

**ANALOG INPUT AND OUTPUT OPTION**

**DESCRIPTION:**

The option is formed by a circuit of four analog inputs and two analog outputs for the Agrónic 4000.

It is used for :

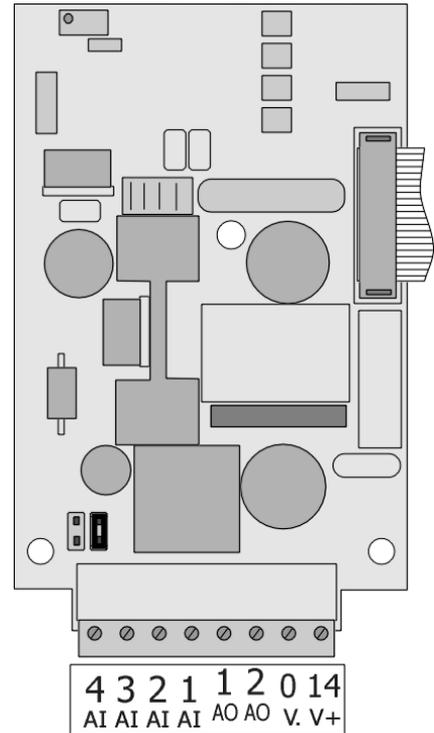
- The pH regulation and EC reading with alarm, option.
- The water pressure regulation of the irrigation, option.
- The reading of sensors.
- The program determiners option.

The 4 inputs operate with sensors and transmitters that generate 4-20mA. Furthermore there are 2 terminals to connect the sensor supply to 14 volts.

The two outputs generate tension from 0 to 10 volts to connect to regulator elements such as frequency variators, injectors, etc. The output number 1 is for the regulation of pH and the second one for the water pressure regulation of irrigation.

The first analog output can be cancelled and in its place can use used a pulse output to operate electrovalves of injection.

Two models are made, one for the equipment supplied with 12 Vdc and another for the equipment supplied with 230 Vac. This last one with a galvanized insulation between the inputs, outputs and the interior circuit.



**TECHNICAL CHARACTERISTICS:**

<b>Model --&gt;</b>	<b>System at 230 volts</b>	<b>System at 12 volts</b>
Power supply of circuit	24 Vac $\pm 20\%$	12 Vdc -5 % +20 %
Sensor supply output	14 Vdc	12 Vdc
Sensor supply current	Max 0,4 Amp.	Max 0,4 Amp.

<b>Outputs</b>		
Analog	Number	1 (for pH) 2 (for pressure)
	Type	0 – 10 volts
Pulses	Number	1 (for pH)
	System 230 V.	Static relay 1 Amp., with output at 24 alternating volts.
	System 12 V.	Relay MOS-FET 1 Amp., with output at 12 direct volts.

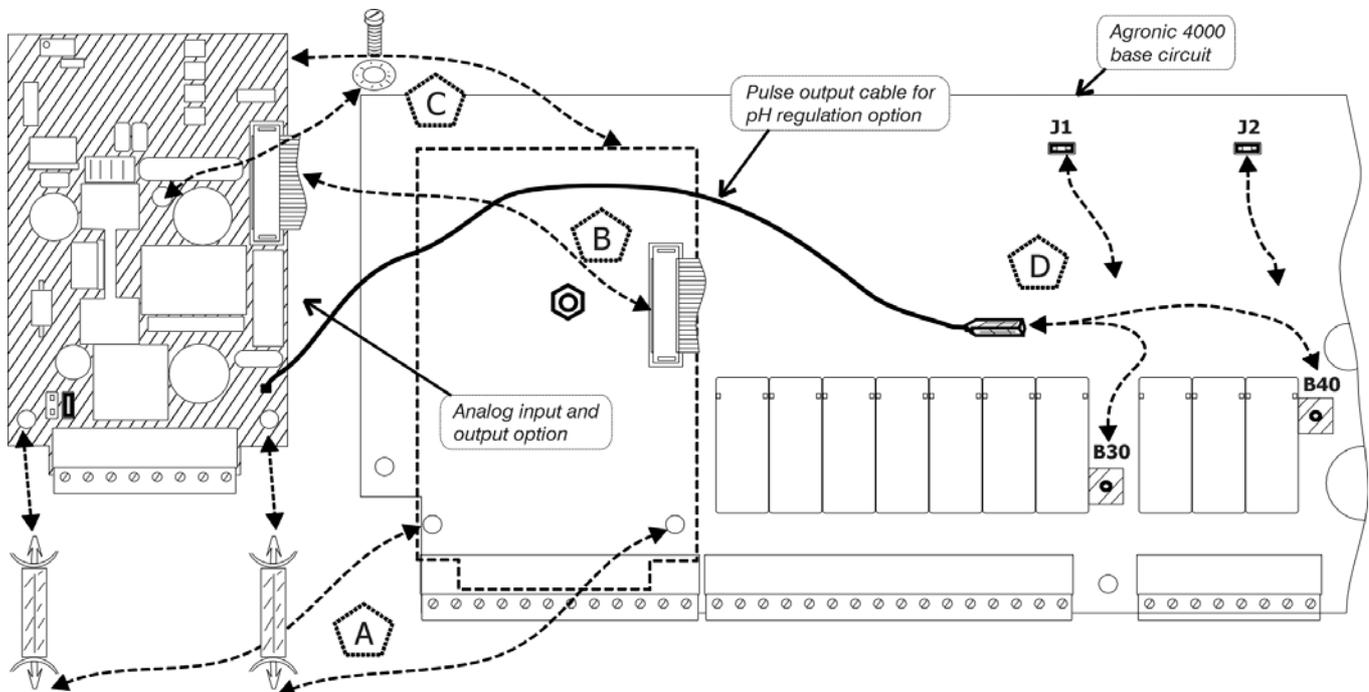
<b>Inputs</b>		
Analog	Number	1 – 2 – 3
	Type	4 – 20 mA
	Number	4
	Type	4 – 20 mA / 0 – 5 V

