FOSTEN
AUTOMATION

F500SR
4-20mA

Remote Seal and Pressure Transmitter

HART
COMMUNICATION PROTOCOL

INDEX

1. OPERATION PRINCIPLE

The intelligent pressure transmitter **F500** 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.
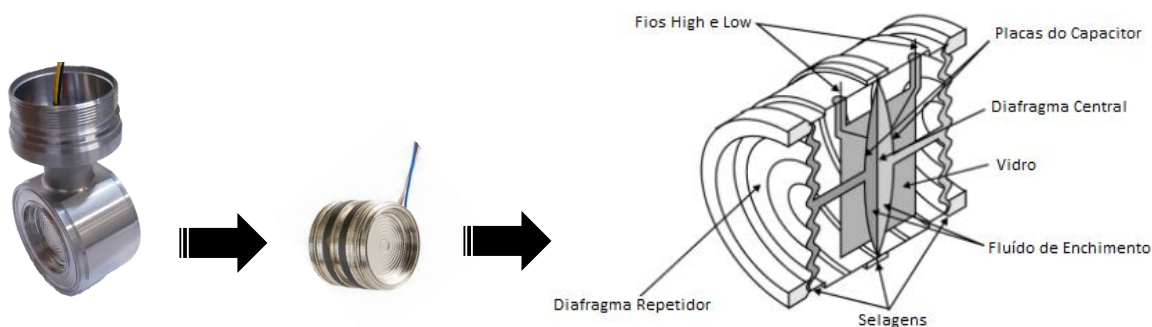
2. TYPES OF TRANSMITTERS

The **FOSTEN SERIES F500** intelligent pressure transmitter can have three models: Differential, Gauge and Absolute. The variation may occur depending on the need for the application / industrial process to be controlled. Each type will therefore imply a different mechanical joint precisely due to the operating principles.

In a Differential transmitter, the pressure on the process is applied to both the high and the low sides of the capacitive sensor.

In a Gauge transmitter, the pressure on the process is applied to the high side of the sensor, while the low side is open to the atmosphere.

In an Absolute transmitter, the pressure on the process is applied on the high side of the sensor, while on the low side there is a vacuum chamber.
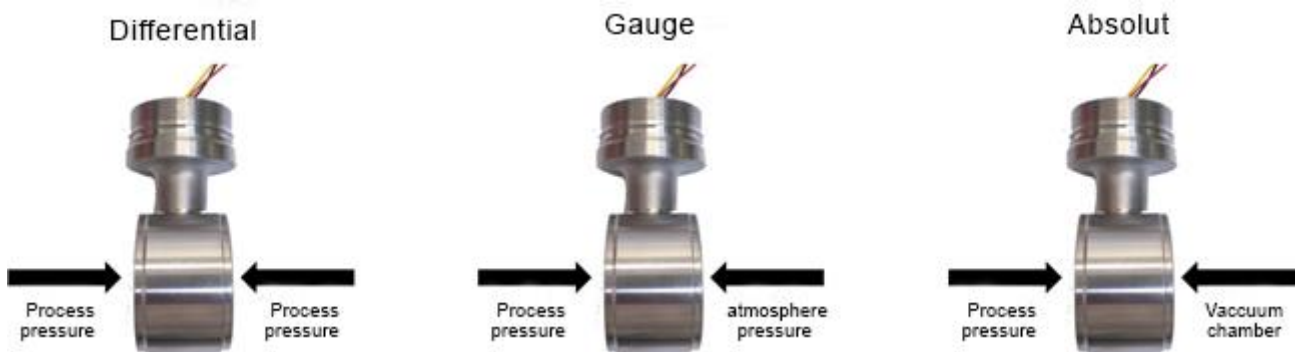
3. MAIN APPLICATIONS

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

4. TECHNICAL CHARACTERISTICS

The following are the main technical characteristics of the F500 intelligent 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 proteçtion	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

5. DIMENSIONAL

6. FIXING SUPPORT

The F500 intelligent pressure transmitter, differential, gauge and absolute models, come with a fixing support suitable for assembling on 2" diameter pipes. Available in two versions: carbon steel and stainless steel (these options are to be defined and chosen in the sales code).

7. F500SR REMOTE SEAL

The F500SR remote seal allows the pressure transmitter to perform the measurement process remotely, efficiently and accurately. It is used whenever the transmitter diaphragm cannot, due to some technical restriction, be used directly in contact with the process fluid. It can be built in three different ways (flanged, threaded or sanitary) the F500SR meets practically 100% of the applications that require remote measurements in different types of industrial applications.

Type of remote seal	Flanged, Threaded, Sanitary
Diaphragm blade	Stainless Steel, Hastelloy, Moxnel 400, Tantalum, Stainless Steel with Hallar or Tefzel coating
Filling fluid	Silicone DC704, Silicone DC200, Neobee

