Aqua-Hort® Manual

Electrolytic Micro Element Production and Electro Magnetic Treatment of Plant Production Water.

Production of free ions (Fe, Cu, Zn, Al) Positive side effect on Fungal and Bacterial Diseases in Plant Production. Gives better plant growth.

Print Construction: Hennning Brøgger, BG Elektronik
Software Development: Lennart Berg, Blogic
Controls Construction: Troels Christensen, Grene Industri Service
Tank Construction: Viggo Skammelsen, VSM Thy

Aksel de Lasson

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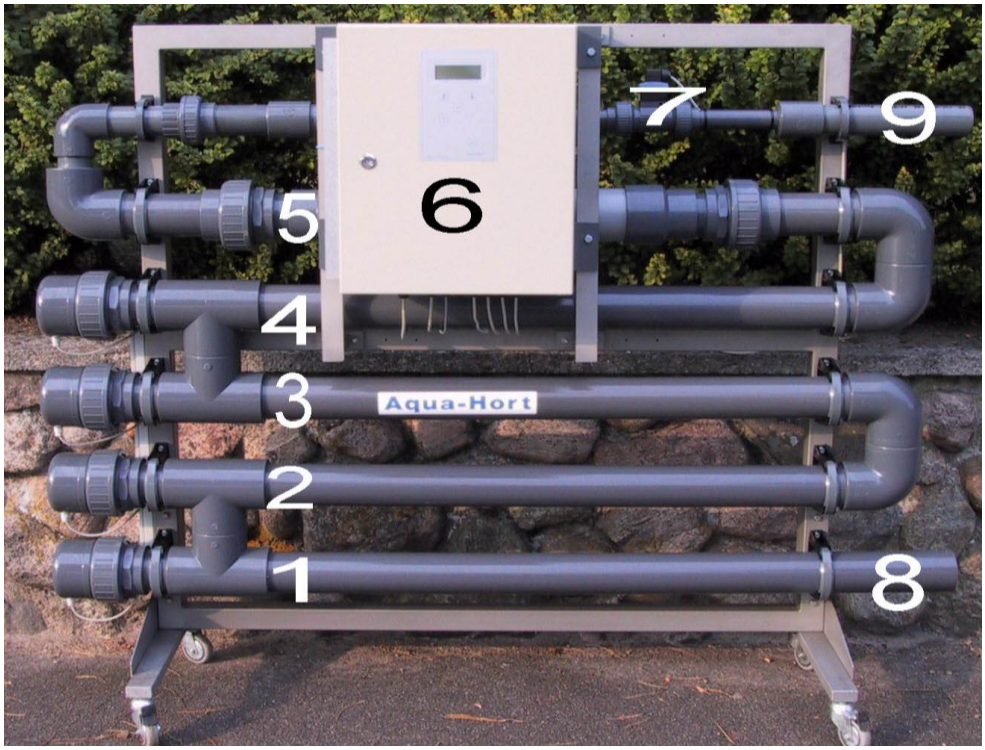
3rd. Generation Controls. Software 3.07

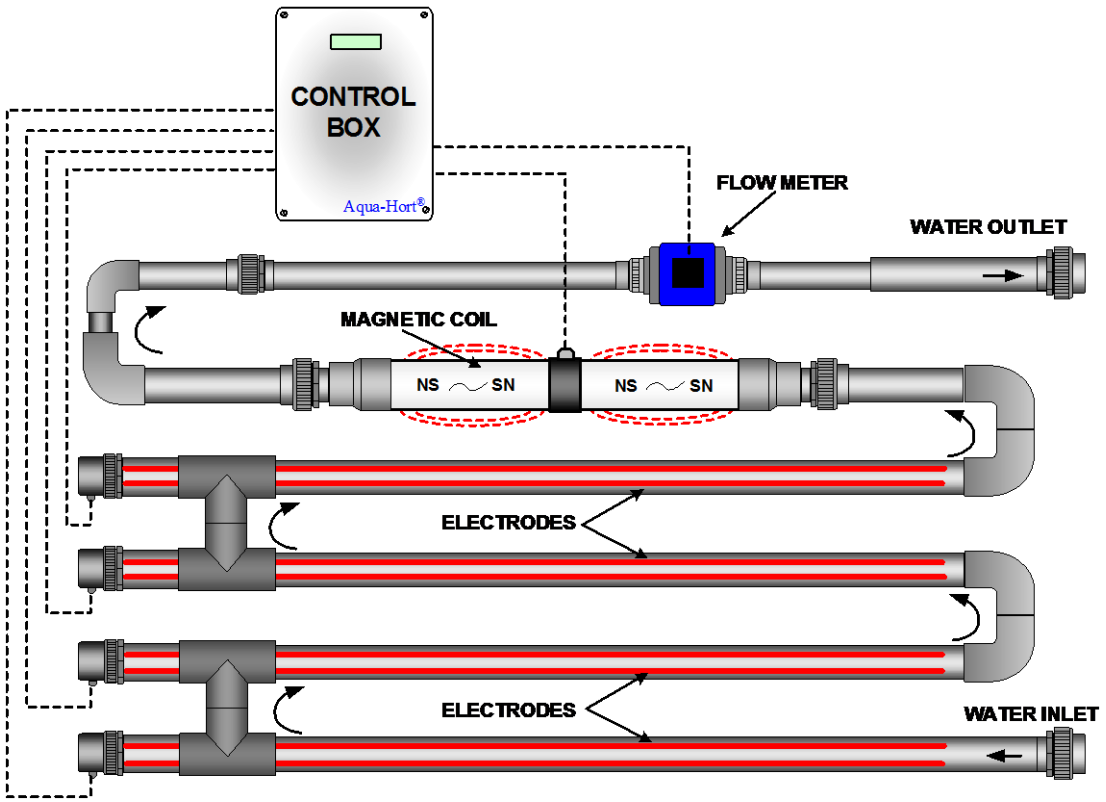
Aqua-Hort®
Engdalsvej 28
DK 8220 Brabrand
Tel +45 70226611
E-mail: aqua-hort@aqua-hort.dk,
Homepage: www.aqua-hort.dk