## INSTALLATION:

The analog input and output circuit is installed in the base circuit of the Agrónic 4000, in the space that has been reserved after the 12 digital inputs. The union between the 2 circuits is by means of a flat cable of 16 wires. This option can be asked for at the same time as the equipment or later, carrying out then the installation of the sheet.

If it is necessary to carry out the installation in a controller, the following steps have to followed according to the drawing:

- Situate the 2 PVC separators in the base circuit. A slight pressure has to be carried out so that it remains attached, in this way it is allowing to put on to the base sheet.
- Connect the flat cable to the base circuit connector. There is a groove on the face for a correct insertion, just as it is shown in the drawing.
- Place the circuit in its correct position and make a slight pressure to insert the head of the PVC separators, then turn the screw and the washer in the central metallic separator.
- Only when the pH regulation option and its injection has been pressed, the output cable of pulses will be connected to the relay of the output 16 (point B30) in a model of 16 outputs and for the rest of the models to the output 24 (point B40). To cancel the output as an irrigation sector or a general, it has to take out the bridge "J1" for the models of 16 outputs, or the bridge "J2" for the rest of the models.



When the analog input and output circuit comes together, it is not necessary to follow the previous steps but it has to take into account that if besides having the regulation of the pH option, there exists an output cable of pulses connected to the output 16 or 24. In the section "Installation configuration", it can choose how it wants to carry out the injection by output 0-10 volts or by pulsed output.

## CONNECTION:

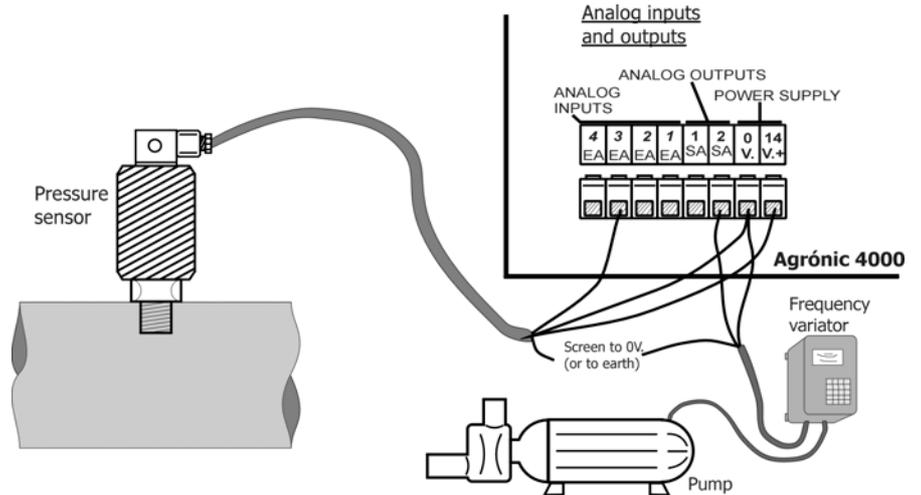
It is necessary to carry out the connection of the inputs and outputs with multi-wired screened cable, with sections between 0,25 and 0,5 millimeters. The screen is joined to the terminal of "0V" or to the earth wire; this last one has to be always free of electronic noise.

