FOSTEN
AUTOMATION

F500G

Gauge Pressure Intelligent Transmitter

HART COMMUNICATION PROTOCOL

www.fosten.com.br

INDEX

1. OPERATION PRINCIPLE

The gauge pressure intelligent transmitter **F500G** is based on the capacitive sensor principle. Capacitive sensors are devices that receive and respond to a physical/chemical stimulus or signal. In turn, this technology is based on the capacitor concept, being able to detect the presence of objects without their contact. The sensor is triggered when it detects the presence of the object at a certain distance. The operating principle is based on changing the capacitance of the detector plate located in the region called sensitive.

But what is a capacitor? A capacitor is a simple device, being a passive electronic component that stores charge and energy in the electrostatic field. It consists of two electrical conductors (known as plates) that store opposite charges. These plates are separated by a special type of isolator (ie, a nonconductor) known as a dielectric. Because these plates have opposite charges, the storage process is characterized by the movement and transfer of electrons from one plate to another. The potential difference caused by this movement is the same as the potential energy stored in the plate. The capacitance of a capacitor is the ratio of the potential difference (PDD) between the plates and the charge on each of the plates. In turn, the capacitance is inversely proportional to the distance between the plates and directly proportional to the area of the plates and the dielectric constant of the isolating material. Based on this concept on capacitors, the capacitive sensors work in a very similar way to the capacitor. The difference is in the way the plates are arranged. In the sensors, the plates are arranged parallel to each other. The operating principle is based on the change in the capacitance of the detector plate located in the region called sensitive, that is, when the dielectric in the middle varies.

The functioning of this capacitive sensor, in turn, is based on the variation of the electric field in the place in front of the electrode of the sensor, which we call the active zone. The sensor will be activated when the object approaches a certain distance and it is positioned in front of the active zone. The distance at which the sensor is triggered is called the switching distance, which can vary greatly depending on the permittivity constant in the diameter of the sensor, the material and mass of the approximate body and also the position at which the sensor is placed. The sensor also comprises an integrated RC oscillator circuit. As a metallic or non-metallic substance approaches the active zone, the capacitance value will change. As the capacitance varies, the frequency of the oscillator circuit changes. This frequency change is sent to another circuit called a detector, where it will transform the frequency variation caused by the capacitance variation into a voltage signal. The trigger schmitt circuit, in turn, has the purpose of transforming the voltage signal into a square wave. Last but not least, the switching circuit. The switching circuit is where the square wave will be excited and transferred to the external circuits.

Capacitive sensors can be used in the most varied types of processes, being able to monitor and detect the presence of dust, concentration of gases, objects and products of an organic and mineral nature, metals and non-metals, solids and liquids, even when fully submerged in the product.

The capacitive gauge type sensor, as it is installed directly in the process, only reads on the high side. The low side is inactive.

2. MAIN APPLICATIONS

- Sugar and Alcohol
- Fertilizers
- Chemistry
- Food and Beverages
- Petrochemical
- Pharmaceutical
- Energy
- Plastic
- Among others

3. TECHNICAL CHARACTERISTICS

The following are the main technical characteristics of the F500G intelligent gauge pressure transmitter.

Accuracy	± 0,075%
Exit sign	4 a 20 mA
Communication protocol	Hart
Feeding	9 to 32 Vcc, without polarity – 12 mA
Operating temperature	-20 °C to 100 °C
Storage Temperature	-20 °C to 100 °C
Environment temperature	-20 °C to 85 °C
Types of exit	Linear and square root
Degree of protection	IP66
Response Time	50 ms
Rangeability	80:1
Thermal stability	± 0,15% URL, 5 years
Display	Backlight type
Approximate weight with support	3,5 kg for differential and gauge version

4. DIMENSIONAL

5. MOUNTING SUPPORT

The F500G intelligent pressure transmitter, in its gauge version, comes with a mounting support, suitable for mounting on 2" diameter pipes.

6. F500G GAUGE PRESSURE INTELLIGENT TRANSMITTER

The F500G gage pressure intelligent transmitter is ideal for applications where direct mounting in the process is required. The sensor reading is only taken on its high side, while the low side is inactive. For greater ease and agility in the field, it can be supplied from the factory with male or female connection, making it very simple to be installed by the user.

Below we have the sale codes for purchasing and throughout this instructional and operational manual, more specifically in the spares section, the sale codes for purchasing spare parts.

PRODUCT									
F500G	: Intelligent Gauge Pressure Transmitter								
.	**COMMUNICATION PROTOCOL**								
.	H	: 4 to 20 mA Hart							
.	.	**CALIBRATION RANGE**							
.	.	2	: 0 to 5000 mmH2O						
.	.	3	: 0 to 25000 mmH2O						
.	.	4	: 0 to 25 Kgf / cm^2						
.	.	5	: 0 to 68 Kgf / cm^2						
.	.	6	: 0 to 160 Kgf / cm^2 (Sob Consult)						
.	.	.	**CAPACITIVE SENSOR DIAPHRAGM / FILLING OIL**						
.	.	.	1	: Stainless Steel / Silicone Oil					
.	.	.	.	**SENSOR MATERIAL**					
.	.	.	.	I	: Stainless Stell				
.	.	.	.	.	**SHELL MATERIAL**				
.	.	.	.	.	A	: Aluminium			
.	.	.	.	.	.	**SHELL ELECTRICAL CONNECTION**			
.	.	.	.	.	.	1	: 1/2 NPT Thread		
.	.	.	.	.	.	.	**PROCESS CONNECTION**		
.	.	.	.	.	.	.	F	: 1/2 NPT Female	
.	.	.	.	.	.	.	M	: 1/2 NPT Male	
.	.	.	.	.	.	.	R	: Remote Seal	
.	.	.	.	.	.	.	Z	: Special	
.	.	.	.	.	.	.	.	**MOUNTING BRACKET**	
.	.	.	.	.	.	.	.	0	: Without Mounting Bracket
.	.	.	.	.	.	.	.	1	: With Mounting Bracket - Type L
.	.	.	.	.	.	.	.	2	: Special
.	.	.	.	.	.	.	.	.	**PAINT**
.	.	.	.	.	.	.	.	.	0 : Standard Sensor Br (Synthetic Liquid Paint)
.	.	.	.	.	.	.	.	.	1 : Special
.	.	.	.	.	.	.	.	.	.
F500G	**H**	**2**	**1**	**I**	**A**	**1**	**F**	**1**	**0**

7. LOCAL ADJUSTMENT

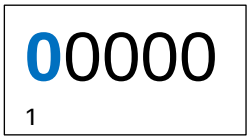
The local adjustment functions include: Zero Trim, Damping, Unit, Range.

The following table shows the operation codes and their corresponding functions:

CHARACTERS DISPLAYED IN THE LOWER LEFT CORNER	FUNCTION
0	Display value.
1	The user can enter the operation code such as 2,3,5,6 or 7 to execute the corresponding function respectively.
2	Configuration of PV unit.
3	Configuration of the lower range value.
4	Configuration of the upper range value.
5	Damping.
6	Zero Trim.
7	Zero and Span configuration.

CONFIGURATION OF THE PV UNIT.

Press Z key to enter the menu mode.
The lower left side of the display shows the operation code 1 to indicate the “Input Operation Code” function. The first 0 will start flashing.



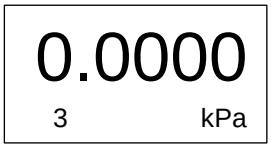
Press the Z key to shift until the last 0 starts flashing.
Press the S key to change the value.
Enter multiple operation codes to perform the corresponding function.
For example enter 2 to set the unit.

