Manual

> INSTALLING NUTRI ONE

CREATING A CLIMATE FOR GROWTH
PRIVA

Contact

Priva (head office)
Zijlweg 3
2678 LC De Lier
The Netherlands

See www.priva.com for contact information of a Priva office or partner for your region.

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Contents

About this manual 4

Aim and scope 4

Target groups and required competencies 4

Symbols in this manual 5

Safety 6

Safety - general 6

Safe handling of chemical substances 6

Electrical safety 7

Safety with mechanical parts 7

Safety with hot parts 8

Noise safety 8

Safeguards 8

Safety icons on the unit 9

Personal protective equipment 9

Product description 10

Functions and intended use 10

Preparing irrigation water 10

Distributing irrigation water using the existing irrigation pump 10

Checking the acidity of the irrigation water 10

Versions 11

Operating principle 12

Dosing channels 12

EC and pH sensors 12

Control panel 12

Construction 13

Type plate on the product 14

Warranty 14

Transport and storage 15

Transport 15

Conditions during transport and storage 15

Positioning the unit 16

Location and environmental conditions 16

Minimum free space around unit 16

Environmental requirements 16

Basic facility requirement 17

Positioning the unit 18

Installation - hydronic part 19
Installing the water supply 19
Water supply at higher elevation 20
Water supply at lower elevation 21
Mixing drain water with clean water 21
Installing the fertiliser supply 22
Installing filters 23
Filters 24
Filter types 24
Position of the filter relative to the unit 25
Installing remaining taps and valves 26
Installation - electrical part 27
Connectors 27
Connecting with flexible wire 27
Connecting with solid wire 27
Screwdriver for terminal block 28
Cabinet layout Nutri One 28
Cable entry 28
Connecting the power supply (Nutri One cabinet) 29
Cabinet layout Compass 30
Connecting Nutri One cabinet to Compass cabinet 30
Connecting the irrigation valves 31
Parts 33
Pump 33
Connecting the pump 33
Dosing channels 33
Connecting the dosing valves 33
Connecting the Dosing Channel Driver 34
Adjusting the dosing valve 36
Technical specifications 37
Dosing channel 3% acid, 300 l/h 37
Dosing channel 3% acid, 600 l/h 37
Dosing channel 3% acid, 300 l/h 37
Dosing channel 3% acid, 600 l/h 38
Cleaning the dosing channel filter 38
Cleaning the dosing channel rotameter 38
EC sensor 39
Connecting the EC sensor 39
Connecting the Compass EC sensor 39
Calibrating the EC measurement (Compass) 40

Cleaning the EC sensors 42
Technical specifications - EC sensor 42
pH sensor 43
Fitting the pH sensor 44
Connecting the pH sensor 44
Calibrating the pH measurement 45
Cleaning the pH sensors 46
Cleaning the pH sensor normally 46
Cleaning the pH sensor thoroughly 46
Technical specifications – pH sensor 47
Inline dirt filter 48
Cleaning the inline dirt filter 48
Technical specifications - inline dirt filter 48
Fertiliser suction 49
Checking the fertiliser suction 49
Flow sensor 50
Connecting 50
Cleaning the flow sensor 50
Technical specifications – flow sensor 51
Technical specifications - T-piece for flow sensor 51
Commissioning the dosing unit 53
Delivery to the user 53
Operation 54
Operating software 54
Taking out of operation 55
Troubleshooting 56
Troubleshooting 56
Maintenance and repair 59
Preventative maintenance schedule 59
Setting the unit to maintenance mode 59
Cleaning the exterior of the unit 60
Disposal of waste equipment 61
Appendices 62
Supply water quality 62

About this manual

Aim and scope

This manual contains all of the information required to safely and correctly transport, install, commission and maintain the fertiliser unit. This manual will also allow you to effectively observe and resolve any faults.

The data and the illustrations in this manual relate to the various models of the fertiliser unit. In addition, each fertiliser unit has customer-specific features, which may differ slightly from the description in this manual. You can find details about this in the project drawings and documents that have been created specifically for your delivery.

For the sake of simplicity this manual uses the term 'unit' to refer to 'fertiliser unit'.

Target groups and required competencies

Target group	Tasks and responsibilities	Training, knowledge and experience required
installers / service engineers	do the following with the unit: • transport • position • install • commission and set up • test after initial commissioning and problem solving • operate • annual check • take out of operation and dispose at the end of the service life	• technical training in the field of electrical engineering and process engineering • experience with water installations for the horticulture industry • Priva product specific training • knowledge of the characteristics and hazards of the chemical substances used in water installations • command of (technical) English

Symbols in this manual

The following symbols may appear on the unit and in the manuals.

Warning symbols for specific hazards	
	danger: read the manual before switching the unit on
	corrosive chemical substance(s)
	hot surface
	live parts (danger of electrocution)
	UV light
	oxidising chemical substance(s)
	High leakage current! Earthing required for the connection of the power supply.

Prescriptive symbols	
	wear ear protection
	wear safety glasses
	wear ear protection and safety glasses
	wear non-permeable gloves that are resistant to chemical substances
	wear clean work clothes that cover as much of the skin as possible
	wear (safety) boots
	Read the device manual

Other symbols	
	danger (instruction to prevent physical injury, damage to health or damage to the environment)
	note (instruction to prevent problems or material damage)
	additional information or explanation
	tip

Safety

- Before starting to work with the product, read the entire manual so that you are familiar will all safety instructions and safety precautions.
- In addition, read any other manuals supplied with specific components.

Safety - general

- Only Priva approved installers/service engineers who have received product-specific training from Priva are allowed to install, configure, repair and, if necessary, alter the product.
- Making alterations to the safeguards and safety icons on the equipment is prohibited.
- The internal connections are made in the factory and are to a large extent customer-specific (refer to the supplied project drawings). Do not, therefore, alter the internal connections.
- External equipment or components that are connected to the unit, such as computers and networks, must comply with the relevant electrical isolation safety regulations.
- Both the installer/service engineer and the user must regularly check and maintain the equipment (the safeguards in particular) in accordance with the instructions in this manual. Keep the equipment clean and the surroundings tidy.
- Report malfunctions or damage to your installer immediately. Take the equipment out of operation and do not use it if a defect is found.
- Only use original spare parts for repairs (refer to the spare parts price list).
- After making repairs check the correct status and functioning of the equipment.
- If the user allows personnel to operate the equipment, he/she must adequately instruct this personnel. In particular this should cover the safety risks and safety instructions stated in this manual. He/she must also supervise correct compliance with the instructions.
- Ensure that the personal protective equipment prescribed in this manual is available and that it is used.
- Display the safety icons that are applicable in the room where the equipment is set up.

Safe handling of chemical substances

When working near or on equipment for chemical substances (such as tanks, lines and dosing channels) there is a danger of contact with concentrated fertilisers and acid or lye. These chemical substances can be caustic and corrosive, so they could cause damage to the eyes and skin and damage to equipment. The unit suctions up the liquids and mixes them with water. Once correctly mixed and at the correct pH there is almost no danger to health or safety under normal use.

Ask the supplier of the chemical substances for detailed safety information. Ensure that everyone working with or near the chemical substances is aware of the following:
- the names of the substances and the concentrations;
- the risks;
- the protective measures required;
- action to be taken in the event of contact with the skin or eyes or after inhalation or ingestion;
- action to be taken in the event of leaks.

The following safety precautions apply for working with chemical substances:
- Ensure that the tanks and lines are positioned and installed correctly in accordance with the applicable local regulations.
- Provide a facility for collecting and disposing of leaked chemical substances. Place, for example, the unit and tanks in a concrete structure that is large enough to contain the entire volume in the event of leaks.

- Set the components up in such a way that they cannot easily be damaged.
- Ensure the dilutions are correct and use materials that are resistant to chemical substances.
- Clearly mark tanks and lines with the substances they contain.
- Ensure that the room is well-ventilated.
- Wear safety glasses, safety gloves and (safety) boots that are impervious to chemical substances. Wear clean work clothes that cover as much of the skin as possible.
- Ensure that there are facilities for showering and bathing the eyes near at hand. Ensure that everyone understands where these facilities are and how to use them. Ensure that the facilities are working at all times and are clean. Regularly rinse eyewash fountains in particular to prevent bacterial pollution.
- Remove clothing immediately if it has been contaminated with chemical substances. Wash the skin and the clothing with copious amounts of water.
- Ensure that the telephone number of professional emergency services is known in case that service is required. Notify the emergency services of which substance is involved in the event of a accident.
- Ensure that facilities for collecting leaking chemical substances, cleaning them up, diluting them with water and rinsing them away are always close to hand.
- Never add water to concentrated substances – add the concentrated substance to the water! This keeps the consequences of the reactions (gas formation, heat generation, effervescence, splashing) to a minimum.
- Empty the equipment and lines and/or rinse them thoroughly with water before opening them for maintenance.
- Drain discharge water - if not reused - in accordance with the locally applicable environmental regulations.

Electrical safety

The unit is powered from the mains voltage. There is a potential hazard of electrocution or fire resulting from a short circuit. You must therefore adhere to the following safety instructions:

- Keep the housings of electrical components closed.
- Keep the electrical parts dry.
- Make sure that the earthing is connected correctly.
- Ensure that the unit is connected to its own fuse group with the correct fuses.
- The electrical connection must comply with the locally applicable regulations.

During installation, maintenance or while resolving faults it may be necessary to open the housing for the electrical components. In this case, adhere to the following safety instructions:

- Preferably, make the unit totally free of electricity by removing the plug from the socket outlet or by removing fuses from the fuse group.
- If the unit cannot be made free of electricity then take extreme care. Use well-insulated tools and do not touch the ends of wires, connections and electrical components with your bare hands. Keep the surroundings dry and ensure that there is someone close by to keep an eye on you.
- Wear an earthed wrist strap when working in the cabinet. Otherwise the electronic components may be damaged due to static electricity.

Safety with mechanical parts

Adhere to the following safety instructions to prevent injury from mechanical causes:

- Transport and position the unit in accordance with the instructions in the (installation) manual. The unit is heavy!
- Install lines in such a way that no one can trip over them. Keep the surroundings tidy and dry to prevent trips and slips.
- Keep the housing of the pump(s) closed.

Take measures to prevent water hammer to avoid damage to equipment. Fill lines gradually and bleed them before switching the pumps to full operation or fully opening main valves.

Safety with hot parts

Parts of the unit that may become hot are equipped with this sticker.

Do not touch these parts during or shortly after operation.

Noise safety

When the unit is in operation, the system pump, in particular, produces noise. This will not cause damage to hearing. If, however, other noise-producing equipment is present in the same room, it may be necessary to wear ear protection.

Safeguards

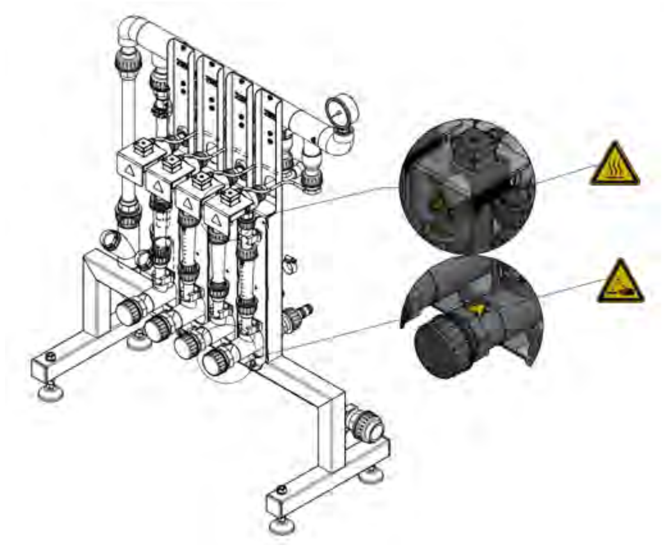
The unit has the following safeguards:

- The switch box containing electrical components is closed with a locked door.
- The power supply of the modules in the cabinet is connected to a circuit breaker that removes the power if overloading occurs.
- The hot parts of the dosing valves are protected by a transparent, L-shaped plastic sheet.

Guards on a dosing valve

- Install and use the equipment in accordance with the instructions in this manual to ensure that the safeguards function correctly.
- Never bridge or remove the safeguards: this may lead to a serious accident.

Safety icons on the unit



Ensure that the safety icons are clearly legible at all times. Replace any stickers with the safety icons which have become illegible.

Personal protective equipment

When working on the unit, tanks and lines always wear the following protective equipment to prevent injury or damage to your health:

Product description

Functions and intended use

The fertiliser unit provides irrigation water for horticulture. To this end, the unit has the following functions:

- Preparing irrigation water
- Distributing irrigation water using the existing irrigation pump
- Measuring the acidity of irrigation water (optional)

The unit can perform these functions simultaneously.

Preparing irrigation water

Only use the unit to dose diluted fertilisers for plant cultivation that are dissolved in water. The fertiliser solutions must be available in fertiliser tanks.

The solution must be such that it contains no solid particles (sediment).

The unit mixes the fertilisers from the fertiliser tanks with supply water in the required ratio to form homogeneous irrigation water. There is no EC-based regulation.

The concentration of a fertiliser solution is usually such that per 100 or 200 litres of supply water approximately 1 litre must be dosed. The capacity of the unit is determined by the capacity of the pump, which in turn must match the capacity of the dosing channels.

Distributing irrigation water using the existing irrigation pump

The unit does not have an integrated system pump; it uses the existing system pump.

The unit distributes the irrigation water to the crop. This can be done in 2 ways:

- **Direct distribution**
  The unit transports the irrigation water directly to the crop area. To do this the unit pressurises the distribution system. Then the control software opens the irrigation valves according to a specific program and controls the quantity of irrigation water. Irrigation systems, such as overhead irrigation systems, drippers and ebb and flow systems on containers and tables are possible depending on the design. In this application the unit is only active during irrigation. The cultivation area that can be irrigated with one unit depends on the crop and the chosen combination of pump and dosing channels.
- **Indirect distribution**
  The unit supplies the irrigation water to a storage tank or silo, for a period of 24 hours for example. From there, a separate pump supplies the irrigation water to the distribution system. This pump and the irrigation valves are not controlled from the unit. With this method, in comparison with the direct method, a simpler design will be adequate with a smaller pump while a larger crop area can be supplied with irrigation water. Complex systems with multiple stock tanks for different recipes and intelligent water management can be realised depending on the process computer that has been selected. For critical crop conditions and large crop areas we recommend installing a reserve unit. This reduces the risk of insufficient irrigation water being available in the event of a fault which could result in damage to the crop. The irrigation water prepared in accordance with the recipe is distributed immediately.

Checking the acidity of the irrigation water

The acidity of the irrigation water is measured. This measurement serves as a check and CANNOT be used for regulation. The acidity can be influenced by adding small concentrations of acid to the fertiliser tank. Phosphoric acid, sulphuric acid or nitric acid are usually used. With phosphoric acid and sulphuric acid there is a risk of calcium phosphate or calcium sulphate deposits respectively. Nitric acid does not have this drawback. Partly for this reason, Priva recommends nitric acid.

The acid concentration must not exceed 3% by weight. A higher concentration reduces the service life of the components.

Versions

The Nutri One is delivered as a substation. This means that the unit does not have a built-in process computer and must be controlled by an external Priva process computer (Compass).

The Nutri One does not have an integrated pump; it uses the existing pump.

