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AZUD QGROW

AT500

Photo no contractual

INSTALLATION MANUAL

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1. INTRODUCTION

The optimization of fertilizers and the responsible and efficient use of irrigation water is the challenge of current agriculture. AZUD QGROW AT500 is a fertigation equipment that applies the appropriate amount of water and fertilizers to the crop at the optimum time and in a homogeneous way, achieving an increase in the production and crop quality.

The purpose of this manual is to describe how the installation and commissioning of AZUD QGROW AT500 fertigation unit should be done. We recommend reading this manual carefully before starting to install or handle the equipment. If you have any questions, please contact Technical Service.

Warning:

all images shown in this document may be different from the current product due to design differences and each particular model.

1.1. General instructions

- Installation should only be done by authorised specialised technicians.
- If any problems occur during the installation process, please contact our Technical Service.
- The installation should be done on a flat and hard surface.
- There must be an electrical outlet where the unit will be located.
- In installations with support electro-pumps, proceed in its first installation to its priming by loosening the screw installed in the body of the pump and purging the air making the water flows through it. Once the pump is charged, the correct direction of rotation of the motor will be checked.
- We recommend disconnecting AZUD QGROW AT500 if you are not going to use it for an extended period of time.
- In order to ensure proper operation of AZUD QGROW AT500, we recommend checking the delivery pressure to the unit, so that it is not greater than 5.4 bar (except for orders for equipment that operates at higher pressures).
- Disconnect the controller during storms.

1.2. Safety instructions

Apply all safety provisions, bearing in mind that:

- The electrical system and wiring must only be done by an authorised electrician.
- The electrical system and wiring must comply with local safety regulations and standards.
- Under no circumstances remove the electrical protections on your own, or delete the ground connection.
- Proceed with the installation of necessary extinguishers according to current regulations.
- In case of observing electrical anomalies, contact the technical service; in no case do you intend to repair it on your own.
- Do not expose electrical appliances, equipment, switchboards and wiring, etc. to rain or humid, wet or corrosive environments.
- In case of electrical contact, do not touch the victim without first disconnecting the power.
- For handling fertilizers, acid and other chemical products, always use protective equipment and follow the manufacturer's instructions.
- Prevent leaks and spills of fertilizers, acid and other chemical products. If you detect any, immediately notify your installer to prevent it from coming into contact with electricity.
- Always wear safety footwear.
- You must not smoke or light a fire in the place where the fertilizers are.
- The noise level of the fertigation equipment is below 70 dB, as the only emitting element does not exceed this value.

1.3. Safety instructions table

Table 1. Safety instructions.

	Instruction	Application		Instruction	Application
	Wearing a helmet is recommended	Installation		Lighting flames near plant due to fire risk is prohibited	Installation, operation and maintenance
	Wearing ear protection if there is significant noise is recommended	Installation		No smoking near plant due to fire risk	Installation, operation and maintenance
	Wearing goggles for protection against flying objects is recommended	Installation		Changing the position of any valve is prohibited	Installation
	Wearing a mask and goggles when handling chemicals is recommended	Operation and maintenance		Danger of slipping, as the unit system may have leaks; proceed with caution	Operation and maintenance
	Wearing gloves for protection against chemicals and cuts is recommended	Operation and maintenance		Electrical risks	Installation, operation and maintenance
	Wearing safety boots is recommended	Installation, operation and maintenance		Danger from corrosive substances like sodium hypochlorite; proceed with caution	Operation and maintenance
	Using a forklift, pallet jack or crane is recommended for handling heavy loads	Installation		Danger of pressure pipes; proceed with caution when opening a pipe	Operation and maintenance
	No entry of unauthorised persons	Installation		Danger of high temperature; proceed with caution when touching motors and metal pipes	Operation and maintenance
	No running near the system installation area	Installation, operation and maintenance		Risk of becoming trapped and cuts from handling equipment	Installation, operation and maintenance

For installation tasks that require qualified personnel, we recommend working as a team and always wearing suitable personal protection equipment (PPEs). This reduces the risks of accidents.

1.4. Use of chemical products

- When using chemical products and acids, always bear in mind the manufacturer's safety instructions and rules.
- Always wear protection equipment, gloves and protective goggles when handling fertilizers, acids and other chemical products.
- Excess acid will damage the injection lines.
- Always keep solution in the stock solution tanks, in order to prevent variations in the fertilizer composition that is supplied for irrigating and air inlets to ducts and motors, which could cause serious breakdowns or failures. When preparing solution from solid fertilizers, pay close attention to its correct dilution, as well as the mixing of the different fertilizers. We also recommend stirring prior to irrigation to prevent stratifications in the tanks.
- Ensure that the fertilizer mixes are especially prescribed by a qualified technician, as well as the types of fertilizers to employ, which will prevent precipitates or adverse chemical reactions that could damage the crops and/or fertigation unit.
- If using rainwater or osmosis waters, the use of acid reaction fertilizers is not recommended in order to prevent drops in pH.
- Ensure that the incorporation of phytosanitary products, disinfectants or special additions have been prescribed by a qualified technician who will warn about possible interactions and/or reactions with the fertigation system. Always rinse afterward to eliminate all remains in the pipes.
- With regard to the addition of the aforesaid products, avoid oily, pasty and sticky materials that could impregnate the sensors, blocking optimal reading and inducing errors.
- There are sensitive parts in the fertigation system that may be susceptible to attack from oxidising agents and/or abrasive products (e.g.: chlorine, sodium hypochlorite or bleach, soaps, etc.). Consulting the installer before using them is recommended.

Warning:
for pH control we recommend the use of nitric acid because the use of sulphuric can produces problems in the installation of PVC due to the strong heating of water when mixed with the acid. In any case, AZUD is not responsible for the problems caused by AZUD QGROW AT500 equipment due to the reactions or precipitates of fertilizers and / or acids.

2. RECEIPT AND STORAGE

2.1. Receipt

It is dispatched packaged in an individual cardboard box.

It is delivered with the hydraulic connections on the pump loosened.

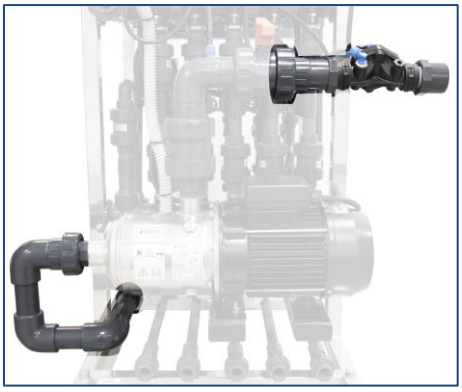


Figure 1. Photo illustrating the hydraulic connections.

The pH sensor is sent packaged in a protected cardboard box along with the hydraulic part of the equipment to prevent deterioration during transport. This pH sensor is submerged in a storage solution. When setting up the equipment, the pH sensor must be installed last to prevent drying and, therefore, damage to the membrane. However, the EC sensor is already installed on the sensor collector.

2.2. Storage

The fertigation unit must be stored under these conditions:

- Protected from inclement weather in a NON corrosive environment.
- In a dry location at temperatures between 5 and 50 ºC.
- Placed on a flat, strong and level surface.