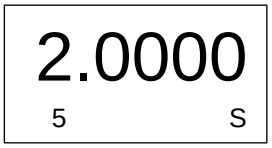
Press the S key until the last number is 2, then press the Z key.
The down arrow will start flashing.

Press the S key to save the operation code. The bottom left side of the display will show the operation code 2 to indicate enter the function “Unit Settings.”

MINIMUM RANGING CONFIGURATION.

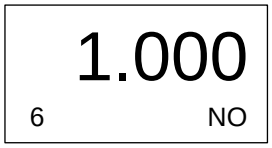
Enter the operation code to execute the corresponding function, respectively.



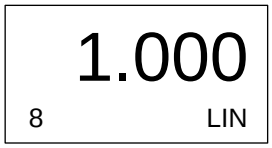


Input **** 3 (* means a random number), Input Value Definition of The Lower PV range.

Input **** 5 (* means a random number), enter in Damping Adjustment.



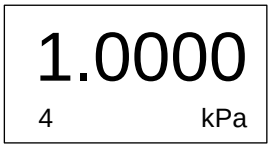
Input **** **6** (* means a random number), enter in Zero Trim.



Input ****8 (* means a random number), enter in Output type.

MAXIMUM RANGE CONFIGURATION.

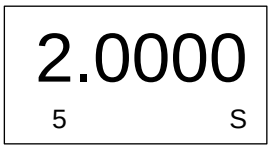
After completing the setting of the lower PV value, enter the Upper range value of the PV.



The way to enter an upper value is the same as for entering the lower value (Please see PV for lower range value).

DAMPING CONFIGURATION.

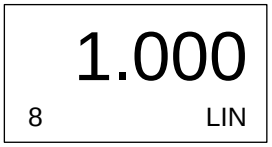
Enter the operation code 5 to enter damping adjustment, or it will enter automatically on damping



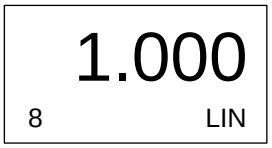
The way to enter the damping value is the same as for entering a lower value. (See PV for lower range value).

OUTPUT TYPE CONFIGURATION:

The **F500** will automatically enter “Output Setup” after Zero Trim.

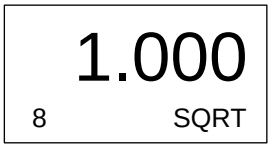


Enter operation code “8”. In output type configuration mode, the operation code “08” is displayed at the bottom left side of the display. "LIN" or “SQRT” will be displayed at the bottom.

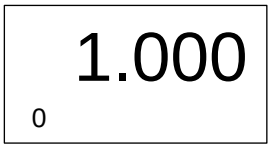


Press S key, then “LIN” symbol will flash, indicating enter into output and the selection is “Linear Output Mode.”

Press the “S” key again to change, the “SQRT” symbol flashes, indicating that the selection is “Square Root Output Mode.”

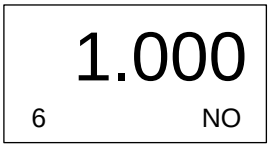


Press M or Z key to save output and complete the configuration.



ZERO TRIM.

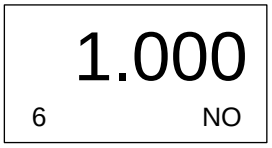
Press the C and Z key simultaneously, and hold for less than 5 seconds.



Enter operation code “6”.

After the adjustment of the damping values.

In Zero Trim function mode, the operation code “6” is displayed at the bottom left side of the display and the pressure value is shown in the middle. “YES” or “NO” will be displayed at the bottom.



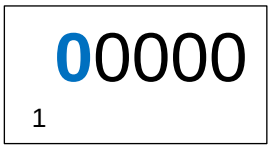
Press “S” key to change, “YES” symbol will flash, indicating that the selection is **“TRIM”.**

When displaying “YES”, press “C” key or “Z” key to execute the function Zero Trim

The pressure value will be set to “0” after successful operation.

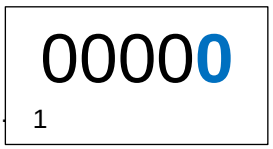
BEARISH TRIM.

Pressing the “C” and “S” keys simultaneously, and keeping them pressed for less than 5 seconds, it will enter the bearish TRIM mode.



Enter operation code “9” as follows:

Press “Z” key to enter the manual mode. The bottom left side of the display will show the operation code “1” to indicate the function “Entry Operation Code.

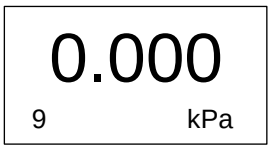


The first zero will start flashing.

Press the “Z” key to change until the last “0” starts flashing.

Press the “S” key to increase the setting number to “9”.

Press “Z” key, the down arrow will start flashing.



HIGH TRIM.

Enter Bearish Trim mode, then press “Z” or “C” key to skip the berish compensation and enter the high TRIM mode, and the lower left side of the display will show the operation code “10”.

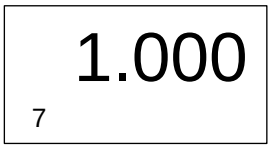
It will automatically enter “**High Trim”** after successfully operating **“Low Trim”.**

Use the following steps for **TRIM:**

1. Using a pressure source, apply a pressure equivalent to the higher calibrated value.

2. Enter the reference pressure to calibrate. The input method of data refers to “Setting the PV Lower Rate Value”.

ZERO SPAN ADJUSTMENT.



Simultaneously pressing the S and Z keys, and holding down at least 5 seconds, it will enter Zero and Span adjustment mode and the operation code "07" will be displayed at the bottom left side of the display.

Use the following steps to adjust Zero and Span:

1 – Using a pressure source, apply a pressure equivalent to the lower calibrated value.

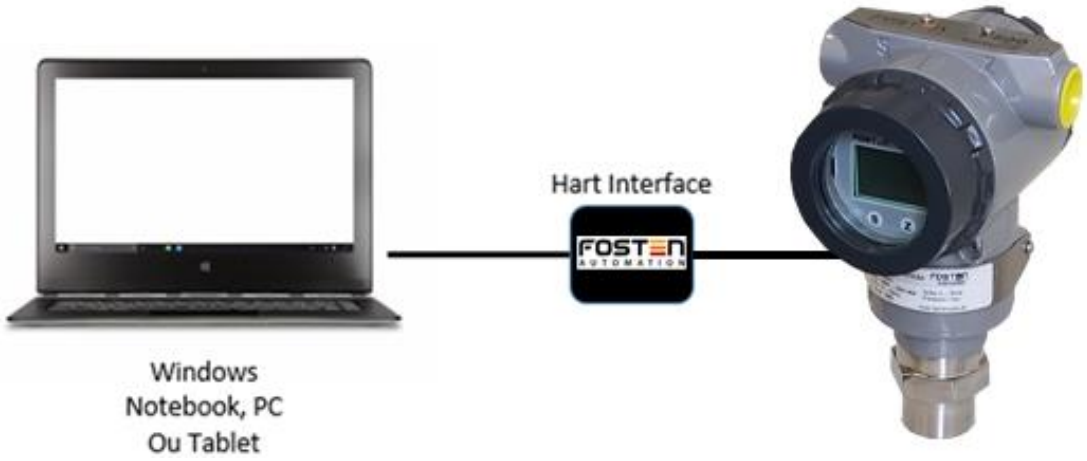
2 – Press the Z key for five seconds to adjust the 4mA point.