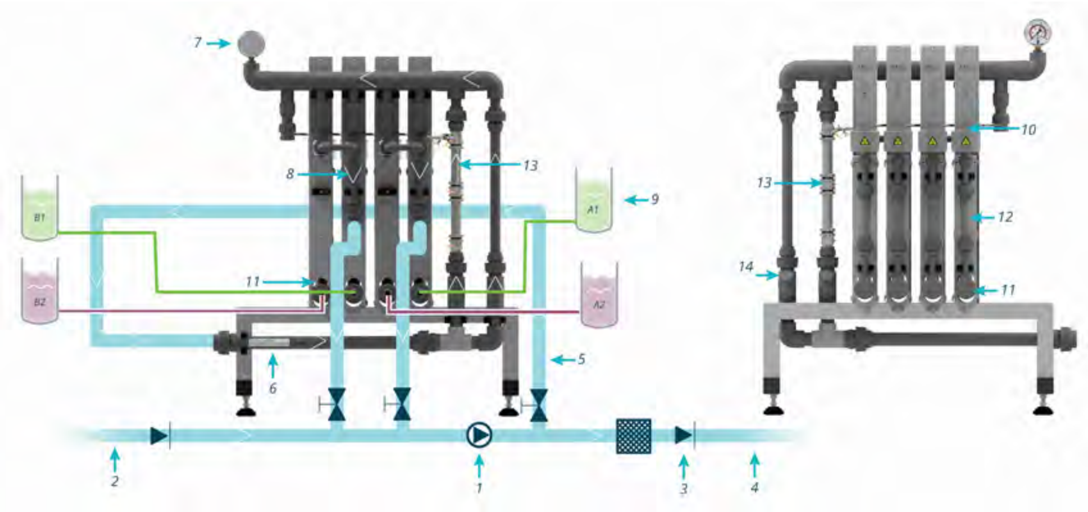
Depending on the version:

- Records at least one EC measurement. Priva recommends recording a second EC measurement for verification.
- A single pH measurement (optional).
- Dosing channels: 300 l/h dosing channel or 600 l/h dosing channel, possibly as a double dosing channel.
  The advantages of a double dosing channel over two single dosing channels:
  a. There is only one venturi (lower purchase price).
  b. The amount of drive water required for the venturis is lower (beneficial for the net capacity of the system pump).

This unit is suitable for lower EC values (1.5 to 2 mS). See the possibilities below for the different types of recipes.

Recipe	Dosing channel	Irrigation capacity at 1:50 dilution [m^3/h]	Irrigation capacity at 1:100 dilution [m^3/h]
NPK	1 x 300 l/h	15	30
	2 x 300 l/h	30	60
	3 x 300 l/h	45	90
	4 x 300 l/h	60	120
	1 x 600 l/h	15	30
	2 x 600 l/h	45	90
AB	2 x 300 l/h	15	30
	4 x 300 l/h	30	60
	2 x 600 l/h	15	30
AB double	2 x 300 l/h double dosing channel	15	30
	2 x 600 l/h double dosing channel	30	60
	4 x 300 l/h	15	30
ABC	3 x 300 l/h	15	30
ABCD	4 x 300 l/h	15	30

Operating principle



Back (left) and front (right) of the Nutri One

Dosing channels

The external pump (1) of the main line pumps the water from the supply line (2) via a non-return valve (3) to the crop (4). Some of the water goes to the branch line (5) with the dosing channels. The inline dirt filter (6) in the branch line (5) prevents clogging of the venturi nozzles in the dosing channels. Visual inspection of the pressure of the supply water upstream of the venturis is done using the pressure gauge (7) in the branch line.

The water in the branch line (drive water) flows through the venturis of the dosing channels (8). The nozzles in the venturis create an area of low pressure that draws in the fertilisers (9). Dosing valves (10) with built-in non-return valves are installed in the fertiliser channels just before the venturis. The control software pulses the dosing valves to control the open time, based on a recipe. A Nutri One has a maximum of four connections for dosing channels. Not all of the connections have to be used. Unused connections can be fitted with a dosing channel at a future time, if needed. Double dosing channels are also possible.

A filter (11) for filtering the fertiliser solution is located in the fertiliser line of a dosing channel. Using a rotameter (12), the fertiliser suction can be checked and the dosing valve adjusted.

EC and pH sensors

The electrical conductivity (measure of fertiliser concentration) of the irrigation water is measured using EC sensors (13) in the branch line. The pH sensor (14) measures the acidity of the irrigation water. The pH sensor is located in a sensor holder that is connected to the branch line with a thin line to eliminate the disruptive influence of the pump pressure.

If two EC sensors are used, it is possible to compare the measured values of the two sensors.

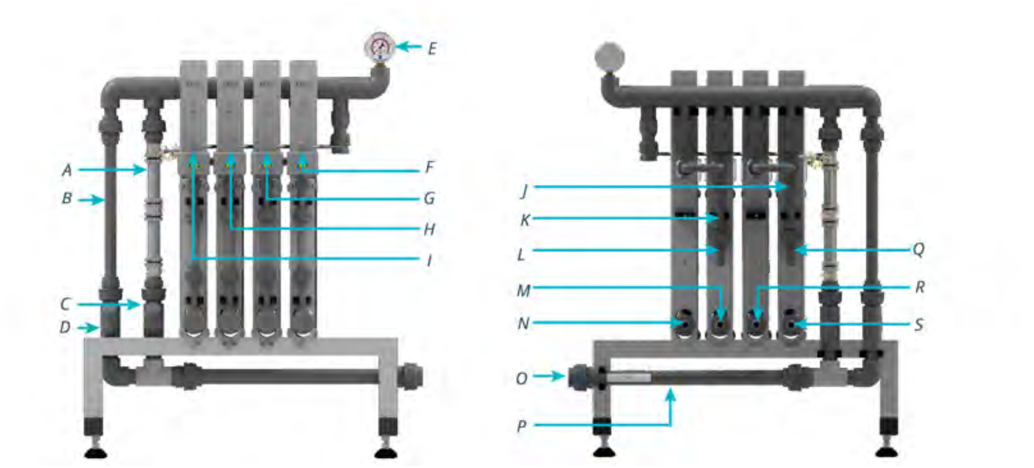
In order to remove the sensors safely, e.g. for maintenance purposes, the unit can be isolated with manually operated valves and depressurised via the drain taps near the pH and EC sensors. These drain taps can also be used to empty the pipe, e.g. if the unit is taken out of operation for a longer period of time due to a period of freezing temperatures.

The pH sensor must always remain under water when the unit is drained. In this case, remove the pH sensor and put it back in the holder it was delivered in.

Control panel

The unit does not have its own process computer; it is a substation of a process computer set up elsewhere. The process computer communicates with the electrical components in the cabinet via the network (Compass). Depending on the model, various other connections are available in the cabinet, e.g. for the mains supply, irrigation valves, a flush valve and sensors.

Construction



Front (Nutri One 2 double dosing channels)		Back (Nutri One 2 double dosing channels)	
A.	EC sensor 1	J.	Venturi 1
B.	EC sensor 2 (optional)	K.	Venturi 2
C.	pH measurement 1 (optional)	L.	Water + fertiliser output 2
D.	pH measurement 2 (optional)	M.	Fertiliser input 3
E.	Pressure gauge	N.	Fertiliser input 4
F.	Fertiliser dosing valve 4	O.	Water inlet
G.	Fertiliser dosing valve 3	P.	Filter
H.	Fertiliser dosing valve 2	Q.	Water outlet 1
I.	Fertiliser dosing valve 1	R.	Fertiliser input 2
		S.	Fertiliser input 1

Type plate on the product

The type plate on the product contains the following information (form top to bottom and from left to right):

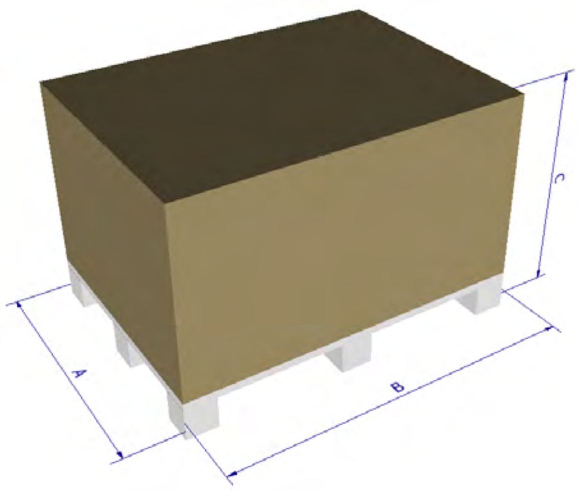
- Product name and type designation
- *Serial No*: serial number
- *Year*: year of construction
- *Connection*: specification of the connections to the mains voltage
- *Mains*: required mains voltage in VAC
- *Frequency*: required mains frequency in Hz
- *Power*: nominal electrical power consumption in kW
- Name, address and web address of the manufacturer (Priva B.V.)
- Manual icon
- CE mark

Warranty

The warranty expires if the product is not installed, used and maintained in accordance with the instructions in the Priva manual. For more details refer to the general terms of delivery (Priva will supply these on request and refer to www.priva.com) and the specifically agreed terms of delivery.

Transport and storage

Transport



The unit is protected by a wooden casing or heavy cardboard for transport. Use a fork-lift truck or pallet transporter to move the pallet with the unit.

A= 122 mm

B= 96 mm

C= 120 mm

The mass (including packaging) is: ±60 kg

Conditions during transport and storage

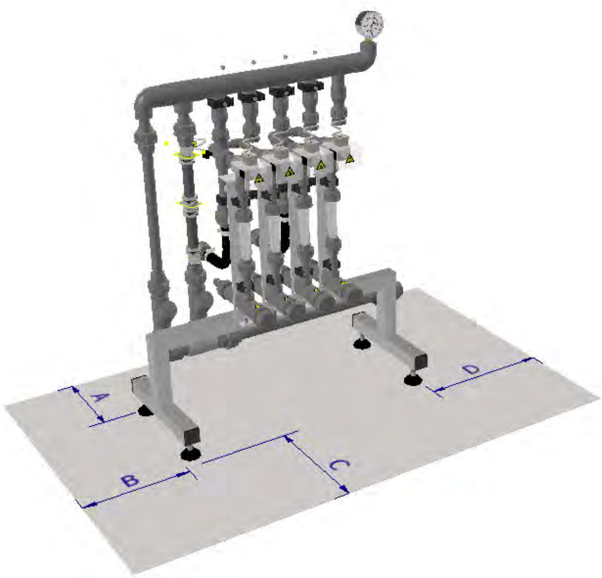
The ambient conditions must remain within the following limits during transport and storage:

- Temperature: 0 - 35°C.
- Relative air humidity: maximum 95% (non-condensing).
- Rain: the packaged equipment must be kept dry and must not, therefore, stand outdoors.
- Sunlight: the packaged equipment must not stand in bright sunlight. Otherwise, the internal temperature may become too high causing deformation in the plastic components.
- Vibrations: avoid exposure to strong vibrations.

Positioning the unit

Location and environmental conditions

Minimum free space around unit



Minimum free space around unit

A = minimum 50 cm

B, C, D = minimum 110 cm

Environmental requirements

The unit must not be in direct sunlight. Due to bright sunlight the temperature will become too high, causing plastic parts to deform, creating malfunctions in electrical components and shortening the service life of electrical components.
Always keep any cabinet ventilation grilles free and open, allowing the electrical components to be cooled.

General	Position the unit in an indoor, well-ventilated room, free from drips and splashes, with a stable temperature (no rapid temperature changes). Select a location where the unit cannot easily be damaged (e.g. by mobile equipment). The surface on which the unit will stand should be hard, flat and level.
Temperature when not operating	0 - 35°C As long as the unit contains water (residue) it must be kept frost-free.
Temperature during operation	5 - 30°C
Supply water temperature	5 - 30°C (the unit can still work at a maximum temperature of 30°C. However, with regard to the water quality and/or the operation of the unit, such a high water temperature is generally unacceptable.)
Relative air humidity	< 85% (this is lower than the maximum relative air humidity during transport because of the presence of chemical substances.) Condensation will form on the pipe-work, particularly when relatively cold supply water is used. This is very corrosive when combined with the vapours from the chemical substances. Hose clamps and other metal parts must therefore be of corrosion-resistant types of metals or must be well coated (and remain so). The cabinet contains sensitive electronic circuits and must definitely remain condensation-free.
Maximum installation height	1000 m above sea level (Cavitation may occur in the system pump when the ambient pressure is too low.)
Pollution factor (NEN-EN-IEC 61010-1)	maximum 2 (normal, non-conducting pollution)

Basic facility requirement

A number of basic facilities must be present in the room before positioning and installing the unit:

- There must be a facility for collecting and disposing of chemical substances in the event of leakages, for instance a concrete tank in which the fertiliser and acid or lye tanks and the unit can be placed or a sloping floor with a drain pit. The tank or pit can be connected to the sewer by a valve, which is normally closed. If a disaster occurs, a decision can be taken as to whether the tank or pit can be discharged into the sewer with dilution water.
- There must be a sufficient supply of water at the right pressure. The water can comprise various sources, such as tap water, drain water, rain water, well water and river water.
- A separate electrical connection must be installed in accordance with local regulations. In doing so, also take into account any other devices that may be part of the system.

  ! It is strongly recommended that an emergency stop is provided which makes all electrical equipment in the system free of electricity simultaneously. Position the emergency stop close to the unit.

- There must be a sufficient number of wall sockets for connecting tools and equipment during installation and maintenance.

Additional facilities may be required, depending on the quality of the supply water:

- Mechanical pretreatment using a filter to prevent blockages due to the sedimentation of solid particles in the system (see Filters (page 24)).
- Thermal conditioning using a heat exchanger if the temperature of the supply water is too low. Heating the water prevents condensation from spreading into the electrical components (such as the EC sensor connections). In addition, heating reduces the chance of precipitation of fertilisers.
- Chemical pretreatment by acidification of the supply water if the water contains too much bicarbonate (see Supply water quality (page 62)).
- Disinfection using UV light, optionally combined with dosage of hydrogen peroxide (Priva Vialux disinfection units). This is necessary in the event of the recycling of drain water and the use of dirty surface water.

In this manual it is assumed that the unit will be installed at the same time as the fertiliser tanks and the distribution system. The description of this, however, falls outside the scope of this manual.

The following facilities must also be present before the system is allowed to be filled with fertilisers:
- personal protective equipment;
- a shower (preferably a special emergency shower to rinse-off leaked chemical substances);
- an eyewash fountain;
- a fire hose to dilute and rinse away leaked chemical substances;
- safety icons on the access door(s) to the room.

Positioning the unit

1. Carefully remove the casing and packaging so that the unit is not damaged.
2. Remove the wooden pallet.
3. Place the unit on a hard, level surface, inside the spill collection provision.
4. Adjust the unit until level using the adjusting feet on the frame.

Installation - hydronic part

Only Priva approved installers/service engineers who have received product-specific training from Priva are allowed to install the unit.

For the purpose of the unit's screw couplings Priva supplies various adapter rings and imperial adapter rings that can be connected to the metric and imperial pipe diameters (refer to specifications and the price list).