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										
F500-SRF	: Remote Seal - Flanged Type									
.	**PROCESS CONNECTION**									
.	1	: 1" 150 # (ANSI B16.5)		A	: 4" 150 # (ANSI B16.5)					
.	2	: 1" 300 # (ANSI B16.5)		B	: 4" 300 # (ANSI B16.5)					
.	3	: 1" 600 # (ANSI B16.5)		C	: 4" 600 # (ANSI B16.5)					
.	4	: 2" 150 # (ANSI B16.5)		D	: DN25 PN 10/40					
.	5	: 2" 300 # (ANSI B16.5)		E	: DN40 PN 10/40					
.	6	: 2" 600 # (ANSI B16.5)		F	: DN50 PN 10/40					
.	7	: 3" 150 # (ANSI B16.5)		G	: DN80 PN 10/40					
.	8	: 3" 300 # (ANSI B16.5)		H	: DN100 PN 10/16					
.	9	: 3" 600 # (ANSI B16.5)		Z	: Special					
.	.	**EXTENSION LENGHT**								
.	.	0	: 00 mm							
.	.	1	: 50 mm							
.	.	2	: 100 mm							
.	.	3	: 150 mm							
.	.	4	: 200 mm							
.	.	Z	: Special							
.	.	.	**FLANGE MATERIAL**							
.	.	.	1	: Stainless Steel						
.	.	.	.	**FLANGE DIAPHRAGM MATERIAL**						
.	.	.	.	1	: Stainless Steel					
.	.	.	.	2	: Hastelloy					
.	.	.	.	3	: Monel 400					
.	.	.	.	4	: Tantalum					
.	.	.	.	5	: Hallar Coating					
.	.	.	.	6	: Tefzel Coating					
.	.	.	.	.	**FLANGE FILLING OIL**					
.	.	.	.	.	1	: Silicone DC704				
.	.	.	.	.	2	: Silicone DC200				
.	.	.	.	.	3	: Neobee				
.	.	.	.	.	Z	: Special				
.	.	.	.	.	.	**CAPILLARY LENGHT**				
.	.	.	.	.	.	1	: 1 meter	8	: 8 meters	
.	.	.	.	.	.	2	: 2 meters	9	: 9 meters	
.	.	.	.	.	.	3	: 3 meters	A	: 10 meters	
.	.	.	.	.	.	4	: 4 meters	B	: 11 meters	
.	.	.	.	.	.	5	: 5 meters	C	: 12 meters	
.	.	.	.	.	.	6	: 6 meters	Z	: Special	
.	.	.	.	.	.	7	: 7 meters			
.	.	.	.	.	.	.	**VACCUM PROCESS**			
.	.	.	.	.	.	.	0	: No		
.	.	.	.	.	.	.	1	: Yes		
.	.	.	.	.	.	.				
F500-SRF	**7**	**0**	**1**	**1**	**1**	**2**	**0**			

PRODUCT							
F500-SRR	: Remote Seal - Threaded Type						

	PROCESS CONNECTION						
.	1	: 1/4 NPT					
.	2	: 3/8 NPT					
.	3	: 1/2 NPT					
.	4	: 3/4 NPT					
.	5	: 1 NPT					
.	6	: 1 1/2 NPT					

		FLANGE MATERIAL					
.	.	1	: Stainless Steel				

			FLANGE DIAPHRAGM MATERIAL				
.	.	.	1	: Stainless Steel			
.	.	.	2	: Hastelloy			
.	.	.	3	: Monel 400			
.	.	.	4	: Tantlum			

				FLANGE FILLING OIL			
.	.	.	.	1	: Silicone DC704		
.	.	.	.	2	: Silicone DC200		
.	.	.	.	3	: Neobee		
.	.	.	.	Z	: Special		

					CAPILLARY LENGHT		
.	.	.	.	.	1	: 1 meter	8	: 8 meters
.	.	.	.	.	2	: 2 meters	9	: 9 meters
.	.	.	.	.	3	: 3 meters	A	: 10 meters
.	.	.	.	.	4	: 4 meters	B	: 11 meters
.	.	.	.	.	5	: 5 meters	C	: 12 meters
.	.	.	.	.	6	: 6 meters	Z	: Special
.	.	.	.	.	7	: 7 meters		

						VACCUM PROCESS	
.	.	.	.	.	.	0	: No
.	.	.	.	.	.	1	: Yes

	.	.	.	.	.	.	.
F500-SRR	**1**	**1**	**1**	**1**	**2**	**0**	

PRODUCT									
F500-SRS	: Remote Seal - Sanitary Type								

		PROCESS CONNECTION							
.	1	: Tri-Clamp 1 1/2" Without Extension			B	: IDF 2" With Extension			
.	2	: Tri-Clamp 2" With Extension			C	: IDF 2" Without Extension			
.	3	: Tri-Clamp 2" Without Extension			D	: IDF 3" With Extension			
.	4	: Tri-Clamp 3" With Extension			E	: IDF 3" Without Extension			
.	5	: Tri-Clamp 3" Without Extension			F	: RJT 2" With Extension			
.	6	: SMS 1 1/2" Without Extension			G	: RJT 2" Without Extension			
.	7	: SMS 2" With Extension			H	: RJT 3" With Extension			
.	8	: SMS 2" Without Extension			I	: RJT 3" Without Extension			
.	9	: SMS 3" With Extension			Z	: Special			
.	A	: SMS 3" Without Extension							

		FLANGE MATERIAL	
.	.	1	: Stainless Steel

			FLANGE DIAPHRAGM MATERIAL	
.	.	.	1	: Stainless Steel
.	.	.	2	: Hastelloy
.	.	.	3	: Monel 400
.	.	.	4	: Tantalum

				FLANGE FILLING OIL	
.	.	.	.	1	: Silicone DC704
.	.	.	.	2	: Silicone DC200
.	.	.	.	3	: Neobee
.	.	.	.	Z	: Special

					CAPILLARY LENGHT			
.	.	.	.	.	1	: 1 meter	8	: 8 meters
.	.	.	.	.	2	: 2 meters	9	: 9 meters
.	.	.	.	.	3	: 3 meters	A	: 10 meters
.	.	.	.	.	4	: 4 meters	B	: 11 meters
.	.	.	.	.	5	: 5 meters	C	
.	.	.	.	.	6	: 6 meters	Z	: Special
.	.	.	.	.	7	: 7 meters		

