

# User Guide

# PRESSURE SWITCHES



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## 1. Important information

The instrument described in this manual has been designed and produced in conformity to the following standards in force. All components are submitted to severe quality and traceability controls. The quality management system is certified according to the ISO 9001 standard. This manual contains important information about the use and the installation of the gauge in safe conditions. Therefore it is highly recommended to read carefully the following instructions before using the instrument.

*The instrument works in safe conditions when correctly selected and installed in the system and when the rules concerning the product as well as the maintenance procedures established by the manufacturer are respected.*

*The staff charged with the selection, installation and maintenance of the instrument must be able to recognize the conditions that may negatively affect the instrument's ability to work and which may lead to premature breakage. The staff must therefore be technically qualified and properly trained, and must carry out the procedures called for in the plant regulations.*

### Standards

- Directive P.E.D. 97/23/CE

NUOVA FIMA instruments are designed and manufactured according to the safety rules included in the safety international standards in force. Some of these standards are included in this manual and they must be known and respected in order to proceed to the installation and the setting at work of the instrument.

**PS ≤200 bar** the instruments must satisfy the essential security requirements and they are designed and produced according to a "Correct Production Procedure" (SEP-Sound Engineering Practice) and they do not have to bring the CE marking.

**PS >200 bar** the instruments must satisfy the essential security requirements, they are classified in Category 1 and certified according to the A Form. They must bring the CE marking as reproduced below.



The CE marking testifies the respect of the following European Directives:

- Directive concerning the low tension **BT 2006/95/CE**
- Directive RoHS **2002/95/CE**



- The manufacturer disclaims all responsibility in case of damages caused by the improper use of the product and by the non-respect of the instructions reported in this manual.
- Follow carefully the specific safety rules in case of measuring oxygen pressure, acetylene, inflammable or toxic gas or liquids.
- Disconnect the instruments only after depressurization of the system.
- The process fluids residuals in the disassembled instruments could affect people, the environment and the system. It is highly recommended to take proper precautions.



- Before installation be sure that the right instrument has been selected following the working conditions and in particular the range, the working temperature and the compatibility between the material used and the process fluid.
- This manual does not concern the instruments conforming to standard 94/9/CE (ATEX).
- The product warranty is no longer valid in case of non-authorized modifications and of wrong use of the product.
- The user is totally responsible for the instrument installation and maintenance

In order to verify the working and manufacturing features of the instruments read the catalogue sheets in the most up-dated edition available on-line on [www.nuovafima.com](http://www.nuovafima.com)

### 1.1 Intended use

The pressure switches are suitable for several uses in the food industry, in the preservation industry, in the pharmaceutical industry, in the petrochemical industry, in conventional and nuclear centrals. They resist to the most serious work conditions produced by the process fluid aggressiveness.

### 2. Installation

Fix the instrument thread forcing by a key which should fit with the process connection without forcing by hand on the case. As for the cylindrical thread process connection is concerned (Gas or metric) a head gasket compatible with the fluid or gas to measure should be used. (Fig.1).

In case of conic connection thread (NTP or Conic gas), a PTFE tape on the male thread (Fig.2) ensures the sealing before proceeding to screw and then to the fixing.

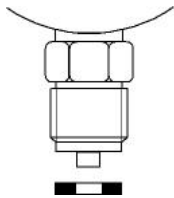


Figure 1

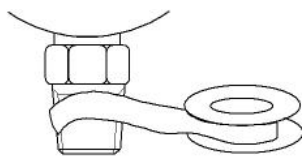


Figure 2

In case of conic connection thread (NTP or Conic gas), a PTFE tape on the male thread (Fig.2) ensures the sealing before proceeding to screw and then to the fixing.

In both cases it is necessary to fix the instrument through two keys: one on the flat sides of the instrument process connection, the other one on the pressure output. All instruments should be mounted in a vertical position unless otherwise shown on the label.

In order to make the instrument dismounting easier it is recommended to mount a shut-off valve between the system and the instrument.

#### 2.1 Electrical connection

Pressure switches type: 3.10 - 3.20 - 3.25 - 3.40 - 3.42 - 3.43 - 3.45 and differential pressure switches model 3.48 - 3.49 are equipped with micro-switch suitable for direct connection through fork wire terminal screws and clamp for ground connection both internal and external provided of cable terminal.