Installing the water supply

Points to be considered

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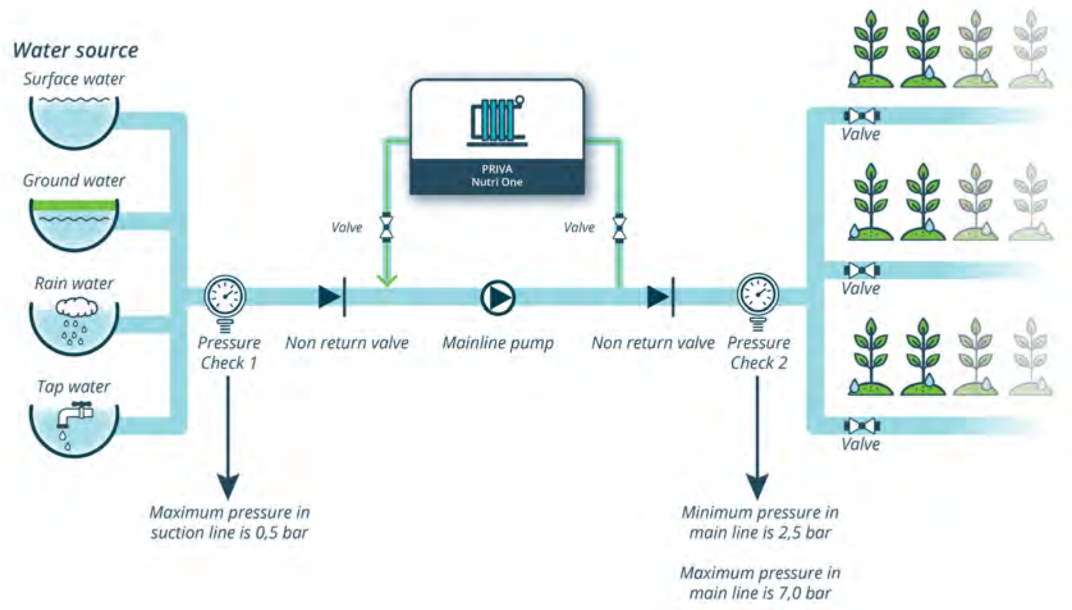
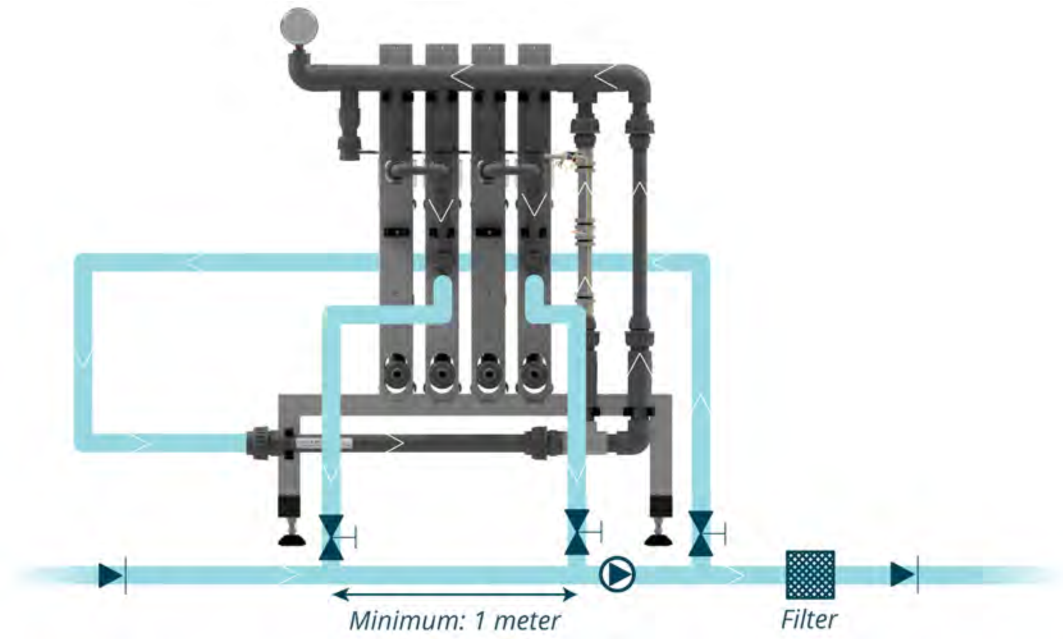


Pressure in suction line
Maximum 0.5 **Pressure in main line**bar

•

Maximum 2.5 bar
Maximum 7.0 bar
Install a pressure regulator if the pressure is higher than 7.0 bar.

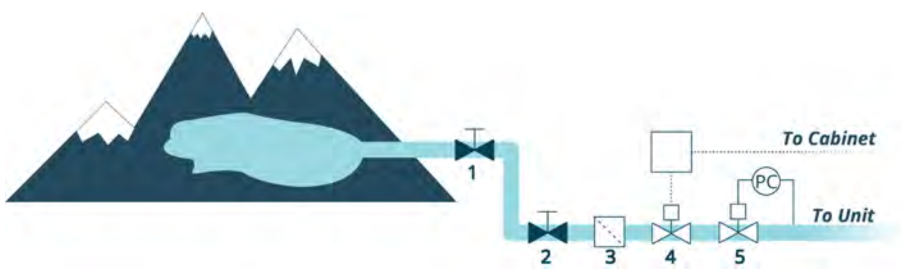
- **Dimensioning**
  Dimension the supply lines so that they are suitable for possible future expansions.
- **Constant flow and pressure**
  Ensure that the flow and pressure of the supply water do not fluctuate.



Rear view

1. **Input**
   Connect the water inlet of the Nutri One to the main line after the pump. The Nutri One is placed over the existing irrigation pump. The Nutri One can be connected to the main line by hose or PVC pipe.
2. **Output**
   Connect water outlet 1 and 2 (3 and 4) to the suction line. Maintain a minimum distance of 1 metre between pump and injection point to reduce the risk of deposits.
3. **Check valve**
   Install a non-return valve (1) between the unit and the main irrigation line to ensure that irrigation water cannot flow back when the unit is at a standstill, which can lead to water hammer.
4. **Manually operated valves**
   Use manually operated valves to allow watering during system maintenance.
5. **Drinking water line**
   Never connect a drinking water line directly to the water supply of the unit. Instead, allow drinking water to flow under atmospheric pressure into the supply water basin, tank or silo or use a separate 'break tank'. Water from a basin, tank or silo can be supplied by a pump.
6. **Bleed valves**
   Install bleed valves at the highest point to bleed the supply system (to minimise water hammer).
7. **Drain valves**
   Install drain valves at the lowest point so the supply system can be completely emptied (in case of freezing temperatures).

Water supply at higher elevation



Water supply at higher elevation

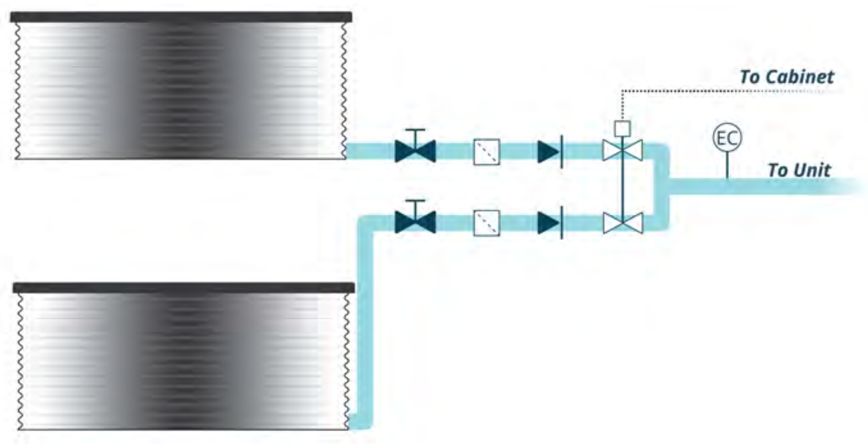
The illustration merely shows possible components. The actual components required depend on the desired configuration.

1. **Supply line**
   Install a manually operated valve (1) directly at the source, and a manually operated valve (2) and a dirt trap (3) in the supply line to the unit.
2. **Supply valve**
   Install a fast-acting electrically operated supply valve (4) to shut off the pressurised water supply when the unit is not in operation. This valve can be controlled by the process computer (via the unit).
3. **Pressure**
   The pressure of the supply water downstream of the supply valve (4) must not exceed 0.5 bar for the Nutri One. Install a pressure reducing valve (5) if a higher pressure is expected.

Water supply at lower elevation

This is not possible.

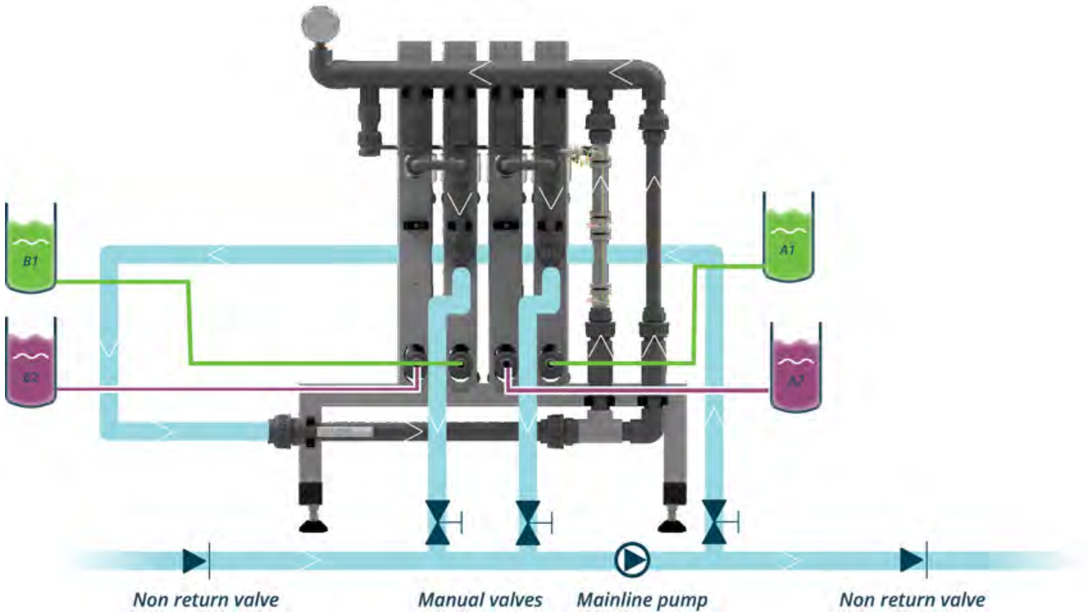
Mixing drain water with clean water



The illustration merely shows possible components. The actual components required depend on the desired configuration.

1. **Uniform pressure**
   Make sure that the drain water and the clean water are in similar tanks or silos, at the same elevation (same pressure).
2. **EC pre-control**
   If drain water is reused, an EC pre-control can be used. This type of pre-control comprises two valves that are contra-controlled by a common motor. One valve allows drain water (with a high EC value) to pass and the other fresh water (with a low EC value). The further one valve closes, the further the other opens and vice versa. The EC value of the mixed water is measured by a separate EC sensor that is connected upstream of the unit. The control software controls the motor on the valves so that the supply water has a constant, desired EC value. For effective control, the EC values of the drain water and clean water must differ by at least 0.5 mS/cm.

Installing the fertiliser supply



Rear view

1. Connect the fertiliser line to the fertiliser inputs. In this case there are 4 channels and thus 4 fertiliser inputs.

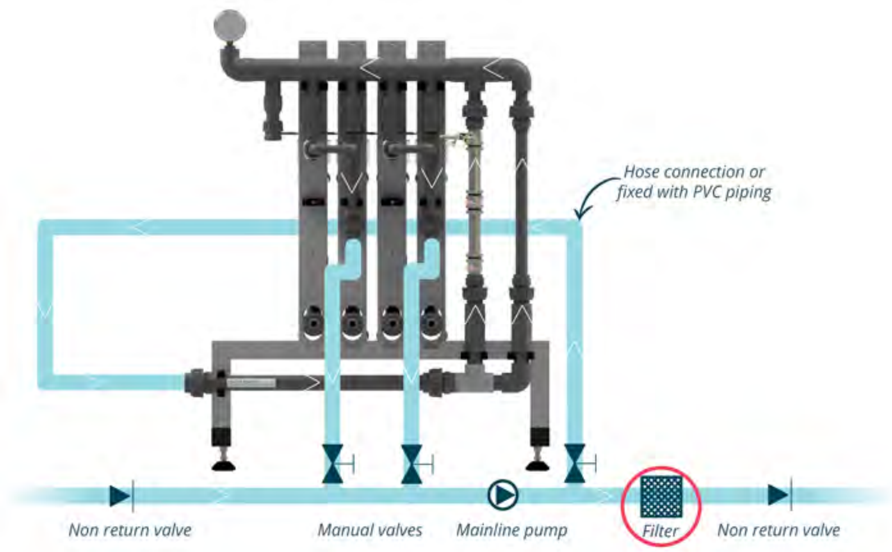
   Example of connection if you use an A1, A2, B1, B2 principle, for example:
   - Fertiliser input 1 to fertiliser A1
   - Fertiliser input 2 to fertiliser A2
   - Fertiliser input 3 to fertiliser B1
   - Fertiliser input 4 to fertiliser B2

   In other configurations, always connect A(1) tank to fertiliser input 1 and so on. See chapter Construction (page 13) for the numbering of the channels.
2. Install a flow sensor at the beginning of the main irrigation line or upstream of the filter if it is a large sand filter. This flow sensor is necessary if the dosing system has to be able to control the amount of irrigation water. This way, the control software can ensure that after a recipe change the filter is rinsed with precisely the right amount of irrigation water and the dosing channels are only activated if there is flow in the main line. This prevents excessive concentration of fertilisers, deposits in the pipes, and wear and corrosion of the pump.
3. The fertiliser and acid flow can be reduced by turning the screw of the dosing valve on the dosing channel. If the dosing valve is activated for a longer period of time (longer duty cycle), there will be less fluctuation in the measurements.
4. The fertiliser tanks must be large enough that in the summer they provide storage space for a good 24-hours and preferably for a week. Consider connecting two fertiliser tanks per fertiliser line. This allows new fertiliser to be prepared without interrupting the current program. When one fertiliser tank is almost empty the other fertiliser tank can be selected by turning manually operated valves.

   Position the tanks:
   - in the facility for capturing and disposing of leaking chemical substances (1);
   - with the outlet at the same height as the bottom of the unit;
   - with the entire bottom surface supported;
   - so that they cannot easily be damaged, by mobile equipment for example;
   - so that there is sufficient workspace around them;
   - with a lid on the tank;
   - in accordance with locally applicable regulations.
5. The fertilisers can best we drawn in from approximately 5 cm above the bottom of the tank. This prevents sediment from being drawn off the bottom, which would otherwise lead to blockages. Create a leak-free penetration in the tank wall for the outlet line. Install a plastic valve in the outlet line.

6. If equalisation control is used, fit the respective fertiliser tanks with a chemical resistant level sensor.
7. Use chemical-resistant electric agitators in the fertiliser tanks to mix the solutions and then keep them homogeneous.

Installing filters



Rear view

Points to be considered

- **Fertiliser pipe**
  The fertiliser solution may contain dirt, grains of sand, incompletely dissolved fertilisers and crystallised fertilisers. Carefully filtering the fertiliser solutions is therefore crucial in preventing blockages in the dosing channels and damage to the dosing valves. The dosing channels have built-in dirt traps. However, these do not capture the smaller particles. Therefore, install a filter with a passage size of <130 µm at the end of each fertiliser line. If necessary, install plastic taps and a rinse water connection on both sides (similar to the arrangement around the filter at the beginning of the fertiliser line).

  Defects to the dosing valves caused by a lack of adequate filtering are not covered by the warranty.

- **Supply line**
  Install a filter between the unit and the main irrigation line to prevent blockages in the distribution system. Depending on the type of dirt or particles, a choice can be made between a sand filter and a screen filter (sieve filter) with a passage size of <500 µm. See also Filters (page 24). Place the filter upstream of the Nutri One and downstream of the first non-return valve.

Filters

Filter types

Use filters to filter organic dirt and solid particles out of the water. The choice of a sand filter and/or screen filter will depend on the quality of the supply water and the irrigation system requirements associated with the crop.

Sand filter

Use a sand filter if the supply water contains large amounts of organic dirt such as algae or plant remnants.

In general, the following operational conditions apply to a sand filter:
- The flow rate of the water through the sand filter is approx. 40 .. 50 m/h.
- The rinse water speed must be approx. 40 .. 50 m/h to achieve an expansion of around 15 % in the bed of sand via an additional backwashing pump.
- The size of sand grains is approx. 1 .. 2 mm.
- The thickness of the bed of sand is approx. 40 cm.