3. DESCRIPTION

AZUD QGROW AT500 is specially designed to maintain the precision in fertigation of small and medium-sized farms, both greenhouse and open-air farms, soil or hydroponic crops, nurseries, drip irrigation and sprinkler. All of this can be controlled from your smartphone, your installation in your pocket.

Accuracy in the dosage of fertilizer and acid or base for stable control of pH and EC is achieved through Venturi type injectors, which perform their work without moving parts. Manufactured on a stainless steel structure, AZUD QGROW AT500 is an equipment with a long useful life, low maintenance and high energy efficiency. Thanks to its compact and robust format, it facilitates its transport and its integration in both new projects and existing projects.

AZUD QGROW AT500 has an approximate irrigation flow maximum of 5 - 50 m^3/h and can inject up to 300 l/h of fertilizers per injection line.

This equipment has the following characteristics:

Table 2. AZUD QGROW AT500 and its main characteristics.

	AZUD QGROW AT500/3	AZUD QGROW AT500/4	AZUD QGROW AT500/5
Number of dosing channel	3	4	5
Frame	Stainless Steel AISI 304 polished	Stainless Steel AISI 304 polished	Stainless Steel AISI 304 polished
Size (L-W-H)	700 x 700 x 1050 mm	700 x 700 x 1050 mm	700 x 700 x 1050 mm
Net weight	69.5 kg	71.5 kg	75.0 kg
Venturi (thread connection)	12.7 mm - 1/2"	12.7 mm - 1/2"	12.7 mm - 1/2"
Electrovalve FIP	4 mm	4 mm	4 mm
Inlet connection diameter (glued joint)	D. 40 mm – 1 1/4"	D. 40 mm – 1 1/4"	D. 40 mm – 1 1/4"
Outlet connection diameter (glued joint)	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"
Mixing chamber diameter	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"
Dosing channel connection	Female Thread BSP 1/2"	Female Thread BSP 1/2"	Female Thread BSP 1/2"
Dosing channel max. flow (per injection line)	300 l/h	300 l/h	300 l/h
Manual Selector	16	16	16
Fertilizer pump (50 Hz)*	1.1 kW	1.1 kW	1.1 kW
Power (50Hz)*	5.5 kW	5.5 kW	5.5 kW
Consumption (50 Hz)*	13.6 A	13.6 A	13.6 A
Fertilizer pump (60 Hz)*	1.5 kW	1.5 kW	1.5 kW
Power (60 Hz)*	6.3 kW	6.3 kW	6.3 kW
Consumption (60 Hz)*	14.4 A	14.4 A	14.4 A
Max. working pressure**	5.4 bar	5.4 bar	5.4 bar
Blower start	✔	✔	✔
Irrigation pump controller	✔	✔	✔
pH & EC sensors	✔	✔	✔
Sensors manifold diameter	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"	D. 40 mm - 1 1/4"
Modem communication	✔	✔	✔
Controller***	MITHRA Hidro	MITHRA Hidro	MITHRA Hidro

* Fertilizer pump power supply 380-400 VAC three fase (50 Hz). In case of different power supply or mains frequency ask for their features.

** Ask AZUD for higher max. working pressures.

*** Control unit languages available: spanish, english and french.

The company reserves the right to change the characteristics of these products without prior notice.

3.1. Description of the different parts of the equipment

The equipment has three parts:

Table 3. Parts of the equipment.

1. **Hydraulic part:** the inlet and outlet manifolds are located on the stainless steel structure, as well as the injection lines, sensor manifold, manometer and fertilizer pump.	
2. **Electrical part:** on the desk are the electrical panel, the selectors of the different elements of the system, the electrical components necessary for the protection and manoeuvre of the equipment, relays... etc.	
3. **Electronic part:** is made up of the Mithra Hidro irrigation control device, the pH and EC sensors and the expansion cards: • 16 Digital Output expansion card • pH and EC sensors card	

3.2. Hydraulic part

The input and output collectors, the injection lines, the pressure gauges, the sensor collector and the fertilizer pump are located on the stainless steel structure.

Below all of the parts of the hydraulic part are detailed:

Table 4. Main parts of the equipment hydraulics.

Inlet manifold (D. 40 mm – 1 1/4"):: manifold via which the fertigation equipment is fed, where the water enters at the maximum pressure (3.5 - 4 bar) required for the Venturi injectors to operate well.	
Water + fertilizer mix manifold D. 40 mm – 1 1/4"): after the injection done by the Venturi, this manifold carries the water with the dissolved fertilizers and acid to inject it once again in the main irrigation pipe.	
Injection lines (female thread BSP 1/2"): they inject the necessary fertilizers and acid/base into the system. The following table describes the component parts.	
Sensor collector (D. 40 mm - 1 1/4”): where the pH and EC sensors are located. The water passes through it to accurately measure the pH and the EC to correct the injection of fertilizers and reach the desired values in the nutrient solution.	
Fertilizer pump: provides the additional pressure required for injecting the fertilizers and acids. The pump is made of stainless steel, with variable flow rates and a maximum working pressure of 5.4 bar. The equipment is supplied with a fertilizer pump of 50 or 60 Hz depending on the customer's requirement.	
Water inlet and outlet. the equipment is delivered with labels that indicate these connections.	
Sustaining hydraulic valve with a pilot-operated regulator: to maintain a certain pressure between the fertiliser pump delivery flow and the sustaining valve.	

Manometers: there are two manometers, one that measures the pressure of the Venturi tubes (inlet) and the other measuring the pressure of the fertilizer pump (outlet). Recommended pressures are:

- Venturi: 2.5 - 4 bar
- Fertilizer pump: 3 – 5.4 bar

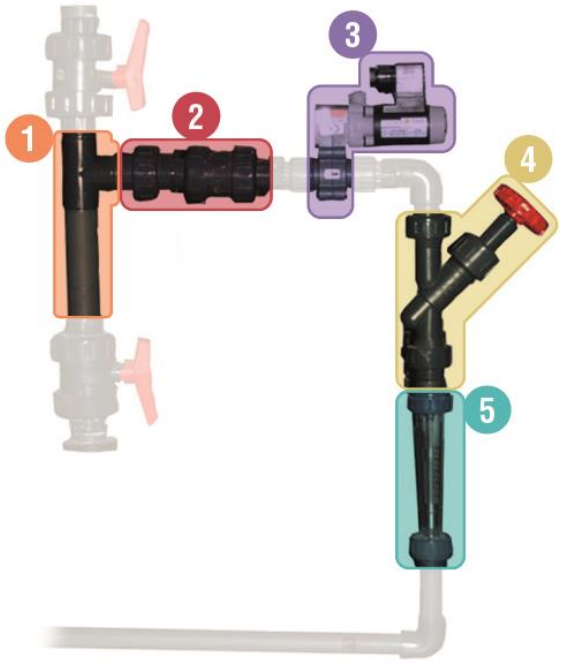
Injection lines: located between the inlet and outlet manifolds. The number of injection lines will depend on the total number of fertilizers to be injected into the system.

The equipment comes standard with 3, 4, or 5 injection lines. If more injection lines are needed with the equipment, please contact AZUD with specifications.

Always using the left one as the acid line is recommended, at the furthest part of the pump suction manifold, so that as little solid residue as possible of any fertiliser is left in the manifold.

The injection lines consist of:

Table 5. Items in injection lines.