Pressure switches type: 3.26 - 3.27 - 3.30 and differential pressure switches model 3.28 - 3.29 are provided of internal terminal blocks with screws terminals (Figure 5) with cables whose maximum section should be di 2.5 mm<sup>2</sup> and terminal block for ground connection both internal and external provided of wire terminal.

In order to perform the electrical connection proceed to unplug the pressure switch case top. For connection, use cables whose section is adequate to the requested electrical charge (1.2...2.5 mm<sup>2</sup> - 14...16 AWG) in conformity to the technical requirements concerning connection and commutation instruments. The cable diameter should be suitable for passing through cable glands.

Wiring:

- do not torch or excessively pull the wire;
- wires should not be frayed and the isolating gain should not be cut or damaged;
- false contacts should be prevented and the terminal screws should be properly tightened;
- calibration should not be altered (in case it has been performed at the factory).

Be sure that no residue remains inside the case and mount the top fixing it through a lock nut.

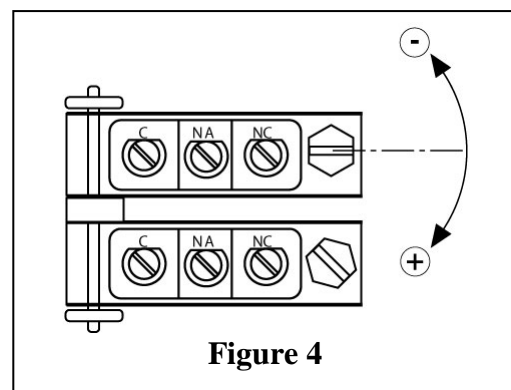


Figure 4

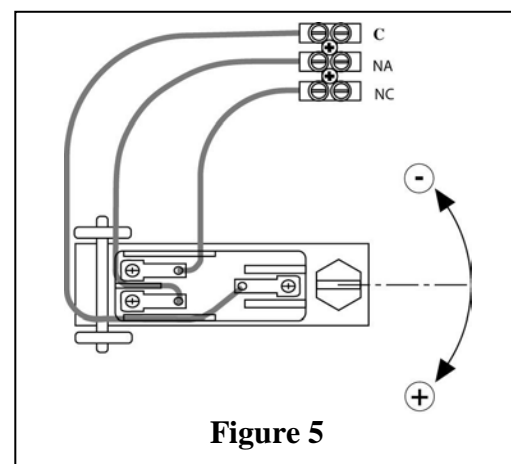


Figure 5

#### 2.2 Electrical connection calibration

If not otherwise specified in the order the instrument is supplied with a set point calibrated on the lowest possible value. Calibration must be performed fixing the pressure switch and a laboratory instrument for the pressure measuring in parallel to a pressure output. and (Fig. 6). For calibration please proceed as follows:

##### Instrument provided of 1 micro-switch

1. Connect the micro-switch to warning lamp or a sound source as shown in fig.5 in order to have a clear reference signal of the performance itself;
2. apply a pressure or depressure to the pressure switch whose value should be equal to the value of operation reading it on the instrument of reference;
3. if when the operational pressure value is reached no signal has been detected, it is necessary to rotate anticlockwise the micro-switch adjustment screw until obtaining the signal of successful operation;