Other points to consider:
- On account of the hydraulic resistance, always position a sand filter at the discharge side of pump.
- In the event of a pressure difference of approx. 0.5 bar over the bed of sand, the sand filter must be rinsed. To do this, you require an additional backwashing pump.
- A multi-layer or multimedia filter can be used for large quantities of suspended particles, such as a filter with layers of anthracite, sand and gravel. For more information, please consult the sand filter supplier's manual.
- If a standstill of the unit during the backwashing of the filter is a problem, consider multiple filters connected in parallel. In this way there is always enough filter capacity if one of the filters is being backwashed.

Screen filter

Use a screen filter ('sieve filter') when the supply water contains a large number of hard and coarse particles.

In general, the following operational conditions apply to a screen filter:
- The flow rate through the filter must be adjusted to the type of filter.
- It must be possible to clean the filter automatically or manually during use.
- The filter must be made from SST or a synthetic material with a passage size < 75 .. 500 µm, depending on the type of supply water and type of irrigation system (dripper or sprinkler).

!
- Clean filters on a regular basis. The frequency depends on the degree of contamination of the supply water. Consult the user instructions or contact the supplier of the filter concerned.
- If the filter is installed on the distribution side of the unit, a dirt filter with a maximum passage size of 2 mm must be installed on the supply side.

Because a screen filter usually has a relatively coarse mesh size (especially if it is a dirt filter), the hydraulic resistance is low and the filter can also be positioned on the suction side of the pump. On account of the hydraulic resistance, a fine-meshed screen filter must be positioned on the discharge side of the pump.

Position of the filter relative to the unit

There are many factors that determine whether a filter should be positioned on the supply side, on the distribution side or possibly on both sides of the unit. Some considerations:

- The smaller the openings on the sprinklers or drippers of the irrigation system, the easer it is for them to become clogged and the more important it is to ensure good filtration.
- Although it may seem logical to fine filter the supply water (thus protecting both the unit and the distribution system against particles), it is often better to position a relatively coarse filter (screen filter) on the supply side of the unit and a fine filter on the distribution side. This is because particles can also be produced in the unit, for instance as a result of algae growth or sediment or the depositing of fertilisers (especially when the unit is at a standstill). In addition, a fine filter may cause problems with the pump on the unit on account of the high hydraulic resistance.
- If recipes are changed frequently, a sand filter on the distribution side will be a disadvantage. This is because the sand filter will have to be frequently rinsed, resulting in a repeated loss of irrigation water.

Installing remaining taps and valves

- **Flush valve**
  Install a manually operated discharge valve on the side of the unit and a manually operated valve between the unit and the main irrigation line. These are required for commissioning, cleaning and emptying the system. Connect the discharge valve to the sewer or the drain water system.
- **Flush valve**
  Install an electrical flush valve at the end of the main irrigation line. This is important for changing recipes and cleaning and emptying the system (for instance in the event of frost). Connect the flush valve to the sewer or drain water system.
- **Irrigation valves and irrigation lines**
  Select the irrigation valves and the irrigation lines so that the flow in the various valve sections is as equal as possible and matches the capacity of the system pump. The irrigation valves may be connected to one long line running along all the valve sections. The irrigation valves may also be connected to a manifold close to the unit with separate lines to the various valve sections.
- **Damping tank or safety valve**
  Consider – especially on large distribution systems – installing a damping tank or a safety valve to limit water hammer. For the same reason, the flow rate in plastic lines may never exceed 2 m/s (nominal rate 0.5 – 1.2 m/s) and sharp bends must be avoided in the pipe-work.

Installation - electrical part

Read the safety instructions in Safety (page 6) before installing the unit.

When connecting sensors use cable with a core diameter of at least 0.8 mm (cross-sectional area 0.5 mm²). For a cable length of 300 – 600 m, connect a second core in parallel with each core.

Connectors

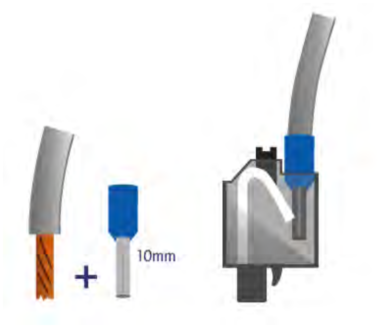
To make connections, use the supplied connectors or the optionally available right-angled screw connectors. Right-angled screw connectors are supplied as a set for a module. The set contains the right-angled screw connectors that are needed for the connectors on the module concerned.

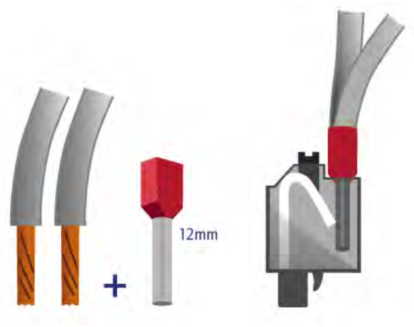
Connecting with flexible wire

When using flexible wire, always use a crimp-on terminal.

With crimp-on terminals

1. Strip the wire:
   - If using single crimp-on terminals: strip 10 mm off (8 mm for RS-485 connector).
   - If using double crimp-on terminals: strip 12 mm off.
2. Fit the crimp-on terminal.
3. Insert the crimp-on terminal into the terminal block until it can go no further.





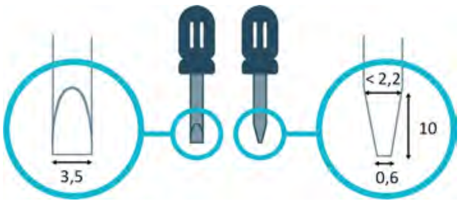
Connecting with solid wire

1. Strip 10 mm off the wire.
2. Insert the wire into the terminal block until it can go no further.

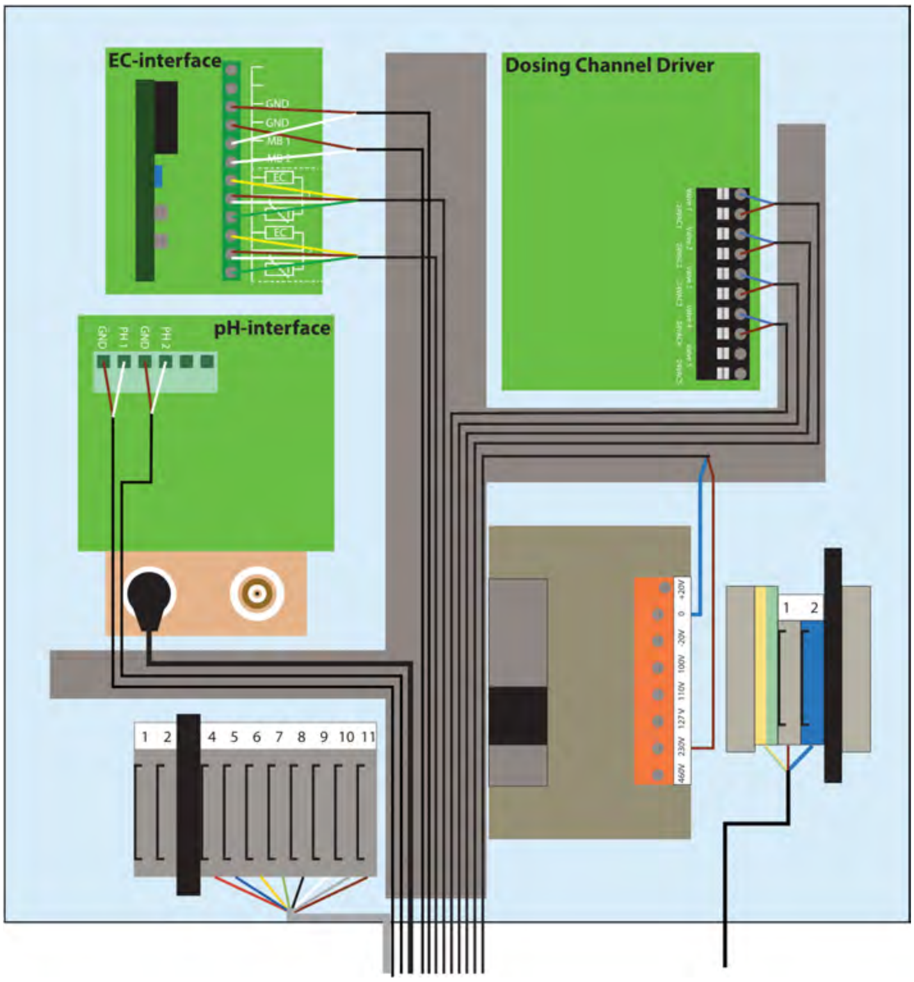
Screwdriver for terminal block

To install wiring in a terminal block, use a screwdriver with the correct dimensions. For instance, a Phoenix Contact Screwdriver SZF 1-0.6X3.5 (article number 1204517).

Using a screwdriver that is too large or too small may damage the connections on the modules.



Cabinet layout Nutri One



The Nutri One cabinet contains the EC interface, the pH interface and the Dosing Channel Driver. Connect the sensors and actuators to these components. In addition, connect the inputs and outputs of the EC interface, the pH interface and the Dosing Channel Driver to the inputs and outputs of the Compass.

Cable entry

The underside of the cabinet has a cable entry and cable glands.

The cable glands are intended for various types of cabling. Always seal a cable gland with a supplied dummy plug if a cable entry is not being used.

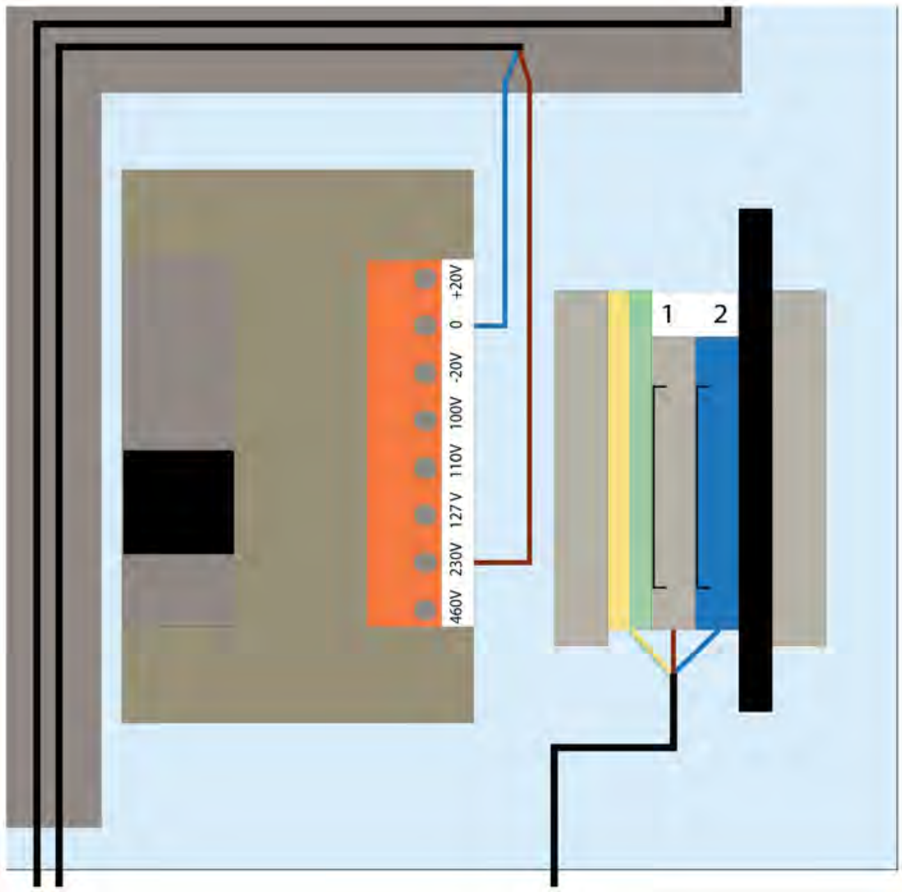
The cable entries are intended for various types of cabling.

Always use a cable entry or cable gland that is suitable for a cable type with the specified cable diameter.

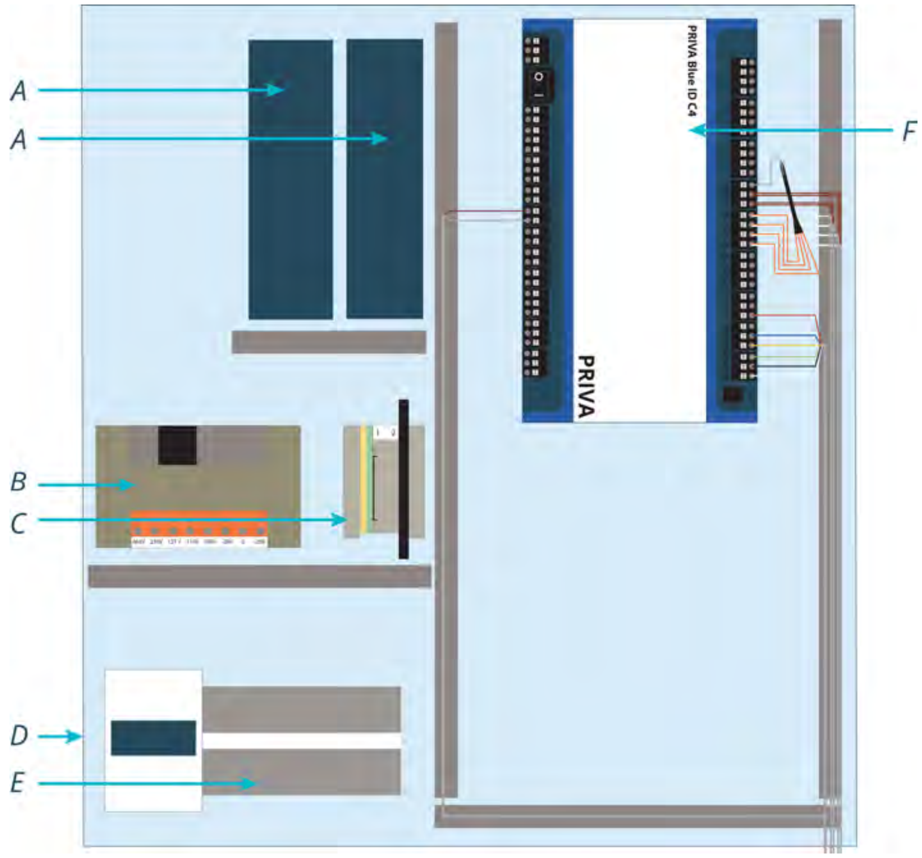
Connecting the power supply (Nutri One cabinet)

1. Make sure the blue wire (neutral wire) is connected to 0 V of the transformer.
2. Make sure the brown wire is connected to: 460, 230, 200, 127, 110 or 100 V of the transformer, depending on the local mains voltage.
3. You can then optionally increase or decrease the value by 20 V by connecting the blue wire to -20 V or +20 V.
4. Connect the mains cable:

Mains cable	Terminal strip
Earth (yellow/green)	PE1
Phase (brown or black)	1
Neutral (blue)	2



Cabinet layout Compass



A= power supply
B= 24 Vac transformer
C= terminal strip
D= Circuit breaker
E= Terminal strip
F= BlueID C4

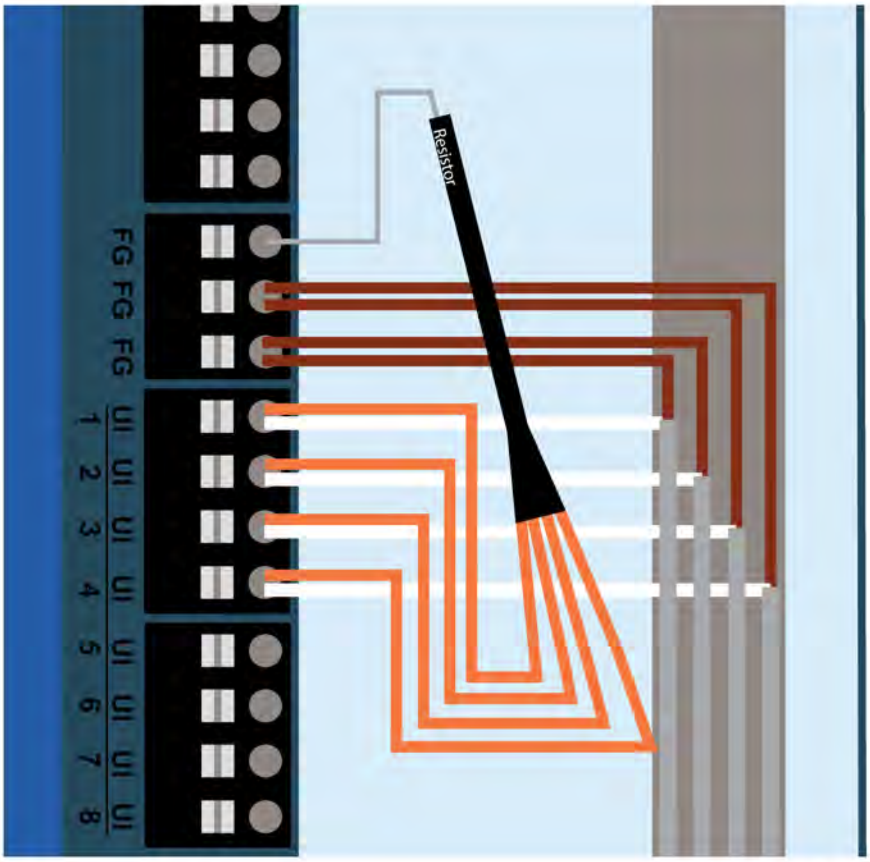
Layout of the cabinet with the various components.

