Options manual

Analog inputs and outputs PH regulation and EC reading water pressure regulation

For Agrónic 4000

INDEX

1. Analog inputs and outputs option (v3)

Option of one or two boards with 6 analog inputs and 5 outputs each.

Useful for:
- The "pH regulation and reading with EC alarm" option.
- The irrigation water "Pressure regulation" option.
- The reading and recording of sensors.
- The "Program Determining factors" option.
- Injection in the "uniform fertilization" mode by analogue output.

Five of the inputs operate with sensors and transmitters that generate 4-20 mA. It has two terminals for powering sensors at 12 volts.

Input "A6" is for a voltage of 0 to 20 volts.

The outputs can be independently configured to operate as a 4-20 mA analog output (default) or pulse output with photo relay.

Independent galvanic isolation on each plate, between the analog inputs and outputs in relation to the pulsed outputs or the rest of the inputs and outputs on the Agrónic 4000.

Installable after version 3.00 of the software.

Inputs

Analog A1 – A5 A7 – A11	Number	5 + 5 in second expansion
	Type	4 – 20 mA
	Resolution	16 bits
A6 and A12	Type	0 – 20 Volts
	Resolution	16 bits

Outputs

Sensor power supply output, V+/CA	Voltage	12 volts
	Thermal fuse	0.2 amps
Analog outputs SA1 – SA5 SA6 – SA10	Number	5 + 5 in second expansion
	Type	0 – 20 mA
	Resolution	12 bits
	Load resistance	250 Ω (maximum)
Pulsed outputs RP1–RP5 / RP6–RP10 (incompatible with analog output)	Number	5 + 5 in second expansion
	Type	PhotoMOS Relay
	Limits	30 Vac / 30 Vdc, 1 Amp

General

Consumption	3.5 W, maximum 0.7 W, idle (without outputs, without sensor power)
Working temperature	-10°C to +60°C
Isolation	500 V between analog inputs/outputs and other circuitry. 500 V on pulsed outputs.

You must connect the analog inputs and outputs with shielded, stranded cables that have sections between 0.25 and 0.5 millimeters. The screen will be attached to the grounding wire; the latter will be done independently, as long as it is free of electrical noise.

The analog input and output cables must be installed away from other cables or elements supplied with an alternating current.
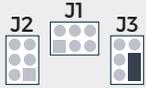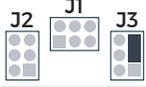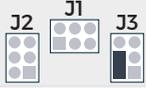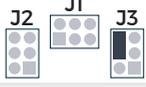
The 5 analog inputs are prepared to measure currents from 4 to 20 mA and can be expanded to a total of 10; the sensor or transmitter element can be located tens of meters from the Agrónic. Inputs A6 and A12 are always 0 - 20 V.

Analog inputs are marked "A1" through "A6" and "A7" through "A12" in the expansion. The 12 Vdc power output for the sensors is the "V+" terminal and the common, or "0V", is the "AC". The power output of the second power board is independent and isolated from the first.

ENTRADAS ANALÓGICAS *ANALOG INPUTS*						ALIMEN-TACIÓN *POWER SUPPLY*		SALIDAS ANALÓGICAS O PULSOS *ANALOG OUTPUTS OR PULSES*						
12 A	11 A	10 A	9 A	8 A	7 A	CA	V+	CSA	10 SA RP	9 SA RP	8 SA RP	7 SA RP	6 SA RP	AUX.
6 A	5 A	4 A	3 A	2 A	1 A	CA	V+	CSA	5 SA RP	4 SA RP	3 SA RP	2 SA RP	1 SA RP	AUX.

The equipment has 5 analog outputs that can be either 0/4 - 20mA or pulsed. These are indicated as analog "SA1" to "SA5" or pulsed "RP1" to "RP5". The outputs can be expanded to a total of 10.
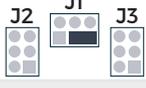
Each output can be individually configured if it is set to be pulsed or 4-20mA. For this, the jumpers J1, J2, and J3, which are behind the terminals, will be used.