						VACCUM PROCESS	
.	.	.	.	.	.	0	: No
.	.	.	.	.	.	1	: Yes

.	.	.	.	.	.	.			
F500-SRS	1	1	1	1	2	0			

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.
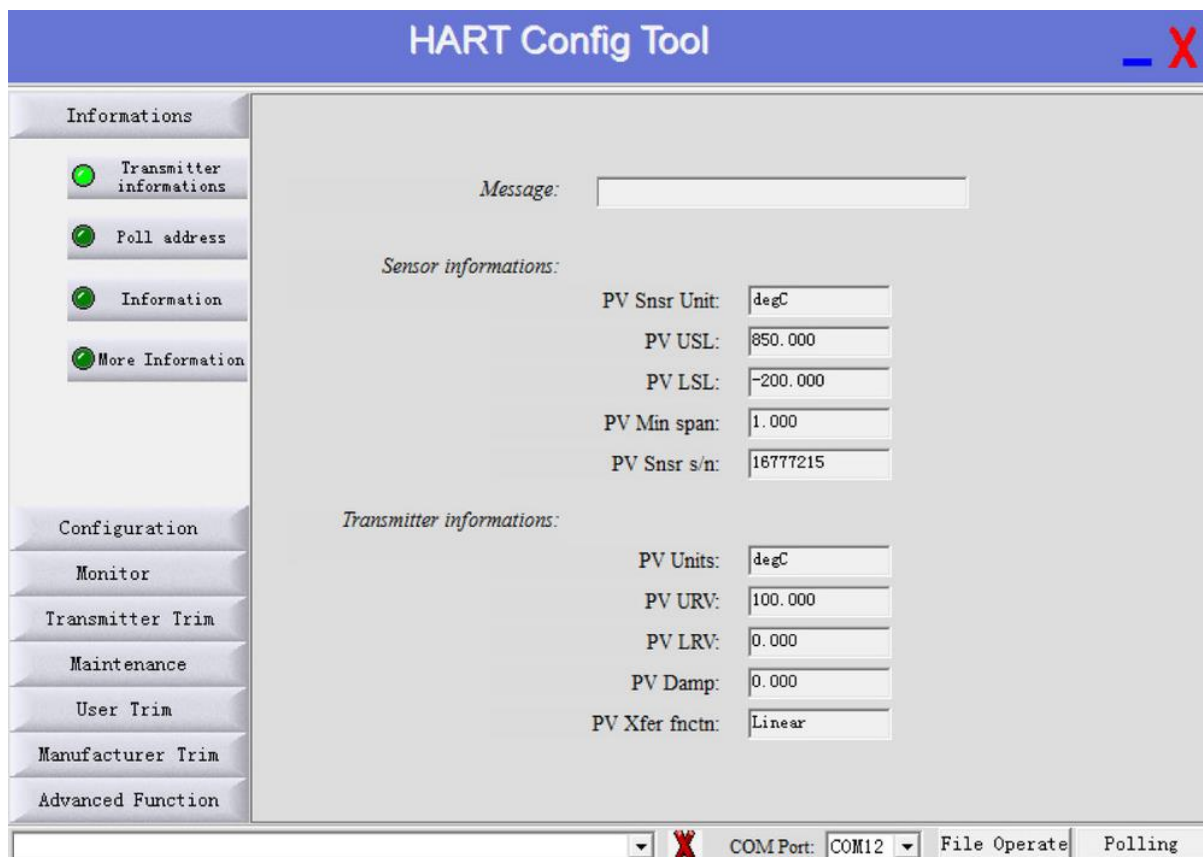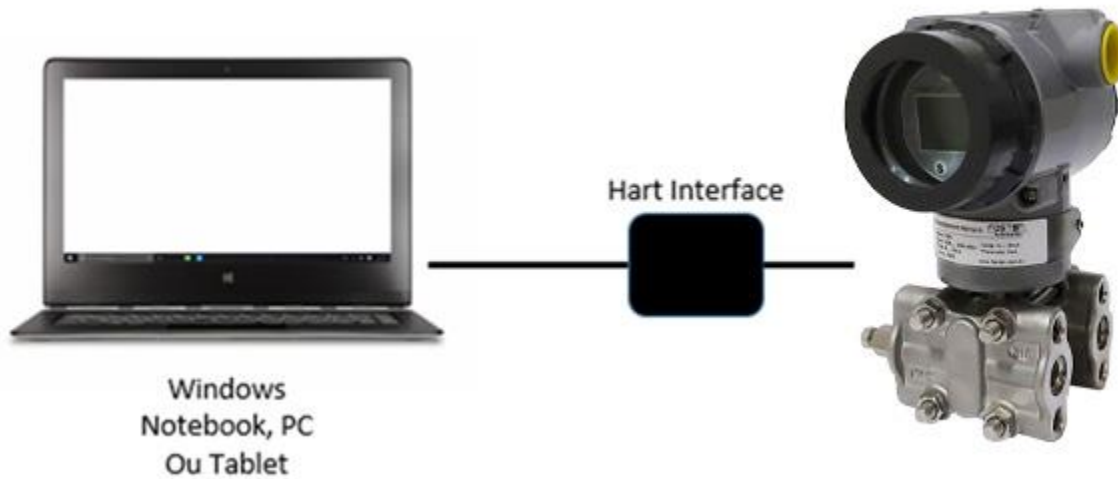
8.1. CONNECTING THE INSTRUMENT

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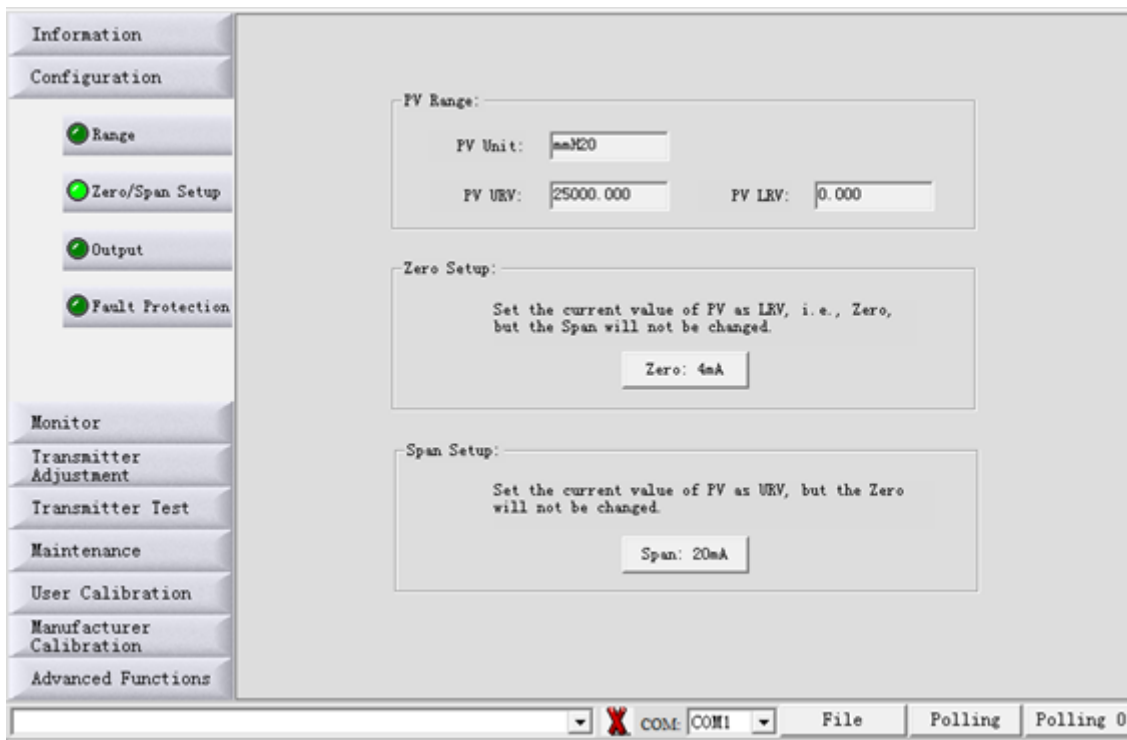
8.4. DAMP, LINEAR OUTPUT OR SQUARE ROOT AND USER UNIT

