SISTEMES ELECTRÒNICS PROGRÉS

AGRÒNIC 5500

EC and pH REGULATION

Installer manual

DESCRIPTION:

CE regulation with 4 different fertilizers. To determine the amounts to add from each fertilizer you set the proportions between them.

pH regulation with an acid or a base.

The regulation of the EC and the pH in the watering is done with **PID** controls (Proportional, Integral, Differential).

The PID comes with a default setting that may need to be adapted to each installation in particular.

The Agrónic has a quick setting screen for the PID.

FUNCTIONING:

EC regulation (fertilizer)

In order to achieve the desired EC in the watering, you progressively inject small amounts of fertilizer in the water. The Agrónic keep changing the duration of the injection pulses, form 0 to 100% to increase or decrease the EC.

If several fertilizers are used, it's necessary to set a proportion between them, if the injection needs to be increased or decreased, this will be done carrying these proportions.

pH regulation (acid)

In order to achieve the desired pH level you progressively inject small amounts of an acid or a base in the water.

If a **base** is used, it gets injected when the pH reading is below the reference. If an **acid** is used it gets injected when the pH reading is above the reference.

PARAMETERS:

The EC and pH reference and the proportion between fertilizers is set for each program.

The PID controls are set in "Function - Parameters - Installer - Fertilization - EC/pH regulation" and are the following:

Kp: proportional gain. It increases the injection of fertilizer when the difference between the EC and the reference is greater. At 0 it doesn't act (from 1 to 10). This value has the largest weight for the control. A too great value can cause oscillations when it reaches the reference. A too low value can cause it to never reach the reference, although this can be compensated with the integral control.

Ki: integral gain. It increases the fertilizer injection in relation to the increase of the accumulated error in time. At 0 it doesn't act (from 1 to 10).

Kd: derivative gain. It increases the fertilizer injection in relation to the decrease of the speed of the EC change. At 0 it doesn't act (from 1 to 10).

Initial delay: upon starting the fertilization, the injection gets on the same value of the last watering during the time set here. Once this time has passed, the PID calculates the injection (from 0 to 30). The value of the injection is stored for each sector.

Calculation time: it's the frequency of the calculation of the injection time (from 1'' to 9''). This value is important for the integral and derivative calculus. Usually it's the time it takes to the water to circulate from the point where it had been injected until it reached the EC or pH sensor.

Modulation cycle: it's the time in which the injection pulsations get repeated (from 1.0'' to 5.0''). Example: if the time is set at 2'' and the injection at 50%, the injection valve will be 1'' open and 1'' closed.

SETTINGS:

The PID control settings must achieve three things:

1. For the system to be stable. The EC and pH values must not present oscillations.

2. For the system to be fast. It's necessary to achieve reaching the reference in the least possible time.

3. For the error to be 0. The error is the difference between the reference and the sensor reader.

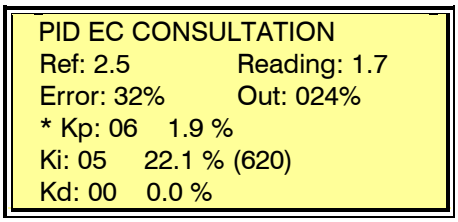
Stable. If the regulation has oscillations, it can be due to a too high value on the gains. They must be lowered, particularly the Ki and Kd.

Fast. In order to be fast, the time the water takes to go from the injection point to the sensor must not be high. In order for the system to be fast, when there are flow changes we can increase the Kd.

Error. If only the Kp is used, the system can have an stationary error, it never reaches the reference. To eliminate it use Ki.

Setting the PID while running:

The Agrónic allows adjusting the settings of the PID while it is carrying out the regulation and seeing how this affects the change in the gains in real time. For this, you must go to "*Consultation – Fertilization*". If on this screen you press the '**1**' key, you see the PID query that regulates the EC. If you press the '**2**' key, you see the PID query that regulates the pH. The gain that can be modified it's indicated with a star *****. It gets modified with the '+' and '-' keys. With the up and down keys you can change the star to the next gain.



Ref: reference to follow.

Read: reading of the regulation sensor.

Error: current error %. The error can be from -100% to +100% and it is calculated with the following formula:

Error = ((Reference – Reading) * 100) / Reference.

Out: % of output injection. It is calculated adding the outputs of each of the controllers.

Kp: Proportional control. It shows the gain (from 0 to 10) and the % it adds to the total output value. As a maximum it can add the 50% of the output.

Ki: integral control. It shows the gain (from 0 to 10), the % it adds to the total output value and the accumulated integration (sum of the errors from the start of the regulation).

Kd: derivative control. It shows the gain (from 0 to 10) and the % it adds to the total output value. It only acts when there is a difference between two consecutive readings, meaning when the reading changes abruptly.

If you press the '0' key on this screen, an error graph appears showing the last 128 days calculated by the PID. The screen central line indicates the 0 error.

Settings table. This table can be used to adjust the system settings. You can take note of the results to which the gain values change.

Cycle	Time	Kp	Ki	Kd	Stable	Fast	Error	Commentaries
1,5"	2"	7	2	0				

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