Output	Type	Terminal	Jumpers	Circuit image
1 – (6)	4-20 mA	Analog output 1	J3. 1-3	
	Pulses	Pulse Relay 1	J3. 5-3	
2 – (7)	4-20 mA	Analog output 2	J3. 2-4	
	Pulses	Pulse Relay 2	J3. 6-4	
3 – (8)	4-20 mA	Analog output 3	J1. 1-3	
	Pulses	Pulse Relay 3	J1. 5-3	
4 – (9)	4-20 mA	Analog output 4	J1. 2-4	
	Pulses	Pulse Relay 4	J1. 6-4	
5 – (10)	4-20 mA	Analog output 5	J2. 1-3	
	Pulses	Pulse Relay 5	J2. 5-3	
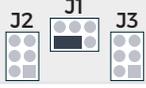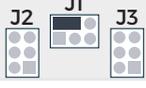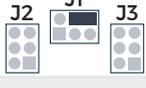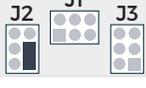
If an output is configured as analog 4-20mA, its common wire must be connected to "CSA" (see connection example).

If the output is configured as "pulsed", its common wire will be linked to the general output "Common wire", and the opposite 24Vac phase must be connected to "AUX". (see connection example).

IMPORTANT

Correctly connect the analog outputs; if you do it incorrectly, the internal circuitry could be damaged
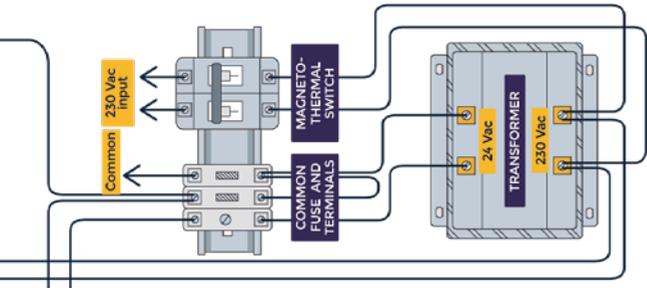
Common 230 Vac input

MAGNETO-THERMAL SWITCH

COMMON FUSE AND TERMINALS

TRANSFORMER
24 Vac
230 Vac
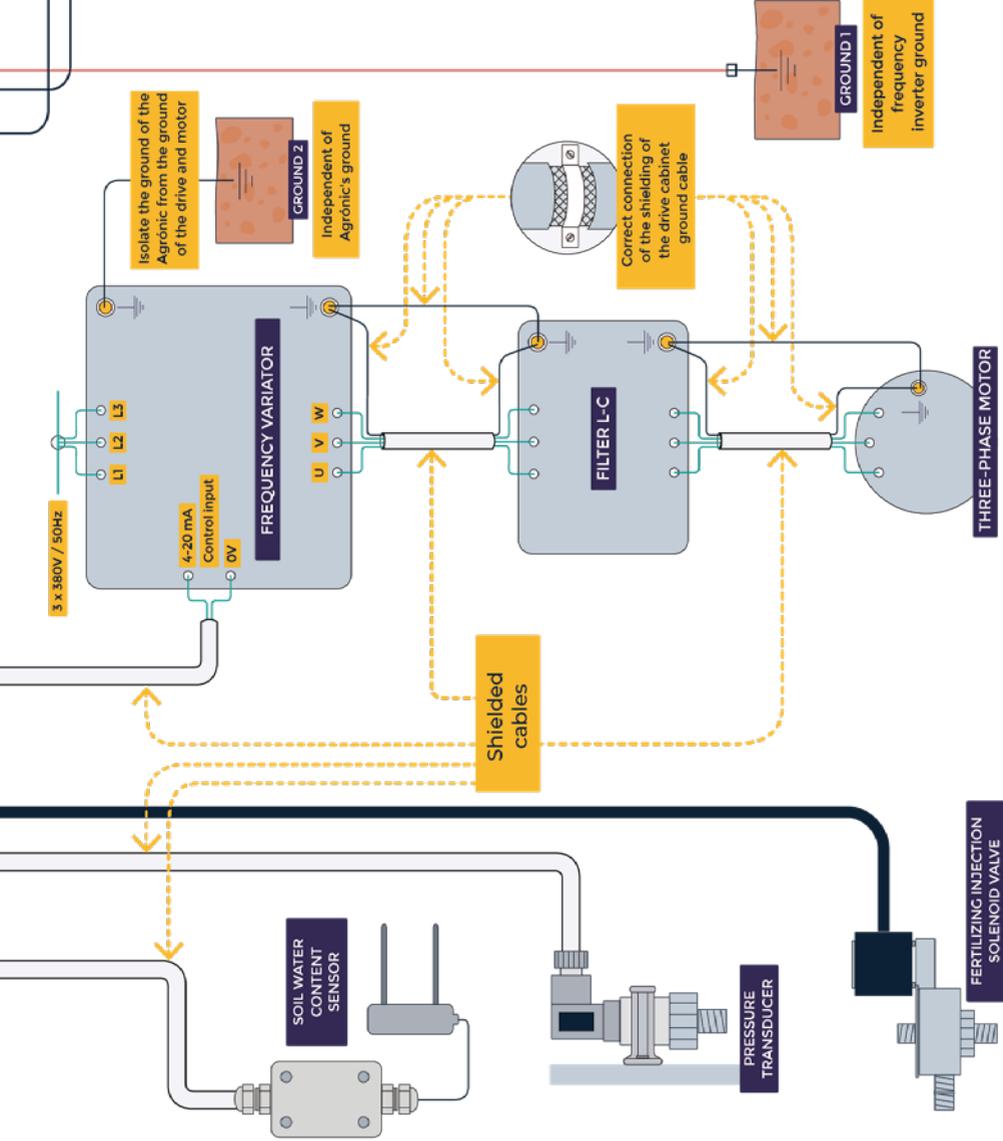
GROUND 1
Independent of frequency inverter ground