1. **Venturi injector:** the inside narrowing permits the suction of fertilizers and acid from their respective tanks, mixing them with irrigation water.
2. **Check valve:** prevents water from flowing from the irrigation system to the fertilizer tanks.
3. **Electrovalve 4 mm:** they allow to open or close the fertilizer passage.
4. **Angle seat valve:** regulates the flow moving through the injection line.
5. **Floating flowmeter:** produced from transparent methacrylate and has a graduated scale. A calibrated weight is located inside it for liquids like water (density 1 g/cm^3) and when the liquid moves through the inside of the flowmeter, it rises, signalling the flow that is moving through it at that time.

3.3. Electrical part

Table 6. Main parts of the electrical part of the equipment.

The **electrical panel** is mounted on the stainless steel structure of the equipment. It has complete insulation to prevent moisture damage.

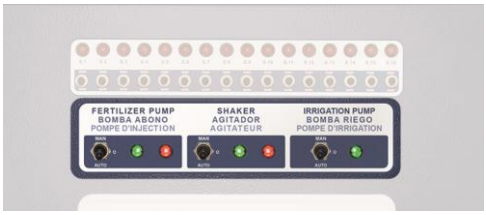
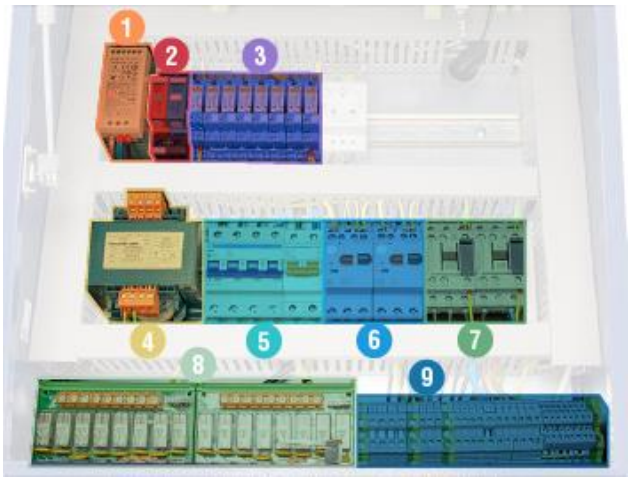
Selectors (Manual/Stop/Automatic): it allows the automatic or manual selection of the different irrigation sectors (up to 16 sectors). These LEDs light up when activated manually or through the equipment.	
Selector of the fertilizer pump / agitator / irrigation pump: it allows automatic or manual selection of the fertilizer pump, the blower and the irrigation pump. The green light indicates that it is active and the red light is stopped.	
Electrical components: elements necessary for the protection and manoeuvre of the panel and basics to activate irrigation valves, pumps, etc. The following table shows a brief description of the components that can be found inside the electrical panel: relays, contactors, pump starters, magneto-thermal switches, differentials, etc.	

Table 7. Interior of the electrical panel.



1. **The power supply** feeds and protects from power surges to the programmer and transforms 220 V AC to 12 V DC that feeds the electronic part.
2. **Surge protector:** it is a surge limiter (ex. Ray) that protects electrical components, but only once. When the colour changes, you have to change the protection, since it indicates that it has fulfilled its function.
3. **Relays:** it works as a switch controlled by an electrical circuit in which, by means of a coil and an electromagnet, a set of one or several contacts is activated that allows opening or closing other independent electric circuits.
4. **Transformer:** configured to transform the 220 V AC into 24 V AC for the manoeuvre.
5. **Magnetothermic:** are devices capable of interrupting the electrical current of a circuit when it exceeds certain maximum values.
6. **Motor protector:** is a current adjustable magneto-thermal circuit breaker specially designed for the protection of electric motors. Its magnetic tripping curve is specially designed to withstand the starting current of the motor while the thermal protection is adjusted with a potentiometer and divided into current ranges. The fertiliser pump is protected with a 2.5 - 4 A motor protection and the agitator with 4 - 6.3 A.
7. **Contactor:** is a power switch that enables the actuation of high electrical loads by means of a control signal. Both the fertiliser pump contactor and the agitator contactor have a rated current of 12 A.
8. **Relay cards:** 2 cards with 8 relays each where the irrigation electrovalves are connected. The card to the left corresponds to the first 8 selectors (S.1 – S.8) and the one on the right to the 8 seconds (S.9 –S.16).
9. **Borne terminal:** the place where the actuators are connected (pumps, agitators, etc.) and sensors.

Warning: You will find a sheet with the specific connections for your terminal block, depending on the equipment and elements required, next to your fertigation equipment.

Take precautions to avoid possible electrical discharges, (garments, safety equipment and insulated tools), as well as to avoid damage to people and property, or the equipment. Do not handle the equipment with wet hands or on wet surfaces, or if your feet are in contact with water or moisture.

3.4. Electronic part

The electronic part consists of the irrigation controller, the expansion cards and the pH and EC sensors.

3.4.1. Irrigation controller

The irrigation controller for this equipment is the Mithra Hidro 3k, whose main features are:

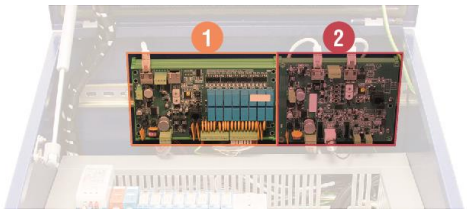
- pH and EC control.
- Up to 1 independent water systems.
- Controls 9 irrigation pumps and 1 water meter per independent water system.
- Manages up to 99 irrigation programs, 100 electrovalves, 30 dosing recipes and 20 automatic backlashing filters.
- Upgrade of the installation without changing the equipment through codes.
- Communication possibility with PC or web communication / App.
- Possibility of connection to the weather station.
- Controls 9 fertilizers, 1 acid and 9 fertilizer meters.
- The option to fertilize and irrigate through control of pH and EC, time and by volume.
- pH & EC: 2 alarm levels.

In the Manual of Mithra Hidro you can find all the specifications of the controller, as well as the guide of irrigation programming.

Figure 2. Mithra Hidro controller.

3.4.2. Expansion cards

AZUD QGROW AT500 is supplied with a sensor card and a 16 digital output card.



1 16 digital output card

2 Sensor card

Figure 3. Sensor card and 16 digital output card.

To check the number of free digital outputs it contains, see the following table:

Table 8. Different digital outputs depending on AZUD QGROW AT500 model.

AZUD QGROW AT500	DIGITAL OUTPUTS									
	Fertilizers	Sectors	Fertilizer pump	Irrigation Pump	Blower	pH & EC alarms	Max P.	Min P.	Busy	Free
AT500/3	3	16	1	1	1	-	-	-	22	10
AT500/4	4	16	1	1	1	-	-	-	23	9
AT500/5	5	16	1	1	1	-	-	-	24	8

To carry out the connection of the equipment, it should be done according to the Inputs / Outputs scheme supplied with the machine as an annex.

3.4.3. pH and EC sensors

The EC and the pH of the irrigation solution are parameters whose knowledge is essential for the correct management of fertigation. A system that doses fertilizers and acid in a stable manner, without oscillations in the EC and pH, will lead to a good development of the crop and an increase in the quality and quantity of production.

Both the pH and EC sensor included in the equipment are designed to fit into the sensor manifold.

The control of the EC is done by the contribution of fertilizers and the pH management is achieved with the controlled contribution of acid, allowing to maintain the ideal conditions for each crop.