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.
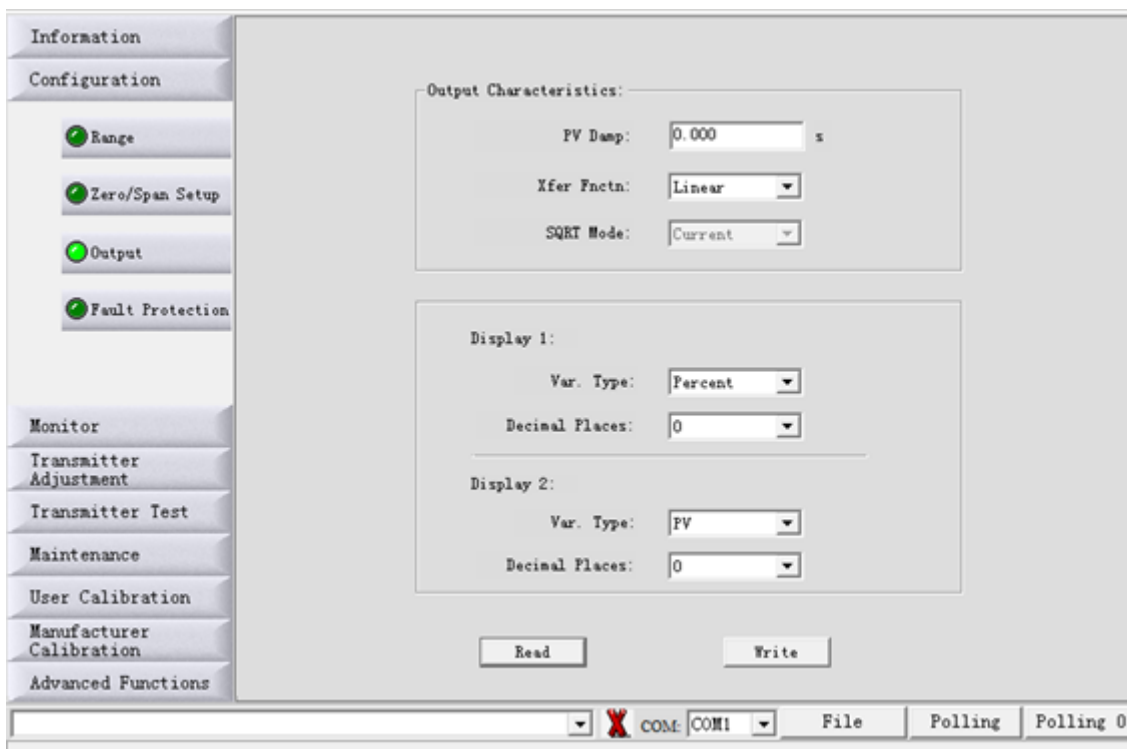
**8.5. INCLUDING USER UNIT**