The standard Aqua-Hort pipe model is shown in the picture below:



***Explanation (Standard Pipe Unit)**: **1**) Electrode 1, **2**) Electrode 2, **3**) Electrode 3, **4**) Electrode 4, **5**) Electromagnet, **6**) Control Box, **7**) Flow meter, **8**) Water in, **9**) Water out.*

The Aqua-Hort is shown in a function diagramme below:



The Aqua-Hort tank Model.

In the Aqua-Hort tank model are the electrodes formed by bended copper plates in a circular tank. This allows for more volume due to the dimensions. The big plates allows for lower conductivity water than otherwise in the pipe models, and lastly the compact construction makes installation easy in tight places. Flange size 4". Water in at the top.
The inside of the tank is shown below. The electrode plates are standing vertically, each with a cable connection. They are alternatively plus and minus or A and B. In this way they act as electrodes on both sides.

The Aqua-Hort Controls

The Aqua-Hort controls are shown in the picture below: (model with one transformer, 65 amp, 24 VDC output).

In the left side of the control box the transformer is placed. Below that the ampere sensor and the polarity switch. In the middle follows the main print. To the right is sitting the temperature thermostate and the internal power supply. Below the terminals for power input and the fuses. The ventilator is placed in the right side of the box, as well as the main switch.

The input power is 1 x 230 V AC, or 3 x 400 VAC 50/60 Hz. It might vary from this level, but this will hamper the performance of the system. US users must be aware of this, and step the voltage up from the usual 110 Volt. For the 65 amp model is the input 1 x 230 V AC.
The output power is taken out from the two screws A and B on the polarity switch. It is connected to a connection box with fuses, from where it is distributed to the electrodes.

Transformers can be chosen with 24 or 48 Volt DC maximum output. There is space for three power supplies, which can operate together in one cabinet.

Transformer	Max No./unit	Max amp 24 V	M amp 48
1,5 kW 33/65	3	200	100
4,5 kW 100/200	3	600	300
10 kW 200/400	1	400	200

As seen from the table a lower voltage version gives more output (ampere). There are a number of factors which one has to consider when choosing the appropriate machine. The flow rate, wanted ppm Cu and the conductivity are the parameters to be considered. The ampere needs are calculated by the formula: m^3/h (flow) x ppm Cu x 0,8 = ampere. Sufficient electrode surface must be available. Less voltage available demands more electrode surface.

Front Display

The front display is shown in the picture below:

The top line of the display is showing to the left the Status of the system.
To the right the actual time. The time setting is made in menu point no. 8. The battery is charged by the system.