The cables of the inputs and of the outputs have to be installed separately from other cables or elements supplied with an alternating current.

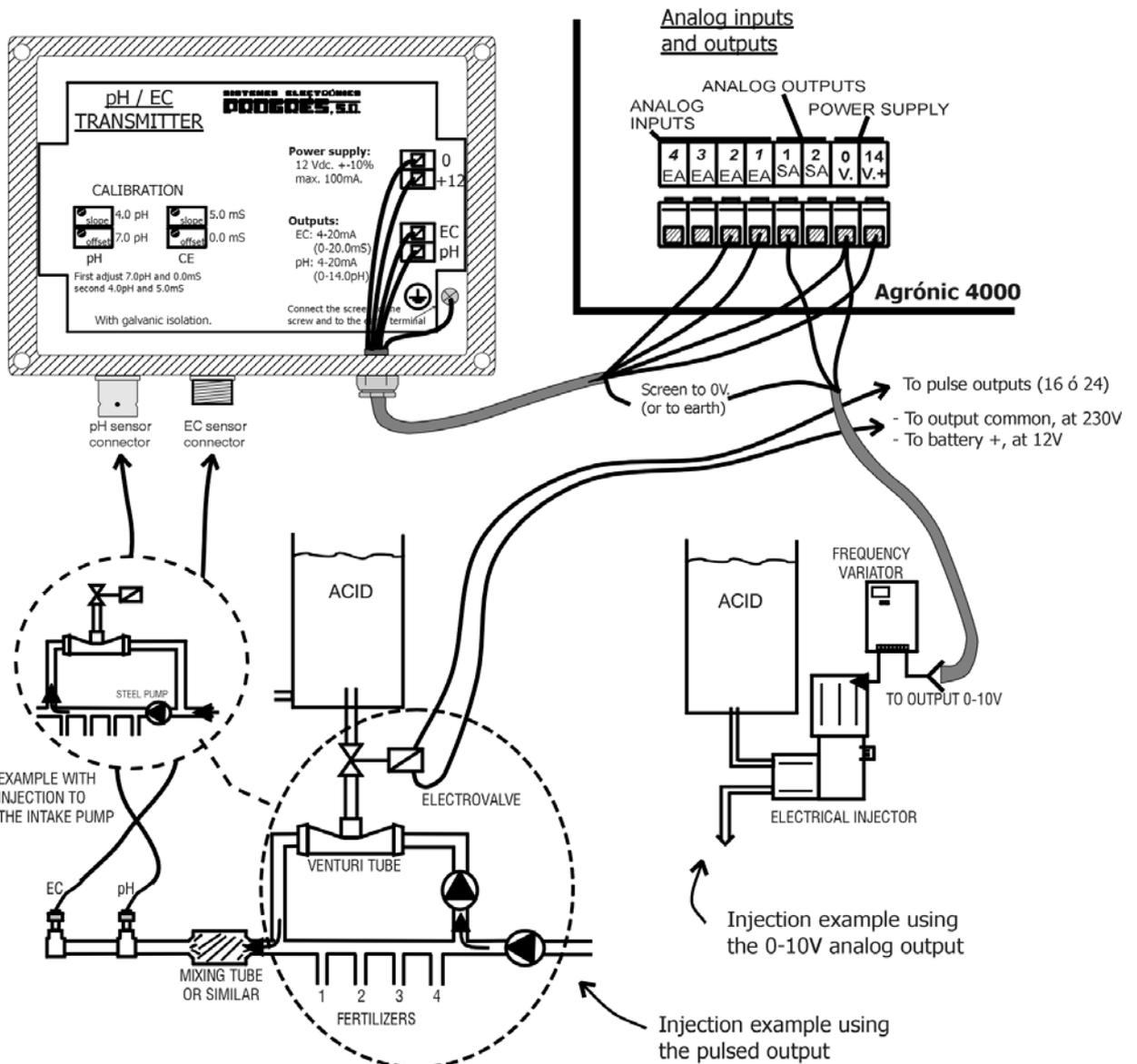
The 4 analog inputs are prepared to measure currents from 4 to 20 mA, the sensor element or transmitter can be situated 10s of a meter away from the Agrónic. The input number 4 can also operate as a tension input from 0 to 5 volts, for which it has to join the bridge "J1" and take out the "J2" one situated behind the terminal of the input 4.