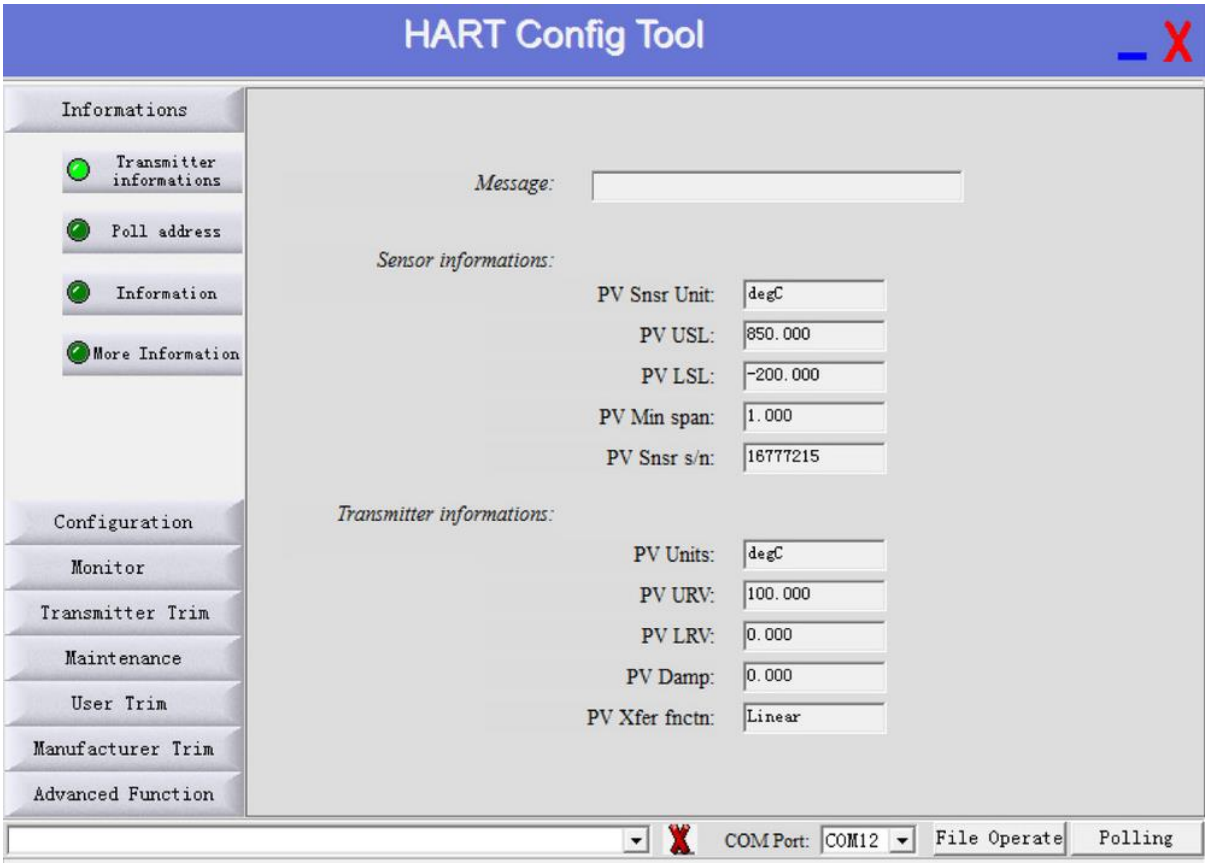
3 – Apply the pressure equivalent to the highest calibrated value.

4 – Press the S key for five seconds to adjust the 20mA point. Check whether the output is 20mA.

8. CONFIGURATION VIA SOFTWARE

The F500 line transmitters are configured using the Hart Config Tool software, which is free and available on the website. A Hart communication interface of any model/manufacturer is required.





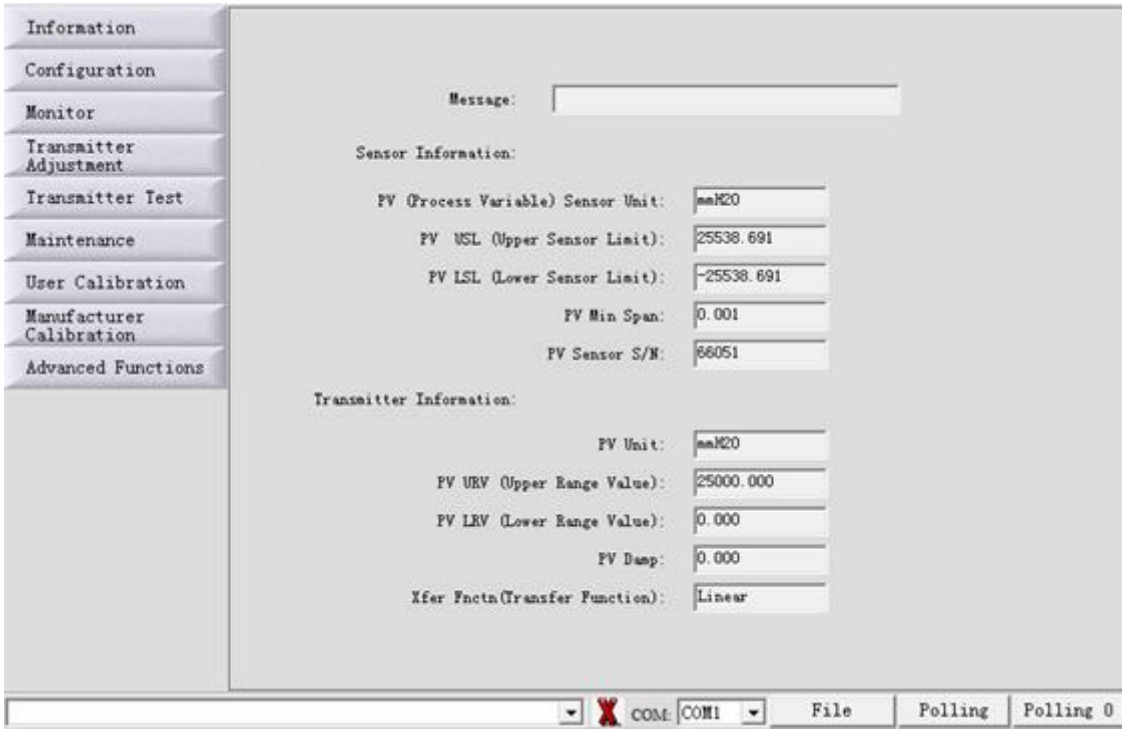
8.1. CONNECTING THE INSTRUMENT

Make sure the instrument and the Hart interface are turned on.
Access the Hart Config Tool software and click on the "Polling 0" button in the lower right corner.