GROUND 2
Independent of Agrónic's ground

Isolate the ground of the Agrónic from the ground of the drive and motor

Correct connection of the shielding of the drive cabinet ground cable

FREQUENCY VARIATOR

L1 L2 L3

3 x 380V / 50Hz

U V W

4-20 mA Control input
0V

FILTER L-C

THREE-PHASE MOTOR

Shielded cables

SOIL WATER CONTENT SENSOR

PRESSURE TRANSDUCER

FERTILIZING INJECTION SOLENOID VALVE

2. Option for pH regulation and EC reading (v3)

1.4. DESCRIPTION

With this option, the Agrónic 4000 can maintain independent levels of acidity in the irrigation water for each sub-program.

Inject acidic or basic substances through a pulsed application system, or regulate the speed of the injector connected to a frequency variator.

Set alarm levels for excess, deficiency, or to be injected at 100%.

Allow for pH regulation in pre-irrigation and post-irrigation.

Injection auto-adjustments memorized independently for each irrigation sector.

General output and analog/pulsed output for pH control. Alarm output for anomalies.

Control the level of electrical conductivity (mS) in the irrigation water, setting the alarm levels and the reaction.

Daily record, for about 20 to 50 days, of the average pH and EC that has been measured in the irrigation of each sector.

2.1. PARAMETERS

To properly configure the option, access "Function – Parameters" and enter the values requested in the parameters for "Fertilization", "General Outputs", "Analog Sensors", and "Sector Parameters".

Each of the following parts is indicated by the numbers [x.x.] of the sections in the A4000 manual.

2.1.1. FERTILIZATION PARAMETERS

In this section, you can first configure the positive and negative alarm value to detect a lag in the pH regulation, after a time delay, caused by an anomaly in the installation. The positive alarm value will be added to the reference value of the current program, and whenever the sensor value exceeds the resulting value, it will wait for the time programmed in "Detection delay"; if the sensor enters the margins again while the delay is being carried out, the delay will end; if, on the other hand, it remains outside the margins, it will go into an anomaly, stopping the pH regulation and, depending on how the equipment is configured, it will activate alarms, send messages, etc.

To disregard it, leave the value at 0.

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

The act of constantly injecting at 100% can be considered an anomaly that stops the injection; to do this, program the seconds considered necessary in the request, "Alarm detection delay 100%". To disregard it, leave the value at 0.

> 100% alarm detection delay: 025"

Once the alarm has been activated, it will stop injecting and go into anomaly and alarms.

To resume pH regulation, enter "Function - Manual - Malfunctions" and end the stop.

To control the level of electrical conductivity in the irrigation water, either due to the poor quality of the supply or to control fertilizer injection, the absolute values will be configured for a high and a low level, in addition to the detection delay.

Once the alarm is activated, it will stop injecting fertilizers and enter anomalies and alarms.

> EC alarm = (+) 02.1 mS   (-) 00.8 mS
> Detection delay: 105"

To resume the option to apply fertilizers, enter "Function - Manual - Malfunctions" and end the stop.

The pH regulation can be configured to apply an acid or a base; to do this answer the following request.

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

The "Modulation cycle" of the pulses is the time, in seconds, by which the acid or base injection pulses are repeated.

The "Proportional band" is used by the controller to calculate the necessary % increase or decrease of the injection when the pH sensor falls below the reference value given by the irrigation program. Here are some examples:

- With a 2.0 band, for every one-tenth (0.1 pH) increase in the sensor, the injection output will decrease by 5%: 100 ÷ 20 = 5.
- With a 5.0 band, the 0.1 pH increase will decrease by 2%: 100 ÷ 50 = 2.