In the analog outputs, it has to avoid short-circuiting the cables of the outputs with the common of "0V", as it can damage internal circuits. Another detail to consider is that the output number 1 will not be operative when the injection of acid is made by pulses.

**\* Connection example for the pressure regulation option:**



**\* Connection example for the pH regulation option:**



## pH REGULATION AND EC READING OPTION

### DESCRIPTION

By means of this option, the Agrónic 4000 can maintain a level of acidity in the water of the irrigation independent for each of the sub-programs.

Injection of acid or base for a system of pulsing application or regulate the speed of the injector connected to a frequency variator.

Fix levels of excess, defect or by 100% injection of alarm levels.

Allow regulation of the pH in the pre-irrigation and in the post-irrigation.

Self-adjust of injection memorized independently for each irrigation sector.

General and alarm output for the control of pH.

Control the electrical conductivity (mS) in the irrigation water, noting the alarm levels and operation forms.

Daily records, during 30 days of the average pH and EC that has been measured in the irrigation of each sector.

### PARAMETERS

To carry out the correct configuration of the option it has to go to "Function-Parameters" and enter the values that are asked for in the parameters of "Fertilizers", "General outputs" "Analog inputs" and "Parameter sectors".

### FERTILIZERS PARAMETERS

In this section, the positive and negative value of alarm is the first configuration to detect, after a temporization, an imbalance in the pH regulation, made by an anomaly condition in the installation. The positive alarm value is summed up to the reference value of the program in course and whenever the sensor value is higher than the resultant value, it will wait the programmed time in "Detection delay "; if, while the delay is being carried out, the sensor returns into the margins, the delay will be finalized. In the contrary, if it continues outside the margins, it will enter in anomaly, producing a stop in the pH regulation and, depending on the configuration of the equipment, it will activate alarms, send messages, etc.

In order not to take this into account leave the value at 0.

Alarm pH = (+) 0.6 pH (-) 0.4 pH  
Detection delay: 038"

The fact that the injection stays at 100% can be considered an anomaly that stops the injection; for this, program the seconds considered necessary in

the question "delay detection alarm 100%". In order not to take this into account leave the value at 0.

Detection delay alarm 100%: 025"

Once the alarm has been produced, it will stop the injection and enter into anomaly and alarms.

To restore the pH regulation, it has to enter into "Function-Manual-Malfunctions" and finish the stop.

To control the level of electrical conductivity in the water of the irrigation, either for poor quality of the supply or to control the fertilizer injection, the absolute values are configured for a high level and another for a low level, as well as the detection delay.

Alarm EC = (+) 02.1 mS (-) 00.8 mS  
Detection delay 105"

Once the alarm has been produced, it will stop the injection of fertilizers and enter into anomaly and alarms.

To restore the possibility of applying fertilizers, enter into "Function - Manual - Malfunctions" and finish the stop.

The pH regulation can be configured to apply an acid or a base, to do so it has to respond to the following question.

Injecting for base (1) acid (2) : 2  
Modulation cycle : 2.5"

The "Modulation cycle" of the impulses is the time in seconds with which the pulsation of acid or base injection are repeated.

The "Proportional band" is used by the equipment to calculate the increase or decrease necessary of the % of the injection when the pH sensor unbalances the reference value given by the irrigation program. It can see this in the following examples:

- With a zone of 2,0 for each increase of a 10<sup>th</sup> (0,1 pH) in the sensor, the output of injection decreases by 5%:  $100 \div 20 = 5$
- With a zone of 5,0 the increase of the 0,1 pH has been decreased by 2%:  $100 \div 50 = 2$

With the previous example, it can see that with a bigger zone a minor variation in the injection is produced which will be useful when a sector has changes in the injection.

Proportional band : 2.0  
Reaction: 1

The value of "Reaction" has the function to slow the changes of the relation of output for the injection. With the value "0" the changes are immediate, with "1" the output will have an approximation every second to arrive at a new value that has been calculated, with "2" it will be every 2 seconds, etc. The standard value is 1 and it is advisable not to exceed 4. It can see an example to move from an injection of 25% to 30% with different reaction values.

