

Nutri-dose 1

Operating and Installation Instructions

DESCRIPTION

The controller continually measures, displays and controls the pH and electrical conductivity factor (CF or EC) of the dilute nutrient in the main reservoir (mixing) tank.

CF

If the CF value drops below its set point for more than the dose interval time (set by the user to between 0 and 99 minutes (typically 10 mins), the controller will open two solenoid valves or switch on dosing pump(s) to allow a small amount of concentrated nutrient stock solutions (A & B) to flow into the main tank. The time that the valves are open may be set by the user to between 0 and 99 seconds. (Good starting times are 5 secs CF, 3 secs pH for a small system and 12 secs CF, 5 secs pH for a larger system). The A and B nutrients flowing into the main tank will cause the CF value to rise. If the CF value remains below the set point after dosing, the system will wait for the detent period before dosing again. This time period is necessary to allow the nutrient to mix thoroughly before re-dosing and to reduce the effects of brief CF changes due to air bubbles or other disturbances. Complete mixing of the nutrient takes some time so do not be surprised if the CF reading wanders around for a few minutes after dosing. By setting the dose interval to zero, the unit will continuously cycle through dosing CF then pH then immediately back to CF until the set point has been reached. This is not a recommended setting for normal operation but may be used to quickly bring the system back up after dumping the nutrient.

It should be noted that both the A & B valves open for the same time and therefore normally give an equal dose of A and B nutrients. If desired, the A/B ratio can be varied by connecting manually adjustable restricting valves into the pipes just above the solenoid valves.

NB the pipes below the solenoid valves must not be restricted, any restriction must be positioned above the valves - below the valves use 10mm diameter pipe or larger with no restriction for the PRO system and 4mm pipe for the ECONOMY system.

The CF set-point may be set within the range 0 to 99 CF (0.1 to 9.9 EC)

pH

The controller can be switched to either RAISE or LOWER the pH. **When switched to pH LOWER, the acid dosing bottle tap must be turned ON and the Alkali turned OFF. When switched to pH RAISE the Alkali tap must be turned ON and the acid tap turned OFF.** As with CF, dosing times may be set by the user. The detent or interval time is common to both CF and pH dosing. The pH control range is from 2.0 to 9.9pH, raise or lower.

AUXILIARY OUTPUT

The auxiliary output at 12V DC may be used to control a solenoid valve directly or may be used to drive a relay in order to control mains powered equipment. The interval time for this output can be adjusted from 1 to 1000 hours and the on-time from 1 to 60 minutes. In addition, the interval time is separately adjustable for night and day and if the night interval is set to 0 (off) the output will only activate during daylight hours. For day/night operation an optional light sensor is required. When not used the light sensor inputs must be connected together. Typical uses of this output include irrigation, misting and nutrient dumping.

Nutrient dosing is disabled while the auxiliary output is active.

Example settings:

- 1) Auxiliary output to activate every 2 hours for 12 minutes during the day and every 6 hours during the night. (Light sensor option required)
Aux. day interval (mode E) = 2
Aux. night interval (mode F) = 6
Aux. Dose Time (mode g) = 12

- 2) Auxiliary output to activate every hour for 1 minute during the day time only (Light sensor option required)
Aux. day interval (mode E) = 1
Aux. night interval (mode F) = 0
Aux. Dose Time (mode g) = 1

- 3) Auxiliary output to activate every 4 weeks hours for 30 (Light sensor option not required but connections must be linked)
Aux. day interval (mode E) = 672 (672 hours = 4 weeks)
Aux. night interval (mode F) = 0
Aux. Dose Time (mode g) = 30

ALARM

An external 12V 1A DC alarm siren may be connected to the controller. This may be switched ON or OFF and sounds when either the CF or pH differs from it's set-point by more than a specified amount. Again, the user has full control over pH and CF deviation values and alarm delay time. A small alarm is supplied with the controller.

SETTING THE CONTROLLER

The controller has seventeen modes of operation (from mode 0 through to mode g). Normally the controller operates in mode 0 in which it displays the measured values of CF and pH and controls the system as required. After changing a setting or if the key pad is untouched for more than 20 seconds, the mode will automatically revert to mode 0. (an exception to this is when the controller is in any of the calibrate modes when it is essential that the user either changes the mode or presses the save button)

In order to observe or change any of the settings, the mode button must be pressed until the required mode number is displayed. The function of each mode is clearly shown on the front panel. For example, to observe and/or change the pH set-point the mode button must be pressed until mode 4 is displayed in the mode window. The left hand LCD display will now change to display only the current pH set-point. If it is desired to alter the set-point, either the UP or DOWN buttons must be pressed until the desired value is displayed. **The SAVE button must then be pressed in order to make the change permanent.** If this is not done, the change will only be effective until the controller is switched off. When switched on again, the previously saved value will return.