Connecting Nutri One cabinet to Compass cabinet

1. Connect an 8-core cable to terminals 4 to 11 of the terminal strip in the bottom left of the Nutri One cabinet (see Cabinet layout Nutri One (page 28)).
2. Connect two 2-core cables to VP8658 in the Nutri One cabinet according to the table below.
3. Connect a 2-core cable to VP8658 in the Nutri One cabinet according to the table below.
4. Connect the cables to the Compass according to the table below.
5. Connect the grey wire of the supplied resistor to the FG terminal of the Compass. The resistor protects the universal inputs of the Compass.

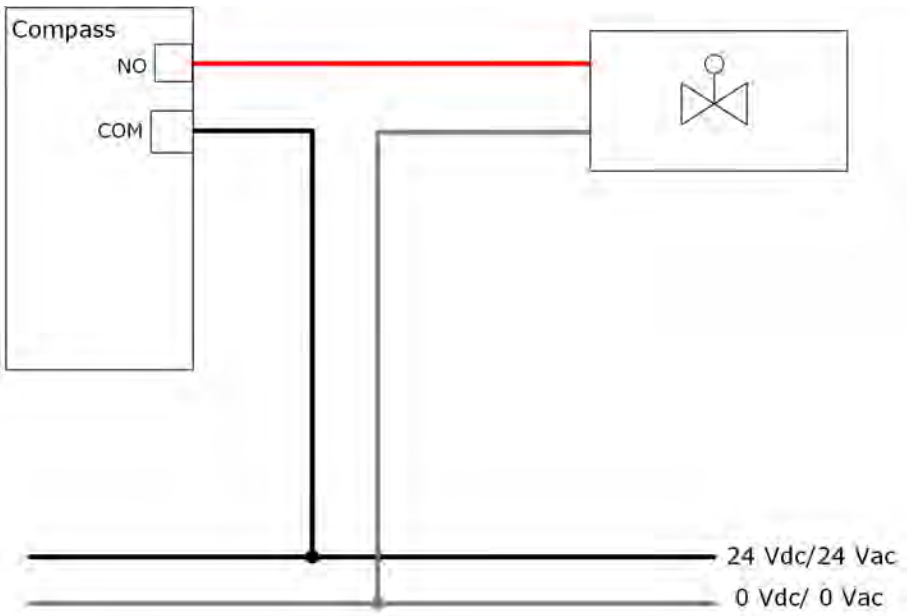
6. Connect the 4 orange wires of the resistor to inputs UI 1 to 4 of the Compass. See figure below.

Nutri One cabinet	number in Nutri One cabinet	Function	Compass cabinet Compass C4
Terminal strip	4	earthing	Common FG
	5	dosing valve 1	AO 2 (analogue output 2)
	6	dosing valve 2	AO 3
	7	dosing valve 3	AO 4
	8	dosing valve 4	AO 5
	9	dosing valve 5	AO 6
	10	enable dosing cycle (control)	Digital output 2 NO
	11	enable dosing cycle (earthing)	Digital output 2 COM
VP8658	EC MB1	EC sensor 1	UI 1
	EC MB2	EC sensor 2 (optional)	UI 2
VP9969	pH 1	pH sensor 1	UI 3
	pH 2	pH sensor 2	UI 4



Connecting the irrigation valves

When connecting the irrigation valves take account of the minimum cross-sectional area (A). Because the wires are usually long (L) the voltage loss (ΔV) resulting from the wire resistivity may be so great that the valve no longer works correctly: $\Delta V = 2 \times \rho \times I \times L/A$ (Based on 2-core copper wire where $\rho = 1.70*10^{-8}\ \Omega m$. Refer to the specifications of the valves involved for the minimum voltage requirement and power consumption (I).)



For AC valves:
1. Connect the COM for digital outputs 3 to 8 of the Compass to terminal X3-1.
2. Connect the control wire to the NO terminal of one of the digital outputs (3 to 8) of the Compass.
3. Connect the common of the irrigation valve to terminal X3-4.

For DC valves:
1. Connect the COM for digital outputs 3 to 8 of the Compass to terminal X3-7.
2. Connect the control wire to the NO terminal of one of the digital outputs (3 to 8) of the Compass.
3. Connect the common of the irrigation valve to terminal X3-10.

Digital outputs 6 to 8 also have an NC output. Do not use these for the irrigation valves.

Parts

Pump

Connecting the pump

1. Connect the pump to digital output 1 (DO1) of the Compass.
2. Connect the pump earth to COM (GN) and to NO.

Dosing channels

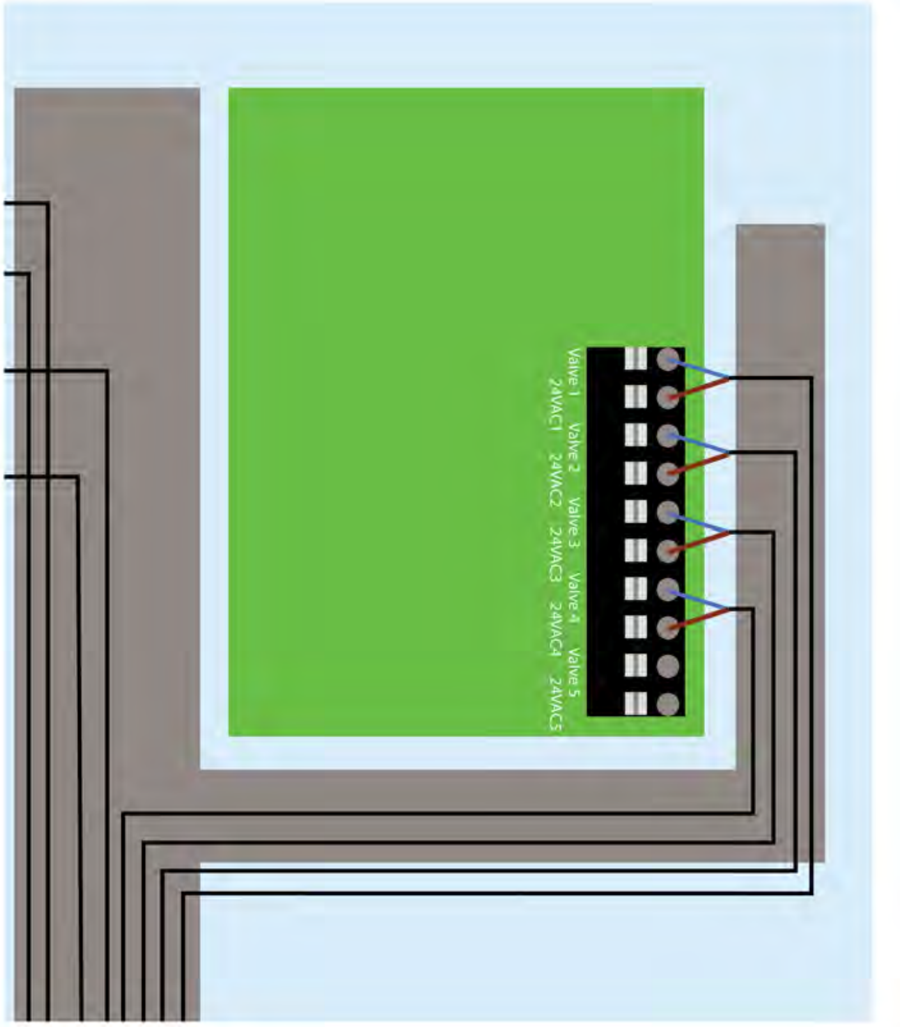
The Nutri One has a maximum of 5 dosing channel positions. If single dosing channels have been installed on all these positions, a maximum of 5 fertiliser solutions can be dosed at one time.

Dosing channels are available in a range of versions:
- 300 l/h and 600 l/h dosing channels;
- 300 l/h and 600 l/h double dosing channels;

Refer to document *Application dosing channels* for more information.

Connecting the dosing valves

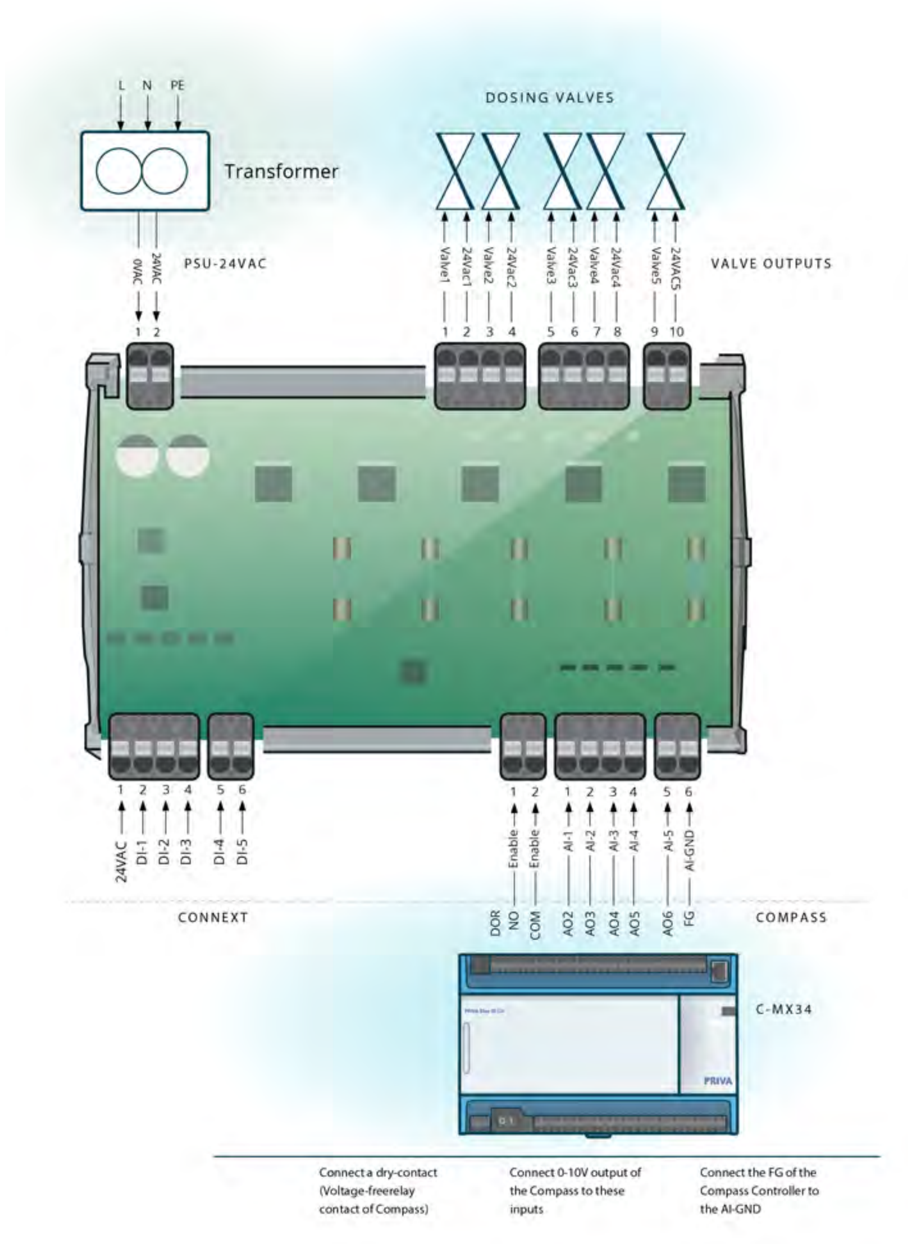
1. Feed the dosing valve cables through the cable glands in the cabinet and then through the cable duct.
2. Connect the dosing valve cables to the Dosing Channel Driver. See also: Connecting the Dosing Channel Driver (page 34).



Connecting the Dosing Channel Driver

Position the Dosing Channel Driver close to the dosing channel. The cable from the TRIAC output of the Dosing Channel Driver to the valve of the dosing channel may be no more than 10 metres long.

1. Use jumper J1 to set the interface for analogue inputs (Converter) for Compass. The jumper must be open for the use of analogue inputs for Compass.
2. Connect the power supply to the connecting terminals (CN2) of the Dosing Channel Driver. Use a 2-core shielded cable with cores of 1.4 mm (1.5 mm²).
3. Connect the wiring of the analogue output of the Priva Blue ID module to the connector terminals (CN1) of the Dosing Channel Driver. Use a 6-core non-shielded cable with cores of 0.8 mm (0.5 mm²). The maximum cable length is 100 metres.
4. Connect the wiring to the 24 VAC TRIACs for the dosing channels to the connecting terminals (CN7-9) of the Dosing Channel Driver. Use a 2-core non-shielded cable with cores of 0.75 mm. The maximum cable length is 10 metres.
5. Connect the wiring of the relay output of the Priva Blue ID module to the Enable connector terminals (CN5) of the interface. Use a 2-core non-shielded cable with cores of 0.8 mm (0.5 mm²). The maximum cable length is 100 metres.



The use of 5 dosing channels with GevaSol valves requires at least 100VA. Therefor the graphic above includes a 300VA transformer. The 24 VAC transformer from the Compass cabinet can be used, but this means there is no output power available for other components.

Dosing Channel Driver power supply cable

Name	Function	Connection
24VAC	24 VAC	to 24 VAC of external power supply [1]
0VAC	0 VAC	to 0 VAC of external power supply [1]

[1] Use a transformer of at least 24 VAC 100VA; 300VA is desirable.

Cables from Dosing Channel Driver to Compass

Name	Function	Connection
ENABLE	start dosing cycle	to relay output (voltage free) of Priva Blue ID module
AI-1 ...AI-5	sensor signal	to AO of Priva Blue ID module
GND	GND	to FG of Priva Blue ID module

Cable from Dosing Channel Driver to dosing channel

Name	Function	Connection
Valve1 ... Valve5	0 VAC	to 0 VAC to TRIAC of dosing channel
24VAC1... 24VAC5	24 VAC	to 24 VAC to TRIAC of dosing channel

Adjusting the dosing valve

The dosing valves are controlled with pulse width modulation. The duty cycle (i.e. the ratio between the time that the valve is open and the time that the valve is closed) determines the average flow. The maximum flow is the flow when the valve is open continuously. This maximum flow is adjusted with a restriction screw on the dosing valve; see also the test report that accompanied the unit. For use of the A+B principle, the maximum flow for all dosing valves is set at the same level.