The pH sensor has an electrode encapsulated in porous glass that allows the irrigation solution to penetrate the interior, making the measurement exactly. The EC sensor has the electrodes that perform the measurement and incorporates a temperature sensor to compensate the variation that the EC undergoes with temperature. In this way, it offers an accurate measurement of the solution.

 pH sensor	 EC sensor

Figure 4. pH and EC sensors.

4. INSTALLATION

4.1. Requirements for setup and installation

Prior to setup of the fertigation equipment, these requirements are essential to prepare the fertigation system:

- Electrical supply prepared for connection of 380 - 400 V AC equipment (3 phase + GND) protected against short circuits and indirect contacts.
- Plumbing materials required to connect the equipment to the fertilizer and acid tanks in accordance with distance between equipment and tanks.
- Assure that there is a water supply for the system.
- Verify that the fertilizer tanks have enough fertilizer to supply the equipment.
- Install mesh filters at the outlet from each fertilizer tank to prevent blockages in the fertigation equipment, scheduling their regular cleaning.
- Qualified personnel and suitable tools for handling, plumbing and electrical tasks.
- Finished civil engineering work required, as the fertilizer and acid tanks should be placed on a raised platform some 50cm above the level of the equipment. This will facilitate the flow of fertilizers and acid to the fertigation equipment and will help the suction of the fertilising pump and Venturi injectors, taking advantage of the energy provided by the difference in levels.
- The installation of the equipment inside a warehouse or irrigation shed is recommended. If the system is outside, a roof is essential.

4.2. Equipment location and assembly

The site allocated for the installation of the equipment must comply with these specifications to assure that it operates correctly:

- Prevent any electromagnetic interference. These types of interferences are primarily caused by: electric motors, transformer substations, electric power transmission lines, power contactors… and any other electric power device without suitable electromagnetic insulation.
- The environmental conditions should match the data provided in the ‘Technical characteristics’ section.

Clean the equipment with a soft cloth.

4.3. Handling the equipment

For handling fertigation equipment, use a pallet jack or forklift. The parts comprising the equipment must be moved carefully to prevent any damages.

4.4. Hydraulic connections

This equipment is designed to work with fertilizers (chemical products), so we recommend following the safety and hygiene regulations at work for these cases.

All connection points are identified for easy assembly. It is connected following the recommendations and images of this manual. As standard, the connection points are according to DIN standard. They are connected to the irrigation pipes by means of a union of three pieces.

Table 9. Hydraulic connections.

WATER INLET: via pipe PVC-U (glued joint), D. 40 mm – 1 1/4"	
WATER OUTLET: via pipe PVC-U (glued joint), D. 40 mm – 1 1/4"	
FERTILIZER INLET: female Thread BSP 1/2"	

4.5 Electrical connections

For any operation or intervention on the equipment, it is recommended to consider the following warnings:

- Take precautions to avoid possible electrical discharges, (garments, safety equipment and isolated tools), as well as to avoid damage to people and property, or to the equipment itself.
- Do not handle the equipment with wet hands or on wet surfaces, or if your feet are in contact with water or moisture.
- Install a UPS (uninterruptible power supply), in the situation that the contracted company does not guarantee a minimum of electrical stability. Install a generator set if power cuts occur from the company supplying the electric power with a certain frequency.

AZUD QGROW AT500 equipment has elements subjected to electrical voltage. The electrical protections that it contains are the following:

- In circuits of 220 V and 380 V (50 Hz), by independent circuit magneto-thermal switch.
- Motors or power elements are protected by a circuit breaker.
- In all elements subjected to voltage, line for grounding.

For installation the equipment will be connected to the ground and its power circuit must be protected under the specifications dictated by current regulations.

The equipment is powered at 380-400 V AC in three-phase with neutral.

The fertilizer pump is powered at 380-400 V AC. There are 3 lines output from the general circuit breaker, L1, L2, L3, which lead to the motor protection switch, from the motor protection switch to the contactor and finally the 3 lines reach the fertilizer pump.

The agitator is powered at 380-400 V AC. There are 3 lines output from the general circuit blower, L1, L2, L3, which lead to the motor protection switch, from the motor protection switch to the contactor and finally the 3 lines reach the agitator.

The controller is connected through a 12 V DC power supply that comes from a single-phase switch powered by wire L1 and Neutral.

The transformer is connected in the same single-phase line and feeds the manoeuvres and the lighting of the panel at 24 V AC. This may vary according to the manoeuvres required.

In the case of having single-phase power, both the pumps and the starters will be single-phase, and a L1, Neutral and Ground wire will arrive at the pump.

The (attached below) shows the multifilar electrical diagram for AZUD QGROW AT500 of 3, 4 or 5 injection lines. If more injection lines are required, please ask for characteristics.