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.
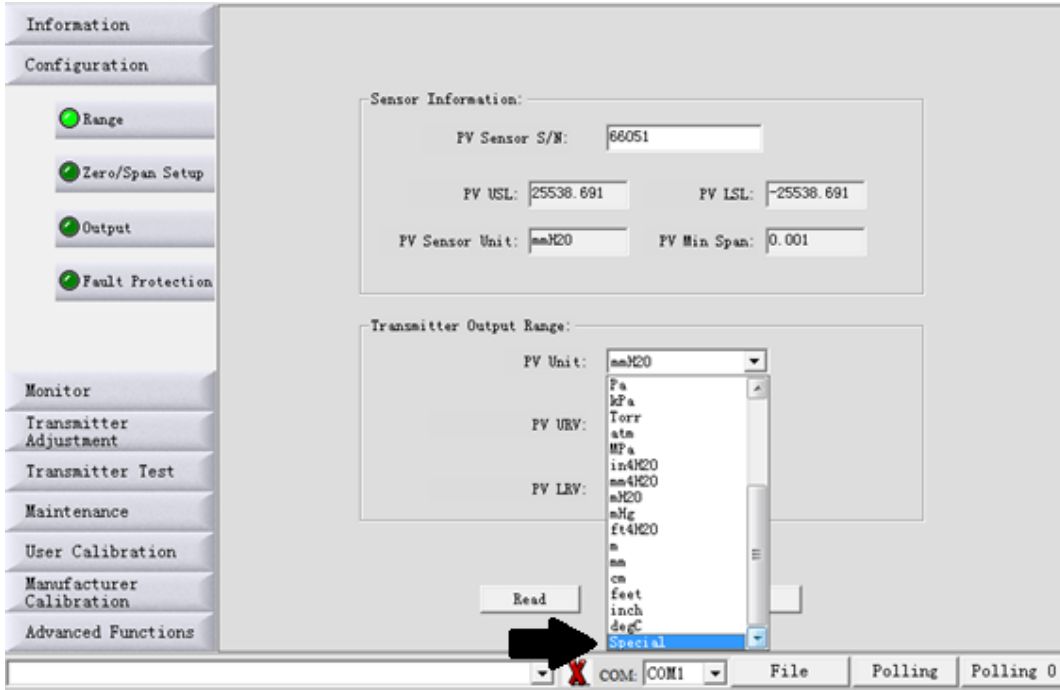
b) Go to the last button "Advanced Functions" and choose the sub-option: "Additional Functions" as shown on the following screen.
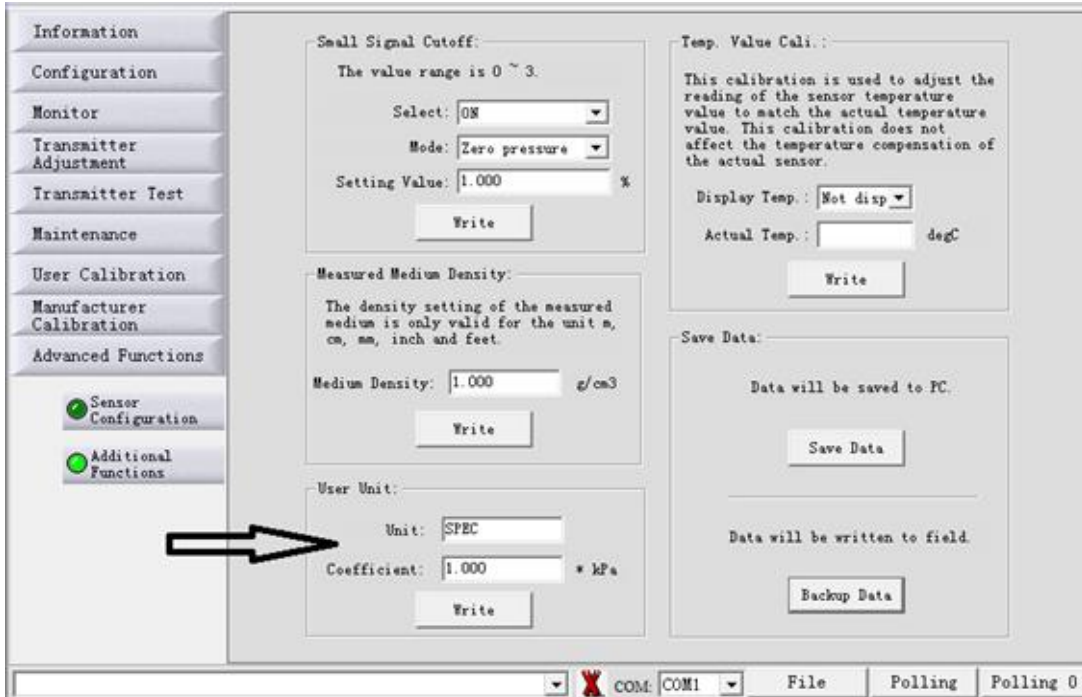
In the "User Unit" box, indicated by the arrow in the previous figure, write the user unit you want to use.
Enter the value of the "Coefficient", which must always be the maximum value of the calibration range divided by the maximum value of the user unit range.

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).

$$\frac{\text{Maximum range value}}{\text{Maximum unit value}}$$

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.
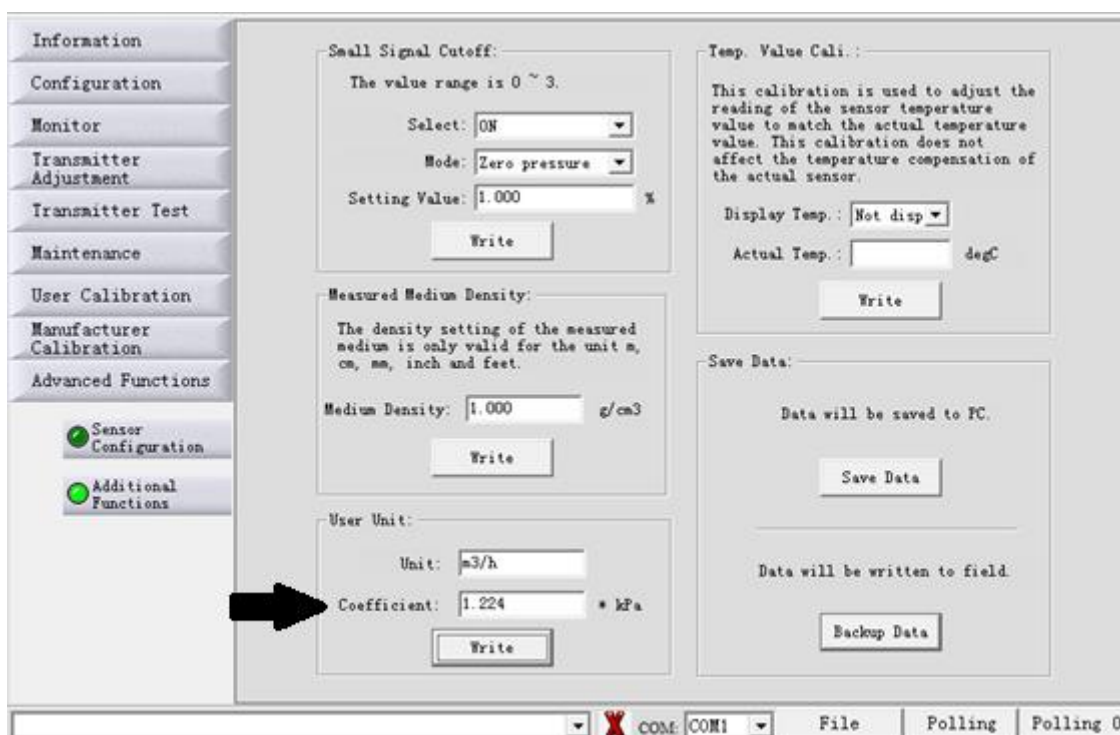
8.6. WRITING AND ALARM PROTECTION