Dosing valve restricting screw

Technical specifications

Dosing channel 3% acid, 300 l/h

Article number	730310 (50 Hz) 730311 (60 Hz)
Liquids to be used	fertilisers, lye and acid solutions containing up to a 3% weight percent nitric acid
Passage size of filter	<2 mm
Reading range of rotameter	0 – 300 l/h
Dosage capacity	30 – 300 l/h
Drive water flow rate	approx. 560 l/h at 3.5 bar (Ø2.7 mm nozzle)
Dosage valve	Geva, 24 VAC, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw
Dosage valve signalling	LED (red)
Flow controller	restricting screw in dosage valve
Non-return valve	integrated in dosage valve
Connection of fertiliser supply	hose connector Ø20 mm

Dosing channel 3% acid, 600 l/h

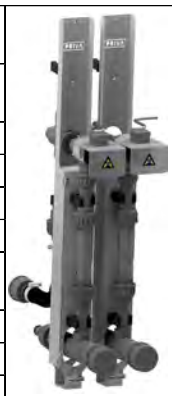
Article number	730320 (50 Hz) 730321 (60 Hz)
Liquids to be used	fertilisers, lye and acid solutions containing up to a 3% weight percent nitric acid
Passage size of filter	<2 mm
Reading range of rotameter	0 – 1000 l/h
Dosage capacity	60 – 600 l/h
Drive water flow rate	approx. 1250 l/h at 3.5 bar (Ø4.0 mm nozzle)
Dosage valve	Geva, 24 VAC, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw
Dosage valve signalling	LED (red)
Flow controller	restricting screw in dosage valve
Non-return valve	integrated in dosage valve
Connection of fertiliser supply	hose connector Ø20 mm

Dosing channel 3% acid, 300 l/h

Article number	730312 (50 Hz) 730313 (60 Hz)
Liquids to be used	fertilisers, lye and acid solutions containing up to 3 % (weight percent) nitric acid
Passage size of filter	<2 mm
Reading range of rotameter	if installed: 0 – 300 l/h
Dosage capacity	30 – 300 l/h
Drive water flow rate	approx. 560 l/h at 3.5 bar (Ø2.7 mm nozzle)
Dosage valve	Geva, 24 VAC, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw
Dosage valve signalling	LED (red)
Flow controller	restricting screw in dosage valve
Non-return valve	integrated in dosage valve
Connection of fertiliser supply	hose connector Ø20 mm

Dosing channel 3% acid, 600 l/h

Article number	730322 (50 Hz) 730323 (60 Hz)
Liquids to be used	fertilisers, lye and acid solutions containing up to 3 % (weight percent) nitric acid
Passage size of filter	<2 mm
Reading range of rotameter	if installed: 0 – 1000 l/h
Dosage capacity	60 – 600 l/h
Drive water flow rate	approx. 1250 l/h at 3.5 bar (Ø4.0 mm nozzle)
Dosage valve	Geva, 24 VAC, 0.60 A, 50 or 60 Hz, 8 W, EPDM membrane and restricting screw
Dosage valve signalling	LED (red)
Flow controller	restricting screw in dosage valve
Non-return valve	integrated in dosage valve
Connection of fertiliser supply	hose connector Ø20 mm



Cleaning the dosing channel filter

1. Set the unit to maintenance mode (software-wise and pump switch(es) off).
2. Close the valve on the fertiliser line concerned. If there are valves at the start and end of the fertiliser line then close the valve at the end (closest to the unit).
3. Place a plastic receptacle underneath the filter.
4. Unscrew the cap from the filter and remove the filter element from the filter housing.
5. Rinse the filter element underneath the tap until clean.
6. Replace the filter element and screw the cap back onto the filter.
7. Open the valve on the fertiliser line concerned.
8. Check that the filter is not leaking.
9. Empty the receptacle into the appropriate tank of fertiliser.
10. Put the unit back into operation.

Cleaning the dosing channel rotameter

1. Set the unit to maintenance mode (software-wise and pump switch(es) off).
2. Close the valve on the fertiliser line concerned. If there are valves at the start and end of the fertiliser line then close the valve at the end (closest to the unit).
3. Unscrew the screw couplings on the rotameter and remove the rotameter.

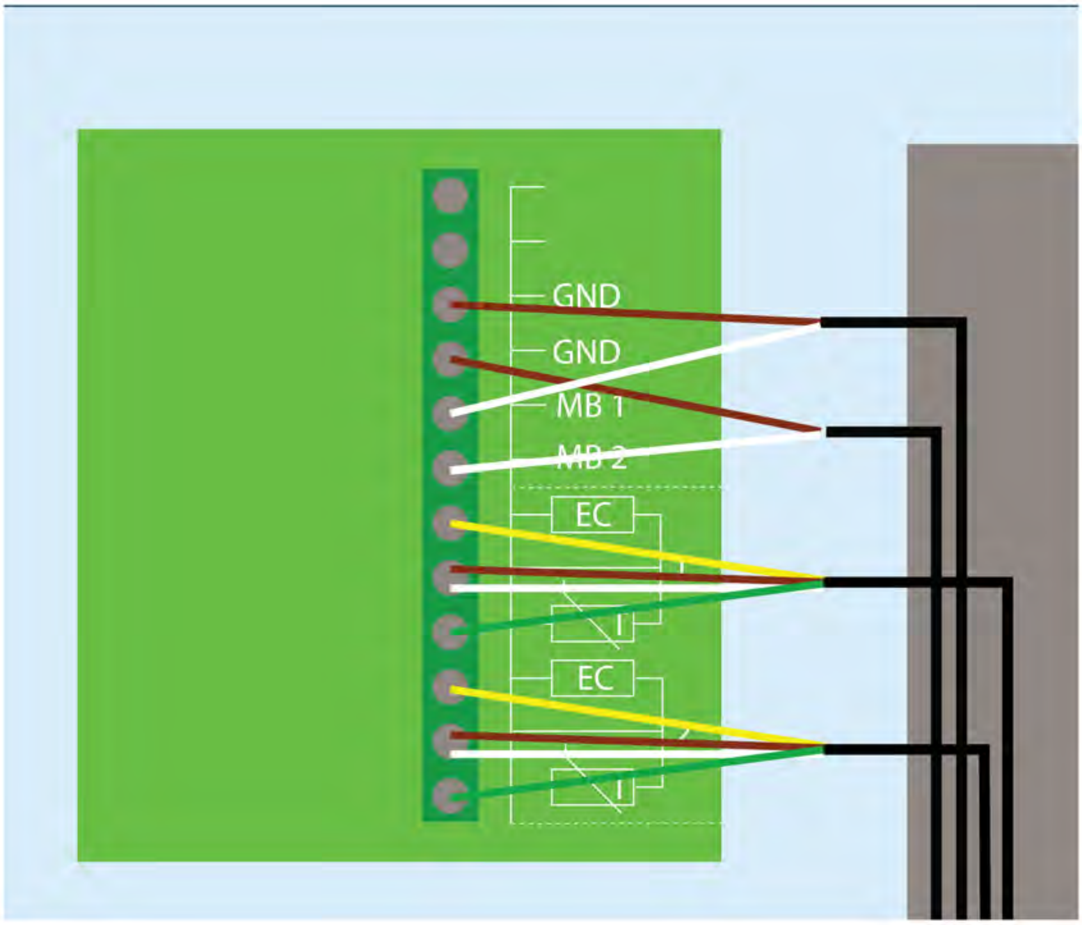
> **!** The fertiliser that flows out cannot be collected. Therefore flush the fertiliser out of the unit using water.

4. Clean the interior of the rotameter with warm water and a small pipe brush.
5. Replace the rotameter and tighten the screw couplings.
6. Open the valve on the fertiliser line concerned.
7. Check the screw couplings for leaks.
8. Put the unit back into operation.

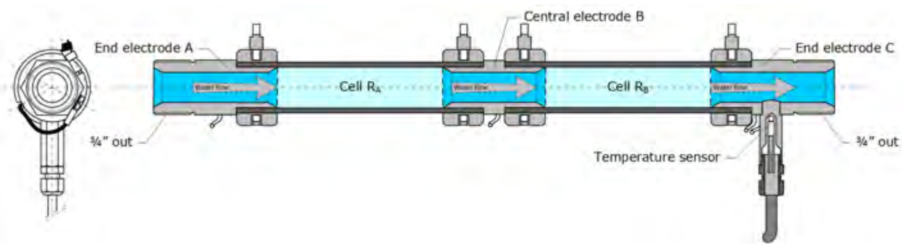
EC sensor

Connecting the EC sensor

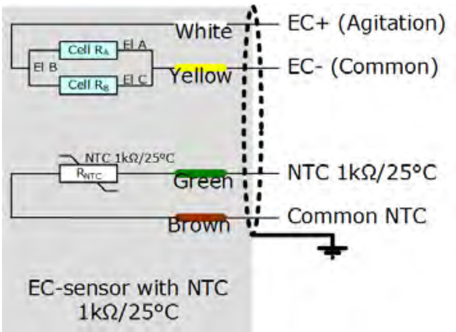
1. Connect EC sensor 1 to VP8658, see also Connecting the Compass EC sensor (page 39).
2. EC sensor 2 is optional.



Connecting the Compass EC sensor



Cross section EC sensor



Connecting the Compass EC sensor

EC sensor	**EC interface VP9943+VP8658**	
Core colour	**Measuring cell 1**	**Measuring cell 2**
White	6 (EC)	3 (EC)
Yellow	5 (Comm.)	2 (Comm.)
Grey	Do not connect	Do not connect
Green	4 (Temp.)	1 (Temp.)
Brown	5 (Comm.)	2 (Comm.)

1. Connect the EC sensor to the interface with a 4-core shielded cable with cores of 0.34 mm^2 (Ø 0.64 mm).
2. It may be possible to extend the cable. Extending the cable will, however, increase the measuring error (see tables below).

   In the case of an EC measurement via single cores, limit the length to 60 m.

3. Connect the shielding on the cable to the earth busbar in the housing.
4. Adjust the cell factor with the potentiometer, see Calibrating the EC measurement (Compass) (page 40).

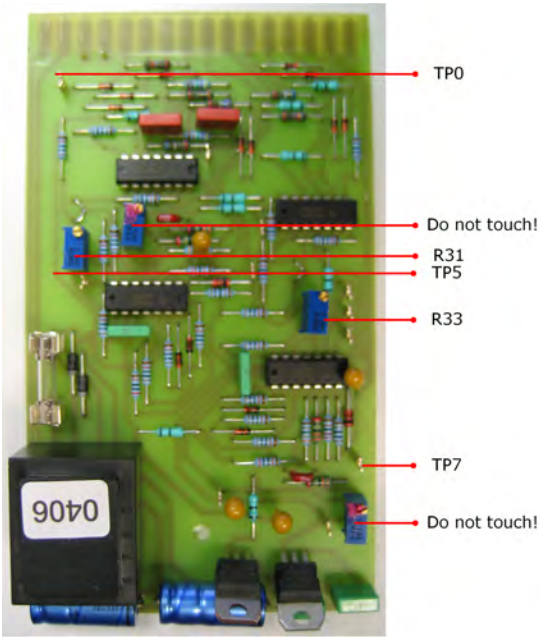
Cable length (2x 0.34 mm²)	**Measuring error at 15 mS**	**Measuring error at 10 mS**	**Measuring error at 5 mS**	**Measuring error at 0.1 mS**
5 m	1%	0.5%	0.3%	--
60 m	9%	6%	3%	0.1%
120 m	16%	11%	6%	0.1%

Cable length (4x 0.34 mm²)	**Measuring error at 15 mS**	**Measuring error at 10 mS**	**Measuring error at 5 mS**	**Measuring error at 0.1 mS**
5 m	0.4%	0.3%	0.1%	--
60 m	5%	3%	1.5%	--
120 m	9%	6%	3%	0.1%

Calibrating the EC measurement (Compass)

Have the EC sensor calibrated by a dealer at least once a year. The calibration can be done using a portable EC meter. Use the portable EC meter to determine the EC value of the water within the sensor.

A portable reference EC meter is required for calibrating the EC measurement, like Portable EC and pH analyzer (3779190) or Portable EC analyzer (3779191).



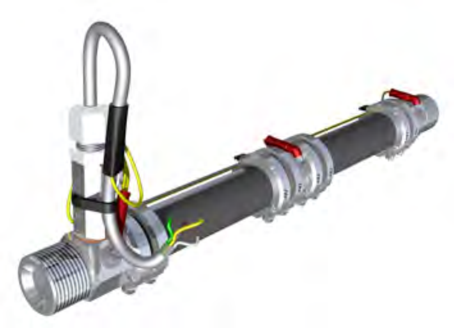
EC Interface VP8658

1. Go to *Water Room* > *Water system* > *Settings* > *Stop water system for maintenance* and select *IMMEDIATE*.
2. Make sure that water with a constant composition is pumped through the EC measuring sensor. Use the available valves and pumps of the unit, depending on the type of unit and the model.

   For a usable calibration the EC value must be within the unit's normal control range, for instance around 2 mS.

3. Collect some water with fertiliser and measure its EC value using a reference EC meter.
4. Calculate the desired output signal (in mV) of the EC Interface VP8658: desired output signal=EC value x 500.
5. Connect a digital multimeter to test point TP0 (Gnd) and TP5 (signal EC sensor 1) on EC Interface VP86583.
6. Adjust the potentiometer R13 until the multimeter shows the desired output signal (calculated in step 4).
7. Connect a digital multimeter to test point TP0 (Gnd) and TP7 (signal EC sensor 2) on EC Interface VP86583.
8. Adjust the potentiometer R33 until the multimeter shows the desired output signal (calculated in step 4).
9. Go to *Water Room* > *Water system* > *Settings* > *Stop water system for maintenance* and select *NO STOP*.
10. Reset the unit valves and pumps to the correct position.

Cleaning the EC sensors



EC measuring tube with EC sensor

In principle, the sensor cables in the cabinet must remain connected. Maintenance work on the EC sensors must, therefore, be carried out in the immediate vicinity of the unit.

1. Set the unit to maintenance mode:
   - Prepare the unit for maintenance software-wise and set the pump switch to off.
   - Close the manually operated valves in the branch line with the dosing channels in order to isolate the line between the manually operated valves.
   - Close the drain valves close to the pH and EC sensors in order to make the line between the manually operated valves pressureless.
2. Unscrew the screw couplings from the EC measuring tubes and remove the 2 EC measuring tubes from the unit.
3. Seal the EC sensors on one side with the attachment, place the EC sensors upright.
4. Fill the EC measuring tubes with strong scale remover and allow it to work in for a few minutes until no, or very few, gas bubbles are visible.

   In addition to the commercially-available scale removers, you can also use nitric acid in a 3% concentration (weight percent).

5. Pour the scale remover out of the EC measuring tubes and dispose of it in accordance with the locally applicable regulations.
6. Check that the contamination has been completely removed. If not, repeat steps 3 to 6.
7. Rinse the EC measuring tubes with drinking water.
8. Replace the EC measuring tubes on the unit and tighten the screw couplings.
9. Calibrate the EC measurement (see the instructions for calibrating the EC measurement).
10. Check the screw couplings for leaks.
11.