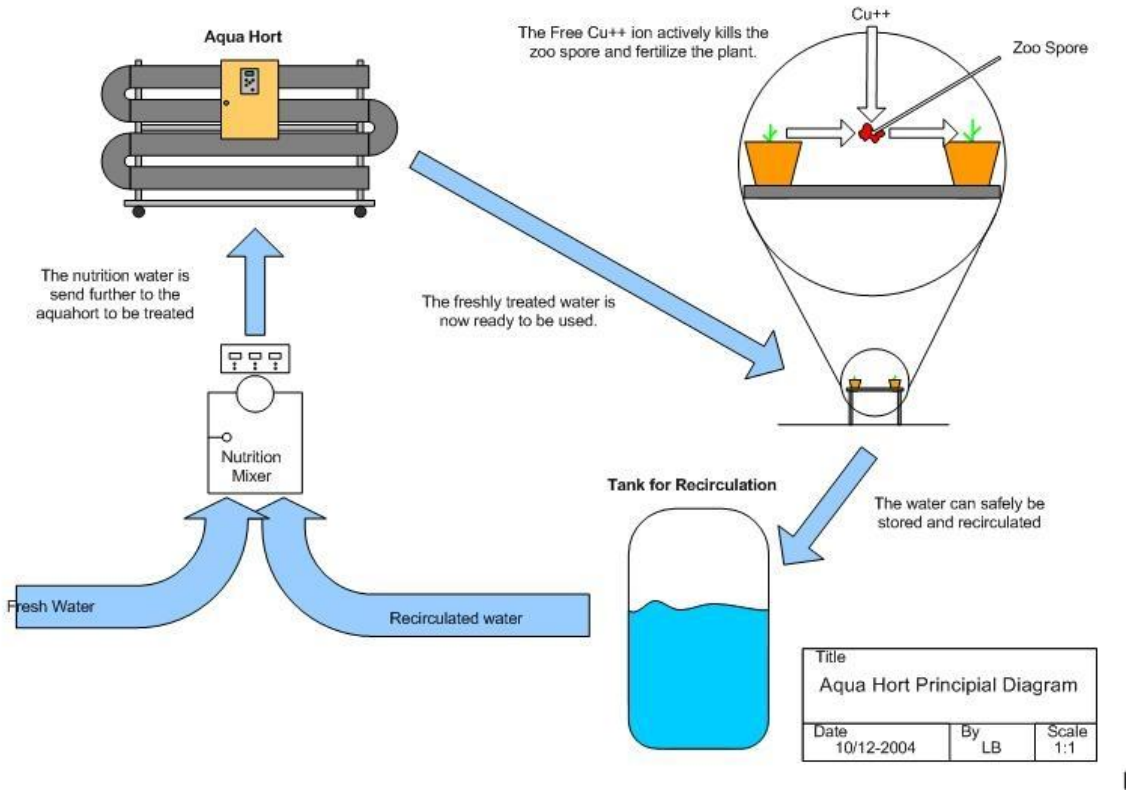
The second line shows to the left the metal bank equal to the amount of electrode metal left in the system. When new electrode metal is inserted the metal bank must be updated. This done in menu point no. 1.
To the right in the second line is the actual PPM of the system. It can be changed by pressing the SET botton, and then with the up and down arrow adjust the value.

In the third line is shown to the left the actual voltage DC of the system. Value shown is between zero and 24 for 24 Volt systems, and between zero and 48 for 48 Volt systems. By low loads are the controls running on-off. The voltage will then be zero at times.
To the right is shown the amperage yielded. The amperes must always be equal to the flow m3/h x ppm x 0,8

In the fourth line is to the left shown the actual flow in cubic meter per hour. Remember to put the k-factor in menu point no. 2 correctly for the specific flow meter used.
To the right is shown the total cubic meter recorded until now. The figure can be reset by pressing Set and Clear Alarm simultaneously for some time.