IMPORTANT

If necessary, a resistor must be connected in series with the positive pole in the instrument

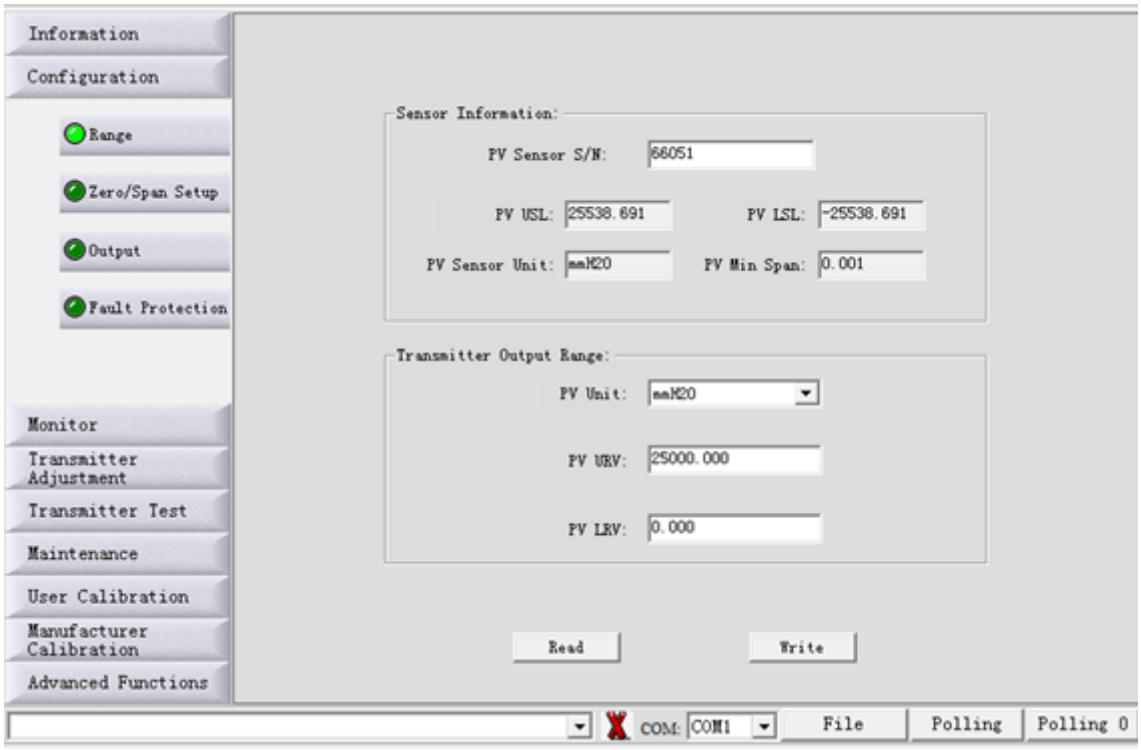
By choosing the "Information" button, all the information contained in the instrument will appear.



8.2. CALIBRATION

To adjust the calibration range, just choose the "Configuration" button.
In the "Range" sub-option, the minimum and maximum ranges will be displayed ("Sensor Information" box) and then the working range in which the instrument is configured ("Output Range" box).

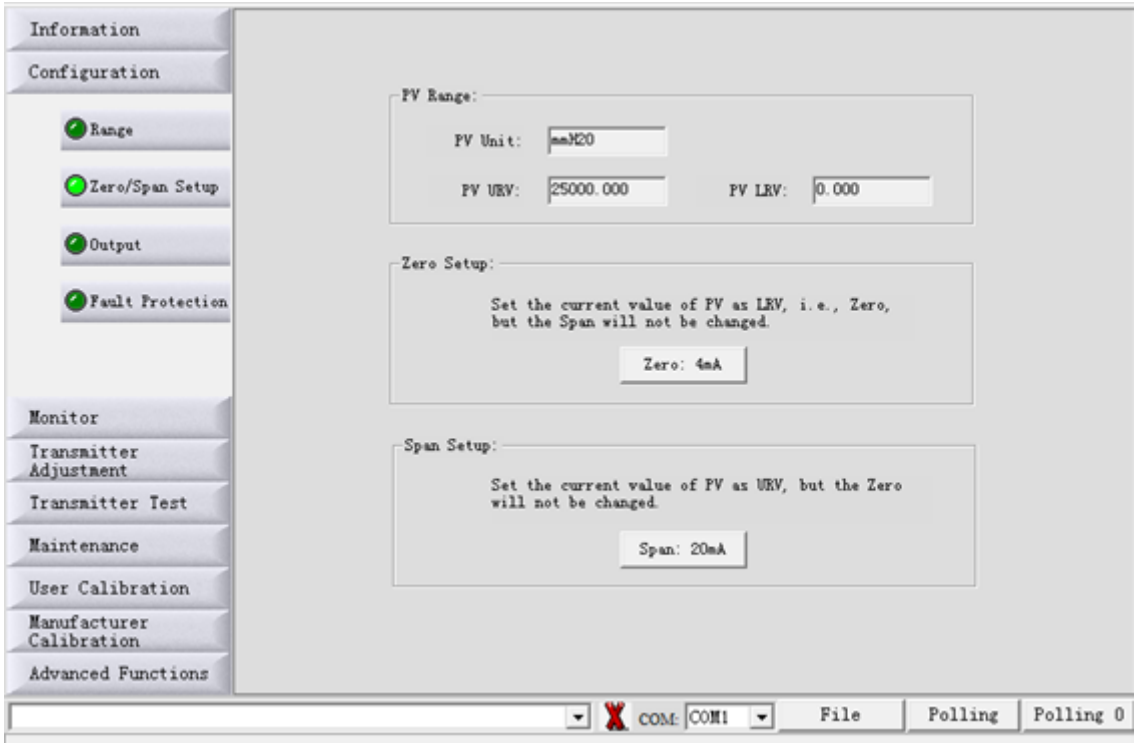
To change this range and adjust it, just select the LRV (low pressure or minimum value) and the URV boxes (high pressure or maximum value). Making change, click on the "Write" button to confirm and save.



8.3. CURRENT TRIM

To perform the current trim, choose the "Configuration" button and the "Zero / Span Setup" sub-option.

On the next screen that will open, choose the "Zero: 4mA" button to adjust the current value to 4 mA, taking the minimum value (LRV) as a reference. Choose the "Span: 4mA" button to adjust the current value to 20 mA, having as reference the maximum value (URV).

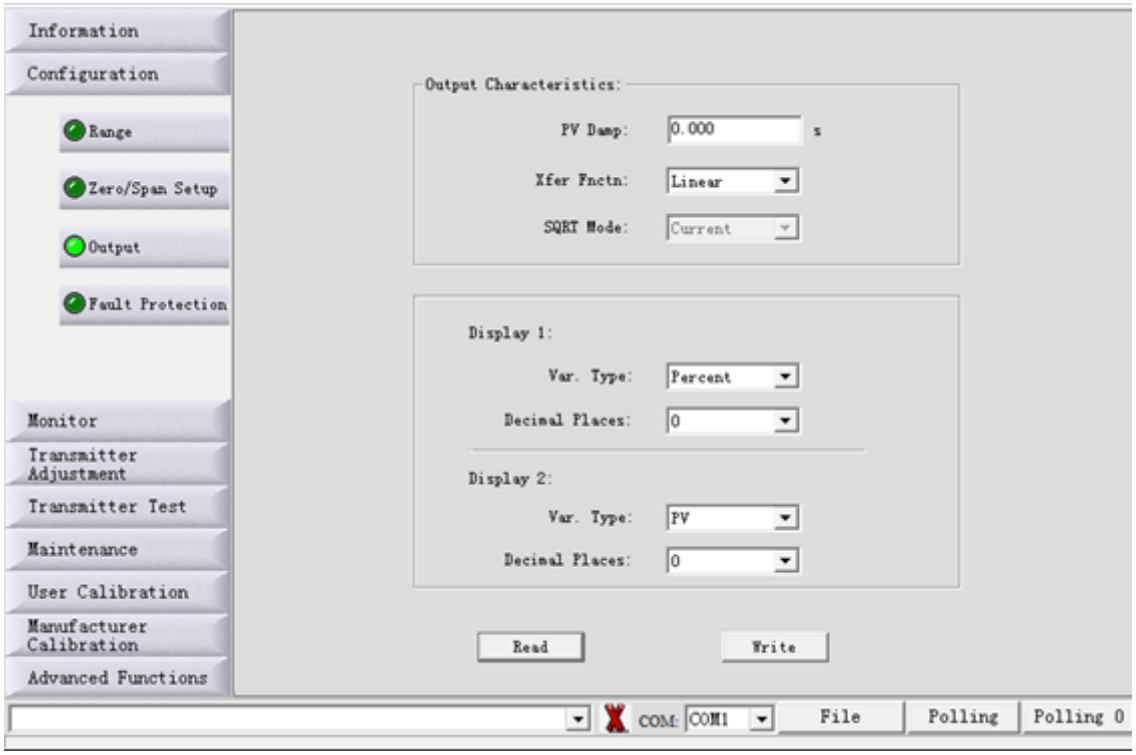


8.4. DAMP, LINEAR OUTPUT OR SQUARE ROOT AND USER UNIT

To adjust options such as Damp, output to linear type or square root extraction, as well as choose the units to be shown on the display, choose the "Configuration" button and then the sub-option: "Output".

