positioned at right angles to the vibration plane, etc.).

1.4 TEMPERATURE

Due to the temperature of both the environment and the process fluid, the temperature of the instrument could exceed the allowed limits (normally from -10° to +40°C). Therefore, in case it does, suitable measures (protection against heat radiation, fluid separators, cooling coils, heated lockers) must be taken. The process fluid or its impurities must not in any case solidify inside the instrument chambers

2 OPERATING PRINCIPLE

The differential pressure acting on a diaphragm, produces a force directly proportional to the differential pressure. This force is counteracted by an helical spring whose preload is adjusted through a proper screw. When the force balance is overcome, the diaphragm moves and actuates the microswitch through a rigid tip

The microswitch is of the snap acting type with automatic reset. When the pressure moves away from the set values, returning towards the normal values, the switch is reset. The dead band (difference between the set point value and the reset value) is fixed.

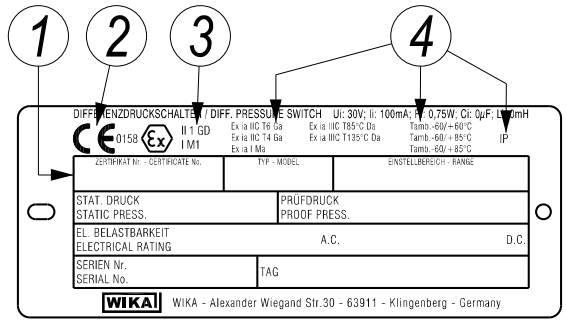
3 MODEL CODE

See Annex 1

4 IDENTIFICATION PLATE AND MARKINGS

The instrument is fitted with a metal plate bearing all its functional characteristics and in case of intrinsic safety execution the markings prescribed by standard IEC/EN 60079-0 (see Fig.1)

Fig. 1 – Nameplate



1 Notified body that issued the type certificate and number of said certificate.
2 CE marking and identification number of the notified body responsible for production surveillance.
3 Apparatus classification according to ATEX 2014/34/EU directive.
4 Type of protection and ambient temperature limits of operation.

The following table gives the relationship between hazardous areas, Atex Categories and Equipment Protection Level (EPL) listed on the instrument nameplate

Hazardous area		Categories according to 2014/34/EU Directive (ATEX)	EPL
Gas, vapours, fog	Zone 0	1G	Ga
Gas, vapours, fog	Zone 1	2G or 1G	Gb or Ga
Gas, vapours, fog	Zone 2	3G, 2G or 1G	Gc, Gb or Ga
Dust	Zone 20	1D	Da
Dust	Zone 21	2D or 1D	Db or Db
Dust	Zone 22	3D, 2D or 1D	Dc, Db or Da

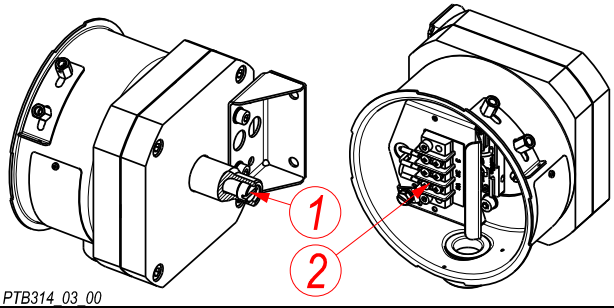
5 SET POINT REGULATION

The set point can be adjusted by means of a screw (for adjustment) to snap when the pressure reaches (increasing or decreasing) the desired value (set point). The instrument is usually supplied with the switch adjusted at the setting range value nearest to zero (**factory calibration**). The instrument is supplied with a label showing the set point calibration value. With **factory calibration** the values are not indicated, as these are temporary and will be modified with the definitive values. Prior to installation the instrument must **be calibrated** and the definitive calibration values written on the label.

If the instrument has been ordered with a **specific calibration,** check the calibration values marked on the relevant label, prior to installation.

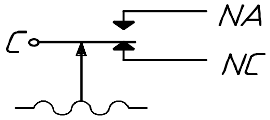
The position of the adjustment screw is given in figure 2.

Fig. 2 - Electrical connections and adjustment screws



1 - Set point calibration screw
2 - Terminal block

Microswitch electrical circuit: State of the contacts at atmospheric pressure



Designation of the contacts:
C - common
NA - Normally open
NC - Normally closed

The effect that the direction of rotation of the adjustment screw has is described on the label.