Calculated value	25%	30%	30%	30%	30%	30%	30%
Reaction 0	25%	30%	30%	30%	30%	30%	30%
Reaction 1	25%	27%	28%	29%	30%	30%	30%
Reaction 2	25%	25%	27%	27%	28%	28%	29%
→ Output value every second →							

In the following screen the injection or not of acid in the pre-irrigation or in the post-irrigation is configured.

Apply acid in pre-irrigation : NO  
Apply acid in post-irrigation : YES

## GENERAL PARAMETERS

The pH control option has a general output that will be activated whenever it is regulating the pH. If it is going to be used it has to assign it a relay output.

Another function to which it has to assign to it a relay of output is the pH control alarm; this activates when there are incidences in the injection of acid or base.

General pH control output: 0091  
Alarm pH control output: 0090

## ANALOG PARAMETERS INPUTS

With the 76 sensors that the Agrónic 4000 controls, the first one, configured as a pH sensor, will be the one used for regulation. The first sensor of conductivity (EC) is also used for the control.

It can see an example of the configuration of a pH sensor and a EC one connected to a Progrés transmitter with an output 4-20mA connected to the analog inputs and outputs.

First, it has to assign a sensor number.

Sensor number (1 – 76) : 01

Then to which of every output of the 4 that have the enlargement it is connected.

Sensor : 01  
Input number : 0002

The measure unit, a 14 for pH and a 13 for the EC.

Sensor : 01      In base      0002  
Measure unit : 14

It can see the voltage margins in the output and the corresponding for the reading on the screen.

As the transmitter carries a current of 4 to 20 milliamps for 0 to 14,0 of pH and 0 to 20,0mS of EC and the resistance of the output is of 200ohms it has to enter the following values:

For the pH=800 millivolts for the 4 milliamps and 4000 millivolts for the 20 milliamps.

Sensor : 01      In base      0002  
Input margin    min.: 0800      max.: 4000 mV

Sensor : 01      In base      0002  
Reading        min.: 00.0 pH    max.: 14.0 pH

For the EC=800 millivolts for the 4 milliamps and 4000 millivolts for the 20 milliamps.

Sensor : 01      In base      0002  
Input margin    min.: 0800      max.: 4000 mV

Sensor : 02      In base      0001  
Reading        min.: 00.0 Ms    max.: 20.0 mS

In order to calibrate the sensor when its reading is higher than the real one, the "calibrate" value has to be diminished below 100, and increased when the reading is lower.

Sensor : 02      In base      0002  
Calibrate (100 = 0) : 100

## PARAMETER SECTORS

The "self-adjustment of pH regulation" together with the "self-adjust temporization" is used to find the optimal injection value for each sector or group of sectors. For this, the equipment modifies constantly the self-adjustment of the value until it has achieved that the pH sensor reads the same value as the irrigation program reference has. When this happens, the %

value of injection output and the self-adjustment is equal. If the value of the sensor is not equal to the reference one, the seconds marked in the self-adjustment temporization are waited for and the self-adjustment output is increased or decreased by 1%. This is repeated every temporization while it is not equal.

In the final preparation of the injection system, it can enter the value that it believes will be necessary for the adjustment for the % of the injection output in each one of the irrigation sectors.

SECTOR	Aux.	<b>Self pH</b>	<b>T.self</b>	F1	F2	F3	F4	Bars
- 01 -	0045	<b>33 %</b>	<b>04"</b>	N	N	N	N	03.2

For each sector, it memorizes the percentage (%) of injection with which the last irrigation finishes (self-adjustment); to begin a new irrigation it takes as a starting point this value of self-adjust to apply it to the injection.

**PROGRAMS**

To carry out the programming of the irrigations, the pH reference value will be asked for each of the sub-programs. To access it go to "Function – Program".

The following example shows 2 sub-programs, in the first, it will irrigate the sectors 2 and 5 with a pH of 06.7 and in the second the sector 3 with a pH of 06.5.

P05-01	S02	05	..	..	..	..	..	..	pH=06.7
I=	0208 m <sup>3</sup>	F1:	0032	F2:	0009	L			

P05-02	S03	..	..	..	..	..	..	..	pH=06.5
I=	0253 m <sup>3</sup>	F1:	0039	F2:	0012	L			

**HISTORICAL**

In every one of the 30 days of the historical, the average of pH and EC of each one of the sectors is memorized. The values to calculate the average are taken when the sector is irrigating.