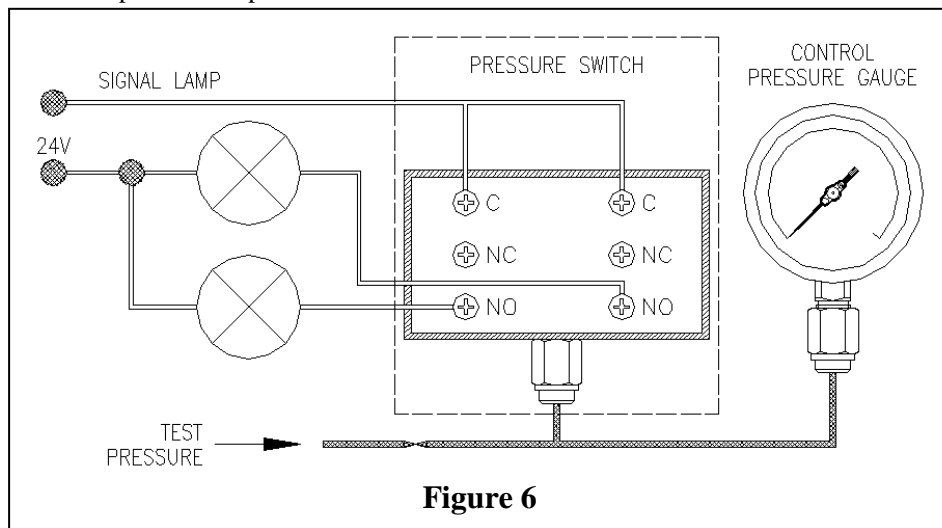


Figure 6

4. On the contrary, if the operation signal shown before the expected pressure value reaching, rotate the adjustment screw clockwise until the operational signal is off.
5. proceed to other pressure ups and downs in order to verify the set point accuracy proceeding as described in points 3 and 4.

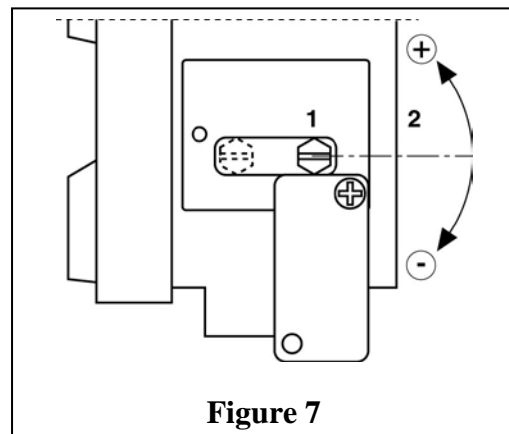
### **Instrument provided of 2 micro-switches**

The calibration procedure is the same as described for instruments provided with 1 micro-switch considering that these operations should be repeated for one micro-switch at a time alternatively until the desired operation accuracy is reached. This is necessary because the two micro-switches interaction on the same measuring instrument.

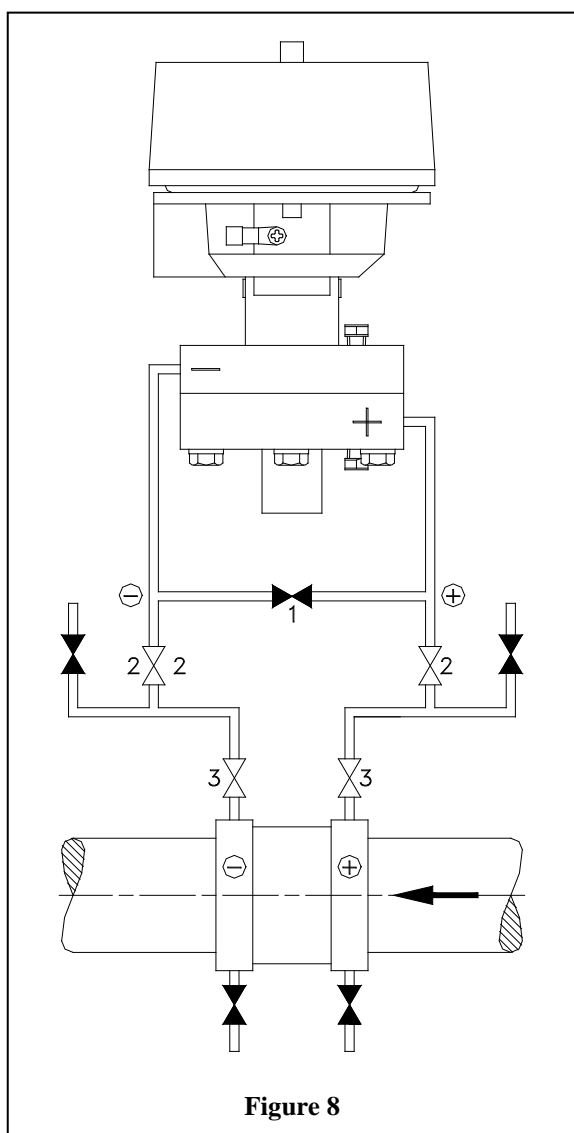
As for model 3.30 the calibration procedure is opposite: the screw should be rotated anticlockwise in order to increase the operation pressure value and clockwise to decrease it. (see fig.7)

### **2.4 Commissioning**

Commissioning should always be performed carefully in order to prevent any shock or sudden temperature variations. Slowly open the shut-off valves placed between the instrument and the process.