6 SET POIT CALIBRATION

In order to proceed with the calibration and the periodical functional verification of the instrument a suitable **calibration circuit** (Fig. 3) and an adequate pressure source is required.

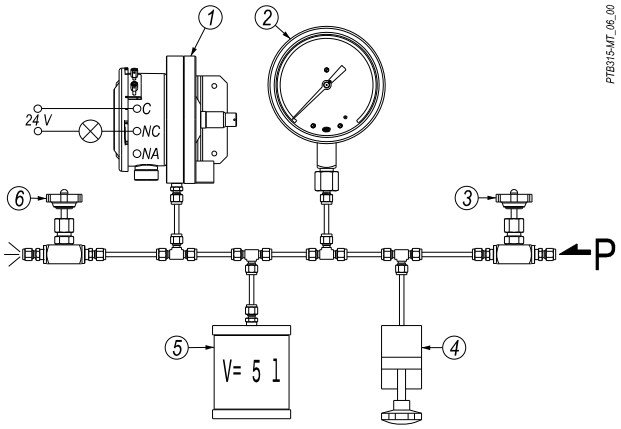
The calibration circuit used for the calibration of these instruments must have:

- a big internal volume (5 litres or bigger) in order to reduce the effect of volumetric variation (and therefore of pressure) caused by the sensing element of the pressure switch during the snap action.
- installed in a thermally stable place in order to guarantee stability to the pressure inside the circuit used for the calibration.

Have to be considered that in a closed circuit with the internal pressure equal to the atmospheric pressure, the variation of temperature of 1°C causes in the circuit a pressure variation of 3,4 mbar. The maximum inlet pressure must not exceed the lesser of overpressure allowed by the pressure switch and the test gauge.

The test instrument should have a measurement range approximately equal to or slightly wider than the pressure switch range and should have an accuracy consistent with the accuracy required to calibrate the set point.
For example DW03 range 0,7/16mbar the accuracy of the test gauge must be ± 0,04 mbar to calibrate the set point with an accuracy of ± 0,16 mbar (1% of the adjustable span).

Fig. 3 – Calibration circuit for instrument with adjustable range less than 60 mbar

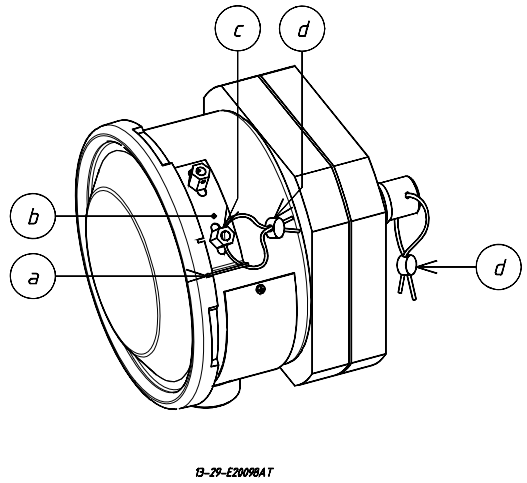


1- Pressure switch
2- Test gauge
3- Inlet valve
4- Volumetric pump
5- Capacity
6- Outlet valve

6.1 PRELIMINARY OPERATIONS

Remove the blocking device fixed to the side of the instrument case (Fig. 4). Remove the cover by rotating it in an anticlockwise direction.

Fig. 4 - Pressure switch blocking device



a) Blocking gap
b) Blocking bracket
c) Blocking nut
d) Plumbing wire

6.2 CALIBRATION CIRCUIT AND OPERATIONS

Prepare the calibration circuit as indicated in Fig.3.
The warning lamps should be connected to contact in the NO or NC position according to the required contact action.

Connection of C and NO terminals

• If the circuit is open at the working pressure, the switch **closes** the circuit as the pressure **increases** when the desired value is reached.
• If the circuit is closed at the working pressure, the switch **opens** the circuit as the pressure **decreases** when the desired value is reached.

Connection of C and NC terminals

• If the circuit is closed at the working pressure, the switch **opens** the circuit as the pressure **increases** when the desired value is reached.
• If the circuit is open at the working pressure, the switch **closes** the circuit as the pressure **decreases** when the desired value is reached.

The pressure switch must be mounted in the normal installation position, i.e. with the pressure connection pointing downwards. The pressure connection + (or H) of the instrument must be connected to the pressure source and the connection - (or L) has to be left to the atmosphere
Increase the pressure in the circuit up to the desired set point value for the first microswitch. Use a wide bladed screwdriver, as indicated on the label, turn the screw until the relative lamp turns on (or turns off).