With the previous example, you can see that there is less variation in the injection with a larger

> Proportional band : 2.0
> Reaction: 1

band, which will be useful when a sector has oscillations in the injection.

The "Reaction" value's function is to slow down the changes in the output ratio for the injection: with the value of "0", the changes are immediate, with "1", the output will make an approximation every second to reach the new value that has been calculated, with "2", it will do it every two seconds, etc. The standard value is 1, and it is recommended that it not exceed 4. Here is an example of going 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 ➔					

On the next screen, you can configure whether or not to inject acid in the pre-irrigation or the post-irrigation.

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

2.1.2.   GENERAL OUTPUT PARAMETERS

The pH control option has a general output that will activate whenever it is regulating the pH; If it is going to be used, an output relay must be assigned to it. The analog output (0-20mA) is for injecting an acid or a base; the same output can also be used as a pulsed output (see the connection of the "analog inputs and outputs" option); in this case, a special relay is used.

> General pH control output : 00000091
> Analog pH output : 00000090

2.1.3. ANALOG SENSOR PARAMETERS

Among the 40 sensors that the Agrónic 4000 can control, the first of them, configured as a pH sensor, will be the one used for regulation. Also, the first conductivity sensor (EC) will be used for control.

First, assign a sensor number.

```
ANALOG SENSOR PARAMETERS
Sensor : 1          Format : 2
```

Then, to which input it will be connected, from the "Analog inputs and outputs" expansion or from external modules.

```
Sensor number :  05
Input number :  0000002
```

The unit of measurement (format), a 14 for pH and a 13 for EC.

```
Analog sensor:  05
Format :  14              00.0 pH
```

```
Analog sensor: 05
Tare :  +00.0 pH
```

```
Analog sensor: 05
Register :  YES
```

To expand the information on sensors and formats, you must take into account section "6.4.2." in the Agrónic 4000 manual.

2.1.4. SECTOR PARAMETERS

The "pH regulation auto-adjustment" along with "Auto-adjustment timing" are used to find the optimum injection value for each sector or group of sectors. To do this, the controller constantly modifies the auto-adjustment value until the pH sensor reads the same value as the irrigation program. When this occurs, the injection output value in % and auto-adjustment are the same. If the sensor value is not equal to the reference value, it will wait for the seconds specified in the auto-adjustment timing and it will increase or decrease the auto-adjustment and the output by 1%; this will repeat for each duration as long as they do not match.

When setting up the injection system, you can enter the value you believed to be the necessary auto-adjustment for the % of injection output in each of the irrigation sectors.

SECTOR	Auto.pH	T.auto	Bars
- 01 -	33 %	04"	03.2

For each sector, it memorizes the injection percentage (%) with which the last irrigation ended (auto-adjustment); when starting a new irrigation, it takes this auto-adjustment value as a starting point to apply it to the injection.

2.2. PROGRAMS

When programming the irrigation, it will ask for a pH reference value in each of the sub-programs. To access, go to "Function - Programs".

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

```
P05-01  S02 05 .. .. .. .. .. .. .. ..        pH=06.7
R= 0208 m3   F1: 0032   F2: 0009 L
```

```
P05-02  S03 .. .. .. .. .. .. .. .. ..        pH=06.5
R= 0253 m3   F1: 0039   F2: 0012 L
```

2.3. ANOMALY READING

ANOMALY PH ALARM | [N 39] [AL-3] [MSG]

If a satisfactory result is not achieved due to some incident when injecting an acid or base, when it goes out of the margins and for a predetermined time, the anomaly is registered and it enters "pH regulation malfunction". To resume pH regulation, enter "Function - Manual - Malfunctions" and end the stop.

ANOMALY 100% PH INJECTION | [N40][AL-3] [MSG]

When the injection is kept at the maximum for a certain amount of time, it registers and goes into "pH regulation malfunction". To resume, enter "Function - Manual - Malfunctions" and finish.

ANOMALY EC ALARM | [N 41] [AL-2] [MSG]

When fertilizing, the conductivity of the irrigation water has gone outside of the allowed margins, so it is registered and enters "conductivity control malfunction". To resume, enter "Function - Manual - Malfunctions" and finish.