Technical specifications - EC sensor

Article description	1 EC sensor (article number 3779043) with fixing materials (single measurement)	2 EC sensors (article number 3779043) with fixing materials (dual measurement)
Article number		
Housing material	PVC and SST	
Measurement principle	electrical conductivity with temperature compensation	
Measurement range	0 .. 10 mS/cm	
Accuracy (if properly maintained)	2 % (of max. measured value)	
Temperature compensation	1.8 .. 2.2 %/˚C	
Cell constant	1.23 cm/cm²	

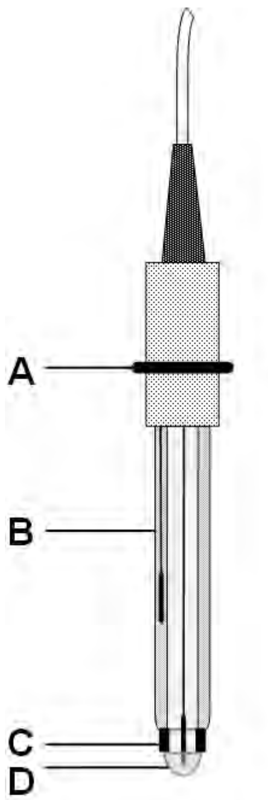
pH sensor

The pH sensor is used to measure the acidity of a liquid or test solution. The pH sensor is equipped with a pH measuring electrode with a pH-sensitive glass membrane (green glass sphere D) and a pH reference electrode. The pH is determined by measuring the potential difference between the pH measuring electrode and the pH reference electrode. The potential of the measuring electrode is dependent on the pH in the test solution, while the potential of the pH reference electrode is fixed. The reference electrode is electrically connected to the test solution via the diaphragm (ceramic ring C).

A protective cover is supplied by default (see picture above, on the right). Placing this protective cover on the pH sensor protects it from impact and therefore makes it suitable for pressureless systems. Without this protective cover, the pH sensor is suitable for pressure systems.

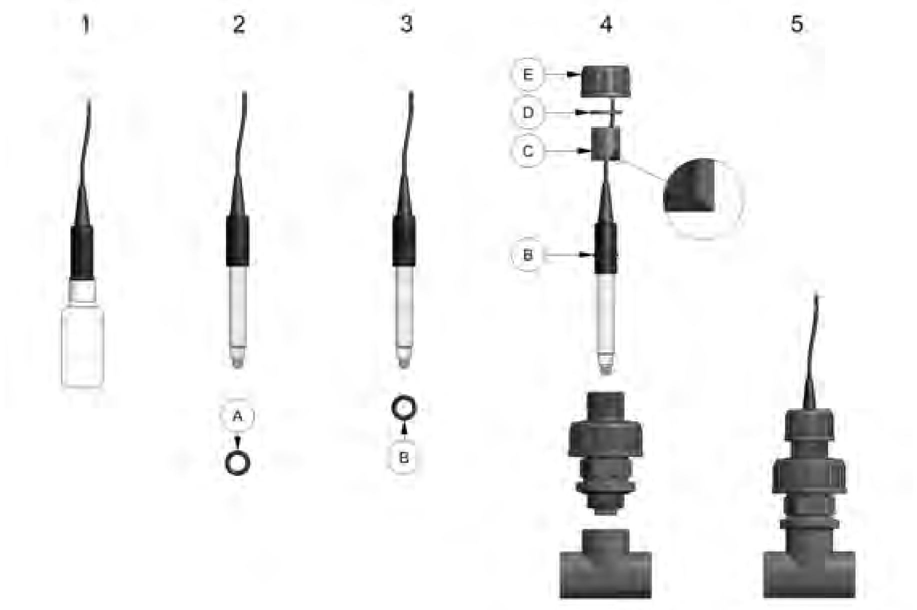
The process computer can apply a temperature correction to the measured value if a temperature measurement is carried out in the same liquid. This is the case with an EC sensor on the same I/O module EC/pH.



Cross section of pH sensor

A. Rubber O-ring
B. Housing
C. Diaphragm
D. Glass membrane

Fitting the pH sensor



Fitting the pH sensor

Follow the procedure below without break so that the pH sensors remain wet.

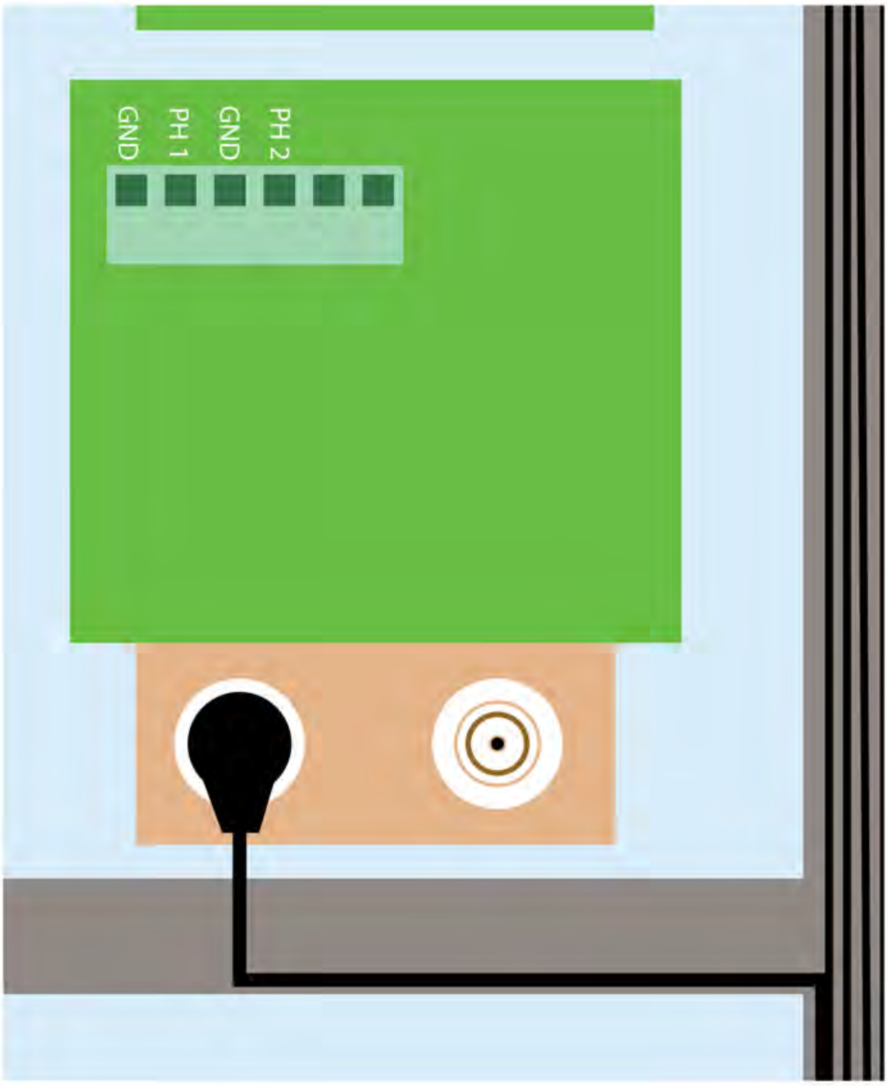
1. Remove the pH sensor from the packaging containing storage liquid.
2. Remove ring (A, if present) from the pH sensor.
3. Slide the O-ring (B) of the holder over the pH sensor.
4. Assemble parts C, D and E in the order shown in the figure. Ensure that the bevel on C is at the bottom.

   Pour water into the holder if it is still dry.

5. Connect the pH sensor to the PCB for pH sensors in the cabinet.
6. Calibrate the pH measurement (refer to Calibrating the pH measurement (page 45)).
7. Screw the pH sensor onto the pH sensor holder.

Connecting the pH sensor

1. Connect the BNC connector of the pH sensor to the left BNC connector of the pH interface.
2. The right BNC connector of the pH interface remains unused.



Calibrating the pH measurement

Calibration is described in the software manual of the relevant process computer (Connext or Compass) and depends on the software version used. See chapter *Procedures > Maintaining, checking and calibrating*.

Cleaning the pH sensors

pH sensor holder and pH sensor

The pH sensors have to be unscrewed from the pH sensor holder for cleaning. Only do this when the unit is in maintenance mode (software-wise and pump switch(es) off). Check the screw coupling on the pH sensor holder for leaks after putting back into operation.

In principle, the sensor cables in the cabinet can remain connected during maintenance. However, the sensor cables must be disconnected if the current situation requires this so that cleaning can taken place elsewhere.

Cleaning the pH sensor normally

1. Clean the glass membrane and the housing of the sensor with a solution of liquid detergent in warm water. Use a soft brush or a clean cloth, dipped in the soap solution. Do not use a paper towel.

   Do not apply excessive pressure to the glass membrane as it is fragile.

2. Rinse the glass membrane well with distilled water. Then immerse the sensor for at least 30 minutes in a 50/50 mixture of pH 4 buffer and 4M KCl before using it again.

It is advisable to recalibrate the pH measurement after cleaning.

Cleaning the pH sensor thoroughly

If there is an anorganic deposit on the pH sensor then remove it as follows:

1. Make a homogeneous acid dilution of:
   - approximately 1 part drinking water and 1 part concentrated nitric acid (38% (by weight)) or
   - 4 parts drinking water and 1 part concentrated phosphoric acid (59% (by weight)).

   Add the acid to the water; never add water to acid.

2. Immerse the glass membrane of the pH sensor in the acid solution for 5 minutes (no longer!).
3. Rinse the pH sensor with drinking water, and rinse the glass membrane with distilled water. Next, calibrate the pH measurement.

4. Dispose of the acid dilution in accordance with the locally applicable regulations.

Technical specifications – pH sensor

Article description	pH sensor (max. 10.0 bar)
Article number	3779046
Housing	glass
Length of sensor	77 mm
Diameter of sensor	Ø 12 mm (Ø 15 mm with protective cover)
Measurement principle	pH electrode for H^+ ions
Discrimination	59 mV/pH (in operating range 4 .. 7 pH at 25 ˚C)
Operating range (measured values satisfy the specified accuracy)	4 .. 7 pH
Range (sensor produces measured values)	3 .. 14 pH
Accuracy (after calibration)	± 0.1 pH (in operating range 4 .. 7 pH at 5 .. 30 ˚C)
Cable	coax, Ø 2.5 mm, length 3 m
Connector	BNC

Inline dirt filter

Cleaning the inline dirt filter

Inline dirt filter

1. Set the unit to maintenance mode (software-wise and pump switch(es) to *0* (off).
2. Loosen the coupling and remove the filter element from the housing.
3. Rinse the filter element underneath the tap until clean.
4. Replace the filter element and tighten the filter element.
5. Put the unit back into operation.

Technical specifications - inline dirt filter

Article description	Inline dirt filter and corresponding PVC coupling 32 mm
Article number	630505
Housing	PVC
Interior	PE
Mesh opening	1.4 mm

Fertiliser suction

Checking the fertiliser suction

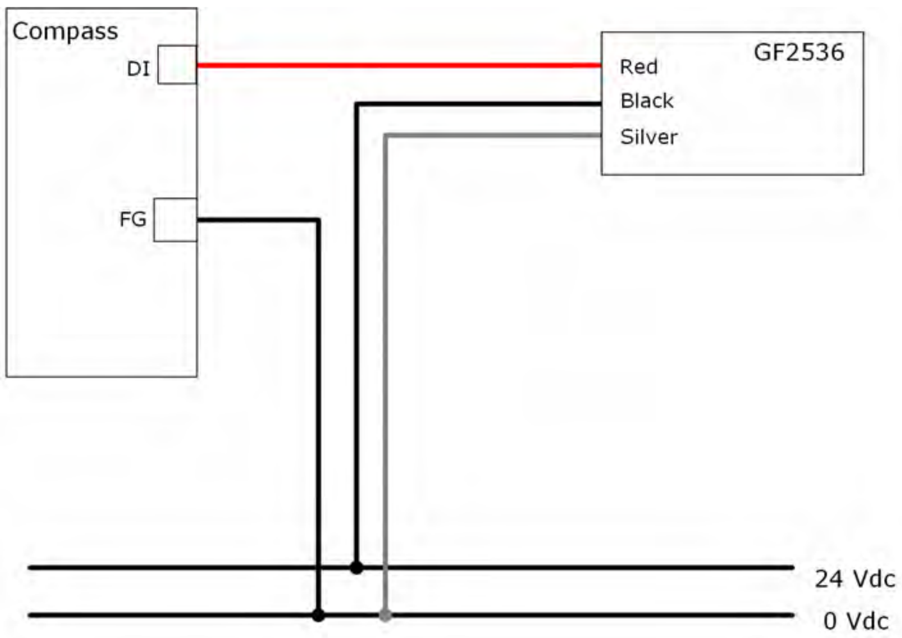
In order to provide good fertiliser suction it is important that the venturis create sufficient vacuum and the fertiliser line and the venturi/dosing valve combination are free from air, deposits and leaks. The suction of a dosing channel can be checked in various ways, depending on the configuration:

-
- If the fertiliser lines are transparent, the movement of small air bubbles and particles (of which there should be as few as possible) shows that fertiliser is being drawn to the dosing channel.
- You can measure the vacuum by temporarily replacing a dosing valve with a vacuum gauge.

Flow sensor

Connecting

The flow sensor records the volume flow through the irrigation water pipe.



Colour	Function	Connection
Red	open collector signal output	digital input of Compass
Black	power supply 3.3 .. 24 VDC	24 VDC
Metallic	ground	FG of Compass

Cleaning the flow sensor

1. Set the unit to maintenance mode (software-wise and pump switch(es) off).
2. Make sure the main irrigation line is pressure-less and, if necessary, empty.
3. Unscrew the flow sensor from the T-piece.
4. Clean the paddle wheel of the flow sensor using a small, soft brush.
5. Apply a little acid-free grease to the rubber O-rings to prevent them from being damaged when placing the sensor back.
6. Screw the flow sensor back onto the T-piece: you can only do this one way.
7. Fill and bleed the main irrigation line to prevent water hammer.
8. Check that the flow sensor coupling is not leaking.

Technical specifications – flow sensor

Article description	Flow sensor GF2536-P0 (for lines Ø 20 – 110 mm and 2 – 4")	Flow sensor GF2536-P0 (for lines Ø 20 – 110 mm and 2 – 4")	Flow sensor GF2536-P1 (for lines Ø 125 – 160 mm and 6")
Article number	750470	750470 (short housing)	750465 (long housing)
Measurement principle	paddle wheel		
Measurement range	0.3 - 3 m/s		
Accuracy	1 % (of max. measured value)		
Reproducibility	0.5 % (of max. measured value)		
IP code	IP67		
Minimum Reynolds number required	4500		
Supply voltage	3.3 - 24 VDC		
Output signal	49 Hz per m/s		
Maximum current requirement	10 mA		
Cable length	7.5 m		
Cable type	2-core shielded twisted pair (22 AWG, 0.326 mm²)		

Technical specifications - T-piece for flow sensor

The K-factor is dependent on the flow sensor, the line diameter of the T-piece and the insertion depth. A certificate showing the K-factor is supplied with the flow sensor. If the certificate is missing, you can look up the K-factor in the tables below.

The maximum speed at which the pulses can be processed depends on the hardware used.