6.3 CHECK OF SET POINT

Generate the normal working pressure and wait the pressure stabilisation. Vary the pressure into the circuit and record the set point value. Write the set point values on the adhesive label.
Note: the repeatability should be checked verifying for three times the set point (Pi) starting always from the same pressure value (Pw). The pressure cycle should be slowly to give the possibility to record the set point with enough accuracy.

6.4 FINAL OPERATIONS

Disconnect the instrument from the calibration circuit.
Take the cover, ensure that the sealing gasket is correctly fitted into its seat, and insert the cover onto the case, with the blocking gap positioned in correspondence to the blocking bracket.
Turn the cover clockwise closing it tightly. Mount the blocking device as in Fig. 4.
Mount on pressure connection, cable entry and adjustment screw the protection caps supplied with the instrument.

Caution: The protection caps should only be definitively removed **during** the connection steps.

7 MOUNTING AND CONNECTIONS

7.1 MOUNTING

Surface mount the instrument by means of the holes provided, (see Fig.10 and 11). In case of surface or panel or rack mounting the instruments can be mounted side by side (see Fig.12 & 13).
The chosen position must be such that vibrations, the possibility of shocks or temperature changes are within tolerable limits. The instrument **must** be positioned higher than the pipe inlet (Fig.14).

7.2 PRESSURE CONNECTIONS

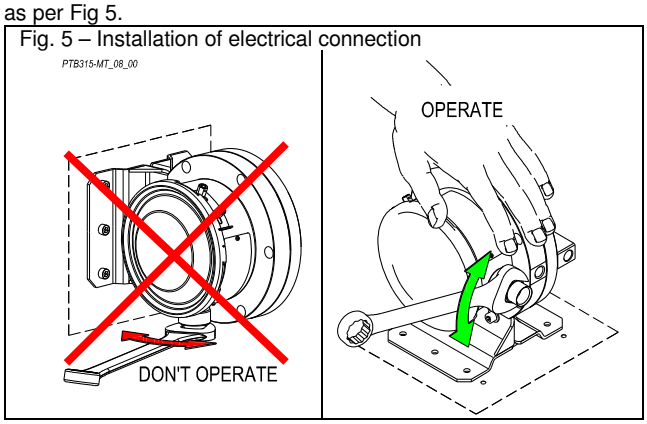
Connecting lines are an integral part of the instrument in transmitting the measured variable from the measuring point to the instrument.
The diameter and length of the two connecting lines between instrument and pressure taps are to be such as not to cause dampening or lag in transmitting the differential pressure.
Run connecting lines always sloping down from instrument to process so that possible condensate flows towards process (avoid forming of siphons).

For a correct installation (see Fig 14) it is necessary to:
Mount a shut-off valve with drain (root valve) on each process pipe inlet to allow the instrument to be excluded and the connection tubing to be drained. It is recommended that said valve has a capstan blocking device aimed at preventing it being activated casually and without authorisation.
Mount a **3 valve manifold** near the instrument to permit possible functional verification on site and removal of the instrument. It is recommended that the manifold is made up of two service valves, one by-pass valve and two suitably connected drain plugs. The three valves with the drains can be reunited by a single device called a “Three valve manifold”
Mount a three piece joint onto the threaded attachment of the instrument to permit the easy mounting or removal of the instrument itself.
Carry out the connection using a flexible tube in such a way that variations in the temperature of the tube itself do not force the instrument attachment.
Ensure that all the pressure connections are airtight. It is important that there are no leakage in the circuit.
Close root valves, the two service valves, drain plugs and open the by-pass valve.

7.3 ELECTRICAL CONNECTIONS

It is recommended to carry out the electrical connections according to the applicable standards. In case of intrinsic safety instrument see also the Standard IEC-60079-14. If the electrical connection is carried out in a protected tube, it shall be made so that condensate is prevented from entering instrument enclosure To guarantee the ingress protection IP66 and prevent loosening of the blocking joint or cable glands, it is prescribed to seal the threads with an anaerobic sealant. For example, use a sealant like Loctite ® 542.
The installation of the cable gland or three-piece joint should be as per Fig 5.