**Figure 7**



**Figure 8**

As for differential pressure switches model 3.28, 3.29 3.48 and 3.49, please refer to figure 8 and follow the following instructions:

1. open the by-pass valve "1";
2. open the root valve "3";
3. open the shut-off valve "2" of the positive side (+);
4. shut the by-pass valve "1";
5. open the shut-off valve "2" of the negative side (-).

Be sure that no obstruction of the sensing element pressure abduction pipe causes the repeated micro-switch unsuccessful rearm. In case of no operation be sure that no pressure is inside the instrument before dismounting, isolate it through a shut-off valve.

### 3. Working limits

#### **3.1 Working temperature**

This instrument is designed to be used safely in an ambient temperature between  $-20$  and  $+65^{\circ}\text{C}$

#### **3.2 Working pressure**

The instrument should be selected among those having an adjustment range which should be approximately the double of working pressure value that could be between 25% and 75% of the pressure switch range. As for ranges  $< 1\text{bar}$  avoid any accidental depression higher than the working range of the instrument.

#### **3.3 Cyclic and dynamic pressures**

They generally appear when the instruments are mounted on pumps bringing to a relevant reduction of the sensing element and the micro-switch life. They cause uninterrupted false alarms. It is necessary to decrease these pulsations placing a shut-off valve between the pressure source and the instrument. A wrong choice of the instrument could bring to a fatigue breakage.

#### **3.4 Overpressure**

Overpressure stresses the sensing element decreasing its life and accuracy. Therefore it is recommended to choose an instrument whose full scale range is wider than the maximum working pressure and which is more likely to absorb overpressure. Shocks could be treated just like the pulsating pressures. Long duration overpressure can be avoided mounting a shut-off valve calibrated on site. Even only one overpressure episode could permanently damage the instrument.

#### **3.5 Vibrations**

When the instrument support receives vibrations, instruments must be mounted remotely and connected through capillaries (for strong and irregular vibrations). If this should not be possible mount the instrument in orthogonal position in comparison to the vibrations plan. Vibrations can be detected through permanent false micro-switch functioning.

#### **3.6 Micro-switch**

Higher values of resistive charge than those indicated on the label should not be applied. If this occurs the superficial temperatures of the case and of the gages containing the cables could increase making the installation unsafe. According to the micro-switch type it is necessary to consider the differential value between the working pressure and the re-establishment one.

#### **3.7 Differential**

The differential or dead-band value is shown on label and it is the difference between the working pressure value and that of the micro-switch rearm. The set point and the differential value must allow to the micro-switch to rearm correctly. This is very important for the micro-switch provided of adjustable differential from 10% to 50% of the full working scale.

The differential value can be adjusted operating on the graduated roller placed under the micro-switch. The roller is graduated from letter A to letter F which represent respectively the minimum differential (around 10% of the adjustment range) and maximum differential (about 40-50% of the adjustment range). During differential adjusting remember that the device increases the set working pressure value leaving the rearm untouched, acting on the micro-switch click force. It is important to remember that when the instrument provided of a micro-switch is calibrated at the factory and then adjusted on site. It is also important to remember this when the instrument works in depression (vacuum).

#### **3.8 Protection degree**

According to EN 60529 regulation. It concerns the instrument's top when completely tightened. A special nut lock mounted on the case body should be tightened to the top preventing any removal during normal conditions.

#### **3.9 Corrosive fluids and gas liquids**

The sensing element thickness is generally moderate so it works in considerable mechanical stress conditions, The chemical compatibility with the fluid to measure has to be considered. No common material can be immune from a chemical attack whose extent can be influenced by the following conditions: concentration, temperature and the mixture type among different chemical substances. A chemical attack can rapidly lead to a corrosion breakage.

### 4. Improper use

#### **4.1 Breakage for fatigue**

Pressure can cause mechanical stress producing a permanent damage and a small crack on the sensing element. The crack can be more dangerous if happen during compressed and liquid gas measuring. The stress breakage release the fluid slowly so that the pressure inside the case increases and the safety gasket opens.