The settings can be changed and saved as often as required. If after inspecting a setting you decide not to change it, simply leave the key-pad untouched for a minute and the mode will automatically revert to mode 0. Alternatively, press the 'mode' key until the mode number changes back to mode 0.

pH raise or Lower

When changing from pH raise to lower (or visa versa) it is necessary to change the setting on the controller (and to save this) **AND also** to close the tap from acid/alkali bottle that is not required and open the tap to the required bottle. In the case of the ECONOMY and LITE systems, where only one bottle and solenoid is supplied, it is necessary to flush out the system and refill with the appropriate pH adjuster after changing the controller between pH raise and lower.

pH CALIBRATION

Place the pH electrode in pH 7 buffer solution and select mode **b**. Wait for the display to stabilise – do not be concerned that the display does not show 7.0 at this stage – the value displayed at this stage is the pre-calibration value. It may take a few minutes for the reading to settle and for best accuracy this should not be rushed. When the value displayed stabilises (ie it may flicker between two values but no longer has a trend to move in one direction), press SAVE. The mode will now automatically change to mode **C**. (*If you press the button for too long it might go back to mode 0*). When in mode **C**, wash the probe in clean water then place in pH 4 buffer. Once the reading stabilises (do not be surprised if it does not read 4pH at this stage) press the SAVE button and the controller is calibrated. (after pressing the save button the controller should read 4.0pH +/- 0.1 ph) and if put back into the 7pH buffer should accurately read 7.0pH +/- 0.1pH, if not, repeat the procedure.

**NEVER LET THE PH PROBE ELECTRODE DRY OUT - WHEN NOT IN USE
STORE IN PLAIN (NOT DISTILLED) WATER.**

CF CALIBRATION

Clean the CF probe thoroughly (see Maintenance section) and dry using a clean cloth or tissue (ensure there is no oil or grease on the rag and do not touch tip with fingers). Place the probe in standard CF solution 27.7 CF and allow to stand for at least 3 minutes (to allow the temperature compensation to take effect), then select mode **d**. When the reading stabilises press SAVE. The reading should now be 28 – if not, repeat the process.

MAINTENANCE

Monthly: Every month thoroughly clean the CF probe. To do this, remove the shroud at the end of the probe and clean the face of the probe using a mildly abrasive kitchen cleaner (eg Jif, Chemico) with a nylon scouring pad (ScotchBrite). Replace the probe shroud ensuring that the end of the probe fully enters the shroud so that it partly covers the round windows in the shroud. (if this is not done it is possible for an air bubble to be trapped inside the shroud).

Yearly: Every year, clean out the nutrient filters and strip down the solenoid valves. Replace the VITON diaphragms at this time. These diaphragms usually last two or three years but it is much better to replace them every year than to have on fail. Ensure the valve is well tightened so that it fully seals onto the new diaphragm.

If using peristaltic pumps, replace the squeeze tubes with the correct type of tubing.

INSTALLATION

Select and follow one of the system layout diagrams which follow these notes. It is important that you follow the correct diagram. If you have any doubts contact your horticultural consultant or equipment supplier.

- (i) A 230/240V mains supply is required adjacent to the controller. The controller requires 12V AC at a current of 2 AMPS to operate. A transformer is supplied to drop the mains voltage to 12V for complete safety. **Ensure the 12Volt transformer is connected between the mains supply and the controller terminals.** In the interests of safety, the mains supply should be protected by means of an RCD circuit breaker or double wound transformer. Your electrician will advise you on this.
- (ii) Mount the controller on a panel in a cool, dry position shaded from direct sunlight.
- (iii) Place the nutrient stock solution tanks on a strong bench or other platform, close to the controller. The nutrient tanks should be black PVC to exclude light and would typically be 20 Ltr to 200 Ltr in capacity. It is important that both containers are of the same size and shape and are mounted at the same height to ensure that the flow rate from each is the same.

- (iv) The A/B nutrient tanks and the acid/alkali bottles must be vented (by loosening the caps) to prevent a vacuum forming when nutrient is drawn from the outlet. If you intend using A and B starter nutrients and then switching to replenisher nutrients you will need to arrange suitable pipework with taps to permit easy switching over.
- (v) Install the solenoid/filter/tap unit for the A & B nutrient dosing. Ensure the filter and solenoid valve are installed **so that the solenoid valves are below the bottom of the nutrient stock tanks by at least 200mm** and with the arrows marked on their sides, pointing in the direction of liquid flow. **The solenoid valves or pumps for nutrient dosing must be mounted at the same height.** Do not over-tighten the screwed connections or mountings on the solenoid valves. Position the filters so that they are NOT above the solenoid valves so that when they are cleaned, any water spilled does not do any harm.
- (v) Connect up the cables to the connectors on the side of the controller. Carefully follow the connector label when doing this. Only remove the link wires across the pressure switch terminal if a *pressure* switch is to be fitted. These terminals cause dosing to stop if not connected together. Similarly, only remove the link across the *light* terminals if a light sensor is to be used.
- (vi) Earth the Nutri-dose by connecting a wire from one of the GND terminals to an earth point. The earth point may be a metal stake (say 1m long) driven into the ground, the metal frame of the green house (if this is solidly earthed) or a connection to the ground of the electrical supply. This ground connection is to help make the sensitive measuring system immune to external electrical interference.
- (vii) Fix the pH dosing solenoid valve assembly just below the shelf supporting the acid/alkali bottles and close enough so that the pipes supplied easily reach.
- (viii) Install the sample pot about 500mm to the left of the controller (pH electrodes usually have 600mm to 800mm leads). Connect the inlet side of the sample pot to the pressure side of the pump by means of PVC pressure pipe. **A flow restricting valve must be installed in this line.** Connect a pipe to the outlet side to return the water to the main tank. Initially set the restricting valve to the closed position then, with the pump running, gradually open it until a little water flows through the sample pot.
- (ix) Insert the stainless steel reference rod into the sample pot and connect its lead to a GND terminal on the controller
- (x) Fill the acid and alkali bottles with dilute acid and alkali (dilute by adding one part of acid or alkali to 20 (or more) parts water). **Never use acid/alkali at a stronger concentration than 10%.** Only open one of the taps - check that the controller is correctly set for raise or lower.
If the controller is set for pH lower - open the acid tap
If the controller is set for pH raise - open the alkali tap