Fig. 5 – Installation of electrical connection

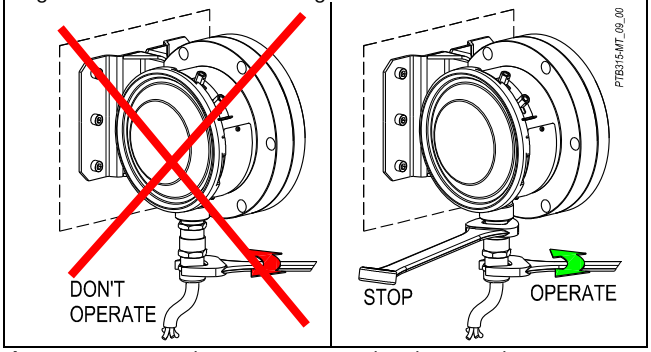


With the instrument into the final position provided that the electric line is not energize, remove the cover and make the electrical connection to the terminal block (see Fig. 2).

If the ambient temperature exceeds 60 °C is recommended to use cables suitable for operating temperatures of at least 105 °C.

Flexible cables with a maximum section of 1,5 mm^2 (16AWG) are recommended using the pre-insulated crimp ring terminal.
Ensure that no deposits or wire ends remain inside the case.
The relevant parameters for intrinsic safety are listed on the nameplate of the instrument.
The tightening of the cable gland or the three-piece joint must be performed as shown in Fig.6.

Fig.6 – Installation of the cable gland

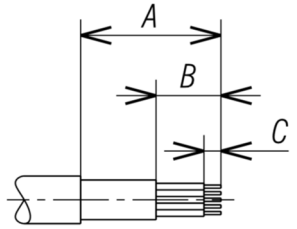


As soon as connection steps are completed, mount the cover on and make sure it is tight and blocked (see fig. 4).

7.4 CONNETTOR 7 POLES TYPE MIL-5015 FOR WEATHER PROOF INSTRUMENT

The free connector, supplied with the instrument, is able to accept multicore cables with maximum outer diameter 11 mm. It is recommended flexible cables with single-conductor with a maximum section of 1.5 mm2 (16AWG).
The cable have to be prepared as per fig.7.

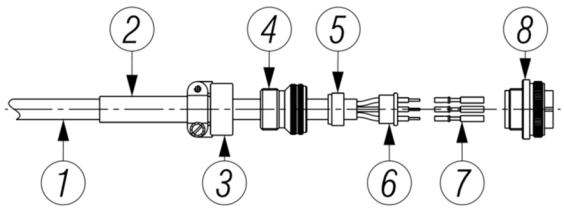
Fig. 7 – Cable preparation



A= 53mm
B= 30mm
C= 6,5 mm

The single stripped conductor has to be crimped with each contact pin. For the electrical connections and for the assembly follow Fig.8.

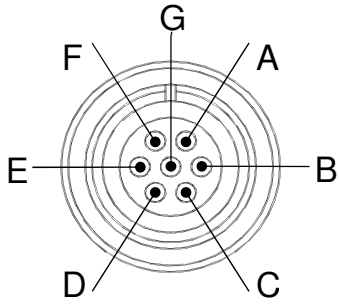
Fig.8 – Free connector assembly



1- Cable	5- Ferrule
2- Heat Shrink Boot	6- Insulator for pin contacts
3- Clamp	7- Pin contacts
4- Extender	8- Shell

The wiring diagram is according Fig.9.

Fig.9 – Wiring diagram MIL C-5015



CONTACT	FUNCTION	
A	1-NA	Micro 1: Normally open
B	1-NC	Micro 1: Normally closed
C	1-C	Micro 1: Common
G	Ground	Internal grounding connection

Once the crimping and assembly activities of the free connector are finished, make sure that all the parts are tight. Screw the bayonet and tighten it to assure the instrument degree of protection

7.5 GROUNDING CONNECTIONS

The instrument is supplied with two grounding connections, one external and one internal. The connections are suitable for a earthing wires of 4 mm^2 section (fig. 2).

8 INSTRUMENT PLUMBING

8.1 PLUMBING CALIBRATION DEVICE

This plumbing is necessary in order to prevent possible tampering of set point. It is obtained with a stainless steel wire inserted into the holes provided on the device (Fig.4). It is to be done at the end of calibration.

8.2 PLUMBING ACCESS COVER TO TERMINAL BLOCK

This plumbing is necessary in order to prevent possible tampering of electric wiring. It is obtained with a stainless steel wire (d) inserted into the holes of screws (c) and of blocking racket (b) (Fig. 4). It is to be made after installing instrument on the plant.