On the next screen that opens, choose in the "Output Characteristics" box the options for Damp, linear function or square root.

In the table below, select the desired option for Display 1 and Display 2.

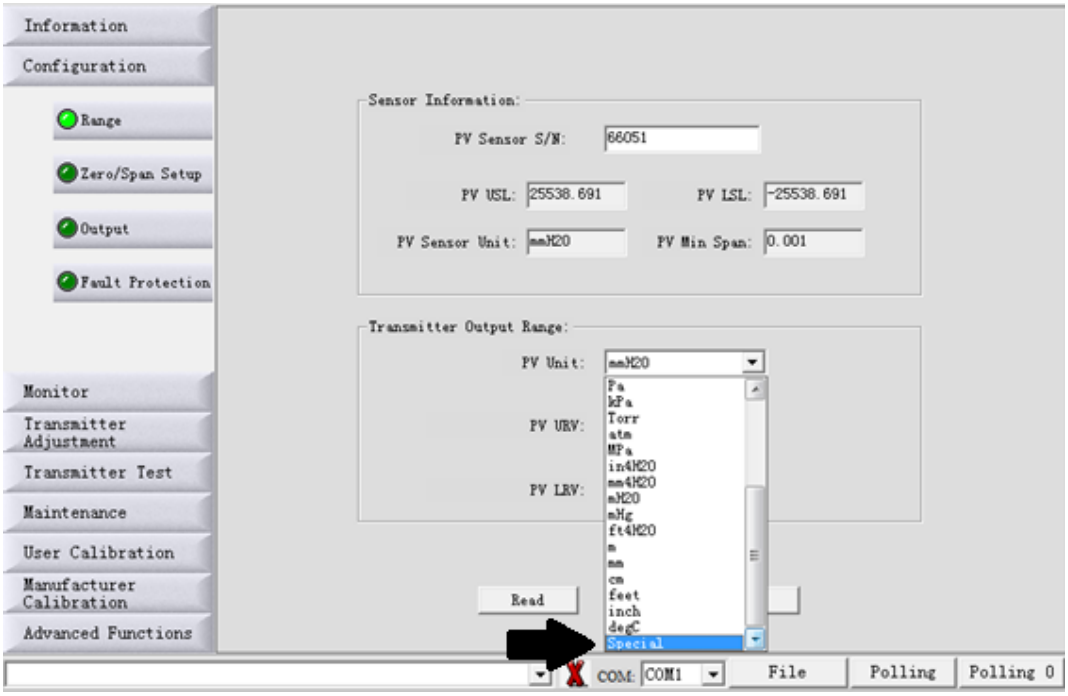


8.5. INCLUDING USER UNIT

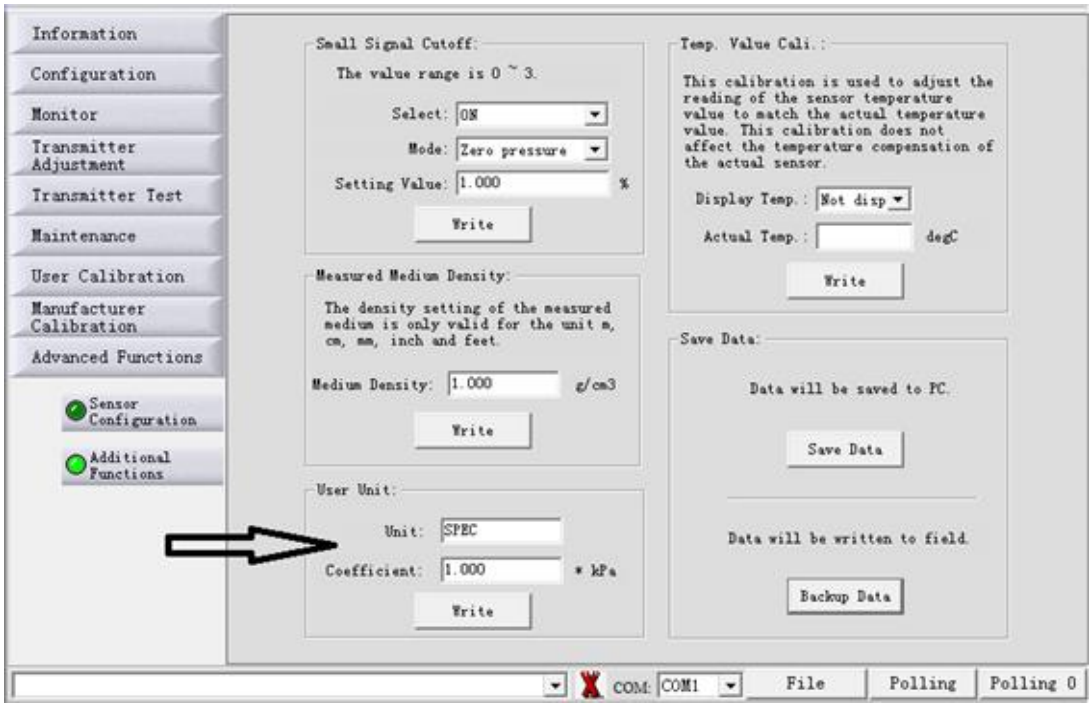
To include a user unit (drive), choose the "Configuration" button and the sub-option: "Range". In the box "Transmitter Output Range", option "PV Unit", select the desired unit.

If the unit to be chosen is not listed for choice, it will be necessary to make a simple adjustment as described below:

a) In the "PV Unit" select "Special". At this time, the calibration value will automatically be converted to kpa.



b) Go to the last button "Advanced Functions" and choose the sub-option: "Additional Functions" as shown on the following screen.



In the "User Unit" box, indicated by the arrow in the previous figure, write the user unit you want to use.
Enter the value of the "Coefficient", which must always be the maximum value of the calibration range divided by the maximum value of the user unit range.