2.4. HISTORY READING

On each of the days of the history, it will record the average pH and EC of each of the sectors. The values to calculate the average are taken when a sector is irrigating.

```
23/07/09  S01  R= 000000L    0000:00.00
F1 0000'00"  F2 0000'00"  F3 0000'00"  F4 0000'00"
```

```
23/07/08  S01  01.3 mS  06.7 pH
F5 0000'00"  F6 0000'00"  F7 0000'00"  F8 0000'00"
```

2.5. CONSULTATION

Within the general consultation, there is a screen dedicated to consulting the values of the pH regulation option and EC reading. The first value corresponds to the instant pH sensor reading, followed by the reference value requested by the current program and the percentage value at which it is being injected; the last value on the right shows the instant electrical conductivity (EC) sensor reading.

```
06.8 pH  Ref.: 06.7 pH  (045%)          02.1 mS
```

When there is a "pH regulation malfunction" or one of "conductivity control", it will show flashing text on the second line of the first consultation screen.

3. Pressure regulation option (v3)

3.1. DESCRIPTION

The purpose of this option in the Agrónic 4000 is to maintain independent pressure in the irrigation pipes for each sector.

The regulated motor is 1.

Regulation auto-adjustments memorized independently for each irrigation sector.

The 0 - 20 mA analog output of the "analog inputs and outputs option" will connect the frequency variator of the irrigation motor.

3.2. PARAMETERS

To properly configure the option, access "Function – Parameters" and enter the values requested in the parameters for "Analog sensors", "Sector parameters", and "General Output Parameters".

3.2.1. ANALOG SENSOR PARAMETERS

Among the 40 sensors that the Agrónic 4000 can control, the first of them, configured in format 12 as a pressure sensor (bars) will be the one used for regulation.

First, assign a sensor number.

```
ANALOG SENSOR PARAMETERS
Sensor : 1        Format : 2
```

Then, to which input it will be connected, from the "Analog inputs and outputs" expansion or from external modules.

```
Sensor number :  02
Input number :  0000001
```

The measurement unit in format 12 for "bars".

```
Analog sensor:  02
Format :  12             00.0 bars
```

```
Analog sensor: 02
Tare :   +00.0 bars
```

```
Analog sensor: 02
Register :  YES
```

To expand the information on sensors and formats, you must take into account section "6.4.2." in the Agrónic 4000 manual.

3.2.2. SECTOR PARAMETERS

An operating pressure can be configured for each irrigation sector. This reference value, "Bars", is entered in the third screen; in addition, motor 1 must be assigned in the first one.

SECTOR	Auto.pH	T.auto	**Bars**
- 01 -	33 %	04"	**03.2**

3.2.3. GENERAL OUTPUT PARAMETERS

The "Proportional pressure regulation band" is used by the controller to calculate the necessary % increase or decrease of the frequency variator regulation when the pressure sensor falls below the reference value given by the irrigation sector. Here are some examples:

- With a 2.0 band, for every one-tenth (0.1 bars) increase in the sensor, the regulation output will decrease by 5%: 100 ÷ 20 = 5.
- With a 5.0 band, the 0.1 bars increase will decrease by 2%: 100 ÷ 50 = 2.

Proportional pressure regulation band 2.0
Reaction in pressure regulation: 1

The "Reaction in pressure regulation" value's function is to slow down the changes in the output ratio for the injection: with the value of "0", the changes are immediate; with "1", the output will make an approximation every second to reach the new value that has been calculated; with "2", it will do it every two seconds, etc.

When there are several sectors irrigating or cleaning filters at the same time, if the question is answered with a "yes", it will enter the highest pressure reference recorded for a sector. If the answer is "no", it will enter the pressure reference of the sector with the lowest sector number of the programs that are operating at that time.

Pressure regulation, use the
higher reference: No

The analog output (0-20mA) is for connecting to the frequency variator. See the connection for the "analog inputs and outputs" option.

Analog Output Reg. Pressure: 00000003

3.2.4. PARAMETERS FILTER CLEANING

When cleaning the filters, the group assigned to Motor 1 will take the pressure programmed in "Pressure for filters". When the cleaning is finished, the pressure assigned to the corresponding irrigation sector will be entered again. If the pressure indicated for filters is 0, it will not change during cleaning; it will be the same as during irrigation.

> Pressure for filters:
> G1: 03.5 bars

3.3. CONSULTATION

Within the general consultation, there is a screen dedicated to consulting the values of the pressure regulation option. The first value corresponds to the instant pressure sensor reading, followed by the reference value requested by the irrigation sector and the percentage value at which the pump is regulating.

> 04.3 bars   Ref.: 04.4 bars   (087%)