9 SAFETY INTEGRITY LEVEL (SIL) INSTALLATION REQUIREMENTS

The pressure switch has been evaluated as Type A safety related hardware. It has an hardware fault tolerance of 0 if it is used in one out one configuration (1oo1). The installation has to be designed to allow a proof test to detect dangerous undetected fault using, as example, the following procedure:

- Take appropriate action to avoid a false trip
- Force the switch to reach a define max or min threshold value and verify that output goes into the safe state.
- Force the switch to reach a define normal threshold value and verify that output goes into the normal state.
- Repeat the check two times evaluating average set point value and repeatability,
- Restore the loop to full operation
- Restore normal operation

10 PUTTING INTO OPERATION

The instrument comes into operation as soon as the root valves are opened and then, afterwards, the service valve attached to the instrument + (H) inlet pipe is opened, the by-pass valve closed and the service valve attached to the instrument – (L) inlet pipe is opened. Any possible drainage of the connection tubing can be carried out by opening the drains positioned on valves.

Do not dispose of the process fluid into the environment, if this can cause pollution or damage to people

11 VISUAL INSPECTION

Periodically check the external condition of the enclosure. There should be no trace of leakage of process fluid outside the instrument.
In case of intrinsic safety instruments, inspections of the electrical installation are to be carried out also according to customer procedures and at least in accordance with IEC-60079-17.

The intrinsic safety instruments installed in explosive atmospheres for the combustible dust presence, must be periodically cleaned up externally in order to avoid dust accumulating.

12 FUNCTIONAL VERIFICATION

This will be carried out according to the Customer's control procedures and because of their particular operating principle, have to be functional inspected every year as minimum if used as an alarm of max pressure

The instruments can be verified on the plant if installed as illustrated in Fig. 14.
To avoid any risk it is recommended check the set point on site without open the cover, without dismount the cable gland and without unplugging the power cable.

The intrinsic safety instruments may be checked on site only if the apparatus used are suitable for explosive atmosphere.

If this is not the case it is necessary remove the instrument from the plant, and carry out the verification in a testing room.

If the verification of the set point is performed unplugging the power cable from the terminal block it is recommended de-energize the instrument to avoid any electrical hazard.
Verification consists in **check the calibration value** and possibly regulating the adjustment bush (see §5).

13 STOPPING AND DISMOUNTING

Before proceeding with these operations **ensure** that the plant or machines have been put into the **conditions** foreseen to allow these operations.

With reference to Figures 14
Remove the power supply (signal) from the electrical line. Close the root valves (6) and open the by-pass valve. Open the drains on the root valves slowly.

Do not dispose of the process fluid into the environment, if this can cause pollution or damage to people.

Unscrew the three-piece joint (1).
Unscrew the cable gland (9).
Remove the cover of the instrument and disconnect the electrical cables from the terminal block and earth screws.
Remove the screws fixing the case to the panel and remove the instrument, taking care to slide the electrical conductors out from the case.
Mount instrument cover. Insulate and protect cables around, if any. Temporarily plug pipes not connected to the instrument.

In case of intrinsic safety instruments it is recommended to follow - at least – the standard IEC-60079-17 for the withdrawal from service of electrical apparatus.

14 DISPOSAL

The instruments are mainly made of stainless steel and aluminium and therefore, once the electrical parts have been dismounted and the parts coming into contact with fluids which could be harmful to people or the environment have been properly dealt with, they can be scrapped.

15 TROUBLESHOOTING

IMPORTANT NOTE: operations involving replacement of essential components must be carried out at our workshop this is to guarantee the user the total and correct restoration of the product original characteristics.

MALFUNCTION	PROBABLE CAUSE	REMEDY
Set point shift	■ Permanent deformation of the sensitive element due to fatigue or non-tolerated over-ranges ■ Variation of the elastic features of the sensitive element due to its chemical corrosion.	■ Recalibrate or replace the sensitive element. ■ Recalibrate or replace the sensitive element with another made of a suitable material.
Slow response	■ Clogged or obstructed connection line. ■ Root or service valve partially closed.	■ Check and clean line. ■ Open valve.
No actuation or undue actuation	■ Root or service valve closed. ■ By-pass valve open. ■ Microswitch contacts damaged. ■ Loosened electrical joints. ■ Interrupted or short-circuited electrical line.	■ Open the valve. ■ Close the valve. ■ Replace the microswitch. ■ Check all electrical joints. ■ Check the conditions of the electrical line.
Undue actuation	■ Accidental shocks or excessive mechanical vibrations.	■ Modify the mounting.