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.
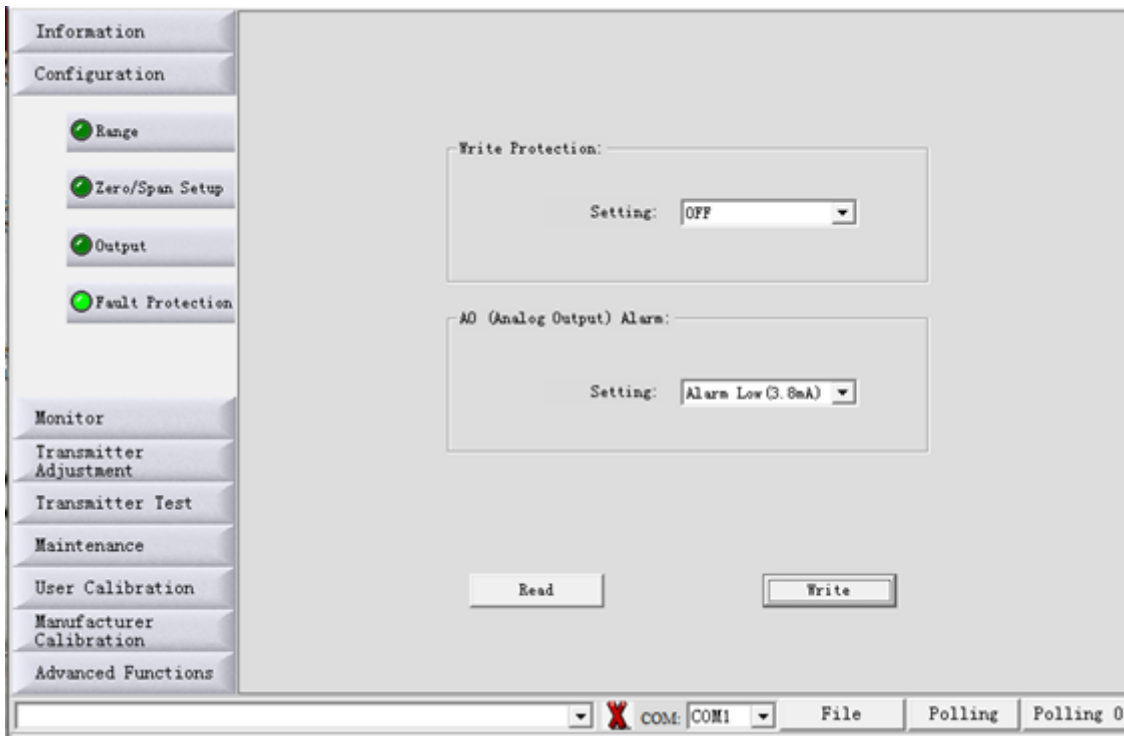
8.7. MONITORING VARIABLES

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.
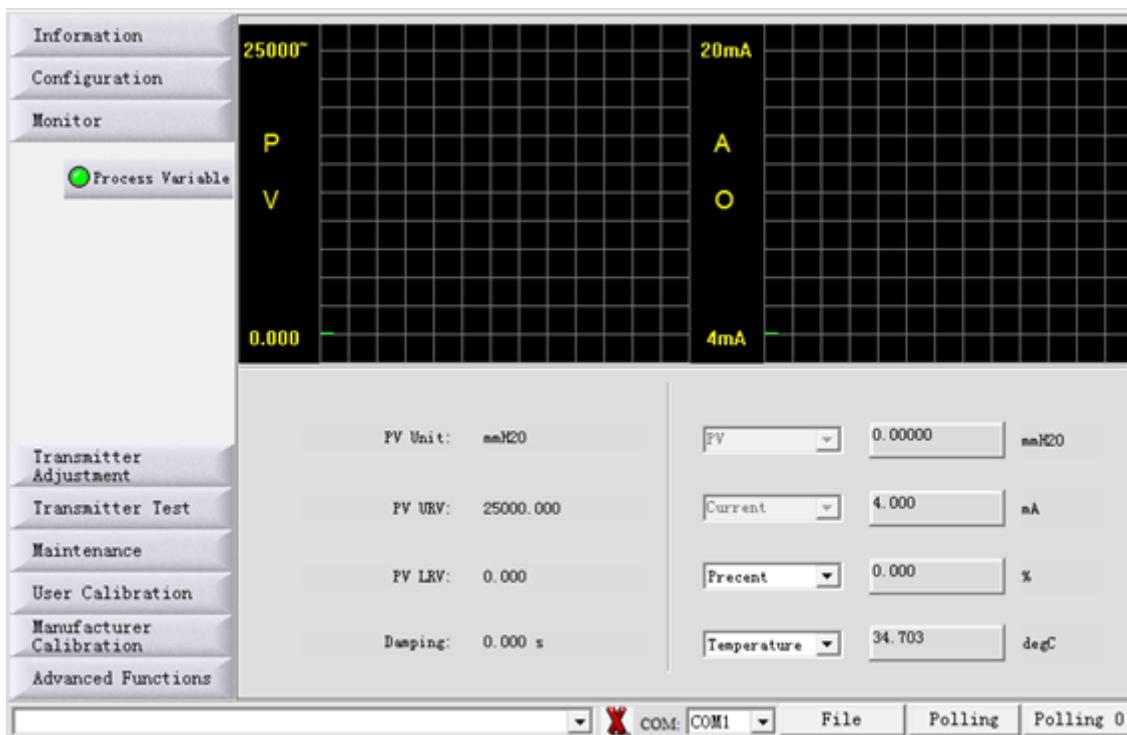
8.8. CURRENT TRIM AND LOOP