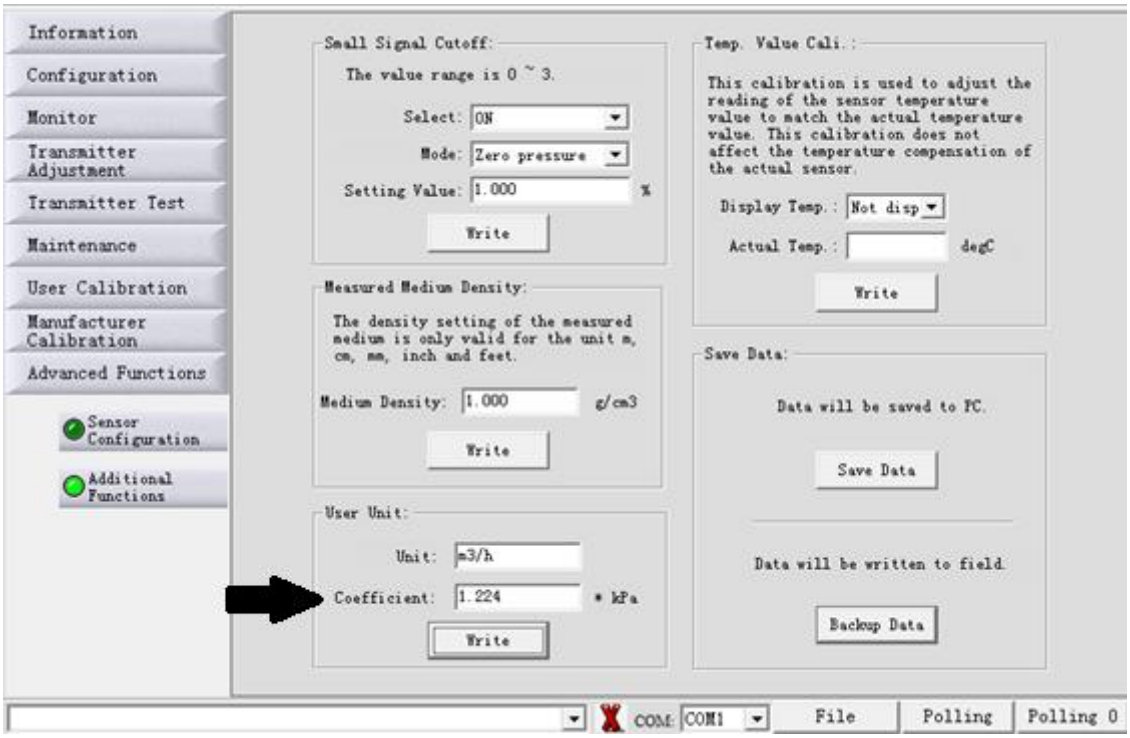
Example:
The instrument works from 0 to 25000 mmH2O, which transformed into Kpa will be from 0 to 244727 kpa.
The user unit you want to work with is from 0 to 200 m3/h.
So, the value of the "Coefficient" will be 244727 ÷ 200, which will result in 1223.63 (or 1224 rounded off to the decimal point).

Maximum range value

÷

Maximum unit value

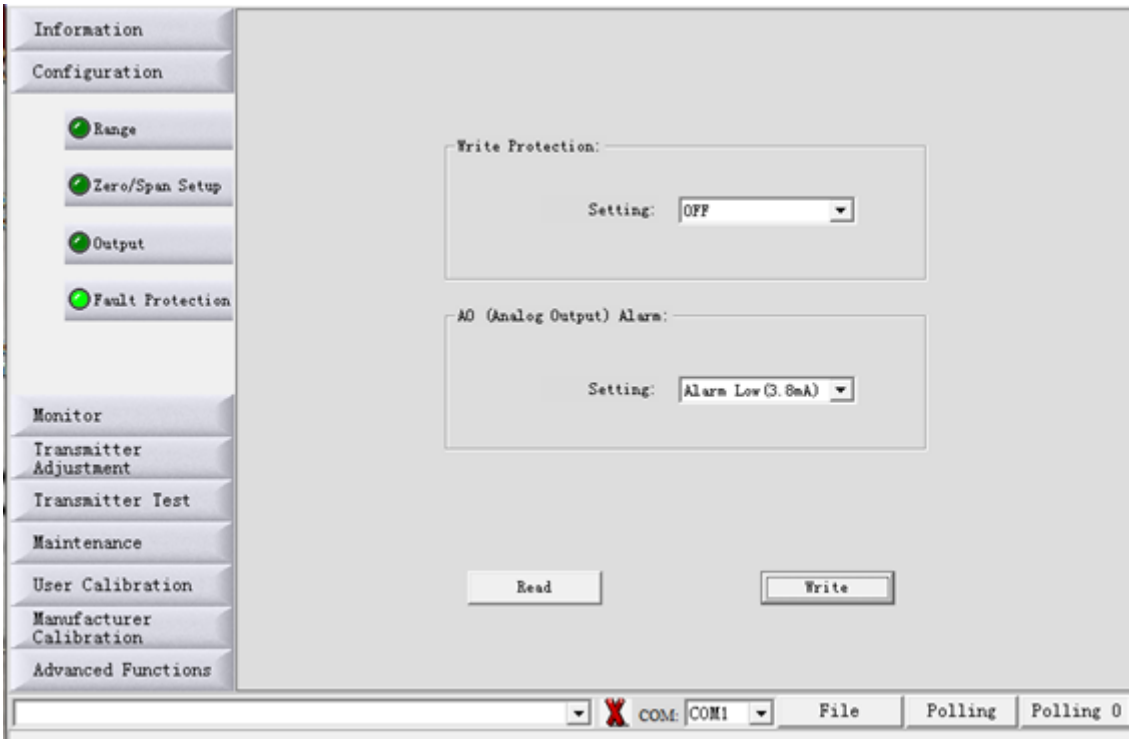
From this setting, the user unit m3/h, which did not exist in the selection list, starts to appear on the display of the instrument.



8.6. WRITING AND ALARM PROTECTION

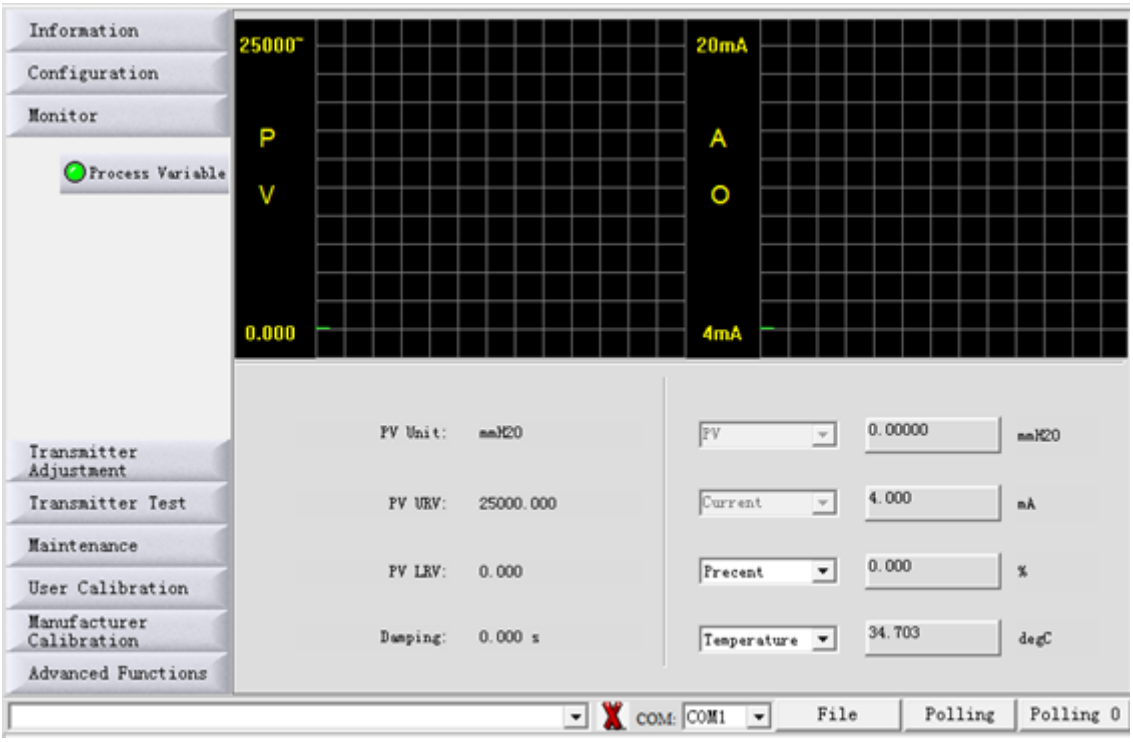
To enable the writing protection, preventing allowed changes to the configuration already made and saved in the memory of the instrument, simply choose the "Configuration" button and the sub-option: "Fault Protection".