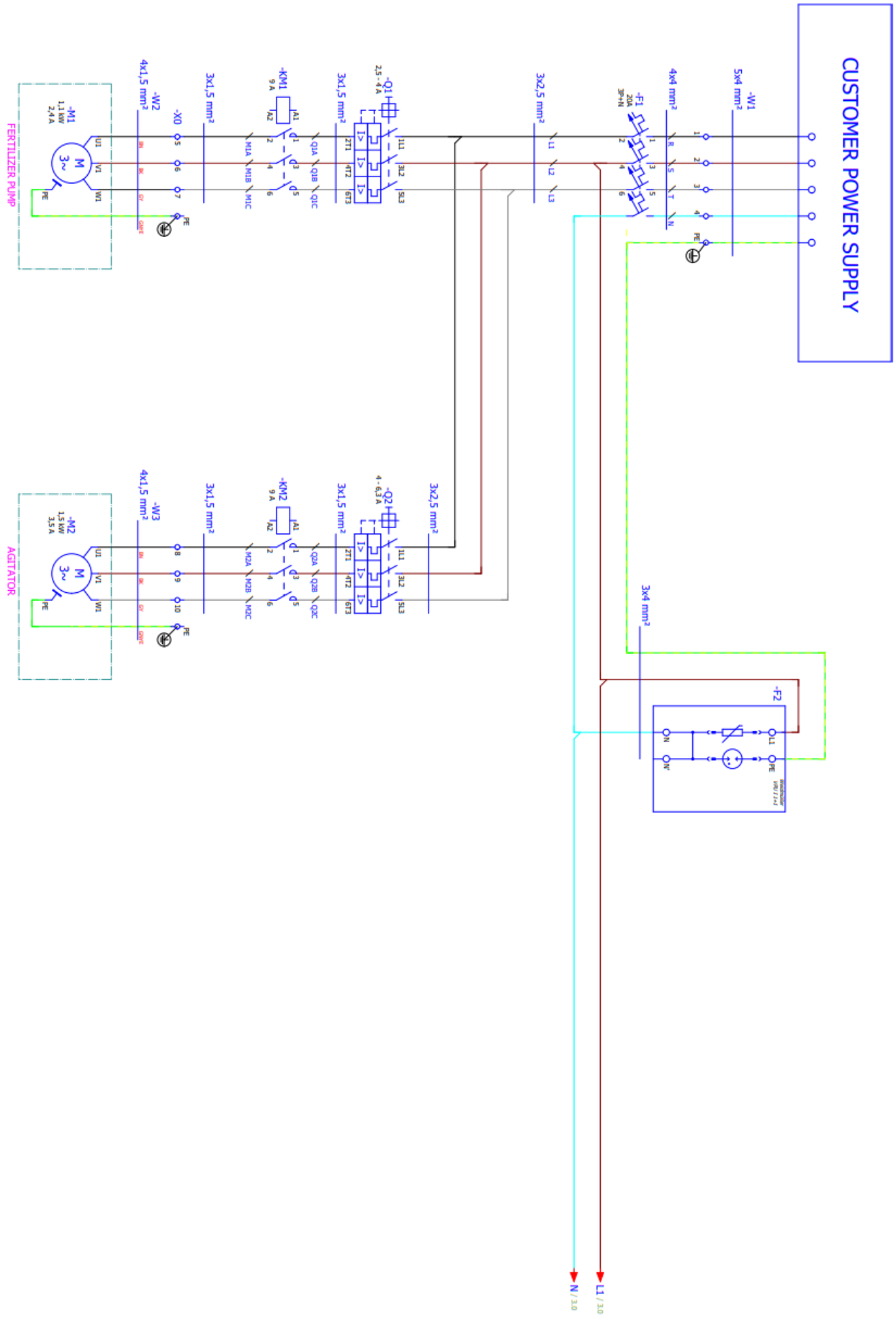


Figure 5. Multifilar diagram of the electrical connections.

4.6. Installation diagram: by-pass

AZUD QGROW AT500 is an equipment with direct injection to the irrigation network and it is installed in Bypass (not all of the irrigation water flow goes through the fertigation equipment), in parallel with the pumping equipment and the filtration head.

The fertigation system must also be fed with the required flow and pressure, meaning with the circuit full of water, and pressurised so it runs properly. The equipment is dimensioned for facilities with 2.5 – 5.4 bar of maximum pressure.

The equipment is fed via a pipe installed at the bottom of the filtration head. The water treated by AZUD QGROW AT500 is injected into the top of the filtration head, if there is one, in the irrigation pump drive (Figure 6). The function of the filtration head, besides eliminating items that obstruct the pipes, is to homogeneously mix the water and fertilizer via the turbulent system that is produced. This ensures that the provision of fertilizer is homogeneous in all irrigation areas and pH and EC readings are correct when the fertiliser is mixed in the filters.

If you do not have a filtration system and have no other options to correctly mix the water and fertiliser, the installation of a mixer is recommended as a last resource you could separate the water inlet connection to the irrigation machine as much as possible from the water + fertiliser outlet, in order to prevent problems with homogenisation of the mix and a heterogeneous provision of fertiliser to the different irrigation areas (Figure 7).

Bear in mind that the measurements for EC and pH differ between the fertigation equipment and the field, due to the chemical reactions that occur, temperature, the distance and diameter of the pipes, and so forth. For more information, please consult your grower (field technician).

GENERAL ASSEMBLY DIAGRAM WITH FILTRATION EQUIPMENT:

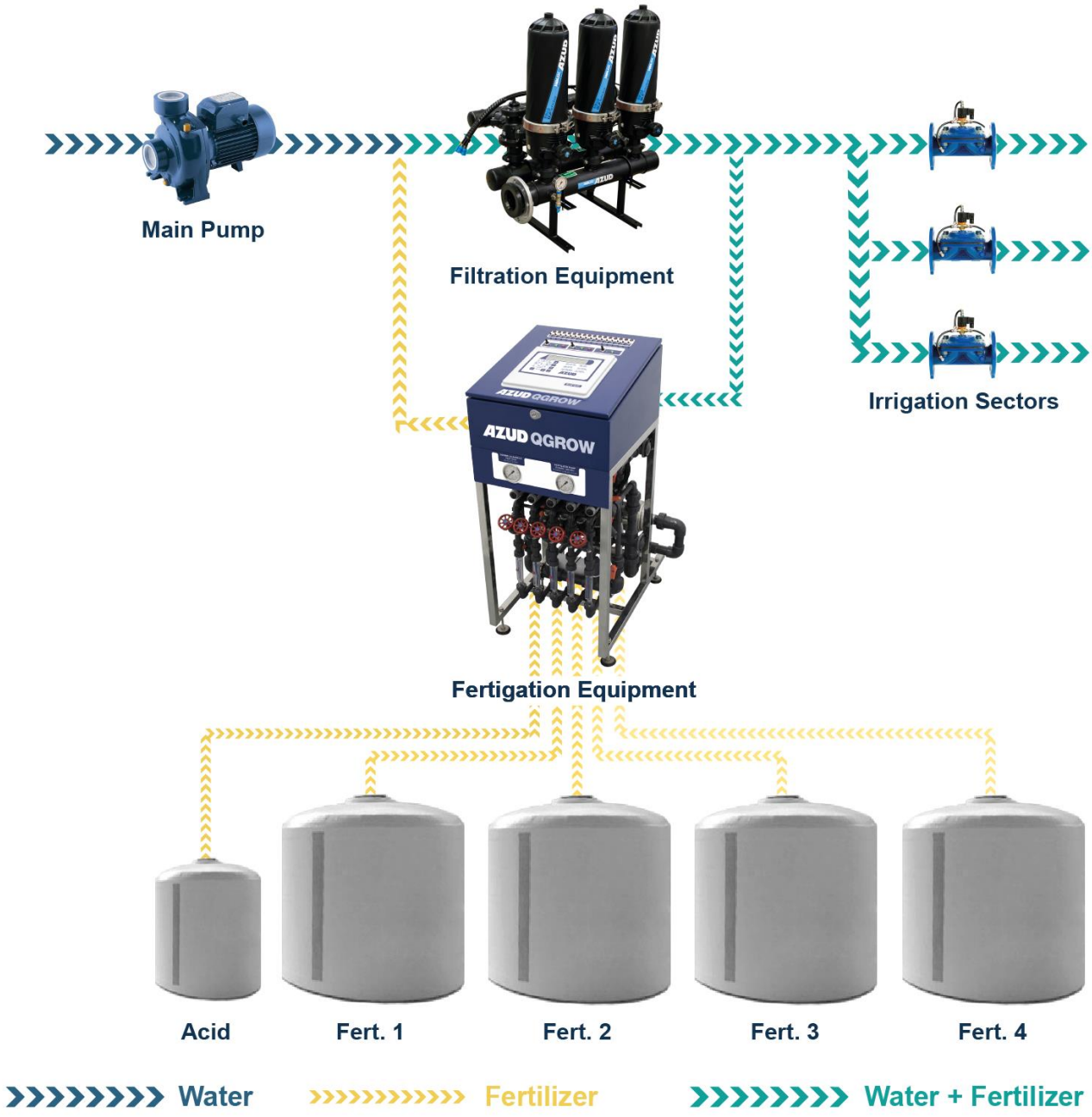


Figure 6. Assembly diagram with filtration equipment.