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.
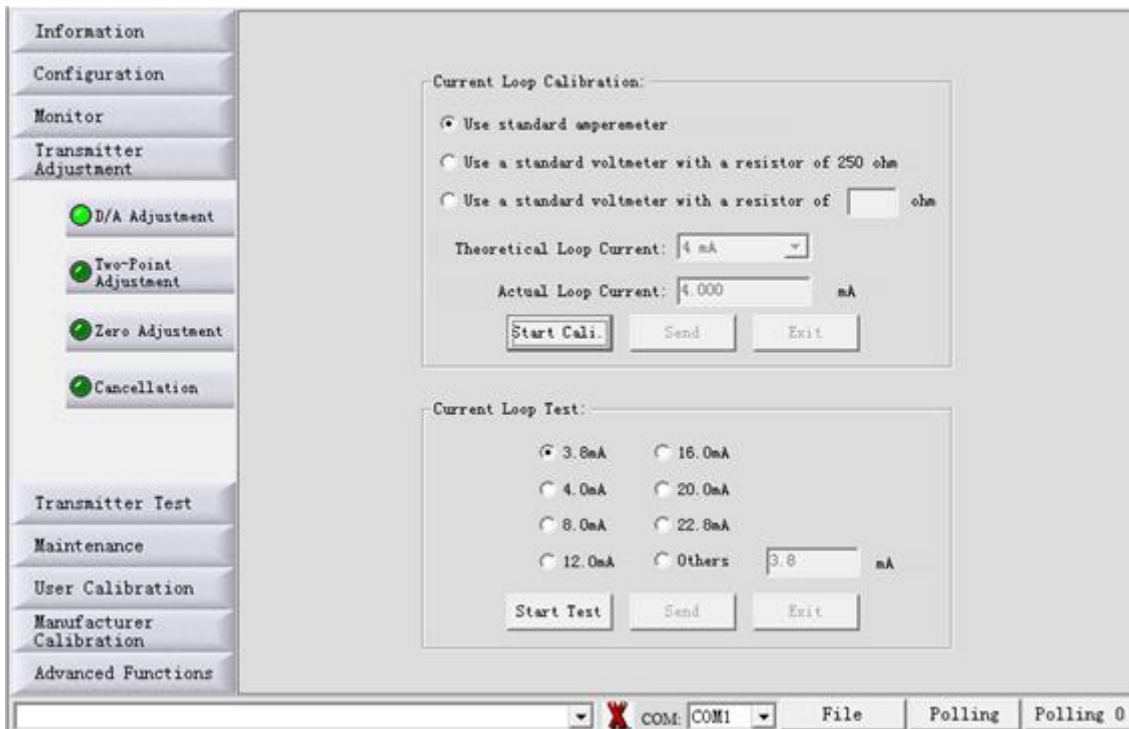
8.9. LOWER TRIM AND UPPER TRIM

To perform the pressure trims, choose the "Transmitter Adjustment" button and the sub-option: "Two-Point Adjustment".
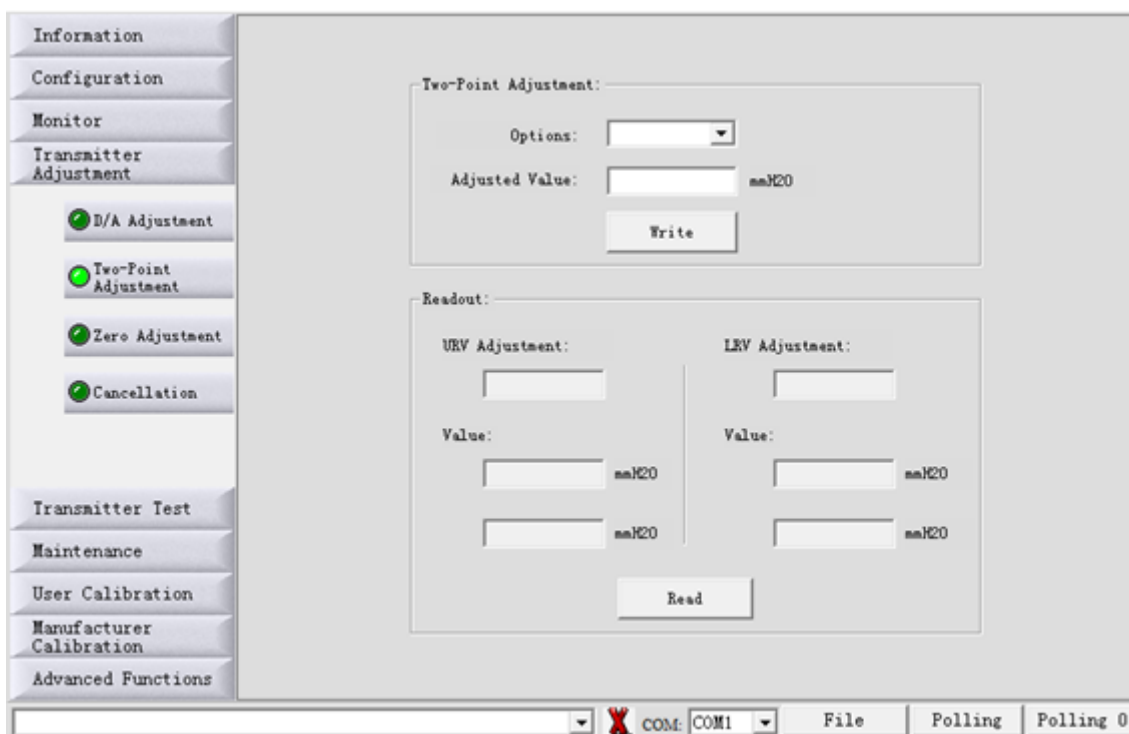
In the "Options" selection box, you can choose whether you want to make a lower trim or a higher trim.