On this same screen, there is also the possibility of setting the alarm, in which you can select an option for very low or very high current to send an alarm signal.



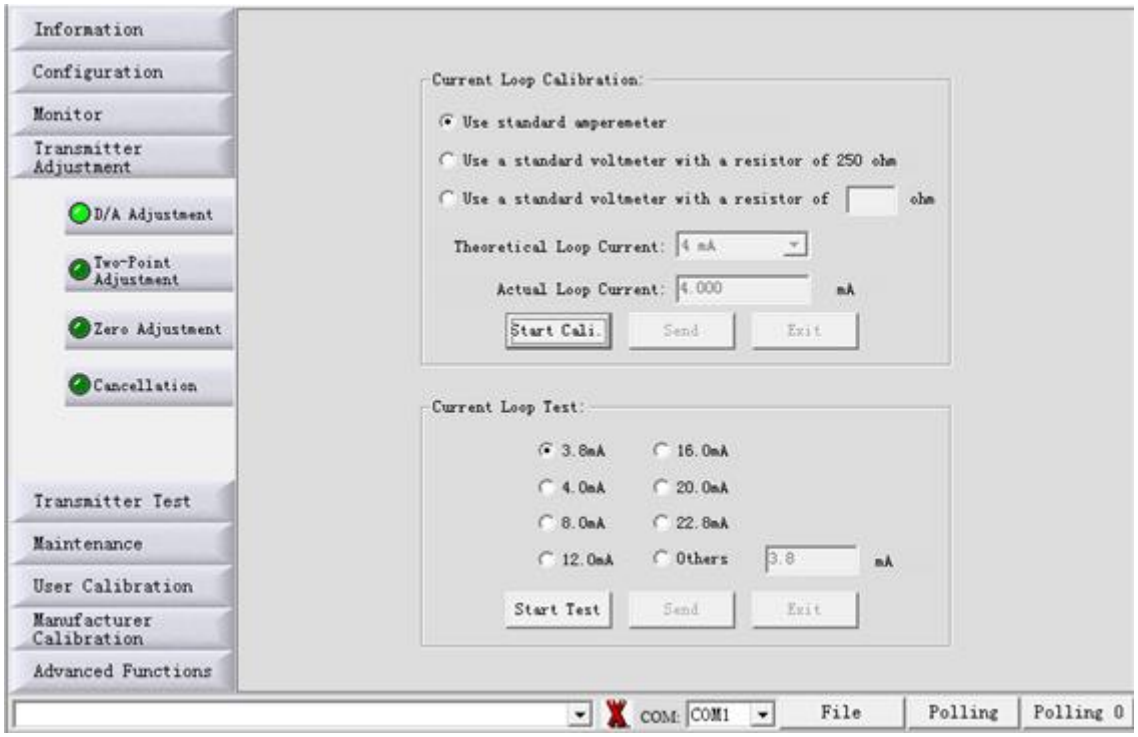
8.7. MONITORING VARIABLES

Choose the "Monitor" button and the "Process Variable" sub-option. A screen will be available in which the variables can be selected to be monitored and displayed in a graph.



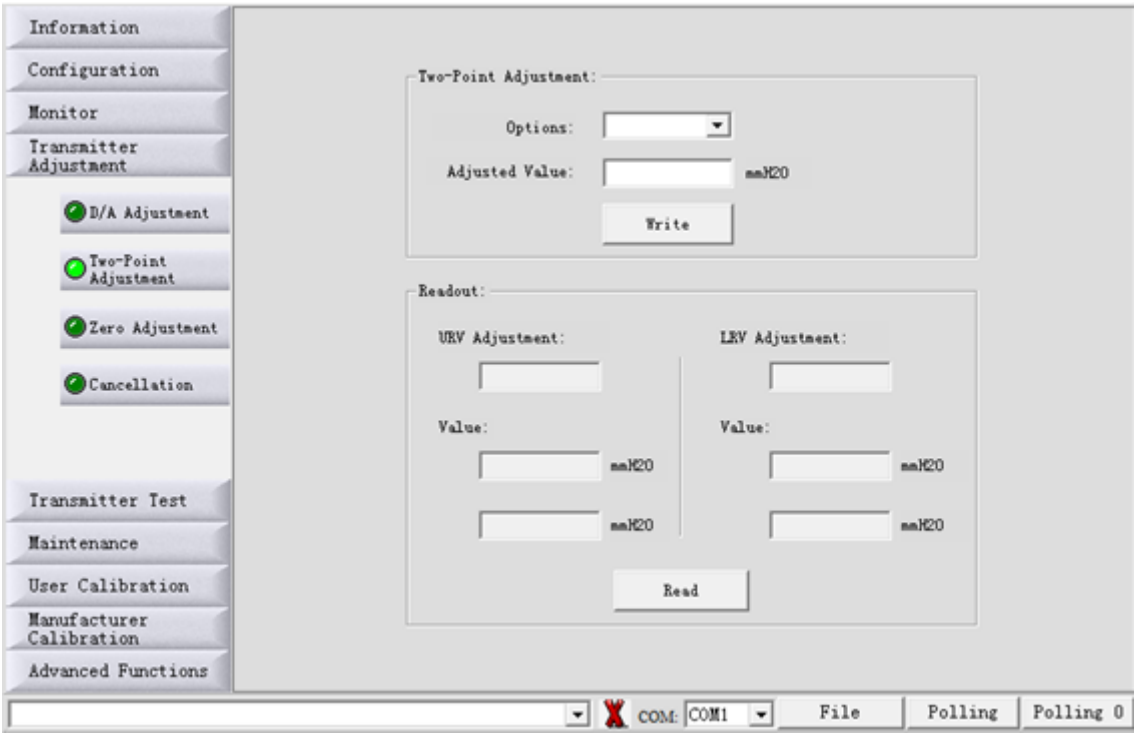
8.8. CURRENT TRIM AND LOOP

Choose the "Transmitter Adjustment" button and the "D/A Adjustment" sub-option to perform the current trim (4 to 20 mA), using a multimeter as a reference. To perform a simulation and test with various current values, see the options in the "Current Loop Test" table.