GENERAL ASSEMBLY DIAGRAM WITHOUT FILTRATION EQUIPMENT:

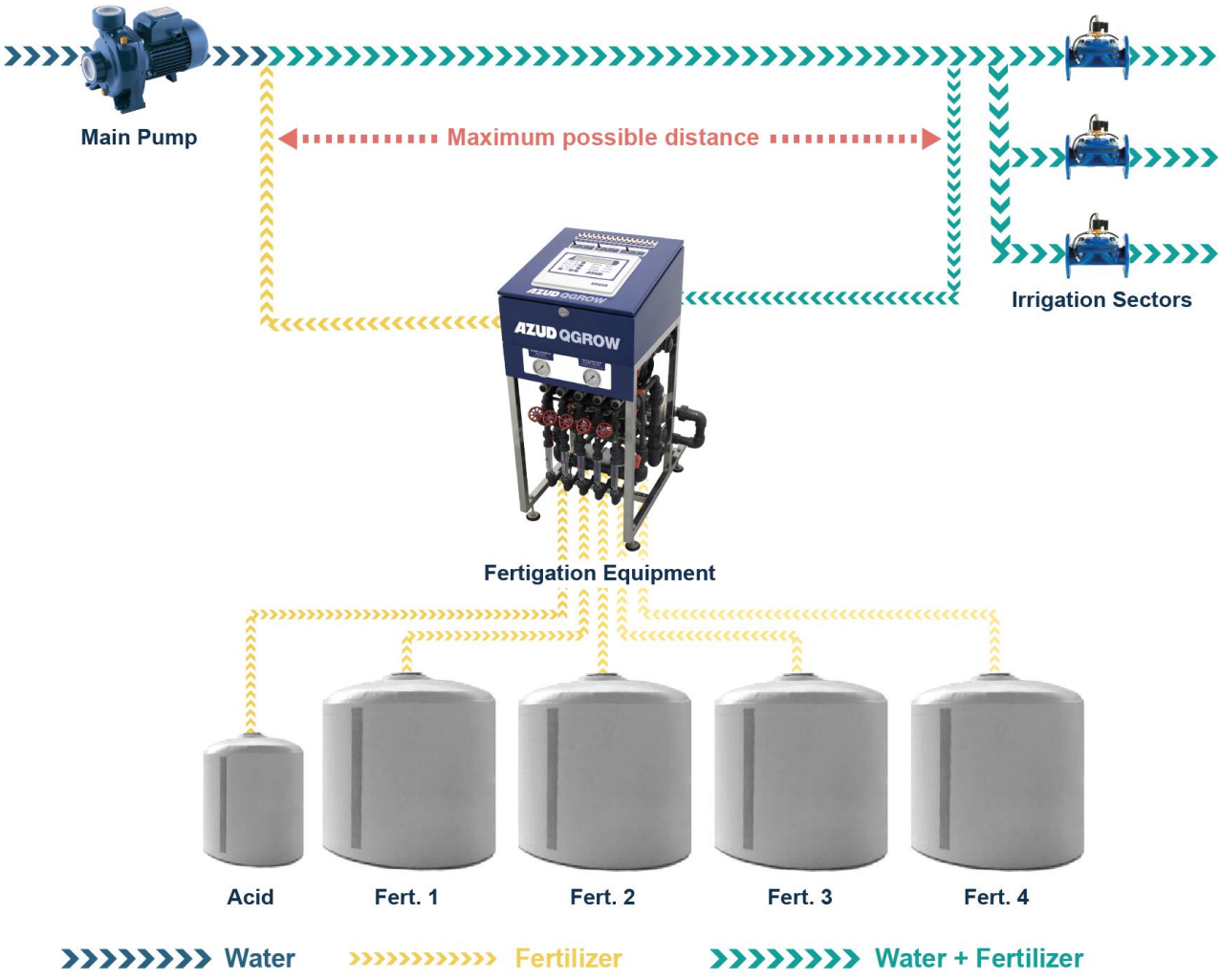


Figure 7. Assembly diagram without filtration equipment.

4.7. Piping and instrumentation diagram (P&ID)

When installed as a bypass, AZUD QGROW AT500 doses fertilisers and acid through venturi injectors. As it moves through the narrowing venturi injectors on each injection line, the speed of the water increases which produces negative pressure. This negative pressure is used to inject the fertiliser or acid from the tanks.

A small flow from the equipment inlet goes to the sensor manifold, where continuous measurements of pH and EC are conducted, whose results are displayed on the controller.

The fertiliser pump generates the necessary pressure to push the mix of water, fertiliser and acid up the filtering head and to the irrigation sectors.

The equipment is fitted with cut-off valves for the sensor collector and at the equipment inlet and outlet for maintenance and sensor repair.