Fig.10 – DW03 wall mounting

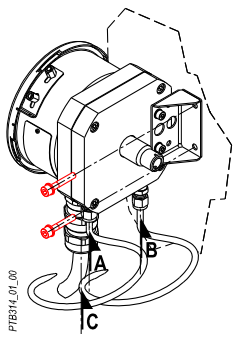


Fig.11 – DW03 wall mounting

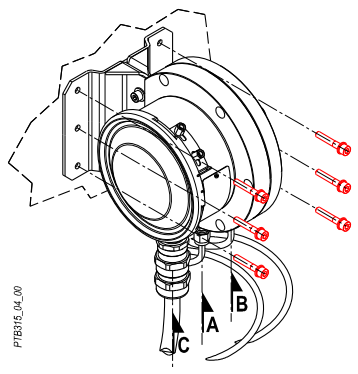


Fig. 12 – DW03 - Rack mounting

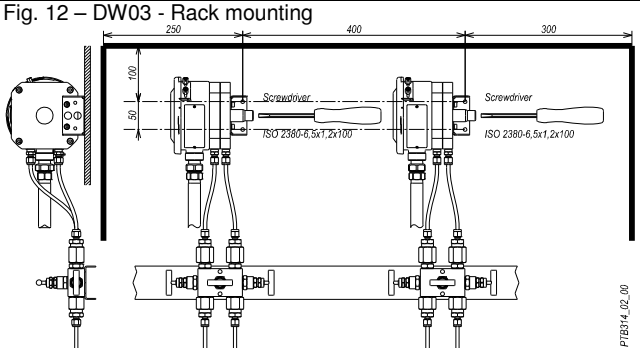


Fig. 13 – – DW03 - Rack mounting

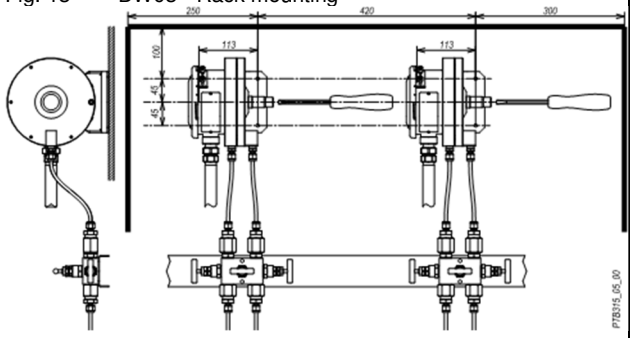
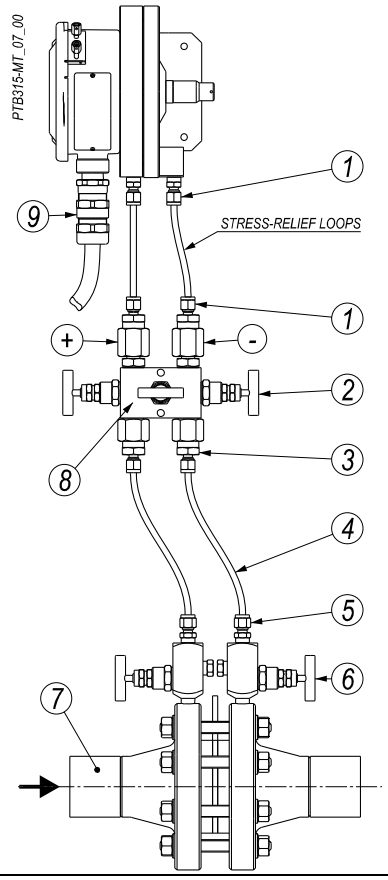


Fig. 14 - Example of connections -



1 - Three pieces fitting
2 - Three valves manifold
3 - Three pieces fitting
4 - Piping
5 - Three pieces fitting
6 - Root valve with drain
7 - Filter or nozzle
8 - Check inlet and drain plug
9 – Cable gland

Annex 1 – Model code

1	**MODEL CODE**	**DW**				For further information see datasheet
1.1	**Sensor code**		-			Low differential pressure
			H			High differential pressure
1.2	**Line (static) pressure**			03		Max line pressure 10 bar
				05		Max line pressure 40 bar
1.3	**Type of Electric Contact**				UW	Silver
					UN	Silver
					UG	Gold
2	**Options**	Example: Intrinsic Safety execution				