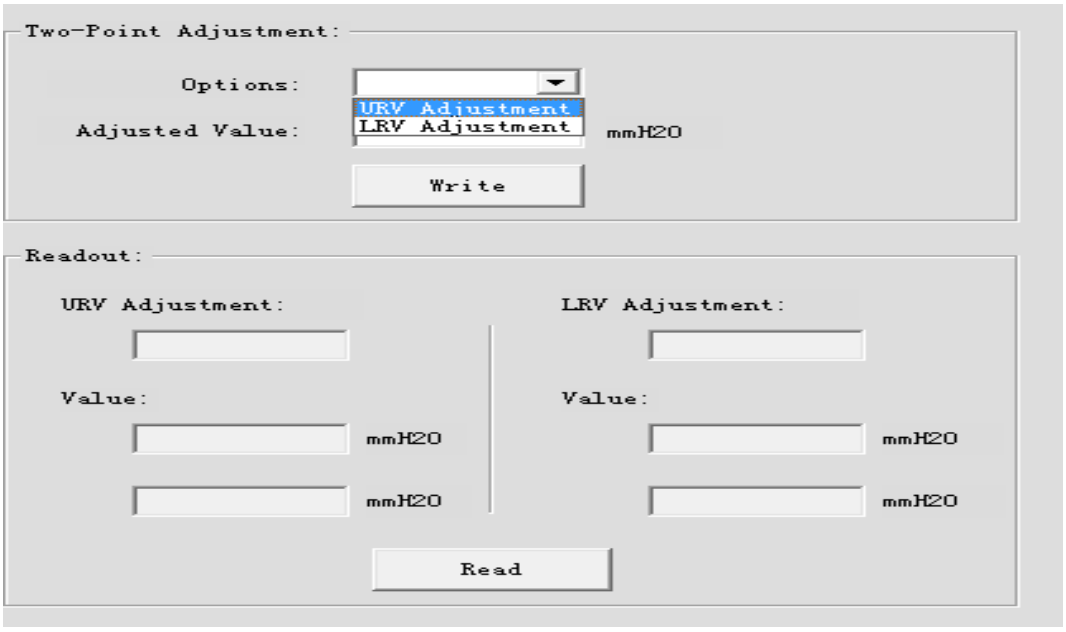


8.9. LOWER TRIM AND UPPER TRIM

To perform the pressure trims, choose the "Transmitter Adjustment" button and the sub-option: "Two-Point Adjustment".

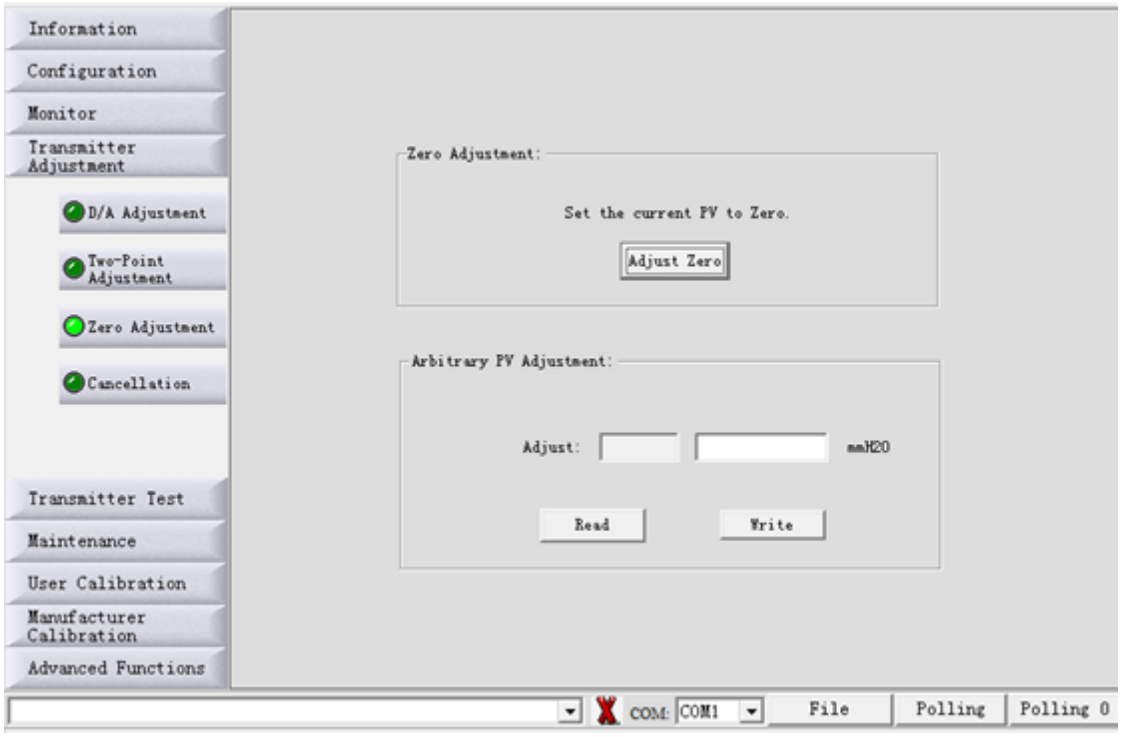


In the "Options" selection box, you can choose whether you want to make a lower trim or a higher trim.



8.10. ZERO TRIM

To perform the zero trim, choose the "Transmitter Adjustment" button and the sub-option: "Zero Adjustment".



9. SPARE PARTS

The **F500** instrument line offers a wide variety of single pieces, also called spare parts. Practically all items can be purchased separately, through the list of codes below.

PRODUCT			
500-0010	Blind Cover - Universal		
.	**MATERIAL**		
.	A	: Aluminum	
.	.	**PAINTING**	
.	.	1	: Standard
.	.	Z	: SPECIAL (see notes)
.	.	.	
500-0010	**A**	**1**	

PRODUCT			
500-0012	: Cover with Viewfinder - Universal		
.	**MATERIAL**		
.	A	: Aluminum	
.	.	**PAINTING**	
.	.	1	: Standard
.	.	Z	: Special (See Notes)
.	.	.	
500-0012	**A**	**1**	

PRODUCT			
500-0016	: Housing with Hart pump for pressure transmitter (without covers)		
.	**MATERIAL**		
.	A	: Aluminum	
.	.	**PAINTING**	
.	.	1	: Standard
.	.	Z	: Special (See Notes)
.	.	.	
500-0016	**A**	**1**	

PRODUCT	
500-0020	: Hart pump for pressure transmitter

PRODUCT		
500-0026	: - L-type mounting support	
.	MATERIAL	
.	1	: Carbon steel
	2	: Stainless steel
.	.	
500-0026	**1**	

PRODUCT	
500-0060	: - Hart main board for pressure transmitter

PRODUCT	
500-0014	: sealing ring for blind cover / with viewfinder – Buna N 7750

PRODUCT	
500-0016	: sealing ring for the electrical connection plug – Buna N 2117

PRODUCT	
500-0018	: sealing ring for the gauge sensor – Buna N 2136

PRODUCT			
500-000G	: Capacitive sensor for gauge pressure transmitter		
.	RANGE		
.	2	: 0 to 5000 mmH2O	
.	3	: 0 to 25000 mmH2O	
.	4	: 0 to 25 Kgf / cm²	
.	5	: 0 to 68 Kgf / cm²	
.	6	: 0 to 160 Kgf / cm² (Sob Consult)	
.	.	DIAPHRAGM MATERIAL AND FILLING FLUID	
.	.	1	: stainless steel - silicone oil
		MATERIAL IN THE BODY OF THE SENSOR	
.	.	.	
.	.	.	I : Stainless steel
.	.	.	.
500-000G	**3**	**1**	**I**

10. WARRANTY

The **F500** Pressure Transmitter has a 12 month warranty.
Such warranty becomes invalid once the following situations are detected:

- Incorrect installation of the instrument
- Use in inappropriate applications
- Mechanical damage by impacts

Electrical damage as a result of damage from other instruments in the industrial plant.

VERSION MAR2023 - 01

FOSTEN AUTOMATION
Rua Marginal Maurílio Bachega, 2652
Sertãozinho / SP

comercial@fosten.com.br

+ 55 16 3511-9800