8.10. ZERO TRIM

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

9. SPARE PARTS

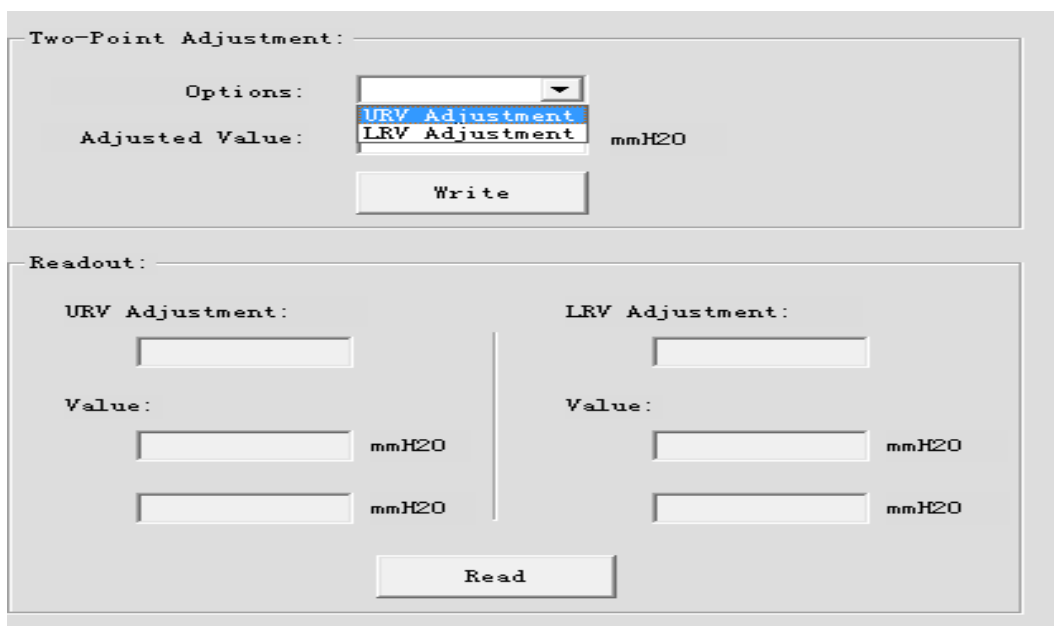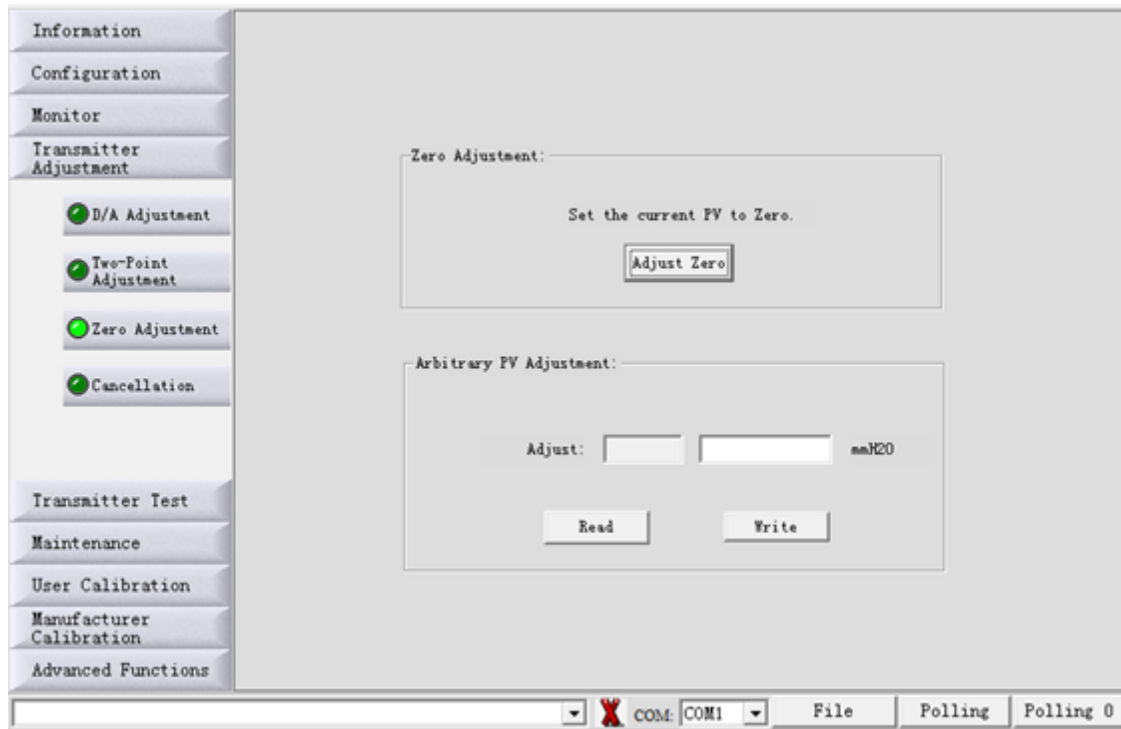The **F500** instrument line offers a wide variety of single pieces, also called spare parts. Practically all items can be purchased separately, through the list of codes below.

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		
500-0024		: U-type mounting support
.		**MATERIAL**
.		1	: Carbon steel
		2	: Stainless steel
.	.	
500-0024	**1**	

PRODUCT	
500-0028	: stainless steel differential flange with bleed

PRODUCT	
500-0030	: stainless steel gauge flange

PRODUCT	
500-0032	: nut / stainless steel adapter with screw

PRODUCT	
500-0036	: stainless steel bleed for flange

PRODUCT	
500-0038	: stainless steel bolt for flange with screw

PRODUCT	
500-0040	: stainless steel nut screw

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	
500-0019	: sealing ring for the differential sensor / Gauge – Buna N 2136

PRODUCT	
500-0015	: sealing ring for the adapter/ nut – Buna 2116

PRODUCT				
500-000D	: Capacitive sensor for differential pressure transmitter			
.	**RANGE**			
.	0	: -100 a 100 mmH2O		
.	1	: -500 a 500 mmH2O		
.	2	: -5000 a 5000 mmH2O		
.	3	: -25000 a 25000 mmH2O		
.	4	: -25 a 25 Kgf / cm²		
.	5	: -68 a 68 Kgf / cm²		
.	6	: -160 a 160 Kgf / cm²		
.	.	**DIAPHRAGM MATERIAL AND FILLING FLUID**		
.	.	1	: Stainless steel - silicone oil	
.	.	.	**MATERIAL IN THE BODY OF THE SENSOR**	
.	.	.	I	: Stainless steel
.	.	.	.	
500-000D	**3**	**1**	**I**	

PRODUCT				
500-000M	: Capacitive sensor for gauge pressure transmitter			
.	**RANGE**			
.	0	: 0 a 100 mmH2O		
.	1	: 0 a 500 mmH2O		
.	2	: 0 a 5000 mmH2O		
.	3	: 0 a 25000 mmH2O		
.	4	: 0 a 25 Kgf / cm²		
.	5	: 0 a 68 Kgf / cm²		
.	6	: 0 a 160 Kgf / cm²		
.	.	**DIAPHRAGM MATERIAL AND FILLING FLUID**		
.	.	1	: Stainless steel - silicone oil	
.	.	.	**MATERIAL IN THE BODY OF THE SENSOR**	
.	.	.	I	: Stainless steel
.	.	.	.	
500-000M	**3**	**1**	**I**	

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

FOSTEN AUTOMATION

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FOSTEN AUTOMATION

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