Installation

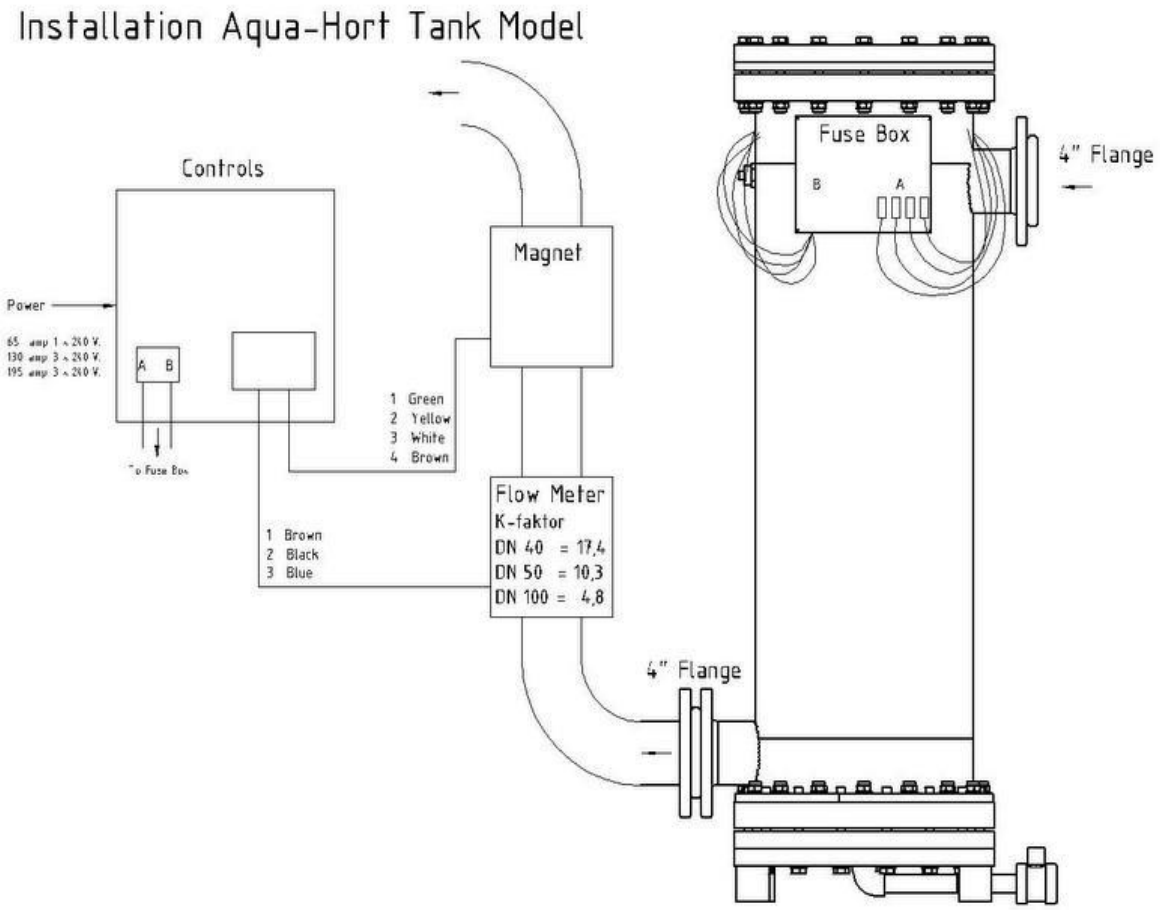
The Aqua-Hort is normally placed after the fertilizer mixer. The purpose being twofold: One to have the conductivity as high as possible, allowing the controls to work less for the same yield. Secondly to have the high charged Aqua-Hort ions to be as fresh as possible when entering the plant production area. This ensures that the positively charged ions have full force when they "attack" the negatively charged spores in the nutrition water and the root zone.



In cases where a placement after the fertilizer mixer is not possible, the Aqua-Hort is placed in the best suitable position, for example after a day tank with nutrition water, or in a inlet reservoir for the nursery. Nurseries with many fertilizer mixers might also be "forced" to choose this solution.

If the installation is in inlet reservoirs the conductivity will often be low, which requires that the Aqua-Hort is adjusted with bigger electrode surfaces.

In case Aqua-Hort is installed in an outdoor reservoir for simultaneous algae control. The solution is mostly to place an Aqua-Hort boat model in the reservoir.



The diagramme above shows in a practical manner how to install the Aqua-Hort Tank Model.
Water is led in at the top and out at the bottom. The flow meter and magnet is placed after the tank.
The controls are connected with the Fuse Box by means of an A and B cable. Since it is DC power being applied there is an issue of voltage loss over the distance. If for example an 200 amp controls is placed several meters away from the tank. The A and B cables must be 75 mm2 each in size. A 65 amp controls placed close to the tank will only need two 16 mm2 cables.

The Flow meter has three wires: 1. Brown, (+12 V) 2. Black, (the pulse) and 3. Blue, (Ground)