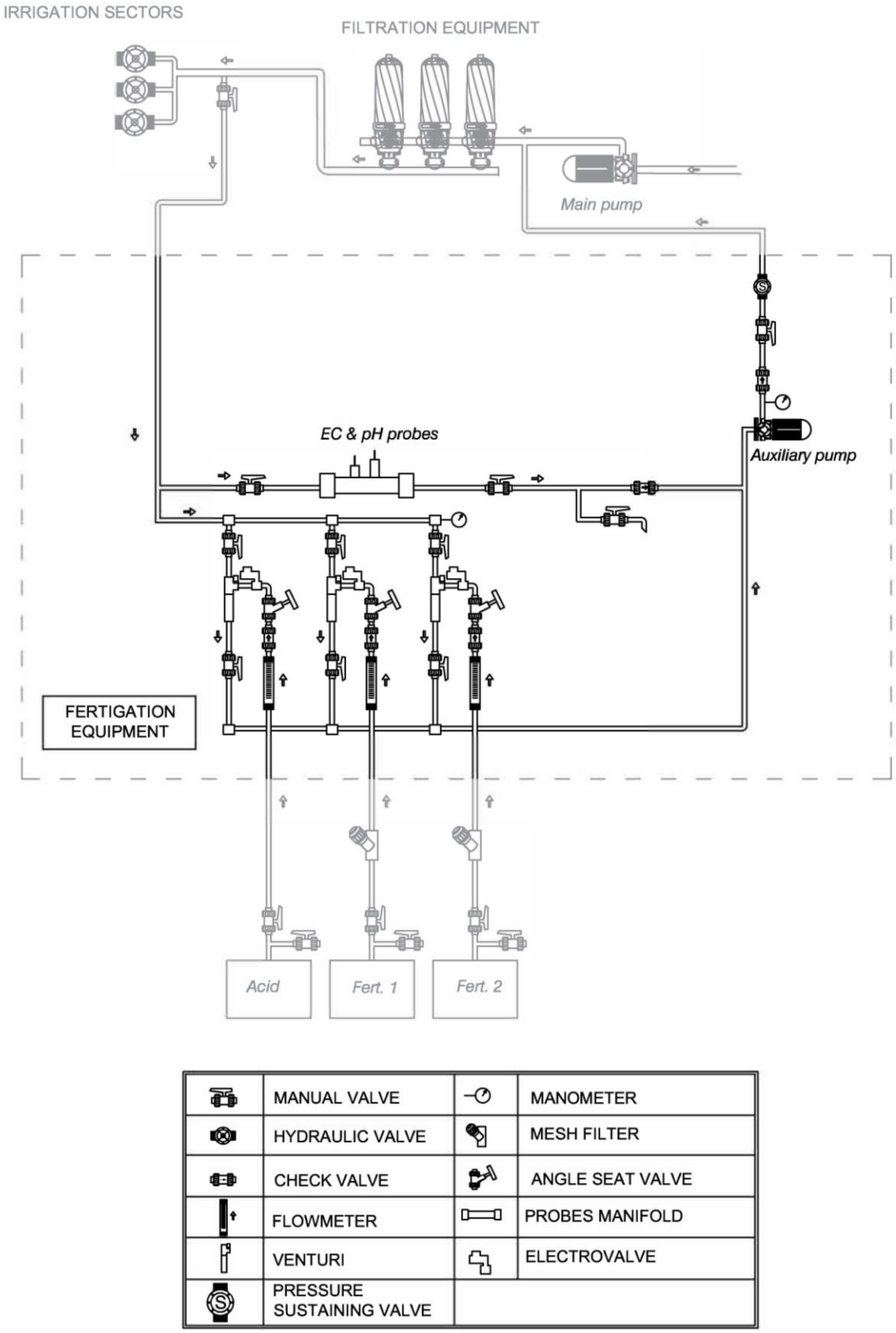
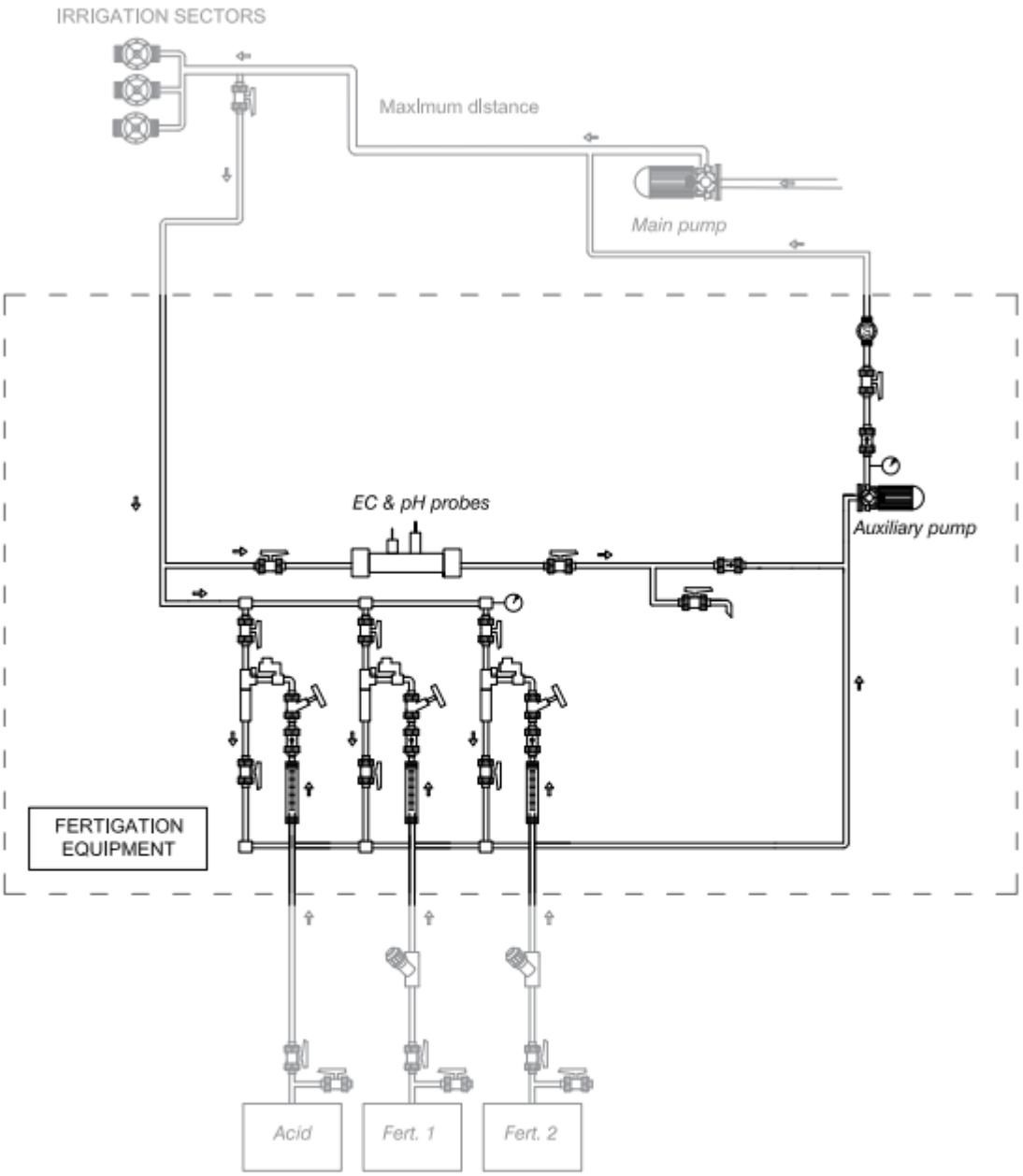


Figure 8. Piping and instrumentation with filtration equipment.



	MANUAL VALVE		MANOMETER
	HYDRAULIC VALVE		MESH FILTER
	CHECK VALVE		ANGLE SEAT VALVE
	FLOWMETER		PROBES MANIFOLD
	VENTURI		ELECTROVALVE
	PRESSURE SUSTAINING VALVE		

Figure 9. Piping and instrumentation diagram without filtration equipment.

NOTE: when looking at the equipment frontally, the acid line will be on the left. These diagrams (Figure 8 and 9) are some orientatives hydraulic diagrams, to clarify the installation.

5. COMMISSIONING

5.1. Safety reminder

Tools and individual protection equipment (PPIs) should be used that are adequate for the jobs executed, paying attention to working conditions to prevent accidents, as well as respecting any prohibitions. Check the safety instructions detailed above.

5.2. Preparation for commissioning

Important: do not start using your AZUD QGROW AT500 system without the filtration elements (rings, wire mesh) closed and totally clean, so that there are no leaks. Otherwise, serious problems could occur in the fertilizer regulation and control mechanisms, which could seriously damage your crops.

The equipment comes with the hydraulic connections for the pump disassembled for transport purposes (Figure 1), which are the pipes that connect the pump to the equipment and the pipe that connects the pump outlet to the line to the filtration equipment. Both connections screw in and come ready to be connected easily and directly without need of any tool. Simply screw them onto the equipment and at the outlets of the pump.

The pH must be connected last to the sensor manifold, before filling the circuit with water, to prevent them from drying out and/or becoming damaged.

The fertigation system must always be loading, meaning with the circuit full of water, and pressurised so it runs properly.

Before starting up the equipment, verify these elements:

- Verify that there is electricity and that the electric voltage is between the necessary values for the model you have.
- Assure that there is a water supply for the system.
- Verify that the fertilizer storage tanks have enough fertilizer-water mix to supply the equipment.
- Verify that the outlet valves to the tanks are open and that the drain overflow valves on the tanks are closed.
- Ensure that the filtration head is cleaned properly, as well as the filters on the fertilizer lines installed at the tank outlets.
- Verify that the suction and water supply line are free from items that could block or prevent irrigation.
- Verify that the section valves on the sensor manifold are open.
- Verify that the pH sensor is well connected to the sensor card, aligning the lugs of the BNC connectors. If they are not, squeeze tightly, pushing the connector on the pH sensor and turning it one-quarter turn.
- Calibrate the pH and EC sensors (see the instruction guide for the Mithra Hidro irrigation controller).