Pressure Switch option

The pressure switch should be fitted into the pipeline on the pressure side of the pump and should be low down so that it is subject to the full head of water. In a run-to-waste system which uses an auxiliary small pump to circulate water through the sample-pot, it should be fitted in the pipe between the auxiliary pump and the flow restricting valve. It may be necessary to tap a 1/8" NPT (or 1/8" BSP) thread into a thick section of an existing PVC pipe fitting. A small amount of PTFE thread sealing tape should be applied to the thread of the pressure switch before screwing it firmly into the PVC fitting. The cable should then be connected between the contacts of the pressure switch (Normally Open - NO contact) and the Nutri-dose controller. Remove the wire link on the Nutri-dose before connecting the cable. The pressure switch should then be adjusted so that the micro switch is positively operated when the pump is running. To adjust the pressure switch, start with it set on a low pressure and ensure system doses. Then increase the pressure in steps until the switch fails to close when the pump starts up. Now reduce the setting by about 33% to ensure reliable operation.

Light Sensor Option

The light sensor, if used, should be mounted so that it points toward the midday sun. When connecting the leads to the Nutridose, first remove the wire link and connect the screen connection to the GND terminal.

IMPORTANT TIPS FOR INSTALLATION

- (1) The A & B nutrient tanks must be the same shape, size and height.
- (2) The A & B solenoid valves/ pumps must be at the same height
- (3) The filters are essential to prevent valve failure.
- (4) Position the filters so that when they are cleaned, any spilled water does not fall on the solenoid valves/pumps or other equipment that should be kept dry
- (5) The outlet pipes from the solenoid valves must not be restricted. Use 10mm pipe or larger
- (6) The outlet pipes from the valves/pumps must end above the surface of the water in the main tank. It is important that an air-gap exists even when the tank overflows.
- (7) Connect the wire from the stainless steel rod to a ground terminal on the controller.
- (8) Connect a wire from the Nutri-dose GND terminal to earth
- (9) Do not overtighten the pipe connections or mounting feet on the solenoid valves.

TROUBLE SHOOTING

- 1) **CF reading falls below set point.** Check that filters are clean and A & B nutrient stock tanks are not empty, taps are open, tanks are adequately vented (air must be able to get in at the top of the tank to avoid the formation of a vacuum when liquid leaves at the bottom) also check that the electrical connections to the solenoids are sound and well insulated.
Watch for a long enough period to observe dosing occurring. You should be able to hear the solenoid valves click-in if dosing occurs.
- 2) **Level in one nutrient stock tank falls faster than the other.** Check that both tanks are at the same height, and are of identical dimensions. Ensure filters are clean, taps are both fully opened, tanks are vented, pipes are not kinked and are both of the same length. Check that the valve controlling the tank with the lower level does not leak. If there is any doubt about this, renew the plunger assembly or the complete valve. (A useful test before doing this is to swap the valves over). Ensure pump squeeze tubes are not flattened unequally.
- 3) **CF Reading wanders around.**
Check that the discharge pipes from the solenoid valves are not touching the surface of the water in the main tank
Check probe is clean and not positioned in rapid flow of liquid or where there are large numbers of bubbles or other turbulence. If in doubt thoroughly clean with an abrasive cleaner. Check for a local source of radio frequency interference. eg arc welder, sparking motor, radio transmitter etc. This should be corrected at the source of the interference or moved away, a CF sensor is a sensitive piece of equipment and cannot produce reliable results in strong radiation fields.

Ensure pressure switch is closed (if used). If pressure switch is not used, ensure the pressure switch terminals are joined together.
- 4) **pH keeps dosing even though the set point has been passed**
Check that the controller and taps are correctly set to either RAISE (alkali) or LOWER (acid).
- 5) **Output from solenoid valve continually drips**
There is probably some foreign matter on the valve seat. Carefully open up the valve and clean the wetted parts in warm water. Do not damage the valve seat or rubber disc.
- 6) **pH fails to dose**
This can happen if the dose interval is set to zero minutes and the CF reading is also zero. This is not an appropriate mode for dosing

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