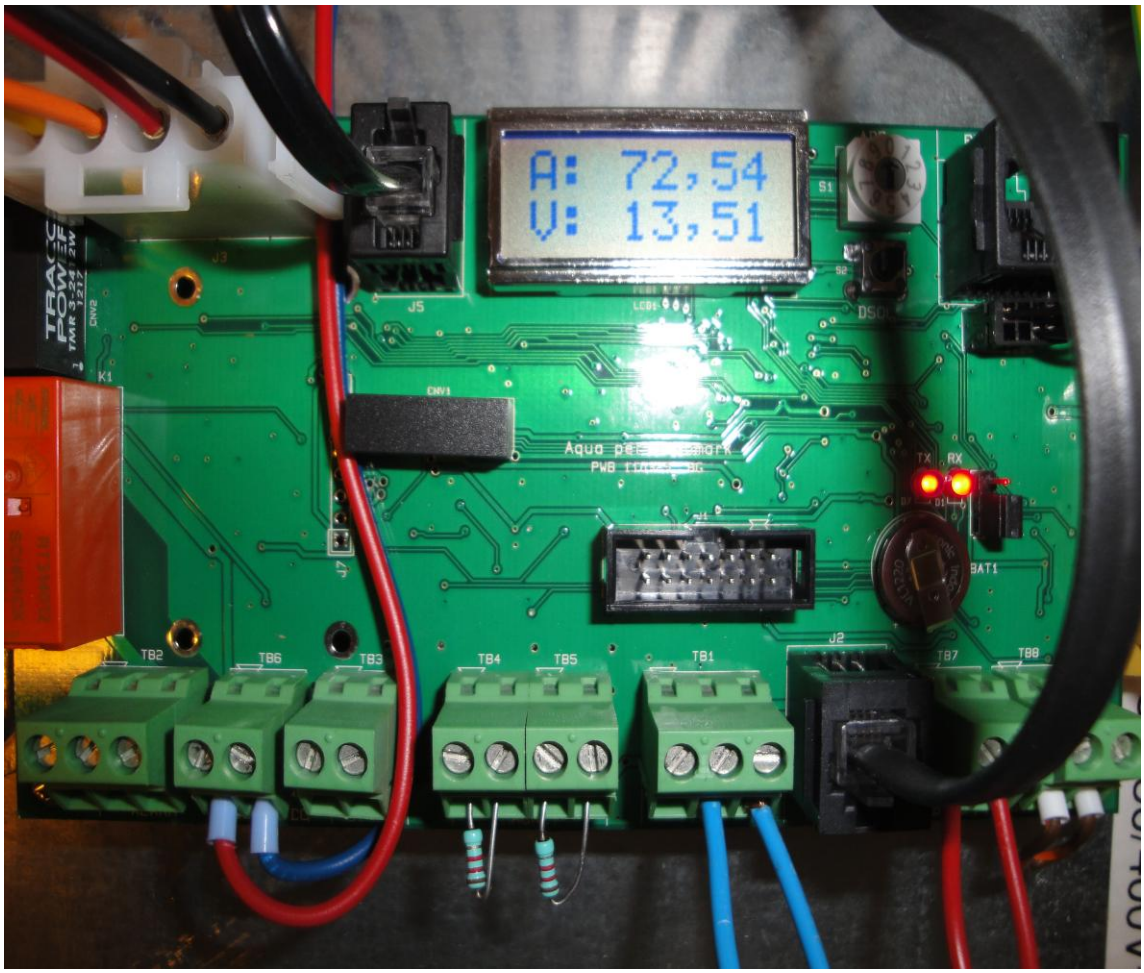
The Magnet has four wires. They sit in the order from the left: Green, yellow, white and brown.

The power supply for the controls is determined by the size of the controls. 65 amp machines need 1 x 230 VAC, while 130 and 200 amp machines need 3 x 400 VAC (400 Volt).

If the nutrition water is applied through fine nozzles or drippers a filter must be placed after the Aqua-Hort machine. This to catch any particles being formed during the electrolysis.

Aqua-Hort Mother Board

The Aqua-Hort Mother Board contains all programs for the system. A small service display on the print shows the output amperes and voltage.
The top left wires are for the polarity switch control. The next connector is for the ampere sensor. The wires to the right of the display controls the transformers. The RS 485 socket at the bottom is for the front display.



From the left the connection pins functions as explained below:

1. **TB2: Alarm: Potential free alarm outlet. C: Common and NC: Normally Closed and NO: Normally Open.**
2. **TB6: Power Supply for the print: 24 VDC. Red is plus.**
3. **TB3: Alarm Siren: 24 VDC out when the alarm is activated.**
4. **TB4 and TB5: Magnet: Pins for the Electro Magnet. From the left: Green, yellow, white and brown.**
5. **TB1: Flow: Flow Meter connection. From the left: +12V: Power supply – Brown cable. IN: Output Pulses – Black cable . GND: Ground connection - Blue cable.**
6. **TB 7: Reduce/Increase or decrease PPM dosing or Flow Watch. Potential free contact.**
7. **TB8: Fuse Break: From Fuse Box. Potential free contact.**