5.3. Starting up the equipment

Do not start up the equipment for the first time until you have verified all the previous steps and sections 1.1, 1.2 y 1.3 of the Safety Instructions. After checking them:

- First, the irrigation pump is activated manually. The pumping equipment must push the water towards the sector. The purpose of this operation is the pressurisation and purging of the irrigation head and dosing circuit of the equipment.
- After irrigation is activated, verify that there are no leaks or anomalies in the head pipes.
- Open all valves by hand. To do so, the valves have a selector that is in the middle position. Turning the selector manually opens and closes the valves.
- Verify that the section valves on each injection line are completely open.
- The angle seat valves are completely opened on each injection line manually. Always remember that all of the lines must be open in order for the pressure created by the pump to be equal in all of them.
- Turn on the fertilizer pump manually, making sure the pump is turning in the right direction.
- Check that the Venturi pressure is between 2.5 bar and 4 bar. If the pressure is greater than 5 bar, lower the head pressure with a reducing valve before the inlet to the machine.
- Check that the fertilizer pump pressure is between 2.5 bar and 5.4 bar. Se comprueba que la presión de la bomba de abono se encuentra entre 2.5 bar- 5.4 bar. The equipment has a hydraulic valve fitted with a pilot-operated regulator at the fertigation equipment outlet.
- Check that no air (bubbles) is passing through the floating flowmeter and that the different weights reach 250-300 l/h (the height depends on the injection lines open, head flow and its pressure). If there is any variation in the flow rate through the different injection lines when the rotameters are completely open, it must be manually adjusted with the angle seat valve until the flow rates in the lines equal the worst flow rate (the lower flow rate).
- Adjust the floating flowmeters to the desired flow. The flow of each fertiliser can be adjusted via the angle seat valve (Figure 10). Once the fertiliser flow rates are adjusted, this is indicated on the irrigation controller.

Figure 10. Manual regulation valves for the flow of each fertilizer (non contractual image).

- When the system is on and a program is active, check whether the quantity of injected fertiliser coincides with the volume (l/h) previously indicated.

6. MAINTENANCE TASKS

6.1. Maintenance by installer

Annually:

- Check the injection flow of the fertilizer dose dispensers, as all of them should have the same peak flow. To do so, manually activate all valves on the injectors and make the peak flow match the regulation valve on each of them.
- Disassemble and clean the Venturi injectors.
- Annual inspection and replacement every two year of the fertilizer injection valves.
- Replacement of the acid injection valve.
- Replacement of the pH sensor.
- Clean the floating flowmeters.
- Verify the consumption, voltage and noise level of the automation (motors, blower pumps, etc.), regulating the automatic switches. Checking the noise level.
- Tighten the electrical connections.

Each three months:

- Calibration of the pH and EC measurement sensors, with standard solutions of pH 7.00, pH 4.00, and EC 1.413 mS/cm.

6.2. Maintenance by client

- Clean the safety filters on the fertilizer injectors and the filters on stock solution tanks at least once a week and always depending on the insoluble material contained in the fertilizer employed (use fully soluble fertilizers).
- Keep the irrigation filtration head clean.
- Verify that there are no air bubbles or remains of chemical precipitates in the circuit.
- Verify, at least weekly, the readings for the pH and EC sensors with an external calibrated device, registering it in the field logbook so you will detect any variations or oscillations.
- Weekly check of the alarm input.

6.3. Cleaning the fertigation system

Irrigation water treatments must be done, whether it is preventively or for cleaning, to combat any blockages in the system caused by microorganisms or chemical precipitates. This basically consists of adding chlorine to fight the bacteria and of adding acids to combat chemical precipitates.

During any water treatment, precautions must be taken to prevent the use of treated water by personsand animals, as well as preventing its return to the community network.

These measures are recommended:

- Microorganisms, which tend to be bacteria that feed on any wastes in the water, cause blockages with an oily black appearance. To eliminate them, apply chlorine to the fertigation system at the suitable concentration. When chlorine dissolves in water, it becomes an oxidising agent and ‘burns’ the microorganisms. For its action to be optimal, the pH of the water should be between 5 and 6.
- For chemical precipitates caused by modification of the initial water conditions such as pH, temperature, mix of incompatible substances or water evaporation in the emitters each time after you irrigate, doing an acidification treatment is imperative. To do so, during fertigation and as a preventive treatment, use an acid solution to maintain the pH of the irrigation water between 5.5 and 6.5, except in crops that other pH ranges are required.

After each season or annually and always without crops, perform a general overall cleaning of the system. To do so, clean the distribution network with water at a pressure greater than 3 bar (if the installation allows it), opening all pipes to their maximum limit. Inject a commercial acid solution with water at maximum pressure for over 30 minutes until the pH of the water drops to 3. The next day, clean again with water like the last time, checking the uniformity of irrigation and checking the pressures of each subunit.

7. POSSIBLE PROBLEMS, CAUSES AND SOLUTIONS

Table 10. Problem solving.

Problem	Cause	Solution
The equipment does not start when pushing the on/off switch	Failure in the network voltage. Lack of power supply.	Wait until the electricity comes on again. Inspect the connection to the cloud.
Injection line does not work	The pressure generated by the pump is less than the irrigation network pressure. Obstruction in the injection line.	Verify that the valve is open. Decrease system pressure or redimension the pump. Disassemble and clean the Venturi injectors. Always keep the pH between 5.5 and 6.5 (except for other recommendations from the technician).
No line injects	Poor connection. Pump not connected correctly.	Verify that all phases are connected correctly. Verify the pump rotation direction.
Pump does not start	Poor connection. Inadequate voltage for this pump.	Verify the proper connection. Verify that the voltage is adequate for this pump. Verify the voltage in each phase with a multimeter.
Loss of water through the pump seal	Broken mechanical seal because the pump has been running empty.	Replace the mechanical seal.
Working pressure different than recommended	Leak in the irrigation distribution network and/or the irrigation subunits.	Inspect the route of these pipelines and fix any damage or faults found.
Abnormal heating of motors, cables, panels ... etc.	Electric problem.	Get in touch with an electrician.
When trying to put a data does not accept it and takes the previous value.	The system is carrying out the irrigation. Value out of range.	Wait until the irrigation finishes. Enter an appropriate range.
In the screen of the equipment appears the irrigation activated, but does not start the irrigation pump or any sector.	Selectors in position 0.	Change manual selectors to automatic position.
The alarms are activated continuously	Incorrect injection.	Check the programming values (technical service).
The output EC or pH value does not remain constant in the marked parameters.	Lack of system adjustment.	Contact your technician. Calibration of the TON Cycle and CR Factor.
We introduce a irrigation, but at the set time it begins to irrigate another sector.	Two programs scheduled at the same start time.	Review the programming. If there are several programs with the same start time, indicate priorities.
The pH or the EC marked by the equipment do not conforms to reality.	Decalibrated sensors.	Calibrate the sensors. Replace the sensors.
When starting the equipment begins to irrigate some sector.	Programming fault	Check the programming.
There is no injection of fertilizers or acid.	It has not been programmed. Sensors values are wrong.	Perform correct programming. Check the values of the sensors.
The total irrigation time is not given.	Faulty programming.	Extend the end time of the program.
With an EC or pH value marked, it does not reach it	Lack of provision of fertilizers.	Fertilizers too diluted. Injection systems with excessively low calibration.
Drop in pH value	Too much addition of acid.	Redo the calculations to have the correct amount of acid.

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