T-pieces - lines with a metric diameter

Article description	PVC T-piece for flow sensor GF2536-P0, metric					
Article number	750471	750472	750473	750474	750475	750476
Line diameter, external (mm)	20 (DN15)	25 (DN20)	32 (DN25)	40 (DN32)	50 (DN40)	63 (DN50)
Measuring range (m^3/hr) at a flow rate of 0.3 .. 3 m/s and lines of pressure class PN16	0.24 .. 2.4	0.38 .. 3.8	0.63 .. 6.3	0.98 .. 9.8	1.54 .. 15.4	2.44 .. 24.4
K-factor (pulses per litre)	256.9	128.32	78.54	44.98	27.4	15.72
Litre per pulse (1/K)	0.00389	0.00779	0.0127	0.0222	0.0364	0.0636

T-pieces saddle fitting - lines with a metric diameter

Article description	Saddle fitting for flow sensor GF2536-P0, metric		
Article number	750477	750478	750479
Line diameter, external (mm)	75 (DN65)	90 (DN80)	110 (DN100)
Measuring range (m^3/hr) at a flow rate of 0.3 .. 3 m/s and lines of pressure class PN16	3.46 .. 34.6	4.90 .. 49.0	7.34 .. 73.4
K-factor (pulses per litre)	9.787	7.281	4.806
Litre per pulse (1/K)	0.102	0.137	0.208

Article description	Saddle fitting for flow sensor GF2536-P1, metric			
Article number	750482	750483	750466	750467
Line diameter, external (mm)	125 (DN115)	140 (DN125)	160 (DN150)	225 (DN200)
Measuring range (m^3/hr) at a flow rate of 0.3 .. 3 m/s and lines of pressure class PN16	11.3 .. 113	14.6 .. 146	10.5 .. 105	33.9 – 339
K-factor (pulses per litre)	4.317	3.446	2.60	1.14
Litre per pulse (1/K)	0.231	0.290	0.385	0.877

T-pieces - lines with an imperial diameter

Article description	T-piece GF for flow sensor GF2536-P0, imperial		
Article number	750781	750782	750783
Line diameter, internal (")	2.5	3	4
Measuring range (m^3/hr) at a flow rate of 0.3 .. 3 m/s and lines of pressure class comparable with PN16	3.42 .. 34.2	4.93 .. 49.3	8.76 .. 87.6
K-factor (pulses per litre)	11.359	7.04	3.964
Litre per pulse (1/K)	0.088	0.142	0.252

Article description	T-piece GF for flow sensor GF2536-P1, imperial
Article number	750784
Line diameter, internal (")	6
Measuring range (m^3/hr) at a flow rate of 0.3 .. 3 m/s and lines of pressure class comparable with PN16	19.7 .. 197
K-factor (pulses per litre)	2.199
Litre per pulse (1/K)	0.455

For different configurations, a K-factor calculator is available at www.gfsignet.com.

Commissioning the dosing unit

Commissioning is described in the software manual of the relevant process computer and is dependent on the software version used. See chapter *Procedures* > *Commissioning the dosing unit*.

Delivery to the user

1. Demonstrate the unit to the user. When doing so explain:
   - what the operating options are;
   - the action to be taken by the user in the event of faults;
   - what maintenance is to be carried out by the user and what must be left to the installer/service engineer.
2. Hand over the unit (user) manual and - if required - the process computer (user) manual.
3. Hand over the remaining documentation containing (maintenance) information for the user, such as the documentation for the system pump.

Operation

- Make sure that you understand the Safety (page 6) instructions before operating the unit.
- Carry out periodic maintenance in accordance with the preventative maintenance schedule (see Maintenance and repair (page 59)).

Operating software

Refer to the relevant process computer software manual.

Taking out of operation

Take the unit (and the rest of the system) out of operation for longer periods – such as winter – as follows:

1. Take the planned taking out of operation into account in your stock planning. Use up the stock to the extent possible.
2. Operate the unit manually to suction and – diluted with supply water – blow off the last remnants from the tank.
3. Spray the inside of the fertiliser tanks clean using water. Operate the unit manually to suction the rinse water out of the fertiliser tanks and in doing so rinse the lines, filters and the unit.
4. Stop the supply of supply water and set the pump switch to off.
5. Drain the branch line to the venturis by opening the drain valves near the pH and EC sensors.
6. Clean the filters.
7. Clean the EC sensors.
8. Clean the pH sensors (if fitted) and place them in the storage liquid.
9. Clean the flow sensor (if fitted).
10. If there is a risk of freezing, drain the water supply system and the water distribution system.
11. It there is a risk of freezing in the room where the unit is set up:
    1. Drain the system pump (refer to the manual for the pump concerned).
    2. Remove the remaining water by unscrewing the lines on the unit or suctioning-off the water.
    3. Disconnect the pH sensors in the cabinet and store them with the glass membrane in storage liquid in a frost-free location.
12. Preferably, cover the unit with a tarpaulin.

Taking back into operation is, in principle, the same as the first commissioning. However, certain actions, such as configuring the I/Os, can be skipped.

Troubleshooting

This chapter provides solutions for the most frequent problems with the equipment. If you have a problem that cannot be resolved using the information in this chapter, please contact Priva.

Troubleshooting

Problem	Possible cause	Solution(s)
The unit does nothing	The electrical supply is off.	• Ensure that the unit is connected and the main switch is set to 1. • Ensure that the external emergency stop (if fitted) is not depressed. • Ensure that the fuse group to which the unit is connected is switched on. • Installer: reset the circuit breaker in the cabinet.
	The power supply to the unit is defective.	• Installer: Check the internal fuses. • Installer: Replace the power supply.
	An internal circuit is defective.	Installer: Determine which circuit is defective and replace it.
The pump does not start	The pump switch is off.	Ensure that the pump switch is set to 2 (automatic).
	The motor protection has been triggered.	Installer: Reset the motor protection in the cabinet.
	An alarm has been activated.	Check which alarm is involved and take action accordingly.
	There is a defect in the circuit that controls the pump motor.	Installer: Determine what is defective and replace the defective components.
The pump runs dry.	The pump has not been properly bled or there is no supply water.	Installer: Check that the pump has not been damaged by running dry.
No water is entering the unit.	The pump has not been properly bled or there is no supply water.	• Installer: Check the valves before and after the unit (if fitted). • Ensure that the filter in the supply line is clean.
The EC value in the line or at the drippers differs significantly from the measured EC value.	The user has entered an incorrect setting.	Check the recipe settings.
	The EC measurement is not calibrated.	Calibrate the EC measurement.
The EC value is not stable.	The dosing valves are opened too briefly.	Dilute the fertiliser. Reduce the flow of the valve.
	The supply water does not mix well with the water in the main line.	Installer: Ensure a turbulent flow in the main line by: • placing injection tubes in the inlet and outlet of the supply line. This is only possible if the distance between the connections of the supply line and the return line in the main line is about 1.5 m; • installing a static mixer.

Problem	Possible cause	Solution(s)
While preparing irrigation water, the manometer on the line to the venturis indicates a pressure that is too low.	The discharge valve is open or there is a (major) leak in the main line or the distribution system.	• Ensure that the discharge valve is closed. • Installer: Check the main line and the distribution system for leaks, and repair them if necessary.
	The system pump is turning in the wrong direction.	Installer: Swap 2 phases of the mains power supply (disconnect electrical power first!)
	There is air is the system pump.	Bleed the system pump (refer to the documentation for the pump concerned).
	The inline dirt filter on the unit is blocked.	Clean the dirt filter.
The manometer on the line after the mixing chamber indicates a suction pressure across the mixing chamber that is too low or too high.	The pressure reducing valve or valves in the bypass line have not been adjusted correctly.	Installer: Adjust the pressure reducing valve or valves in the bypass line.
A fertiliser is not being dosed.	The level in the fertiliser tank is too low, causing air to be drawn in.	Ensure an adequate level in the fertiliser tank. Then ensure that the air is bled from the fertiliser line.
	A valve in the fertiliser line (if fitted) is closed.	Check whether the valve or valves in the fertiliser line are open.
	There is an air bubble in the fertiliser line.	Ensure that the air bubble is bled from the line.
	The dosing valve does not open.	• Check the software settings (for instance whether the fertiliser is included in the recipe). • Installer: Check the circuit that controls the dosing valve. Replace any defective components. • Installer: Check the dosing valve. Replace it if necessary.
	There is no flow, or an insufficient flow, of water through the venturi.	Installer: The flow through the venturis cannot be checked. The only possibility is to disassemble the venturis and check for blockages etc.
	A filter in the fertiliser line is blocked.	Clean the filter.
	There is a leak in the fertiliser line or in the connection between the dosing valve and the venturi allowing air to be suctioned-in.	Installer: Check the lines for leaks.
The desired EC value is not being achieved.	The desired value is higher than the value that can be achieved with the fertiliser solutions.	• Correct the set value. • Increase the concentration of the fertiliser solutions.
	The set value and the nutrient recipe are correct, but the concentration of one or more fertiliser solutions is too low.	Ensure that the concentrations of the fertiliser solutions are correct.
	A fertiliser is not being dosed.	See the solutions for the problem ‘A fertiliser (or acid or lye) is not being dosed’.
	The EC sensors are dirty.	Installer: Clean the EC sensors.

Problem	Possible cause	Solution(s)
Alarm 34 EC measurement alarm	At least one of the two sensors is dirty or defective.	Installer: • Check the sensors. • Clean the EC sensors and perform a new calibration. • Replace the suspect sensor(s) if this does not resolve the problem. A measuring case with a reference pH meter and a reference EC-meter (the meters are also available separately) is available for checking pH sensors and EC sensors and for measurements outside of the unit. Calibration liquids and storage liquids are available separately.
Flow alarm	The alert threshold has been set incorrectly.	Correct the alert threshold setting.
	The flow sensor is not correctly adjusted.	Installer: Check the flow sensor settings.
	The flow sensor is dirty or defective.	• Clean the flow sensor. • Installer: Replace the flow sensor if cleaning does not resolve the problem.
	There is a leak in the main irrigation line or in a valve section.	Installer: Trace the leak and fix it.
The plants receive more water than the set amount.	The flow sensor is dirty or defective.	• Clean the flow sensor. • Installer: Replace the flow sensor if cleaning does not resolve the problem.
Analysis shows that the fertiliser concentrations do not match the recipe.	The dosing valves are supplying a flow rate that differs from that expected by the software.	Installer: Readjust the dosing valve(s).

Maintenance and repair

- Carry out periodic maintenance in accordance with the preventative maintenance schedule.
- Some maintenance activities may only be performed by authorised Priva installers/service engineers who have received product-specific training from Priva. This is indicated in the preventative maintenance schedule.
- Switch the unit off using the main switch before carrying out any maintenance work. If the unit has to remain on within the scope of the maintenance work take extra care.
- Only use original Priva spare parts.

Preventative maintenance schedule

Minimum frequency	Action	To be carried out by	Explanation
always	be alert for leaks and abnormal noises (from the system pump)	user	
weekly	check quantity of irrigation water to plants	user	1. For each irrigation valve, place a number of drippers in plastic beakers. 2. After the irrigation cycle, add the content of the beakers to a measuring beaker and read the volume. 3. Divide this volume by the number of beakers to determine the average volume per dripper.
	keep the unit and surrounding area clean	user	
monthly	clean dirt filters and other filters	user	
	check system pump pressure (via manometer on pipe-work to venturis)	user	Test with system pump running and normal consumption of irrigation water. See the pump documentation for the correct pressure.
	check pH sensors	user	
annually	flow sensor	user	
	check EC sensors	installer / service engineer	See EC sensor (page 39).
	clean rotameters on the dosing channels	installer / service engineer	See Cleaning the dosing channel rotameter (page 38).
	check the operation of the dosing channels	installer / service engineer	
	clean sprinkler pipes in mixing chamber	installer / service engineer	1. Close the manually operated valves in the supply line and main irrigation line. 2. Open the drain point of mixing chamber and let the unit run dry. 3. Open the mixing chamber and clean the sprinkler pipes.
depending on the sensor	maintain other sensors that are connected to the unit (such as a light sensor)	depending on the sensor	Refer to the documentation for the sensor concerned.

Setting the unit to maintenance mode

The unit has to be taken out of operation for maintenance. The unit can be taken out of operation via the software.

Cleaning the exterior of the unit

1. Turn off the main switch of the unit.
2. Clean the exterior of the unit:
   - Remove dust using a soft brush.
   - Wipe-down the surfaces with a damp cloth.

   - Do not use aggressive or abrasive cleaners: they may damage the plastic. Use warm water only, with a few drops of washing-up liquid if necessary.
   - Make sure that no water runs into the electrical components. For example, do not spray water onto the unit and thoroughly wring out the cleaning cloth before use.
   - Do not press too hard on the operating panel / display and the keyboard (if fitted) when removing dirt.

3. Put the unit back into operation.

Disposal of waste equipment

The unit must be disposed of as follows at the end of its service life:

1. Take the system out of operation (see Taking out of operation (page 55)).

   It is important that the entire system is free from chemical substances and has been drained.

2. Disconnect the unit from the electricity network.
3. Disconnect all lines.
4. Loosen the fertiliser hoses or saw through the fertiliser pipes (whichever is applicable).
5. Use a fork-lift truck to load the unit onto a lorry (see Transport and storage (page 15)).
6. Take the unit to an approved collection centre for waste electrical equipment.

   The equipment is marked in accordance with European Directive 2002/96/EC relating to waste electrical and electronic equipment (WEEE):

   The mark indicates that the equipment cannot be disposed of with other household waste at the end of its service life. To prevent possible harm to the environment or to human health from uncontrolled waste disposal the equipment must be kept separate from other types of waste and be recycled in a responsible manner, so that the sustainable reuse of material sources is stimulated.

Appendices

Supply water quality

Composition and pH value

The dosing unit adds acid or lye to the supply water to:

- regulate the pH value of the irrigation water;
- chemically mix (homogenise) the irrigation water in a optimum manner;
- allow a chemical reaction to take place (convert bicarbonate into carbon dioxide).

The pH value of the irrigation water must be between 5.2 and 6.2, depending on the crop and growing medium.

Supply water consists of (a combination of) rain water, drinking water, well water, downstream mill water, river water or reverse osmosis water, typically mixed with (disinfected) drain water. The variety of chemical elements in the supply water determine not only the composition and the pH value of the supply water but also whether or not the supply water can be used as irrigation water once fertiliser and acid or lye have been added using the dosing unit.

Influence of bicarbonate

It is important that the quantity of HCO_3^- (bicarbonate) in the supply water is established by means of water analysis. Bicarbonate has a buffering effect on the pH value and affects the operation of the acid dosing control in the dosing unit:

- An optimum quantity of HCO_3^- in the supply water helps to ensure that plants receive irrigation water with a reliable and accurate pH value via the dosing unit. The correct pH value of the irrigation water is necessary for the good take up of fertilisers by the plant.
- An excessively low quantity of HCO_3^- causes the pH control to become unstable.
-

The table below shows the limit values for the quantity of HCO_3^- and the qualification of the supply water. In some cases, the quantity of HCO_3^- in the water is also displayed as calcium carbonate ($CaCO_3$), in which case it is usually quoted in mg/l. The corresponding values are included in the table.

Bicarbonate limit values and supply water qualification

Quantity of bicarbonate (HCO_3^-)		**Quantity of bicarbonate expressed as calcium carbonate ($CaCO_3$)**		**Supply water qualification**
[mmol/l]	**[mg/l] or [ppm]**	**[mmol/l]**	**[mg/l] or [ppm]**	
< 0.10	< 6.1	< 0.050	< 5.0	Too low
0.10 – 0.50	6.1 – 30.5	0.050 – 0.250	5.0 – 25.0	Optimum
0.50 – 1.0	30.5 – 61.0	0.250 – 0.5	25.0 – 50	High
≥ 1.0	≥ 61.0	≥ 0.5	≥ 50	Too high

Pre-treat supply water

On the basis of the concentration of HCO_3^-, it must be determined which measures or combinations of measures should be taken to pre-treat the supply water.

Supply water with too low a concentration of bicarbonate

When using reverse osmosis water, but in some cases rain water also, too low a quantity of HCO_3^- (< 0.10 mmol/l) may be deemed to exist in the supply water. Dosing acid may give rise to an unstable chemical reaction in the irrigation water.

This unstable reaction can be stabilised by taking one of the following measures, or a combination thereof:

- Add disinfected drain water, which typically contains bicarbonate, to the supply water (via an EC pre-control).
- Add a small amount of drinking water or spring water (1 – 2%) to the supply water by means of an electric valve with a low flow rate.
- Add a small quantity of bicarbonate to one of the fertiliser solutions. This can be done, for example, by replacing 1% of caustic potash with an equal quantity of potassium carbonate ($KHCO_3$) or calcium carbonate (K_2CO_3).

Priva (head office)
Zijlweg 3
2678 LC De Lier
The Netherlands

See www.priva.com for contact information of a Priva office or partner for your region.