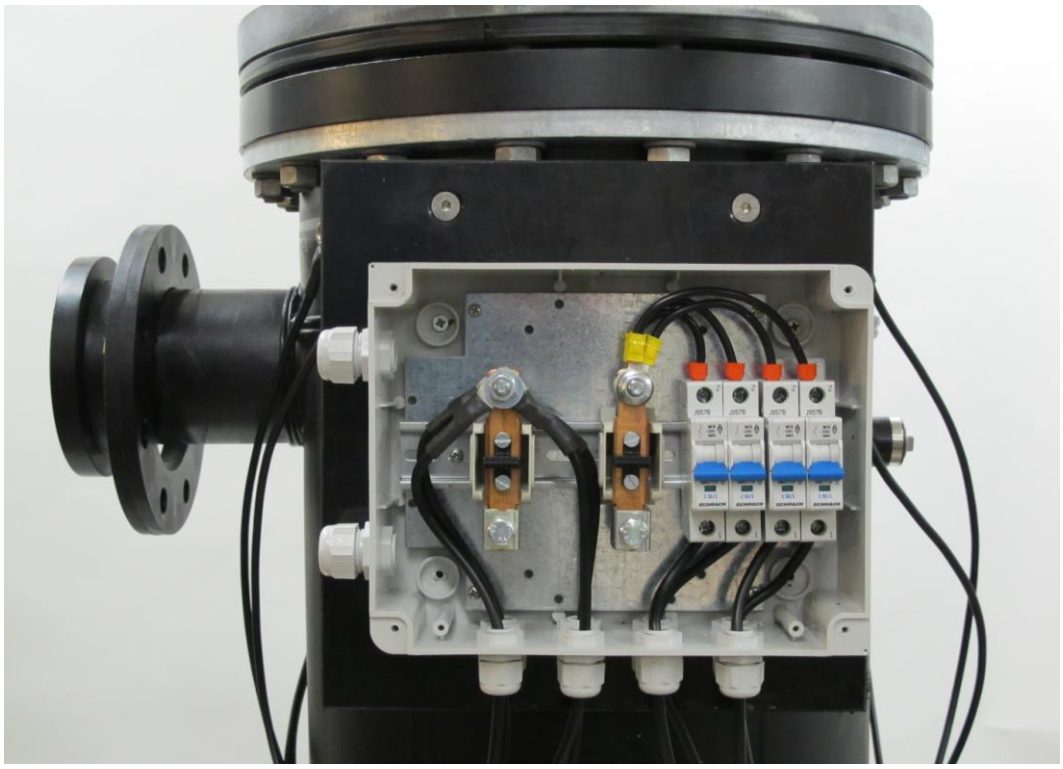
Aqua-Hort menu

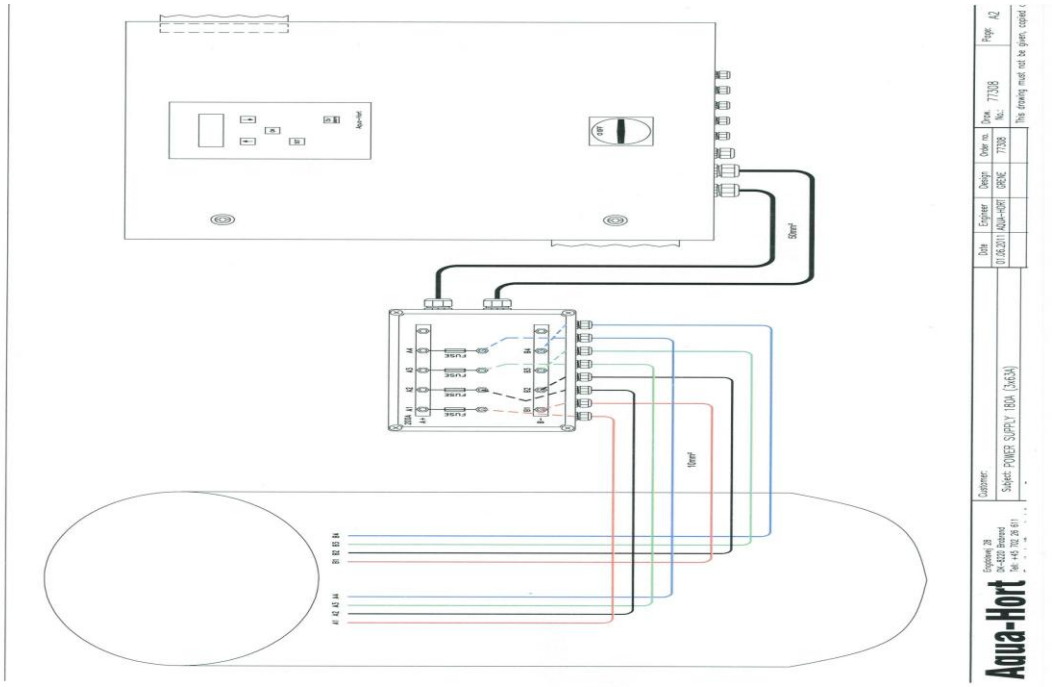
The menu mode is arrived at by pressing the Arrow up and down simultaneously for some time.
The Aqua-Hort Menu has the following items:

1. ***Set Copper amount:*** **Here is the amount of metal installed, mostly copper, recorded. The controls will keep control of the balance. In this way it can be observed when metal change is needed.**
2. ***Set water Flow Data:*** **Here is the k-Factor (puls per liter) of the Flow meter recorded.**
3. ***Set Virtual Flow Data:*** **Here is the setting of the virtual flow facility. Either On or Off. By On the simulated Pulse per Liter must also be set. Remember to swith the Virtual Flow Meter off by use of a regular flow meter. When using the virtual flow meter must a connection be laid between the two right pins of the flow input.**
4. ***Measurement Unit*****: Here is the unit chosen in which the data should be shown. Metric or US Imperial Gallons.**
5. ***External PPM Adjustment*****: (Dual level) or Flow Watch. This is a facility to adjust the dosing in a particular watering situation. Either higher or lower. An alternative use is to make it act as an flow watch within a minimum and maximum flow setting. A potential free contact must be laid to make it operate. Normally from the irrigation computer.**
6. ***Set Hardware Type:*** **To tell the controls about the Max. Capacity in amps. Standard 200 amp.**
7. ***Auto Start/Stop*****: By this facility a programmed start and stop can be employed. When the Auto Start is On the Aqua-Hort will only operate within the hours programmed.**
8. ***Set Time*****: This is a feature to set the time.**

The Aqua-Hort Fuse Box.

The Fuse Box is placed between the electrodes and the controls. The purpose is to collect the electrode cables into one A and one B cable for the controls. Fuses for each electrode pair is provided. Fuse breaker contacts are included.





Fuses in the Connection Box ensures that the current does not run over one electrode in case of a short circuit. For the 190 amp version the cables to the electrodes must be 10 mm^2 in size. The cable between the Controls and the Connection Box must be 50 mm^2 in size for 200 amp machines. 35 mm2 for 100 amp machines.

Flow Meter (burkert):

The connecting slots are used according to the following plan: (See also the wiring diagram)

1: + to 1 on Hall generator flow sensor. Brown colour
2: in to 2 on Hall generator flow sensor. Black colour
3: GND to 3 on Hall generator flow sensor. Blue Colour
Earthing on Hall generator is not used.

DN 15:	20	mm pipe,	min flow	0,5 m3/h	Max flow 6	m3/h	k-Factor	107,6
DN 20:	25	mm pipe,	min flow	0,8 m3/h	Max flow 10	m3/h	k-Factor	75,3
DN 25:	32	mm pipe,	min flow	1,3 m3/h	Max flow 18	m3/h	k-Factor	52,9
DN 32:	40	mm pipe,	min flow	1,9 m3/h	Max flow 25	m3/h	k-Factor	28,5
DN 40:	50	mm pipe,	min flow	3,0 m3/h	Max flow 40	m3/h	k-Factor	17,3
DN 50:	63	mm pipe,	min flow	5,0 m3/h	Max flow 70	m3/h	k-Factor	10,2
DN 65:	75	mm pipe,	min flow	7,0 m3/h	Max flow 100	m3/h	k-Factor	11,2
DN 80:	90	mm pipe,	min flow	11 m3/h	Max flow 150	m3/h	k-Factor	7,4
DN 100:	110	mm pipe,	min flow	18 m3/h	Max flow 210	m3/h	k-Factor	4,8
DN 125:	140	mm pipe,	min flow	30 m3/h	Max flow 400	m3/h	k-Factor	3,45
DN 150:	160	mm pipe,	min flow	48 m3/h	Max flow 600	m3/h	k-Factor	2,55

When pressing the up and down arrows simultaneously on the front panel, the menu for setting the k-Factor appears. In rare cases where no flow meter is used, the flow simulator is activated. Maximum pulse per second 100.

Magnet:

Cable pairs with low resistance forms a pair.

1: pair 1 coil 1 green to 1 on magnet
2: pair 1 coil 1 yellow to 2 on magnet
3: pair 2 coil 2 white to 3 on magnet
4: pair 2 coil 2 brown to 4 on magnet

To prevent condensation on the electronic parts it is recommended that the power remains on always.
By overload the thermo shut-off switches will be activated. Deactivation is done by cutting the power supply for a short period.

Maintenance

Checking the Aqua-Hort Controls.

1) Disconnect the electrode cables from the polarity switch.
2) Put water on so the unit shows flow.
3) Set the ppm to zero. Measure the DC Voltage on the electrode outlets. It must be zero VDC.
4) Set the ppm to one. Measure the DC Voltage on the electrode outlets. It must be 24 VDC.

When the controls has been checked, and problems still occur it must the electrodes or the connections to them which are faulthy. By **measuring the resistance on each electrode** pair, the weak point can be found. It might be broken cables or the electrodes worn out or short circuited.