20/08	<b>S</b> 01	I=	00377 m <sup>3</sup>	06.8 pH	01.7 mS
F1:	0045.2	F2:	0016.0	F3:	0035.4

**CONSULTATION**

Within the general consultation there is a screen dedicated to the consultation of values of the pH regulation option and the reading of EC. The first value corresponds to the instant reading of a pH sensor, containing the reference value that the current program asks for and the percentage value of what is injected; the last value on the right shows the instant reading of the electrical conductivity sensor (EC).

06.8 pH	Ref.: 06.7 pH	(045%)	02.1 mS
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## PRESSURE REGULATION OPTION

### DESCRIPTION

The object of this option in the Agrónic 4000 is that of maintaining a pressure in the irrigation tube independently for each sector.

The motor regulated is 1.

Self-adjustment of the regulation memorized independently for each sector of irrigation.

The analog output 0-10 volts of the input and the output option is number 2, in which the frequency variator of the irrigation motor is connected.

### PARAMETERS

To carry out the correct configuration of the option it has to go to "Function - Parameters" and enter the values that are asked for in the parameters of "Parameters – Analog Inputs", "Parameter sectors" and "Various Parameters".

### ANALOG INPUT PARAMETERS

Within the 76 sensors that can be controlled by the Agrónic 4000, the first of these configured as a pressure sensor (bars) will be that which is used for the regulation.

It can see an example of the configuration of the pressure sensor with the output 4-20mA connected to the analog input and output option.

First, it has to assign a sensor number.

Then to whichever output of the 4 that has the enlargement will be connected and the measure unit, a 12 for bars.

Sensor : 05 Input number: 0003
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Sensor : 05      In base      0003 Measure unit: 12
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It can see the margins of voltage in the input and the corresponding ones for the reading on the screen.

As the transmitter carries a current of 4 to 20 milliamps for 0 to 10,0 bars and the resistance of the input is 200 ohms, It has to enter the following values:

Sensor : 05      In base      0003 Input margin min.: 0800      max.: 4000 mV
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Sensor : 05      In base      0003 Reading      min.: 00.0 bars      max.: 10.0 bars
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In order to calibrate the sensor when its reading is higher than the real one, the "Calibrate" value has to be diminished below 100, and increased when the reading is lower.

Sensor : 05      In base      0003 Calibrate (100 = 0) : 100
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### SECTOR PARAMETERS

For each irrigation sector, it can configure an operation pressure; this reference value "Bars is entered in the second screen, furthermore in the first the motor 1 has to be assigned.

SECTOR Aux. Self pH T.self F1F2F3F4 Bars - 01 - 0045 33 % 04" N N N N 03.2
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### VARIOUS PARAMETERS

The "Pressure regulation proportional band" is used by the equipment to calculate the increase or decrease necessary of the % of regulation of the frequency variator when the pressure sensor unbalances the reference value given by the irrigation sector. You can see this in the following example:

- With a zone of 2.0, for each increase of a 10<sup>th</sup> (0.1 bars) in the sensor, the output of regulation decreases by 5%:  $100 \div 20 = 5$
- With a zone of 5.0 the increase of 0.1 bars has been decreased by 2%:  $100 \div 50 = 2$

Pressure regulation prop. band: 2.0 Pressure regulation reaction: 1
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The value of "Pressure Regulation Reaction" has the function to slow down the changes of the relation of the output for the injection: with a value "0" the changes are immediate, with "1" the output has an approximation every second to arrive at the new value that has been calculated. With 2 it will be done every 2 seconds, etc.

When a filter cleaning will take place, the group assigned to the pump 1 will have the pressure programmed in "Pressure for filters". At the end of filter cleaning, it will come back the pressure of the irrigations sector working. If the pressure for filters is 0, this one will be same during cleaning, it will be the same that the ones in irrigation.

Pressure for filters: 3.5 bars
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When there are several sectors watering at the same time or during filter cleaning, only one will give the working value. If you answer yes to the next question, it will be the highest reference in the sectors in progress or the filter reference, otherwise it will be the first one in the program with the lowest ordinal number from those that are operating at the time.

Pressure regulation, use the higher reference : No

## CONSULTATION

Within the general consultation there is a screen dedicated to the consultation of values of the pressure regulation option. The first value corresponds to the instant reading of pressure sensor, following a reference value that the irrigation sector asks for and the percentage value of which the pump is regulating.

04.3 bars    Ref.: 04.4 bars    (087%)

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