#### **4.2 Breakage for overpressure**

It occurs when a higher pressure than the declared one for the sensing element is applied (e.s. when an instrument for low pressures is installed on a system working with high pressure). The effects of this kind of damage, commonly more relevant in case of compressed gas measuring, are not predictable and can lead to the case explosion despite the safety gasket. Spikes can happen in hydraulic and pneumatic systems especially after the opening and the closing of valves.

Spikes amplitude can be much higher than the working pressure. The instrument cannot detect them because of their quickness so that they are invisible for the operator. They can lead to the permanent breakage on the instrument. A choke can reduce the overpressure amplitude pike transmitted to the sensing element. A shut-off valve could protect the instrument from all pressures higher the one the instrument is calibrated for.

#### **4.3 Breakage for corrosion**

It happens when the sensing element material is attacked by the process fluid chemical substances or by substances around the pressure system. The damage is shown by a leakage or by a stress crack. In this case the use of a diaphragm compatible with the process fluid or the use of a fluid diaphragm seal is recommended.

#### **4.4 Breakage for explosion**

It can be caused by a powerful release of thermal energy due to chemical reactions such as the oxygen adiabatic compression reaction in presence of hydrocarbons. The inability to force this kind of damage is generally accepted. It is recommended to clean and de-grease the wetted parts with special products in case the instrument has to be interchanged in the system in order to prevent any chemical reaction. In case of use of highly oxydant agents (e.s.oxygen) it is essential that the producer is informed during order procedure.

#### **4.5 Breakage for vibrations**

The mobile parts of the instrument can be damaged by vibrations even if they are not relevant. At the beginning they can cause a working accuracy decrease and then to damages which can involve the general functioning of the instrument. In order to prevent vibrations damage the instruments should be mounted remotely, in safe areas and connected through a capillary.

#### **4.6 Stress breakage caused by vibrations**

Another effect caused by wide amplitude vibrations can be cracks in the sensing element structure with process fluid leakage as a consequence.

#### **4.7 Mechanical stress**

Instruments should not receive any mechanical stress. If the installation points are under mechanical stress, the instruments should be mounted remotely, in safe areas and connected through a capillary.

Instruments must be selected among those provided of wall or panel anchorage.

## **5. Maintenance**

The instrument's characteristics should be maintained during time through a special maintenance program which should be carried out and managed by qualified technicians.

Le caratteristiche dello strumento devono essere mantenute in modo da prevenire i pericoli derivanti da temperature elevate, ed i rischi di incendio e di esplosione derivanti da eventuali anomalie che si verificano nel loro esercizio.

As for heavy work instruments operating in severe conditions plants (vibrations, pulsating pressures, corrosive or sedimentous fluids, fuel or inflammable fluids) we recommend to schedule their replacement according to the maintenance program schedule. In case the instrument does not work properly it is necessary to proceed to an unscheduled checking procedure.

#### **5.1 Routine check**

In order to verify the sensing element condition install the instrument on the pressure generator introducing an interception valve between them. Apply the maximum pressure value to the gauge and exclude it from the pressure source through the valve. Any possible leakage of the sensing element can be noticed from the slow return of the pointer to zero.

#### **5.2 Recalibration**

If after recalibration results are different from the nominal values declared on the catalogue sheet the recalibration procedure should be repeated. It is recommended to return the instrument to NUOVA FIMA for this procedure.

The verification of the intervention point must be performed depending on the conditions of use of the instrument and in particular the frequency with which successive interventions.

By way of example, it is suggested that a control every six months in the case of a reduced number of interventions newspapers, while the range for the control must be reduced in case of frequencies higher intervention.

A correct definition of the interval between successive tests of the switching point can be made by evaluating the results of the checks carried out, increasing the interval when successive checks provide positive results or otherwise reducing it when the results are negative.

**NUOVA FIMA will not be responsible for any non authorized intervention on the instrument. Moreover the contract warranty and the CE Conformity Declaration will be no longer valid.**

## **6. Disposal**

Any process fluid residue remaining inside the instrument must be removed before disposal. It is also recommended to remove tops and plastic components and to proceed to disposal as aluminum and stainless steel.