Inspect the electrodes

The electrodes should normally be inspected every six months. When worn out, replacement must take place.

Errors displayed:

1) **Current too low:** This means the demands are higher than what the unit can yield. Either too high volume or ppm setting, or the conductivity is too low for the circumstances. Solution: bigger unit eventually increase the EC.
2) **Current too high:** This means a short circuit in the electrodes. Must be repaired.
3) **Komm. Error to Dos**: The signal to the display print is not transmitted. Try to take the cable out a couple of times.

Test for free Copper

The Aqua-Hort system will release exactly the amount of free charged copper which the ppm setting and the flow prescribes (m^3/h x ppm x 0,8 = amp).
Still interference might change the amount arriving at the plant site, binding some of the free ions as complexed bound ions. Therefore it is recommended to test from time to time that the right levels are achieved.
With the system is delivered a set of the Hanna Instruments HI 96702, 0,0-5,0 ppm.
Test reagent HI 93702-0. The system has a zero calibration function, and a digital readout. Only one chemical is needed.

Under "normal" circumstances with a good water source giving clean water with a balanced mineral mixture and some bicarbonate there are seldom problems. The setting on the Aqua-Hort will be the same as what can be measured at the plant site.
Interference can often be found under the following circumstances:

a) Use of "aggressive" water like reverse osmosis water or water from rock mountains very low conductivity.
b) Water from river sources with many organic particles.
c) Use of "cheap" iron chelates combined with aggressive water. Good experiences with HEDTA 4,5% liquid and HEEDTA 13% in case of loss due to iron chelates.
d) Use of water with high pH. Above 7,2.

If the interference is less than 1 ppm is the cure often compensatory dosing. If higher some measure must be undertaken. Addition of bicarbonate (50 ppm) is normally a good cure. It also adds pH buffer to the water. Another measure is to change the iron chelate to a more stable type like EDDHA chelates. If the iron dosing is very high, it might help to lower that.
If rainwater is the source it is a good measure to add 10-20% well water to the rain water. A practice which is normally followed in Denmark – with or without Aqua-Hort.

Nutrition water with high pH should normally be acid treated to bring the pH down.

Practical Hints:

Check the ampere output

The ampere reading in the upper right corner of the display must always correspond to the formula: Flow x ppm x 0,8 = ampere. The flow in cubic meter per hour.

Flow Meter

In the flow meter house there is a small wheel rotating. It is situated in the side of the wall.
If the unit shows no flow during watering it is most likely because the small wheel is blocked by some dirt particle. Unscrew the flow meter housing, and clean away the dirt.

The following check points are used for running the Aqua-Hort:

1) **Set the desired Cu level by pressing the Set button. Then choose the level by means of the arrows ⇑ or ⇓ and confirm with the OK button.**

2) **Check the ampere output by the formula: (m^3/h) * ppm Cu * 0,8 = ampere. Example: 10 m^3/h * 1,2 ppm Cu * 0,8 = 9,6 ampere**

3) **Set The copper consumption is the total water flow multiplied by the average ppm setting. Example: 12000 m^3 * 1,2 ppm = 14,4 kg copper. The copper reservoir in a Aqua-Hort standard unit is 33 kg copper. Order new copper rods from the Aqua-Hort agent for replacement.**

4) **There are three error displays which might occur. 1: EL. X CURR. TOO LOW. This appears if the demands are higher than the capacity. The voltage will reach the max. of 24 volt. The common cause is too low EC in the water. A fault in the electronics might also be the cause. : EL. X CURR. TOO HIGH. A fault in the electronics is likely. 3: KOMM. ERROR TO DOS. Communication between the main board and the display fails. Try to disconnect the connection cable for a short while.**

Dosing:

The dosing applied depends on the conditions at the installation site. The dosing level is set by the user, who is responsible for maintaining the right levels. Recommended starting levels are: 1,0 to 2,0 ppm for fungus diseases. 1,0 to 3,0 for bacterial problems, and 2,0 to 4,0 for algae problems. The copper test set is used to check that the plants receive the dosing desired.
When recirculation is employed, care must be taken to adjust the dosing downward to avoid accumulation in the media. This especially applies to use in inactive media like Grodan and Perlite. This because the inactive media does not have the complex binding capacity which the organic media like peat has. For vegetable production on inactive media with frequent watering the dosing might be something like 0,2-0,3 ppm.

Guarantees:

The guarantee period for the Aqua-Hort machine is 2 years. The guarantees applies for the technical performance of the machine as such.
Undesired consequences for production and other installations are not covered by the guarantee. The Aqua-Hort machine is made available to the user, who takes the responsibility for the application in the nursery.